Instruction Manual

Tektronix

TSG-170D
Digital Composite Generator

070-6943-02

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

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

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

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injury

Use Proper Power Cord. Use only the power cord specified for this product and certified for the country of use.

Connect and Disconnect Properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

Ground the Product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Use Proper Fuse. Use only the fuse type and rating specified for this product.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Provide Proper Ventilation. Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

Symbols and Terms

Terms in this Manual. These terms may appear in this manual:

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

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

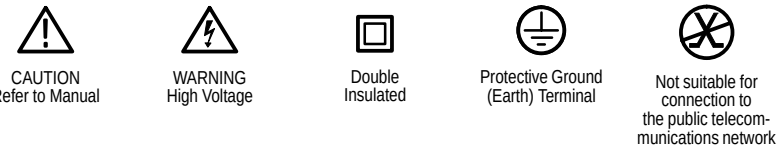
Terms on the Product. These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product. The following symbols may appear on the product:



SECTION 1
INTRODUCTION

PRODUCT DESCRIPTION

The TSG–170D Digital Composite Generator is designed for easy operation, and is suitable for both operation and maintenance of NTSC Composite digital television equipment. The TSG–170D provides both test signals and an audio tone, in digital and analog form; an analog black burst, for equipment synchronization. In addition, there are alphanumeric ID and tape leader countdown functions available on both digital and analog test signals.

Test Signal Generator

The TSG–170D uses 10-bit digital test signal generation, conforming to the Proposed American National Standard for digital encoding of composite video signals (System M/NTSC). The digital test signal output is a 10-bit parallel interface clocked at 4 F_{SC}.

The analog test signal output is obtained by applying the digital test signal data to a precise D-to-A converter, ensuring signal accuracy and long-term stability.

Test signals generated by the TSG–170D are:

- SMPTE Bars
- Convergence
- Pulse Bar w/Window
- Multiburst
- 5-Step Staircase
- Y Ramp
- Modulated Ramp
- APL (10% or 90%)
- Bounce
- 100/10 IRE Flat Fields
- Red Field
- Multibars
- NTC7 Composite
- Line Sweep
- Multipulse
- System Test Matrix
- Monitor Setup Matrix
- DAC Test*

*Available in diagnostics mode only.

All TSG–170D test signals conform to RS–170A timing specifications.

ID and Tape Leader

An ID of up to 12 alphanumeric characters may be inserted in the test signal output. This ID is front panel programmable, and is useful for source identification. Using the Remote connector, up to four separate IDs may be stored in non-volatile memory and recalled as needed.

The tape leader countdown function, controlled by the remote, switches the audio tone off and the test signal to black. A ten-second countdown is inserted in the black background, counting from ten to two at a one-second rate. The countdown display is then switched off, and the black background remains until the countdown program is terminated.

Internal Reference/Genlock Operation

The digital genlock calculates sync timing and subcarrier phase to properly identify color framing of the input reference signal. If there is no input reference applied, the TSG–170D automatically switches to an internal oscillator. This high-stability crystal oscillator, with its constant temperature oven, ensures long-term frequency stability. All outputs are correctly SCH phased, in both internal reference and genlock operation, even if the TSG–170D is locked to an improperly SCH-phased reference input. The TSG–170D provides a stable RS–170A black burst output for equipment synchronization.

Front-panel controls are provided to digitally advance or delay the TSG–170D outputs relative to the genlock reference input. As many as eight different timing offsets may be stored in non-volatile memory, for applications where the picture source output is delegated to different locations. As with the ID function, these are addressed through the remote connector.

Audio Tone Generator

The parallel and serial audio tone generators produce 20- and 24-bit digital streams respectively, each representing a sine wave reference signal. The frequency of the reference signal is factory set to 800 Hz, but is user selectable to 1 kHz. The parallel digital data output is a byte-wide serial interface, clocked at 768 kHz. The serial digital data is output in the AES/EBU serial format.

The analog audio tone output is the same frequency as that selected for the digital tone outputs. The analog amplitude is adjustable over a 0 to +8 dBu range.

Remote Control

Remote selection of test signals, genlock timing presets, internal reference/genlock, character ID presets, and tape leader generator functions is accomplished by simple ground closure through a 9-pin rear-panel connector.

Packaging

The TSG–170D's rugged, 1-3/4 inch package makes it ideal for remote vans or anywhere space is at a premium.

SECTION 2
OPERATING INSTRUCTIONS

This section explains how to operate the TSG–170D. It also describes each of the test signals and the rear-panel connector outputs.

FRONT-PANEL CONTROLS

Thirteen click-dome switches control the TSG–170D (see Fig. 2-1). The MODE SELECT switch on the right selects three modes of operation: SELECT TEST SIGNAL, SET IDENTIFICATION, and SET GENLOCK TIMING. The primary function of the twelve remaining switches is to select test signals; however, they also double as controls for genlock timing, and for identification (ID).

The four leftmost test signal switches double as ID selection controls in SET IDENTIFICATION mode. The four rightmost test signal switches double as test signal phase advance/delay controls in SET GENLOCK TIMING mode. In this manual, eight of the twelve of these two-function switches have two names, one for their primary function and one for the secondary. Fig. 2-2 shows these names for each operating mode. Operation of the front panel in each of the three modes is described in more detail below.

SELECT TEST SIGNAL Mode

In this mode, all twelve switches select test signals (see Table 2-1). The instrument is powered up in the SELECT TEST SIGNAL mode. If the instrument is not in this mode, press the MODE SELECT switch on the right of the front panel until the SELECT TEST SIGNAL LED is lighted and then press the desired test signal switch.

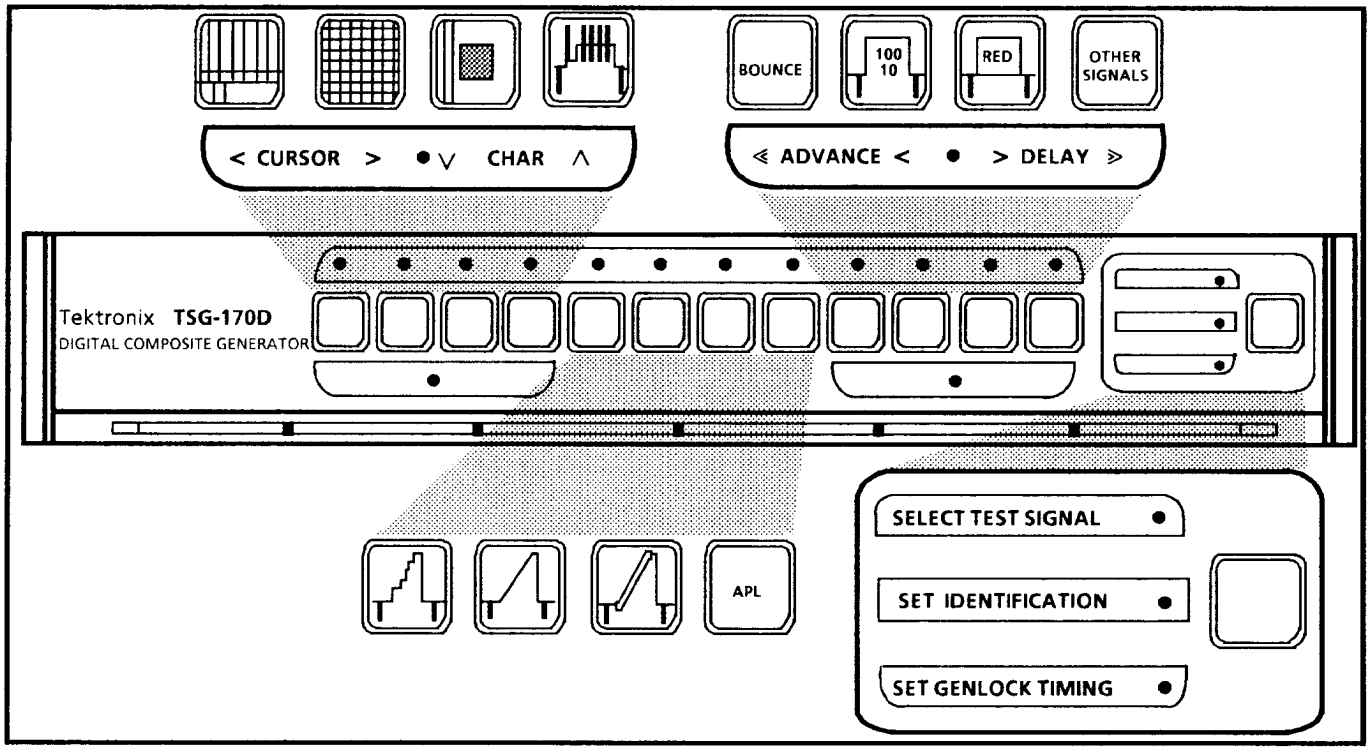


Fig. 2-1. TSG–170D front panel.

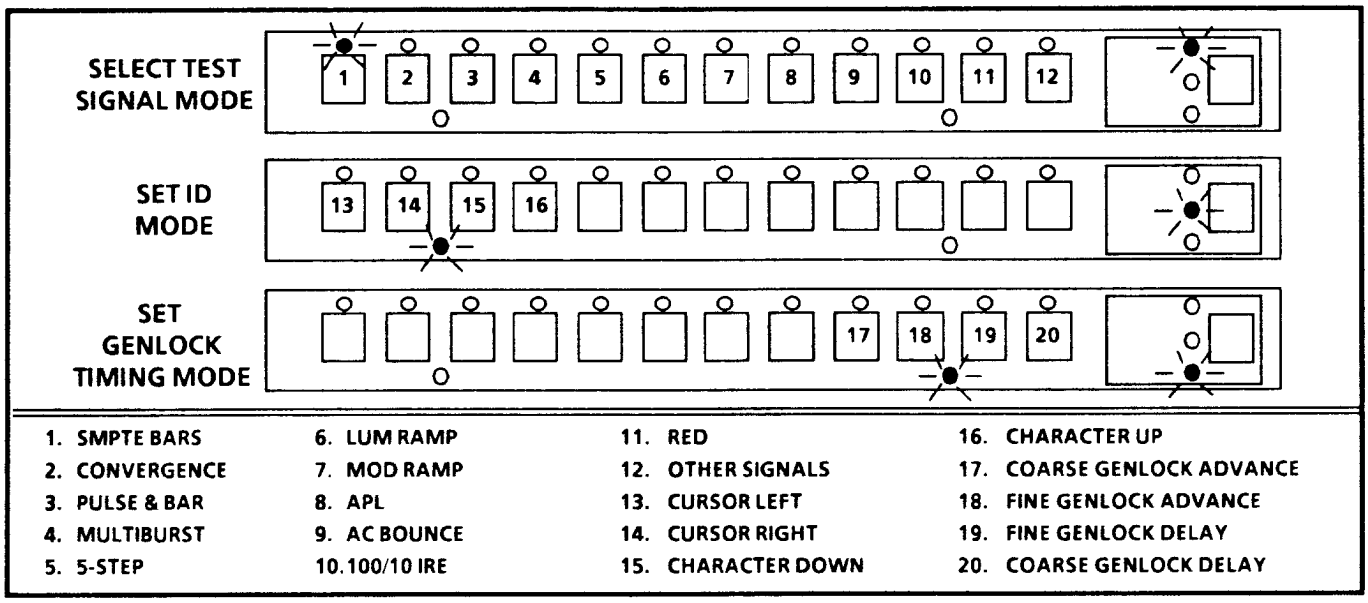


Fig. 2-2. TSG–170D front-panel switch names in the three front-panel modes.

Table 2-1
Signals Available in Select Test Signal Mode

SIGNAL	DESCRIPTION
SMPTE BARS	Selects a split field signal, comprising EIA Color Bars for the first 2/3^{rds} of the field, Reverse Blue Bars for the next 1/12th of the field, and a –IWQB signal with Pluge for the remaining 1/4th. The signal is used for checking gain, setup, hue, and saturation.
CONVER-GENCE	Selects a signal that produces a cross-hatch display of horizontal and vertical lines on a picture monitor. Midway between each vertical line the horizontal lines are broken and restarted to provide dots. This signal is used for checking and adjusting color convergence on picture monitors.
PULSE & BAR	Selects a signal consisting of a modulated 100 IRE 12.5T pulse, a 100 IRE 2T pulse, and a luminance bar with an inverted 100 IRE 2T pulse. The bar is gated to provide a window signal. The bar is used for measuring short-time, line-time, and field-time luminance distortion. The modulated pulse is used to measure chrominance-luminance gain and delay.
MULTI-BURST	Selects a signal consisting of a 70 IRE white flag and a 10 IRE black flag followed by six 60 IRE peak-to-peak packets of sine-wave bursts on a 40 IRE pedestal. The frequencies of the packets are: 500 kHz, 1 MHz, 2 MHz, 3 MHz, 3.58 MHz, and 4.2 MHz. The Multiburst signal is used to check the approximate frequency response of the television system.
5-STEP STAIRCASE	Selects a Staircase signal, consisting of five equal steps of luminance information from 0 to 100 IRE. This signal allows measurement of luminance nonlinearities.
LUM RAMP	Selects a Linear Ramp from 0 to 100 IRE, centered within the active line time. This signal is used for measuring luminance nonlinearity, especially in systems with ADCs and DACs.
MOD RAMP	Selects a Linear Ramp from 0 to 100 IRE, modulated with a 40 IRE subcarrier at 180° (same phase as burst). The Modulated Ramp is used for measurement of differential gain and phase.

Table 2-1 Signals Available in Select Test Signal Mode (cont)

SIGNAL	DESCRIPTION
APL	Selects one of three signals each time it is pressed: First is a 90% APL signal, comprised of a repeated sequence of a 100 IRE flat field inserted on four lines followed by the previously selected signal on the fifth line. Second is a 10% APL signal, comprised of a repeated sequence of a 0 IRE flat field on four lines followed by the previously selected signal on the fifth line. Third is a 50% APL signal, comprised of the previously selected signal on five out of five lines. The APL signals are used to measure APL-dependent distortion.
BOUNCE	Selects a signal comprised of a repeated sequence of four lines of flat field followed by one line of the previously selected signal. The amplitude of the flat field alternates between 100 and 0 IRE every second. The Bounce signal is used to check ac-coupled circuitry and APL-dependent distortion.
100/10 IRE	Selects one of two flat field signals (100 IRE or 10 IRE). The flat fields are used for color monitor alignment.
RED FIELD	Selects a 21.5 IRE flat field luminance signal modulated with a subcarrier of 103.4° phase and 100 IRE p-p amplitude. It is used to observe moire, color purity, and noise.
OTHER SIGNALS	Selects one of six signals each time it is pressed, in the following order: 1. **Multibars** — This signal is comprised of Color Bars in the first half of the line, followed by Multiburst during the second. Color Bars are used for checking luminance, hue, and saturation. Multiburst is used for an approximate measurement of frequency response. The combined signal is part of the System Test Matrix. 2. **NTC7 Composite** — This signal consists of a 100 IRE bar; a 2T sine-squared pulse; a 12.5T modulated sine-squared pulse; and an 90 IRE, 5-step staircase modulated with ±20 IRE subcarrier. The bar is used to measure line-time tilt. The 2T sine-squared pulse is used to measure high frequency response and group delay. The modulated 12.5T pulse is used to measure chrominance-to-luminance gain and delay. The staircase is used for measuring nonlinear distortion such as differential gain and phase. 3. **Line Sweep** — A 100 IRE p-p sine wave that begins each line at 500 kHz and increases in frequency to 5 MHz at the end of the line. Four markers show position of 1, 2, 3, and 4 MHz frequencies. Line Sweep provides more detailed measurement of frequency than multiburst. 4. **Multipulse** — This signal is comprised of a 100 IRE White Flag, a 100 IRE 2T sine-squared pulse, followed by five 100 IRE modulated pulses at frequencies of 1.0, 2.0, 3.0, 3.58, and 4.2 MHz. Multipulse is used for measurement of gain/frequency and group delay distortions. 5. **System Test Matrix** — A combination of Multibars in the upper half of the field, followed by the NTC7 Composite in the lower. Simple enough even for waveform monitors without line select, this matrix signal is used for multiple testing of the studio with one signal. 6. **Monitor Setup Matrix** — A combination of four signals, displayed from the top to the bottom of the field in the following order: Convergence, -IWQB, Convergence, EIA Color Bars, Reverse Blue, and Convergence. Monitor Setup Matrix has a complete set of signals for setting up a color monitor.
DAC Test	A non-composite, split-field signal (500 kHz/3.58 MHz, 100 IRE P-P), available only in diagnostics mode. This signal is used in calibration.

Two of the switches (FLAT FIELDS and OTHER SIGNALS) may need to be pressed more than once to get the desired signal. Press the FLAT FIELDS switch once to select the 100 IRE Flat Field signal, and press it again to select 10 IRE Flat Field. Press the OTHER SIGNALS switch repeatedly to sequence through the following signals: Multibars, NTC7 Composite, Line Sweep, Multipulse, System Test Matrix, and Monitor Setup Matrix. The signal used last in OTHER SIGNALS is the one returned to after a different signal has been selected.

SET GENLOCK TIMING Mode

In SET GENLOCK TIMING mode, the four rightmost switches shift the timing of the test signals together with respect to the Genlock Input. While the front panel is in this mode, the four rightmost switches take on the following names (from left to right): COARSE GENLOCK ADVANCE, FINE GENLOCK ADVANCE, FINE GENLOCK DELAY, and COARSE GENLOCK DELAY.

FINE GENLOCK ADVANCE and FINE GENLOCK DELAY provide fine adjustment of genlocked test signal timing over a total range of about 55° in 0.2° steps. COARSE GENLOCK ADVANCE and COARSE GENLOCK DELAY provide coarse adjustment over a total range of ±8 μs in 35 ns (45°) steps. (See Fig. 2-3). Arrows below the switches indicate the direction (advance or delay) and amount of timing offset.

Setting Genlock Timing

To adjust genlock timing, first press the MODE SELECT switch until the SET GENLOCK TIMING LED is lighted. Note that the red LED under the four right hand switches is lighted to indicate that these switches now control genlock timing instead of selecting test signals.

To advance genlock timing, press the FINE GENLOCK ADVANCE switch for fine increments of advance (steps of 0.2°), or press the COARSE GENLOCK ADVANCE switch for coarse increments (35 ns steps or 45°). To delay genlock timing, press and hold down the FINE GENLOCK DELAY switch for fine increments of delay, or press the COARSE GENLOCK DELAY switch for coarse increments of delay.

If none of the switches are pressed within 30 seconds after the SET GENLOCK TIMING mode is selected, the front panel automatically reverts to the SELECT TEST SIGNAL mode.

If the end of the fine advance range is reached and more adjustment is desired, push the COARSE GENLOCK ADVANCE switch to advance the phase by a whole coarse step. If this introduces more advance than desired, press the FINE GENLOCK DELAY switch to reduce the amount of advance.

Note that when the genlock timing switches are held down, they shift genlock timing at a rate of 5 steps per second for the first three seconds and then speed up to 20 steps per second.

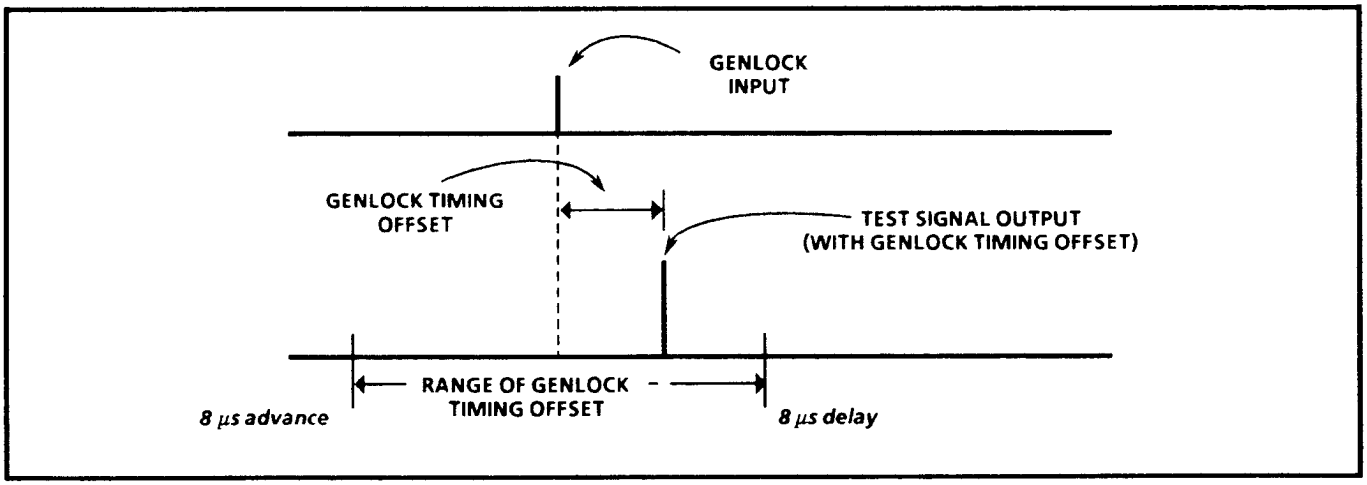


Fig. 2-3. Relative timing of Genlock Input signal and Test signals.

Storing Genlock Setting

The genlock timing setting can be permanently stored in non-volatile memory. To store the settings in non-volatile memory, cycle the MODE SELECT switch through to the SELECT TEST SIGNAL mode after selecting the settings. A setting is saved automatically upon a 30-second timeout to SELECT TEST SIGNALS mode.

SET IDENTIFICATION Mode

In the SET IDENTIFICATION mode, the four leftmost switches write up to 12 characters of text for display on the upper two-thirds of the test signal. While the front panel is in this mode, these switches take on the following names (from left to right):

CURSOR LEFT, CURSOR RIGHT, CHARACTER DOWN, and CHARACTER UP.

The ID characters may be thought of as twelve character lists consisting of the letters A through Z, numerals 0 through 9, three punctuation marks (a dash, a period, and a slash), and a space (see Fig. 2-4). Only one character from each list shows on screen; the grey-shaded areas of Fig. 2-4 would not be visible, only the white row which says "TEKTRONIX_____". The cursor, shown as a heavy outline in the illustration, is moved horizontally across this row by the CURSOR LEFT and CURSOR RIGHT push buttons, while the CHARACTER DOWN and CHARACTER UP push buttons scroll the character list at the cursor's character position up or down to select the desired character for that position.

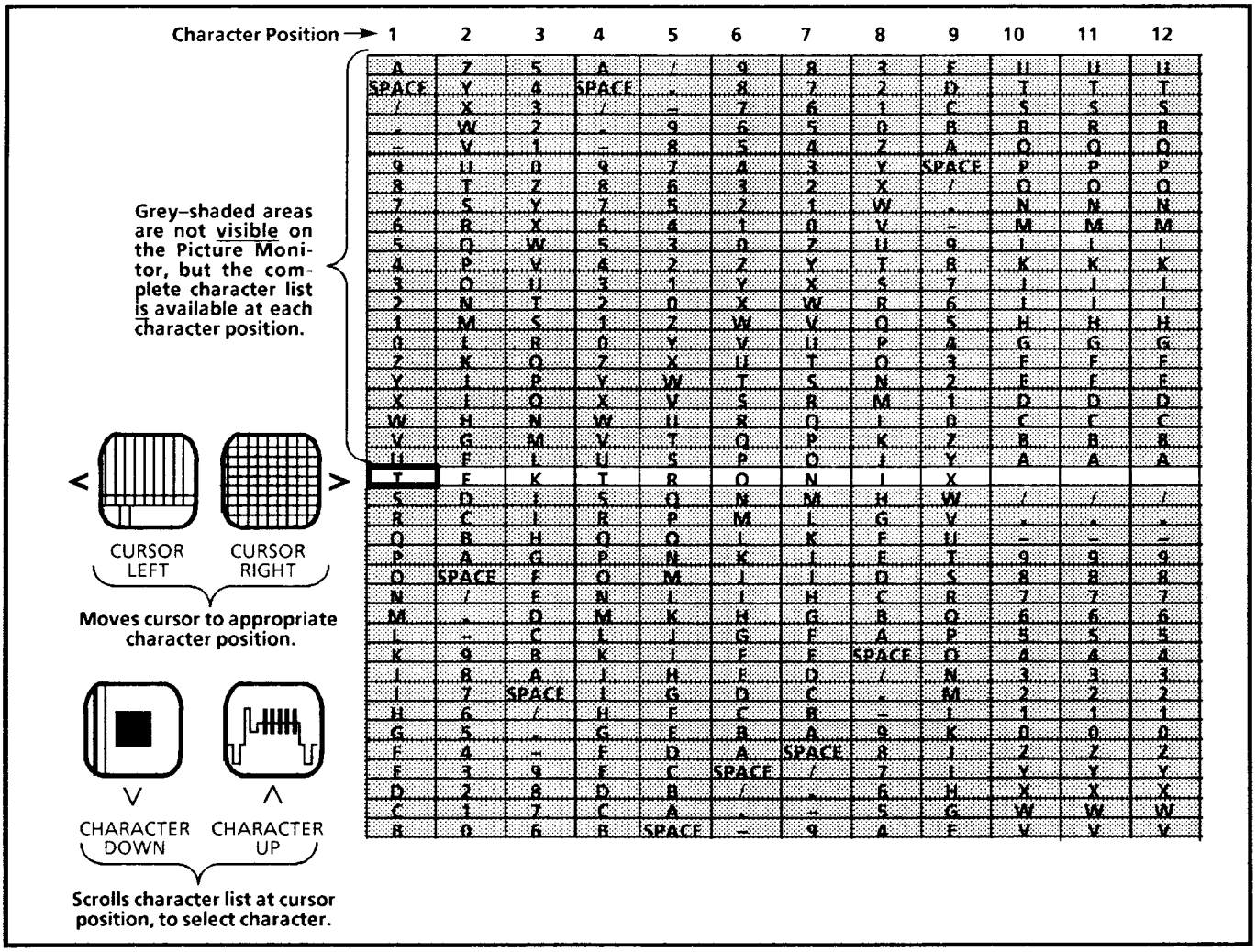


Fig. 2-4. Selecting ID characters from the front panel.

Selecting the ID

To select an ID character, press the MODE SELECT switch until the SET IDENTIFICATION LED is lighted. Note that the LED below the four leftmost switches is lighted to indicate these switches control ID selection. Looking at the 12 character positions on a video monitor, note that a gray square is superimposed over one of the characters to indicate the cursor position.

Assume that the number 123 is to be added, following the word TEKTRONIX, in Fig. 2-4. Press the CURSOR LEFT or the CURSOR RIGHT push button (it will wrap around the ends) until the cursor is in character position 10. Then press either the CHARACTER DOWN or the CHARACTER UP push button (this one wraps, too) until the "1" appears. Step the cursor to position 11 and scroll the character list to the "2", and then repeat to put the "3" in character position 12. Of course, the order in which these positions are filled in makes no difference; you could fill in position 12, then position 10, and then position 11 with the same end result.

Storing the Selection

Follow the instructions for storing the genlock timing settings.

Switching Off the Characters

To switch off the Character Generator and the black background window, delete all the characters by selecting a blank in all 12 character positions. There is also an internal jumper which can disable the ID function.

REAR-PANEL CONNECTORS

The rear panel has two 25-pin data connectors, four BNC video connectors, one 9-pin remote control connector, two audio XLR connectors, and one power socket. Fig. 2-5 shows the rear panel, and Fig. 2-6 shows the multipin connector pinouts.

REAR-PANEL CONTROLS

POWER ON/OFF push-push switch.

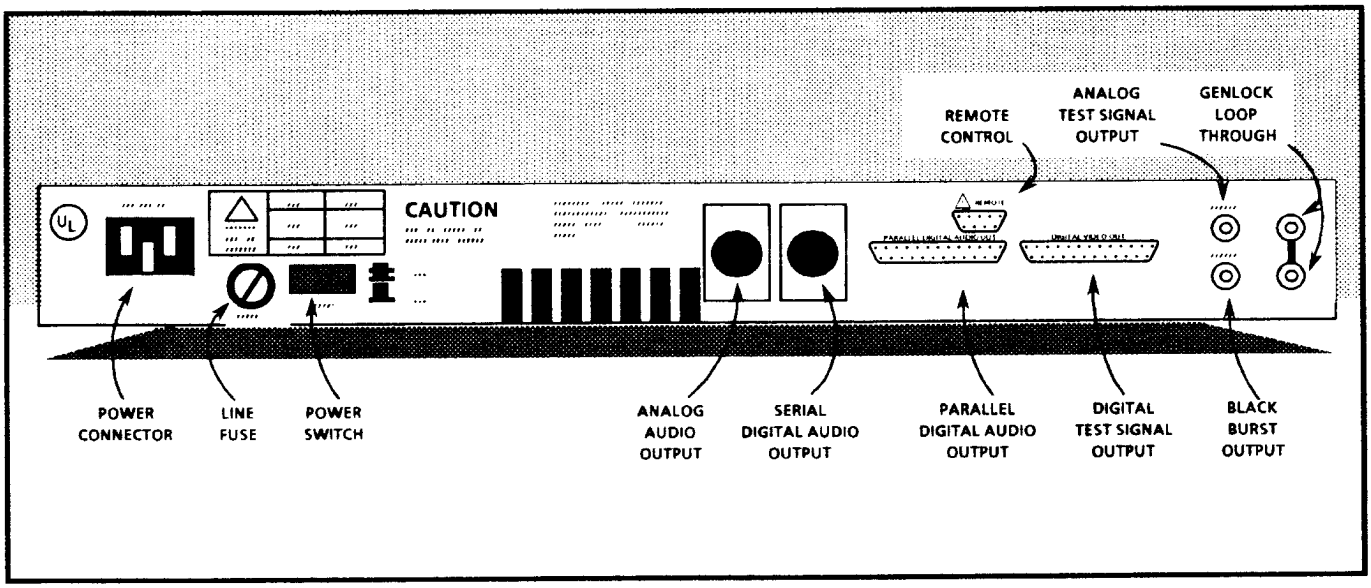


Fig. 2-5. TSG–170D rear panel.

REMOTE OPERATION

The TSG–170D can be remotely controlled through the 9-pin Remote Control connector located on the rear panel. By TTL-compatible ground closure, these pins control six different functions (described below). Typically, the pins would be grounded through user-supplied switches, using pin 9 as ground. The instrument can be locked into a fixed operating mode by wiring directly at the remote connector. To do this, attach a male 9-pin DIN plug to the remote connector and solder the appropriate pins to ground. Fig. 2-6 shows the connector pinout.

Explanation of Pins

Pin 1

Selects Tape Leader countdown out of the Option 1 rear-panel connector. (To generate a tape leader record Bars, ID, and Audio Tone. Then ground pin 1* to select Tape Leader Countdown.) Tape Leader goes through the following sequence:

1. Switches off Audio Tone.
2. Selects a character ID countdown from 10 to 2 against a black background.
3. Selects black background until pin 1 is ungrounded.

*While pin 1 is grounded, the front panel cannot exit the SELECT TEST SIGNAL mode.

Pin 2

Selects Internal Sync Generator Reference mode when grounded. Otherwise, automatically switches to Genlock mode when a Genlock Input signal is present.

Pin 3

Increments through the front-panel selectable test signals when grounded. Starts at the signal currently selected and sequences from left to right across the front panel, skipping only the APL and BOUNCE selections. Note: Pin 3 should be used only with a momentary contact switch.

Pins 4, 5, & 6

Three binary-coded control lines that select one of eight sets of genlock timing presets. A timing preset can be programmed to select a different genlock timing setting. To do this, ground the appropriate pins, set the genlock timing at the front panel, then cycle the front-panel MODE SELECT switch back to SELECT TEST SIGNAL mode.

Pins 7 & 8

Two binary-coded control lines that are used to select one of four different character ID presets. The ID presets can be programmed to select a different ID. To do this, ground the appropriate pins, select the ID at the front panel, then cycle the front-panel MODE SELECT switch back to SELECT TEST SIGNAL mode.

Pin 9

Ground.

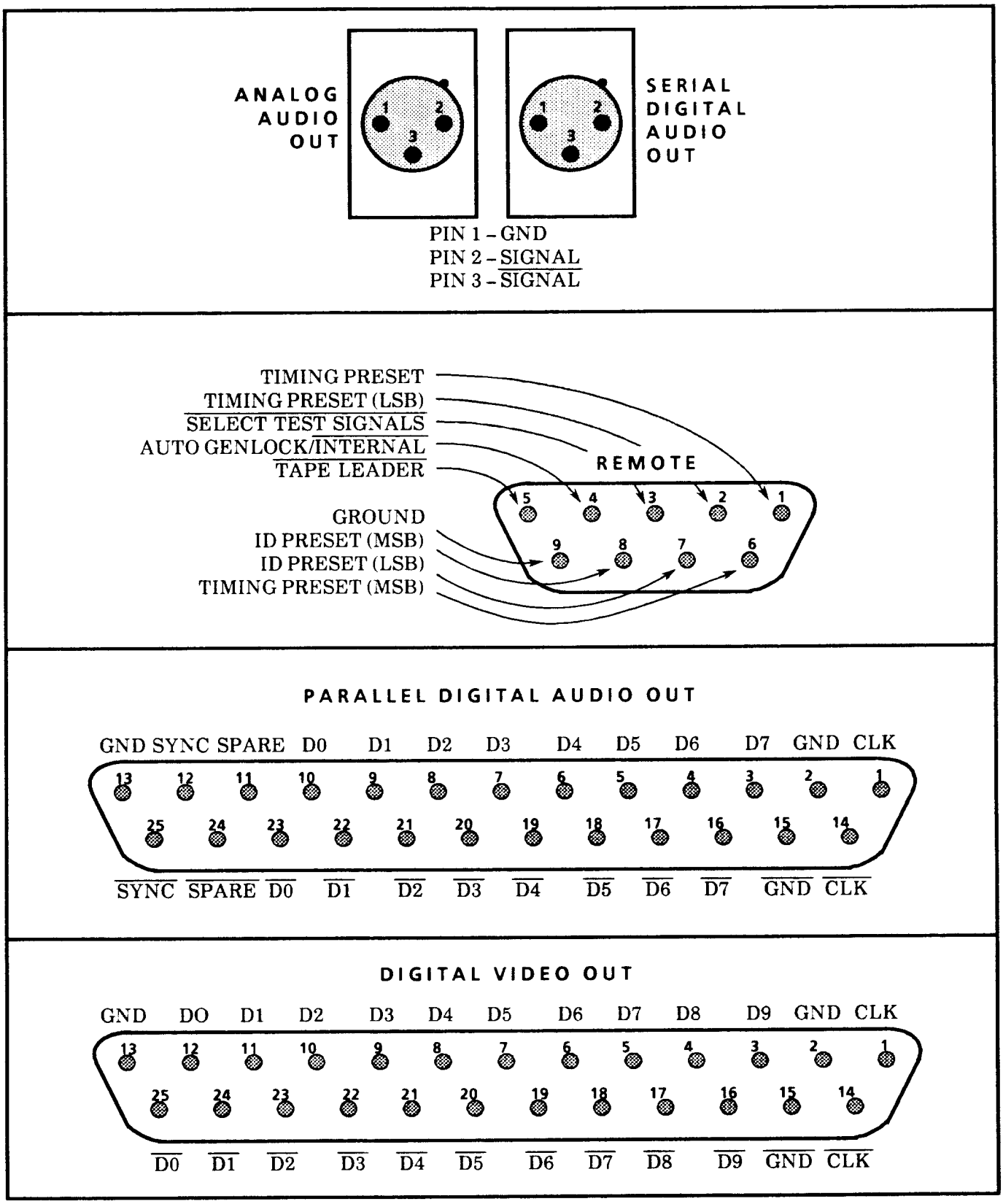


Fig. 2-6. TSG-170D rear-panel multipin connector pinouts.

Table 2-2
Table of rear-panel connector outputs.

CONNECTOR	STANDARD SIGNAL	OPTIONAL SIGNAL*
GENLOCK LOOP-THROUGH	Genlock Input.	—
TEST SIGNAL	Test Signal Output.	—
BLACK	Black Burst Output.	—
REMOTE	Remote Control Input.	—
ANALOG AUDIO OUT	800 Hz tone.	Jumper-selectable to 1000 Hz tone.
SERIAL DIGITAL AUDIO OUTPUT	800 Hz tone. Serial, 2s complement binary audio data, with 24-bit quantized resolution.	Jumper-selectable to 1000 Hz tone.
PARALLEL DIGITAL AUDIO OUTPUT	800 Hz tone. Parallel 8-bit complementary audio data, a clock, and a frame sync signal.	Jumper-selectable to 1000 Hz tone.
DIGITAL VIDEO OUTPUT	10-bit complementary digital data and clock.	Jumper-selectable to 8-bit resolution.

***See operating mode jumper table for access to optional signals.**

SECTION 3
TABLE OF SPECIFICATIONS

The performance requirements listed here apply over an ambient temperature range of 0°C to +50°C after a warmup time of 20 minutes. The rated accuracies are valid when this instrument is calibrated at +20°C to +30°C.

Test equipment used in verifying performance requirements must be calibrated and working within the limits specified under Table 5-1 of this manual.

Table 3-1
Digital Video Output Interface

Characteristics	Performance Requirement	Supplemental Information
Connector		25 pin subminiature "D" type, female contacts.
Digital Format		Parallel, 11 balanced signal pairs consisting of 10 data bits per sample, and a clock.
Output Logic Levels		10K ECL compatible.
Receiver Termination Required		110Ω ±10Ω.
Encoding Format	Positive Binary.	Linear PCM.
Sampling Frequency	Four times color subcarrier nominal (14.31818 MHz).	
Sampling Phase Angle		Referenced to I and Q axes.
Dynamic Range 10 bits/sample	Blanking level (0 IRE) is at digital word 240. Reference white (100 IRE) is at digital word 800 (5.6 LSB/IRE).	
Clock Timing	The 50% point of the rising edge of the clock pulse follows the data by 35 ns ±5 ns.	
Resolution	10 bits.	Jumper selectable to 8 bits.
SCH Phase		0°.

Table 3-2
Test Signal Generator — General Test Signal Characteristics

Characteristics	Performance Requirement	Supplemental Information
Luminance Amplitude Accuracy	±1%.	Measured at 100 IRE.
Chrominance-to-Luminance Gain	±1%.	Measured at 500 kHz and 3.58 MHz.
Chrominance-to-Luminance Delay	≤10 ns.	
Blanking Level	0 Vdc ±50 mV.	
Luminance Rise Time	250 ns ±25 ns.	Except where specified otherwise.
Chrominance Rise Time	400 ns ±40 ns.	
Burst Amplitude	285.7 mV (40 IRE) ±2%.	
Burst Rise Time	400 ns ±40 ns.	
Sync Amplitude	285.7 mV ±1%.	
Sync Rise Time	140 ns ±20 ns.	
Line Timing	See Figs. 3-1 through 3-16.	
Front Porch Duration	1.5 μs ±0.1 μs.	
Line Blanking Interval Wide Blanking	10.9 μs ±0.2 μs.	Beginning at 20 IRE point of active video.
Breezeway Duration	600 ns ±50 ns.	
Line Sync Duration	4.7 μs ±50 ns.	50% amplitude point.
Vertical Serration Duration	4.7 μs ±50 ns.	50% amplitude point.
Equalizing Pulse Duration	2.35 μs ±50 ns.	50% amplitude point.
Burst Delay from Sync Burst Duration	 5.308 μs ±35 ns. 2.51 μs ±0.1 μs.	 19 cycles of subcarrier. 9 cycles of subcarrier.
Output Impedance	75Ω.	
Return Loss	≥36 dB to 4.2 MHz.	
Residual Subcarrier	≥60 dB down.	
SCH Phasing	0° ±5°.	
Phase Match between Test Signal and Black Burst	Within 5°.	

Table 3-3
Test Signal Generator —Test Signals

Characteristics	Performance Requirement	Supplemental Information
COLOR BARS	SMPTE Bars.	
CONVERGENCE Amplitude	549.1 mV (76.9 IRE).	
Pattern		Crosshatch — 14 horizontal lines and 17 vertical lines per field.
Pulse HAD	250 ns ±50 ns.	
PULSE & BAR WITH WINDOW 2T Pulse HAD	250 ns ±25 ns, 100 IRE	
12.5T Mod Pulse	1.5625 μs ±25 ns, 100 IRE, 60.84°.	
White Bar Amplitude	100 IRE.	
Field Tilt	≤0.5%.	
Line Tilt	≤0.5%.	
Field Timing	Lines 72 to 202.	
Pulse-to-Bar Ratio	1:1 ±1%.	
Ringing	≤1% peak.	
MULTIBURST White Reference Bar Amplitude	500 mV (70 IRE).	
Packet Amplitudes	428.6 mV (60 IRE) p-p.	
Pedestal	285.7 mV (40 IRE).	
Burst Frequencies	500 kHz, 1.0 MHz, 2.0 MHz, 3.0 MHz, 3.58 MHz, and 4.2 MHz.	
Packet Rise Time 500 kHz		140 ns typical (sine-squared shaped packets).
Other Packets		400 ns typical (sine-squared shaped packets).
5-STEP STAIRCASE Amplitude	714.3 mV (100 IRE).	
Linearity Error	≤1%.	Relative step matching.
LUMINANCE RAMP Luminance Amplitude	0 to 714.3 mV (100 IRE).	

Table 3-3 (cont.)
Test Signal Generator —Test Signals (cont.)

Characteristics	Performance Requirement	Supplemental Information
Linearity Error	≤1%.	
MODULATED RAMP Luminance Amplitude and Linearity Chrominance Amplitude Diff Gain Diff Phase	 Same as LUMINANCE RAMP. 285.7 mV (40 IRE). 0.6% maximum. 0.3° maximum.	
APL	1 line full-field signal and 4 lines 0 or 100 IRE flat field.	
AC BOUNCE Bounce Rate	 1 second high, 1 second low.	
FLAT FIELDS Amplitudes	 71.4 mV (10 IRE). 714.3 mV (100 IRE).	
RED FIELD Luminance Pedestal Chrominance Amplitude	 153.6 mV (21.5 IRE). 714.3 mV (100 IRE).	
MULTIBARS	Color bars and multiburst.	
NTC 7 COMPOSITE	100 IRE bar; 2T and 12.5T mod pulse; 90 IRE 5-step staircase, modulated with 40 IRE subcarrier.	
LINE SWEEP	714.3 mV p-p. Linear sweep from 500 kHz to 5 MHz.	Markers at 1, 2, 3, and 4 MHz.
MULTIPULSE Amplitude Frequencies	 714.3 mV. 1.0 MHz, 2.0 MHz, 3.0 MHz, 3.58 MHz, and 4.2 MHz.	
SYSTEM TEST MATRIX	Multibars and Composite.	
MONITOR SETUP MATRIX	Convergence, Color Bars, Reverse Bars, Convergence, IWQB, and Convergence.	
DAC TEST 1	Split field: 500 kHz (140 IRE p-p) followed by 3.58 MHz (140 IRE) p-p.	Non-composite signal. Available only in Diagnostic mode.

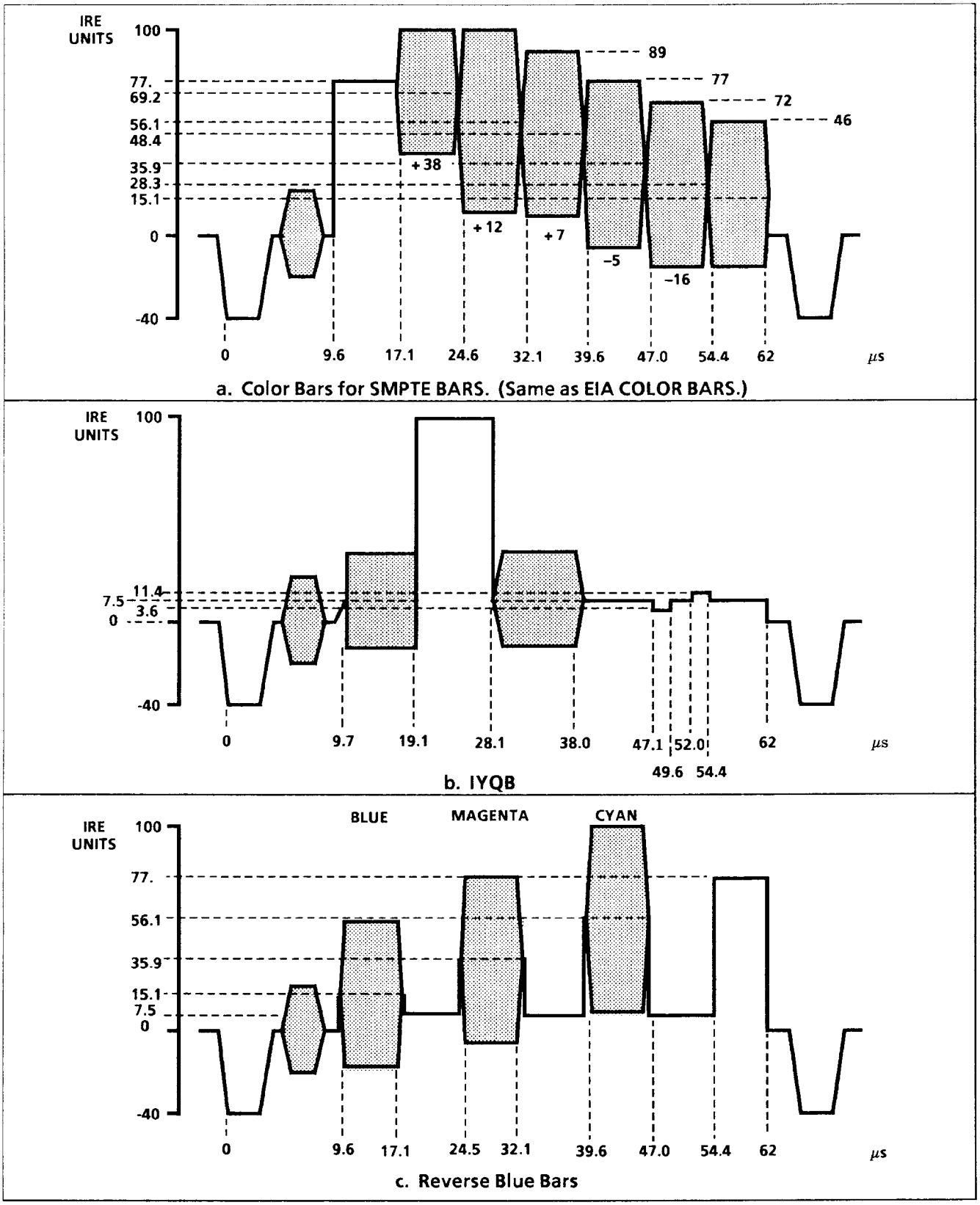


Fig. 3-1. Color Bar signal components.

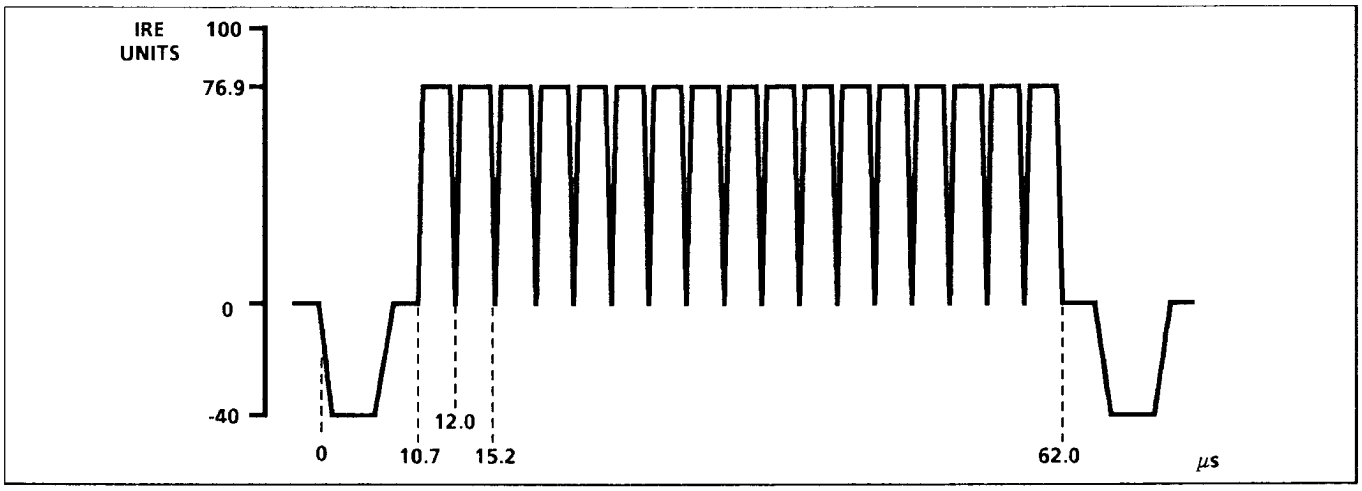


Fig. 3-2a. Horizontal component of Convergence test signal.

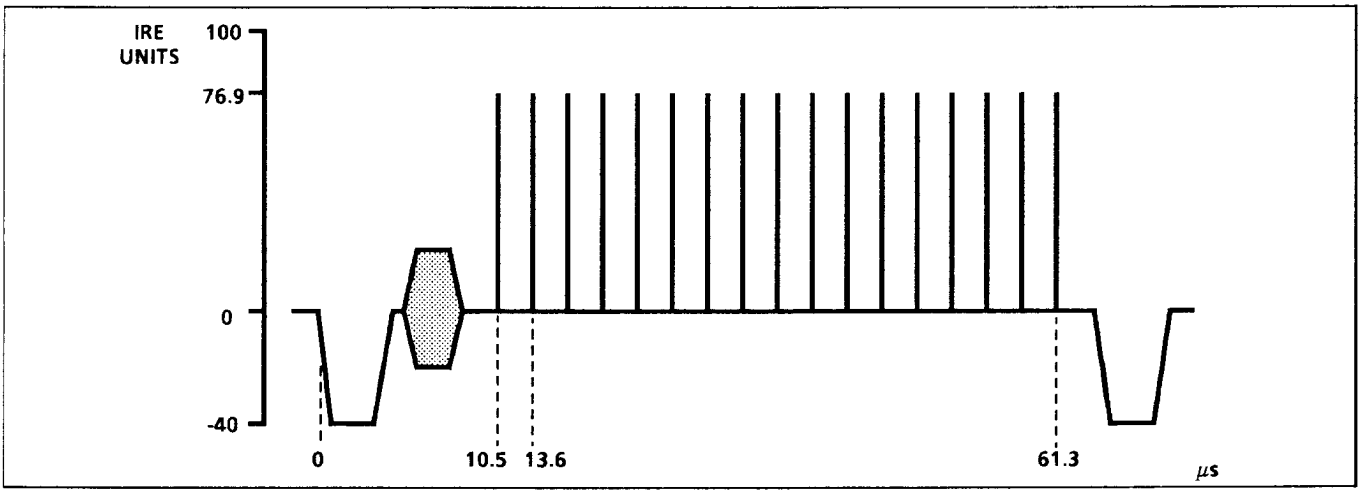


Fig. 3-2b. Vertical component of Convergence test signal.

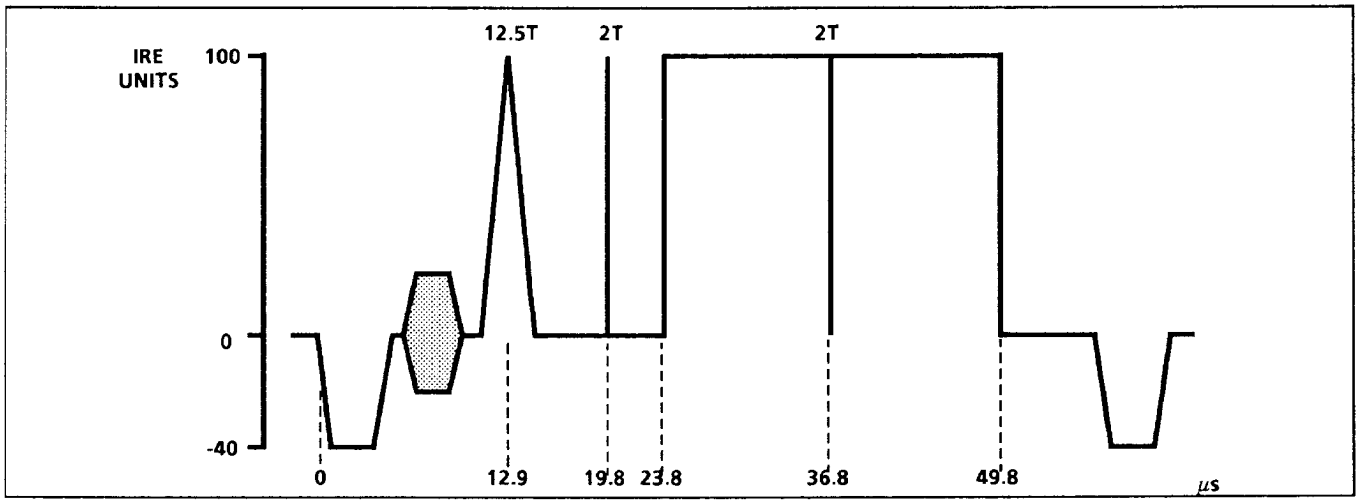


Fig. 3-3. Mod Pulse and Bar.

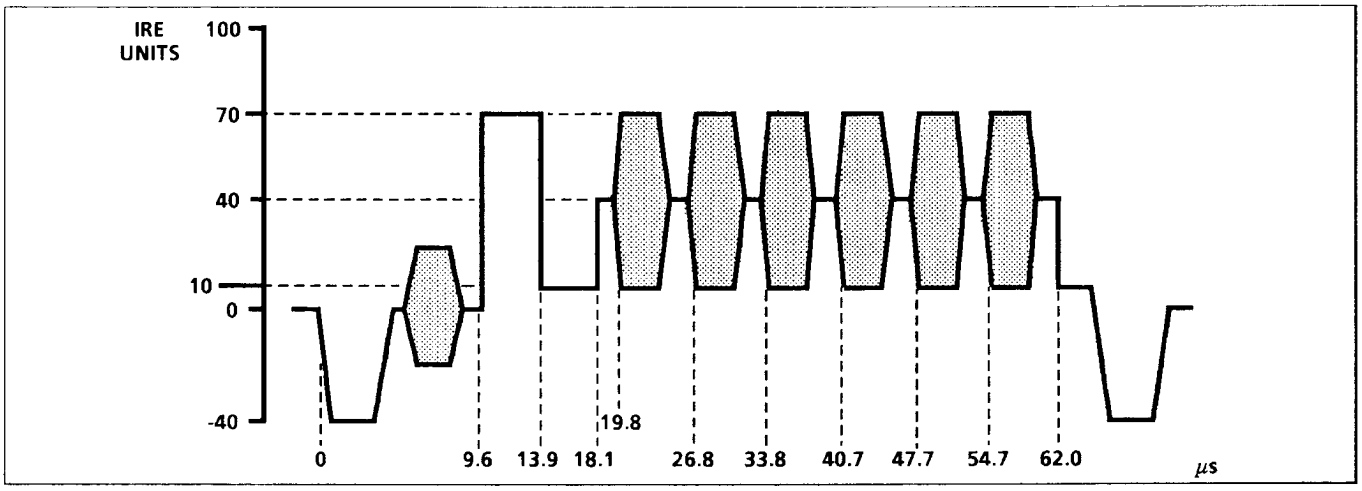


Fig. 3-4. Multiburst.

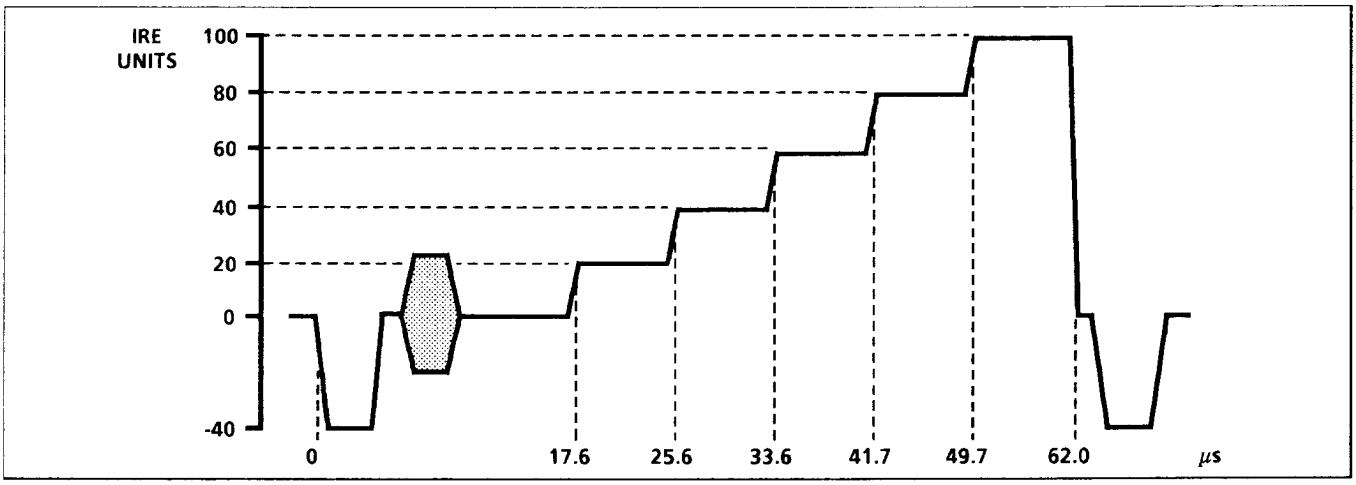


Fig. 3-5. 5-Step Staircase.

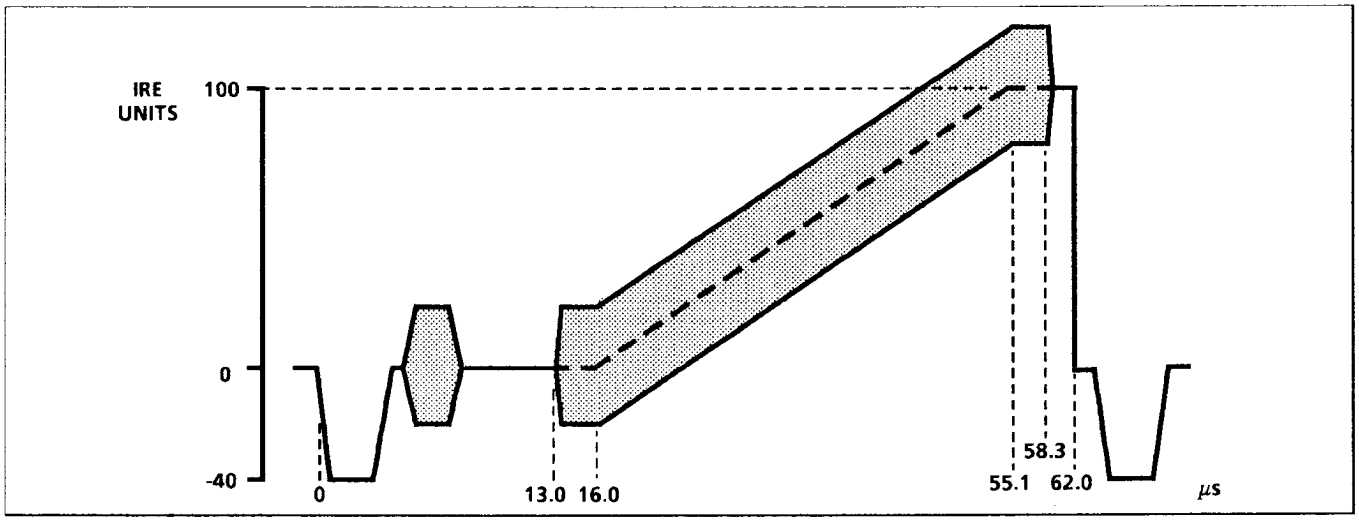


Fig. 3-6. Mod/Luminance Ramp.

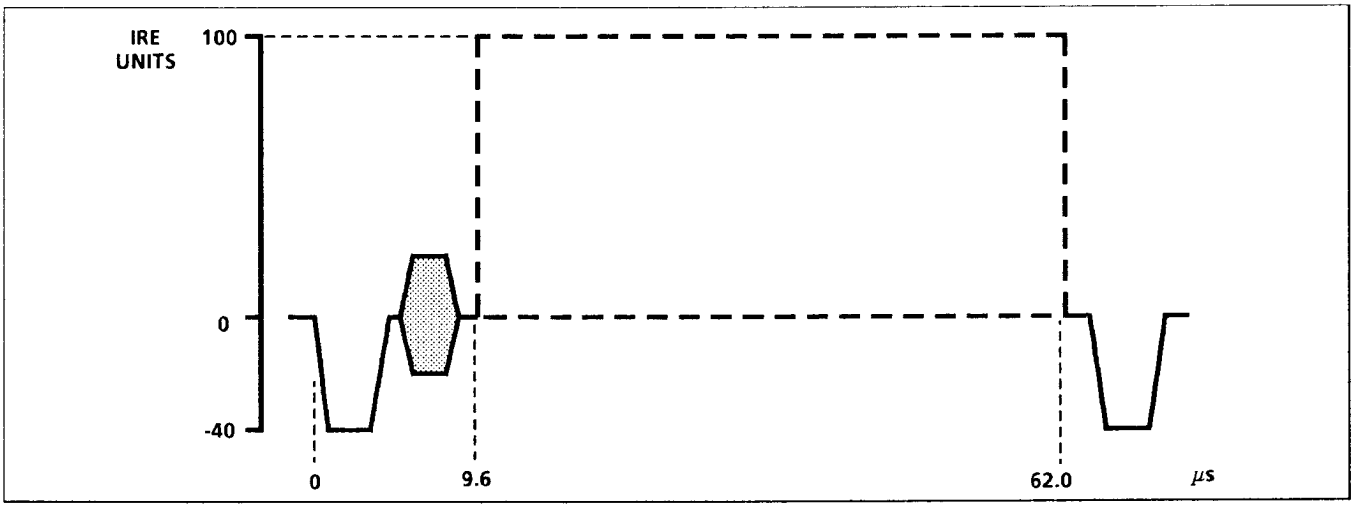


Fig. 3-7. APL and Bounce.

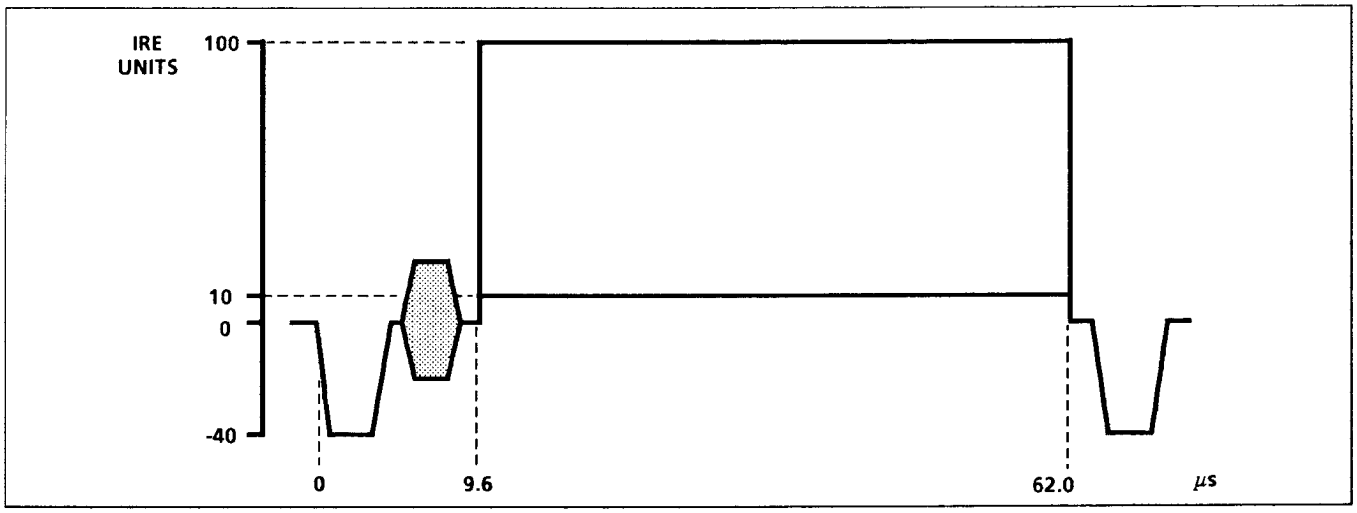


Fig. 3-8. 100/10 IRE Flat Fields.

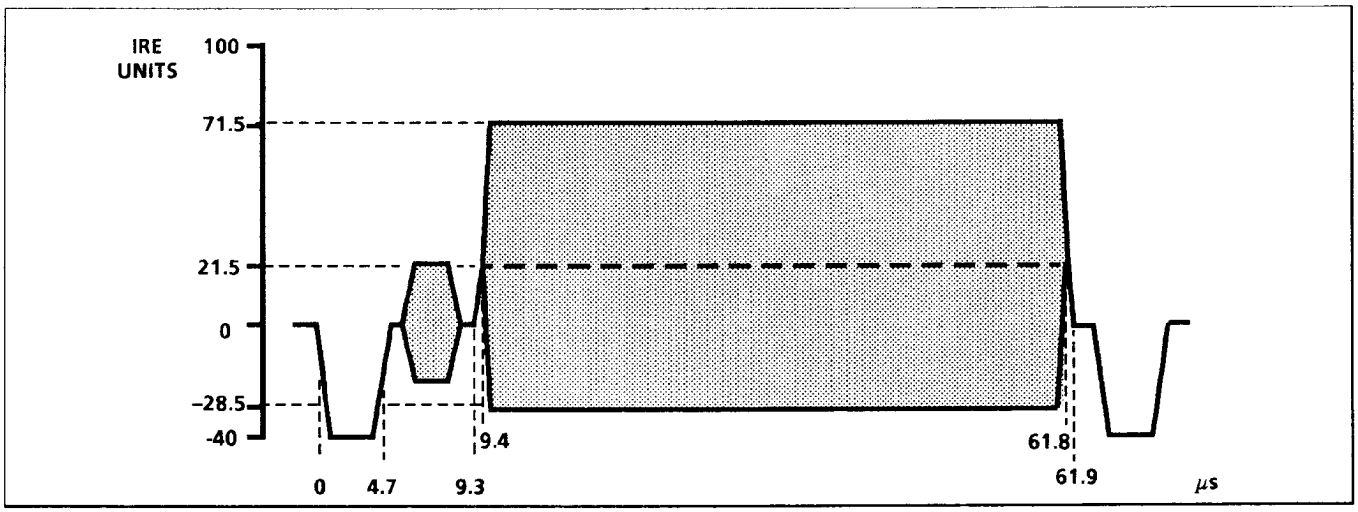


Fig. 3-9. Red Field.

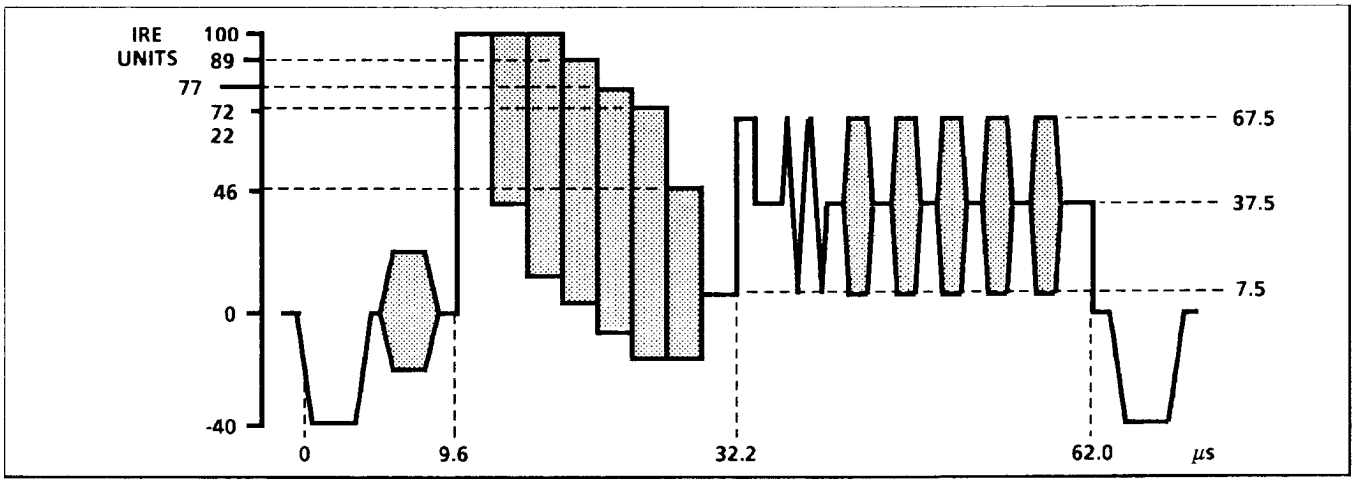


Fig. 3-10. Multibars.

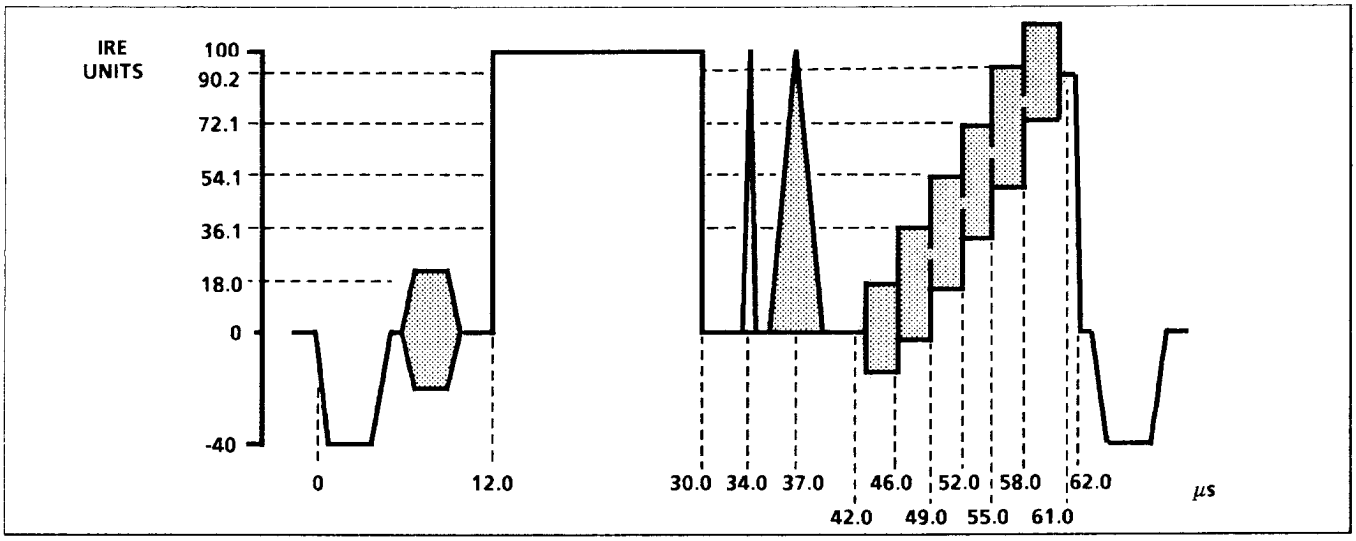


Fig. 3-11. NTC7 Composite.

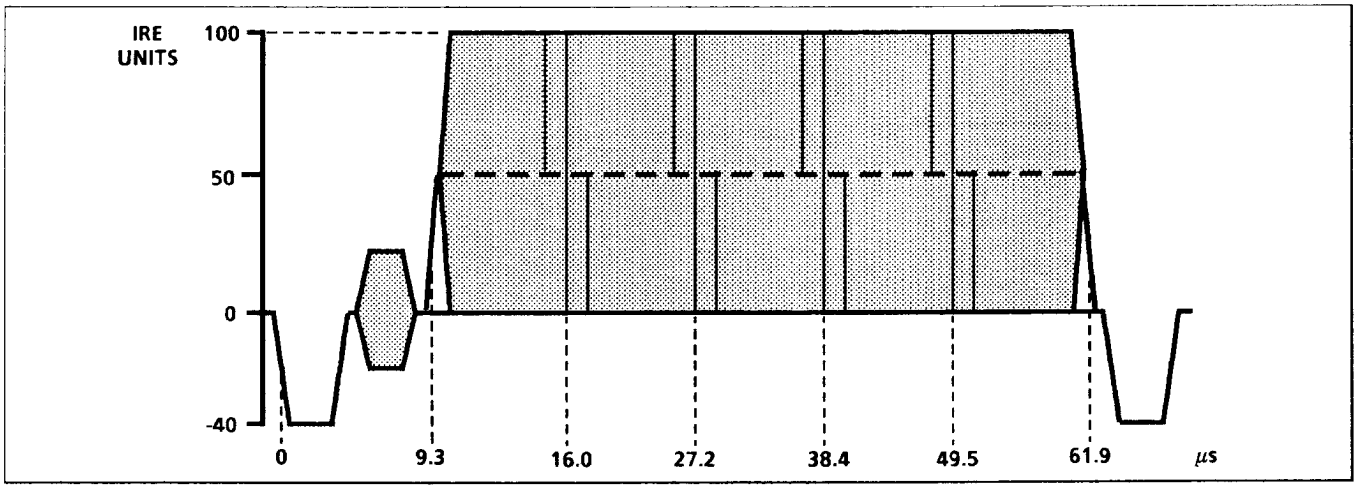


Fig. 3-12. Line Sweep with Markers.

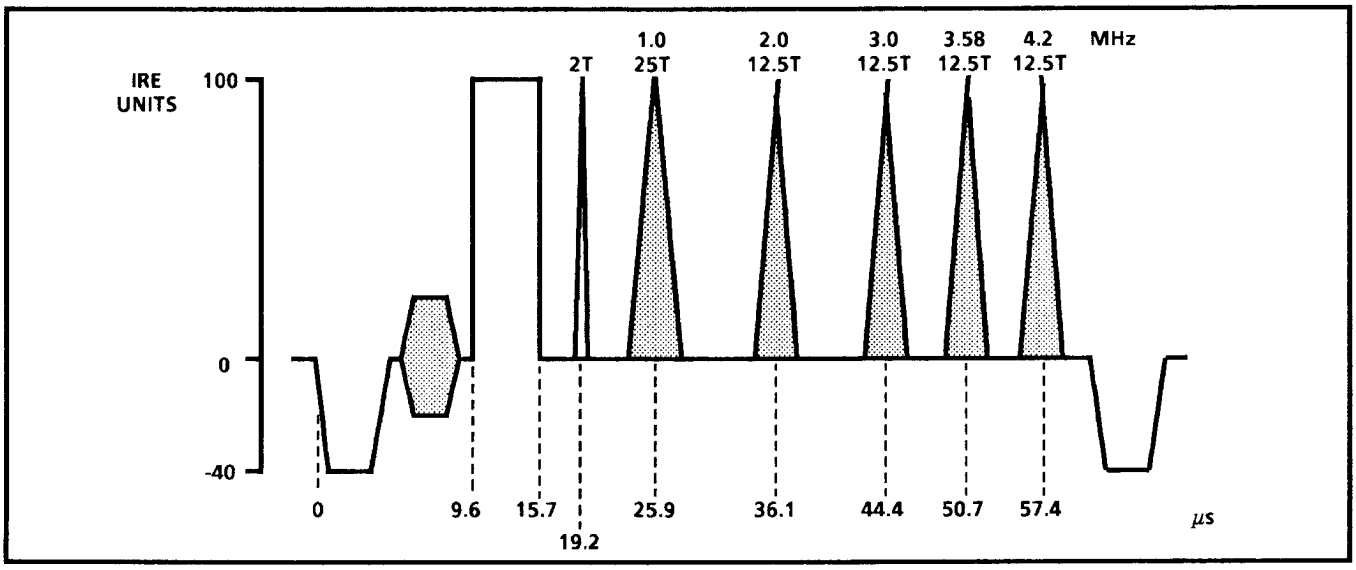


Fig. 3-13. Multipulse.

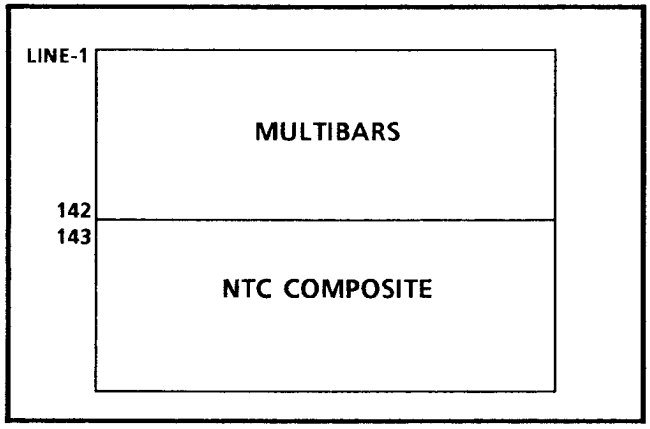


Fig. 3-14. System test matrix.

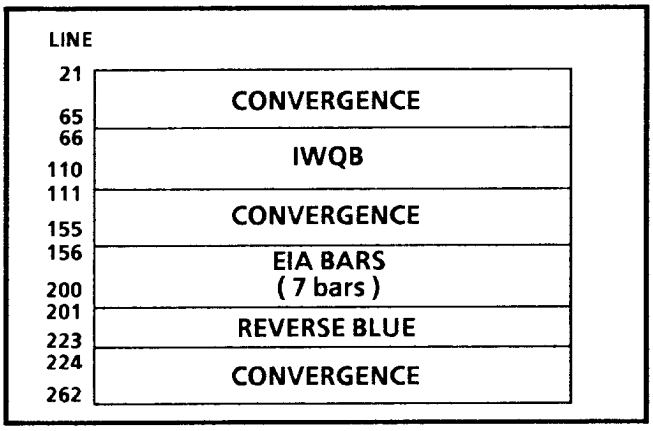


Fig. 3-15. Monitor setup matrix.

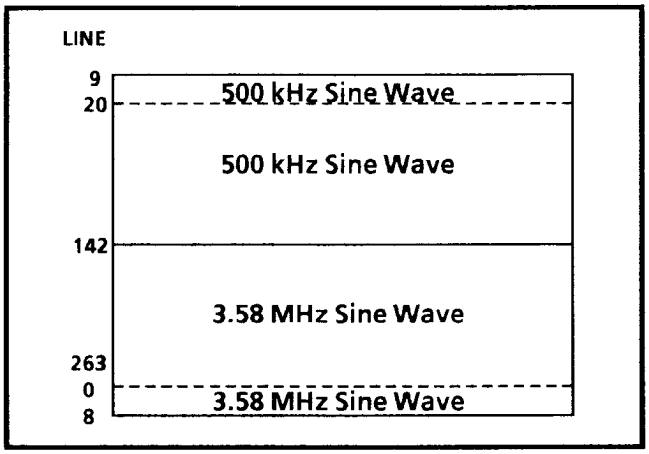


Fig. 3-16. DAC test signal.

Table 3-4
Test Signal Generator — Black Burst Output

Characteristics	Performance Requirement	Supplemental Information
Black Amplitude	7.5 IRE ±1 IRE.	Adjustable to 0 IRE.
Blanking Width	10.2 μs ±0.2 μs.	
Sync Timing	See Fig. 3-17.	

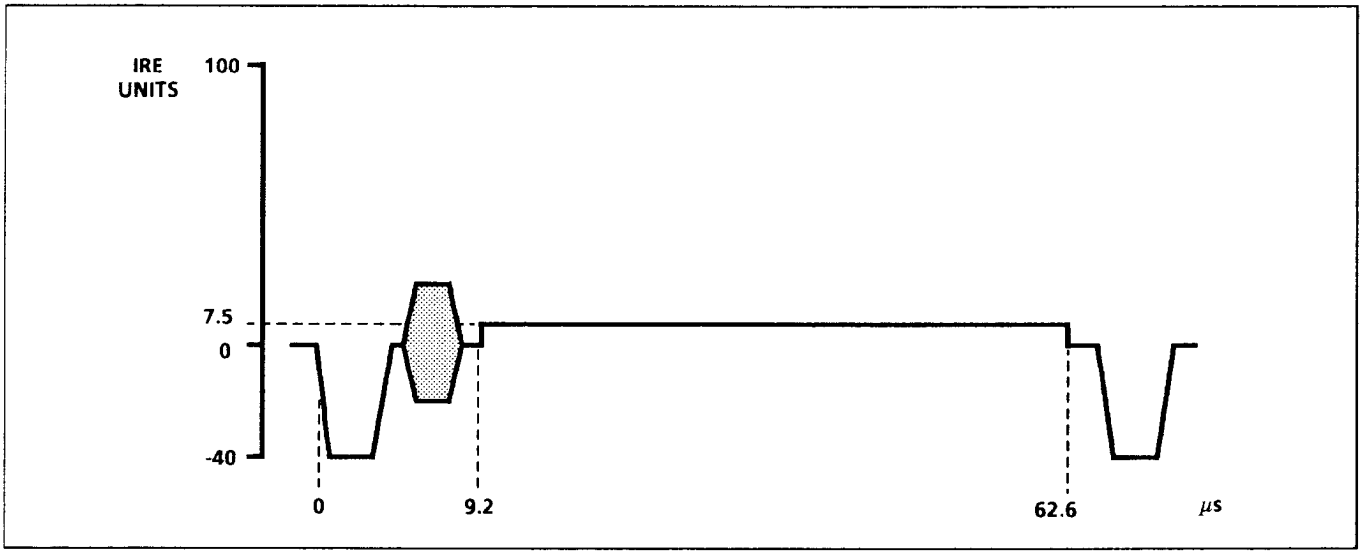


Fig. 3-17. Black Burst.

Table 3-5
Genlock Function

Characteristics	Performance Requirement	Supplemental Information
Input Configuration	75Ω loop-through.	
Return Loss (GENLOCK INPUT)	At least 40 dB to 4.2 MHz.	
Genlock Phase Change with Input Burst Amplitude	286 mV +1 to -6 dB.	≤1° phase shift (burst lock).
Genlock Phase Change with Input Sync Amplitude	286 mV +3 to -6 dB.	≤10° phase shift (sync lock).
Genlock Phase Change with Input Signal APL	≤1° burst phase change over 10% to 90% APL.	
Burst Lock Frequency Dependence	≤1° burst phase change for ±20 Hz change in incoming subcarrier.	
Horizontal Genlock Timing Range	At least 8 μs advance and delay relative to Genlock Input.	Front-panel control (resolution: 0.2° steps).
Vertical Timing Range	0, 1, or 2 lines advance. 1 line delay.	
Burst Lock Range	3.579545 MHz ±20 Hz.	
Color Framing Decisions Hysteresis Angle of Decision		120°. See Fig. 3-18. Initially, genlock circuit chooses field 1 if SCH Phase angle is <90° or >270°. Chooses field 3 if angle is >90° or <270°. Maintains field 1 decision from 0° ±120°. Maintains field 3 decision from 180° ±120°.
Phase Resolution (Burst)	≤0.5°.	
Jitter Burst Lock Sync Lock	 ≤0.5°. <2 ns.	
Continuous Wave Input Specs Genlock Phase Change with Input CW Amplitude Change CW Lock Range Jitter	 ≤1° burst phase change for input CW amplitude range of 2 V +1, -6 dB. 3.578545 MHz ±20 Hz. ≤0.5°.	

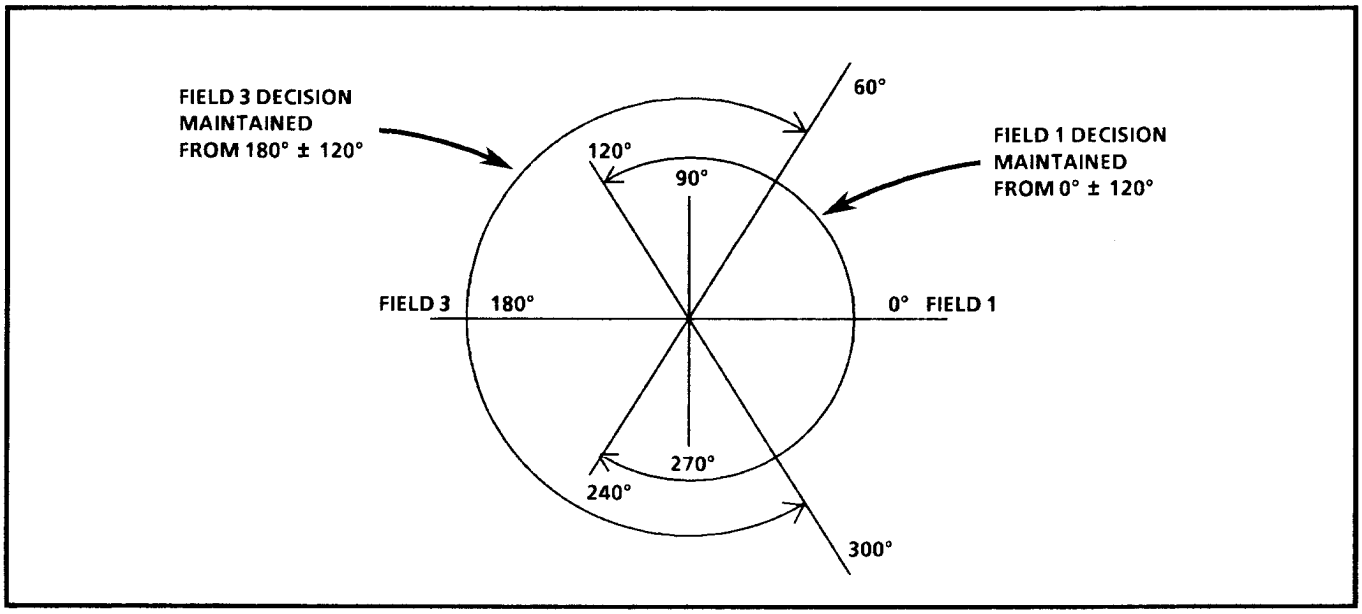


Fig. 3-18. Color framing decision angles.

Table 3-6
Parallel Digital Audio Output Interface

Characteristics	Performance Requirement	Supplemental Information
Output Connector		25 pin subminiature "D" type, female contacts.
Digital Format		Parallel, 11 balanced signal pairs consisting of 8 data bits per sample, a clock, a frame sync signal, and a spare.
Output Logic Levels		10K ECL compatible.
Receiver Termination		110Ω ±10Ω.
Encoding Format		Two's Complement Binary, Linear PCM.
Output Clock Rate		768 kHz, nominal.
Output Clock Jitter	<100 ns peak-to-peak.	
Audio Sampling Frequency		48 kHz, nominal.
Number of Audio Channels		4.
Quantized Resolution		20 bits.
Clock Timing	The 50% point of the rising edge of the clock pulse follows the data by 650 ns ±100 ns.	
Tone Frequency		800 Hz*, jumper selectable for 1 kHz.
Tone Amplitude		Positive peaks 0CCD0 hex* Negative peaks F3330 hex*
Pre-Emphasis		None*

*Specified by SMPTE RP-4.40X Appendix 1

Table 3-7
Serial Digital Audio Output Interface

Characteristics	Performance Requirement	Supplemental Information
Output Connector		3 pin XLR, male contacts.
Digital Format		Serial, balanced signal pair and a ground.
Digital Code		Bi-phase mark.
Output Level	3–10 volts.	Measured differentially across 110Ω.
Receiver Termination		110Ω ±10Ω.
Encoding Format		Two's Complement Binary, Linear PCM.
Audio Sampling Frequency		48 kHz, nominal.
Number of Audio Channels		2.
Quantized Resolution		24 bits.
Tone Frequency		800 hz*, jumper selectable for 1 kHz.
Tone Amplitude		Positive peaks: 0CCD00 hex* Negative peaks: F33300 hex*
Pre-Emphasis		None*.

*Specified by SMPTE RP–4.40X Appendix 1

Table 3-8
Analog Audio Output Interface

Characteristics	Performance Requirement	Supplemental Information
Output Connector		3 pin XLR, male contacts.
Output Level	0–8 dBu†, adjustable.	Low impedance to drive 150Ω or 600Ω.
Tone Frequency		800 Hz, jumper selectable for 1 kHz.

†0 dBu is the voltage that would deliver 1 mW to a load of 600Ω.

Table 3-9
Identification

Characteristics	Performance Requirement	Supplemental Information
IDENTIFICATION	12 characters, 7 x 9 matrix.	

Table 3-10
Power Supply

Characteristics	Performance Requirement	Supplemental Information
Supply Accuracy +12 V +5 V –5.2 V –12 V		 12 V ±300 mV. 5 V ±100 mV. –5.2 V ±300 mV. –12 V ±300 mV.
Current Limit +12 V +5 V –5.2 V –12 V		 Total power limited to 75W
Hum +12 V +5 V –5.2 V –12 V		**Typical** 10 mV. 10 mV. 20 mV. 10 mV.
Noise +12 V –12 V +5 V –5.2 V		 ≤50 mV (5 MHz bandwidth). ≤50 mV (5 MHz bandwidth). ≤50 mV (5 MHz bandwidth). ≤50 mV (5 MHz bandwidth).
Line Voltage Range 110 Vac 220 Vac	 90 - 132 Vac. 180 - 250 Vac.	
Crest Factor		≥1.35.
Fuse Data 115 V Setting 230 V Setting		 2 A Med-Blow. 1A Med-Blow.
Power Consumption Maximum		 60 W.
Line Frequency		48 Hz to 62 Hz.

Table 3-11
Physical Characteristics

Characteristics	Information
Dimensions Rackmount Height	 1.734 inches (4.4 cm).
Width	19.0 inches (48.3 cm).
Length	22.1 inches (56.1 cm).
Net Weight	13.5 lbs (6.14 kg).
Shipping Weight	22 lbs, 14 oz (10.4 kg).

Table 3-12
Environmental Characteristics

Characteristics	Information
Temperature Non-Operating	 –40°C to +65°C.
Operating	0°C to +50°C.
Altitude Non-Operating	 To 50,000 feet.
Operating	To 15,000 feet.
Vibration (Operating)	15 minutes each axis at 0.025 inch, frequency varied from 10-55-10 c/s in 4-minute cycles with instrument secured to vibration platform. Ten minutes each axis at any resonant point or at 55 c/s.
Shock	50 g's, 1/2 sine, 11 ms duration, 3 guillotine-type shocks per side.
Transportion	Qualified under NTSC Test Procedure 1A, Category II (24-inch drop).

Table 3–13: Certifications and compliances

Category	Standards or description	
EC Declaration of Conformity – EMC [1]	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Union:	
	EN 55011	Class A Radiated and Conducted Emissions
	EN 50082-1 Immunity:	
	IEC 801-2	Electrostatic Discharge Immunity
	IEC 801-3	RF Electromagnetic Field Immunity
	IEC 801-4	Electrical Fast Transient/Burst Immunity
	IEC 801-5	Power Line Surge Immunity
	[1] High-quality shielded cables must be used to ensure compliance to the above listed standards.	
FCC Compliance	Emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits.	
Installation (Overvoltage) Category	Terminals on this product may have different installation (overvoltage) category designations. The installation categories are:	
	CAT III	Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location.
	CAT II	Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected.
	CAT I	Secondary (signal level) or battery operated circuits of electronic equipment.
Pollution Degree	A measure of the contaminates that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.	
	Pollution Degree 1	No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.
	Pollution Degree 2	Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.
	Pollution Degree 3	Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.
	Pollution Degree 4	Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.
Safety Standards		
U.S. Nationally Recognized Testing Laboratory Listing	UL1244	Standard for electrical and electronic measuring and test equipment.
Canadian Certification	CAN/CSA C22.2 No. 231	CSA safety requirements for electrical and electronic measuring and test equipment.

Table 3–13: Certifications and compliances (cont.)

Category	Standards or description	
European Union Compliance	Low Voltage Directive 73/23/EEC, amended by 93/69/EEC	
	EN 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use.
Additional Compliance	IEC61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use.
Safety Certification Compliance		
Temperature, operating	+5 to +40° C	
Altitude (maximum operating)	2000 meters	
Equipment Type	Test and measuring	
Safety Class	Class 1 (as defined in IEC 1010-1, Annex H) – grounded product	
Overvoltage Category	Overvoltage Category II (as defined in IEC 1010-1, Annex J)	
Pollution Degree	Pollution Degree 2 (as defined in IEC 1010-1). Note: Rated for indoor use only.	

WARNING

The following servicing instructions are for use only by qualified personnel. To avoid injury, do not perform any servicing other than that stated in the operating instructions unless you are qualified to do so. Refer to all Safety Summaries before performing any service.

Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

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

Disconnect Power. To avoid electric shock, switch off the instrument power, then disconnect the power cord from the mains power.

