Instruction Manual

Tektronix

TSG-422
Digital Component Generator

070-7022-02

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

For further information, contact: Tektronix, Inc., Corporate Offices, P.O. Box 1000, Wilsonville, OR 97070-1000. Phone: (503) 627-7111; TLX: 192825; TWX: (910) 467-8708; Cable: TEKWSGT.

Subsidiaries and distributors worldwide.

WARRANTY

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; or c) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

THIS WARRANTY IS GIVEN BY TEKTRONIX WITH RESPECT TO THIS PRODUCT IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED. TEKTRONIX AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TEKTRONIX' RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. TEKTRONIX AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER TEKTRONIX OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

Contacting Tektronix

Product Support	For application-oriented questions about a Tektronix measurement product, call toll free in North America: 1-800-TEK-WIDE (1-800-835-9433 ext. 2400) 6:00 a.m. – 5:00 p.m. Pacific time Or contact us by e-mail: tm_app_supp@tek.com For product support outside of North America, contact your local Tektronix distributor or sales office.
Service Support	Contact your local Tektronix distributor or sales office. Or visit our web site for a listing of worldwide service locations. http://www.tektronix.com
For other information	In North America: 1-800-TEK-WIDE (1-800-835-9433) An operator will direct your call.
To write us	Tektronix, Inc. P.O. Box 1000 Wilsonville, OR 97070-1000

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

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.

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.

Wear Eye Protection. Wear eye protection if exposure to high-intensity rays or laser radiation exists.

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.*

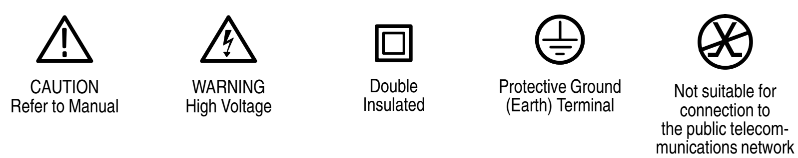
Terms on the Product. These terms may appear on the product:

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:



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.

Introduction

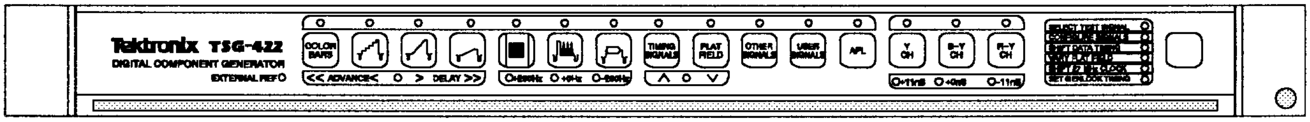


Fig. 1-1. Front panel of the TSG-422.

SECTION 1
INTRODUCTION

The TSG-422 Digital Component Generator (see Figs. 1-1 and 1-2) is a CCIR 601, 4:2:2 format digital test signal generator. The TSG-422 provides all the test signals needed to operate, maintain, and evaluate 4:2:2 equipment. Analog black burst outputs are provided for equipment synchronization. The TSG-422 supports both 525/60 and 625/50 systems, selected by either an internal jumper or the remote control.

DIGITAL GENLOCK

The TSG-422's unique digital genlock and stable internal oscillator make it ideal for either slave or stand alone operation. After the incoming signal is digitized, a processor analyzes timing to control the TSG-422's system clock. The digital genlock works with component video or composite NTSC, PAL, or SECAM sources operating in either 525/60 or 625/50 systems. The TSG-422 automatically switches to its internal oscillator in the absence of a reference input signal. This high stability crystal oscillator, with its constant temperature oven, ensures long-term frequency stability.

DIGITAL SIGNAL GENERATION

The TSG-422 uses 10-bit digital signal generation in all channels, to ensure the accuracy and stability of the test signals. (Prior to S/N B010253 it used 8-bit unless a TVGF03 kit was installed.) The luminance channel is clocked at 13.5 MHz and the color difference channels are clocked at 6.75 MHz. Color difference samples are co-sited with the odd numbered luminance samples.

The TSG-422 signal complement contains both general purpose signals and signals tailored specifically to the 4:2:2 environment. Test signals includes are:

- Color Bars (100% and 75%)
- Pluge
- 5-Step
- Ramp
- Limit Ramp
- Valid Ramps
- Light Blue Shallow Ramp
- Shallow Ramp
- Shallow Ramp Matrix
- Pulse and Bar
- Field Square Wave
- Co-Siting Verification
- Multipulse
- Multiburst
- Full and Reduced Amplitude Sweeps
- Bowtie Timing
- 50% Flat Field
- Convergence Pattern
- Digital/Analog Blanking Markers
- Digital Gray
- APL: High, Low and Bounce
- (SIN X) / X*
- Black*
- Serial Pathological Equalization*

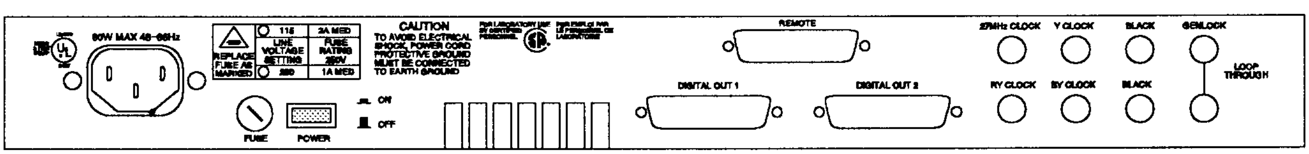


Fig. 1-2. Rear panel of the TSG-422.

- Serial Pathological PLL*
- Serial Pathological Matrix*

*SN B010505 and above

REVERSE BARS MATRIX

The Reverse Bars Matrix may be used to keep track of both analog and digital blanking widths, by viewing it on a waveform monitor set for line rate sweep. The blanking edges of the Level Reference signal (at the 50% points) mark digital blanking, while the blanking edges formed by the 75% Bars and the 75% Reverse Bars mark the analog blanking.

The Reverse Bars Matrix may also be used for a quick channel timing check. Again, display it on a waveform monitor set for line rate sweep; if the channel timing is correct, there should be an intersection at the center of the line which is coincident for all three channels.

RAMP SIGNALS

The Ramp signal extends 5% below blanking and 5% above peak white, to provide indication of clipping. The Limit Ramp provides signal information to test the maximum dynamic range of the system, levels 4 through 1016 in a 10-bit system (levels 1 through 254 in an 8-bit system).

Shallow Ramp, Shallow Ramp Matrix, and Light Blue Shallow Ramp are provided for measurement of quantization noise and the detection of rounding and truncation errors.

VALID RAMP

Component processing and switching equipment may transcode Y, B-Y, and R-Y signals to GBR for internal processing. A linearity test in these mixed format systems should not drive the GBR channels below zero or above maximum signal level. The Valid Ramp signal consists of three separate ramps in each of three channels. Each ramp is optimized to test one channel and is accompanied by smaller ramps in the other channels to allow valid transcoding to GBR.

SHALLOW RAMP

Subtle linearity errors introduced by ADCs and DACs in video processors can accumulate on multiple generations. In the past, full scale ramps were used to test these converters, but sometimes an error occurring at one specific digital word would be hidden when using conventional ramps. With full scale ramps, single word errors last for only a single clock cycle and are masked by the system's anti-aliasing filters.

The TSG-422 Shallow Ramp extends the duration of the error, making them easier to see. A digital system can be tested over its full dynamic range using the Shallow Ramp Matrix. The Matrix extends from 0 to 700 mV in the luminance channel and -350 to +350 mV in the color difference channels.

BOWTIE

Channel matching is critical in component systems. Timing mismatch causes color fringing on fine details while amplitude mismatch cause color saturation and hue shift. The Bowtie signal simplifies channel timing and provides a quick check of gain matching.

The Bowtie signal is made up of two separate sinewave packets, one for each channel. The channel delays are compared by subtracting channels with the A-B display on a waveform monitor. The WFM-300 Component Waveform Monitor can simultaneously compare Channel 1 with both Channel 2 and Channel 3, forming the Bowtie display (after the signal has been converted from digital to analog).

Channel timing errors move the null off center. Markers built into the Bowtie signal indicate 20 ns delay increments, making it possible to resolve errors as small as 5 ns. Channel amplitude mismatch will appear as an incomplete null of the Bowtie.

CO-SITING VERIFICATION

The Co-siting signal provides a one-sample wide pulse on each horizontal scan line. The luminance channel pulse occurs on an odd sample, and it is coincident with the like pulses in the color difference channels. This signal is intended to provide an easy means of verifying correct luminance and color difference sample positioning in the digital domain.

DIGITAL/ANALOG BLANKING MARKERS

The Blanking Marker's signal provides two raised samples at the beginning and end of both digital and analog blanking. These samples mark the first and last active video samples of the respective blanking width.

The analog blanking widths conform to CCIR and RS-170A recommendations. These signals are useful in determining that proper blanking width is maintained throughout the system.

DIGITAL GRAY

The Digital Gray signal sets the luminance channel to word 511 (127 in an 8-bit system) and the color difference channel to word 512 (128 in an 8-bit system). This sets up a high/low sequence on each of the parallel interface lines, thus providing a high frequency signal for testing the transmission medium.

PATHOLOGICAL SIGNALS

There are two signal patterns which have been described by Sony, in their 1602a serial receiver data sheet, which stress the capabilities of serial receivers using this IC. The TSG-422 does generate these "pathological" signals, for use with the Option 1S serial output. These signals, Serial Pathological Equalization and Serial Pathological PLL, are selected with the OTHER SIGNALS push button, as shown in Table 2-2.

USER-CONFIGURABLE CONTROLS

Operation of the TSG-422 is simplified by its user-configurable controls. Many of the test signal controls access a variety of similar signals. These signals are accessed by repeatedly pressing the switch. By simply entering the Configure Signal Mode and specifying which signal is desiredd to appear first, the problem of searching for a signal is eliminated.

RECEIVER TESTING

The TSG-422 also provides facilities for time offsetting the clock and data information. This is useful in verifying receiver performance. In addition, the frequency of the 27 MHz interface clock may be shifted by 200 Hz in each direction, providing a means to test phase lock loops in clock regeneration circuits.

OUTPUTS

There are two separate digital test signal outputs provided, as well as separate outputs for each clock signal (27 MHz Clock, Y Clock, B-Y Clock, and R-Y Clock). These clock outputs may be used with a demultiplexer, in order to separate the desired channel from the digital output data stream.

REMOTE CONTROL

Remote operation of test signal selection, system timing, and line rate selection is available by simple ground closure control through a rear panel connector.

PACKAGING

The TSG-422's rugged, 1-3/4 inch package makes it ideal for use anywhere space is at a premium.

Operating Instructions

SECTION 2
OPERATING INSTRUCTIONS

This section explains how to operate the TSG-422. It also lists the selectable test signals and the rear panel output connectors.

FRONT PANEL CONTROLS

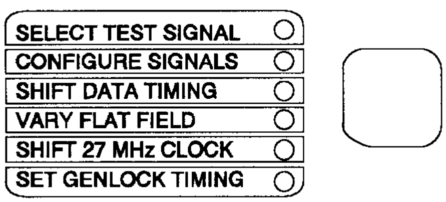


Fig. 2-1. The MODE SELECT button on the TSG-422.

MODE SELECTION

The key to the front panel is the MODE SELECT switch. Located on the right of the front panel (see Fig. 2-1), this switch puts the front panel in one of six operating modes:

- Select Test Signal
- Configure Signals
- Shift Data Timing
- Vary Flat Field
- Shift 27MHz Clock
- Set Genlock Timing

In each of these modes, the switches have different functions. Fig. 2-2 and Table 2-1 show the assigned functions for each mode.

The following text explains which functions are selectable in each front panel mode and how to select them.

Table 2-1. Functions of the front panel buttons.

SWITCH		FUNCTION IN MODE:					
		SELECT TEST SIGNAL	CONFIGURE SIGNALS	SHIFT DATA TIMING	VARY FLAT FIELD	SHIFT 27 MHz CLOCK	SET GENLOCK TIMING
1	MODE SELECT	MODE SELECT	MODE SELECT	MODE SELECT	MODE SELECT	MODE SELECT	MODE SELECT
2	COLOR BARS	COLOR BARS	COLOR BARS				COARSE GENLOCK ADVANCE
3	STAIRSTEP	STAIRSTEP	STAIRSTEP				FINE GENLOCK ADVANCE
4	RAMP	RAMP	RAMP				FINE GENLOCK DELAY
5	SHALLOW RAMP	SHALLOW RAMP	SHALLOW RAMP				COARSE GENLOCK DELAY
6	PULSE & BAR	PULSE & BAR	PULSE & BAR			+ 200 Hz	
7	MULTIPULSE	MULTIPULSE	MULTIPULSE			+ 0 Hz	
8	SWEEP	SWEEP	SWEEP			- 200 Hz	
9	TIMING SIGNALS	TIMING SIGNALS	TIMING SIGNALS		PEDESTAL ∧		
10	FLAT FIELD	FLAT FIELD	FLAT FIELD		PEDESTAL ∨		
11	OTHER SIGNALS	OTHER SIGNALS	OTHER SIGNALS				
12	USER SIGNALS	USER SIGNALS	USER SIGNALS				
13	APL	APL					
14	Y CH	Y CH ON/OFF		+ 11 ns			
15	B-Y CH	B-Y CH ON/OFF		+ 0 ns			
16	R-Y CH	R-Y CH ON/OFF		- 11 ns			

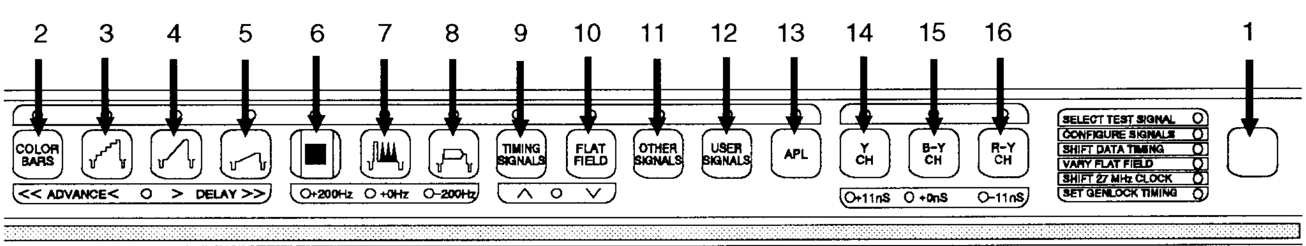
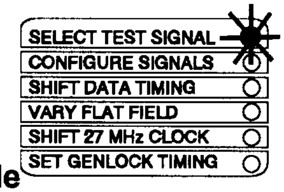


Fig. 2-2. Front panel buttons.



Select Test Signal Mode

Selecting Signals

The instrument powers up in Select Test Signal mode, generating Color Bars. In this mode, the front panel allows selection of any of the available test signals.

Most of the test signal switches select several signals of the same type. To select a signal, just press the appropriate test signal switch repeatedly until it selects the desired signal. Table 2-2 shows the signals selectable with each switch.

Selecting APL

To get high APL, press the APL switch once. Press it again to get low APL, press it a third time to get a one-second bounce between high and low APL, and press it a fourth time to switch off APL.

The TSG-422 can be set (by jumper selection) to operate as a 525/60 or 625/50 system. In 525/60, high APL is made up of 20 lines of 100% flat field followed by 5 lines of the selected test signal. Low APL is comprised of 20 lines of 0% flat field followed by 5 lines of the selected test signal.

In 625/50, high APL is made up of 18 lines of 100% flat field followed by 6 lines of the selected test signal. Low APL is comprised of 18 lines of 100% flat field followed by 6 lines of the selected test signal.

Selecting Channel Outputs

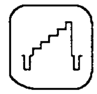
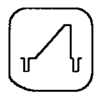
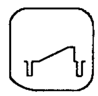
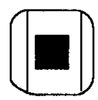
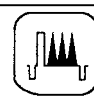
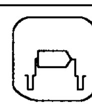
In Select Test Signal mode, the three right most buttons (Y CH, B-Y CH, and R-Y CH) allow any of the three data channels to be turned on and off. This is especially useful for checking crosstalk between channels.

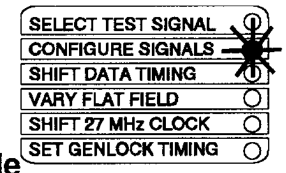
User Signals

The USER SIGNALS button is not in use at this time.

* Note: In Table 2-2, signals with asterisks are for instruments with serial numbers B010505 and above.

Table 2-2. Signals available in the Test Signal Mode.

SWITCH	SWITCH NAME	SIGNALS
COLOR BARS	COLOR BARS	100% Color Bars w/ Level Ref 75% Color Bars w/ Level Ref 100% Color Bars 75% Color Bars Reverse Bars Matrix
	STAIRSTEP	5-Step
	RAMP	Ramp Limit Ramp Valid Y Ramp Valid B-Y Ramp Valid R-Y Ramp
	SHALLOW RAMP	Shallow Ramps (1-10) Shallow Ramp Matrix
	PULSE & BAR	50 HZ 2T 4T 10T Pulse & Bar Field Square Wave Component/50 Hz Mod Pulse 60 Hz 2T 4T 10T Pulse & Bar Field Square Wave 60 Hz Mod Pulse Component Mod Pulse
	MULTIPULSE	Multipulse Multiburst
	SWEEP	100% Line Sweep 60% Line Sweep Multiburst (SIN X) / X *
TIMING SIGNALS	TIMING SIGNALS	500 kHz Bowtie 2.5 MHz Bowtie Blanking Markers Co-siting Pulse
FLAT FIELD	FLAT FIELD	Flat Field Field ID Black *
OTHER SIGNALS	OTHER SIGNALS	Convergence Light Blue Ramp Digital Gray Measurement Matrix Serial Pathological EQ * Serial Pathological PLL * Serial Pathological Matrix *
USER SIGNALS	USER SIGNALS	Not implemented.
APL	APL	100% APL 0% APL Bounce



Configure Signals Mode

Since most of the test signal switches select several signals of the same type, it would be convenient if the signal which appears first under each switch. The Configure Signals mode allows this.

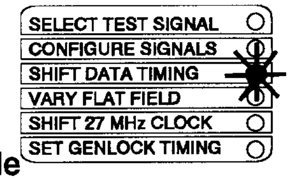
How to Configure the Signal Buttons:

For example, the SWEEP switch allows selection of either 100% Sweep, 60% Sweep, or Multiburst. To select the 60% Sweep as the first signal:

a. Enter the Configure Signals mode.

b. Press the SWEEP switch until the 60% Sweep is displayed.

c. Exit the Configure Signals mode to save the selection.



Shift Data Timing Mode

This mode allows the clock to be phase-shifted with respect to the data by ±11 ns, in order to test both the equipment receiving a digital component data stream and the link to it. See Fig. 2-3.

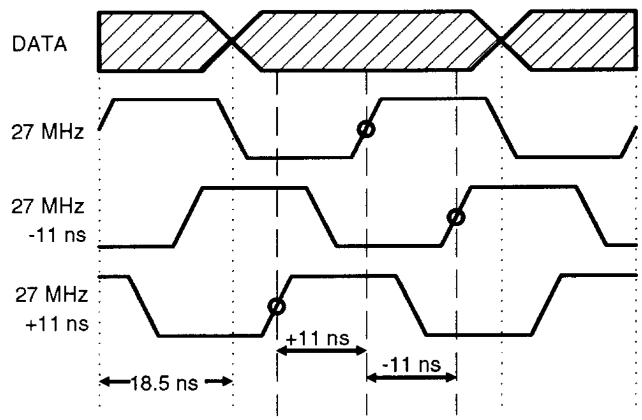


Fig. 2-3. How the clock is shifted with respect to the data.

While in this mode the three right most switches have the following functions (right to left): +11 ns, +0 ns, and -11 ns (see Fig. 2-4). Pressing one of these will advance or delay the data timing accordingly, and the red LED beneath the button lights to indicate which selection has been made. Upon exiting this front panel mode, the data timing reverts to +0 ns.

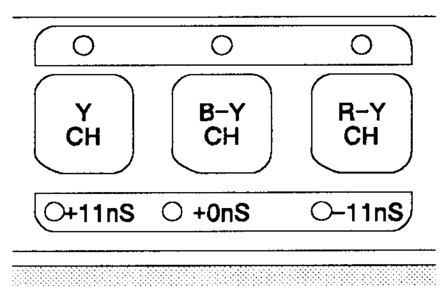
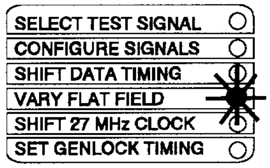


Fig. 2-4.
The buttons used in the Shift Data Timing Mode.

Vary Flat Field Mode



This mode gives the operator full control of the amplitude of a Flat Field signal. The amplitude may be adjusted throughout the range of active video, in steps of ± 1 LSB. This allows a static view of any individual data word, much more so than a shallow ramp display.

The Flat Field signal available in this mode is independent of the selected test signal. That is, Flat Field does not need to be selected in order for this mode to operate. If Color Bars is selected and Vary Flat Field mode is chosen, the color bar signal will be displayed until the ∧ or ∨ button is pressed, then the display changes to show the flat field signal (see Fig. 2-5).

When one of the buttons is first pressed, the amplitude will move 1 LSB. If the button is held down, after a 2 second delay the amplitude will start changing at approximately a 10 LSB/second rate. Upon exiting this mode, the display returns to the previously selected test signal.

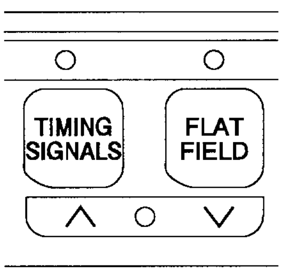
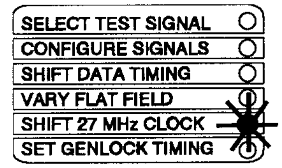


Fig. 2-5.
Buttons used in the Vary Flat Field Mode.

Shift 27 MHz Clock Mode



In this mode, the PULSE & BAR, MULTIBURST, and SWEEP buttons allow adjustment of the 27 MHz clock by +200 Hz, +0 Hz, and -200 Hz. This is useful for checking the pull-in range of other instruments.

When this mode is first entered, the +0 Hz LED is turned on, indicating that the oscillator is running at 27 MHz. Pressing the button above either +200 Hz or -200 Hz will shift the oscillator by that amount, and light the appropriate LED to indicate the selection (see Fig. 2-6). Pressing the +0 Hz returns the oscillator to 27 MHz. Regardless of the final selection, upon exiting this mode, the oscillator returns to 27 MHz.

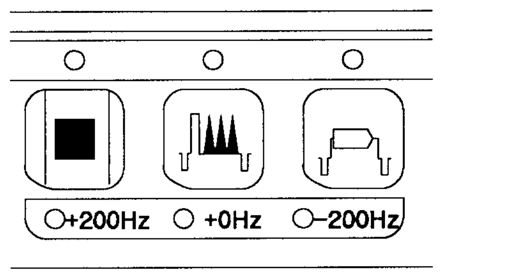
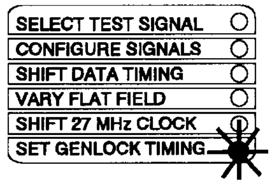


Fig. 2-6.
Buttons used in the Shift 27 MHz Clock Mode.

Set Genlock Timing Mode



In the Set Genlock Timing mode, the timing of the test signal can be advanced or delayed relative to the genlock input. The timing range is ±8 µs (see Fig. 2-7). While the front panel is in this mode, the buttons above the light gray ADVANCE/DELAY strip take on the following functions (from right to left): Coarse Genlock Advance, Fine Genlock Advance, Fine Genlock Delay, and Coarse Genlock Delay (see Fig. 2-8). The coarse adjustment shifts the genlock timing over a total range of 16 µs in approximately 45 ns steps. The fine adjustments shift the genlock timing over a minimum range of 47 ns in approximately 1.5 ns steps. Arrows below the buttons indicate direction and amount of timing advance or delay.

Setting Genlock Timing:

a. Select Set Genlock Timing mode with the MODE SELECT switch. Note the red LED under the four genlock timing buttons lights to indicate that they control genlock timing.

b. Advance genlock timing by pressing and holding down the < button for small increments of advance or press << for large increments. The delay buttons operate in the same manner.

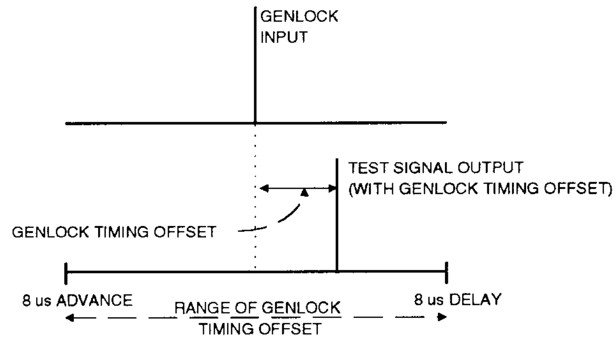


Fig. 2-7. Relative timing of the Genlock Input signal and the Test signals.

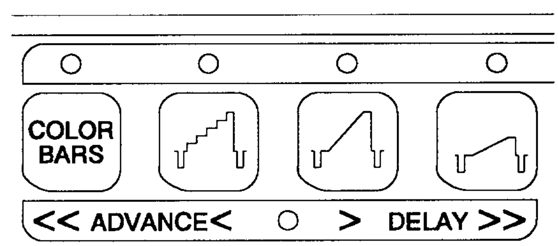


Fig. 2-8.
Buttons used to set the Genlock Timing.

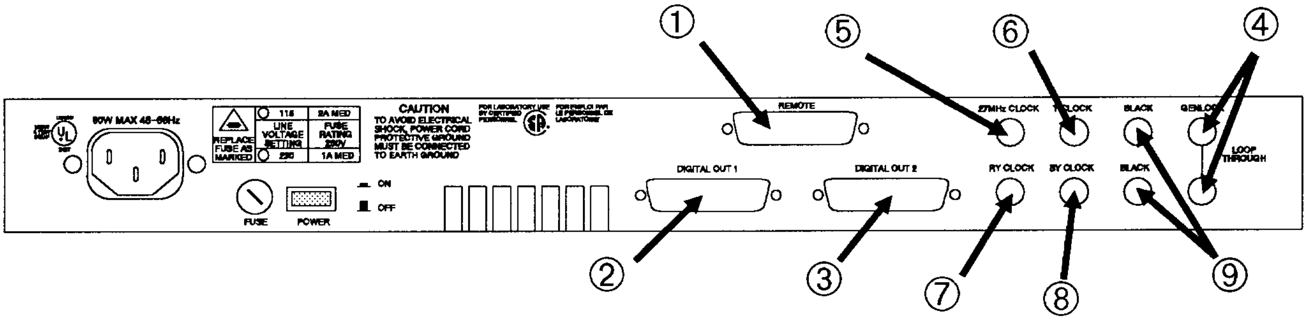


Fig. 2-9. Rear panel of the TSG-422.

REAR PANEL CONNECTORS
See Fig. 2-9

The rear panel has eight BNC video connectors, one 25-pin remote control connector, two 25-pin digital video output connectors, and one power socket. Table 2-3 shows the output from each connector.

Rear Panel Controls

POWER. On/Off push-push switch.

Rear Panel Outputs

Genlock Loop Through. The digital genlock works with component video or composite NTSC, PAL, or SECAM sources operating in either 525/60 or 625/50 systems. The TSG-422 automatically switches to its internal oscillator in the absence of a reference input signal.

27 MHz Clock, Y Clock, R-Y Clock, & B-Y Clock. (See Fig. 2-10.) These clock signals can be used with a demultiplexer to demultiplex the signal from the digital output data stream.

Black. Analog Black Burst outputs that can be used to time other equipment to the TSG-422.

Table 2-3. Summary of rear panel connectors.

CONNECTOR	FUNCTION
① Remote	Remote Control Input.
② Digital Out 1	Parallel Digital Video Output (Buffered). See Table 2-4.
③ Digital Out 2	Parallel Digital Video Output (Buffered). See Table 2-4.
④ Genlock Loop Through	Genlock Input.
⑤ 27 MHz Clock	ECL Levels. Positive transition during each data packet. See Fig. 2-10.
⑥ Y Clock	ECL levels. Positive transition during luminance data packets. See Fig. 2-10.
⑦ R-Y Clock	ECL levels. Positive transition during R-Y data packets. See Fig. 2-10.
⑧ B-Y Clock	ECL levels. Positive transition during B-Y data packets. See Fig. 2-10.
⑨ Black	Analog Black Burst Outputs.

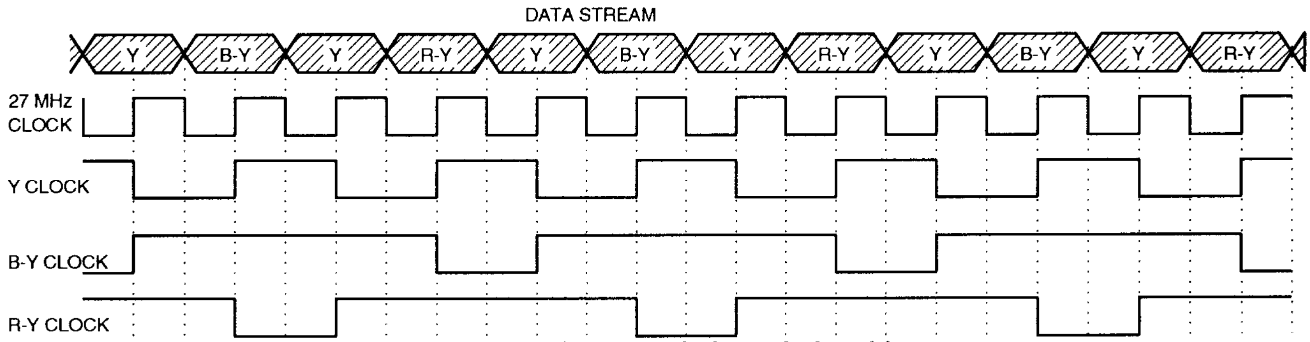


Fig. 2-10. Clock output timing relationships.

Digital Out 1 & 2. The luminance channel is clocked at 13.5 MHz and the color difference channels are clocked at 6.75 MHz. Color difference samples are co-sited with the odd numbered luminance samples illustrated in Fig. 2-10. Table 2-4 lists the pinout for the Digital Out 1 & 2 connectors and Fig. 2-11 illustrates the connector as an aid in pin location.

NOTE

If Option -1S (serial digital) is added to the TSG-422, these two outputs are no longer interchangeable. DIGITAL OUT 2 is no longer timed to the output clocks (27 MHz, Y, B-Y, & R-Y) and the Shift Data function is no longer valid for this output.

Remote. The ground-closure remote control allows for remote operation of test signal selection, system timing, and line rate selection. See the following pages for how to operate the Remote Control.

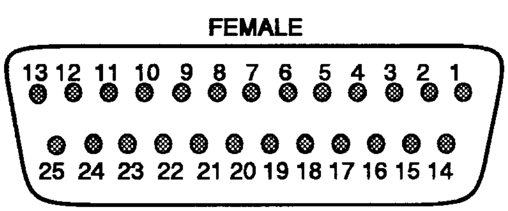


Fig. 2-11. Pinout of the Digital Video outputs.

Table 2-4. Pinout for the Digital Video Outputs.

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	Clock	14	Clock Return
2	System Ground	15	System Ground
3	Data 9 (MSB)	16	Data 9 Return
4	Data 8	17	Data 8 Return
5	Data 7	18	Data 7 Return
6	Data 6	19	Data 6 Return
7	Data 5	20	Data 5 Return
8	Data 4	21	Data 4 Return
9	Data 3	22	Data 3 Return
10	Data 2 LSB 8-bit system	23	Data 2 Return LSB 8-bit system
11	Data 1	24	Data 1 Return
12	Data 0 LSB 10-bit system	25	Data 0 Return LSB 10-bit system
13	Cable Shield		

Remote Operation

The TSG-422 can be remotely controlled through the 25-pin remote connector located on the rear panel. Through TTL-compatible ground closures, these pins control the functions described below. Typically, the pins would be grounded through user supplied switches, using pin 9, 10, 11, or 12 as ground. The instrument can be locked into a fixed operating mode by wiring directly to the connector. To do this, attach a male 25-pin DIN plug to the remote connector and solder the appropriate pins to ground. Fig. 2-12 shows this connector's pinout and Table 2-5 gives the pins functions.

Table 2-5. Pinout of the Remote connector.

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	Signal Select 0	14	DSP0 (not used)
2	Signal Select 1	15	DSP1 (not used)
3	Signal Select 2	16	DSP2 (not used)
4	Signal Select 3	17	DSP3 (not used)
5	Timing Preset 0	18	DSP4 (not used)
6	Timing Preset 1	19	DSP5 (not used)
7	Genlock/(Internal)	20	DSP6 (not used)
8	50 Hz/(60 Hz)	21	DSP7 (not used)
9	Ground	22	Not Connected
10	Ground	23	Not Connected
11	Ground	24	+ 5 V
12	Ground	25	+ 5 V
13	Not Connected		

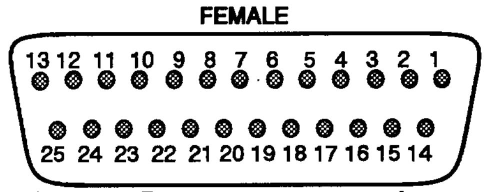


Fig. 2-12. Remote connector pinout.

Remote Connector Pins

Signal Select — Pins 1-4

Four binary-code control lines can be programmed to select a set of 15 test signals. These pins can be reprogrammed to select a different set.

For example to set Multiburst to be selected by pin setting 1001 (1=open 0=ground):

a. Turn the power OFF.

b. Set J205 on the Main board (A2-1) to its program position (2-3), and turn the power ON.

c. Set the remote pins 1-4 to 1001, and select Multiburst from the front panel. The Remote is now programmed for Multiburst with a pin setting of 1001.

d. To add another signal to the programmed selections:
set the remote pins to the desired positions and select the signal at the front panel.

e. When all desired signals are programmed:
turn the power OFF,
return J205 to the nonprogram position,
and turn the power ON.

Remote selection 1111 selects the signal last selected at the front panel.

Timing Presets — Pins 5-6

Two binary-coded control lines can be programmed to select one of four genlock timing presets. To program different genlock timing settings:

a. Ground the selected pins.

b. Set the genlock timing at the front panel.

c. Cycle the front panel MODE SELECT switch back to the Select Test Signal mode.

Internal/External Genlock — Pin 7

Selects one of two timing references for the TSG-422. When grounded, pin 7 selects the Internal Timing Reference. Ungrounded, it selects the Genlock Input reference when a genlock input is present. If none is present, it defaults to Internal Timing Reference.

50 Hz/60 Hz — Pin 8

Selects between 50 Hz (high) and 60 Hz (low) standards, only when J380 (on A3) is in the 2-4 position.

Ground — Pins 9, 10, 11, and 12

Ground.

Pins 13-23

Not used at this time.

+ 5 V — Pins 24 and 25

+5 V outputs.

Selecting Between 525/60 and 625/50 Timing

The TSG-422 can generate test signals with either the 525/60 timing or 625/50 timing. Table 4-1, in the Installation Section, shows how to jumper select between these two systems.

Specifications

SECTION 3
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.

Table 3-1
Encoding Parameters

Characteristics	Performance Requirements	Supplemental Information	Perf. Step Check #
Coded Signals		Y, R-Y, B-Y.	
Number of Samples Per Total Line Luminance (Y) Color Difference (B-Y and R-Y)		525/60 625/50 858 864 429 432	
Sampling Structure		Orthogonal, line, field, and picture repetitive. R-Y and B-Y samples co-sited with odd (1st, 3rd, 5th, etc.) Y samples in each line.	
Sampling Frequency Luminance (Y) Color Difference (B-Y and R-Y)		 13.5 MHz. 6.75 MHz.	
Form of Coding		Uniformly quantized PCM, 10 bits per sample, for the luminance signal and each color difference signal.	
Number of Samples Per Digital Active Line Luminance (Y) Color Difference (B-Y and R-Y)		 720. 360.	
Correspondence Between Video Signal Levels and Quantization Levels Luminance (Y)		877 quantization levels with the black level corresponding to level 64 and the peak white level corresponding to level 940.	
Color Difference (B-Y and R-Y)		897 quantization levels in the center part of the quantization scale with zero signal corresponding to level 512.	

Table 3-2
Timing Relationships

Characteristics	Performance Requirements	Supplemental Information	Perf. Step Check #
Line Timing 625/50 525/60		 See Fig. 3-1. See Fig. 3-2.	
Field Timing 625/50 525/60		 See Fig. 3-3. See Fig. 3-4.	
Timing Reference Signal EAV / SAV		BIT NO. — PREAMBLE SIGNAL 9 1 0 0 1 Fixed 8 1 0 0 F F = 1 during field 2. (Change state when H = 1 in EAV). F = 0 during Field 1. 7 1 0 0 V V = 1 during vertical blanking. (Change state when H = 1 in EAV). V = 0 during active video. 6 1 0 0 H H = 1 at start of horizontal blanking. H = 1 EAV. H = 0 SAV. 5 * 1 0 0 P3 4 * 1 0 0 P2 Hamming Code 6:3 3 * 1 0 0 P1 Even parity bits 1 – 6 2 * 1 0 0 P0 1 * 0 0 0 0 0 * 0 0 0 0	
Protection Bit States		(see below)	

Protection Bit States:

7	F	V	H	P3	P2	P1	P0		
9	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
1	0	0	0	0	0	0	0	0	0
1	0	0	1	1	1	0	1	0	0
1	0	1	0	1	0	1	1	0	0
1	0	1	1	0	1	1	0	0	0
1	1	0	0	0	1	1	1	0	0
1	1	0	1	1	0	1	0	0	0
1	1	1	0	1	1	0	0	0	0
1	1	1	1	0	0	0	1	0	0

* Protection Bits

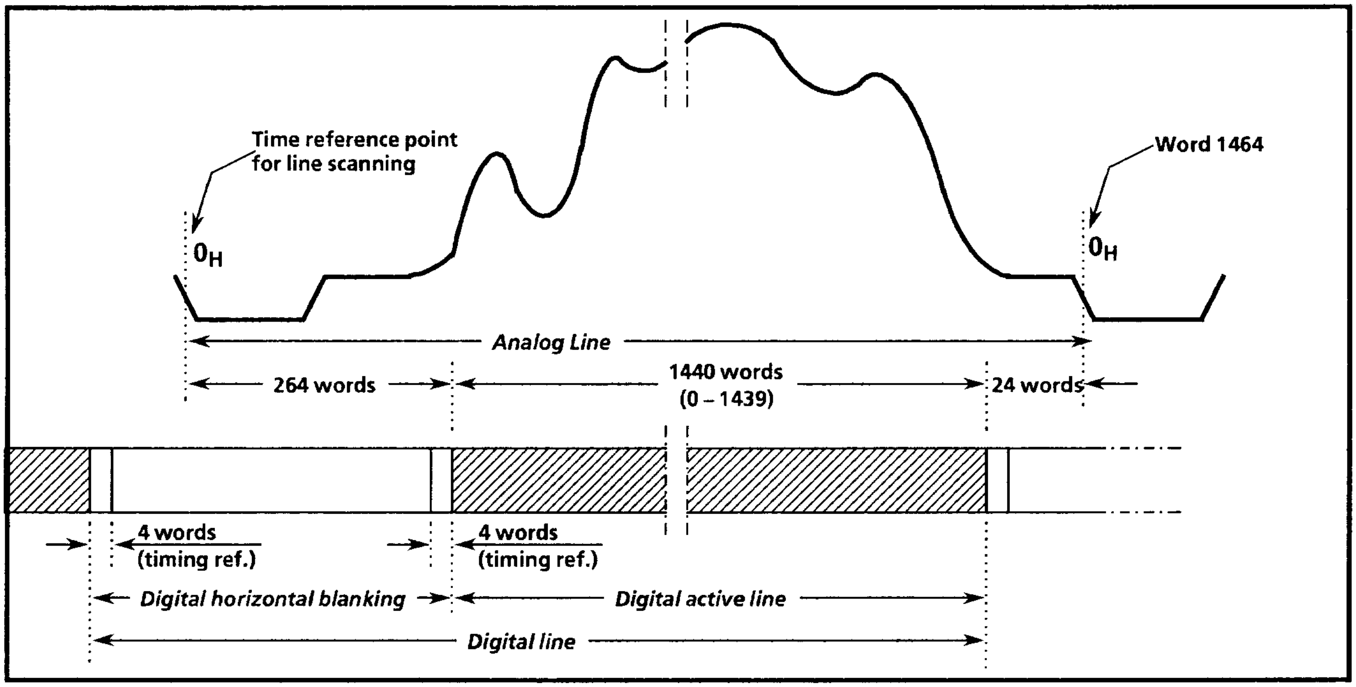


Fig. 3-1. Timing relationship between the digital video data and the analog line synchronization (reference for line scanning) in the 625-line system.

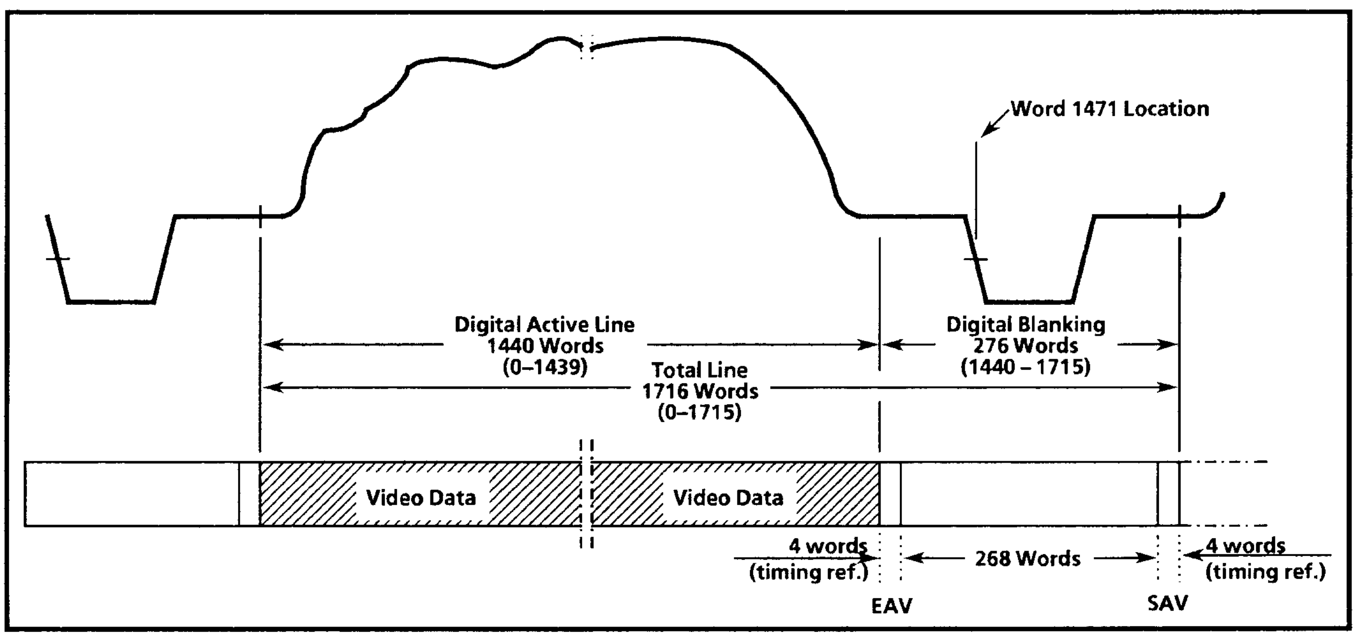


Fig. 3-2. 525 / 60 Line Timing.

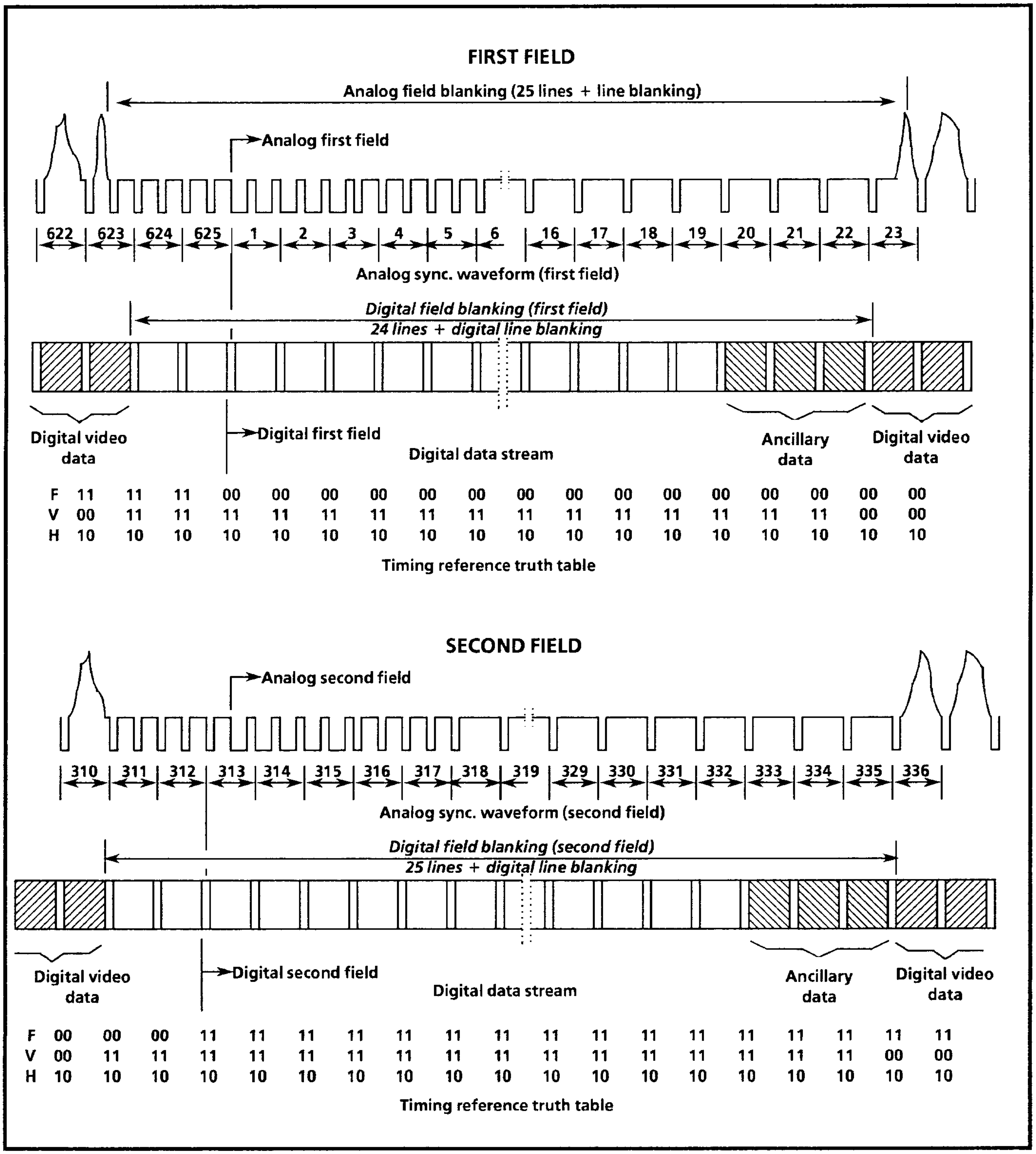


Fig. 3-3. Relationship between the digital and analog fields, showing also the position of the digital field-blanking interval, in the 625 system.

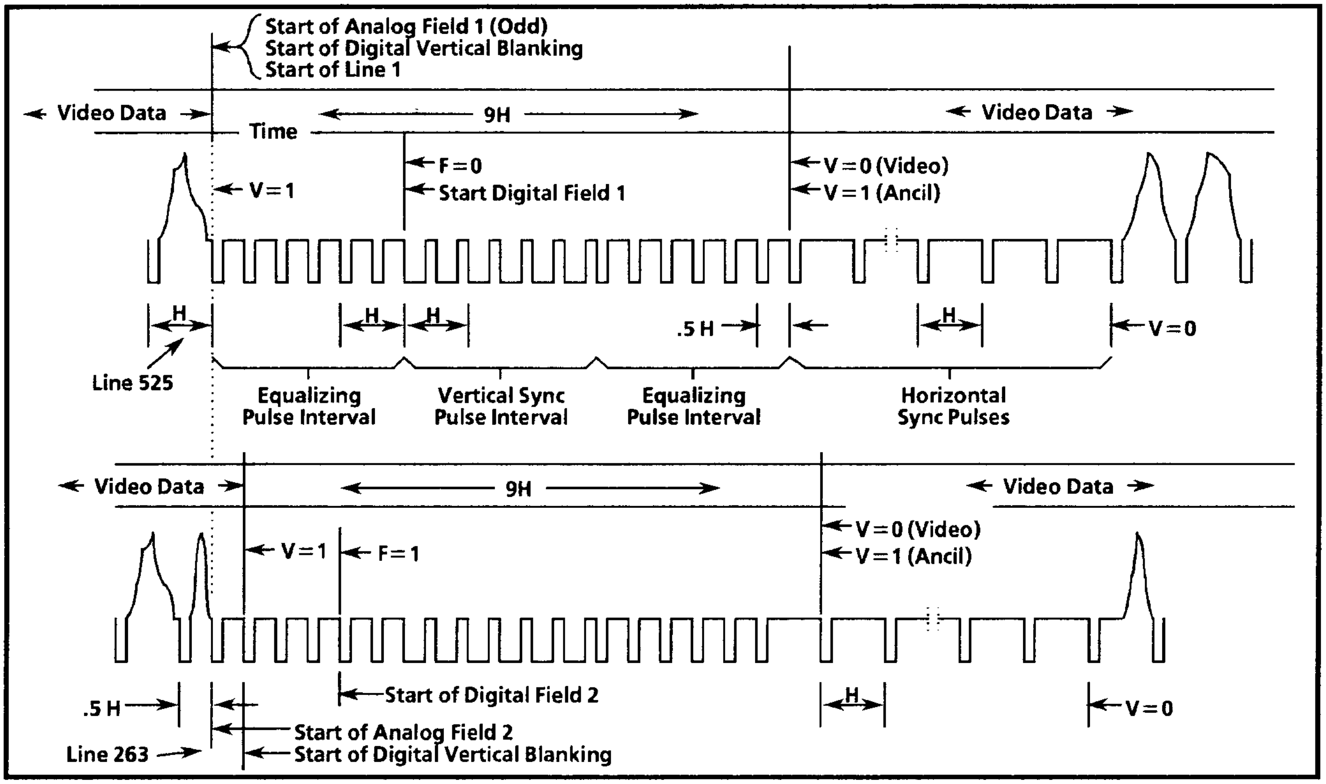


Fig. 3-4. Relationship of Video Data / Vertical Sync, in the 525 system (SN B010442 and below).

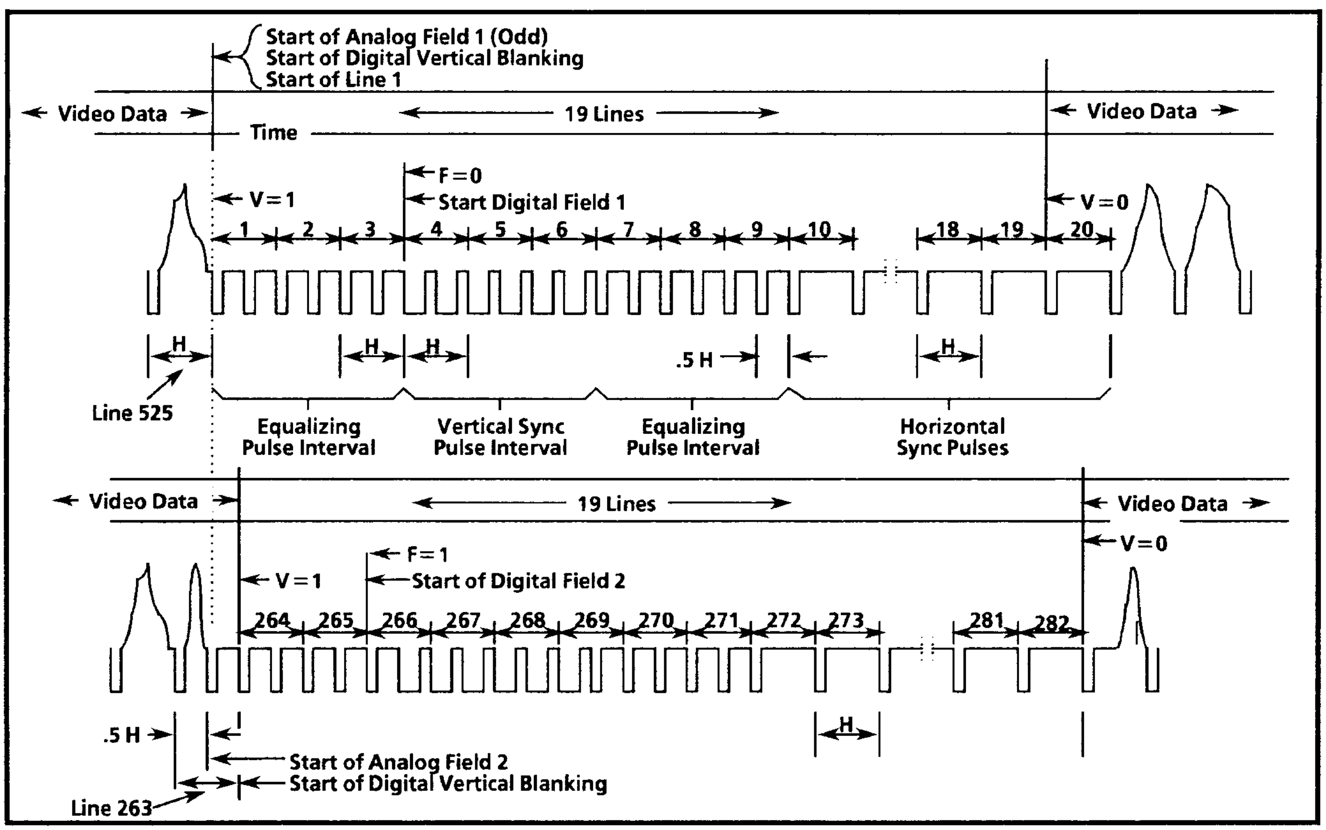


Fig. 3-4a. Relationship of Video Data / Vertical Sync, in the 525 system. (S/N B010443 and above).