Use Care When Servicing With Power On. Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

SECTION 4
INSTALLATION

PACKAGING

At installation time, save the shipping carton and packaging materials for repackaging in case reshipment becomes necessary. See Fig. 4-1.

ELECTRICAL INSTALLATION

Power Supply Frequency and Voltage Ranges

The power supply in this instrument operates over a line frequency range of 48 to 62 Hz and is set (by jumper P810) to receive a nominal line voltage of 110 V. Its installed line fuse is rated for 250 V and 2 Amps. To set the power supply to receive a nominal line voltage of 220 V, move P810 as shown in Table 4-5 and replace the line fuse with one rated for 250 V and 1 Amp.

MECHANICAL INSTALLATION

Rack Mounting

The TSG–170D is shipped with hardware for rackmounting. The instrument fits in a standard 19-inch rack. Spacing between the front rails of the rack must be at least 17–3/4 inches to allow clearance for the slide-out tracks.

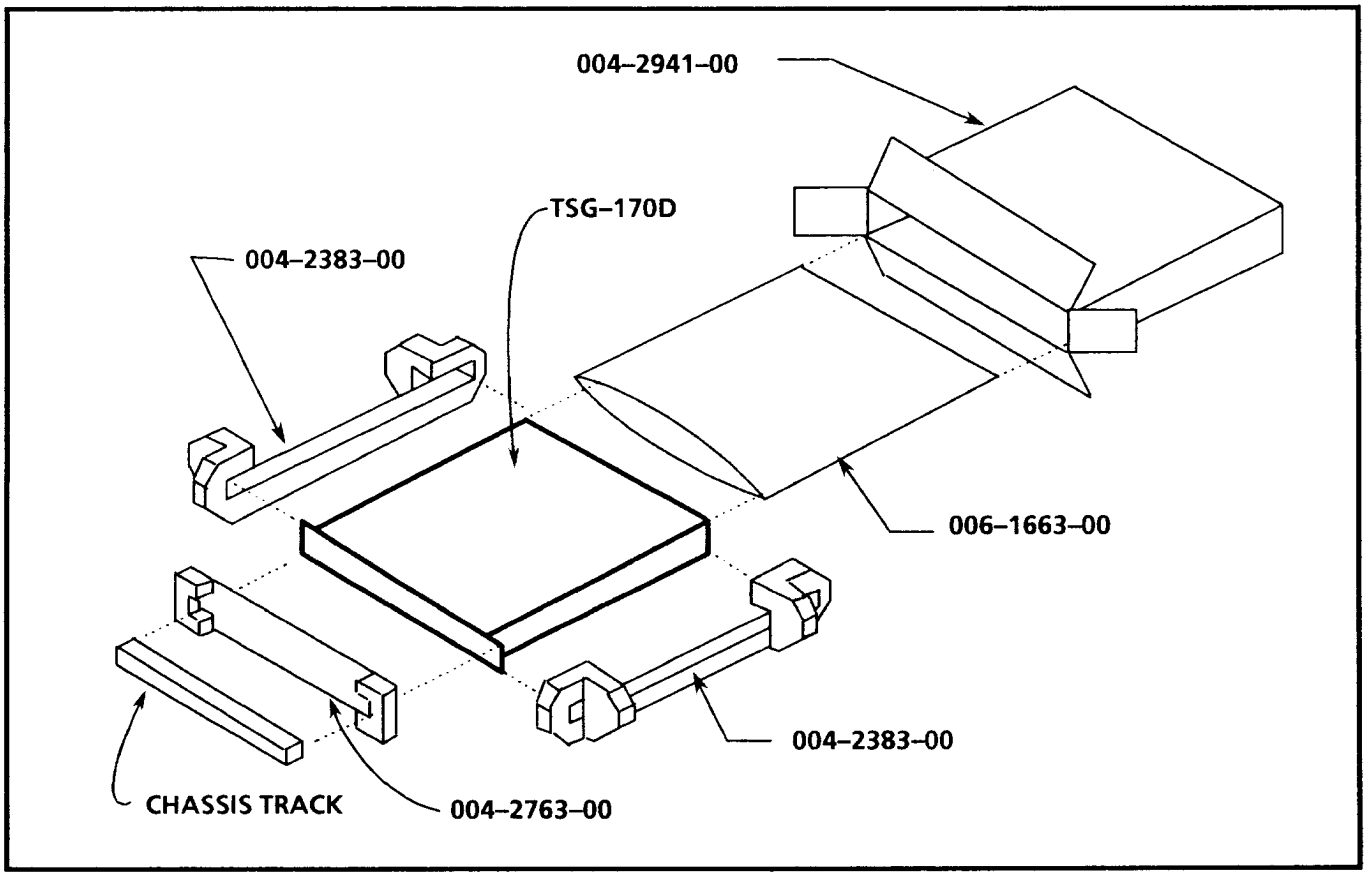


Fig. 4-1. Repacking Instructions.

Rack slides conveniently mount in any rack that has a front-to-rear rail spacing between 15–1/2 and 28 inches. Six inches of clearance between the instrument's rear panel and any rear cabinet panel is required for connector space and to provide adequate air circulation.

Mounting the Slide Tracks

Locate the proper rack holes as shown in Fig. 4-2. Notice that the hole spacing varies with the type of rack. When installing the slides in EIA-type racks, make certain that the slides are attached to the 1/2–inch-spaced holes.

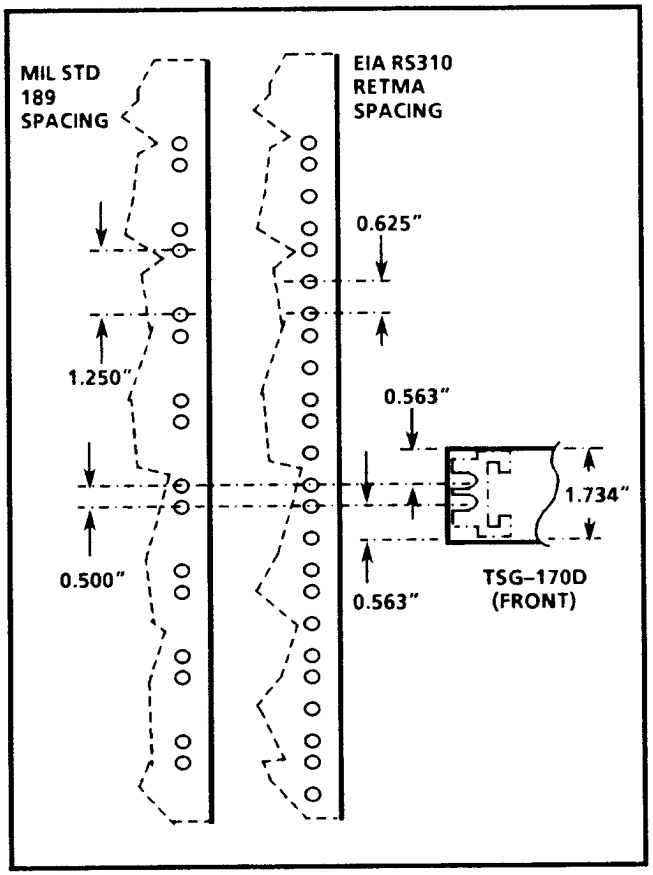


Fig. 4-2. Rail detail for mounting slide tracks.

Mount the rails using enclosed hardware as shown in Fig. 4-3. Fig. 4-4 shows the rail mounting details for both deep and shallow racks. Make sure the stationary sections are horizontally aligned and are level and parallel.

Installing the Instrument

Install the instrument in the rack, as shown in Fig. 4-5. Table 4-1 lists the signals available at the rear-panel connectors.

Rack Adjustments

After installation, the slide tracks may bind if they are not properly adjusted. To adjust the tracks, slide the instrument out about 10 inches, slightly loosen the screws holding the tracks to the front rails, and allow the tracks to seek an unbound position. Retighten the screws and check the tracks for smooth operation by sliding the instrument in and out of the rack several times.

Once the instrument is in place within the rack, tighten the knurled retaining screw to fasten it securely into the rack.

Rack Slide Maintenance

The slide-out tracks do not require lubrication. The dark gray finish on the tracks is a permanent, lubricated coating.

Removing the Instrument

First, loosen the front-panel knurled retaining screw. See Fig. 4-5. Grasp the front handles and pull the instrument out until all three slide sections latch. The instrument is firmly held in this position.

To completely remove the instrument, press both release-latch buttons (visible in the stop-latch holes) and carefully slide the instrument free from the tracks. Be sure that all cabling is disconnected before removing the instrument.

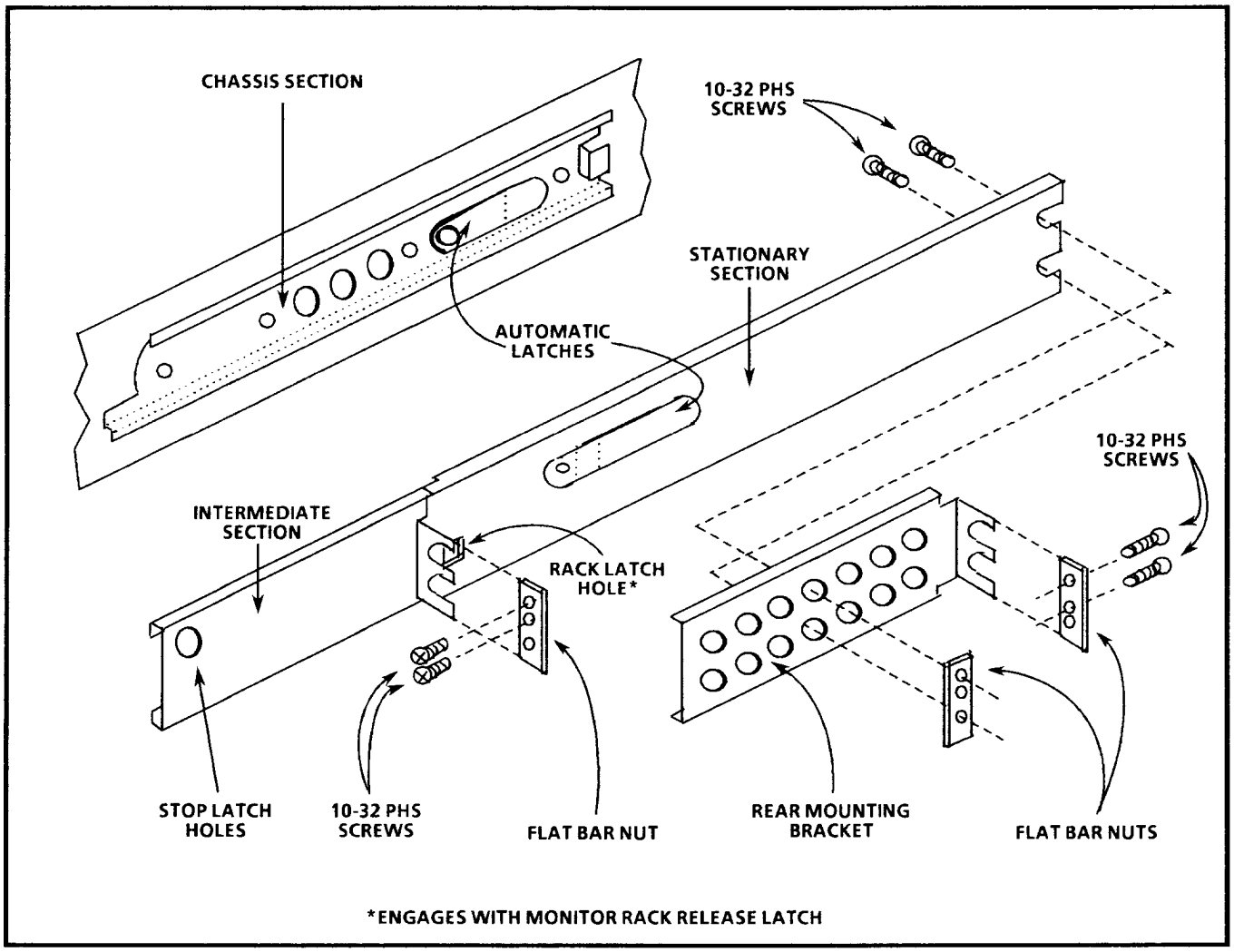


Fig. 4-3. Assembly of rack mounting hardware.

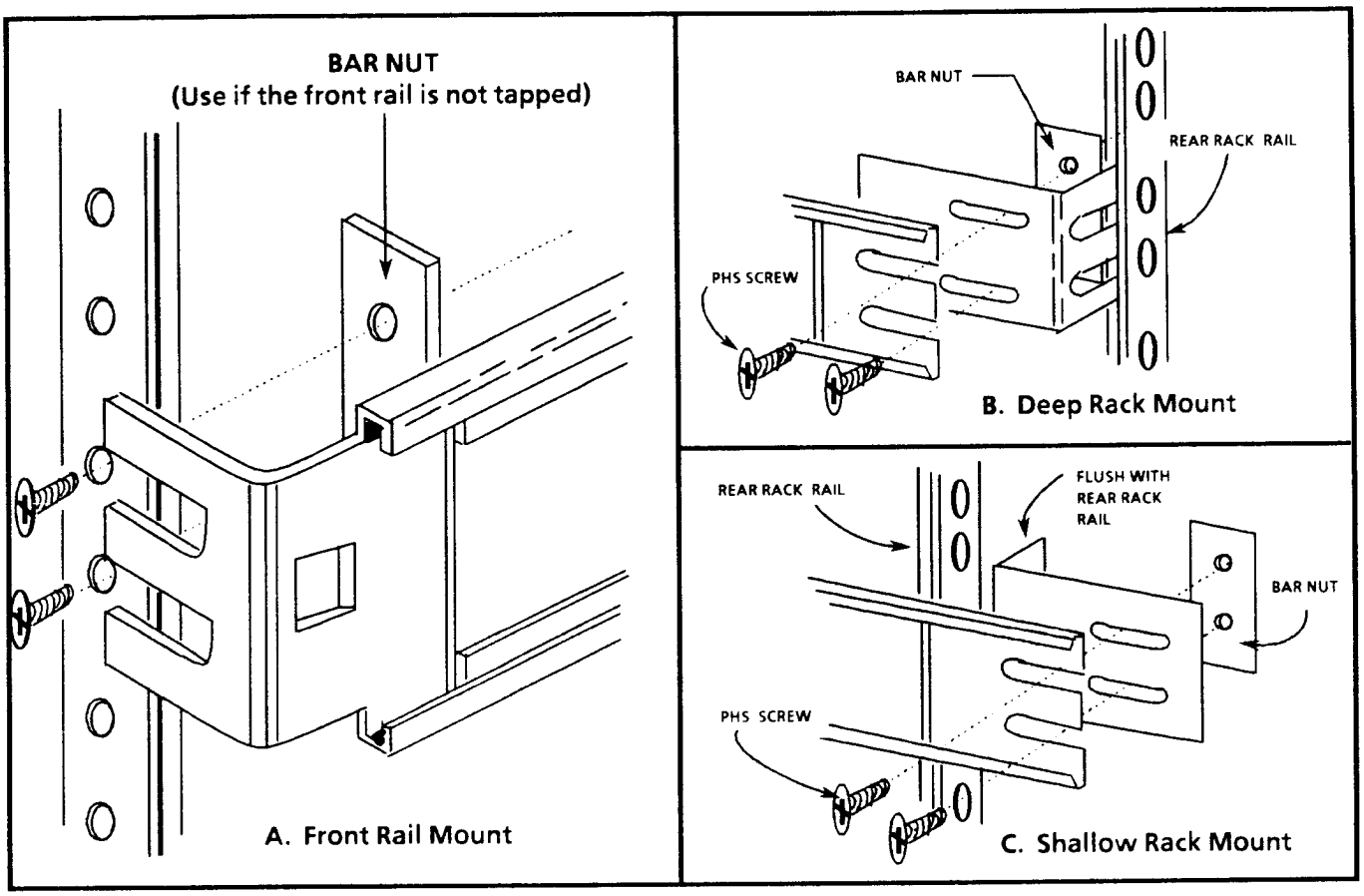


Fig. 4-4. Mounting stationary track sections.

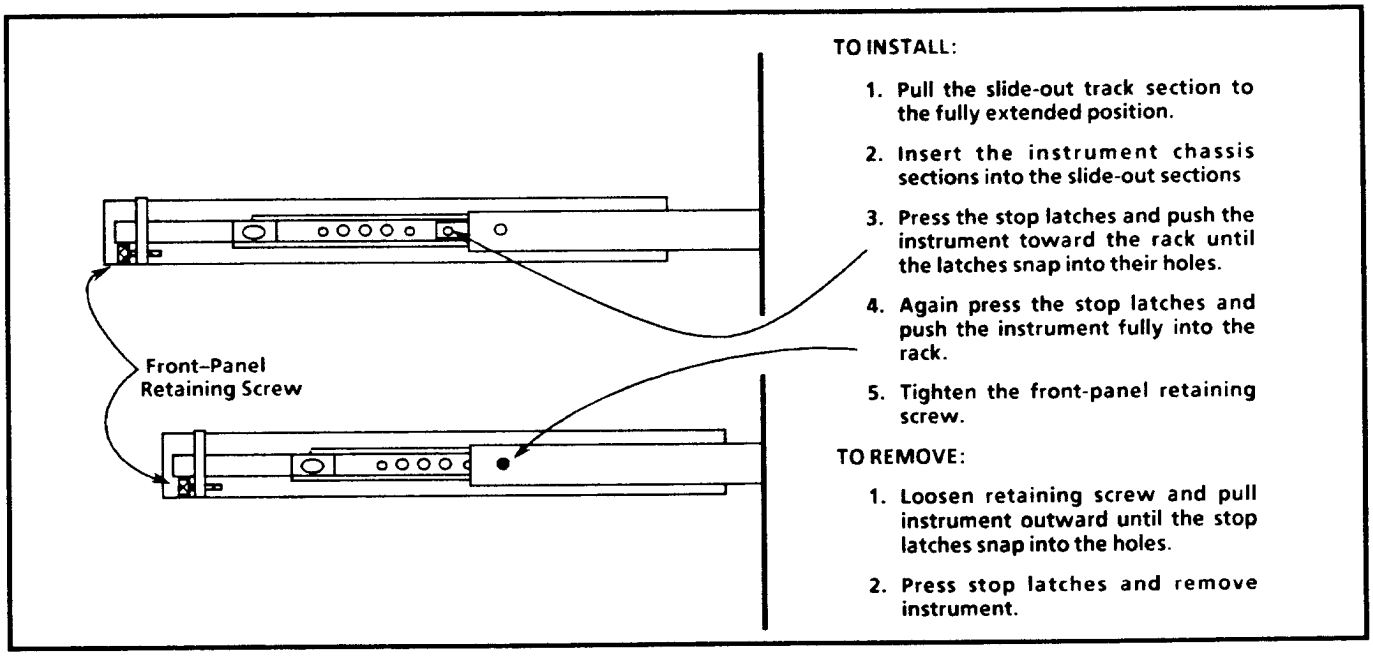


Fig. 4-5. Racking and unracking the TSG-170D.

Jumper Tables

This section gives jumper tables for the entire instrument. In all cases, the ▼ symbol on the circuit boards identifies pin 1. Green jumpers are for selecting operating modes. Red jumpers are for testing the instrument. The red jumpers should only be used by qualified service personnel.

Table 4-1
Output Board (A3) Operating Mode Selection Jumpers

FUNCTION	JUMPER #	DESCRIPTION	FACTORY SET
Video Resolution	J1	Pins 1–2: 10-bit data. Pins 2–3: 8-bit data.	Pins 1–2
Character ID Enable	J8	Pins 1–2: Character ID Enabled. Pins 2–3: Character ID Disabled.	Pins 1–2
Genlock Input Select	J13	Pins 1–2: Dc coupling for Genlock Input. Pins 2–3: Ac coupling for locking to 3.58 MHz CW input.	Pins 1–2
Genlock Input Select	J14	Pins 1–2: Selects correct Input Buffer gain for Composite Video input. Pins 2–3: Selects correct Input Buffer gain for 3.58 MHz CW input.	Pins 1–2
Genlock Input Select	J15	Pins 1–2: Enables Genlock Clamp for Genlock Input. Pins 2–3: Disables Genlock Clamp, for CW Lock.	Pins 1–2
Analog Audio Channel Select	J17, J18	J18 J17 Channel Pins 1–2 Pins 1–2 0 Pins 1–2 Pins 2–3 1 Pins 2–3 Pins 1–2 2 Pins 2–3 Pins 2–3 3	Pins 1–2
1000/800 Hz Select	J19	Pins 1–2: 800 Hz. Pins 2–3: 1000 Hz.	Pins 1–2
Audio Disable	J21	Pins 1–2: Audio Enabled. Pins 2–3: Audio Disabled.	Pins 1–2

Table 4-2
Output Board (A3) Test Mode Selection Jumpers

FUNCTION	JUMPER #	DESCRIPTION	FACTORY SET
Test Signal Disable	J2	Pins 1–2: Enables test signal at TEST SIGNAL connector. Pins 2–3: Disables test signal at TEST SIGNAL connector to allow testing of return loss.	Pins 1–2
Genlock Input Clamp Disable	J16	Pins 1–2: Enables Genlock Clamp for Genlock Input Pins 2–3: Disables Genlock Clamp.	Pins 1–2
Bit Diddler Enable	J22	Pins 1–2: Enabled. Pins 2–3: Disabled.	Pins 1–2

Table 4-3
Digital Board (A2) Operating Mode Selection Jumpers

FUNCTION	JUMPER #	DESCRIPTION	FACTORY SET
Spare	J211	Pins 1–2: For future use. Pins 2–3: For future use.	Pins 1–2
Disable Genlock/Sync Timing Modes	J210	Pins 1–2: Enables full front-panel operation. Pins 2–3: Enables only Select Test Signal and Set ID modes.	Pins 1–2
Genlock Input Select	J407, J408	J407 J408 Pins 1–2 1–2: Allows μP to lock to composite video. Pins 1–2 2–3: For future use. Pins 2–3 1–2: For future use. Pins 2–3 2–3: Allows μP to lock to 3.58 MHz CW.	Pins 1–2, 1–2
Vertical Timing	J881, J882	J881 J882 Timing Pins 1–2 Pins 1–2: No delay. Pins 1–2 Pins 2–3: 1 line delay. Pins 2–3 Pins 1–2: 2 lines advance. Pins 2–3 Pins 2–3: 1 line advance.	Pins 1–2, 1–2

Table 4-4
Digital Board (A2) Test Jumpers

FUNCTION	JUMPER #	DESCRIPTION	FACTORY SET
VCO Test See visual aid below*.	J180	Pins 1–3: Sets VCO control voltage to mid-range (ground) so VCO can be tuned to 4Fsc with C19. Pins 2–3: μP controls genlock loop response. Pins 4–3: Fixed test voltage (–10 V) increases VCO frequency. Pins 5–3: Fixed test voltage (+ 10 V) decreases VCO frequency.	Pins 2–3
Hard Reset See visual aid below**.	J425	Pins 1–2: Enables $\overline{\text{HARD RESET}}$ signal. Pins 2–3: Forces $\overline{\text{HARD RESET}}$. Pins 3–4: Disables $\overline{\text{HARD RESET}}$ signal.	Pins 1–2
Manual Reset	J122	Pins 1–2: Normal operation. Pins 2–3: Reset μP.† †J425 must be in its 1–2 position.	Pins 1–2
Field Reference Disable	J767	Pins 1–2: Enables FLD REF signal to provide a genlocked field reference (field 3, line 10) pulse to the timing circuits. Pins 2–3: Disables FLD REF signal from providing a genlocked field reference (field 3, line 10) pulse to the timing circuits.	Pins 1–2
Crystal Oven Heater	J396	Pins 1–2: Oven heater operating. Pins 2–3: Oven heater disabled.	Pins 1–2

*Visual aid for P180.

**Visual aid for P425

Table 4-5
Power Supply Board (A4) Operating Mode Selection Jumpers

FUNCTION	JUMPER #	DESCRIPTION	FACTORY SET
115 V/230 V Line Voltage Select	J810	Pin 1 aligned with 115 V: Power Supply accepts 115 V line voltage. Fuse rating must be 2 A, medium blow. Pin 1 aligned with 230 V: Power Supply accepts 230 V line voltage. Fuse rating must be 1 A, medium blow.	115 V

Table 4-6
Power Supply Board (A4) Test Jumpers

FUNCTION	JUMPER #	DESCRIPTION	FACTORY SET
Primary Enable	J556	Jacks 1 and 2 shorted: Normal operation Jacks 1 and 2 unshorted: Disconnects 300V supply from T440.	Shorted
Undervoltage Lockout	J660	Jacks 1 and 2 shorted: Normal operation. Jacks 1 and 2 unshorted: Power Supply disabled, cycles through kick start sequence.	Shorted
Current Limit Disable	J720	Jacks 1 and 2 shorted: Normal operation. Jacks 1 and 2 unshorted: Current Limit Disabled.	Shorted

SECTION 5

PERFORMANCE CHECK AND CALIBRATION PROCEDURES

This section gives procedures for checking and calibrating your TSG–170D. They are split into short and long form. Short form procedures provide a quick reference for experienced technicians. The long form procedures give more detailed steps.

Table 5-1 lists the equipment you will need. If you use alternate equipment, make sure it meets the specifications given in this table.

These procedures are designed to be done in sequence. If you do not need to do a full procedure, start at the nearest convenient step that has a setup drawing.

NOTE

After completing each step, immediately return jumpers to their original position.

Table 5-1
Recommended Test Equipment (Including Accessories)

Test Equipment	Minimum Specifications	Equipment Examples
Test Oscilloscope Mainframe	At least 50 MHz bandwidth with dual-trace plug-in and 10X probe.	TEKTRONIX 7603.
Test Oscilloscope Differential Comparator Plug-In	Minimum deflection factor 10 mV/div with 10X probe.	TEKTRONIX 7A13; plugs into 7603 mainframe.
Test Oscilloscope Dual-Trace Amplifier Plug-In	Minimum deflection factor 50 mV/div with 10X probe.	TEKTRONIX 7A26; plugs into 7603 mainframe.
Test Oscilloscope Dual Time Base Plug-In	Sweep rate 5 ns/div to 5 μs/div.	TEKTRONIX 7B53A; plugs into 7603 mainframe.
Spectrum Analyzer	Capable of measuring to at least 5 MHz.	TEKTRONIX 7L12; plugs into TEKTRONIX 7603 mainframe.
Low Pass Filter	5 MHz.	Tektronix Part No. 015-0213-00.
NTSC Waveform Monitor	For displaying and measuring field-rate and line-rate waveforms.	TEKTRONIX 1480 MOD W5F.
NTSC Vectorscope	For measuring differential phase and gain.	TEKTRONIX 520A.
NTSC Test Signal Generator	Provides the following test signals: black burst, flat field, staircase, pulse & bar, manual and continuous sweep, V drive, and subcarrier output. Provides variable subcarrier and sync amplitudes.	TEKTRONIX 1410/SPG2A (Opt AA)/TSP1/TSG3/TSG5/ TSG6.

Table 5-1 (cont.)
Recommended Test Equipment (Including Accessories)

Test Equipment	Minimum Specifications	Equipment Examples
Video Amplitude Calibration Fixture (VAC)	Provides a chopped voltage reference accurate to ±0.05% from 0 to 1 V in 0.1 mV increments. (Used with the TEKTRONIX 1480 MOD W5F Waveform Monitor.)	Tektronix Part No. 067-0916-00. Plugs into a TEKTRONIX TM 5006 Power Mainframe.
Leveled Sine Wave Generator	250 kHz to 5 MHz.	TEKTRONIX SG 503; plugs into TM 5006 Power Mainframe.
Frequency Counter	For measuring subcarrier frequency. Accurate to within 2-1/2 Hz out of 5 MHz.	TEKTRONIX DC 503A; plugs into TM 5006 Power Mainframe.
Peak-to-Peak Detector Amplifier with Detector Head	Facilitates differential frequency-response measurements. Provides a high-impedance load and bias for the 015-0413-00 Detector Head.	Tektronix Part No. 015-0408-00. (Includes one Detector Head, Tektronix Part No. 015-0413-00.) Detector Amplifier plugs into the TM 5006 mainframe.
Return Loss Bridge	At least 54 dB, dc to 10 MHz; 75Ω inputs.	Tektronix Part No. 015-0149-00.
Low Loss Coaxial Cable (Qty 4)	Belden 8281 video cable. Impedance, 75Ω; length, 6 feet[a]. Equipped with bnc connectors.	Tektronix Part No. 012-0159-01.
RG59/U Coaxial Cables (Qty 2)	Impedance, 75Ω; length, 42 inches. Equipped with bnc connectors.	Tektronix Part No. 012-0074-00.
End-Line Termination (Qty 3)	Impedance, 75Ω. Equipped with bnc connectors.	Tektronix Part No. 011-0102-00.
Feed-Through Termination (Qty 2)	Impedance, 75Ω. Equipped with bnc connectors.	Tektronix Part No. 011-0103-02.
Jumper-Type Termination	Impedance 75Ω. (Two-pin connector with a 75Ω, 1%, 1/8 W resistor installed.)	Tektronix Part No. 119-1158-00.
50Ω to 75Ω Minimum Loss Attenuator	Equipped with bnc connectors.	Tektronix Part No. 011-0057-00.
DC Block	None.	Tektronix Part No. 015-0221-00.
BNC Female-to-BNC Female Adapter	None.	Tektronix Part No. 103-0028-00.
50Ω Coaxial Cable	Length, 42 inches. Equipped with bnc connectors. For use with the spectrum analyzer and SG 503.	Tektronix Part No. 012-0057-01.

[a]Six-foot length was used to interconnect the test equipment. If 42-inch length is preferred, the Tektronix Part No. is 012-0159-00.

Table 5-1 (cont.)
Recommended Test Equipment (Including Accessories)

Test Equipment	Minimum Specifications	Equipment Examples
Distortion Analyzer	Must test to at least 0.01% THD and test power output over range of 0 to 8 dBm.	TEKTRONIX AA501A.
Audio Connector-to-Triple Banana Cable	None.	ITT Pomona Electronics, Model 4953-J-36. Must be reconfigured to match the TSG–170D audio output. Pin 1: Shield, pin 2: +, pin 3: —.
Digital Video Probe	Capable of converting up to 10 bits of digital data, at rates up to 50 MHz, to video output.	TEKTRONIX DP–100.
Digital Output Termination Fixture	110Ω terminations for the Digital Outputs, mounted on a 25-pin D connector.	See Fig. 5-1.

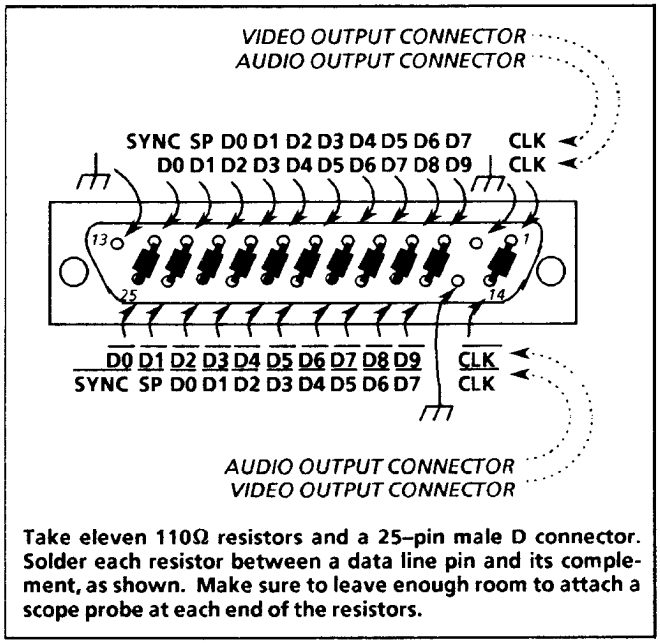


Fig. 5-1. Digital Output Termination fixture.

SHORT FORM PERFORMANCE CHECK PROCEDURE

PRELIMINARY CHECKS

1. Check Power Supply Voltages and Ripple

   +5V ±100 mV, –5 V ±300 mV, +12 V ±300 mV, –12 V ±300 mV.

   Ripple ≤ 50 mV on each supply

2. Check Oscillator Frequency

   14.318180 MHz ±2.0 Hz.

3. Check Front Panel

   All LEDs and push buttons.

ANALOG DC LEVEL AND GAIN

4. Check DC Level

   Analog Test Signal Blanking 0 V ±50 mV.
   Black Burst Blanking 0 V ±50 mV.

5. Check Output Gain

Luminance Ramp Amplitude	714.3 mV ±7.14 mV
Burst Amplitude	285.7 mV ± 5.7 mV
Sync Amplitude	285.7 mV ± 5.7 mV
Black Burst Sync Amplitude	285.7 mV ± 5.7 mV
Burst Amplitude	285.7 mV ± 5.7 mV
Setup Amplitude	53.6 mV ±5 mV

ANALOG FREQUENCY RESPONSE

6. Check Frequency Response

   Line Sweep Flat ±7.1 mV to 4 MHz
   ±14.2 mV to 14.2 MHz

7. Check 5-Step Staircase Linearity

   ≤7.14 mV.

8. Check Pulse-to-Bar Ratio

   100% ±3.5 mV.

9. Check Group Delay

   100 IRE 25T pulse should be ±3.5 mV p-p or less at the base. 100 IRE 12.5T pulse should be ±7.0 mV p-p or less.

10. Check Ringing

    ≤7.1 mV.

11. Check Line Tilt

    ±3.5 mV.

12. Check Field Tilt

    ±3.5 mV.

13. Check Differential Gain and Phase

    0.6% or less; 0.3° or less.

14. Check Chrominance-to-Luminance Gain

    ±10 mV.

15. Check Phase Matching

    ±2°.

COMPOSITE VIDEO LOCK

16. Check Lock Acquisition

    ≤5 seconds.

17. Video Lock Jitter

    ≤5°.

18. Genlock Range

    ≤5° for ±20 Hz change in incoming subcarrier.

19. Check Phase Change With Incoming Burst Amplitude Change

    ≤1°, 40 IRE +1 dB, –6 dB.

20. Check Phase Change With Incoming Signal Amplitude Change

    ≤1°, 0 dB, –3 dB, and –6 dB.

21. Check Phase Shift With Incoming APL Change

    ≤1°, 10% to 90% APL.

SYNC LOCK

22. Lock Acquisition

    ≤5 seconds.

23. Sync Lock Jitter

    ≤2.5°.

24. Phase Change With Incoming Signal Amplitude Change

    ≤1°, 0 dB, –3 dB, and –6 dB

CW LOCK

25. Acquisition

    ≤5 seconds.

26. Check Subcarrier Amplitude

    Approximately 800 mV around –0.5 V.

27. Check CW Lock Jitter

    ≤0.5°.

GENLOCK TIMING

28. Check Genlock Timing Range

    ≥8 μs advance and delay.

OUTPUTS

29. Digital Video Clock Amplitude Rise & Fall Time

    0.8 V – 2.0 V p-p, ≤5 ns 20% to 80%.

30. Check Digital Video Clock to Data Timing

    Clock to LSB 35 ns ±2 ns.
    All data transitions ±2 ns.

31. Check Digital Video Output Non-Inverted Data

    No clock errors, minor steps on 10-bit luminance ramp, even steps on 8-bit luminance ramp

32. Check Digital Video Output Inverted Data

    Unfiltered luminance ramp, even steps.

33. Check Parallel Digital Audio Inverted Data

    Sine wave output, 800 Hz/1000 Hz.

34. Check Parallel Digital Audio Non-Inverted Data

    Sine wave output.

35. Check Serial Digital Audio Output Amplitude

    3 V – 10 V p-p.

37. Check Serial Digital Audio Rise & Fall Time

    10 ns – 30 ns, 10% – 90%.

38. Check Analog Audio Tone

    +8 dBu.

RETURN LOSS

39. Check GENLOCK Loop-Through

    At least 40 dB down to 4.2 MHz.

40. Check BLACK BURST Output

    At least 36 dB down to 4.2 MHz.

41. Check TEST SIGNAL Output

    At least 36 dB down to 4.2 MHz.

LONG FORM CHECKOUT PROCEDURE

1. Power Supply Voltages and Ripple

a. Connect power to the TSG–170D through the Variac, and set the Variac for 115 V output.

b. Turn on the TSG–170D, and allow a 20 minute warm-up period.

c. CHECK – that each supply meets the criteria listed in Table 5-2, using the DM501.

Table 5-2
Power Supply Voltage Ranges

Supply	Voltage Range	Location
+5	+5V ± 100 mV	+5V TP
–5	–5.2V ± 300 mV	–5V TP
+12	12V ± 300 mV	CR169 Cathode
–12	–12V ± 300 mV	CR269 Anode

d. CHECK – that there is less than 50 mV ripple on each of the supplies, using the test oscilloscope. Set the bandwidth on the vertical to 5 MHz to make this check.

e. Set the Variac to 90 Vac output.

f. Turn the TSG–170D power switch off.

g. Turn the TSG–170D power switch back on and check for a normal power-up.

2. Oscillator Frequency

a. Connect the equipment as in Fig. 5-2. Use a X1 probe from the DC503 CH B input to pin 4 of U841, on the TSG–170D Output board.

b. Set the DC503A as follows:

Function	Ratio A/B
Avg	10^6

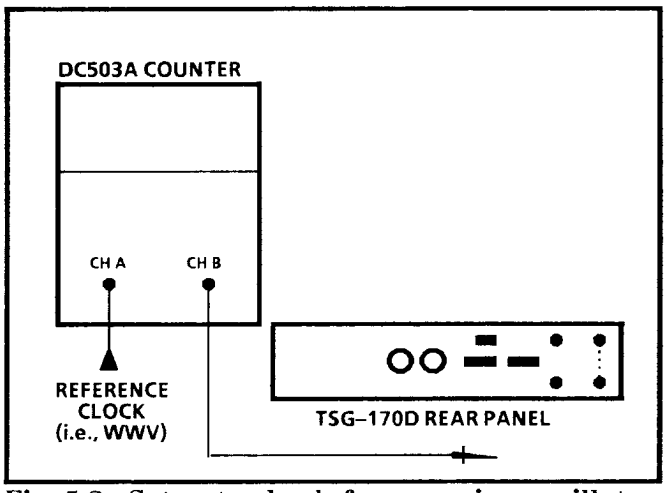


Fig. 5-2. Setup to check free-running oscillator frequency.

c. Make sure that J180 is on pins 2–3.

d. CHECK – that the oscillator frequency is 14.318180 MHz ±2.0 Hz.

3. Front-Panel Operation

a. Set S407 to 000000 (all switch segments closed).

b. Turn the TSG–170D off and back on.

c. CHECK – that all front-panel LEDs are flashing on and off.

d. Set S407 to 111111 (all switch segments open), and turn the TSG–170D off and back on.

e. Connect the equipment as shown in Fig. 5-3.

f. Set Sync to Internal on the 1485, 520, and 655HR–1. Set the 520 Φ Ref control to Burst.

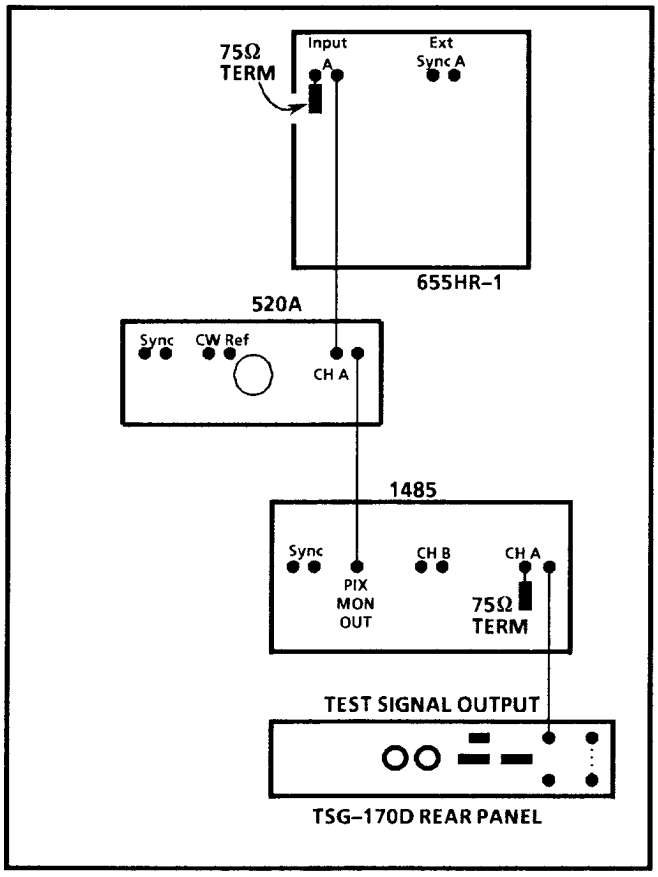


Fig. 5-3. Setup to check front panel operation.

g. CHECK – that as each of the Test Signal push buttons is depressed:

The push-button operates properly,
The LED over that button lights, and
The correct test signal is output.

h. Depress the MODE SELECT switch once, until the red SET IDENTIFICATION LED lights.

i. CHECK – that the red CURSOR/CHAR LED is lit.

j. Depress the MODE SELECT switch once, until the red SET GENLOCK TIMING LED lights.

k. CHECK – that the red ADVANCE/DELAY LED is lit.

4. Check DC Level

a. Connect the equipment as shown in Fig. 5-4.

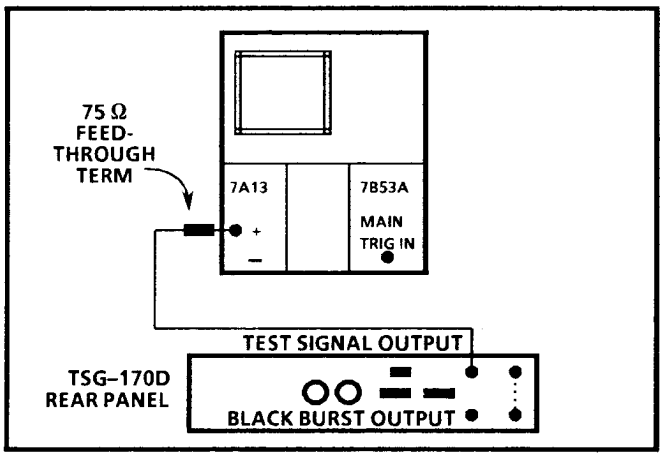


Fig. 5-4. Setup to check dc level of TEST SIGNAL output.

b. Set the following controls:

Oscilloscope			
Vertical		**Time Base**	
Volts/Div	50 mV	Slope	—
Coupling	DC	Mode	Auto
Display Mode	Ch 1	Coupling	AC
Trigger Source	Ch 1	Time/Div	10 μs
BW	Full	Mag	X1

c. CHECK – for a Test Signal blanking level of 0 V ±50 mV.

d. Move the cable from the TEST SIGNAL output to the BLACK BURST output on the TSG–170D.

e. CHECK – that the Black Burst blanking level is 0 V ±50 mV.

5. Output Gain

a. Connect the equipment as shown in Fig. 5-5. Use low loss 75Ω coax for the VAC connection.

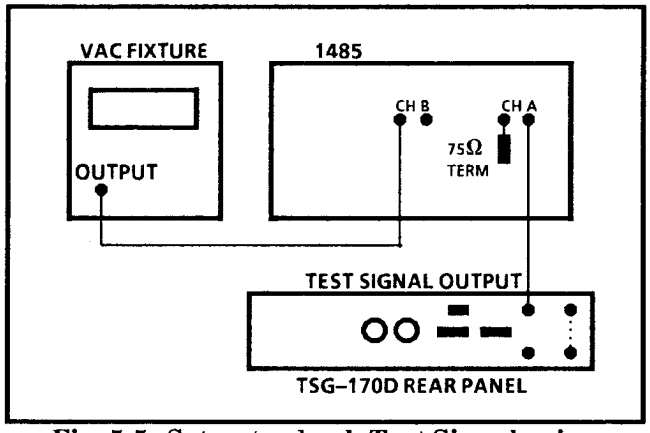


Fig. 5-5. Setup to check Test Signal gain.

b. Set the following controls:

1485		VAC	
Input	A–B (DC)	Output	714.3 mV
Response	Flat		
Volts Full Scale	1.0		
DC Restorer	Off		
Oper/Cal	Oper		
Sync	Int, Direct		
Display	10 μs		
Mag	X1		

c. Select the Luminance Ramp signal at the TSG–170D front panel.

d. CHECK – that the luminance amplitude is 714.3 mV (100 IRE) ±7.1 mV.

e. Change the 1485 to 0.2 Volts Full Scale, and the VAC output to 285.7 mV.

f. CHECK – for 285.7 mV ±5.7 mV of burst on the TEST SIGNAL output.

g. CHECK – for 285.7 mV ±5.7 mV of sync on the TEST SIGNAL output.

h. Move the cable from the TEST SIGNAL output to the BLACK BURST output on the TSG–170D.

i. CHECK – for a Black Burst Sync amplitude of 285.7 mV (40 IRE) ±5.7 mV.

j. CHECK – for a Black Burst amplitude of 285.7 mV ±5.7 mV.

k. Change the VAC Output to 53.6 mV.

l. CHECK – for a setup level of 53.6 mV (7.5 IRE) ±5 mV on the Black Burst signal.

ANALOG VIDEO RESPONSE

6. Frequency Response

a. Move the coax from the BLACK BURST output to the TEST SIGNAL output.

b. Set the VAC output to 714.3 mV.

c. Select Line Sweep with the OTHER SIGNALS push button.

d. CHECK – that the Line Sweep waveform is flat ±7.1 mV to 4 MHz, ±14.2 mV to 4.2 MHz.

e. Select the Multipulse signal, using the OTHER SIGNALS push button.

f. Set the VAC output to 000.0 mV.

g. CHECK – that the bottom of the 25T pulse is flat ±3.5 mV, and that the 12.5T pulses are flat ±7.0 mV.

7. 5-Step Staircase Linearity

a. Change the 1485 controls as follows:

Input	A(DC)
Response	Diff'd Step
Display	5 μs

b. Select the 5-Step Staircase signal on the TSG–170D front panel.

c. Use the Variable Volts Full Scale control on the 1485 to adjust the Differentiated Steps display to full scale (140 IRE/1.0 V).

d. CHECK – that the difference in relative amplitude of each differentiated step riser (spike) is ≤7.14 mV (1 IRE).

8. Pulse-to-Bar Ratio

a. Change the 1485 controls as follows:

Input	A–B (DC)
Response	Flat
Volts Full Scale	0.2
Magnifier	X20

b. Select the Mod Pulse and Bar signal from the TSG–170D.

c. CHECK – that the inverted 2T pulse is at the Bar amplitude, ±3.5 mV, using the VAC.

9. Group Delay

a. Select Multipulse from the TSG–170D.

b. Set the 1485 to view the bottom of the pulses.

c. CHECK — that the sine-wave-like envelope at the base of the pulses is no more than 3.6 mV p-to-p (0.5 IRE) for the 25T pulse and no more than 7.1 mV p-to-p (1 IRE) for the 12.5T pulse.

10. Ringing

a. Change the 1485 controls as follows:

Display	10 μs
Magnifier	X5

b. CHECK – for undershoot following the 2T pulse of ≤ 7.1 mV.

11. Line Tilt

a. Attach an external NTSC graticule to the 1485.

b. Use the 1485 controls to align one end of the bar with the Line Distortion (L.D.) section of the NTSC graticule.

c. CHECK – while moving the waveform across the L.D. section of the graticule, that the bar does not tilt by more than ±3.5 mV.

12. Field Tilt

a. Change the 1485 controls as follows:

Display	2–Field
Magnifier	X1

b. Align one end of the top of the first field with the L.D. section of the external graticule.

c. CHECK – while moving the waveform across the L.D. section of the graticule, that the field tilt is not more than ±3.5 mV from one end to the other.

13. Diff Gain and Diff Phase

a. Connect the TSG–170D TEST SIGNAL output to the 520A Channel B input. Terminate the loop-through in 75Ω.

b. Set the following controls:

	520A		
Ch A	Out	Ch B	In
Ch A Φ	Out	Ch B Φ	In
Full Field	In	Φ Ref	Burst
Vector	In	Sync	Int
Calibrated Φ	0		

c. Select the Modulated Ramp signal from the TSG–170D.

d. Use the 520A Ch B Gain control to set the burst vector tip to the outer graticule circle (compass rose), and use the Phase control to set the vector to 180°.

e. Depress the 520A Diff Gain push button.

f. CHECK – that the Diff Gain of the Mod Ramp is ≤0.6% from 0 IRE to 100 IRE.

g. Depress the 520A Diff Phase push button.

h. CHECK – that Diff Phase is ≤0.3°, using the Calibrated Phase control.

14. Chrominance-to-Luminance Gain

a. Connect test equipment as in Fig. 5-6.

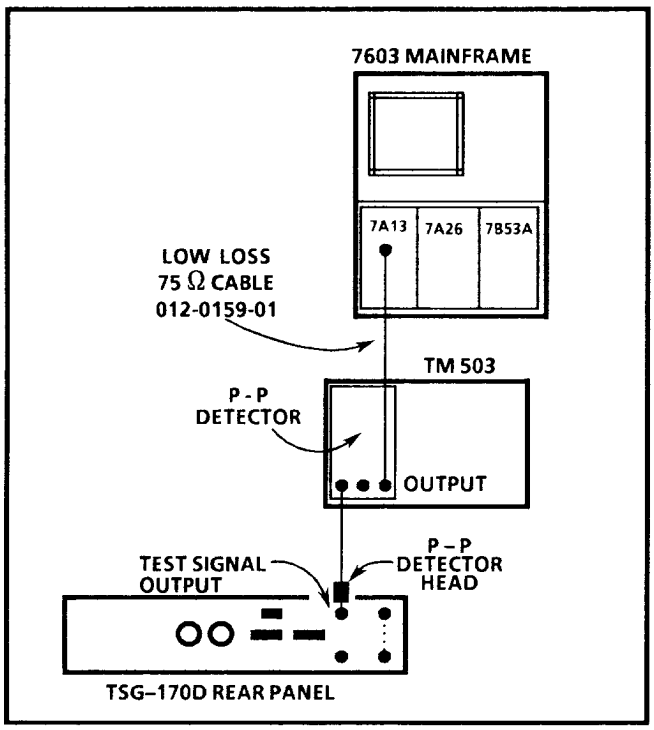


Fig. 5-6. Setup to check TEST SIGNAL output chrominance-to-luminance gain.

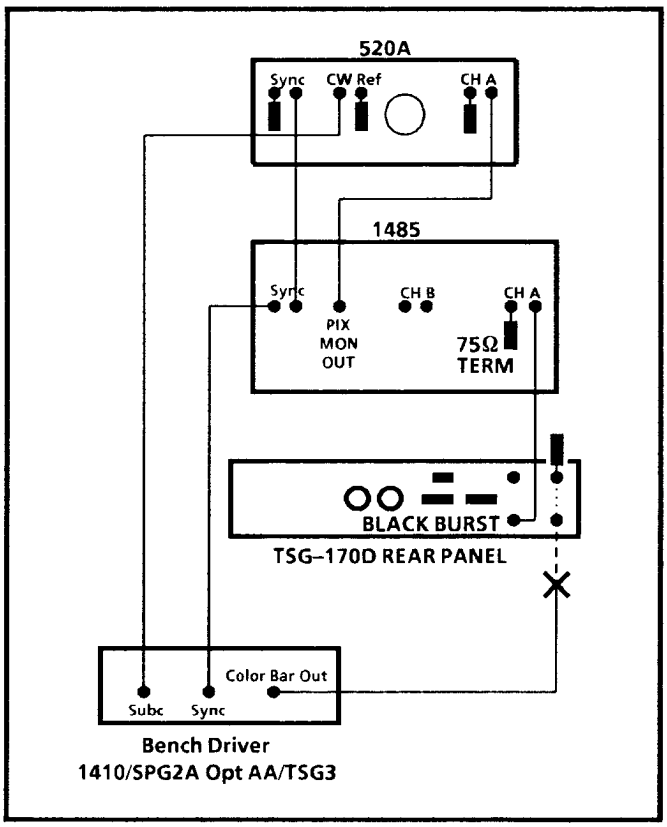


Fig. 5-7. Setup to check Phase Matching.

b. Select the DAC Test signal from the TSG-170D. (To select DAC Test signal, set switch S407 to 011011 (1=OPEN), power down and up, then cycle through the OTHER SIGNALS button until DAC Test is displayed.)

c. Set the 7A13 to view a vertical rate signal at 10 mV/Div, then balance the peak-to-peak detector.

d. CHECK – on the oscilloscope that the chrominance-to-luminance gain (displayed as a square wave on the scope) is no more than ±1% (±10 mV). Typical chrominance-to-luminance gain is approx. ±0.3% (±3.3 mV).

e. Exit Diagnostics mode (close switch 6 of S407, then power down and up).

15. Phase Matching

a. Connect the equipment as shown in Fig. 5-7, Do not make the connection to the TSG-170D GENLOCK input.

b. Set the following controls:

520A		1485	
Ch A	In	Input	A (DC)
AΦ	In	Display	10 μs
Full Field	In		
Φ Ref	Ext		
Vector	In		
Sync	Ext		

c. CHECK – that the 520A display is rotating (not locked).

d. Connect the Video Output from the bench driver to the GENLOCK input on the TSG-170D.

e. CHECK – that the TSG-170D is genlocked (520A display is stable). Use the 520A Gain control to set the burst tip to the outer graticule circle (compass rose), and use the Phase control to set the vector to 180°.

f. Move the coax from the TSG-170D BLACK BURST output to the TEST SIGNAL output. Select Luminance Ramp from the TSG-170D front panel.

g. CHECK - that the TEST SIGNAL output burst phase matches the BLACK BURST output burst phase within 2°, by moving the coax back and forth between the TEST SIGNAL output and the BLACK BURST output.

COMPOSITE VIDEO LOCK

16. Lock Acquisition

a. Connect the equipment as shown in Fig. 5-6. Do not connect the bench driver to the TSG-170D GENLOCK input.

b. Set the following controls:

1485		520A	
Input	A (DC)	Ch A	In
Volts Full Scale	1.0	AΦ	In
Response	Flat	Full Field	In
DC Restorer	Off	Φ Ref	Ext
Display	10 μs	Vector	In
Magnifier	X1	Sync	Ext
Sync	Ext		

c. CHECK - that the 520A Vector display is rotating, and the 1485 is unlocked.

d. Connect the 1410 bench driver color bar output to the TSG-170D GENLOCK input. Use a 75Ω feed-through terminator to terminate the loop-through.

e. CHECK - that both the 520A and the 1485 displays are locked.

17. Video Lock Jitter

a. Select Mod Ramp at the TSG-170D front panel.

b. Connect the TSG-170D TEST SIGNAL output to the 520A Ch B Input, and select Ch B and BΦ on the 520A.

c. Use the 520A Gain control to set the burst tip to the outer graticule circle (compass rose), and use the Phase control to set the vector to 180°.

d. Select Diff Phase on the 520A.

e. CHECK - for jitter of ≤5°.

18. Genlock Range

a. Select a +20 Hz offset at the 1410/SPG2A Mod AA Bench Driver.

b. CHECK - that the TSG-170D re-acquires Genlock, and there has been ≤5° of phase shift.

c. Select a -20 Hz offset at the bench driver.

d. CHECK - that the TSG-170D re-acquires Genlock, and there has been ≤5° of phase shift.

e. Turn off the 20 Hz offset at the bench driver.

19. Phase Change with Incoming Burst Amplitude Change

a. With the SPG2A Opt AA, increase burst amplitude from 40 IRE p-p to 56.5 IRE (+1 dB).

b. CHECK — for ≤1° phase shift.

c. Decrease the burst amplitude from 40 IRE p-p to 20 IRE p-p (-6 dB).

d. CHECK — for ≤1° phase shift.

20. Phase Change with Incoming Signal Amplitude Change

a. Check that the TSG-170D loop-through input is terminated with a 75Ω feed-through terminator. Terminating with one terminator gives a reference of 0 dB.

b. CHECK – that the Differential Phase is ≤1°, using the Calibrated Phase control.

c. Add a second feed-through terminator to the first one. This will reduce the input signal by approximately 3 dB.

d. CHECK – that the Differential Phase is ≤1°, using the Calibrated Phase control.

e. Add a third terminator to the loop-through, reducing the input signal to –6 dB.

f. CHECK – that the Differential Phase is ≤1°, using the Calibrated Phase control.

g. Remove all but one of the terminators from the GENLOCK loop-through input.

h. Return the 520A to Vector mode.

21. Phase Shift with Incoming APL Change

a. Move the cable to the TSG–170D GENLOCK input from the 1410 bench driver Color Bars output to the TSG3 output.

b. Set the TSG3 controls as follows:

IRE/Level /Alt Linearity	AC, Bounce In
90° Subcarrier	Off
180° Subcarrier	Off
Ramp	On

c. Use the 520A Gain control to set the burst tip to the outer graticule circle (compass rose), and use the Phase control to set the vector to 180°.

d. Select Diff Phase on the 520A.

e. CHECK – for ≤1° phase shift with APL change.

f. Select Vector mode on the 520A.

SYNC LOCK

22. Lock Acquisition

a. Connect the 1410 Bench Driver Black Burst output to the TSG–170D GENLOCK input. All other connections remain the same as in Fig. 5-6.

b. Use the 520A Gain control to set the burst tip to the outer graticule circle (compass rose), and use the Phase control to set the vector to 180°.

c. Disable burst at the 1410/SPG2A, by releasing the Internal push button.

d. CHECK – that the TSG–170D remains genlocked to the bench driver. (The Mod Ramp vector will be at either 180° or at 0°.)

e. CHECK – that as the burst is alternately enabled and disabled the Mod Ramp vector always locks in at 180° when the burst is enabled, and locks in at 180° ±20° or at 0° ±20° when the burst is disabled. Cycle the SPG2A Internal switch at least 4 times for this check.

f. Disable burst and disconnect the input cable to the TSG–170D GENLOCK input.

g. Re-connect the cable to the GENLOCK input after approximately 15 seconds.

h. CHECK – that the TSG–170D locks to this sync only input at either 180° ±20° or at 0° ±20°.

23. Sync Lock Jitter

a. Select Diff Phase at the 520A.

b. CHECK – for ≤2.5° of jitter.

24. Phase Change with Incoming Signal Amplitude Change

a. Check that the TSG–170D loop-through input is terminated with a 75Ω feed-through terminator.

b. CHECK – that the Differential Phase is ≤1°, using the Calibrated Phase control.

c. Add a second feed-through terminator to the first one. This will reduce the input signal by approximately 3 dB.

d. CHECK – that the Differential Phase is ≤1°, using the Calibrated Phase control.

e. Add a third terminator to the loop-through, reducing the input signal to –6 dB.

f. CHECK – that the Differential Phase is ≤1°, using the Calibrated Phase control.

g. Remove all but one of the terminators from the GENLOCK loop-through input.

h. Return the 520A to Vector mode.

CW LOCK

25. CW Lock Acquisition

a. Move J407 and J408 (on the Digital board) to their pins 2–3 positions. Move J13, J14, and J15 (on the Output board) to their pins 2–3 positions.

b. Cycle the TSG–170D power off and on.

c. Select Red Field signal at the TSG–170D front panel.

d. CHECK – that the vector display on the 520A is unlocked (rotating).

e. Connect the Subcarrier output from the 1410 Bench Driver to the TSG–170D GENLOCK input.

f. CHECK – that the vector display on the 520A is now locked.

26. Subcarrier Amplitude

a. Connect a X10 probe from the oscilloscope to TP913 on the Digital board.

b. Set the oscilloscope vertical to 200 mV/Div, DC coupled, with the 20 MHz filter enabled. Set the oscilloscope horizontal to 100 ns/Div, AC coupled, and internally triggered.

c. CHECK – that the positive peaks of the subcarrier waveform at TP913 are below 0 Vdc. Typically these peaks are at approximately –100 mV.

d. CHECK – that the amplitude of the subcarrier waveform at TP913 is approximately 800 mV.

27. CW Lock Jitter

a. Set the Red Field burst vector tip to the outer graticule circle (compass rose), and use the 520A Ch A Phase control to set the vector to 180°.

b. CHECK – for jitter on the vector display of ≤0.5°.

c. Return J407 and J408 (on the Digital board) and J13, J14, and J15 (on the Output board) to their pins 1–2 positions.

d. Remove the Subcarrier input from the TSG–170D GENLOCK input.

e. Cycle the TSG–170D power off and on.

28. Genlock Timing Range

a. Connect test equipment as in Fig. 5-8.

b. Set the oscilloscope to display both the TSG–170D MOD RAMP output and the Black Burst Genlock Source at 10 μs/Div. (Use Channel 1 as trigger source.)

c. At the TSG–170D front panel, advance and delay the TEST SIGNAL output as far as it will go (with the coarse genlock timing buttons) in either direction.

d. CHECK – that the test signal advances and delays at least 8 μs with respect to the reference (Black Burst) signal.

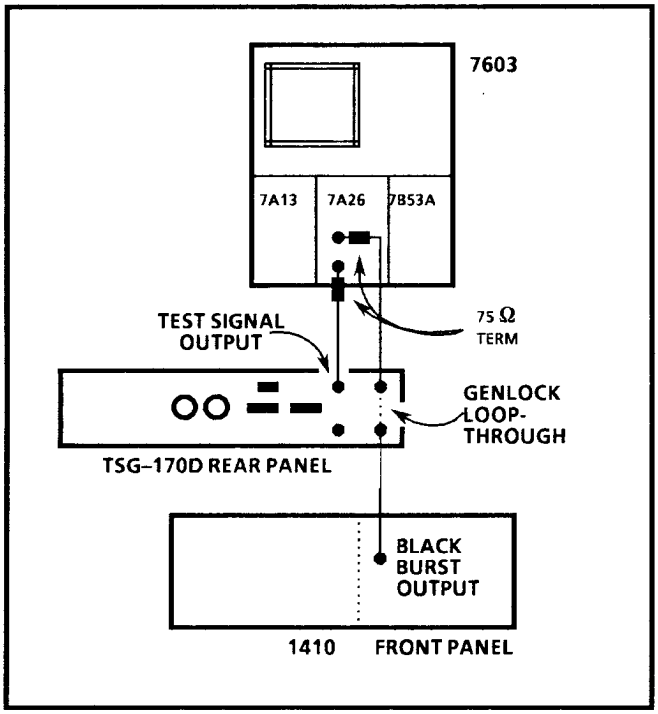


Fig. 5-8. Setup to test Genlock timing range.

29. Audio Tone

a. Connect the equipment as in Fig. 5-9.

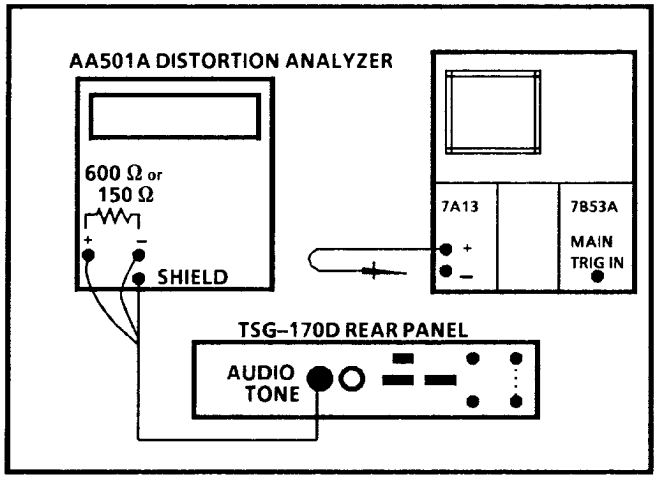


Fig. 5-9. Setup to check AUDIO output level.

b. Connect the scope probe to pin 2 of J12.

c. Set the following controls:

Oscilloscope

Vertical (7A13)		Time Base(7B53A)	
+ Input	DC	Slope	—
- Input	GND	Mode	Auto
Volts/Div	200 mV	Coupling	AC
BW	5 MHz	Source	Int
		Time/Div	200 μs
		Mag	X1

AA501A

Input Level Range	Auto range
dBm Switch	In
Level Switch	In
All Filter Switches	Out
Response	RMS

d. CHECK – that the period of the sine wave at J12–2 is approximately 1.24 ms (800 Hz) when J19 is on pins 1–2, and that the period is approximately 1 ms (1000 Hz) when J19 is on pins 2–3.

e. SET – J19 for the desired output frequency (factory setting is 800 Hz).

f. Attach a load resistor (either 150Ω or 600Ω, to represent the load of your system) across the AA501A Audio Input pins.

g. CHECK – for the desired dB output (factory setting is +8 dBm).

30. Digital Video Clock Amplitude, Rise, and Fall Times

a. Connect the Digital Output Termination Fixture (see Fig. 5-10) to the DIGITAL VIDEO output.

b. Connect a X10 probe from the oscilloscope + input to the CLK connection on the Termination Fixture, and another X10 probe from the – input to the $\overline{\text{CLK}}$ connection. Make sure to ground each of the probes.

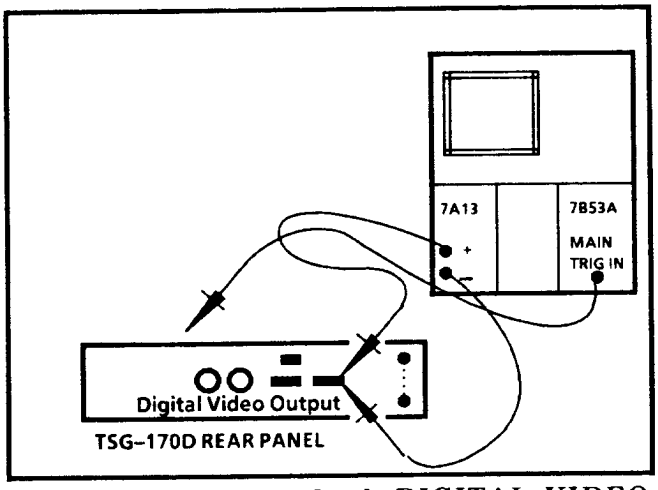


Fig. 5-10. Setup to check DIGITAL VIDEO Clock Output.

b. Center the CLOCK waveform vertically, and set the midpoint of its rising edge at a convenient reference at the right side of the screen.

c. Move the scope probes to the LSB connections, pins 12 and 25.

d. CHECK – that the LSB Data crossover point follows the CLOCK rising edge by 35 ns ± 2 ns.

e. CHECK – that the crossover points for the remaining Data pairs occur at the same time as the LSB crossover point, ±2 ns.

c. Set the following controls:

Oscilloscope			
Vertical (7A13)		**Time Base(7B53A)**	
+ Input	DC	Slope	—
– Input	DC	Mode	Auto
Volts/Div	200 mV	Coupling	AC
BW	Full	Source	Ext
		Time/Div	50 ns
		Mag	X10

d. Trigger the oscilloscope from U841–4.

e. CHECK – that the waveform amplitude is between 0.8 V p-to-p and 2.0 V p-to-p.

f. Use the oscilloscope Vertical Var control to adjust the waveform for a display that is five divisions in height.

g. CHECK – that the waveform rise and fall times are ≤5 ns, measured between 20% and 80%.

h. Return the Volts/Div Var control to its Cal position.

31. Check Digital Video Clock to Data Timing

a. Select the Luminance Ramp signal at the TSG–170D.

32. Check Digital Video Output Non-Inverted Data

a. Connect the DP–100 to the DIGITAL VIDEO output non-inverted Data and Clock lines, using a blank 25-pin D connector. Connect the DP–100 Video Output to the 1485 Ch A input, using low-loss 75Ω coax. See Fig. 5-11.

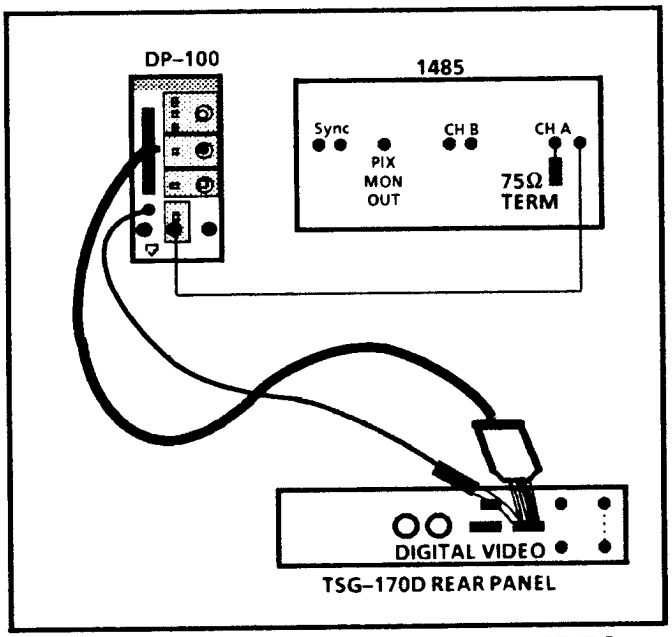


Fig. 5-11. Setup to check DIGITAL VIDEO.

b. Set the following controls:

DP-100		1485	
Data		Input	A (DC)
Inv/Norm	Norm	Response	Flat
2 Comp/Binary	Binary	VFS	1.0
ECL/TTL	ECL	DC Restorer	Off
Threshold	Cal	Oper/Cal	Oper
Clock Phase		Sync	Int
Inv/Norm	Norm	Display	10 μs
Filter		Magnifier	X1
On/Off	Off		

c. Ensure that J1, on the Output board, is in its pins 2–3 position.

d. Select Luminance Ramp at the front panel.

e. CHECK – for an unfiltered luminance ramp on the 1485.

f. CHECK – that no errors occur on the ramp as the DP–100 Clock Phase control is varied from end to end. To see an example of clock phase error, depress the Clock Phase Inv/Norm switch and vary the Clock Phase control.

g. Change the 1485 to 0.2 VFS and 0.5 μs/div (X10).

h. Vary the 1485 Horizontal and Vertical controls to view a section of the ramp.

i. CHECK – for no missing bits. Steps should be approximately one minor division high and one minor division wide.

j. Move J1 to pins 2 and 3 (8-bit position).

k. CHECK – for no missing bits. Steps should be approximately three minor divisions high and three minor divisions wide.

l. Move J1 back to its pins 1 and 2 position.

m. Return the 1485 to 1.0 VFS and 5 μs/div (X1).

33. Check Parallel Digital Audio Output Non-Inverted Data

a. Connect the DP–100 to the PARALLEL DIGITAL AUDIO output non-inverted Data and Clock lines, and connect the DP–100 Video Output to the Oscilloscope vertical + input (see Fig. 5-12).

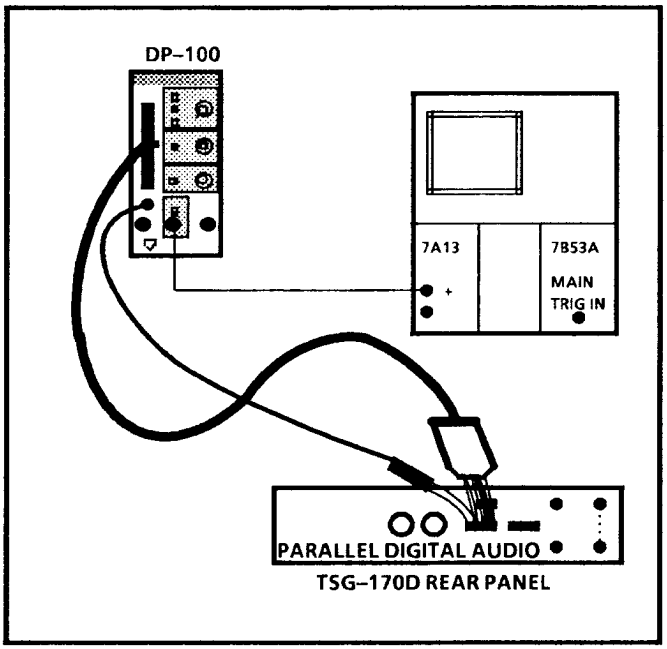


Fig. 5-12. Setup to check PARALLEL DIGITAL AUDIO.

b. Set the following controls:

Vertical (7A13)		Time Base(7B53A)	
+ Input	DC	Slope	—
– Input	GND	Mode	Auto
Volts/Div	200 mV	Coupling	AC
BW	Full	Source	Int
		Time/Div	500 μs
DP–100		Mag	X1
2 Comp/Bin	2 Comp		

c. Remove the LSB wire from the D connector.

d. CHECK – for a pattern similar to that in Fig. 5-13.

e. CHECK – that with J19 on pins 1–2, the sine wave period is approximately 1250 μs (800 Hz), and with J19 on pins 2–3 the sine wave period is approximately 1000 μs (1000 Hz).

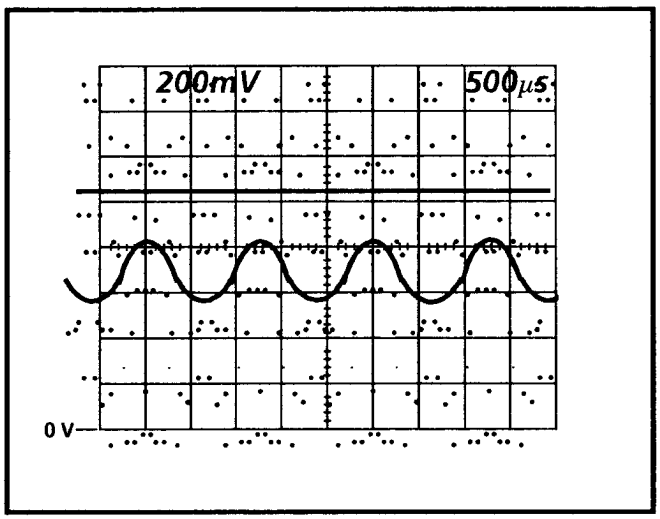


Fig. 5-13. Parallel Digital Audio Output.

34. Check Parallel Audio Output Inverted Data

a. Move the DP–100 inputs to the inverted data output pins on the D connector, and change the DP–100 Data and Clock Phase Inv/Norm controls to Inv.

b. CHECK – for a pattern similar to that in Fig. 5-13.

c. Replace the LSB wire on the D connector.

35. Check Digital Video Output Inverted Data

a. Connect the DP–100 to the DIGITAL VIDEO Output Inverted data output pins, and connect the DP–100 Video Output to the 1485 Ch A input. See Fig. 5-11.

b. CHECK – for an unfiltered ramp display on the 1485.

c. Change the 1485 to 0.2 VFS and 0.5 µs/div (X10).

d. CHECK – for no missing bits. Steps should be approximately one minor division high and one minor division wide.

e. Disconnect the DP–100.

36. Serial Digital Audio Output Amplitude

a. Remove the cable from J20, on the Output board, and attach a 110Ω resistor between pins 1 and 2.

b. Connect a 10X scope probe from the 7A13 + input to J20–1, and another 10X scope probe from the 7A13 – input to J20–2.

c. Set the controls as follows:

Vertical (7A13)		Time Base(7B53A)	
+ Input	DC	Slope	—
– Input	DC	Mode	Auto
Volts/Div	0.2	Coupling	AC HF Rej
BW	Full	Source	Int
		Time/Div	500 µs
		Mag	X1

d. CHECK – that the waveform is centered about ground, with an amplitude between 3 V and 10 V p-to-p.

37. Serial Digital Audio Rise and Fall Times

a. Change the oscilloscope Volts/Div to 0.1, the Time/Div to 0.1 µs, and Mag to X10.

b. Set the oscilloscope controls to give a display that is 5 divisions in amplitude.

c. CHECK – that the rise and fall times are between 10 ns and 30 ns, measured between 10% and 90%.

d. Remove the 110Ω resistor and replace the cable onto J20.

RETURN LOSS

38. Genlock Loop-Through

a. Connect test equipment as in Fig. 5-14.

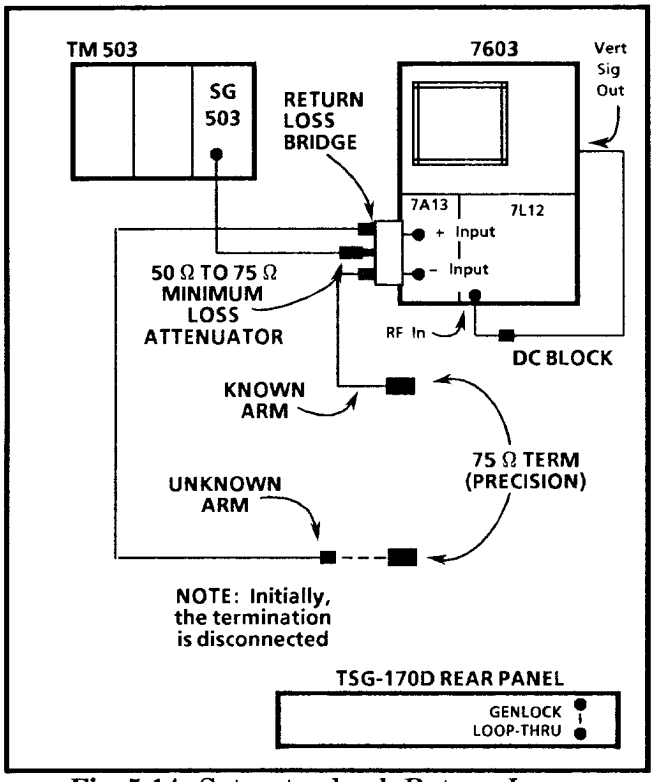


Fig. 5-14. Setup to check Return Loss.

b. Set the following controls:

7A13		**7L12**	
+Input	DC	Freq	0 MHz
-Input	DC	Time/Div	5 ms
BW	Full	Ref Level	-20 dB
Volts/Div	50 mV	Display Mode	10 dB/Div
		Gain Selector	CCW
7603		Freq Span/Div	1 MHz
Vert Mode	Right	Resolution	300 kHz
Trig Source	Left		
SG503			
Amplitude	500 mV		

c. Set the SG503 to 5 MHz.

d. With both precision terminators connected, adjust the Return Loss Bridge to null the 4.2 MHz response displayed on the spectrum analyzer.

e. Remove the precision 75Ω terminator from the UNKNOWN cable and connect the terminator to one of the TSG–170D GENLOCK loop-through connectors.

f. Place the peak of the displayed 5 MHz to be at the top line of the graticule by adjusting the spectrum analyzer Vertical Position controls.

g. Connect the UNKNOWN cable to the other TSG–170D GENLOCK loop-through connector.

h. CHECK — that the return loss is >40 dB (4 major divisions) as you vary the SG503 frequency between 4.2 MHz and 250 kHz.

i. Switch off the TSG–170D power and repeat Step h.

39. Check TEST SIGNAL Output

a. Switch off the TSG–170D and disable its output by moving jumper P2 (Output board) to the 2–3 position.

b. Connect the UNKNOWN cable to the TEST SIGNAL output and switch on the TSG–170D.

c. CHECK — at the spectrum analyzer, check that the return loss is >36 dB as you vary the SG503 frequency between 4.2 MHz and 250 kHz.

d. Return P2 to the 1–2 position.

40. Check BLACK BURST Output

a. Connect the UNKNOWN cable to the BLACK BURST output.

b. CHECK — that the return loss is >36 dB as you vary the SG503 frequency between 4.2 MHz and 250 kHz.

SHORT FORM CALIBRATION PROCEDURES

PRELIMINARY ADJUSTMENTS

1. Adjust Power Supply

   Adjust +5 V ±100 mV with R510, adjust R415 for no current limiting.

2. Adjust Oscillator Frequency

   Adjust C19 for 14.318180 MHz ±0.1 Hz.

3. Adjust Audio VCO Frequency (SN B010619 and above)

   Adjust C95 on the A3A1 Audio VCO board for 6.144 MHz at TP12 on the A3 Output board.

4. DC Level Adjust

   Adjust TEST SIGNAL output blanking level for 0 V ±50 mV with R202. Check Black Burst blanking level for 0 V ±40 mV.

5. Output Gain Adjust

   Adjust R51 for Luminance Ramp amplitude of 714.3 mV, adjust R61 for Black Burst Sync amplitude of 285.7 mV, and adjust R91 for 53.6 mV of setup on the BLACK BURST output.

ANALOG VIDEO RESPONSE

6. Coarse $^{SIN\ X}/_{X}$ Adjustment

   Adjust C29 for 285.7 mV of burst on BLACK BURST output, and adjust C22 for 285.7 mV of burst on the TEST SIGNAL output.

7. Adjust Group Delay

   Adjust L1, L2, L8, and L9 for flat pulse response. 25T: flat ±7.0 mV, 12.5T: flat ±3.5 mV.

8. Adjust Frequency Response

   Adjust L3, L4,and L5 for flat response (±1% to 4 MHz, ±2% to 4.2 MHz.

9. Adjust Chrominance-to-Luminance Gain

   Adjust C22 for Peak-to-Peak Detector output of ≤10 mV p-to-p.

10. Adjust Phase Matching

    Adjust C37 for ≤2° phase difference between Black Burst and Test Signal burst phases.

NOTE

Due to interaction, steps 5, 6, 7, 8, and 9 should be repeated until the best overall response is obtained.

OUTPUTS

11. Adjust Audio Tone

    Adjust R119 for +8 dBu (factory setting).

12. Adjust Digital Video Clock to Data Timing

    Adjust C51 for clock rising edge to precede LSB data transition by 35 ns ±2 ns. Check that all data transitions are ±2 ns of LSB.

LONG FORM CALIBRATION PROCEDURES

PRELIMINARY ADJUSTMENTS

(See Fig. 5-16 for adjustment locations.)

1. Power Supply Adjustment

NOTE

Adjustment of the Power Supply should be done only if the supply voltage is out of tolerance. This is not a part of normal maintenance.

a. Set the Variac to apply 90 V as the input voltage. Set R415 (current limit) 1/4 turn from its counterclockwise limit.

b. CHECK/ADJUST – for +5 V ±100 mV at the +5 V test point on the Power board. Use R510 to adjust it, if necessary. Set R415 (current limit) to its clockwise limit.

c. CHECK – to see if the LED (DS670) is flashing or not. If the LED is flashing, then the supply is current limiting. If the LED is not flashing, go to part e.

d. ADJUST – R415 slowly counterclockwise until the supply stops current limiting (the LED stops flashing).

e. ADJUST – R415 counterclockwise 1/4 turn from the point where the LED stops flashing.

f. CHECK – that the +5 V test point is still at +5 V ±100 mV.

2. Oscillator Frequency Adjustment

a. Connect the equipment as in Fig. 5-15. Use a X1 probe from the DC503A CH B input to pin 4 of U841, on the TSG-170D Output board. Remove the plug in the top of the oven cover.

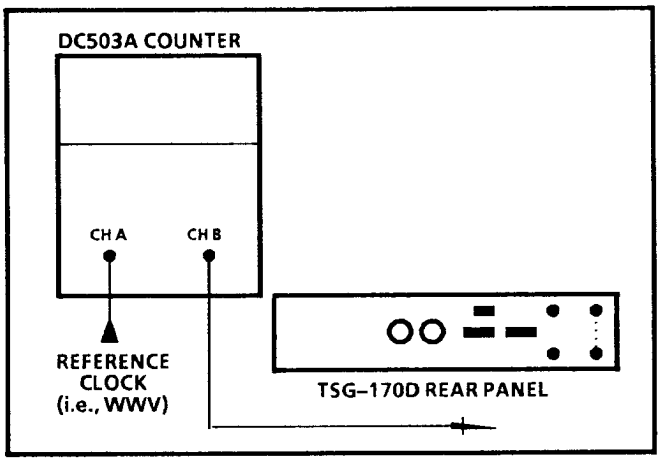


Fig. 5-15. Setup to adjust free-running oscillator frequency.

b. Set the DC503A as follows:

Function	Ratio A/B
Avg	10^6

c. Make sure that J180 is on pins 2–3.

d. Adjust the crystal frequency with C19 (through the hole in the oven cover) to bring the oscillator frequency to within 0.1 Hz of 14.318180 MHz.

e. Replace the plug in the oven cover.

3. Audio VCO Frequency Adjustment (SN B010619 and above)

a. Continuing from the preceding step, move the X1 probe from pin 4 of U84 to TP12 on the A3 Output board.

b. Use a jumper wire to connect J90-2 to ground. Alternatively, you can connect R188 (the end closest to C53) to ground.

c. ADJUST – C95 on the A3A1 Audio VCO board for an oscillator frequency of 6.144 MHz ± 1 Hz.

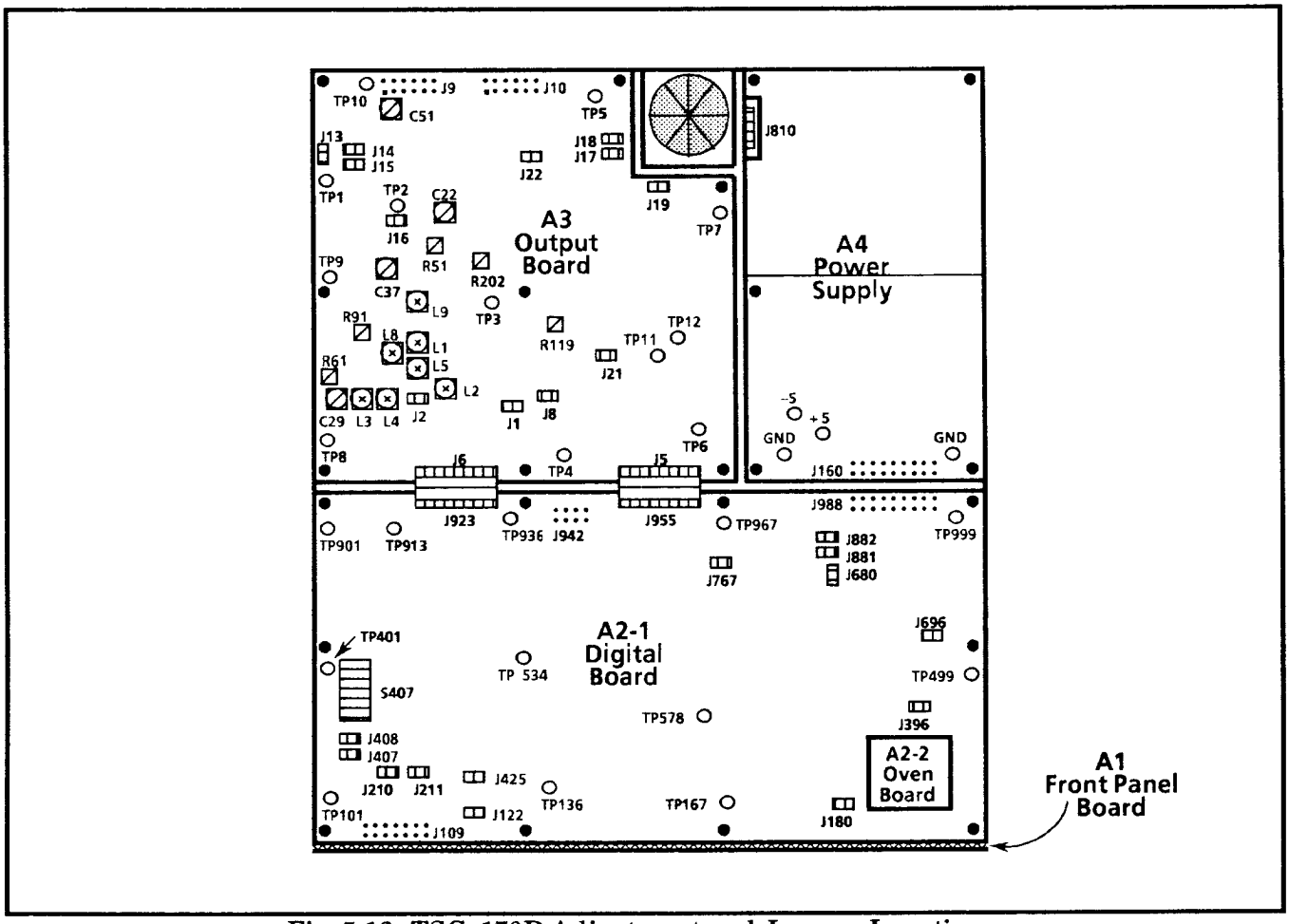


Fig. 5-16. TSG–170D Adjustment and Jumper Locations.

d. Set the oscilloscope for 2V/Div, and set a ground reference.

e. Remove the jumper wire and connect the oscilloscope probe to J90–2.

f. CHECK – that the control voltage at J90–2 is at or centered around 0 volts.

4. DC Level Adjust

a. Connect the equipment as shown in Fig. 5-17.

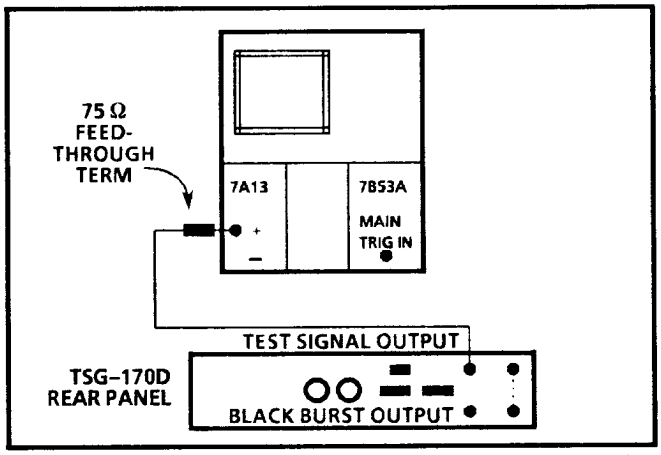


Fig. 5-17. Setup to check dc level of TEST SIGNAL output.

b. Set the following controls:

Oscilloscope			
Vertical		**Time Base**	
Volts/Div	50 mV	Slope	—
Coupling	DC	Mode	Auto
Display Mode	Ch 1	Coupling	AC
Trigger Source	Ch 1	Time/Div	10 μs
BW	Full	Mag	X1

c. ADJUST – R202, on the Output board, for a blanking level of 0 V ±50 mV.

d. Move the cable from the TEST SIGNAL output to the BLACK BURST output on the TSG-170D.

e. CHECK – that the Black Burst blanking level is 0 V ±50 mV.

5. Output Gain Adjust

a. Connect the equipment as shown in Fig. 5-18. Use low loss 75Ω coax for the VAC connection.

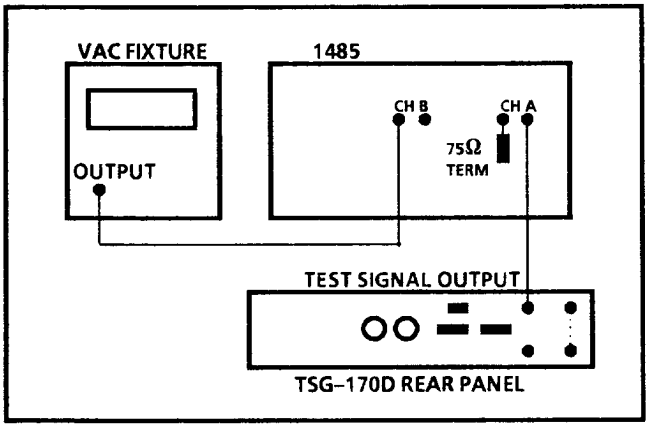


Fig. 5-18. Setup to adjust Test Signal gain.

b. Set the following controls:

1485		VAC	
Input	A–B (DC)	Output	714.3 mV
Response	Flat		
Volts Full Scale	1.0		
DC Restorer	Off		
Oper/Cal	Oper		
Sync	Int, Direct		
Display	10 μs		
Mag	X1		

c. Select the Luminance Ramp signal at the TSG-170D front-panel.

d. ADJUST – R51, on the Output board, for a luminance amplitude of 714.3 mV (100 IRE).

e. Change the following controls:

1485		VAC	
Volts Full Scale	0.2	Output	285.7 mV

f. Move the cable from the TEST SIGNAL output to the BLACK BURST output on the TSG-170D.

g. ADJUST – R61, on the Output board, for a Black Burst Sync amplitude of 285.7 mV (40 IRE).

h. Change the VAC output to 53.6 mV.

i. ADJUST – R91, on the Output board, for a setup level of 53.6 mV (7.5 IRE) on the Black Burst signal.

ANALOG VIDEO RESPONSE

NOTE

The following adjustments are interactive, and should be done as a set. Repeat the adjustments in sequence until the best overall response is obtained.

6. Coarse $^{SIN\ X}/_{X}$ Adjustment

a. Change the VAC Output to 285.7 mV.

b. ADJUST – C29 (Black Burst $^{SIN\ X}/_{X}$) on the Output board for 285.7 mV of Black Burst amplitude.

c. Move the cable from the BLACK BURST output to the TEST SIGNAL output.

d. ADJUST – C22 (Test Signal $^{SIN\ X}/_{X}$), on the Output board, for 285.7 mV of burst.