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

Characteristics	Performance Requirements	Supplemental Information	Perf. Step Check #
Luminance Rise Time		200 ns ±10%.	
Color Difference Rise Time		400 ns ±10%.	
Digital Outputs		Standard ECL.	

Table 3-4
Digital Video Outputs

Characteristics	Performance Requirements	Supplemental Information	Perf. Step Check #
Digital Amplitudes	0.8 V to 2.0 V.	Measured differentially, terminated into 110Ω, no transmission line.	3
Digital Rise and Fall Times	<5 ns. Differ <2 ns.	Measured differentially, terminated into 110Ω, no transmission line.	4
Clock Symmetry	18.5 ns ±3 ns.	Measured differentially, terminated into 110Ω, no transmission line.	5
Clock to Data Timing	18.5 ns ±3 ns.	Measured differentially, terminated into 110Ω, no transmission line.	6
Shift Data Timing Advance Delay	 +11 ns ±2 ns. –11 ns ±2 ns.	Measured differentially, terminated into 110Ω, no transmission line.	7
Shift 27 MHz Clock Advance Delay	 +200 Hz ±20 Hz. –200 Hz ±20 Hz.	Measured differentially, terminated into 110Ω, no transmission line.	2

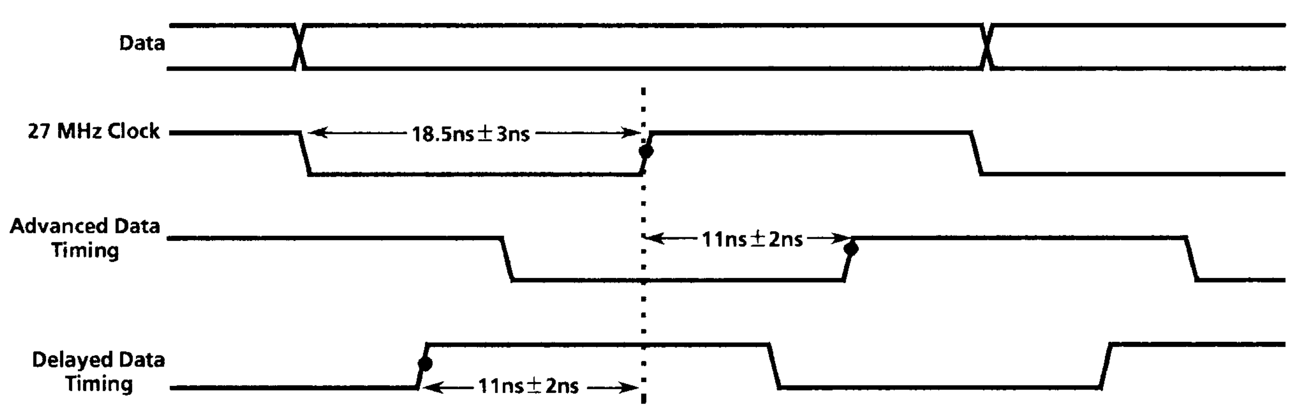


Fig. 3-5. Clock output timing relationships.

Table 3-5
Auxiliary Clocks

Characteristics	Performance Requirements	Supplemental Information	Perf. Step Check #
Clock to Data Timing 27 MHz Clock Y Clock B-Y Clock R-Y Clock	18.5 ns ±3 ns	See Fig. 3-5. Standard single ended ECL levels	8

Table 3-6
Test Signal Generator — Black Burst Output*

Characteristics	Performance Requirement	Supplemental Information	Perf. Step Check #
Black (Setup) Level 60 Hz 50 Hz	7.5 IRE ±1 IRE / 0 IRE ±1 IRE. Blanking Level.	User selectable (60 Hz only).	13 23
Blanking Level	0 V ±50 mV.		14, 23
Blanking Width 60 Hz	10.9 μs ±0.2 μs.		15
Sync Timing 60 Hz 50 Hz	See Fig. 3-6a. See Fig. 3-6b.		
Burst Frequency 60 Hz 50 Hz	3.579545 MHz ±1 Hz. 4.43361875 MHz ±1 Hz.		17 25
Return Loss	≥36 dB to 5 MHz.		29
SCH Phase Accuracy	0° ±5°.		16, 24

* For SN B010569 and Below (U.S.A.) and SN B020565 and Below (outside U.S.A.): The Black Burst output is intended for use as a digital video reference only. If genlocked to a composite signal, the Black Burst output is not guaranteed to maintain proper color framing.

For SN B010570 and Above (U.S.A.) and SN B020566 and Above (outside U.S.A.): The Black Burst will now maintain correct color framing.

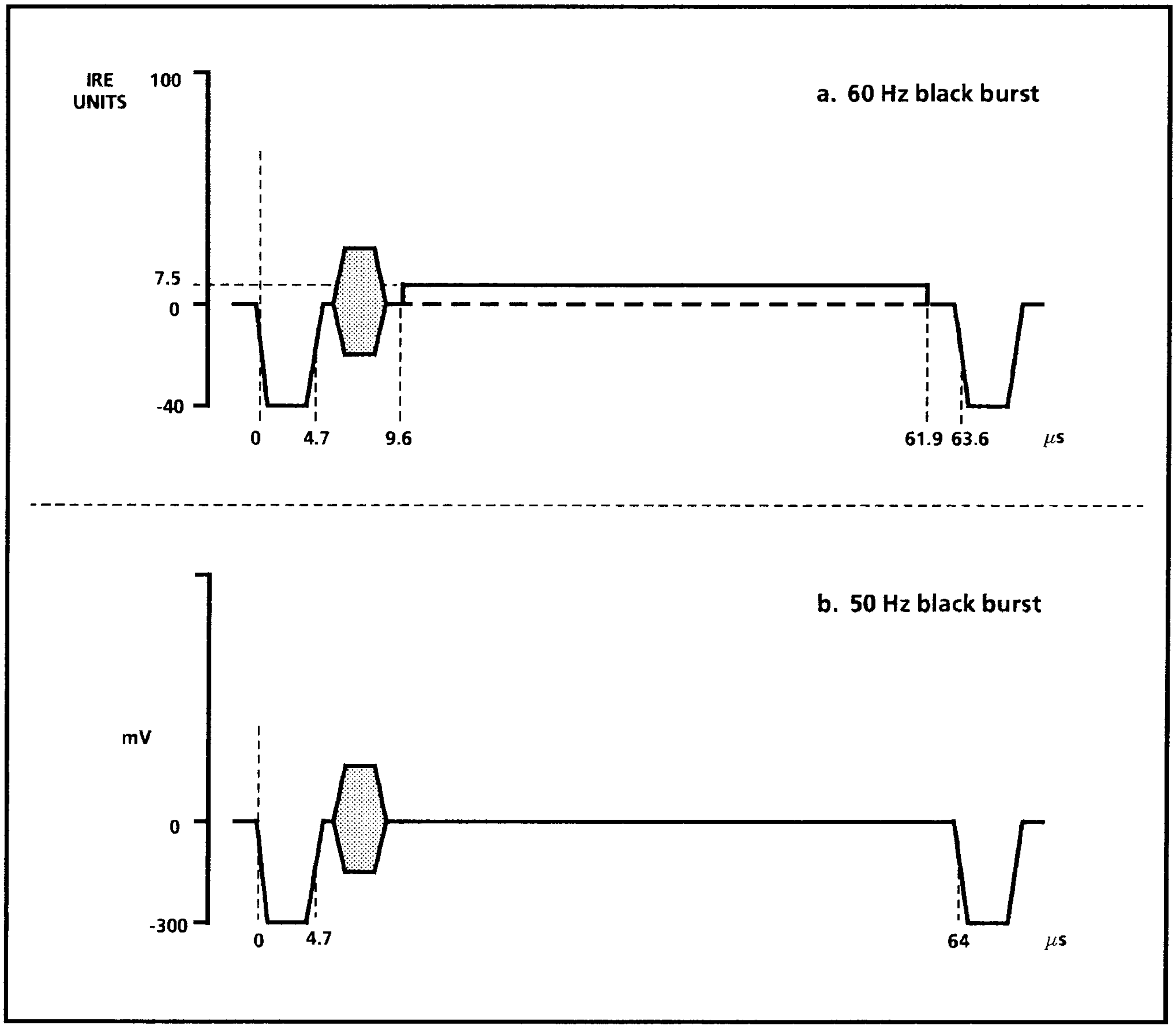


Fig. 3-6. Black burst output.

Table 3-7
Test Signal Generator — Test Signals

Characteristics	Performance Requirements	Supplemental Information	Perf. Step Check #
100% Bars With Level Reference		See Figs. 3-7, 3-8, and 3-9.	
75% Bars With Level Reference		60 Hz: See Figs. 3-10 and 3-11. 50 Hz: See Figs. 3-15, 3-16, and 3-17.	
100% Bars		See Fig. 3-9.	
75% Bars		See Fig. 3-12.	
Reverse Bars Matrix		60 Hz: See Figs. 3-10, 3-12, 3-13, and 3-14. 50 Hz: See Figs. 3-15, 3-17, 3-18, and 3-19.	
5-Step Staircase		See Fig. 3-20.	
Amplitude			
Y Channel		0 to 702.4 mV in steps of 176 words.	
B-Y, R-Y Channels		–351.6 to +351.6 mV in steps of 180 words.	
Ramp		See Fig. 3-21.	
Amplitude			
Y Channel		–35 to 735 mV. (Notches show 0 to 700 mV points.)	
B-Y, R-Y Channels		–385 to +385 mV. (Notches show –350 and +350 mV points.)	
Limit Ramp		Extends from word 01 to 254 for 8 bits, 04 to 1016 for 10 bits. See Fig. 3-22.	
Valid Ramps			
Amplitude		Each channel has 700 mV ramp. See Figs. 3-23, 3-24, and 3-25.	
Shallow Ramp		See Fig. 3-26.	
Amplitude		80 mV.	
Pedestal		Sits on a variable pedestal with range of 0 to 700 mV in Y channel and ±350 mV in B-Y, R-Y channels.	
Shallow Ramp Matrix		Ramps overlap by 10 mV.	

Table 3-7 (cont.)
Test Signal Generator — Test Signals

Characteristics	Performance Requirements	Supplemental Information	Perf. Step Check #
2T, 4T, 10T Pulse & Bar With Pulse Time Flag		See Fig. 3-27.	
2T Pulse HAD		200 ns.	
4T Pulse HAD		400 ns.	
10T Pulse HAD		1000 ns.	
Bar Amplitude			
Y Channel		0 to 700 mV.	
B-Y, R-Y Channels		±350 mV peak.	
Field Square Wave		See Fig. 3-28.	
Bar Amplitude		700 mV.	
Window Timing			
525 Line Systems		Lines 118 – 167.	
625 Line Systems		Lines 138 – 196.	
Mod Pulse & Bar (60 Hz)		See Fig. 3-30a.	
12.5T Pulse			
HAD		1562.5 ns. (Encodes to 12.5T modulated pulse at 60.7° in NTSC.)	
Amplitude			
Y Channel		350 mV.	
B–Y Channel		196.33 mV [1], 346.7 mV [2].	
R–Y Channel		248.1 mV [1], 346.7 mV [2].	
2T Pulse HAD		200 ns. (Y Channel only)	
Mod Pulse & Bar (50 Hz/Component)		See Fig. 3-29a.	
HAD			
4T Pulse		400 ns.	
10T Pulse		1000 ns.	
		200 ns (Y Channel only).	
Amplitude			
Y Channel		350 mV.	
B–Y Channel		196.33 mV [1], 347.9 mV [2].	
R–Y Channel		248.1 mV [1], 347.9 mV [2].	
2T Pulse HAD		200 ns. (Y Channel only)	

[1] S/N B010556 and above. [2] S/N B010555 and below.

Table 3-7 (cont.)
Test Signal Generator — Test Signals

Characteristics	Performance Requirements	Supplemental Information	Perf. Step Check #
Multipulse		See Fig. 3-31.	
Amplitude		420 mV.	
Frequencies			
Y Channel		1 MHz, 2 MHz, 3 MHz, 4 MHz, and 5.75 MHz.	
B-Y, R-Y Channels		0.5 MHz, 1 MHz, 1.5 MHz, 2 MHz, and 2.75 MHz (on –210 mV pedestal).	
Envelope HAD			
Y Channel		2 μs.	
B-Y, R-Y Channels		0.5 MHz pulse: 4 μs. All other pulses: 2 μs.	
Multiburst		See Fig. 3-32.	
Amplitude		420 mV p-p centered on 350 mV pedestal.	
White Flag		420 mV p-p (Y channel centered on 350 mV pedestal).	
Frequencies			
Y Channel		0.5 MHz, 1 MHz, 2 MHz, 3 MHz, 4 MHz, and 5.75 MHz (centered on 350 mV pedestal).	
B-Y, R-Y Channels		0.5 MHz, 1 MHz, 1.5 MHz, 2 MHz, and 2.75 MHz (centered around 0 Vdc).	
60% Line Sweep		See Fig. 3-34.	
Amplitude		700 mV.	
Frequency Range			
Y Channel		200 kHz to 5.75 MHz.	
B-Y, R-Y Channels		100 kHz to 2.75 MHz.	
Markers			
Y Channel		At 0.5 MHz, 1 MHz, 2 MHz, 3 MHz, 4 MHz, and 5 MHz.	
B-Y, R-Y Channels		At 0.25 MHz, 0.5 MHz, 1 MHz, 1.5 MHz, 2 MHz, and 2.5 MHz.	
100% Line Sweep		See Fig. 3-33.	
Amplitude		700 mV.	
Frequency Range			
Y Channel		200 kHz to 5.75 MHz.	
B-Y, R-Y Channels		100 kHz to 2.75 MHz.	

Table 3-7 (cont.)
Test Signal Generator — Test Signals

Characteristics	Performance Requirements	Supplemental Information	Perf. Step Check #
Markers			
Y Channel		At 0.5 MHz, 1 MHz, 2 MHz, 3 MHz, 4 MHz, and 5 MHz.	
B-Y, R-Y Channels		At 0.25 MHz, 0.5 MHz, 1 MHz, 1.5 MHz, 2 MHz, and 2.5 MHz.	
SIN X*/X		See Fig. 3-46.	
Bandwidth			
Y Channel		6 MHz.	
B-Y, R-Y Channels		3 MHz.	
Peak Amplitude			
Y Channel		462 mV.	
B-Y, R-Y Channels		294 mV.	
Pedestal Amplitude			
Y Channel		168 mV.	
B-Y, R-Y Channels		0 mV.	
500 kHz Bowtie		See Fig. 3-35.	
Y Channel		500 kHz sine wave.	
R-Y, B-Y Channels		502 kHz sine wave.	
Amplitude		700 mV.	
2.5 MHz Bowtie		See Fig. 3-36.	
Y Channel		2.49 MHz.	
B-Y, R-Y Channels		2.5 MHz.	
Timing Markers		9 timing Markers. (Marker spacings indicate 20 ns delay or advance between channels.)	
Convergence		See Fig. 3-42.	
Amplitude		525 mV (75%).	
Pattern		Crosshatch, 14 horizontal lines and 15 vertical lines per field.	
Pulse HAD		225 ns ±25 ns.	
Flat Field		See Fig. 3-40.	
Nominal Amplitude			
Y Channel		350 mV.	
B-Y, R-Y Channels		0 V.	

* SN B010505 and above.

Table 3-7 (cont.)
Test Signal Generator — Test Signals

Characteristics	Performance Requirements	Supplemental Information	Perf. Step Check #
Black * Amplitude Y Channel B-Y, R-Y Channels		See Fig. 3-47. 0 mV. 0 mV.	
Blanking Markers		See Figs. 3-37 and 3-38.	
Co-Siting Pulse		See Fig. 3-39.	
Field ID		See Fig. 3-41.	
Light Blue Ramp		See Fig. 3-43.	
Digital Gray		See Fig. 3-44.	
Measurement Matrix		See Fig. 3-45.	

* SN B010505 and above.

Table 3-8
Genlock Function

Characteristics	Performance Requirements	Supplemental Information	Perf. Step Check #
Input Configuration	75Ω loop-through.		
Return Loss (Genlock Input)	At least 40 dB to 5.5 MHz.		28
Sync Lock Timing Change with Input Sync Amplitude	≤15 ns shift.	Over sync amplitude range of 300 mV +3 to -6 dB.	10, 20
Horizontal Timing Range	At least 8 μs advance and delay.	Front-panel control.	11, 21
Sync Lock Jitter	≤2 ns.	(2.5° at F_{SC} = 3.58 MHz). (3.25° at F_{SC} = 4.43 MHz). Measured at nominal signal conditions.	9, 19
Pull In Range	Subcarrier ±20 Hz.		12,22

Table 3-8 (Cont.)
Genlock Function

Characteristics	Performance Requirements	Supplemental Information	Perf. Step Check #
Free Running Frequency	27 MHz ± 10 Hz.		1
Color Framing Decisions	Will be correct for input SC/H error of 0° ± 20°.	For SN B010570 and above (U.S.A.) and SN B020566 and above (outside U.S.A.).	12a, 22a

Table 3-9
Power Supply

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

Table 3-10
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	6.14 kg (13.5 lbs.).
Shipping Weight	10.4 kg (22 lbs., 14 oz.).

Table 3-11
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 (Non-Operating)	50 g's, 1/2 sine, 11 ms duration, 3 guillotine-type shocks per sine.
Transportation	Qualified under NTSC Test Procedure 1A, Category II (24-inch drop).
Emissions	FCC 47 CFR Part 15, Subpart B, Class A Refer to frontmatter for EC declaration of compliance

CAUTION

Do not operate this instrument in an ambient temperature above 40° C when Option 1S (Serial Digital) is installed.

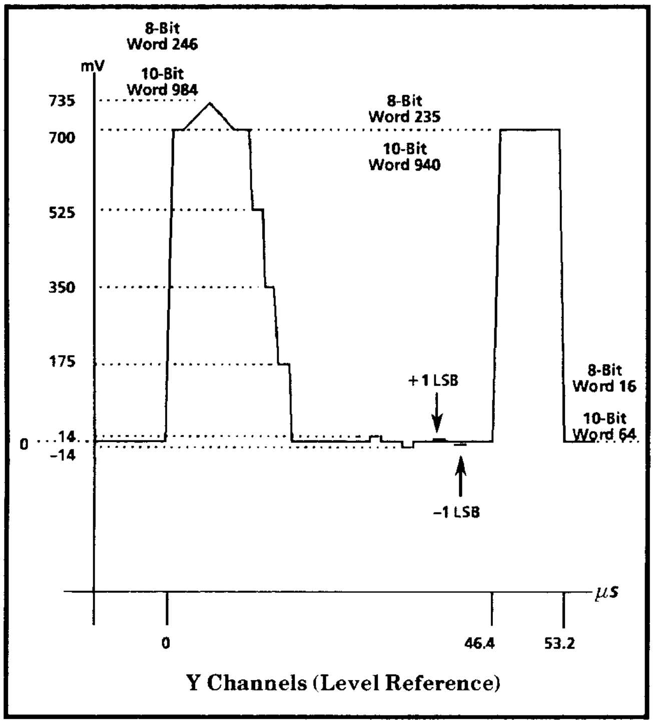


Fig. 3-7. Level Reference.

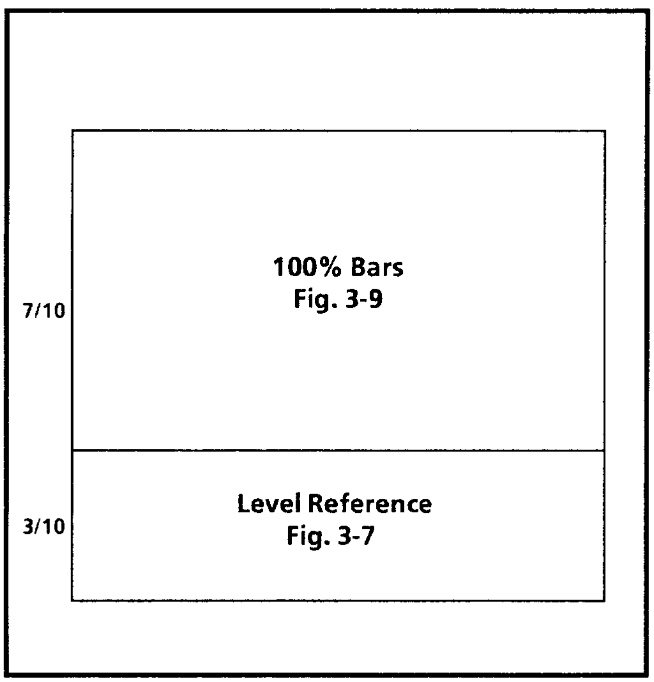


Fig. 3-8. Color Bars Matrix.

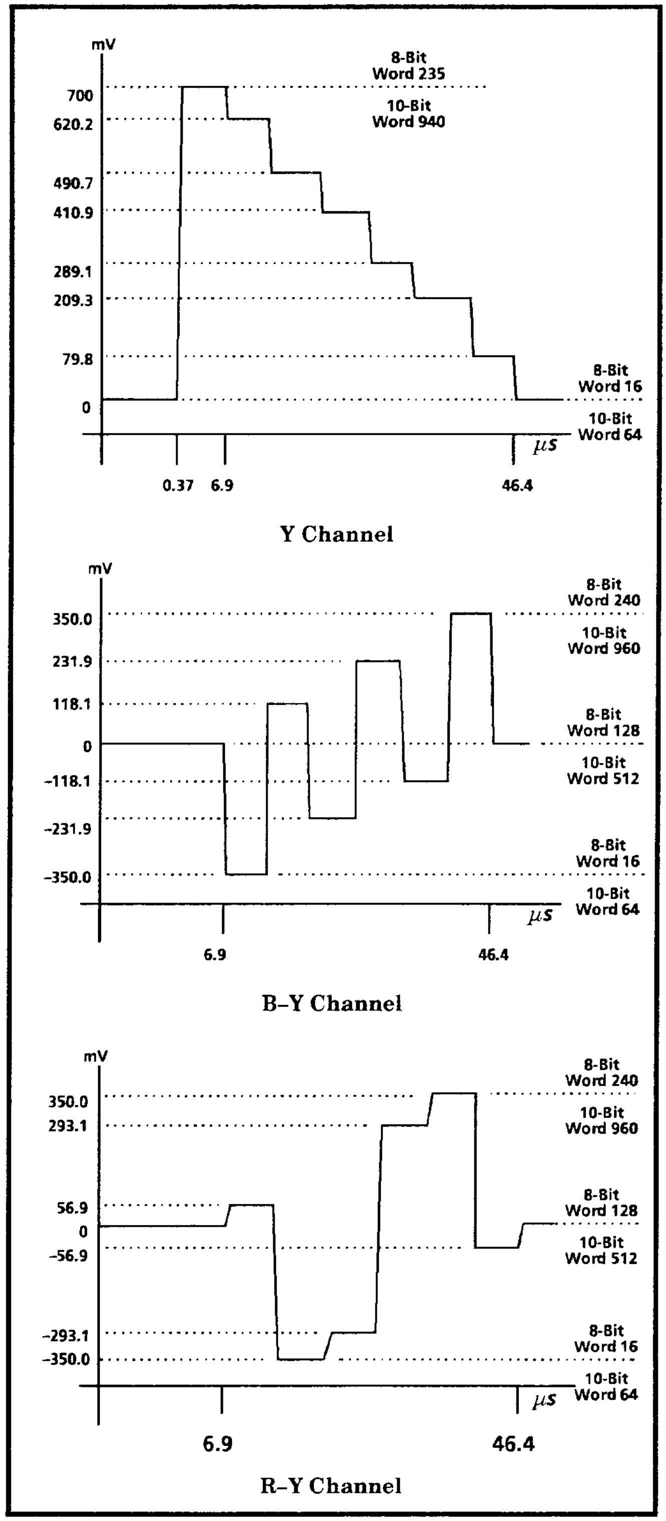


Fig. 3-9. 100% Color Bars.

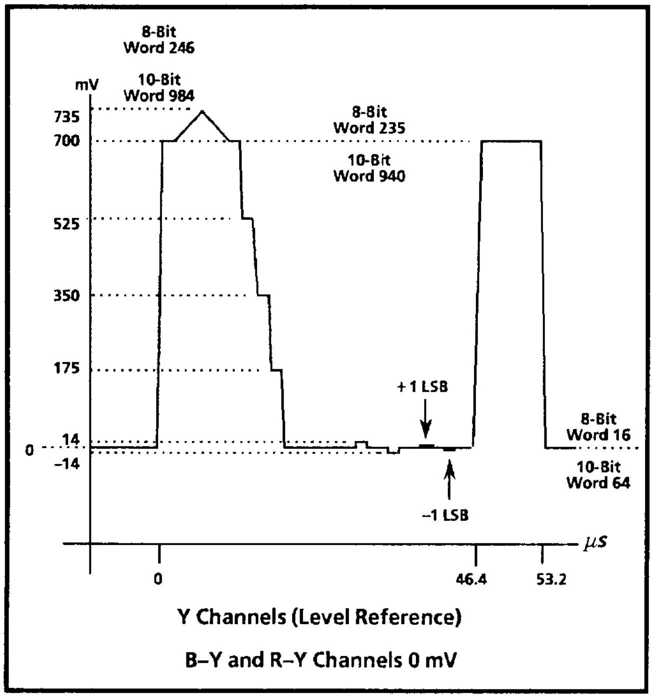


Fig. 3-10. Level Reference (60 Hz).

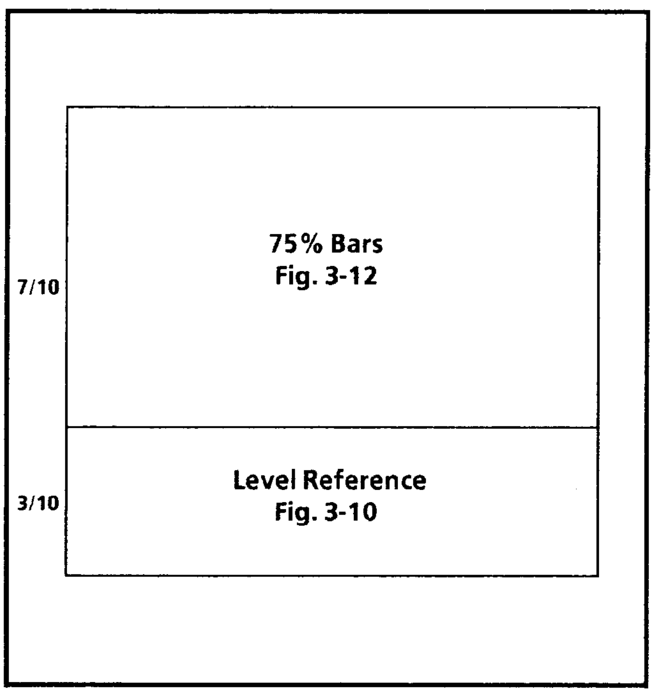


Fig. 3-11. 75% Bars with Reference Matrix (60 Hz).

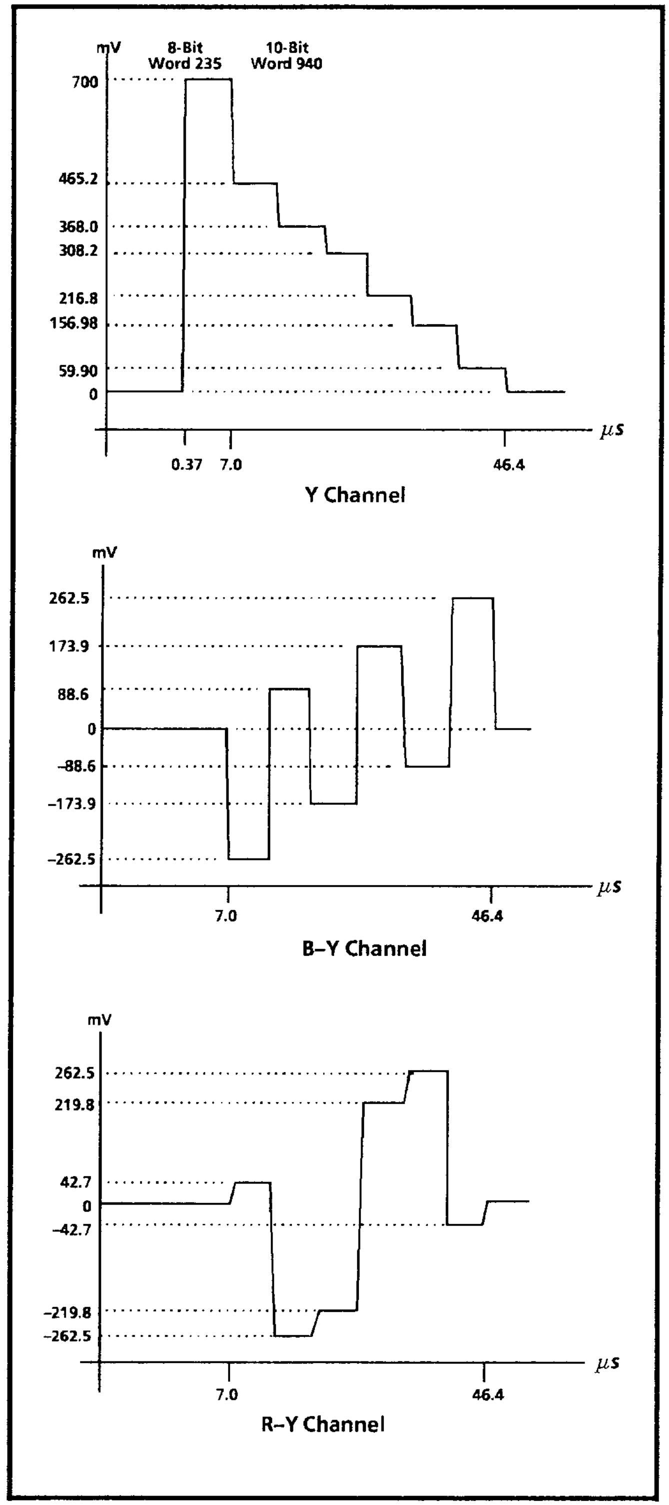


Fig. 3-12. 75% Bars (60 Hz).

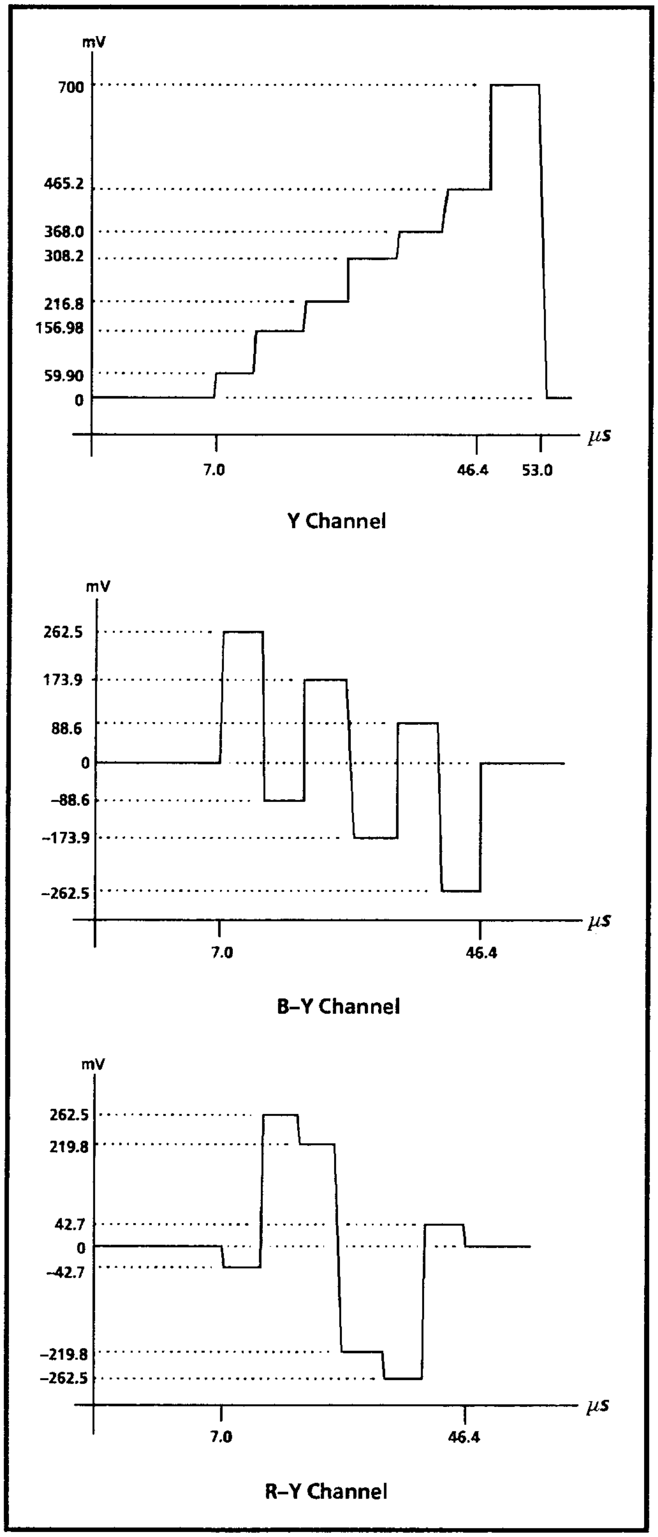


Fig. 3-13. 75% Reverse Bars (60 Hz).

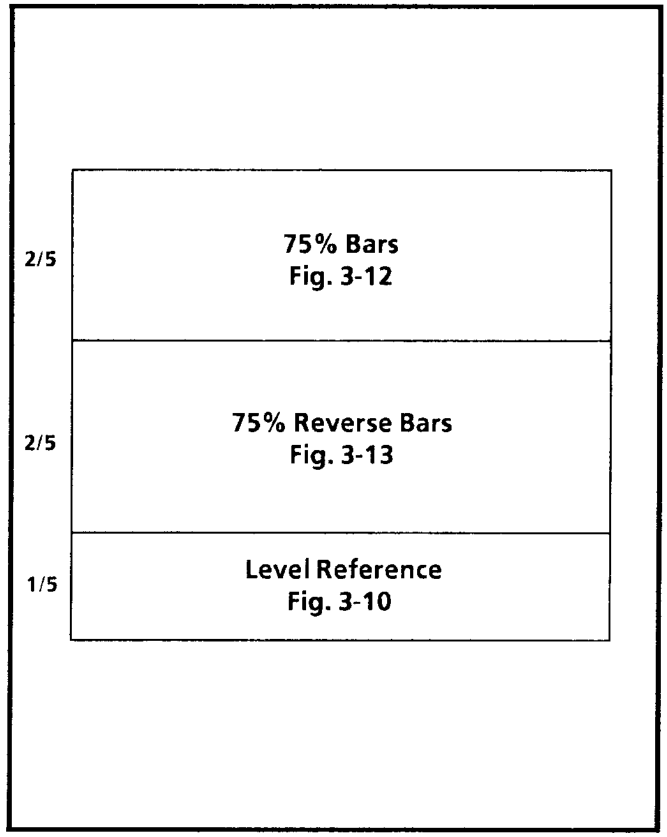


Fig. 3-14. Reverse Bars Matrix (60 Hz).

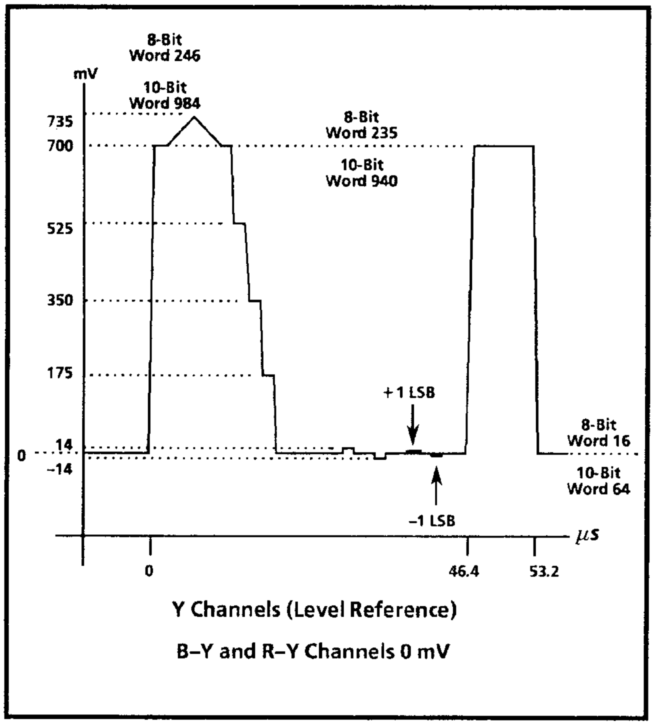


Fig. 3-15. Level Reference (50 Hz).

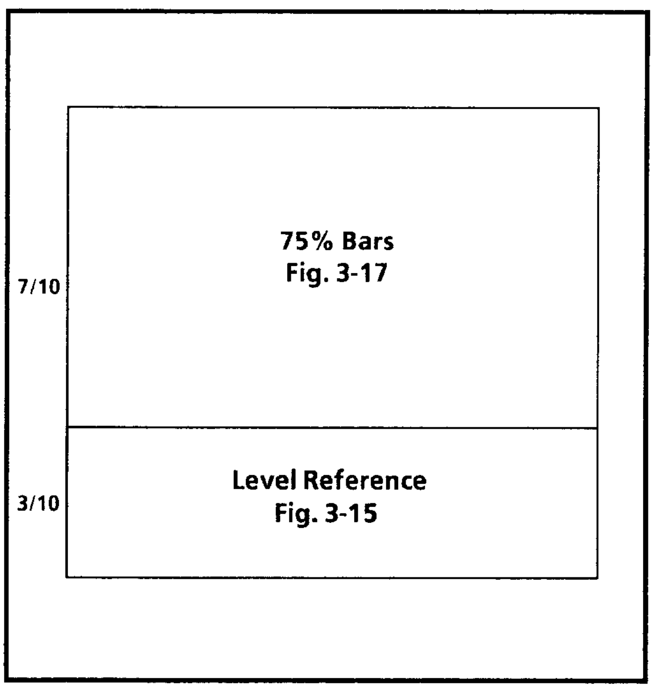


Fig. 3-16. 75% Bars with Reference Matrix (50 Hz).

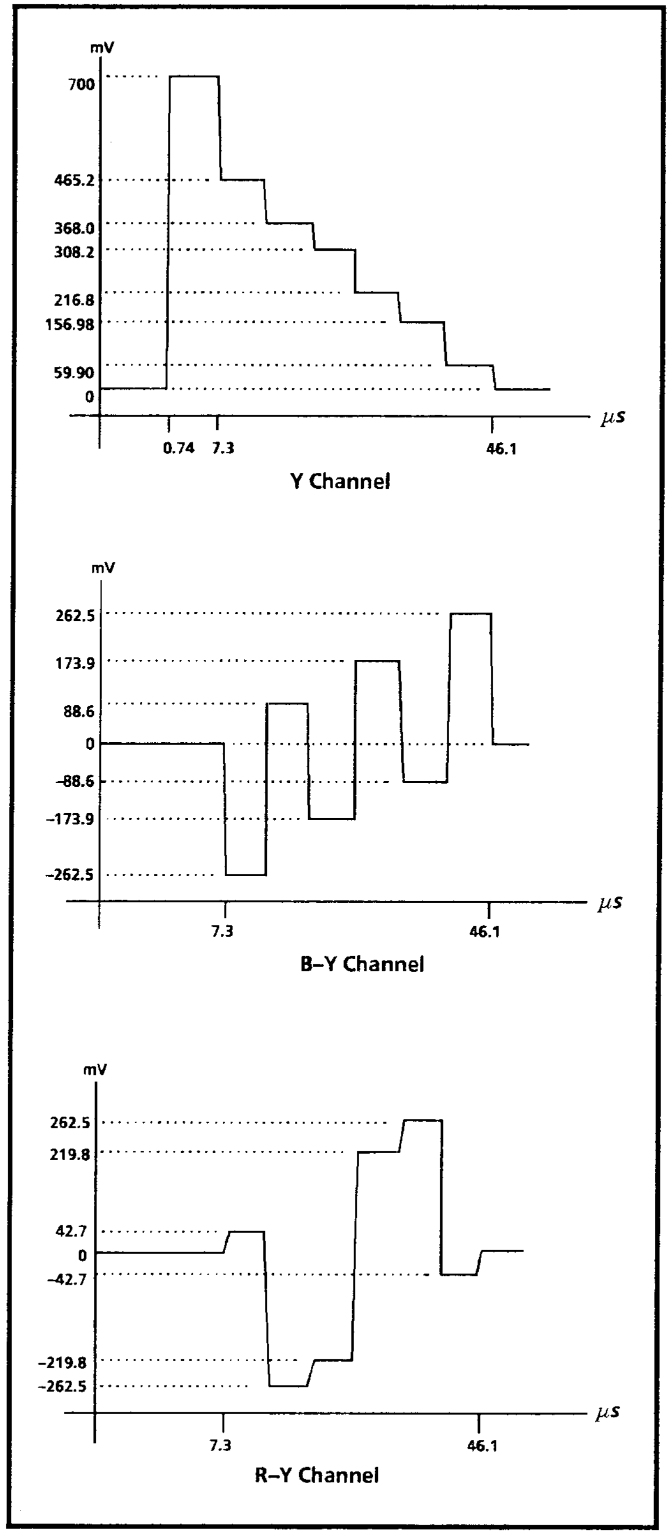


Fig. 3-17. 75% Bars (50 Hz).

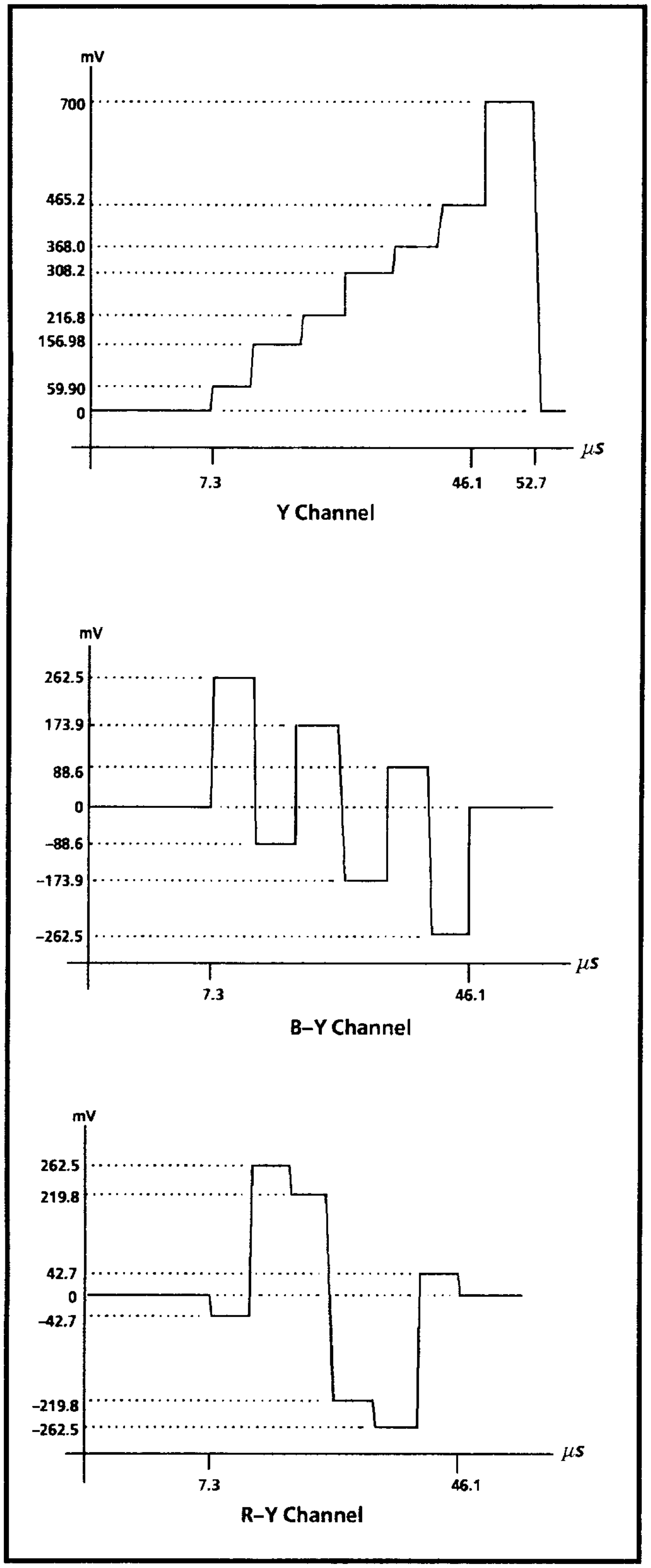


Fig. 3-18. 75% Reverse Bars (50 Hz).

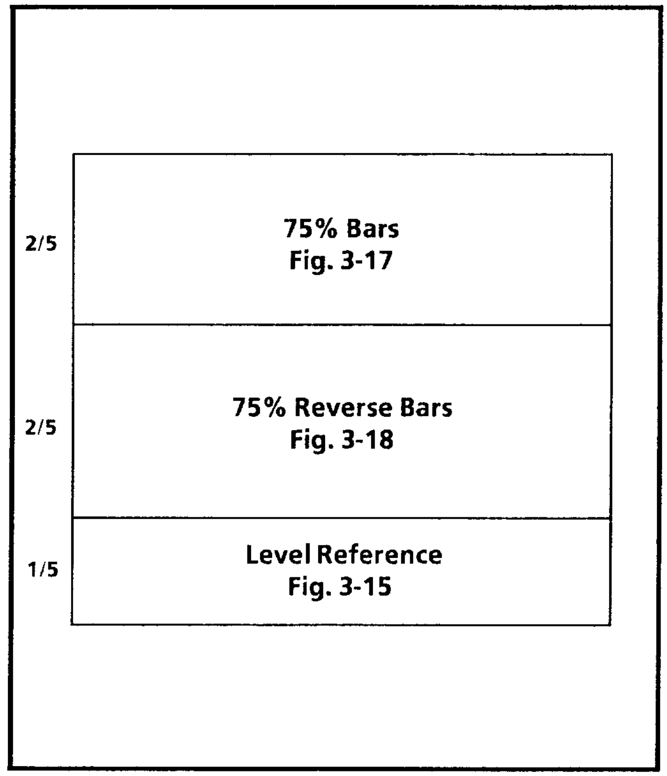


Fig. 3-19. Reverse Bars Matrix (50 Hz).

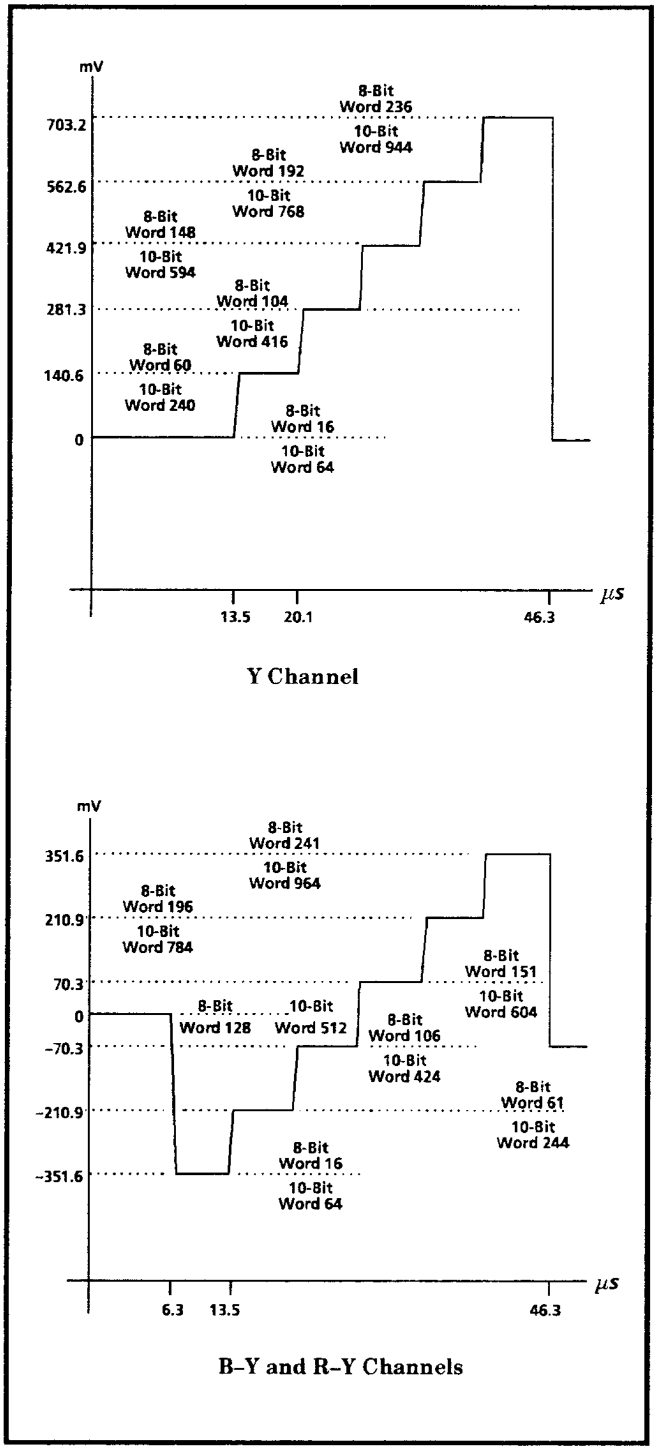


Fig. 3-20. 5–Step Staircase.

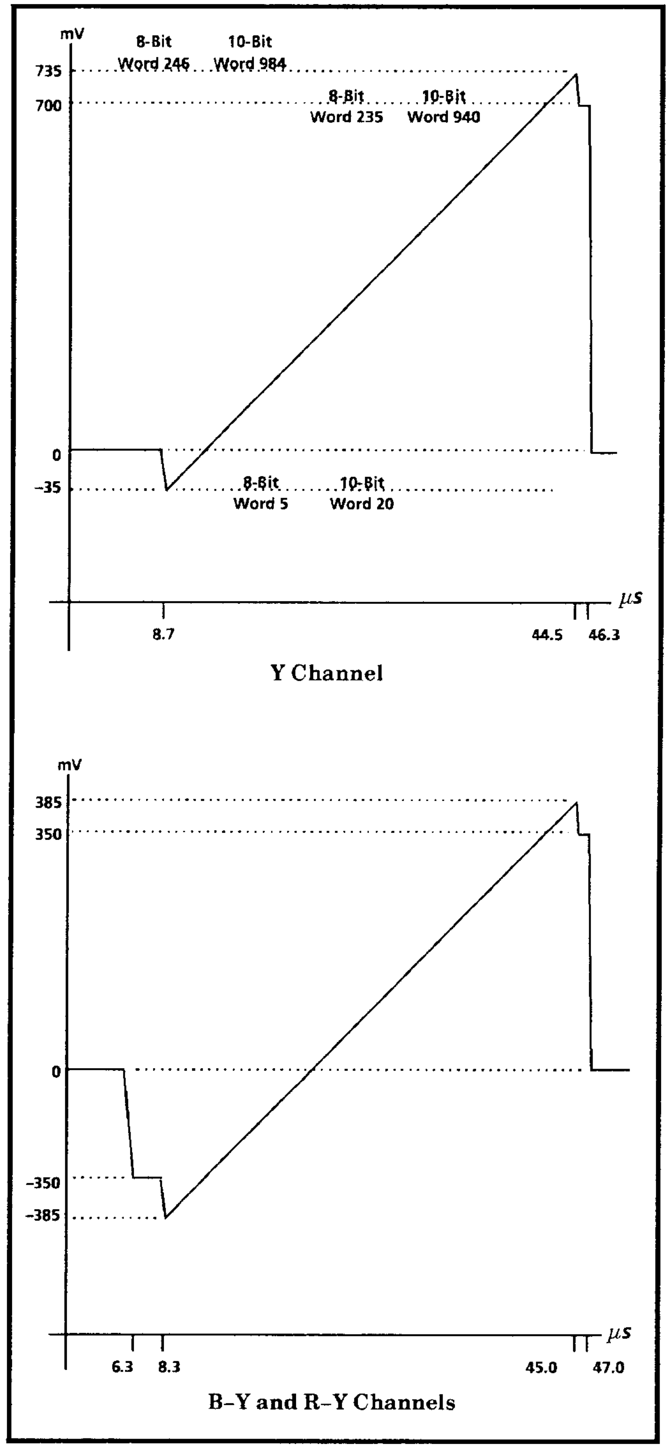


Fig. 3-21. Oversize Ramp.

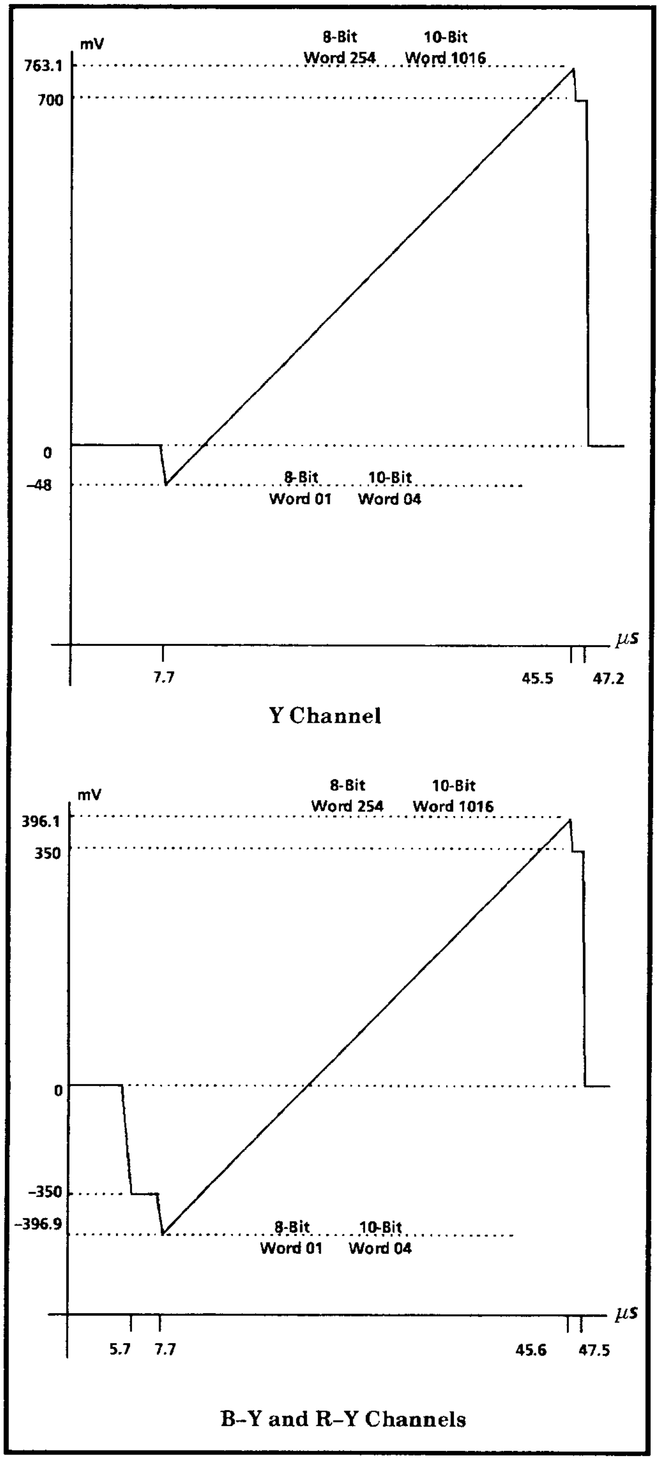


Fig. 3-22. Limit Ramp.

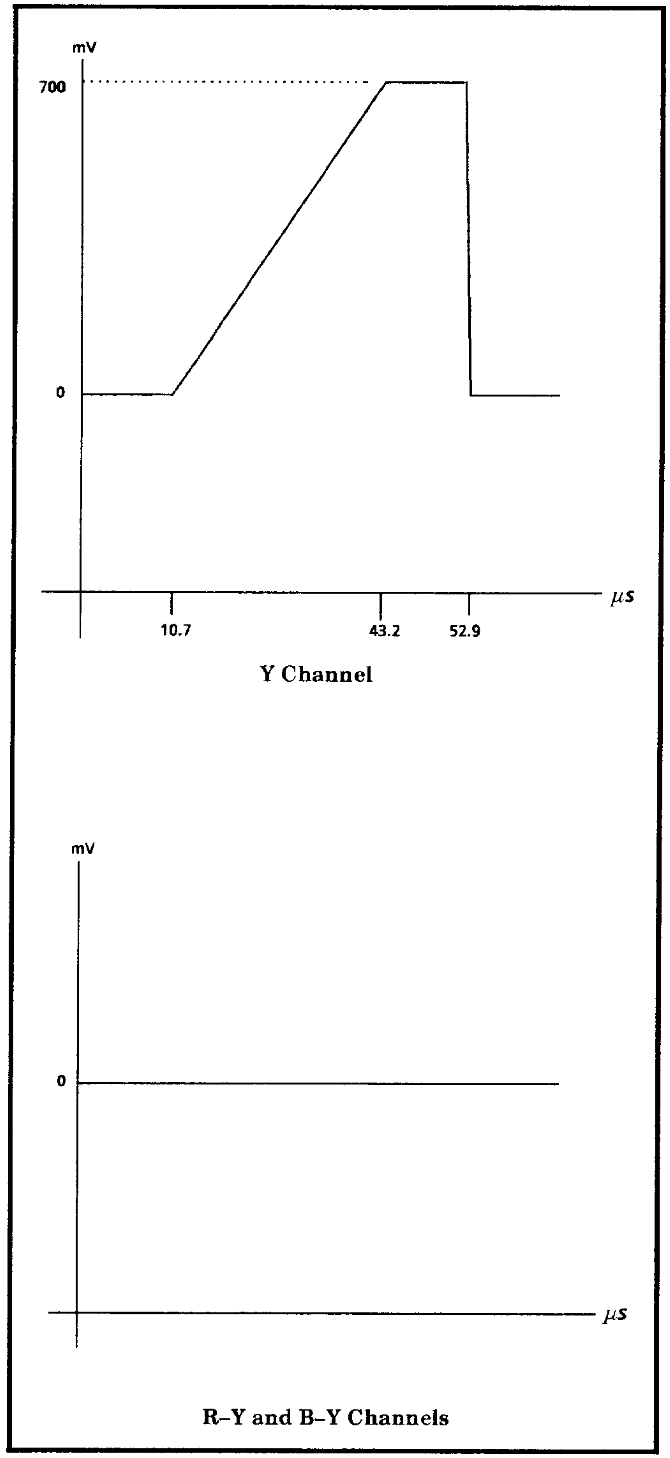


Fig. 3-23. Y Valid Ramp.

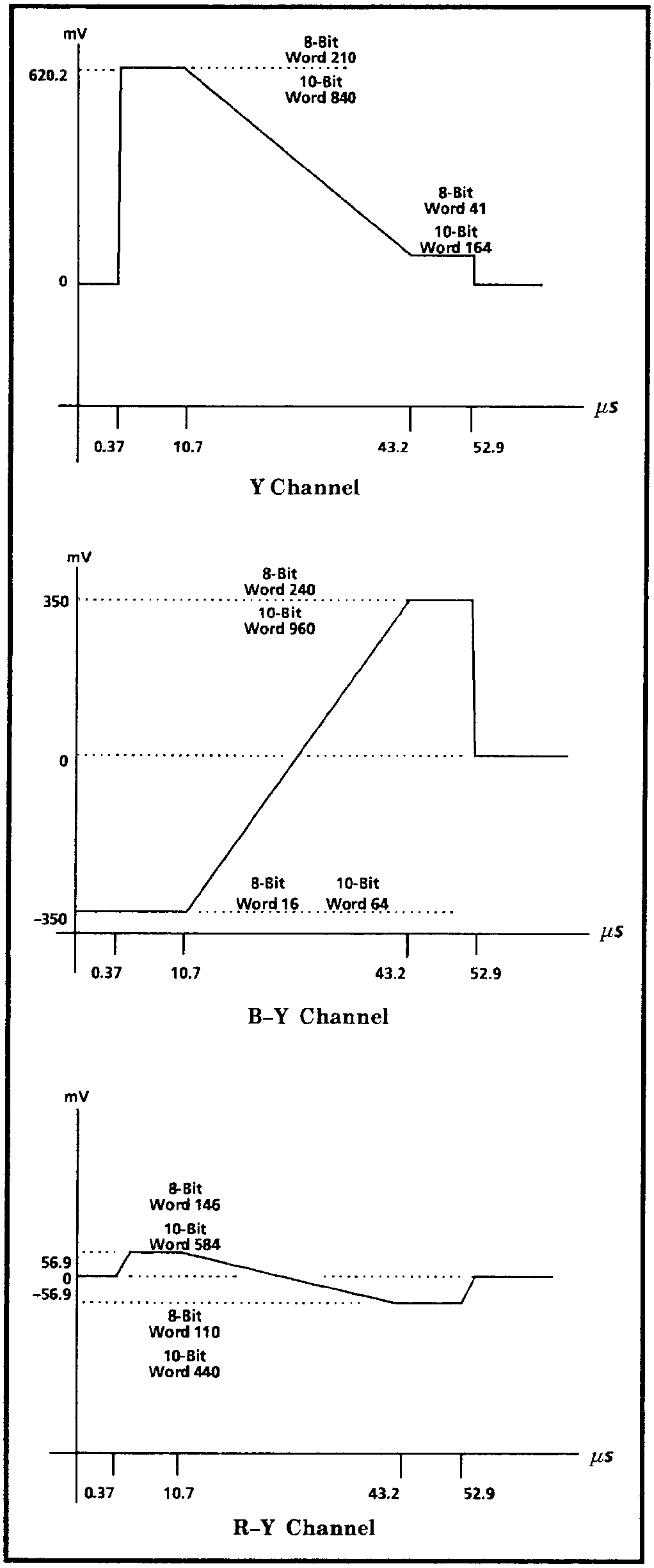


Fig. 3-24. B–Y Valid Ramp.

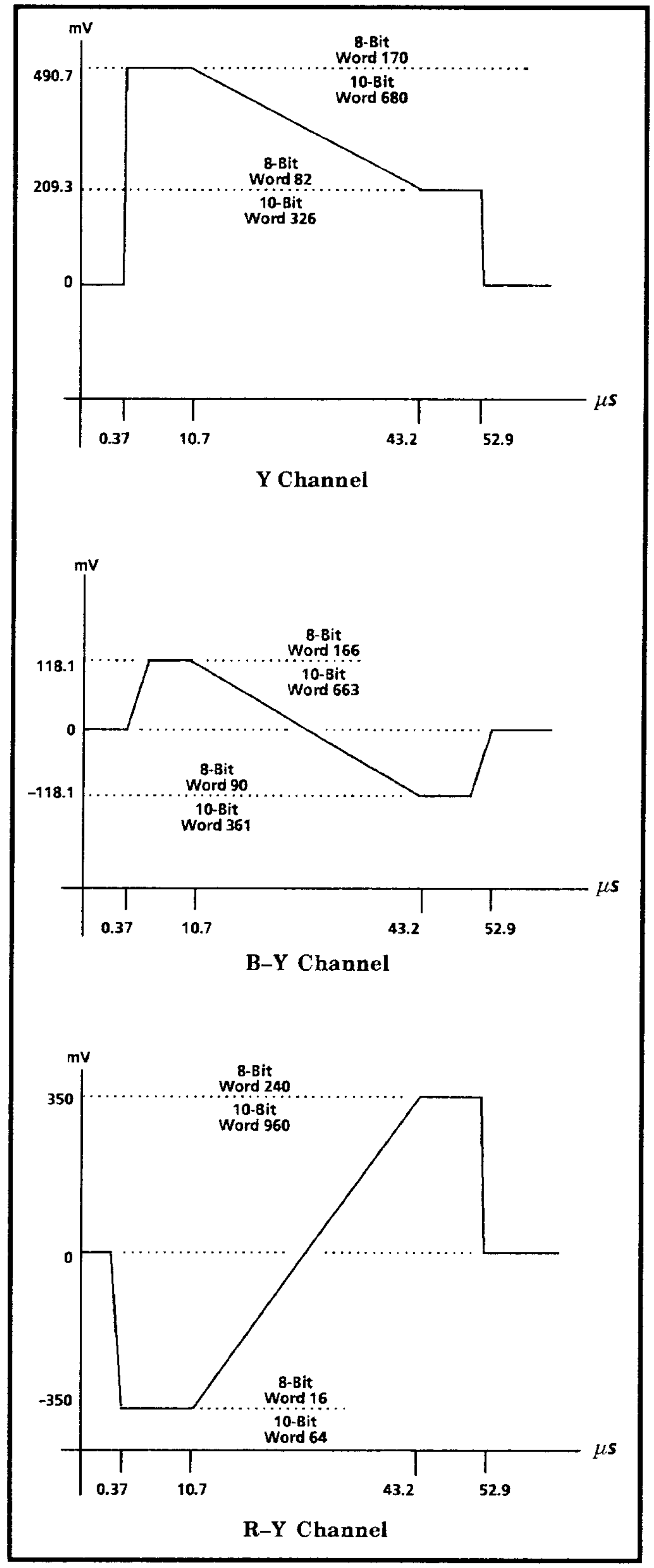


Fig. 3-25. R–Y Valid Ramp.

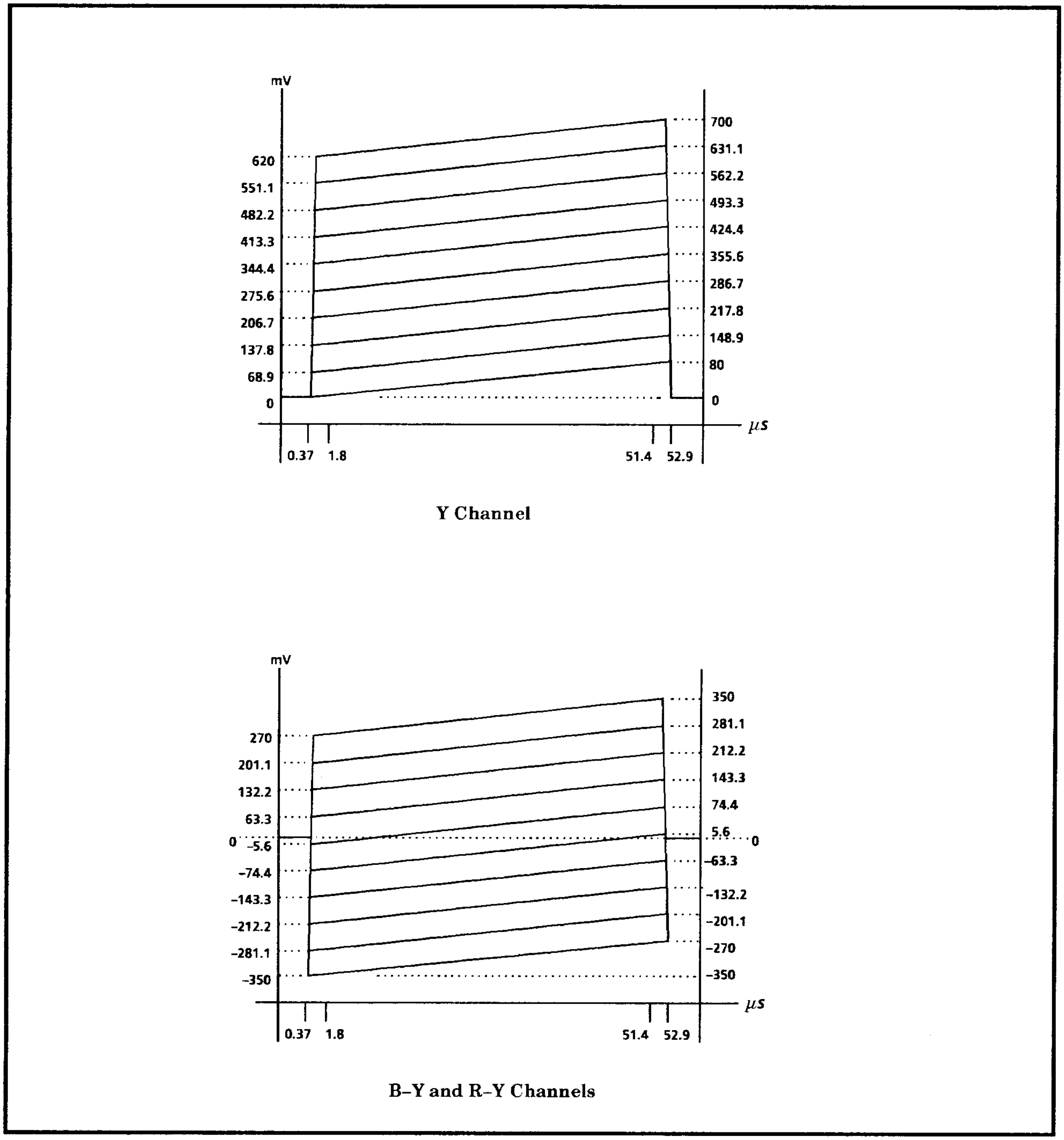


Fig. 3-26. Shallow Ramp.

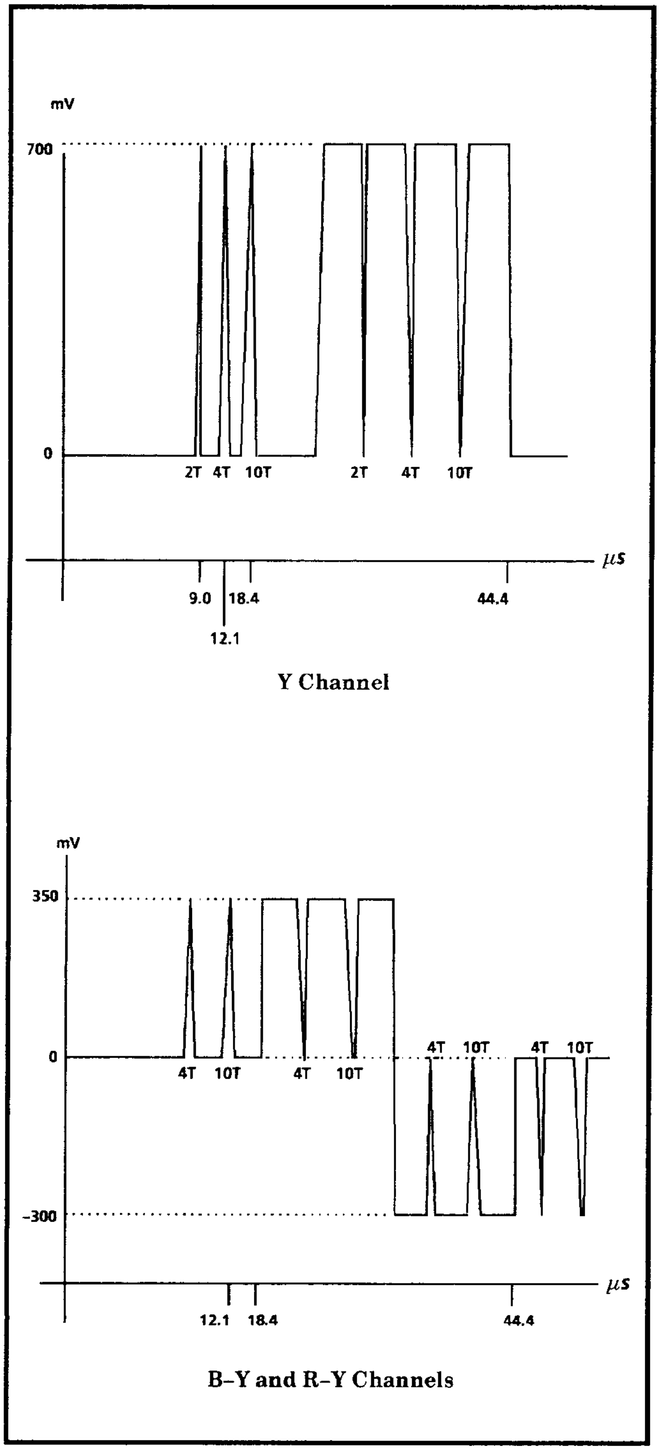


Fig. 3-27. 2T 4T 10T Pulse & Bar.

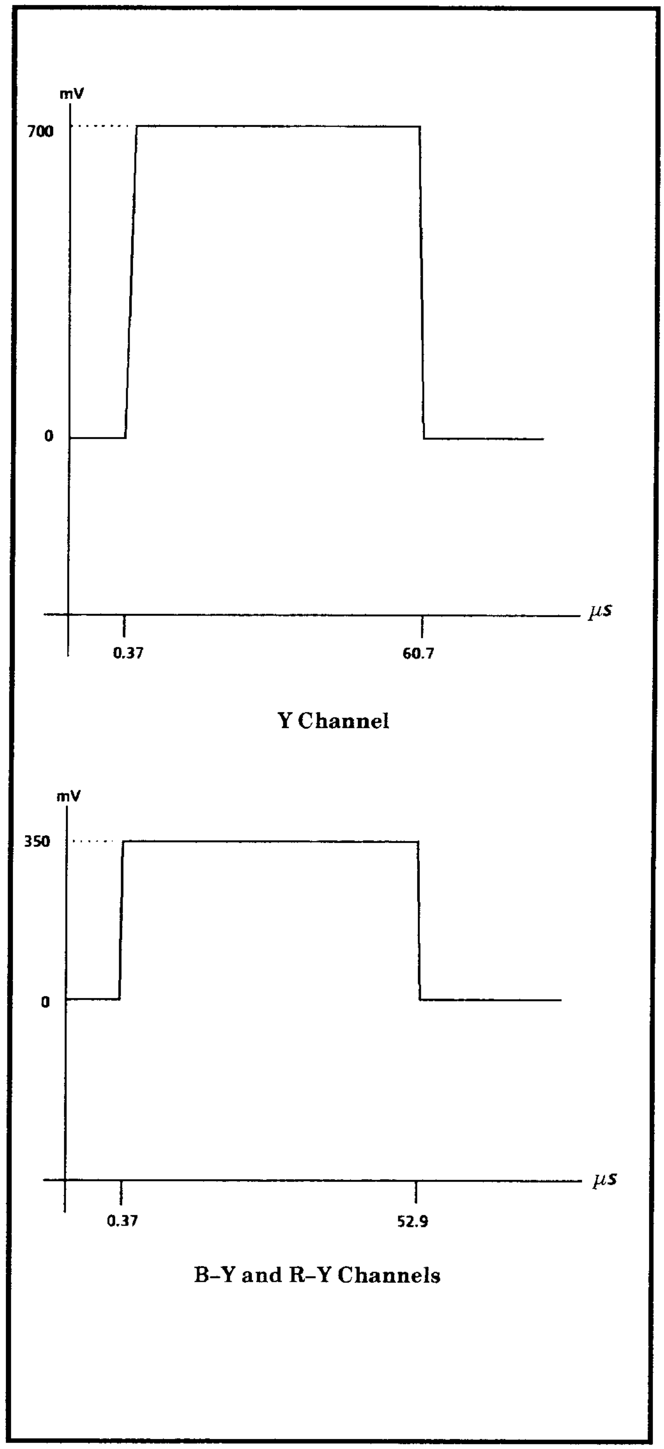


Fig. 3-28. Field Square Wave.

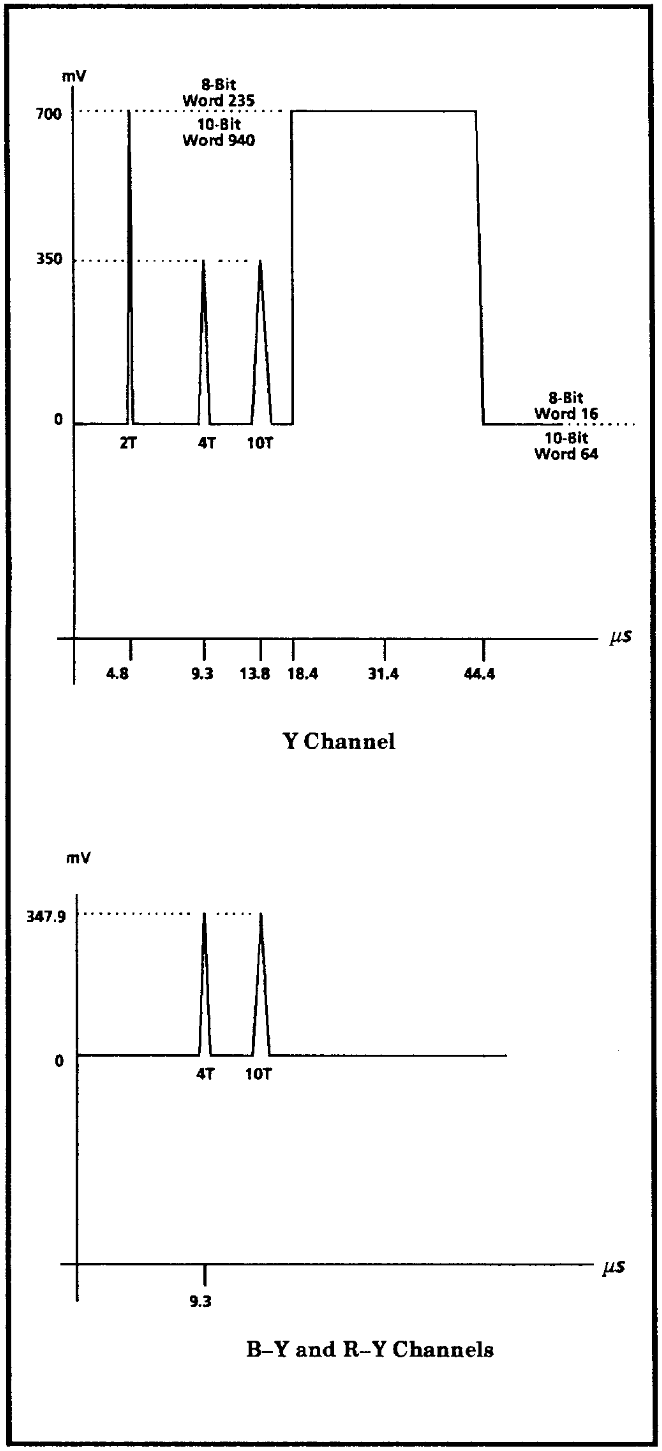


Fig. 3-29. Mod Pulse & Bar (Component/50 Hz).

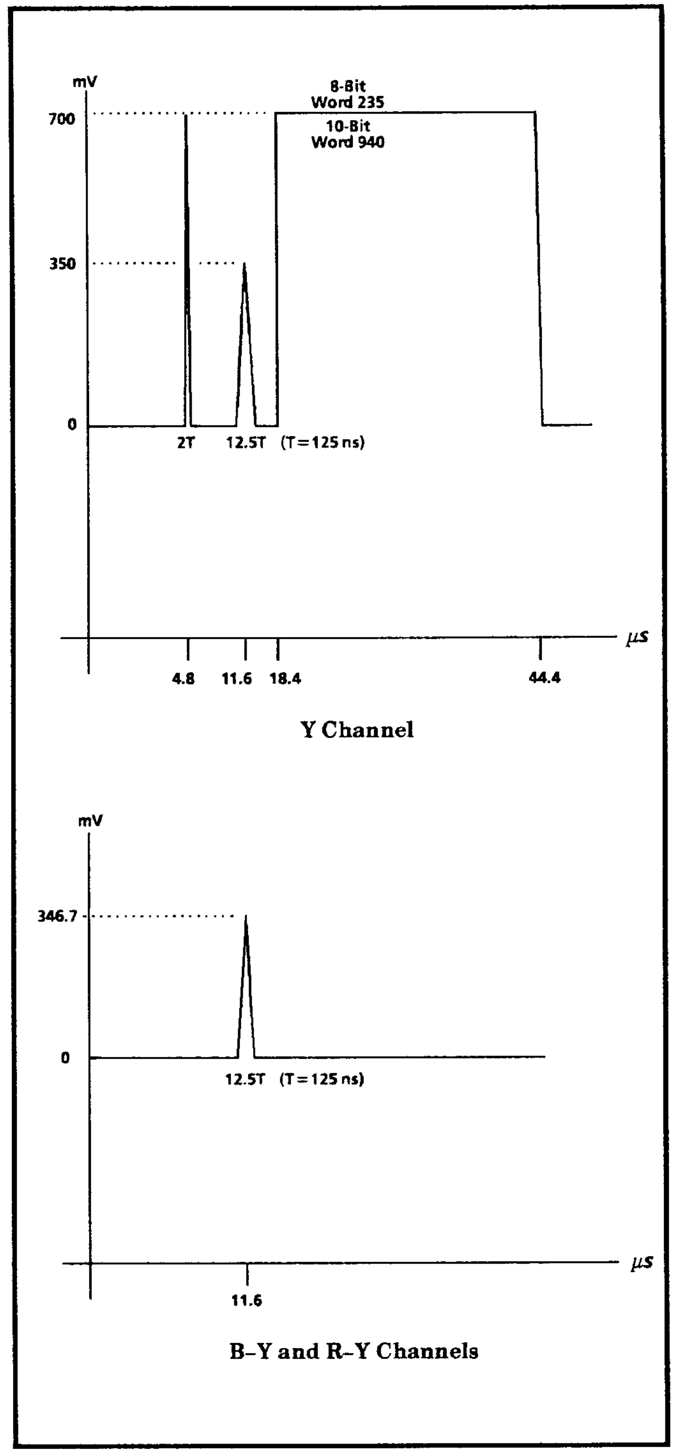


Fig. 3-30. Mod Pulse & Bar (60 Hz).

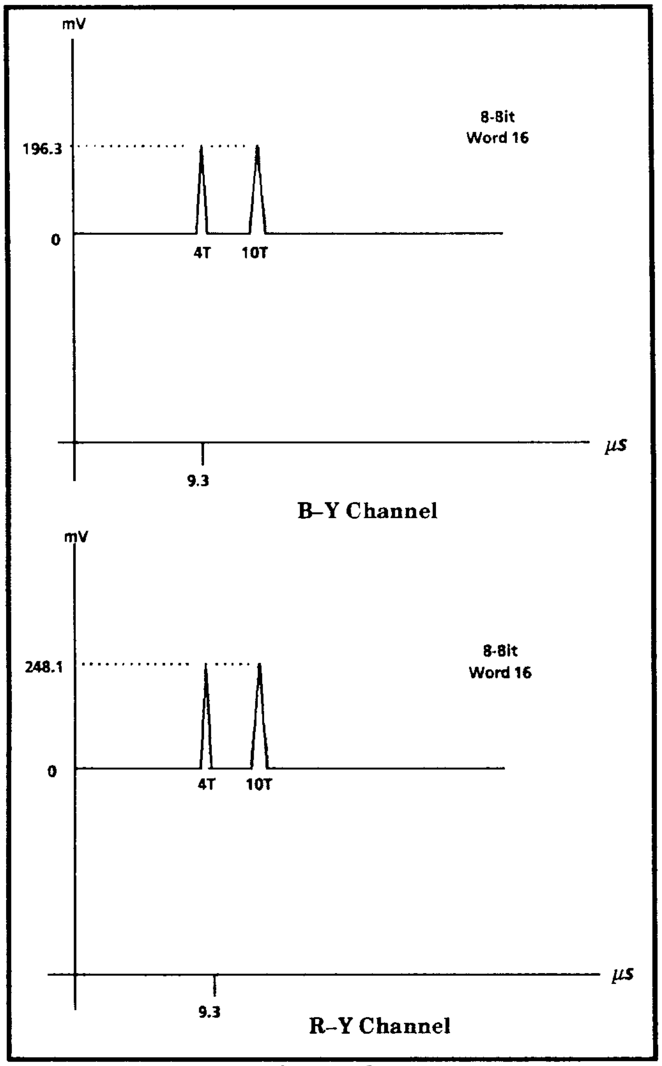


Fig. 3-29a. Mod Pulse & Bar (Component/50 Hz)
B–Y and R–Y B010556 and above.

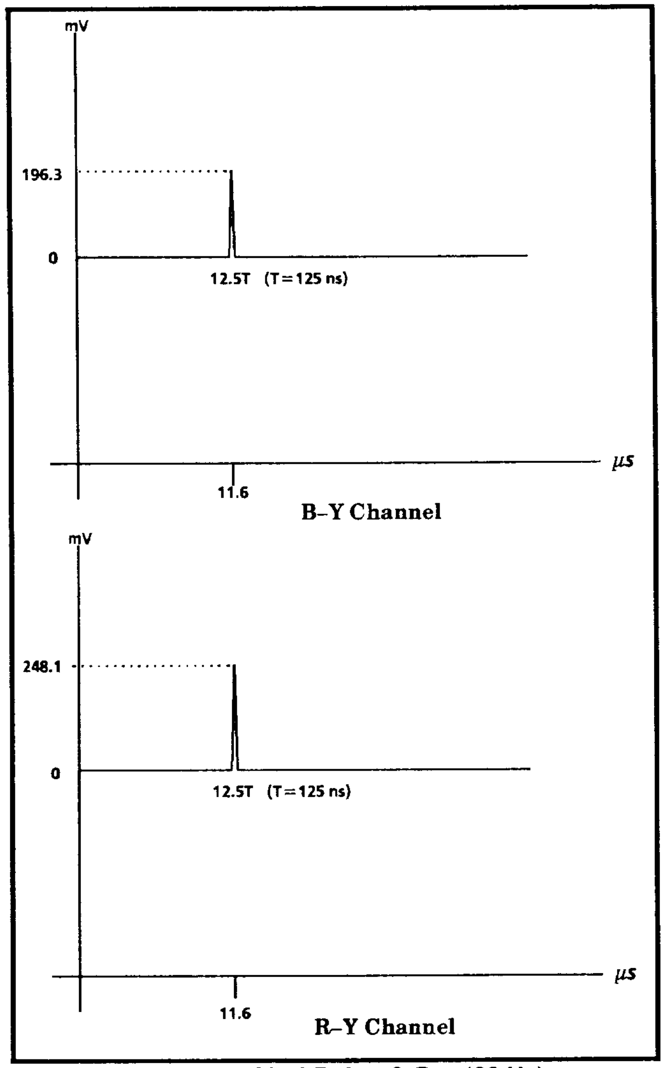


Fig. 3-30a. Mod Pulse & Bar (60 Hz).
B–Y and R–Y, B010556 and above.

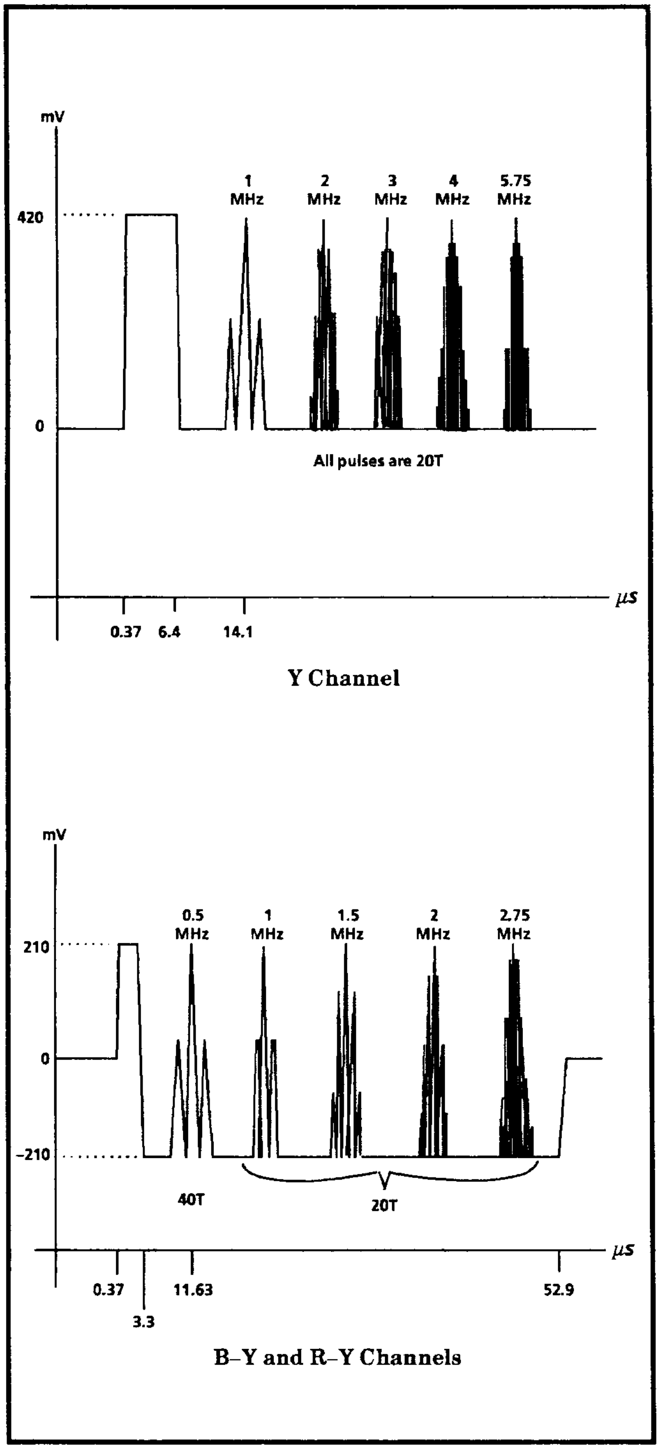


Fig. 3-31. Multipulse.

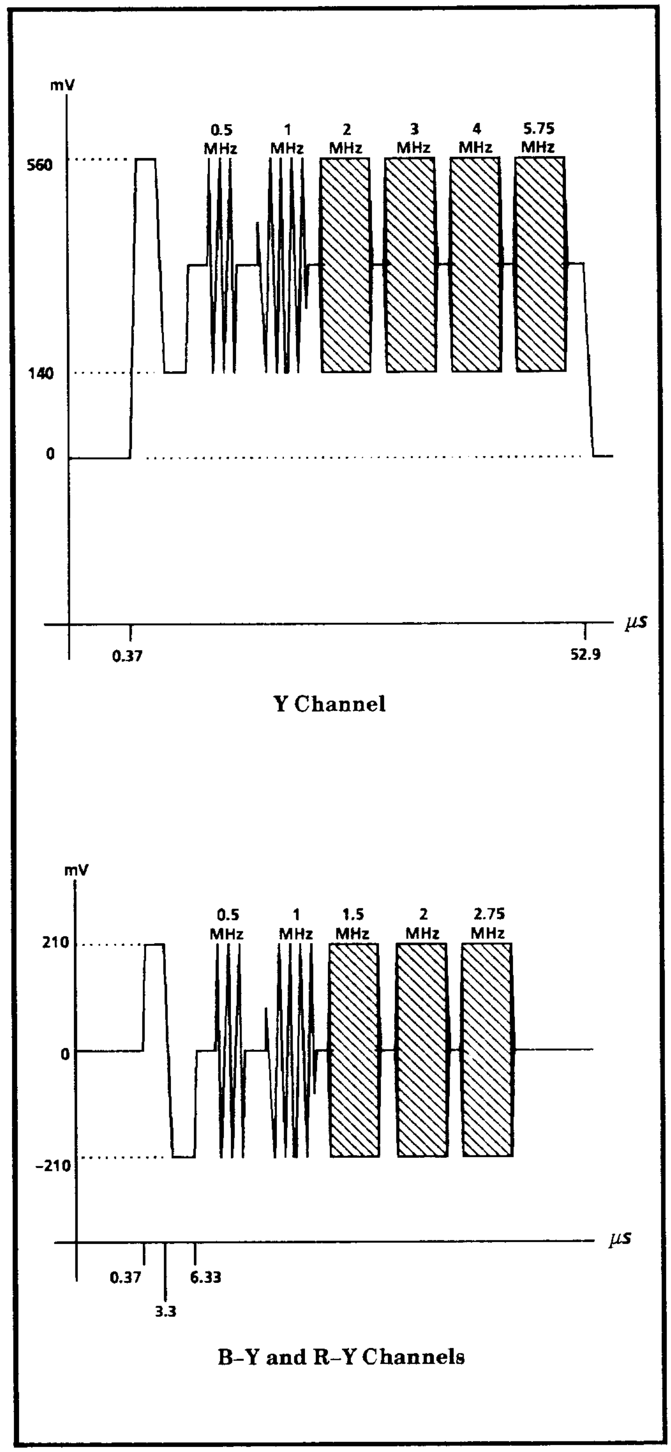


Fig. 3-32. Multiburst.

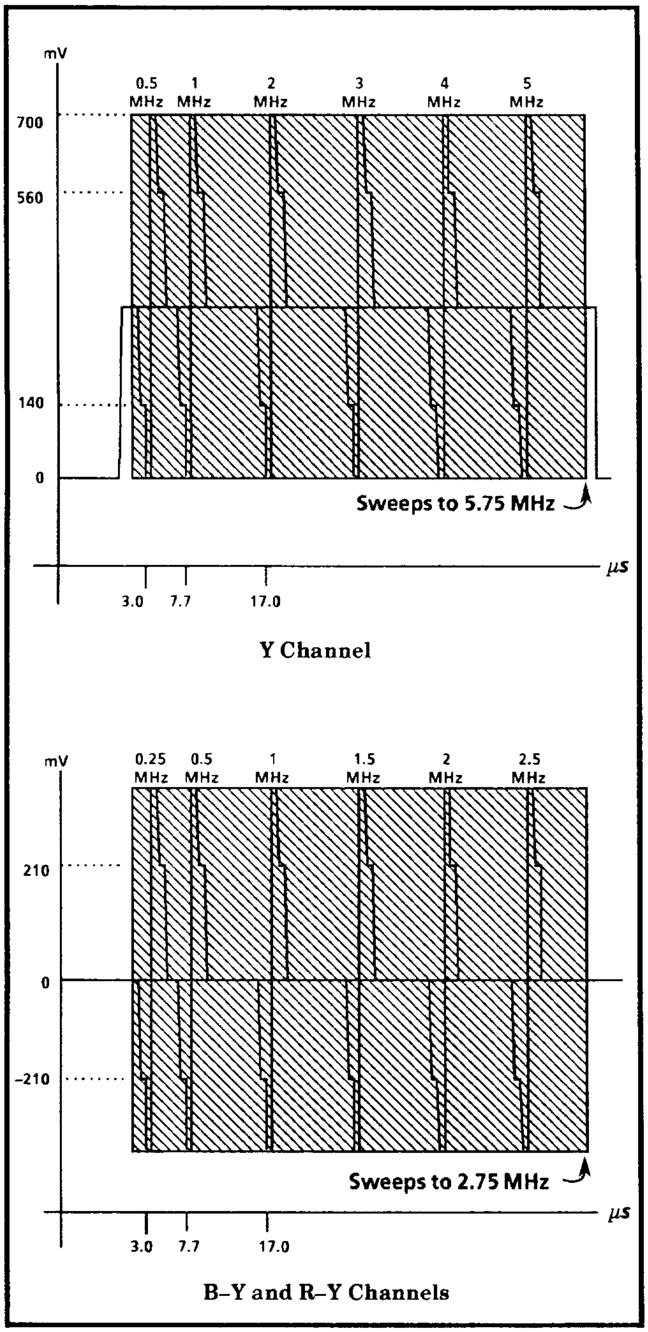


Fig. 3-33. 100% Sweep.

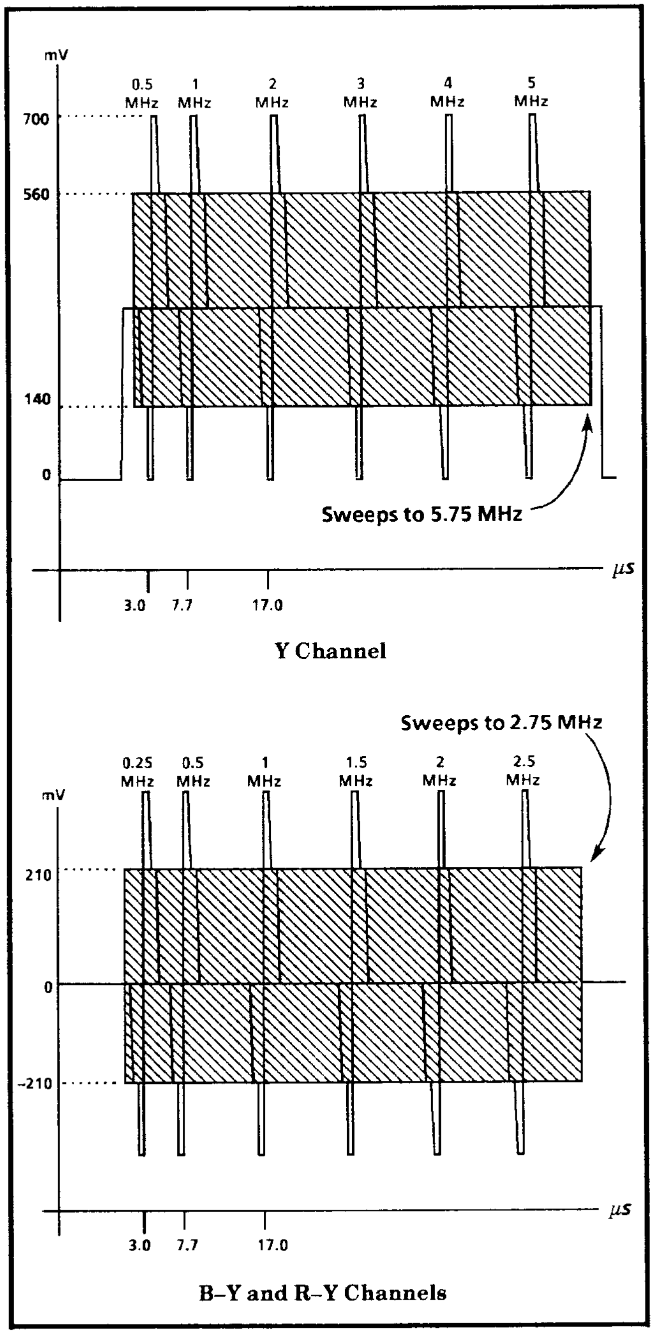


Fig. 3-34. 60% Sweep.

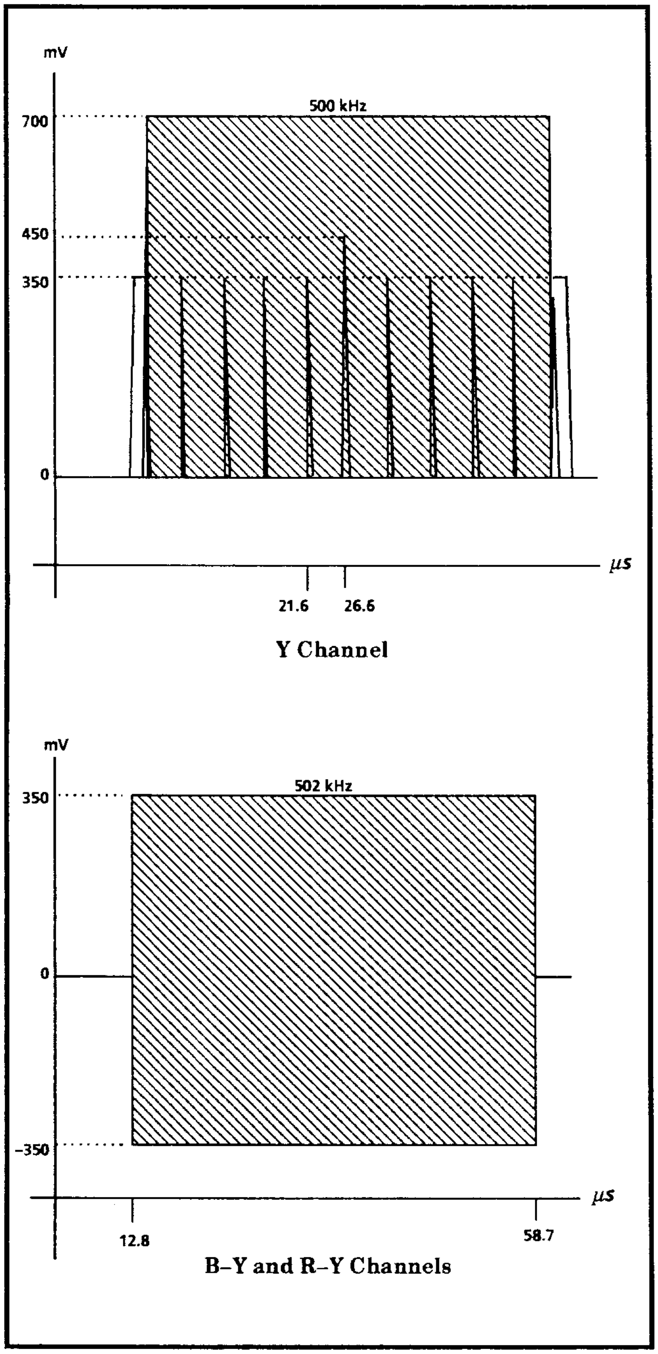


Fig. 3-35. 500 kHz Bowtie.

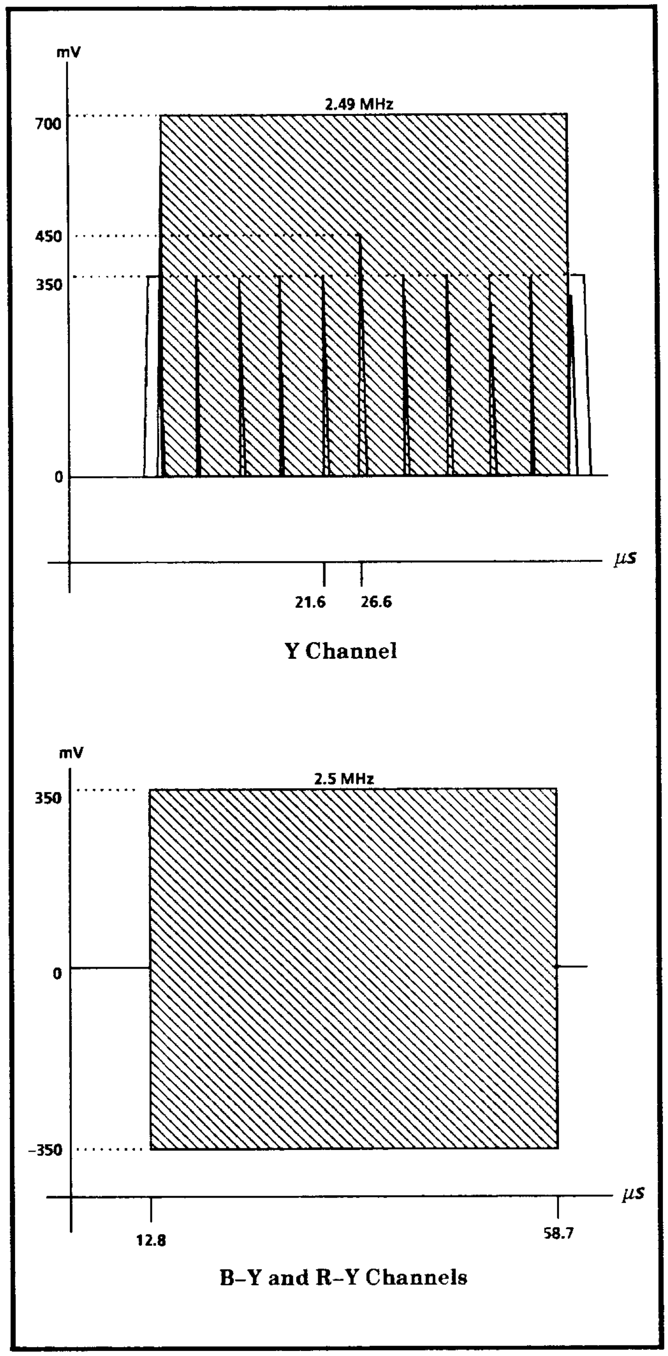


Fig. 3-36. 2.5 MHz Bowtie.