7. Group Delay

a. Set S407 to 011011 (segments 6 and 3 closed) and cycle the TSG–170D power off and on.

b. Select the Multipulse signal, using the OTHER SIGNALS push button.

c. Change the following controls:

1485		VAC	
Display	5 μs	Output	000.0 mV

d. ADJUST – L9, L8, L1, and L2, on the Output board, for as flat as possible response and symmetrical ringing at the bottom of the 2T pulse.

e. CHECK – that the bottom of the 25T pulse is flat ±3.5 mV, and that the 12.5T pulses are flat ±7.0 mV. Overshoot on the 2T pulse should be ≤7 mV.

8. Frequency Response

a. Set the VAC output to 714.3 mV.
b. Select Line Sweep with the OTHER SIGNALS push button.

c. ADJUST – L3, L4, and L5, on the Output board, for as flat of response as possible. Some roll-off will occur starting at about 4 MHz.

d. CHECK – that the Line Sweep is flat ±1% to 4 MHz, ±2% to 4.2 MHz.

9. Chrominance-to-Luminance Gain

a. Connect the equipment as shown in Fig. 5-19.

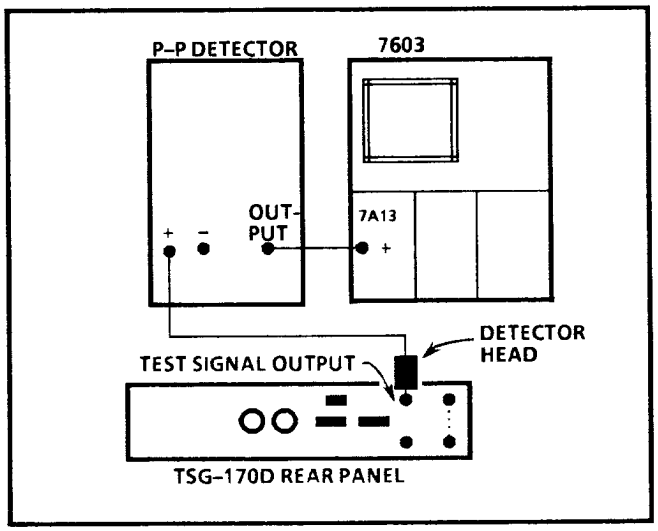


Fig. 5-19. Setup to adjust chrominance-to-luminance gain of TEST SIGNAL output.

b. Select DAC Test signal with the front-panel OTHER SIGNALS button.

c. Set the following controls:

Oscilloscope			
Vertical (7A13)		Time Base(7B53A)	
Volts/Div	2 mV	Slope	—
+ Input	DC	Mode	Auto
– Input	GND	Coupling	AC
BW	Full	Source	Int
		Time/Div	10 μs

d. If there is significant chrominance-to-luminance gain, the displayed waveform on the oscilloscope will look like a square wave. ADJUST – C22 (Output board) to reduce this square wave to a straight line.

e. Check that the square wave amplitude is no more than 10 mV.

f. Set S407 to 111111 (all segments open), and cycle the TSG–170D power off and on. This disables diagnostics.

10. Phase Matching

a. Connect the equipment as shown in Fig. 5-20, Do not make the connection to the TSG–170D GENLOCK input.

b. Set the following controls:

520A		VAC	
Ch A	In	Output	000.0 mV
AΦ	In		
Full Field	In	1485	
Φ Ref	Ext	Input	A (DC)
Vector	In	Display	10 μs
Sync	Ext		

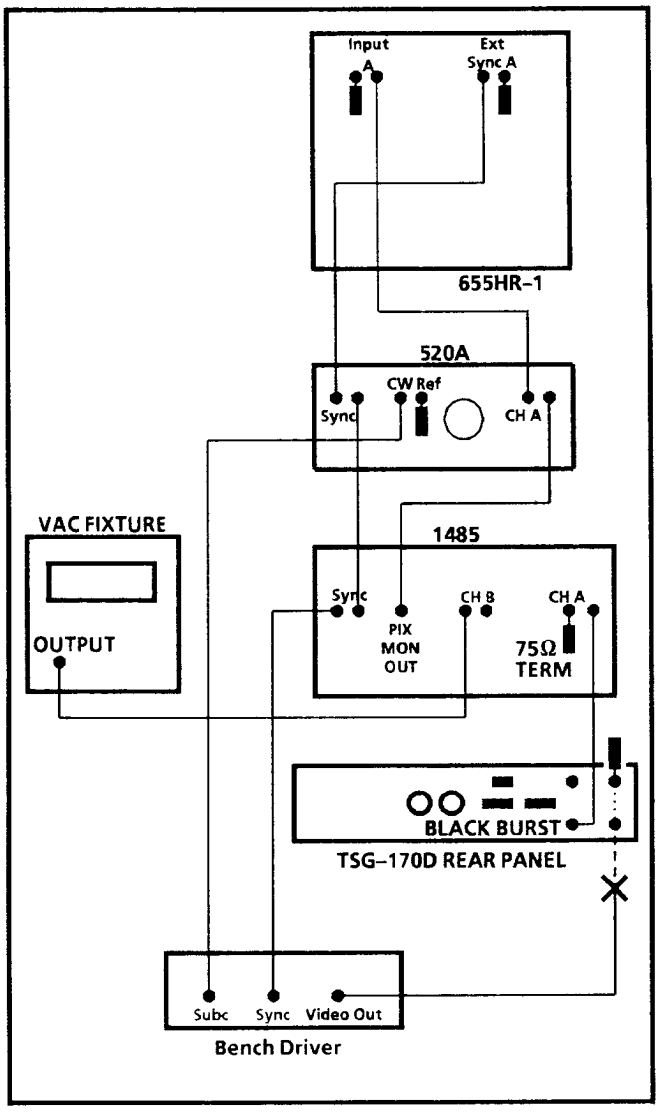


Fig. 5-20. Setup to adjust Phase Matching.

c. CHECK – that the 520A display is rotating (not locked).

d. Connect the Video Output from the bench driver to the GENLOCK input on the TSG–170D.

e. CHECK – that the TSG–170D is genlocked (520A display is stable). Use the 520A Gain control to set the burst tip to the outer graticule circle (compass rose), and use the Phase control to set the vector to 180°.

f. Move the coax from the TSG–170D BLACK BURST output to the TEST SIGNAL output. Select Luminance Ramp from the TSG–170D front panel.

g. ADJUST – C37 on the Output board to place the test signal burst phase to the 180° mark.

h. CHECK – that the TEST SIGNAL output burst phase matches the BLACK BURST output burst phase within 2°, by moving the coax back and forth between the TEST SIGNAL output and the BLACK BURST output.

i. REPEAT – steps 5, 6, 7, 8, and 9 until the best overall response is obtained.

11. Audio Tone Adjustment

a. Connect the equipment as in Fig. 5-21.

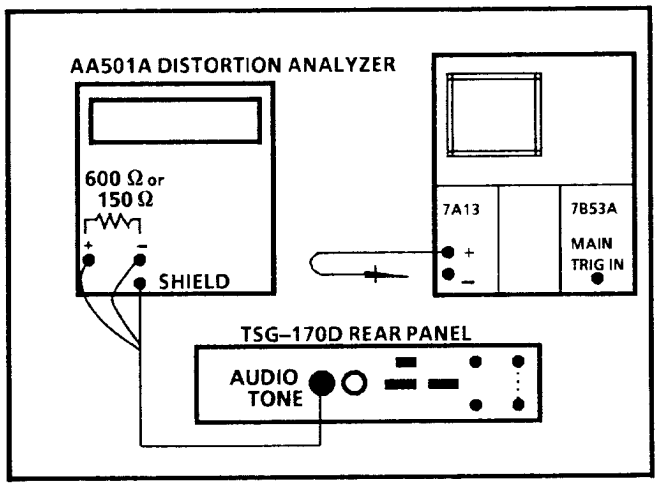


Fig. 5-21. Setup to adjust AUDIO output level.

b. Set the following controls:

AA501A

Input Level Range	Auto range
dBm Switch	In
Level Switch	In
All Filter Switches	Out
Response	RMS

c. Attach a load resistor (either 150Ω or 600Ω, to represent the load of your system) across the AA501A Audio Input pins.

d. Adjust R119 to obtain the desired dB output. (Factory setting is +8 dBm.)

12. Adjust Digital Video Clock to Data Timing

a. Connect the Digital Output Termination Fixture (see Fig. 5-10) to the DIGITAL VIDEO output.

b. Connect a X10 probe from the oscilloscope + input to the LSB connection on the Termination Fixture, and another X10 probe from the – input to the LSB connection.

c. Set the following controls:

Vertical (7A13)		Time Base(7B53A)	
+ Input	DC	Slope	—
– Input	DC	Mode	Auto
Volts/Div	200 mV	Coupling	AC
BW	Full	Source	Ext
		Time/Div	50 ns
		Mag	X10

d. Trigger the oscilloscope from U841–4.

e. Center the waveform vertically, and set the Data crossover point at a convenient reference at the right side of the display (at least three divisions to the right of center).

f. Move the scope probes to the Clock pins of the connector, pins 1 and 14.

g. ADJUST – C51 so that the midpoint of the clock rising edge occurs 35 ns ±2 ns before the Data crossover point noted in part b of this step.

h. Repeat parts a through d of this step to ensure the timing. (If the transitions seem to move, check the grounding of the scope probes.)

i. CHECK – that the crossover points for the remaining Data pairs occur at the same time as the LSB crossover point, ±2 ns.

This concludes the adjustment portion of the procedure. For a complete calibration return to the beginning of this section and go through the performance check, to verify all specifications.

SECTION 6
THEORY OF OPERATION

INTRODUCTION

Two parts make up the Theory of Operation. First is the Block Diagram Overview that describes the architecture of the TSG–170D in function blocks. Second are the Circuit Descriptions. These describe the 13 schematic diagrams that make up the function blocks.

CAUTION

Be sure the circuit descriptions and schematics you use in this section match your instrument's serial number. Where necessary, schematics and circuit descriptions have serial number labels.

BLOCK DIAGRAM OVERVIEW

This overview divides the TSG–170D into five sections: Input Processing, Genlock Loop, Signal Generation, Output Processing, and Power Supply. Refer to the Block Diagram in Section 9 when reading the description of these sections.

INPUT PROCESSING

To prepare the input reference (Genlock Input) signal for ADC sampling, the Input Processing circuit inverts it, clamps its sync tips to –50 mV, and filters it. The Sync Stripper extracts composite sync from the Genlock Input signal, then supplies it to the Input Clamp and the Address Control (in the Genlock Loop). Both these circuits use it as a timing reference. The processed Genlock Input signal is passed to the Genlock Loop, where it is continuously sampled by the ADC.

GENLOCK LOOP

The Genlock Loop locks the TSG–170D outputs to the Genlock Input signal. It does this by generating two signals (CLK1 and FLD REF) that control the timing of the Signal Generation circuits. CLK1 is the 4Xsubcarrier system clock, and FLD REF (field reference) is a field-timing reference signal from which the Signal Generation circuits derive vertical and horizontal timing when the instrument is genlocked to composite video.

The TSG–170D accepts two types of Genlock Input signals: composite video (color or monochrome) and continuous-wave reference. After appropriate jumpers have been set in the Input Processing circuits, the Genlock Loop detects the type of Genlock Input signal being inserted. It responds by switching to a different mode of operation to handle the detected signal.

When a composite video signal (color or monochrome) is inserted, the Genlock Loop puts out both the system clock (CLK1) and the field timing signal (FLD REF) to the Signal Generation circuits. When a sine-wave reference is inserted, or when no signal is inserted, the Genlock Loop puts out only the system clock (CLK1).

Locking to Composite Video

To lock to composite video, the Genlock circuit finds the sync and burst portion of the incoming composite video signal (called the sync and burst window) and stores it in the Sample RAM every line. With this data, the μP calculates sync timing and burst phase. From this, it can lock to sync and burst, as described below.

Locking to Sync — Initially, the Genlock Loop acquires horizontal sync by locking its Line Counter in the Address Control circuits directly to incoming sync. This allows the μP to sample the sync and burst window to find vertical sync. Once it has found vertical sync, the Genlock Loop obtains a more accurate horizontal sync lock as follows: First, the μP switches the Line Counter to internal timing and synchronizes the Line Counter timing with incoming sync timing as calculated from the window data. Since internal timing has less jitter than incoming sync, it provides a more accurate reference.

Once the Address Control is set to internal timing, the μP begins locking the VCO to either incoming burst or sync samples, depending on whether the incoming composite video signal has burst or is monochrome.

Locking to Burst — When the Genlock Input is composite video with burst, the μP uses burst samples contained in the sync and burst window to lock the VCO to incoming burst.

Because the ADC is clocked by the VCO, samples of incoming burst indicate VCO phase in relation to incoming burst phase. The μP extracts the burst-to-VCO phase information and uses it to generate a VCO correction word that the Genlock DAC converts to a voltage. An integrated version of this voltage keeps the VCO and its CLK1 output phase-locked to incoming burst by shifting the VCO frequency.

Once the VCO is burst locked, the μP calculates the timing for line 10 of field 3 and indicates this timing with a pulse to the Address Decoder. The Address Decoder gates this pulse with the 50% point of horizontal sync to generate the FLD REF signal.

When the Genlock Input is monochrome composite video, the μP uses incoming sync samples to calculate VCO phase relative to incoming sync. It then generates a correction word to shift VCO frequency (which shifts phase) accordingly. Thus, the VCO output (CLK1) is locked to incoming sync.

Fine Genlock Timing — Adjustment of fine genlock timing is done inside the Genlock Loop. When fine genlock timing is adjusted at the front panel, the μP adds an offset to its VCO correction word to shift VCO phase in the desired direction. This results in new ADC sample timing, and consequently, new sample values. When analyzing the new values, the μP takes into account the timing offset. Hence, it does not attempt to "correct" its own offset.

Locking to a Continuous Wave Reference

To lock to a continuous wave reference, the Genlock Input block samples the sync and burst window at a line rate in the same manner as for composite video reference. Except, of course, the window is no longer synchronized with sync, and it contains a continuous sine wave without sync.

The continuous wave reference is sampled by the ADC, stored in the Sample RAM, and then used by the μP to calculate correct VCO phase. When locked to a continuous wave, the Genlock circuit still generates the system clock (CLK1), but not the FLD REF signal. FLD REF is not needed since the sine-wave reference signal has no fields to which the TSG-170D must lock.

SIGNAL GENERATION

The Signal Generation section puts out two separately timed sets of signals: one set contains sync pulse signals and subcarrier, the other contains the selected test signal and black burst. All the signals are locked to the Genlock Input signal, but an additional timing offset (advance or delay) can be added to the sync pulse and subcarrier signals with respect to the test and black burst signals. The circuits that generate these signals are described below.

Test Signal Generation

The main job of the Test Signal Generation circuitry is to produce one of 18 selectable test signals. It does this by using two genlocked timing signals (CLK1 and FLD REF) plus delay information from the μP to drive its signal selection and timing circuits. These circuits control the Test Signal PROMs, which generate the signals. The circuit blocks that generate the timing and signal selection are the Genlock Timing Offset, H Timing Counter, Vertical Counter, H and V Timing PROMs, and Signal Selector.

The Genlock Timing Offset is controlled by the μP. When coarse genlock timing is adjusted at the front panel, the Genlock Timing Offset shifts the timing of the H and V Counters, thus shifting the timing of the whole Test Signal Generation circuitry by up to ±8 μs.

The H Timing Counters provide timing to the Test Signal PROMs by addressing the horizontal components of the selected signal. The V Counter provides vertical timing to the V Timing PROM, which in turn provides vertical timing to the Signal Selector.

Signal selection is updated during the vertical interval. The μP sends out a selection code that, combined with V Timing PROM outputs, tells the Signal Selector which signal to select and when to select it. The V Timing PROM also tells the selector which

elements of the signal to select. The V Pulse PROM tells the selector when to select vertical sync.

The signals selected at the Test Signal PROMs are converted to analog by the Test Signal DAC, then low-pass filtered and buffered.

Black Burst Generation

Black burst is generated by switching the currently selected test signal to setup level during active video and then switching back to the sync and burst portion of the test signal during sync and burst time.

ID Character Generation

A 12-character identification may be combined with the test signal. This is displayed on the upper two-thirds of the test signal.

AUDIO GENERATION AND OUTPUT

The Audio Generation and Output circuitry produces an audio tone of either 800 Hz or 1 kHz, user selectable. This tone is produced in three separate formats: Serial Digital, Parallel Digital, and Analog.

Digital Audio and 6.144 MHz Clocks

The Digital Audio Clock circuitry divides the 14.31818 MHz video clock down to 768 kHz. The 6.144 MHz clock is locked to this input by a PLL. The 6.144 MHz clock is divided down and decoded into the clocks and timing signals for the Audio Data Generation circuitry.

Audio Data Generation

The Audio Data Generation uses the 6.144 MHz clock to access audio data for both serial and parallel data streams.

Serial Digital Audio Output

The Serial Digital Audio Output shifts the data out at a 6.144 MHz rate, through a differential buffer, and a transformer couples it to the rear-panel XLR connector.

Parallel Digital Audio Output

The parallel data stream from the Audio Data Generation block is read into a latch, and then TTL-to-ECL buffers drive the rear-panel connector.

Analog Audio Output

The Analog Audio Output converts the parallel data stream into offset binary, and applies it to a DAC. The DAC output is reconstructed, buffered, and applied to the rear-panel XLR connector.

OUTPUT PROCESSING

Test Signal and Black Burst Output

The Test Signal Output converts the digital signal outputs to analog, filters the analog signal to remove out-of-band components, provides the signal with the correct power and amplitude levels, and boosts the high end of the signal frequency to compensate for sinx/x roll-off.

POWER SUPPLY

The switching power supply generates ±5 V for TTL and ECL devices. A stable linear supply of ±12 V is required for powering the analog components.

FRONT PANEL INTERFACE CIRCUIT DESCRIPTION (Schematic 1)

The five main functions of the Front-Panel I/O circuitry are (1) to transfer user selections to the μP, (2) to transfer signal timing offset data from the μP to the Digital board, (3) to transfer diagnostic switch data to the μP, (4) to transfer remote control data to the μP, and (5) to transfer operating status and diagnostic data from the μP to the front-panel LEDs. Each of these is described below.

Front-Panel Selection

Decoder U307 converts the front-panel data, selected by the 13 click dome switches (S129-S176), into a 4-bit word and applies it to buffer U311. During the vertical interval, the μP checks the front panel by enabling $\overline{\text{KEYBOARD}}$. This loads the 4-bit word onto the data bus. To determine if a new selection has been made at the front panel, the μP checks for a high level on the ED5 line. The Data Available output (pin 13, U307) pulls this line high for about 20 ms whenever a new front-panel selection is made.

In the 2–3 position, jumper P210 disables any attempts to change signal timing through the front panel. In the 1–2 position, the jumper allows normal front-panel operation.

Timing Offset Latch

The μP sends the coarse user-selectable genlock timing offsets to the Genlock Timing Offset circuit (Schematic 5), through U459.

Diagnostic Switches

Through the Diagnostic switches (S407) the user selects the diagnostic routines. Immediately after the μP is reset, it checks the diagnostic switch buffer (U412), by asserting $\overline{\text{DIAG PORT}}$, and performs the selected diagnostic routine(s). When all switches are open, the instrument is in normal operation; that is, no diagnostics are selected. Refer to **Diagnostics** in the **Maintenance** section for a full description of the diagnostic routines.

Remote Control Port

The remote control and front panel can both operate simultaneously, but the remote control has priority. That is, during the vertical interval, the μP first checks the remote control buffers (U848 and U851) and then the front-panel buffer (U311). But if a new selection has been made at the remote control since the previous vertical interval, the μP executes the new selection and does not check for front-panel input.

Front Panel LEDs and LED Latches

The 17 front-panel LEDs are all controlled by the μP through three latches (U303, U218, and U314). The μP enables these latches with the $\overline{\text{LED0}}$, $\overline{\text{LED1}}$, and $\overline{\text{LED2}}$ signals. Note that U314 also puts out four additional signals: $\overline{\text{CHAR EN}}$, CONTROL1, $\overline{\text{INT/GENLOCK}}$, and $\overline{\text{HOLD/ACQUIRE}}$. $\overline{\text{CHAR EN}}$ switches on the ID characters in the ID Generation circuitry on Schematic 9. CONTROL1 switches off the test signal and tone to provide a black background for the Tape Leader countdown. $\overline{\text{INT/GENLOCK}}$ forces the Genlock Loop to either free run or lock to the Genlock Input signal. $\overline{\text{HOLD/ACQUIRE}}$ controls the loop response of the Genlock Loop.

MICROPROCESSOR (μP) KERNEL CIRCUIT DESCRIPTION (Schematic 2)

This section briefly describes the functions of the μP Kernel and describes the components that make up the Kernel. For a description of the diagnostics executed by the μP, refer to the **Maintenance** section.

THE KERNEL

The μP Kernel has four main functions: to acquire and maintain genlock with the incoming reference signal, to service the front panel, to set the genlock timing offsets in the Signal Generation circuitry, and to execute diagnostics. The components of the Kernel are described as follows.

Microprocessor

The μP (U239) is the heart of the Kernel. Receiving its program instructions from the EPROM, the μP controls the Kernel through its address lines (A0-A15), its data lines (D0-D7), and its various control lines.

The clock that drives the μP is derived from CLK 28.6 (28.6 MHz). PAL U429 divides this clock by 5 to obtain a 5.72 MHz clock, called μPCLK, for the μP and the CTCs. U332D, U332C, and Q235 waveshape the μPCLK and apply it to the μP.

U221 monitors three vital conditions of the μP (U239):

a) low power supply.
b) software hangups (lost).
c) manual reset.

U221 monitors the status of the +5V power supply line for a 10% low condition. When this condition is detected, the reset output is activated and held in this condition until approximately 250 ms after the supply voltage returns to a within-tolerance condition.

The second function of U221 is to monitor the $\overline{\text{AWAKE}}$ line for negative pulses; the pulses should occur at a field rate. These pulses are from the μP via the decoder (U162) and indicate that the μP is going through its routines normally. If the μP gets lost, the $\overline{\text{AWAKE}}$ pulse no longer occurs. If this pulse is absent for approximately 600 ms, U221 times out and activates the μP reset line.

The third function of U221 is manual reset which is activated by moving J122 to pins 2–3 momentarily while J425 is in its pins 1–2 position. U221 keeps the reset activated for approximately 250 ms after J122 is returned to pins 1–2.

In the 2–3 position test jumper J425 forces $\overline{\text{RESET}}$ by pulling the line low, and in the 3–4 position test jumper P245 disables $\overline{\text{RESET}}$ by letting it be pulled high.

If the μP is not sending correct addressing and data to the two CTCs (U132 and U127), CTC1 puts out the SOFT RESET pulse that reinitializes the μP through U332B.

Kernel Memory

EPROM (U245) and RAM (U152) — EPROM U245 contains the micro-instructions that control the μP. The addresses allocated to the EPROM are 0-7FFF. RAM U152 stores temporary data such as results of calculations. Its address allocations are 8000-9FFF.

NVRAM (U157) — This is a combined permanent (EEPROM) and temporary (static RAM) memory that stores the front-panel-selected genlock timing offset settings, and also the character ID data for the ID Generator (Schematic 9). The address allocations for this memory device are C000-FFFF.

If a new timing offset is selected at the front panel, the μP loads the new timing data into the RAM portion of the NVRAM during the vertical interval. When the MODE SELECT button is cycled back to the TEST SIGNAL SELECTION mode, the new offset data is permanently stored in the EEPROM part of the NVRAM.

When a new ID character is selected at the front panel, the μP loads the new ID character into NVRAM in the same manner as described for new timing offsets but also loads the character into the Character RAM (Schematic 9).

Immediately following a μP reset (which occurs whenever the instrument is powered up), the μP loads the front-panel data from the EEPROM portion of the NVRAM into the RAM portion. From the RAM portion, it loads the timing offsets (PRESET1) into the H & V Timing circuits (Schematic 5), and loads the character ID data (PRESET1) into the Character RAM (Schematic 9).

NVRAM Save Control

Made up of Q355, U332D, and associated components, the NVRAM Save Control prevents the NVRAM from saving data during power-up and power-down.

During power-up, $\overline{\text{RESET}}$ forces the output of U332A high to pull $\overline{\text{NVSAVE}}$ high.

During power-down, Q355 and associated components ensure that $\overline{\text{NVSAVE}}$ remains high until the power (NVPWR) has dropped to 3 V. Below 3 V, the NVRAM will not save data, regardless of $\overline{\text{NVSAVE}}$.

When power is switched off, C259 and C359 supply current to the $\overline{\text{NVSAVE}}$ line. As these capacitors discharge, they allow Q355 to switch on. This allows C355 to supply current to the $\overline{\text{NVSAVE}}$ line while NVPWR drops below 3 V.

Decoders

CTC and Memory Decoder (U352) – U352 is a PAL programmed to function as two separate decoder networks; one for the CTCs and I/O, and the other one for the Kernel memory. The decoder for the CTCs and I/O is enabled by $\overline{\text{IORQ}}$, which decodes address lines 4 and 5 to enable the CTCs and the three I/O control lines ($\overline{\text{IO0}}$, $\overline{\text{IO2}}$, and $\overline{\text{IO3}}$). $\overline{\text{IO0}}$ enables the I/O Decoder, U162; $\overline{\text{IO2}}$ enables the Character RAM on the Output board; and $\overline{\text{IO3}}$ enables the External Data Transceiver, U420.

The memory decoder portion of U352 is enabled by $\overline{\text{MREQ}}$ from the μP, address lines 13 through 15 are decoded into four enable lines, three for the memory devices in the Kernel (EPROM U245, RAM U152, and NVRAM U157) and one for the Sample RAM in Schematic 3.

I/O Decoder (U162) — This chip decodes four address lines (A0-A3) to enable DACs, LEDs, and I/O ports throughout the instrument.

Sample RAM and Character RAM Address Buffers

Sample RAM Address Buffer (U620) — Enabled by the $\overline{\text{SAMPL RAM EN}}$ signal, this buffer is the port through which the μP addresses the Sample RAM when reading or writing to it. The address range of the Sample RAM is from A000 to BFFF.

Character RAM Address Buffer U755 — When the μP updates the Character RAM in the ID Generation circuitry (Schematic 9), it addresses the RAM through this buffer.

CTCs

CTC0 and CTC1 (U132 and U127) — The two CTCs are configured as programmable event counters. Their job is to count pulse signals generated by the Genlock circuit (S HSYNC, SAMPLE FINISHED, and START SAMPLE) and indicate to the μP the sequence in which these signals occur. The μP instructs each channel clock to count a specified number of input pulses and to interrupt the μP when it has reached the specified count. In this manner, the μP can determine the sequence in which the genlock signals are occurring.

The CTCs are daisy chained so that CTC0 (U132) has interrupt priority. This means that CLK0 through CLK3 of CTC0 have higher interrupt priority than the CLK0 through CLK3 of CTC1. The signal level at the IEI inputs of the two CTCs determines the priority. When CTC0 is not servicing an interrupt, it pulls the IEI input of CTC1 (U127) high to allow CTC1 to service interrupts.

Data I/O

External Data Transceiver (U420) — Enabled by the IO3 signals from the CTC and I/O Decoder (part of U352), this transceiver transfers data between the Kernel data bus and circuits outside the Kernel.

Sample RAM Data Transceiver (U416) — Enabled by the $\overline{\text{SAMPL RAM EN}}$ signal from decoder U252, this port sends data to and receives data from the Sample RAM (U616, Schematic 3). Normally, U416 will be receiving data samples every line.

GENLOCK DATA ACQUISITION CONTROLLER CIRCUIT DESCRIPTION (Schematic 3)

Introduction

The Genlock Data Acquisition circuit is the part of the Genlock Loop that acquires samples of the incoming reference signal for the μP to analyze. For a general description of the Genlock Loop, refer to **Genlock Loop** in the Block Diagram description.

Input Filter

Made up of C910, C911, C913, and L907, this filter attenuates spectral components above the video band to prevent aliasing of the Genlock Input signal when it is quantized by the ADC.

ADC (Analog-to-Digital Converter)

The ADC (U814) converts the clamped and inverted video signal from the Analog board into 6-bit data. Dither inserted into the signal on the Output board increases the resolution of the 6-bit data to that obtained from a 10-bit converter. U811 provides a regulated +2.5 V reference that U807 inverts and steps down to provide a precise –1 V reference to the ADC.

Because the ADC is clocked by the VCO (CLK1A), the ADC output indicates the VCO-to-burst phase relationship. During each field, the μP repeatedly checks this phase relationship and, if necessary, shifts the VCO frequency to keep it in phase with incoming burst.

Sample Multiplexer and Sample RAM

The main function of the Sample RAM (U616) is to store samples of the Genlock Input sync and burst (each sync and burst sample contains 256 sample points). The μP uses these samples to obtain and maintain lock with the Genlock Input.

Both the μP and the Memory Controller (U712) control the Sample RAM, but the μP has priority. When the μP needs to analyze the sync and burst samples stored in the Sample RAM, it asserts SAMPLER EN. The SAMPLER EN, via the Memory Controller (U712) output COUNTER EN, disables the RAM Address Counter and tristates three other functions: the RAM Address Counter Latch, U612; the ADC Output Latch, U716; and the WE signal at U720, generated by the Memory Controller. The μP can then address and read data from the RAM (U616).

When the μP is not looking at sync and burst samples, it pulls the SAMPLER EN signal low during the sync window to give control of the Sample RAM to the Memory Controller. With SAMPLER EN low, the COUNTER EN output of the Memory Controller is activated and enables the RAM Address Counter. It also un-tristates the output latch of the RAM Address Counter, and ADC Output; and the WE signal is allowed to reach the Sample RAM to enable it to write data into itself. Storage of sync and burst data in the Sample RAM is described under **Memory Controller** in this section.

Each time the μP is reset, it checks the diagnostic port (U412, Schematic 1). If the switches are set for Sample RAM diagnostics, the μP asserts SAMPLER EN and SAMPL RAM EN and loads diagnostic data into the RAM through the Sample Multiplexer, then checks the RAM output by dis-asserting SAMPL RAM EN while SAMPLER EN is still asserted

Address Control

Five circuits make up the Address Control: the Line Counter (U603, U703, and U803), the Line Counter Offset Latch (U403), the Address Decoder (U708), the Memory Controller (U712), and the Address Counter (U607). The combined function of these circuits is to provide timing to the Sample RAM such that the RAM's 28th sample (out of 256 sample points) is coincident with the 50% point of horizontal sync.

Line Counter and Address Decoder — By counting 910 positive CLK1B edges every line, the Line Counter generates timing for the Address Control circuits. When the Line Counter reaches the 910th count (1023), it sends an HSYNC pulse to the Memory Controller. Thirty-two counts before the HSYNC pulse occurs, the Address Decoder decodes the Line Counter output into the START SAMPLE pulse; 250 counts after the START SAMPLE pulse first occurred, the SAMPLE FINISHED pulse occurs. During counts 165 through 235 the Address Decoder decodes the Line Counter output into the B DITHER pulse.

The START SAMPLE, SAMPLE FINISHED, and S HSYNC outputs of the Address Decoder are seven clock cycles wide so that they are long enough to clock the CTCs in the μP Kernel.

At the start of line 10 on field 3, the μP asserts F3L10. The Address Decoder ANDs this with count 1019 from the Line Counter to generate the FLD REF signal for the Signal Generation circuits.

Memory Controller and Address Counter — To provide correct timing, the Line Counter should be accurately locked to incoming sync. When the instrument is first fired up, or when the μP has lost the position of sync, the μP asserts UNLOCKED. In this condition, a derivative of the incoming sync (GEN CSYNC) provides the most accurate reference available. The Memory Controller (U712) decodes GEN CSYNC into the LOAD pulse, which loads the Line Counter with its nominal starting count of 115.

Once the μP has found the vertical interval, it can provide a more accurate sync reference by locking the Line Counter to the 50% point of the leading edge of incoming sync. The μP calculates this point by analyzing the samples of the sync window stored in the Sample RAM.

To lock the Line Counter to the 50% point of sync, the μP waits until the end of the vertical interval and pulls UNLOCKED false. This allows HSYNC to control the LOAD signal instead of GEN CSYNC. The μP then analyzes the sampled data and shifts (in 280-ns increments) the Line Counter offset (via U403) until HSYNC coincides with the 50% point of incoming sync. At this point, it returns the offset to 115.

The Memory Controller (U712) controls the storage of ADC data in the Sample RAM. The Address Counter (U607) generates 249 addresses (0 to 248) in which the Sample RAM stores the ADC samples. Fig. 6-1 shows the timing for the Memory Controller and Address Counter outputs.

When CSTRSMP is true and SAMPLER EN is false, the Memory Controller enables the Address Counter with the CNTR EN pulse. The Memory Controller also allows WE to start clocking the inverse of clock

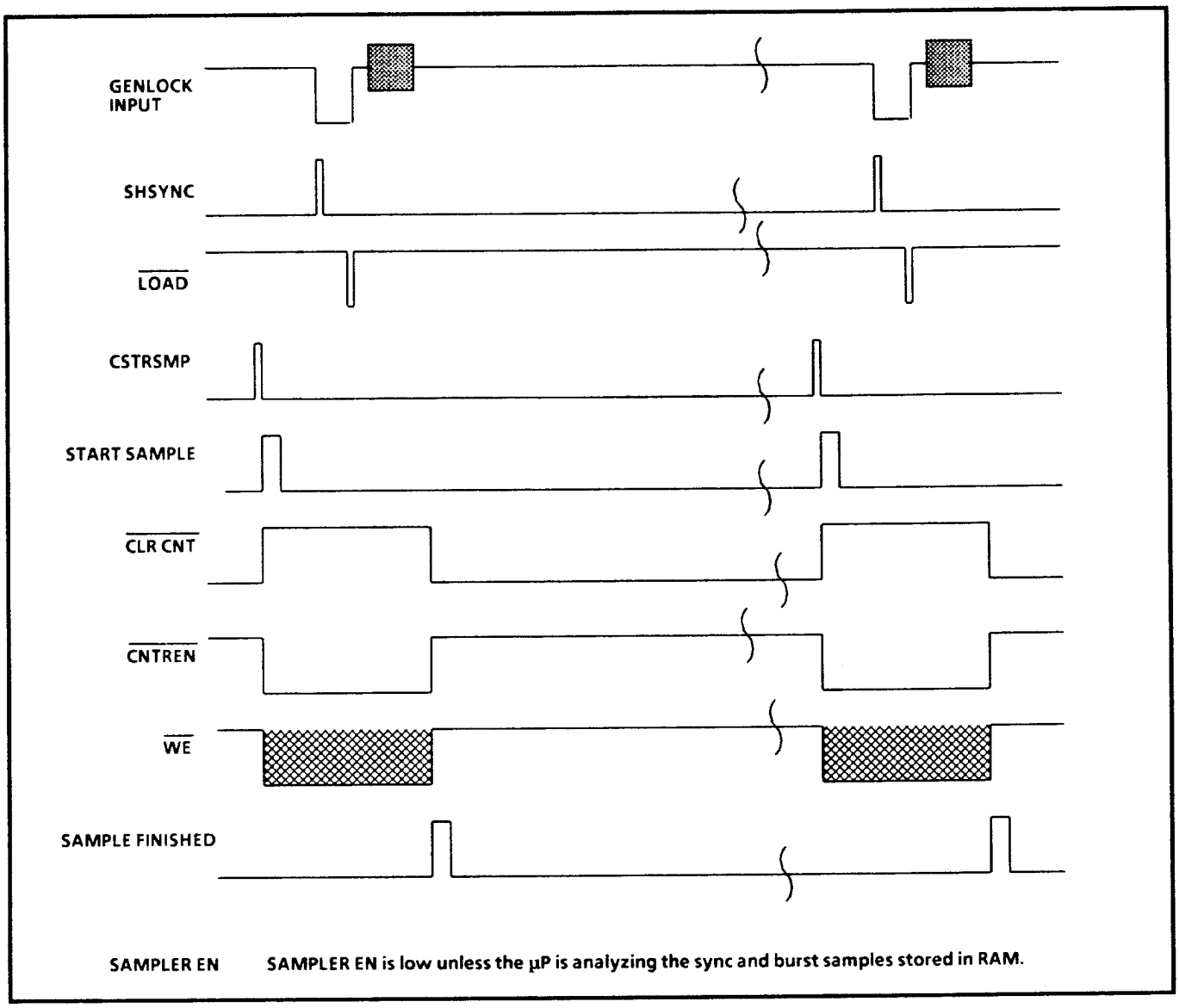


Fig. 6-1. Timing for Memory Controller and Address Counter outputs.

CLK1B. The sample data from the ADC, U814, is written into the Sample RAM.

The Memory Controller allows this operation to continue until SAMPLE FINISHED is asserted (approximately 249 counts later). SAMPLE FINISHED tells the Memory Controller to enable $\overline{\text{CLR CNT}}$, disable $\overline{\text{CNTR EN}}$, and wait for the next CSTRSMP.

During the vertical interval, CSTRSMP never occurs if $\overline{\text{UNLOCKED}}$ is true. Remember that when $\overline{\text{UNLOCKED}}$ is true, the Address Decoder uses $\overline{\text{GEN CSYNC}}$ (instead of HSYNC) to derive the $\overline{\text{LOAD}}$ pulse for the Line Counter. In the vertical interval, this $\overline{\text{GEN CSYNC}}$ (and thus $\overline{\text{LOAD}}$) occurs at a half line rate. Because this prevents the counter from reaching a full line count, the Address Decoder cannot generate CSTRSMP.

CLOCK CIRCUIT (Schematic 4)

Introduction

The Clock circuit generates several 4Xsubcarrier clock signals that it distributes throughout the instrument. It has three main sections: (1) VCO & Oven Heater, (2) DAC, Integrator & Switcher, and (3) Clock Shaper & Drivers.

At the heart of the Clock circuit is the VCO. Controlled by the μP, the VCO generates a 4Xsubcarrier signal that is either free-running or locked to the Genlock Input.

The Clock Shaper circuit converts the VCO output to an ECL square wave and ensures its duty cycle is exactly 50%. The Drivers distribute this square-wave throughout the instrument as the CLK1 signal.

VCO

CAUTION

If it becomes necessary to remove Q293 from its heat sink, move J396 to the 2–3 position to prevent Q293 from overheating.

Configured as a Colpitts oscillator, the VCO circuit generates the 4Xsubcarrier signal from which all clocks in the instrument are derived. C15, in series with C8, and C6; C16, in series with varactor CR14; and C19 form the parallel resonant circuit with the crystal, Y11. C6 and C8 also provide some additional positive feedback to the base of Q1, to ensure oscillation.

Varactor diode CR14, in series with C16, establishes the frequency correction range of the oscillator. As the μP changes the VCO correction voltage over a range of +9 to –10 V (at pin 4 of P11), the reverse-biased varactor diode shifts the oscillator frequency over a correction range centered around the oscillator's free-running frequency.

Adjustment of the free-running frequency is accomplished with C19. See **Calibration** (Section 5) for full instructions on adjusting the VCO free-running frequency.

P180 allows the VCO correction voltage to be grounded when the free-running frequency is being adjusted. Also, P180 allows the VCO frequency to be checked over the full VCO correction voltage range. See **Performance Check** in Section 5.

Oven Heater Circuit — Comprised of thermistor RT11, op-amp U390B, darlington transistor Q293, and associated circuitry, the oven heater circuit is a feedback loop that keeps the crystal oven at a constant 60°C.

When the oven is cold, the resistance of RT11 is high, placing a more positive voltage at pin 6 of U390B. This pulls the output of U390B more negative and biases Q293 to increase its current flow and thus heat. As the oven heats up, the resistance of RT11 decreases, pulling the bias at the base of Q293 more positive to decrease its current flow.

Diode CR394 prevents U390B from excessively reverse biasing Q293 by limiting the maximum positive output of U390B to 5.6 V. Diode CR395 and DS397 current limit Q293 when U390B is at its maximum negative output. They do this by limiting the voltage at the base of Q293 to about 3.1 V. This limits the current through the emitter leg of the darlington to about 0.7 amps (one diode voltage drop across R296).

The current limiting occurs only when the oven is cold. This allows DS397 to act as an "Oven Cold" indicator.

DAC Integrator and Switcher — The μP controls the VCO through the VCO DAC (U267). Enabled by the $\overline{\text{VCO DAC}}$ signal from Decoder U162 (Schematic 2), the VCO DAC converts the μP correction words to current pulses and applies them to integrator U270A. The correction word ranges from 00 to FF (hex).

Integrator U270A has two main functions. First, it works as a current-to-voltage converter for the correction pulses generated by the VCO DAC. These pulses shift the VCO frequency to correct VCO phase. Second, the integrator produces an average of the correction pulses. This average is essentially a DC level that changes only to track the input burst frequency.

The switches in U176 put the Genlock Loop in one of four operating modes: Internal, Genlock, Hold, and Acquire. Each is described below. The μP controls the switches through the $\overline{\text{INT}}$/GENLOCK and $\overline{\text{HOLD}}$/ACQUIRE lines.

Internal Mode: When the μP cannot detect a valid Genlock Input signal, it switches the Genlock Loop into Internal mode by pulling the $\overline{\text{INT}}$/GENLOCK line low. This pulls the correction voltage at the integrator output to midrange or zero volts by closing three switches. The first switch (pin 16, U176) shorts out the integrator capacitor; the second and third switches (pins 8 and 9, U176) short out any residual voltage to ensure the correction voltage applied to the VCO is truly zero or midrange.

NOTE

Although the range of correction voltage from the integrator is +10 to -10 V, the correction range at pin 4 of the VCO board is +3 V to -10 V, due to the voltage divider (R385 and R181) and its -10 V supply.

Genlock Mode: When the μP detects a valid Genlock Input signal, it pulls the $\overline{\text{INT}}$/GENLOCK line high to apply the VCO correction voltage to the VCO.

Acquire Mode: To acquire lock with the Genlock Input, the Genlock Loop needs to be faster than when it is just holding lock. To speed up the Genlock Loop, the μP increases integrator gain by pulling the $\overline{\text{HOLD}}$/ACQUIRE line high. This adds a large resistance (R171) to the integrator feedback loop.

Hold Mode: To hold lock, the μP slows down the Genlock Loop by pulling the $\overline{\text{HOLD}}$/ACQUIRE line low to remove R171 from the integrator feedback loop.

Clock Shaper, Drivers, and 28 MHz Clock

Q491 buffers the VCO output. ECL driver U596A converts the buffered output into a complementary pair of square-wave clocks. Two RC circuits (R494 with C493 and R495 with C495) average the square waves. Op-amp U390A amplifies these averages and shifts the bias of the VCO output (at Q491) to correct its duty cycle.

Through U591A, the Clock Shaper distributes a pair of corrected clock outputs to the Digital board via ECL-to-TTL Translators U841 and U425, and to the Output board through drivers U591A and U591C.

U596C, U596B, and U585A together produce a 28.6 MHz clock by doubling the frequency of an output from the VCO.

The 4Xsubcarrier clock output from driver U596C goes directly to EXOR gate U585A and also to a delay network. Made up of R595, R596, and C594, this network delays the clock by 17.5 ns and applies it to the other input of EXOR gate U585A, via driver U596B.

With a delayed and undelayed clock on its inputs, U585A generates a 28.6 MHz clock. Divided by 5 (by U429 in Schematic 2), this becomes the μP clock (μPCLK).

SIGNAL GENERATION CIRCUITS (Schematics 5, 6, and 7)

Introduction

The Signal Generation section consists of three schematics: Pulse and Test Signal Timing (Schematic 5), Test Signal Selection (Schematic 6), and Signal Memory & Multiplexing (Schematic 7). See Fig. 6-2 for a block diagram of the Signal Generation circuits.

Overview

The Vertical Counter provides timing to the V Pulse PROM.

The H Timing Counter and Vertical Counter provide timing to the H Timing PROM and V Timing PROM, respectively. These PROMs provide timing to the Signal Selection Logic, which uses this timing, along with a code generated by the μP, to select the test signal in the Test Signal PROMs. The output rate from these PROMs is multiplexed by shift registers to provide the required test signal output rate.

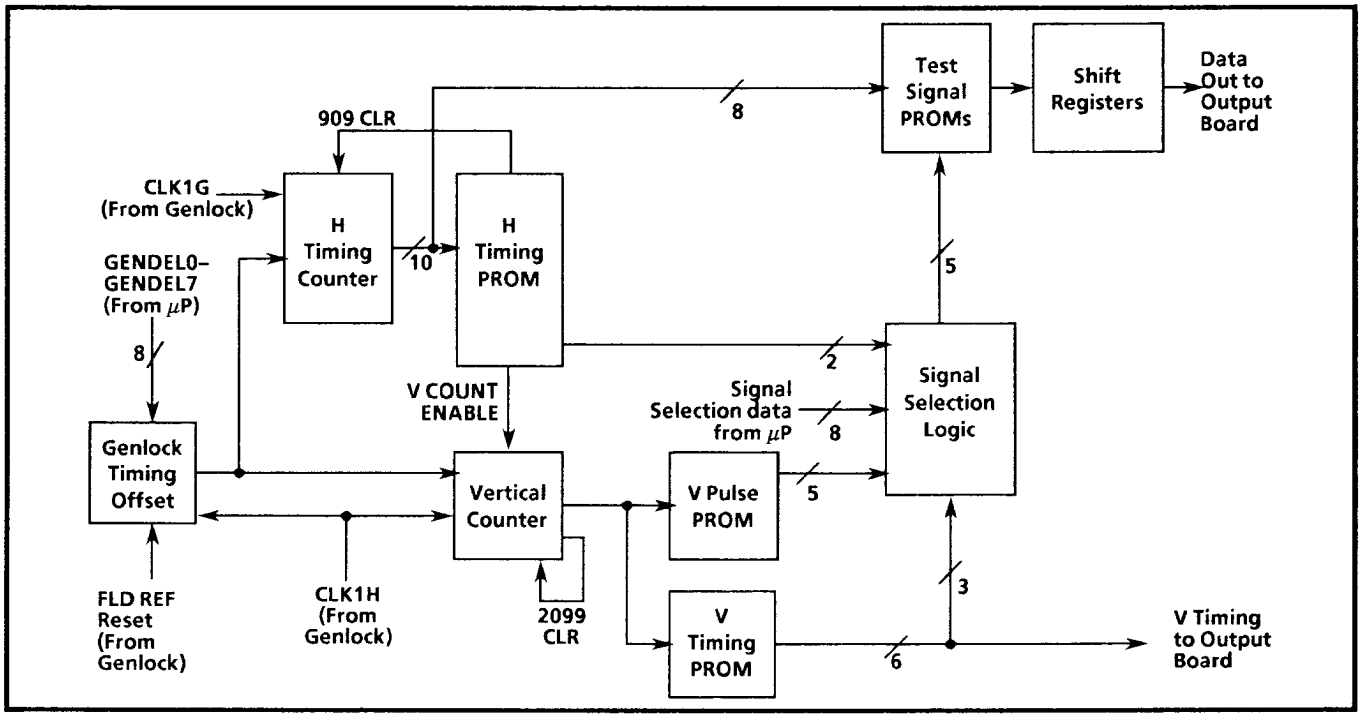


Fig. 6-2. Block diagram of Signal Generation circuits.

PULSE & TEST SIGNAL TIMING (Schematic 5)

Genlock Timing Offset

The Genlock Timing Offset circuit is comprised of two 4-bit counters (U463 and U563) and two D flip-flops (U867A and U867B). The job of this circuit is to add the front-panel-selected coarse genlock timing offset to the Signal Generation circuits. It does this by delaying the time at which the FLD REF signal loads the Horizontal and Vertical Timing Counters

Normally, counters U463 and U563 are in the load mode (disabled). But on line 10 of field 3, the FLD REF pulse enables the counters through flip-flop U867B, and the counters count to 255, beginning from the offset value at their load inputs (GENDEL0-GENDEL7). At the end of the count, the Carry output from U563 loads the Horizontal and Vertical Counters (through U867A) with their fixed offset values. In addition, the Carry output disables counters U463 and U563 through U867A and U867B.

When coarse genlock timing is adjusted at the front panel, the μP sends a new 8-bit offset word (GENDEL0-GENDEL7) to U463 and U563. On line 10 of field 1 the word is loaded into U463 and U563. As a result, U463 and U563 start their count at a different value, thus changing the time that the Horizontal and Vertical Timing Counters are loaded.

Horizontal Timing

H Timing Counter — Loaded by the delayed FLD REF signal and clocked at a 4Xsubcarrier frequency by CLK1G, the H Timing Counter (U663, U763, and U863) provides horizontal timing to the H Timing PROM and Test Signal PROMs (Schematic 7). It does this by addressing the H Timing PROM and Test Signal PROM at a rate of 910 words per line.

When the H Timing Counter has reached count 909, the H Timing PROM automatically clears it with the $\overline{\text{H COUNTER CLEAR}}$ signal. This signal is gated at U670A to prevent the H Timing Counter from being cleared while a genlock timing offset is being loaded.

The load inputs to the H Timing Counter present a fixed offset of 98 (hex). This offset allows the Genlock Timing Offset circuit to both advance and delay the genlock timing.

Vertical Timing

Vertical Counter — Three 4-bit counters (U684, U784, and U884) make up the Vertical Counter. Clocked by CLK1H, the Vertical Counter provides vertical timing for the V Pulse PROM (U895) and the V Timing PROM (U889, Schematic 6). It does this by addressing the PROMs at a rate of 2100 counts per color frame (525 counts per field x 4 fields), one count occurring every half line. The counting cycle for the Vertical Counter is as follows:

Every half line, the V-COUNT ENABLE signal from the H Timing PROM (U859, Schematic 6) enables the three counters for 70 ns, allowing CLK1H to clock the counters once. This is repeated until the counters have reached a count of 2099, at which point gate U792B clears the counters to start a new four-field frame.

The V-COUNT ENABLE signal is combined with 1H0 and 1V0 (at gates U788C, U788D, and U792A) to prevent the counters from clearing in the middle of a line when the instrument is operating as a master generator, i.e., when the Genlock Input is without sync.

When the Vertical Counter attempts to clear in the middle of a line, its timing is a half line off and the 1V0 bit is a logic 1 instead of 0. Consequently, the 1V0 input to gate U788C locks out V-COUNT ENABLE, making the Vertical Counter skip a count and thus shifting its timing by half a line.

When the instrument is operating in genlocked mode, the delayed FLD REF signal inserts the genlock timing offset into the Vertical Counter just as it does for the H Timing Counter. That is, it delays the loading of the Vertical Counter's fixed offset. When the instrument is operating in internal mode or subcarrier locked mode, the delayed FLD REF signal never occurs and the Vertical Counter is never loaded.

Jumpers P881 and P882 are used together to advance vertical timing by as much as two lines or delay it by one line. The Vertical Timing table in Schematic 5 shows the appropriate pin positions for advance/delay.

V Pulse PROM — The V Pulse PROM (U895) has two functions: (1) to produce vertical timing for the Test Signal Selection Logic, and (2) to provide a vertical timing interrupt for μP Kernel (Schematic 2). Table 6-1 summarizes the outputs of this PROM.

Five of these V Pulse PROM outputs (D0-D3 and D5) are sent to the Test Signal Selection circuits (Schematic 6), where they provide timing for the Signal Selection Logic.

The latched D3 output of the V Pulse PROM ($\overline{\text{LV DRIVE}}$ from pin 15, U880, Schematic 6) is also sent to CTC1 (Schematic 2) where it interrupts the μP to tell it to start servicing the front panel during the vertical interval when there is no Genlock Input signal. (Note that when a composite Genlock Input signal is present, the μP uses the vertical sync of the Genlock Input as a front-panel interrupt, not $\overline{\text{LV DRIVE}}$ from U796.)

TEST SIGNAL SELECTION (Schematic 6)

H Timing PROM

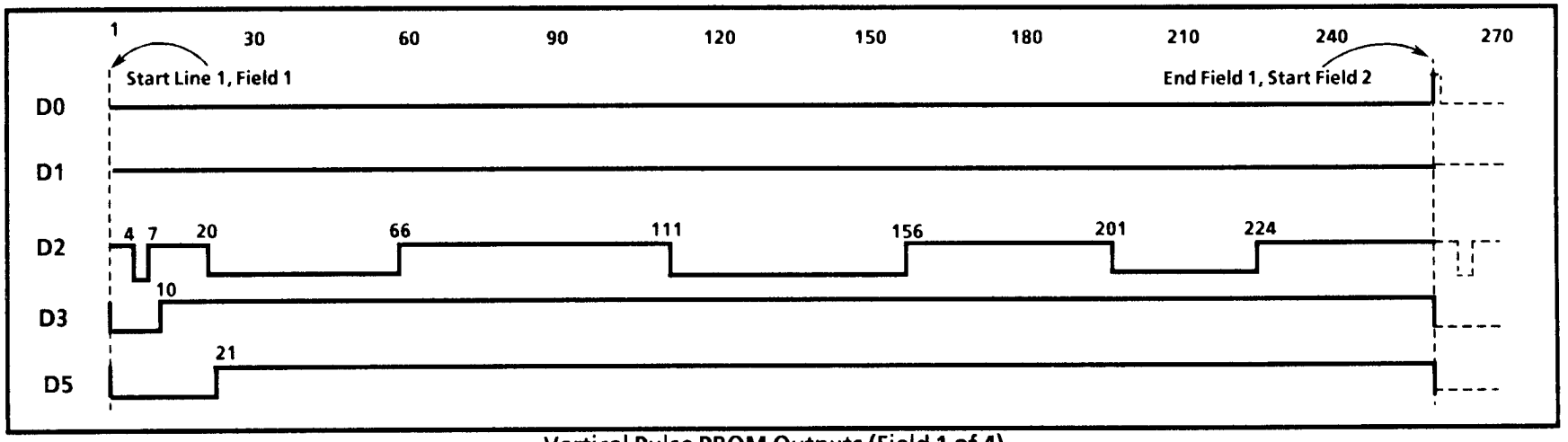
Addressed by the genlocked H Timing Counter (Schematic 5), the H Timing PROM (U859) has four functions: (1) to generate a pulse ($\overline{\text{BURST TIMING}}$) coincident with burst, (2) to generate timing control signals for the H & V Timing circuits in Schematic 5, (3) to generate timing signals for the Signal Selection Logic, and (4) to align the vertical timing inputs of latch U880 with the H Timing Counter. See Table 6-2 for a summary of the H Timing PROM outputs.

V Timing PROM

Addressed by the genlocked Vertical Counter (Schematic 5), the V Timing PROM (U889) has two main functions: (1) To provide vertical timing for the Signal Selection PROM (U447) in the Signal Selection Logic, and (2) to provide vertical timing for the Color Bar Generator and the ID Generator (Schematic 9). See Table 6-3 for a summary of the outputs.

Table 6-1
Vertical Pulse PROM Outputs

Output	Function
D0	Half-line signal selection timing. High during line 263 of fields 1 and 3.
D1	Half-line signal selection timing. High during line 20 of fields 2 and 4.
D2	Timing for SYNC output when D3 is low. Also provides timing for matrix-signal selection.
D3	Low during vertical sync time.
D5	Timing for 20-line V-Blanking portion of BLANKING output.



Vertical Pulse PROM Outputs (Field 1 of 4)
(Numbers Refer to Beginning of H-Line)

Signal Selection Logic

The heart of the Signal Selection Logic is the Signal Selection PROM (U447). Addressed by the μP (Schematic 2) and two vertical timing PROMs (V Timing and V Pulse), the Signal Selection PROM generates the selection code that determines which test signal the Test Signal PROMs generate. The V Timing PROM (U889) provides the selection PROM with timing for selecting the split-field signals, and the V Pulse PROM (U895, Schematic 5) provides the Selection PROM with timing for selecting the vertical sync pulses.

When a test signal is selected at the front panel, the μP encodes the selection into an 8-bit data word (ED0-ED7) and sends it to the Signal Selection PROM via latch U443. Combined with the vertical timing signals, this data addresses the appropriate test signal selection code in U447.

The output of U447 is summarized as follows: Signals S0-S3 form the code that select the test signals at the Test Signal PROMs. Signals ϕA and ϕB make up part of that code when the selected test signal does not have chrominance. (See Table 6-4 for selection codes from U447.) When the selected signal does have chrominance, ϕA and ϕB determine which phase of test signal is selected from line to line. (Chrominance phase alternates 180° from line to line.)

ϕA and ϕB are gated with four signals (H BLANK, LV DRIVE, VB, and BURSTϕ) at U363A-B and U788A-B to become the B1 and B2 signals at U788A and U559B. Gated by U559A (Schematic 7) and latched through U555 (Schematic 7), B1 and B2 are the signals that actually select chrominance phase or form part of the signal selection code described above.

When monochrome signals are selected, burst is still generated. This is done by the S0-S3 codes selecting the monochrome signal for the active portion of the line and then alternately selecting opposite-phased burst segments for the horizontal intervals.

At the end of fields 1 and 3 and the beginning of fields 2 and 4, the Signal Selection PROM selects half-line segments of the selected test signal. Gates U455C, U455D, and U363B combine the LF1L263V and LF2L20V signals with half-line pulses (F2L20H and F1L263H) from the H Timing PROM to tell the Test Signal PROMs when to generate the half-line segments.

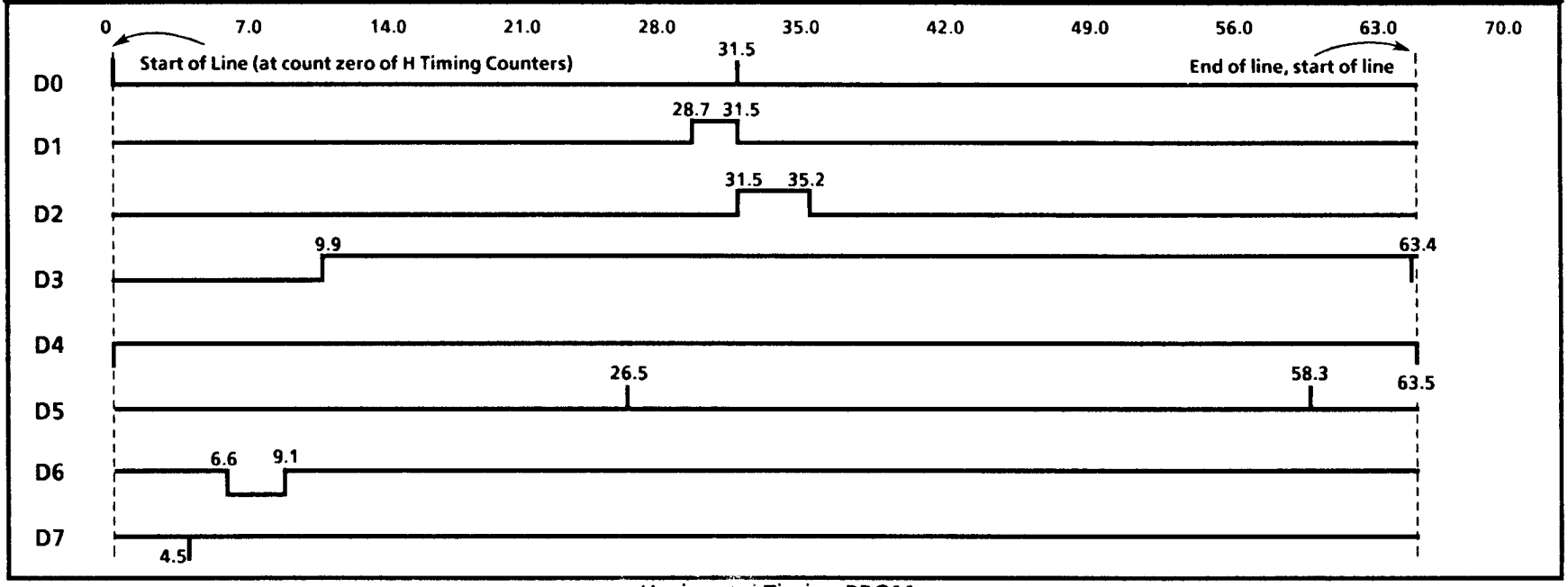
Note that the LF2L20V and LF1L263V signals are generated by the V Pulse PROM (U895, Schematic 5). To align them with the H Timing PROM, the H Timing PROM latches the signals into U880 with its V LATCH output.

Gates U696D, U696B, and U780B combine the VB (Vertical Blanking), LV DRIVE, and BURST TIMING signals to generate the BURST GATE signal at U780B. This signal supplies timing for the output clamp circuit (U440 and U532) in Schematic 7. VB prevents the BURST GATE from activating the output clamp when the DAC TEST signal is selected.

At U780A, the $\overline{\text{LV BL20}}$ (Latched Vertical Blanking) signal combines with the H BLANK signal to generate the BB ENABLE signal for the Black Burst circuit in Schematic 12.

Table 6-2
Horizontal Timing PROM

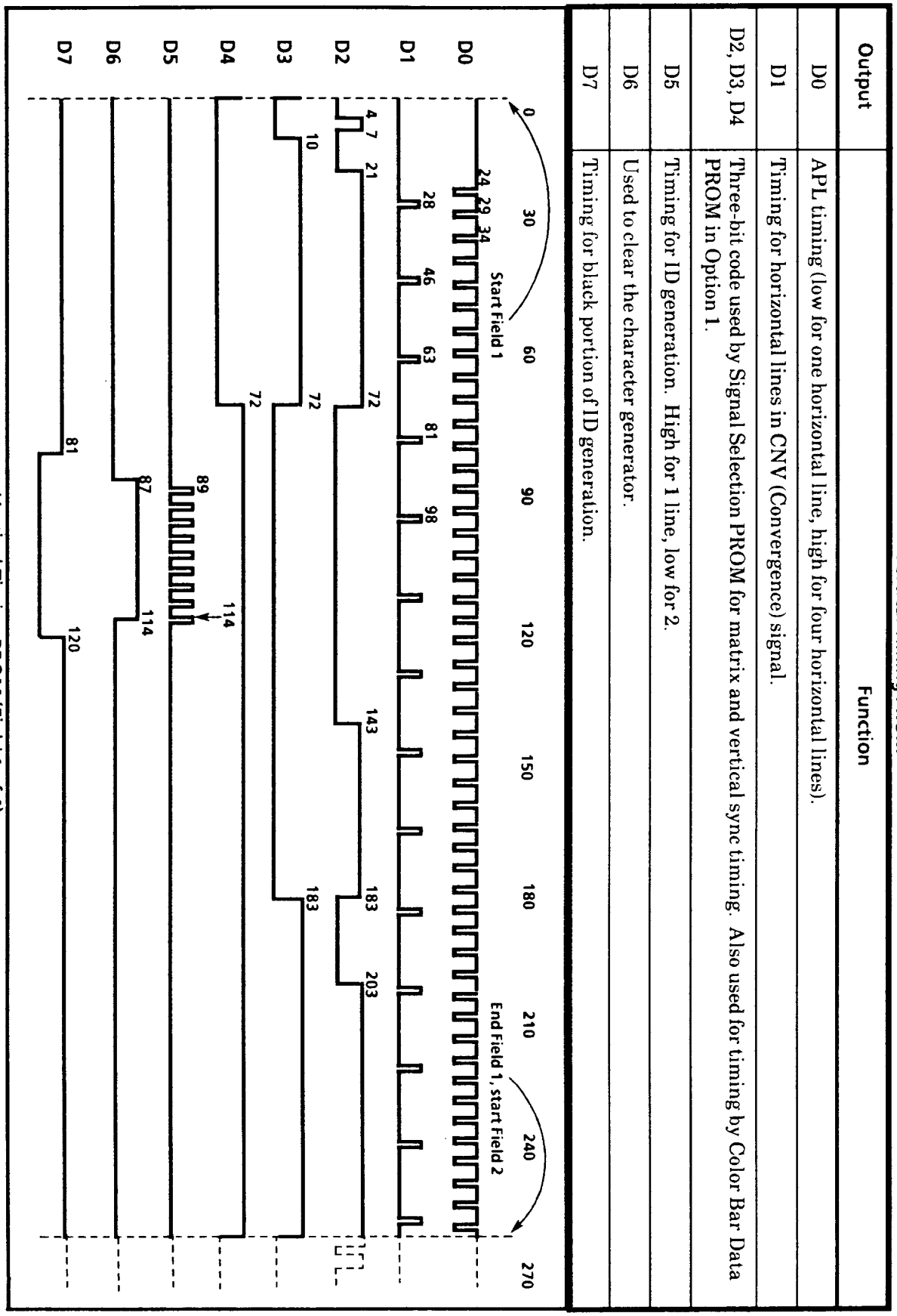
Output	Function
D0	Positive pulse twice a line used to latch vertical information from the V Timing PROM, V Pulse PROM, and Signal Selection PROM.
D1	Half-line timing at a horizontal rate for selecting half-line signal segments.
D2	Half-line timing at a horizontal rate for selecting half-line signal segments.
D3	Timing for B B ENABLE signal and for alternating burst phase from line to line (B1, B2).
D4	Negative, 70 ns pulse to clear the H Timing Counter to zero at count 909.
D5	Positive, 70 ns pulse twice a line enables the Vertical Counter to count twice a line.
D6	Negative pulse that is NORed with V DR to provide the BURST GATE signal. This signal is used on the Analog board to clamp the test signal output.
D7	Negative, 70 ns pulse used to load the H Pulse Counter once a line with a count specified by the μP.



Horizontal Timing PROM
(Numbers are in μs)

Table 6-3
Vertical Timing PROM

Output	Function
D0	APL timing (low for one horizontal line, high for four horizontal lines).
D1	Timing for horizontal lines in CNV (Convergence) signal.
D2, D3, D4	Three-bit code used by Signal Selection PROM for matrix and vertical sync timing. Also used for timing by Color Bar Data PROM in Option 1.
D5	Timing for ID generation. High for 1 line, low for 2.
D6	Used to clear the character generator.
D7	Timing for black portion of ID generation.



Vertical Timing PROM (Field 1 of 4)
(Numbers Refer to Beginning of H-Line)

Table 6-4
Signal Selection PROM Output Codes

S3	S2	S1	S0	ϕA	ϕB	SELECTED SIGNAL
0	0	0	0	X	X	7 BAR COLOR BARS
0	0	0	1	X	X	REVERSE BLUE BARS
0	0	1	0	X	X	IWQB BARS
0	0	1	1	0	1	CONVERGENCE (HORIZ.)
0	0	1	1	1	0	CONVERGENCE (VERT.)
0	1	0	0	0	1	LINEAR RAMP
0	1	0	0	1	0	5 STEP
0	1	0	1	X	X	MOD RAMP
0	1	1	0	X	X	PULSE AND WINDOW
0	1	1	1	X	X	SWEEP MARKERS
1	0	0	0	0	1	MULTIBURST
1	0	0	0	1	0	BLANKING
1	0	0	1	0	1	10 IRE
1	0	0	1	1	0	100 IRE
1	0	1	0	X	X	MULTIBARS
1	0	1	1	X	X	RED FIELD
1	1	0	0	X	X	NTC7 COMPOSITE
1	1	0	1	0	1	3.58 MHz CW
1	1	0	1	1	0	500 kHz CW
1	1	1	0	0	1	LINE SWEEP
1	1	1	0	1	0	MULTIPULSE
1	1	1	1	0	1	EQUALIZERS
1	1	1	1	1	0	VERTICAL SYNC

TEST SIGNAL MEMORY AND MULTIPLEXING (Schematic 7)

Test Signal Memory

The test signals and signal components are stored in five PROMS (U624, U631, U637, U644, and U650), in ten-bit binary form. The output data rate from this memory array is ten parallel bits every 70 ns. To achieve this, the data is spatially and temporally multiplexed before programming. Demultiplexing is accomplished by the shift registers.

There are 32 lines of test signals stored in the five PROMs. Each of these lines can be a monochrome signal or one chroma phase of a color signal. These lines of test signal are selected by the five most significant bits of the PROM address. This forms the first spatial dimension of the multiplexing scheme.

The second spatial multiplexing dimension is created by spreading the ten data bits forming each word amongst the PROMs; bits 0 and 1 in the first PROM, bits 2 and 3 in the second, and so on.

In addition, the data bits are divided into four sequential samples (of two bits per PROM, as mentioned) and assembled into a byte. This means that the first byte of the first PROM contains bits 0 and 1 of the first four data words needed to generate the first test signal. This is the third spatial dimension, and the temporal multiplexing as well.

As the chroma phase alternates from line to line in NTSC, there are two lines stored for each color signal, one of each phase. There is only one signal stored for each monochrome signal, even though the burst must still alternate from line to line.

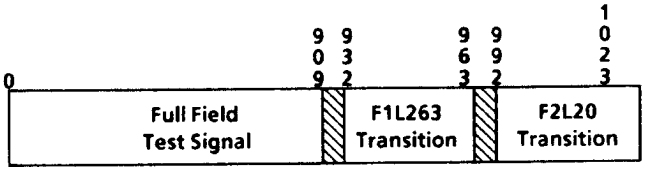
When a color signal is to be generated, the signal selection PROM produces a four-bit selection code (S0–S3), and sets ϕA and ϕB both low. These signals are applied to the Signal Selection circuitry, which returns the B1 and B2 signals. These are NANDed by U559A and applied to latch U555, to produce the HD8 signal. For a color signal, B2 is held high while B1 (and HD8) alternate at a line rate. HD8 determines which phase of the color signal selected by S0–S3 is to be output.

When generating a monochrome signal, the signal selection PROM still produces S0–S3 to select the signal, and uses ϕA and ϕB to control the burst phase to be produced. As an example, if the desired monochrome signal was stored under selection code 0100, the signal selection PROM would output 0100 on the S0–S3 lines, and would hold ϕA high and ϕB low. B1 and B2 will then both be high, except during horizontal blanking; then B1 alternates high and low for each line. HD8 will be low except during horizontal blanking, when it too will alternate high and low.

Monochrome signals are stored so that adjacent signals have opposite burst phases. Then, when HD8 is low during horizontal blanking the sync and burst stored with the selected signal is output; and when HD8 is high, the sync and burst stored with the adjacent signal is output. In this way, the burst phase alternates from line to line.

In the NTSC format there are two half lines. One is line 263 of field 1, which has a transition from test signal to blanking between samples 420 and 451, and the other is line 20 of field 2, which has a transition from blanking to test signal between samples 480 and 511.

As there are only 910 test signal samples stored in each 1024 byte memory block, there is sufficient space for the half line transitions to be stored there as well. They fit into each memory block like this:



In order to access these transition signals, the vertical and horizontal timing hardware modify the PROM addresses when they are needed. On line 263 of field 1, H9 is toggled high during samples 420–451 to force the PROM addressing to the 932–963 area; on line 20 of field 2, H9 toggles high during samples 480–511, forming addresses 992–1023.

Shift Registers

At the input of the test signal PROMS, the S0–S3 signals select the desired test signal, while the HD0–HD6 signals (derived from the H Timing Counter, Schematic 6) address the components of the selected signal.

Each four bit nibble read out of the PROMs into a shift register contains one bit each for four sequen-

tial data words. After 280 ns, the shift registers load the data nibble, placing the data bit at D3 (W, a bit in word 0) at the output. On the next clock cycle, the next sequential data bit (X, a bit in word 1) is sent to the output. On the next clock cycle, the next sequential data bit (Y, a bit in word 2) is sent to the output. On the next clock cycle, the next sequential data bit (Z, a bit in word 3) is sent to the output. Under normal conditions the bit stream is generated by this LOAD–SHIFT–SHIFT–SHIFT sequence.

There are 910 samples in a line, however, and 910 is not evenly divisible by four; therefore, two of the samples must come from somewhere else. The SHIFT/$\overline{\text{LOAD}}$ signal is generated by NANDing the two LSBs of the horizontal count (1H0 and 1H1), so an extra pair of shift pulses will occur on counts 2 and 3 (see Fig. 6-3). During this time, the data at the shift register's serial input is used. As this occurs during blanking, the serial inputs for the shift registers are hard-wired to the digital code for blanking.

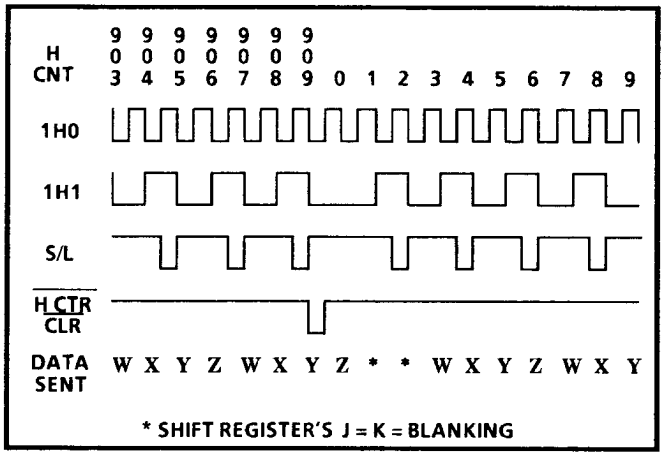


Fig. 6-3. Shift register blanking timing.

The test signal data is converted to ECL levels by U821, U824, and U827, and applied to the Video Output Multiplexer (Schematic 11).

OUTPUT BOARD

GENLOCK INPUT (Schematic 8)

Genlock Input Buffer

The AC-coupled Genlock Input Buffer inverts and amplifies the Genlock Input signal so that sync and burst fill the range of the Genlock ADC on the Digital board.

At the input stage, differential pair Q14 and Q15 isolate and current-amplify the Genlock Input signal. The second stage (Q16) inverts and voltage-amplifies the signal. The third stage, an emitter follower (Q17), applies the signal to the input filter on the Digital board via jumper P13. It also feeds the inverted signal back to the input, at the base of Q14.

As well as amplifier feedback, three other signals feed to the input of the Genlock Input Buffer: Line dither comes through R150, the Clamp circuit adds a DC offset through R153, and burst dither comes through R147.

Line Dither

The function of the Dither circuit is to increase the ADC's resolution (Schematic 3) to that of a 10-bit ADC by inserting 16-level pseudorandom noise into the Genlock Input signal.

Counter U53, DAC U54, and op-amp U56A make up the Dither circuit. The counter outputs are connected to the four high-order bits of the DAC, with the LSB tied to the highest order bit (bit 7) and the MSB tied to the low-order bit (bit 4). Op-amp U56A converts the DAC output current to voltage and applies it to the Genlock Input Buffer. An internal resistor connected to pins 1 and 16 is the feedback path for U56A.

Schottky diode CR6 protects the DAC against negative transients by switching on at –0.3 V. R140 and R141 set a –0.625 V reference for DAC U54.

Input Clamp

By comparing the sync tip voltage of the Genlock Input signal with a –50 mV reference, the Input Clamp circuit generates a DC offset voltage to clamp the incoming signal to –50 mV. It does this as follows:

Monostable multivibrator U57A shortens the incoming 4.7 μs sync pulse detected by the Sync Stripper to about 2 μs. This shortened pulse switches on U59, allowing U59 to generate a voltage equal to the difference between the sync of the input video with dither (up to 1 mV) applied to pin 3 and the reference applied to pin 2. This difference voltage is stored in C50 for the remainder of the line. Through Darlington Q20, the voltage is applied to the base of Q14, where it clamps the sync tip of the Genlock Input to

-50 mV, or to the emitter of Q17, where it clamps the output sync tip to -50 mV.

Burst Dither

NOTE

Burst dither is active only if a Genlock Input signal is connected and detected.

During burst, a sawtooth wave adds an increasing offset to the Genlock Input signal. This offset dithers the burst samples to improve sampling accuracy in the Genlock Data Acquisition circuits.

Q18 and C46 generate the sawtooth. A low $\overline{\text{BURST DITHER}}$ pulse turns off Q18 just before burst and leaves it off until just after burst. During this time, the collector of Q18 charges C46 to produce the sawtooth. This signal feeds to the Genlock Input buffer through R147.

Sync Stripper

The Sync Stripper extracts sync pulses from the buffered Genlock Input signal and applies them to the Input Clamp and the Genlock Data Acquisition circuits (Schematic 3). C44 filters off the chrominance portion of the Genlock Input. The remainder of the signal goes to peak detector U47B and inverting op-amp U47A. U58 compares the output of these devices and produces the composite sync.

When the Genlock Input is a continuous wave, no sync pulses are available to time the clamp, so the Sync Stripper output must be switched off by moving P16 (GENLOCK INPUT CLAMP DISABLE) to the 2–3 position.

One of the purposes of the Input Clamp is to remove 60 Hz hum. When the Genlock Input is a continuous wave and there are no sync pulses to drive the Input Clamp, the hum can be removed by feeding the signal through a high-pass filter comprised of C47, R148, and R149. This is done by moving P13 (GENLOCK ADC INPUT) to the 2–3 position.

In the high-pass filter, R148 and R149 also act as a voltage divider to bring the CW signal within the ADC range.

ID GENERATION (Schematic 9)

The Character ID Generation circuit produces a set of up to twelve characters, which are inserted in a black field and then inserted on lines 87-114 of every field. Each character is made up of a 7 X 9 dot matrix, and each dot is three horizontal lines high.

Character Control

Initially, the μP loads the character codes into the Character RAM (U25) by asserting $\overline{\text{IO2}}$ and selecting character locations with address lines UPA0 - UPA3. $\overline{\text{IO2}}$ is also applied to a digital one shot comprised by U93 and U94, which gives the address time to pass through multiplexer U26. The delayed pulse then enables the character data port (U33) and the character RAM (U25), applying the character code from the external data bus to the RAM.

In normal operation, the character ID is generated by a state machine. U31 decodes the horizontal timing count to produce the horizontal timing signals for character generation. Counter U29 is clocked by the $\overline{\text{PRE LD}}$ signal, to specify the character location. Characters are generated in order across the video line. As $\overline{\text{IO2}}$ is not asserted, multiplexer U26 passes the counter output through to address the character RAM.

Character ID Generator

The character codes output by the character RAM are then latched into U32, which applies them to the character selection inputs of the character ID generator IC, U28. Horizontal timing signals from U31 ($\overline{\text{DOT CLK}}$ and $\overline{\text{START CHAR}}$), and vertical timing signals ($\overline{\text{L CLK}}$ and $\overline{\text{CLR}}$) from the vertical timing PROM (U889 on Schematic 6) are also applied to U28 to specify the size and position of the characters. The output of U28 is a serial bit stream specifying a black and white pattern corresponding to the character selected.

This data from U28 generates character edges of zero risetime which, if used directly, would produce unacceptable ringing on the analog output. The data is therefore digitally low-pass filtered by U36 and U37.

Character Encoding

U36 contains a state machine that counts up and down to specify several states along the edges of the characters. These states are encoded by U37 to create 8-bit data words which correspond to the low-pass-filtered character data. The data words are translated to ECL levels by U34 and U35, and inserted into the test signal data stream by U14 and U15 (on Schematic 11). The insertion timing is controlled by the WINDOW signal, which is also generated by U36.

While the characters are being changed by the user, the character position is marked with a cursor. This is enabled by setting bit 7 of the character select code, which generates the CURSOR signal. CURSOR modifies the state machine in U36 to create the white cursor with shaped edges, and then inserts the character in reverse video. Again, the data encoding is done in U37.

Tape Leader Operation

The tape leader function clears the active video to black while the characters count down from 10 to 2. To do this, the WINDOW signal is expanded to cover all of the active video region. The character generator works normally in the usual area, while the μP updates the counting-down characters. The rest of the screen uses black burst data created by U27. This shaped setup signal is generated in the same way that U36 generated the character states, and is applied directly to U37, which encodes the black burst states to the proper levels.

6.144 MHz Audio Clock

This is actually the second stage of the Audio Clock; the first stage is on Schematic 10. Starting with S/N B010619, the 6.144 MHz clock is driven by the SA_CT1 signal from U81–14, one of the counters in the Audio Data Generation block on schematic 10. From S/N B010446 to S/N B010619, it was driven by a 192 kHz clock from U73–13 (768 kHz ÷ 4), and prior to S/N B010446 it was driven directly by the 768 kHz clock.

In this stage, U78, U88, and associated components form an analog/digital phase locked loop (PLL) multiplier. This PLL locks voltage controlled oscillator A3A1 (U90A, prior to S/N B010619) to the input drive from schematic 10. The 6.144 MHz clock is then used to clock the Audio Data Counters (U80–U84) and the Serial Digital Audio Output shift register (U86), both on schematic 10.

AUDIO GENERATION & AUDIO OUTPUT (Schematic 10)

Audio Clock Generation

The Audio Clock circuitry generates a 768 kHz clock and a 6.144 MHz clock from the 14.31818 MHz Video Clock. This is accomplished in two stages, but only the 768 kHz generation is shown on this schematic. The 6.144 MHz generation is shown on Schematic 9.

The first stage uses U67 to digitally divide the video clock down to 768 kHz. This gives a division ratio of 14,318,180/768,000 = 18.64346. In order to achieve this, the division ratio is controlled by the BIT DIDDLE signal generated by U38, U39, U55, U70, U71, and U72. This pseudo–randomly switches the division ratio between 18 and 19, dividing by 19 for 64.346...% of the time. This produces a 768 kHz clock with a predictable 70 ns peak-to-peak jitter. In order to ensure that the audio clock remains locked to the video signal, U67 is reset every 10 video vertical intervals by U42, U68, and U69.

Serial Digital Audio Output

The SERIAL DIGITAL AUDIO OUTPUT is provided to test the AES/EBU serial audio interface in the D–2 composite studio. The frequency and amplitude are chosen to facilitate the calibration of the audio level indicators. Because the tone is 20 dB below the system maximum, the tone can be recorded and played back to verify the transparency of the record, playback, and transmission circuits.

The serial digital audio output is a linear PCM (uniformly quantized) representation of 2 channels of an audio tone. P19 allows the user to select either an 800 Hz or 1 kHz frequency for this tone.

The tones are quantized to a resolution of 24 bits at a rate of 48 kHz, and the data is represented in two's complement form. The data words for a channel form a subframe, a subframe for each channel forms a frame, and a group of 192 frames forms an audio block. The words that form a frame are time-multi-

Table 6-5.
Serial Digital Audio Output Format

One Frame	Sub Frame A	BYTE 0	A3	A2	A1	A0	S3	S2	S1	S0
		BYTE 1	A11	A10	A9	A8	A7	A6	A5	A4
		BYTE 2	A19	A18	A17	A16	A15	A14	A13	A12
		BYTE 3	P	C	U	V	A23	A22	A21	A20
	Sub Frame B	BYTE 0	A3	A2	A1	A0	S3	S2	S1	S0
		BYTE 1	A11	A10	A9	A8	A7	A6	A5	A4
		BYTE 2	A19	A18	A17	A16	A15	A14	A13	A12
		BYTE 3	P	C	U	V	A23	A22	A21	A20

plexed within the 48 kHz sampling period. A total of 32 data bits are transmitted for each channel in a serial manner, starting with the LSB of byte 0of subframe A.

The format for each frame is specified by ANSI S4.4–1985. See Table 6-5.

Bits S0–S3 form an unambiguous preamble to the subframe data. One specific code represents the start of an audio block; a second, the start of an ordinary subframe A; and a third, the start of a subframe B. The A0–A23 bits are the two's complement audio samples. The V bit is set to '0' to indicate that the data was not interpolated. The U bit is used to transmit bits from the serial user data stream. The U bit is set to the default value of '0'. The C bit is a bit from the serial channel status data stream. The channel status information used specifies 48 kHz locked sampling of two independent channels of audio with 24 bit resolution and no pre-emphasis. The P bit provides for even parity across the subframe data bits.

Aside from the preambles, the data bits defined above are encoded into bi-phase mark code, a self-clocking Manchester code. Each data bit is transmitted as a two-bit doublet which begins with a transition. If the original bit was a '1', the doublet is either '01' or '10', depending on the value of the preceding data bit. Similarly, if the original data bit is a '0', then the doublet is either '11' or '00', again depending on the value of the preceding bit.

The TSG–170D stores five blocks of audio data in an EPROM, U77. U80–U84 form a counter chain, clocked by the 6.144 MHz clock, which sequentially reads the bi-phase-encoded data bytes out of the EPROM. The bits are latched into a shift register (U86) at the 768 kHz rate, and serially shifted out at 6.144 MHz. This encoded bit stream is buffered by U87, a differential TTL driver, and transformer coupled to the output XLR connector on the rear panel.

Parallel Digital Audio Output

The parallel digital audio output is provided to test the parallel audio dubbing interface in the D–2 composite studio. The frequency and amplitude are chosen to facilitate the calibration of the audio level indicators. Because the tone is 20 dB below the system maximum, the tone can be recorded and played back to verify the transparency of the record, playback, and transmission circuits.

The parallel digital audio output is a linear PCM (uniformly quantized) representation of four channels of an audio tone. This tone is factory set to 800 Hz, but a 1 kHz tone can be selected by the user.

The tones are quantized to a resolution of 20 bits at a rate of 48 kHz, with the data represented in two's complement form. The data words for a channel form a subframe, a subframe for each channel forms a frame, and a group of 192 frames forms an audio block. The words that form a frame are time-multiplexed within the 48 kHz sampling period. Twelve control bits are added to the 20 audio data bits for

each subframe, so a total of 32 data bits (four bytes) are transmitted for each channel in a byte-serial manner, starting with byte zero of subframe zero.
In addition to the byte-wide audio data, a clock and a frame sync signal are transmitted. The clock is 768 kHz (four subframes per frame, times four bytes per subframe, times the 48 kHz sampling frequency equals 768 kHz). The rising edge of the clock occurs midway between the data word transitions and is used to latch the data into the receiving device. The frame sync signal is used by the receiving device to demultiplex the byte-serial data stream. It is a 48 kHz square wave which is low while the data for channels 2 and 3 are transmitted.

The format for each frame of the parallel digital audio is specified by SMPTE RP4.40X. See Table 6-6.

Bits A19 – A0 are the audio sample data. The SM bit is set to a '1' every 192 frames to indicate the start of an audio block. The WM2–WM0 bits are set to '111' to indicate that the audio data resolution is 20 bits. The CH2–CH0 bits are set to '001' to define the audio format to be four independant audio channels. The VJ and VD bits are cleared to indicate that the data is not known to have been interpolated. Finally, the EM2–EM0 bits are cleared to indicate that no pre-emphasis was used.

The TSG–170D stores five blocks of audio data in an EPROM, U91. The counter composed of U80 – U84 sequentially reads the audio data bytes out of the EPROM. The data bytes are then latched into U92. TTL-to-ECL buffers (U49, U50, and U51) use data from the latch to drive the rear-panel connector.

Analog Audio Output

The analog audio tone is generated by acquiring the 12 MSBs of one channel (selected through U48 by J17 and J18) of the parallel digital audio data stream. U48 converts the code to offset binary, and the data word is converted to an analog voltage by DAC U52. The DAC output is reconstructed with an active low-pass filter comprised by U46A and its

Table 6-6.
Parallel Digital Audio Output Format

One Frame	Sub Frame 0	BYTE 0	A19	A18	A17	A16	A15	A14	A13	A12
		BYTE 1	A11	A10	A9	A8	A7	A6	A5	A4
		BYTE 2	A3	A2	A1	A0	SM	WM2	WM1	WM0
		BYTE 3	CH2	CH1	CH0	VJ	VD	EM2	EM1	EM0
	Sub Frame 1	BYTE 0	A19	A18	A17	A16	A15	A14	A13	A12
		BYTE 1	A11	A10	A9	A8	A7	A6	A5	A4
		BYTE 2	A3	A2	A1	A0	SM	WM2	WM1	WM0
		BYTE 3	CH2	CH1	CH0	VJ	VD	EM2	EM1	EM0
	Sub Frame 2	BYTE 0	A19	A18	A17	A16	A15	A14	A13	A12
		BYTE 1	A11	A10	A9	A8	A7	A6	A5	A4
		BYTE 2	A3	A2	A1	A0	SM	WM2	WM1	WM0
		BYTE 3	CH2	CH1	CH0	VJ	VD	EM2	EM1	EM0
	Sub Frame 3	BYTE 0	A19	A18	A17	A16	A15	A14	A13	A12
		BYTE 1	A11	A10	A9	A8	A7	A6	A5	A4
		BYTE 2	A3	A2	A1	A0	SM	WM2	WM1	WM0
		BYTE 3	CH2	CH1	CH0	VJ	VD	EM2	EM1	EM0

associated components. U46B is used as a low impedence buffer amplifier which drives the output XLR connector on the rear panel.

DIGITAL VIDEO OUTPUT (Schematic 11)

Output Multiplexers

U14, U15, and U16 are multiplexers which select between the Character Data and the Test Signal Data. The 8-bit Character Data is applied to U14 and U15, while the 10-bit Test Signal Data is applied to U14, U15 and U16. The WINDOW EN line, from the Character Generation circuitry, is applied to U11 through P8 (Char ID Enable), which is used in conjunction with P1 (Video Resolution) to control the multiplexers.

U14 and U15 are controlled by U11-5, while U16 is controlled by U11-6. As long as P8 is in its 1–2 position, U11-5 is a buffered copy of the WINDOW EN line; when it's high, U14 and U15 select their A inputs (Character Data), and when it's low, they select their B inputs (Test Signal Data). When P8 is set to pins 2–3, U11–5 is held low, locking out the character data. U11-6 is not only controlled by the WINDOW EN line, but by P1 as well. If P1 is set to it's pins 2–3 position, U11-6 will follow the WINDOW EN line exactly, but if P1 is set to its 1–2 position U11-6 is held high. This holds U16 in its channel A mode, locking out the two LSBs of the Test Signal Data, and reducing the Test Signal output to 8-bit resolution.

Video Output Latches

The Multiplexer output, DAC D0 through D9, along with XOCLK and XOCLK, is applied to the Video Output Latches (U8, U9, U10, U74, and U75). These five ICs, clocked by the Video Output Clock, output complementary data and clock signals to the DIGITAL VIDEO OUTPUT connector on the rear panel.

Video Output Clock

U20B buffers the ECL CLK 1 and ECL,CLK,1 signals from the Digital board, and applies them to U76A and U76B. U76A passes the ECL CLK 1 signal to the Video Output Latches, while U76B applies the clock signals to U76C through a phase shift network. This phase shift network (L7, C51, and C52) is used to match the clock signal to the digital video data at the rear-panel connector. C51 provides manual phase adjustment. U76C then drives the DIGITAL VIDEO OUTPUT connector, pins 1 and 14.

Analog Video Output (Schematic 12)

Output DACs

Two 6-bit DACs (U18 and U19) accept the test signal or character data from the multiplexers on Schematic 11, and convert it into an analog signal. U18 converts the six MSBs and U19 converts the four LSBs. The two DAC outputs are combined at pin 8 of U18.

Both DACs draw a constant current. Current drawn through pin 8 of each DAC is proportional to the input data, and the current through pin 7 of each DAC is the remaining portion. The source of current is a reference of approximately 1.1 V, generated by U23 and U24.

Current drawn by pin 8 of U18 generates the MSB portion of the signal voltage across a 75Ω parallel resistor network: R34, R36, R37, and R40. Pin 8 of U19 draws the same amount of current as pin 8 of U18, but R36, R40, and R37 divide its voltage contribution to the total DAC output by 64.

U21 produces a 2.5 V reference that is used in the DACs to set their internal operating current.

Output Filter

To remove out-of-band signal components, the analog test signal from the Output DACs is filtered by a low-pass reconstruction filter that is terminated in 75Ω. The front end of this filter provides the reconstruction filtering, and the following stages provide group delay correction.

Jumper P2 is for checking the return loss of the Test Signal and Black Burst Output Amplifiers. When P2 is in the 2–3 position, the filter input is grounded and the Test Signal and Black Burst outputs are at 0 V. This allows the return loss of the Test Signal Output Amplifier and Black Burst Output Amplifier to be tested. In the 1–2 position, the DAC output is passed directly to the filter.

Output Amplifier

After filtering, the signal is applied to the Output Amplifier, which is a discrete, non-inverting op-amp having two differential amplifiers and an output stage. The first stage (Q1 and Q2) is an input buffer, the second (Q3 and Q4) is a gain stage, and the third (Q5) is an output driver.

From the emitter of Q5, negative feedback is applied to Q2 through a voltage divider network. At R51, the gain of the output is adjusted. In this feedback path, an RC network (connected to C22) provides $^{SINX}/_{X}$ compensation as C22 decreases negative feedback in the high end of the video spectrum. This compensation is adjustable through C22. R202 provides DC offset adjustment.

Black Burst Output Amplifier

The Black Burst Amplifier generates black burst by using the currently generated test signal and inserting a setup-level during the active video portion of the signal.

Taken from the output filter, the test signal is buffered by a pair of emitter followers (Q10 and Q11). It is then applied to a switchable op-amp made up of three differential amplifier stages and an output driver.

The B B ENABLE signal controls the first two differential stages (U22A and U22B). During the horizontal sync interval, B B ENABLE switches on the first stage, allowing the first stage to send sync and burst to the third stage (Q6 and Q7). During active video, B B ENABLE switches the first stage off and the second stage on. This second stage sends setup-level video to the third stage. The resulting output at the driver (Q8) is Black Burst.