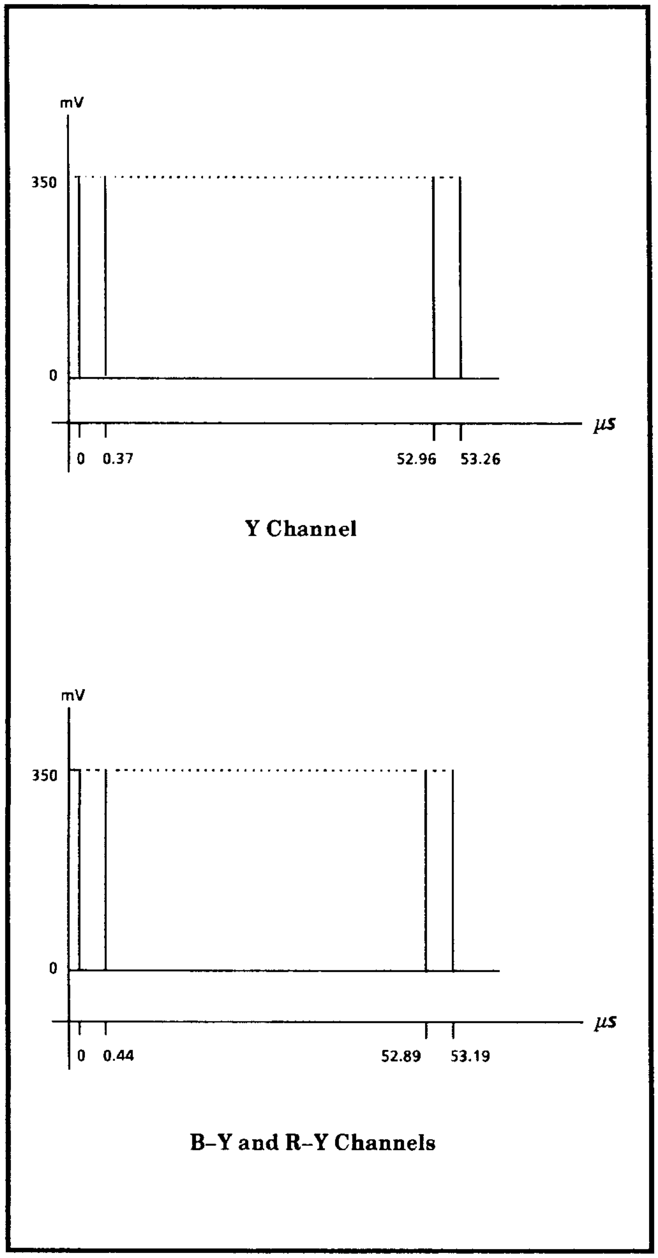


Fig. 3-37. Blanking Markers (60 Hz).

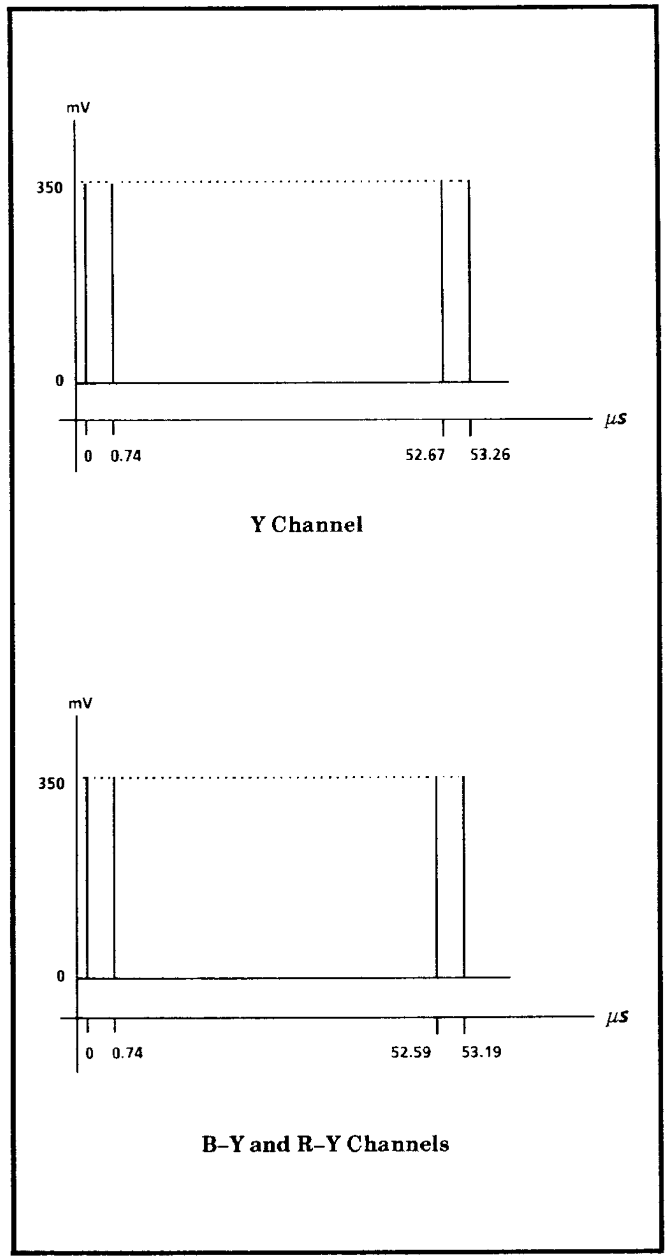


Fig. 3-38. Blanking Markers (50 Hz).

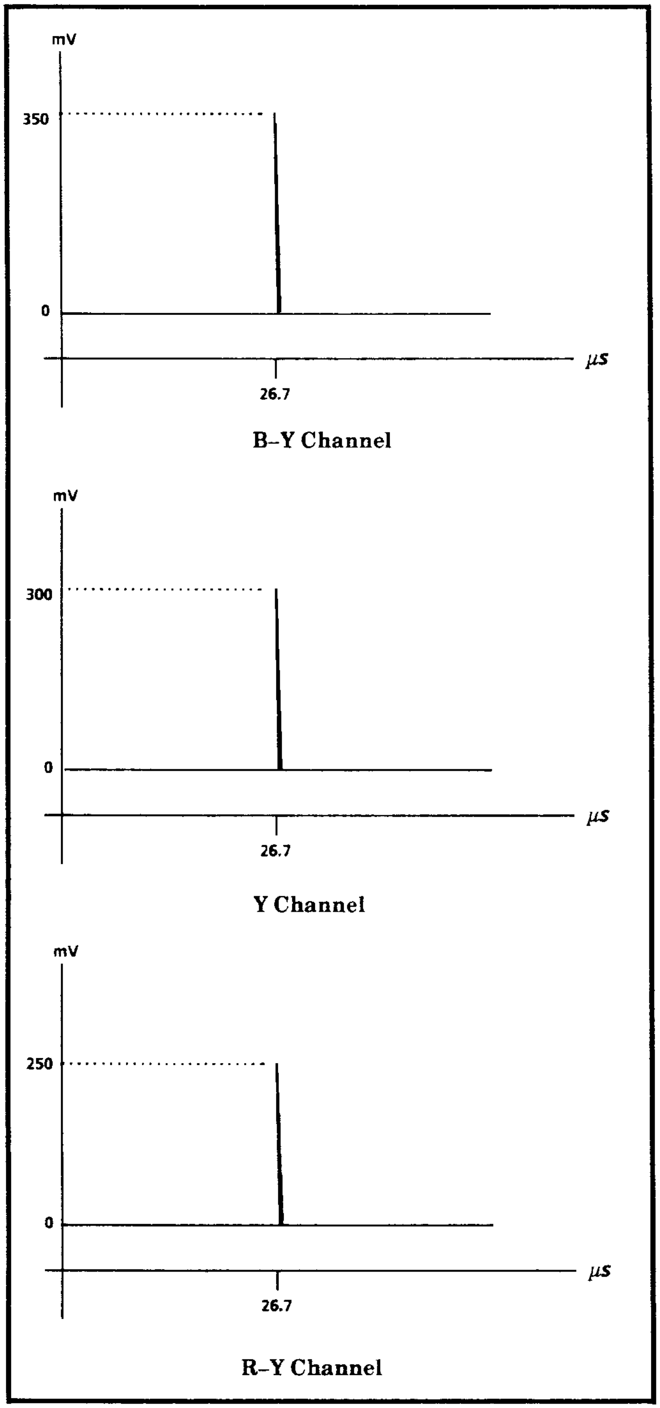


Fig. 3-39. Co-siting Pulse. All Pulses are 1 sample wide.

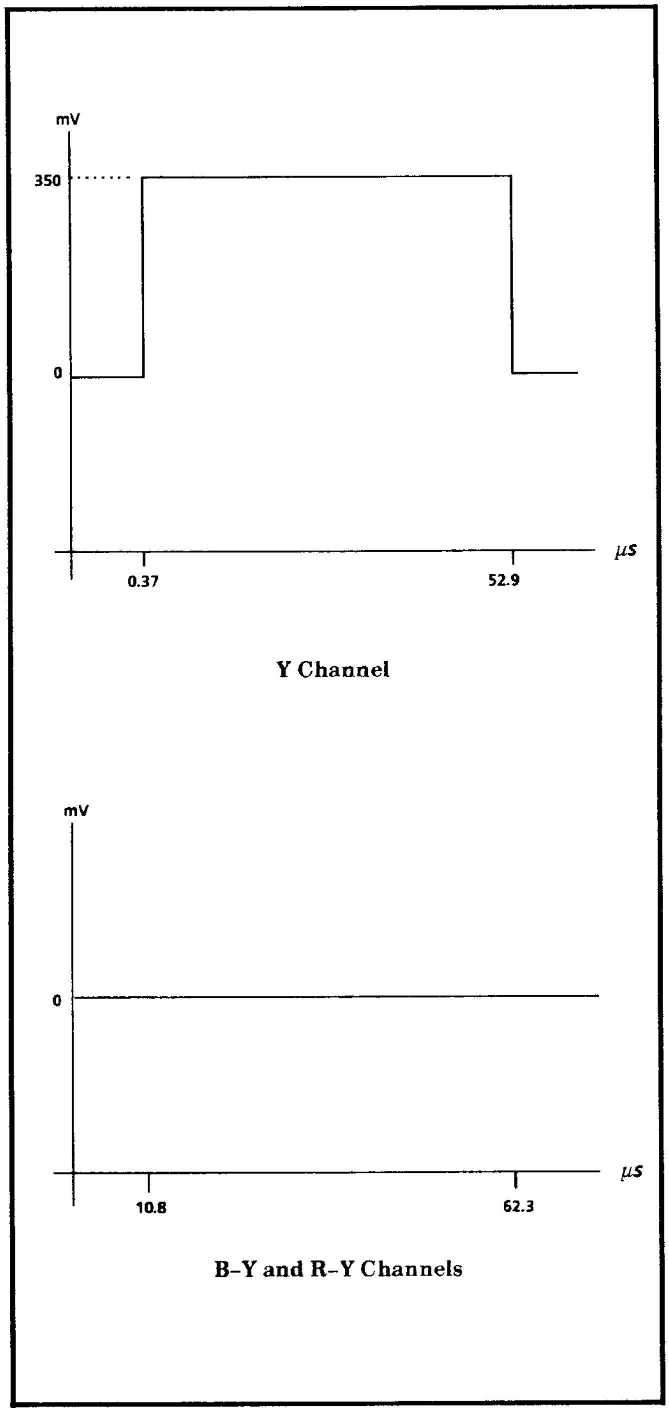


Fig. 3-40. Flat Field.

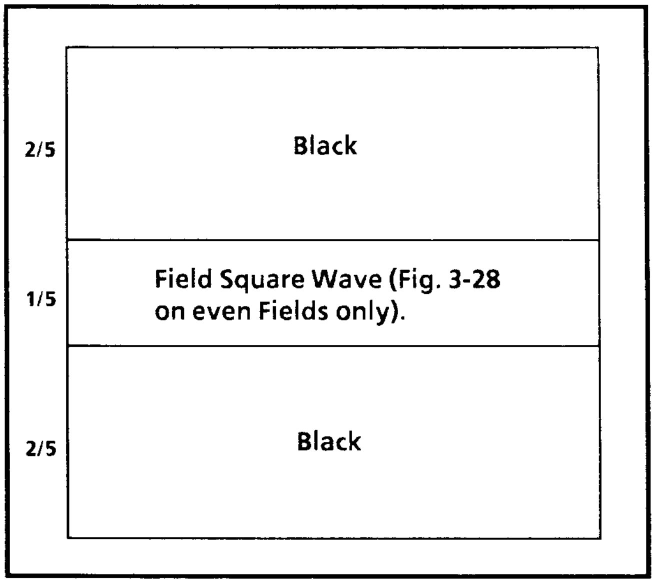


Fig. 3-41. Field ID.

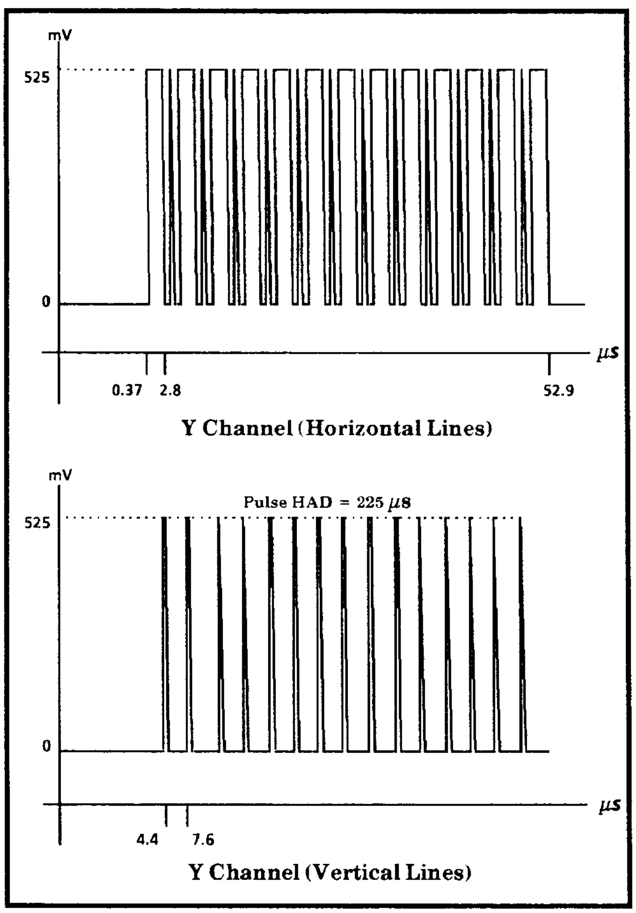


Fig. 3-42. Convergence (generated in Channel 1 only).

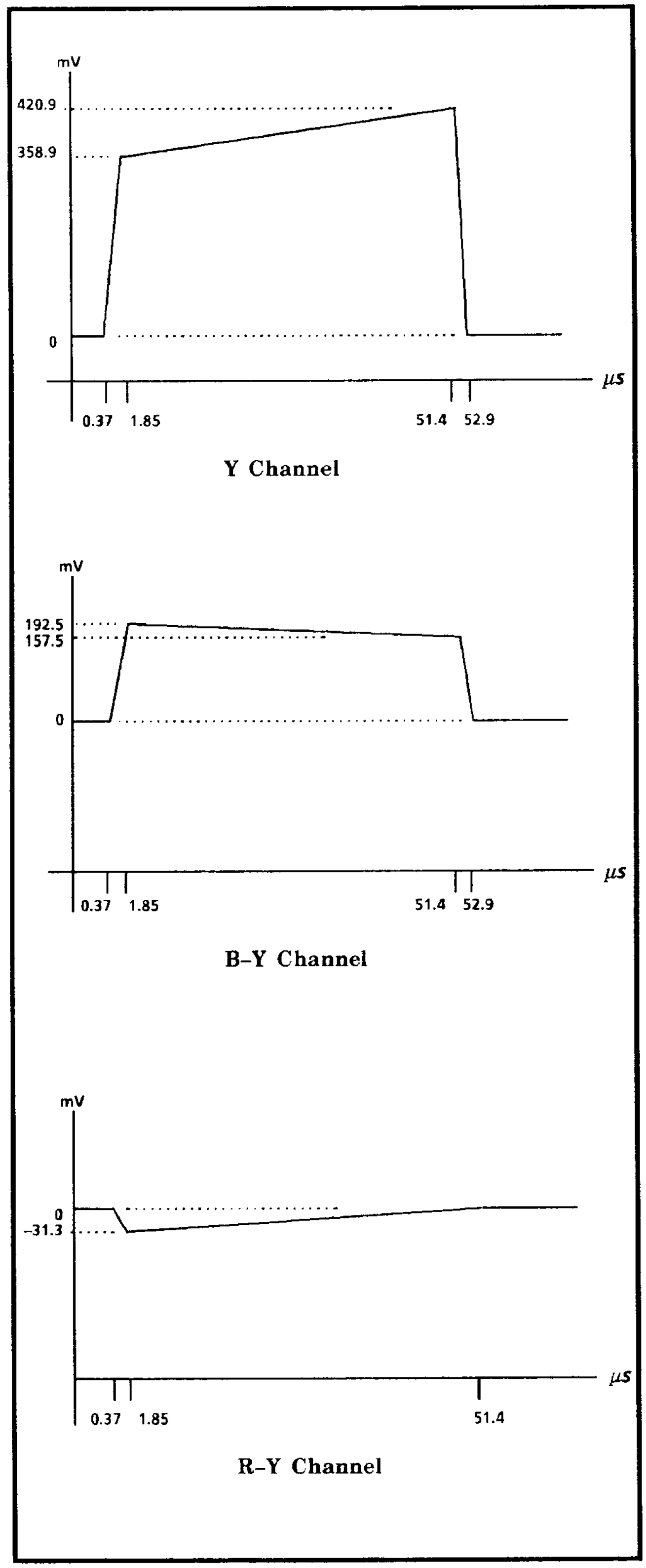


Fig. 3-43. Light Blue Ramp.

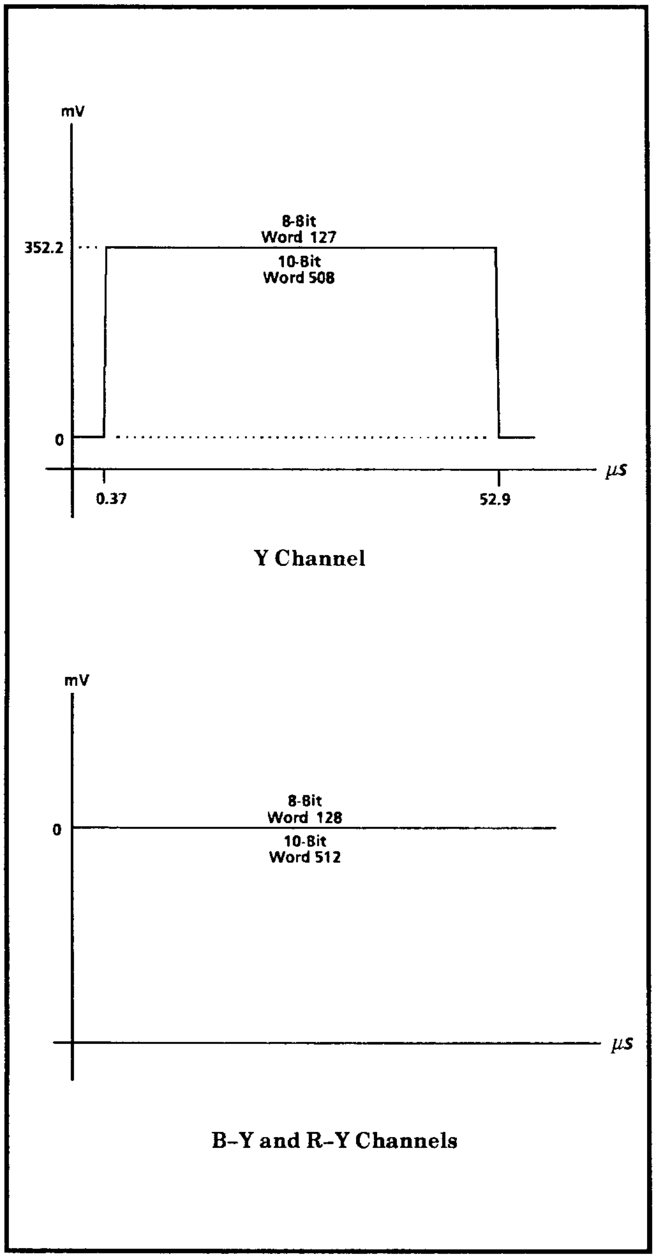


Fig. 3-44. Digital Gray.

1/10	75% Color Bars
	75% Reverse Bars
	Level Reference
	Limit Ramp
	Light Blue Ramp
	60% Sweep
	Sweep Markers
	Multipulse
	2T 4T 10T Pulse & Bar
	Co-siting Pulse

Fig. 3-45. Measurement Matrix.

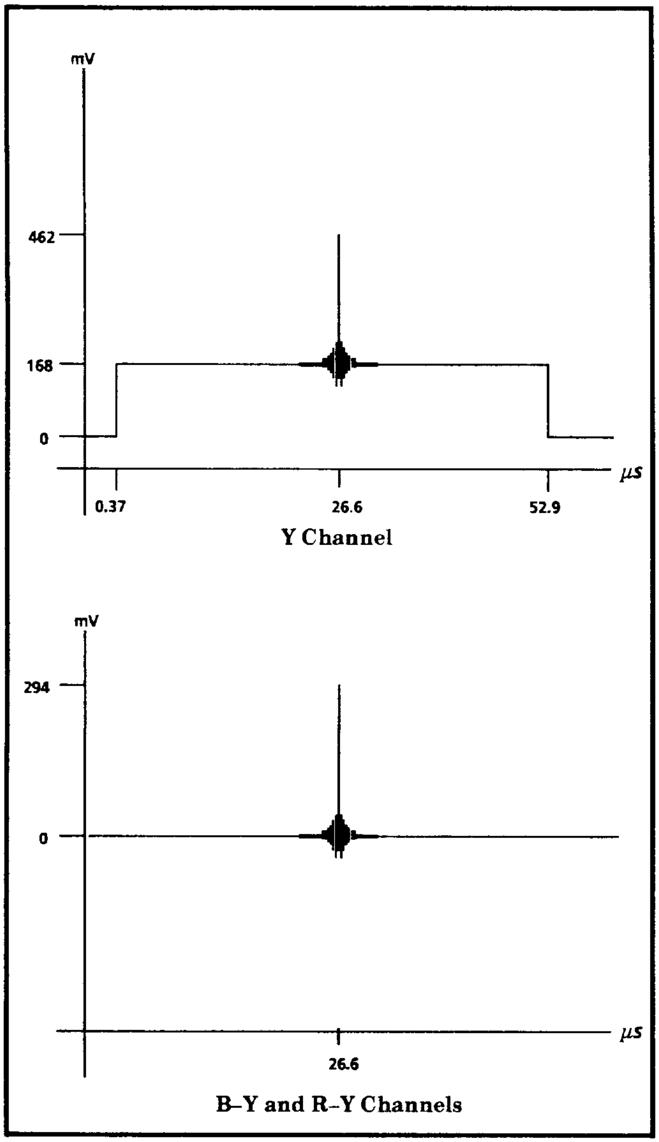


Fig. 3-46. SIN X/x.

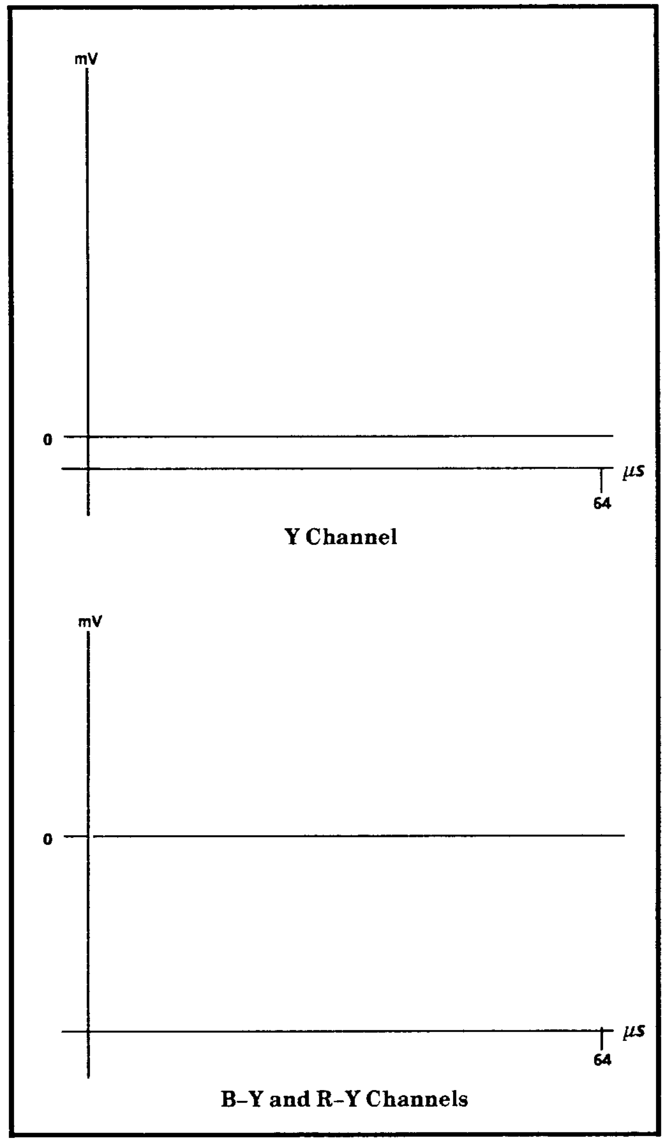


Fig. 3-47. Black.

Table 3–12: 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 50081-1 Emissions:	
	EN 55022	Class B 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
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 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.
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.
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.	

1 **High quality shielded cables must be used to ensure compliance to the listed specifications.**

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.

Installation

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 SETTING AND POWER CORD OPTIONS

The power supply in this instrument operates over a line frequency range of 48 to 62 Hz. The power cord option you ordered determines which rating of fuse you receive and also the position of two jumpers: J810 (line voltage select), and J380 (50/(60) Hz select). See Table 4-1

MECHANICAL INSTALLATION

RACKMOUNTING

The TSG-422 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.

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.

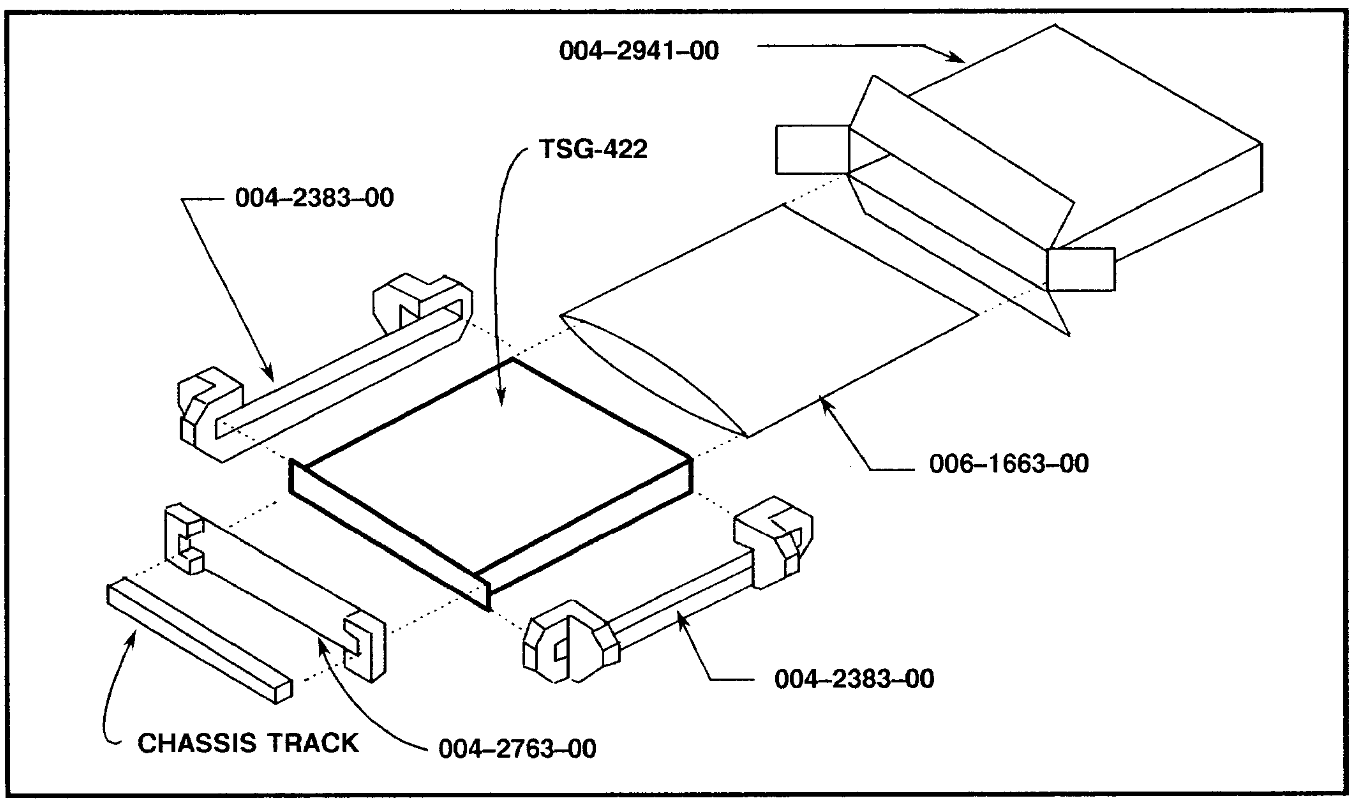


Fig. 4-1. Repacking instructions.

Table 4-1
Jumper Settings for Power Cord Options

Power Cord Option	Fuse Rating	J380, Output Board (50/60 Hz Select)	J810, Power Supply (115/230 V Select)
Standard North American	2 Amp Medium Blow	Pins 1–2 (60 Hz).	Pin 1 aligned with 115 V.
Option A1 (Universal Euro), Option A2 (UK), Option A3 (Australia)	1 Amp Medium Blow	Pins 2–4 (puts selection under remote control, with 50 Hz as the default).	Pin 1 aligned with 230 V.

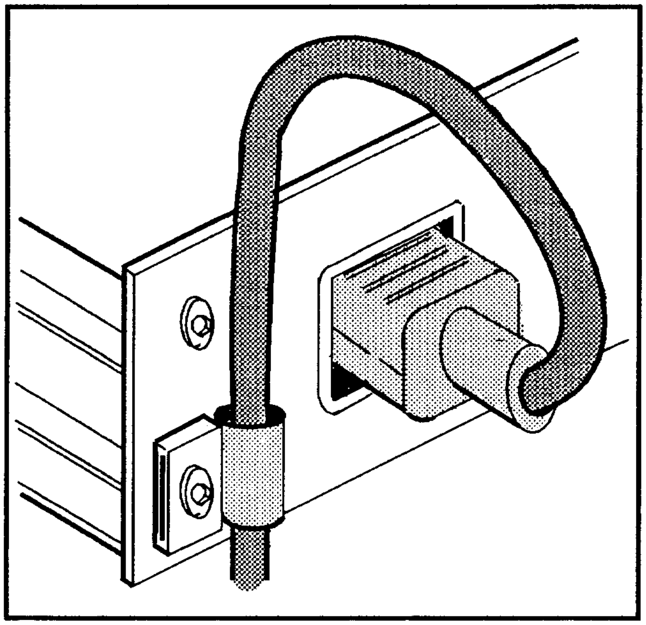


Fig. 4-2. Mounting the power cord.

MOUNTING THE SLIDE TRACKS

Locate the proper rack holes as shown in Fig. 4-3. 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.

Mount the rails using enclosed hardware as shown in Fig. 4-4. Fig. 4-5 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. 4-6. Table 4-2 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 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.

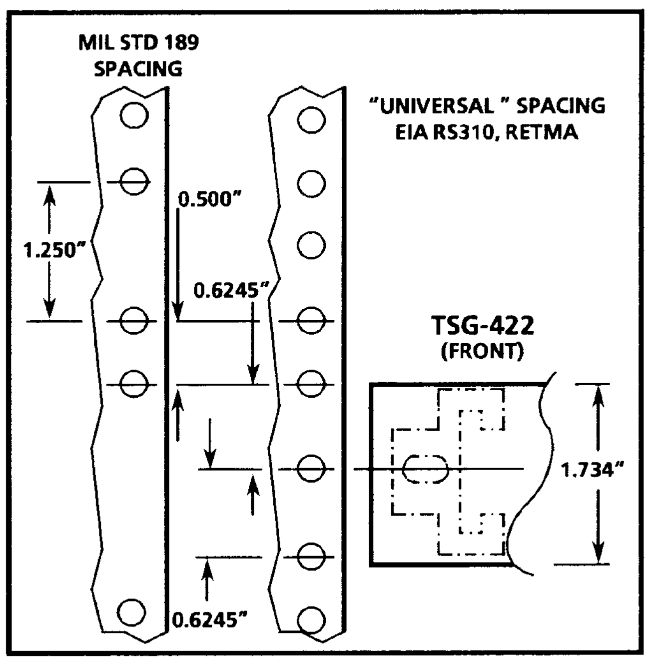
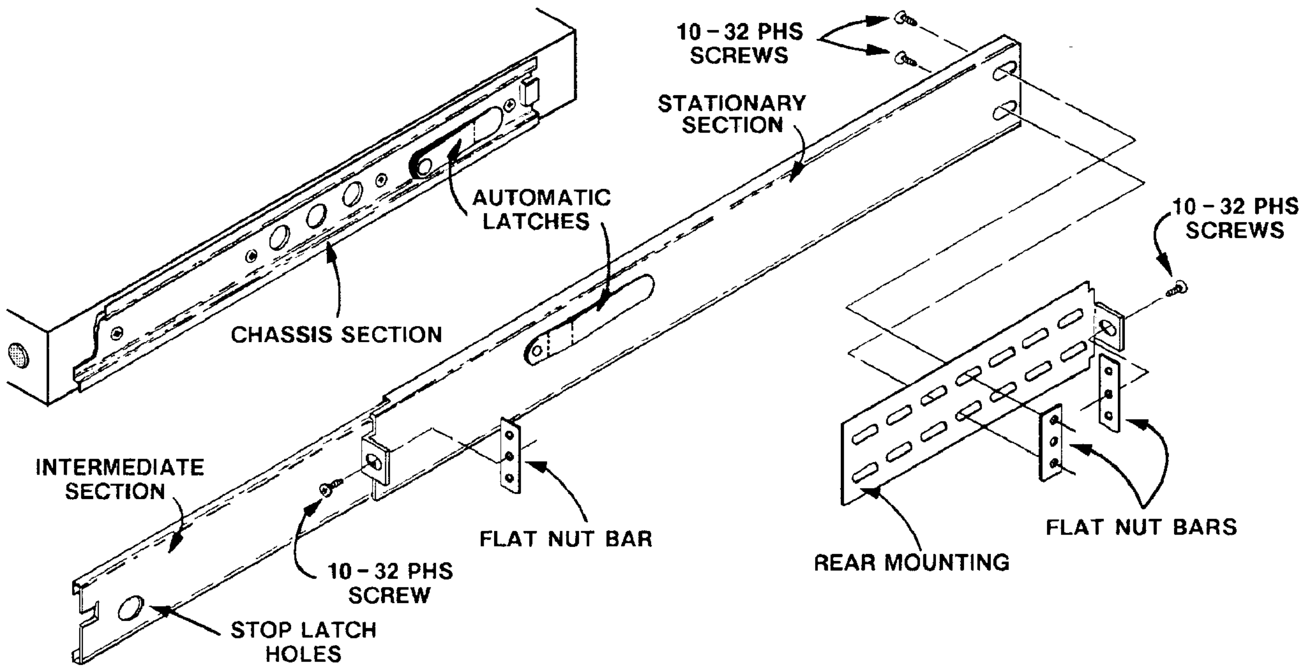


Fig. 4-3. Rail detail for mounting slide tracks.



***NOTE*:**

Right hand and left hand stationary section is designated by the RH and the LH marked on the rails. Stop latch holes should be towards the bottom when slides are in place. (The right hand rail is shown above.)

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

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. 4-6. 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.

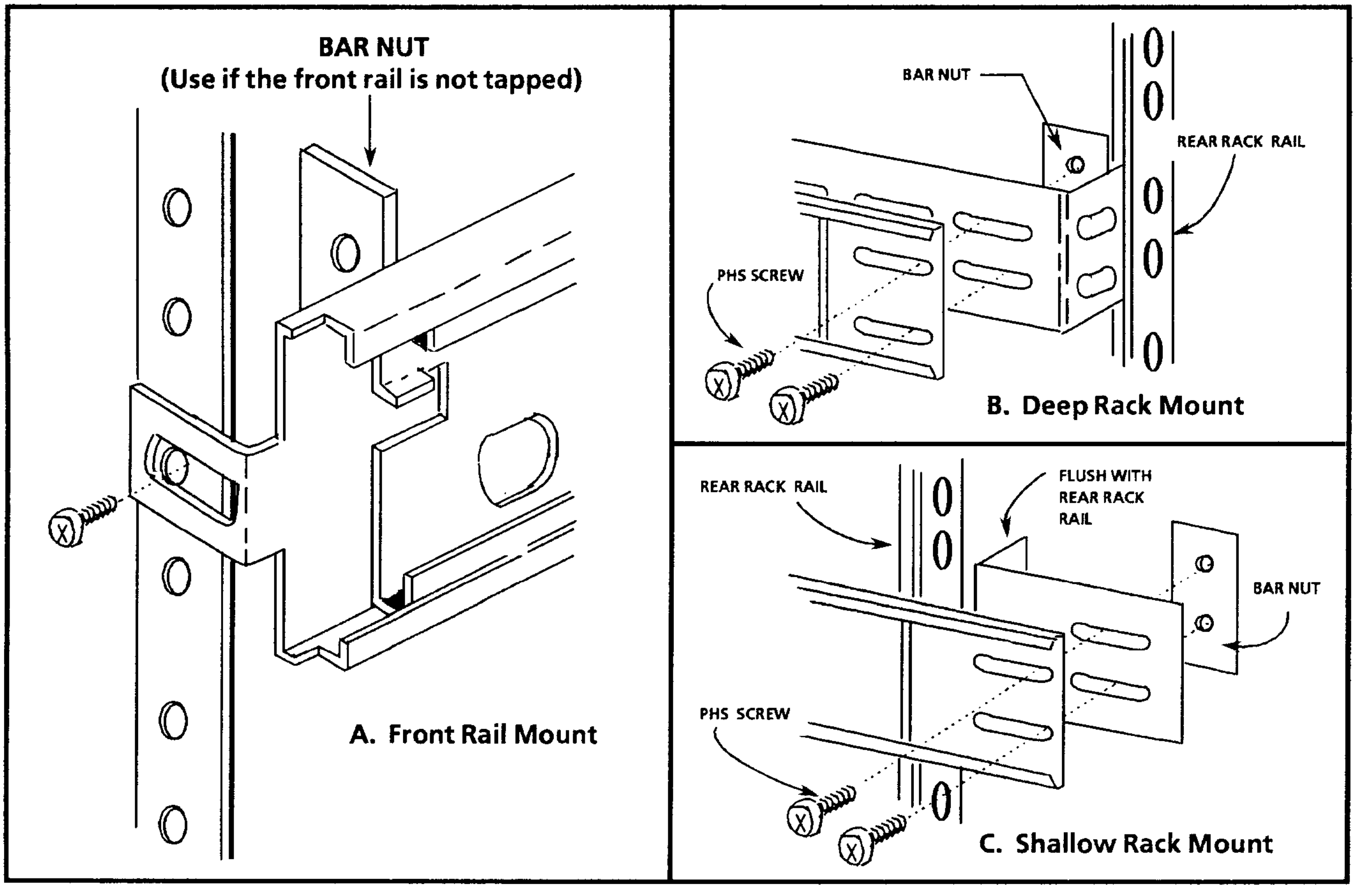
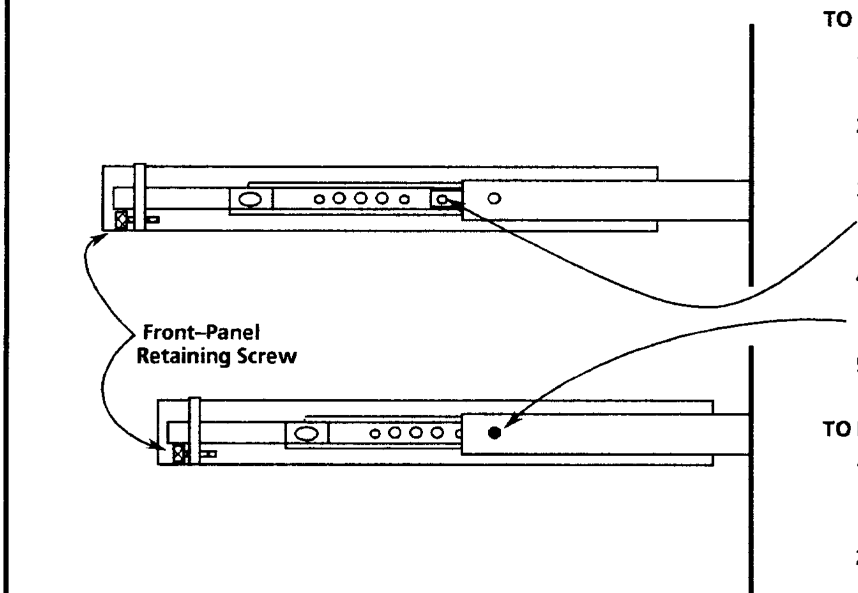


Fig. 4-5. Mounting stationary track sections.



TO INSTALL:

1. Pull the slide-out track section to the fully extended position.
2. Insert the instrument chassis sections into the slide-out sections.
3. Press the stop latches and push the instrument toward the rack until the latches snap into their holes.
4. Again press the stop latches and push the instrument fully into the rack.
5. Tighten the front-panel retaining screw.

TO REMOVE:

1. Loosen retaining screw and pull instrument outward until the stop latches snap into the holes.
2. Press stop latches and remove instrument.

Fig. 4-6. Racking and unracking the TSG-422.

Table 4-2
TSG–422 Rear Panel Connectors

Connector	Function
Remote	Remote Control Input.
Digital Out 1	Digital Video Output (Buffered).
Digital Out 2	Digital Video Output (Buffered).
Genlock Loop Through	Genlock input.
27 MHz Clock	ECL levels. Positive transition during each data packet. See Fig. 4-7.
Y Clock	ECL levels. Positive transition during Luminance (Y) data packets. See Fig. 4-7.
R-Y Clock	ECL levels. Positive transition during R-Y data packets. See Fig. 4-7.
B-Y Clock	ECL levels. Positive transition during B-Y data packets. See Fig. 4-7.
Black	Analog Black Burst output.

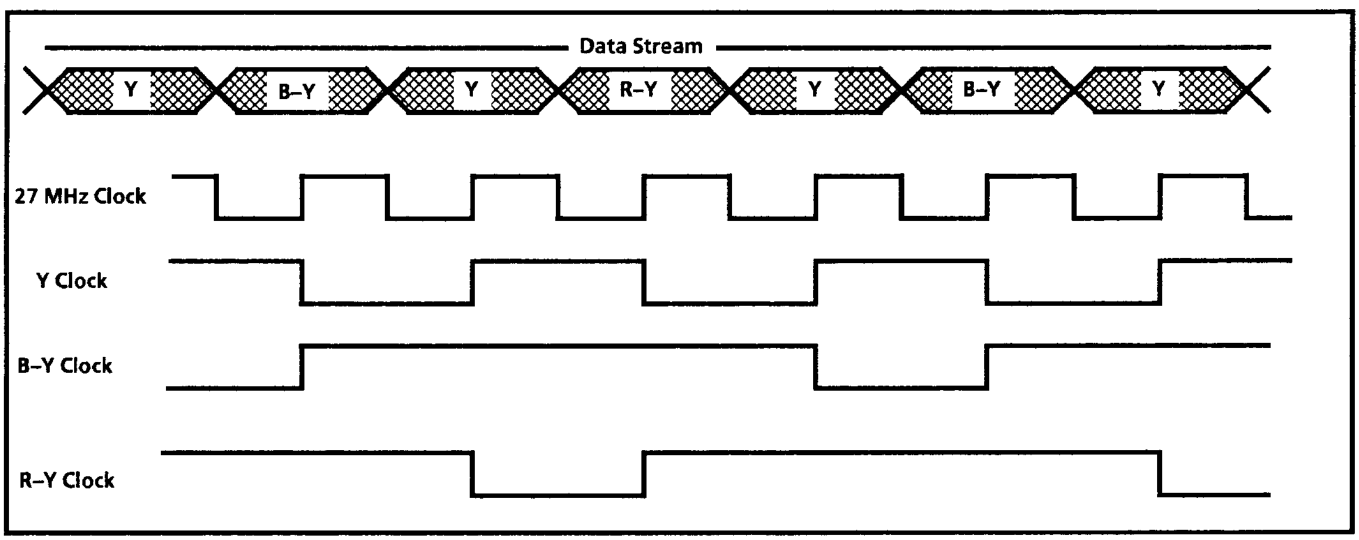


Fig. 4-7. Clock output timing relationships.

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 <#> references denote the schematic the jumper will be found on. The red jumpers should be used only by qualified service personnel.

Table 4-3
Main Board (A2–1) Operating Jumpers

Function	Jumper #	Description	Factory Set
Program Remote	J205 <1>	Pins 1–2: Disables program mode for remote control. Pins 2–3: Enables program mode for remote control.	Pins 1–2
8/10-Bit Select	J209 <1>	Pins 1–2: 10-bit operation. Pins 2–3: 8-bit operation.	Pins 2–3
Disable Mode Select	J309 <1>	Pins 1–2: Allows all front panel modes to be selected. Pins 2–3: Allows selection of test signals only.	Pins 1–2
Disable Timeout	J311 <1>	Pins 1–2: Timeout enabled. Pins 2–3: Timeout disabled.	Pins 2–3
Oscillator Shift Cal	J312 <1>	Pins 1–2: Normal operation. Pins 2–3: Calibrate.	Pins 1–2

Table 4-4
Output Board (A3) Operating Jumpers

Function	Jumper #	Description	Factory Set
50/(60) Hz Select *	J380 <10>	Pins 1–2: 60 Hz. Pins 2–3: 50 Hz. Pins 2–4: Remote Control (50 Hz default).	See Table 4-1
Black Burst Setup	J660 <12>	Pins 1–2: Setup On (60 Hz only). Pins 2–3: Setup Off.	Pins 1–2

* Visual aid for J380

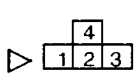
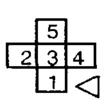


Table 4-5
Power Supply Board (A4) Operating Mode Selection Jumpers

Function	Jumper #	Description	Factory Set
115 V/230 V Line Voltage Select	J810 <14>	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.	See Table 4-1

Table 4-6
Main Board (A2–1) Test Jumpers

Function	Jumper #	Description	Factory Set
VCO Test *	J179 <4>	Pins 1–3: Sets VCO control voltage to mid-range (ground) so VCO can be tuned to 13.5 MHz with C19. Pins 2–3: μP controls genlock loop response. Pins 3–4: Fixed test voltage (–10 V) increases VCO frequency. Pins 3–5: Fixed test voltage (+10 V) decreases VCO frequency.	Pins 2–3
FLD REF	J225 <5>	Pins 1–2: Normal operation. Pins 2–3: Allows timing and outputs to run without genlock circuitry.	Pins 1–2
Crystal Oven Heater	J497 <4>	Pins 1–2. Normal operation. Pins 2–3: Disables oven heater.	Pins 1–2
Software Reset Test	J658 <2>	Pins 1–2: Operate. Pins 2–3: For Future Use.	Pins 1–2
Hard Reset *	J676 <2>	Pins 1–2: Normal operation. Pins 2–3: Forces hard reset. Pins 3–4: Disables hard reset in μP kernel.	Pins 1–2
Manual Reset	J776 <2>	Pins 1–2: Normal operation. Pins 2–3: Manual reset (J676 must be in 1–2 position).	Pins 1–2

* Visual aid for J179 

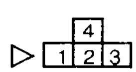
Visual aid for J676 

Table 4-7
Output Board (A3) Test Jumpers

Function	Jumper #	Description	Factory Set
Black Burst Disable	J335 <12>	Pins 1–2: Normal operation. Pins 2–3: Black Burst output disabled.	Pins 2–3
Genlock Input Clamp Disable	J510 <13>	Pins 1–2: Enables input clamp for Genlock input. Pins 2–3: Disables clamp.	Pins 1–2

Table 4-8
Power Supply Board (A4) Test Jumpers

Function	Jumper #	Description	Factory Set
Inductor Enable	J556 <14>	Jacks 1 and 2 shorted: Normal operation. Jacks 1 and 2 unshorted: Disconnects 300 V supply from T440.	Shorted
Undervoltage Lockout	J660 <14>	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 <14>	Jacks 1 and 2 shorted: Normal operation. Jacks 1 and 2 unshorted: Current Limit disabled.	Shorted

Performance Checks & Adjustment Procedures

SECTION 5
PERFORMANCE CHECKS & ADJUSTMENT PROCEDURES

This section consists of checklists and detailed procedures to use in verifying and calibrating TSG-422 performance parameters.

The order of these procedures has been chosen to minimize changes in equipment setup. Performance parameters may be checked in any order. However, because many calibration steps are interactive, care must be taken when adjusting individual parameters to ensure that all others remain within specification.

The following is a list of equipment required for the Performance Check and Adjustment Procedure. While alternate equipment may be used for the Performance Check, it is not recommended for the Adjustment Procedure. Use of inadequate equipment may result in faulty measurements or calibration.

List of Required Test Equipment

1. **NTSC Video Measurement Set.** For measuring and displaying field-rate and line-rate waveforms, and differential phase and gain.
   Example: Tektronix 1780 Video Measurement Set.

   NOTE

   For calibration, it is recommended that a Tektronix 1780 or equivalent test set be used. For Performance Check only, the following equipment may be used in place of the 1780.

   a. **NTSC Waveform Monitor.** Example: Tektronix 1480 Mod W5F.

   b. **NTSC Vectorscope.** Example: Tektronix 520A.

   c. **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 waveform monitor).
   Example: Tektronix part number 067-0916-00: plugs into Tektronix TM 503B Power Mainframe.

2. **PAL Video Measurement Set.** For measuring and displaying field-rate and line-rate waveforms, and differential phase and gain.
   Example: Tektronix 1781 Video Measurement Set.

   NOTE

   For calibration, it is recommended that a Tektronix 1781 or equivalent test set be used. For Performance Check only, the following equipment may be used in place of the 1781.

   a. **PAL Waveform Monitor.** Example: Tektronix 1481 Mod W5F.

   b. **PAL Vectorscope.** Example: Tektronix 521A.

   c. **Video Amplitude Calibration Fixture (VAC).** Example: Tektronix part number 067-0916-00: plugs into Tektronix TM 503B Power Mainframe.

3. **BNC Coax Cables.** 75 Ω impedance.
   Example: Tektronix part number 012-0074-00.

4. **End-Line Termination.** 75 Ω termination equipped with a BNC connector.
   Example: Tektronix part number 011-0102-00.

5. **Feed-Through Termination.** 75 Ω termination equipped with BNC connectors.
   Example: Tektronix part number 011-0103-00.

6. **Television Test Signal Generator (NTSC).** Capable of providing several NTSC video test signals such as: full-field Color Bars and Black Burst. In the Black Burst signal, the SCH burst phase and amplitude should be capable of

being readily varied and set. The subcarrier portion of the linearity staircase and ramp signals should be easily turned "on" and "off" from the front panel.

Example: Tektronix 1410 Generator with Option AA (modified SPG2), TSG3, TSG5, TSG6, and TSG7. The 1410 Option AA is a mainframe with a modified SPG2 sync pulse generator having the added features: Variable subcarrier frequency (±20 Hz and ±50 Hz), variable burst amplitude, variable sync amplitude, and SC/H unlock. These features make several checks easier.

7. **Television Test Signal Generator (PAL).**

   Capable of providing several PAL video test signals such as: full-field Color Bars and Black Burst. In the Black Burst signal, the SCH burst phase and amplitude should be capable of being readily varied and set. The burst portion of the signal; and the subcarrier portion of the linearity staircase and ramp signals should be easily turned "on" and "off" from the front panel.

   Example: Tektronix 1411 Generator with Option AA (modified SPG12), TSG13, TSG15, TSG16, and TSG11. The 1411 Option AA is a mainframe with a modified SPG12 sync pulse generator having the added features: Variable subcarrier frequency (±20 Hz and ±50 Hz), variable burst amplitude, variable sync amplitude, and SCH unlock. These features make several checks easier.

8. **Oscilloscope.** A 1 GHz Tektronix 11403A mainframe with a 1 GHz Tektronix 11A72 Dual trace plug-in is recommended for testing the option 1S Serial Output.

9. **Spectrum Analyzer with 012-0113-00 cable.** Capable of measuring to at least 5.5 MHz. Example: Tektronix 2710.

10. **Leveled Sine Wave Generator.** 250 kHz to 5.5 MHz. Example: Tektronix SG503A plugs into a 500 series Power Mainframe.

11. **Step Attenuator.** Capable of attenuating in 1 dB steps: DC coupled with 75 Ω impedance; flat response to at least 5 dB. Example: Wavetek 7580.

12. **Frequency Counter.** Accurate to 1 Hz to 27 MHz. Example: Tektronix DC503A plugs into a 500 series Power Mainframe.

13. **Variable Auto Transformer.** Example: General Radio Metered Auto Transformer W10MT3W. If 220V operation needs to be checked, a different autotransformer or conversion transformer is needed.

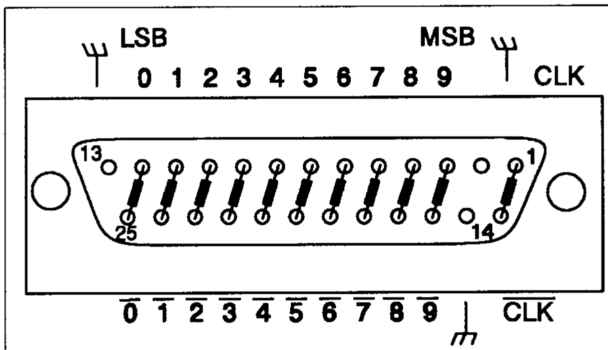
14. **Return Loss Bridge.** At least 54 dB, dc to 10 MHz; 75 Ω inputs. Example: Tektronix 015-0149-00.

15. **DC Block.** Tektronix 015-0221-00.

16. **DMM.** Tektronix DM503A.

17. **Decoder.** Capable of taking 4:2:2 and decoding it into Y, B-Y, and R-Y in analog component form. Example: Grass Valley Group DAC-100.

18. **Digital Termination.** See Fig. 5-1.



Take eleven 110 Ω resistors and a 25-pin male D connector. Solder each resistor between a data line pin and its complement, as shown. Make sure to leave enough room to attach a scope probe at each end of the resistors.

Fig. 5-1. Digital Termination.

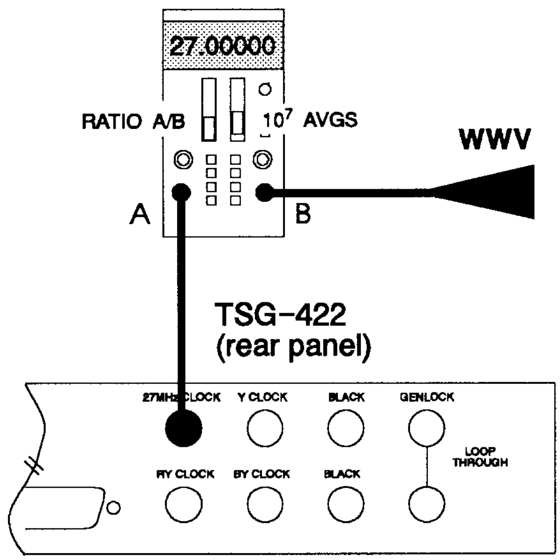


Fig. 5-2. Setup to check the 27 MHz CLOCK's frequency.

FREQUENCY CHECK

1. **Free Running Frequency**
   27 MHz ± 10 Hz

   a. Connect the equipment as shown in Fig. 5-2.

   b. Attach the Frequency Counter to the 27 MHz CLOCK output.

   c. **CHECK** — that for a frequency of 27 MHz ± 10 Hz.

2. **Shift 27 MHz Clock**
   Advance & Delay by 200 Hz ± 20 Hz

   a. Connect the equipment as shown in Fig. 5-2.

   b. Attach the Frequency Counter to the 27 MHz CLOCK output.

   c. Select +200 Hz from the front panel of the TSG-422.

   d. **CHECK** — that the frequency is 27.0002 MHz ± 20 Hz.

   e. Select -200 Hz from the front panel of the TSG-422.

   f. **CHECK** — that the frequency is 26.9998 MHz ± 20 Hz.

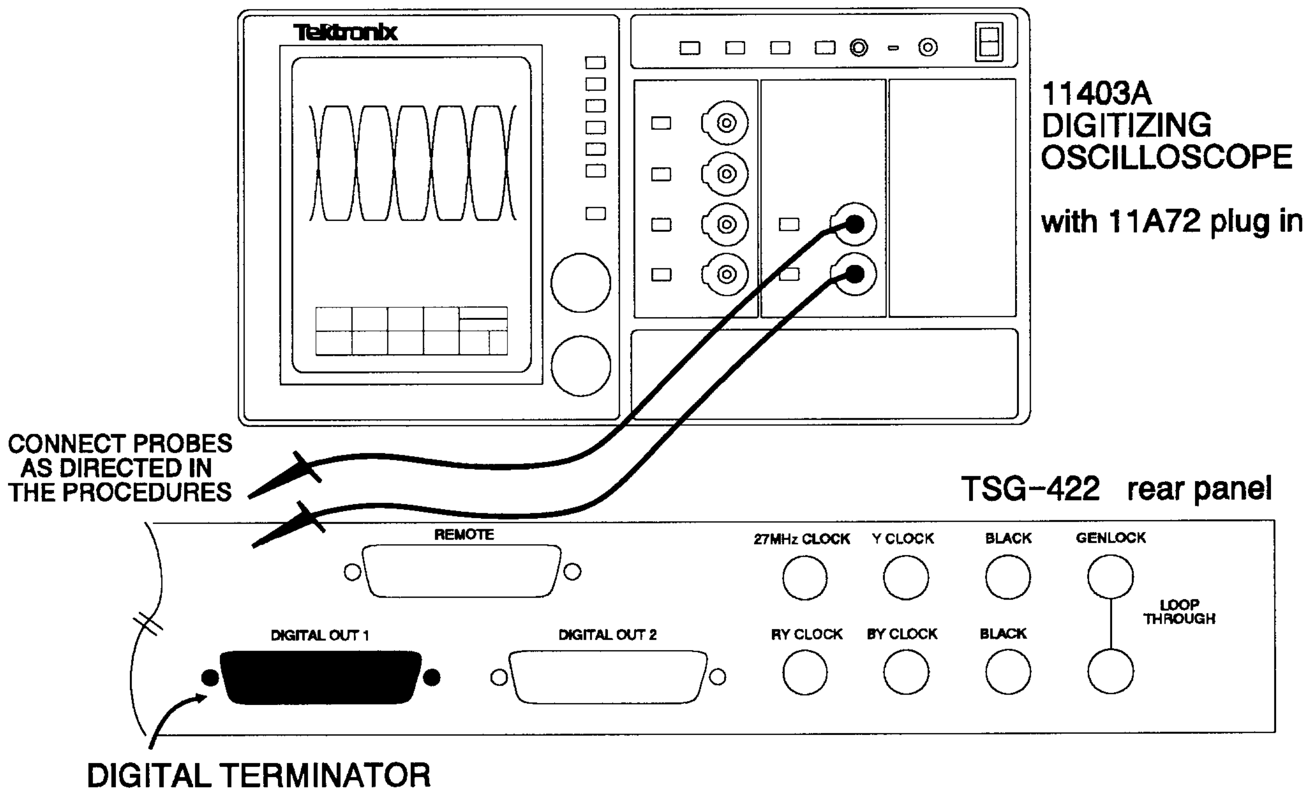


Fig. 5-3. Setup to check the DIGITAL VIDEO Outputs.

DIGITAL VIDEO OUTPUTS

3. Digital Amplitudes
0.8 V to 2.0 V

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

b. Using the digital terminator, connect a probe to the clock output of the parallel digital output.

c. **CHECK** — that the amplitude of the waveform is between 0.8 V_{p-p} and 2.0 V_{p-p}.

d. Repeat for each of the data pairs.

4. Digital Rise & Fall Times
< 5 ns with < 2 ns difference between data samples

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

b. Connect a probe to the clock output pair and the other probe to the LSB Data pair.

c. **CHECK** — that the rise and fall times of the clock and data waveforms are less than 5 ns as measured between the 20% and 80% amplitude points.

d. Repeat for all the data pairs.

e. **CHECK** — that the rise times between the data pairs do not differ by more than 2 ns.

5. Clock Symmetry
18.5 ns ± 3 ns

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

b. Connect the probes to the clock outputs.

c. Measure the time from the rising edge of the clock to the falling edge and the time from the falling edge to the rising edge (half amplitude point).

d. **CHECK** — that the half amplitude times are 18.5 ns ± 3 ns.

6. 27 MHz Clock to Data Timing
18.5 ns ± 3 ns

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

b. Connect one oscilloscope input to the 27 MHz CLOCK and one to an LSB data output.

c. Trigger from the LSB.

d. **CHECK** — that the data cross over point is 18.5 ns ± 3 ns advanced from the rising edge of the 27 MHz CLOCK.

7. Shift Data Timing
advance & delay by 11 ns ± 2 ns

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

b. Attach a probe to one data pair and a cable to the 27 MHz CLOCK output.

c. Trigger the scope on the data signal.

d. Adjust the horizontal position of the signals to put a data crossing point on the center vertical graticule.

e. Select -11 ns from the front panel of the TSG-422.

f. **CHECK** — that the rising edge of the clock is 11 ns before the X transition of the data signal.

g. Select +0 ns from the front panel of the TSG-422.

h. **CHECK** — that the rising edge of the clock is even with the middle vertical graticule line (data X transition).

i. Select -11 ns from the front panel of the TSG-422.

j. **CHECK** — that the rising edge of the clock is 11 ns after the data X transition.

CLOCK TO DATA TIMING

8. Y Clock to Data Stream
18.5 ns ± 3 ns

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

b. Adjust the horizontal position on the oscilloscope to center the data crossing point (X).

c. **CHECK** — that the time between the rise of the Y CLOCK output and the data crossing point is 18.5 ns ± 3 ns.

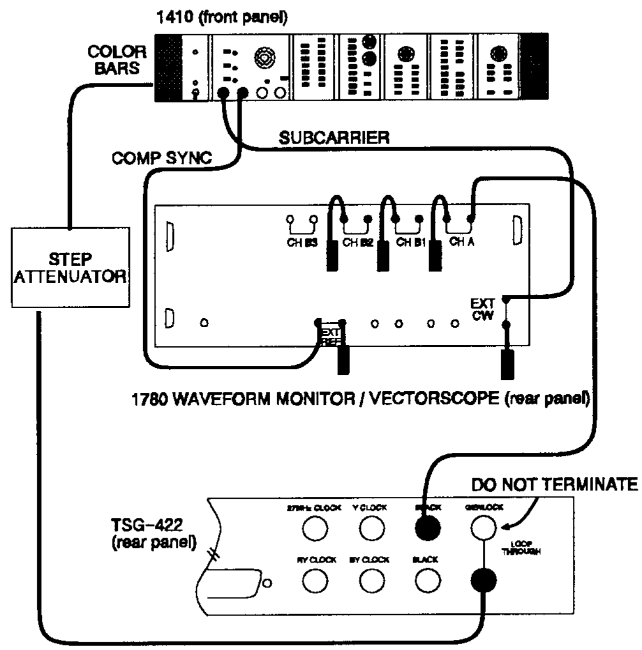


Fig. 5-4. Setup to check the 525/60 genlock.

NTSC (525/60) GENLOCK

9. Sync Lock Jitter
< 2 ns (2.5°)

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

b. Set the Step Attenuator to read 6 (equivalent to 0 dB).

c. Make sure that the TSG-422 is set for 525/60 operation (J380 on the Output board is in 1-2 position).

d. On the 1410 Color Bar module (TSG 7) remove burst from the Color Bars signal.

e. **CHECK** — with the vectorscope in vector mode for 2.5° of jitter.

10. Sync Lock Timing Change with an Input Sync Amplitude Change of +3 dB to -6 dB
< 15 ns shift

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

b. Make sure that the TSG-422 is set for 525/60 operation (J380 on the Output board is in 1-2 position).

c. On the 1410 Color Bar module (TSG 7) remove burst from the Color Bars signal.

NOTE

To get the step attenuator to provide the range needed for the following tests remove the signal termination from the waveform monitor, causing the signal to be increased by 6 dB above nominal levels. Setting the step attenuator to read 6, therefore results in a normal signal level. To attenuate the signal -6 dB, set the step attenuator to read 12. To attenuate the signal +6 dB, set the attenuator to read 0.

d. Set the step attenuator to read 3 (+3 dB).

e. **CHECK** — that the front panel EXTERNAL REF light on the TSG-422 is lit.

f. **CHECK** — using the vectorscope, for <19° color shift on the vectorscope.

g. Set the step attenuator to read 12 (-6 dB).

h. **CHECK** — that the front panel EXTERNAL REF light on the TSG-422 is lit.

i. **CHECK** — using the vectorscope for <19° color shift on the vectorscope.

11. Horizontal Timing Range
At least 8 μs advance and delay

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

b. Set the Step Attenuator to read 6 (equivalent to 0 dB).

c. Make sure that the TSG-422 is set for 525/60 operation (J380 on the Output board is in 1-2 position).

d. Use front panel controls to adjust the timing as far as possible.

e. **CHECK** — that the signal can be advanced and delayed by ± 8 μs.

12. Pull-in Range
Subcarrier ± 20 Hz

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

b. Make sure that the TSG-422 is set for 525/60 operation (J380 on the Output board is in 1-2 position).

c. Adjust the burst frequency on the 1410 front panel ± 20 Hz.

d. **CHECK** — that the EXTERNAL REF light on the front panel of the TSG-422 is lit.

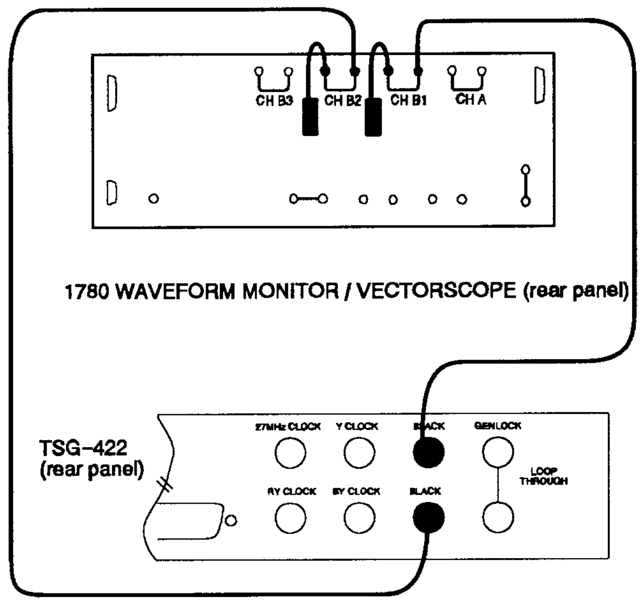


Fig. 5-5. Setup to check the Black Burst Output.

NTSC (525/60) BLACK BURST OUTPUT

13. Black Setup Level
7.5 IRE ± 1 IRE or 0 IRE ± 1 IRE

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

b. Make sure that the TSG-422 is set for 525/60 operation (J380 on the Output board is in 1-2 position).

c. Move jumper J660 on the Output board to the 1-2 position (setup enabled).

d. Display CH B1 on the waveform monitor.

e. With the WFM + CAL function of the measurement set match the dc level of the lower waveform to the black level of the upper waveform.

f. **CHECK** — that the black amplitude is 7.5 ± 1 IRE.

g. Display CH B2 on the waveform monitor.

h. With the WFM + CAL function of the measurement set match the dc level of the lower waveform to the black level of the upper waveform.

i. **CHECK** — that the black amplitude is 7.5 ± 1 IRE.

j. Move J660 to the 2-3 position (setup disabled).

k. Display CH B1 on the waveform monitor.

l. With the WFM + CAL function of the measurement set match the dc level of the lower waveform to the black level of the upper waveform.

m. **CHECK** — that the black amplitude is 0 ± 1 IRE.

n. Display CH B2 on the waveform monitor.

o. With the WFM + CAL function of the measurement set match the dc level of the lower waveform to the black level of the upper waveform.

p. **CHECK** — that the black amplitude is 0 ± 1 IRE.

q. Return jumper J660 to its original position.

14. Blanking Level
0 mV ± 50 mV

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

b. Make sure that the TSG-422 is set for 525/60 operation (J380 on the Output board is in 1-2 position).

c. Display CH B1 on the waveform monitor.

d. Confirm that any DC-restorer feature of the monitor is off.

e. Toggle the display between DC coupled and ground reference.

f. **CHECK** — that the dc level is 0 mV ± 50 mV.

g. Display CH B2 on the waveform monitor.

h. Confirm that any DC-restorer feature of the monitor is off.

i. Toggle the display between DC coupled and ground reference.

j. **CHECK** — that the dc level is 0 mV ± 50 mV.

15. Blanking Width (60 Hz)
10.9 μs ± 0.2 μs

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

b. Make sure that the TSG-422 is set for 525/60 operation (J380 on the Output board is in 1-2 position).

c. Display CH B1 on the waveform monitor.

d. **CHECK** — using the timing cursors that the blanking width is 10.9 μs ± 0.2 μs.

e. Display CH B2 on the waveform monitor.

f. **CHECK** — using the timing cursors that the blanking width is 10.9 μs ± 0.2 μs.

16. SCH Phase Accuracy
$0^\circ \pm 5^\circ$

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

b. Make sure that the TSG-422 is set for 525/60 operation (J380 on the Output board is in 1-2 position).

c. Display CH B1 on the waveform monitor.

d. Put the vectorscope in SCH mode.

e. Measure the SCH of the Black Burst using the 1780's special SCH mode.

f. **CHECK** — that the SCH is $0^\circ \pm 5^\circ$.

g. Repeat for CH B2.

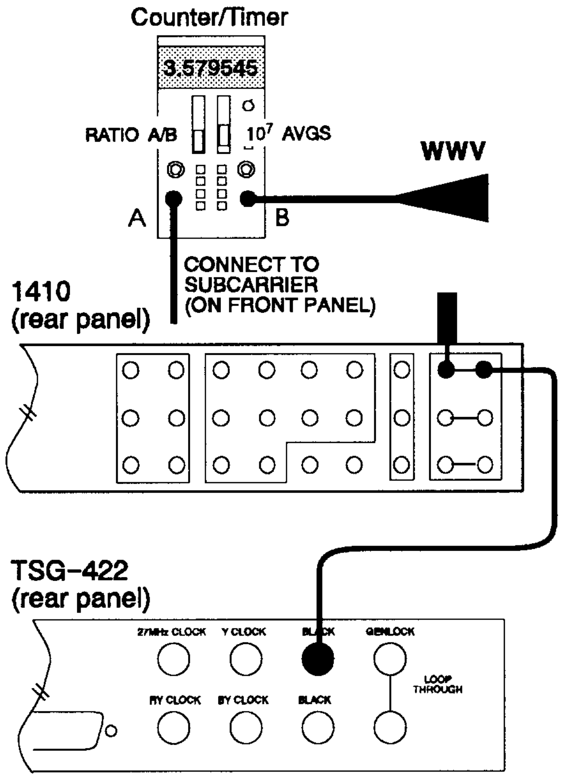


Fig. 5-6. Setup to check the burst frequency.

17. Burst Frequency (60 Hz)
3.579545 MHz ± 1 Hz

a. Connect the equipment as shown in Fig. 5-6.

b. Make sure that the TSG-422 is set for 525/60 operation (J380 on the Output board is in 1-2 position).

c. Make sure that the 1410 is genlocked to the TSG-422.

d. **CHECK** — that the frequency of the 1410's subcarrier is 3.579545 MHz ± 1 Hz.

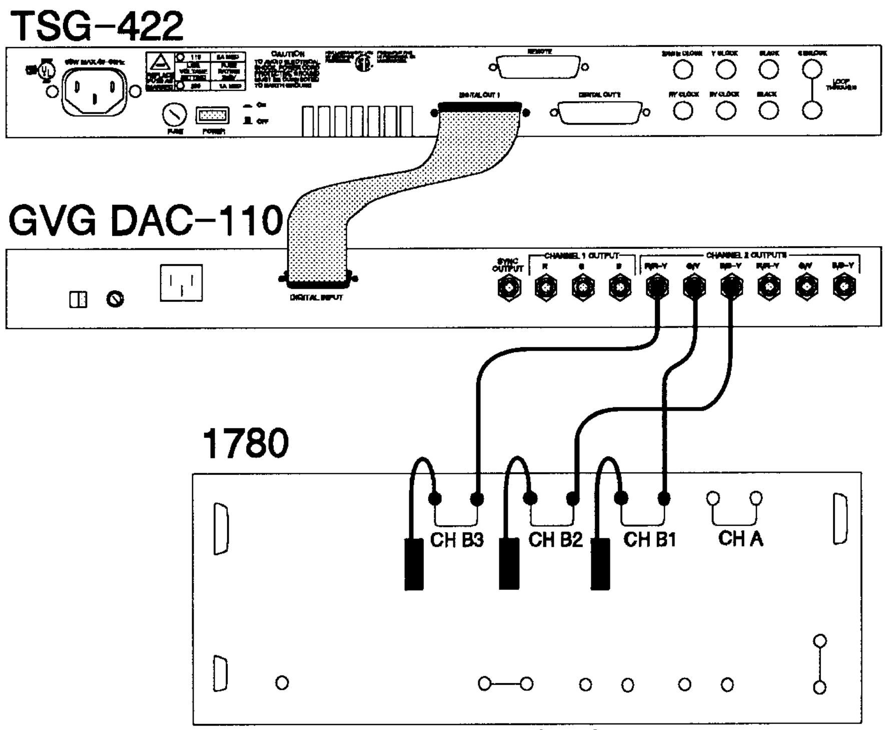


Fig. 5-7. Setup to check the signal outputs.

NTSC (525/60) TEST SIGNAL CHECKS

18. Check Availability of Test Signals

NOTE

The following procedure is only a qualitative NOT a quantitative test. The only specification under test is whether or not the test signals are available — not the quality of the test signal that the DAC-110 produces.

a. Connect the test equipment as shown in Fig. 5-7.

b. Make sure that the TSG-422 is set for 525/60 operation (J380 on the Output board is in 1-2 position).

c. Set the Grass Valley Group (GVG) DAC-110 front panel switches as follows:
MODE = SMPTE
TEST = OFF
DATA = 10 BITS (unless the TSG-422 under test is an 8-bit machine)
CH 2 FORMAT = Y/B-Y/R-Y

d. Assure that the internal switches are set for 4:2:2 operation with SMPTE output.

e. Put the waveform monitor in parade display mode, displaying CH B1, B2, and B3.

f. Cycle through all of the available front panel test signals.

g. **CHECK** — that all of the test signals listed in Table 5-1 are available from the TSG-422. Signal drawings are available in Section 3 and can be used as a reference to make this check.

Table 5-1. List of signals available in 525/60 mode.

SWITCH NAME	SIGNALS
COLOR BARS	100% Color Bars with Level Reference 75% Color Bars with Level Reference 100% Color Bars 75% Color Bars Reverse Bars Matrix
STAIRSTEP	5-Step
RAMP	Ramp Limit Ramp Valid Y Ramp Valid B-Y Ramp Valid R-Y Ramp
SHALLOW RAMP	Shallow Ramps (1-10) Shallow Ramp Matrix
PULSE & BAR	2T 4T 10T Pulse & Bar Field Square Wave 60 Hz Mod Pulse Component Mod Pulse
MULTIPULSE	Multipulse Multiburst
SWEEP	100% Line Sweep 60% Line Sweep Multiburst
TIMING SIGNALS	500 kHz Bowtie 2.5 MHz Bowtie Blanking Markers Co-siting Pulse
FLAT FIELD	Flat Field Field ID
OTHER SIGNALS	Convergence Light Blue Ramp Digital Gray Measurement Matrix
USER SIGNALS	Not implemented.
APL	100% APL 0% APL Bounce

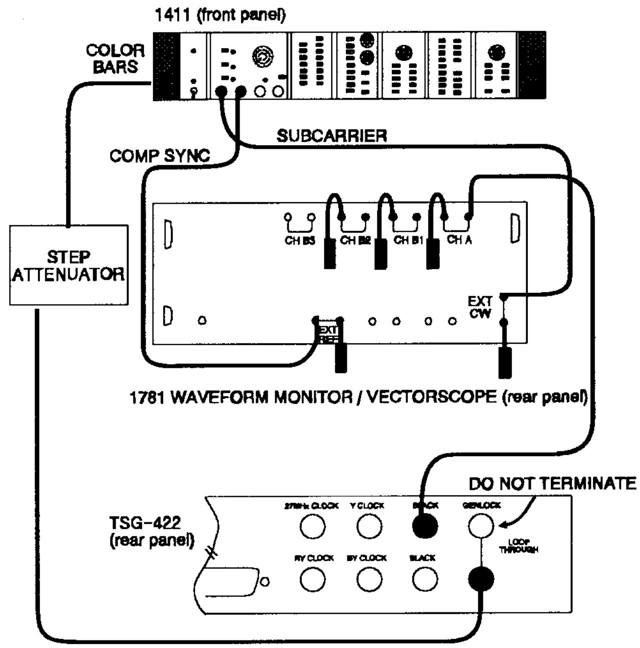


Fig. 5-8. Setup to check the 625/50 genlock.

PAL (625/50) GENLOCK

19. Sync Lock Jitter
≤ 2 ns (3.25°)

a. Connect the equipment as shown in Fig. 5-8.

b. Set the Step Attenuator to read 6 (equivalent to 0 dB).

c. Make sure that the TSG-422 is set for 625/50 operation (J380 on the Output board is in 2-3 position).

d. On the 1411 Color Bar module (TSG 11) remove burst from the Color Bars signal.

e. **CHECK** — with the vectorscope in vector mode for ≤ 3.25° of jitter.

20. Sync Lock Timing Change with Input Sync Amplitude Change +3 dB to -6 dB
<15 ns shift

a. Connect the equipment as shown in Fig. 5-8.

b. Make sure that the TSG-422 is set for 625/50 operation (J380 on the Output board is in 2-3 position).

c. On the 1411 Color Bar module (TSG 11) remove burst from the Color Bars signal.

NOTE

To get the step attenuator to provide the range needed for the following tests remove the signal termination from the waveform monitor, causing the signal to be increased by 6 dB above nominal levels. Setting the step attenuator to read 6, therefore results in a normal signal level. To attenuate the signal -6 dB, set the step attenuator to read 12. To attenuate the signal +6 dB, set the attenuator to read 0.

d. Set the step attenuator to read 3 (+3 dB).

e. **CHECK** — that the EXTERNAL REF light on the TSG-422 front panel is lit.

f. **CHECK** — using the vectorscope for <24° (15 ns) color shift on the vectorscope.

g. Set the step attenuator to read 12 (-6 dB).

h. **CHECK** — that the EXTERNAL REF light on the TSG-422 front panel is lit.

i. **CHECK** — using the vectorscope for <24° (15 ns) color shift on the vectorscope.

21. Horizontal Timing Range
At least 8 µs advance and delay

a. Connect the equipment as shown in Fig. 5-8.

b. Set the Step Attenuator to read 6 (equivalent to 0 dB).

c. Return the burst to the 1411 output.

d. Make sure that the TSG-422 is set for 625/50 operation (J380 on the Output board is in 2-3 position).

e. Use front panel controls to adjust the timing as far as possible.

f. **CHECK** — that the signal can be advanced and delayed by ± 8 µs.

22. Pull-in Range
Subcarrier ± 20 Hz

a. Connect the equipment as shown in Fig. 5-8.

b. Make sure that the TSG-422 is set for 625/50 operation (J380 on the Output board is in 2-3 position).

c. Adjust the burst frequency on the front panel of the 1411 ± 20 Hz.

d. **CHECK** — that the TSG-422 is genlocked to the 1411 (EXTERNAL REF LED on the front panel of the TSG-422 is lit).

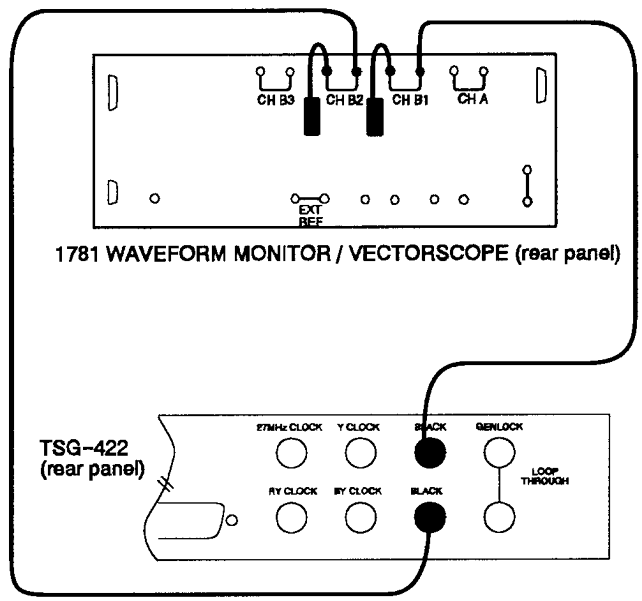


Fig. 5-9. Setup to check the Black Burst Outputs.

PAL (625/50) BLACK BURST OUTPUT

23. Blanking Level
0 mV ± 50 mV

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

b. Make sure that the TSG-422 is set for 625/50 operation (J380 on the Output board is in 2-3 position).

c. Display CH B1 on the waveform monitor.

d. Confirm that any DC-restorer feature of the monitor is off.

e. Toggle the display between DC coupled and ground reference.

f. **CHECK** — that the dc level is 0 mV ± 50 mV.

g. Repeat these steps for channel B2.

24. SCH Phase Accuracy
$0^{\circ} \pm 5^{\circ}$

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

b. Make sure that the TSG-422 is set for 625/50 operation (J380 on the Output board is in 2-3 position).

c. Display CH B1 on the waveform monitor.

d. Put the vectorscope in SCH mode.

e. Measure the SCH of the SMPTE Bars using the 1781's special SCH mode.

f. **CHECK** — that the SCH is $0^{\circ} \pm 5^{\circ}$

g. Repeat these steps for Channel B2.

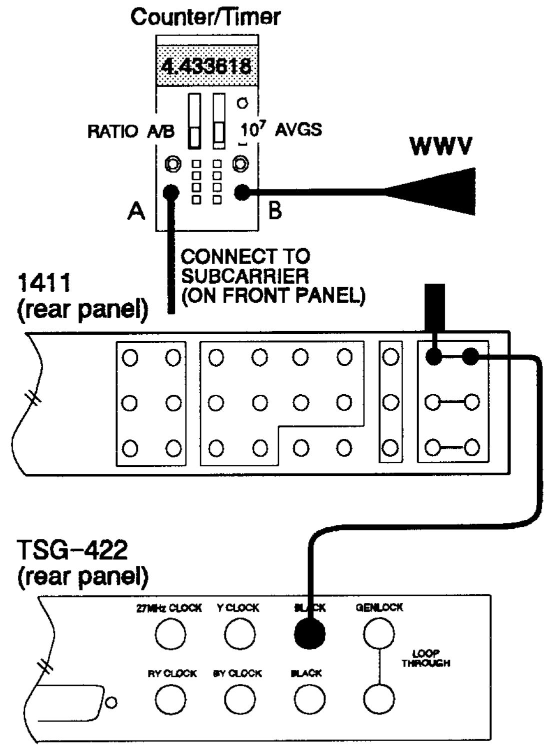


Fig. 5-10. Setup to check the 625/50 burst frequency.

25. Burst Frequency (625/50)
4.43361875 MHz ± 1 Hz

a. Connect the equipment as shown in Fig. 5-10.

b. Make sure that the TSG-422 is set for 625/50 operation (J380 on the Output board is in 2-3 position).

c. Assure that the 1411 is genlocked to the TSG-422.

d. **CHECK** — that the subcarrier signal from the 1411 is 4.43361875 MHz ± 1 Hz.

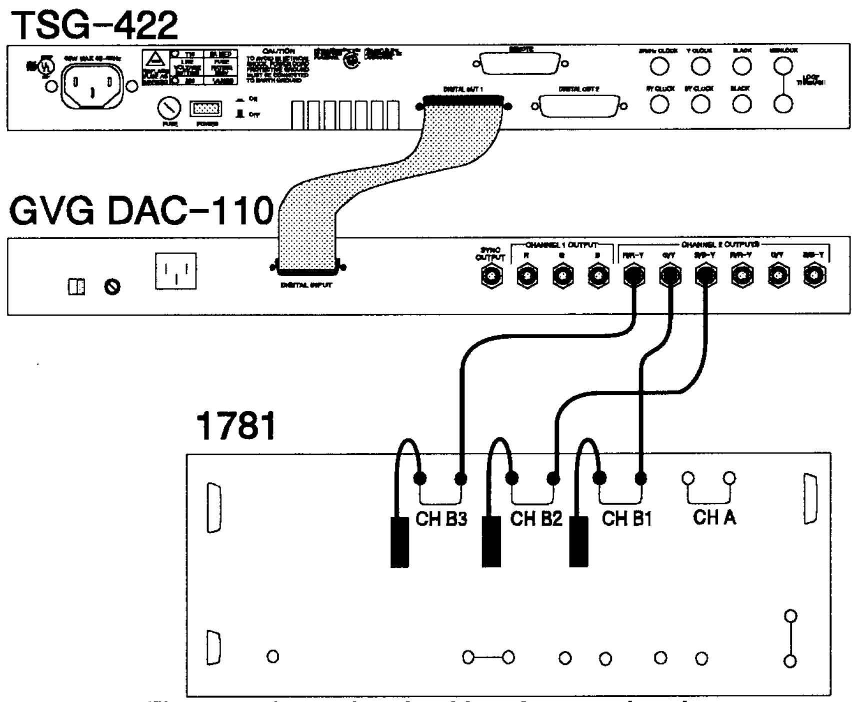


Fig. 5-11. Setup for checking the test signals.

PAL (625/50) TEST SIGNAL CHECKS

26. Check Availability of Test Signals

NOTE

The following procedure is a qualitative NOT a quantitative test. The only specification under test is whether or not the test signals are available — not the quality of the test signal that the DAC-110 produces.

a. Connect the test equipment as shown in Fig. 5-11.

b. Make sure that the TSG-422 is set for 625/50 operation (J380 on the Output board is in 2-3 position).

c. Set the Grass Valley Group (GVG) DAC-110 front panel switches as follows:
MODE = EBU
TEST = OFF
DATA = 10 BITS (unless the TSG-422 under test is an 8-bit machine)
CH 2 FORMAT = Y/B-Y/R-Y

d. Assure that the internal switches are set for 4:2:2 operation with EBU output.

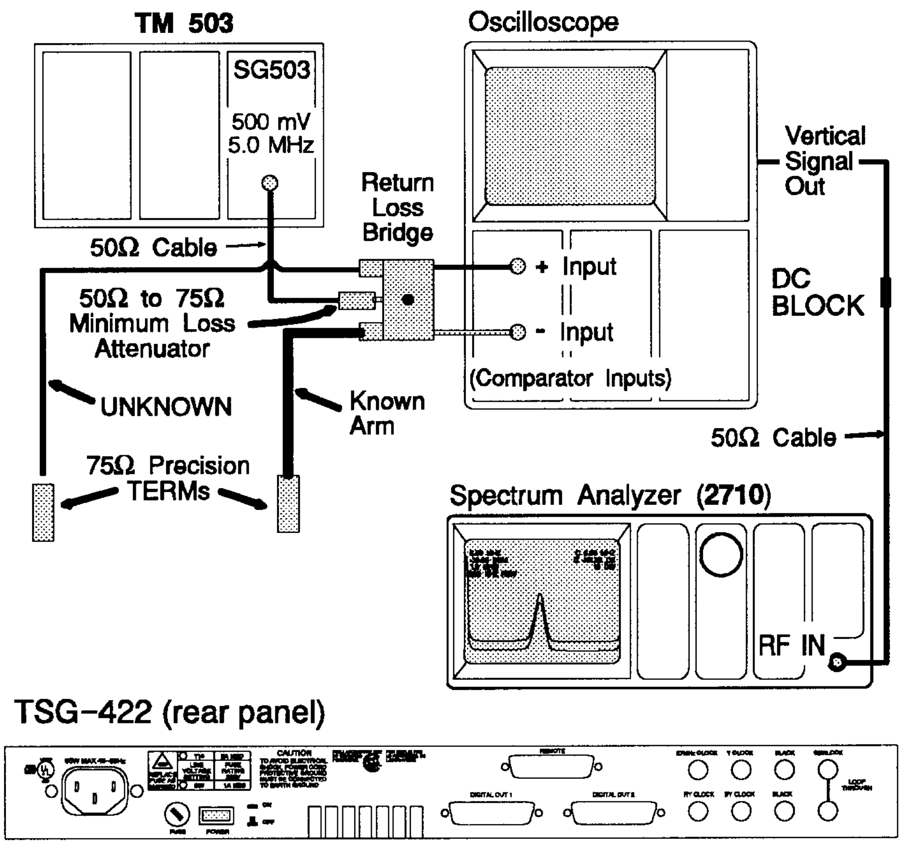
e. Put the waveform monitor in parade display mode, displaying CH B1, B2, and B3.

f. Cycle through all of the available front panel test signals.

g. **CHECK** — that all of the test signals listed in Table 5-2 are available from the TSG-422. Signal drawing are available in Section 3 and can be used as a reference to make this check.

Table 5-2. List of signals available in 625/50.

SWITCH NAME	SIGNALS
COLOR BARS	100% Color Bars with Level Reference 75% Color Bars with Level Reference 100% Color Bars 75% Color Bars Reverse Bars Matrix
STAIRSTEP	5-Step
RAMP	Ramp Limit Ramp Valid Y Ramp Valid B-Y Ramp Valid R-Y Ramp
SHALLOW RAMP	Shallow Ramps (1-10) Shallow Ramp Matrix
PULSE & BAR	2T 4T 10T Pulse & Bar Field Square Wave Component/50 Hz Mod Pulse
MULTIPULSE	Multipulse Multiburst
SWEEP	100% Line Sweep 60% Line Sweep Multiburst
TIMING SIGNALS	500 kHz Bowtie 2.5 MHz Bowtie Blanking Markers Co-siting Pulse
FLAT FIELD	Flat Field Field ID
OTHER SIGNALS	Convergence Light Blue Ramp Digital Gray Measurement Matrix
USER SIGNALS	Not implemented.
APL	100% APL 0% APL Bounce



OSCILLOSCOPE	
Vertical Mode	Left
Trig Source	Left
COMPARATOR (7A13)	
+ Input	DC
- Input	DC
Bandwidth	Full
Volt/Div	50 mV
SPECTRUM ANALYZER	
Freq Start	0 MHz
Freq Stop	10 MHz
Ref Level	-10 dB
Display Mode	10 dB/Div
Freq Span/Div	1 MHz
Resolution	300 kHz
Video Filter	ON
SINE WAVE GENERATOR	
Amplitude	500 mV
Frequency	5.5 MHz

Fig. 5-12. Setup to do the Return Loss Check.

RETURN LOSS

27. Return Loss Basic Setup

a. Connect the equipment as shown is Fig. 5-12.

b. Set the controls according to the following Table:

NOTE

If a 2710 is not available, a Tektronix 7L12 or 7L13 Spectrum Analyzer installed in a 7603 Oscilloscope mainframe can be used with the 7A13 to check return loss.

c. With both precision terminators connected, adjust the Return Loss Bridge to null the 5.5 MHz response displayed on the spectrum analyzer.

d. Remove the terminator from the UNKNOWN cable.

e. Place the peak of the displayed 5.5 MHz response at the top line of the graticule by choosing the "marker reference level" from the MKR/FREQ menu of the 2710.

NOTE

All return loss measurements will be measured in dB from this reference level.

28. Genlock Loop Through
40 dB or more to 5.5 MHz operating

a. Connect the precision terminator to one of the reference loop through inputs.

b. Connect the UNKNOWN cable to the other input.

c. **CHECK** — that the return loss is 40 dB (4 major divisions) as the SG503 frequency is varied between 5.5 MHz and 500 kHz.

29. Black Burst Output
≥ 36 dB to 5 MHz

a. Connect the UNKNOWN cable to the MONITOR input.

b. **CHECK** — that the return loss is 36 dB (3.6 major divisions) as the SG503 is varied from 5 MHz to 500 kHz.

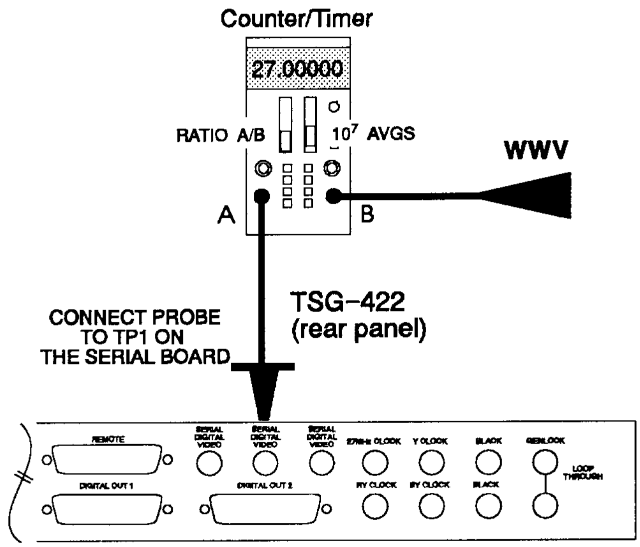


Fig. 5-13. Setup to check the Serial VCO.

OPTION -1S SERIAL DIGITAL CHECKS

30. Check VCO Frequency

a. Connect the equipment as shown in Fig. 5-13. Connect the probe to TP1 on the Serial board.

b. Make sure that S2-2 is in the OFF (OPEN) position.

c. Set the DC503 (Counter/Timer) AVGS to 10^7.

d. **CHECK** — that the frequency at TP1 is 27.0000 MHz ± 2 Hz.

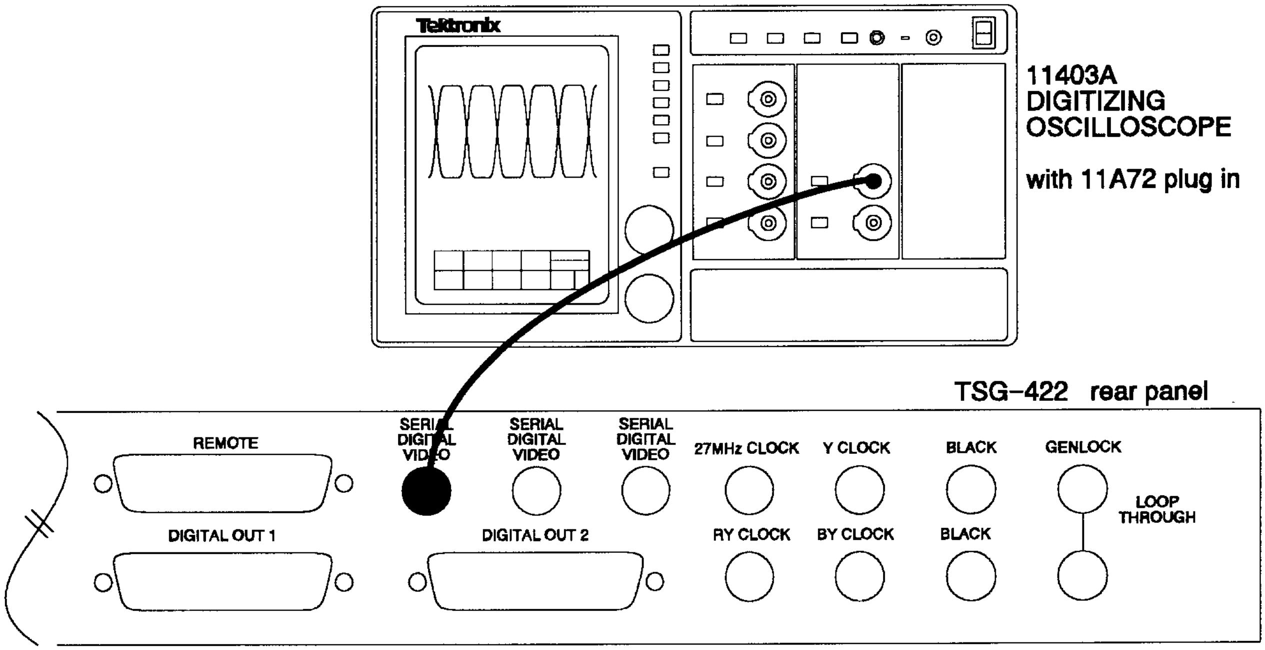


Fig. 5-14. Setup to check the Serial Digital Output Amplitude, Rise & Fall Times, Overshoot & Undershoot, and DC Level.

31. Check Serial Digital Output Amplitude

a. Connect the equipment as shown in Fig. 5-14.

b. Press the AUTOSET button on the oscilloscope to give a starting point for triggering and adjusting the signal.

c. In the ***WAVEFORM HORIZONTAL DESC*** menu, set the ***Display Type*** to: ***VARIABLE PERSISTENT***. This adjustment should result in the outline of the eye pattern displayed on the screen.

d. Set the oscilloscope to view the signal at 100 mV/Div and 2 ns/Div. Trigger from the main window, on the positive slope (+).

e. **CHECK** — using the oscilloscope cursors (horizontal bar) that the signal amplitude, not including undershoot or overshoot, is between 720 and 880 mV_{p-p}.

f. Repeat this procedure for the other two SERIAL TEST SIGNAL outputs.

32. Check SERIAL DIGITAL Output Rise and Fall Times

a. Connect the equipment as shown in Fig. 5-14.

b. In the ***WAVEFORM HORIZONTAL DESC*** menu, set the ***Display Type*** to: ***NORMAL***.

c. From the oscilloscope's ***MEASUREMENTS*** menu timing selections, select ***RISE*** and ***FALL***.

d. Set the ***RISE*** time menu as shown:

Tracking	Both
Proximal	20%
Distal	80%
Left Limit & Right Limit	Set to bracket the transition to be measured. Transition should change color between proximal and distal cursors.

e. From the oscilloscope's ***TRIGGER*** menu, set the slope to "+".

f. **CHECK** — that the rise time is between 0.75 and 1.50 ns.

g. Change the slope to "—", from the ***TRIGGER*** menu.

h. Select ***FALL*** from the ***MEASUREMENTS*** menu.

i. **CHECK** — that the fall time is between 0.75 and 1.50 ns.

j. Repeat this procedure for the other two SERIAL TEST SIGNAL outputs.

33. Check Serial Digital Output Overshoot and Undershoot

a. Connect the equipment as shown in Fig. 5-14.

b. Select ***OVERSHOOT*** and ***UNDERSHOOT*** from the ***MEASUREMENTS*** menu.

c. Select from the ***OVERSHOOT*** menu:

Left Limit	0%
Right Limit	100%
Tracking	Both
Time Mode	Relative

d. Set the ***TRIGGER SLOPE*** to "+".

e. **CHECK** — that the measured overshoot is less than 10%.

f. Set the ***TRIGGER SLOPE*** to "—".

g. Select ***UNDERSHOOT***.

h. **CHECK** — that the measured undershoot is less than 10%.

i. Repeat this procedure for the other two SERIAL TEST SIGNAL outputs.

34. Check Serial Digital Output DC Level

a. Connect the equipment as shown in Fig. 5-14.

b. Select ***MID*** from the ***MEASUREMENTS*** menu.

c. From the ***MID*** menu select:

Left Limit	0%
Right Limit	100%
Time Mode	Relative

d. **CHECK** — that the measured ***MID*** point is 0 V ± 0.5 V.

e. Repeat this procedure for the other two SERIAL TEST SIGNAL Outputs.

ADJUSTMENT PROCEDURE CHECKLIST

1. Power Supply + 5 V & -5 V
   R415

2. Oscillator Frequency
   C19

3. Black Burst Sync & Burst Amplitude (NTSC)
   R830 — Sync Amplitude
   C638 — Burst Amplitude

4. Black Burst Amplitude (PAL)
   L535, L630, and L635

5. Black Burst DC Level
   R638
   R830 (recheck)

6. SCH Phase
   L420 & L530

7. Shift Data Timing
   C575, C580, & C585

Option -1S Serial Digital Calibration

8. Adjust VCO Frequency
   R22

9. Adjust Serial Digital Video Output Amplitude
   R39

ADJUSTMENT PROCEDURES

NOTE

Before making any adjustments allow the TSG-422 a 20 minute warm-up time.

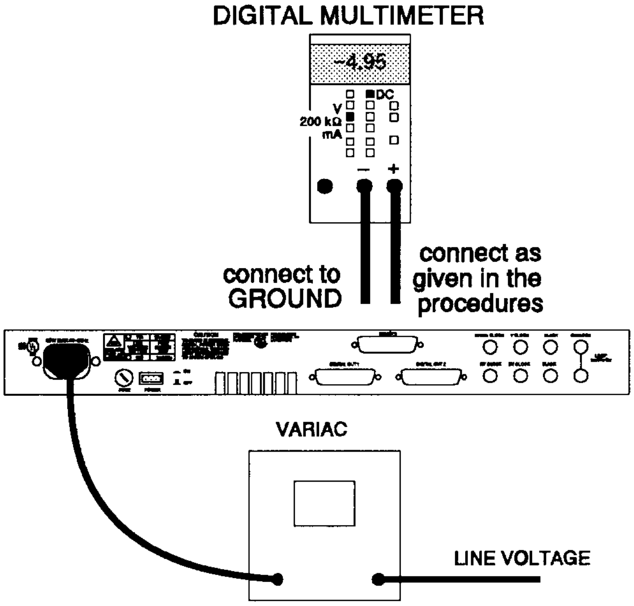


Fig. 5-15. Setup to adjust the power supply - R415.

1. Power Supply + 5 V & -5 V R415

a. Connect the equipment as shown in Fig. 5-15.

b. Turn on the Variac and the TSG-422.

c. Set the Variac for 90 V.

d. Connect the DM 501A to the -5 V test point on the Output board.

e. Adjust R415 (on the Power Supply board) for > -4.95 V.

NOTE

If the Serial Option board is installed the -5 V test point may need to be adjusted to -4.95 V so that the +5 V test point is ≤ +5.1 V.

f. Connect the DM501 to test point + 5 V on the Output board.

g. Adjust R415 so that the +5 V test point is <+5.1 V.

h. Alternate between the two test points until both requirements (> -4.95 V and < +5.1 V) are met.

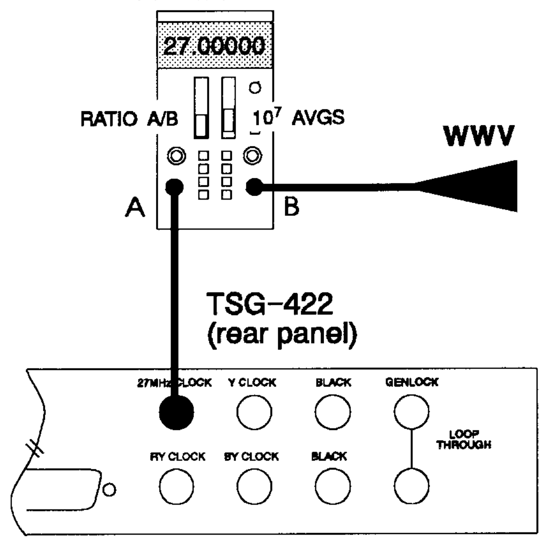


Fig. 5-16. Setup to adjust the oscillator

2. Oscillator Frequency C19

NOTE

The crystal may drift after adjustment. Leave the TSG-422 powered up for 20 minutes after adjustment, then recheck the frequency to assure that it stays within spec.

a. Connect the equipment as shown in Fig. 5-16.

b. Set the DC503A Counter/Timer to count a frequency referenced to channel B (ratio A/B).

c. Remove the round plastic cap from the top of the Crystal Oven board.

d. Fine-adjust the oscillator frequency to bring the oscillator output to 27.000000 MHz ± 1 Hz.

e. Reinstall the plastic cap.

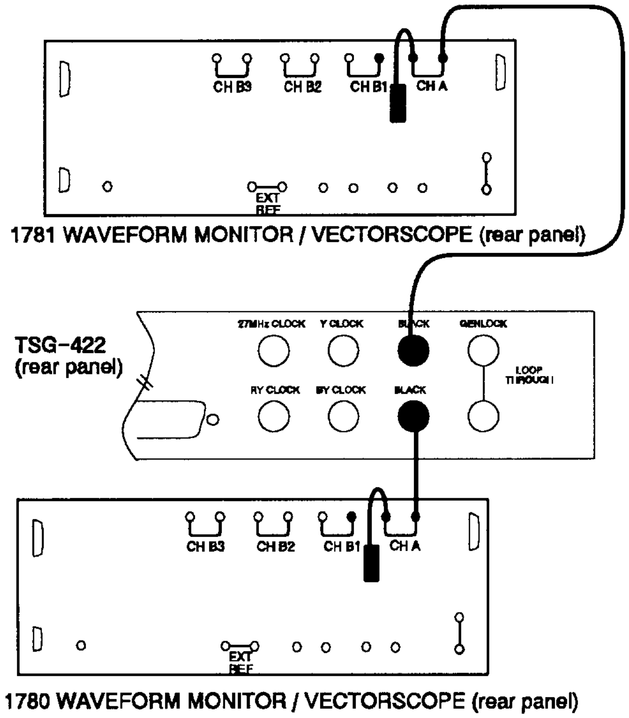


Fig. 5-17. Setup to adjust Black Burst Sync & Burst Amplitude (NTSC), Black Burst Amplitude (PAL), Black Burst DC Level, and SCH Phase.

3. **Black Burst Sync & Burst Amplitude (NTSC)**
   R830 — Sync Amplitude
   C638 — Burst Amplitude

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

   b. Move J380 to pins 1-2 (60 Hz).

   c. Put the **1780 (NTSC)** waveform monitor in WFM+CAL mode and set the CAL to fixed at 285.7 mV (40 IRE).

   d. Adjust R830 on the Output board for 285.7 mV of sync. Use the CAL signal as an aid.

   e. Adjust C638 for 285.7 mV of burst, using the CAL signal as an aid.

4. **Black Burst Amplitude (PAL)**
   L535, L630, and L635

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

   b. Move J380 to pins 2-3 (50 Hz).

   c. Put the **1781 (PAL)** waveform monitor in WFM+CAL mode and set the CAL for fixed 300 mV.

   d. Adjust L535, L630, and L635 for 300 ± 3 mV of burst amplitude.

5. **Black Burst DC Level**
   R638
   R830 (recheck)

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

   b. Set the coupling on the **1781 (PAL)** to GND.

   c. Adjust the display to a convenient reference graticule.

   d. Set the coupling back to DC.

   e. Adjust R638 for a blanking level of 0 V ± 25 mV.

   f. Readjust R830 and R638 until no further interaction is seen. (Assure that the sync amplitude and dc level remain within spec.)