R91 adjusts the setup level, and R61 adjusts Black Burst gain. C29 provides $^{SINX}/_{X}$ compensation for the Black Burst output.

Timed by the burst gate, U24 and U23 clamp the test signal output. U24 generates an offset voltage, and C34 stores this voltage throughout the line. U23 buffers C34 and adjusts the 1.1 V DAC reference in proportion to the offset voltage.

POWER SUPPLY CIRCUIT DESCRIPTION (Schematic 13)

This type of power supply is called a current-mode-controlled, discontinuous, flyback, switching power supply. The current output is distributed between the four supplies as follows:

+12V	0.5 Amps max
+5V	7 Amps max
-5V	2 Amps max
-12V	0.5 Amps max

The maximum power is limited by the maximum current in the primary of T440. This is also the only current limit for the ±5 V supplies, as they have no secondary current limit. The ±12 V supplies are current limited on the secondaries by the ±12 V linear regulators, U176 and U276.

The power inductor, T440, is driven by switching the current to it's primary on and off. T440 is not used as a transformer, but as an energy storage device, storing the energy in the primary while the current is being applied. On the second half of the switching cycle the current to the primary is switched off, and the energy stored in the primary is transferred to the secondaries (flyback). Regulation is accomplished by applying feedback from the +5 V supply to the Pulse Width Modulator controlling the current to the primary. This varies the length of time that the current is applied to the primary, causing it to store either more or less energy.

There is also circuitry to provide for operation from both 110 and 220 Vac supplies, under-voltage shutdown if the ac input is too low, overvoltage protection (crowbar) on the +5 V supply, and shutdown circuitry which forces a restart of the supply if it remains in current limit for more than a short period of time (<1 second).

WARNING

All primary voltages are referenced to a floating ground, not chassis ground. An isolation transformer or a differential amplifier is therefore needed in order to troubleshoot the circuitry in the primary and the Pulse Width Modulator, and in their supporting circuitry.

As current never flows simultaneously in both the primary and the secondary, there is never any actual transformer action. As the magnetic flux in the inductor goes to zero at the end of each switching cycle, it is discontinuous.

Input, AC to DC Converter, and Voltage Doubler

This circuitry filters and rectifies the input ac voltage, placing a charge of approximately 320 Vdc across capacitors C845 and C865.

The line current passes through line filter LF950, fuse F940, and power switch S930, and is applied to rectifier CR820. At the input of CR820, J810 is used to select between 110 V and 220 V operation. If set to 220 V, CR820 works as a full-wave rectifier and C845 and C865 act in series, charging to the peak voltage (approximately 320 Vdc) during the first part of each one-half cycle. They then maintain that voltage through the rest of the cycle, as the input voltage and current fall to zero.

If, on the other hand, J810 is set for 110 V operation, CR820, C845, and C865 act as a half-wave rectifier and voltage doubler. During the positive half-cycle of the ac input only one of the diodes within CR820 conducts, charging C865 to the peak positive voltage. A different diode within CR820 conducts during the negative half-cycle, and charges C845 to the negative peak. The total voltage across C845 and C865 is then approximately 320 Vdc.

RV920 and RV820 limit voltage surges on the input which might pass the line filter, while R831 and R830 discharge C865 and C845 when the power is off. C830 and C730 bypass switching noise to ground, keeping it out of the input power line. DS720 and associated parts form a relaxation oscillator, so DS720 blinks when the instrument is powered up.

Kick Starter, Housekeeping Supply, and Undervoltage Lockout Circuits

These circuits supply the power to start and maintain oscillation of the Pulse Width Modulator, so long as the input ac voltage is sufficient to maintain regulation.

The primary purpose of the undervoltage lockout circuit is to prevent the supply from starting up when set for 220 V operation and 110 Vac is applied instead, but it will stop the oscillation in the Pulse Width Modulator whenever the voltage across C845 and C865 (normally at 320 V) falls below approximately 200 V.

VR765 holds the emitter of Q755 at about 20 V, while the base is controlled by a divider comprised of R766, R767, and R768. So long as the charge across C845 and C865 remains around 320 V, Q755's base is held at approximately +30 V, and the transistor is off. As the voltage across C845 and C865 decreases, the base voltage does as well; when the voltage across the caps is down to approximately 200 V, Q755's base is at about +19 V, and Q755 is turned on. This, in turn, turns on Q727, applying the +5 V reference from U722-8 to U722-2. This disables the Pulse Width Modulator.

When the input voltage is sufficient to maintain the charge across C845 and C865 above 200 V, Q755 is off. This allows the Kick Start circuit to operate, providing the initial power to start up the Pulse Width Modulator. It does this by charging up C656 through Q667 and R560. During start-up, the +5 V reference output of U722 is at 0 V, and Q660 is off. The base current for Q667 during this time is supplied by R667.

When the charge across C656 reaches approximately 16 V, U722 starts to operate. It switches Q638 on and off through the base drive circuitry (Q741, Q750, Q648, and associated circuitry). The +5 V reference voltage at U722-8 is developed, which turns Q660 on. This diverts the base current from Q667, so it turns off and DS670 turns on to indicate normal operation.

The power to maintain the +16 V charge on C656 is now provided by the housekeeping winding of T440, pins 5 and 6, through CR556. If there is insufficient power to maintain the charge on C656 for any reason, such as the removal of J660, then the charge on C656 is quickly depleted. This stops the operation of U772, and the kick start sequence is repeated.

Power Inductor Operation

The heart of this power supply is T440, the multi-winding power inductor. The operation of T440 is as follows (see Fig. 6-4). Inductor T440 is initially uncharged (has zero magnetic flux). Q638, acting as a switch, is turned on by the base drive from U722. This places the charge developed on C845 and C865 (approximately 320 V) across the primary winding. The polarity of this charge is such that the voltages induced in the secondaries all reverse bias their respective diodes (note the polarity dots). In this way, there is no current flowing in the secondaries while it is flowing in the primary.

The primary current builds a linear ramp, storing the energy in T440 according to the relation $E = \frac{1}{2}Li^2$, where L is the primary inductance and i is the current flowing through it.

The current path is broken when Q638 is switched off, so current stops flowing in the primary. The flyback action of T440 then causes the voltages in the secondaries to reverse polarities, and all their diodes to turn on. The current in the secondaries linearly ramps down to zero as the energy which was stored in T440's primary is delivered to the load, charging the output capacitors.

When all of the energy which was stored in T440 during the first half of this cycle is delivered to the load, the current in the secondaries is at zero, and the diodes turn off. There is no current flowing in either the primary or the secondaries until Q638 is turned back on to start the next cycle. As there is not a continuous flow of energy in T440, this is called discontinuous flyback operation.

Load regulation is provided by sensing the +5 V supply with a divider comprised by R314, R315, and R415, and using U410 to convert this to an error signal. This error signal is optically coupled through U520 back to the Pulse Width Modulator, U722. U722 uses the error signal to vary the width of the pulse which drives Q638.

When the +5 V goes too high, U722 narrows the pulse width. This reduces the amount of energy stored in T440, and therefore the amount transferred to the load, so the +5 V goes down. Contrariwise, when the +5 V is too low, the pulse width is increased, increasing the amount of energy stored in T440 and then transferred to the load, so the voltage goes up.

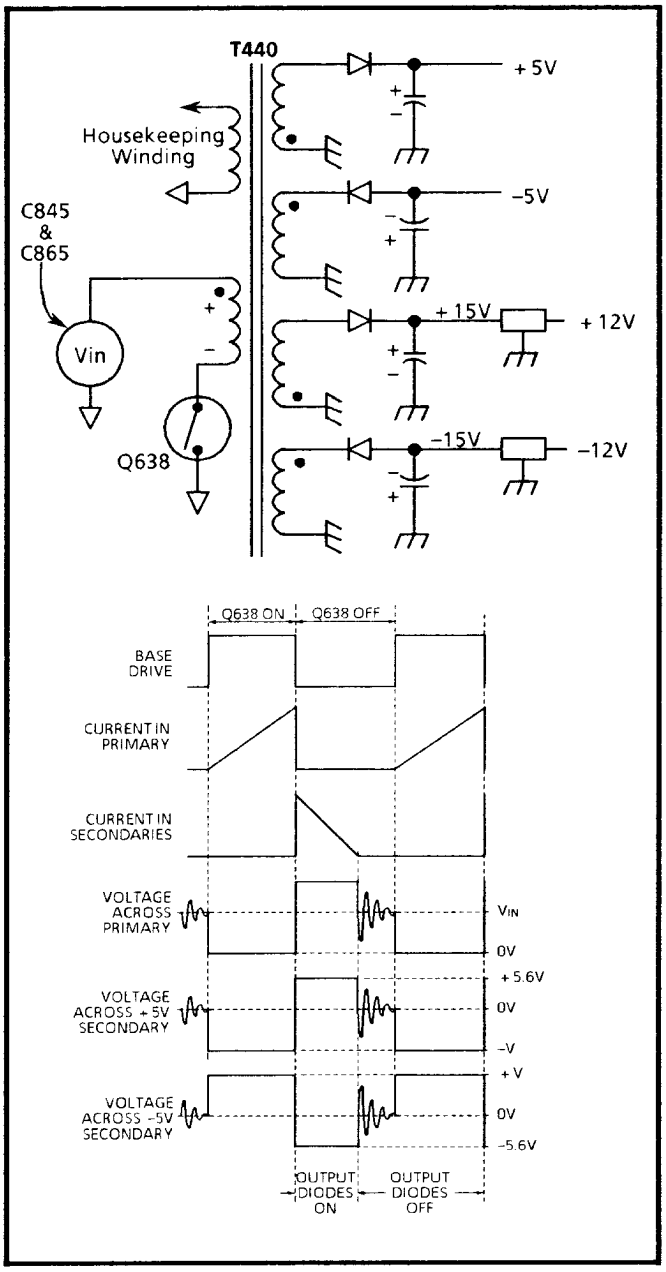


Fig. 6-4. Basic operation of T440.

Pulse Width Modulator and Error Amp

The Pulse Width Modulator, U722, is a current-mode controller. It uses inputs from the primary circuit and from the +5 V output to vary the width of the pulse which controls Q638, as mentioned above. This regulates the secondary voltages throughout variations of input voltage, output load, temperature, etc.

Current mode control works by allowing the current flowing in the primary to reach a peak level that is set by the output of the error amp, which is controlled by the +5 V output (see Fig. 6-5). The current in the primary winding is sensed by R630, and applied to U722-3 as a voltage. At the start of the cycle the oscillator sets the flip-flop within U722, which turns Q638 on. The primary current, and therefore the voltage to U722-3, ramp up until the I SENSE level is sufficient to trip the comparator. This resets the flip-flop, ending the drive pulse to Q638, and the energy stored in the transformer is transferred to the secondaries.

Line regulation, then, is a function of line voltage. As the line voltage varies, so will the primary current. An increase in line voltage causes an increase in primary current, so the slope of the ramp increases and the trip point is reached sooner. This results in a shorter pulse width. A decrease in line voltage causes a decrease in primary current, the slope of the ramp decreases, and it takes longer to reach the trip point. The same peak current is reached in both cases, however, so the same amount of energy is transferred to the load. Line regulation, then, is achieved without having to wait for output voltage variations.

Load regulation is accomplished by sensing the output voltage of the +5 V supply, and applying an error signal through opto-isolator U520 to U722-2. If the load increases, the supply voltage decreases, and so does the error signal at U722-2. This has the following results:

1. The comparator input increases, due to inversion of the IC.
2. The output pulse width increases, keeping Q638 on for a longer time.
3. I_p increases.
4. Power flow increases.

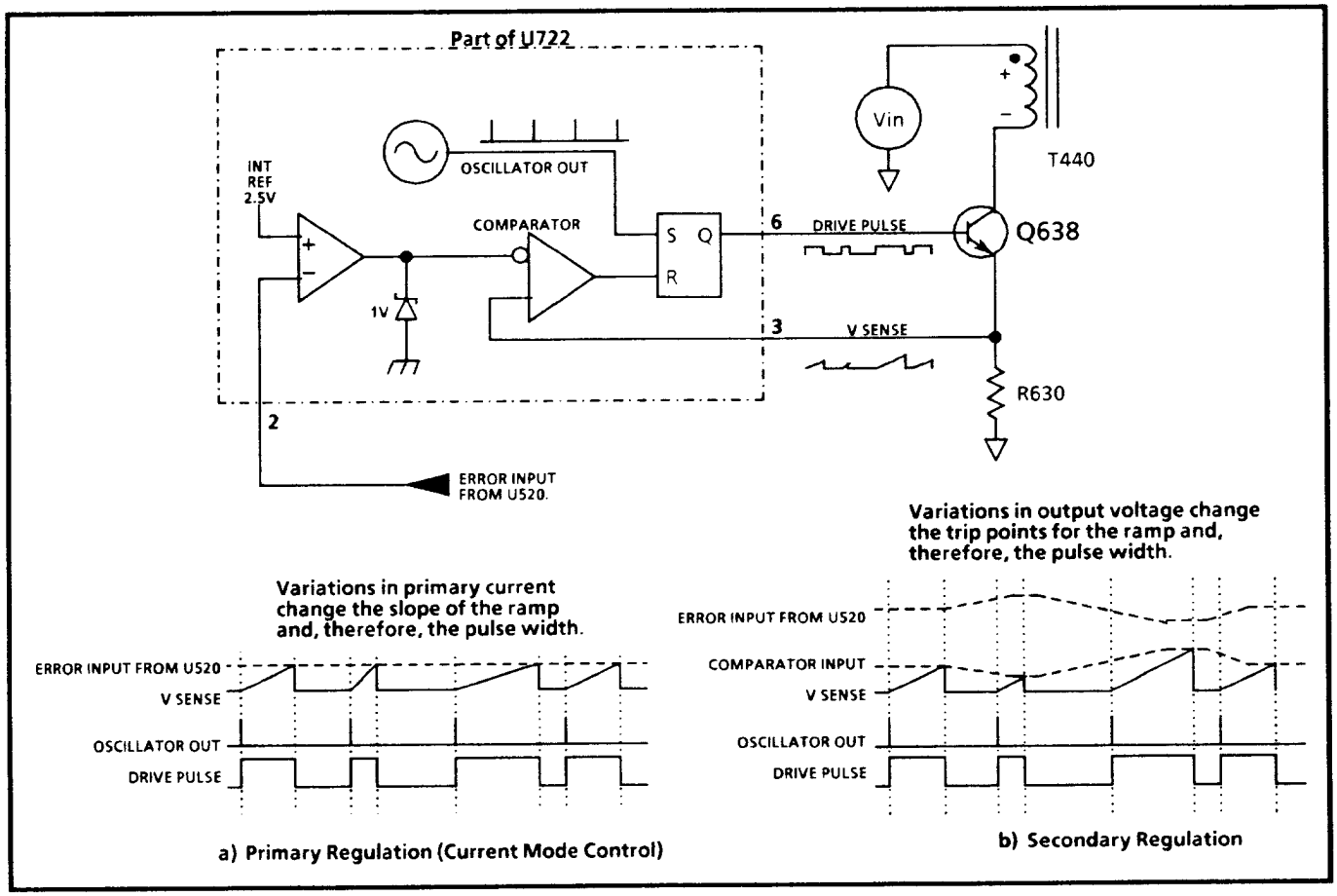


Fig. 6-5. Pulse Width Modulator operation.

On the other hand, if the load decreases, the +5 V increases, so the output pulse width decreases along with I_p, and less power is transferred to the secondaries. In this way, the +5 V is kept constant through changes in the load, and, as it varies the amount of energy transferred to the other secondaries too, it regulates them as well.

The error amplifier is U410, a band-gap reference. It keeps the voltage at its cathode at a constant 2.5 V, set by the voltage applied to its reference, pin 2. This reference is set by R314, R315, and R415. R415 is also used to adjust the +5 V supply.

As U410's cathode is held at 2.5 V, the current through R416 will vary with changes in the output voltage, as will the current through the LED within opto–isolator U520. This changes the conductance of the transistor element of the opto-isolator, which then varies the voltage applied to the feedback input, U722-2.

Current Limit

Current limit is provided for the primary circuit by the internal circuitry of U722. As the ramp voltage at U722-2 reaches 1 V, the output drive pulse ends. This shuts Q638 off, so no further current is supplied. The maximum primary current is approximately 1.5 Amps, which corresponds to a maximum power level of approximately 75 Watts.

As the supply goes into current limit, U615A and Q717 come into play. U615A starts to turn on as the ramp voltage passes ≈900 mV, and starts to charge C717. If the current limit condition persists long enough for the charge on C717 to reach 700 or 800 mV, Q717 is turned on. This applies the reference voltage from U722-8 directly to U722-3, shutting down the supply and forcing a kick start. The supply will then cycle through kick start, current limit, and shutdown until the problem is corrected.

Base Drive and Snubber

The pulse width modulated drive pulse from U722-6 is amplified by emitter followers Q741 and Q750. When the drive pulse is positive, Q750 is on and Q741 is off. Current flows through R746 and R747, through Q648 and CR649, and turns Q638 on. CR640, CR648, and CR649 form a Baker clamp to keep Q638 out of hard saturation.

As Q638 approaches saturation its collector-emitter voltage differential falls, and it needs less base current to maintain the same collector current. As saturation is approached, CR640 starts to conduct, providing a path for the excess base current.

When U722-6 goes to zero volts, Q750 is shut off and Q741 is turned on, so current is shunted to ground through CR651. C648 and VR650 speed up the switching off of Q638. The driven side of C648 is charged to approximately 5 V during the positive input half-cycle; then, when Q741 is turned on, C648's driven side is pulled down to +0.7 V by CR651, which pulls the base of Q638 down to approximately –3.3 V, through CR684. This abrupt transition draws a large current spike from the base momentarily (approximately 1A for $<0.3\ \mu s$), turning off Q638 very rapidly, along with CR640 and CR649.

When Q638 is turned off, there is a voltage spike applied to it's collector. A combination of reflected secondary voltages, input voltage, and transformer leakage inductance can combine to produce a spike of over a thousand volts. As this can exceed the ratings of Q638, a snubber circuit, consisting of C540, CR545, and R647, limits the spike to approximately 800 V.

Secondary Circuits

The secondary circuits all work in the same manner. As mentioned earlier, under basic operation, during the first half of the cycle, all their diodes are reverse-biased, so there is no current flow.

On the second half of the cycle, when Q638 is shut off, the flyback action reverses the polarities of the secondaries, and the diodes are forward biased. This allows the energy stored within T440 to charge up the capacitors in the secondaries.

The +5 V and the –5 V supplies use LC filters from this point, to further smooth the voltage and eliminate most of the ripple.

The +12 V and -12 V supplies actually start as +15 V and -15 V at the transformer. These voltages are used for the fan, B100 (-15 V), and for the opto-isolator U520 (+15 V) only. Then they are filtered and applied to linear regulators, U176 and U276. These provide clean +12 V and -12 V outputs, respectively. CR169 prevents the +12 V from going negative, while CR170 keeps it from exceeding +15.7 V. CR269 and CR369 perform identical functions for the -12 V output.

Overvoltage Protection

Overvoltage protection is provided on the +5 V output by a crowbar circuit comprised by Q127, VR120, and R120. If the +5 V output exceeds approximately +5.5 V, VR120 starts to conduct. When VR120 is drawing enough current through R120 to raise SCR Q127's gate voltage above its cathode, Q127 will turn on. This shorts the +5 V output to ground, forcing the primary circuit into current limit.

SECTION 7
MAINTENANCE

INTRODUCTION

This section has four main parts: preventive maintenance, troubleshooting aids, diagnostics, and corrective maintenance.

PREVENTIVE MAINTENANCE

Under average environmental conditions, preventive maintenance should be done about every 2000 hours. This includes cleaning, visual inspection, a performance check, and, if needed, calibration. See Section 5 for performance check and calibration procedures.

Cleaning

Clean the instrument often enough to prevent dust or dirt from accumulating in or on it. Dirt prevents efficient heat dissipation. It also provides high-resistance electrical leakage paths between conductors or components in a humid environment.

CAUTION

The front panel is molded plastic. Do not allow water to get inside any enclosed assembly or component. Do not clean any plastic materials with organic cleaning solvents, such as benzene, toluene, xylene, acetone, or similar compounds, because they may damage the plastic.

Static-Sensitive Components

CAUTION

Static discharge can damage any semiconductor component in this instrument.

This instrument contains electrical components that are susceptible to damage from static discharge. Static voltages of 1 kV to 30 kV are common in unprotected environments.

Observe the following precautions to avoid damage:

1. Minimize handling of static-sensitive components.
2. Transport and store static-sensitive components or assemblies in their original containers, on a metal rail, or on conductive foam. Label any package that contains static-sensitive assemblies or components.
3. Discharge the static voltage from your body by wearing a wrist strap while handling these components. Servicing static-sensitive assemblies or components should be performed only at a static-free work station by qualified personnel.
4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.
5. Keep the component leads shorted together whenever possible.
6. Pick up components by the body, never by the leads.
7. Do not slide the components over any surface.
8. Avoid handling components in areas that have a floor or work surface covering capable of generating a static charge.
9. Use a soldering iron that is connected to earth ground.
10. Use only special antistatic, suction-type or wick-type desoldering tools.

TROUBLESHOOTING AIDS

The following is miscellaneous information about schematics, circuit board illustrations, component numbering, and assembly numbering.

NOTE

No repair should be attempted during the warranty period.

Foldout Pages

The foldout pages at the back of the manual give block and schematic diagrams and circuit board illustrations. See Fig. 7-1.

Diagrams

The circuit number and electrical value of each component is shown on the diagrams. The first page in the Diagrams section explains the schematic symbols. The Replaceable Electrical Parts List gives a complete description of each component. Those portions of the circuit that are mounted on circuit boards or assemblies are enclosed in a gray border, with the name and assembly number shown on the border.

NOTE

Check the Change Information section at the rear of the manual for inserts describing corrections and modifications to the instrument and manual.

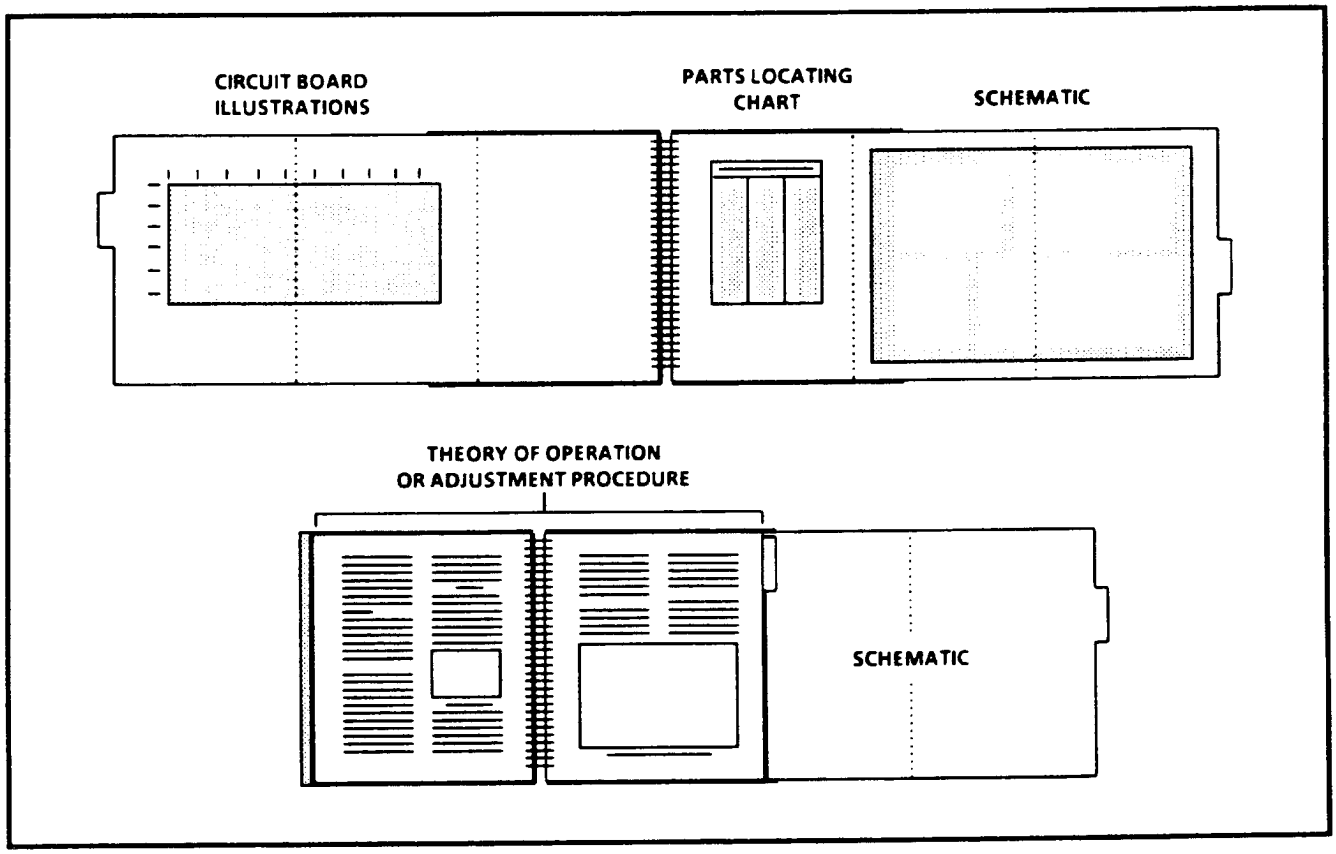


Fig. 7-1. Using the foldout pages.

Circuit Board Illustrations

Electrical components, connectors, and test points are identified on circuit board illustrations located on the inside fold of the corresponding circuit diagram or the back of the preceding diagram.

Assembly and Circuit Numbering

The circuit board assemblies are assigned assembly numbers starting with A1. Fig. 7-2 shows the location of the circuit board assemblies in the instrument. This illustration also shows the location of chassis-mounted components.

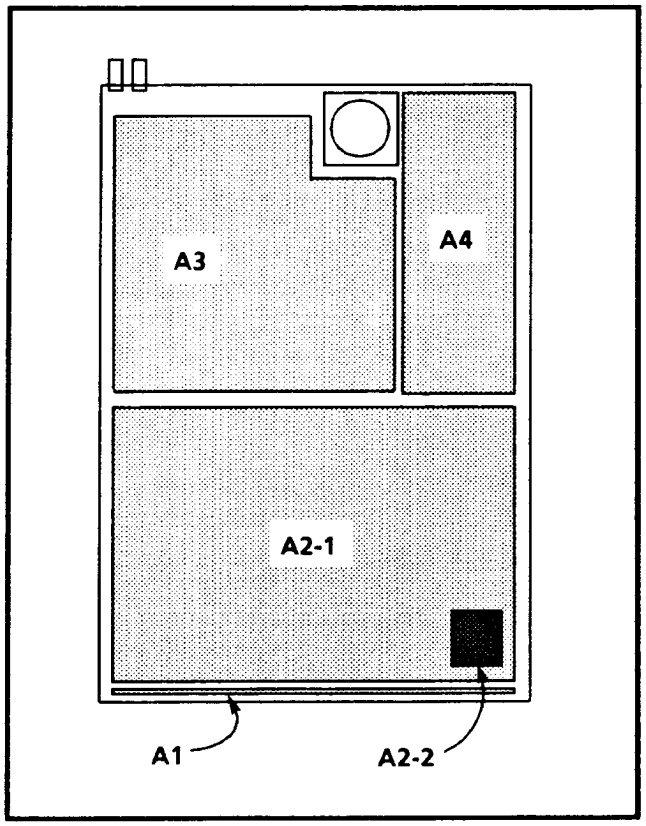


Fig. 7-2. Circuit board assembly locations.

Circuit boards have been assigned an assembly number so that they may be ordered from Tektronix, Inc. They are as follows:

A1	Front Panel Board Assembly
A2-1	Digital Board Assembly
A2-2	VCO Assembly
A3	Output Board Assembly
A4	Power Supply Board Assembly

The part numbers for ordering these boards are given on the first page of the Replaceable Electrical Parts List in Section 9.

Each component is assigned a circuit number according to its location within an assembly. Component circuit numbers increase in units from left to right, and in hundreds from top to bottom on the circuit board.

The Replaceable Electrical Parts List is arranged in assembly-by-assembly order, as designated by ANSI Standard Y32.16-1975. The circuit number in the parts list is made up by combining the assembly number and the circuit number.

EXAMPLE: R123 on A2 would be listed in the Replaceable Parts List as A2R123.

In the Replaceable Electrical Parts List, assemblies are listed first, followed by circuit board-mounted parts in alpha numeric order.

NOTE

The parts list number should be used when ordering replacement parts.

DIAGNOSTICS

Two Types of Diagnostics

EPROM U245 (Schematic 2) stores diagnostic programs that check the μP kernel and external data paths that interface with the kernel. These diagnostics are divided into two types.

First are the Stimulus/Response (S/R) tests. In these tests the μP executes a selected diagnostic routine, analyzes the results, then gives a pass/fail indication through the front-panel LEDs. Table 7-1 describes the tests and how to interpret the LED readout.

The μP automatically executes the Stimulus/Response tests one time when the instrument is powered up or reset. These one-time Stimulus/Response tests are called Power-up Diagnostics. The μP indicates detected failures in these tests by lighting all the front-panel LEDs and bringing the instrument to a stop.

Second are the Stimulus Loop (SL) tests. These are free-running, continuous loop routines that do not provide a pass/fail indication. Instead, they allow a data path to be tested. The μP sends a periodic signal through the path under test. The signal can then be viewed on a scope at points along the path to isolate problems. Figs. 7-3 through 7-16 show waveforms at critical points along the tested paths for each Stimulus Loop test.

Selecting Diagnostics

Both Stimulus/Response and Stimulus Loop tests are selected through the Diagnostic switch (S407, Schematic 1). Table 7-1 is a switch guide for Stimulus/Response tests, and Table 7-2 is a guide for Stimulus Loop tests.

To Select a diagnostic test, set the Diagnostic switch for the desired test, then reset the μP by switching power off and on or by momentarily moving jumper P122 (Schematic 2) to its 2–3 position. Immediately after the reset, the μP polls the Diagnostic switch port (U412, Schematic 1) and performs the routine selected at switch S407.

Once the μP has been reset, all Stimulus Loop tests (except Sampler Test 2) can be selected without having to reset again.

Table 7-1
S/R (Stimulus/Response) Diagnostic Tests

Switch Setting * 654321	Test	Test Function	Pass/Fail Indication
011111	EPROM Read Test (U245, Schematic 2)	Sums all data stored in EPROM and compares this to checksum stored in EPROM.	Lights LED above STAIRCASE signal button if checksums do not match.
011110	μP RAM Read/ Write Test (U152, Schematic 2)	Writes to and reads from all μP RAM locations. Checks for a match between data written to and read from RAM.	Lights LED above RAMP signal button if data read from RAM does not match data written to it.
011101	NVRAM Read/ Write Test (U157, Schematic 2)	Writes to and reads from all locations in the RAM portion of the NVRAM. Checks for a match between data written to and read from NVRAM.	Lights LED above MOD RAMP signal button if data read from NVRAM does not match data written to it.

* 1 = Switch open, 0 = switch closed.

Table 7-1 (cont.)
S/R (Stimulus/Response) Diagnostic Tests

Switch Setting * 654321	Test	Test Function	Pass/Fail Indication
011100	Sample RAM Test (U616, Schematic 3)	Writes to and reads from all Sample RAM locations and checks for a match between data written to and read from the Sample RAM.	Lights LED above APL signal button if data read from the Sample RAM does not match data written to it.
010000	NVRAM (ROM portion) Test (U157, Schematic 2).	Writes to and reads from all locations of the ROM portion of the NVRAM. Checks for a match between data written to and data read from the ROM portion. To protect from inadvertent use, this test must be accessed through the following front-panel sequence: 1. With the Diagnostics switch set for this test, power the instrument off and then on. 2. Press the BOUNCE switch until the BOUNCE LED lights. 3. Press the RED FIELD switch until the RED FIELD LED lights. 4. Press the BOUNCE switch until the BOUNCE LED lights.	Lights MOD RAMP LED if data read from the ROM portion of NVRAM does not match data written to it. Lights CONVERGENCE LED if the data does match.
001111	Initialize	Sets the four remotely controlled ID presets to be "TEKTRONIX1", "TEKTRONIX2", "TEKTRONIX3", and "TEKTRONIX4". Also midranges the genlock and sync lock timing presets. Since this routine writes to the ROM portion of the NVRAM, it is protected from inadvertent use. To access this routine, follow the four-step sequence described in the NVRAM test routine above.	The four ID presets are set to "TEKTRONIX1–4".
001100	CTC Test	Sets up the Counter Timer Chips as timers and checks to see that they can generate interrupts. Each of the CTC's four sections are set up to interrupt after 4096 processor clock cycles. If any of the CTC's sections have not interrupted within the allocated time, an error is logged and the test continues.	Lignts CHARACTER ID CONTROLS LED if an error is detected in U132. Lights DELAY CONTROLS LED if an error is detected in U127.

* 1 = Switch open, 0 = switch closed.

Table 7-1 (cont.)
S/R (Stimulus/Response) Diagnostic Tests

Switch Setting * 654321	Test	Test Function	Pass/Fail Indication
000000	Cycle Diagnostic	Continuously cycles through the EPROM, μP RAM, NVRAM, and SAMPLE RAM tests, then turns on all LEDs. On detecting an error, the appropriate LED is lit, and the test stops.	Lights STAIRCASE LED to indicate an error during the EPROM test. Lights RAMP LED to indicate an error during the μP RAM test. Lights MOD RAMP LED to indicate an error during the NVRAM test. Lights APL LED to indicate an error during the SAMPLE RAM test.

Table 7-2
SL (Stimulus Loop) Diagnostic Tests

Switch Setting * 654321	Test	Operation	Applications
011011	Calibration Signals	Configures front-panel software to allow consecutive selection of three signals (Line Sweep, Multipulse, and DAC Test) through the OTHER SIGNALS button on the front panel.	For checking and calibrating Test Signal output and Black Burst output paths. Allows consecutive selection of Line Sweep, Multipulse, and DAC Test Signal with the OTHER SIGNALS button.
011010	Port Test 1	μP places a shifting 1 on the ED0-ED7 bus and enables each of the ten I/O ports connected to this bus, one at a time.	For checking the data and load paths, connected to the ten I/O ports (U314, U267, U412, U459, U403, U443, U218, U303, U848, and U311). See Fig. 7-3.
011001	Port Test 2	μP places a shifting 0 on the ED0-ED7 bus and enables each of the ten I/O ports connected to this bus, one at a time.	Same as Port Test 1. See Fig. 7-4.
011000	Port Test 3	μP sends a count from 0 to 255 to the ED0-ED7 bus and enables each of the ten I/O ports connected to this bus, one at a time.	Same as Port Test 1. See Fig. 7-5.

* 1 = Switch open, 0 = switch closed.

Table 7-2 (cont.)
SL (Stimulus Loop) Diagnostic Tests

Switch Setting * 654321	Test	Operation	Applications
010111	Port Test 4	μP alternately sends all 1s then all 0s to the ED0-ED7 bus and enables each of the 13 decoded I/O locations (0-12) of U162 (Schematic 2).	Same as Port Test 1. See Figs. 7-6 and 7-7.
010101	Genlock DAC Test	μP sends data to the Genlock DAC (U267, Schematic 4). This data generates a field-rate ramp at the Genlock DAC Output.	For checking range and linearity of genlock DAC. Also for checking genlock DAC integrator. See Fig. 7-8.
010100	Sampler Test 1	μP acquires a sample of sync and burst via the Genlock Input and then reconstructs the sampled sync and burst through the VCO DAC (U267, Schematic 4). Requires that genlock input is terminated. Also requires that the Analog Input, Data Acquisition, Sample RAM, CTCs, and μP are all working.	For checking that the μP is acquiring sync and burst. Also for checking the Genlock Data Acquisition Circuits. See Fig. 7-9.
010011	Sampler Test 2	μP sets up the Genlock Data Acquisition circuits to sample the incoming video continuously, by forcing the circuits into UNLOCKED mode.	For checking Acquisition timing. See Figs. 7-10, 7-11, and 7-12.
010010	Front-Panel LED Test	Turns on all front-panel LEDs.	For checking that all LEDs work. For checking front-panel LEDs and LED latches (U303, U218, U314) in Schematic 1. See Fig. 7-13.
010001	Character Generator Test	Alternately writes two-character selection codes to the Character RAM on the Output board (Schematic 9). These codes (AA hex and 55 hex) select a U and * at the Character Generator.	For checking the Character Generation circuits. ***NOTE**: This test puts some noise on displayed characters.* See Figs. 7-14 and 7-15.
001110	Software Reset Test	Sets up the CTCs to pull the NMI input of the μP low. This causes the μP to start locking to the Genlock Input. This test requires that a Genlock Input signal is present.	For checking the software reset (NMI) in the μP kernel.
001101	Hardware Reset Test	First set J245 to its 1–2 position, then select Hardware Reset Test. Check J425-1 with an oscilloscope to verify that there is a 1200 ms square wave (low = true).	Checks the hardware reset circuitry. See Fig. 7-16.

* 1 = Switch open, 0 = switch closed.

PORT TEST 1
(Switch position: 011010)

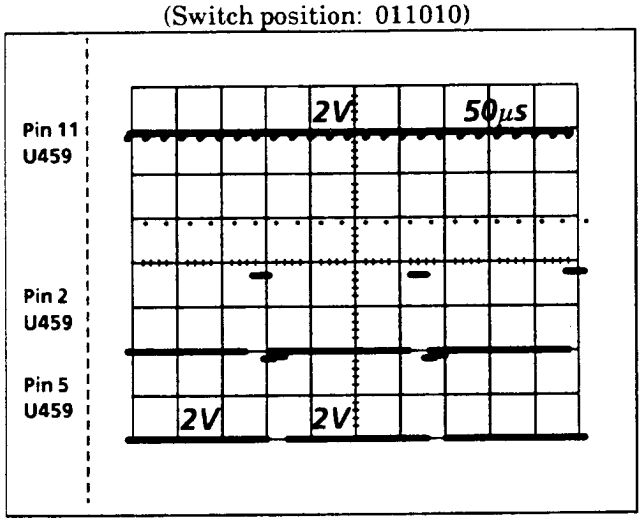


Fig. 7-3. Shows a shifting 1 through the two LSB outputs of the Genlock Offset Port (U459, Schematic 1), as well as the Enable Pulse (GEN DEL SEL).

PORT TEST 2
(switch position: 011001)

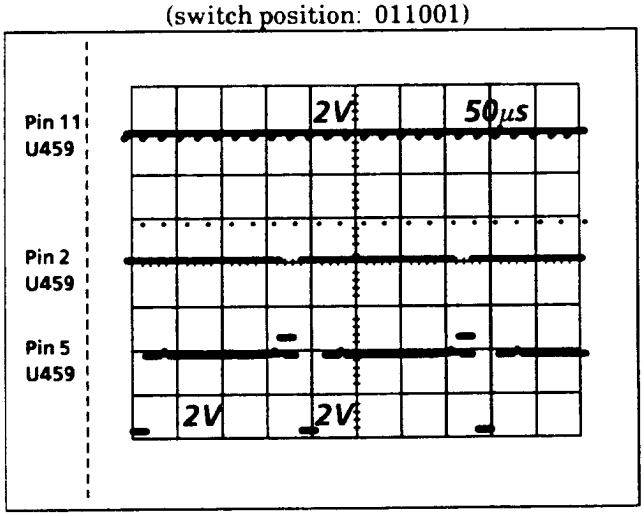


Fig. 7-4. Shows a shifting 0 through the two LSB outputs of the Genlock Offset Port (U459, Schematic 1), as well as the Enable Pulse (GEN DEL SEL).

PORT TEST 3
(switch position: 011000)

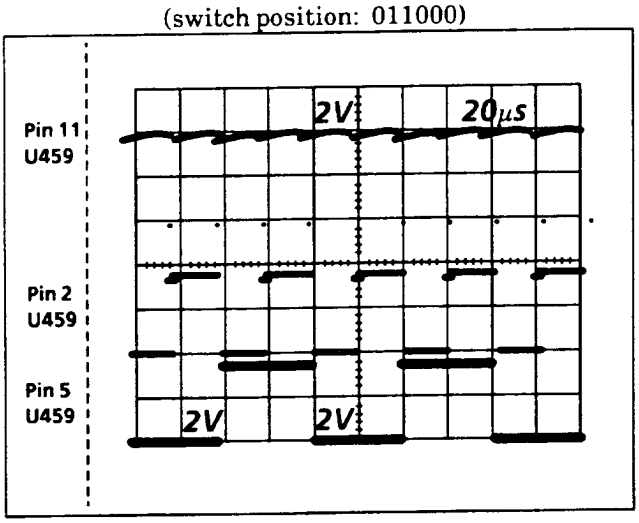


Fig. 7-5. Pin 2, U459 (output LSB), toggling twice as fast as pin 5 (next LSB) as μP counts from 0-255. Pin 11 (GEN DEL SEL) enables U459.

PORT TEST 4
(switch position: 010111)

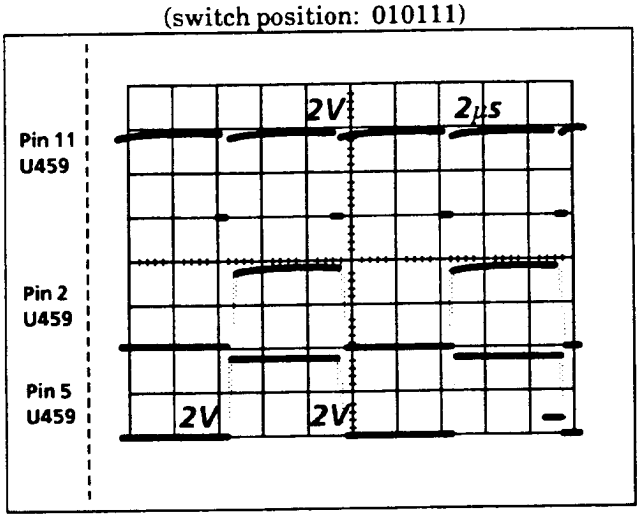


Fig. 7-6. Two LSB outputs (pins 2 and 5) of the Genlock Offset Port (U459, Schematic 1) as μP switches its I/O data from all 0's to all 1's. The GEN DEL SEL pulse enables U459.

PORT TEST 4
(switch position: 010111)

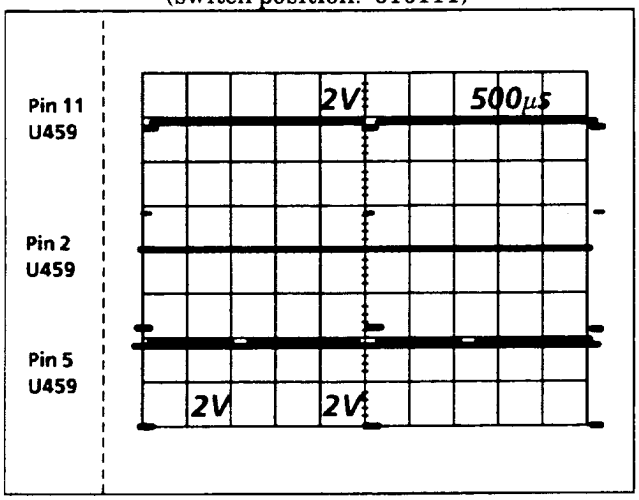


Fig. 7-7. Shows the same test setup as in Fig. 7-6, except with the scope at a slower sweep rate to show the test frequency.

SAMPLER TEST 1
(switch position 010100)

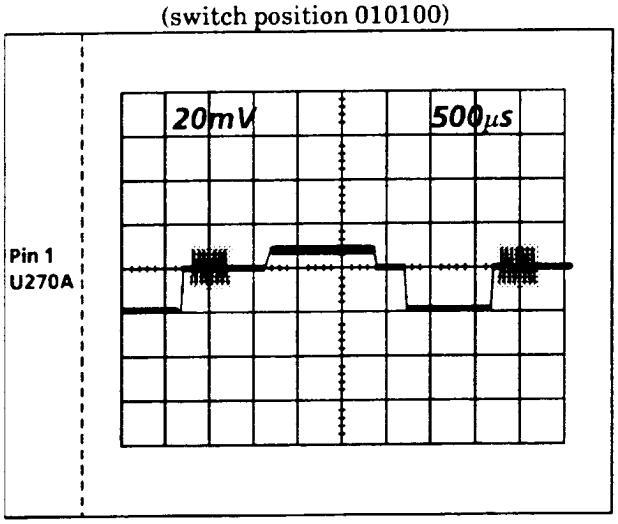


Fig. 7-9. Shows a µP-generated reconstruction of sync and burst at pin 1 of U270. Reconstruction shows the relative timing and amplitude of sync and burst.

GENLOCK DAC TEST
(switch position: 010101)

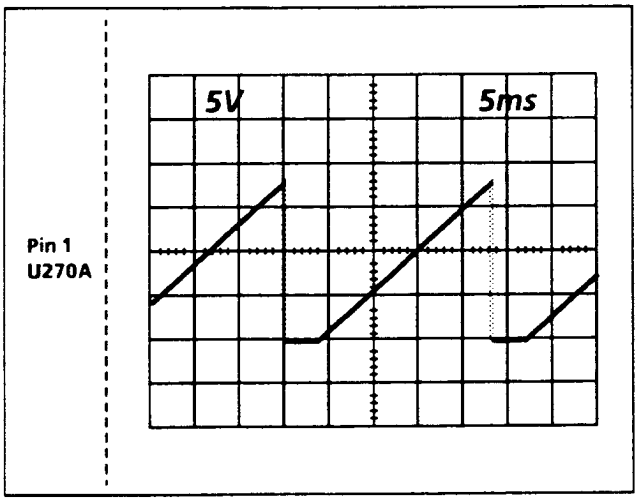


Fig. 7-8. Repeated ramp from pin 1 of integrator U270A. µP generates ramp by counting from 0-255 at a field rate.

SAMPLER TEST 2
(switch position: 010011)

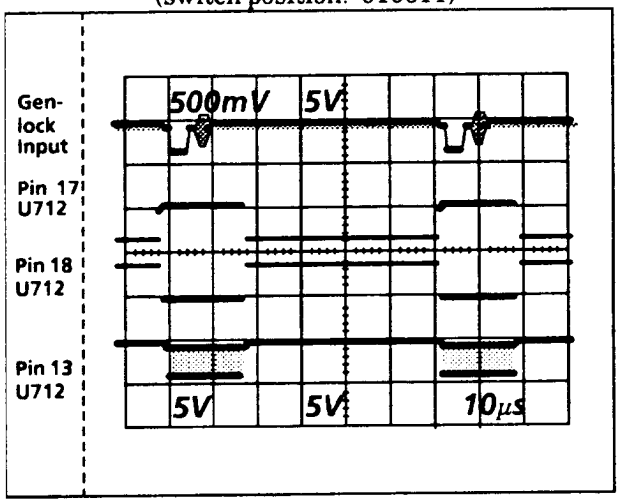


Fig. 7-10. Shows signals through the Genlock Data Acquisition circuit (Schematic 3) when it is in the UNLOCKED mode.

SAMPLER TEST 2
(switch position: 010011)

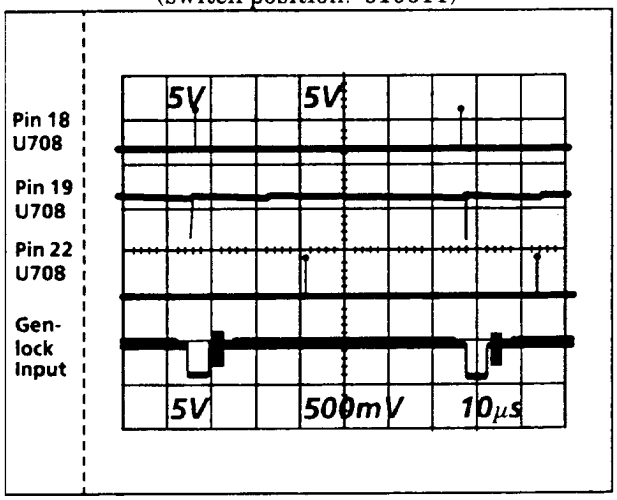


Fig. 7-11. Shows signals through the Genlock Data Acquisition circuit (Schematic 4) when it is in the UNLOCKED mode.

FRONT PANEL LED TEST
(switch position: 010010)

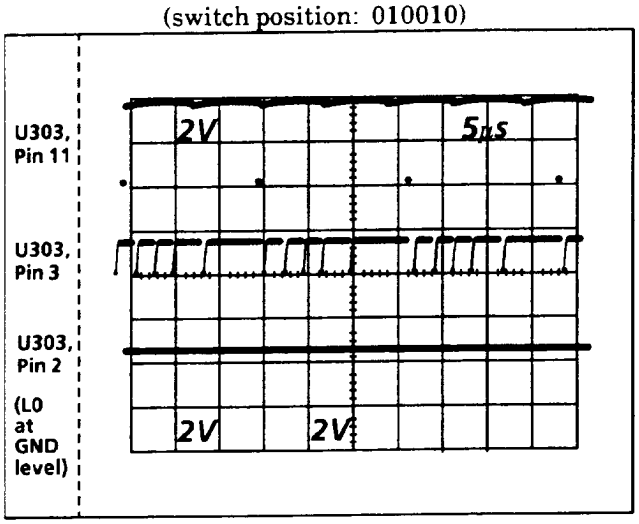


Fig. 7-13. Shows LED0 repeatedly loading a zero into the ED0 input (pin 3) of LED latch U303 (Schematic 1). This holds the L0 output (pin 2) on U303 low to light the DS129 LED. All other LEDs are tested in the same manner.

SAMPLER TEST 2
(switch position: 010011)

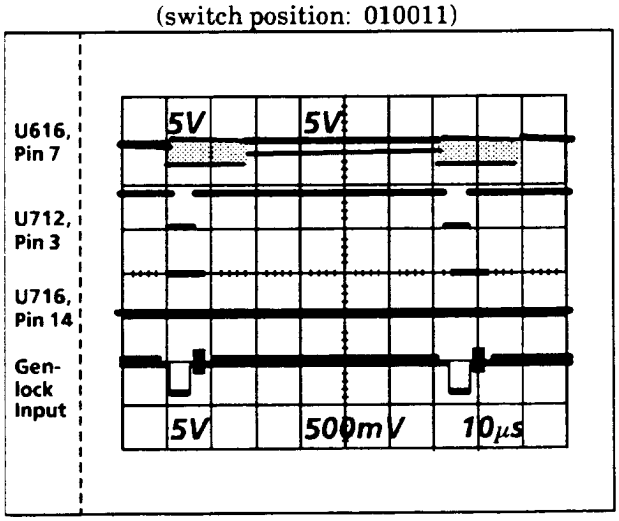


Fig. 7-12. Shows signals through the Genlock Data Acquisition circuit (Schematic 4) when it is in the UNLOCKED mode.

CHARACTER GENERATOR TEST
(switch position: 010001)

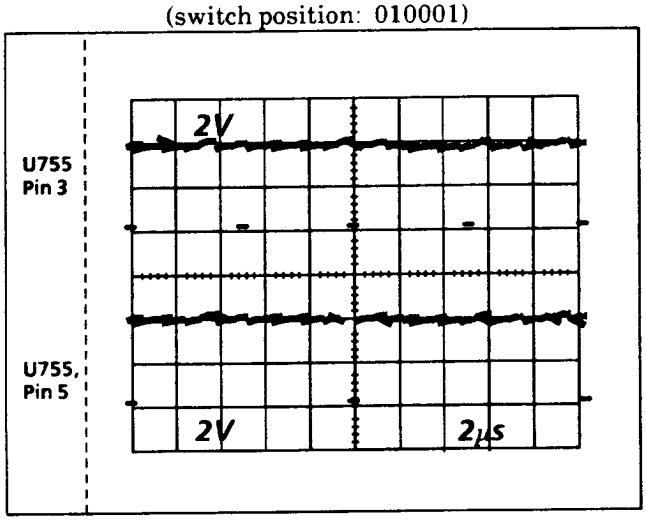


Fig. 7-14. Shows the $\overline{WR}$ and $\overline{I02}$ (Schematic 2) signals asserted to load the character selection codes into the Character RAM.

CHARACTER GENERATOR TEST
(switch position: 010001)

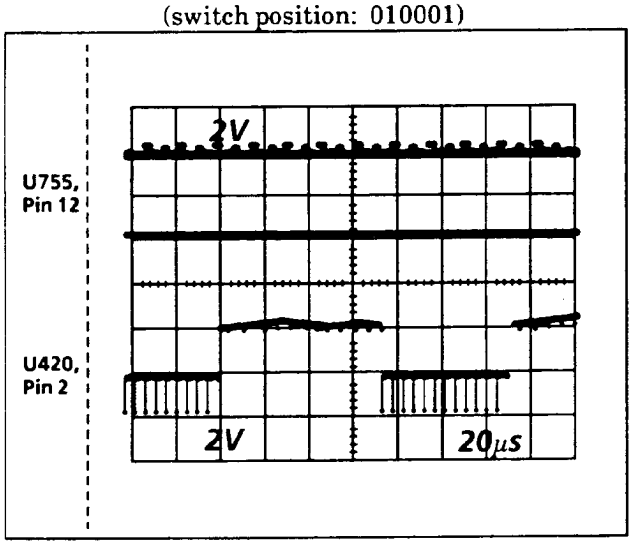


Fig. 7-15. Shows the A3 and ED0 (Schematic 2) lines as the μP repeatedly sends addresses and character selection codes to the Character RAM.

CORRECTIVE MAINTENANCE

Corrective maintenance deals with obtaining replacement parts, torque specifications, and component replacement.

Obtaining Replacement Parts

Replacement parts are available from or through the local Tektronix, Inc., field office or representative.

When ordering parts be sure to include the following information in your order:

1. Instrument type (and option numbers, if any)
2. Instrument serial number
3. Description of the part, as it appears in the Replaceable Electrical or Mechanical Parts Lists.
4. The Tektronix part number

If a part that has been ordered is replaced with a new or improved part, the local Tektronix field office or representative will contact you concerning any change in the part number. After repair, the circuits may need readjustment.

Torque Specifications

Only #4, #6, and #8 screws are used in the TSG-170D. Table 7-3 shows the torque ranges for these.

Table 7-3

Screw #	Torque Range (in inch pounds)
4	3½–5
6	7–9
8	14–18

Replacing Circuit Assemblies

WARNING

Disconnect the instrument power cord before replacing components.

Use the following procedures to remove circuit board assemblies. Reverse the order of the removal procedures to reinstall or replace an assembly.

Power Supply Board Removal

1. Remove the main power connector and fan connector.
2. Remove the nuts and screws attaching the line filter to the rear panel.
3. Remove the three screws attaching the shield and circuit board to the bottom pan.
4. Remove the remaining three mounting screws.

Output Board Removal

1. Remove the two Digital Output ribbon-cable connectors from the Output board, and the Remote ribbon cable from the Digital board.
2. Unplug the six coaxial cables from the Output board.
3. Remove the eight mounting screws.
4. Disconnect the Output board from the two 48-pin DIN connectors, making sure to keep the Output board square with the Digital board (to prevent bending the pins).

Digital Board Removal

1. Disconnect the two ribbon connectors and remote ribbon cable.
2. Remove the ten mounting screws.
3. Disconnect the Digital board from the Output board, making sure to keep the Output board square with the Digital board to prevent bending the pins.

Front Panel Removal

1. Remove the two nuts on the rear of the front panel.
2. Disconnect the front-panel ribbon connector from the Digital board.
3. Making sure to avoid pushing on the front-panel LEDs, push the front panel away from the front-panel frame to break the glue which holds them together. Avoid bending the front panel any more than necessary.

Oven Assembly Removal

1. Unscrew the plastic insulating case and remove the top part of the case.
2. Remove the screw and nut that attach the power transistor to the outside of the metal oven.
3. Remove the oven from the Digital board by carefully pulling the oven off the seven square pins that attach it to the Digital board.
4. Remove the screw attaching the metal cover to the oven.
5. Remove the screw attaching the circuit board to the oven and pull the oscillator out of the oven.

EPROM Replacement Procedure

1. Making sure the power is switched off, remove the old EPROM (U245) from the Digital board and replace it with the new EPROM.
2. Switch on power.

NVRAM Replacement Schedule

The NVRAM (U157, Schematic 2) will save at least 10,000 front panel timing selections before it must be replaced. This amounts to about three years of use if you make ten selections a day.

Section 8
Replaceable Electrical Parts

This section contains a list of the components that are replaceable for the TSG-170D. Use this list to identify and order replacement parts. There is a separate Replaceable Electrical Parts list for each instrument.

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. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument 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.

Using the Replaceable Electrical Parts List

The tabular information in the Replaceable Electrical Parts list is arranged for quick retrieval. Understanding the structure and features of the list will help you find all of the information you need for ordering replaceable parts.

Cross Index–Mfr. Code Number to Manufacturer

The Mfg. Code Number to Manufacturer Cross Index for the electrical parts list is located immediately after this page. The cross index provides codes, names, and addresses of manufacturers of components listed in the electrical parts list.

Abbreviations

Abbreviations conform to American National Standards Institute (ANSI) standard Y1.1.

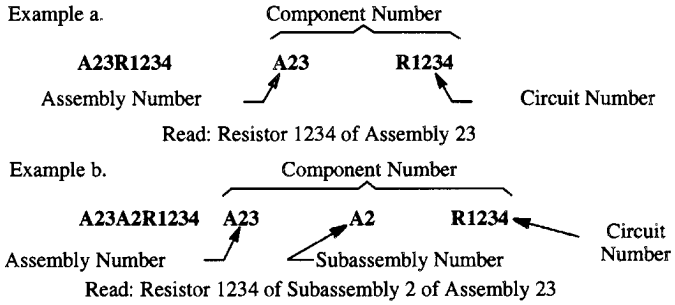
List of Assemblies

A list of assemblies can be found at the beginning of the electrical parts list. The assemblies are listed in numerical order. When the complete component number of a part is known, this list will identify the assembly in which the part is located.

Column Descriptions

Component No. (Column 1)

The component circuit number appears on the diagrams and circuit board illustrations, located in the diagrams section. Assembly numbers are also marked on each diagram and circuit board illustration, in the Diagram section and on the mechanical exploded views, in the mechanical parts list. The component number is obtained by adding the assembly number prefix to the circuit number.



The electrical parts list is arranged by assemblies in numerical sequence (A1, with its subassemblies and parts, precedes A2, with its subassemblies and parts).

Mechanical subparts to the circuit boards are listed in the electrical parts list. These mechanical subparts are listed with their associated electrical part (for example, fuse holder follows fuse).

Chassis-mounted parts and cable assemblies have no assembly number prefix and are located at the end of the electrical parts list.

Tektronix Part No. (Column 2)

Indicates part number to be used when ordering replacement part from Tektronix.

Serial/Assembly No. (Column 3 and 4)

Column three (3) indicates the serial or assembly number at which the part was first used. Column four (4) indicates the serial or assembly number at which the part was removed. No serial or assembly number entered indicates part is good for all serial numbers.

Name and Description (Column 5)

An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification.

The mechanical subparts are shown as *ATTACHED PARTS* / *END ATTACHED PARTS* or *MOUNTING PARTS* / *END MOUNTING PARTS* in column five (5).

Mfr. Code (Column 6)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

Mfr. Part No. (Column 7)

Indicates actual manufacturer's part number.

CROSS INDEX – MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code.	Manufacturer	Address	City, State, Zip Code
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
00853	SANGAMO WESTON INC COMPONENTS DIV	SANGAMO RD PO BOX 128	PICKENS SC 29671–9716
01121	ALLEN–BRADLEY CO INDUSTRIAL CONTROL PRODUCTS	1201 S 2ND ST	MILWAUKEE WI 53204–2410
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP	13500 N CENTRAL EXPY PO BOX 655012	DALLAS TX 75265
01536	TEXTRON INC CAMCAR DIV SEMS PRODUCTS UNIT	1818 CHRISTINA ST	ROCKFORD IL 61108
03508	GENERAL ELECTRIC CO SEMI–CONDUCTOR PRODUCTS DEPT	W GENESEE ST	AUBURN NY 13021
04222	AVX CERAMICS DIV OF AVX CORP	19TH AVE SOUTH P O BOX 867	MYRTLE BEACH SC 29577
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS SECTOR	5005 E MCDOWELL RD	PHOENIX AZ 85008–4229
05292	ITT COMPONENTS DIV		CLIFTON NJ
05397	UNION CARBIDE CORP MATERIALS SYSTEMS DIV	11901 MADISON AVE	CLEVELAND OH 44101
05828	GENERAL INSTRUMENT CORP GOVERNMENT SYSTEMS DIV	600 W JOHN ST	HICKSVILLE NY 11802
07716	TRW INC TRW IRC FIXED RESISTORS/BURLINGTON	2850 MT PLEASANT AVE	BURLINGTON IA 52601
09023	CORNELL–DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO	2652 DALRYMPLE ST	SANFORD NC 27330
09922	BURNDY CORP	RICHARDS AVE	NORWALK CT 06852
11236	CTS CORP BERNE DIV THICK FILM PRODUCTS GROUP	406 PARR ROAD	BERNE IN 46711–9506
12969	MICROSEMI CORPORATION WATERTOWN DIVISION	530 PLEASANT STREET	WATERTOWN MA 02172
14752	ELECTRO CUBE INC	1710 S DEL MAR AVE	SAN GABRIEL CA 91776–3825
17856	SILICONIX INC	2201 LAURELWOOD RD	SANTA CLARA CA 95054–1516
18565	CHOMERICS INC	77 DRAGON COURT	WOBURN MA 01801–1039
19396	ILLINOIS TOOL WORKS INC PAKTRON DIV	1205 MCCONVILLE RD PO BOX 4539	LYNCHBURG VA 24502–4535
19701	PHILIPS COMPONENTS DISCRETE PRODUCTS DIV RESISTIVE PRODUCTS FACILITY AIRPORT ROAD	PO BOX 760	MINERAL WELLS TX 76067–0760
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT ELECTRONICS DEPT	515 FISHING CREEK RD	NEW CUMBERLAND PA 17070–3007
24165	SPRAGUE ELECTRIC CO	267 LOWELL ROAD	HUDSON NH 03051
24546	CORNING GLASS WORKS	550 HIGH ST	BRADFORD PA 16701–3737
26364	COMPONENTS CORP	6 KINSEY PLACE	DENVILLE NJ 07834–2611
27014	NATIONAL SEMICONDUCTOR CORP	2900 SEMICONDUCTOR DR	SANTA CLARA CA 95051–0606
31223	MICRO PLASTICS INC	20821 DEARBORN ST	CHATSWORTH CA 91311–5916
32436	SYSCON INTERNATIONAL INC	1701 S MAIN ST	SOUTH BEND IN 46613–2211
50558	ELECTRONIC CONCEPTS INC	526 INDUSTRIAL WAY W	EATONTOWN NJ 07724–2212
54583	TDK ELECTRONICS CORP	12 HARBOR PARK DR	PORT WASHINGTON NY 11550
55285	BERGQUIST CO INC THE	5300 EDINA INDUSTRIAL BLVD	MINNEAPOLIS MN 55435–3707
55680	NICHICON /AMERICA/ CORP	927 E STATE PKY	SCHAUMBURG IL 60195–4526
56708	ZILOG INC	1315 DELL AVE	CAMPBELL CA 95008–6609
56845	DALE ELECTRONICS INC	2300 RIVERSIDE BLVD PO BOX 74	NORFOLK NE 68701–2242
57668	ROHM CORP	8 WHATNEY PO BOX 19515	IRVINE CA 92713
57924	BOURNS INC NETWORKS DIV	1400 NORTH 1000 WEST	LOGAN UT 84321
58361	QUALITY TECHNOLOGIES CORP		
60395	XICOR INC	851 BUCKEYE CT	MILPITAS CA 95035–7408
71400	BUSSMANN DIV OF COOPER INDUSTRIES INC	114 OLD STATE RD PO BOX 14460	ST LOUIS MO 63178
71744	CHICAGO MINIATURE LAMP INC	CHEVY CHASE BUSINESS PARK 1080 JOHNSON DRIVE	BUFFALO GROVE IL 60089
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD	COLD SPRING KY 41076–9749
75042	IRC ELECTRONIC COMPONENTS PHILADELPHIA DIV TRW FIXED RESISTORS	401 N BROAD ST	PHILADELPHIA PA 19108–1001
76493	BELL INDUSTRIES INC JW MILLER DIV	19070 REYES AVE PO BOX 5825	COMPTON CA 90224–5825
77900	ILLINOIS TOOL WORKS SHAKEPROOF DIV	ST CHARLES RD	ELGIN IL 60120

Mfr. Code.	Manufacturer	Address	City, State, Zip Code
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIV	ST CHARLES ROAD	ELGIN IL 60120
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077–0001
81073	GRAYHILL INC	561 HILLGROVE AVE PO BOX 10373	LA GRANGE IL 60525–5914
81312	WINCHESTER ELECTRONICS DIVISION OF LITTON SYSTEMS INC	400 PARK RD	WATERTOWN CT 06795–1612
82389	SWITCHCRAFT INC SUB OF RAYTHEON CO	5555 N ELSTRON AVE	CHICAGO IL 60630–1314
91506	AUGAT INC	33 PERRY AVE P O BOX 779	ATTLEBORO MA 02703–2417
91637	DALE ELECTRONICS INC	2064 12TH AVE PO BOX 609	COLUMBUS NE 68601–3632
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61108–5181
S3629	SCHURTER AG H C/O PANEL COMPONENTS CORP	2015 SECOND STREET	BERKELEY CA 94170
S4307	SCHAFFNER ELECTRONIK AG		LUTERBACH SWITZERLAND
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609–3320
TK0510	PANASONIC COMPANY DIV OF MATSUSHITA ELECTRIC CORP	ONE PANASONIC WAY	SECAUCUS NJ 07094
TK0858	STAUFFER SUPPLY CO (DIST)		
TK1134	TUSONIX INC	2155 N FORBES BLVD	TUCSON AZ 85705
TK1345	ZMAN & ASSOCIATES		
TK1424	MARCON AMERICA CORP		
TK1573	WILHELM WESTERMAN	PO BOX 2345 AUGUSTA–ANLAGE 56	6800 MANNHEIM 1 WEST GERMANY
TK1960	U S TOYO FAN CORP	4915 WALNUT GROVE AVE DRAWER G	SAN GABRIEL CA 91776
TK2165	TRIQUEST CORP		

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A1	333-3613-00			PANEL,FRONT:	80009	333-3613-00
A2-1	670-9111-51	B010100	B010577	CIRCUIT BD ASSY:DGTL	80009	670-9111-51
A2-1	670-9111-54	B010578		CIRCUIT BD ASSY:DGTL (STANDARD ONLY)	80009	670-9111-54
A2-1	670-9111-52	B010456	B010559	CIRCUIT BD ASSY:DGTL	80009	670-9111-52
A2-1	670-9111-53	B010560	B010603	CIRCUIT BD ASSY:DGTL	80009	670-9111-53
A2-1	670-9111-55	B010604		CIRCUIT BD ASSY:DGTL (OPTION 1V ONLY)	80009	670-9111-55
A2-2	119-2321-02	B010100	B010242	OVEN ASSEMBLY:	80009	119-2321-02
A2-2	119-2321-03	B010243	B010274	OVEN ASSEMBLY:TSG170A	80009	119-2321-03
A2-2	119-2321-04	B010275		OVEN ASSEMBLY:TSG170A	80009	119-2321-04
A3	671-0631-00	B010100	B010276	CIRCUIT BD ASSY:OUTPUT	80009	671-0631-00
A3	671-0631-01	B010277	B010361	CIRCUIT BD ASSY:OUTPUT	80009	671-0631-01
A3	671-0631-02	B010362	B010385	CIRCUIT BD ASSY:OUTPUT	80009	671-0631-02
A3	671-0631-03	B010386	B010445	CIRCUIT BD ASSY:OUTPUT	80009	671-0631-03
A3	671-0631-04	B010446	B010559	CIRCUIT BD ASSY:OUTPUT	80009	671-0631-04
A3	671-0631-05	B010560	B010618	CIRCUIT BD ASSY:OUTPUT	80009	671-0631-05
A3	671-0631-06	B010619		CIRCUIT BD ASSY:OUTPUT	80009	671-0631-06
A3A1	671-2641-00	671-0631-06		CIRCUIT BD ASSY:AUDIO	80009	671-2641-00
A4	671-0572-00	B010100	B010142	CIRCUIT BD ASSY:PWR SPLY	80009	671-0572-00
A4	671-0572-01	B010143	B010311	CIRCUIT BD ASSY:PWR SPLY	80009	671-0572-01
A4	671-0572-02	B010312	B010474	CIRCUIT BD ASSY:PWR SPLY	80009	671-0572-02
A4	671-0572-03	B010475	B010584	CIRCUIT BD ASSY:PWR SPLY	80009	671-0572-03
A4	671-0572-04	B010585	B010643	CIRCUIT BD ASSY:PWR SPLY	80009	671-0572-04
A4	671-0572-05	B010644	B010659	CIRCUIT BD ASSY:PWR SPLY	80009	671-0572-05
A4	671-0572-06	B010660		CIRCUIT BD ASSY:PWR SPLY	80009	671-0572-06
A1	333-3613-00			PANEL,FRONT:	80009	333-3613-00
A2-1	670-9111-51	B010100	B010577	CIRCUIT BD ASSY:DGTL	80009	670-9111-51
A2-1	670-9111-54	B010578		CIRCUIT BD ASSY:DGTL (STANDARD ONLY)	80009	670-9111-54
A2-1	670-9111-52	B010456	B010559	CIRCUIT BD ASSY:DGTL	80009	670-9111-52
A2-1	670-9111-53	B010560	B010603	CIRCUIT BD ASSY:DGTL	80009	670-9111-53
A2-1	670-9111-55	B010604		CIRCUIT BD ASSY:DGTL (OPTION 1V ONLY)	80009	670-9111-55
				ATTACHED PARTS		
	131-0157-00			TERMINAL,PIN:0.25 L X 0.04 OD,BRS,SLDR PL (QUANTITY 2)	80009	131-0157-00
				END ATTACHED PARTS		
A2-1C170	290-0990-00			CAP,FXD,ELCTLT:10UF,20%,50V	24165	502D437
A2-1C180	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2-1C205	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C206	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C207	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C214	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C259	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2-1C270	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C273	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2-1C275	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C276	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA

Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2-1C280	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C290	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C325	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C329	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C335	283-0629-00			CAP,FXD,MICA DI:62PF,1%,500V	80009	283-0629-00
A2-1C351	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C355	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2-1C359	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2-1C363	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C367	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C370	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C372	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C374	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C376	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C378	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C380	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C390	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C397	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C435	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C443	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C455	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C467	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C481	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C485	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C489	283-0785-00			CAP,FXD,MICA DI:250PF,1%,500V	80009	283-0785-00
A2-1C491	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C492	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C493	283-0666-00			CAP,FXD,MICA DI:890PF,2%,100V	80009	283-0666-00
A2-1C495	283-0666-00			CAP,FXD,MICA DI:890PF,2%,100V	80009	283-0666-00
A2-1C496	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C507	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C520	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C583	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2-1C586	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2-1C592	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C594	283-0175-00			CAP,FXD,CER DI:10PF,5%,200V	05397	C312C100D2G5CA 8
A2-1C663	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C707	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C714	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C717	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C723	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C729	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C736	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C742	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C748	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C759	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C788	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C807	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C809	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C811	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C812	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C817	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2-1C821	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C824	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C827	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C841	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C842	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C843	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C844	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C845	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C846	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C847	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C848	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C867	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C875	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA

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A2-1C907	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C910	283-0647-00			CAP,FXD,MICA DI:70PF,1%,100V	80009	283-0647-00
A2-1C911	283-0772-00			CAP,FXD,MICA DI:497 PF,1%,500V	80009	283-0772-00
A2-1C913	283-0625-00			CAP,FXD,MICA DI:220PF,1%,500V	80009	283-0625-00
A2-1C918	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2-1C933	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2-1C939	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2-1C944	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C945	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A2-1C970	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2-1C972	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2-1C975	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2-1C978	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2-1CR179	152-0141-02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A2-1CR257	152-0141-02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A2-1CR357	152-0141-02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A2-1CR358	152-0322-00			DIODE,SIG:SCHTKY;15V,410MVF AT 1MA,1.2PF;5082-2811,T&R	80009	152-0322-00
A2-1CR359	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A2-1CR394	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A2-1CR395	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A2-1CR912	152-0322-00			DIODE,SIG:SCHTKY;15V,410MVF AT 1MA,1.2PF;5082-2811,T&R	80009	152-0322-00
A2-1DS397	150-1014-00			DIODE,OPTO:LED;RED,66ONM,1 MCD AT 10 MA;T1 3/4	58361	Q6444/MV5054-1
A2-1J109	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 34)	80009	131-0608-00
A2-1J122	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A2-1J180	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 5)	80009	131-0608-00
A2-1J210	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A2-1J211	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A2-1J286	131-0787-00			TERMINAL,PIN: (QUANTITY 5)	22526	47359-001
A2-1J396	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A2-1J407	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A2-1J408	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A2-1J425	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 4)	80009	131-0608-00
A2-1J767	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A2-1J881	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A2-1J882	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	80009	131-0608-00

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				(QUANTITY 3)		
A2-1J942	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	80009	131-0608-00
				(QUANTITY 10)		
A2-1J988	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	80009	131-0608-00
				(QUANTITY 34)		
A2-1L907	108-0103-01			COIL,RF:FIXED,2.5UH,2%	80009	108-0103-01
				ATTACHED PARTS		
	337-1417-00			SHIELD,ELEC:0.55 SQ X 0.685 INCH HIGH	32436	A-1020002-1
				END ATTACHED PARTS		
A2-1P122	131-0993-02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1-850100-O
A2-1P180	131-0993-02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1-850100-O
A2-1P210	131-0993-05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100-5
A2-1P211	131-0993-05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100-5
A2-1P396	131-0993-02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1-850100-O
A2-1P407	131-0993-05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100-5
A2-1P408	131-0993-05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100-5
A2-1P425	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	80009	131-0608-00
A2-1P425	131-0993-02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1-850100-O
A2-1P767	131-0993-02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1-850100-O
A2-1P881	131-0993-05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100-5
A2-1P882	131-0993-05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100-5
A2-1P923	131-3440-00			CONN,DIN:PCB;MALE,RTANG,3 X 16,0.1 CTR,0.498 X 0.114 TAIL,30 GOLD,BD RETENTION	80009	131-3440-00
				MOUNTING PARTS		
	210-0001-00			WASHER,LOCK:#2 INTL,0.013 THK,STL	77900	1202-00-00-0541C
				(QUANTITY 2)		
	210-0405-00			NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
				(QUANTITY 2)		
	211-0185-00			SCREW,MACHINE:2-56 X 0.438,PNH,STL	TK0435	ORDER BY DESCR
				(QUANTITY 2)		
				END MOUNTING PARTS		
A2-1P955	131-3440-00			CONN,DIN:PCB;MALE,RTANG,3 X 16,0.1 CTR,0.498 X 0.114 TAIL,30 GOLD,BD RETENTION	80009	131-3440-00
				MOUNTING PARTS		
	210-0001-00			WASHER,LOCK:#2 INTL,0.013 THK,STL	77900	1202-00-00-0541C
				(QUANTITY 2)		
	210-0405-00			NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
				(QUANTITY 2)		
	211-0185-00			SCREW,MACHINE:2-56 X 0.438,PNH,STL	TK0435	ORDER BY DESCR
				(QUANTITY 2)		
				END MOUNTING PARTS		
A2-1Q235	151-0199-00			XSTR,SIG:BIPOLAR,PNP;12V,80MA, SWITCHING;MPS3640,TO-92 EBC	80009	151-0199-00
A2-1Q293	151-0657-00			XSTR,PWR:BIPOLAR,PNP;80V,8.0A, 4.0MHZ,DARLINGTON,AMPLIFIER;2N6041,TO-220	80009	151-0657-00
				MOUNTING PARTS		
	210-0586-00			NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
	211-0021-00			SCREW,MACHINE:4-40 X 1.25,PNH,STL	TK0435	ORDER BY DESCR
				END MOUNTING PARTS		
A2-1Q355	151-0220-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA, 400MHZ,AMPLIFIER;2N3906(SEL),TO-92 EBC	80009	151-0220-00
A2-1Q491	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AMPLIFIER;2N3904,TO-92 EBC	80009	151-0190-00
A2-1R112	315-0621-00			RES,FXD,FILM:620 OHM,5%,0.25W	80009	315-0621-00
A2-1R113	315-0621-00			RES,FXD,FILM:620 OHM,5%,0.25W	80009	315-0621-00
A2-1R114	315-0621-00			RES,FXD,FILM:620 OHM,5%,0.25W	80009	315-0621-00
A2-1R115	315-0621-00			RES,FXD,FILM:620 OHM,5%,0.25W	80009	315-0621-00
A2-1R116	315-0621-00			RES,FXD,FILM:620 OHM,5%,0.25W	80009	315-0621-00
A2-1R117	315-0621-00			RES,FXD,FILM:620 OHM,5%,0.25W	80009	315-0621-00

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A2-1R118	307-0636-00			RES NTWK,FXD,FI:8,330 OHM,2%,0.125 W	80009	307-0636-00
A2-1R121	315-0272-00			RES,FXD,FILM:2.7K OHM,5%,0.25W	80009	315-0272-00
A2-1R122	315-0272-00			RES,FXD,FILM:2.7K OHM,5%,0.25W	80009	315-0272-00
A2-1R168	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	80009	315-0472-00
A2-1R169	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	80009	315-0222-00
A2-1R171	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	80009	315-0203-00
A2-1R178	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	80009	315-0202-00
A2-1R179	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	80009	315-0202-00
A2-1R181	321-0441-00			RES,FXD,FILM:383K OHM,1%,0.125W,TC=T0	80009	321-0441-00
A2-1R203	307-0636-00			RES NTWK,FXD,FI:8,330 OHM,2%,0.125 W	80009	307-0636-00
A2-1R254	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
A2-1R255	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	80009	315-0472-00
A2-1R256	315-0112-00			RES,FXD,FILM:1.1K OHM,5%,0.25W	80009	315-0112-00
A2-1R257	315-0271-00			RES,FXD,FILM:270 OHM,5%,0.25W	80009	315-0271-00
A2-1R258	308-0433-00			RES,FXD,WW:1 OHM,10%,0.25W	80009	308-0433-00
A2-1R272	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322-3289-00
A2-1R273	321-1643-07			RES,FXD,FILM:11.03K OHM,0.1%,0.125W,TC=T9	80009	321-1643-07
A2-1R274	321-1264-07			RES,FXD,FILM:5.56K OHM,0.1%,0.125W,TC=T9	07716	
A2-1R275	315-0362-00			RES,FXD,FILM:3.6K OHM,5%,0.25W	80009	315-0362-00
A2-1R277	315-0242-00			RES,FXD,FILM:2.4K OHM,5%,0.25W	80009	315-0242-00
A2-1R278	321-0264-07			RES,FXD,FILM:5.49K OHM,0.1%,0.125W,TC=T9	07716	CEAE54900B
A2-1R279	321-0264-07			RES,FXD,FILM:5.49K OHM,0.1%,0.125W,TC=T9	07716	CEAE54900B
A2-1R296	321-0353-00			RES,FXD,FILM:46.4K OHM,1%,0.125W,TC=T0	07716	CEAD46401F
A2-1R297	321-0413-00			RES,FXD,FILM:196K OHM,1%,0.125W,TC=T0	07716	CEAD19602F
A2-1R298	308-0677-00			RES,FXD,WW:1 OHM,5%,2W	75042	ORDER BY DESC
A2-1R334	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A2-1R335	315-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.25W	80009	315-0152-00
A2-1R336	315-0621-00			RES,FXD,FILM:620 OHM,5%,0.25W	80009	315-0621-00
A2-1R356	315-0106-00			RES,FXD,FILM:10M OHM,5%,0.25W	01121	CB1065
A2-1R358	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A2-1R360	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00
A2-1R373	315-0271-00			RES,FXD,FILM:270 OHM,5%,0.25W	80009	315-0271-00
A2-1R374	315-0270-00			RES,FXD,FILM:27 OHM,5%,0.25W	80009	315-0270-00
A2-1R378	315-0270-00			RES,FXD,FILM:27 OHM,5%,0.25W	80009	315-0270-00
A2-1R379	315-0271-00			RES,FXD,FILM:270 OHM,5%,0.25W	80009	315-0271-00
A2-1R385	322-3318-00			RES,FXD:METAL FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 20K0
A2-1R392	322-3318-00			RES,FXD:METAL FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 20K0
A2-1R393	321-0413-00			RES,FXD,FILM:196K OHM,1%,0.125W,TC=T0	07716	CEAD19602F
A2-1R394	321-0353-00			RES,FXD,FILM:46.4K OHM,1%,0.125W,TC=T0	07716	CEAD46401F
A2-1R398	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
A2-1R410	307-0650-00			RES NTWK,FXD,FI:9,2.7K OHM,5%,0.150W	11236	750-101-R2.7K
A2-1R423	307-0526-00			RES,NTWK:THICK FILM;(5)510 OHM,10%,0.125W EACH,TC=100 PPM;SIP6,PIN 1 COMMON	57924	4306X-101-511
A2-1R440	307-0650-00			RES NTWK,FXD,FI:9,2.7K OHM,5%,0.150W	11236	750-101-R2.7K
A2-1R487	315-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.25W	80009	315-0152-00
A2-1R488	321-0387-00			RES,FXD,FILM:105K OHM,1%,0.125W,TC=T0	07716	CEAD10502F
A2-1R489	322-3318-00			RES,FXD:METAL FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 20K0
A2-1R490	322-3385-00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 100K
A2-1R493	315-0392-00			RES,FXD,FILM:3.9K OHM,5%,0.25W	80009	315-0392-00
A2-1R494	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	80009	315-0302-00
A2-1R495	315-0682-00			RES,FXD,FILM:6.8K OHM,5%,0.25W	80009	315-0682-00
A2-1R496	315-0394-00			RES,FXD,FILM:390K OHM,5%,0.25W	80009	315-0394-00
A2-1R593	315-0242-00			RES,FXD,FILM:2.4K OHM,5%,0.25W	80009	315-0242-00
A2-1R594	307-0503-00			RES NTWK,FXD,FI:(9) 510 OHM,20%,0.125W	91637	CSC10A01511GDO3

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A2-1R595	322-3210-00			RES,FXD:METAL FILM;1.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K50
A2-1R596	322-3210-00			RES,FXD:METAL FILM;1.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K50
A2-1R777	307-0650-00			RES NTWK,FXD,FI:9,2.7K OHM,5%,0.150W	11236	750-101-R2.7K
A2-1R809	315-0270-00			RES,FXD,FILM:27 OHM,5%,0.25W	80009	315-0270-00
A2-1R810	321-0929-07			RES,FXD,FILM:2.5K OHM,0.1%,0.125W,TC=T9	80009	321-0929-07
A2-1R811	322-3193-07			RES,FXD,FILM:1K OHM,0.1%,0.2W,TC=T9	80009	322-3193-07
A2-1R829	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
A2-1R837	307-0650-00			RES NTWK,FXD,FI:9,2.7K OHM,5%,0.150W	11236	750-101-R2.7K
A2-1R839	315-0511-00			RES,FXD,FILM:510 OHM,5%,0.25W	80009	315-0511-00
A2-1R846	307-0650-00			RES NTWK,FXD,FI:9,2.7K OHM,5%,0.150W	11236	750-101-R2.7K
A2-1R904	322-3179-00			RES,FXD,FILM:715 OHM,1%,0.2W,TC=T0	80009	322-3179-00
A2-1R916	321-0793-07			RES,FXD,FILM:37.5 OHM 0.1%,0.125W TC=T9	24546	NE55E37R5B
A2-1R921	307-0526-00			RES,NTWK:THICK FILM;(5)510 OHM,10%,0.125W EACH,TC=100 PPM;SIP6,PIN 1 COMMON	57924	4306X-101-511
A2-1R925	307-0526-00			RES,NTWK:THICK FILM;(5)510 OHM,10%,0.125W EACH,TC=100 PPM;SIP6,PIN 1 COMMON	57924	4306X-101-511
A2-1R929	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
A2-1R939	315-0511-00			RES,FXD,FILM:510 OHM,5%,0.25W	80009	315-0511-00
A2-1R953	315-0511-00			RES,FXD,FILM:510 OHM,5%,0.25W	80009	315-0511-00
A2-1R954	315-0511-00			RES,FXD,FILM:510 OHM,5%,0.25W	80009	315-0511-00
A2-1S407	260-1589-00			SWITCH,ROCKER:(6)SPST,125MA,30VDC	81073	76SB06S
A2-1TP101	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A2-1TP136	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A2-1TP167	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A2-1TP401	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A2-1TP499	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A2-1TP534	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A2-1TP578	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A2-1TP901	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A2-1TP913	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A2-1TP936	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A2-1TP967	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A2-1TP999	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A2-1U127	156-2628-00			IC,PROCESSOR:NMOS,PERIPHERAL;COUNTER TIMER;Z80-CTC,DIP28	56708	Z8430B PS OR CS
				MOUNTING PARTS		
	136-0755-00			SOCKET,DIP:	09922	DILB28P-108
				END MOUNTING PARTS		
A2-1U132	156-2628-00			IC,PROCESSOR:NMOS,PERIPHERAL;COUNTER TIMER;Z80-CTC,DIP28	56708	Z8430B PS OR CS
				MOUNTING PARTS		
	136-0755-00			SOCKET,DIP:	09922	DILB28P-108
				END MOUNTING PARTS		
A2-1U152	156-1632-00			MICROCKT,DGTL:CMOS,2048 X 8 SRAM	80009	156-1632-00
				MOUNTING PARTS		
	136-0751-00			SOCKET DIP:	09922	DILB24P108

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
				END MOUNTING PARTS		
A2-1U157	156-2491-00			IC,MEMORY:NMOS,EEPROM;128 X 8,200NS;2001,DIP24.6	60395	X2001 P OR D
				MOUNTING PARTS		
	136-0751-00			SOCKET DIP:	09922	DILB24P108
				END MOUNTING PARTS		
A2-1U162	156-1026-02			IC,DGTL:LSTTL,DEMUX;74LS154,DIP24.6,TUBE	01295	SN74LS154N P3
A2-1U176	156-1850-00			IC,MISC:CMOS,ANALOG SWITCH;QUAD;DG211,DIP16.3	17856	SDG21107
A2-1U218	156-0865-02			IC,DGTL:LSTTL,FLIP FLOP;74LS273,DIP20.3,TUBE	80009	156-0865-02
A2-1U221	156-3050-00			IC,MISC:	80009	156-3050-00
A2-1U239	156-0983-03			IC,PROCESSOR:NMOS,MICROPROCESSOR;8-BIT;Z80B,DIP40.6	56708	Z80BCPUDS
				MOUNTING PARTS		
	136-0757-00			SOCKET,DIP:	09922	DILB40P-108
				END MOUNTING PARTS		
A2-1U245	160-5664-00	670-9111-51	670-9111-51	MICROCKT,DGTL:NMOS,32768 X 8 EPROM,PRGM	80009	160-5664-00
A2-1U245	160-5664-01	670-9111-54		IC,DGTL:NMOS,EPROM;32768 X 8,3-STATE OUT,27256-3,DIP28	80009	160-5664-01
				(STANDARD ONLY)		
A2-1U245	160-5664-00	670-9111-52	670-9111-53	MICROCKT,DGTL:NMOS,32768 X 8 EPROM,PRGM	80009	160-5664-00
A2-1U245	160-5664-01	670-9111-55		IC,DGTL:NMOS,EPROM;32768 X 8,3-STATE OUT,27256-3,DIP28	80009	160-5664-01
				(OPTION 1V ONLY)		
				MOUNTING PARTS		
	136-0755-00			SOCKET,DIP:	09922	DILB28P-108
				END MOUNTING PARTS		
A2-1U265	160-4190-00			MICROCKT,DGTL:QUAD 16 INPUT REGISTERED AND/OR ARRAY,PRGM	80009	160-4190-00
				MOUNTING PARTS		
	136-0752-00			SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP	09922	DILB20P-108
				END MOUNTING PARTS		
A2-1U267	156-1367-00			IC,CONV:CMOS,D/A;8 BIT,400NS,CUR OUT,MPU COMPATIBLE,MULTIPLYING;AD7524JN,DIP16.3	80009	156-1367-00
A2-1U270	156-0158-07			IC,LIN:BIPOLAR,OP-AMP;MC1458P1,DIP08.3	80009	156-0158-07
A2-1U276	156-1437-00			IC,LIN:BIPOLAR,VOLTAGE REFERENCE;POSITIVE,5V,1.0%,25PPM,SERIES;MC1404AU5,DIP08.3	80009	156-1437-00
A2-1U303	156-0865-02			IC,DGTL:LSTTL,FLIP FLOP;74LS273,DIP20.3,TUBE	80009	156-0865-02
A2-1U307	156-1215-01			IC,DGTL:CMOS,MUX/ENCODER;20-KEY ENCODER;74C923,DIP18.3,TUBE,SCRN	27014	MM74C923JA+
A2-1U311	156-0956-02			IC,DGTL:LSTTL,BUFFER/DRIVER;74LS244,DIP20.3,TUBE	80009	156-0956-02
A2-1U314	156-0865-02			IC,DGTL:LSTTL,FLIP FLOP;74LS273,DIP20.3,TUBE	80009	156-0865-02
A2-1U325	156-2338-00			IC,DGTL:ASTTL,FLIP FLOP;DUAL D-TYPE;74AS74,DIP14.3,TUBE	80009	156-2338-00
A2-1U332	156-2626-00			IC,DGTL:ALSTTL,GATE;QUAD 2-INPUT NAND, OC;74ALS03,DIP14.3,TUBE	01295	74ALS03
A2-1U352	160-5504-00	670-9111-51	670-9111-55	MICROCKT,DGTL:10 LOW OUT LOGIC ARRAY,PRGM	80009	160-5504-00
A2-1U352	160-5504-01	670-9111-55		IC,DGTL:CMOS,PLD;EEPLD,22V10,25NS,33.3MHZ, 90MA,22V10-25,DIP24.3,TUBE	80009	160-5504-01
				MOUNTING PARTS		
	136-0925-00			SOCKET,DIP:	91506	224-AG30D
				END MOUNTING PARTS		
A2-1U363	156-0479-02			IC,DGTL:LSTTL,GATE;74LS32,DIP14.3,TUBE	80009	156-0479-02
A2-1U376	156-0158-07			IC,LIN:BIPOLAR,OP-AMP;MC1458P1,DIP08.3	80009	156-0158-07
A2-1U390	156-0158-07			IC,LIN:BIPOLAR,OP-AMP;MC1458P1,DIP08.3	80009	156-0158-07
A2-1U403	156-0865-02			IC,DGTL:LSTTL,FLIP FLOP;74LS273,DIP20.3,TUBE	80009	156-0865-02
A2-1U412	156-0956-02			IC,DGTL:LSTTL,BUFFER/DRIVER;74LS244,DIP20.3,TUBE	80009	156-0956-02