6. **SCH Phase**
   L420 & L530

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

   b. Move J380 to pins 1-2 (60 Hz).

   c. Put the **1780 (NTSC)** vectorscope in SCH.

   d. Adjust L420 and L530 for $0 \pm 5^{\circ}$ SCH phase.

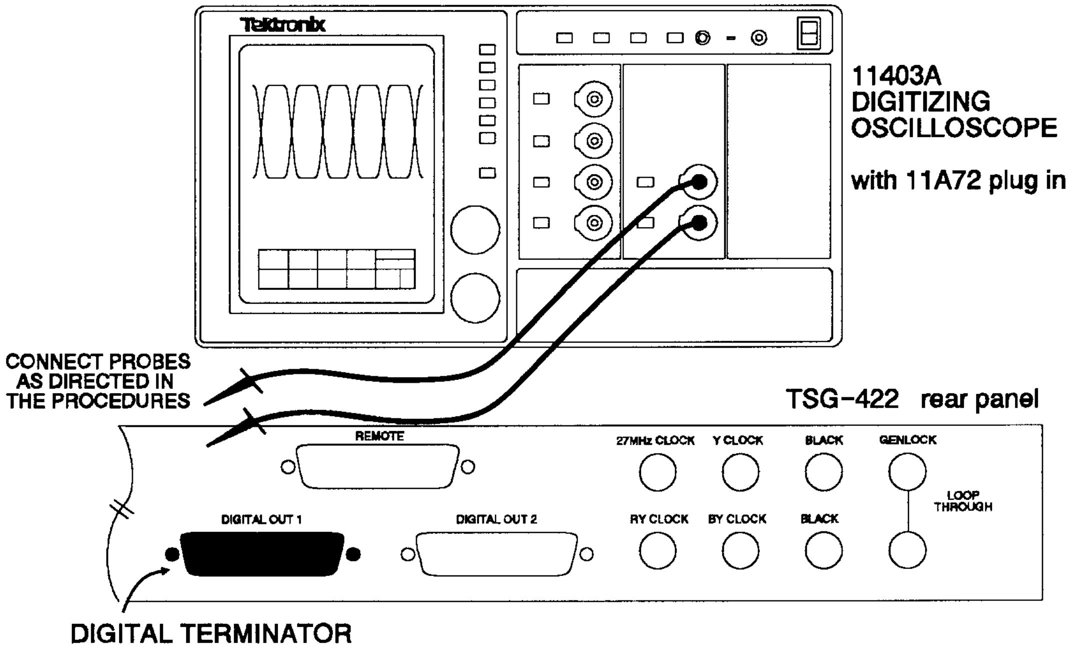


Fig. 5-18. Setup to adjust the Shift Data Timing.

7. **Shift Data Timing**
   C575, C580, & C585

   a. Set up the equipment as shown in Fig. 5-18.

   b. Select Sweep from the front panel of the TSG-422.

   c. Connect the digital output fixture to the DIGITAL OUT 1 on the TSG-422 rear panel.

   d. Connect a 10X probe from CH 1 of the 11A72 to the Clock/data output of the fixture.

   e. Connect a 10X probe from CH 2 of the 11A72 to the inverted Clock data output of the fixture (cables must be the same length as CH 1).

   f. Connect a 10X probe to the Y CLOCK bnc of the TSG-422 rear panel.

   g. Trigger the oscillscope on the Y Clock signal.

   h. Use the position control to center an "X" transition on the scope.

   i. Select Shift Data Timing on the TSG-422 front panel.

   j. Select -11 ns.

   k. Adjust C575 (Output board) so that the midpoint of the rising edge of the clock is 11 ns before the middle Vertical graticule line (reference previously established).

   l. Select +0 ns.

   m. Adjust C580 (Output board) so that the rising edge of the clock (CH 2) is right at the middle vertical graticule line.

   n. Select +11 ns.

   o. Adjust C585 (Output board) so that the rising edge of the clock (CH 2) 11 ns after the middle vertical graticule line.

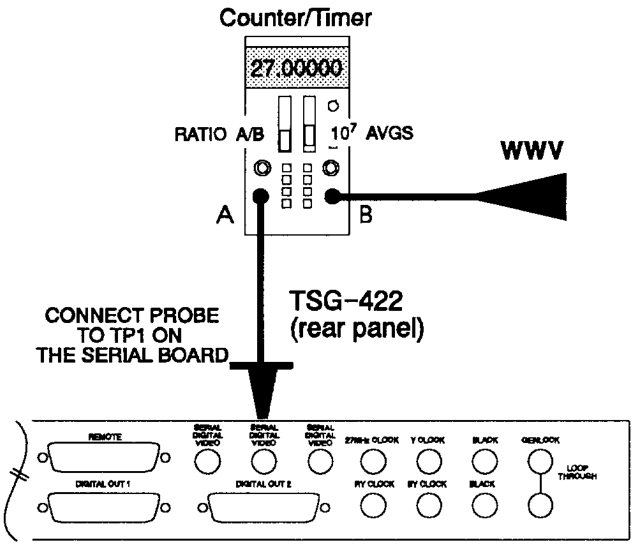


Fig. 5-19. Setup to calibrate Serial VCO (R22).

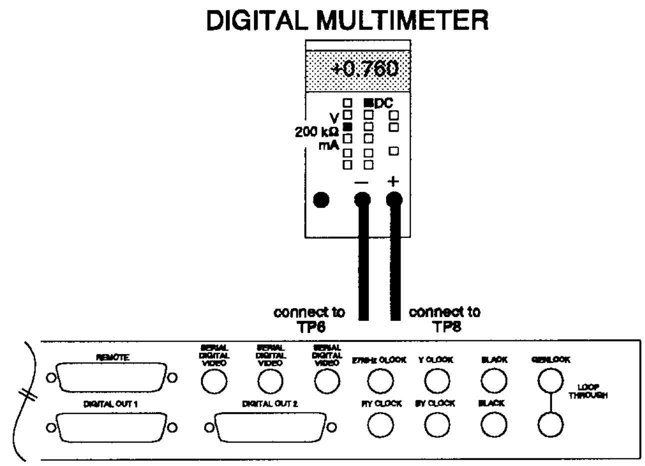


Fig. 5-20. Setup to calibrate the output levels (R39).

Option -1S Serial Digital Calibration

8. Adjust VCO Frequency R22

a. Connect the equipment as shown in Fig. 5-19, connecting the A probe to TP1.

b. Set the DC 503A (Counter/Timer) function selection to Ratio A/B and the AVGS to 10^2.

c. Set S2-2 on the Serial Output board to ON (CLOSED).

d. **ADJUST** — R22 on the Serial Output board for a frequency of approximately 17.73 MHz.

e. Set S2-2 to OFF (OPEN) and set the Counter/Timer's AVGS to 10^7.

f. **CHECK** — that the frequency at TP1 is 17.734475 MHz ± 2 Hz.

g. Repeat the above procedures until the frequency is within spec.

h. Return S2-2 on the Serial board to the OPEN position.

9. Adjust Serial Digital Video Output Amplitude R39

a. Connect the "—" probe from the digital multimeter to TP6 (-5 V) and the + probe to TP8 as shown in Fig. 5-20.

b. **ADJUST —** R39 for 760 mV between TP6 and TP8.

This ends the adjustment portion of the Calibration Procedure. Now do a complete Performance Check to verify all specifications.

Theory of Operation

SECTION 6
THEORY OF OPERATION

NOTE
The following conventions are used throughout this manual for signal names:

(1) (B_DITHER) is equivalent to B_DITHER — negation.

(2) [CLK_C] is an aside.

(3) [(B_DITHER)] is an aside of (B_DITHER).

OVERVIEW

The TSG-422 Theory of Operation is made up of two parts. First, the Block Diagram which describes the basic architecture of the TSG-422 via function blocks. The Circuit Descriptions are second. These describe the schematic diagrams that make up the function blocks.

BLOCK DIAGRAM

This section divides the TSG-422 into seven functions: Input Processing, Genlock Loop, Signal Timing, Signal Generation, Output Processing, Black Burst and Power Supply. Refer to Fig. 6-1 or the more detailed block diagram in Section 9 when reading the description of these functions.

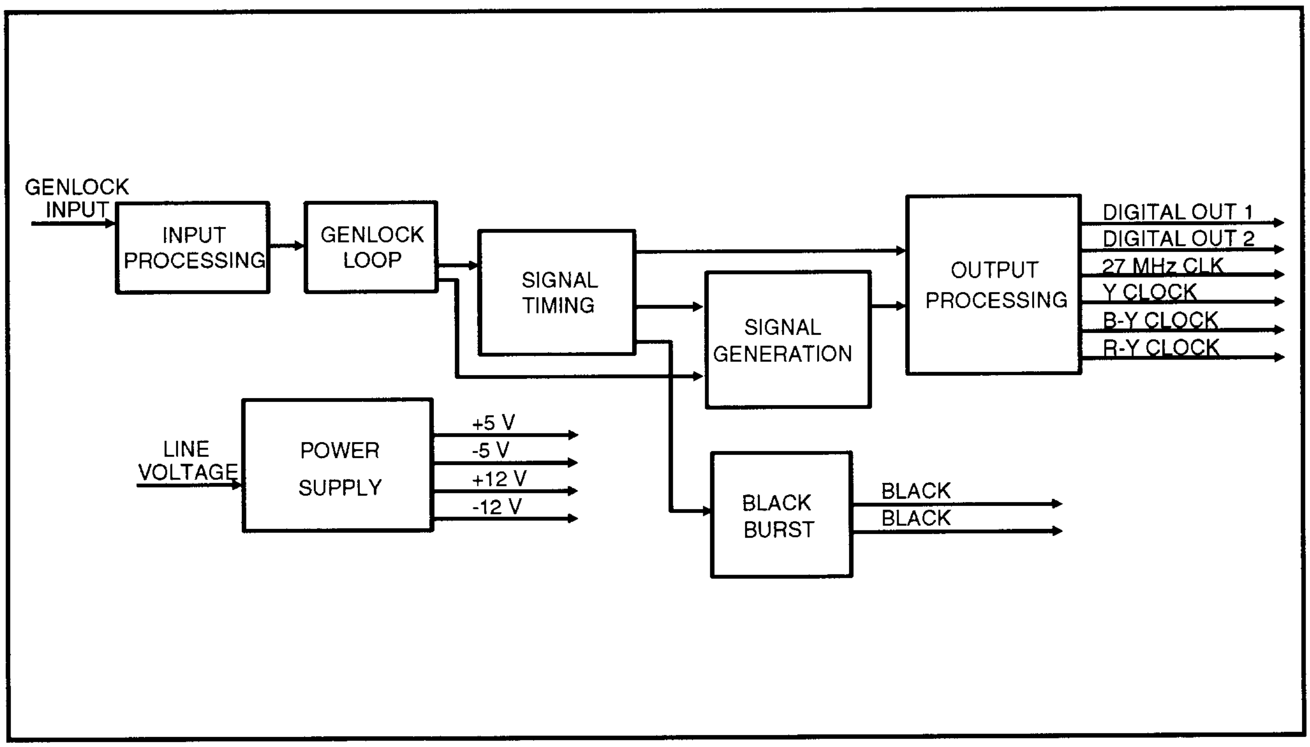


Fig. 6-1. Basic block diagram of the TSG-422.

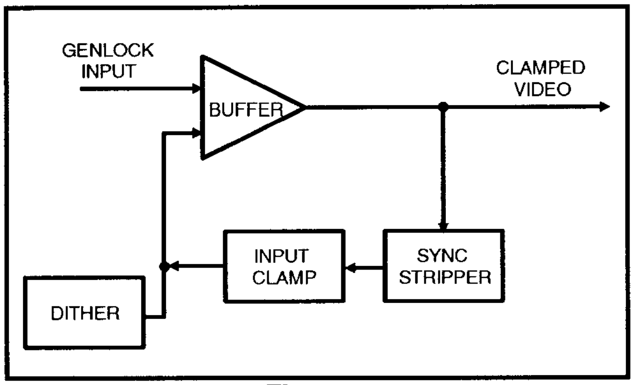


Fig. 6-2.
Block diagram of the Input Processing circuit.

INPUT PROCESSING
(See Fig. 6-2)

To prepare the GENLOCK reference input for ADC sampling, the Input Processing circuit inverts it, clamps the 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 Memory Controller (in the Genlock Loop). Both of these circuits use the composite sync 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
(See Fig. 6-3)

The Genlock Loop locks the TSG-422 outputs to the Genlock Input signal. It does this by generating signals [clocks and FLD_REF] which control the timing of the Signal Generation circuits. 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.

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. Using this data, the µP calculates sync timing and burst phase, so the Genlock Loop 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 the 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: (1) First, the µP switches the Line Counter to internal timing, and synchronizes the Line Counter timing with incoming sync timing as calculated from the

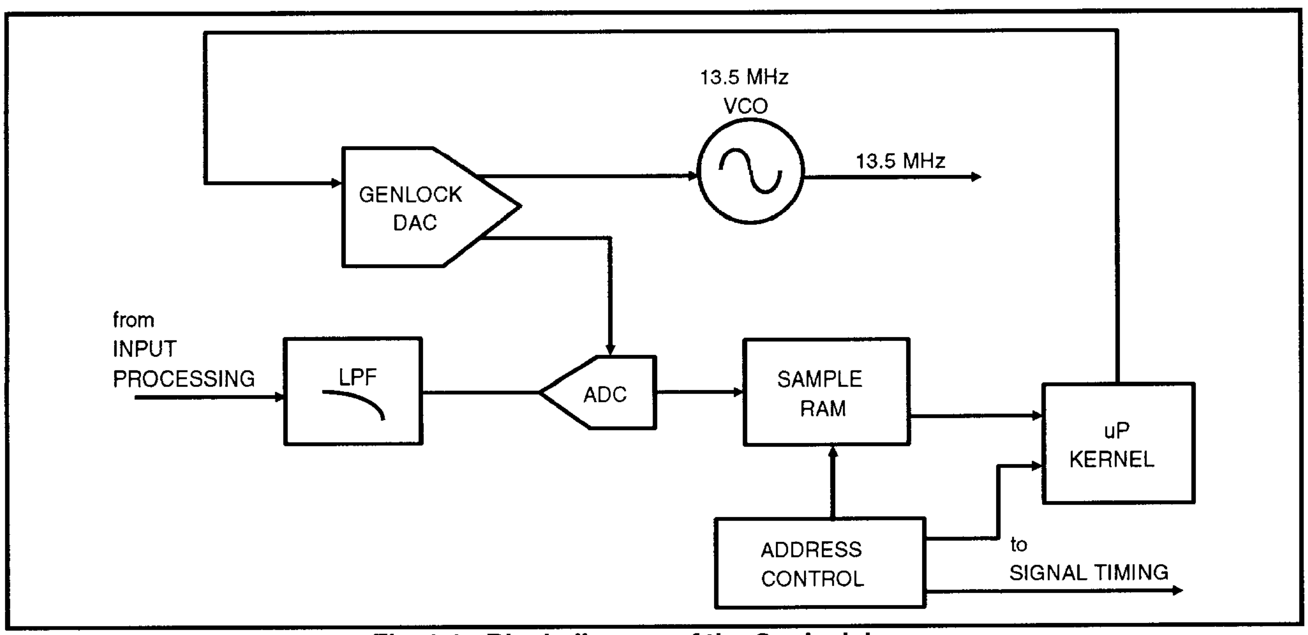


Fig. 6-3. Block diagram of the Genlock Loop.

window data. (Since internal timing has less jitter than incoming sync, it provides a more accurate reference.) (2) 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. Four cycles of burst on a line of video are sampled and averaged together.

Because the ADC is clocked by the VCO, samples of incoming burst indicate VCO phase relation to the incoming burst phase. The µP extracts the burst-to-VCO phase information during the next four video lines and uses it to generate a VCO correction word on the fifth. The Genlock DAC converts the correction word to a voltage. This voltage is integrated and used to keep the VCO and its CLK1 output phase-locked to incoming burst by shifting the VCO frequency.

Because the Genlock Clock is line-locked and the PAL burst frequency is offset from the line-locked frequency by 25 Hz, the burst-to-VCO phase varies throughout the video field. As the phase calculations are done, a phase offset value is read from a line offset look-up table.

The phase calculations executed by the µP include an arctangent trigonometric function. To improve the execution speed, the arctangent calculation is replaced with a table look-up from the Arctangent PROM. Once the VCO is burst locked, the µP calculates the timing for line 10 of field 1 and indicates it with a pulse to the Address Decoder. The Address Decoder gates this pulse with the 50% point of sync to generate the FLD_REF signal.

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

Fine Genlock Timing

Adjustment of the 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.

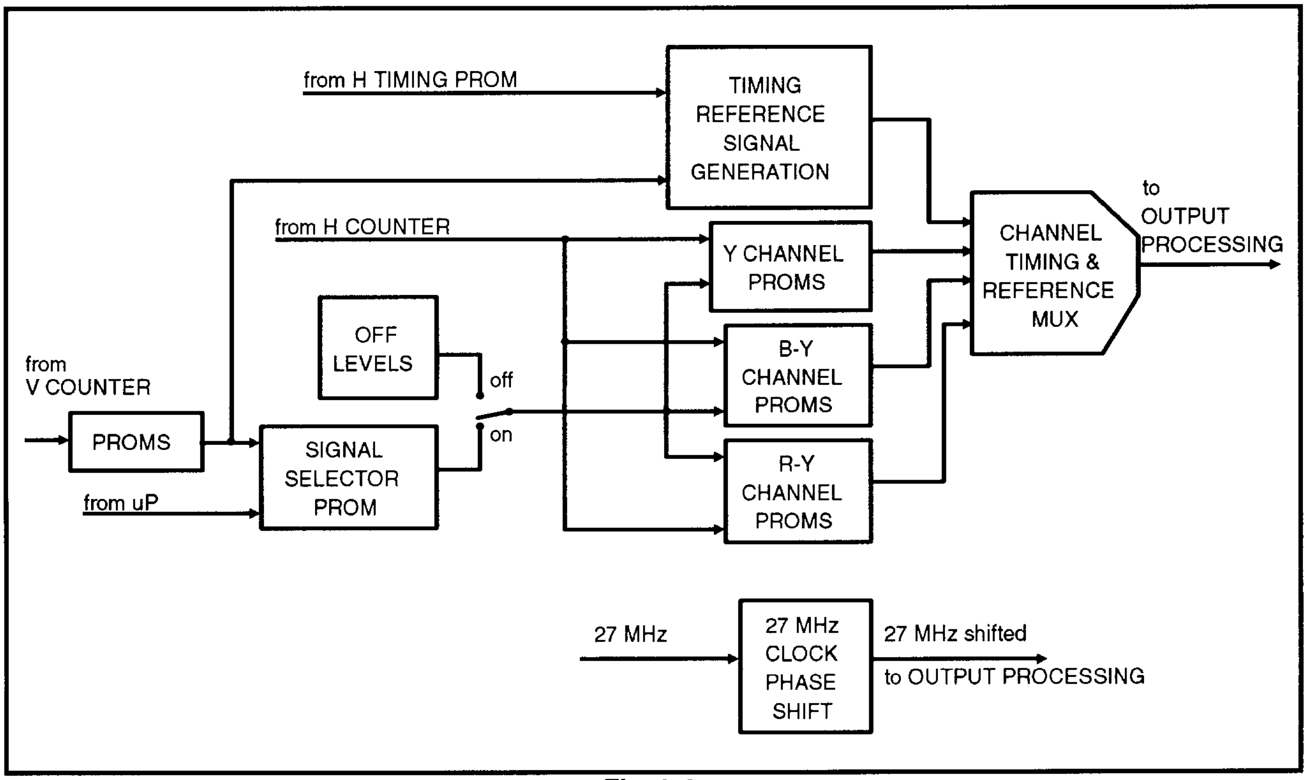


Fig. 6-4.
Block diagram of the Signal Generation circuit.

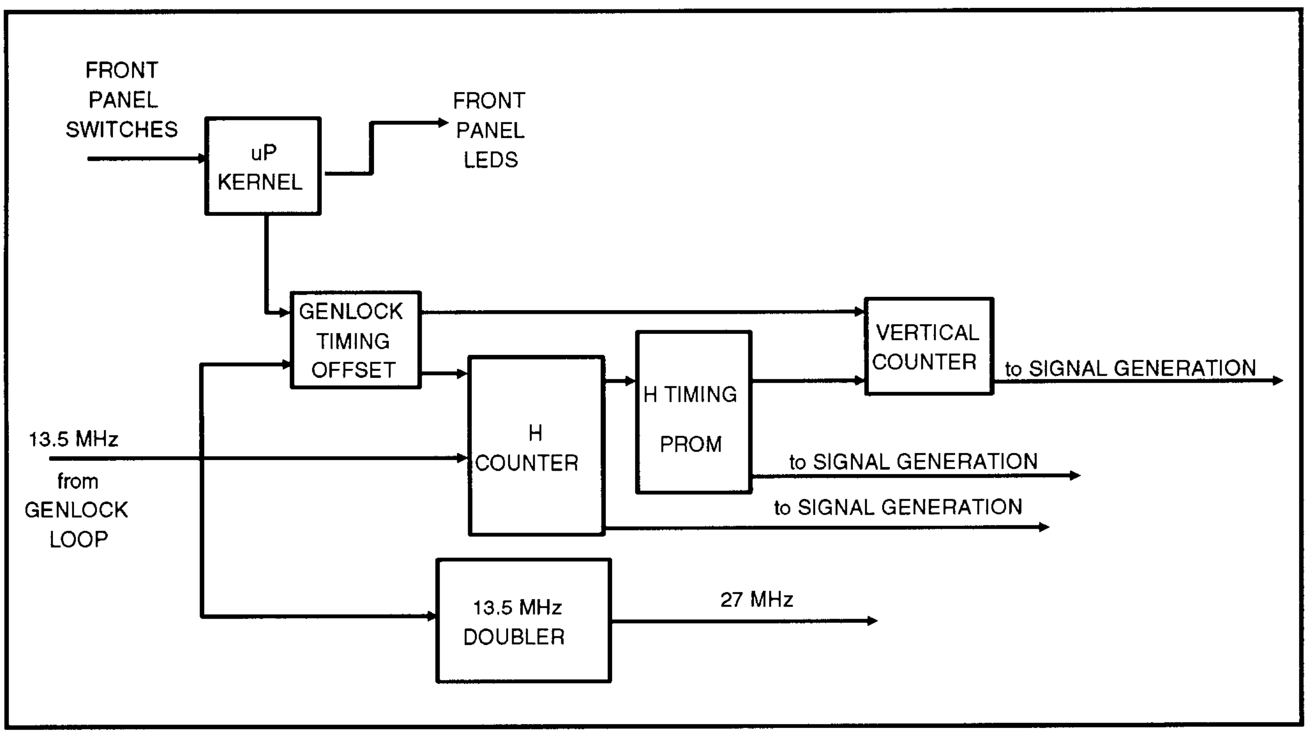


Fig. 6-5. Block diagram of the Signal Timing.

SIGNAL TIMING & GENERATION (See Figs. 6-4 & 6-5)

The Signal Generation section puts out two sets of signals: clocks and the line-locked and multiplexed test signal data. All the signals are locked to the Genlock Input signal. The circuits that generate these signals are described below.

The main job of the Test Signal Generation circuitry is to produce the front-panel-selectable test signals. It does this by using genlocked timing signals plus delay information from the µP to drive its signal selection and timing circuits. These circuits control the Test Signal PROMs, which contain the test signals. The circuit blocks which generate the timing and signal selection are: the Genlock Timing Offset, the H Counter, the Vertical Counter, the H Timing PROM, and the 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 Vertical 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 sent on to the Signal Interpolation circuitry.

The Signal Generation circuitry produces the test signal in multiplexed 4:2:2 format and the correctly timed 27 MHz clock which all of the other clocks are derived from. The V Counter and µP control the Signal Selector PROM and can also turn on or off selected channels to allow for crosstalk checking. The Channel PROMs send their signals to the MUX which interleaves the signal into the 4:2:2 format but still at TTL levels. The 27 MHz clock is phase shifted (± 11 ns) then this signal is used to derive the output clocks.

OUTPUT PROCESSING
(See Fig. 6-6)

Digital Component Output Buffers

The test signal output from the Signal Generation circuitry is buffered and converted to ECL levels in the Digital Component Output Buffers.

Black Generation

Black is separately derived from the test signal data, sent through a DAC, then low-pass filtered to remove out-of-band components. The Output Amplifier provides the signal with the correct power and amplitude levels. It also boosts the high end of the signal frequency spectrum to compensate for sin(x)/x roll-off.

Auxiliary Clock Generation

The Auxiliary Clock Generation circuit take the 27 MHz clock, 13.5 MHz clock, and the H Counter signals and derives the output clocks for the TSG-422.

POWER SUPPLY

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

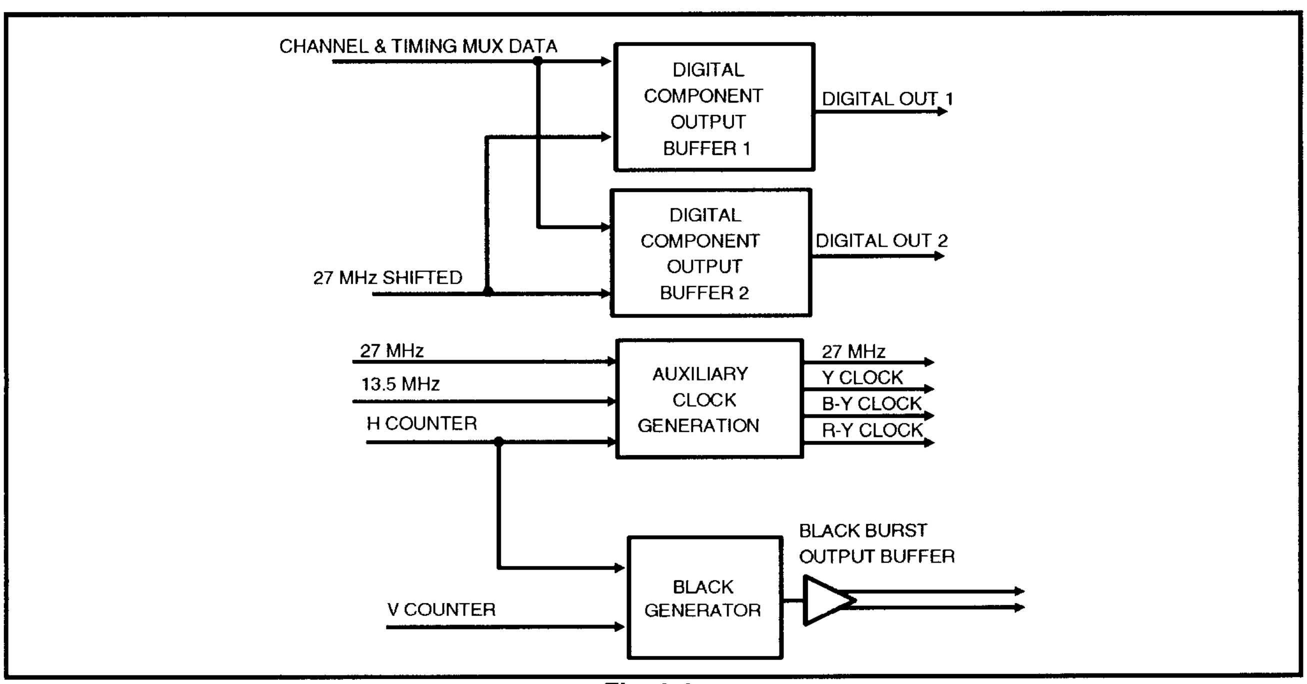


Fig. 6-6.
Block diagram of the Output Processing circuit.

CIRCUIT DESCRIPTIONS

FRONT PANEL 1 (See Fig. 6-7)

The seven main functions of the Front Panel I/O circuitry are (1) to transfer front-panel 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 channel on/off data to the µP, (5) to transfer clock timing offsets to the µP, (6) to transfer genlock timing offset data from the front panel to the µP, and (7) to transfer operating status and diagnostic data from the µP to the front-panel LEDs. Each of these is described below.

FRONT-PANEL SWITCHES & SWITCH DECODER

Decoder U205 converts the front-panel data selected by the 16 switches into a 4-bit word and applies it to buffer U209. During the vertical interval, the µP checks the front panel by asserting (RD_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 (U205, pin 13) pulls this line high for about 20 ms whenever a new front-panel selection is made.

Jumpers J205, J209, J309, J311, and J312 are shipped in the 1-2 position. These positions select the normal front-panel operation and other TSG-422 operation. In the 2-3 position, jumper J309 disables the selection of operating modes from the front panel. In the 2-3 position, jumper J205 enables the programming of remote controlled test signal selection. In the 2-3 position, J209 selects 8 bit operation rather than the standard 10 bits. J311 in the 2-3 position disables the front panel time-out function, allowing the TSG-422 to remain in mode other than SELECT TEST SIGNAL for extended periods of time. J312 is used to calibrate the shift oscillator.

DIAGNOSTIC SWITCHES

The user selects the diagnostic routines through the Diagnostic Switches (S412). Immediately after the µP is reset, it checks the diagnostic switch buffer (U416) by asserting the (RD_DIAG_PORT) line, and performs the selected diagnostic routine(s). When all switches are open, the instrument is in normal operation. 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 has priority. That is, during the vertical interval, the µP first checks the remote control buffers (U846 and U849) and then the front-panel buffer (U208). But if a new selection since the previous vertical interval has been made at the remote control, the µP executes the new selection and does not check for the front-panel input.

FRONT-PANEL LED DRIVERS AND LEDS

The front-panel LEDs are all controlled by the µP through the four latches (U302, U121, U212, and U215). The µP enables these latches with the (LD_LED[0..3]) signals. U215 also puts out two additional signals: (INT)/GEN and (HOLD)/ACQUIRE. When the (INT)/GEN line is high, the instrument is

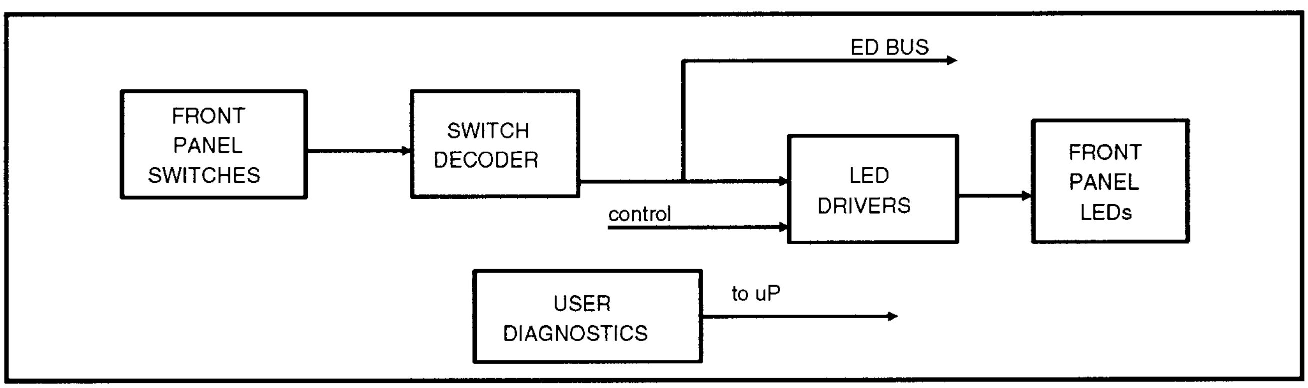


Fig. 6-7.
Block diagram of the Front Panel Interface.

forced to use the internal reference; when the line is low, the instrument will genlock to the reference input (if it is available). (HOLD)/ACQUIRE controls the loop response of the Genlock Loop.

MICROPROCESSOR (μP) KERNEL 2 (See Fig. 6-8)

This section briefly describes the functions of the μP Kernel and its components. For a description of the diagnostics executed by the μP, refer to the Maintenance section of this manual.

The μP Kernel has four main functions: (1) to acquire and maintain genlock with the incoming reference signal, (2) to service the front panel and remote control, (3) to control the test signal timing, and (4) to execute diagnostics. The components of the Kernel are described as follows.

MICROPROCESSOR

The Microprocessor (μP) (U875) is the heart of the Kernel. Receiving its program instructions from the EPROM (U881), the μP controls the Kernel through address lines A[0..15], data lines D[0..7], and various other control lines.

The clock that drives the μP is derived from the 27 MHz clock. PAL U870 divides this clock by 5 to obtain a 5.4 MHz clock, named μP_CLK, for the μP and the CTCs. U683B, U683C, and the associated parts shape the clock signal and apply it to the μP.

When the instrument is being powered up, the (RESET) pulse from U676 goes low, resetting the μP Kernel. The μP can be manually reset by momentarily moving jumper J676 to the 2-3 position.

During normal operation, the CTCs (U691 and U696) monitor the μP. If the μP is not sending correct data and addresses to the CTCs, the CTCs put out (SOFT_RESET) to interrupt and re-initialize the μP. The CTC's (SOFT_RESET) pulse can be prevented from interrupting the μP by moving jumper J658 to the 2-3 position.

U676 also contains a timer circuit. During normal operation, the μP keeps this timer reset by asserting (AWAKE) repeatedly. If, for some reason, the μP fails to reset the timer, U676 resets the μP. Moving jumper J676 to the 2-3 position forces (RESET) low and moving J676 to the 2-4 position disables μP resets for troubleshooting purposes.

KERNEL MEMORY

EPROM (U881) contains the instructions that control the μP. The EPROM occupies the μP's address space between 0000 and 7FFF (hex).

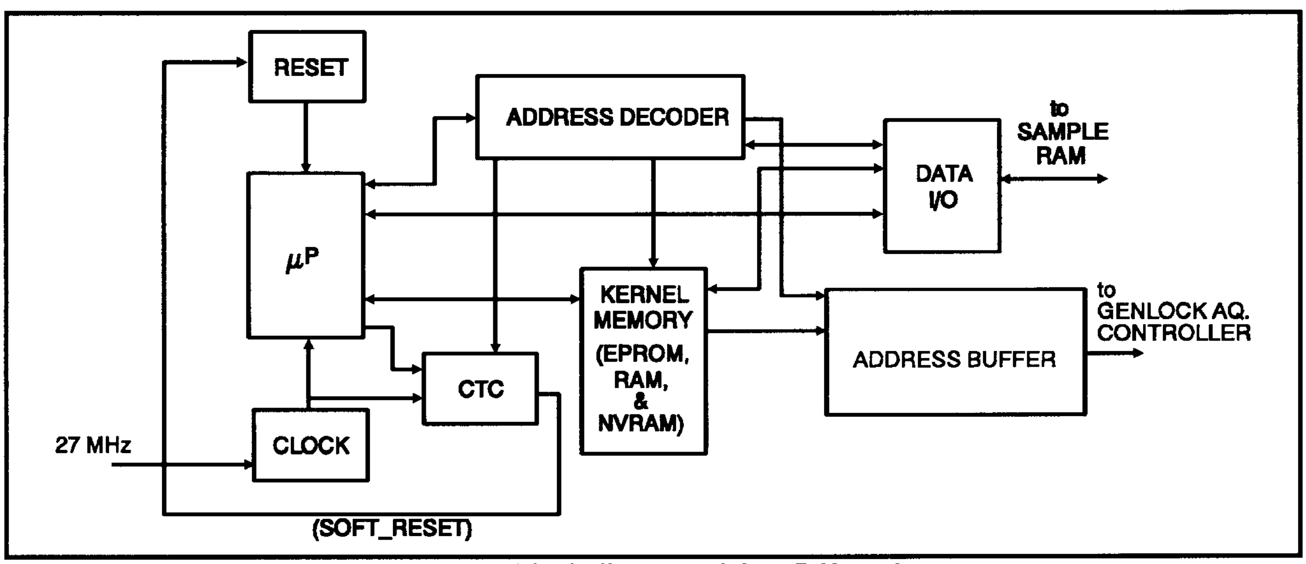


Fig. 6-8. Block diagram of the μP Kernel.

RAM (U887) stores temporary data and program variables for the µP. The RAM occupies addresses A000-A7FF (hex).

NVRAM (U896) is a combined non-volatile memory and a static RAM. The NVRAM contains genlock timing presets, character ID presets, and remote control signal selection data. The NVRAM occupies addresses E000-E07F.

Immediately following a µP reset, the µP loads the front-panel data from the non-volatile portion of the NVRAM into the RAM portion. Then, from the RAM portion, it loads the timing offset into the H and V Timing circuits ⑥.

If a new timing offset is selected at the front panel, the µP loads the new data into the RAM portion of the NVRAM during the vertical interval. When the MODE SELECT switch is cycled back to the SELECT TEST SIGNAL position or the mode times out, the new data is stored in the non-volatile part of the NVRAM.

The NVRAM is controlled by the µP via the NVRAM Controller PAL (U687). The Controller PAL decodes the µP address and control lines to generate read, write, and chip select pulses for the NVRAM. Consisting of Q991, U683D, and the associated parts, the NVRAM Save Control prevents the NVRAM from saving data during power-up and power-down. During power-up, (RESET) forces the output of U683D high to keep the (NV_SAVE) line high (inactive). During power-down, Q991 and its associated components keep the (NV_SAVE) line high until the NV_PWR power supply has dropped below 3 V.

CTCS

CTC0 and CTC1 (U691 and U696, respectively) are 4-channel programmable counter/timer chips configured as programmable event counters. Their job is to count pulse signals generated by the Genlock circuit 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 this count. In this manner, the µP can determine the sequence in which the genlock signals are occurring.

The CTC input signals are synchronized with the system clock. The clock latches the Genlock Loop pulses ⑨, and CLK_2.7 latches the (GEN_CSYNC) in U518B. The CTCs are daisy-chained (with their IEI and IEO lines) so that CTC0 has interrupt priority. This means that interrupts caused by channels 0 through 3 of CTC0 have higher priority than those caused by channels 0 through 3 of CTC1. When CTC0 interrupts, its IEO line goes low, disabling CTC1 interrupts. When CTC0 is not interrupting, its IEI line is high, enabling CTC1 to interrupt the µP.

ADDRESS DECODERS

PAL U679 decodes the µP address and control lines to generate chip select signals for: the Kernel Memories, the Sample RAM, CTCs, the I/O Decoder, the Character ID Memory, and the External Data Bus Buffer.

The I/O Decoder (U220) decodes the µP I/O port addresses 0-15 to enable Front-Panel, Remote Control, & Diagnostic Switch Input Buffers ①; Front-Panel LED & Timing Offset Latch Outputs ①; the Genlock Line Counter ③; the Sync Timing & VCO Control DACs ④; and the Signal Select Latch ⑥.

ADDRESS BUFFERS

When reading from or writing to the Sample RAM, the µP uses the Sample RAM Address Buffer (U507) [enabled by (SAMPL_RAM_EN)] as a port.

DATA I/O BUFFERS

The External Data Bus transceiver (U514) isolates the Kernel while allowing two-way communication with external devices.

The Sample RAM Data transceiver (U511) sends data to and receives data from the Sample RAM (U612, ③). Normally, U511 receives data samples on every video line.

GENLOCK DATA ACQUISITION CONTROLLER 3

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. See Fig. 6-9 for a block diagram of the circuit. For a general description of the Genlock Loop, refer to the Genlock Loop section in the Block Diagram description.

INPUT FILTER

Made up of C906, C907, C909, and L904, this filter attenuates spectral components above the video band to prevent aliasing of the Genlock Input signal when it is quantized by the ADC.

DATA ACQUISITION

Analog-To-Digital Converter (ADC)

The ADC (U815) converts the clamped and inverted video signal from the Analog board into 6-bit data. Dither is inserted into the signal on the Output board to increase the resolution. U912 provides a regulated +2.5 V reference that U805 inverts and scales down to provide a precise -1 V reference to the ADC.

Because the ADC is clocked by the VCO with CLK_C, 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.

The data from the ADC is latched in U712 and sent to the Sample RAM.

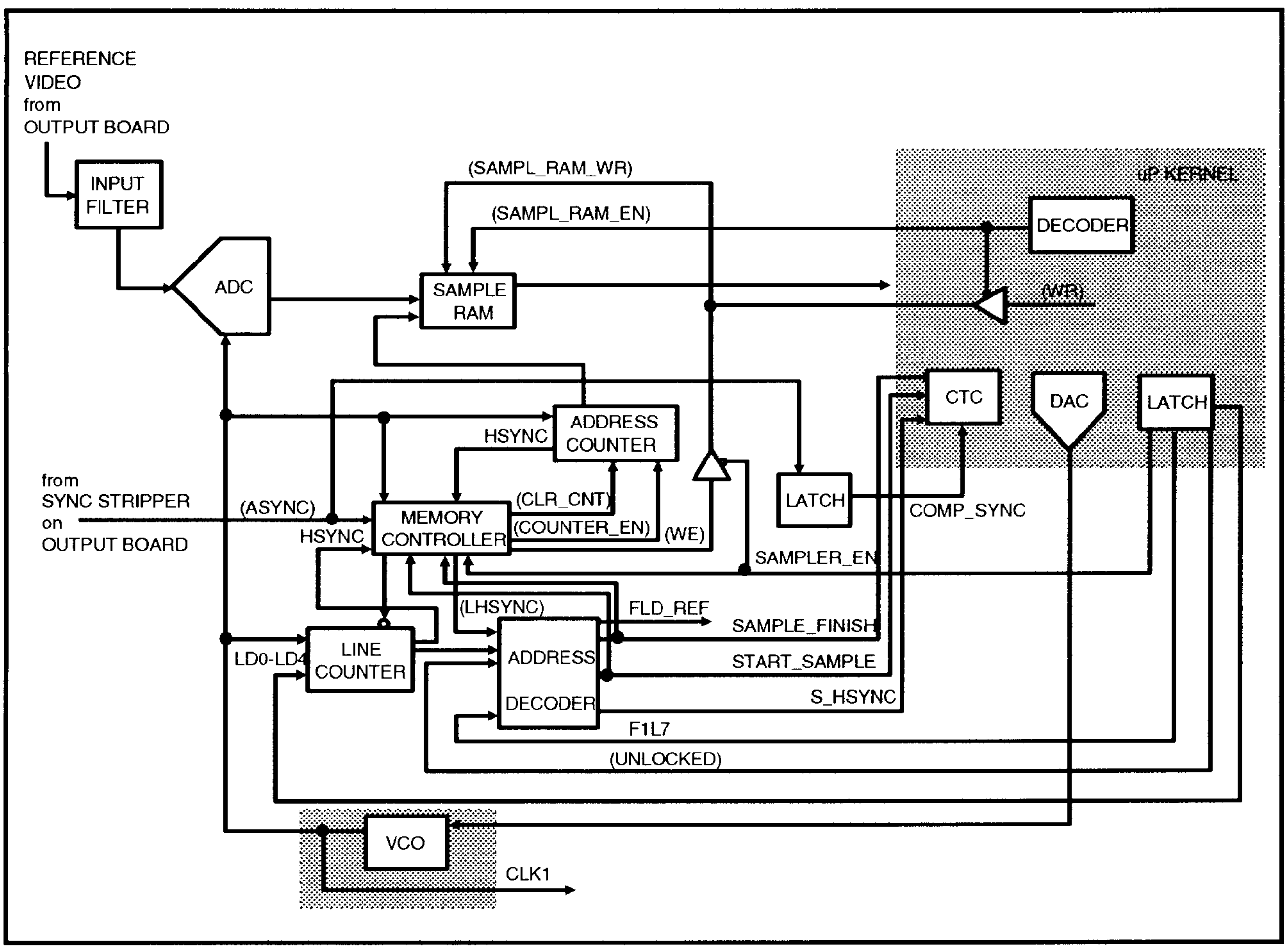


Fig. 6-9. Block diagram of Genlock Data Acquisition.

Sample RAM

The main function of the Sample RAM (U612) is to store samples, in real time, of the Genlock Input sync and burst. Each acquisition stores 256 samples of sync and burst. The µP uses these samples to obtain and maintain lock with the Genlock Input. The Sample RAM occupies addresses C000-C0FF (hex). Both the µP (U875, ◈2) and Memory Controller (U709) control the Sample RAM (U612), 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 to gain control. The µP then asserts (SAMPL_RAM_EN) to read the RAM and also asserts (WR) to write to the RAM.

When the µP is not looking at sync and burst samples, it pulls SAMPLER_EN low to give control of the Sample RAM to the Memory Controller. Storage of sync and burst data in the Sample RAM is described under Memory Controller in this section.

ADDRESS CONTROL

Five circuits make up the Address Control section: the Line Counter (U602, U702, and U802), the Line Counter Offset Latch (U504), the Address Decoder (U705), the Memory Controller (U709), and the Address Counter (U605 and U609). The combined function of these circuits is to provide timing to the Sample RAM such that the RAM's 28^{th} sample (out of 256 samples) is coincident with the 50% point of horizontal sync (SCH phase is 0^{o}).

Line Counter and Address Decoder

By counting 1135 cycles of CLK_E on every line, the Line Counter provides the Address decoder with unique addresses for each sample on the line. The Address Decoder generates timing pulses from these addresses. On the 1135^{th} count, the HSYNC pulse is generated. Twenty-eight counts before HSYNC, the START_SAMPLE pulse is generated.

To provide correct timing, the Line Counter should be accurately locked to incoming sync. When the instrument is powered up, or when the µP has lost the position of sync, the µP asserts (UNLOCKED). In this condition, the Address Decoder generates the (LOAD) pulse, deriving it from (GEN_CSYNC), since this is the most accurate timing available. This pulse loads the Line Counter with a nominal starting count of B92 (hex). 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) high. This allows the Memory Controller to use the HSYNC signal to produce the (LOAD) pulse. The µP then analyzes the sampled data and shifts (in 212 ns increments) the Line Counter offset until HSYNC coincides with the 50% of incoming sync. At this point, the µP returns the offset to B92 (hex).

At the start of line 10 of field 1, the µP asserts (F1/F3_L10). The Address Decoder gates this signal with (L_HSYNC) to generate FLD_REF for the Signal Generation circuits.

Memory Controller and Address Counter

The Memory Controller (U709) controls the storage of ADC data in the Sample RAM. The Address Counter (U605) generates 256 addresses (0 to 255) in which the Sample RAM stores the ADC samples. Fig. 6-10 shows the timing for the Memory Controller and Address Counter outputs.

When START_SAMPLE is high and both SAMPLER_EN and (COUNTER_EN) are low, the Memory Controller enables the Address Counter on the next rising edge of the clock. The Memory Controller then asserts (WE) and a sample point is written into the Sample RAM. The Memory Controller repeats this sequence of (COUNTER_EN) followed by (WE) until the Address Counter generates SAMPL_FINISH pulse on the 256th count.

During the vertical interval, START_SAMPLE never occurs if (UNLOCKED) is low. Remember, when (UNLOCKED) is low, the Address Decoder uses (HSYNC) to derive the (LOAD) pulse for the Line Counter. In the vertical interval, this pulse occurs at a half-line rate. Because this prevents the counter from reaching a full line count, the Address Decoder cannot generate START_SAMPLE.

Memory Controller outputs START_SAMPLE, SAMPLE_FINISH, and S_HSYNC are sent to the CTCs along with (LV_DRIVE1). The µP continuously analyzes the sequence of these four signals to find and keep track of the vertical interval.

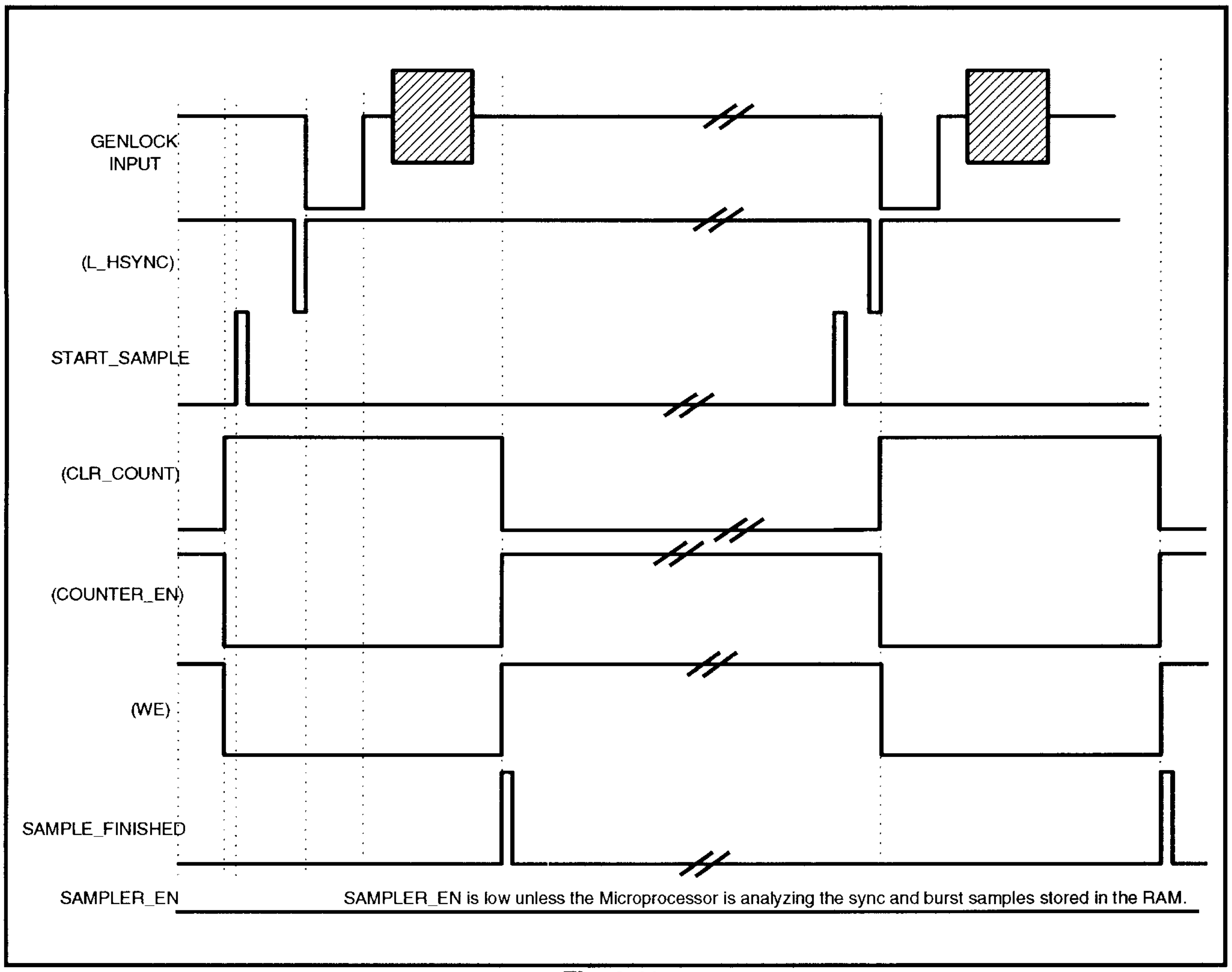


Fig. 6-10.
Timing for the Memory Controller and Address Counter.

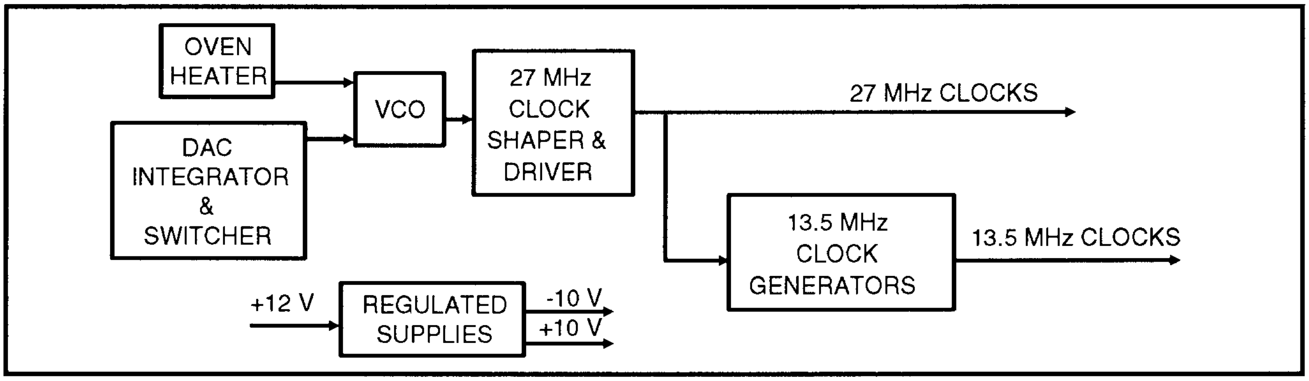


Fig. 6-11. Block diagram of the Clock Circuit.

CLOCK CIRCUIT 4 (See Fig. 6-11)

The Clock Circuit generates several clock signals that it distributes throughout the instrument. It has four main sections: (1) VCO and Oven Heater, (2) DAC, Integrator, and Switcher, (3) 27 MHz Clock Shaper and Drivers, and (4) 13.5 MHz Clock Generators

At the heart of the Clock circuit is the Voltage Controlled Oscillator (VCO). Controlled by the µP, the VCO generates a 13.5 MHz signal that is either free-running or locked to the Genlock Input.