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2-1U416	156-1111-02			IC,DGTL:LSTTL,TRANSCEIV-ER;74LS245,DIP20.3,TUBE	80009	156-1111-02
A2-1U420	156-1111-02			IC,DGTL:LSTTL,TRANSCEIV-ER;74LS245,DIP20.3,TUBE	80009	156-1111-02
A2-1U425	156-0316-04			IC,DGTL:ECL,TRANSLATOR;QUAD ECL TO TTL;10125,DIP16.3,TUBE	04713	MC10125P/L
A2-1U429	160-3619-02			MICROCKT,DGTL:QUAD 16 INP RGTR AND/ OR,PRGM	80009	160-3619-02
				MOUNTING PARTS		
	136-0752-00			SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP	09922	DILB20P-108
				END MOUNTING PARTS		
A2-1U443	156-0865-02			IC,DGTL:LSTTL,FLIP FLOP;74LS273,DIP20.3,TUBE	80009	156-0865-02
A2-1U447	160-5637-00	670-9111-51		MICROCKT,DGTL:NMOS,4096 X 8 EPROM,PRGM	80009	160-5637-00
				(STANDARD ONLY)		
A2-1U447	160-8656-00	670-9111-52	670-9111-52	IC,MEMORY:NMOS,4096 X 8 EPROM W/3 STATE OUT,2732A,DIP24	80009	160-8656-00
A2-1U447	160-8656-01	670-9111-53		IC,MEMORY:NMOS,4096 X 8 EPROM W/3 STATE OUT,2732A,DIP24	80009	160-8656-01
				(OPTION 1V ONLY)		
				MOUNTING PARTS		
	136-0751-00			SOCKET DIP:	09922	DILB24P108
				END MOUNTING PARTS		
A2-1U452	156-1664-00			IC,DGTL:ALSTTL,FLIP FLOP;OCTAL NONINV D-TYPE, 3-STATE;74ALS574,DIP20.3,TUBE	80009	156-1664-00
A2-1U455	156-0480-02			IC,DGTL:LSTTL,GATES;74LS08,DIP14.3,TUBE	80009	156-0480-02
A2-1U459	156-0865-02			IC,DGTL:LSTTL,FLIP FLOP;74LS273,DIP20.3,TUBE	80009	156-0865-02
A2-1U463	156-2520-00			IC,DGTL:ASTTL,COUNTER;SYNCH 4-BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2-1U555	156-2382-00			IC,DGTL:ASTTL,FLIP FLOP;OCTAL D-TYPE, 3-STATE;74AS374,DIP20.3,TUBE	01295	SN74AS374 N/J
A2-1U559	156-1707-00			IC,DGTL:FTTL,GATE;QUAD 2-INPUT NAND;74F00,DIP14.3,TUBE	80009	156-1707-00
A2-1U563	156-2520-00			IC,DGTL:ASTTL,COUNTER;SYNCH 4-BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2-1U581	156-0860-02			IC,DGTL:ECL,RECEIVER;TRIPLE LINE;10116,DIP16.3,TUBE,SCRN	80009	156-0860-02
A2-1U585	156-0295-02			IC,DGTL:ECL,GATE;TRIPLE 2-INPUT XOR/ XNOR;10107,DIP16.3,TUBE,SCRN	80009	156-0295-02
A2-1U591	156-0860-02			IC,DGTL:ECL,RECEIVER;TRIPLE LINE;10116,DIP16.3,TUBE,SCRN	80009	156-0860-02
A2-1U596	156-0860-02			IC,DGTL:ECL,RECEIVER;TRIPLE LINE;10116,DIP16.3,TUBE,SCRN	80009	156-0860-02
A2-1U603	156-2520-00			IC,DGTL:ASTTL,COUNTER;SYNCH 4-BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2-1U607	156-2331-00			IC,DGTL:LSTTL,COUNTER;8-BIT, WITH STORAGE REGISTER, 3-STATE;74LS590,DIP16.3,TUBE	01295	SN74LS590N3
A2-1U612	156-2065-00			IC,DGTL:ASTTL,LATCH;OCTAL D-TYPE TRANS-PARENT, 3-STATE;74AS373,DIP20.3	01295	SN74AS373N
A2-1U616	156-2992-00			IC,MEMORY:CMOS,SRAM;2K X 8,35NS,OE;,DIP24.3	80009	156-2992-00
				MOUNTING PARTS		
	136-0925-00			SOCKET,DIP:	91506	224-AG30D
				END MOUNTING PARTS		
A2-1U620	156-0956-02			IC,DGTL:LSTTL,BUFFER/DRIVER;74LS244, DIP20.3,TUBE	80009	156-0956-02
A2-1U624	160-5638-00	670-9111-51	670-9111-51	MICROCKT,DGTL:NMOS,8192 X 8 EPROM,PRGM	80009	160-5638-00
A2-1U624	160-5638-01	670-9111-54		IC,DGTL:NMOS,EPROM;8192 X 8,W/3 STATE OUT,2764A-25,DIP28	80009	160-5638-01
				(STANDARD ONLY)		

Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2-1U624	160-8657-00	670-9111-52	670-9111-53	IC,MEMORY:NMOS,8192 X 8 EPROM W/3 STATE OUT,2764A-25,DIP28	80009	160-8657-00
A2-1U624	160-8657-01	670-9111-55		MICROCKT,DGTL:NMOS,8192 X 8 EPROM,PRGM, W/3 STATE OUT,2764A-25,DIP28,156-2196-00	80009	160-8657-01
				(OPTION 1V ONLY)		
				MOUNTING PARTS		
	136-0755-00			SOCKET,DIP:	09922	DILB28P-108
				END MOUNTING PARTS		
A2-1U631	160-5639-00	670-9111-51	670-9111-51	MICROCKT,DGTL:NMOS,8192 X 8 EPROM,PRGM	80009	160-5639-00
A2-1U631	160-5639-01	670-9111-54		IC,DGTL:NMOS,EPROM;8192 X 8,W/3 STATE OUT,2764A-25,DIP28	80009	160-5639-01
				(STANDARD ONLY)		
A2-1U631	160-8658-00	670-9111-52	670-9111-53	IC,MEMORY:NMOS,8192 X 8 EPROM W/3 STATE OUT,2764A-25,DIP28	80009	160-8658-00
A2-1U631	160-8658-01	670-9111-55		MICROCKT,DGTL:NMOS,8192 X 8 EPROM,PRGM,W/3 STATE OUT,2764A-25,DIP28	80009	160-8658-01
				(OPTION 1V ONLY)		
				MOUNTING PARTS		
	136-0755-00			SOCKET,DIP:	09922	DILB28P-108
				END MOUNTING PARTS		
A2-1U637	160-5640-00	670-9111-51	670-9111-51	MICROCKT,DGTL:NMOS,8192 X 8 EPROM,PRGM	80009	160-5640-00
A2-1U637	160-5640-01	670-9111-54		IC,DGTL:NMOS,EPROM;8192 X 8,W/3 STATE OUT,2764A-25,DIP28	80009	160-5640-01
				(STANDARD ONLY)		
A2-1U637	160-8659-00	670-9111-52	670-9111-53	IC,MEMORY:NMOS,8192 X 8 EPROM W/3 STATE OUT,2764A-25,DIP28	80009	160-8659-00
A2-1U637	160-8659-01	670-9111-55		MICROCKT,DGTL:NMOS,8192 X 8 EPROM,PRGM,W/3 STATE OUT,2764A-25,DIP28	80009	160-8659-01
				(OPTION 1V ONLY)		
				MOUNTING PARTS		
	136-0755-00			SOCKET,DIP:	09922	DILB28P-108
				END MOUNTING PARTS		
A2-1U644	160-5641-00	670-9111-51	670-9111-51	MICROCKT,DGTL:NMOS,8192 X 8 EPROM,PRGM	80009	160-5641-00
A2-1U644	160-5641-01	670-9111-54		IC,DGTL:NMOS,EPROM;8192 X 8,W/3 STATE OUT,2764A-25,DIP28	80009	160-5641-01
				(STANDARD ONLY)		
A2-1U644	160-8660-00	670-9111-52	670-9111-53	IC,MEMORY:NMOS,8192 X 8 EPROM W/3 STATE OUT,2764A-25,DIP28	80009	160-8660-00
A2-1U644	160-8660-01	670-9111-55		MICROCKT,DGTL:NMOS,8192 X 8 EPROM,PRGM, W/3 STATE OUT,2764A-25,DIP28	80009	160-8660-01
				(OPTION 1V ONLY)		
				MOUNTING PARTS		
	136-0755-00			SOCKET,DIP:	09922	DILB28P-108
				END MOUNTING PARTS		
A2-1U650	160-5642-00	670-9111-51	670-9111-51	MICROCKT,DGTL:NMOS,8192 X 8 EPROM,PRGM	80009	160-5642-00
A2-1U650	160-5642-01	670-9111-54		IC,DGTL:NMOS,EPROM;8192 X 8,W/3 STATE OUT,2764A-25,DIP28	80009	160-5642-01
				(STANDARD ONLY)		
A2-1U650	160-8661-00	670-9111-52	670-9111-53	IC,MEMORY:NMOS,8192 X 8 EPROM W/3 STATE OUT,2764A-25,DIP28	80009	160-8661-00
A2-1U650	160-8661-01	670-9111-55		MICROCKT,DGTL:NMOS,8192 X 8 EPROM,PRGM, W/3 STATE OUT,2764A-25,DIP28	80009	160-8661-01
				(OPTION 1V ONLY)		
				MOUNTING PARTS		
	136-0755-00			SOCKET,DIP:	09922	DILB28P-108
				END MOUNTING PARTS		
A2-1U659	156-2382-00			IC,DGTL:ASTTL,FLIP FLOP;OCTAL D-TYPE, 3-STATE;74AS374,DIP20.3,TUBE	01295	SN74AS374 N/J
A2-1U663	156-2520-00			IC,DGTL:ASTTL,COUNTER;SYNCH 4-BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2-1U670	156-0479-02			IC,DGTL:LSTTL,GATE;74LS32,DIP14.3,TUBE	80009	156-0479-02
A2-1U684	156-2520-00			IC,DGTL:ASTTL,COUNTER;SYNCH 4-BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2-1U696	156-0383-02			IC,DGTL:LSTTL,GATES;74LS02,DIP14.3,TUBE	80009	156-0383-02
				MOUNTING PARTS		
	136-0728-00			SKT,PL-IN ELEK:MICROCKT,14 CONTACT	09922	DILB14P-108
				END MOUNTING PARTS		
A2-1U703	156-2520-00			IC,DGTL:ASTTL,COUNTER;SYNCH 4-BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2-1U708	160-5505-00			IC,DGTL:CMOS,PLD;OTP,20G10,25NS,55MA;20G10 -25,DIP24.3	80009	160-5505-00
				MOUNTING PARTS		
	136-0925-00			SOCKET,DIP:	91506	224-AG30D
				END MOUNTING PARTS		
A2-1U712	160-4422-00			IC,DGTL:CMOS,PLD;EEPLD,16V8,25NS,90MA;16V8 -25,DIP20.3	80009	160-4422-00
				MOUNTING PARTS		
	136-0752-00			SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP	09922	DILB20P-108
				END MOUNTING PARTS		
A2-1U716	156-2065-00			IC,DGTL:ASTTL,LATCH;OCTAL D-TYPE TRANSPARENT, 3-STATE;74AS373,DIP20.3	01295	SN74AS373N
A2-1U720	156-1754-01			IC,DGTL:ALSTTL,BUFFER/DRIVER;OCTAL NON-INV, 3-STATE;74ALS244,DIP20.3,TUBE	01295	SN74ALS244AN3
A2-1U723	156-2518-00			IC,DGTL:FTTL,SHIFT REGISTER;4-BIT BIDIRECTIONAL UNIVERSAL;74F195,DIP16.3,TUBE	80009	156-2518-00
A2-1U726	156-2518-00			IC,DGTL:FTTL,SHIFT REGISTER;4-BIT BIDIRECTIONAL UNIVERSAL;74F195,DIP16.3,TUBE	80009	156-2518-00
A2-1U729	156-2518-00			IC,DGTL:FTTL,SHIFT REGISTER;4-BIT BIDIRECTIONAL UNIVERSAL;74F195,DIP16.3,TUBE	80009	156-2518-00
A2-1U732	156-2518-00			IC,DGTL:FTTL,SHIFT REGISTER;4-BIT BIDIRECTIONAL UNIVERSAL;74F195,DIP16.3,TUBE	80009	156-2518-00
A2-1U736	156-2518-00			IC,DGTL:FTTL,SHIFT REGISTER;4-BIT BIDIRECTIONAL UNIVERSAL;74F195,DIP16.3,TUBE	80009	156-2518-00
A2-1U739	156-2518-00			IC,DGTL:FTTL,SHIFT REGISTER;4-BIT BIDIRECTIONAL UNIVERSAL;74F195,DIP16.3,TUBE	80009	156-2518-00
A2-1U742	156-2518-00			IC,DGTL:FTTL,SHIFT REGISTER;4-BIT BIDIRECTIONAL UNIVERSAL;74F195,DIP16.3,TUBE	80009	156-2518-00
A2-1U745	156-2518-00			IC,DGTL:FTTL,SHIFT REGISTER;4-BIT BIDIRECTIONAL UNIVERSAL;74F195,DIP16.3,TUBE	80009	156-2518-00
A2-1U748	156-2518-00			IC,DGTL:FTTL,SHIFT REGISTER;4-BIT BIDIRECTIONAL UNIVERSAL;74F195,DIP16.3,TUBE	80009	156-2518-00
A2-1U752	156-2518-00			IC,DGTL:FTTL,SHIFT REGISTER;4-BIT BIDIRECTIONAL UNIVERSAL;74F195,DIP16.3,TUBE	80009	156-2518-00
A2-1U755	156-0956-02			IC,DGTL:LSTTL,BUFFER/DRIVER;74LS244,DIP20.3,TUBE	80009	156-0956-02
A2-1U763	156-2520-00			IC,DGTL:ASTTL,COUNTER;SYNCH 4-BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2-1U780	156-0480-02			IC,DGTL:LSTTL,GATES;74LS08,DIP14.3,TUBE	80009	156-0480-02
A2-1U784	156-2520-00			IC,DGTL:ASTTL,COUNTER;SYNCH 4-BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2-1U788	156-1707-00			IC,DGTL:FTTL,GATE;QUAD 2-INPUT NAND;74F00,DIP14.3,TUBE	80009	156-1707-00
A2-1U792	156-0464-02			IC,DGTL:LSTTL,GATES;74LS20,DIP14.3,TUBE	80009	156-0464-02
A2-1U803	156-2520-00			IC,DGTL:ASTTL,COUNTER;SYNCH 4-BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2-1U807	156-0067-13	670-9111-51	670-9111-54	IC,LIN:	80009	156-0067-13
A2-1U807	156-0067-00	670-9111-54		IC,LIN:	80009	156-0067-13
A2-1U811	156-1173-00			IC,LIN:BIPOLAR,VOLTAGE REFERENCE;POSITIVE,2.5V,1.0%,40PPM,SERIES;MC1403U,DIP08.3	80009	156-1173-00

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A2-1U814	156-2487-00			IC,CONV:BIPOLAR,A/D;6-BIT,25MSPS FLASH;TDC1046,DIP18.3	80009	156-2487-00
				MOUNTING PARTS		
	136-0756-00			SOCKET,DIP:PCB,;FEMALE,STR,2 X 9,18 POS,0.1 X 0.3 CTR,0.175 H X 0.130 TAIL,BECU,TIN	09922	DILB18P-108
				END MOUNTING PARTS		
A2-1U821	156-0368-03			IC,DGTL:ECL,TRANSLATOR;QUAD TTL-TO-ECL;10124,DIP16.3,TUBE	80009	156-0368-03
A2-1U824	156-0368-03			IC,DGTL:ECL,TRANSLATOR;QUAD TTL-TO-ECL;10124,DIP16.3,TUBE	80009	156-0368-03
A2-1U827	156-0368-03			IC,DGTL:ECL,TRANSLATOR;QUAD TTL-TO-ECL;10124,DIP16.3,TUBE	80009	156-0368-03
A2-1U841	156-0316-04			IC,DGTL:ECL,TRANSLATOR;QUAD ECL TO TTL;10125,DIP16.3,TUBE	04713	MC10125P/L
A2-1U848	156-0956-02			IC,DGTL:LSTTL,BUFFER/DRIVER;74LS244,DIP20.3,TUBE	80009	156-0956-02
A2-1U851	156-0956-02			IC,DGTL:LSTTL,BUFFER/DRIVER;D74LS244,DIP20.3,TUBE	80009	156-0956-02
A2-1U859	160-5643-00	670-9111-51		MICROCKT,DGTL:CMOS,1K X 8 REG PROM,PRGM (STANDARD ONLY)	80009	160-5643-00
A2-1U859	160-8655-00	670-9111-52		IC,MEMORY:CMOS,1K X 8 REGISTERED PROM W/3 STATE OUT,CY7C235,DIP24	80009	160-8655-00
				(OPTION 1V ONLY)		
				MOUNTING PARTS		
	136-0925-00			SOCKET,DIP:	91506	224-AG30D
				END MOUNTING PARTS		
A2-1U863	156-2520-00			IC,DGTL:ASTTL,COUNTER;SYNCH 4-BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2-1U867	156-2338-00			IC,DGTL:ASTTL,FLIP FLOP;DUAL D-TYPE;74AS74,DIP14.3,TUBE	80009	156-2338-00
A2-1U875	156-1911-00			IC,DGTL:FTTL,FLIP FLOP;HEX D-TYPE, WITH / MR;74F174,DIP16.3,TUBE	04713	MC74F174S
A2-1U880	156-1911-00			IC,DGTL:FTTL,FLIP FLOP;HEX D-TYPE, WITH / MR;74F174,DIP16.3,TUBE	04713	MC74F174S
				MOUNTING PARTS		
	136-0729-00			SOCKET,DIP:PCB;FEMALE,STR,2 X 8,16 POS,0.1 X 0.3 CTR,0.175 H X 0.130 TAIL,BECU,TIN	09922	DILB16P-108T
				END MOUNTING PARTS		
A2-1U884	156-2520-00			IC,DGTL:ASTTL,COUNTER;SYNCH 4-BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2-1U889	160-3560-01			MICROCKT,DGTL:NMOS,4096 X 8 EPROM,PRGM	80009	160-3560-01
				MOUNTING PARTS		
	136-0751-00			SOCKET DIP:	09922	DILB24P108
				END MOUNTING PARTS		
A2-1U895	160-3561-01			MICROCKT,DGTL:NMOS,4096 X 8 PROM W/3 STATE OUT,PRGM	80009	160-3561-01
				MOUNTING PARTS		
	136-0751-00			SOCKET DIP:	09922	DILB24P108
				END MOUNTING PARTS		
A2-2	119-2321-02	B010100	B010242	OVEN ASSEMBLY:	80009	119-2321-02
A2-2	119-2321-03	B010243	B010274	OVEN ASSEMBLY:TSG170A	80009	119-2321-03
A2-2	119-2321-04	B010275		OVEN ASSEMBLY:TSG170A	80009	119-2321-04
				ATTACHED PARTS		
	134-0209-00			BUTTON,PLUG:0.187 DIA HOLE,PLASTIC	31223	62PP018BM14
	200-3264-00			COVER,TOP:ALUMINUM	80009	200-3264-00
	200-3266-01			CAP,HEAT SINK:PLASTIC	80009	200-3266-01
	214-3863-01			HEAT SINK,ELEC:ALUMINUM	80009	214-3863-01
	211-0513-00			SCREW,MACHINE:6-32 X 0.625,PNH,STL (QUANTITY 2)	93907	B80-00032-003

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	211-0661-00			SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,CD PL,POZ,MACHINE	01536	821-01655-024
				(QUANTITY 2)		
	348-0935-00			GASKET:2.0 X 1.7,NEOPRENE	80009	348-0935-00
	432-0154-00			BASE,HEAT SINK:PLASTIC	80009	432-0154-00
				END ATTACHED PARTS		
A2-2C6	283-5025-00	119-2321-02	119-2321-03	CAP,FXD,CER DI:220PF,5%,50V	80009	283-5025-00
A2-2C6	283-5238-00	119-2321-04		CAP,FXD,CER DI:150PF,5%,100V	04222	12061A151JAT1A
A2-2C8	283-5025-00			CAP,FXD,CER DI:220PF,5%,50V	80009	283-5025-00
A2-2C15	283-5008-00	119-2321-02	119-2321-03	CAP,FXD,CER:MLC;12PF,5%,50V,NPO,1206;SMD,8 MM T&R	54583	C3216COG1H120J
A2-2C15	283-5000-00	119-2321-04		CAP,FXD,CER:MLC;10PF,5%,50V,NPO,1206;SMD,8 MM T&R	80009	283-5000-00
A2-2C16	283-5206-00			CAP,FXD,CER DI:56PF,5%,100V	80009	283-5206-00
A2-2C17	283-5004-00			CAP,FXD,CER:MLC;0.1UF,10%,25V,X7R,1206;SMD, 8MM T&R	80009	283-5004-00
A2-2C19	281-0165-00			CAP,VAR,AIR DI:0.8-10PF,250V	80009	281-0165-00
A2-2CR14	152-0612-00			DIODE,SIG:,VVC;50V,15-20PF,C4/30=2.33,Q=15;1N 4806 FMLY,DO-7	04713	SMV 1561
A2-2Q10	151-5001-00	119-2321-02	119-2321-02	XSTR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AM-PLIFIER;MMBT3904L,TO-236/SOT-23, 8MM T&R	80009	151-5001-00
A2-2Q10	151-5035-00	119-2321-03		XSTR,SIG:BIPOLAR,NPN;25V,30MA, 650MHZ,AM-PLIFIER;MMBTH10L,TO-236/SOT-23, 8MM T&R	04713	MMBTH10T1
A2-2R1	321-5043-00			RES,FXD:THICK FILM;47.5 OHM,1%,0.125W,TC=100 PPM;1206,T&R	80009	321-5043-00
A2-2R3	307-1161-00			RES,FXD,FILM:1M OHM,5%,0.062W,0805,8MM	TK0510	ERJ-6GCSJ105V
A2-2R4	321-5078-00			RES,FXD,FILM:20K OHM,1%,125MW,0805 PKG	80009	321-5078-00
A2-2R5	321-5078-00			RES,FXD,FILM:20K OHM,1%,125MW,0805 PKG	80009	321-5078-00
A2-2R9	321-5012-00			RES,FXD:THICK FILM;332 OHM,1%,0.125W,TC=100 PPM;1206,T&R	80009	321-5012-00
A2-2RT11	307-0181-01			RES,THERMAL:20K OHM,5%,AT 60 DEG C	80009	307-0181-01
A3	671-0631-00	B010100	B010276	CIRCUIT BD ASSY:OUTPUT	80009	671-0631-00
A3	671-0631-01	B010277	B010361	CIRCUIT BD ASSY:OUTPUT	80009	671-0631-01
A3	671-0631-02	B010362	B010385	CIRCUIT BD ASSY:OUTPUT	80009	671-0631-02
A3	671-0631-03	B010386	B010445	CIRCUIT BD ASSY:OUTPUT	80009	671-0631-03
A3	671-0631-04	B010446	B010559	CIRCUIT BD ASSY:OUTPUT	80009	671-0631-04
A3	671-0631-05	B010560	B010618	CIRCUIT BD ASSY:OUTPUT	80009	671-0631-05
A3	671-0631-06	B010619		CIRCUIT BD ASSY:OUTPUT	80009	671-0631-06
				ATTACHED PARTS		
	131-0157-00			TERMINAL,PIN:0.25 L X 0.04 OD,BRS,SLDR PL	80009	131-0157-00
				(QUANTITY 2)		
				END ATTACHED PARTS		
A3C1	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C2	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C3	290-0990-00			CAP,FXD,ELCTLT:10UF,20%,50V	24165	502D437
A3C4	290-0990-00			CAP,FXD,ELCTLT:10UF,20%,50V	24165	502D437
A3C5	283-0780-00			CAP,FXD,MICA DI:125PF,1%,500V	00853	D155F1250F0
A3C6	283-0648-00			CAP,FXD,MICA DI:10PF,+/-0.5PF,500V	80009	283-0648-00
A3C7	283-0659-00			CAP,FXD,MICA DI:1160PF,2%,500V	80009	283-0659-00
A3C8	283-0779-00			CAP,FXD,MICA DI:27 PF,2%,500V	80009	283-0779-00
A3C9	283-0625-00			CAP,FXD,MICA DI:220PF,1%,500V	80009	283-0625-00
A3C10	283-0667-00			CAP,FXD,MICA DI:420PF,1%,500V	80009	283-0667-00
A3C11	285-0597-00			CAP,FXD,PLASTIC:0.001UF,1%,100V	14752	410B1B102F
A3C12	283-0615-00			CAP,FXD,MICA DI:33PF,5%,500V	80009	283-0615-00
A3C13	283-0640-00			CAP,FXD,MICA DI:160PF,1%,500V	80009	283-0640-00

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A3C14	283–0780–00			CAP,FXD,MICA DI:125PF,1%,500V	00853	D155F1250F0
A3C15	283–0672–00			CAP,FXD,MICA DI:200PF,1%,500V	80009	283–0672–00
A3C16	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C17	283–0648–00			CAP,FXD,MICA DI:10PF,+/–0.5PF,500V	80009	283–0648–00
A3C18	283–0648–00			CAP,FXD,MICA DI:10PF,+/–0.5PF,500V	80009	283–0648–00
A3C19	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C20	283–0648–00			CAP,FXD,MICA DI:10PF,+/–0.5PF,500V	80009	283–0648–00
A3C21	283–0223–00			CAP,FXD,CER DI:3PF,+/–5PF,50V	TK1134	835XXXCOJO309D
A3C22	281–0153–00			CAP,VAR,AIR DI:1.7–10PF,250V	80009	281–0153–00
A3C23	283–0648–00			CAP,FXD,MICA DI:10PF,+/–0.5PF,500V	80009	283–0648–00
A3C24	283–0648–00			CAP,FXD,MICA DI:10PF,+/–0.5PF,500V	80009	283–0648–00
A3C25	283–0648–00			CAP,FXD,MICA DI:10PF,+/–0.5PF,500V	80009	283–0648–00
A3C26	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C27	283–0648–00			CAP,FXD,MICA DI:10PF,+/–0.5PF,500V	80009	283–0648–00
A3C28	281–0756–00			CAP,FXD,CER:MLC;2.2PF,+/–0.5PF,200V,0.100 X 0.170;AXIAL,MI	04222	SA102A2R2DAA
A3C29	281–0153–00			CAP,VAR,AIR DI:1.7–10PF,250V	80009	281–0153–00
A3C30	283–0648–00			CAP,FXD,MICA DI:10PF,+/–0.5PF,500V	80009	283–0648–00
A3C31	283–0631–00			CAP,FXD,MICA DI:95PF,1%,500V	80009	283–0631–00
A3C32	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C33	283–0625–00			CAP,FXD,MICA DI:220PF,1%,500V	80009	283–0625–00
A3C34	283–0198–00			CAP,FXD,CER DI:0.22UF,20%,50V	05397	C330C224M5U1CA
A3C35	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C36	283–0648–00			CAP,FXD,MICA DI:10PF,+/–0.5PF,500V	80009	283–0648–00
A3C37	281–0131–00			CAP,VAR,AIR DI:2.4–24.5PF,250V	80009	281–0131–00
A3C38	285–1130–00			CAP,FXD,PLASTIC:0.22UF,1%,100V	50558	MH12D224F
A3C39	283–0594–00			CAP,FXD,MICA DI:0.001UF,1%,100V	80009	283–0594–00
A3C40	285–0597–00			CAP,FXD,PLASTIC:0.001UF,1%,100V	14752	410B1B102F
A3C41	290–0990–00			CAP,FXD,ELCTLT:10UF,20%,50V	24165	502D437
A3C42	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C43	283–0223–00			CAP,FXD,CER DI:3PF,+/–5PF,50V	TK1134	835XXXCOJO309D
A3C44	283–0051–00			CAP,FXD,CER DI:0.0033UF,5%,100V	80009	283–0051–00
A3C45	283–0615–00			CAP,FXD,MICA DI:33PF,5%,500V	80009	283–0615–00
A3C46	283–0687–00			CAP,FXD,MICA DI:560PF,2%,300V	80009	283–0687–00
A3C47	290–0990–00			CAP,FXD,ELCTLT:10UF,20%,50V	24165	502D437
A3C48	283–0672–00			CAP,FXD,MICA DI:200PF,1%,500V	80009	283–0672–00
A3C49	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C50	283–0594–00			CAP,FXD,MICA DI:0.001UF,1%,100V	80009	283–0594–00
A3C51	281–0284–00			CAP,VAR,CER DI:2.2–34PF,250V	80009	281–0284–00
A3C52	283–0648–00			CAP,FXD,MICA DI:10PF,+/–0.5PF,500V	80009	283–0648–00
A3C53	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C54	285–0889–00	671–0631–00	671–0631–03	CAP,FXD,PLASTIC:0.0027UF,5%,100V	19396	DU490/74–28221
A3C54	281–0775–01	671–0631–04	671–0631–05	CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C54	283–0194–00	671–0631–06		CAP,FXD,CER DI:4.7UF,20%,50V	05397	C350C475M5UICA
A3C55	285–0889–00	671–0631–00	671–0631–03	CAP,FXD,PLASTIC:0.0027UF,5%,100V	19396	DU490/74–28221
A3C55	281–0775–01	671–0631–04	671–0631–05	CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C55	283–0194–00	671–0631–06		CAP,FXD,CER DI:4.7UF,20%,50V	05397	C350C475M5UICA
A3C56	285–0809–00	671–0631–00	671–0631–03	CAP,FXD,PLASTIC:1UF,10%,50V	24165	LP66A1A105K
A3C56	290–0963–00	671–0631–04	671–0631–05	CAP,FXD,ALUM:;220UF,+50–20%,25WVDC,10 X 12MM;RDL	80009	290–0963–00

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A3C56	283–0164–00	671–0631–06		CAP,FXD,CER DI:2.2UF,20%,25V	05397	C340C225M5UICA
A3C57	285–0809–00	671–0631–00	671–0631–03	CAP,FXD,PLASTIC:1UF,10%,50V	24165	LP66A1A105K
A3C57	290–0963–00	671–0631–04	671–0631–05	CAP,FXD,ALUM:;220UF,+50–20%,25WVDC,10 X 12MM;RDL	80009	290–0963–00
A3C57	283–0164–00	671–0631–06		CAP,FXD,CER DI:2.2UF,20%,25V	05397	C340C225M5UICA
A3C58	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C59	283–0706–00	671–0631–00	671–0631–05	CAP,FXD,MICA DI:91PF,1%,500V	80009	283–0706–00
A3C59	281–0775–01	671–0631–06		CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C60	290–0963–00	671–0631–04		CAP,FXD,ALUM:;220UF,+50–20%,25WVDC,10 X 12MM;RDL	80009	290–0963–00
A3C61	290–0963–00	671–0631–04		CAP,FXD,ALUM:;220UF,+50–20%,25WVDC,10 X 12MM;RDL	80009	290–0963–00
A3C100	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C101	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C102	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C103	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C104	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C105	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C106	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C107	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C108	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C109	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C189	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C190	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C191	283–0637–00			CAP,FXD,MICA DI:20PF,2.5%,500V	80009	283–0637–00
A3C192	283–0663–00			CAP,FXD,MICA DI:16.8PF,+/0.5PF,500V	80009	283–0663–00
A3C193	283–0623–00			CAP,FXD,MICA DI:1200PF,1%,100V	80009	283–0623–00
A3C194	283–0677–00			CAP,FXD,MICA DI:82PF,1%,500V	80009	283–0677–00
A3C195	283–0672–00			CAP,FXD,MICA DI:200PF,1%,500V	80009	283–0672–00
A3C300	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C301	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C302	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C303	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C304	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C305	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C306	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C307	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C308	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C309	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C310	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C312	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C313	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C314	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA

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A3C315	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C316	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C317	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C319	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C320	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C321	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C322	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C324	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C325	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C326	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C327	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C402	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C408	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C409	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C410	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C412	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C413	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C414	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C415	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C417	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C418	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C419	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C420	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C500	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C501	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C502	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C504	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C505	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C506	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C508	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA

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A3C509	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C600	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C601	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C602	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C604	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C606	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C607	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C608	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C700	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C701	283-0631-00	671-0631-00	671-0631-04	CAP,FXD,MICA DI:95PF,1%,500V	80009	283-0631-00
A3C701	283-0668-00	671-0631-05		CAP,FXD,MICA DI:184PF,1%,100V	80009	283-0668-00
A3CR1	152-0322-00			DIODE,SIG:SCHTKY,;15V,410MVF AT 1MA,1.2PF;5082-2811,T&R	80009	152-0322-00
A3CR2	152-0322-00			DIODE,SIG:SCHTKY,;15V,410MVF AT 1MA,1.2PF;5082-2811,T&R	80009	152-0322-00
A3CR3	152-0141-02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR4	152-0141-02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR5	152-0141-02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR6	152-0322-00			DIODE,SIG:SCHTKY,;15V,410MVF AT 1MA,1.2PF;5082-2811,T&R	80009	152-0322-00
A3CR7	152-0141-02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR8	152-0141-02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3J1	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A3J2	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A3J3	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 2)	80009	131-0608-00
A3J4	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 2)	80009	131-0608-00
A3J5	131-3439-00			CONN,DIN:PCB;FEMALE,RTANG,3 X 16,0.1 CTR,0.209 MLG X 0.114 TAIL,30 GOLD	81312	48S-6043-0731-0
				MOUNTING PARTS		
	210-0405-00			NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL (QUANTITY 2)	73743	12157-50
	211-0185-00			SCREW,MACHINE:2-56 X 0.438,PNH,STL (QUANTITY 2)	TK0435	ORDER BY DESCR
				END MOUNTING PARTS		
A3J6	131-3439-00			CONN,DIN:PCB;FEMALE,RTANG,3 X 16,0.1 CTR,0.209 MLG X 0.114 TAIL,30 GOLD	81312	48S-6043-0731-0
				MOUNTING PARTS		
	210-0405-00			NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL (QUANTITY 2)	73743	12157-50
	211-0185-00			SCREW,MACHINE:2-56 X 0.438,PNH,STL (QUANTITY 2)	TK0435	ORDER BY DESCR
				END MOUNTING PARTS		

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A3J7	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 4)	80009	131-0608-00
A3J8	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A3J9	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 26)	80009	131-0608-00
A3J10	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 26)	80009	131-0608-00
A3J12	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A3J13	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A3J14	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A3J15	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A3J16	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A3J17	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A3J18	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A3J19	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A3J20	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A3J21	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A3J22	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A3L1	120-1829-00			TRANSFORMER,RF:VAR, 1.6-1.8 UH, PRESET TO 1.71UH +/- 5%, POT CORE	80009	120-1829-00
A3L2	114-0436-00			COIL,RF:VAR,POT CORE,0.753UH	80009	114-0436-00
A3L3	114-0433-00			COIL,RF:VAR,2.22-2.45UH, PRESET TO 2.39UH +/-1%,POT CORE	80009	114-0433-00
A3L4	114-0434-00			COIL,RF:VAR,POT CORE,1.92UH	80009	114-0434-00
A3L5	114-0435-00			COIL,RF:VAR,POT CORE,1.76UH	80009	114-0435-00
A3L6	108-1212-00			COIL,RF:FIXED,9UH,2%	TK1345	108-1212-00
A3L7	108-0549-00			COIL,RF:FIXED,4.45UH	80009	108-0549-00
A3L8	114-0437-00			COIL,RF:VAR,0.26-0.295UH, PRESET TO 0.28UH, +/-5%, POT CORE	80009	114-0437-00
A3L9	120-1830-00			TRANSFORMER,RF:VAR, 1.73-1.92 UH, PRESET TO 1.83UH +/- 5%, POT CORE	80009	120-1830-00
A3P1	131-0993-05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100-5
A3P2	131-0993-02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1-850100-O
A3P8	131-0993-05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100-5
A3P13	131-0993-05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100-5
A3P14	131-0993-05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100-5
A3P15	131-0993-05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100-5
A3P16	131-0993-02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1-850100-O
A3P17	131-0993-05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100-5
A3P18	131-0993-05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100-5
A3P19	131-0993-05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100-5
A3P21	131-0993-05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100-5
A3P22	131-0993-02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1-850100-O
A3Q1	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AMPLIFIER;2N3904,TO-92 EBC	80009	151-0190-00
A3Q2	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AMPLIFIER;2N3904,TO-92 EBC	80009	151-0190-00

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A3Q3	151-0220-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA, 400MHZ,AM-PLIFIER;2N3906(SEL),TO-92 EBC	80009	151-0220-00
A3Q4	151-0220-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA, 400MHZ,AM-PLIFIER;2N3906(SEL),TO-92 EBC	80009	151-0220-00
A3Q5	151-0103-02			XSTR,SIG:BIPOLAR,NPN;2N2219A,TO-39	80009	151-0103-02
A3Q6	151-0220-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA, 400MHZ,AM-PLIFIER;2N3906(SEL),TO-92 EBC	80009	151-0220-00
A3Q7	151-0220-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA, 400MHZ,AM-PLIFIER;2N3906(SEL),TO-92 EBC	80009	151-0220-00
A3Q8	151-0103-02			XSTR,SIG:BIPOLAR,NPN;2N2219A,TO-39	80009	151-0103-02
A3Q9	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AM-PLIFIER;2N3904,TO-92 EBC	80009	151-0190-00
A3Q10	151-0220-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA, 400MHZ,AM-PLIFIER;2N3906(SEL),TO-92 EBC	80009	151-0220-00
A3Q11	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AM-PLIFIER;2N3904,TO-92 EBC	80009	151-0190-00
A3Q12	151-0220-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA, 400MHZ,AM-PLIFIER;2N3906(SEL),TO-92 EBC	80009	151-0220-00
A3Q13	151-1103-00			XSTR,SIG:DMOSFET,N-CH;ENH,2V,50MA,45 OHM;SD210DE,TO-72	80009	151-1103-00
A3Q14	151-0367-00			XSTR,SIG:BIPOLAR,NPN;25V,30MA, 1.0GHZ;MPS-H10 SPECIAL,TO-92 EBC	80009	151-0367-00
A3Q15	151-0367-00			XSTR,SIG:BIPOLAR,NPN;25V,30MA, 1.0GHZ;MPS-H10 SPECIAL,TO-92 EBC	80009	151-0367-00
A3Q16	151-0220-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,400MHZ,AM-PLIFIER;2N3906(SEL),TO-92 EBC	80009	151-0220-00
A3Q17	151-0367-00			XSTR,SIG:BIPOLAR,NPN;25V,30MA,1.0GHZ;MPS-H10 SPECIAL,TO-92 EBC	80009	151-0367-00
A3Q18	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AM-PLIFIER;2N3904,TO-92 EBC	80009	151-0190-00
A3Q19	151-0220-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,400MHZ,AM-PLIFIER;2N3906(SEL),TO-92 EBC	80009	151-0220-00
A3Q20	151-0254-00			XSTR,SIG:BIPOLAR,NPN;30V,500MA,125MHZ,AM-PLIFIER,DARLINGTON;MPSA14,TO-92 EBC	80009	151-0254-00
A3R15	307-0841-00			RES NTWK,FXD,FI:(4)10 OHM,10%,0.3W	91637	CSC08A-03-100G
A3R16	307-0841-00			RES NTWK,FXD,FI:(4)10 OHM,10%,0.3W	91637	CSC08A-03-100G
A3R17	307-0841-00			RES NTWK,FXD,FI:(4)10 OHM,10%,0.3W	91637	CSC08A-03-100G
A3R23	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00
A3R24	322-3222-07			RES,FXD,FILM:2K OHM,0.1%,0.2W TC=T9	80009	322-3222-07
A3R25	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	80009	315-0202-00
A3R26	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	80009	315-0202-00
A3R27	322-3222-07			RES,FXD,FILM:2K OHM,0.1%,0.2W TC=T9	80009	322-3222-07
A3R28	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00
A3R29	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 75E0
A3R30	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 75E0
A3R31	315-0621-00			RES,FXD,FILM:620 OHM,5%,0.25W	80009	315-0621-00
A3R32	315-0511-00			RES,FXD,FILM:510 OHM,5%,0.25W	80009	315-0511-00
A3R33	322-3086-00			RES,FXD,FILM:76.8 OHM,1%,0.2W,TC=T0	91637	CCF50-2G76R80F
A3R34	322-3086-00			RES,FXD,FILM:76.8 OHM,1%,0.2W,TC=T0	91637	CCF50-2G76R80F
A3R35	321-0830-03			RES,FXD,FILM:2.41K OHM,0.25%,0.125W,TC=T2	07716	CEAC24100C
A3R36	321-0830-03			RES,FXD,FILM:2.41K OHM,0.25%,0.125W,TC=T2	07716	CEAC24100C
A3R37	322-3392-00			RES,FXD,FILM:118K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 118K
A3R38	322-3001-00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322-3001-00
A3R39	321-0793-07			RES,FXD,FILM:37.5 OHM 0.1%,0.125W TC=T9	24546	NE55E37R5B
A3R40	321-0793-07			RES,FXD,FILM:37.5 OHM 0.1%,0.125W TC=T9	24546	NE55E37R5B

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A3R41	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A3R42	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A3R43	322-3132-00			RES,FXD,FILM:232 OHM,1%,0.2W,TC=T0	80009	322-3132-00
A3R44	321-0830-03			RES,FXD,FILM:2.41K OHM,0.25%,0.125W,TC=T2	07716	CEAC24100C
A3R45	321-0830-03			RES,FXD,FILM:2.41K OHM,0.25%,0.125W,TC=T2	07716	CEAC24100C
A3R46	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	80009	315-0150-00
A3R47	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 75E0
A3R48	301-0201-00			RES,FXD,FILM:200 OHM,5%,0.5W	80009	301-0201-00
A3R49	322-3226-00			RES,FXD:METAL FILM;2.21K OHM,1%,0.2W, TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 2K21
A3R50	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 2K00
A3R51	311-0634-00			RES,VAR,NONWW:TRMR,500 OHM,0.5W	80009	311-0634-00
A3R52	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A3R53	322-3146-00			RES,FXD,FILM:324 OHM,1%,0.2W,TC=T0	91637	
A3R54	322-3132-00			RES,FXD,FILM:232 OHM,1%,0.2W,TC=T0	80009	322-3132-00
A3R55	321-0830-03			RES,FXD,FILM:2.41K OHM,0.25%,0.125W,TC=T2	07716	CEAC24100C
A3R56	321-0830-03			RES,FXD,FILM:2.41K OHM,0.25%,0.125W,TC=T2	07716	CEAC24100C
A3R57	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	80009	315-0150-00
A3R58	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 75E0
A3R59	301-0201-00			RES,FXD,FILM:200 OHM,5%,0.5W	80009	301-0201-00
A3R60	322-3210-00			RES,FXD:METAL FILM;1.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K50
A3R61	311-0634-00			RES,VAR,NONWW:TRMR,500 OHM,0.5W	80009	311-0634-00
A3R62	322-3164-00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 499E
A3R63	321-0068-00			RES,FXD,FILM:49.9 OHM,0.1%,0.125W,TC=T0	80009	321-0068-00
A3R64	321-0068-00			RES,FXD,FILM:49.9 OHM,0.1%,0.125W,TC=T0	80009	321-0068-00
A3R65	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 2K00
A3R66	322-3208-00			RES,FXD,FILM:1.43K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K43
A3R67	322-3183-00			RES,FXD,FILM:787 OHM,1%,0.2W,TC=T0	80009	322-3183-00
A3R68	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A3R69	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A3R70	322-3178-00			RES,FXD,FILM:698 OHM,1%,0.2W,TC=T0	91637	CCF50-2G698ROF
A3R71	321-0247-00			RES,FXD,FILM:3.65K OHM,1%,0.125W,TC=T0	80009	321-0247-00
A3R72	322-3260-00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 4K99
A3R73	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 2K00
A3R74	322-3175-00			RES,FXD,FILM:649 OHM,1%,0.2W,TC=T0	80009	322-3175-00
A3R75	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
A3R76	321-0926-07			RES,FXD,FILM:4K OHM,0.1%,0.125W,TC=T9	19701	5033RE4K00B
A3R77	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
A3R78	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	80009	315-0150-00
A3R79	315-0122-00			RES,FXD,FILM:1.2K OHM,5%,0.25W	80009	315-0122-00
A3R80	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A3R81	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	80009	315-0104-00
A3R82	322-3392-00			RES,FXD,FILM:118K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 118K
A3R83	315-0513-00			RES,FXD,FILM:51K OHM,5%,0.25W	80009	315-0513-00
A3R84	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	80009	315-0150-00
A3R85	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00
A3R86	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00

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A3R87	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	80009	315-0302-00
A3R88	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	80009	315-0202-00
A3R89	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00
A3R90	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	80009	315-0104-00
A3R91	311-1035-00			RES,VAR,NONWW:TRMR,50K OHM,0.5W	80009	311-1035-00
A3R92	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	80009	315-0150-00
A3R93	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	80009	315-0150-00
A3R94	322-3306-00			RES,FXD:METAL FILM;15K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 15K0
A3R95	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	80009	315-0150-00
A3R96	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	80009	315-0150-00
A3R97	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	80009	322-3126-00
A3R98	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	80009	322-3126-00
A3R99	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00
A3R100	322-3164-00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 499E
A3R101	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	80009	322-3126-00
A3R102	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
A3R103	307-0540-00			RES NTWK,FXD,FI:(5)1K OHM,2%,0.7W	91637	CSC06A-01-102G
A3R104	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
A3R105	315-0272-00			RES,FXD,FILM:2.7K OHM,5%,0.25W	80009	315-0272-00
A3R106	315-0362-00			RES,FXD,FILM:3.6K OHM,5%,0.25W	80009	315-0362-00
A3R107	307-0541-00			RES NTWK,FXD,FI:(7)1K OHM,10%,1W	01121	108A102
A3R108	307-0503-00			RES NTWK,FXD,FI:(9) 510 OHM,20%,0.125W	91637	CSC10A01511GDO3
A3R109	307-0503-00			RES NTWK,FXD,FI:(9) 510 OHM,20%,0.125W	91637	CSC10A01511GDO3
A3R110	307-0539-00			RES NTWK,FXD,FI:(7)510 OHM,10%,1W	80009	307-0539-00
A3R111	322-3039-00			RES,FXD,FILM:24.9 OHM,1%,0.2W,TC=T0	80009	322-3039-00
A3R112	322-3039-00			RES,FXD,FILM:24.9 OHM,1%,0.2W,TC=T0	80009	322-3039-00
A3R113	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322-3289-00
A3R114	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322-3289-00
A3R115	322-3296-00			RES,FXD,FILM:11.8K OHM,1%,0.2W,TC=T0	80009	322-3296-00
A3R116	322-3296-00			RES,FXD,FILM:11.8K OHM,1%,0.2W,TC=T0	80009	322-3296-00
A3R119	311-1035-00			RES,VAR,NONWW:TRMR,50K OHM,0.5W	80009	311-1035-00
A3R120	322-3264-00			RES,FXD,FILM:5.49K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 5K49
A3R121	322-3306-00			RES,FXD:METAL FILM;15K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 15K0
A3R122	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 2K00
A3R123	322-3294-00			RES,FXD,FILM:11.3K OHM,1%,0.2W,TC=T0	80009	322-3294-00
A3R124	322-3210-00			RES,FXD:METAL FILM;1.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K50
A3R125	322-3207-00			RES,FXD,FILM:1.4K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K4
A3R126	322-3264-00			RES,FXD,FILM:5.49K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 5K49
A3R127	315-0201-00			RES,FXD,FILM:200 OHM,5%,0.25W	80009	315-0201-00
A3R128	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	80009	315-0150-00
A3R129	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 2K00
A3R130	315-0111-00			RES,FXD,FILM:110 OHM,5%,0.25W	80009	315-0111-00
A3R131	321-0340-00			RES,FXD,FILM:34.0K OHM,1%,0.125W,TC=T0	80009	321-0340-00
A3R132	315-0511-00			RES,FXD,FILM:510 OHM,5%,0.25W	80009	315-0511-00
A3R133	322-3250-00			RES,FXD:METAL FILM;3.92K OHM,1%,0.2W, TC=100 PPM;AXIAL,T&R,SMALL BODY	91637	CCF50-2F39200F
A3R134	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A3R135	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A3R136	322-3260-00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 4K99
A3R137	321-0348-00			RES,FXD,FILM:41.2K OHM,1%,0.125W,TC=T0	80009	321-0348-00

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A3R138	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322-3289-00
A3R139	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322-3289-00
A3R140	322-3175-00			RES,FXD,FILM:649 OHM,1%,0.2W,TC=T0	80009	322-3175-00
A3R141	322-3292-00			RES,FXD,FILM:10.7K OHM,1%,0.2W,TC=T0	80009	322-3292-00
A3R142	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00
A3R143	322-3207-00			RES,FXD,FILM:1.4K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K4
A3R144	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00
A3R145	315-0272-00			RES,FXD,FILM:2.7K OHM,5%,0.25W	80009	315-0272-00
A3R146	322-3385-00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 100K
A3R147	322-3481-00			RES,FXD,FILM:1M OHM.1%,0.2W,TC=T0	80009	322-3481-00
A3R148	322-3385-00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 100K
A3R149	321-0247-00			RES,FXD,FILM:3.65K OHM,1%,0.125W,TC=T0	80009	321-0247-00
A3R150	321-0793-07			RES,FXD,FILM:37.5 OHM 0.1%,0.125W TC=T9	24546	NE55E37R5B
A3R151	322-3284-00			RES,FXD,FILM:8.87K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 8K87
A3R152	322-3205-00			RES,FXD,FILM:1.33K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K33
A3R153	321-0380-00			RES,FXD,FILM:88.7K OHM,1%,0.125W,TC=T0	07716	CEAD88701F
A3R154	307-0540-00			RES NTWK,FXD,FI:(5)1K OHM,2%,0.7W	91637	CSC06A-01-102G
A3R155	315-0163-00			RES,FXD,FILM:16K OHM,5%,0.25W	80009	315-0163-00
A3R156	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	80009	315-0203-00
A3R157	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00
A3R158	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	80009	315-0302-00
A3R159	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	80009	315-0202-00
A3R160	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	80009	315-0150-00
A3R161	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00
A3R162	315-0106-00			RES,FXD,FILM:10M OHM,5%,0.25W	01121	CB1065
A3R163	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	80009	322-3126-00
A3R164	315-0201-00			RES,FXD,FILM:200 OHM,5%,0.25W	80009	315-0201-00
A3R165	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322-3289-00
A3R166	307-0541-00			RES NTWK,FXD,FI:(7)1K OHM,10%,1W	01121	108A102
A3R167	307-0540-00			RES NTWK,FXD,FI:(5)1K OHM,2%,0.7W	91637	CSC06A-01-102G
A3R168	307-0675-00			RES NTWK,FXD,FI:(9),1K OHM,2%,1.25W	11236	750-101-R1K OHM
A3R169	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	80009	315-0203-00
A3R170	307-0841-00			RES NTWK,FXD,FI:(4)10 OHM,10%,0.3W	91637	CSC08A-03-100G
A3R171	307-0841-00			RES NTWK,FXD,FI:(4)10 OHM,10%,0.3W	91637	CSC08A-03-100G
A3R172	307-0540-00			RES NTWK,FXD,FI:(5)1K OHM,2%,0.7W	91637	CSC06A-01-102G
A3R173	322-3164-00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 499E
A3R174	322-3164-00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 499E
A3R175	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00
A3R176	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00
A3R177	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00
A3R178	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00
A3R179	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00
A3R180	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00
A3R181	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00
A3R182	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00

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A3R183	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00
A3R184	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00
A3R185	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00
A3R186	307-0841-00			RES NTWK,FXD,FI:(4)10 OHM,10%,0.3W	91637	CSC08A-03-100G
A3R187	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00
A3R188	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
A3R189	321-0340-00	671-0631-00	671-0631-03	RES,FXD,FILM:34.0K OHM,1%,0.125W,TC=T0	80009	321-0340-00
A3R189	322-3423-00	671-0631-04	671-0631-05	RES,FXD,FILM:249K OHM,1%,0.2W,TC=T0	80009	322-3423-00
A3R189	322-3311-00	671-0631-06		RES,FXD,FILM:16.9K OHM,1%,0.2W,TC=T0	56845	CCF-50-2-1692F
A3R190	321-0340-00	671-0631-00	671-0631-03	RES,FXD,FILM:34.0K OHM,1%,0.125W,TC=T0	80009	321-0340-00
A3R190	322-3423-00	671-0631-04	671-0631-05	RES,FXD,FILM:249K OHM,1%,0.2W,TC=T0	80009	322-3423-00
A3R190	322-3311-00	671-0631-06		RES,FXD,FILM:16.9K OHM,1%,0.2W,TC=T0	56845	CCF-50-2-1692F
A3R191	321-0340-00	671-0631-00	671-0631-03	RES,FXD,FILM:34.0K OHM,1%,0.125W,TC=T0	80009	321-0340-00
A3R191	322-3423-00	671-0631-04	671-0631-05	RES,FXD,FILM:249K OHM,1%,0.2W,TC=T0	80009	322-3423-00
A3R191	322-3311-00	671-0631-06		RES,FXD,FILM:16.9K OHM,1%,0.2W,TC=T0	56845	CCF-50-2-1692F
A3R192	321-0340-00	671-0631-00	671-0631-03	RES,FXD,FILM:34.0K OHM,1%,0.125W,TC=T0	80009	321-0340-00
A3R192	322-3423-00	671-0631-04	671-0631-05	RES,FXD,FILM:249K OHM,1%,0.2W,TC=T0	80009	322-3423-00
A3R192	322-3311-00	671-0631-06		RES,FXD,FILM:16.9K OHM,1%,0.2W,TC=T0	56845	CCF-50-2-1692F
A3R193	315-0474-00			RES,FXD,FILM:470K OHM,5%,0.25W	80009	315-0474-00
A3R194	321-0159-00	671-0631-00	671-0631-03	RES,FXD,FILM:442 OHM,1%,0.125W,TC=T0	07716	CEAD442R0F
A3R194	322-3145-00	671-0631-04	671-0631-05	RES,FXD,FILM:316 OHM,1%,0.2W,TC=T0	80009	322-3145-00
A3R194	322-3385-00	671-0631-06		RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 100K
A3R195	321-0159-00	671-0631-00	671-0631-03	RES,FXD,FILM:442 OHM,1%,0.125W,TC=T0	07716	CEAD442R0F
A3R195	322-3145-00	671-0631-04	671-0631-05	RES,FXD,FILM:316 OHM,1%,0.2W,TC=T0	80009	322-3145-00
A3R195	322-3385-00	671-0631-06		RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 100K
A3R196	307-0540-00			RES NTWK,FXD,FI:(5)1K OHM,2%,0.7W	91637	CSC06A-01-102G
A3R197	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00
A3R198	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	80009	315-0104-00
A3R200	315-0820-00			RES,FXD,FILM:82 OHM,5%,0.25W	80009	315-0820-00
A3R201	322-3306-00			RES,FXD:METAL FILM;15K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 15K0
A3R202	311-0644-00			RES,VAR,NONWW:TRMR,20K OHM,0.5W	80009	311-0644-00
A3R203	315-0272-00			RES,FXD,FILM:2.7K OHM,5%,0.25W	80009	315-0272-00
A3R204	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
A3R220	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00
A3R221	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00
A3R253	322-3311-00	671-0631-06		RES,FXD,FILM:16.9K OHM,1%,0.2W,TC=T0	56845	CCF-50-2-1692F
A3T1	120-0487-01	671-0631-00	671-0631-05	XFMR,TOROID:5 TURNS,BIFILAR,3T2	80009	120-0487-01
A3T1	120-1933-00	671-0631-06		TRANSFORMER,RF:0.02-100MHZ,1.5 OHM	80009	120-1933-00
A3TP1	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A3TP2	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A3TP3	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A3TP4	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A3TP5	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A3TP6	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A3TP7	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02

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A3TP8	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104–01–02
A3TP9	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104–01–02
A3TP10	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104–01–02
A3TP11	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104–01–02
A3TP12	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104–01–02
A3U8	156–0230–02			IC,DGTL:ECL,FLIP FLOP;DUAL D–TYPE MASTER SLAVE;10131,DIP16.3,TUBE,CER PACK	80009	156–0230–02
A3U9	156–0230–02			IC,DGTL:ECL,FLIP FLOP;DUAL D–TYPE MASTER SLAVE;10131,DIP16.3,TUBE,CER PACK	80009	156–0230–02
A3U10	156–0230–02			IC,DGTL:ECL,FLIP FLOP;DUAL D–TYPE MASTER SLAVE;10131,DIP16.3,TUBE,CER PACK	80009	156–0230–02
A3U11	156–0631–00			IC,DGTL:ECL,GATE;QUAD 2–INPUT OR/ NOR;10101,DIP16.3,TUBE	80009	156–0631–00
A3U14	156–0746–01			IC,DGTL:ECL,MUX;QUAD 2–INPUT MUX;10158,DIP16.3,TUBE	80009	156–0746–01
A3U15	156–0746–01			IC,DGTL:ECL,MUX;QUAD 2–INPUT MUX;10158,DIP16.3,TUBE	80009	156–0746–01
A3U16	156–0746–01			IC,DGTL:ECL,MUX;QUAD 2–INPUT MUX;10158,DIP16.3,TUBE	80009	156–0746–01
A3U18	155–0282–00			MICROCKT,DGTL:DGTL TO ANALOG CONV M219B	80009	155–0282–00
				MOUNTING PARTS		
	136–0752–00			SKT,PL–IN ELEK:MICROCIRCUIT,20 DIP	09922	DILB20P–108
				END MOUNTING PARTS		
A3U19	155–0282–00			MICROCKT,DGTL:DGTL TO ANALOG CONV M219B	80009	155–0282–00
				MOUNTING PARTS		
	136–0752–00			SKT,PL–IN ELEK:MICROCIRCUIT,20 DIP	09922	DILB20P–108
				END MOUNTING PARTS		
A3U20	156–0860–02			IC,DGTL:ECL,RECEIVER;TRIPLE LINE;10116,DIP16.3,TUBE,SCRN	80009	156–0860–02
A3U21	156–1173–00			IC,LIN:BIPOLAR,VOLTAGE REFERENCE;POS-ITIVE,2.5V,1.0%,40PPM,SERIES;MC1403U,DIP08.3	80009	156–1173–00
A3U22	156–0534–01			IC,LIN:DUAL DIFF AMPL,BURN–INCA3102,MI	80009	156–0534–01
A3U23	156–0067–13	671–0631–00	671–0631–06	IC,LIN:	80009	156–0067–13
A3U23	156–0067–00	671–0631–06		IC,LIN:	80009	156–0067–13
A3U24	156–0912–01			IC,LIN:	80009	156–0912–01
A3U25	156–3253–00			IC,MEMORY:CMOS,SRAM;2K X 8,55NS;,DIP24.3	80009	156–3253–00
A3U26	156–2159–00			IC,DGTL:ASTTL,MUX;QUAD 2–TO–1 DATA SELEC-TOR, NONINV;74AS157,DIP16.3,TUBE	80009	156–2159–00
A3U27	160–5607–00			MICROCKT,DGTL:STTL,QUAD 16 INPUT AND/OR	80009	160–5607–00
				MOUNTING PARTS		
	136–0752–00			SKT,PL–IN ELEK:MICROCIRCUIT,20 DIP	09922	DILB20P–108
				END MOUNTING PARTS		
A3U28	156–2517–00			MICROCKT,DGTL:7 X 9 UPPERCASE CHARACTER GENERATOR	27014	DM86S64 BWF/N
A3U29	156–2251–00			IC,DGTL:FTTL,COUNTER;SYNCH 4–BIT BINARY, WITH /MR;74F161,DIP16.3,TUBE	04713	MC74F161AN
A3U30	156–0316–04			IC,DGTL:ECL,TRANSLATOR;QUAD ECL TO TTL;10125,DIP16.3,TUBE	04713	MC10125P/L
A3U31	160–5610–00			MICROCKT,DGTL:CMOS,1K X 8 REG PROM,PRGM	80009	160–5610–00
				MOUNTING PARTS		
	136–0925–00			SOCKET,DIP:	91506	224–AG30D
				END MOUNTING PARTS		
A3U32	156–0865–02			IC,DGTL:LSTTL,FLIP FLOP;74LS273,DIP20.3,TUBE	80009	156–0865–02
A3U33	156–0956–02			IC,DGTL:LSTTL,BUFFER/DRIV-ER;74LS244,DIP20.3,TUBE	80009	156–0956–02

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A3U34	156–0368–03			IC,DGTL:ECL,TRANSLATOR;QUAD TTL–TO–ECL;10124,DIP16.3,TUBE	80009	156–0368–03
A3U35	156–0368–03			IC,DGTL:ECL,TRANSLATOR;QUAD TTL–TO–ECL;10124,DIP16.3,TUBE	80009	156–0368–03
A3U36	160–5608–00			MICROCKT,DGTL:STTL,QUAD 16 INPUT AND/OR	80009	160–5608–00
				MOUNTING PARTS		
	136–0752–00			SKT,PL–IN ELEK:MICROCIRCUIT,20 DIP	09922	DILB20P–108
				END MOUNTING PARTS		
A3U37	160–5614–00			MICROCKT,DGTL:OCTAL 2 INPUT REG,PRGM	80009	160–5614–00
				MOUNTING PARTS		
	136–0925–00			SOCKET,DIP:	91506	224–AG30D
				END MOUNTING PARTS		
A3U38	160–5611–00			MICROCKT,DGTL:CMOS,1K X 8 REG PROM,PRGM	80009	160–5611–00
				MOUNTING PARTS		
	136–0925–00			SOCKET,DIP:	91506	224–AG30D
				END MOUNTING PARTS		
A3U39	160–5609–00			MICROCKT,DGTL:QUAD 16 IN RGTR AND/OR	80009	160–5609–00
				MOUNTING PARTS		
	136–0752–00			SKT,PL–IN ELEK:MICROCIRCUIT,20 DIP	09922	DILB20P–108
				END MOUNTING PARTS		
A3U42	156–2251–00			IC,DGTL:FTTL,COUNTER;SYNCH 4–BIT BINARY, WITH /MR;74F161,DIP16.3,TUBE	04713	MC74F161AN
A3U46	156–1272–00			IC,LIN:BIPOLAR,OP–AMP;DUAL,HIGH OUTPUT DRIVE,LOW NOISE;NE5532N,DIP08.3	80009	156–1272–00
A3U47	156–1272–00			IC,LIN:BIPOLAR,OP–AMP;DUAL,HIGH OUTPUT DRIVE,LOW NOISE;NE5532N,DIP08.3	80009	156–1272–00
A3U48	160–5613–00	671–0631–00	671–0631–02	IC,DGTL:STTL,PLD;PAL,16R6,16MHZ,90MA;16R6A–2,DIP20.3	80009	160–5613–00
A3U48	160–5613–01	671–0631–03		IC,DGTL:STTL,PLD;PAL,16R6,16MHZ,90MA;16R6A–2,DIP20.3	80009	160–5613–01
				MOUNTING PARTS		
	136–0752–00			SKT,PL–IN ELEK:MICROCIRCUIT,20 DIP	09922	DILB20P–108
				END MOUNTING PARTS		
A3U49	156–0368–03			IC,DGTL:ECL,TRANSLATOR;QUAD TTL–TO–ECL;10124,DIP16.3,TUBE	80009	156–0368–03
A3U50	156–0368–03			IC,DGTL:ECL,TRANSLATOR;QUAD TTL–TO–ECL;10124,DIP16.3,TUBE	80009	156–0368–03
A3U51	156–0368–03			IC,DGTL:ECL,TRANSLATOR;QUAD TTL–TO–ECL;10124,DIP16.3,TUBE	80009	156–0368–03
A3U52	156–2621–00			IC,CONV:BIPOLAR,D/A;12 BIT,VOLTAGE OUT,MPU COMPATIBLE,REFERENCE;DAC811JP, DIP28.6	80009	156–2621–00
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A3U53	156–2251–00			IC,DGTL:FTTL,COUNTER;SYNCH 4–BIT BINARY, WITH /MR;74F161,DIP16.3,TUBE	04713	MC74F161AN
A3U54	156–1367–00			IC,CONV:CMOS,D/A;8 BIT,400NS,CUR OUT,MPU COMPATIBLE,MULTIPLYING;AD7524JN,DIP16.3	80009	156–1367–00
A3U55	156–2251–00			IC,DGTL:FTTL,COUNTER;SYNCH 4–BIT BINARY, WITH /MR;74F161,DIP16.3,TUBE	04713	MC74F161AN
A3U56	156–0158–07			IC,LIN:BIPOLAR,OP–AMP;MC1458P1,DIP08.3	80009	156–0158–07
A3U57	156–1335–00			IC,DGTL:LSTTL,MULTIVIBRATOR;DUAL RETRIG MONOSTABLE;96LS02,DIP16.3	80009	156–1335–00
A3U58	156–1324–00			IC,LIN:BIPOCOMPTRLAR,;TTL,20NS, COMPLEMENTARY OUTPUT,W/STROBES;LM361N, DIP14.3	27014	LM361N/GLAA054
A3U59	156–0912–01			IC,LIN:	80009	156–0912–01
A3U67	160–5612–00			MICROCKT,DGTL:STTL,OCTAL 16 INP RGTR,PRGM	80009	160–5612–00
				MOUNTING PARTS		
	136–0752–00			SKT,PL–IN ELEK:MICROCIRCUIT,20 DIP	09922	DILB20P–108

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				END MOUNTING PARTS		
A3U68	160-5616-00			MICROCKT,DGTL:STTL,OCTAL 16 IN AOI,PRGM	80009	160-5616-00
				MOUNTING PARTS		
	136-0752-00			SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP	09922	DILB20P-108
				END MOUNTING PARTS		
A3U69	156-0388-03			IC,DGTL:LSTTL,FLIP FLOP;74LS74,DIP14.3,TUBE	80009	156-0388-03
A3U70	156-2251-00			IC,DGTL:FTTL,COUNTER;SYNCH 4-BIT BINARY, WITH /MR;74F161,DIP16.3,TUBE	04713	MC74F161AN
A3U71	156-2251-00			IC,DGTL:FTTL,COUNTER;SYNCH 4-BIT BINARY, WITH /MR;74F161,DIP16.3,TUBE	04713	MC74F161AN
A3U72	160-5617-00			MICROCKT,DGTL:STTL,OCTAL 16 IN AOI,PRGM	80009	160-5617-00
				MOUNTING PARTS		
	136-0752-00			SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP	09922	DILB20P-108
				END MOUNTING PARTS		
A3U73	156-2251-00			IC,DGTL:FTTL,COUNTER;SYNCH 4-BIT BINARY, WITH /MR;74F161,DIP16.3,TUBE	04713	MC74F161AN
A3U74	156-0230-02			IC,DGTL:ECL,FLIP FLOP;DUAL D-TYPE MASTER SLAVE;10131,DIP16.3,TUBE,CER PACK	80009	156-0230-02
A3U75	156-0230-02			IC,DGTL:ECL,FLIP FLOP;DUAL D-TYPE MASTER SLAVE;10131,DIP16.3,TUBE,CER PACK	80009	156-0230-02
A3U76	156-0860-02			IC,DGTL:ECL,RECEIVER;TRIPLE LINE;10116,DIP16.3,TUBE,SCRN	80009	156-0860-02
A3U77	160-5606-00	671-0631-00	671-0631-00	MICROCKT,DGTL:NMOS,65536 X 8 EPROM,PRGM	80009	160-5606-00
A3U77	160-5606-01	671-0631-01		MICROCKT,DGTL:CMOS,EPROM;64K X 8,250NS;27C512,DIP28.6	80009	160-5606-01
				MOUNTING PARTS		
	136-0755-00			SOCKET,DIP:	09922	DILB28P-108
				END MOUNTING PARTS		
A3U78	156-0124-00			IC,LIN:TTL,MISC;PHASE-FREQ DETECTOR,DUAL;MC4044P,DIP14.3	04713	MC4044
A3U79	156-1727-00			MICROCKT,DGTL:1 OF 8 DCDR/DEMULTIPLEXER	04713	MC74F138 N
A3U80	156-2251-00			IC,DGTL:FTTL,COUNTER;SYNCH 4-BIT BINARY, WITH /MR;74F161,DIP16.3,TUBE	04713	MC74F161AN
A3U81	156-2251-00			IC,DGTL:FTTL,COUNTER;SYNCH 4-BIT BINARY, WITH /MR;74F161,DIP16.3,TUBE	04713	MC74F161AN
A3U82	156-2251-00			IC,DGTL:FTTL,COUNTER;SYNCH 4-BIT BINARY, WITH /MR;74F161,DIP16.3,TUBE	04713	MC74F161AN
A3U83	156-2251-00			IC,DGTL:FTTL,COUNTER;SYNCH 4-BIT BINARY, WITH /MR;74F161,DIP16.3,TUBE	04713	MC74F161AN
A3U84	156-2251-00			IC,DGTL:FTTL,COUNTER;SYNCH 4-BIT BINARY, WITH /MR;74F161,DIP16.3,TUBE	04713	MC74F161AN
A3U86	156-3643-00			IC,DGTL:FTTL,SHIFT REGISTER;8-BIT SI/PISO, WITH /MR;74F166,DIP16.3,TUBE	80009	156-3643-00
A3U87	156-3453-00	671-0631-00	671-0631-05	IC,MISC:	80009	156-3453-00
A3U87	156-3314-00	671-0631-06		IC,MISC:	80009	156-3314-00
A3U88	156-1156-00			IC,LIN:BIFET,OP-AMP;;LF356N,DIP08.3	80009	156-1156-00
A3U89	160-5618-00	671-0631-00	671-0631-01	MICROCKT,DGTL:STTL,OCTAL 16 IN AOI GATE ARRAY	80009	160-5618-00
A3U89	160-5618-01	671-0631-02		MICROCKT,DGTL:STTL,OCTAL 16 IN AO1 GATE A	80009	160-5618-01
				MOUNTING PARTS		
	136-0752-00			SKT,PL-IN ELEK:MICROCIRCUIT,20 DIP	09922	DILB20P-108
				END MOUNTING PARTS		
A3U90	156-0861-01	671-0631-00	671-0631-05	IC,LIN:LSTTL,VCO;DUAL;74LS629, DIP16.3,SCRN	01295	SN74LS629NP3
A3U91	160-5615-00	671-0631-00	671-0631-02	MICROCKT,DGTL:NMOS,65536 X 8 EPROM,PRGM	80009	160-5615-00
A3U91	160-5615-01	671-0631-03		IC,DGTL:NMOS,65536 X 8 EPROM,PRGM,W/3 STATE OUT;27512,DIP28,CER PKG	80009	160-5615-01
				MOUNTING PARTS		
	136-0755-00			SOCKET,DIP:	09922	DILB28P-108
				END MOUNTING PARTS		
A3U92	156-0865-02			IC,DGTL:LSTTL,FLIP FLOP;74LS273,DIP20.3,TUBE	80009	156-0865-02

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A3U93	156-1722-00			IC,DGTL:FTTL,GATE;HEX INV;74F04,DIP14.3,TUBE	04713	MC74F04ND
A3U94	156-1611-00			IC,DGTL:FTTL,FLIP FLOP;DUAL D-TYPE;74F74, DIP14.3,TUBE	80009	156-1611-00
A3VR1	152-0688-00			DIODE,ZENER:,;2.4V,5%,0.4W;1N4370A,DO-7 OR 35	04713	1N4370A
A3A1	671-2641-00	671-0631-06		CIRCUIT BD ASSY:AUDIO	80009	671-2641-00
A3A1C90	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3A1C91	283-0639-01			CAP,FXD,MICA DI:56PF,1%,500V,TAPE & AMMO PACK	09023	CDA15ED560F03
A3A1C92	283-0648-01			CAP,FXD,MICA DI:10PF,5%,500V	80009	283-0648-01
A3A1C93	283-0644-01			CAP,FXD,MICA DI:150PF,1%,500V	80009	283-0644-01
A3A1C94	283-0644-01			CAP,FXD,MICA DI:150PF,1%,500V	80009	283-0644-01
A3A1C95	281-0153-00			CAP,VAR,AIR DI:1.7-10PF,250V	80009	281-0153-00
A3A1C96	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3A1CR9	152-0269-01			DIODE,SIG:,VVC;C4=33PF,5%,C4/C20=2;SMV1263-1,DO-7,T&R	04713	SMV1263-1
A3A1J90	131-0589-00			TERMINAL,PIN:	22526	48283-087
A3A1Q90	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AMPLIFIER;2N3904,TO-92 EBC	80009	151-0190-00
A3A1Q91	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AMPLIFIER;2N3904,TO-92 EBC	80009	151-0190-00
A3A1R1	322-3481-00			RES,FXD,FILM:1M OHM.1%,0.2W,TC=T0	80009	322-3481-00
A3A1R2	322-3385-00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 100K
A3A1R3	322-3318-00			RES,FXD:METAL FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 20K0
A3A1R4	322-3147-00			RES,FXD:METAL FILM;332 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322-3147-00
A3A1R5	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A3A1R6	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 100E
A3A1Y2	158-0405-00			XTAL,UNIT QTZ:6.144MHZ,+/-0.005%,PARALLEL,CL 30PF,ESR 40 OHM, PKG	80009	158-0405-00
A4	671-0572-00	B010100	B010142	CIRCUIT BD ASSY:PWR SPLY	80009	671-0572-00
A4	671-0572-01	B010143	B010311	CIRCUIT BD ASSY:PWR SPLY	80009	671-0572-01
A4	671-0572-02	B010312	B010474	CIRCUIT BD ASSY:PWR SPLY	80009	671-0572-02
A4	671-0572-03	B010475	B010584	CIRCUIT BD ASSY:PWR SPLY	80009	671-0572-03
A4	671-0572-04	B010585	B010643	CIRCUIT BD ASSY:PWR SPLY	80009	671-0572-04
A4	671-0572-05	B010644	B010659	CIRCUIT BD ASSY:PWR SPLY	80009	671-0572-05
A4	671-0572-06	B010660		CIRCUIT BD ASSY:PWR SPLY	80009	671-0572-06
A4C142	290-1069-00	671-0572-00	671-0572-03	CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290-1069-00
A4C142	290-1301-00	671-0572-04		CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM (0.492 X 1.180);RDL,LOWIMP,1.95A RIPPLE,BULK	80009	290-1301-00
A4C161	290-0804-00	671-0572-00	671-0572-03	CAP,FXD,ELCTLT:10UF,+50-20%,25V	80009	290-0804-00
A4C161	290-0943-00	671-0572-04		CAP,FXD,ALUM:;47UF,+50-20%,25V,6 X 11MM;RDL	55680	UVX1V470MPA
A4C169	283-0423-00			CAP,FXD,CER DI:0.22UF,+80-20%,50V	04222	MD015E224ZAA
A4C225	290-1069-00	671-0572-00	671-0572-03	CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290-1069-00
A4C225	290-1301-00	671-0572-04		CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM (0.492 X 1.180);RDL,LOWIMP,1.95A RIPPLE,BULK	80009	290-1301-00
A4C241	290-1034-00	671-0572-00	671-0572-03	CAP,FXD,ALUM:;330UF,20%,25V,13 X 25MM;RDL	TK1424	CEUFM1E331
A4C241	290-1302-00	671-0572-04		CAP,FXD,ALUM:,;1000UF,20%,35V,12.5 X 30MM (0.492 X 1.180);RDL,LOWIMP,1.95A RIPPLE,BULK	80009	290-1302-00
A4C250	290-1034-00	671-0572-00	671-0572-03	CAP,FXD,ALUM:;330UF,20%,25V,13 X 25MM;RDL	TK1424	CEUFM1E331
A4C250	290-1302-00	671-0572-04		CAP,FXD,ALUM:,;1000UF,20%,35V,12.5 X 30MM (0.492 X 1.180);RDL,LOWIMP,1.95A RIPPLE,BULK	80009	290-1302-00
A4C258	290-1069-00	671-0572-00	671-0572-03	CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290-1069-00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A4C258	290–1301–00	671–0572–04		CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM (0.492 X 1.180);RDL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1301–00
A4C269	283–0423–00			CAP,FXD,CER DI:0.22UF,+80–20%,50V	04222	MD015E224ZAA
A4C270	283–0423–00			CAP,FXD,CER DI:0.22UF,+80–20%,50V	04222	MD015E224ZAA
A4C320	283–0423–00			CAP,FXD,CER DI:0.22UF,+80–20%,50V	04222	MD015E224ZAA
A4C321	283–0005–00	B010143		CAP,FXD,CER DI:0.01UF,+100–0%,250V	04222	SR30VE103ZAA
A4C325	290–1069–00	671–0572–00	671–0572–03	CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C325	290–1301–00	671–0572–04		CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM (0.492 X 1.180);RDL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1301–00
A4C358	290–1069–00	671–0572–00	671–0572–03	CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C358	290–1301–00	671–0572–04		CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM (0.492 X 1.180);RDL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1301–00
A4C360	290–1069–00	671–0572–00	671–0572–03	CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C360	290–1301–00	671–0572–04		CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM (0.492 X 1.180);RDL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1301–00
A4C361	290–0804–00	671–0572–00	671–0572–03	CAP,FXD,ELCTLT:10UF,+50–20%,25V	80009	290–0804–00
A4C361	290–0943–00	671–0572–04		CAP,FXD,ALUM:;47UF,+50–20%,25V,6 X 11MM;RDL	55680	UVX1V470MPA
A4C370	290–1069–00	671–0572–00	671–0572–03	CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C370	290–1301–00	671–0572–04		CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM (0.492 X 1.180);RDL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1301–00
A4C371	283–0423–00			CAP,FXD,CER DI:0.22UF,+80–20%,50V	04222	MD015E224ZAA
A4C415	283–0268–00			CAP,FXD,CER DI:0.015UF,20%,50V	80009	283–0268–00
A4C464	290–1069–00	671–0572–00	671–0572–03	CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C464	290–1301–00	671–0572–04		CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM (0.492 X 1.180);RDL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1301–00
A4C475	290–1069–00	671–0572–00	671–0572–03	CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C475	290–1301–00	671–0572–04		CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM (0.492 X 1.180);RDL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1301–00
A4C521	283–0672–00			CAP,FXD,MICA DI:200PF,1%,500V	80009	283–0672–00
A4C525	285–1196–00			CAP,FXD,PPR DI:0.01UF,20%,250V	80009	285–1196–00
A4C540	285–1329–00			CAP,FXD,PLASTIC:METALIZED FILM;680PF,10%, 1600V,POLYPROPYLENE,.70X.43; RDL,T/A	80009	285–1329–00
A4C548	285–1331–00			CAP,FXD,MTLZD:0.47UF,5%,400V	TK1573	MKS4 .47/400/5
A4C575	283–0005–00	B010143		CAP,FXD,CER DI:0.01UF,+100–0%,250V	04222	SR30VE103ZAA
A4C621	283–0051–00			CAP,FXD,CER DI:0.0033UF,5%,100V	80009	283–0051–00
A4C648	285–1187–00			CAP,FXD,MTLZD:0.47 UF,10%,100 V	05292	PMT 3R .47K 100
A4C656	290–0844–00			CAP,FXD,ELCTLT:100UF,+75–20%,35WVDC	24165	513D107M035CC4D
A4C717	290–0804–00			CAP,FXD,ELCTLT:10UF,+50–20%,25V	80009	290–0804–00
A4C718	283–0211–00			CAP,FXD,CER DI:0.1UF,10%,200V	80009	283–0211–00
A4C722	283–0032–00			CAP,FXD,CER DI:470PF,5%,500V	80009	283–0032–00
A4C727	283–0423–00			CAP,FXD,CER DI:0.22UF,+80–20%,50V	04222	MD015E224ZAA
A4C730	285–1196–00			CAP,FXD,PPR DI:0.01UF,20%,250V	80009	285–1196–00
A4C830	285–1196–00			CAP,FXD,PPR DI:0.01UF,20%,250V	80009	285–1196–00
A4C845	290–1070–00	671–0572–00	671–0572–04	CAP,FXD,ELCTLT:220UF,20%,200V	80009	290–1070–00
A4C845	290–1293–00	671–0572–05		CAP,FXD,ALUM:390UF,20%,200V,25 X 30MM;SNAP IN,105 DEG,BULK	80009	290–1293–00
A4C865	290–1070–00	671–0572–00	671–0572–04	CAP,FXD,ELCTLT:220UF,20%,200V	80009	290–1070–00
A4C865	290–1293–00	671–0572–05		CAP,FXD,ALUM:390UF,20%,200V,25 X 30MM;SNAP IN,105 DEG,BULK	80009	290–1293–00
A4C920	285–1323–00			CAP,FXD,MTLZD:0.22UF,250V,X	80009	285–1323–00
A4CR169	152–0198–00			DIODE,RECT:,;200V,3A,125A IFSM,1VF AT 3A,SAF CONT;1N5624	05828	1N5624
A4CR170	152–0066–00			DIODE,RECT:,;400V,1A,IFSM=30A,1.2VF,2US;GP10 G/1N5060,T&R,SAF CONT	05828	GP10G–020
A4CR215	152–0066–00			DIODE,RECT:,;400V,1A,IFSM=30A,1.2VF,2US;GP10 G/1N5060,T&R,SAF CONT	05828	GP10G–020
A4CR269	152–0198–00			DIODE,RECT:,;200V,3A,125A IFSM,1VF AT 3A,SAF CONT;1N5624	05828	1N5624
A4CR320	152–0884–00			SEMICOND DVC,DI:16 AMP,35V,TO–220,AC PKG	04713	MBR1635

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
				MOUNTING PARTS		
	210-0586-00			NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
	210-1178-00			WASHER,SHLDR:	80009	210-1178-00
	211-0097-00			SCREW,MACHINE:4-40 X 0.312,PNH,STL	93907	ORDER BY DESCR
	214-2953-00			HEAT SINK,XSTR:TO-220,AL	80009	214-2953-00
	342-0563-00			INSULATOR,PLATE:XSTR,FIBERGLASS RE-INFORCED SILICON RUBBER	18565	69-11-8805-1674
				END MOUNTING PARTS		
A4CR340	152-0601-01			SEMICOND DVC,DI:RECTIFIER,SI,150V,1A,35NS	04713	MUR115RL
A4CR348	152-0601-01			SEMICOND DVC,DI:RECTIFIER,SI,150V,1A,35NS	04713	MUR115RL
A4CR369	152-0066-00			DIODE,RECT:,;400V,1A,IFSM=30A,1.2VF,2US;GP10 G/1N5060,T&R,SAF CONT	05828	GP10G-020
A4CR545	152-0897-00			DIODE,RECT:,FAST RCVRY;1000V,1.5A, 300NS,SOFT RCVRY;BYV96E,T&R	80009	152-0897-00
A4CR556	152-0400-00			DIODE,RECT:,FAST RCVRY;400V,1A,200NS;1N4936,DO-41,T&R	80009	152-0400-00
A4CR575	152-0884-00			SEMICOND DVC,DI:16 AMP,35V,TO-220,AC PKG	04713	MBR1635
				MOUNTING PARTS		
	210-1178-00			WASHER,SHLDR:	80009	210-1178-00
	211-0097-00			SCREW,MACHINE:4-40 X 0.312,PNH,STL	93907	ORDER BY DESCR
	214-2953-00			HEAT SINK,XSTR:TO-220,AL	80009	214-2953-00
	214-4115-00			HEAT SINK:COPPER	80009	214-4115-00
	342-0563-00			INSULATOR,PLATE:XSTR,FIBERGLASS RE-INFORCED SILICON RUBBER	18565	69-11-8805-1674
	211-0244-00			SCR,ASSEM WSHR:4-40 X 0.312,PNH STL	TK0858	211-0244-00
				END MOUNTING PARTS		
A4CR640	152-0841-00			DIODE,RECT:,ULTRA FAST;1KV,100NS;BYT-12P-1000,TO-220	80009	152-0841-00
A4CR648	152-0864-00			DIODE,RECT:,ULTRA FAST;150V,2A, 25NS,IFSM=50A,SOFT REC;BYV-150	80009	152-0864-00
A4CR649	152-0864-00			DIODE,RECT:,ULTRA FAST;150V,2A, 25NS,IFSM=50A,SOFT REC;BYV-150	80009	152-0864-00
A4CR651	152-0581-04			DIODE,RECT:SCHTKY,;20V,1A,.450VF,25A IFSM;1N5817,T&R	04713	1N5817RL
A4CR820	152-0750-00			DIODE,RECT:,FAST RCVRY;BRIDGE,600V,3A, IFSM=125A,250NS,SAF CONT; RKBPC606	80009	152-0750-00
A4DS670	150-1017-00			LT EMITTING DIO:GREEN,550NM,55MA MAX	80009	150-1017-00
A4DS720	150-0035-00			LAMP,GLOW:90V MAX,0.3MA,AID-T,WIRE LD	71744	A1B-120
A4F940	159-0023-00			FUSE,CARTRIDGE:3AG,2A,250V,SLOW BLOW (FOR 90-132VAC OPERATION)	71400	MDX2
A4F940	159-0019-00			FUSE,CARTRIDGE:3AG,1A,250V,SLOW BLOW,SAF CONT (FOR 180-250VAC OPERATION)	71400	MDL 1
				MOUNTING PARTS		
	200-2264-00			CAP,FUSEHOLDER:3AG FUSES	S3629	FEK 031 1666
	204-0906-00			BODY,FUSEHOLDER:3AG & 5 X 20MM FUSES	S3629	TYPEFAU031.3573
				END MOUNTING PARTS		
A4J160	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 34)	80009	131-0608-00
A4J310	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 2)	80009	131-0608-00
A4J556	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 2)	80009	131-0608-00
A4J660	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 2)	80009	131-0608-00
A4J720	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 2)	80009	131-0608-00
A4J810	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A4L230	108–0554–00			COIL,RF:FIXED,5UH,+/–20%, 17 1/2 TURNS (2 LAYERS) OF 16AWG,ON FORM 276–0147–00	TK1345	108–0554–00
A4L261	108–1262–00			COIL,RF:FXD,100UH,10%,Q=30,SRF 8.2MHZ,DCR 0.23 OHM,I MAX 0.75ARDL LEAD	80009	108–1262–00
A4L358	108–0554–00			COIL,RF:FIXED,5UH,+/–20%, 17 1/2 TURNS (2 LAYERS) OF 16AWG,ON FORM 276–0147–00	TK1345	108–0554–00
A4L361	108–1262–00			COIL,RF:FXD,100UH,10%,Q=30,SRF 8.2MHZ,DCR 0.23 OHM,I MAX 0.75ARDL LEAD	80009	108–1262–00
A4L520	108–1448–00			COIL,RF:TOROID,1MH,+/–30%,AWG #20,PKG 0.65 DIA X 0.6	TK1345	108–1448–00
A4L770	108–0205–00			COIL,RF:,INDUCTOR;FXD,1MH,+–5%, DCR 2.12 OHMS, FERRITE CORE	76493	8209
A4LF950	119–1946–00			FILTER,RFI:1A,250V,400HZ W/PC TERMINAL	S4307	FN326–1/02–K–D–T
A4P556	131–0993–02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1–850100–O
A4P660	131–0993–02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1–850100–O
A4P720	131–0993–02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1–850100–O
A4Q127	151–0528–00			THYRISTOR,PWR:BIPOLAR,SCR;50V,16A RMS,PHASE CONTROL;2N6400,TO–220	80009	151–0528–00
A4Q215	151–0435–00			XSTR:DARLINGTON,PNP,SI,TO–92	80009	151–0435–00
A4Q638	151–0908–00			XSTR,PWR:BIPOLAR,NPN;500V VCEO, 1000V VCEV,5A,SWITCHING;MJH16002A,TO–218	80009	151–0908–00
				MOUNTING PARTS		
	210–0586–00			NUT,PL,ASSEM WA:4–40 X 0.25,STL CD PL	78189	211–041800–00
	210–1178–00			WASHER,SHLDR:	80009	210–1178–00
	211–0097–00			SCREW,MACHINE:4–40 X 0.312,PNH,STL	93907	ORDER BY DESCR
	214–2953–00			HEAT SINK,XSTR:TO–220,AL	80009	214–2953–00
	342–0354–00			INSULATOR,PLATE:XSTR	55285	7403–09FR–52
				END MOUNTING PARTS		
A4Q648	151–0323–00			XSTR,PWR:BIPOLAR,NPN;80V,4.0A, 2.0MHZ,AMPLIFIER;2N5192,TO–126	80009	151–0323–00
A4Q660	151–0190–00			XSTR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AMPLIFIER;2N3904,TO–92 EBC	80009	151–0190–00
A4Q667	151–0750–00			XSTR,SIG:BIPOLAR,NPN;400V,300MA, 20MHZ,AMPLIFIER;MPSA44,TO–92 EBC	80009	151–0750–00
A4Q717	151–0188–00			XSTR,SIG:BIPOLAR,PNP;40V,200MA, 250MHZ,AMPLIFIER;2N3906,TO–92 EBC	80009	151–0188–00
A4Q727	151–0190–00			XSTR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AMPLIFIER;2N3904,TO–92 EBC	80009	151–0190–00
A4Q741	151–0324–00			XSTR,PWR:BIPOLAR,PNP;80V,4.0A, 2.0MHZ,AMPLIFIER;2N5195,TO–126	80009	151–0324–00
A4Q750	151–0323–00			XSTR,PWR:BIPOLAR,NPN;80V,4.0A, 2.0MHZ,AMPLIFIER;2N5192,TO–126	80009	151–0323–00
A4Q755	151–0188–00			XSTR,SIG:BIPOLAR,PNP;40V,200MA, 250MHZ,AMPLIFIER;2N3906,TO–92 EBC	80009	151–0188–00
A4R120	315–0101–00			RES,FXD,FILM:100 OHM,5%,0.25W	80009	315–0101–00
A4R215	315–0272–00			RES,FXD,FILM:2.7K OHM,5%,0.25W	80009	315–0272–00
A4R216	315–0472–00			RES,FXD,FILM:4.7K OHM,5%,0.25W	80009	315–0472–00
A4R225	301–0680–00			RES,FXD,FILM:68 OHM,5%,0.5W	80009	301–0680–00
A4R314	315–0202–00			RES,FXD,FILM:2K OHM,5%,0.25W	80009	315–0202–00
A4R315	315–0152–00			RES,FXD,FILM:1.5K OHM,5%,0.25W	80009	315–0152–00
A4R316	315–0163–00	671–0572–00	671–0572–01	RES,FXD,FILM:16K OHM,5%,0.25W	80009	315–0163–00
A4R316	322–3254–00	671–0572–02		RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=T0	80009	322–3254–00
A4R321	315–0100–00	B010143		RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A4R415	311–1225–00			RES,VAR,NONWW:TRMR,1K OHM,0.5W	80009	311–1225–00
A4R416	315–0102–00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315–0102–00
A4R510	311–0978–00			RES,VAR,NONWW:TRMR,250 OHM,0.5W	80009	311–0978–00
A4R560	301–0204–00	671–0572–00	671–0572–05	RES,FXD,FILM:200K OHM,5%,0.5W	80009	301–0204–00
A4R560	303–0204–00	671–0572–06		RES,FXD,CMPSN:200K OHM,5%,1W	80009	303–0204–00
A4R575	315–0100–00	B010143		RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A4R614	315–0152–00			RES,FXD,FILM:1.5K OHM,5%,0.25W	80009	315–0152–00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A4R615	322-3181-00	671-0572-00	671-0572-02	RES,FXD,FILM:750 OHM,1%,0.2W,TC=T0	80009	322-3181-00
A4R615	322-3175-00	671-0572-03		RES,FXD,FILM:649 OHM,1%,0.2W,TC=T0	80009	322-3175-00
A4R616	322-3258-00			RES,FXD:METAL FILM;4.75K OHM,1%,0.2W, TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322-3258-00
A4R617	315-0182-00			RES,FXD,FILM:1.8K OHM,5%,0.25W	80009	315-0182-00
A4R619	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00
A4R620	315-0432-00	671-0572-00	671-0572-01	RES,FXD,FILM:4.3K OHM,5%,0.25W	80009	315-0432-00
A4R620	322-3254-00	671-0572-02		RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=T0	80009	322-3254-00
A4R621	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00
A4R622	322-3275-00	671-0572-00	671-0572-03	RES,FXD,FILM:7.15K OHM,1%,0.2W,TC=T0	80009	322-3275-00
A4R622	322-3248-00	671-0572-04		RES,FXD,FILM:3.74K OHM,1%,0.2W,TC=T0	80009	322-3248-00
A4R625	322-3181-00	671-0572-00	671-0572-02	RES,FXD,FILM:750 OHM,1%,0.2W,TC=T0	80009	322-3181-00
A4R625	322-3199-00	671-0572-03		RES,FXD,FILM:1.15K OHM,1%,0.2W,TC=T0	80009	322-3199-00
A4R630	308-0755-00			RES,FXD,WW:0.75 OHM,5%,2W	91637	CPF-1-0R75JT1
A4R647	301-0274-00			RES,FXD,FILM:270K OHM,5%,0.5W	80009	301-0274-00
A4R665	315-0332-00			RES,FXD,FILM:3.3K OHM,5%,0.25W	80009	315-0332-00
A4R666	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	80009	315-0473-00
A4R667	301-0105-00	671-0572-00	671-0572-05	RES,FXD,FILM:1M OHM,5%,0.50W	19701	5053CX1M000J
A4R667	303-0105-00	671-0572-06		RES,FXD,CMPSN:1M OHM,5%,1W	01121	GB1055
A4R717	315-0183-00			RES,FXD,FILM:18K OHM,5%,0.25W	80009	315-0183-00
A4R718	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	80009	315-0221-00
A4R722	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00
A4R723	307-0863-00			RES,THERMAL:10 OHM,10%,NTC	80009	307-0863-00
A4R731	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	80009	315-0473-00
A4R746	303-0750-00			RES,FXD,CMPSN:75 OHM,5%,1W	80009	303-0750-00
A4R747	303-0750-00			RES,FXD,CMPSN:75 OHM,5%,1W	80009	303-0750-00
A4R765	301-0105-00			RES,FXD,FILM:1M OHM,5%,0.50W	19701	5053CX1M000J
A4R766	322-3439-00			RES,FXD,FILM:365K OHM,1%,0.2W,TC=T0	80009	322-3439-00
A4R767	322-3439-00			RES,FXD,FILM:365K OHM,1%,0.2W,TC=T0	80009	322-3439-00
A4R768	322-3374-00	671-0572-00	671-0572-03	RES,FXD,FILM:76.8K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE76K8
A4R768	315-0104-00	671-0572-04		RES,FXD,FILM:100K OHM,5%,0.25W	80009	315-0104-00
A4R818	315-0106-00			RES,FXD,FILM:10M OHM,5%,0.25W	01121	CB1065
A4R822	301-0105-00			RES,FXD,FILM:1M OHM,5%,0.50W	19701	5053CX1M000J
A4R830	301-0154-00			RES,FXD,FILM:150K OHM,5%,0.5W	80009	301-0154-00
A4R831	301-0154-00			RES,FXD,FILM:150K OHM,5%,0.5W	80009	301-0154-00
A4RV820	307-0449-00			RES,V SENSITIVE:1900PF,100A,130V,METAL OXD MM (0	03508	V130LA20A
A4RV920	307-0449-00			RES,V SENSITIVE:1900PF,100A,130V,METAL OXD MM (0	03508	V130LA20A
A4S930	260-1849-07			SWITCH,PUSH:DPST,4A,250VAC *ATTACHED PARTS*	80009	260-1849-07
	200-2735-00			COVER,POWER SW:BLACK,POLYCARBONATE	TK2165	ORDER BY DESCR
	210-0001-00			WASHER,LOCK:#2 INTL,0.013 THK,STL (QUANTITY 2)	77900	1202-00-00-0541C
	210-0405-00			NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL (QUANTITY 2)	73743	12157-50
	211-0022-00			SCREW,MACHINE:2-56 X 0.188,PNH,STL (QUANTITY 2)	TK0435	ORDER BY DESCR
	366-1160-00			PUSH BUTTON:CHARCOAL,0.523 X 0.253 X 0.43 *END ATTACHED PARTS*	80009	366-1160-00
A4T440	120-1782-00			TRANSFORMER,RF:	80009	120-1782-00
A4TP133	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A4TP137	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A4TP140	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02
A4TP173	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104-01-02

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A4TP341	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104–01–02
A4TP350	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104–01–02
A4TP667	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYLON COLLAR	26364	104–01–02
A4U176	156–3633–00			IC,LIN:BIPOLAR,VOLTAGE REGULATOR;POSITIVE,12V,1A,3%,LOW DROPOUT;LM2940CT–12,TO–220	80009	156–3633–00
				MOUNTING PARTS		
	210–0586–00			NUT,PL,ASSEM WA:4–40 X 0.25,STL CD PL	78189	211–041800–00
	210–1178–00			WASHER,SHLDR:	80009	210–1178–00
	211–0097–00			SCREW,MACHINE:4–40 X 0.312,PNH,STL	93907	ORDER BY DESCR
	214–2953–00			HEAT SINK,XSTR:TO–220,AL	80009	214–2953–00
	342–0563–00			INSULATOR,PLATE:XSTR,FIBERGLASS REINFORCED SILICON RUBBER	18565	69–11–8805–1674
				END MOUNTING PARTS		
A4U215	156–3217–00			IC,MISC:	80009	156–3217–00
A4U276	156–2559–00			IC,LIN:BIPOLAR,VOLTAGE REGULATOR;NEGATIVE,–12V,1.5A,2%;MC7912ACT,TO–220	80009	156–2559–00
				MOUNTING PARTS		
	210–0586–00			NUT,PL,ASSEM WA:4–40 X 0.25,STL CD PL	78189	211–041800–00
	210–1178–00			WASHER,SHLDR:	80009	210–1178–00
	211–0097–00			SCREW,MACHINE:4–40 X 0.312,PNH,STL	93907	ORDER BY DESCR
	214–2953–00			HEAT SINK,XSTR:TO–220,AL	80009	214–2953–00
	342–0563–00			INSULATOR,PLATE:XSTR,FIBERGLASS REINFORCED SILICON RUBBER	18565	69–11–8805–1674
				END MOUNTING PARTS		
A4U410	156–1631–00			IC,LIN:BIPOLAR,VOLTAGE REGULATOR;SHUNT,ADJUSTABLE,100MA;TL431CLP,TO–92	01295	TL431C–LP
A4U520	156–0885–00			CPLR,OPTOELECTR:LED,5KV ISOLATION	04713	SOC 123A
A4U615	156–1225–01			IC,LIN:BIPOLAR,COMPTR;LM393N,DIP08.3	80009	156–1225–01
A4U722	156–2524–00	671–0572–00	671–0572–03	IC,LIN:	12969	UC3842N
A4U722	156–4236–00	671–0572–04		IC,LIN:	80009	156–4236–00
A4VR120	152–0662–00			DIODE,ZENER:,;5V,1%,0.4W;1N751 FMLY,DO–7 OR 35,TR	04713	SZG195RL
A4VR650	152–0395–00			DIODE,ZENER:,;4.3V,5%,0.4W;1N749A,DO–35 OR 7,TR	80009	152–0395–00
A4VR765	152–0304–00			DIODE,ZENER:,;20V,5%,0.4W;1N968B,DO–35 OR 7,TR	80009	152–0304–00
A4W810	198–5653–00			WIRE SET,ELEC:	80009	198–5653–00
B100	119–2068–00	B010100	B010204	FAN,TUBEAXIAL:24VDC,20CFM,60 X 60 MM 4800RPM, MM (0	TK1960	TFDD6024RXA
B100	119–2068–01	B010205		FAN,TUBEAXIAL:	80009	119–2068–01
J100	131–3207–00			CONN,RCPT,ELEC:MALE,3 CONTACT	82389	D3M
J200	131–3207–00			CONN,RCPT,ELEC:MALE,3 CONTACT	82389	D3M
W3	175–9860–00			CABLE ASSY,RF:75 OHM COAX,9.75 L,9–2	80009	175–9860–00
W4	174–1280–00			CABLE ASSY,RF:75 OHM COAX,11.047 L	80009	174–1280–00
W7	175–9861–00			CABLE ASSY,RF:75 OHM COAX,4.797 L,9–3 (QUANTITY 2;W7A,W7B)	80009	175–9861–00
W9	174–1339–00			CA ASSY,SP,ELEC:26,28 AWG,3.0 L	80009	174–1339–00
W10	174–1339–00			CA ASSY,SP,ELEC:26,28 AWG,3.0 L	80009	174–1339–00
W109	174–0034–00			CA ASSY,SP,ELEC:28 AWG,3.0 L,RIBBONMM (0	80009	174–0034–00
W942	175–9877–00			CA ASSY,SP,ELEC:10,28 AWG,12.5 L,RIBBON	80009	175–9877–00
W988	174–0034–00			CA ASSY,SP,ELEC:28 AWG,3.0 L,RIBBONMM (0	80009	174–0034–00

DIAGRAMS/CIRCUIT BOARD ILLUSTRATIONS

Symbols

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

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

Both overline and parenthesis indicate a low asserting state.

Example: $\overline{\text{ID CONTROL}}$ or (ID CONTROL)

Abbreviations are based on ANSI Y1.1-1972.

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

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

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

Component Values

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

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

Resistors = Ohms (Ω).

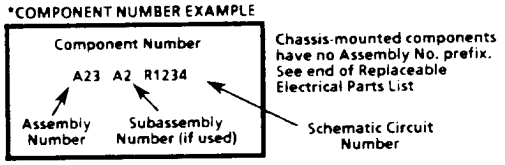
** The following information and special ** *** symbols may appear in this manual ***

Assembly Numbers

Each assembly in the instrument is assigned an assembly number (e.g., A20). The assembly number appears on the:

diagram in circuit board outline,
circuit board illustration title,
lookup table for the schematic diagram.

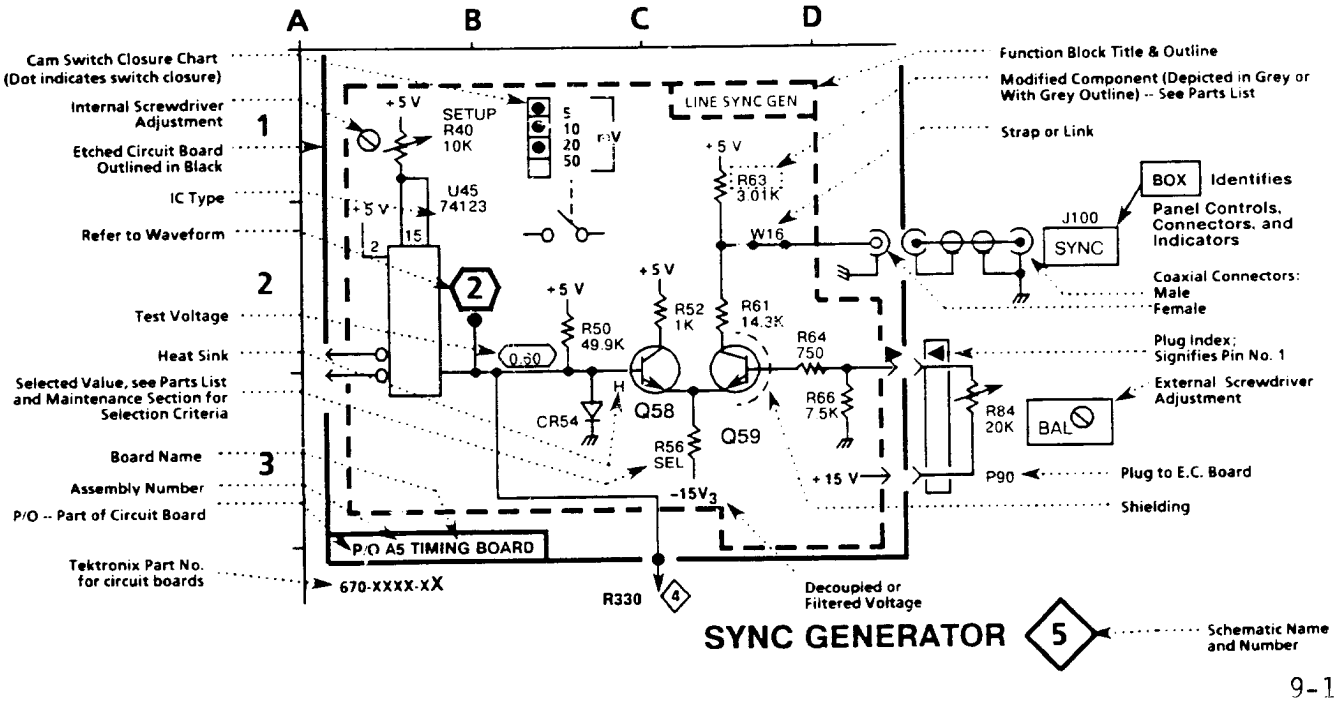
The Replaceable Electrical Parts List is arranged by assembly number in numerical sequence; the components are listed by component number. Example:

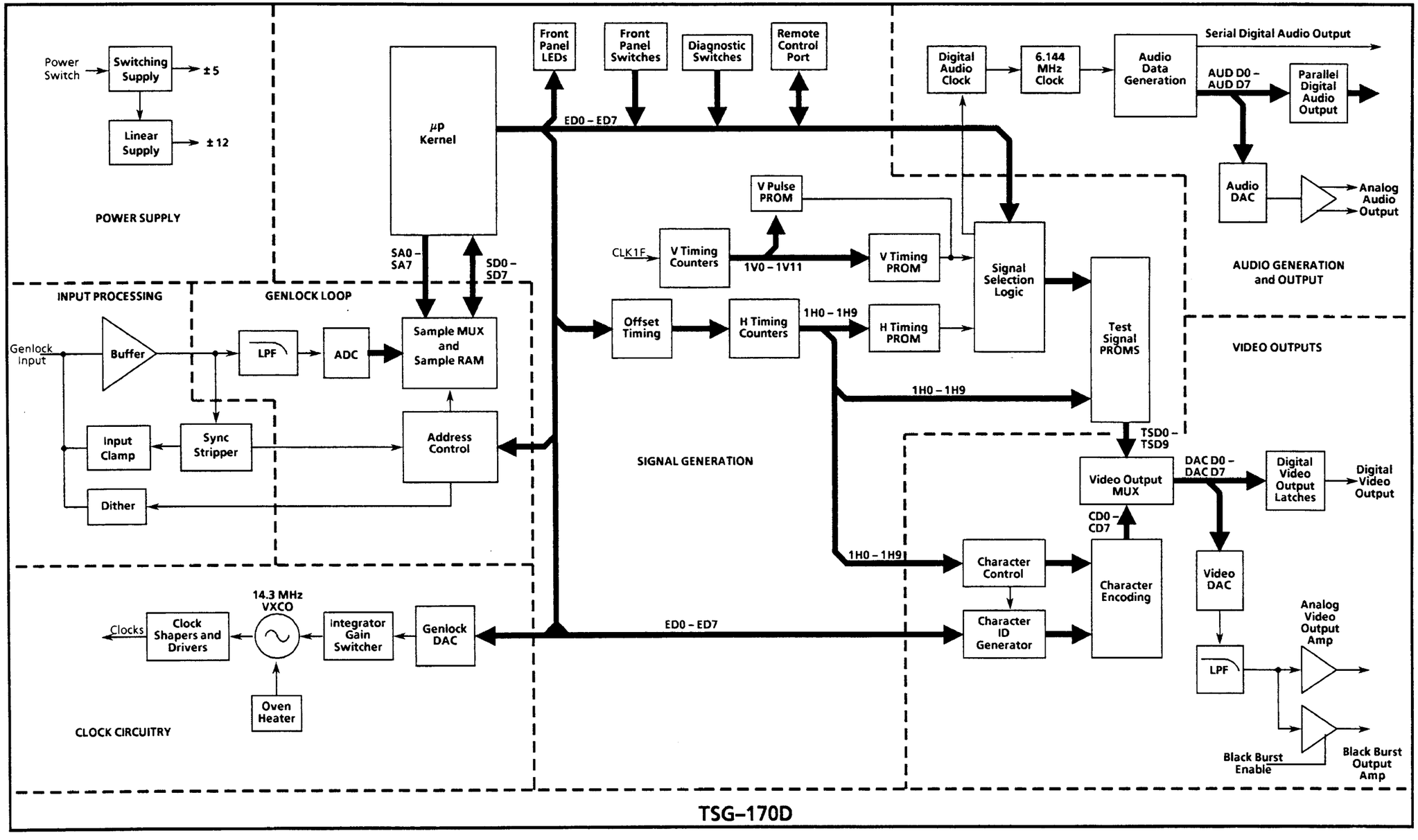


Grid Coordinates

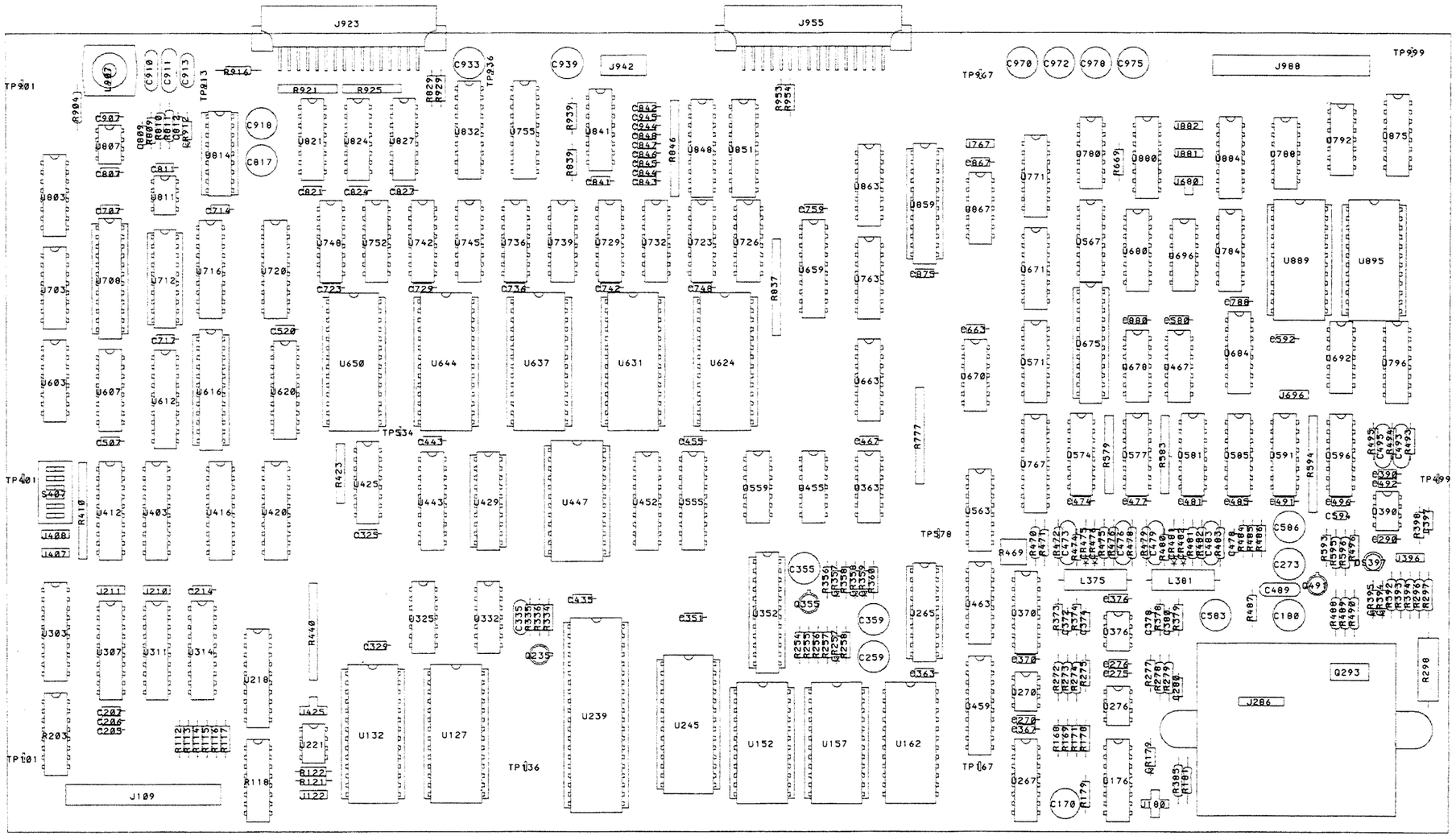
The schematic diagram and circuit board component location illustration have grids. A lookup table with the grid coordinates is provided for ease of locating the component. Only the components illustrated on the facing diagram are listed in the lookup table.

When more than one schematic diagram is used to illustrate the circuitry on a circuit board, the circuit board illustration may only appear opposite the first diagram; the lookup table will list the diagram number of other diagrams that the other circuitry appears on.

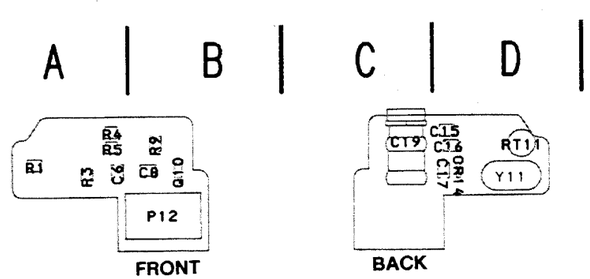



Power Switch
Switching Supply
±5
Linear Supply
±12
POWER SUPPLY
μP Kernel
Front Panel LEDs
Front Panel Switches
Diagnostic Switches
Remote Control Port
ED0 – ED7
SA0 – SA7
SD0 – SD7
Digital Audio Clock
6.144 MHz Clock
Audio Data Generation
Serial Digital Audio Output
AUD D0 – AUD D7
Parallel Digital Audio Output
Audio DAC
Analog Audio Output
AUDIO GENERATION and OUTPUT
INPUT PROCESSING
GENLOCK LOOP
Genlock Input
Buffer
LPF
ADC
Sample MUX and Sample RAM
Input Clamp
Sync Stripper
Address Control
Dither
SIGNAL GENERATION
V Pulse PROM
CLK1F
V Timing Counters
1V0 – 1V11
V Timing PROM
Signal Selection Logic
Offset Timing
H Timing Counters
1H0 – 1H9
H Timing PROM
Test Signal PROMS
VIDEO OUTPUTS
TSD0 – TSD9
Video Output MUX
DAC D0 – DAC D7
Digital Video Output Latches
Digital Video Output
CD0 – CD7
Character Control
Character Encoding
Character ID Generator
Video DAC
LPF
Analog Video Output Amp
Black Burst Enable
Black Burst Output Amp
14.3 MHz VXCO
Clocks
Clock Shapers and Drivers
Integrator Gain Switcher
Genlock DAC
Oven Heater
CLOCK CIRCUITRY

TSG–170D



A2–1 Digital Board



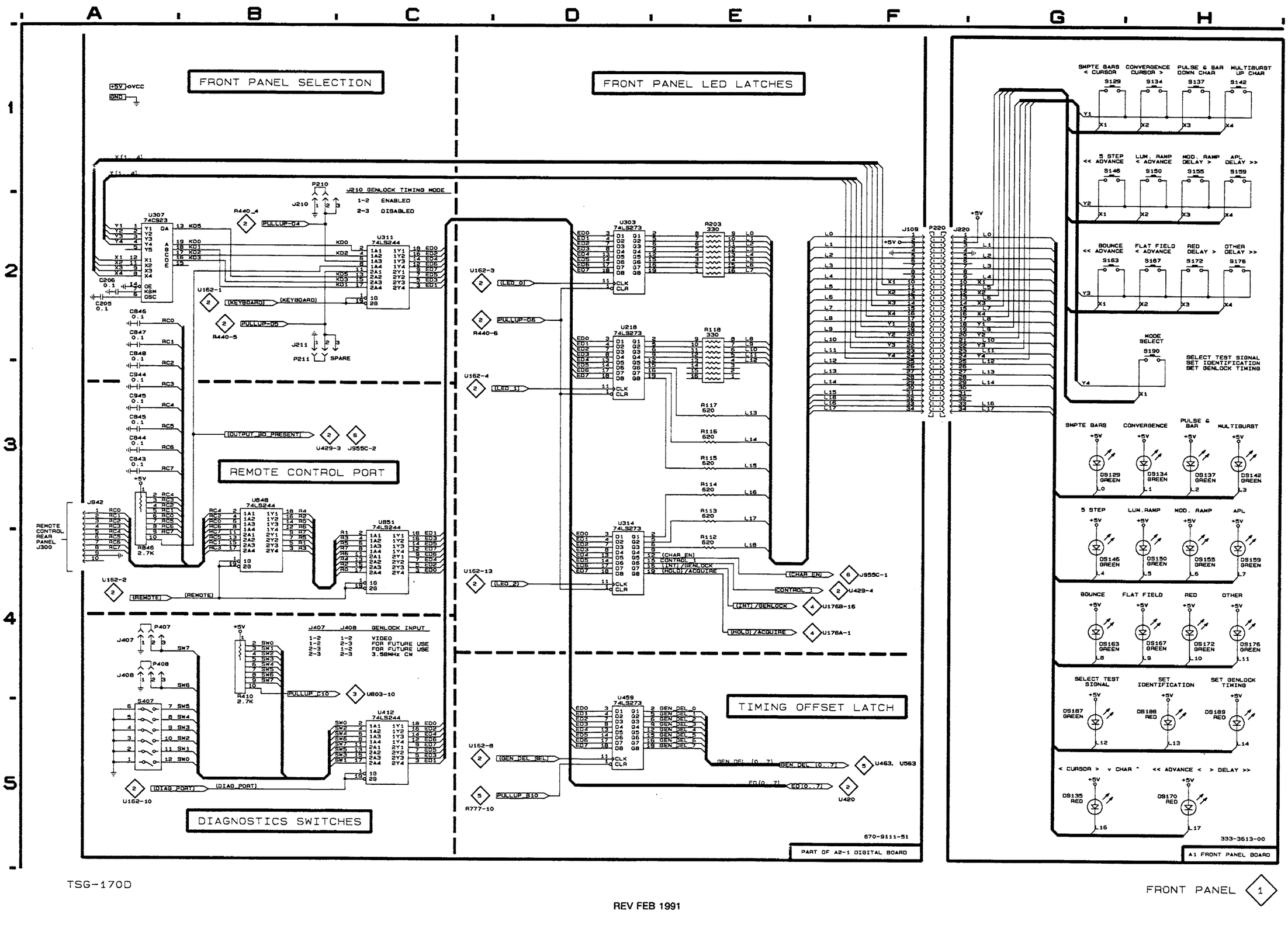
A2–2 Oven Board

Static Sensitive Devices
See Maintenance Section

DIGITAL BOARD DIAGRAM 1

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSEMBLY A2-1		
C205	A2	B8
C206	A2	B8
C843	A3	H3
C844	A3	H2
C845	A3	H2
C846	A2	H2
C847	A2	H2
C848	A3	H2
C944	A3	H2
C945	A3	H2
J109	F2	B9
J210	B2	B7
J211	B2	B7
J407	A4	A6
J408	A4	A6
J942	A3	H1
R112	E4	C9
R113	E3	C9
R114	E3	C9
R115	E3	C9
R116	E3	C9
R117	E3	C9
R118	E2	D9
R203	E2	A8
R410	B4	B6
R846	A3	H2
S407	A4	A6
U218	D2	D8
U303	D2	S7
U307	A2	B8
U311	C2	B8
U314	D4	C8
U412	C5	B6
U459	D5	L8
U848	B3	H2
U851	C4	J2



TSG-170D

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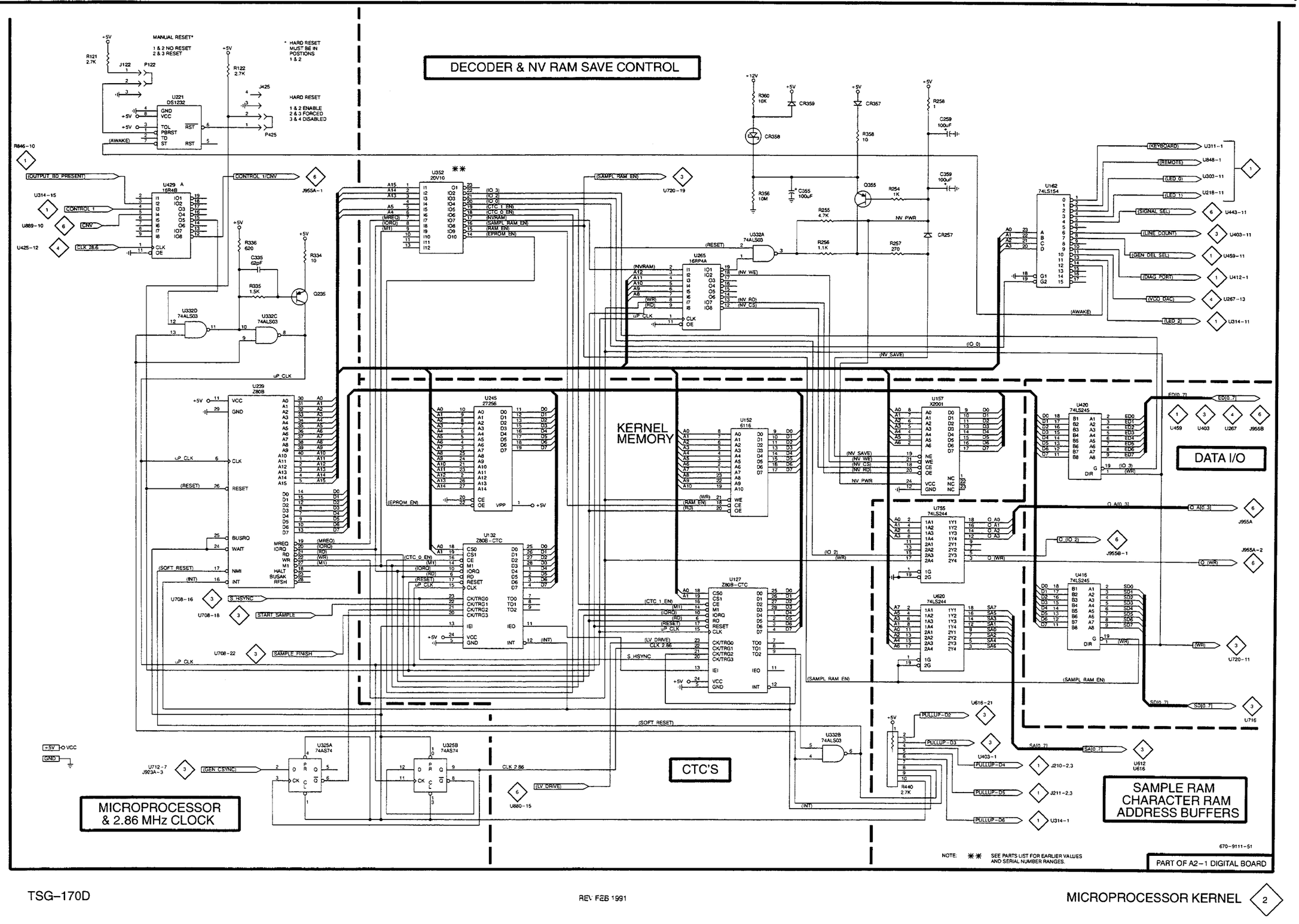
FRONT PANEL 1

DIGITAL BOARD DIAGRAM 2

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSEMBLY A2-1		
C259	F1	K8
C335	B2	F7
C355	E2	J7
C359	F2	K7
CR257	F2	K8
CR357	F1	K7
CR358	E1	K7
CR359	E1	K7
J122	A1	D9
J425	B1	D8
Q235	B2	G8
Q355	F2	J7
R121	A1	D9
R122	B1	D9
R254	F2	J8
R255	F2	J8
R256	F2	K8
R257	F2	K8
R258	F1	K8
R334	B2	G7
R335	B2	F7
R336	B2	G7
R356	E2	K7
R358	F1	K7
R360	E1	K7
R440	F5	D7
U127	E4	F8
U132	C4	E8
U152	E3	J9
U157	F3	K9
U162	G2	L9
U221	B1	D9
U239	B3	G8
U245	D3	H8
U265	E2	L7
U325	C5	E7
U332A	E2	F7
U332B	F5	F7
U332C	B2	F7
U332D	B2	F7
U352	C2	J7
U416	G4	C6
U420	G3	D6
U429A	B2	F6
U620	F4	D5
U755	F3	F2


DECODER & NV RAM SAVE CONTROL
KERNEL MEMORY
CTC'S
DATA I/O
SAMPLE RAM CHARACTER RAM ADDRESS BUFFERS
MICROPROCESSOR & 2.86 MHz CLOCK
MANUAL RESET*
1 & 2 NO RESET
2 & 3 RESET
* HARD RESET MUST BE IN POSTIONS 1 & 2
HARD RESET
1 & 2 ENABLE
2 & 3 FORCED
3 & 4 DISABLED
U221 DS1232
U429 A 16R4B
U352 20V10 **
U332A 74ALS03
U332B 74ALS03
U332C 74ALS03
U332D 74ALS03
U265 16RP4A
U239 Z80B
U245 27256
U152 6116
U157 X2001
U132 Z80B-CTC
U127 Z80B-CTC
U325A 74AS74
U325B 74AS74
U162 74LS154
U420 74LS245
U755 74LS244
U620 74LS244
U416 74LS245
(IO 3)
(IO 2)
(IO 0)
(CTC 1 EN)
(CTC 0 EN)
(NVRAM)
(SAMPL RAM EN)
(EPROM EN)
(RAM EN)
(NV WE)
(NV RD)
(NV CS)
(NV PWR)
(NV SAVE)
(IO 2)
(IO 3)
(WR)
(RD)
(IORQ)
(MREQ)
(M1)
(RESET)
(INT)
(SOFT RESET)
(LV DRIVE)
CLK 2.86
uP CLK
(AWAKE)
(KEYBOARD)
(REMOTE)
(LED 0)
(LED 1)
(SIGNAL SEL)
(LINE COUNT)
(GEN DEL SEL)
(DIAG PORT)
(VCO DAC)
(LED 2)
ED[0..7]
SD[0..7]
SA[0..7]
A[0..3]
PULLUP-D2
PULLUP-D3
PULLUP-D4
PULLUP-D5
PULLUP-D6
R440 2.7K
NOTE: ** SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES.
670-9111-51
PART OF A2-1 DIGITAL BOARD

DIGITAL BOARD DIAGRAM 3

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSEMBLY A2-1		
C809	E2	B2
C811	D2	C2
C812	E2	C2
C910	E1	B1
C911	E1	C1
C913	E1	C1
CR912	E1	C2
J923A	A1	E1
J923C	A2	E1
L907	E1	B1
R809	E2	B2
R810	D2	C2
R811	E2	C2
R904	D2	B2
R916	E1	C1
TP913	F1	C1
U403	B5	B6
U603	C4	A5
U607	E2	B5
U612	F2	C5
U616	G2	C5
U703	C4	A4
U708	D4	B4
U712	D2	C4
U716	G2	C3
U720	F3	D3
U803	C3	A3
U807	E2	B2
U811	D2	C3
U814	F2	C2

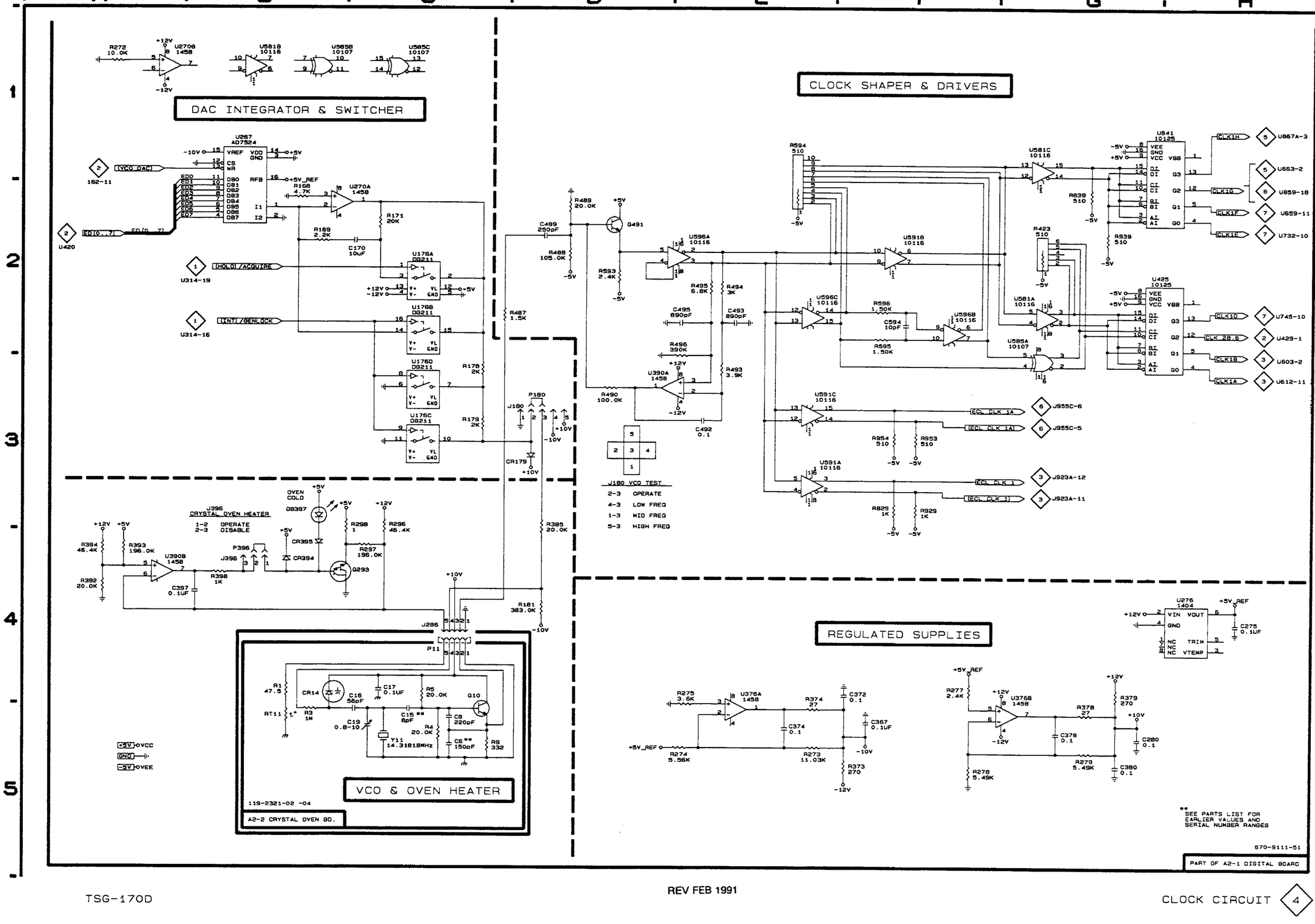
INPUT FILTER
ADC
SAMPLE MULTIPLEXER & SAMPLE RAM
ADDRESS CONTROL
GEN ADC IN
(GEN_CSYNC)
BURST DITHER
BURST_GATE
BB_ENABLE
(ECL_CLK_1)
ECL_CLK_1
OUTPUT 8D.
J6A
J6C
U325A-2
U780B-6
U780A-3
U591A-3
U591A-3
R916 37.5
C913 220pF
L907 2.5uH
C910 70pF
C911 497pF
CR912
TP913
U811 1403
R904 715
R810 2.50K
C811 0.1
U807 741
C809 0.1
R809 27
R811 1.00K
C812 0.1
U814 TDC1046
U715 74AS373
U425-4
CLK1A
U712 16V8-25
U607 74LS590
U612 74AS373
U616 7C128-35
U620
U803 74AS163
U703 74AS163
U603 74AS163
U708 20010-25
U720 74AL5244
R410-10
PULLUP_C10
U425-5
CLK1B
U403 74LS273
U420
U162-7
(LINE_COUNT)
PULLUP-03
R440-3
PULLUP-02
R440-2
(SAMPLE_RAM_WR)
(COUNTER_EN)
(SAMPL_RAM_EN)
U239-22
(WR)
U352-16
SAMPLE_FINISH
START_SAMPLE
S_HSYNC
(LV_DRIVE)
FLD_REF
U132-20
U132-22
U132-23
U880-15
J767-1
J9238-2
670-9111-51
PART OF A2-1 DIGITAL BOARD

DIGITAL AND OVEN BOARDS
DIAGRAM 4

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSEMBLY A2-1		
C170	C2	M9
C275	H4	N8
C280	G5	N8
C367	E5	M7
C372	E4	M7
C374	E5	M7
C378	G5	N7
C380	G5	N7
C397	B4	R6
C489	D2	Q7
C492	E3	R6
C493	E2	R5
C495	E2	R5
C594	F2	Q6
CR179	D3	N9
CR394	B4	R7
CR395	B4	R7
DS397	B3	R7
J180	D3	N9
J286	C4	P8
J396	B4	R7
Q293	B4	Q8
Q491	D2	Q7
R168	B2	M9
R169	B2	M9
R171	C2	M9
R178	C3	M9
R179	C3	M9
R181	D4	P9
R272	A1	M7
R273	E5	M7
R274	D5	M7
R275	D4	M7
R277	F4	N8
R278	F5	N8
R279	G5	N8
R296	C3	R7
R297	C4	R7
R298	B3	R8
R373	E5	M7
R374	E5	M7
R378	G5	N7
R379	G4	N7
R385	D3	N9
R392	A4	R7
R393	A4	R7
R394	A4	R7
R398	B4	R6
R423	G2	D6
R487	C2	P6
R488	D2	Q7
R489	D2	Q7
R490	D3	Q7
R493	E3	R5
R494	E2	R5
R495	E2	R5
R496	E2	Q6

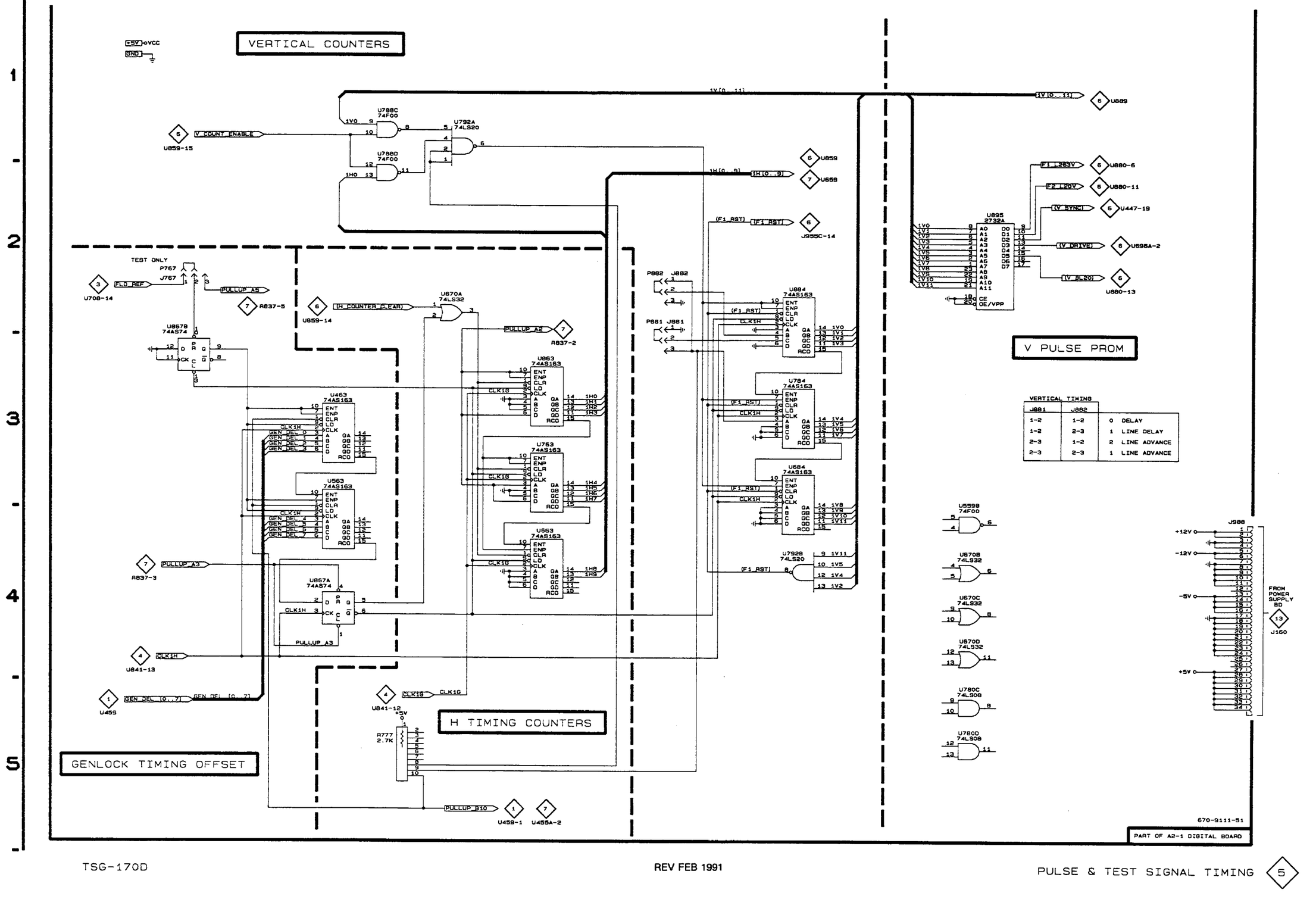
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
R593	D2	Q6
R594	E2	Q6
R595	F2	Q6
R596	F2	Q6
R829	F3	E2
R839	G2	G2
R929	F3	F2
R939	G2	G2
R953	F3	J2
R954	F3	J2
U176A	C2	N9
U176B	C2	N9
U176C	C3	N9
U176D	C3	N9
U267	B2	M9
U270A	C2	M7
U270B	A1	M7
U276	H4	N8
U376A	E4	N7
U376B	G5	N7
U390A	D3	R6
U390B	A4	R6
U425	G2	E6
U581A	G2	P5
U581B	B1	P5
U581C	G1	P5
U585A	G2	P5
U585B	B1	P5
U585C	C1	P5
U591A	E3	Q5
U591B	F2	Q5
U591C	E3	Q5
U596A	D2	Q5
U596B	F2	Q5
U596C	E2	Q5
U841	G1	G2
ASSEMBLY A2-2		
C6	C5	A1
C8	C5	B1
C15	C5	D1
C16	C4	D1
C17	C4	D1
C19	C5	C1
CR14	B4	D1
P12	C4	B1
Q10	C4	B1
R1	B4	A1
R3	B5	A1
R4	C5	A1
R5	C4	A1
R9	C5	B1
RT11	B5	D1
Y11	C5	D1


DAC INTEGRATOR & SWITCHER
CLOCK SHAPER & DRIVERS
VCO & OVEN HEATER
REGULATED SUPPLIES
J180 VCO TEST
2-3 OPERATE
4-3 LOW FREQ
1-3 MID FREQ
5-3 HIGH FREQ
J396 CRYSTAL OVEN HEATER
1-2 OPERATE
2-3 DISABLE
119-2321-02 -04
A2-2 CRYSTAL OVEN BD.
670-9111-51
PART OF A2-1 DIGITAL BOARD
** SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES

DIGITAL BOARD DIAGRAM 5

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSEMBLY A2-1		
J767	A2	L2
J881	D2	P2
J882	D2	P2
J988	H4	Q1
R777	C5	L5
U463	B3	L7
U559B	F4	J6
U563	B3	L6
U663	D4	K5
U670A	C2	L5
U670B	F4	L5
U670C	F4	L5
U670D	F4	L5
U684	E3	P4
U763	D3	K4
U780C	F5	N2
U780D	F5	N2
U784	E3	P3
U788C	C1	Q2
U788D	C2	Q2
U792A	C1	Q2
U792B	E4	Q2
U863	D3	K3
U867A	B4	L3
U867B	A3	L3
U884	E2	P2
U895	F2	R3


VERTICAL COUNTERS
+5V oVCC
GND
V_COUNT_ENABLE
U859-15
U788C 74F00
U788D 74F00
U792A 74LS20
1V0
1H0
1V[0..11]
1H[0..9]
(F1_RST)
J955C-14
U859-14
(H_COUNTER_CLEAR)
U670A 74LS32
PULLUP_A5
R837-5
PULLUP_A2
R837-2
TEST ONLY
P767
J767
FL0_REF
U708-14
U867B 74AS74
U867A 74AS74
U863 74AS163
U763 74AS163
U663 74AS163
U563 74AS163
U463 74AS163
CLK1H
CLK10
GEN_DEL_0
GEN_DEL_1
GEN_DEL_2
GEN_DEL_3
GEN_DEL_4
GEN_DEL_5
GEN_DEL_6
GEN_DEL_7
PULLUP_A3
R837-3
U841-13
U459
GEN_DEL [0..7]
U841-12
+5V
R777 2.7K
PULLUP_B10
U459-1
U455A-2
GENLOCK TIMING OFFSET
H TIMING COUNTERS
P882 J882
P881 J881
U884 74AS163
U784 74AS163
U684 74AS163
U7928 74LS20
U895 2732A
V PULSE PROM
F1_L263V
F2_L20V
V_SYNC
V_DRIVE
V_BL20
U880-6
U880-11
U447-19
U695A-2
U880-13
VERTICAL TIMING
J881
J882
0 DELAY
1 LINE DELAY
2 LINE ADVANCE
1 LINE ADVANCE
U5598 74F00
U670B 74LS32
U670C 74LS32
U670D 74LS32
U780C 74LS08
U780D 74LS08
J988
+12V
-12V
-5V
+5V
FROM POWER SUPPLY BD
J160
670-9111-51
PART OF A2-1 DIGITAL BOARD

DIGITAL BOARD DIAGRAM 6

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSEMBLY A2-1			U696A	C2	P3
			U696B	F2	P3
J955A	H1	K1	U696D	F1	P3
J955B	H4	K1	U780A	F2	N2
J955C	H2	K1	U780B	F2	N2
U363B	F2	K6	U788A	G3	Q2
U363C	F3	K6	U788B	F3	Q2
U363D	F3	K6	U859	C2	L3
U429B	D4	F6	U875	F4	R2
			U880	D3	N2
U443	D4	E6	U889	B4	Q3
U447	E4	G6			
U452	F4	H6			
U455C	E2	K6			
U455D	E2	K6			
U559D	G3	J6			

H TIMING PROM & LATCH

SIGNAL SELECTION LOGIC

V TIMING PROM

+5V OVCC

GND

U863 U783 U663

1H[0..9]

U859 7C235-40

(H COUNTER CLEAR) U670A-1

V COUNT ENABLE U788C-10

V LATCH

F1 L263H

F2 L20H

H BLANK

BURST TIMING

CLK1G U841-12

INIT CP C ES

(V DRIVE) U895-13

U696A 74LS02

U895-9 F1 L263V

U895-15 (V BL20)

U895-10 F2 L20V

1V1

U880 74F174

L V DRIVE

BURST G

L F1 L263V

L F2 L20V

L (V BL20)

V LATCH

CLR CLK

(LV DRIVE) U127-23 U708-15

U420 ED[0..7]

U895-11 (V SYNC)

(V DRIVE)

U889 2732A

APL TIMING

CNV

1V[0..11] U884, U784, U684

R837-7 PULLUP A7

R837-3 PULLUP A3

U162-5 (SIGNAL SEL)

U443 74LS273

U4298 16R4B

H/L

APL

U447 2732A

U429-5 CNV

U452 74ALS574

SEL[0..3] U624

U875 74F174

VC[0..5]

U6960 74LS02

BURST TIMING

L V DRIVE

U7808 74LS08

BURST GATE J923A-8

U5968 74LS02

V8

U780A 74LS08

BB ENABLE J923A-9

U4550 74LS08

F1 L263H

L F1 L263H

U3638 74LS32

172 LYNE U363A-1

U455C 74LS08

F2 L20H

L F2 L20V

U363C 74LS32

H BLANK

V8

U363D 74LS32

L V DRIVE

U7888 74F00

U559D 74F00

BURST O

U788A 74F00

U559A

U429-12 CONTROL 1/CNV

U755-3 O (WR)

U755 O A[0..3]

J955A

U314-12 (CHAR EN)

U311-8 (OUTPUT BD PRESENT)

U591C-14 (ECL CLK 1A)

U591C-15 ECL CLK 1A

-12V

+12V

-5V

+5V

J955C

TO OUTPUT BD. J5A, B, C

U7928-8 (F1 RST)

U755-5 O (I/O 2)

J9558

670-9111-51

PART OF A2-1 DIGITAL BOARD

DIGITAL BOARD
DIAGRAM 7

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSEMBLY A2-1		
C180	A4	Q7
C207	B5	B8
C214	B5	C7
C270	B5	M7
C273	A5	Q7
C276	B5	N8
C290	B5	R6
C325	B5	E6
C329	B5	E8
C351	C5	H7
C363	C5	L8
C370	B4	M7
C376	B4	N7
C390	B4	R6
C435	C5	G7
C443	C5	E5
C455	D5	H5
C481	B5	P6
C485	B5	P6
C491	C5	Q6
C496	C5	Q6
C507	D5	B5
C520	D5	D4
C583	A5	P6
C586	A5	Q6
C592	A5	Q4
C663	A5	L4
C707	B5	B3
C714	C5	C3
C717	B5	C4
C723	B5	D4
C729	B5	E4
C736	C5	F4
C742	C5	G4
C748	C5	H4
C759	C5	K3
C788	D5	P4
C807	C5	B2
C817	A5	D2
C821	C5	D3
C824	D5	E3
C827	D5	E3
C841	D5	G3
C842	D5	H2
C867	D5	L2
C875	D5	L4
C907	C4	B2
C918	A5	D2
C933	A5	F1
C939	A4	G1
C970	B5	M1
C972	B5	M1
C975	B5	N1
C978	B4	N1
J923B	H3	E1
R837	B1	J4
R921	H3	D2
R925	H3	E2
TP101	E5	A9
TP136	E5	F9
TP167	F5	L9
TP401	F5	A6
TP499	F5	R6
TP534	G5	E5
TP578	G5	L6
TP901	G5	A1
TP936	G5	F1
TP967	H5	L1
TP999	H5	R1
U363A	A2	K6
U455A	B3	K6
U555	B2	H6
U559A	A1	J6
U559C	C3	J6
U624	C2	J4
U631	C2	H4
U637	D2	G4
U644	E2	F4
U650	F2	E4
U659	B3	K3
U723	C3	H3
U726	C4	J3
U729	D3	G3
U732	D4	H3
U736	E3	F3
U739	E4	G3
U742	F3	E3
U745	F4	F3
U748	G3	D3
U752	G4	E3
U821	G2	D2
U824	G2	E2
U827	G1	E2

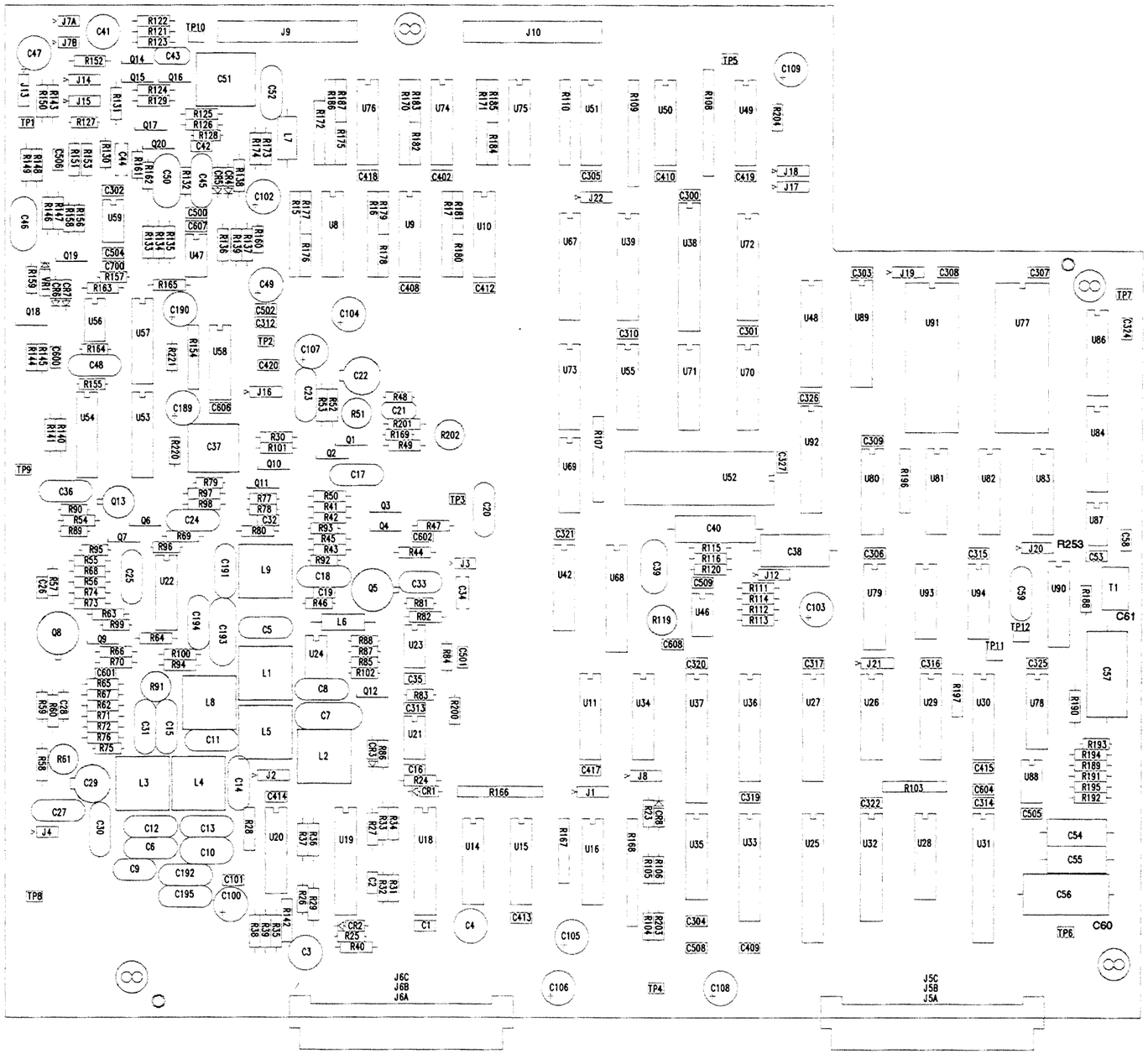
TEST SIGNAL PROMS & H TIMING LATCHES

TTL TO ECL CONVERTERS

SHIFT REGISTERS

PART OF A2-1 DIGITAL BOARD

670-9111-51



Static Sensitive Devices
See Maintenance Section

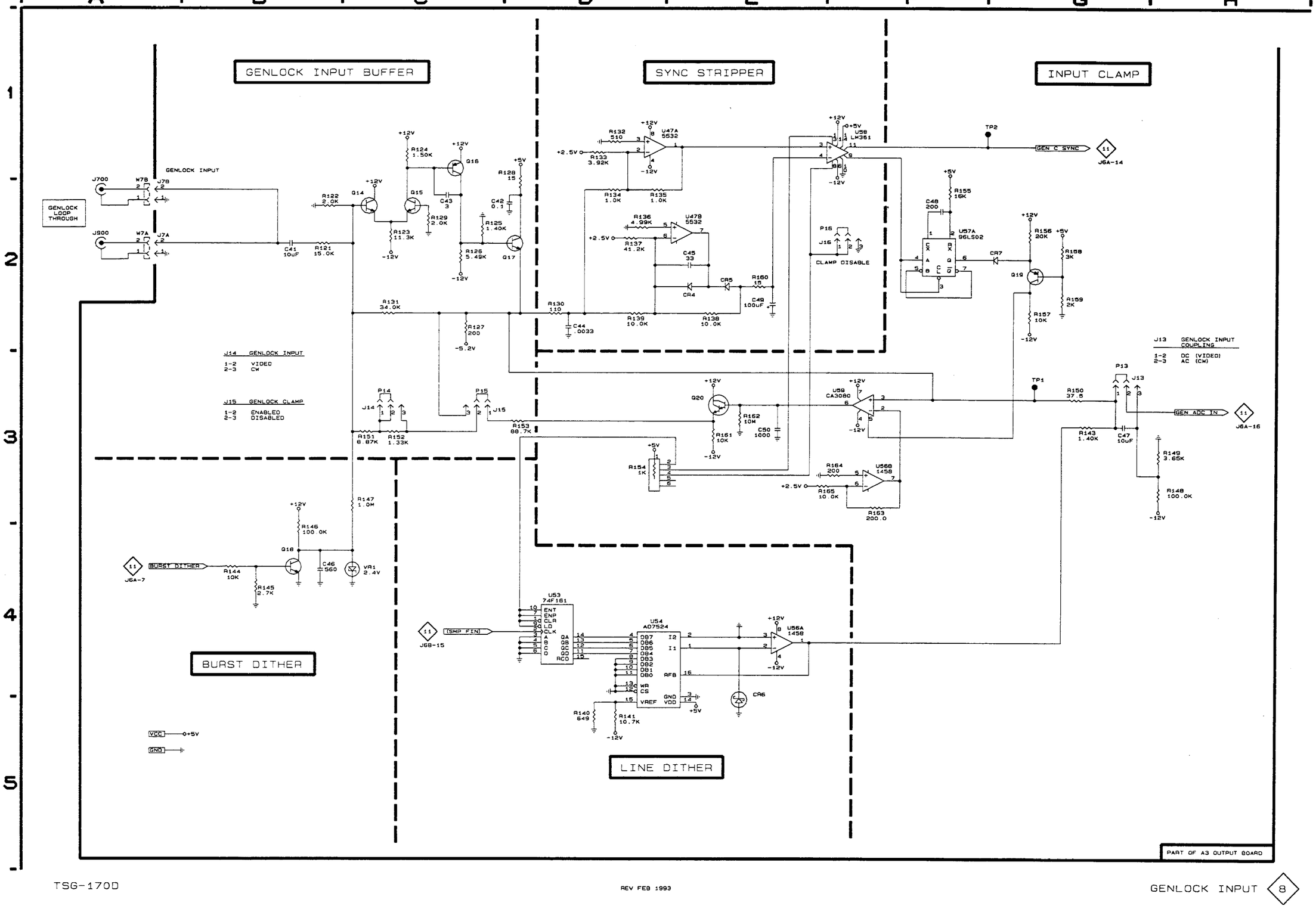
A3 Output Board

REV JUL 1993

OUTPUT BOARD DIAGRAM 8

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSEMBLY A3		
C41	B2	A1
C42	D2	B2
C43	C2	B1
C44	D2	B2
C45	E2	B2
C46	B4	A2
C47	G3	A1
C48	F2	A4
C49	E2	C3
C50	E3	B2
CR4	E2	C2
CR5	E2	B2
CR6	E4	A3
CR7	G2	A3
J7A	A2	A1
J7B	A2	A1
J13	G3	A1
J14	C3	A1
J15	C3	A1
J16	F2	C4
Q14	C2	B1
Q15	C2	B1
Q16	C1	B1
Q17	D2	B2
Q18	B4	A3
Q19	G2	A3
Q20	E3	B2
R121	B2	B1
R122	B2	B1
R123	C2	B1
R124	C1	B1
R125	C2	B2
R126	C2	B2
R127	C2	A2
R128	D2	B2
R129	C2	B1
R130	D2	A2
R131	C2	B1
R132	D1	B2
R133	D1	B3
R134	D2	B3
R135	D2	B3
R136	D2	C3
R137	D2	C3
R138	E2	C2
R139	D2	C3
R140	D5	A4
R141	D5	A4
R143	G3	A1
R144	B4	A4
R145	B4	A4
R146	B3	A2
R147	C3	A2
R148	H3	A2
R149	H3	A2
R150	G3	A1
R151	C3	A2
R152	C3	A1
R153	D3	A2
R154	D3	B4
R155	F2	A4
R156	G2	A2
R157	G2	A3
R158	G2	A2
R159	G2	A3
R160	E2	C3
R161	E3	B2
R162	E3	B2
R163	F4	A3
R164	F3	A4
R165	E3	B3
TP1	G3	A2
TP2	F1	C4
U47A	D1	B3
U47B	E2	B3
U53	D4	B4
U54	D4	A4
U56A	E4	A3
U56B	F3	A3
U57A	F2	B4
U58	F1	B4
U59	F3	A3
VR1	C4	A3


GENLOCK INPUT BUFFER
SYNC STRIPPER
INPUT CLAMP
BURST DITHER
LINE DITHER
GENLOCK LOOP THROUGH
GENLOCK INPUT
J700
J800
W7B
W7A
J7B
J7A
J14 GENLOCK INPUT
1-2 VIDEO
2-3 CW
J15 GENLOCK CLAMP
1-2 ENABLED
2-3 DISABLED
CLAMP DISABLE
GEN C SYNC
J6A-14
GEN ADC IN
J6A-16
J13 GENLOCK INPUT COUPLING
1-2 DC (VIDEO)
2-3 AC (CW)
BURST DITHER
J6A-7
(SMP FIN)
J6B-15
VCC +5V
GND
PART OF A3 OUTPUT BOARD

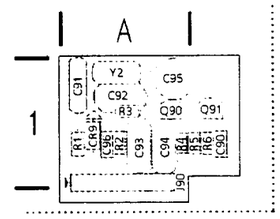
OUTPUT BOARD
DIAGRAM 9

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram.

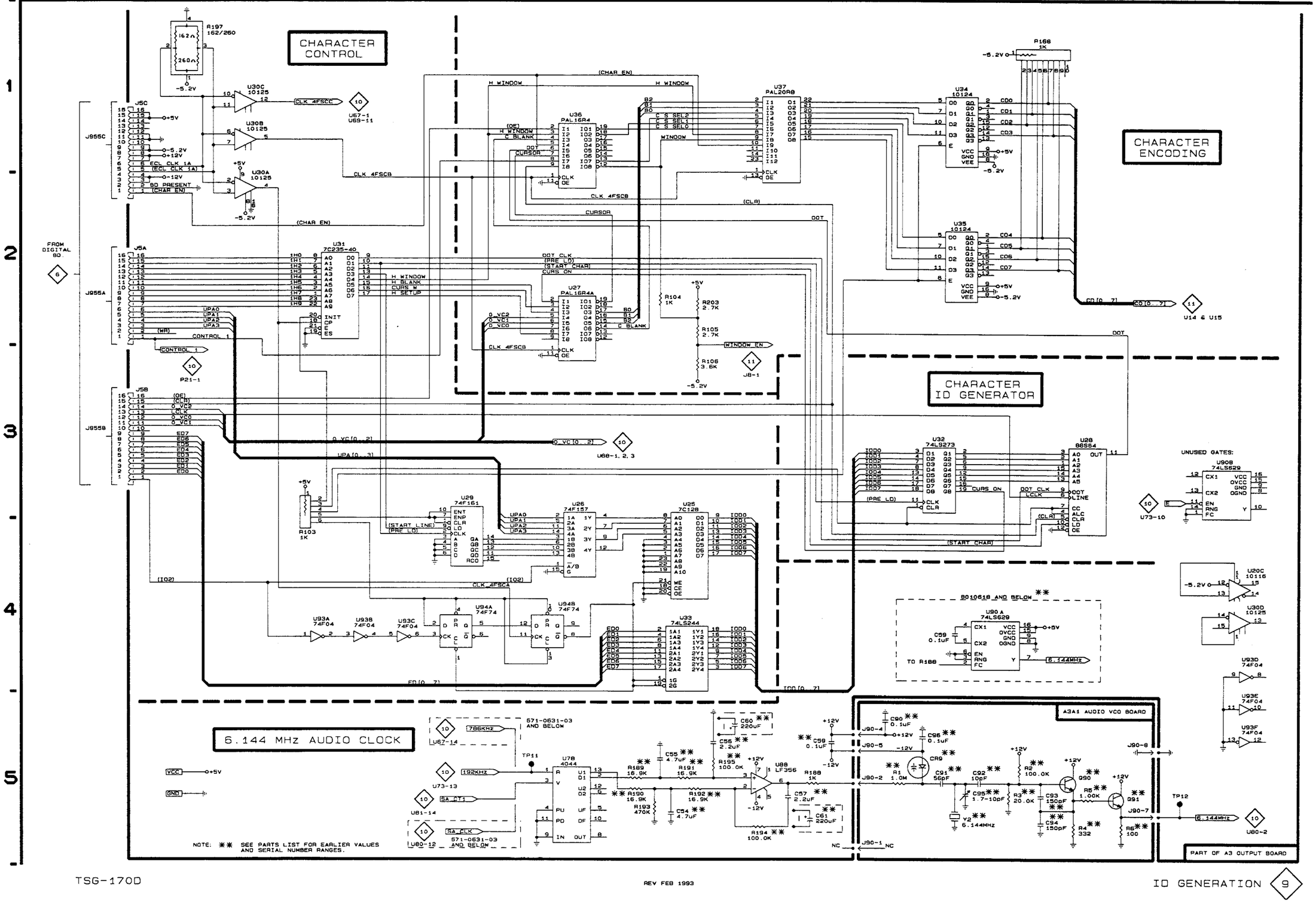
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSEMBLY A3		
C54	E5	K8
C55	E5	K9
C56	E5	J9
C57	E5	K7
C59	F5	J6
C60 *†	E5	I9
C61 *†	E5	I9
J5A	A2	I10
J5B	A3	I10
J5C	A1	I10
R103	B3	I8
R104	D2	G9
R105	E2	G8
R106	E2	G8
R168	G1	F8
R188	E5	K6
R189	D5	K8
R190	D5	K7
R191	E5	K8
R192	E5	K8
R193	D5	K7
R194	E5	K8
R195	E5	K8
R197	B1	I7
R203	E2	G9
TP11	D5	J7
TP12	F5	J6
U20C	H4	C8
U25	E3	H8
U26	D3	I7
U27	D2	H7
U28	G3	I8
U29	C3	I7
U30A	B1	J7
U30B	B2	J7
U30C	B2	J7
U30D	H4	J7
U31	B2	J8
U32	F3	I8
U33	E4	G8
U34	F1	F7
U35	F2	G8
U36	D1	G7
U37	E1	G7
U78	D5	J7
U88	E5	J8
U90A *	F5	J6
U93A	B4	I6
U93B	C4	I6
U93C	C4	I6
U93D	H5	I6
U93E	H5	I6
U93F	H5	I6
U94A	C4	J6
U94B	D4	J6

*** See parts list for serial number ranges.**

† Located on Back of board



A3A1 Audio VCO Board

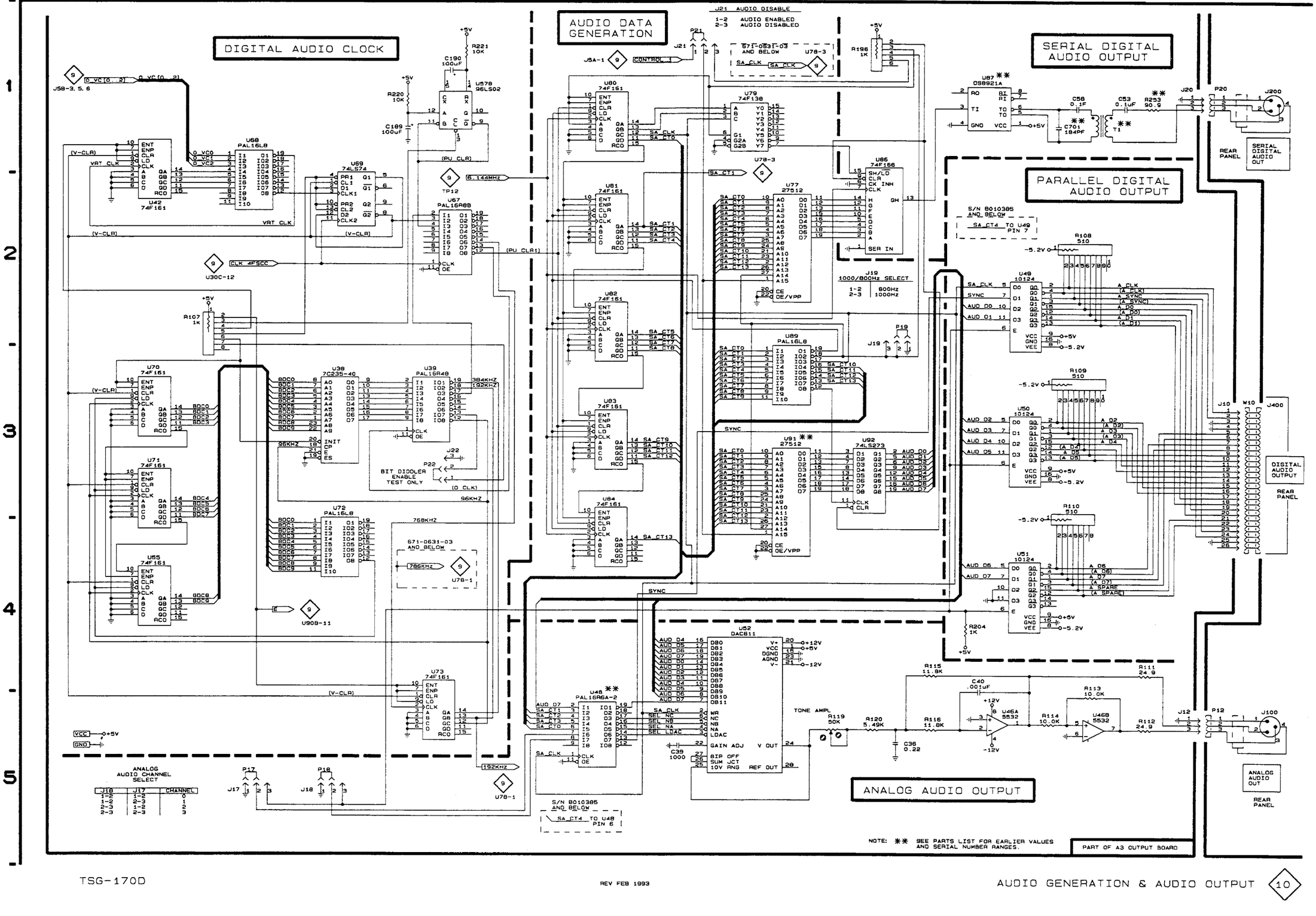

CHARACTER CONTROL
CHARACTER ENCODING
CHARACTER ID GENERATOR
6.144 MHz AUDIO CLOCK
A3A1 AUDIO VCO BOARD
PART OF A3 OUTPUT BOARD
UNUSED GATES:
80 10618 AND BELOW
671-0631-03 AND BELOW
NOTE: ** SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES.
R197 162/260
U30C 10125
U30B 10125
U30A 10125
J5C
J955C
J5A
J955A
J5B
J955B
U31 7C235-40
U36 PAL16R4
U37 PAL20R8
U27 PAL16R4A
U34 10124
U35 10124
R168 1K
U29 74F161
U26 74F157
U25 7C128
U33 74LS244
U32 74LS273
U28 86S64
U90 74LS629
U908 74LS629
U78 4044
U88 LF356
U20C 10116
U30D 10125
U93A 74F04
U93B 74F04
U93C 74F04
U93D 74F04
U93E 74F04
U93F 74F04
U94A 74F74
U94B 74F74
R103 1K
R104 1K
R203 2.7K
R105 2.7K
R106 3.6K
R189 16.9K
R190 16.9K
R191 16.9K
R192 16.9K
R193 470K
R194 100.0K
R195 100.0K
R188 1K
R1 1.0M
R2 100.0K
R3 20.0K
R4 332
R5 1.00K
R6 100
C59 0.1uF
C60 220uF
C56 2.2uF
C55 4.7uF
C54 4.7uF
C57 2.2uF
C61 220uF
C90 0.1uF
C96 0.1uF
C58 0.1uF
C91 56pF
C92 10pF
C95 1.7-10pF
C93 150pF
C94 150pF
CR9
Y2 6.144MHz
Q90
Q91
TP11
TP12
FROM DIGITAL 80
CLK 4FSCC
CLK 4FSCB
CLK 4FSCA
CHAR EN
H WINDOW
C BLANK
DOT CURSOR
WINDOW
CURSOR
DOT
(CLR)
(START CHAR)
(START LINE)
(PRE LD)
CURS ON
H WINDOW
H BLANK
CURS W
H SETUP
WINDOW EN
CD[0..7]
ED[0..7]
IDD[0..7]
UPA[0..3]
0 VC[0..2]
786KHz
192KHz
5A CT1
5A CLK
TO R188
J90-1
J90-2
J90-4
J90-5
J90-6
J90-7
J8-1
U67-1 U69-11
U68-1, 2, 3
U73-10
U80-2
U80-12
U81-14
P21-1
U14 & U15
U73-13

OUTPUT BOARD
DIAGRAM 10

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSEMBLY A3		
C38	F5	H6
C39	E5	G6
C40	F5	G5
C53	G1	K6
C58	G1	K5
C189	C1	B4
C190	C1	B3
C701*	H1	
J10	H3	E1
J12	H4	H6
J17	B5	H2
J18	B5	H2
J19	F2	I3
J20	G1	J6
J21	E1	I7
J22	C3	F2
R107	B2	F4
R108	G2	G1
R109	G3	F1
R110	G3	F1
R111	G4	H6
R112	G5	H6
R113	G5	H6
R114	G5	H6
R115	F4	G6
R116	F5	G6
R119	E5	G6
R120	F5	G6
R196	F1	I5
R204	F4	H1
R220	C1	B5
R221	C1	B4
T1	G1	K6
U38	B3	G3
U39	C3	F3
U42	A1	F6
U46A	G5	G6
U46B	G5	G6
U48	D5	H3
U49	G2	G2
U50	G3	G2
U51	G4	F1
U52	E4	G5
U55	A4	F4
U57B	C1	B4
U67	C2	F3
U68	B1	F6
U69	B2	F5
U70	A3	G4
U71	A3	G4
U72	B4	G3
U73	C4	F4
U77	E2	J3
U79	E1	I6
U80	D1	I5
U81	D2	I5
U82	D2	J5
U83	D3	J5
U84	D3	K5
U86	F2	K4
U87	F1	K5
U89	E3	H3
U91	E3	I3
U92	F3	H5

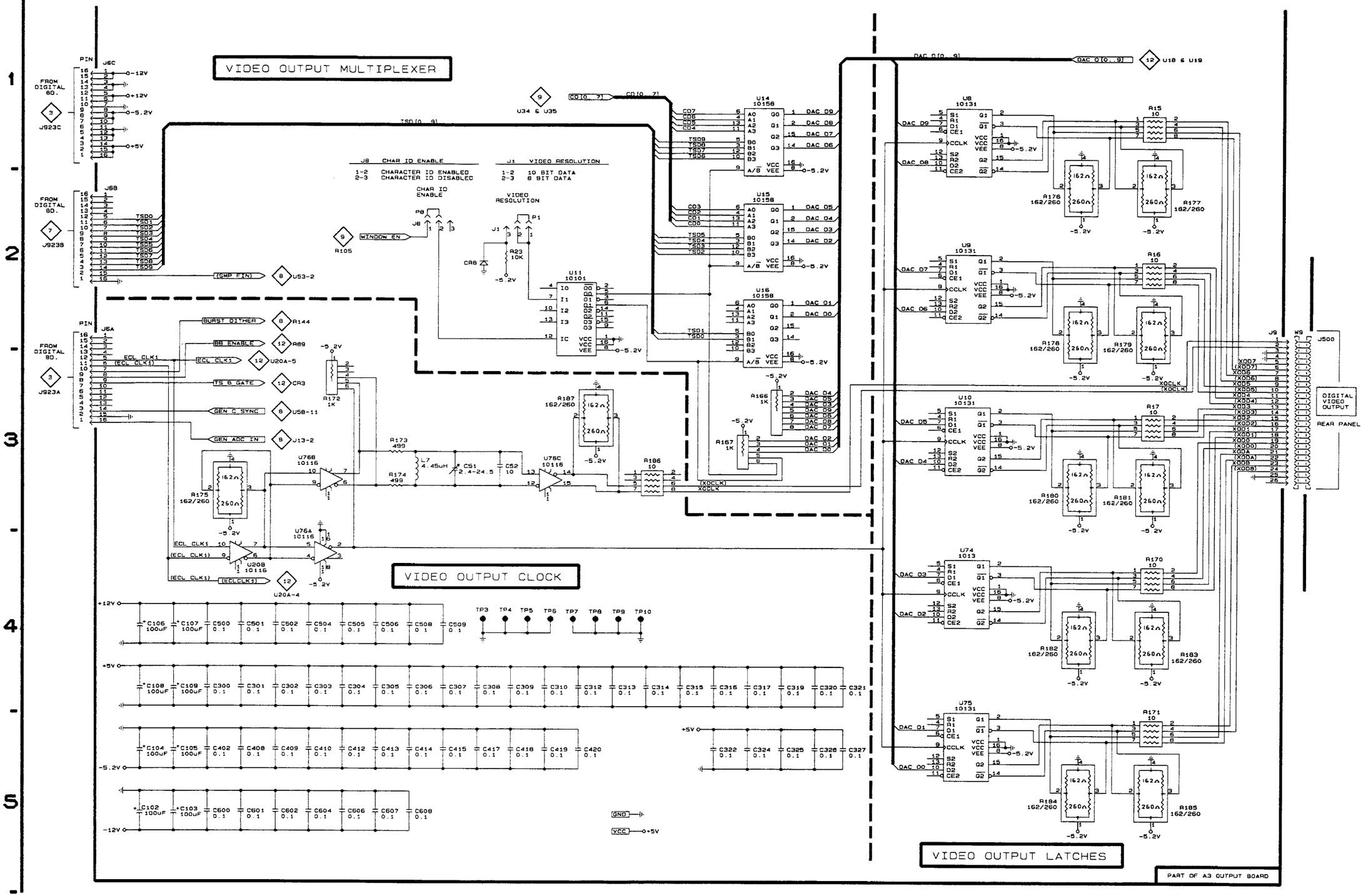
*** See parts list for serial number ranges.**


DIGITAL AUDIO CLOCK
AUDIO DATA GENERATION
SERIAL DIGITAL AUDIO OUTPUT
PARALLEL DIGITAL AUDIO OUTPUT
ANALOG AUDIO OUTPUT
J21 AUDIO DISABLE
1-2 AUDIO ENABLED
2-3 AUDIO DISABLED
671-0631-03 AND BELOW
S/N B010385 AND BELOW
SA_CT4 TO U49 PIN 7
SA_CT4 TO U48 PIN 6
J19 1000/800Hz SELECT
1-2 800Hz
2-3 1000Hz
ANALOG AUDIO CHANNEL SELECT
J18 J17 CHANNEL
1-2 1-2 0
1-2 2-3 1
2-3 1-2 2
2-3 2-3 3
REAR PANEL
SERIAL DIGITAL AUDIO OUT
DIGITAL AUDIO OUTPUT
ANALOG AUDIO OUT
TONE AMPL
NOTE: ** SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES.
PART OF A3 OUTPUT BOARD

OUTPUT BOARD
DIAGRAM 11

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSEMBLY A3		
C51	C3	C1
C52	C3	C1
C102	A5	C2
C103	B5	H6
C104	A5	D3
C105	B5	F9
C106	A4	F10
C107	B4	C4
C108	A4	G10
C109	B4	H1
C300	B4	G2
C301	B4	G4
C302	B4	A2
C303	B4	H3
C304	C4	G9
C305	C4	F2
C306	C4	I6
C307	C4	J3
C308	C4	I3
C309	D4	I5
C310	D4	F4
C312	D4	C4
C313	D4	D7
C314	D4	J8
C315	E4	J6
C316	E4	I7
C317	E4	H7
C319	E4	G8
C320	E4	G7
C321	F4	F5
C322	E5	I8
C324	E5	K3
C325	E5	J7
C326	E5	H4
C327	F5	H5
C402	B5	E2
C408	B5	D3
C409	B5	G9
C410	B5	G2
C412	C5	E3
C413	C5	E9
C414	C5	C8
C415	C5	J8
C417	C5	F8
C418	D5	D2
C419	D5	G2
C420	D5	C4
C500	B4	B2
C501	B4	E7
C502	B4	C3
C504	B4	A3
C505	C4	J8
C506	C4	A2
C508	C4	G9
C509	C4	G6
C600	B5	A4
C601	B5	A7
C602	B5	D6
C604	B5	J8
C606	C5	B4
C607	C5	B3
C608	C5	G7
CR8	C2	G8
J1	D2	F8
J6A	A2	D10
J6B	A2	D10
J6C	A1	D10
J8	C2	F8
J9	H2	C1
L7	C3	C2
R15	G1	C2
R16	G2	D2
R17	G3	E2
R23	D2	G8
R166	E3	E8
R167	E3	F8
R170	G4	D1
R171	G5	E1
R172	B3	C1
R173	C3	C2
R174	C3	C2
R175	B3	D2
R176	G1	C3
R177	G1	C2
R178	G2	D3
R179	G2	D2
R180	G3	E3
R181	G3	E2
R182	G4	D2
R183	G4	D1
R184	G5	E2
R185	G5	E1
R186	D3	D1
R187	D3	D1
TP3	C4	E5
TP4	D4	G10
TP5	D4	G1
TP6	D4	J9
TP7	D4	K3
TP8	D4	A9
TP9	D4	A5
TP10	D4	B1
U8	F1	D3
U9	F2	D3
U10	F3	E3
U11	D2	F7
U14	E1	E8
U15	E2	E8
U16	E2	F8
U20B	B4	C8
U74	F4	E1
U75	F5	E1
U76A	B4	D1
U76B	B3	D1
U76C	D3	D1

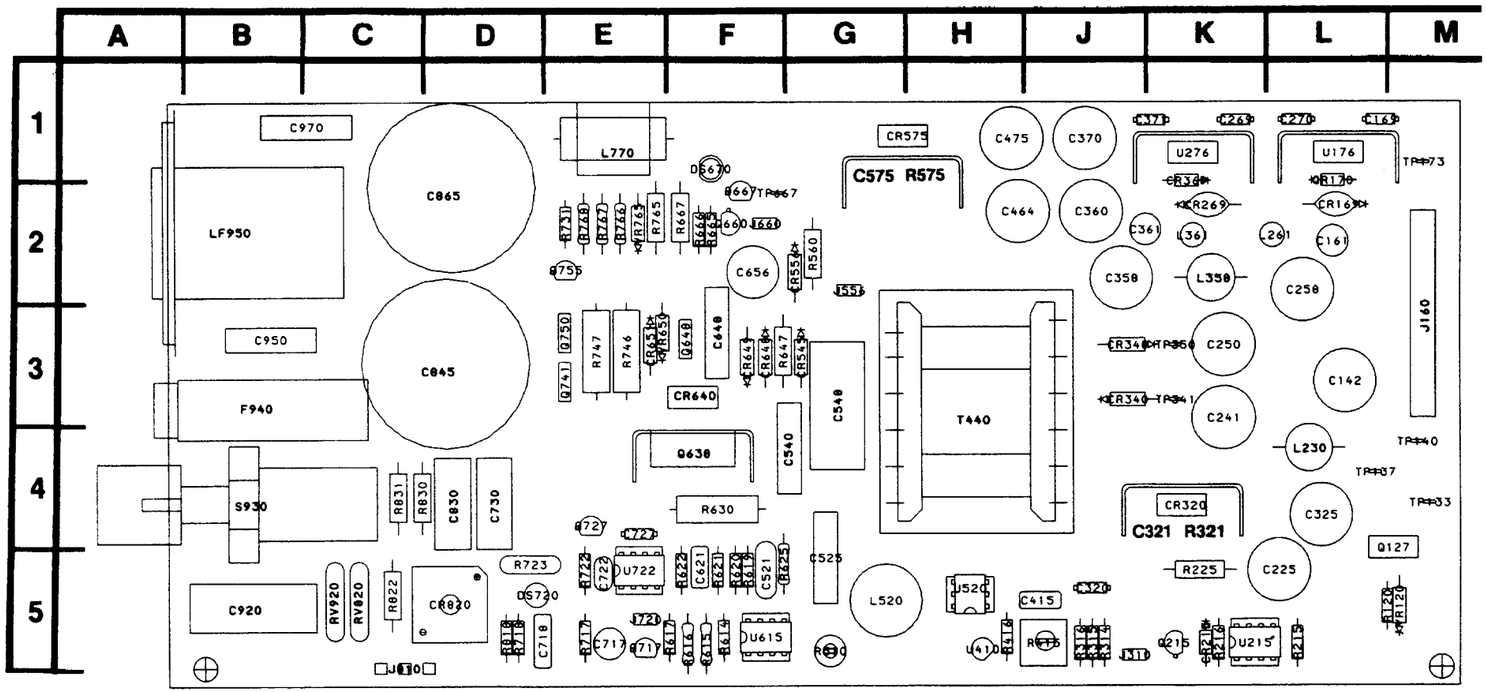

VIDEO OUTPUT MULTIPLEXER
VIDEO OUTPUT CLOCK
VIDEO OUTPUT LATCHES
PART OF A3 OUTPUT BOARD
J8 CHAR ID ENABLE
1-2 CHARACTER ID ENABLED
2-3 CHARACTER ID DISABLED
J1 VIDEO RESOLUTION
1-2 10 BIT DATA
2-3 8 BIT DATA
CHAR ID ENABLE
VIDEO RESOLUTION
FROM DIGITAL BD.
J6C
J6B
J6A
J923C
J923B
J923A
TS0[0..9]
CD[0..7]
DAC D[0..9]
WINDOW EN
(CMP FIN)
BURST DITHER
BB ENABLE
ECL CLK1
TS B GATE
GEN C SYNC
GEN ADC IN
XOCLK
U11 10101
U14 10158
U15 10158
U16 10158
U8 10131
U9 10131
U10 10131
U74 1013
U75 10131
U76B 10116
U76C 10116
U76A 10116
U20B 10116
DIGITAL VIDEO OUTPUT
REAR PANEL
J500

OUTPUT BOARD DIAGRAM 12

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSEMBLY A3		
C1	B2	D9
C2	B3	D9
C3	B3	C9
C4	B2	E9
C5	E1	C6
C6	D2	B8
C7	E2	C7
C8	E2	C7
C9	D2	B9
C10	D2	B8
C11	E1	B7
C12	D1	B8
C13	D1	B8
C14	E1	C8
C15	D2	B7
C16	B5	D8
C17	G2	D5
C18	G2	C6
C19	H2	C6
C20	H2	E5
C21	G2	D4
C22	F3	D4
C23	G3	C4
C24	G4	B5
C25	G4	B6
C26	H4	A6
C27	H5	A8
C28	G5	A7
C29	F5	A8
C30	F5	A8
C31	E5	B7
C32	E4	C5
C33	B4	D6
C34	C4	E6
C35	C4	D7
C36	D4	A5
C37	F2	B5
C100	C2	C9
C101	C2	C9
C191	E1	C6
C192	D2	B9
C193	E2	C6
C194	E2	B6
C195	E2	B9
C700	C5	A3
CR1	B2	D8
CR2	B3	D9
CR3	B3	D7
J2	D1	C8
J3	H2	E6
J4	H4	A8
L1	E1	C7
L2	E2	C8
L3	D1	B8
L4	D1	B8
L5	E1	C7
L6	B4	D6
L8	E2	B7
L9	E1	C6
Q1	F2	D5
Q2	F2	D5
Q3	G1	D5
Q4	G1	D5
Q5	G2	D6
Q6	G3	B5
Q7	G3	B6
Q8	G4	A6
Q9	F4	A6
Q10	D4	C5
Q11	D4	C5
Q12	B4	D7
Q13	E4	B5
R24	B2	D8
R25	B2	D9
R26	B3	C9
R27	B3	D8
R28	A1	C8
R29	C1	C9
R30	F2	C5
R31	B2	D9
R32	B2	D9
R33	C1	D8
R34	C1	D8
R35	C1	C9
R36	C1	C8
R37	C1	C8
R38	D2	C9
R39	C2	C9
R40	D2	D9
R41	F1	D5
R42	F1	D5
R43	G1	D6
R44	G2	D6
R45	G2	C6
R46	G2	C6
R47	H2	D5
R48	G2	D4
R49	G2	D5
R50	F2	D5
R51	G2	D4
R52	G3	D4
R53	G2	C4
R54	G3	A5
R55	G4	A6
R56	G4	A6
R57	H4	A6
R58	H5	A8
R59	G5	A7
R60	G5	A7
R61	G5	A8
R62	F5	A7
R63	E4	A6
R64	F4	B6
R65	E4	A7
R66	E5	B7
R67	F5	A7
R68	E3	A6
R69	E3	B6
R70	F5	B7
R71	G4	A7
R72	G4	A7
R73	E4	A6
R74	E4	A6
R75	E5	A7
R76	E5	A7
R77	D4	C5
R78	D3	C5
R79	D4	B5
R80	B4	C5
R81	C4	D6
R82	C3	D6
R83	D4	D7
R84	D4	E7
R85	B3	D7
R86	B4	D7
R87	A4	D7
R88	B4	D6
R89	D5	A5
R90	E5	A5
R91	F4	B7
R92	G1	C6
R93	G1	C5
R94	F4	B7
R95	G3	A6
R96	G3	B6
R97	E4	B5
R98	E4	B5
R99	E4	B6
R100	G4	B7
R101	F2	C5
R102	B4	D7
R142	A2	C9
R169	F2	D5
R198	F4	B6
R200	D1	E7
R201	F2	D4
R202	F2	E5
U18	B1	D8
U19	B2	D8
U20A	A3	C8
U21	B5	D7
U22A	E4	B6
U22B	F4	B6
U23	C4	D7
U24	B4	C7

VIDEO DAC
OUTPUT FILTER
VIDEO OUTPUT AMPLIFIER
BLACK BURST OUTPUT AMPLIFIER
U14, U15, U16
DAC 0 (0 - 9)
U18 155-0282
U19 155-0282
U20A 10116
U21 1403
U22A CA3102E
U22B CA3102E
U23 LM741
U24 CA3080
TCLK
TCCLCLK1
TS B GATE
BB ENABLE
VCC
GND
TEST ONLY
DAC REF
TEST SIGNAL TIMING
DC LEVEL
SETUP AMPL
GAIN
SINX/X CORR
VIDEO OUTPUT
REAR
BLACK BURST
PART OF A3 OUTPUT BOARD



A4 POWER SUPPLY BOARD

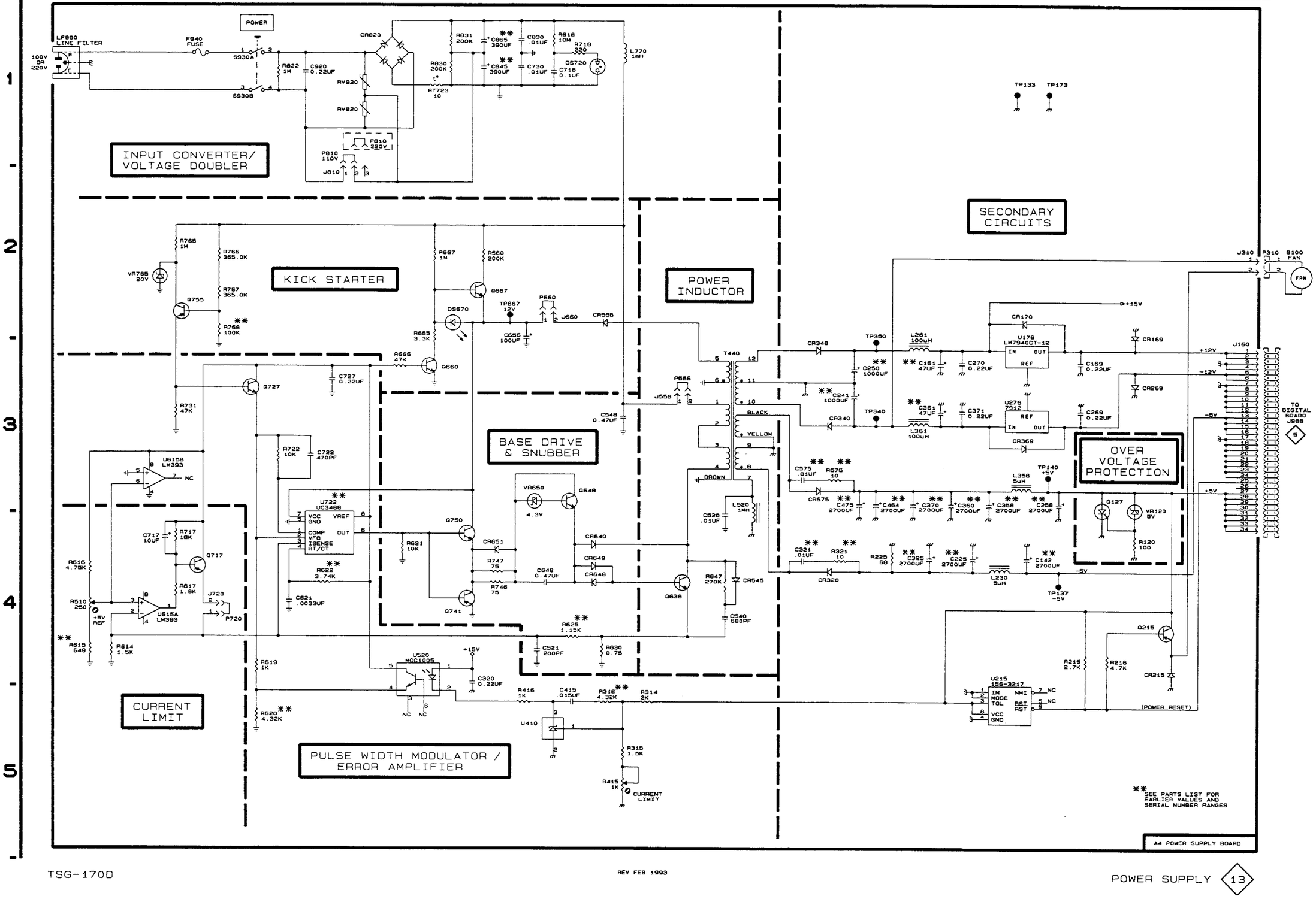
Static Sensitive Devices
See Maintenance Section

POWER SUPPLY
DIAGRAM 13

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C142	F4	L3
C161	F3	L2
C169	G3	L1
C225	F4	L5
C241	F3	K3
C250	F3	K3
C258	G4	L2
C269	G3	K1
C270	F3	L1
C320	C4	J5
C321 *	E4	K4
C325	F4	L4
C358	G4	J2
C360	F4	J2
C361	F3	J2
C370	F4	J1
C371	F3	K1
C415	D5	J5
C464	F4	H2
C475	F4	H1
C521	D4	F5
C525	E4	G5
C540	E4	F4
C548	D3	G3
C575 *	E3	G1
C621	B4	F5
C648	D4	F3
C656	D2	F2
C717	A4	E5
C718	D1	D5
C722	B3	E5
C727	B3	E4
C730	D1	D4
C830	D1	D4
C845	C1	D3
C575 *	E3	G1
C830	D1	D4
C845	D1	D3
C865	D1	D2
C920	B1	B5
C950	A1	B3
C970	A1	B1
CR169	G3	L2
CR170	G2	L1
CR215	G4	K5
CR269	G3	K2
CR320	E4	K4
CR340	F3	J3
CR348	E3	J3
CR369	G3	K2
CR545	E4	G3
CR556	D2	G2
CR575	E4	G1
CR640	D4	F3
CR648	D4	F3
CR649	D4	F3
CR651	C4	E3
CR820	C1	D5
DS670	C2	F1
DS720	D1	D5
F940	B1	B3
J160	H3	M3
J310	H2	J5
J556	E3	G2
J660	D2	F2
J720	B4	E5
J810	B1	C5
L230	F4	L4
L261	F3	L2
L358	G4	K2
L361	F3	K2
L520	E3	G5
L770	D1	E1
LF950	A1	B2
Q127	G4	L5
Q215	G4	K5
Q638	E4	F4
Q648	D3	F3
Q660	C3	F2
Q667	C2	F2
Q717	B4	E5
Q727	B3	E4
Q741	C4	E3
Q750	C4	E3
Q755	B2	E2
R120	G4	L5
R215	G4	L5
R216	G4	K5
R225	F4	K5
R314	D5	J5
R315	D5	J5
R316	D5	J5
R321 *	E4	K4
R415	D5	J5
R416	D5	H5
R510	A4	G5
R560	C2	G2
R575 *	E3	G1
R614	A4	F5
R615	A4	F5
R616	A4	F5
R617	B4	F5
R619	B4	F5
R620	B5	F5
R621	C4	F5
R622	B4	F5
R625	D4	F5
R630	D4	F4
R647	E4	F3
R665	C2	F2
R666	C3	F2
R667	C2	F2
R717	A4	E5
R718	D1	D5
R722	B3	E5
R723	C1	D5
R731	B3	E2
R746	C4	E3
R747	C4	E3
R765	B2	E2
R766	B2	E2
R767	B2	E2
R768	B2	E2
R818	D1	D5
R822	B1	C5
R830	C1	C4
R831	C1	C4
RV820	C1	C5
RV920	C1	C5
S330A	B1	B4
S930B	B1	B4
T440	E3	H3
TP133	G1	M4
TP137	F4	L4
TP140	G3	M4
TP173	G1	M1
TP341	F3	K3
TP350	F3	K3
TP667	D2	F2
U176	G3	L1
U215	G5	K5
U276	G3	K1
U410	D5	H5
U520	C4	F5
U615A	A4	F5
U615B	A3	F5
U722	B4	E5
VR120	G4	M5
VR650	D3	E3
VR765	A2	E2

*** See parts list for serial number ranges.**


INPUT CONVERTER/ VOLTAGE DOUBLER
KICK STARTER
BASE DRIVE & SNUBBER
CURRENT LIMIT
PULSE WIDTH MODULATOR / ERROR AMPLIFIER
POWER INDUCTOR
SECONDARY CIRCUITS
OVER VOLTAGE PROTECTION
POWER
LF950 LINE FILTER
100V OR 220V
F940 FUSE
S930A
S930B
R822 1M
C920 0.22UF
CR820
R831 200K
R830 200K
C865 390UF
C845 390UF
C830 .01UF
C730 .01UF
R818 10M
R718 220
DS720
C718 0.1UF
L770 1mH
RT723 10
RV920
RV820
P810 220V
P810 110V
J810
TP133
TP173
R765 1M
R766 365.0K
R767 365.0K
R768 100K
VR765 20V
Q755
R667 1M
R560 200K
Q667
DS670
TP667 12V
P660
J660
CR555
C656 100UF
R665 3.3K
R666 47K
Q660
Q727
C727 0.22UF
R731 47K
R722 10K
C722 470PF
U615B LM393
U722 UC3488
VCC GND VREF
COMP VFB ISENSE RT/CT OUT
C717 10UF
R717 18K
Q717
R616 4.75K
R617 1.8K
R510 250
+5V REF
U615A LM393
J720
P720
R622 3.74K
C621 .0033UF
R615 649
R614 1.5K
R619 1K
R620 4.32K
Q750
R621 10K
VR650 4.3V
Q648
CR651
CR640
CR649
CR648
R747 75
R746 75
C648 0.47UF
Q741
Q638
CR545
C540 680PF
R625 1.15K
C521 200PF
R630 0.75
U520 MOC1005
C320 0.22UF
R416 1K
C415 .015UF
R316 4.32K
R314 2K
U410
R315 1.5K
R415 1K
CURRENT LIMIT
T440
P656
J656
BLACK
YELLOW
BROWN
C548 0.47UF
L520 1mH
C626 .01UF
CR348
TP350
L261 100uH
C250 1000UF
C241 1000UF
CR340
TP340
L361 100uH
C161 47UF
C270 0.22UF
C361 47UF
C371 0.22UF
U178 LM7940CT-12
U276 7912
REF
IN OUT
CR170
CR369
C169 0.22UF
C269 0.22UF
CR169
CR269
+15V
+12V
-12V
-5V
+5V
J160
J310
P310
B100 FAN
FAN
TO DIGITAL BOARD J988
5
C575 .01UF
R578 10
CR575
C475 2700UF
C464 2700UF
C370 2700UF
C360 2700UF
C358 2700UF
C258 2700UF
L356 5uH
TP140 +5V
Q127
VR120 5V
R120 100
C321 .01UF
R321 10
CR320
R225 68
C325 2700UF
C225 2700UF
C142 2700UF
L230 5uH
TP137 -5V
Q215
R215 2.7K
R216 4.7K
CR215
U215 156-3217
IN MODE TOL VCC GND
NMI RST RST
NC NC
(POWER RESET)
** SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES
A4 POWER SUPPLY BOARD

Section 10
Replaceable Mechanical Parts

This section contains a list of the components that are replaceable for the TSG–170D. Use this list to identify and order replacement parts. There is a separate Replaceable Mechanical Parts list for each instrument.