The Clock Shaper circuit converts the VCO output to a 27 MHz ECL square wave and ensures its duty cycle is exactly 50%. The Drivers distribute this square wave throughout the instrument.

The 13.5 MHz Clock Generator halves the frequency of the 27 MHz base clock. It then makes several copies to prevent loading.

VOLTAGE-CONTROLLED OSCILLATOR (VCO)

CAUTION

If it becomes necessary to remove Q293 from its heat sink, move jumper J497 to the 2-3 position to prevent Q293 from overheating.

The VCO circuit generates a 13.5 MHz signal. All the test signal generation clocks in the instrument are derived from this base frequency.

Capacitor C19 and the series combination of C15, C8, and C6 appear in parallel with crystal Y11. This parallel circuit is the heart of the oscillator. The series combination of varactor CR14 and C16 also appear in parallel with the crystal and determines the frequency correction range of the oscillator. As the µP changes the VCO correction voltage (at J286 pin 4), the reverse-biased diode shifts the frequency over a correction range centered around the oscillator's free-running frequency. Jumper J179 (in the 1-3 position) allows the VCO correction voltage to be grounded when the free-running frequency is being adjusted with C19. Jumper positions 3-4 and 3-5 select the minimum and maximum correction voltages to check the full VCO correction range.

OVEN HEATER CIRCUIT

Thermistor RT11, U495B, Q293, and associated parts make up the Oven Heater circuit which 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 negative voltage at pin 6 of U495B. This causes the output of U495B to rise and biases Q293 on. As current flows in the transistor, it heats up. As the oven heats up, the resistance of RT11 decreases. This decreases the bias at the base of Q293 and consequently, the transistor power dissipation.

Diode CR395 prevents U495B from excessively reverse biasing Q293 by limiting the negative voltage to -5.6 V. Diodes CR394 and DS494 current limit Q293 when U495B is at its maximum value. This current limiting occurs only when the oven is cold. This allows DS494 to act as an "Oven Cold" indicator.

DAC INTEGRATOR & SWITCHER

The µP controls the VCO through the VCO DAC (U170). Enabled by the (LD_VCO_DAC) signal, 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 U177 put the Genlock Loop in one of four operating modes: Internal, Genlock, Acquire, and Hold. Each is described below. The µP controls the switches through the (INT)/GEN and (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 (INT)/GEN line low. This pulls the correction voltage at the integrator output to midrange or zero volts by closing three switches. The first switch shorts out the integrator capacitor. The second and third switches short out any residual voltage to ensure the correction voltage applied to the VCO is truly zero or midrange.

Genlock Mode

When the µP detects a valid Genlock Input signal, it pulls the (INT)/GEN 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 (HOLD)/ ACQUIRE line high. This adds a large resistance (R274) to the integrator feedback loop.

Hold Mode

To hold lock, the µP slows down the Genlock Loop by pulling the (HOLD)/ACQUIRE line low to remove R274 from the integrator feedback loop.

27 MHz CLOCK SHAPERS & DRIVERS

Q390 buffers the VCO output. ECL driver U592A converts the buffered output into a complementary pair of square-wave clocks. Two RC circuits (R596 with C596 and R594 with C594) average the square waves. Op amp U495A amplifies the difference between these averages and shifts the bias of the VCO output to correct the duty cycle to 50%.

The square wave then goes through two delay stages, to shift it one quarter cycle and this signal is exclusive ORed with the original square wave to produce a 27 MHz square wave. This is the main 27 MHz clock signal.

13.5 MHz CLOCK GENERATOR

U480A takes the 27 MHz reference clock signal and cuts the frequency in half to produce the 13.5 MHz clocks. Several copies of this clock are made in U578 and U966 to drive the many circuits that use this clock signal.

SIGNAL GENERATION 5 - 7

The Signal Generation section consists of three schematics: H & V Timing 5, Signal Selection 6, and Test Signal Memory 7.

OVERVIEW

The H & V Counters provide timing to the H Pulse and V Pulse PROMs.

The H Timing Counter and Vertical Counter provide timing to the H and V Control PROMs, 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 test signal output is a digital representation of the test signal, in the 4:2:2 format. This signal is applied to the Output board.

H & V TIMING ⑤

See Fig. 6-12 for a block diagram of the H & V Timing circuit.

GENLOCK TIMING OFFSET & DELAY CONTROL

The Genlock Timing Offset & Delay Control circuits are comprised of two 4-bit counters (U128 and U228) and two D flip-flops (U255A and U255B). The job of these circuits is to add the front-panel 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 U128 and U228 are in the load mode (disabled). But on line 10 of field 1, the FLD_REF pulse enables the counters through flip-flop U255A, and counters count to 255, beginning from the offset value at their load inputs (GEN_DEL[0..7]). At the end of the count, the Carry output from U228 loads the Horizontal and Vertical Counters (through U225B) with their fixed offset values. In addition, the Carry output disables counters U128 and U228 through U255B and U255A. Jumper P255 can be moved to the 2-3 position to disable the FLD_REF input to U255A and thus disable the genlock function.

When coarse genlock timing is adjusted at the front panel, the µP sends a new 8-bit offset word (GEN_DEL[0..7]) to U128 and U228 via U125. On line 10 of field 1, the word is loaded into U128 and U228. As a result, U128 and U228 start their count at a different value, thus changing the time that the Horizontal and Vertical Timing Counters are loaded.

HORIZONTAL TIMING

H Counter

Loaded by the delayed FLD_REF signal and clocked at the 13.5 MHz rate, the Horizontal Counter (U458, U358, and U258) provides horizontal timing to the H Timing PROM. It does this by addressing the PROMs at a rate of 1135 words per video line.

When the H Counter has reached count 1134, it is cleared with the (COUNTER_CLEAR) signal. This signal is gated at U566D to prevent the H Counter from being cleared while a genlock timing offset is being loaded.

The load inputs to the H Counter present a fixed offset of 09F (hex). This offset allows the Genlock Timing Offset circuit to both advance and delay genlock timing.

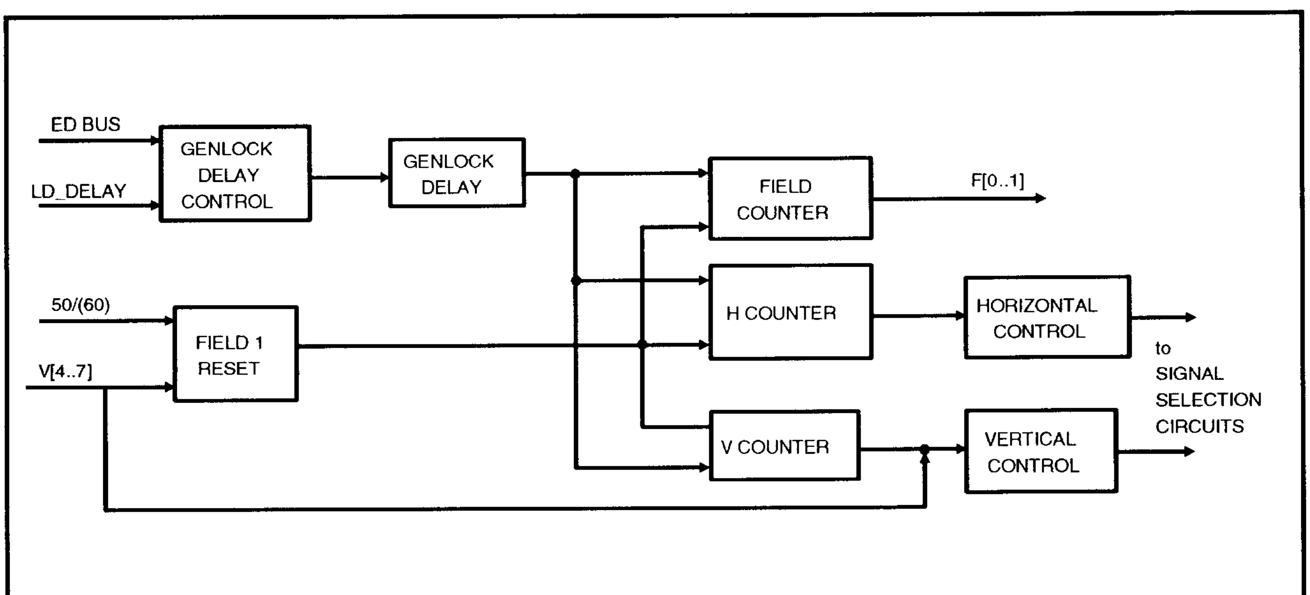


Fig. 6-12. Block diagram of the H & V Timing circuit.

Table 6-1. Horizontal Timing PROMs.

SIGNAL NAME	FUNCTION
VERTICAL_LATCH	Positive pulse twice/line used to latch vertical information from the V Timing PROM, V pulse PROM, and the Signal Selection PROM.
(H_BLANK)	Horizontal Blanking timing.
(H_COUNTER_ CLEAR)	Positive, 56 ns pulse to clear the H Timing Counter to zero at count 1133.
V_COUNT_ENABLE	Positive, 70 ns pulse twice/line enables the Vertical Counter to count twice/line.
(START_LINE_HOLD)	Used for LSB loading.
HV_SYNC	Used for horizontal timing control.
SELECTOR_LATCH	Used as the clock signal in the Test Signal Selections Latch ⟨6⟩.
EAV/SAV	Timing for end of active video/start of active video.
(EQUALIZER)	Timing for equalizing pulses in SYNC output.
(H_SYNC)	Timing for horizontal sync portion of SYNC output.
(T_REF)	Timing Reference control signal for channel control.
V_BLANK_LATCH	Positive (twice/line) 70 ns signal to latch the V Pulse PROM outputs, aligning them with the H Pulse PROM timing.

Horizontal Control PROMs

See Table 6-1 for a summary of the H Timing PROM outputs.

Addressed by the genlocked H Timing Counter, the Horizontal Control PROMs (U361 & U261) have six functions: (1) to generate timing control signals for the H and V Timing circuits, (2) to generate timing signals for the Signal Selection Logic ⟨6⟩, (3) to align the vertical timing inputs of latch U466 with the H Timing Counter, (4) to clear the H Pulse Counter after it has counted a line of addresses, (5) to provide horizontal timing pulses, and (6) to provide latch timing for V Pulse PROM outputs.

Horizontal Counter

The H Pulse Counter (U458, U358, and U258) provides horizontal timing for the H Pulse PROM.

VERTICAL TIMING

Vertical Counter

Three 4-bit counters (U571, U570, and U470) make up the 11-bit Vertical Counter. Clocked by a 13.5 MHz clock, the Vertical Counter provides vertical timing for the various circuits. The counting cycle for the Vertical Counter is as follows:

Every half line, the V_COUNT_ENABLE output of the H Control PROM enables the counters for one clock cycle, allowing the clock to increment the counters once. This is repeated until the counters have reached maximum count, at which point gate U477 clears the counters with (F1_RST) to start a new color frame.

The V_COUNT_ENABLE signal is combined with H7 and V0 (in U566A, U566B, and U566C) 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 the line, its timing is a half line off, and the V0 bit is high. Consequently, the V0 input 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 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, the delayed FLD_REF signal never occurs and the Vertical Counter is never loaded.

Table 6-2. Vertical Pulse PROM Outputs.

Output	Signal Name	Function
D0	CNV	Used as part of the address for the Signal Select PROM. 6
D2	(V_DRIVE)	Low during vertical sync time.
D3	APL_TIMING	Flags high and low for the APL signals.
D4	VC0	Used as the address for the Signal Select PROM. 6
D5	VC1	
D6	VC2	
D7	VC3	

V Timing PROM (See Table 6-2)

Addressed by the genlocked Vertical Counter, the V Timing PROM (U574) main function is to provide vertical timing for the Signal Selection PROM (U562, 6).

Output D3 provides timing for APL & bounce signals. This signal has the following pattern throughout active video: high for 18 lines & low for 6 lines. Output D0 provides the timing pattern for the selection of horizontal lines in the convergence signal: low for 1 line every 20 lines. Outputs D4-D7 provide ITS selection, test signal matrix, & vertical sync timing.

SIGNAL SELECTION 6 (See Fig. 6-13)

SIGNAL SELECTION

The heart of the Signal Selection Logic is the Signal Select PROM (U562). Addressed by the µP 2 and the Vertical Control PROM 5, the Signal Selection PROM provides the selection code that determines which test signal is generated.

When a test signal is selected at the front panel, the µP encodes the selection into an 8-bit data word and sends it to the Signal Selection PROM via latch U670. The V Control PROM (U574 on 5) provides the Signal Selection PROM with timing for selecting split-field signals, including the vertical interval. The Signal Selection PROM output [SEL[0..5]] is latched in the Test Signal Selection Latches: U858, U658, U558, and U355.

TEST SIGNAL SELECTION LATCH

Latch U670 latches the selected test signal code from the ED bus as clocked by the (LD_SIGNAL) signal from the µP 2. The latched signal, S[0..6], addresses the Signal Select PROM.

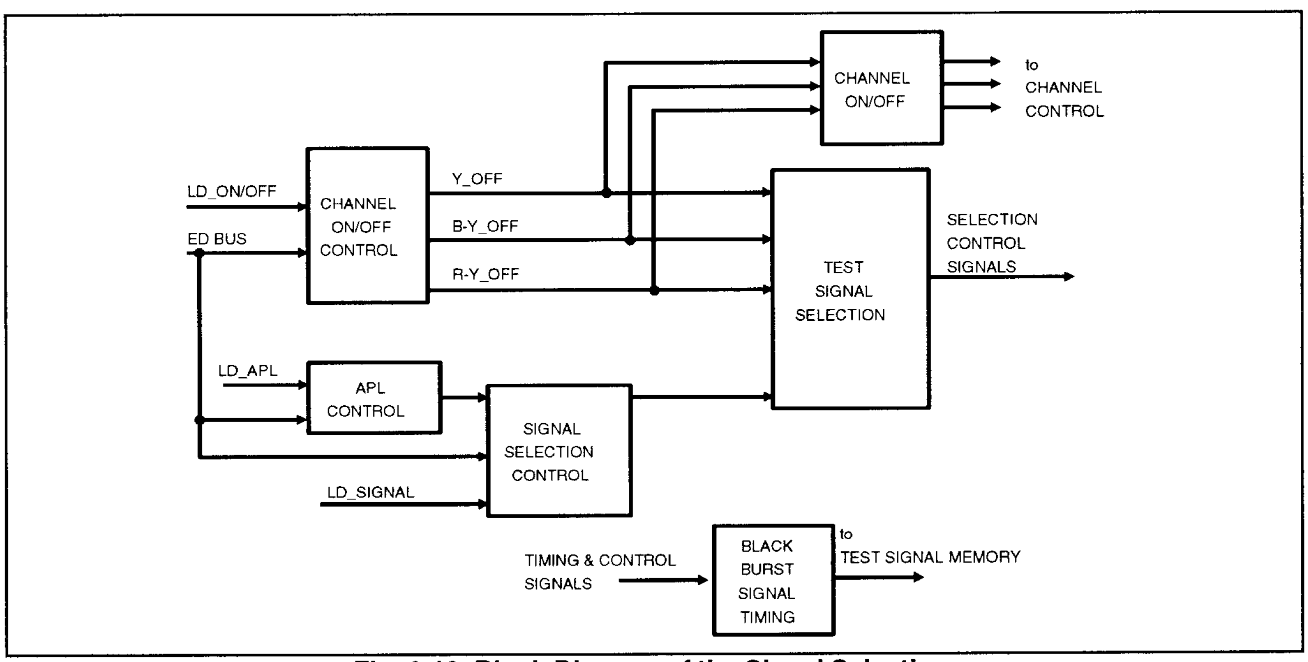


Fig. 6-13. Block Diagram of the Signal Selection.

CHANNEL ON/OFF CONTROL & CHANNEL ON/OFF

Latch U661 latches the channel control signals from the ED bus as clocked by (LD_ON/OFF). Its companion latch, U662, then relatches the signal as timed by the SELECTOR_LATCH signal from the Horizontal Control PROMs. This produces the control signals that turn on/off the test signal selection latches if a channel is turned off.

If the channel is turned off the Test Signal Selection Latch is Output Cleared and the Channel On/Off Latches drive that channel output to 0 (low).

APL CONTROL

Latch U666 latches the APL information from the ED bus and makes it available for the Signal Select PROM, U562.

BLACK BURST SIGNAL TIMING

The Black Burst Timing circuit decodes the horizontal timing information from the Horizontal Counter on ⑥. The result is the horizontal addressing for the Test Signal Memory ⑦.

TEST SIGNAL MEMORY ⑦

The Test Signal Memory is a memory matrix, as illustrated in Fig. 6-14.

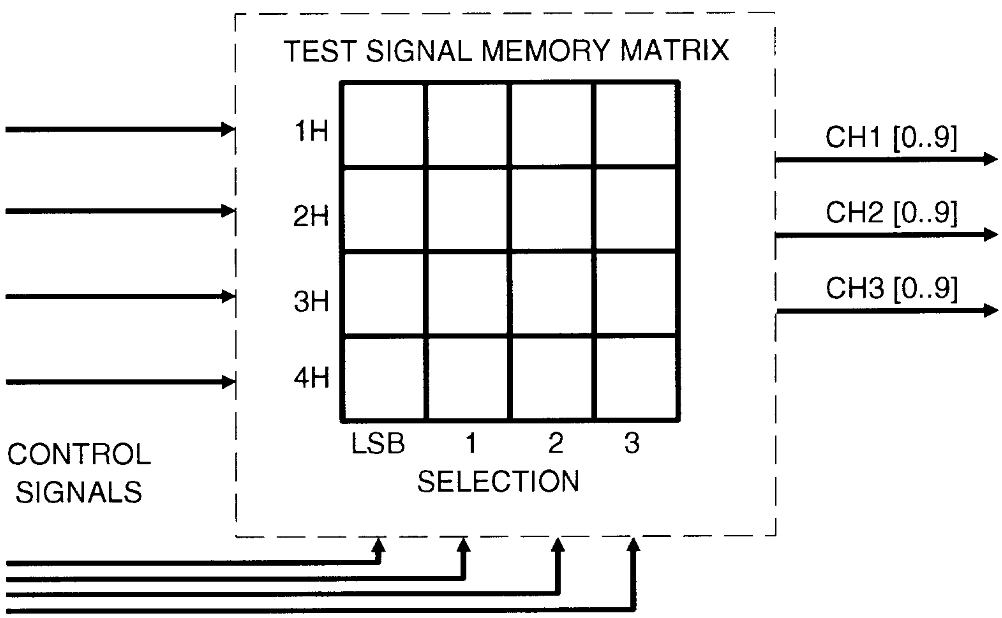


Fig. 6-14. Block diagram of the Test Signal Memory.

DIGITAL OUTPUT 8 (See Fig. 6-15)

LSB LOADING

The LSB Loading circuit derives timing control signals and latches the two LSBs of signal data for the Signal Multiplexer. U366A and U366B derive the clock signals for latches U131, U321, and U331 by ANDing (START_LINE_HOLD) with (13.5) and L_(H0). The resulting clock signal is also used by the Signal Multiplexer. The results of the LSB Loading circuit are L_CH1[0..1], L_CH2[0..1], and L_CH3[0..1] which are sent to the Signal Multiplexer.

CHANNEL CONTROL

The Channel Control circuit is a series of latches and gates that derive the timing signals for the Signal Multiplexer, LSB Loading, and Output Clock Driver circuits. The main signals created are: (LSB_EN), (BY_EN), and (RY_EN).

SIGNAL MULTIPLEXER

The main function of the Signal Multiplexer is to create the data stream pattern of Y, B-Y, Y, R-Y, Y, ... It consists of a multiplexer (U328) for the LSBs, latches for the 8 MSBs of the components (U431, U631, and U831), a PAL (U628) to insert vertical and horizontal interval information, and two separate latches for APL and shallow ramp information (U425 and U428). The latch outputs are cleared when the data is not being output as part of the data stream. The resulting signal is MX[0..9].

TTL → ECL CONVERTER

The TTL → ECL Converter consists of U821, U825, U828A, and U828B. It takes the MX[0..9] signal from the Signal Multiplexer and converts it to ECL levels to prepare it to be output in standard 4:2:2 format.

OUTPUT CLOCK DRIVER

The Output Clock driver takes control signals from the Channel Control circuit and converts them to the Y_CLK, BY_CLK, and RY_CLK signals. These signals are sent to the Component Clock Driver 10.

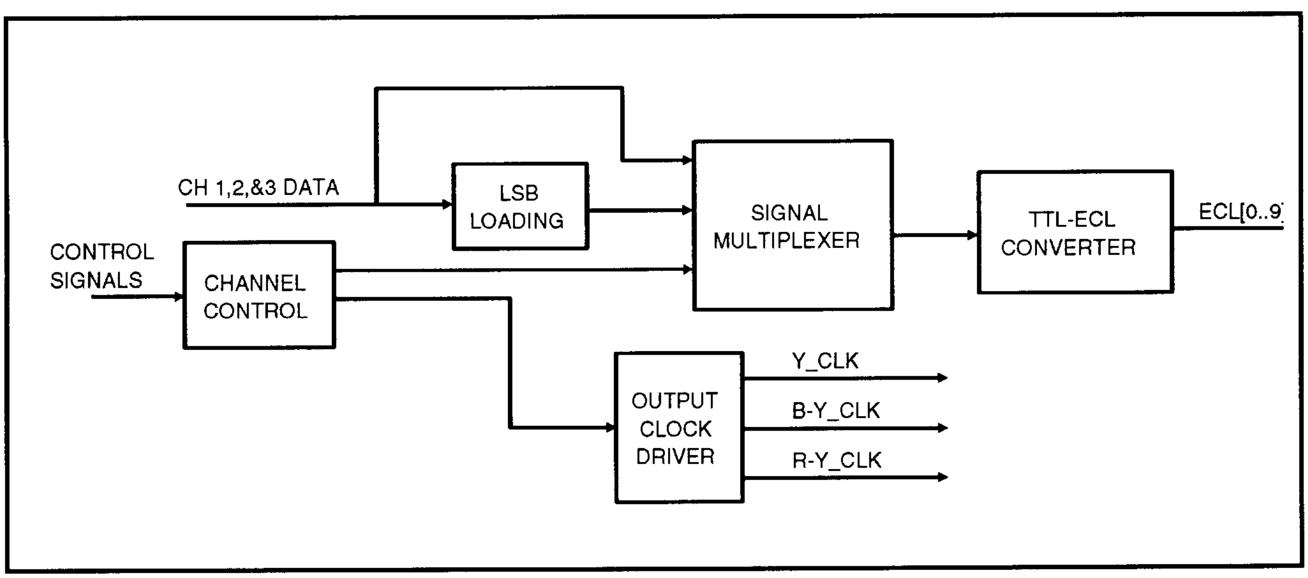


Fig. 6-15. Block diagram of the Digital Output.

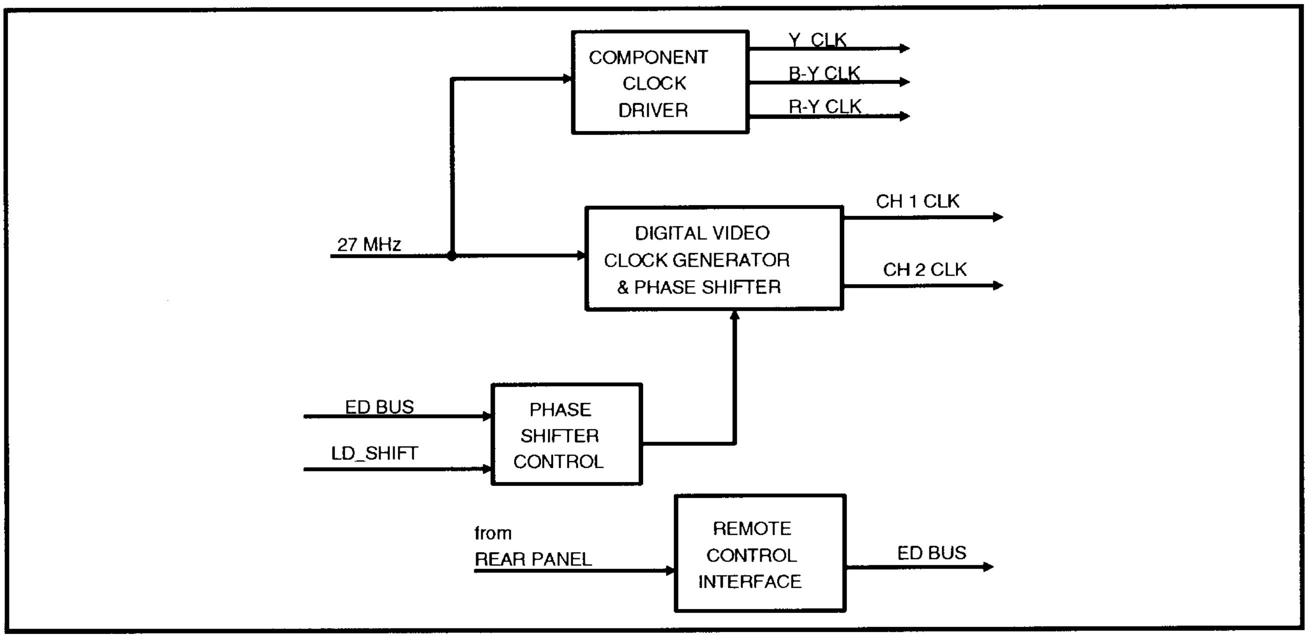


Fig. 6-16. Phase Shifter & Clock Outputs.

PHASE SHIFTER & CLOCK OUTPUTS 10 (See Fig. 6-16)

COMPONENT CLOCK DRIVER

U645A, U650A, and U645B use signals from the Output Clock Driver 8 to drive the output clocks.

PHASE SHIFTER CONTROL

The Phase Shifter Control latches data from the µP 2 via the ED bus as clocked by the control signal (LD_SHIFT). The two bits of data are used to turn on and off transistors Q275 and Q270. These transistors, in turn, turn on/off the K480 and K380 switches in the Digital Video Phase Shifter & Clock Generator, thus controlling the amount of delay inserted in the data clocks.

DIGITAL VIDEO CLOCK GENERATOR & PHASE SHIFTER

This circuit takes the 27 MHz clock signals from the VCO 4 and delays them either -11 ns, +0 ns, or +11 ns as requested by the Phase Shifter Control.

If -11 ns is requested all the switches are turned off and a minimum amount of delay is inserted in the clock line (only C573, C684, and C575 are in the data line). If +0 ns is needed more capacitors are inserted in the data line slowing down the circuit a little more (added to the first set of capacitors are: C570, C682, and C580). If the maximum amount of delay is requested all of the capacitors are in the data line.

The resulting signals are CH1_CLK and CH2_CLK (one for each set of parallel data outputs). These signal go directly to the DIGITAL OUT 1 & 2 on the rear panel 1 as the data clocks.

REMOTE CONTROL INTERFACE

The Remote Control Interface buffers the ED bus from the rear panel REMOTE port. The REMOTE has two sets of signals: DSP[0..7] and RC[0..7]. The DSP signals are not currently in use. The RC signals are buffered by U280 and U285 and clocked onto the ED bus by the (LD_REMOTE) control signal from the µP 2. The µP then uses the signals to control signal selection, genlock timing and control, and 50/60 Hz selection.

BLACK OUTPUT & DATA GENERATION 12 (See Fig. 6-17)

TIMING LATCHES

The Timing Latches provide the addresses for the Signal Address PROMs. U225 and U220 latch the vertical and field count from 5; these are used directly. The horizontal address is derived from the horizontal count in U240, for the horizontal sync address.

SIGNAL ADDRESS EPROMS

There are two separate sections, one for 625/50 (PAL) and one for 525/60 (NTSC). The 50/(60) control signal enables whichever is needed. The result is S[0..11].

SIGNAL ADDRESS LATCHES

The Signal Address Latches latch the signals from the Signal Address PROMs timed to the H2 horizontal data bit. U350 is for both NTSC and PAL signals, while U360 is for the additional PAL data.

DELAY LATCHES & SIGNAL PROMS

Delay Latches U450 and U460 provide PROM U560 with the data properly timed. U550 uses the data without the delay. The resulting signal from the PROMs is B[0..7].

BLACK BURST OUTPUT LATCH & DAC

U440 latches the B[0..7] signal from the Signal PROMs as clocked by 13.5 MHz. The resulting signal, BB[0..7] drives the Black Burst DAC. The DAC (U430) converts this signal to a voltage and sends it to the Black Output Filter.

BLACK OUTPUT FILTER

To remove out-of-band signal components, the Black Burst signal from the DAC is filtered by a low-pass filter consisting of: L530, L420, L535, L630, L635, and associated components.

BLACK OUTPUT DRIVER

After filtering, the signal is applied to the Black Output Driver, which is a discrete, non-inverting op amp composed of differential amplifiers and an output stage. The first stage (Q730 and Q735) is an input buffer, the second (Q835 and Q830) is a gain stage, and the third (Q838) is an output driver.

From the emitter of Q838, negative feedback is applied to Q735 through a voltage divider network. At R830, the output gain is adjusted. In this feedback path, a capacitor provides adjustable sin(x)/x compensation through C638 increasing or decreasing negative feedback in the high end of the video spectrum.

From the emitter of Q838, the amplified and compensated signal is applied to the rear panel connectors through R837 and R839.

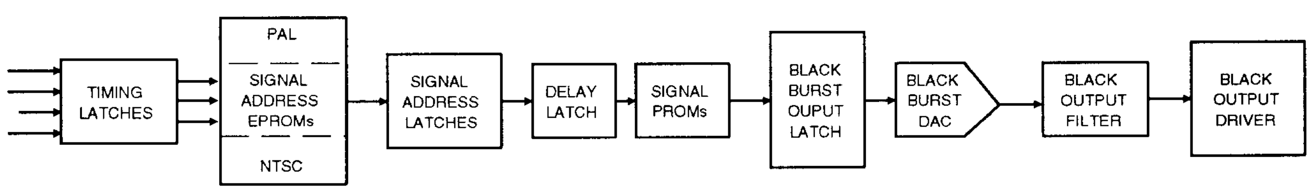


Fig. 6-17. Black Output Data Generation Block Diagram.

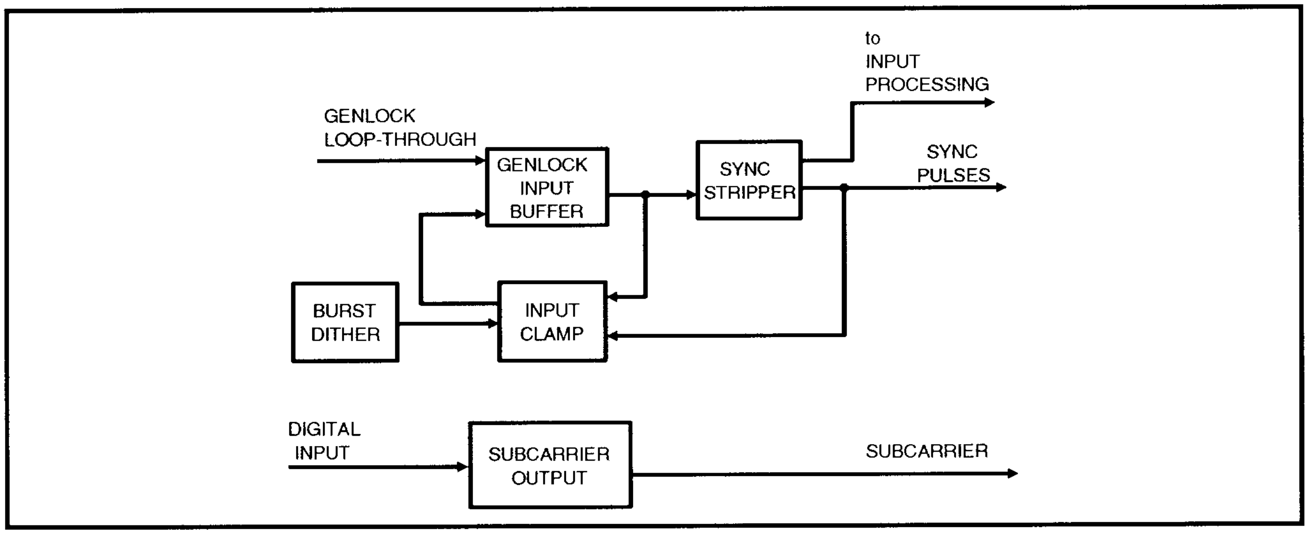


Fig. 6-18. Block Diagram of the Genlock Input.

GENLOCK INPUT 13 (See Fig. 6-18)

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 Q915 and Q910 isolate and current-amplify the Genlock Input signal. The second stage, Q813, inverts and voltage-amplifies the signal. The third stage, an emitter follower (Q815), applies the signal to the Sync Stripper and Input Clamp.

The signal is fed back to the input of the amplifier, at the base of Q915. Two other signals are also added in at the summing node: the Input Clamp feedback and Burst Dither.

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 U515A shortens the incoming 4.7 μs sync pulse detected by the Sync Stripper to about 2 μs. The shortened pulse enables U810, allowing it to generate a voltage equal to the difference between the sync of the input video applied to pin 3 and the -50 mV reference (U715A and associated components) applied to pin 2. The difference is stored in C811 for the remainder of the line. This correction voltage is applied to the base of Q915 through the series resistance R912, where it clamps the sync tip of the Genlock Input to -50 mV.

BURST DITHER

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.

U310 and U315 generate the sawtooth. U310 is a counter clocked by the SAMPLE_FINISH signal. Its digital count goes to DAC U315, which converts the count to an analog sawtooth waveform. The sawtooth is then inverted by U325A and added to the Input Clamp.

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 3. C810 filters off the chrominance portion of the Genlock Input. The remainder of the signal goes to the sync peak detector U710A and inverting op amp U710B. U510 compares the output of these devices and produces the composite sync.

POWER SUPPLY ⟨14⟩

NOTE

Substitute T1 for T440 for SN B020000 and above .

This type of power supply is called a current-mode-controlled, discontinuous, flyback, switching power supply. See Fig. 6-19 for a functional block diagram. The current output is distributed between the four supplies as follows:

+12 V	0.5 Amps max
+5 V	7 Amps max
-5 V	2 Amps max
-12 V	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 in the secondaries by the ±12 V linear regulators, U176 and U276. For SN B020000 & above: The ±12 V supplies are current limited on the secondaries by the ±12 V linear regulators, U150 and U152, and the secondary +14.5 V regulator, U200.

The power inductor, T440, is driven by switching the current to its 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 in 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 V_{AC} supplies, under voltage shutdown if the ac input is too low, over voltage 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).

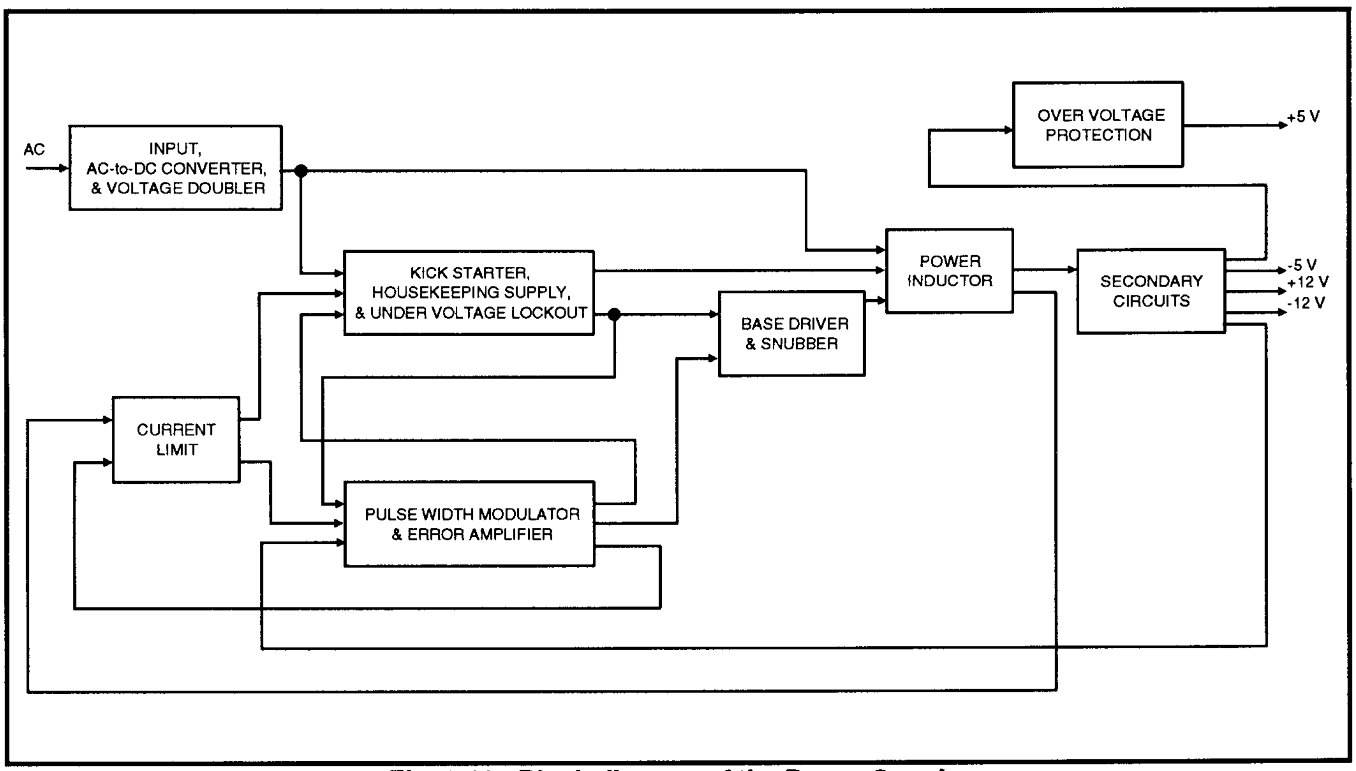


Fig. 6-19. Block diagram of the Power Supply.

WARNING

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

As the 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 V_{dc} 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 V_{dc}) 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 falls 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 V_{dc}.

For SN B020000 and above: E920 and E820 limit voltage surges on the input which might pass the line filter, while R865 and R845 discharge C865 and C845 when the power is off. DS720 and associated parts form a relaxation oscillator, so DS720 blinks when the instrument is powered up. L700, C5, C6, and C700 form a filter to keep noise developed by the power supply from getting onto C865 and C845 and out the line cord.

For SN B0199999 and below: 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 UNDER VOLTAGE 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. For SN B019999 and below: the primary purpose of the under voltage lockout circuit is to prevent the supply from starting up when set for 220 V operation and 110 V is applied instead, but it will stop oscillation in the Pulse Width Modulator whenever the voltage across C845 and C865 (normally at 320 V) falls below approximately 200 V.

For SN B019999 and below: VR765 holds the emitter of Q755 at about 20 V, while the base is controlled by a divider comprised of R766, R676, 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.

For SN B019999 and below: 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). For SN B019999 and below: 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.

For SN B019999 and below: 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.

For SN B020000 and above: the power to maintain the +16 V charge on C656 is now provided by the housekeeping winding of T1, pins 5 and 6 through CR600. If there is insufficient power to maintain the charge on C656 for any reason, such as the removal of P660, then the charge on C656 is quickly depleted. U722 will turn off when the voltage on C656 drops to approximately 10 V. Then C656 will slowly charge again through R921, and the kick start sequence will be repeated. P660 may be used as a troubleshooting jumper, to trigger and verify the kick start sequence before applying power to T1 through P810.

POWER INDUCTOR OPERATION

The heart of this power supply is T440, the multiwinding power inductor. The operation of T440 is as follows (see Fig. 6-20): 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 the 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.

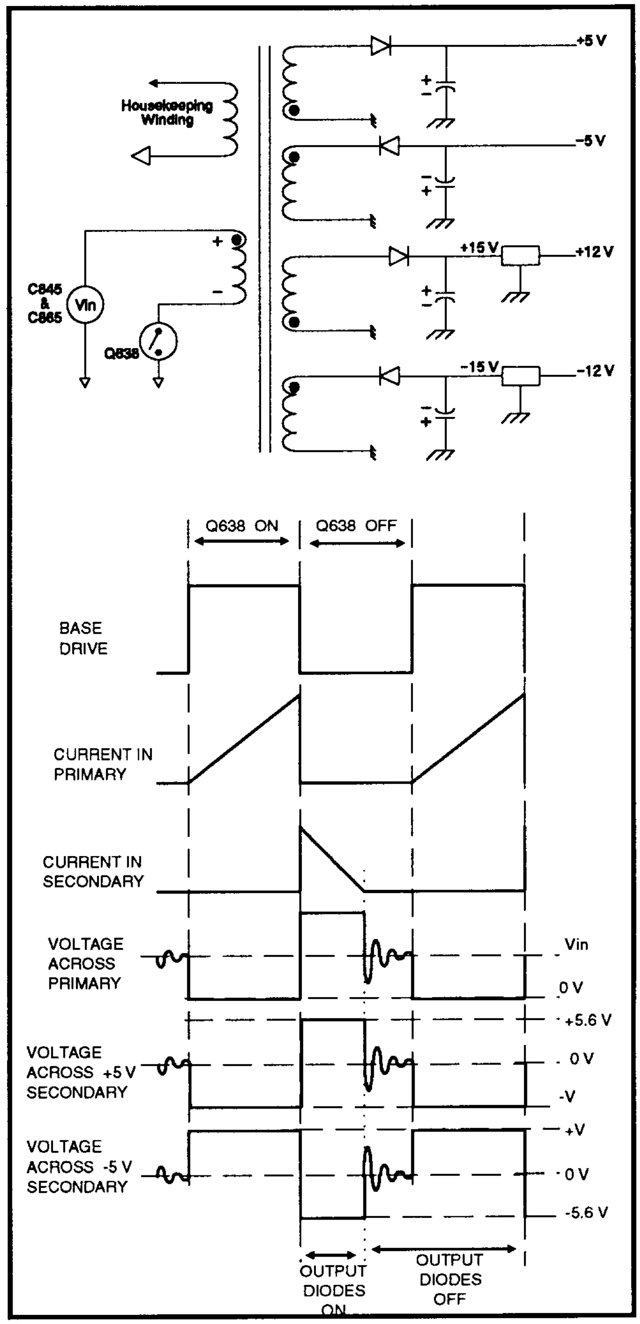


Fig. 6-20. Basic operation of T440.

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 linearly ramp 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

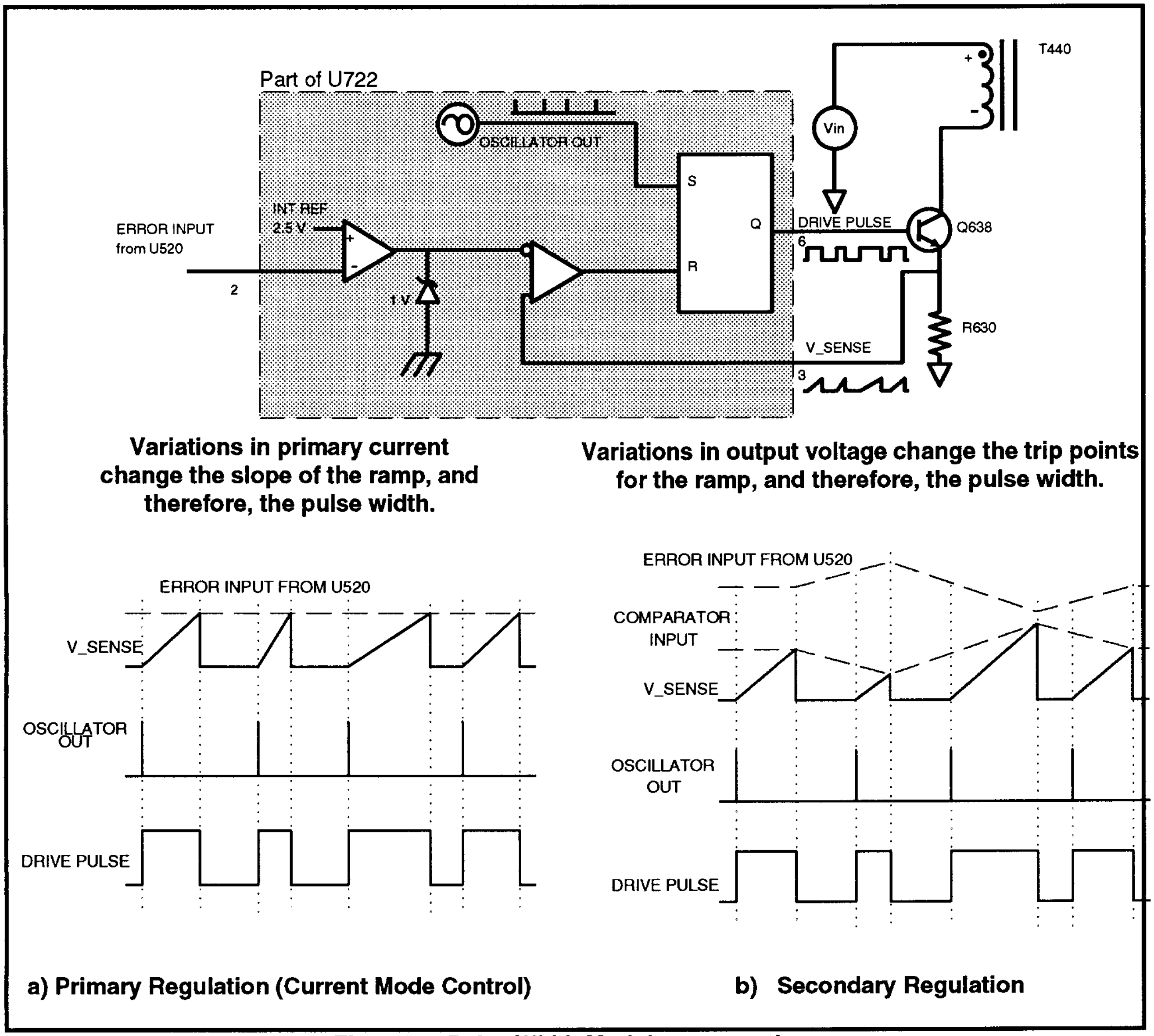


Fig. 6-21. Pulse Width Modulator operation.

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 of 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 +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. Inversely, 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.

For SN B020000 and above: Jumper P810 is included for troubleshooting. Removing P810 will interrupt power to T1, which will allow inspection of U722 and the Q638 base drive circuits. Once U722 and Q638 have checked out, high voltage can be applied to T1.

PULSE WIDTH MODULATOR AND ERROR AMPLIFIER

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 through 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. 6-21). 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 on Q638. The primary current, and therefore, the voltage to U722-3, ramps 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. However, the same peak current is reached in both cases, so the same amount of energy is transferred to the load. Line regulation is then 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 the optoisolator 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 the 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.

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 optoisolator, U520. This changes the conductance of the transistor element of the optoisolator, 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. For SN B019999 and below: the maximum primary current is approximately 1.5 Amps, which corresponds to a maximum power level of approximately 75 Watts. For SN B020000 and above: the maximum primary current is approximately 2.5 Amps, which corresponds to a maximum power level of approximately 140 Watts.

As supply goes into current limit, U615A and Q717 come into play. U615A starts to turn on as the ramp voltage passes approximately 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. For SN B020000 and above: Jumper P720 is included for troubleshooting; its removal will disable the current limit shutdown circuits.

BASE DRIVE AND SNUBBER

NOTE

Change all references of Q750 to Q650 for SN B020000 and above.

The pulse width modulator 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 for SN B019999 and below), 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, then CR640 starts to conduct, providing a path for the excess base current.

When U722-6 goes to 0 V, 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 half-cycle; then, when Q741 is turned on, C748'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 1 A for <0.3 μs), turning off Q638 very rapidly, along with CR640 and CR649.

When Q638 is turned off, there is a voltage spike applied to its collector. A combination of reflected secondary voltages, input voltage, and transformer leakage inductance can combine to produce a spike of over a thousand volts. For SN B019999 and below: since this can exceed the ratings of Q638, a snubber circuit, consisting of C540, CR545, and R647, limits the spike to approximately 800 V. For SN B020000 and above: as this can exceed the ratings of Q638, a snubber circuit, consisting of CR500, C500 and the pins 3 and 4 winding of T1 limits the spike to approximately twice the rectified line voltage.

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.

For SN B019999 and below: 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 optoisolator (+15 V) only. Then they are filtered and applied to linear regulators, U176 and U276, which 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.

GENERATION OF 12 VOLTS

(For SN B020000 and Above)

The ±12 V supplies are generated with a secondary PWM and regulator composed of U200, Q250, T2, and the associated circuits. This secondary PWM is free-running with respect to the primary PWM, at a frequency of approximately 60 kHz. The frequency is set by R105 and C105. Q250 is controlled by U200 to switch +5 V and -5 V across T2 during the first half of the switching cycle. During the second half of the cycle, the voltage across T2 reverses and CR150 and CR160 turn on, causing a charge to build up on C150 and C152. The voltage on C150 is regulated by U200 to be approximately +14.5 V, and the voltage on C152 will follow at approximately -14.5 V. The 14.5 V is then filtered by L150 and L162, respectively, and applied to the 3-terminal linear regulators (U150 and U152) to derive the +12 V and -12 V outputs.

R260 senses the current in T2 and feeds it back as a voltage to U200-3. Q200 applies part of the ramp voltage on U200-4 through R125 to U200-3 for better noise immunity.

Q100 is in the voltage feedback path for the +14.5 volts and acts as a level shifter to get the voltage feedback signal to a level referenced at +2.5 V with respect to U200-5. U200-5 is at -5 V with respect to ground. P800 disables the operation of U200 and turns Q250 off. With U200 disabled, the ±14.5 Voutputs will go to ±5 V. Jumper P800 is provided for troubleshooting. Its removal will disable the ±12 V PWM, which may be necessary to diagnose or repair the primary portion of the circuitry.

OVER VOLTAGE PROTECTION

Over voltage protection is provided on the +5 V output by a crowbar circuit comprised of Q127, VR120, and R120. If the +5 V output exceeds approximately +5.5 V, VR120 will start 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.

Maintenance

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 adjustment 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.

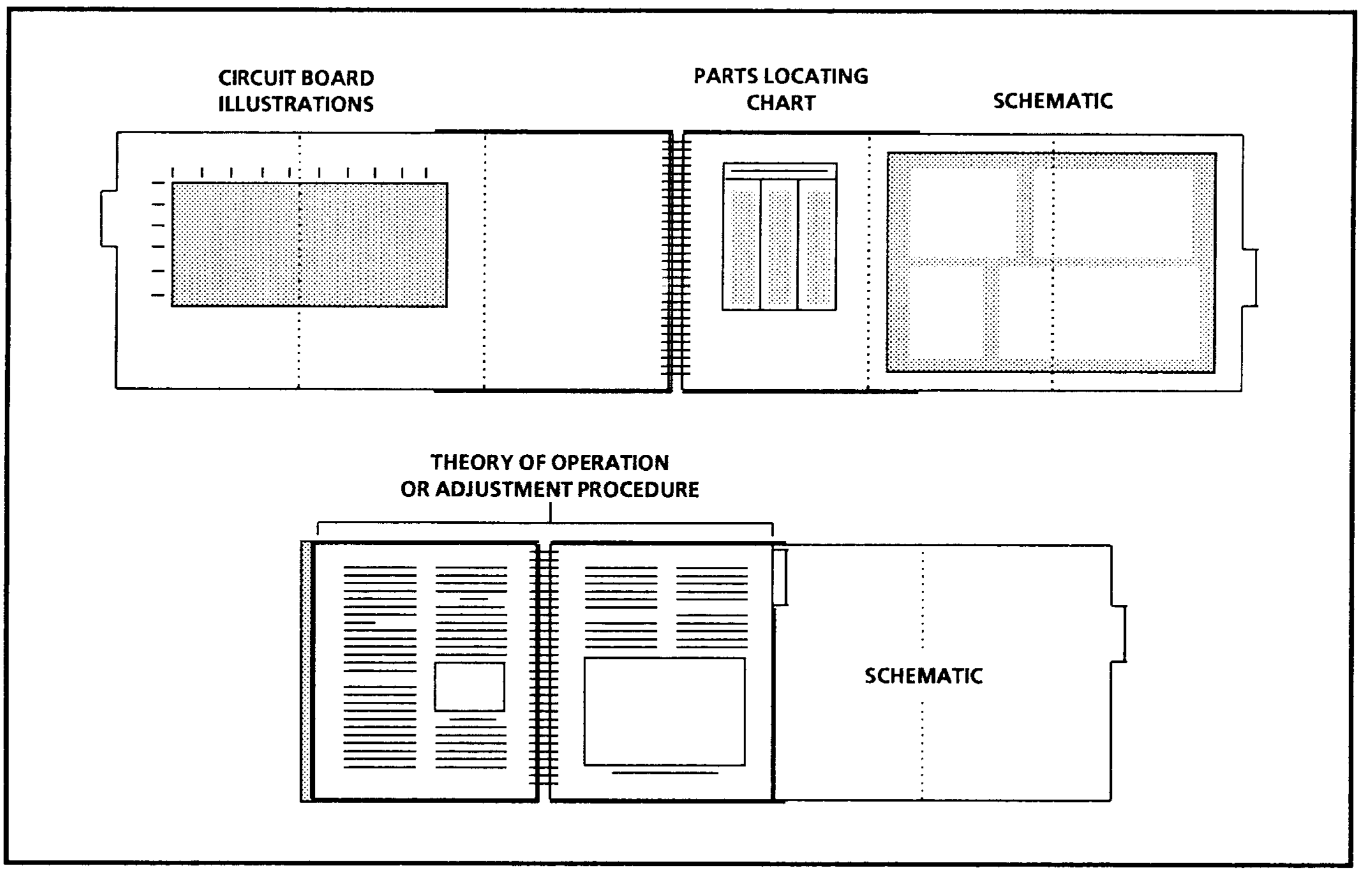


Fig. 7-1. Using the foldout pages.