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. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument 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.

Using the Replaceable Mechanical Parts List

The tabular information in the Replaceable Mechanical Parts list is arranged for quick retrieval. Understanding the structure and features of the list will help you find all of the information you need for ordering replaceable parts.

Cross Index–Mfr. Code Number to Manufacturer

The Mfg. Code Number to Manufacturer Cross Index for the mechanical parts list is located immediately after this page. The cross index provides codes, names, and addresses of manufacturers of components listed in the mechanical parts list.

Abbreviations

Abbreviations conform to American National Standards Institute (ANSI) standard Y1.1.

Chassis Parts

Chassis-mounted parts and cable assemblies are located at the end of the Replaceable Electrical Parts list.

Column Descriptions

Figure & Index No. (Column 1) Items in this section are referenced by figure and index numbers to the illustrations.

Tektronix Part No. (Column 2) Indicates part number to be used when ordering replacement part from Tektronix.

Serial No. (Column 3 and 4) Column three (3) indicates the serial number at which the part was first used. Column four (4) indicates the serial number at which the part was removed. No serial number entered indicates part is good for all serial numbers.

Qty (Column 5) This indicates the quantity of mechanical parts used.

Name and Description (Column 6) An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification.

Following is an example of the indentation system used to indicate relationship.

```
1  2  3  4  5        Name & Description
Assembly and/or Component
Mounting parts for Assembly and/or Component
*MOUNTING PARTS*/*END MOUNTING PARTS*
    Detail Part of Assembly and/or Component
    Mounting parts for Detail Part
    *MOUNTING PARTS*/*END MOUNTING PARTS*
        Parts of Detail Part
        Mounting parts for Parts of Detail Part
        *MOUNTING PARTS*/*END MOUNTING PARTS*
```

Mounting 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. **Mounting parts must be purchased separately, unless otherwise specified.**

Mfr. Code (Column 7) Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

Mfr. Part Number (Column 8) Indicates actual manufacturer's part number.

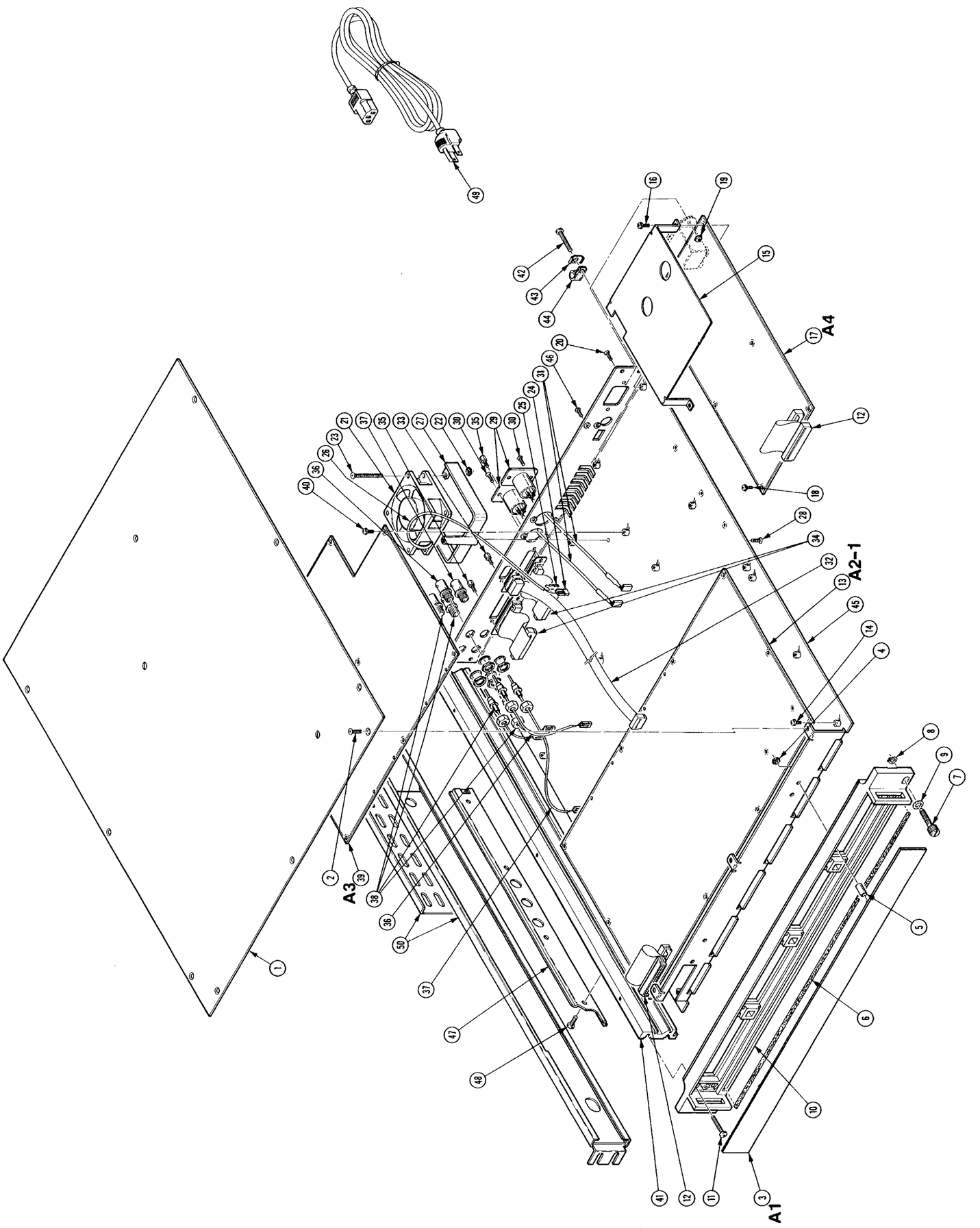
CROSS INDEX – MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code.	Manufacturer	Address	City, State, Zip Code
06666	GENERAL DEVICES CO INC	1410 S POST RD PO BOX 39100	INDIANAPOLIS IN 46239–9632
06915	RICHCO PLASTIC CO	5825 N TRIPP AVE	CHICAGO IL 60646–6013
09422	PLASTIC STAMPING CORP	2216 W ARMITAGE AVE	CHICAGO IL 60647–4461
71468	ITT CANNON COMERCIAL COMPONENTS DIV (CCD)	1851 E DEERE AVE	SANTA ANA CA 92705
72228	AMCA INTERNATIONAL CORP CONTINENTAL SCREW CO DIV	459 MT PLEASANT	NEW BEDFORD MA 02742
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIV	ST CHARLES ROAD	ELGIN IL 60120
79136	WALDES KOHINOOR INC	47–16 AUSTEL PLACE	LONG ISLAND CITY NY 11101–4402
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077–0001
82389	SWITCHCRAFT INC SUB OF RAYTHEON CO	5555 N ELSTRON AVE	CHICAGO IL 60630–1314
83385	MICRODOT MFG INC GREER–CENTRAL DIV	3221 W BIG BEAVER RD	TROY MI 48098
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
95987	BRADY/WECKESSER MFG CO	4444 WEST IRVING PARK RD	CHICAGO IL 60641
96904	HIGH VOLTAGE ENGINEERING CORP NARVAR CO DIV	ROUTE 70 EAST PO BOX 658	CLAYTON NC 27520
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609–3320
TK0588	UNIVERSAL PRECISION PRODUCTS	1775 NW 216TH	HILLSBORO OR 97123
TK0858	STAUFFER SUPPLY CO (DIST)		
TK1960	U S TOYO FAN CORP	4915 WALNUT GROVE AVE DRAWER G	SAN GABRIEL CA 91776

Fig. & Index No.	Tektronix Part No.	Serial Number Effective	Serial Number Dscont	Qty	12345	Name & Description	Mfr. Code	Mfr. Part No.
1–1	200–3552–01	B010100	B010410	1		COVER,TOP:	80009	200–3552–01
	200–3951–00	B010411		1		COVER,TOP:ALUMINUM	80009	200–3951–00
						MOUNTING PARTS		
–2	211–0559–00			10		SCREW,MACHINE:6–32 X 0.375,FLH,100 DEG,STL	TK0435	1593–300
						END MOUNTING PARTS		
–3	——— ———			1		PANEL,FRONT:		
						(SEE A1 REPL)		
						MOUNTING PARTS		
–4	210–0457–00			2		NUT,PL,ASSEM WA:6–32 X 0.312,STL CD PL	78189	511–061800–00
–5	166–0035–00			2		SPACER,SLEEVE:0.5 L X 0.18 ID,AL	80009	166–0035–00
						END MOUNTING PARTS		
–6	378–0269–00			1		FILTER,AIR:	80009	378–0269–00
–7	213–0216–00			1		THUMBSCREW:10–32 X 0.85,0.375 OD HD,SST	80009	213–0216–00
						MOUNTING PARTS		
–8	354–0025–00			1		RING,RETAINING:EXTERNAL,U/O 0.187 DIA SFT	79136	5555–18
						END MOUNTING PARTS		
–9	210–0894–00			1		WASHER,FLAT:0.19 ID X 0.438 OD X 0.031	09422	ORDER BY DESCR
–10	426–2116–01			1		FRAME,FRONT:	80009	426–2116–01
						MOUNTING PARTS		
–11	213–0760–00			4		SCREW,TPG,TF:8–32 X 0.875,SPCL TAPTITE,FILH,STL	72228	ORDER BY DESCR
						END MOUNTING PARTS		
–12	——— ———			2		CA ASSY,SP,ELEC:28 AWG,3.0 L,RIBBONSAFETY CONTROLLED		
						(SEE W109,W988 REPL)		
	——— ———	B010421		1		CIRCUIT BD ASSY:SERIAL OUTPUT		
						(SEE A7 REPL, APPENDIX A OPTION 1S ONLY)		
						MOUNTING PARTS		
	211–0244–00	B010421		2		SCR,ASSEM WSHR:4–40 X 0.312,PNH STL	TK0858	211–0244–00
						(OPTION 1S ONLY)		
	385–0149–00	B010421		2		SPACER,POST:0.625 L W/4–40 THD EA END,NYL	TK0588	ORDER BY DESCR
						(OPTION 1S ONLY)		
–13	——— ———			1		CIRCUIT BD ASSY:DIGITAL		
						(SEE A2–1 REPL)		
						MOUNTING PARTS		
–14	211–0244–00			10		SCR,ASSEM WSHR:4–40 X 0.312,PNH STL	TK0858	211–0244–00
						(STANDARD ONLY)		
	211–0244–00	B010421		6		SCR,ASSEM WSHR:4–40 X 0.312,PNH STL	TK0858	211–0244–00
						(OPTION 1S ONLY)		
	129–1349–00	B010421		4		SPACER,POST:0.62 L X 4–40 X 0.25 INT THD &4–40 X 0.2 EXT THD,STUD0.25 HEX	80009	129–1349–00
						(OPTION 1S ONLY)		
						END MOUNTING PARTS		
–15	337–3286–01			1		SHIELD,PWR SPLY:LOW VOLTAGE	80009	337–3286–01
						MOUNTING PARTS		
–16	211–0244–00			3		SCR,ASSEM WSHR:4–40 X 0.312,PNH STL	TK0858	211–0244–00
						END MOUNTING PARTS		
–17	——— ———			1		CIRCUIT BD ASSY:PWR SPLY		
						(SEE A4 REPL)		
						MOUNTING PARTS		
–18	211–0244–00			2		SCR,ASSEM WSHR:4–40 X 0.312,PNH STL	TK0858	211–0244–00
–19	210–0586–00			2		NUT,PL,ASSEM WA:4–40 X 0.25,STL CD PL	78189	211–041800–00
–20	211–0025–00			2		SCREW,MACHINE:4–40 X 0.375,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
						END MOUNTING PARTS		
–21	——— ———			1		FAN,TUBEAXIAL:24VDC,20CFM,60 X 60 MM 4800RPM, SAFETY CONTROLLED		
						(SEE B100 REPL)		
						MOUNTING PARTS		

Fig. & Index No.	Tektronix Part No.	Serial Number Effective	Serial Number Dscont	Qty	12345	Name & Description	Mfr. Code	Mfr. Part No.
-22	210-0458-00			2		NUT,PL,ASSEM WA:8-32 X 0.344,STL CD PL	78189	511-081800-00
-23	212-0012-00			2		SCREW,MACHINE:8-32 X 1.25,FLH,100 DEG,STL *END MOUNTING PARTS*	83385	ORDER BY DESCR
-24	352-0169-00	B010100	B010204	1		HLDR,TERM CONN:2 WIRE,BLACK	80009	352-0169-00
-25	131-0707-00	B010100	B010204	2		CONTACT,ELEC:22-26 AWG,BRS,CU BE GLD PL	80009	131-0707-00
-26	162-0013-00	B010100	B010204	1		INSUL SLVG,ELEC:0.148 ID,VINYL,BLK,105 DEG	96904	TYPE400SIZE7BLK
-27	407-3379-01			1		BRKT,FAN MTG:ALUMINUM *MOUNTING PARTS*	80009	407-3379-01
-28	211-0559-00			1		SCREW,MACHINE:6-32 X 0.375,FLH,100 DEG,STL *END MOUNTING PARTS*	TK0435	1593-300
-29	——— ———			2		CONN,RCPT,ELEC:MALE,3 CONTACT (SEE J100,J200 REPL) *MOUNTING PARTS*		
-30	211-0025-00			4		SCREW,MACHINE:4-40 X 0.375,FLH,100 DEG,STL *END MOUNTING PARTS*	TK0435	ORDER BY DESCR
-31	174-1496-00			2		CA ASSY,SP,ELEC:3,26 AWG,7.6 L	80009	174-1496-00
-32	——— ———			1		CA ASSY,SP,ELEC:10,28 AWG,12.5 L,RIBBON (SEE W942 REPL) *MOUNTING PARTS*		
-33	131-0890-00			2		CONN,HARDWARE: *END MOUNTING PARTS*	71468	D 20418-2
-34	——— ———			2		CA ASSY,SP,ELEC:26,28 AWG,3.0 L (SEE W9,W10 REPL) *MOUNTING PARTS*		
-35	131-0890-00			4		CONN,HARDWARE: *END MOUNTING PARTS*	71468	D 20418-2
-36	——— ———			1		CABLE ASSY,RF:75 OHM COAX,9.75 L,9-2 (SEE W3 REPL)		
-37	——— ———			1		CABLE ASSY,RF:75 OHM COAX,11.047 L (SEE W4 REPL)		
-38	——— ———			2		CABLE ASSY,RF:75 OHM COAX,4.797 L,9-3 (SEE W7 REPL)		
-39	——— ———			1		CIRCUIT BD ASSY:OUTPUT (SEE A3 REPL) *MOUNTING PARTS*		
-40	211-0244-00			8		SCR,ASSEM WSHR:4-40 X 0.312,PNH STL *END MOUNTING PARTS*	TK0858	211-0244-00
-41	426-2115-00			2		FRAME SECTION:SIDE *MOUNTING PARTS*	80009	426-2115-00
-42	213-0760-00			4		SCREW,TPG,TF:8-32 X 0.875,SPCL TAPTITE,FILH,STL *END MOUNTING PARTS*	72228	ORDER BY DESCR
-43	210-0863-00			1		WSHR,LOOP CLAMP:0.091 ID U/W 0.5 W CLP,STLCD PL	95987	C191
-44	343-0003-00			1		CLAMP,LOOP:0.25 ID,PLASTIC	06915	E4 CLEAR ROUND
-45	200-3611-00	B010100	B010410	1		COVER,BOTTOM:	80009	200-3611-00
	200-3611-01	B010411		1		COVER,BOTTOM:ALUMINUM	80009	200-3611-01
-46	211-0177-00			1		SCREW,MACHINE:4-40 X 0.312,PNH,STL	TK0435	ORDER BY DESCR
-47	351-0104-03			1		SL SECT,DWR EXT:12.625 L,W/O HARDWARE *MOUNTING PARTS*	06666	C-720-3
-48	212-0158-00			8		SCREW,MACHINE:8-32 X 0.375,PNH,STL *END MOUNTING PARTS*	83486	ORDER BY DESCR
-49	161-0066-00			1		CA ASSY,PWR:3,18 AWG,250V/10A,98 IN,STR,IEC320,RCPT X NEMA 5-15P,US,SAF CONT	80009	161-0066-00
-50	351-0751-00	B010100	B010165	1		TRK,SL OUT SECT:STATIONARY & INTERMEDIATE	80009	351-0751-00
	351-0751-01	B010166		1		TRK,SL OUT SECT:STATIONARY &INTERMEDIATE	80009	351-0751-01
	070-6943-01			1		MANUAL,TECH:TSG170D	80009	070-6943-00

FIG. 1 EXPLODED VIEW



TSG-170D

APPENDIX A
OPTION 1S SERIAL DIGITAL OUTPUT

INTRODUCTION

Option 1S adds Serial Digital Video Output to the TSG 170D. There are three bnc connectors added to the rear panel (see Fig. A-1), each of which provides serial NTSC composite video output in scrambled NRZI code. The serial signals conform to the following standards: SMPTE 259M Proposed Smpte Standard for Television — 10-Bit 4:2:2 Component and 4fsc NTSC Composite Digital Signals — Serial Digital Interface and Proposed SMPTE Recommended Practice for Television S17.363 Nov. 18, 1992.

Operation of the TSG 170D Option 1S is nearly identical to the standard instrument. SDI (Serial Digital Interface) Check Field signals[1] may replace the 10 IRE signal as selected by internal DIP switches. (See page A-2 for details.) Also there are two case when the DIGITAL VIDEO OUT and SERIAL DIGITAL VIDEO are not identical to the TEST SIGNAL. EDH could be added to the sync tip or the SDI Check Field signals could be output instead of the 10 IRE signal.

Internally, there is one circuit board added to the instrument (see Fig. A-4). The parallel video from the Output board (A3) is applied to the Serial Output board, and a retimed copy of the parallel data is then rerouted from the Serial Output board to the rear panel DIGITAL VIDEO OUT connector.

TRS-ID (Timing Reference Signal and Line ID) is added to the sync tip, along with ancillary data for the serial signal. The ancillary data includes Error Detection and Handling (EDH) flags and embedded audio[2].

A Digital Black[3] signal can be available from the Serial Digital Video Output based on the configuration of the instrument.

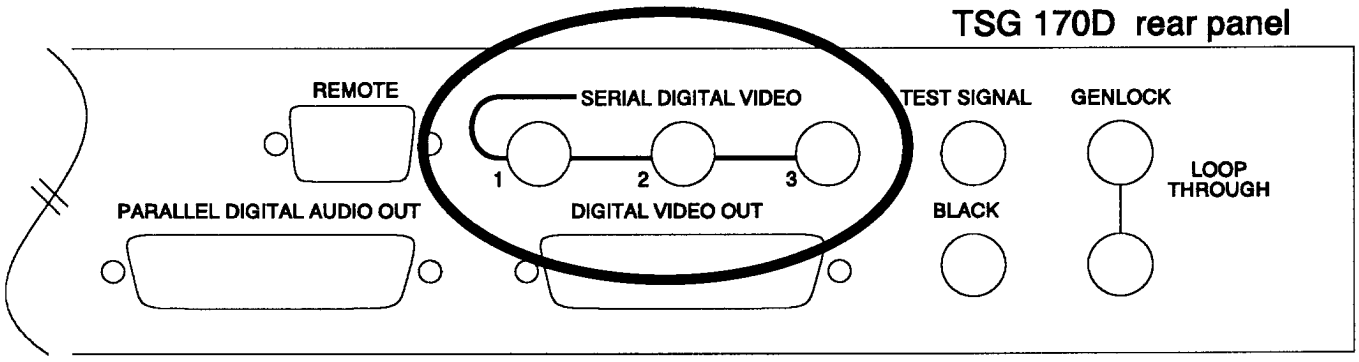


Fig. A-1. Location of the Serial Digital Outputs.

1 SDI signal are available from the from panel on instruments with s/n B010578 and above.
2 Embedded Audio is available on instruments with s/n B010689 and above.
3 Serial Digital Black is available on instrument with serial numbers B010689 and above.

Operating Selections

Tables A-1 and A-2 list the operating selections available for the Serial Digital Output board through switch and jumper settings.

Serial Digital Black[1]

Selected with wires W3, W4, and W23 attached to jumpers J3, J4, and J23 for test signal output or J103, J104, and J123 for Digital Black output. (See Fig. A-2.) These jumpers can be set in any combination. The digital black signal can be set for either 0 or 7.5 IRE setup level with S101-4 and S101-5.

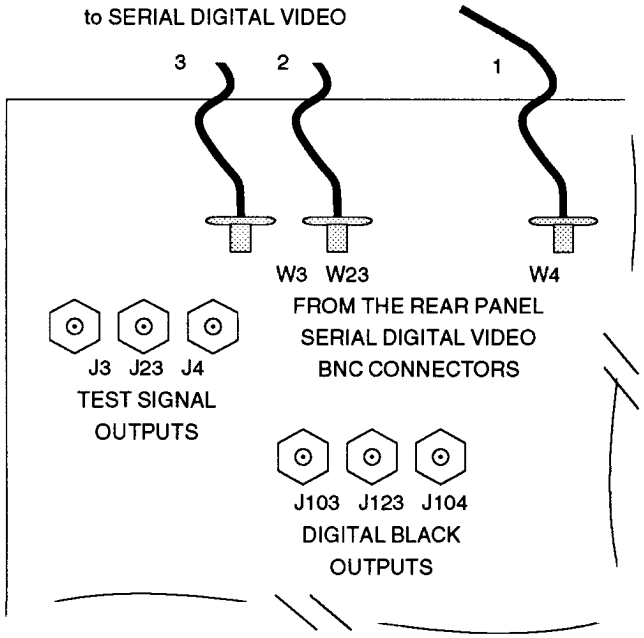


Fig. A-2. How to configure the serial outputs for either Test Signal or Black.

The following lists the factory set position of the Black jumpers:

SERIAL DIGITAL VIDEO OUTPUT #	3	W3	J3	TEST SIGNAL
	2	W23	J23	TEST SIGNAL
	1	W4	J104	BLACK

0-AP-CRC[2]

In each field, the last five words of the active picture portion of lines 262 and 525 are modified so that a CRC calculation for the active picture yields zero. This zero-value active picture cyclic redundancy check (0-AP-CRC) can be detected by a waveform monitor which supports serial digital video, such as the Tektronix 1730D. On detecting 0-AP-CRC the 1730D will treat the signal as if it were error free, even if the EDH information on line 9 is missing. This is particularly useful for testing digital equipment which does not pass the vertical and horizontal intervals including the line 9 EDH information.

The TSG 170D Option 1S, used in conjunction with a 1730D, may be used to test digital still stores, frame synchronizers, serializers, deserializers, and other equipment which passes the active picture area of the signal without modification. The 0-AP-CRC encoding is available at both the parallel and serial outputs of the TSG 170D Option 1S, allowing the testing of both parallel and serial digital equipment.

0-AP-CRC is **only** available from the Digital Black output jumpers, J103, J123, and J104 on Serial board with part numbers (671-2126-07).

0-AP-CRC insertion is controlled by S101-1 and S101-2, as shown in Table A-1. Both the 10-bit and the 8-bit modes of operation will insert the 0-AP-CRC into the parallel output, regardless of the setting of S1-4 (Parallel Enhanced/Test port mode).

SDI (Serial Digital Interface) Check Field Signals

There are three signals patterns which have been described by Sony, in their 1602a serial receiver data sheet, which stress the capabilities of the serial receivers using this IC. There are three SDI signal available from the TSG 170D: the complete SDI Check Field, or either of its components Cable Equalize or Phase Lock Loop. Which SDI Check Field signal replaces 10 IRE Flat Field is controlled by S1-7 and S1-8 for the Serial Test Signal

1 It is possible to have an instrument that does have embedded audio but not Serial Digital Black, if an older Serial board (field upgrade kit F1S s/n B010152 and below) was upgraded.

2 0-AP-CRC is only available through the Digital Black output (J103, J123, and J104). Therefore on older Serial boards that do have embedded audio but not Digital Black, 0-AP-CRC is **not** available.

output and S101-7 and S101-8 for the Digital Black output. See Tables A-1 and A-2. The default is the Check Field signal. These signals are only available in 10-bit format.

Error Insertion

Errors introduced through the use of S1-6 include the following:

TRS placement errors
Parity errors
Ancillary data checksum errors
Ancillary data placement errors
full field CRC errors
Active Picture errors
0-AP-CRC errors

Audio[1]

The TSG 170D will insert either a 1 KHz or 800 Hz tone as the embedded audio signal. Two channels can be turned on at a time, all four channel can be turned on, they can all be disabled, or they can have "quiet lines" which simply put out a zero amplitude audio signal on all four channels. The embedded audio signal is only available on the Digital Test Signals not on the Digital Black Signal.

The audio signal conforms to Proposed SMPTE Standard, Formatting AES/EBU Audio and Auxiliary Data into Digital Video Ancillary Data Space, Jan. 1992. For more details about the audio signal, see Audio Data beginning on page A-18.

1 Embedded Audio is only available on instrument with Serial board p/n 671-2126-07 or instruments with serial numbers B010689 and above.

Jumpers & Switches

Table A-1. Switch S1 Operating Selections.
OFF = 1 = OPEN
ON = 0 = CLOSED

SWITCH NAME		SWITCH POSITION			DESCRIPTION	FACTORY SETTING
1		2	1			
2	8 or 10 Bit Resolution & Error Insertion	open open closed closed	open closed open closed		Normal operation Disable TRS and ID insertion Insert Error 8-bit format on Serial and Parallel Digital Outputs.	2=open 1=open
3	Service Use Only	closed open			Normal Operation. Debug (Service use only).	closed
4		4	5	6		
5		open	open	open	Transmit all channels with 1 KHz tone	
		open	open	closed	Transmit all channels with 800 HZ tone	
		open	closed	open	Transmit only CH 3 and CH 4 with 1 KHz tone	
		open	closed	closed	Transmit only CH 3 and CH 4 with 800 Hz tone	
		closed	open	open	Transmit only CH 1 and CH 2 with 1 KHz tone	
		closed	open	closed	Transmit only CH 1 and CH 2 with 800 Hz tone	
		closed	closed	open	Transmit all channels with 0 Hz tone	
6	Audio Selections	closed	closed	closed	Audio Disabled.	6=open 5=open 4=open
7		7	8			
8	SDI Signal Selection	open open closed closed	open closed open closed		Normal operation Matrix of SDI Signals SDI Test Pattern A, Test equalizer SDI Test Pattern B, Test clock recovery (bit slip)	8=open 7=open
9	not used					
10	Emphasis	open closed			No emphasis. Emphasis on.	open

Table A-2. Switch S101 (Black) Operating Selections.

SWITCH NAME		SWITCH POSITION		DESCRIPTION	FACTORY SETTING
1	8 or 10 Bit Resolution & 0-AP-CRC	1	2		2=open 1=open
2		open open closed closed	open closed open closed	Normal operation 0-AP-CRC inserted on the serial output port Disable TRS and ID insertion 8-bit format on Serial and Parallel Digital Outputs and insert 0-AP-CRC inserted on the serial output port.	
3	Service Use Only	closed open		Normal Operation. Debug (Closed position required for power-up.)	closed
4	Black/Test Signal Selection	4	5		5=open 4=open
5		open open closed closed	open closed open closed	0 IRE Black Signal Normal Test Signal[1] 7.5 IRE Black Signal Normal Test Signal[1]	
6	EDH Enable	open closed		Normal operation EDH disabled	open
7	SDI Signal Selection	7	8		8=open 7=open
8		open open closed closed	open closed open closed	Normal operation Matrix of SDI Signals SDI Test Pattern A, Test equalizer SDI Test Pattern B, Test clock recovery (bit slip)	
9	not used				
10	not used				

[1]To get a Normal Test signal, S101-7 and S101-8 must also be set to Normal operation.

Specifications

The specifications for the serial digital output are shown in Table A-3. As with the specifications listed in Section 3, the performance requirements apply over an ambient temperature range of 0°C to +50°C after a warm-up time of 20 minutes is calibrated at +20°C to +30°C.

Table A-3. Specifications for the Serial Output.

CHARACTERISTIC	PERFORMANCE REQUIREMENT	SUPPLEMENTAL INFORMATION
Connector		BNC
Number of Outputs	3	Selectable from test signal or digital black outputs. Separate drivers for each signal.
Digital Format		$4F_{sc}$ Composite NTSC 8-bit or 10-bit data, Scrambled NRZI, per SMPTE 259M.
Bit Rate		143 Mb/s
Source Impedance		75 Ω
Return Loss		more than 15 dB from 5 MHz to 270 MHz.
Signal Amplitude	800 mV ± 10% into a 75 Ω load.	Set for +8%, -0%.
DC Offset	0 ± 0.5 Volts	
Rise and Fall Times	0.75 to 1.50 ns	20% to 80% amplitude points.
Jitter		less than 0.25 ns over a period of one line.
Receiver Termination		75Ω with return loss more than 15 dB, 5 to 270 MHz.
Video Signals	Per Table 3-3.	
Error Detection Ancillary Data		Active picture CRC (AP-CRC), Full field CRC (FF-CRC), On lines 9 & 272 (See Table A-4 for details.)

**Table A-4. EDH Codes for the TSG-170D.
Found on Lines 9 and 272.**

Data Word & Description (start with sample 795)	bits										#
	9	8	7	6	5	4	3	2	1	0	
Aux Data Flag	1	1	1	1	1	1	1	1	0	0	795
Data ID	$\overline{P}$[7]	P[7]	1	1	1	1	0	1	0	0	796
Block Number	$\overline{P}$	P	0	0	0	0	0	0	0	0	797
Data Count	$\overline{P}$	P	0	0	0	1	0	0	0	0	798
APL[1] data word 0	$\overline{P}$	P	AP-CRC[8] bits 5-0						0	0	799
APM[1] data word 1	$\overline{P}$	P	AP-CRC bits 11-6						0	0	800
APH[1] data word 2	$\overline{P}$	P	V[6]	0	AP-CRC bits 15-12				0	0	801
FFL[2] data word 3	$\overline{P}$	P	FF-CRC[9] bits 5-0						0	0	802
FFM[2] data word 4	$\overline{P}$	P	FF-CRC bits 11-6						0	0	803
FFH[2] data word 5	$\overline{P}$	P	V	0	FF-CRC bits 15-12				0	0	804
AN STAT[3] data word 6	$\overline{P}$	P	0	an ues (10)	an ida (11)	an idh (12)	an eda (13)	an edh (14)	0	0	805
AP STAT[4] data word 7	$\overline{P}$	P	0	ap ues	ap ida	ap idh	ap eda	ap edh	0	0	806
FF STAT[5] data word 8	$\overline{P}$	P	0	ff ues	ff ida	ff idh	ff eda	ff edh	0	0	807
reserved words 9-15	$\overline{P}$	P	x[15]	x	x	x	x	x	x	x	808 - 814
Checksum	$\overline{8}$	8	7	6	5	4	3	2	1	0	815

[1] APL, APM, & APH — Active Picture Low, Middle, and High. Includes samples 0-948.
[2] FFL, FFM, & FFH — Full Field Low, Middle, and High. Includes all samples in all lines except line 5-7.
[3] AN STAT — Status of Ancillary data. Error status flags are active high.
[4] AP STAT — Status of Active Picture data. All flags are active high.
[5] FF STAT — Status of Full Field data. All Flags are active high.
[6] V — Validity bit.
[7] P & $\overline{P}$ — Even Parity.
[8] AP-CRC — Active Picture Cyclic Redundancy Code. 16-bit code derived from all bits in the active picture.
[9] FF-CRC — Full Field Cyclic Redundancy Code. 16-bit code derived from all bits in the field, except lines 5-7.
[10] ues — Unknown Error Status. The signal has not been checked for errors.
[11] ida — Internal Device Error Detected Already. Non-transmission error detected previously in the signal.
[12] idh — Internal Device Error Detected Here. Non-transmission error detected in the current unit.
[13] eda — Error Detected Already. A transmission error was previously detected in the signal.
[14] edh — Error Detected Here. A transmission error is detected in this unit.
[15] x — don't care.

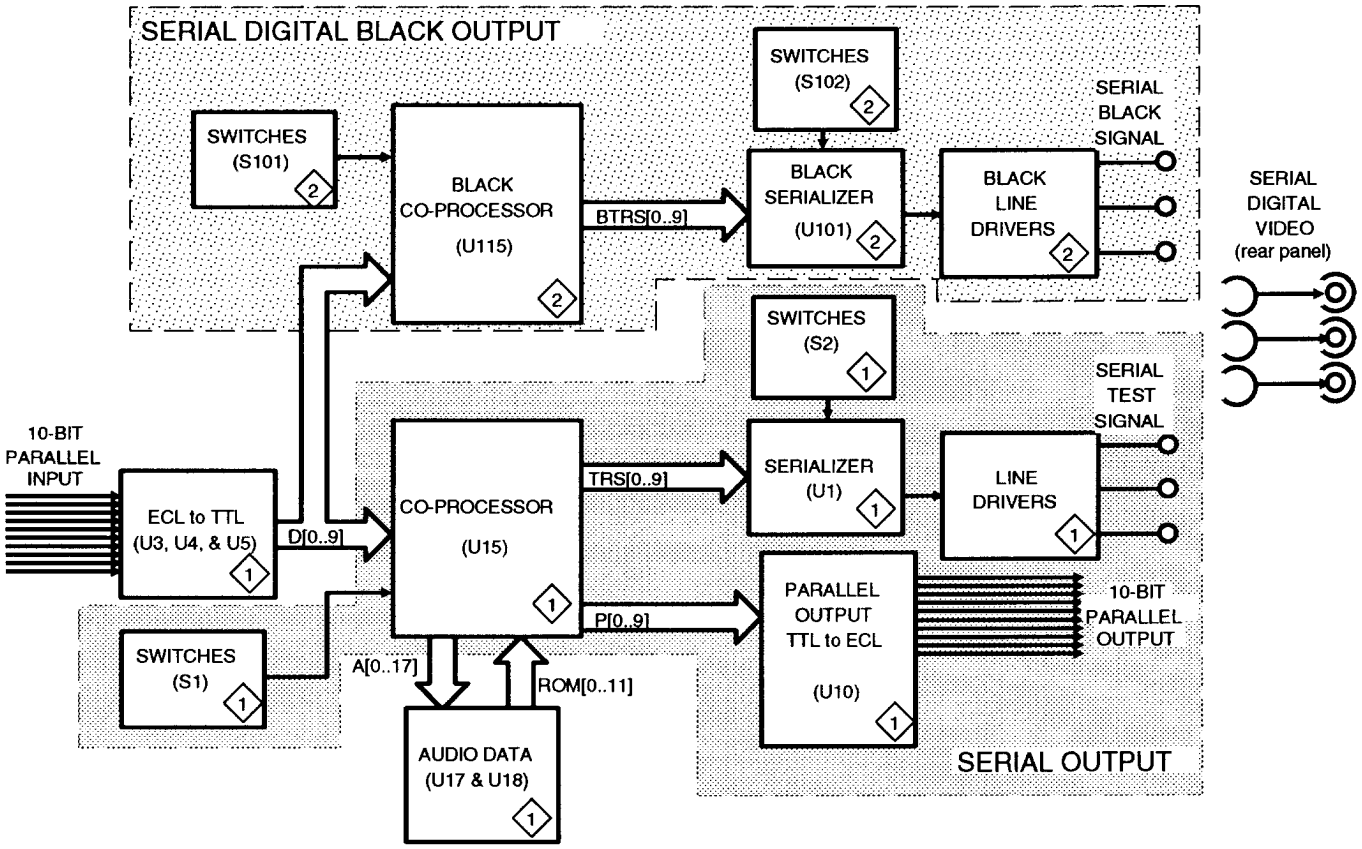


Fig. A-3.
Block Diagram of the TSG-170D Serial Output Board.

THEORY OF OPERATION

Fig. A-3 shows a basic block diagram of the TSG 170D's Serial Output board.

The Parallel Output (from J9 on the Output board) is routed to J6 connector on the Serial Output board. U3, U4, and U5 convert the ECL signals to TTL levels and apply them to Co-processors U15 (for the Serial Output) and the Black Co-processor U115.

Serial Output

U15 handles the TTL parallel signals according to its program instructions and the S1 switch selections.

SDI Signals are selected by S1. If the 10 IRE test signal is selected from the front panel, the co-processor replaces that signal with the selected SDI signal.

Audio information comes from the Audio Data PROMs, U17 and U18, and is incorporated into the ancillary data by the co-processor. For more details about the audio signal, see "Audio Data" beginning on page A-18.

The Co-processor calculates the EDH status, and sets the appropriate EDH flags. It also inserts the TRS-ID and audio data. The Co-processor then outputs two sets of the parallel data: one for the parallel output path (P[0..9]) and the other for the serial output path (TRS[0..9]).

The data for the parallel output path is applied to TTL-ECL converter U10, which clocks it through to the rear panel DIGITAL VIDEO OUT connector.

The data for the serial output path is applied to the serializer, U1. The serializer provides digital composite 8-bit or 10-bit serial data in scrambled NRZI code, at a 143 Mb/s bit rate. The serial data stream is output at U1-3 and U1-4.

The serial data is applied to a differential amplifier, Q7 and Q11, which drives emitter followers Q9, Q2, Q8, and Q4. The differential amplifier and emitter followers are arranged to provide three approximately 1X gain Line Drivers. The current for Q7 and Q11 is supplied by Q10 and U16, and is set by R39. The output of each of these drivers meets the specification in proposed SMPTE standard for serial digital video.

Serial Digital Black Output

The Black Co-processor, U115, finds the data for the active picture on the D[0..9] signal and replaces it with a black level value of either $0F0_h$ (0 IRE blanking level) or $11A_h$ (7.5 IRE blanking level). The TRS-ID and the EDH are calculated and inserted in the signal. The signal is then applied to the Black Serializer, U101. The serializer provides either 8-bit or 10-bit serial black in NRZI code at a 143 MHz rate. The serial data stream is output at pins 3 and 4.

The serial data is applied to a differential amplifier, Q107 and Q111, which drives emitter followers Q109, Q102, Q108, and Q104. The differential amplifier and emitter followers are arranged to provide three approximately 1X gain Line Drivers. The current for Q107 and Q111 is supplied by Q110 and U116, and is set by R139. The output of each of these drivers meets the specification in proposed SMPTE standard for serial digital video.

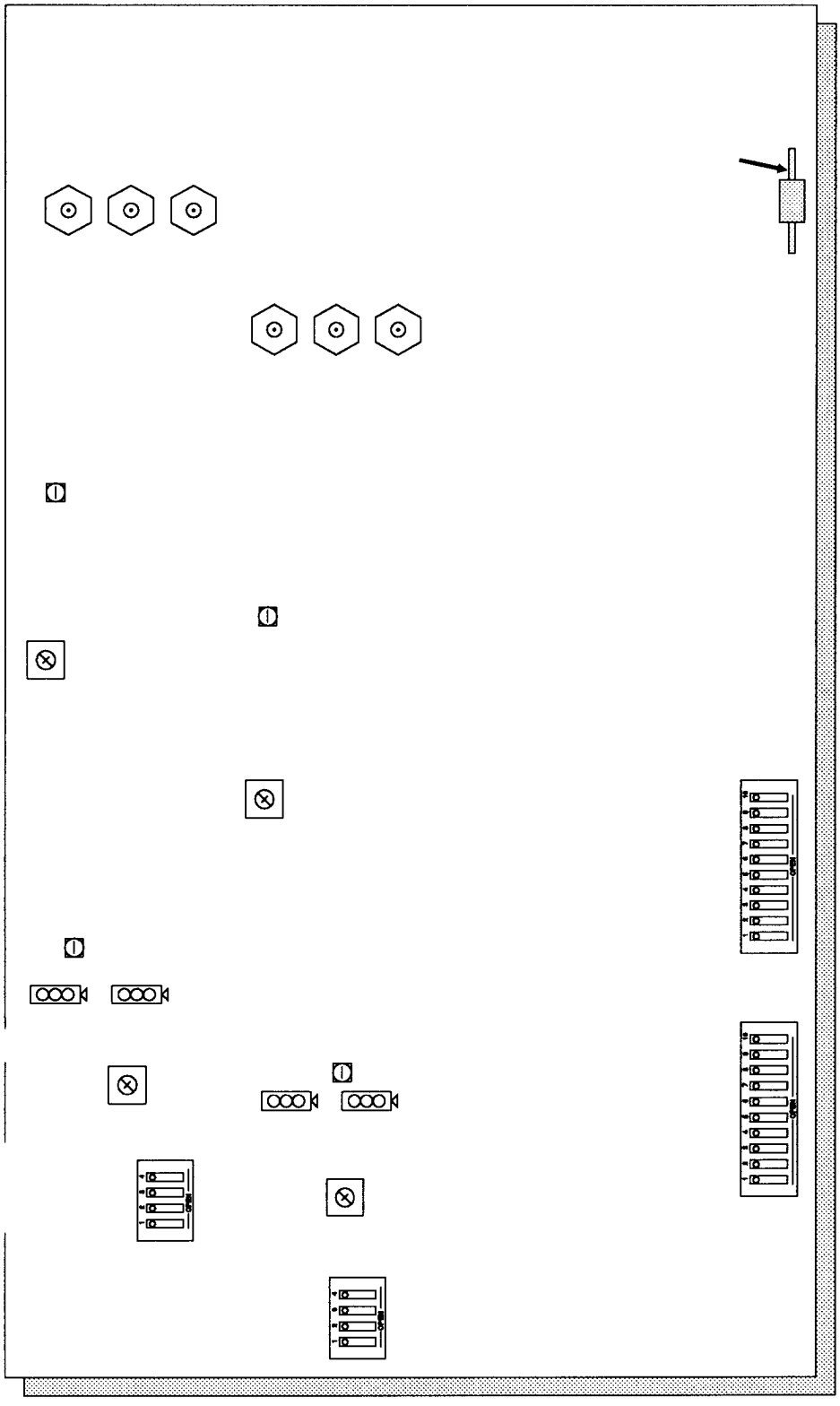


Fig. A-4. Location of User-adjustable jumpers and switches on the Serial Output board.

PERFORMANCE CHECK & ADJUSTMENT PROCEDURE

REQUIRED TEST EQUIPMENT

There is three pieces of equipment added to the list of required equipment for the Serial Digital option.

① 1730D or equivalent waveform monitor. The waveform monitor must be able to:

- display the serial digital stream (for amplitude and rise and fall time checks),
- check the EDH data (for the accuracy and placement of the EDH data),
- check the data stream using 0-AP-CRC, and
- check for transmission of embedded audio signal.

② A serial digital demultiplexer, SONY D2-AVD. The demux must be able to:

- check for the presence of embedded audio and
- have a separate digital audio output.

③ A digital audio tape deck (DAT) recorder. The DAT recorder must be able to:

- accept ASE\EBU digital audio signal,
- have a output for headphones or speakers, and
- optionally had an output for an oscilloscope connection.

OPTIONAL: headphones to listen to the quality of the audio tone.

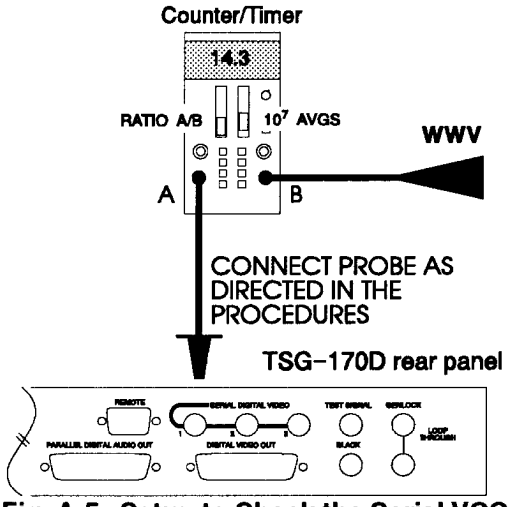


Fig. A-5. Setup to Check the Serial VCO Frequency.

PERFORMANCE CHECK PROCEDURES

VCO Frequency

A-1. Check VCO Frequency of the Test Signal

a. Connect the equipment as shown in Fig. A-5. Connect the probe to TP1 on the Serial Output board.

b. Make sure that S2-2 is open.

c. Set the DC503 (Counter/Timer) AVGS to 10^7.

d. **CHECK** — that the frequency at TP1 is 14.3 ± 0.1 MHz.

A-2. Check VCO Frequency of the Black Signal

a. Connect the equipment as shown in Fig. A-5. Connect the probe to TP101 on the Serial Output board.

b. Make sure that S102-2 is open.

c. Set the DC503 (Counter/Timer) AVGS to 10^7.

d. **CHECK** — that the frequency at TP1 is 14.3 ± 0.1 MHz.

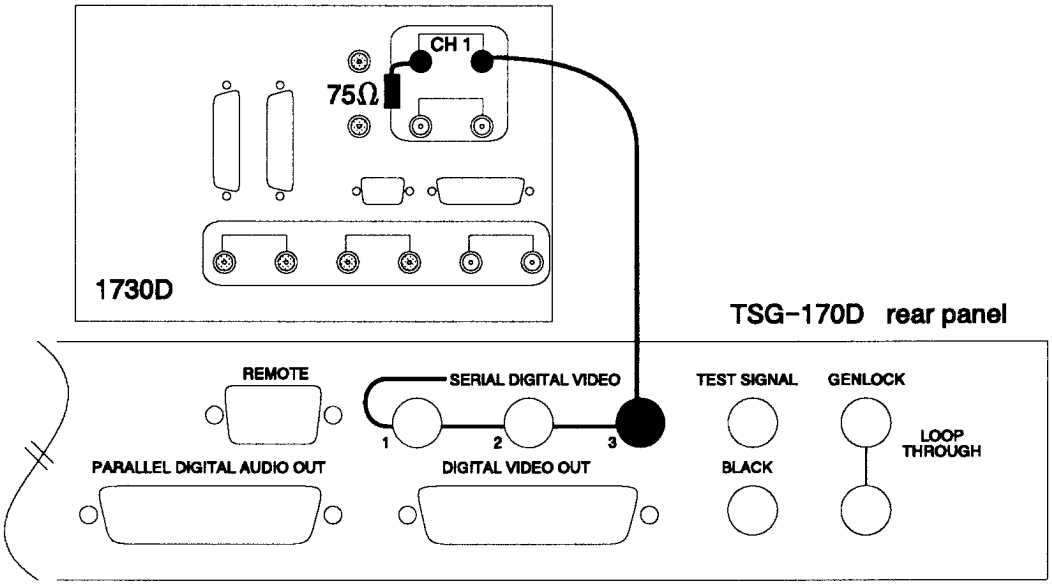


Fig. A-6.
Setup to check the Serial Digital Output:
Amplitude, Rise & Fall Times, Overshoot & Undershoot, and DC Level.

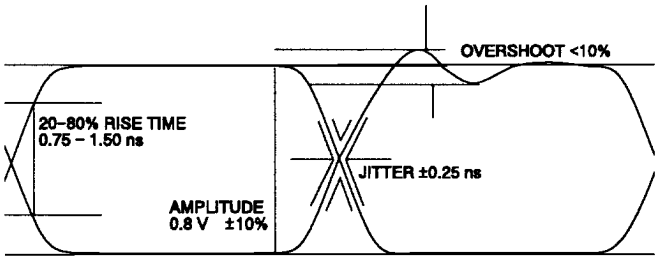


Fig. A-7. Eye pattern specs for the serial signal.

Test Signal Checks

NOTE

Before performing any of these checks assure that **SERIAL DIGITAL VIDEO 3** *is set for Test Signal output. It must be connected to either J2, J23, or J4 on the Serial Output board.*

A-3. Check the Amplitude
800 mV_{p-p} ± 10%

a. Connect the equipment as shown in Fig. A-6.

b. Select any Color Bar signal from the TSG 170D front panel.

c. Verify the calibration of the waveform monitor with the internal calibrator. The calibrator's amplitude should be 140 IRE (1 V).

NOTE

When the 1730D waveform monitor is correctly calibrated, 10 IRE = 100 mV in the eye pattern display.

d. Set the waveform monitor to display the eye pattern of the serial input CH 1. See Fig A-7.

e. **CHECK** — that the eye pattern amplitude is 800 mV_{p-p} ± 10%. (Ignore overshoot.)

A-4. Check the Rise and Fall Times between 0.75 to 1.50 ns with ≤ 0.5 ns difference

a. Connect the equipment as shown in Fig. A-6.

b. Select any Color Bar signal from the TSG 170D front panel.

c. Set the waveform monitor to display the eye pattern of serial input CH 1.

d. Use the variable gain control to adjust the eye pattern to exactly 10 major divisions (100 IRE on the graticule).

e. Position bottom of the eye pattern on the -20 IRE graticule.

f. Adjust the horizontal position so that the rising edge of one of the eye patterns is on a horizontal graticule mark of the 0 IRE graticule.

g. Adjust the vertical position of the display (being careful not to move the horizontal position) until the top of the eye pattern is on the 20 IRE graticule.

h. Note the position of the rising edge on the 0 IRE graticule.

i. The difference in position of the rising edge is the rise time.

NOTE

In the eye pattern display, the 1730D horizontal calibration is 2 ns/major div (0.4 ns/minor div).

j. **CHECK** — that the rise time is between 0.75 and 1.5 ns. Note the value of the rise time for later use.

k. Adjust the horizontal position of the eye pattern until a falling edge is on a major division of the 0 IRE graticule.

l. Adjust the vertical position (being careful not to change the horizontal position) until the bottom of the eye pattern is on the -20 IRE graticule.

m. Note the value of the falling edge on the 0 IRE graticule.

n. The difference in position between the top and bottom of the falling edge is the fall time.

o. **CHECK** — that the fall time is between 0.75 and 1.5 ns. Note the value of the fall time.

p. **CHECK** — that the difference between the rise and fall times is ≤ 0.5 ns.

A-5. Check Jitter
< 25 ns over the period of one line

a. Connect the equipment as shown in Fig. A-6.

b. Select any Color Bar signal from the TSG 170D front panel.

c. Display serial CH 1 using the eye pattern.

d. Use the variable vertical position control to place the center of the eye (where the rising and falling edges cross) on the 0 IRE graticule.

e. Turn on the 5X horizontal magnification.

f. Adjust the horizontal position so that the width of the crossing point can be measured easily.

g. **CHECK** — that the width of the crossing point is less than 250 ps. (With the 5X horizontal magnification turned on, 1 major div = 400 ps and 1 minor div = 80 ps.)

A-6. Check Overshoot and Undershoot
< 10%

a. Connect the equipment as shown in Fig. A-6.

b. Select any Color Bar signal from the TSG 170D front panel.

c. Display serial CH 1's eye pattern.

d. Use the variable vertical gain to normalize the signal to 10 major divisions.

e. Use the vertical position control to place the top of the signal on the 0 IRE graticule.

f. **CHECK** — that the overshoot of the signal does not extend above the 10 IRE graticule (10%) and that the undershoot is not below the -10 IRE graticule.

g. Use the vertical position control to place the bottom of the eye pattern on the 0 IRE graticule.

h. **CHECK** — that the overshoot of the signal does not extend below the -10 IRE graticule and that the undershoot is not above the 10 IRE graticule.

A-7. Check TRS-ID Insertion

a. Connect the equipment as shown in Fig. A-6.

b. Select any Color Bar signal from the TSG 170D front panel.

c. Set the waveform monitor to display serial CH 1 in the eye pattern display.

d. Make sure that switches S1-1 and S1-2, on the TSG 170D's Serial Output board, are set to "open" so EDH and TRS ID are inserted.

e. Press the READOUT button on the front panel of the 1730D.

f. **CHECK** — that there are no errors and that both the active picture (AP) and Full Field (FF) EDHs are valid. Allow this check to run for a few minutes to assure that there are no errors.

Black Signal Checks

NOTE

Before performing any of these checks assure that **SERIAL DIGITAL VIDEO 3** *is set for Black Signal output. It must be connected to either J102, J123, or J104 on the Serial Output board.*

A-8. Check the Amplitude
800 mV_{p-p} ± 10%

a. Connect the equipment as shown in Fig. A-6.

b. Select any Color Bar signal from the TSG 170D front panel.

c. Verify the calibration of the waveform monitor with the internal calibrator. The calibrator's amplitude should be 140 IRE (1 V).

NOTE

When the 1730D waveform monitor is correctly calibrated, 10 IRE = 100 mV in the eye pattern display.

d. Set the waveform monitor to display the eye pattern of the serial input CH 1. See Fig A-7.

e. **CHECK** — that the eye pattern amplitude is 800 mV_{p-p} ± 10%. (Ignore overshoot.)

A-9. Check the Rise and Fall Times between 0.75 to 1.50 ns with ≤ 0.5 ns difference

a. Connect the equipment as shown in Fig. A-6.

b. Select any Color Bar signal from the TSG 170D front panel.

c. Set the waveform monitor to display the eye pattern of serial input CH 1.

d. Use the variable gain control to adjust the eye pattern to exactly 10 major divisions (100 IRE on the graticule.)

e. Position bottom of the eye pattern on the -20 IRE graticule.

f. Adjust the horizontal position so that the rising edge of one of the eye patterns is on a horizontal graticule mark of the 0 IRE graticule.

g. Adjust the vertical position of the display (being careful not to move the horizontal position) until the top of the eye pattern is on the 20 IRE graticule.

h. The difference in position between the top and bottom of the falling edge is the fall time.

i. Note the position of the rising edge on the 0 IRE graticule.

j. The difference in position of the rising edge is the rise time.

NOTE

In the eye pattern display, the 1730D horizontal calibration is 2 ns/major div (0.4 ns/minor div).

k. **CHECK** — that the rise time is between 0.75 and 1.5 ns. Note the value of the rise time for later use.

l. Adjust the horizontal position of the eye pattern until a falling edge is on a major division of the 0 IRE graticule.

m. Adjust the vertical position (being careful not to change the horizontal position) until the bottom of the eye pattern is on the -20 IRE graticule.

n. Note the value of the falling edge on the 0 IRE graticule.

o. **CHECK** — that the fall time is between 0.75 and 1.5 ns. Note the value of the fall time.

p. **CHECK** — that the difference between the rise and fall times is ≤ 0.5 ns.

A-10. Check Jitter
< 25 ns over the period of one line

a. Connect the equipment as shown in Fig. A-6.

b. Select any Color Bar signal from the TSG 170D front panel.

c. Display serial CH 1 using the eye pattern.

d. Use the variable vertical position control to place the center of the eye (where the rising and falling edges cross) on the 0 IRE graticule.

e. Turn on the 5X horizontal magnification.

f. Adjust the horizontal position so that the width of the crossing point can be measured easily.

g. **CHECK** — that the width of the crossing point is less than 250 ps. (With the 5X horizontal magnification turned on, 1 major div = 400 ps and 1 minor div = 80 ps.)

A-11. Check Overshoot and Undershoot < 10%

a. Connect the equipment as shown in Fig. A-6.

b. Select any Color Bar signal from the TSG 170D front panel.

c. Display serial CH 1's eye pattern.

d. Use the variable vertical gain to normalize the signal to 10 major divisions.

e. Use the vertical position control to place the top of the signal on the 0 IRE graticule.

f. **CHECK** — that the overshoot of the signal does not extend beyond the 10 IRE graticule (10%) and that the undershoot does not go below the -10 IRE graticule.

g. Use the vertical position control to place the bottom of the eye pattern on the 0 IRE graticule.

h. **CHECK** — that the overshoot of the signal does not extend below the -10 IRE graticule and that the undershoot does not extend above the 10 IRE graticule.

A-12. Check TRS-ID Insertion

a. Connect the equipment as shown in Fig. A-6.

b. Select any Color Bar signal from the TSG 170D front panel.

c. Set the waveform monitor to display serial CH 1 in the eye pattern display.

d. Make sure that switches S101-1 and S101-2, on the TSG 170D's Serial Output board, are set to "open" so EDH and TRS ID are inserted.

e. Press the READOUT button on the front panel of the 1730D.

f. **CHECK** — that there are no errors and that both the active picture (AP) and Full Field (FF) EDHs are valid. Allow this check to run for a few minutes to check for errors.

A-13. Check 0-AP-CRC Insertion

a. Connect the equipment as shown in Fig. A-6.

b. Select any Color Bar signal from the TSG 170D front panel.

c. Display serial CH 1's eye pattern on the waveform monitor.

d. Set Switch S101-1 on the TSG 170D Serial Output board open and S101-2 closed. (Enable 0-AP-CRC.)

e. Press the READOUT button on the front panel of the 1730D to get to the EDH readout screen.

f. **CHECK** — that the "ZERO VALUE APCRC" message is displayed on the screen.

g. Set switch S101-1 and S101-2 on the TSG 170D Serial Output board open. (Normal EDH.)

h. **CHECK** — that the "ZERO VALUE APCRC" message is no longer displayed on the screen.

Embedded Audio Checks

NOTE

Before performing any of these checks assure that **SERIAL DIGITAL VIDEO 3** *is set for Test Signal output. It must be connected to either J2, J23, or J4 on the Serial Output board.*

A-14. Check for Presence of Embedded Audio

a. Connect the equipment as shown in Fig. A-6.

b. Select any Color Bar signal from the TSG 170D front panel.

c. Display serial CH 1's eye pattern on the waveform monitor.

d. Set switches S1-4, S1-5, and S1-6 on the TSG 170D Serial Output board to open. (Enable 1 KHz audio on all four channels.)

e. Press the READOUT button on the front panel of the 1730D to get to the EDH readout screen.

f. **CHECK** — that the "AUDIO 1 2 3 4" message is displayed on the screen, indicating that all four channels have valid audio data. Also check this display for any error messages.

g. Set switches S1-4, S1-5, and S1-6 on the TSG 170D Serial Output board to closed. (Disable audio.)

h. Press the READOUT button on the front panel of the 1730D to get to the EDH readout screen.

i. **CHECK** — that the AUDIO message is not displayed indicating that there is not a valid audio input. Also check this display for any error messages.

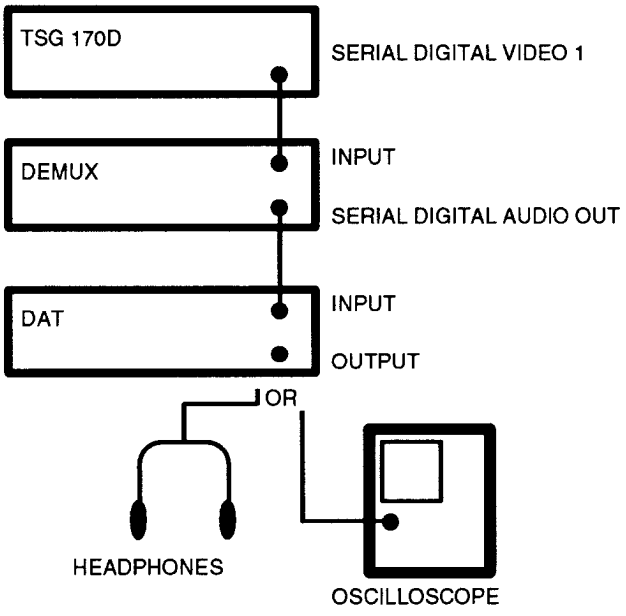


Fig. A-8. How to connect the test equipment to check the content of the embedded audio.

A-15. Check The Accuracy of the Embedded Audio

a. Connect the equipment as shown in Fig. A-8.

b. Ensure that DIGITAL AUDIO is selected on the DAT.

c. Set S1-4, S1-5, and S1-6 on the Serial board to "open". (Transmit 1 KHz on all channels.)

d. **CHECK**—that the LEDs on the DEMUX board are lit as given in the following table:

LED	RESULTS
PLL Unlock	OFF (NOT red)
VIDEO EXIST	GREEN
AUDIO EXIST (A1- A4)	All GREEN
AUDIO ERROR (A1 - A4)	All OFF (NOT red)

e. Select REC on the DAT. Ensure that the DAT is in PAUSE and the "INPUT" Digital LED in a solid RED.

f. **CHECK** — for a pure 1KHz audio tone using either headphones or an oscilloscope.

g. Change S1-4 on the TSG 170D Serial board to "closed". (Transmit 800 Hz on all channels.)

h. **CHECK** — that the tone changes to 800 Hz.

i. Change S1-5 on the TSG 170D Serial board to "closed". (Transmit 800 Hz on CH 3 and Ch 4 only.)

j. **CHECK** — that AUDIO EXIST LEDs A1 and A2 on the DEMUX board turn off and the Audio FREQUENCY is no longer locked (no frequency on CH 1 and CH 2).

k. Change S1-6 to "closed" and S1-4 to "open". (Transmit 800 Hz on CH 1 and CH 2.)

l. **CHECK** — that AUDIO EXIST LEDs A3 and A4 turn off; LEDs A1 and A2 turn back on; and the Audio FREQUENCY in no longer locked (no frequency on CH 3 and CH 4).

m. Change S1-4 to "closed". (S1-4, 5, and 6 are all closed.) (Audio disabled.)

n. **CHECK** — that AUDIO EXIST LEDs A1-A4 are all off (DEMUX) and the audio frequency is no longer locked.

ADJUSTMENT PROCEDURE

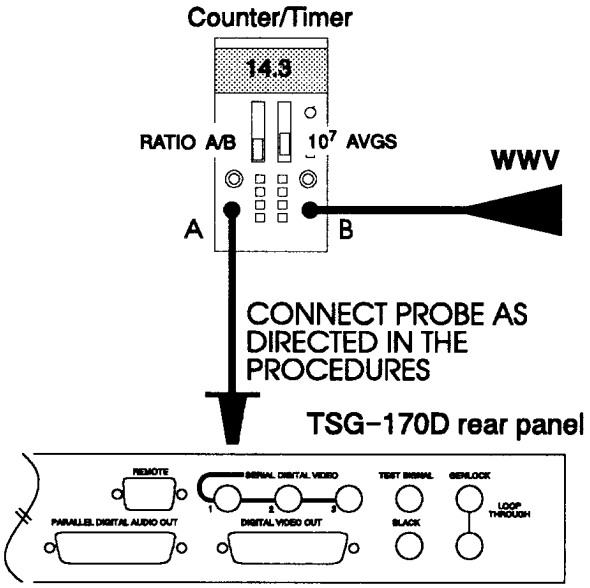


Fig. A-9. Setup to Adjust the Serial VCO Frequency.

A-1. Adjust Test Signal VCO Frequency

a. Connect the equipment as shown in Fig. A-9, connecting the A probe to TP1.

b. Set the DC 503 (Counter/Timer) function selection to Ratio A/B and the AVGS to 10^7.

c. Set S2-2 on the Serial Output board closed.

d. **ADJUST** — R22 on the Serial Output board for a frequency of approximately 14.3 MHz.

e. Set S2-2 open and set the Counter/Timer's AVGS to 10^7.

f. **CHECK** — that the frequency at TP1 is 14.3 MHz ± 0.1 MHz.

g. Repeat the above procedures until the frequency is within spec.

A-2. Adjust Black Signal VCO Frequency

a. Connect the equipment as shown in Fig. A-9, connecting the A probe to TP101.

b. Set the DC 503 (Counter/Timer) function selection to Ratio A/B and the AVGS to 10^7.

c. Set S102-2 on the Serial Output board closed.

d. **ADJUST** — R122 on the Serial Output board for a frequency of approximately 14.3 MHz.

e. Set S102-2 open and set the Counter/Timer's AVGS to 10^7.

f. **CHECK** — that the frequency at TP101 is 14.3 MHz ± 0.1 MHz.

g. Repeat the above procedures until the frequency is within spec.

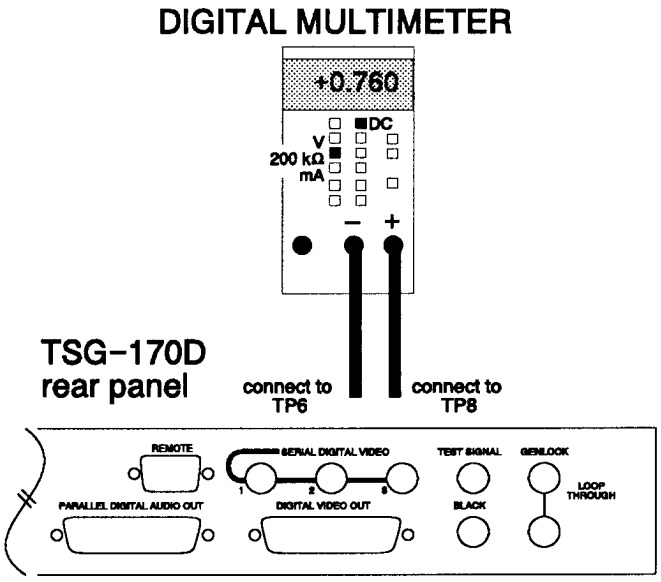


Fig. A-10. Setup to adjust the output amplitude.

A-3. Adjust Digital Video Output Amplitude

a. Connect the "—" probe from the digital multimeter to L4 (-12VA as shown in Fig. A-4) and the + probe to TP8 as shown in Fig. A-10.

b. **ADJUST** — R39 for 1.4 V between TP8 and -12VA.

c. Remove the probes from the TSG 170D.

d. Connect the equipment as shown in Fig. A-6 on page A-12.

e. Make sure that J3 (SERIAL DIGITAL OUT 3) is connected to W3, W4, or W23.

f. Select any Color Bar signal from the TSG 170D front panel.

g. Verify the calibration of the waveform monitor with the internal calibrator. The calibrator's amplitude should be 140 IRE (1 V).

NOTE

When the 1730D waveform monitor is correctly calibrated, 10 IRE = 100 mV in the eye pattern display.

h. Set the waveform monitor to display the eye pattern of the serial input CH 1. See Fig A-7.

i. **CHECK** — that the eye pattern amplitude is 800 mV_{p-p} ± 10%. (Ignore overshoot.)

j. If the amplitude does not meet spec, go back to step a and repeat this procedure until it does meet spec.

A-4. Adjust Digital Black Output Amplitude

a. Connect the "—" probe from the digital multimeter to L4 (-12VA as shown in Fig. A-4) and the + probe to TP108 as shown in Fig. A-10.

b. **ADJUST** — R139 for 1.4 V between TP108 and -12VA.

c. Remove the probes from the TSG 170D.

d. Connect the equipment as shown in Fig. A-6. on page A-12.

e. Make sure that J3 (SERIAL DIGITAL OUT 3) is connected to W103, W104, or W123.

f. Select any Color Bar signal from the TSG 170D front panel.

g. Verify the calibration of the waveform monitor with the internal calibrator. The calibrator's amplitude should be 140 IRE (1 V).

NOTE

When the 1730D waveform monitor is correctly calibrated, 10 IRE = 100 mV in the eye pattern display.

h. Set the waveform monitor to display the eye pattern of the serial input CH 1. See Fig A-7.

i. **CHECK** — that the eye pattern amplitude is 800 mV_{p-p} ± 10%. (Ignore overshoot.)

j. If the amplitude does not meet spec, go back to step a and repeat this procedure until it does meet spec.

This ends the calibration portion of the Adjustment Procedure. Now do a complete Performance Check to re-verify all specifications.

Audio Data

The audio data is put into the serial data stream according to SMPTE standard: 10-Bit 4:2:2 Component and $4F_{SC}$ NTSC Composite Digital Signals — Serial Digital Interface, SMPTE 259M. The audio data stream is found in the ancillary data space during horizontal sync.

There is a choice of several different types of audio for the TSG 170D to output: either 800 or 1000 Hz and on all channels or one channel pair at a time. The embedded audio can also be disabled. The selection is made by S1-4, S1-5, and S1-6 on the Serial Output board. (See Table A-1 on page A-3 for the available options and how the switches are set to choose these options.)

The basic structure of the audio data is given in Table A-5. Table A-5 illustrates one sample (subframe) of audio data (three words: X, X+1, and X+2). The sample words need to stay together and cannot be broken across ancillary data packets. There are 3 or 4 samples/channel in each ancillary data packet of the TSG 170D.

The structure of the transmitted audio signal is given in Table A-6. Table A-6 includes all control information that needs to be transmitted with the audio in each ancillary data stream.

The minimum buffer size required for the receiver is well under the standard requirement of 64 samples/channel.

NOTE

Because of the evolving development of serial digital video interfaces with embedded audio, some generations of video equipment may be unable to recover the embedded audio data provided by the TSG170D.

If an audio sample buffer size selection is available, set the audio buffer size in the receiving equipment to at least 48 samples per audio channel.

Details of the buffer size and sample distribution specific to the TSG 170D are given in the section titled: *Sample Distribution of Audio Data on the TSG 170D's Serial Signal*, beginning on page A-21.

Table A-5. Distribution of AES/EBU Audio Data. One Sample (Subframe) Unit.

bit	1st word x	2nd word x+1	3rd word x+2
b9	$\overline{b8}$	$\overline{b8}$	$\overline{b8}$
b8	d5	d14	P
b7	d4	d13	C
b6	d3	d12	U
b5	d2	d11	V
b4	d1	d10	d19
b3	d0	d9	d18
b2	CH msb	d8	d17
b1	CH lsb	d7	d16
b0	Z	d6	d15

CH = audio channel number, in binary (1, 2, 3, or 4).
Z = Set to one when the subframe coincides with the beginning of a new channel status block, otherwise zero.
P = Parity
C = Audio channel status bit.
U = User bit.
V = Sample validity bit.
d[0..19] = two's compliment linearly represented audio data.

Table A-6. Audio Packet Structure.
General Audio Format.

Data Word & Description (start with sample 972)	bits										sample #
	9	8	7	6	5	4	3	2	1	0	
Aux Data Flag[1]	1	1	1	1	1	1	1	1	0	0	795
Data ID[2]	1	0	1	1	1	1	1	1	1	1	796
Block Number	$\overline{P}$	P	0	0	0	0	0	0	0	0	797
Data Count[3]	$\overline{P}$	P	x	x	x	x	x	x	x	x	798
AUD A[4] x	$\overline{d5}$	d5	d4	d3	d2	d1	d0	CH (msb)	CH (lsb)	Z	799
AUD A x+1	$\overline{d14}$	d14	d13	d12	d11	d10	d9	d8	d7	d6	800
AUD A x+2	$\overline{P}$	P	C	U	V	d19	d18	d17	d16	d15	801
AUD B x	$\overline{d5}$	d5	d4	d3	d2	d1	d0	CH (msb)	CH (lsb)	Z	802
AUD B x+1	$\overline{d14}$	d14	d13	d12	d11	d10	d9	d8	d7	d6	803
AUD B x+2	$\overline{P}$	P	C	U	V	d19	d18	d17	d16	d15	804
AUD A x AUD A x+1 AUD A x+2 AUD B x AUD B x+1 AUD B x+2	Audio Data sequence repeats until finished										805 to 848 (max)
Checksum	$\overline{8}$	8	7	6	5	4	3	2	1	0	849

1. Audio Data Flag — is defined as $3FC_h$ indicates the start of a data packet within the ancillary data space.
2. Data ID — Indicates the type of data within the ancillary data packet. It is defined for audio as $2FF_h$ for the main group of four channels, $1FD_h$ for the secondary group. (The second group is not used in the TSG-170D.)
3. Data Count — Indicates the length of the audio data packet.
4. AUD A & B — See Table A-5 on page A-19 for audio signal details.

Sample Distribution of Audio Data on the TSG 170D's Serial Signal

Field 1: Line Number	Transmitted Samples/CH	Field 1: Line Number	Transmitted Samples/CH	Field 1: Line Number	Transmitted Samples/CH
1- 3	0 samples	83 - 87	16 samples	173 - 177	16 samples
4 - 6	12 samples	88 - 92	16 samples	178 - 182	16 samples
7 - 11	0 samples	93 - 97	16 samples	183 - 187	16 samples
12	4 samples	98 - 102	15 samples	188 - 192	16 samples
13 -17	16 samples	103 - 107	15 samples	193 - 197	16 samples
18 - 22	16 samples	108 - 112	15 samples	198 - 202	16 samples
23 - 27	16 samples	113 - 117	15 samples	203 - 207	16 samples
28 - 32	16 samples	118 - 122	15 samples	208 - 212	16 samples
33 - 37	16 samples	123 - 127	15 samples	213 - 217	16 samples
38 - 42	16 samples	128 - 132	15 samples	218 - 222	16 samples
43 - 47	16 samples	133 - 137	15 samples	223 - 227	15 samples
48 - 52	16 samples	138 - 142	16 samples	228 - 232	15 samples
53 - 57	16 samples	143 - 147	16 samples	233 - 237	15 samples
58 - 62	16 samples	148 - 152	16 samples	238 - 242	15 samples
63 - 67	16 samples	153 - 157	16 samples	243 - 247	15 samples
68 - 72	16 samples	158 - 162	16 samples	248 - 252	15 samples
73 - 77	16 samples	163 - 167	16 samples	253 - 257	15 samples
78 - 82	16 samples	168 - 172	16 samples	258 - 262	16 samples
				263	0 samples

TSG-170D — Option 1S
Sample Distribution of Audio Data

Field 1: Line Number	Transmitted Samples/CH	Field 1: Line Number	Transmitted Samples/CH	Field 1: Line Number	Transmitted Samples/CH
264 - 266	0 samples	346 - 350	16 samples	436 - 440	16 samples
267 - 269	12 samples	351 - 355	16 samples	441 - 445	16 samples
270 - 274	0 samples	356 - 360	16 samples	446 - 450	16 samples
275	4 samples	361 - 365	15 samples	451 - 455	16 samples
276 - 280	16 samples	366 - 370	15 samples	456 - 460	16 samples
281 - 285	16 samples	371 - 375	15 samples	461 - 465	16 samples
286 - 290	16 samples	376 - 380	15 samples	466 - 470	16 samples
291 - 295	16 samples	381 - 385	15 samples	471 - 475	16 samples
296 - 300	16 samples	386 - 390	15 samples	476 - 480	16 samples
301 - 305	16 samples	391 - 395	15 samples	481 - 485	16 samples
306 - 310	16 samples	396 - 400	15 samples	486 - 490	15 samples
311 - 315	16 samples	401 - 405	16 samples	491 - 495	15 samples
316 - 320	16 samples	406 - 410	16 samples	496 - 500	15 samples
321 - 325	16 samples	411 - 415	16 samples	501 - 505	15 samples
326 - 330	16 samples	416 - 420	16 samples	506 - 510	15 samples
331 - 335	16 samples	421 - 425	16 samples	501 - 515	15 samples
336 - 340	16 samples	426 - 430	16 samples	516 - 520	15 samples
341 - 345	16 samples	431 - 435	16 samples	521 - 525	16 samples

These are the results for one channel of audio data being sent. If more than one channel is sent, then the numbers are just multiplied by the number of channels for a maximum of four. If all four channels are turned on, then need to check to see if all the data will fit into the allotted space.

$$\frac{4\ samples}{channel} \times 4\ channels \times \frac{3\ words}{sample} = 48\ words \qquad \textbf{A.14}$$

Now add the 5 overhead control words. (① Auxiliary Data Flag, ② Data Identification, ③ Data Block Number, ④ Data Count, and ⑤ Checksum.)

$$48\ words + 5\ control\ words = 53\ words \qquad \textbf{A.15}$$

The maximum number of words that are allowed in the ancillary data horizontal interval is 55, therefore this sampling distribution will fit in the allotted space.

Determine Buffer Requirements

Now determine the buffer requirements of this sample distribution. The specification allows for a minimum buffer size of 64 samples/channel, so the calculations will be done for one channel.

According to equation A.1, ideally there should be 3.05066667 samples/line. During the vertical interval there is a maximum of 4 lines where data is not sent (lines 263 - 266, and 1 - 3 in the horizontal interval). The total buffer requirements are then:

$$\frac{3.05066667\ samples}{line} \times 4\ lines = 12.27\ samples \qquad \textbf{A.16}$$

This is less than the minimum requirement of 64 samples, so the signal meets specifications.

Appendix A
Replaceable Electrical Parts

This section contains a list of the components that are replaceable for the TSG-170D OPTION 1S. Use this list to identify and order replacement parts. There is a separate Replaceable Electrical Parts list for each instrument.

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. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument 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.

Using the Replaceable Electrical Parts List

The tabular information in the Replaceable Electrical Parts list is arranged for quick retrieval. Understanding the structure and features of the list will help you find all of the information you need for ordering replaceable parts.

Cross Index–Mfr. Code Number to Manufacturer

The Mfg. Code Number to Manufacturer Cross Index for the electrical parts list is located immediately after this page. The cross index provides codes, names, and addresses of manufacturers of components listed in the electrical parts list.

Abbreviations

Abbreviations conform to American National Standards Institute (ANSI) standard Y1.1.

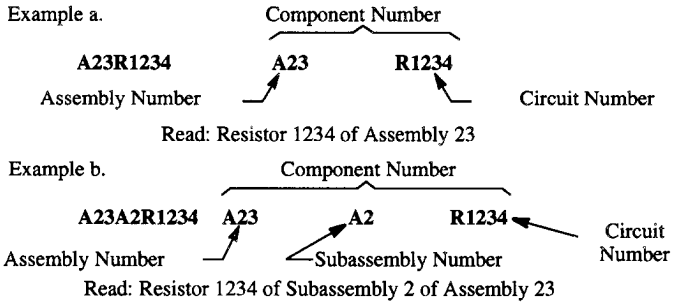
List of Assemblies

A list of assemblies can be found at the beginning of the electrical parts list. The assemblies are listed in numerical order. When the complete component number of a part is known, this list will identify the assembly in which the part is located.

Column Descriptions

Component No. (Column 1)

The component circuit number appears on the diagrams and circuit board illustrations, located in the diagrams section. Assembly numbers are also marked on each diagram and circuit board illustration, in the Diagram section and on the mechanical exploded views, in the mechanical parts list. The component number is obtained by adding the assembly number prefix to the circuit number.



The electrical parts list is arranged by assemblies in numerical sequence (A1, with its subassemblies and parts, precedes A2, with its subassemblies and parts).

Mechanical subparts to the circuit boards are listed in the electrical parts list. These mechanical subparts are listed with their associated electrical part (for example, fuse holder follows fuse).

Chassis-mounted parts and cable assemblies have no assembly number prefix and are located at the end of the electrical parts list.

Tektronix Part No. (Column 2)

Indicates part number to be used when ordering replacement part from Tektronix.

Serial/Assembly No. (Column 3 and 4)

Column three (3) indicates the serial or assembly number at which the part was first used. Column four (4) indicates the serial or assembly number at which the part was removed. No serial or assembly number entered indicates part is good for all serial numbers.

Name and Description (Column 5)

An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification.

The mechanical subparts are shown as *ATTACHED PARTS* / *END ATTACHED PARTS* or *MOUNTING PARTS* / *END MOUNTING PARTS* in column five (5).

Mfr. Code (Column 6)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

Mfr. Part No. (Column 7)

Indicates actual manufacturer's part number.

CROSS INDEX – MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code.	Manufacturer	Address	City, State, Zip Code
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
04222	AVX CERAMICS DIV OF AVX CORP	19TH AVE SOUTH P O BOX 867	MYRTLE BEACH SC 29577
05397	UNION CARBIDE CORP MATERIALS SYSTEMS DIV	11901 MADISON AVE	CLEVELAND OH 44101
09023	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO	2652 DALRYMPLE ST	SANFORD NC 27330
09922	BURNDY CORP	RICHARDS AVE	NORWALK CT 06852
09969	DALE ELECTRONICS INC	EAST HIGHWAY 50 P O BOX 180	YANKTON SD 57078
11236	CTS CORP BERNE DIV THICK FILM PRODUCTS GROUP	406 PARR ROAD	BERNE IN 46711-9506
22526	BERG ELECTRONICS INC (DUPONT)	857 OLD TRAIL RD	ETTERS PA 17319
26364	COMPONENTS CORP	6 KINSEY PLACE	DENVILLE NJ 07834-2611
32997	BOURNS INC TRIMPOT DIV	1200 COLUMBIA AVE	RIVERSIDE CA 92507-2114
53387	MINNESOTA MINING MFG CO	PO BOX 2963	AUSTIN TX 78769-2963
55680	NICHICON /AMERICA/ CORP	927 E STATE PKY	SCHAUMBURG IL 60195-4526
57668	ROHM CORP	8 WHATNEY PO BOX 19515	IRVINE CA 92713
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
81073	GRAYHILL INC	561 HILLGROVE AVE PO BOX 10373	LA GRANGE IL 60525-5914
91637	DALE ELECTRONICS INC	2064 12TH AVE PO BOX 609	COLUMBUS NE 68601-3632
TK1345	ZMAN & ASSOCIATES		
TK1450	TOKYO COSMOS ELECTRIC CO LTD	2-268 SOBUDAI ZAWA	KANAGAWA 228 JAPAN

Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A7	671-2126-00	B010421	B010458	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-00
A7	671-2126-01	B010459	B010470	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-01
A7	671-2126-02	B010471	B010494	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-02
A7	671-2126-03	B010495	B010512	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-03
A7	671-2126-04	B010513	B010533	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-04
A7	671-2126-05	B010534	B010577	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-05
A7	671-2126-06	B010578	B010688	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-06
A7	671-2126-07	B010689	B010714	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-07
A7	671-2126-08	B010715	B010745	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-08
A7	671-2126-09	B010746		CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-09
A7	671-2126-00	B010421	B010458	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-00
A7	671-2126-01	B010459	B010470	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-01
A7	671-2126-02	B010471	B010494	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-02
A7	671-2126-03	B010495	B010512	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-03
A7	671-2126-04	B010513	B010533	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-04
A7	671-2126-05	B010534	B010577	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-05
A7	671-2126-06	B010578	B010688	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-06
A7	671-2126-07	B010689	B010714	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-07
A7	671-2126-08	B010715	B010745	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-08
A7	671-2126-09	B010746		CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2126-09
A7C1	283-0644-00			CAP,FXD,MICA DI:150PF,1%,500V	80009	283-0644-00
A7C3	283-0604-00			CAP,FXD,MICA DI:304PF,2%,500V	80009	283-0604-00
A7C4	290-0167-00			CAP,FXD,ELCTLT:10UF,20%,15V	05397	T110B106M015AS
A7C7	281-0775-01	671-2126-00	671-2126-05	CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C7	283-0177-05	671-2126-06		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A7C8	281-0775-01	671-2126-00	671-2126-05	CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C8	283-0177-05	671-2126-06		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A7C9	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C10	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C11	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C12	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C13	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C14	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C15	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C16	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C17	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C18	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C19	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C20	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C21	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C22	290-0167-00	671-2126-00	671-2126-06	CAP,FXD,ELCTLT:10UF,20%,15V	05397	T110B106M015AS
A7C22	290-0973-01	671-2126-07		CAP,FXD,ALUM:100UF,20%,25VDC;8 X 11MM,0.2 LS;RDL,T&A	55680	UVX1E101MPA1TA
A7C23	290-0167-00			CAP,FXD,ELCTLT:10UF,20%,15V	05397	T110B106M015AS

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A7C25	281–0775–01	671–2126–00	671–2126–05	CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C25	283–0177–05	671–2126–06		CAP,FXD,CER DI:1UF,+80–20%,25V	04222	SR303E105ZAAAP1
A7C26	290–0267–00			CAP,FXD,TANT:DRY;1UF,20%,35V,TANT OX-IDE,0.151 X 0.317;AXIAL,MI	05397	T320A105M035AS
A7C27	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C28	281–0775–01	671–2126–00	671–2126–05	CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C28	131–4566–00	671–2126–06	671–2126–06	BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131–4566–00
A7C28	281–0765–00	671–2126–07		CAP,FXD,CER DI:100PF,5%,100V	04222	SA102A101JAA
A7C29	281–0775–01	671–2126–00	671–2126–05	CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C29	131–4566–00	671–2126–06	671–2126–06	BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131–4566–00
A7C29	281–0808–00	671–2126–07		CAP,FXD,CER:MLC;7 PF,20%,100V,0.100 X 0.170;AXIAL,MI	04222	SA102A7RODAA
A7C30	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C31	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C32	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C33	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C34	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C35	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C36	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C37	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C38	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C39	281–0775–01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C40	290–0973–01	671–2126–07		CAP,FXD,ALUM:100UF,20%,25VDC;8 X 11MM,0.2 LS;RDL,T&A	55680	UVX1E101MPA1TA
A7C41	290–0167–00	671–2126–07		CAP,FXD,ELCTLT:10UF,20%,15V	05397	T110B106M015AS
A7C42	281–0775–01	671–2126–07		CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C43	281–0775–01	671–2126–07		CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C44	281–0861–00	671–2126–06	671–2126–06	CAP,FXD,CER DI:270PF,5%,50V	04222	SA101A271JAA
A7C44	281–0775–01	671–2126–07		CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C45	283–0785–01	671–2126–07		CAP,FXD,MICA DI:250PF,1%,500V,T&A	09023	CDA15FD251F03
A7C46	281–0775–01	671–2126–07		CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C47	290–0973–01	671–2126–07		CAP,FXD,ALUM:100UF,20%,25VDC;8 X 11MM,0.2 LS;RDL,T&A	55680	UVX1E101MPA1TA
A7C48	281–0775–01	671–2126–07		CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C49	281–0756–00	671–2126–07		CAP,FXD,CER:MLC;2.2PF,+/–0.5PF,200V,0.100 X 0.170;AXIAL,MI	04222	SA102A2R2DAA
A7C50	281–0756–00	671–2126–07		CAP,FXD,CER:MLC;2.2PF,+/–0.5PF,200V,0.100 X 0.170;AXIAL,MI	04222	SA102A2R2DAA
A7C51	281–0756–00	671–2126–07		CAP,FXD,CER:MLC;2.2PF,+/–0.5PF,200V,0.100 X 0.170;AXIAL,MI	04222	SA102A2R2DAA
A7C101	283–0644–01	671–2126–07		CAP,FXD,MICA DI:150PF,1%,500V	80009	283–0644–01
A7C103	283–0604–00	671–2126–07		CAP,FXD,MICA DI:304PF,2%,500V	80009	283–0604–00

Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A7C104	290–0167–00	671–2126–07		CAP,FXD,ELCTLT:10UF,20%,15V	05397	T110B106M015AS
A7C107	283–0177–05	671–2126–07		CAP,FXD,CER DI:1UF,+80–20%,25V	04222	SR303E105ZAAAP1
A7C108	283–0177–05	671–2126–07		CAP,FXD,CER DI:1UF,+80–20%,25V	04222	SR303E105ZAAAP1
A7C125	283–0177–05	671–2126–07		CAP,FXD,CER DI:1UF,+80–20%,25V	04222	SR303E105ZAAAP1
A7C126	290–0267–00	671–2126–07		CAP,FXD,TANT:DRY;1UF,20%,35V,TANT OX-IDE,0.151 X 0.317;AXIAL,MI	05397	T320A105M035AS
A7C127	281–0775–01	671–2126–07		CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C128	281–0765–00	671–2126–07		CAP,FXD,CER DI:100PF,5%,100V	04222	SA102A101JAA
A7C129	281–0808–00	671–2126–07		CAP,FXD,CER:MLC;7 PF,20%,100V,0.100 X 0.170;AXIAL,MI	04222	SA102A7RODAA
A7C139	281–0775–01	671–2126–07		CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C141	290–0167–00	671–2126–07		CAP,FXD,ELCTLT:10UF,20%,15V	05397	T110B106M015AS
A7C142	281–0775–01	671–2126–07		CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C143	281–0775–01	671–2126–07		CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C144	281–0775–01	671–2126–07		CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C145	283–0785–01	671–2126–07		CAP,FXD,MICA DI:250PF,1%,500V,T&A	09023	CDA15FD251F03
A7C146	281–0775–01	671–2126–07		CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A7C147	281–0791–00	671–2126–07		CAP,FXD,CER:MLC;270PF,10%,100V,0.100 X 0.170;AXIAL,MI	04222	SA102C271KAA
A7C149	281–0756–00	671–2126–07		CAP,FXD,CER:MLC;2.2PF,+/–0.5PF,200V,0.100 X 0.170;AXIAL,MI	04222	SA102A2R2DAA
A7C150	281–0756–00	671–2126–07		CAP,FXD,CER:MLC;2.2PF,+/–0.5PF,200V,0.100 X 0.170;AXIAL,MI	04222	SA102A2R2DAA
A7C151	281–0756–00	671–2126–07		CAP,FXD,CER:MLC;2.2PF,+/–0.5PF,200V,0.100 X 0.170;AXIAL,MI	04222	SA102A2R2DAA
A7J1	131–0608–00			TERM,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131–0608–00
A7J3	131–0391–00			CONN,RF JACK:	80009	131–0391–00
A7J4	131–0391–00			CONN,RF JACK:	80009	131–0391–00
A7J5	131–1425–00	671–2126–00	671–2126–06	CONN,HDR:PCB;MALE,RTANG,1 X 36,0.1 CTR,0.230 MLG X 0.090 TAIL,30 GLD,STACKABLE	22526	65521–136
A7J5	131–1426–00	671–2126–00	671–2126–06	CONN,HDR:PCB;MALE,RTANG,1 X 36,0.1 CTR,0.23 MLG X 0.195 TAIL,GLD,STACKABLE	22526	65524–136
A7J5	131–3364–00	671–2126–07		CONN,HDR:	53387	2534–6002UB
A7J6	131–0608–00	671–2126–00	671–2126–06	TERM,PIN:0.365 L X 0.025 BRZ GLD PL	80009	131–0608–00
A7J6	131–3362–00	671–2126–07		CONN,HDR: (QUANTITY 26)	53387	2526–6002UB
A7J12	131–0608–00	671–2126–00	671–2126–06	TERM,PIN:0.365 L X 0.025 BRZ GLD PL	80009	131–0608–00
A7J12	131–3362–00	671–2126–07		CONN,HDR: (QUANTITY 26)	53387	2526–6002UB
A7J13	131–0608–00			TERM,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131–0608–00
A7J23	131–0391–00			CONN,RF JACK:	80009	131–0391–00
A7J24	131–0608–00	671–2126–07		TERM,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 6)	80009	131–0608–00
A7J101	131–0608–00	671–2126–07		TERM,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131–0608–00
A7J103	131–0391–00	671–2126–07		CONN,RF JACK:	80009	131–0391–00
A7J104	131–0391–00	671–2126–07		CONN,RF JACK:	80009	131–0391–00
A7J113	131–0608–00	671–2126–07		TERM,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131–0608–00
A7J123	131–0391–00	671–2126–07		CONN,RF JACK:	80009	131–0391–00
A7J124	131–0608–00	671–2126–07		TERM,PIN:0.365 L X 0.025 BRZ GLD PL	80009	131–0608–00

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				(QUANTITY 6)		
A7J125	131-0608-00	671-2126-07		TERM,PIN:0.365 L X 0.025 BRZ GLD PL	80009	131-0608-00
				(QUANTITY 10)		
A7L1	108-1341-00			COIL,RF:FXD,180NH,10%,0.1 OHM,1100MA MI AXIAL LEADS	80009	108-1341-00
A7L2	108-1263-00	671-2126-07		COIL,RF:FXD,10UH, 10%,Q=70,SRF 27 MHZ,DCR 0.043 OHM,I MAX 2.1A RDL LEAD	80009	108-1263-00
A7L3	108-0413-00			COIL,RF:FIXED,0.4UH	80009	108-0413-00
A7L4	108-0215-00	671-2126-07		COIL,RF:IDCTR;FXD,1.1UH,10%,38AWG,31 TURNS,276-0020-00 FORM,NYL	TK1345	108-0215-00
A7L5	108-1263-00	671-2126-00	671-2126-06	COIL,RF:FXD,10UH, 10%,Q=70,SRF 27 MHZ,DCR 0.043 OHM,I MAX 2.1A RDL LEAD	80009	108-1263-00
A7L101	108-1341-00	671-2126-07		COIL,RF:FXD,180NH,10%,0.1 OHM,1100MA MI AXIAL LEADS	80009	108-1341-00
A7L103	108-0413-00	671-2126-07		COIL,RF:FIXED,0.4UH	80009	108-0413-00
A7P1	131-0993-02			BUS,CNDCT:SHUNT ASSY,RED	00779	1-850100-O
A7P13	131-0993-02			BUS,CNDCT:SHUNT ASSY,RED	00779	1-850100-O
A7P101	131-0993-02	671-2126-07		BUS,CNDCT:SHUNT ASSY,RED	00779	1-850100-O
A7P113	131-0993-02	671-2126-07		BUS,CNDCT:SHUNT ASSY,RED	00779	1-850100-O
A7Q1	151-0190-00	671-2126-00	671-2126-01	XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ, AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A7Q2	151-0472-00	671-2126-00	671-2126-06	XSTR,SIG:BIPOLAR,NPN;14V,80MA,1.0GHZ, AMPL;NE41632B,TO-92 EBC	80009	151-0472-00
A7Q2	151-0965-00	671-2126-07		XSTR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPL;MPS571,TO-92 BEC	80009	151-0965-00
A7Q3	151-0472-00	671-2126-00	671-2126-06	XSTR,SIG:BIPOLAR,NPN;14V,80MA,1.0GHZ, AMPL;NE41632B,TO-92 EBC	80009	151-0472-00
A7Q3	151-0965-00	671-2126-07		XSTR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPL;MPS571,TO-92 BEC	80009	151-0965-00
A7Q4	151-0472-00	671-2126-00	671-2126-06	XSTR,SIG:BIPOLAR,NPN;14V,80MA,1.0GHZ, AMPL;NE41632B,TO-92 EBC	80009	151-0472-00
A7Q4	151-0965-00	671-2126-07		XSTR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPL;MPS571,TO-92 BEC	80009	151-0965-00
A7Q7	151-0720-00	671-2126-00	671-2126-06	XSTR,SIG:BIPOLAR,NPN;25V,50MA,650MHZ, AMPL;MPSH10,TO-92 BEC	80009	151-0720-00
A7Q7	151-0965-00	671-2126-07		XSTR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPL;MPS571,TO-92 BEC	80009	151-0965-00
A7Q8	151-0472-00	671-2126-00	671-2126-06	XSTR,SIG:BIPOLAR,NPN;14V,80MA,1.0GHZ, AMPL;NE41632B,TO-92 EBC	80009	151-0472-00
A7Q8	151-0965-00	671-2126-07		XSTR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPL;MPS571,TO-92 BEC	80009	151-0965-00
A7Q9	151-0472-00	671-2126-00	671-2126-06	XSTR,SIG:BIPOLAR,NPN;14V,80MA,1.0GHZ, AMPL;NE41632B,TO-92 EBC	80009	151-0472-00
A7Q9	151-0965-00	671-2126-07		XSTR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPL;MPS571,TO-92 BEC	80009	151-0965-00
A7Q10	151-0139-00			XSTR,SIG:BIPOLAR,NPN;15V,50MA,600MHZ, AMPL,DUAL;MD918,TO-77	80009	151-0139-00
A7Q11	151-0720-00	671-2126-00	671-2126-06	XSTR,SIG:BIPOLAR,NPN;25V,50MA,650MHZ, AMPL;MPSH10,TO-92 BEC	80009	151-0720-00
A7Q11	151-0965-00	671-2126-07		XSTR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPL;MPS571,TO-92 BEC	80009	151-0965-00
A7Q12	151-0188-00	671-2126-07		XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ, AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A7Q102	151-0965-00	671-2126-07		XSTR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPL;MPS571,TO-92 BEC	80009	151-0965-00
A7Q103	151-0965-00	671-2126-07		XSTR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPL;MPS571,TO-92 BEC	80009	151-0965-00
A7Q104	151-0965-00	671-2126-07		XSTR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPL;MPS571,TO-92 BEC	80009	151-0965-00
A7Q107	151-0965-00	671-2126-07		XSTR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPL;MPS571,TO-92 BEC	80009	151-0965-00

Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A7Q108	151-0965-00	671-2126-07		XSTR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPL;MPS571,TO-92 BEC	80009	151-0965-00
A7Q109	151-0965-00	671-2126-07		XSTR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPL;MPS571,TO-92 BEC	80009	151-0965-00
A7Q110	151-0139-00	671-2126-07		XSTR,SIG:BIPOLAR,NPN;15V,50MA,600MHZ, AMPL,DUAL;MD918,TO-77	80009	151-0139-00
A7Q111	151-0965-00	671-2126-07		XSTR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPL;MPS571,TO-92 BEC	80009	151-0965-00
A7Q112	151-0188-00	671-2126-07		XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ, AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A7R1	322-3322-00			RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A7R2	311-0609-00	671-2126-00	671-2126-03	RES,VAR,NONWW:TRMR,2K OHM,0.5W	80009	311-0609-00
A7R2	311-0633-00	671-2126-04	671-2126-06	RES,VAR,NONWW:TRMR,5K OHM,0.5W	32997	3329H-L58-502
A7R3	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A7R4	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A7R5	322-3068-00	671-2126-00	671-2126-06	RES,FXD:MET FILM;49.9 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3068-00
A7R5	322-3077-00	671-2126-07		RES,FXD,FILM:61.9 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 61E9
A7R6	322-3068-00	671-2126-00	671-2126-06	RES,FXD:MET FILM;49.9 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3068-00
A7R6	322-3077-00	671-2126-07		RES,FXD,FILM:61.9 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 61E9
A7R7	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A7R8	322-3082-00			RES,FXD,FILM:69.8 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 69E8
A7R9	322-3082-00			RES,FXD,FILM:69.8 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 69E8
A7R10	322-3114-00	671-2126-07		RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A7R11	322-3114-00	671-2126-07		RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A7R12	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A7R13	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A7R14	322-3085-00	671-2126-00	671-2126-06	RES,FXD:MET FILM;75 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 75E0
A7R14	322-3068-00	671-2126-07		RES,FXD:MET FILM;49.9 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3068-00
A7R15	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A7R16	322-3097-00	671-2126-07	671-2126-08	RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A7R18	307-0717-00			RES NTWK,FXD,FI:4,100 OHM,2%,0.3W EACH	80009	307-0717-00
A7R19	307-0717-00			RES NTWK,FXD,FI:4,100 OHM,2%,0.3W EACH	80009	307-0717-00
A7R20	307-0717-00			RES NTWK,FXD,FI:4,100 OHM,2%,0.3W EACH	80009	307-0717-00
A7R21	322-3164-00	671-2126-09		RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 499E
A7R22	311-0609-00	671-2126-00	671-2126-03	RES,VAR,NONWW:TRMR,2K OHM,0.5W	80009	311-0609-00
A7R22	311-0633-00	671-2126-04	671-2126-06	RES,VAR,NONWW:TRMR,5K OHM,0.5W	32997	3329H-L58-502
A7R22	311-2234-00	671-2126-07	671-2126-08	RES,VAR,TRMR:CERMET;5K OHM,20%,0.5W,0.197 SQ,TOP ADJUST;T&R	TK1450	GF06UT 5K
A7R22	311-2232-00	671-2126-09		RES,VAR,TRMR:CERMET,2K OHM,20%,0.5W,0.197 SQ,TOP ADJUST;T&R	TK1450	GF06UT 2K
A7R23	322-3215-00	671-2126-00	671-2126-06	RES,FXD,FILM:1.69K OHM,1%,0.2W,TC=T0	91637	CCF50-2F16900F
A7R25	322-3220-00	671-2126-00	671-2126-06	RES,FXD,FILM:1.91K OHM,1%,0.2W,TC=T0	80009	322-3220-00
A7R25	322-3318-00	671-2126-07		RES,FXD:MET FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 20K0
A7R27	322-3082-00			RES,FXD,FILM:69.8 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 69E8

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A7R28	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A7R29	307-0675-00	671-2126-00	671-2126-06	RES NTWK,FXD,FI:(9),1K OHM,2%,1.25W	11236	750-101-R1K OHM
A7R31	322-3130-00	671-2126-00	671-2126-06	RES,FXD:MET FILM;221 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3130-00
A7R31	322-3114-00	671-2126-07		RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A7R32	322-3216-00	671-2126-00	671-2126-06	RES,FXD,FILM:1.74K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K74
A7R33	322-3211-00	671-2126-00	671-2126-06	RES,FXD,FILM:1.54K OHM,1%,0.2W,TC=T0	80009	322-3211-00
A7R34	322-3097-00	671-2126-00	671-2126-06	RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A7R34	322-3085-00	671-2126-07		RES,FXD:MET FILM;75 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 75E0
A7R35	322-3097-00	671-2126-00	671-2126-06	RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A7R35	322-3085-00	671-2126-07		RES,FXD:MET FILM;75 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 75E0
A7R36	322-3058-00	671-2126-00	671-2126-06	RES,FXD:MET FILM;39.2 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3058-00
A7R36	322-3068-00	671-2126-07		RES,FXD:MET FILM;49.9 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3068-00
A7R37	322-3066-00	671-2126-00	671-2126-06	RES,FXD:MET FILM;47.5 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	09969	CCF502G47R50F
A7R37	322-3077-00	671-2126-07		RES,FXD,FILM:61.9 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 61E9
A7R39	311-1007-00	671-2126-00	671-2126-06	RES,VAR,NONWW:TRMR,20 OHM,20%,0.5W	80009	311-1007-00
A7R39	311-2224-00	671-2126-07		RES,VAR,NONWW:TRMR,20 OHM,20%,0.5W LIN T&R	TK1450	GFO6UT
A7R40	322-3135-00	671-2126-00	671-2126-05	RES,FXD,FILM:249 OHM,1%,0.2W,TC=T0	80009	322-3135-00
A7R40	322-3114-00	671-2126-06		RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A7R41	322-3135-00	671-2126-00	671-2126-05	RES,FXD,FILM:249 OHM,1%,0.2W,TC=T0	80009	322-3135-00
A7R41	322-3114-00	671-2126-06		RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A7R42	322-3135-00	671-2126-00	671-2126-05	RES,FXD,FILM:249 OHM,1%,0.2W,TC=T0	80009	322-3135-00
A7R42	322-3114-00	671-2126-06		RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A7R43	307-0717-00	671-2126-00	671-2126-06	RES NTWK,FXD,FI:4,100 OHM,2%,0.3W EACH	80009	307-0717-00
A7R44	307-0717-00	671-2126-00	671-2126-06	RES NTWK,FXD,FI:4,100 OHM,2%,0.3W EACH	80009	307-0717-00
A7R45	307-0717-00	671-2126-00	671-2126-06	RES NTWK,FXD,FI:4,100 OHM,2%,0.3W EACH	80009	307-0717-00
A7R46	322-3130-00	671-2126-00	671-2126-06	RES,FXD:MET FILM;221 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3130-00
A7R46	322-3114-00	671-2126-07		RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A7R47	322-3117-00	671-2126-00	671-2126-06	RES,FXD,FILM:162 OHM,1%,0.2W,TC=T0	80009	322-3117-00
A7R48	322-3114-00	671-2126-00	671-2126-05	RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A7R48	322-3058-00	671-2126-06	671-2126-06	RES,FXD:MET FILM;39.2 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3058-00
A7R48	322-3001-00	671-2126-07		RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A7R49	322-3068-00			RES,FXD:MET FILM;49.9 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3068-00
A7R50	322-3068-00			RES,FXD:MET FILM;49.9 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3068-00
A7R53	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A7R54	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A7R55	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00

Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A7R56	322-3068-00			RES,FXD:MET FILM;49.9 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3068-00
A7R57	322-3147-00	671-2126-00	671-2126-06	RES,FXD:MET FILM;332 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3147-00
A7R58	322-3147-00	671-2126-00	671-2126-06	RES,FXD:MET FILM;332 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3147-00
A7R59	322-3135-00			RES,FXD,FILM:249 OHM,1%,0.2W,TC=T0	80009	322-3135-00
A7R60	322-3126-01	671-2126-00	671-2126-06	RES,FXD,FILM:200 OHM,0.5%,0.2W,TC=TO	91637	CCF501G200R0D
A7R60	322-3167-00	671-2126-07	671-2126-08	RES,FXD,FILM:536 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 536E
A7R60	322-3164-00	671-2126-09		RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 499E
A7R61	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A7R64	322-3058-00	671-2126-00	671-2126-06	RES,FXD:MET FILM;39.2 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3058-00
A7R64	322-3077-00	671-2126-07		RES,FXD,FILM:61.9 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 61E9
A7R65	322-3001-00	671-2126-07		RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A7R66	322-3001-00	671-2126-07		RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A7R67	322-3039-00	671-2126-07		RES,FXD,FILM:24.9 OHM,1%,0.2W,TC=T0	80009	322-3039-00
A7R68	322-3039-00	671-2126-07		RES,FXD,FILM:24.9 OHM,1%,0.2W,TC=T0	80009	322-3039-00
A7R69	307-0888-00	671-2126-07		RES NTWK,FXD,FI:5,1K OHM,2%,1.5W	80009	307-0888-00
A7R70	307-0888-00	671-2126-07		RES NTWK,FXD,FI:5,1K OHM,2%,1.5W	80009	307-0888-00
A7R71	322-3295-00	671-2126-07		RES,FXD:MET FILM;11.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3295-00
A7R72	322-3147-00	671-2126-07		RES,FXD:MET FILM;332 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3147-00
A7R73	322-3147-00	671-2126-07		RES,FXD:MET FILM;332 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3147-00
A7R74	322-3193-00	671-2126-07		RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A7R101	322-3322-00	671-2126-07		RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A7R103	322-3097-00	671-2126-07		RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A7R104	322-3097-00	671-2126-07		RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A7R105	322-3077-00	671-2126-07		RES,FXD,FILM:61.9 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 61E9
A7R106	322-3077-00	671-2126-07		RES,FXD,FILM:61.9 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 61E9
A7R107	322-3193-00	671-2126-07		RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A7R108	322-3082-00	671-2126-07		RES,FXD,FILM:69.8 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 69E8
A7R109	322-3082-00	671-2126-07		RES,FXD,FILM:69.8 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 69E8
A7R110	322-3114-00	671-2126-07		RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A7R111	322-3114-00	671-2126-07		RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A7R112	322-3193-00	671-2126-07		RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A7R113	322-3193-00	671-2126-07		RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A7R114	322-3068-00	671-2126-07		RES,FXD:MET FILM;49.9 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3068-00
A7R115	322-3289-00	671-2126-07		RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A7R121	322-3164-00	671-2126-09		RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 499E
A7R122	311-2234-00	671-2126-07	671-2126-08	RES,VAR,TRMR:CERMET;5K OHM,20%,0.5W,0.197 SQ,TOP ADJUST;T&R	TK1450	GF06UT 5K
A7R122	311-2232-00	671-2126-09		RES,VAR,TRMR:CERMET,2K OHM,20%,0.5W,0.197 SQ,TOP ADJUST;T&R	TK1450	GF06UT 2K

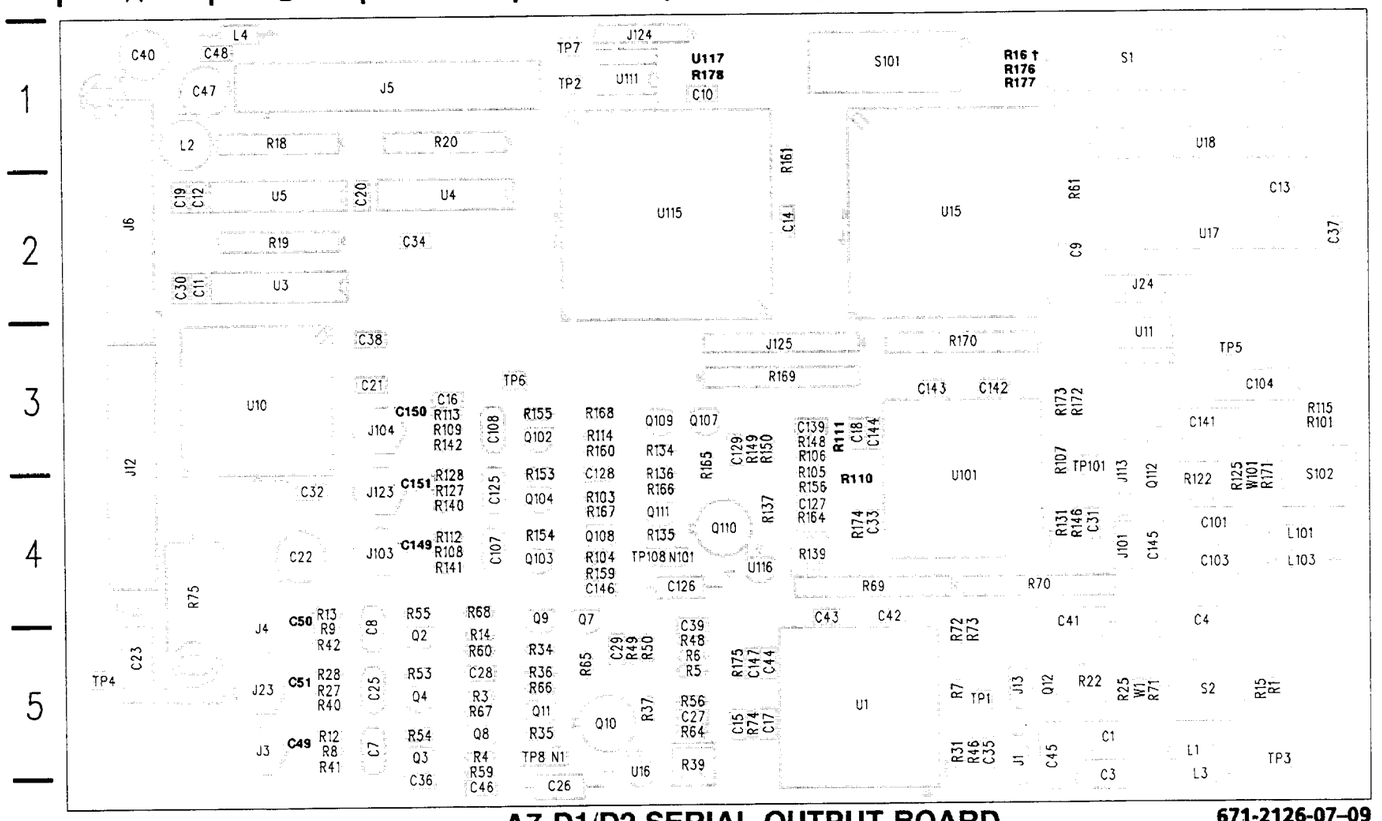
Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A7R125	322-3318-00	671-2126-07		RES,FXD:MET FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 20K0
A7R127	322-3082-00	671-2126-07		RES,FXD,FILM:69.8 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 69E8
A7R128	322-3193-00	671-2126-07		RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A7R131	322-3114-00	671-2126-07		RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A7R134	322-3085-00	671-2126-07		RES,FXD:MET FILM;75 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 75E0
A7R135	322-3085-00	671-2126-07		RES,FXD:MET FILM;75 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 75E0
A7R136	322-3068-00	671-2126-07		RES,FXD:MET FILM;49.9 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3068-00
A7R137	322-3077-00	671-2126-07		RES,FXD,FILM:61.9 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 61E9
A7R139	311-2224-00	671-2126-07		RES,VAR,NONWW:TRMR,20 OHM,20%,0.5W LIN T&R	TK1450	GFO6UT
A7R140	322-3114-00	671-2126-07		RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A7R141	322-3114-00	671-2126-07		RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A7R142	322-3114-00	671-2126-07		RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A7R146	322-3114-00	671-2126-07		RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A7R149	322-3068-00	671-2126-07		RES,FXD:MET FILM;49.9 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3068-00
A7R150	322-3068-00	671-2126-07		RES,FXD:MET FILM;49.9 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3068-00
A7R154	322-3001-00	671-2126-07		RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A7R155	322-3001-00	671-2126-07		RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A7R156	322-3068-00	671-2126-07		RES,FXD:MET FILM;49.9 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3068-00
A7R159	322-3135-00	671-2126-07		RES,FXD,FILM:249 OHM,1%,0.2W,TC=T0	80009	322-3135-00
A7R160	322-3167-00	671-2126-07	671-2126-08	RES,FXD,FILM:536 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 536E
A7R160	322-3164-00	671-2126-09		RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 499E
A7R161	322-3193-00	671-2126-07		RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A7R164	322-3077-00	671-2126-07		RES,FXD,FILM:61.9 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 61E9
A7R165	322-3001-00	671-2126-07		RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A7R166	322-3001-00	671-2126-07		RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A7R167	322-3039-00	671-2126-07		RES,FXD,FILM:24.9 OHM,1%,0.2W,TC=T0	80009	322-3039-00
A7R168	322-3039-00	671-2126-07		RES,FXD,FILM:24.9 OHM,1%,0.2W,TC=T0	80009	322-3039-00
A7R169	307-0888-00	671-2126-07		RES NTWK,FXD,FI:5,1K OHM,2%,1.5W	80009	307-0888-00
A7R170	307-0888-00	671-2126-07		RES NTWK,FXD,FI:5,1K OHM,2%,1.5W	80009	307-0888-00
A7R171	322-3295-00	671-2126-07		RES,FXD:MET FILM;11.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3295-00
A7R172	322-3147-00	671-2126-07		RES,FXD:MET FILM;332 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3147-00
A7R173	322-3147-00	671-2126-07		RES,FXD:MET FILM;332 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3147-00
A7R174	322-3193-00	671-2126-07		RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A7R175	322-3097-00	671-2126-07		RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A7R176	322-3139-00	671-2126-09		RES,FXD:MET FILM;274 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3139-00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A7R177	322-3139-00	671-2126-09		RES,FXD:MET FILM;274 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3139-00
A7R178	322-3139-00	671-2126-09		RES,FXD:MET FILM;274 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3139-00
A7S1	260-2272-00			SW,RKR:SPST,2.5A,28V	81073	76SB10S
A7S2	260-1965-00			SW,RKR:(4)SPST,125MA,30VDC	80009	260-1965-00
A7S101	260-2272-00	671-2126-07		SW,RKR:SPST,2.5A,28V	81073	76SB10S
A7S102	260-1965-00	671-2126-07		SW,RKR:(4)SPST,125MA,30VDC	80009	260-1965-00
A7TP1	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A7TP2	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A7TP3	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A7TP4	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A7TP5	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A7TP6	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A7TP7	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A7TP8	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A7TP101	214-4085-00	671-2126-07		TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A7TP108	214-4085-00	671-2126-07		TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A7U1	156-4132-00	671-2126-00	671-2126-01	IC,MISC:ECL,ENCDR;PRL DATA TO SER DATA XMSN;SBX1601A,PGA37	80009	156-4132-00
A7U1	156-4132-01	671-2126-02		IC,MISC:	80009	156-4132-01
				MOUNTING PARTS		
	136-1159-00	671-2126-00	671-2126-08	SKT,PGA:	80009	136-1159-00
	214-4321-00	671-2126-09		HTSK,ELEC:ALUM	80009	214-4321-00
	214-4582-00	671-2126-09		HTSK ASSY:IC,PGA;MTG SHOE AND SPR FOR PGA PKGS;8301-PF11	80009	214-4582-00
				END MOUNTING PARTS		
A7U3	156-2290-00			IC,DGTL:ECL,XLTR;QUAD ECL-TO-TTL;10H125,DIP16.3,TUBE	80009	156-2290-00
A7U4	156-2290-00			IC,DGTL:ECL,XLTR;QUAD ECL-TO-TTL;10H125,DIP16.3,TUBE	80009	156-2290-00
A7U5	156-2290-00			IC,DGTL:ECL,XLTR;QUAD ECL-TO-TTL;10H125,DIP16.3,TUBE	80009	156-2290-00
A7U10	156-5966-00			MICROCKT,DGTL:BIPOLAR,10-BIT VIDEO LINE DRVR,SMPTE RP-125 COMPATIBLE	80009	156-5966-00
				MOUNTING PARTS		
	136-0959-00			SKT,PL-IN ELEK:PLCC,52,PCB,0.361 H X 0.147 TAIL,TIN	80009	136-0959-00
				END MOUNTING PARTS		
A7U11	160-8589-00	671-2126-00	671-2126-00	IC,MEM:CMOS,PROM;64K X 1,PRGM,SER CONFIG;DIP08.3	80009	160-8589-00
A7U11	160-8589-01	671-2126-01	671-2126-02	IC,MEM:CMOS,PROM,64K X 1,SER CONFIG,DIP08.3	80009	160-8589-01
A7U11	160-8589-02	671-2126-03	671-2126-04	IC,MEM:CMOS,PROM,64K X 1,SER CONFIG,DIP08.3	80009	160-8589-02
A7U11	160-8589-03	671-2126-05	671-2126-05	IC,MEM:CMOS,PROM,64K X 1,SER CONFIG,DIP08.3	80009	160-8589-03
A7U11	160-8589-04	671-2126-06	671-2126-06	IC,MEM:CMOS,PROM,64K X 1,SER CONFIG,DIP08.3	80009	160-8589-04

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A7U11	160-8589-05	671-2126-07	671-2126-08	IC,MEM:CMOS,PROM,64K X 1,SER CONFIG,DIP08.3	80009	160-8589-05
A7U11	160-9737-00	671-2126-09		IC,MEM:CMOS,PROM,64K X 1,SER	80009	160-9737-00
				MOUNTING PARTS		
	136-0727-00			SKT,PL-IN ELEK:MICROCKT,8 CONT	09922	DILB8P-108
				END MOUNTING PARTS		
A7U14	156-5966-00	671-2126-00	671-2126-06	MICROCKT,DGTL:BIPOLAR,10-BIT VIDEO LINE DRVR,SMPTE RP-125 COMPATIBLE	80009	156-5966-00
				MOUNTING PARTS		
	136-0959-00	671-2126-00	671-2126-06	SKT,PL-IN ELEK:PLCC,52,PCB,0.361 H X 0.147 TAIL,TIN	80009	136-0959-00
				END MOUNTING PARTS		
A7U15	156-6147-00	671-2126-00	671-2126-00	IC,DGTL:	80009	156-6147-00
A7U15	156-6357-00	671-2126-01	671-2126-06	IC,DGTL:	80009	156-6357-00
A7U15	156-6495-00	671-2126-07		IC,DGTL:	80009	156-6495-00
				MOUNTING PARTS		
	136-0965-00			SKT,PLCC:PCB;84,0.05 CTR,0.360 H X 0.125 TAIL,TIN,0.055-0.075 SHLDR HGT	80009	136-0965-00
				END MOUNTING PARTS		
A7U16	156-1529-00			IC,LIN:BIPOLAR,VR;POS,ADJUST,100MA,5%;LM317LZ,TO-92	80009	156-1529-00
A7U17	160-9463-00	671-2126-07		IC,MEM:CMOS,EPROM,8192 X 8,7C265-15	80009	160-9463-00
				MOUNTING PARTS		
	136-1038-00			SKT,DIP:	00779	2-641873-1
				END MOUNTING PARTS		
A7U18	160-9464-00	671-2126-07		IC,MEM:CMOS,EPROM,8192 X 8,7C265-15	80009	160-9464-00
				MOUNTING PARTS		
	136-1038-00			SKT,DIP:	00779	2-641873-1
				END MOUNTING PARTS		
A7U101	156-4132-01	671-2126-07		IC,MISC:	80009	156-4132-01
				MOUNTING PARTS		
	136-1159-00	671-2126-07	671-2126-08	SKT,PGA:	80009	136-1159-00
	214-4321-00	671-2126-09		HTSK,ELEC:ALUM	80009	214-4321-00
	214-4582-00	671-2126-09		HTSK ASSY:IC,PGA;MTG SHOE AND SPR FOR PGA PKGS;8301-PF11	80009	214-4582-00
				END MOUNTING PARTS		
A7U111	160-9523-00	671-2126-07	671-2126-07	IC,MEM:CMOS,PROM,64K X 1,SER CONFIG,DIP08.3	80009	160-9523-00
A7U111	160-9523-01	671-2126-08	671-2126-08	IC,MEM:CMOS,PROM,64K X 1,SER CONFIG,DIP08.3	80009	160-9523-01
A7U111	160-9738-00	671-2126-09		IC,MEM:CMOS,PROM,64K X 1,SER	80009	160-9738-00
				MOUNTING PARTS		
	136-0727-00	671-2126-07		SKT,PL-IN ELEK:MICROCKT,8 CONT	09922	DILB8P-108
				END MOUNTING PARTS		
A7U115	156-6357-00	671-2126-07		IC,DGTL:	80009	156-6357-00
				MOUNTING PARTS		
	136-0965-00	671-2126-07		SKT,PLCC:PCB;84,0.05 CTR,0.360 H X 0.125 TAIL,TIN,0.055-0.075 SHLDR HGT	80009	136-0965-00
				END MOUNTING PARTS		
A7U116	156-1529-00	671-2126-07		IC,LIN:BIPOLAR,VR;POS,ADJUST,100MA,5%;LM317LZ,TO-92	80009	156-1529-00
A7U117	156-4072-00	671-2126-09		IC,MISC:	80009	156-4072-00
A7W1	131-4566-00	671-2126-07	671-2126-08	BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A7W101	131-4566-00	671-2126-07	671-2126-08	BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
W3	174-2576-00			CA,ASSY RF:COAX;RFD,75 OHM,18.25 L,9-2,BNC,FRT MT,JACK X RTANG,50 OHM SMB	80009	174-2576-00
				(A7J3 TO SER OUT)		
W4	174-2576-00			CA,ASSY RF:COAX;RFD,75 OHM,18.25 L,9-2,BNC,FRT MT,JACK X RTANG,50 OHM SMB	80009	174-2576-00

Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
				(A7J4 TO SER OUT)		
W12	174-2578-00			CA ASSY,SP,ELEC:25,28 AWG,14.375 L,RBN,FEM (A7J12 TO DGTL OUT)	80009	174-2578-00
W23	174-2576-00			CA,ASSY RF:COAX;RFD,75 OHM,18.25 L,9-2,BNC,FRT MT,JACK X RTANG,50 OHM SMB (A7J23 TO SER OUT)	80009	174-2576-00
W900	174-2545-00			CA ASSY,SP,ELEC:34,28 AWG,8.125 L RBN (A4J160 TO A2-1J988 & A7J5)	80009	174-2545-00
W940	174-2575-00			CA ASSY,SP,ELEC:26,28 AWG,14.375 L,RBN (A3J940 TO A7J6)	80009	174-2575-00



A7 D1/D2 SERIAL OUTPUT BOARD

671-2126-07-09

A7 D1/D2 SERIAL OUTPUT BOARD LOOKUP TABLE

The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

ASSEMBLY A7. *Partial Assembly A7 shown on Schematic 2.* Use this circuit board lookup table for schematic <1>.

CKT NO.	SCHEM	SCHEM LOC	BD LOC
C1	1	D5	G5
C3	1	D5	G6
C4	1	E5	H5
C7	1	H4	C5
C8	1	H3	C5
C9	1	B4	G2
C10	1	B4	E1
C11	1	B4	A2
C12	1	B4	A2
C13	1	B4	H2
C14	1	B5	E2
C15	1	B4	E5
C16	1	B4	C3
C17	1	B5	E5
C18	1	B4	F3
C19	1	B4	A2
C20	1	B4	C2
C21	1	B5	B3
C22	1	A4	B4
C23	1	A4	A5
C25	1	H4	C5
C26	1	F5	D6
C27	1	F5	E5
C28	1	G4	C5
C29	1	F4	D5
C30	1	B4	A2
C31	1	B4	G4
C32	1	B4	B4
C33	1	B5	F4
C34	1	B5	C2
C35	1	B4	G5
C36	1	B4	C6
C37	1	C5	I2
C38	1	C4	B3
C39	1	F4	E5
C40	1	B3	A1
C41	1	D3	G5
C42	1	D3	F5
C43	1	E3	E5
C44	1	E3	E5
C45	1	D5	G5
C46	1	G5	C6
C47	1	A4	A1
C48	1	B3	A1
C49	1	H4	B5
C50	1	H3	B4
C51	1	H4	B5
C101	2	B5	H4
C103	2	B5	H4
C104	2	C5	H3
C107	2	F4	C4
C108	2	F3	C3
C125	2	F4	C4
C126	2	E5	D4
C127	2	E5	E4
C128	2	E4	D4
C129	2	E4	E3
C139	2	E4	E3
C141	2	B3	H3
C142	2	C3	G3
C143	2	C3	F3
C144	2	C3	F3
C145	2	B5	H4
C146	2	F5	D4
C147	1	C5	E5
C149	2	G4	C4
C150	2	G3	C3
C151	2	G4	C4
J1	1	D5	G5
J3	1	H4	B5
J4	1	H3	B5
J5	1	A3	B1
J6	1	A2	A3
J12	1	H1	A4
J13	1	C5	G5
J23	1	H4	B5
J24	1	E1	H2
J101	2	B5	G4
J103	2	G4	C4
J104	2	G3	C3
J113	2	A5	G3
J123	2	G4	C4
J124	2	C1	E1
J125	2	B3	F3
L1	1	D5	H5
L2	1	A4	B1
L3	1	D5	H6
L4	1	B3	A1
L101	2	B5	I4
L103	2	B5	I4
P1	1	D5	
P13	1	C5	
P101	2	B5	
P113	2	A5	
Q2	1	G3	C5
Q3	1	G4	C5
Q4	1	G4	C5
Q7	1	G4	D4
Q8	1	G4	C5
Q9	1	G3	D4
Q10A	1	F5	D5
Q10B	1	G5	D5
Q11	1	G4	D5
Q12	1	C5	G5
Q102	2	F3	D3
Q103	2	F4	D4
Q104	2	F4	D4
Q107	2	E4	E3
Q108	2	F3	D4
Q109	2	F3	D3
Q110A	2	D5	E4
Q110B	2	E5	E4
Q111	2	F4	E4
Q112	2	A5	H4
R1	1	E5	I5
R3	1	G4	C5
R4	1	G4	C5
R5	1	F4	E5
R6	1	E4	F5
R7	1	H4	B5
R8	1	H3	B5
R9	1	F4	E5
R10	1	F4	E5
R11	1	H4	B5
R12	1	H3	B4
R13	1	G3	C5
R14	1	E5	H5
R15*	1	E2	G1
R18	1	B2	B1
R19	1	B2	B2
R20	1	B3	D1
R21*	1	C5	H5
R22	1	C5	G5
R25	1	C5	H5
R27	1	H4	B5
R28	1	H5	B5
R31	1	F4	F5
R34	1	G3	D5
R35	1	G3	D5
R36	1	G4	D5
R37	1	G5	D5
R39	1	F5	E5
R40	1	H5	B5
R41	1	H4	B5
R42	1	H3	B5
R46	1	F4	G5
R48	1	F4	E5
R49	1	F4	D5
R50	1	F4	D5
R53	1	H4	C5
R54	1	H3	C5
R55	1	H3	C4
R56	1	F5	E5
R59	1	G4	C6
R60	1	G3	C5
R61	1	D1	G2
R64	1	F5	E5
R65	1	G4	D5
R66	1	G4	D5
R67	1	G3	C5
R68	1	G3	C4
R69	1	D4	F4
R70	1	D4	F4
R71	1	C5	H5
R72	1	D3	F5
R73	1	D3	G5
R74	1	C4	E5
R75	1	A4	A4
R101	2	C5	I3
R103	2	F4	D4
R104	2	F4	D4
R105	2	D4	E4
R106	2	D4	E3
R107	2	D4	G4
R108	2	G4	C4
R109	2	G3	C3
R110	2	D4	F4
R111	2	D4	F3
R112	2	F4	C4
R113	2	C3	D3
R114	2	F3	D3
R115	2	C5	I3
R121*	2	A5	H4
R122	2	A5	H3
R125	2	A5	H4
R127	2	G4	C4
R128	2	F4	C4
R131	2	D4	G4
R134	2	E3	D3
R135	2	F3	D4
R136	2	E4	D4
R137	2	F3	D4
R139	2	F3	D3
R140	2	F4	C4
R141	2	F4	C4
R142	2	F3	C3
R146	2	D4	G4
R148	2	E4	E3
R149	2	E4	E3
R150	2	E4	E3
R153	2	F4	D4
R154	2	F3	D4
R155	2	F3	D3
R156	2	E5	E4
R159	2	F4	D4
R160	2	F3	D3
R161	2	B1	E2
R164	2	E5	E4
R165	2	E4	E4
R166	2	F4	D4
R167	2	F3	D4
R168	2	F3	D3
R169	2	B4	E3
R170	2	B4	G3
R171	2	A5	H4
R172	2	B3	G3
R173	2	B4	F4
R174	2	B4	F4
R175	1	C4	E5
R176*	1	E2	G1
R177*	1	E2	G1
R178*	1	B1	E1
S1	1	E1	H1
S2	1	D5	H5
S101	2	D1	F1
S102	2	C5	I3
TP1	1	E4	F5
TP2	1	A3	D1
TP3	1	A3	H6
TP4	1	A3	A5
TP5	1	A3	H3
TP6	1	A4	C3
TP7	1	A4	D1
TP8	1	G5	C6
TP101	2	D4	G4
TP108	2	F5	D4
U1	1	E4	F6
U3	1	B2	B2
U4	1	B3	C1
U5	1	B1	B1
U10	1	G1	B4
U11	1	E1	H3
U15	1	D1	F1
U16	1	F5	D5
U17	1	F1	I2
U18	1	F2	I1
U101	2	C4	G4
U111	2	C1	E1
U115	2	B1	D2
U116	2	D5	E4
U117*	2	B1	E1
W1*	1	C5	H5
W101*	2	A5	H4

*See parts list for serial number ranges.

REV OCT 1993

ECL TO TTL

SERVICE ONLY

AUDIO DATA

PARALLEL OUTPUT TTL TO ECL

CO-PROCESSOR

R176 WAS R16 ON 671-2126-07 & 08

SERIALIZER

LINE DRIVERS

TOP VIEW

PINS MODE
1-2 4:2:2 NTSC
2-3

MODE 1 2
4:2:2 NTSC ON OFF
NORMAL ADJUST OFF ON

PINS MODE
1-2 4:2:2 NTSC
2-3

R21 WAS W1 ON 671-2126-07 & 08

16mA TREE CURRENT

TP8 SHOULD BE 1.4V ABOVE -12VA

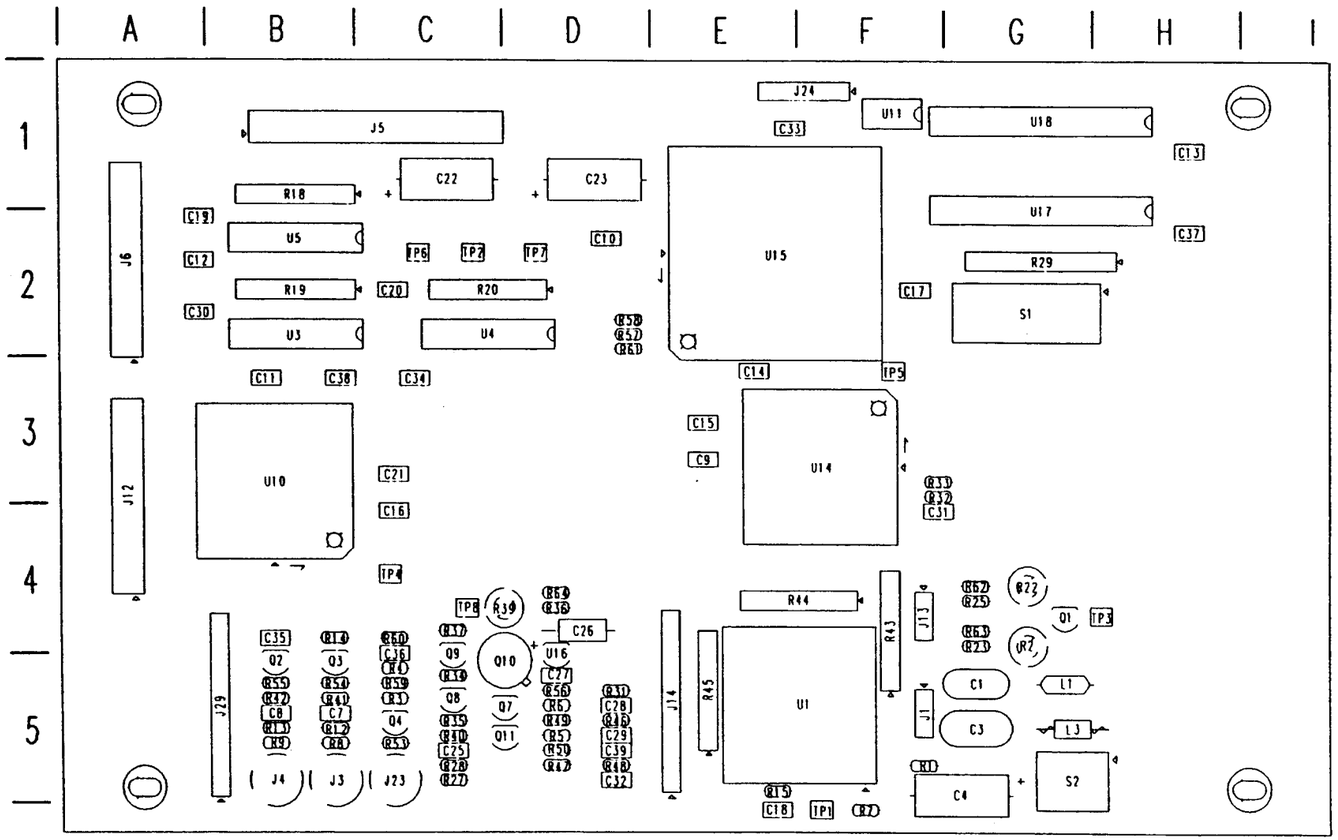
OUTPUT LEVEL

** SEE ELECTRICAL PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES.

SERIAL DIGITAL VIDEO OUTPUTS TO ANY USER SELECTABLE COMBINATION OF W3, W4 OR W23 ON

671-2126-07 - 09

P/O A7 SERIAL OUTPUT BOARD



A7 D1/D2 SERIAL OUTPUT BOARD 671-2126-00-06

Static Sensitive Devices
See Maintenance Section

OPTION 1S

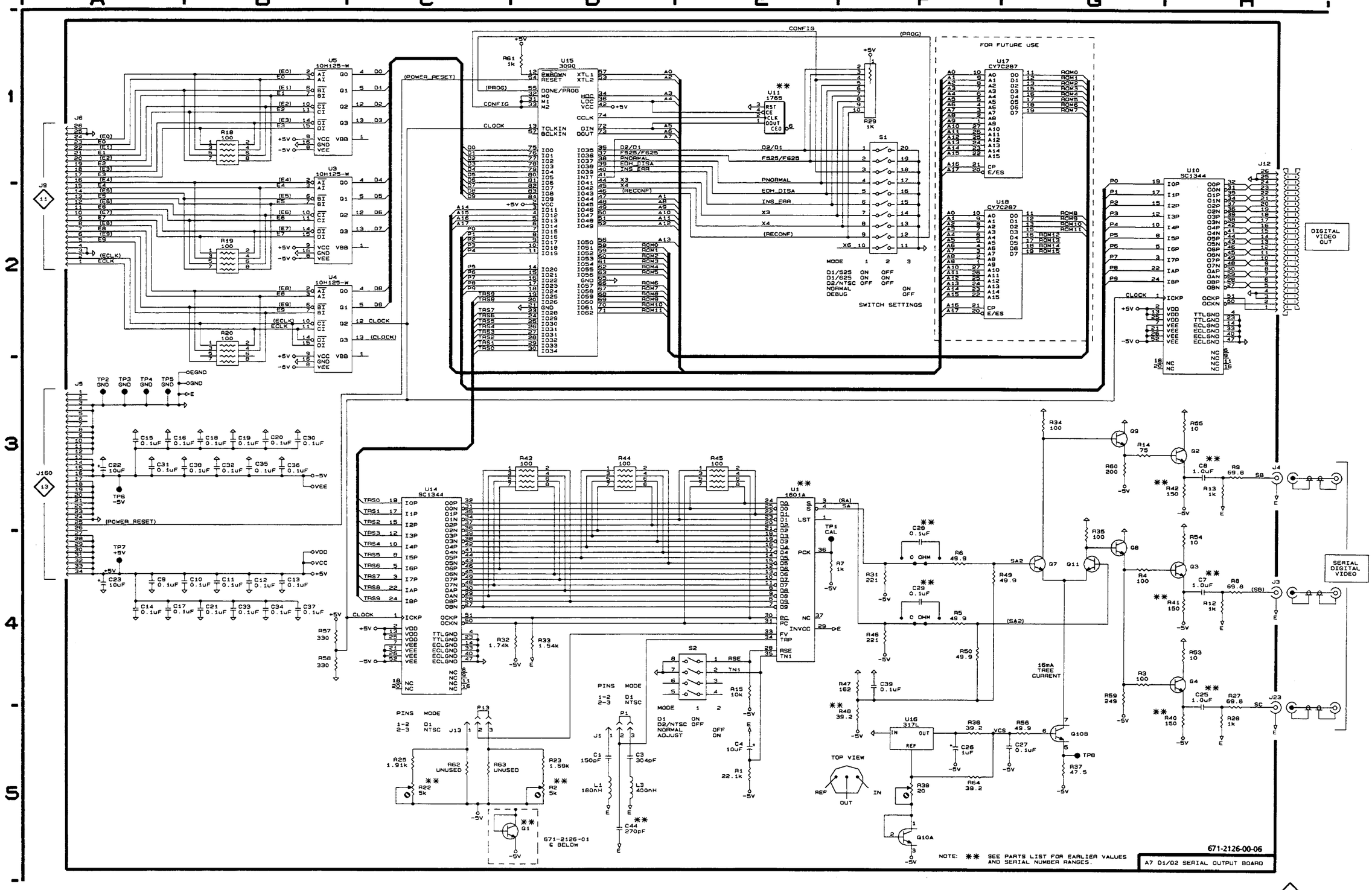
DIAGRAM <1>

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSEMBLY A7		
C1	D5	G5
C3	D5	G5
C4	E5	G5
C7	H4	B5
C8	H3	B5
C9	A4	E3
C10	A4	D2
C11	B4	B3
C12	B4	A2
C13	B4	H1
C14	A4	E3
C15	A3	E3
C16	A3	C4
C17	A4	F2
C18	B3	E6
C19	B3	A2
C20	B3	C2
C21	B4	C3
C22	A3	C1
C23	A4	D1
C25	H4	C5
C26	F5	D4
C27	G5	D5
C28	F4	D5
C29	F4	D5
C30	B3	A2
C31	A3	F4
C32	B3	D5
C33	B4	E1
C34	B4	C3
C35	B3	B4
C36	B3	C5
C37	B4	H2
C38	A3	B3
C39	F4	D5
C44 *†	D5	
J1	D5	F5
J3	H4	B5
J4	H3	B5
J5	A3	C1
J6	A1	A2
J12	H1	A3
J13	C5	F4
J23	H4	C5
L1	D5	G5
L3	D5	G5
P1	D5	F5
P13	C5	F4
Q1 *	C5	G4
Q2	H3	B5
Q3	H4	B5
Q4	H4	C5
Q7 *	G4	C5
Q8	G4	C5
Q9	G3	C5
Q10A	F5	C5
Q10B	G5	C5
Q11	G4	C5
R1	E5	F5
R2	D5	G4
R3	G4	C5
R4	G4	C5
R5	F4	D5
R6	F4	D5
R7	E4	F6
R8	H4	B5
R9	H3	B5
R12	H4	B5
R13	H3	B5
R14	G3	B4
R15	E4	E5
R18	B1	B1
R19	B2	B2
R20	B2	C2
R22	C5	G4
R23	D5	G4
R25	C5	G4
R27	H4	C5
R28	H5	C5
R29	E1	G2
R31	F4	D5
R32	D4	F3
R33	D4	F3
R34	G3	C5
R35	G4	C5
R36	F5	D4
R37	G5	C4
R39	F5	C4
R40	H5	C5
R41	H4	B5
R42	H3	B5
R43	D3	F4
R44	D3	E4
R45	E3	E5
R46	F4	D5
R47	F4	D5
R48	F5	D5
R49	F4	D5
R50	F4	D5
R53	H4	C5
R54	H4	B5
R55	H3	B5
R56	G5	D5
R57	B4	D2
R58	B4	D2
R59	G4	C5
R60	G3	C4
R61	C1	D2
R62	C5	G4
R63	C5	G4
R64	F5	D4
S1	F1	G2
S2	E4	G5
TP1	E4	F6
TP2	A3	C2
TP3	A3	H4
TP4	A3	C4
TP5	A3	F3
TP6	A3	C2
TP7	A4	D2
TP8	G5	C4
U1	E3	E5
U3	B1	B2
U4	B2	C2
U5	B1	B2
U10	H1	B3
U11	E1	F1
U14	C3	F3
U15	D1	E2
U16	F5	D5
U17	F1	G2
U18	F2	G1

*See parts list for serial number ranges.

† Located on Back of board.


A B C D E F G H
1 2 3 4 5
CONFIG
(PROG)
FOR FUTURE USE
U5 10H125-W
U3 10H125-W
U4 10H125-W
U15 3090
U11 1765
U17 CY7C287
U18 CY7C287
U10 SC1344
U12 SC1344
U1 1601A
U16 317L
S1
S2
J6
J9
J160
J5
J12
J4
J3
J23
R18 100
R19 100
R20 100
R29 1K
R61 1K
R43 100
R44 100
R45 100
R57 330
R58 330
R32 1.74k
R33 1.54k
R25 1.91k
R22 5k
R62 UNUSED
R63 UNUSED
R23 1.89k
R2 5k
R15 10k
R1 22.1k
C4 10uF
C1 150pF
L1 180nH
C3 304pF
L3 400nH
C44 270pF
Q1
671-2126-01
& BELOW
(POWER RESET)
CLOCK
(ECLK)
(PROG)
CONFIG
D2/D1
F525/F625
PNORMAL
EDH_DISA
INS_ERR
X3
X4
(RECONF)
MODE 1 2 3
D1/525 ON OFF
D1/625 ON ON
D2/NTSC OFF OFF
NORMAL ON
DEBUG OFF
SWITCH SETTINGS
PINS MODE
1-2 D1 NTSC
2-3
D1 ON
D2/NTSC OFF
NORMAL
ADJUST
OFF
ON
TOP VIEW
REF
IN
OUT
16mA TREE CURRENT
DIGITAL VIDEO OUT
SERIAL DIGITAL VIDEO
671-2126-00-06
A7 D1/D2 SERIAL OUTPUT BOARD
NOTE: ** SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES.

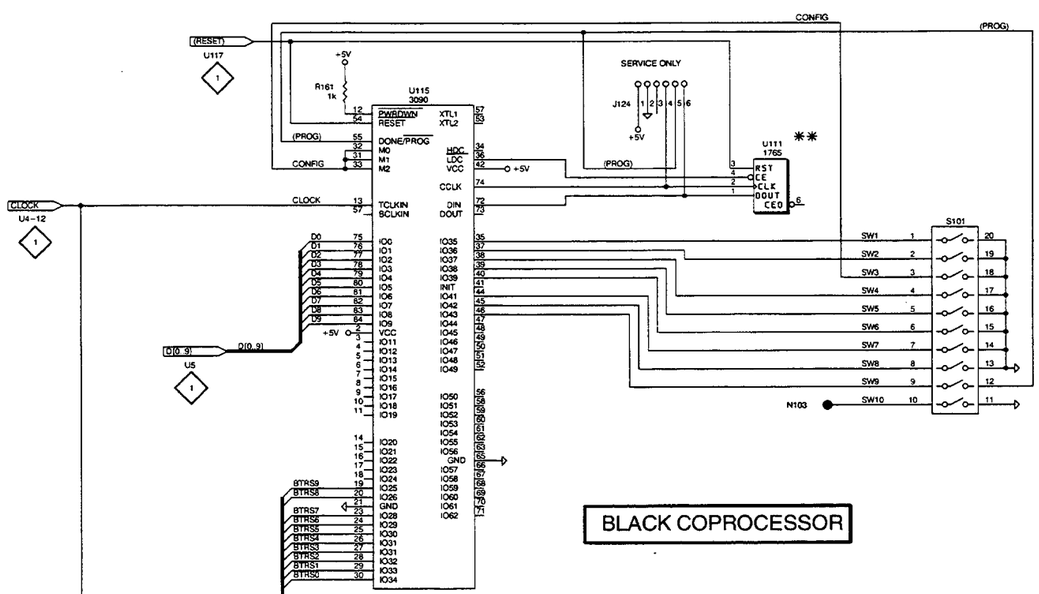
SCHEMATIC DIAGRAM <2>
D1/D2 SERIAL OUTPUT BOARD

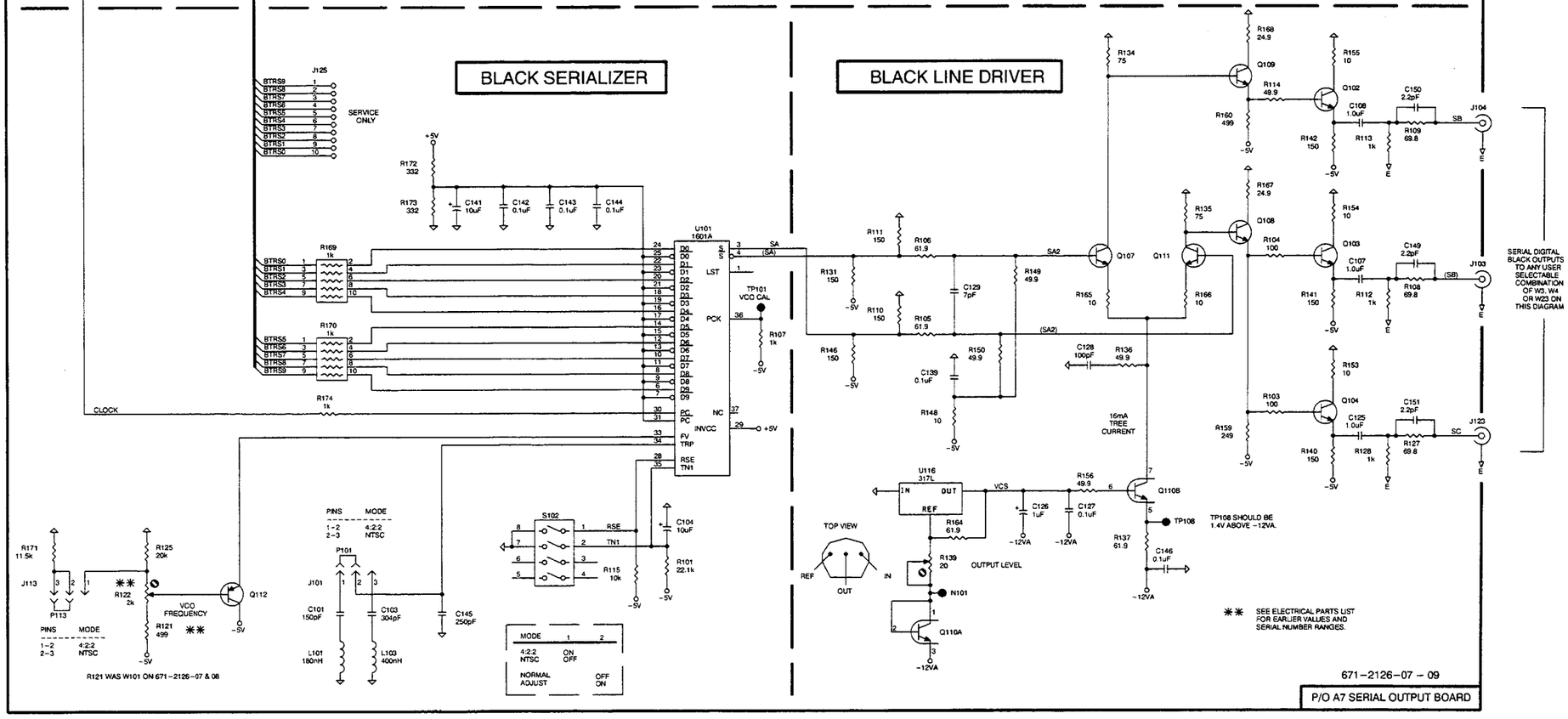
The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

ASSEMBLY A7. *Partial Assembly A7 also shown on Schematic 1.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C101	B5	H4
C103	B5	H4
C104	C5	H3
C107	F4	C4
C108	F3	C3
C125	F4	C4
C126	E5	D4
C127	E5	E4
C128	E4	D4
C129	E4	E3
C139	E4	E3
C141	B3	H3
C142	C3	G3
C143	C3	F3
C144	C3	F3
C145	B5	H4
C146	F5	D4
C149	G4	C4
C150	G3	C3
C151	G4	C4
J101	B5	G4
J103	G4	C4
J104	G3	C3
J113	A5	G3
J123	G4	C4
J124	C1	E1
J125	B3	F3
L101	B5	I4
L103	B5	I4
P101	B5	
P113	A5	
Q102	F3	D3
Q103	F4	D4
Q104	F4	D4
Q107	E4	E3
Q108	F3	D4
Q109	F3	D3
Q110A	D5	E4
Q110B	E5	E4
Q111	F4	E4
Q112	A5	H4
R101	C5	I3
R103	F4	D4
R104	F4	D4
R105	D4	E4
R106	D4	E3
R107	D4	G4
R108	G4	C4
R109	G3	C3
R110	D4	F4
R111	D4	F3
R112	F4	C4
R113	F3	C3
R114	F3	D3
R115	C5	I3
R121*	A5	H4
R122	A5	H3
R125	A5	H4
R127	G4	C4
R128	F4	C4
R131	D4	G4
R134	E3	D3
R135	F3	D4
R136	E4	D4
R137	E5	E4
R139	D5	E4
R140	F4	C4
R141	F4	C4
R142	F3	C3
R146	D4	G4
R148	E4	E3
R149	E4	E3
R150	E4	E3
R153	F4	D4
R154	F3	D4
R155	F3	D3
R156	E5	E4
R159	F4	D4
R160	F3	D3
R161	B1	E2
R164	E5	E4
R165	E4	E4
R166	F4	D4
R167	F3	D4
R168	F3	D3
R169	B4	E3
R170	B4	G3
R171	A5	H4
R172	B3	G3
R173	B3	G3
R174	B4	F4
S101	D1	F1
S102	C5	I3
TP101	D4	G4
TP108	F5	D4
U101	C4	G4
U111	C1	E1
U115	B1	D2
U116	D5	E4
W101*	A5	H4

*** See parts list for serial number ranges.**


(RESET)
U117
CONFIG
(PROG)
SERVICE ONLY
J124
R161
1k
U115
3090
PWRDWN
RESET
DONE/PROG
M0
M1
M2
HDC
LDC
VCC
CCLK
DIN
DOUT
TCLKIN
SCLKIN
U111
1765
RST
CE
CLK
DOUT
CEO
CLOCK
U4-12
D[0..9]
U5
S101
SW1
SW2
SW3
SW4
SW5
SW6
SW7
SW8
SW9
SW10
N103
BTRS9
BTRS8
BTRS7
BTRS6
BTRS5
BTRS4
BTRS3
BTRS2
BTRS1
BTRS0
BLACK COPROCESSOR


BLACK SERIALIZER
BLACK LINE DRIVER
J125
SERVICE ONLY
R172
332
R173
332
C141
10uF
C142
0.1uF
C143
0.1uF
C144
0.1uF
U101
1601A
R169
1k
R170
1k
R174
1k
CLOCK
TP101
VCO CAL
R107
1k
R171
11.5k
J113
P113
R125
20k
R122
2k
VCO
FREQUENCY
R121
499
Q112
R121 WAS W101 ON 671-2126-07 & 08
P101
J101
C101
150pF
C103
304pF
C145
250pF
L101
180nH
L103
400nH
S102
RSE
TN1
C104
10uF
R115
10k
R101
22.1k
R111
150
R106
61.9
R131
150
R110
150
R105
61.9
R146
150
C129
7pF
C139
0.1uF
R149
49.9
R150
49.9
R148
10
Q107
Q111
R135
75
R165
10
R166
10
C128
100pF
R136
49.9
16mA
TREE
CURRENT
U116
317L
R156
49.9
Q110B
C126
1uF
C127
0.1uF
R164
61.9
R137
61.9
C146
0.1uF
TP108
TP108 SHOULD BE
1.4V ABOVE -12VA.
TOP VIEW
R139
20
OUTPUT LEVEL
N101
Q110A
R134
75
R168
24.9
Q109
R114
49.9
R160
499
R142
150
R155
10
Q102
C108
1.0uF
R113
1k
C150
2.2pF
R109
69.8
J104
SB
R167
24.9
Q108
R154
10
Q103
C107
1.0uF
R112
1k
C149
2.2pF
R108
69.8
J103
(SB)
R153
10
Q104
C125
1.0uF
R128
1k
C151
2.2pF
R127
69.8
J123
SC
R103
100
R159
249
R140
150
R141
150
SERIAL DIGITAL BLACK OUTPUTS TO ANY USER SELECTABLE COMBINATION OF W3, W4 OR W23 ON THIS DIAGRAM
FROM ANY USER SELECTABLE COMBINATION OF J103, J104 OR J123 ON THIS DIAGRAM OR J3, J4 OR J23 ON
REAR PANEL
W4
SERIAL DIGITAL VIDEO 1
W3
SERIAL DIGITAL VIDEO 2
W23
SERIAL DIGITAL VIDEO 3
** SEE ELECTRICAL PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES.
671-2126-07 - 09
P/O A7 SERIAL OUTPUT BOARD

APPENDIX B
OPTION 1V

Option 1V for the TSG–170D provides a custom signal set for use with the Tektronix VM700A. This custom signal set replaces several of the test signals with new ones, and changes the button assignment for the NTC7 Composite signal (see Table B-1 for details). Table B-2 shows the characteristics of the added signals, and Figs. B-1 through B-8 provide timing information for them.

Table B-1
Option 1V Test Signal Changes

Standard Signal	Option 1V Signal
Pulse & Bars	NTC7 Composite.
Other Signals	
Multibars	FCC Color Bars.
NTC7 Composite	$SIN^X/_X$.
Line Sweep w/Markers	Chroma Freq Response.
Multipulse	Field Square Wave[1].
System Test Matrix	NTC7 Combination.
Monitor Setup Matrix	New matrix. See Fig. B-7.
10% Flat Field	50% Flat Field.
Red Field (12.5% pedestal)	Red Field. (50% pedestal).

Version 1.1 and above (Multipulse below Version 1.1).

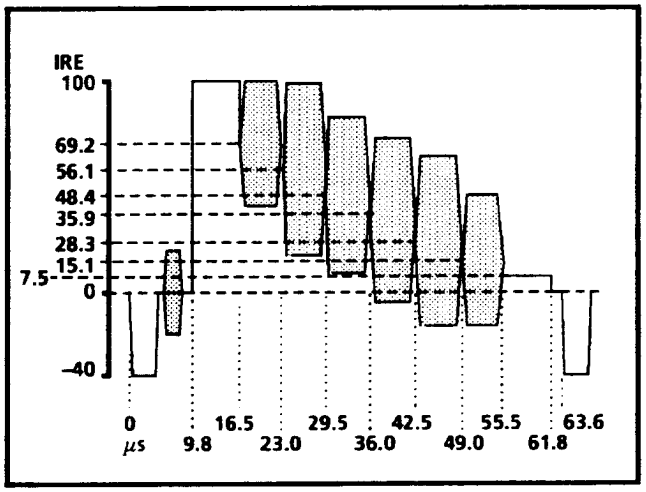


Fig. B-1. Option 1V FCC Color Bars.

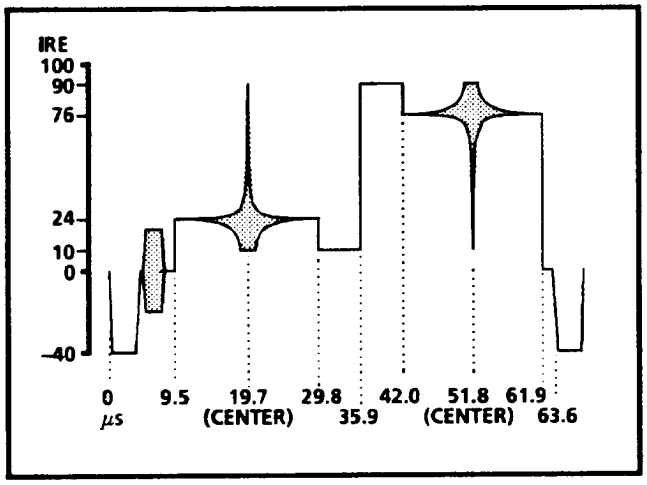


Fig. B-2. Option 1V $SIN^X/_X$

Table B-2. Option 1V Test Signal Characteristics

Characteristics	Performance Requirement	Supplemental Information
FCC COLOR BARS	Full Field color bars	75% Amplitude, 7.5% setup with a 100 IRE White Flag. See Fig. B-1.
SIN $X/_X$ Spectrum		See Fig. B-2. -3 dB at 4.75 MHz
Chroma Frequency Response	100 IRE BAR;50 IRE Pedestal with 30 IRE sine wave at five frequencies: 3.08, 3.33, 3.58, 3.83, and 4.08 MHz	See Fig. B-4.
NTC7 Combination	100 IRE BAR; 50 IRE Pedestal with six 50 IRE Multiburst packets at 0.5, 1.0, 2.0, 3.0, 3.58, and 4.2 MHz; 20 IRE, 40 IRE, 80 IRE 90° modulation	See Fig. B-3.
50% Flat Field Amplitude	357.2 mV (50 IRE)	See Fig. B-5.
Red Field Luminance Pedestal Chrominance Amplitude	 357.2 mV (50 IRE) 714.3 mV (100 IRE)	See Fig. B-6.
Monitor Setup Matrix	FCC Color Bars, 50% Flat Field, NTC7 Combination, $SIN^X/_X$, NTC7 Composite, Red Field, and Chroma Frequency Response	See Fig. B-7.
Field Square Wavel Amplitude Field Timing	 714 mV (100 IRE) Lines 72 - 202	See Fig. B-8.

Version 1.1 and above.

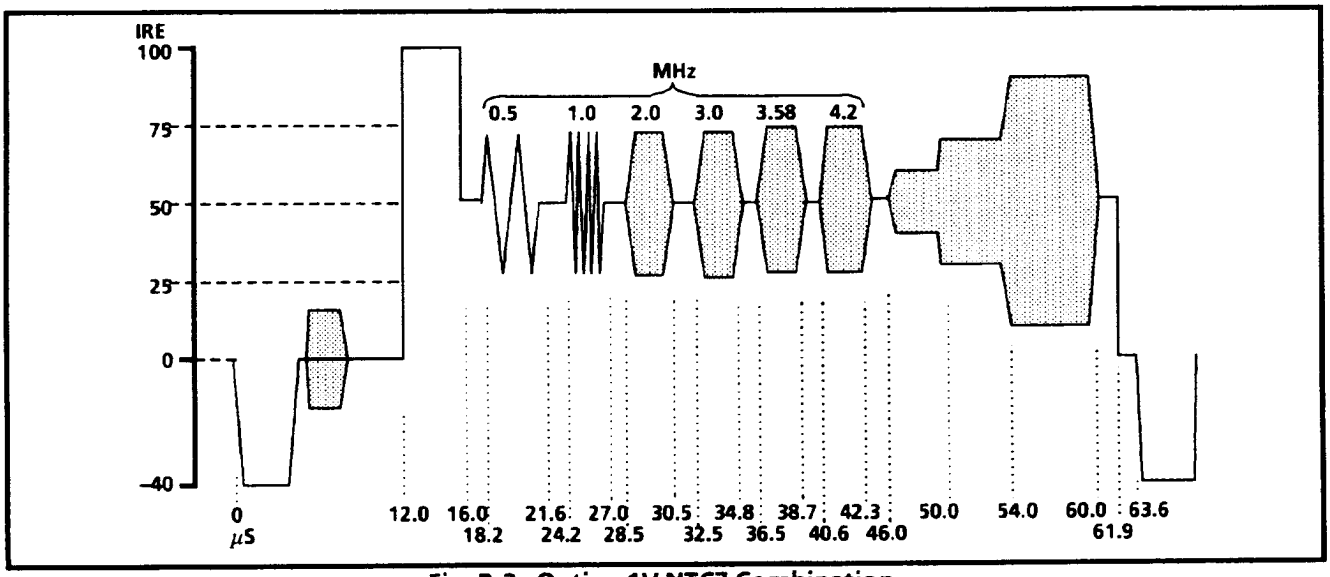


Fig. B-3. Option 1V NTC7 Combination.

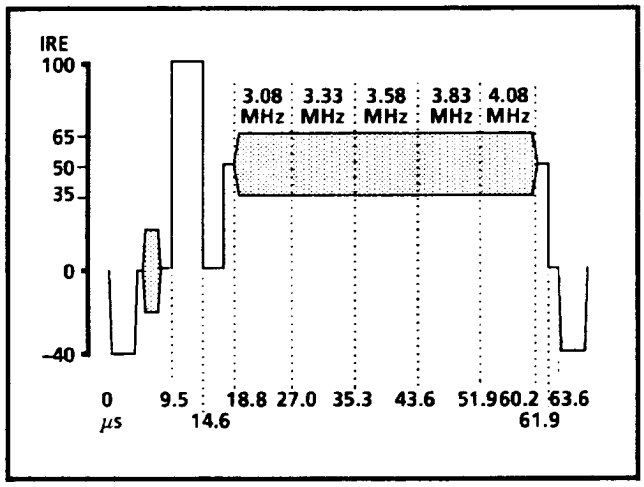


Fig. B-4. Option 1V Chroma Frequency Response.

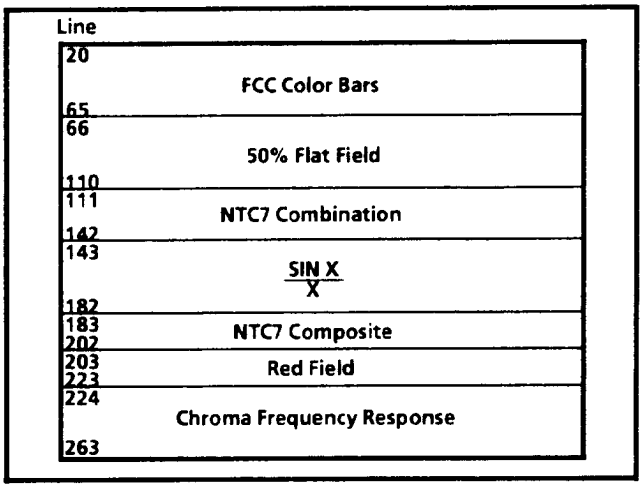


Fig. B-7. Option 1V Monitor Setup Matrix.

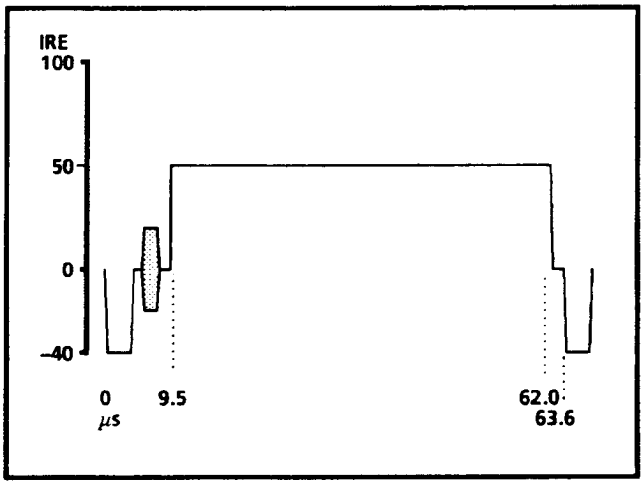


Fig. B-5. Option 1V 50% Flat Field.

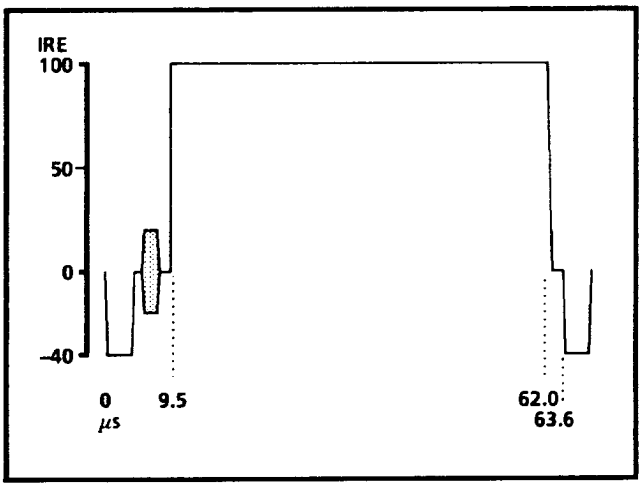


Fig. B-8. Option 1V Field Square Wave (Ver. 1.1 and above).

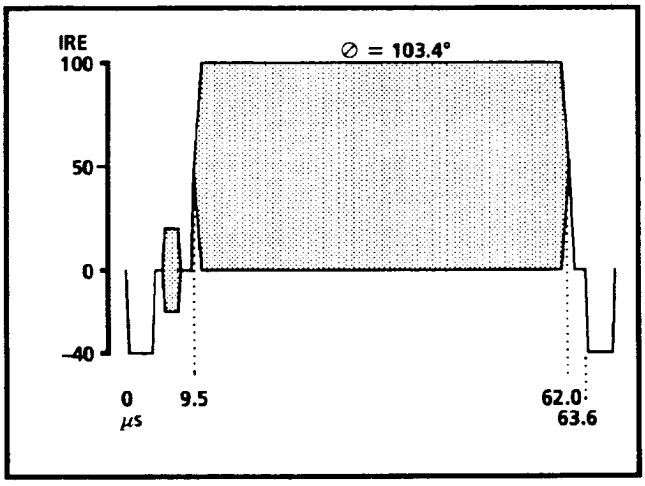


Fig. B-6. Option 1V Red Field.

Manual Change Information

Tektronix products are constantly under development for increased performance or lower cost to the customer. Often, changes are incorporated into a product as soon as they are shown to meet the highest quality standards.

This aggressive policy of product improvement can result in changes that are not reflected in the appropriate sections of the manual. Information regarding such changes will appear on the following pages. If no change notices are inserted after this page, the manual is correct as printed.

Please review any included change information and note the changes that will affect your use of the product. A single change may apply to several sections of the manual. Because change information sheets are inserted until all the changes are incorporated into every applicable section of the manual, some duplication may result.

Tektronix

MANUAL CHANGE INFORMATION

Date: 4/8/94 **Change Reference:** M81036

Product: TSG–170D **Manual Part Number:** 070–6943–00

Eff S/N: B010790
SOFTWARE VER: 1.4

ELECTRICAL PARTS LIST CHANGES

SECTION 8 REPLACEABLE ELECTRICAL PARTS

CHANGE TO READ:

A2–1	670–9111–56	CKT BD ASSY:DIGITAL BOARD (OPT 1J ONLY)
A2–1	670–9111–57	CKT BD ASSY:DIGITAL BOARD (STANDARD)
A2–1	670–9111–58	CKT BD ASSY:DIGITAL BOARD (OPT 1V ONLY)
A2–1U245	160–5664–02	IC,MEMORY:CMOS,EPROM;32K X 8,3–ST OUT;27C256–250,PRGM

Tektronix

MANUAL CHANGE INFORMATION

Date: 4/12/94 **Change Reference:** M80468

Product: TSG–170D **Manual Part Number:** 070–6943–00

Eff S/N: B010790

TEXT, ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

SECTION 1 INTRODUCTION

Page 1–2, following the Packaging discussion

ADD AS FOLLOWS:

OPTIONS

The following options are currently available for the TSG–170D.

Option 1J – This option modifies the standard signal set so that the signals have a 0% setup level, instead of the 7.5% setup level found in the standard signal set. For the TSG–170D this primarily impacts the SMPTE Color Bar signals (see Fig. 3–1a). Option 1J is fully documented in this manual.

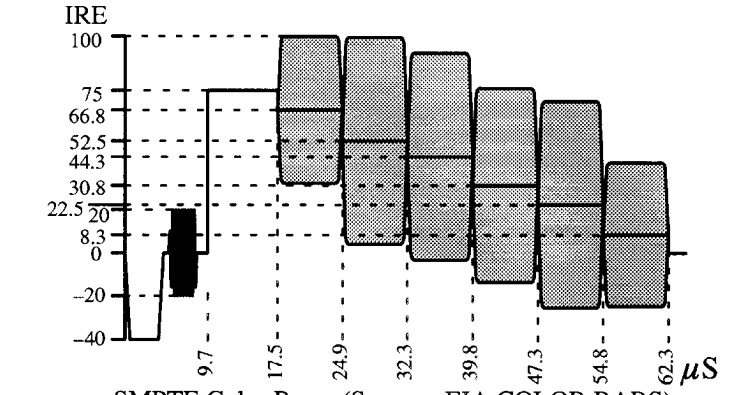
Option 1S – Option 1S adds serial digital video output to the TSG–170D. Up to three channels of serial digital test signals or Black Burst are available at the rear panel. Serial Digital Interface check fields, Error Detection and Handling, and (S/N B010689 and above) an embedded audio tone are among the capabilities offered. Option 1S is documented in Appendix A of this manual.

Option 1V – This option provides a custom signal set for use with the Tektronix VM700A. See Appendix B for details of this option.

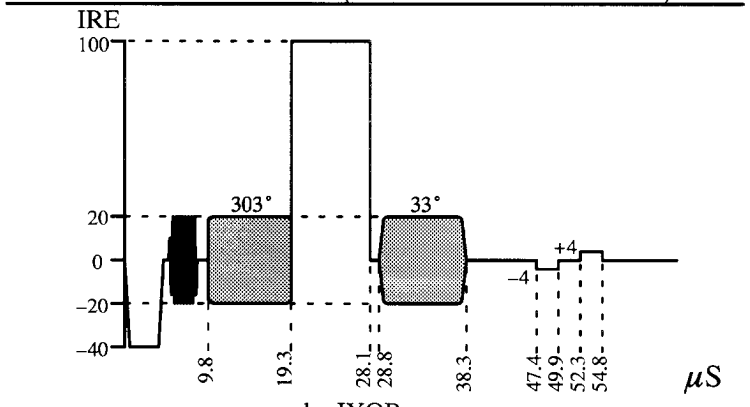
Date:	4/12/94	**Change Reference:**	M80468
Product:	TSG–170D	**Manual Part Number:**	070–6943–00

SECTION 3 SPECIFICATIONS

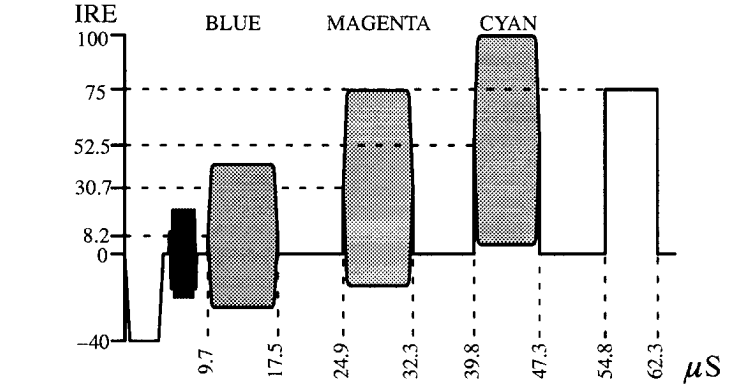
ADD Fig 3–1a for Option 1J **AS FOLLOWS:**



a. SMPTE Color Bars. (Same as EIA COLOR BARS)



b. IYQB



c. Reverse Blue Bars

Fig. 3–1a. SMPTE BARS signal components for Option 1J

Date:	4/12/94	**Change Reference:**	M80468
Product:	TSG–170D	**Manual Part Number:**	070–6943–00

SECTION 5 PERFORMANCE CHECK and CALIBRATION PROCEDURES

page 5–23, Calibration Procedure step 5, OUTPUT GAIN ADJUST

CHANGE parts h and i of step 5 **TO READ:**

h. Change the VAC output to:
Std: 53.6 mV
Opt 1J: 0.0 mV

i. ADJUST – R91, on the Output board, for a setup level of:
Std: 53.6 mV (7.5 IRE)
Opt 1J: 0.0 mV (0 IRE)
on the black burst signal.

SECTION 8 REPLACEABLE ELECTRICAL PARTS LIST

ADD AS FOLLOWS:

A2–1	670–9111–56	CKT BD ASSY:DIGITAL BOARD (OPT 1J ONLY)
A2–1U447	160–9887–00	IC,DIGITAL,NMOS:4096 X 8 EPROM;W/3–STATE OUT 2732A,PRGM (OPT 1J ONLY)
A2–1U624	160–9888–00	IC,MEMORY,NMOS:EPROM;8192 X 8,3–STATE;2764A–25,PRGM (OPT 1J ONLY)
A2–1U631	160–9889–00	IC,MEMORY,NMOS:EPROM;8192 X 8,3–STATE;2764A–25,PRGM (OPT 1J ONLY)
A2–1U637	160–9890–00	IC,MEMORY,NMOS:EPROM;8192 X 8,3–STATE;2764A–25,PRGM (OPT 1J ONLY)
A2–1U644	160–9891–00	IC,MEMORY,NMOS:EPROM;8192 X 8,3–STATE;2764A–25,PRGM (OPT 1J ONLY)
A2–1U650	160–9892–00	IC,MEMORY,NMOS:EPROM;8192 X 8,3–STATE;2764A–25,PRGM (OPT 1J ONLY)

APPENDIX A OPTION 1S SERIAL DIGITAL OUTPUT

Table A–2. Switch S101 (Black) Operating Selections

CHANGE segment 4 and 5 entries **TO READ:**

4		4	5		
5	Black/Test Signal Selection	open open closed closed	open closed open closed	0 IRE Black Signal Normal Test Signal 7.5 IRE Black Signal Normal Test Signal	5=open 4=closed [2]

[2] For Option 1J the Factory Setting is 5=open, 4=open

Tektronix

MANUAL CHANGE INFORMATION

Date: 6/6/94 **Change Reference:** M81265

Product:	Manual P/N:	Product	Manual P/N:
067–1011–00	070–3679–00	TSG 1125	061–3629–00
118AS/118RC	070–5114–00	TSG 1250	061–3719–00
1450–1	070–5568–00	TSG–170A	070–5680–00
1450–2	070–2998–00	TSG–170D	070–6943–00
1450–3A	070–3660–01	TSG200	070–8351–00
1910	070–4523–00	TSG–271	070–6304–00
728D	070–7629–00	TSG–273	070–7956–00
728E	070–7630–02	TSG–300	070–5722–00
728M	070–8045–00	TSG–370	070–7446–00
751	070–7631–00	TSG–371	070–7707–00
ASG100	070–8546–00	TSG–422	070–7022–00
ASG140	070–8867–01	VITS100	061–3939–00
DAC422	070–8595–00	VITS200	061–3923–00
ECO–170A	070–6113–00	VITS200 AA	061–3984–00
PE1000	070–8474–00	VITS201	070–7385–00
SPG1000	070–8074–00	VM700 Vol 1	070–8197–00
SPG–170A	070–5965–00	VM700 Vol 2	070–8275–00
SPG–271	070–6814–00	VM700A	070–8165–00
TPG–625	070–7248–00	VS210	070–8754–00
TSG 1001	070–8625–00	VS211	070–8164–00
TSG 1050	061–3718–00	VS211A	070–8827–00

Mechanical Parts List Changes

In the 1910

CHANGE all occurances of 131–0890–00 **TO READ:**

214–3903–01	1	SCREW,JACK:4–40 X 0.312 EXT THD,4–40 INT THD,0.188 HEX, STEEL,CAD PLATE
		ATTACHED PARTS
210–0004–00	2	WASHER,LOCK:#4 INTL,0.015 THK,STL CD PL
210–0406–00	2	NUT,PLAIN,HEX: 4–40 X 0.188,BRS CD PL
		END ATTACHED PARTS

In all other instruments

CHANGE all occurances of 131–0890–00 **TO READ:**

214–3903–01	1	SCREW,JACK:4–40 X 0.312 EXT THD,4–40 INT THD,0.188 HEX, STEEL,CAD PLATE