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.

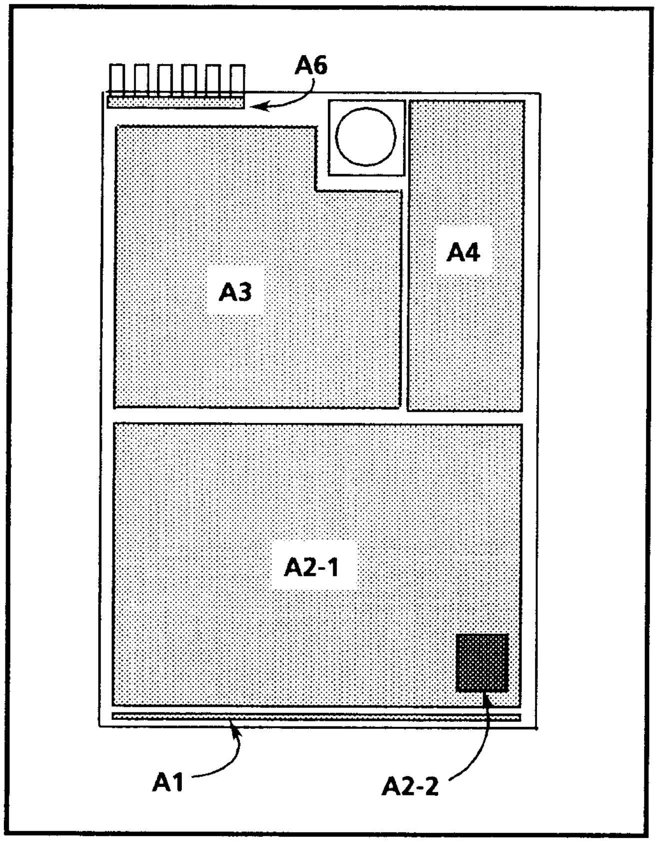


Fig. 7-2. Circuit board assembly locations.

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	Main Board Assembly
A2-2	VCO Assembly
A3	Output Board Assembly
A4	Power Supply Board Assembly
A6	BNC Board Assembly

The part numbers for ordering these boards are given on the first page of the Replaceable Electrical Parts List in Section 8.

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.

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-422. Table 7-1 shows the torque ranges for these.

Table 7-1
Torque Ranges

Screw #	Torque Range (in inch pounds)
4	$3\frac{1}{2}$ – 5
6	7–9
8	14–18

Correct torque is critical on the screws holding the devices to the Power Supply heat sink.

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 two mounting screws.

Output Board Removal

1. Remove the ribbon-cable connector.
2. Remove the six mounting screws.
3. Disconnect the Output board from the 48-pin DIN connector, making sure to keep the Output board square with the Main board (to prevent bending the pins).

Main Board Removal

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

Front Panel Removal

1. Remove the two nuts securing the front panel to the frame.
2. Disconnect the front-panel ribbon connector from the Main 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.

BNC Board Removal

1. Remove the Output board ribbon-cable connector.
2. Unsolder the BNC board from the eight center connector lugs and the three terminal lugs.
3. Pull the BNC board away from the lugs.

BNC Removal

1. To remove any of the top six BNC connectors, unsolder the center connector lug and the terminal lug (if attached).
2. Unbolt the BNC connector from the rear panel and pull out the connector.

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 Main board by carefully pulling the oven off the seven square pins that attach it to the Main 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 (U881) from the Main board and replace it with the new EPROM.

2. Switch on power.

NVRAM Replacement Schedule

The NVRAM (U896, 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.

Diagnostics

Two Types of Diagnostics

EPROM U881 (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: Power-Up Diagnostics and User Diagnostics.

First are the Power-Up Diagnostics. In these tests the μP automatically executes selected diagnostic routines, analyzes the results, then gives a pass/fail indication for each one by lighting specific front-panel LEDs and bringing the instrument to a stop on detecting a failure. Table 7-2 describes the tests and how to interpret the LED readout. Power-Up Diagnostics include System PROM Checksum test, μPRAM Read/Write test, NVRAM Read/Write test, and the Sample RAM Read/Write test.

Second are the User Diagnostics. The user diagnostics can be classified as two types: pass/fail, and interactive. The pass/fail tests require the user to simply set the diagnostic switch, in some cases press front-panel buttons, and watch the front-panel LEDs for an indication of pass or fail. The pass/fail tests are the System PROM Checksum test, the μPRAM test, the NVRAM test, the Sample RAM test, the NVROM test, and the CTC test.

The interactive tests repeatedly exercise the TSG-422 hardware to allow the user to verify and troubleshoot specific features of the instrument.

Selecting Diagnostics

To select a diagnostic test, set the Diagnostic switch (S412, Schematic 1) for the desired test (see Table 7-3), then reset the μP by switching power off and on, or by momentarily moving jumper P775 to its 1–2 position (Schematic 2). Immediately after the reset, the μP polls the Diagnostic switch port (U416, Schematic 1) and performs the routine selected at switch S412.

Once the μP has been reset, all diagnostic routines can be selected without having to reset again, except for the Timing Initialization test.

Table 7-2
Power-Up Diagnostics

SWITCH SETTING 654321	TEST	TEST FUNCTION	PASS/FAIL INDICATION
N/A	System PROM Checksum Test (U881, Schematic 2)	Computes the checksum of the System PROM and compares the value with one that has been written in the PROM. During power-up diagnostics this test is run one time.	Lights the COLOR BARS LED on error.
N/A	μP RAM Read/ Write Test (U887, Schematic 2)	Writes to and then reads from all μP RAM locations and checks for a match between data written to and read from μP RAM. During power-up diagnostics this same test is run one time.	Lights the STAIR STEP LED on error.
N/A	NVRAM Read/ Write Test (U896, Schematic 2)	Writes to and then reads from all NVRAM locations and checks for a match between data written to and read from NVRAM. During power-up diagnostics this test is run one time.	Lights the RAMP LED on error.
N/A	Sample RAM Read/Write Test (U612, Schematic 3)	Writes to and then reads from all Sample RAM locations and checks for a match between data written to and read from Sample RAM. During power up diagnostics this test is run one time.	Lights the SHALLOW RAMP LED on error.

Table 7-3
User Diagnostics

SWITCH SETTING 654321	TEST	TEST FUNCTION	PASS/FAIL INDICATION
011111	System PROM Checksum Test (U881, Schematic 2)	Computes the checksum of the System PROM and compares the value with one that has been written in the PROM. This test is run continuously.	Lights the COLOR BARS LED on error.
011110	μP RAM (U887, Schematic 2)	Writes to and then reads from all μP RAM locations and checks for a match between data written to and read from μP RAM. This test is run continuously.	Lights the STAIR STEP LED on error.
011101	NVRAM (U896, Schematic 2)	Writes to and then reads from all NVRAM locations and checks for a match between data written to and read from NVRAM. This test is run continuously.	Lights the RAMP LED on error.
011100	Sample RAM (U612, Schematic 3)	Writes to and then reads from all Sample RAM locations and checks for a match between data written to and read from Sample RAM. This test is run continuously.	Lights the SHALLOW RAMP LED on error.
011011	Port Test	Counts from 0–255 on the I/O ports of the microprocessor system. This is the External Data bus (ED0-ED7).	For checking the data and load paths connected to the I/O ports. See Fig. 7-3.
011010	VCO DAC Test (U170, U270 Schematic 4)	Generates a field rate ramp at the VCO DAC. Visible at the integrator output (U270-1).	For checking the VCO DAC and integrator. See Fig. 7-4.
011001	Sampler Test 1 (U370, Schematic 4)	Acquires a sample of sync and burst via the genlock input and then reconstructs the sampled sync and burst at equivalent time through the VCO DAC (U270-1), Schematic 4.	For checking Genlock Acquisition circuitry. See Fig. 7-5.
011000	Sampler Test 2	Sets up the Genlock Acquisition system to sample incoming video continuously for checking acquisition timing at U705.	For checking Genlock Acquisition circuitry. See Figs. 7-6, 7-7, and 7-8.
010111	Front Panel LED Test	Turns on all the front panel LEDs.	For checking brightness consistency.
010110	Software Reset Test (U691, U696 Schematic 2)	Sets up the CTCs (Counter Timer Chips) allowing them to pull the NMI input of the μP low. This causes the μP to start executing genlock code. The test procedure is to have the genlock input connected to the instrument, select the Software Reset Test while in diagnostics, and see that the instrument locks to the genlock source.	Tests the software reset function.

Table 7-3 (cont.)
User Diagnostics

SWITCH SETTING 654321	TEST	TEST FUNCTION	PASS/FAIL INDICATION
010101	Hardware Reset Test	First set J676 (Schematic 2) to the 1–2 position and then select the hardware reset test. Check J676 pin 1 with a scope and verify that there is a 1400 ms square wave (low = true).	Tests the hardware reset circuitry.
010010	NVROM Test (U896, Schematic 2)	Tests the ROM portions of the Non-volatile RAM. Since writing to the ROM portion of the NVRAM is destructive, a key sequence is required to run the test. First set the diag-port switch to the NVROM test and switch power off and on. Press the COLOR BARS switch until the COLOR BARS LED lights. Next press the APL switch until the APL LED lights. The last step is to press the COLOR BARS switch until the COLOR BARS LED lights again.	The SELECT TEST SIGNAL LED will light if the NVROM has passed the test. The SET GENLOCK TIMING LED will light on a failure.
010001	Timing Initialization	Initializes the NVRAM, sets the Genlock timings to midrange, preconfigures signal switches, and presets values for the 27 MHz clock shift. Since this initialization writes to the NVROM portion of the NVRAM, the same key sequence as the NVROM test is used to run the timing initialization. At the end of initialization the software waits for a reset to continue operation.	
010000	CTC Test	This test sets up the Counter Timer Chips (CTC's) U691 and U696 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 one of the CTC's sections have not interrupted wthin an allocated time, an error is logged and the test continues.	An error in U691 lights the PULSE AND BAR LED. An error in U696 lights the MULTIPULSE LED.
000000	Cycle Test	Continuously cycles through the EPROM, μPRAM, NVRAM, Sample RAM, and CTC tests, then turns on all the LEDs. On failure the error is logged by turning on the appropriate front-panel LED and stopping the test.	

PORT TEST
(switch position: 011011)

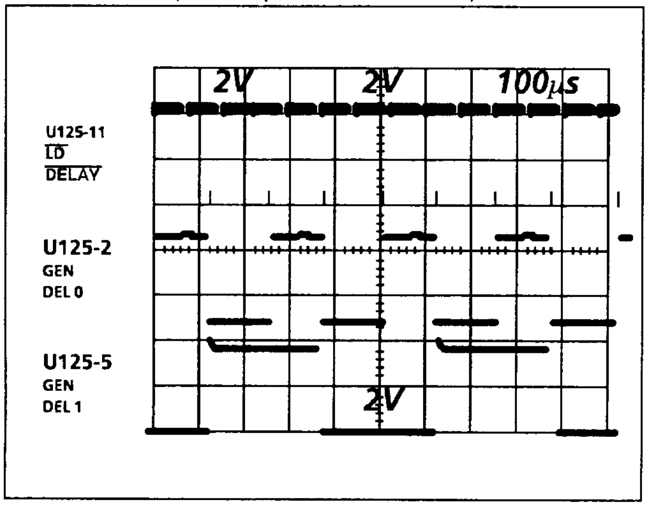


Fig. 7-3. Pin 2, U125 (output LSB), toggling twice as fast as pin 5 (next LSB) as μP counts from 0-255. Pin 11 ($\overline{LD,DEL}$) enables U125.

SAMPLER TEST 1
(switch position 011001)

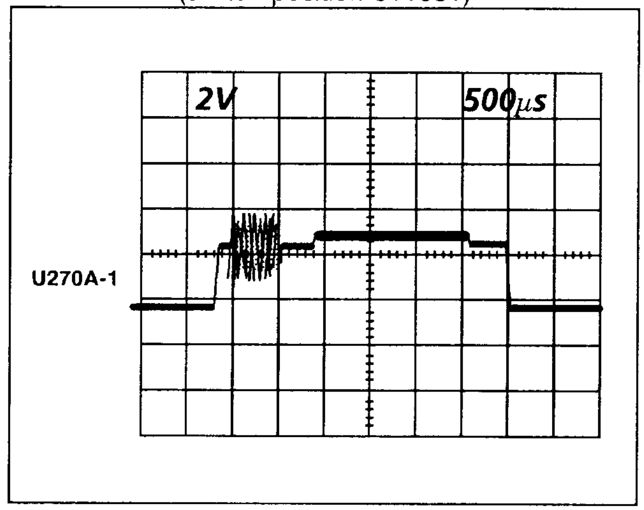


Fig. 7-5. Shows a μP-generated reconstruction of sync and burst at pin 1 of U270. Reconstruction shows the relative timing and amplitude of sync and burst.

VCO DAC TEST
(switch position: 011010)

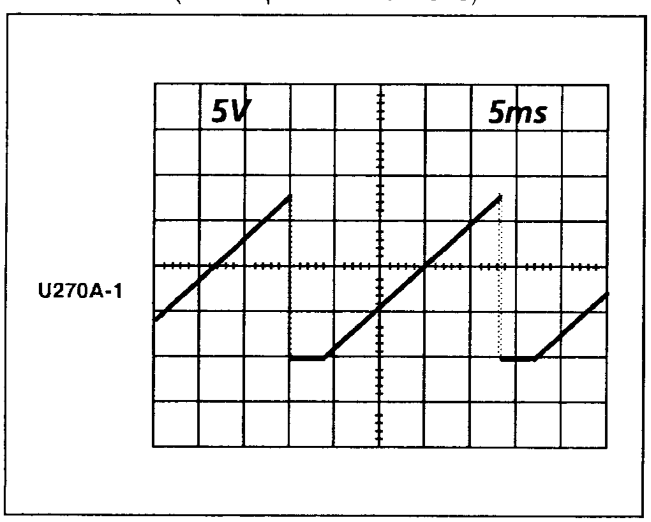


Fig. 7-4. Repeated ramp from pin 1 of integrator U270A. μP generates ramp by counting from 0-255 at a field rate.

SAMPLER TEST 2
(switch position: 011000)

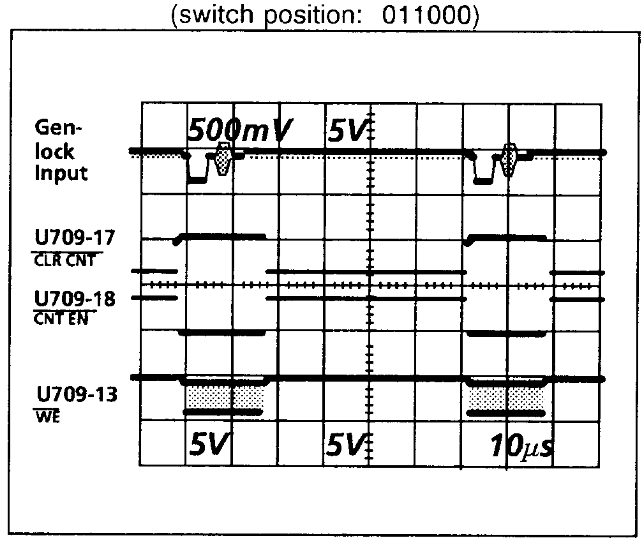


Fig. 7-6. Shows signals through the Genlock Data Acquisition circuit (Schematic 3) when it is in the UNLOCKED mode.

SAMPLER TEST 2
(switch position: 011000)

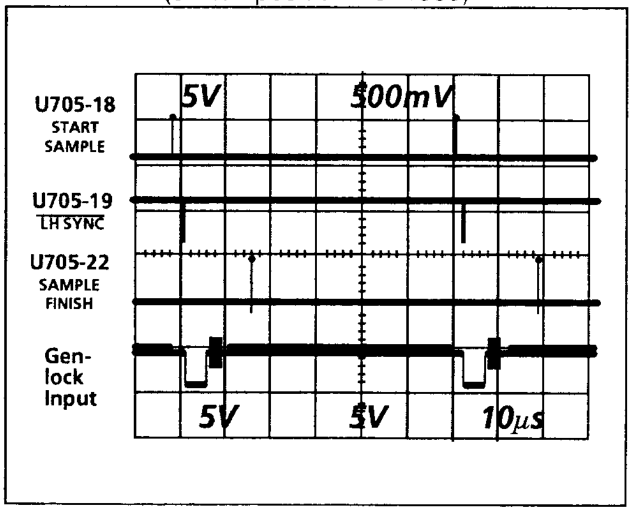


Fig. 7-7. Shows signals through the Genlock Data Acquisition circuit (Schematic 3) when it is in the UNLOCKED mode.

SAMPLER TEST 2
(switch position: 011000)

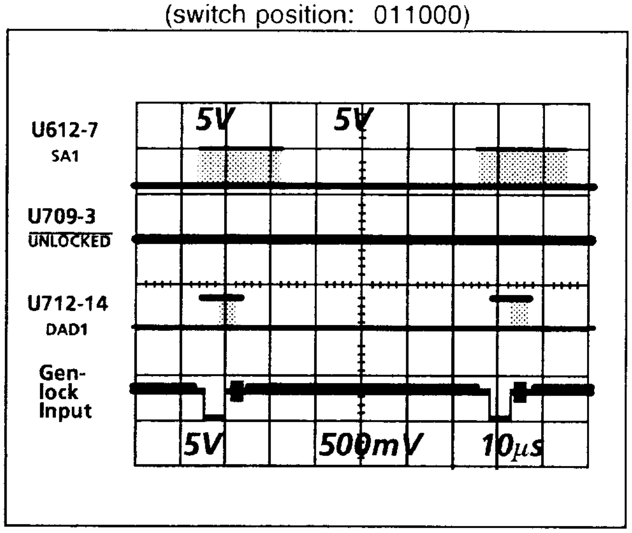


Fig. 7-8. Shows signals through the Genlock Data Acquisition circuit (Schematic 3) when it is in the UNLOCKED mode.

FRONT PANEL LED TEST
(switch position: 010111)

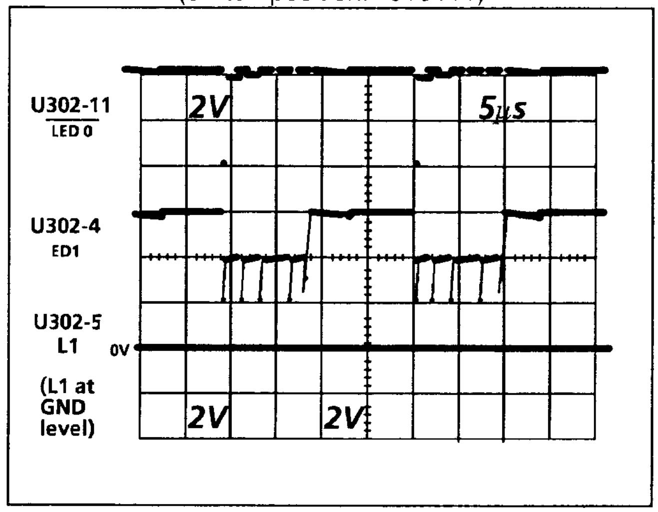


Fig. 7-9. Shows LED0 repeatedly loading a zero into the ED1 input (pin 4) of LED latch U302 (Schematic 1). This holds the L1 output (pin 4) on U302 low to light the DS227 LED. All other LEDs are tested in the same manner.

Replaceable Electrical Parts

Section 8
Replaceable Electrical Parts

This section contains a list of the components that are replaceable for the TSG-422. 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 benifit 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 confrom 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.

Example a.

Component Number

A23R1234 **A23** **R1234**

Assembly Number Circuit Number

Read: Resistor 1234 of Assembly 23

Example b.

Component Number

A23A2R1234 **A23** **A2** **R1234**

Assembly Number Subassembly Number Circuit Number

Read: Resistor 1234 of Subassembly 2 of Assembly 23

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 futher 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
02735	RCA CORP SOLID STATE DIVISION		
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
09922	BURNDY CORP	RICHARDS AVE	NORWALK CT 06852
11236	CTS CORP BERNE DIV THICK FILM PRODUCTS GROUP	406 PARR ROAD	BERNE IN 46711–9506
12327	FREEWAY CORP	9301 ALLEN DR	CLEVELAND OH 44125–4632
12969	MICROSEMI CORPORATION WATERTOWN DIVISION	530 PLEASANT STREET	WATERTOWN MA 02172
17856	SILICONIX INC	2201 LAURELWOOD RD	SANTA CLARA CA 95054–1516
18565	CHOMERICS INC	77 DRAGON COURT	WOBURN MA 01801–1039
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
23499	HIGH VOLTAGE ENGINEERING CORP JUDD WIRE DIV	870 LOS VALLECITOS BLVD	SAN MARCOS CA 92069–1432
24165	SPRAGUE ELECTRIC CO	267 LOWELL ROAD	HUDSON NH 03051
24546	CORNING GLASS WORKS	550 HIGH ST	BRADFORD PA 16701–3737
25088	SIEMENS CORP	186 WOOD AVE S	ISELIN NJ 08830–2704
26364	COMPONENTS CORP	6 KINSEY PLACE	DENVILLE NJ 07834–2611
27014	NATIONAL SEMICONDUCTOR CORP	2900 SEMICONDUCTOR DR	SANTA CLARA CA 95051–0606
30161	AAVID ENGINEERING INC	ONE KOOL PATH PO BOX 400	LACONIA NH 03247
31223	MICRO PLASTICS INC	20821 DEARBORN ST	CHATSWORTH CA 91311–5916
32436	SYSCON INTERNATIONAL INC	1701 S MAIN ST	SOUTH BEND IN 46613–2211
53387	MINNESOTA MINING MFG CO	PO BOX 2963	AUSTIN TX 78769–2963
54937	DEYOUNG MANUFACTURING INC	12920 NE 125TH WAY	KIRKLAND WA 98034–7716
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
57668	ROHM CORP	8 WHATNEY PO BOX 19515	IRVINE CA 92713
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
71468	ITT CANNON DIV OF ITT CORP	666 E DYER RD	SANTA ANA CA 92702
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

Mfr. Code.	Manufacturer	Address	City, State, Zip Code
77900	ILLINOIS TOOL WORKS SHAKEPROOF DIV	ST CHARLES RD	ELGIN IL 60120
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
86928	SEASTROM MFG CO INC	701 SONORA AVE	GLENDALE CA 91201–2431
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
D5243	ROEDERSTEIN E SPEZIALFABRIK FUER KONDENSATOREN GMBN	LUDMILLASTRASSE 23–25	8300 LANDSHUT GERMANY
S3629	SCHURTER AG H C/O PANEL COMPONENTS CORP	2015 SECOND STREET	BERKELEY CA 94170
S4307	SCHAFFNER ELECTRONIK AG		LUTERBACH SWITZERLAND
TK0040	TRIO–TECH RELIABILITY SERVICES	975 BENICIA AVE	SUNNYVALE CA 94086–2805
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
TK1134	TUSONIX INC	2155 N FORBES BLVD	TUCSON AZ 85705
TK1345	ZMAN & ASSOCIATES		
TK1424	MARCON AMERICA CORP		
TK1483	TEKA PRODUCTS		
TK1573	WILHELM WESTERMAN	PO BOX 2345 AUGUSTA–ANLAGE 56	6800 MANNHEIM 1 WEST GERMANY
TK1601	PULSE ENGINEERING INC	2801 MOORPARK AVE SUITE 7	SAN JOSE CA 95128
TK1960	U S TOYO FAN CORP	4915 WALNUT GROVE AVE DRAWER G	SAN GABRIEL CA 91776
TK2133	SCHAFFNER		
TK2165	TRIQUEST CORP		

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A1	333–3646–00			PANEL,FRONT:	80009	333–3646–00
A2–1	671–0764–00	B010100	B010105	CIRCUIT BD ASSY:MAIN	80009	671–0764–00
A2–1	671–0764–01	B010106	B010119	CIRCUIT BD ASSY:MAIN	80009	671–0764–01
A2–1	671–0764–02	B010120	B010252	CIRCUIT BD ASSY:MAIN	80009	671–0764–02
A2–1	671–0764–03	B010253	B010442	CIRCUIT BD ASSY:MAIN	80009	671–0764–03
A2–1	671–0764–04	B010443	B010504	CIRCUIT BD ASSY:MAIN	80009	671–0764–04
A2–1	671–0764–05	B010505	B010555	CIRCUIT BD ASSY:MAIN	80009	671–0764–05
A2–1	671–0764–06	B010556	B010569	CIRCUIT BD ASSY:MAIN	80009	671–0764–06
A2–1	671–0764–07	B010570		CIRCUIT BD ASSY:MAIN	80009	671–0764–07
				(FOR ALL COUNTRIES EXCEPT GERMANY)		
A2–1	671–0764–07	B020566		CIRCUIT BD ASSY:MAIN	80009	671–0764–07
				(FOR GERMANY ONLY)		
A2–2	119–2323–02	B010100	B010224	OVEN ASSEMBLY:	80009	119–2323–02
A2–2	119–2323–03	B010225		OVEN ASSEMBLY:TSG300	80009	119–2323–03
A3	671–0765–00	B010100	B010213	CIRCUIT BD ASSY:OUTPUT	80009	671–0765–00
A3	671–0765–01	B010214	B010456	CIRCUIT BD ASSY:OUTPUT	80009	671–0765–01
A3	671–0765–02	B010457		CIRCUIT BD ASSY:OUTPUT	80009	671–0765–02
A4	671–0572–00	B010100	B010144	CIRCUIT BD ASSY:PWR SPLY	80009	671–0572–00
A4	671–0572–01	B010145	B010248	CIRCUIT BD ASSY:PWR SPLY	80009	671–0572–01
A4	671–0572–02	B010249	B010348	CIRCUIT BD ASSY:PWR SPLY	80009	671–0572–02
A4	671–0572–03	B010349	B010481	CIRCUIT BD ASSY:PWR SPLY	80009	671–0572–03
A4	671–0572–04	B010482	B010534	CIRCUIT BD ASSY:PWR SPLY	80009	671–0572–04
A4	671–0572–05	B010535	B010573	CIRCUIT BD ASSY:PWR SPLY	80009	671–0572–05
A4	671–0572–06	B010574	B019999	CIRCUIT BD ASSY:PWR SPLY	80009	671–0572–06
A4	671–1906–05	B020000	B020565	CIRCUIT BD ASSY:PWR SPLY,GERMANY ORDERS	80009	671–1906–05
A4	671–1906–07	B020566		CIRCUIT BD ASSY:PWR SPLY	80009	671–1906–07
A6	671–0763–00			CIRCUIT BD ASSY:BNC	80009	671–0763–00
A8	671–2811–00	B020000		CIRCUIT BD ASSY:DIG P EMI	80009	671–2811–00
A9	671–2812–00			CIRCUIT BD ASSY:FRONT PANEL EMI	80009	671–2812–00
A1	333–3646–00			PANEL,FRONT:	80009	333–3646–00
A2–1	671–0764–00	B010100	B010105	CIRCUIT BD ASSY:MAIN	80009	671–0764–00
A2–1	671–0764–01	B010106	B010119	CIRCUIT BD ASSY:MAIN	80009	671–0764–01
A2–1	671–0764–02	B010120	B010252	CIRCUIT BD ASSY:MAIN	80009	671–0764–02
A2–1	671–0764–03	B010253	B010442	CIRCUIT BD ASSY:MAIN	80009	671–0764–03
A2–1	671–0764–04	B010443	B010504	CIRCUIT BD ASSY:MAIN	80009	671–0764–04
A2–1	671–0764–05	B010505	B010555	CIRCUIT BD ASSY:MAIN	80009	671–0764–05
A2–1	671–0764–06	B010556	B010569	CIRCUIT BD ASSY:MAIN	80009	671–0764–06
A2–1	671–0764–07	B010570		CIRCUIT BD ASSY:MAIN	80009	671–0764–07
				(FOR ALL COUNTRIES EXCEPT GERMANY)		
A2–1	671–0764–07	B020566		CIRCUIT BD ASSY:MAIN	80009	671–0764–07
				(FOR GERMANY ONLY)		
				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		
A2–1C104	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C131	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C158	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C173	290–0990–00			CAP,FXD,ELCTLT:10UF,20%,50V	24165	502D437
A2–1C180	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C212	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C218	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C228	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C266	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C270	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C277	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2–1C302	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C303	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C331	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C355	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C366	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C372	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C377	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C382	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C388	283–0785–00			CAP,FXD,MICA DI:250PF,1%,500V	80009	283–0785–00
A2–1C389	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2–1C403	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C421	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C455	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C473	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C474	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C477	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C479	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C480	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C485	283–0639–00			CAP,FXD,MICA DI:56PF,1%,500V	80009	283–0639–00
A2–1C486	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2–1C487	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2–1C488	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C489	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2–1C490	283–0648–00			CAP,FXD,MICA DI:10PF,+/–0.5PF,500V	80009	283–0648–00
A2–1C491	283–0175–00			CAP,FXD,CER DI:10PF,5%,200V	05397	C312C100D2G5CA 8
A2–1C492	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C495	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C496	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C498	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C531	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C579	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C592	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C594	283–0666–00			CAP,FXD,MICA DI:890PF,2%,100V	80009	283–0666–00
A2–1C595	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C596	283–0666–00			CAP,FXD,MICA DI:890PF,2%,100V	80009	283–0666–00
A2–1C618	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C655	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C683	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C684	283–0629–00	671–0765–00	671–0765–01	CAP,FXD,MICA DI:62PF,1%,500V	80009	283–0629–00
A2–1C684	283–0644–01	671–0765–02		CAP,FXD,MICA DI:150PF,1%,500V	80009	283–0644–01
A2–1C702	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C709	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C725	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C731	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C755	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C761	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C787	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C805	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C807	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C809	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C812	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C815	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C818	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C821	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C825	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C828	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C831	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C866	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2–1C905	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C906	283–0647–00			CAP,FXD,MICA DI:70PF,1%,100V	80009	283–0647–00
A2–1C907	283–0772–00			CAP,FXD,MICA DI:497 PF,1%,500V	80009	283–0772–00
A2–1C909	283–0625–00			CAP,FXD,MICA DI:220PF,1%,500V	80009	283–0625–00
A2–1C912	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C938	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2–1C946	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2–1C949	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2–1C951	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2–1C958	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C962	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2–1C970	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2–1C973	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
A2–1C990	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2–1C996	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A2–1C997	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
A2–1CR394	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
A2–1CR810	152–0322–00			DIODE,SIG:SCHTKY,;15V,410MVF AT 1MA,1.2PF;5082–2811,T&R	80009	152–0322–00
A2–1CR985	152–0141–02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS, 2PF;1N4152,DO–35,T&R	80009	152–0141–02
A2–1CR986	152–0322–00			DIODE,SIG:SCHTKY,;15V,410MVF AT 1MA,1.2PF;5082–2811,T&R	80009	152–0322–00
A2–1CR988	152–0141–02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS, 2PF;1N4152,DO–35,T&R	80009	152–0141–02
A2–1CR995	152–0141–02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS, 2PF;1N4152,DO–35,T&R	80009	152–0141–02
A2–1DS494	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 40)	80009	131–0608–00
A2–1J179	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 5)	80009	131–0608–00
A2–1J205	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131–0608–00
A2–1J209	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131–0608–00
A2–1J225	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
A2–1J309	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131–0608–00
A2–1J311	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131–0608–00
A2–1J312	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131–0608–00
A2–1J497	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131–0608–00
A2–1J658	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131–0608–00
A2–1J676	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	80009	131–0608–00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
				(QUANTITY 4)		
A2–1J776	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	80009	131–0608–00
				(QUANTITY 3)		
A2–1J988	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	80009	131–0608–00
				(QUANTITY 34)		
A2–1L585	108–0735–00			COIL,RF:FIXED,584NH	80009	108–0735–00
A2–1L904	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		
A2–1P179	131–0993–02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1–850100–O
A2–1P205	131–0993–05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100–5
A2–1P209	131–0993–05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100–5
A2–1P225	131–0993–02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1–850100–O
A2–1P309	131–0993–05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100–5
A2–1P311	131–0993–05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100–5
A2–1P312	131–0993–02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1–850100–O
A2–1P497	131–0993–02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1–850100–O
A2–1P658	131–0993–02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1–850100–O
A2–1P676	131–0993–02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1–850100–O
A2–1P776	131–0993–02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1–850100–O
A2–1P922	131–3692–00			CONN DIN:PCB,;MALE,RTANG,3 X 32,0.1 CTR,0.104 TAIL,BD RETENTION;,,	80009	131–3692–00
				MOUNTING PARTS		
	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		
A2–1Q293	151–0657–00			TRANSISTOR,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		
A2–1Q390	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AMPLIFIER;2N3904,TO–92 EBC	80009	151–0190–00
A2–1Q587	151–0199–00			TRANSISTOR,SIG:BIPOLAR,PNP;12V,80MA, SWITCHING;MPS3640,TO–92 EBC	80009	151–0199–00
A2–1Q991	151–0220–00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA, 400MHZ,AMPLIFIER;2N3906(SEL),TO–92 EBC	80009	151–0220–00
A2–1R103	315–0331–00			RES,FXD,FILM:330 OHM,5%,0.25W	80009	315–0331–00
A2–1R104	315–0331–00			RES,FXD,FILM:330 OHM,5%,0.25W	80009	315–0331–00
A2–1R105	315–0331–00			RES,FXD,FILM:330 OHM,5%,0.25W	80009	315–0331–00
A2–1R106	315–0331–00			RES,FXD,FILM:330 OHM,5%,0.25W	80009	315–0331–00
A2–1R107	315–0331–00			RES,FXD,FILM:330 OHM,5%,0.25W	80009	315–0331–00
A2–1R108	315–0621–00			RES,FXD,FILM:620 OHM,5%,0.25W	80009	315–0621–00
A2–1R109	315–0621–00			RES,FXD,FILM:620 OHM,5%,0.25W	80009	315–0621–00
A2–1R110	315–0621–00			RES,FXD,FILM:620 OHM,5%,0.25W	80009	315–0621–00
A2–1R111	315–0621–00			RES,FXD,FILM:620 OHM,5%,0.25W	80009	315–0621–00
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	315–0331–00			RES,FXD,FILM:330 OHM,5%,0.25W	80009	315–0331–00
A2–1R118	307–0636–00			RES NTWK,FXD,FI:8,330 OHM,2%,0.125 W	80009	307–0636–00
A2–1R174	315–0202–00			RES,FXD,FILM:2K OHM,5%,0.25W	80009	315–0202–00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2–1R180	322–3318–00			RES,FXD:METAL FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 20K0
A2–1R181	321–0441–00			RES,FXD,FILM:383K OHM,1%,0.125W,TC=T0	80009	321–0441–00
A2–1R202	307–0636–00			RES NTWK,FXD,FI:8,330 OHM,2%,0.125 W	80009	307–0636–00
A2–1R217	307–0650–00			RES NTWK,FXD,FI:9,2.7K OHM,5%,0.150W	11236	750–101–R2.7K
A2–1R256	307–0650–00			RES NTWK,FXD,FI:9,2.7K OHM,5%,0.150W	11236	750–101–R2.7K
A2–1R264	307–0650–00			RES NTWK,FXD,FI:9,2.7K OHM,5%,0.150W	11236	750–101–R2.7K
A2–1R271	315–0222–00			RES,FXD,FILM:2.2K OHM,5%,0.25W	80009	315–0222–00
A2–1R272	315–0272–00			RES,FXD,FILM:2.7K OHM,5%,0.25W	80009	315–0272–00
A2–1R273	315–0472–00			RES,FXD,FILM:4.7K OHM,5%,0.25W	80009	315–0472–00
A2–1R274	315–0203–00			RES,FXD,FILM:20K OHM,5%,0.25W	80009	315–0203–00
A2–1R275	315–0202–00			RES,FXD,FILM:2K OHM,5%,0.25W	80009	315–0202–00
A2–1R298	308–0677–00			RES,FXD,WW:1 OHM,5%,2W	75042	ORDER BY DESC
A2–1R372	321–1643–07			RES,FXD,FILM:11.03K OHM,0.1%,0.125W,TC=T9	80009	321–1643–07
A2–1R373	321–1264–07			RES,FXD,FILM:5.56K OHM,0.1%,0.125W,TC=T9	07716	
A2–1R374	315–0362–00			RES,FXD,FILM:3.6K OHM,5%,0.25W	80009	315–0362–00
A2–1R379	315–0242–00			RES,FXD,FILM:2.4K OHM,5%,0.25W	80009	315–0242–00
A2–1R380	321–0264–07			RES,FXD,FILM:5.49K OHM,0.1%,0.125W,TC=T9	07716	CEAE54900B
A2–1R381	321–0264–07			RES,FXD,FILM:5.49K OHM,0.1%,0.125W,TC=T9	07716	CEAE54900B
A2–1R386	315–0152–00			RES,FXD,FILM:1.5K OHM,5%,0.25W	80009	315–0152–00
A2–1R391	321–0387–00			RES,FXD,FILM:105K OHM,1%,0.125W,TC=T0	07716	CEAD10502F
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	322–3385–00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 100K
A2–1R395	321–0413–00			RES,FXD,FILM:196K OHM,1%,0.125W,TC=T0	07716	CEAD19602F
A2–1R396	322–3318–00			RES,FXD:METAL FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 20K0
A2–1R397	321–0353–00			RES,FXD,FILM:46.4K OHM,1%,0.125W,TC=T0	07716	CEAD46401F
A2–1R398	321–0353–00			RES,FXD,FILM:46.4K OHM,1%,0.125W,TC=T0	07716	CEAD46401F
A2–1R399	321–0413–00			RES,FXD,FILM:196K OHM,1%,0.125W,TC=T0	07716	CEAD19602F
A2–1R414	307–0650–00			RES NTWK,FXD,FI:9,2.7K OHM,5%,0.150W	11236	750–101–R2.7K
A2–1R425	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A2–1R472	315–0301–00			RES,FXD,FILM:300 OHM,5%,0.25W	80009	315–0301–00
A2–1R473	315–0270–00			RES,FXD,FILM:27 OHM,5%,0.25W	80009	315–0270–00
A2–1R480	315–0270–00			RES,FXD,FILM:27 OHM,5%,0.25W	80009	315–0270–00
A2–1R481	315–0271–00			RES,FXD,FILM:270 OHM,5%,0.25W	80009	315–0271–00
A2–1R485	315–0102–00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315–0102–00
A2–1R491	315–0242–00			RES,FXD,FILM:2.4K OHM,5%,0.25W	80009	315–0242–00
A2–1R492	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
A2–1R493	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
A2–1R497	315–0102–00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315–0102–00
A2–1R580	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A2–1R581	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A2–1R583	322–3218–00			RES,FXD:METAL FILM;1.82K OHM,1%,0.2W, TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322–3218–00
A2–1R584	322–3218–00			RES,FXD:METAL FILM;1.82K OHM,1%,0.2W, TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322–3218–00
A2–1R586	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A2–1R590	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A2–1R591	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2–1R594	315–0682–00			RES,FXD,FILM:6.8K OHM,5%,0.25W	80009	315–0682–00
A2–1R596	315–0302–00			RES,FXD,FILM:3K OHM,5%,0.25W	80009	315–0302–00
A2–1R597	315–0392–00			RES,FXD,FILM:3.9K OHM,5%,0.25W	80009	315–0392–00
A2–1R663	307–0650–00			RES NTWK,FXD,FI:9,2.7K OHM,5%,0.150W	11236	750–101–R2.7K
A2–1R677	315–0272–00			RES,FXD,FILM:2.7K OHM,5%,0.25W	80009	315–0272–00
A2–1R682	315–0621–00			RES,FXD,FILM:620 OHM,5%,0.25W	80009	315–0621–00
A2–1R683	315–0152–00			RES,FXD,FILM:1.5K OHM,5%,0.25W	80009	315–0152–00
A2–1R684	315–0100–00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A2–1R716	315–0272–00			RES,FXD,FILM:2.7K OHM,5%,0.25W	80009	315–0272–00
A2–1R781	315–0272–00			RES,FXD,FILM:2.7K OHM,5%,0.25W	80009	315–0272–00
A2–1R808	315–0270–00			RES,FXD,FILM:27 OHM,5%,0.25W	80009	315–0270–00
A2–1R809	321–0929–07			RES,FXD,FILM:2.5K OHM,0.1%,0.125W,TC=T9	80009	321–0929–07
A2–1R810	322–3193–07			RES,FXD,FILM:1K OHM,0.1%,0.2W,TC=T9	80009	322–3193–07
A2–1R868	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A2–1R906	322–3179–00			RES,FXD,FILM:715 OHM,1%,0.2W,TC=T0	80009	322–3179–00
A2–1R910	321–0793–07			RES,FXD,FILM:37.5 OHM 0.1%,0.125W TC=T9	24546	NE55E37R5B
A2–1R918	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A2–1R921	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A2–1R985	315–0103–00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315–0103–00
A2–1R987	315–0100–00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A2–1R988	315–0106–00			RES,FXD,FILM:10M OHM,5%,0.25W	01121	CB1065
A2–1R992	315–0102–00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315–0102–00
A2–1R993	315–0472–00			RES,FXD,FILM:4.7K OHM,5%,0.25W	80009	315–0472–00
A2–1R994	315–0112–00			RES,FXD,FILM:1.1K OHM,5%,0.25W	80009	315–0112–00
A2–1R995	315–0271–00			RES,FXD,FILM:270 OHM,5%,0.25W	80009	315–0271–00
A2–1R996	308–0433–00			RES,FXD,WW:1 OHM,10%,0.25W	80009	308–0433–00
A2–1S412	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 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A2–1TP130	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	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 BRASS,W/ RED NYLON COL-LAR	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 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A2–1TP464	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	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 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A2–1TP531	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	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 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A2–1TP909	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	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 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2–1TP965	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A2–1TP996	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A2–1U121	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A2–1U125	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A2–1U128	156–2520–00			IC,DIGITAL:ASTTL,COUNTER;SYNCH 4–BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2–1U131	156–1611–00			IC,DIGITAL:FTTL,FLIP FLOP;DUAL D–TYPE;74F74,DIP14.3,TUBE	80009	156–1611–00
A2–1U170	156–1367–00			IC,CONVERTER:CMOS,D/A;8 BIT,400NS,CUR-RENT OUT,MPU COMPATIBLE,MULTIPLY-ING;AD7524JN,DIP16.3	80009	156–1367–00
A2–1U177	156–1850–00			IC,MISC:CMOS,ANALOG SWITCH;QUAD;DG211,DIP16.3	17856	SDG21107
A2–1U205	156–1215–01			IC,DIGITAL:CMOS,MUX/ENCODER;20–KEY EN-CODER;74C923,DIP18.3,TUBE,SCRN	27014	MM74C923JA+
A2–1U209	156–0956–02			IC,DIGITAL:LSTTL,BUFFER/DRIVER;DUPLICATE OF 156–0956–00;74LS244,DIP20.3,TUBE	80009	156–0956–02
A2–1U212	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A2–1U215	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A2–1U220	156–1026–02			IC,DIGITAL:LSTTL,DEMUX;DUPLICATE OF 156–1026–00;74LS154,DIP24.6,TUBE	01295	SN74LS154N P3
A2–1U225	156–2338–00			IC,DIGITAL:ASTTL,FLIP FLOP;DUAL D–TYPE;74AS74,DIP14.3,TUBE	80009	156–2338–00
A2–1U228	156–2520–00			IC,DIGITAL:ASTTL,COUNTER;SYNCH 4–BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2–1U231	156–1611–00			IC,DIGITAL:FTTL,FLIP FLOP;DUAL D–TYPE;74F74,DIP14.3,TUBE	80009	156–1611–00
A2–1U234	156–1911–00			IC,DIGITAL:FTTL,FLIP FLOP;HEX D–TYPE, WITH /MR;74F174,DIP16.3,TUBE	04713	MC74F174S
A2–1U237	156–1726–00			IC,DIGITAL:FTTL,DEMUX/DECODER;DUAL 1–OF–4 DECODER;74F139,DIP16.3,TUBE	04713	MC74F139 N
A2–1U241	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A2–1U244	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A2–1U247	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A2–1U250	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A2–1U253	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A2–1U258	156–2520–00			IC,DIGITAL:ASTTL,COUNTER;SYNCH 4–BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2–1U261	160–4633–00			MICROCKT,DGTL:2048 X 8 RGTR PROM,PRGM	80009	160–4633–00
				MOUNTING PARTS		
	136–0925–00			SOCKET,DIP::	91506	224–AG30D
				END MOUNTING PARTS		
A2–1U266	156–2109–00			IC,DIGITAL:ALSTTL,MUX/ENCODER;DUAL 1–OF–4 SELECTOR;74ALS153,DIP16.3,TUBE	01295	SN74ALS153N3
A2–1U270	156–0158–07			IC,LINEAR:BIPOLAR,OP–AMP;DUPLICATE OF 156–0158–00,DO NOT USE;MC1458P1,DIP08.3	80009	156–0158–07
A2–1U277	156–1437–00			IC,LINEAR:BIPOLAR,VOLTAGE REFERENCE;POS-ITIVE,5V,1.0%,25PPM,SERIES;MC1404AU5,DIP08.3	80009	156–1437–00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2–1U302	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A2–1U325	156–2290–00			IC,DIGITAL:ECL,TRANSLATOR;QUAD ECL–TO–TTL;10H125,DIP16.3,TUBE	80009	156–2290–00
A2–1U328	156–2260–00			IC,DIGITAL:FTTL,MUX;DUAL 4–TO–1 DATA SELECTOR, 3–STATE;74F253,DIP16.3,TUBE	80009	156–2260–00
A2–1U331	156–1611–00			IC,DIGITAL:FTTL,FLIP FLOP;DUAL D–TYPE;74F74,DIP14.3,TUBE	80009	156–1611–00
A2–1U335	––––– –––––	671–0764–00	671–0764–02	(AVAILABLE WITH TVGF03 KIT ONLY)		
A2–1U335	160–6207–00	671–0764–03	671–0764–04	MICROCKT,DGTL:CMOS,16 X 8 EPROM,PRGM	80009	160–6207–00
A2–1U335	160–6207–01	671–0764–05	671–0764–05	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128–15,PRGM 156–3298–00,DIP28.6	80009	160–6207–01
A2–1U335	160–6207–02	671–0764–06		IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM 156–3298–00,DIP28.6	80009	160–6207–02
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U340	––––– –––––	671–0764–00	671–0764–02	(AVAILABLE WITH TVGF03 KIT ONLY)		
A2–1U340	160–6208–00	671–0764–03	671–0764–04	MICROCKT,DGTL:CMOS,16 X 8 EPROM,PRGM	80009	160–6208–00
A2–1U340	160–6208–01	671–0764–05	671–0764–05	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128–15,PRGM 156–3298–00,DIP28.6	80009	160–6208–01
A2–1U340	160–6208–02	671–0764–06		IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM 156–3298–00,DIP28.6	80009	160–6208–02
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U345	––––– –––––	671–0764–00	671–0764–02	(AVAILABLE WITH TVGF03 KIT ONLY)		
A2–1U345	160–6209–00	671–0764–03	671–0764–04	MICROCKT,DGTL:CMOS,16 X 8 EPROM,PRGM	80009	160–6209–00
A2–1U345	160–6209–01	671–0764–05	671–0764–05	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128–15,PRGM 156–3298–00,DIP28.6	80009	160–6209–01
A2–1U345	160–6209–02	671–0764–06		IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM 156–3298–00,DIP28.6	80009	160–6209–02
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U351	––––– –––––	671–0764–00	671–0764–02	(AVAILABLE WITH TVGF03 KIT ONLY)		
A2–1U351	160–6210–00	671–0764–03	671–0764–04	MICROCKT,DGTL:CMOS,16 X 8 EPROM,PRGM	80009	160–6210–00
A2–1U351	160–6210–01	671–0764–05	671–0764–05	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128–15,PRGM 156–3298–00,DIP28.6	80009	160–6210–01
A2–1U351	160–6210–02	671–0764–06		IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM 156–3298–00,DIP28.6	80009	160–6210–02
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U355	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A2–1U358	156–2520–00			IC,DIGITAL:ASTTL,COUNTER;SYNCH 4–BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2–1U361	160–4634–00			MICROCKT,DGTL:2048 X 8 RGTR PROM,PRGM	80009	160–4634–00
				MOUNTING PARTS		
	136–0925–00			SOCKET,DIP::	91506	224–AG30D
				END MOUNTING PARTS		
A2–1U366	156–1663–00			IC,DIGITAL:FTTL,GATE;TRIPLE 3–INPUT AND;74F11,DIP14.3,TUBE	80009	156–1663–00
A2–1U370	156–2520–00			IC,DIGITAL:ASTTL,COUNTER;SYNCH 4–BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2–1U377	156–0158–07			IC,LINEAR:BIPOLAR,OP–AMP;DUPLICATE OF 156–0158–00,DO NOT USE;MC1458P1,DIP08.3	80009	156–0158–07
A2–1U405	156–1754–01			IC,DIGITAL:ALSTTL,BUFFER/DRIVER;OCTAL NON-INV, 3–STATE;74ALS244,DIP20.3,TUBE	01295	SN74ALS244AN3

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2–1U416	156–0956–02			IC,DIGITAL:LSTTL,BUFFER/DRIVER;DUPLICATE OF 156–0956–00;74LS244,DIP20.3,TUBE	80009	156–0956–02
A2–1U425	156–1704–00			IC,DIGITAL:FTTL,FLIP FLOP;OCTAL D–TYPE, 3–STATE;74F374,DIP20.3,TUBE	80009	156–1704–00
A2–1U428	156–1704–00			IC,DIGITAL:FTTL,FLIP FLOP;OCTAL D–TYPE, 3–STATE;74F374,DIP20.3,TUBE	80009	156–1704–00
A2–1U431	156–1704–00			IC,DIGITAL:FTTL,FLIP FLOP;OCTAL D–TYPE, 3–STATE;74F374,DIP20.3,TUBE	80009	156–1704–00
A2–1U458	156–2520–00			IC,DIGITAL:ASTTL,COUNTER;SYNCH 4–BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2–1U466	156–1911–00			IC,DIGITAL:FTTL,FLIP FLOP;HEX D–TYPE, WITH /MR;74F174,DIP16.3,TUBE	04713	MC74F174S
A2–1U470	156–2520–00			IC,DIGITAL:ASTTL,COUNTER;SYNCH 4–BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2–1U473	156–0530–02			IC,DIGITAL:LSTTL,MUX/ENCODER;DUPLICATE OF 156–0530–00;74LS157,DIP16.3,TUBE	80009	156–0530–02
A2–1U477	156–0465–02			IC,DIGITAL:LSTTL,GATES;DUPLICATE OF 156–0465–00;74LS30,DIP14.3,TUBE	80009	156–0465–02
A2–1U480	156–1639–00			IC,DIGITAL:ECL,FLIP FLOP;DUAL D–TYPE MASTER–SLAVE;10H131,DIP16.3,TUBE	80009	156–1639–00
A2–1U483	156–2289–00			IC,DIGITAL:ECL,TRANSLATOR;QUAD TTL–TO–ECL;10H124,DIP16.3,TUBE	04713	MC10H124P
A2–1U495	156–0158–07			IC,LINEAR:BIPOLAR,OP–AMP;DUPLICATE OF 156–0158–00,DO NOT USE;MC1458P1,DIP08.3	80009	156–0158–07
A2–1U504	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A2–1U507	156–0956–02			IC,DIGITAL:LSTTL,BUFFER/DRIVER;DUPLICATE OF 156–0956–00;74LS244,DIP20.3,TUBE	80009	156–0956–02
A2–1U511	156–1111–02			IC,DIGITAL:LSTTL,TRANSCEIVER;DUPLICATE OF 156–1111–00;74LS245,DIP20.3,TUBE	80009	156–1111–02
A2–1U514	156–1111–02			IC,DIGITAL:LSTTL,TRANSCEIVER;DUPLICATE OF 156–1111–00;74LS245,DIP20.3,TUBE	80009	156–1111–02
A2–1U518	156–1611–00			IC,DIGITAL:FTTL,FLIP FLOP;DUAL D–TYPE;74F74,DIP14.3,TUBE	80009	156–1611–00
A2–1U521	156–1611–00			IC,DIGITAL:FTTL,FLIP FLOP;DUAL D–TYPE;74F74,DIP14.3,TUBE	80009	156–1611–00
A2–1U535	160–5697–00	671–0764–00	671–0764–01	MICROCKT,DGTL:16 X 8 EPROM,PRGM	80009	160–5697–00
A2–1U535	160–5697–01	671–0764–02	671–0764–02	MICROCKT,DGTL:16 X 8 EPROM,PRGM	80009	160–5697–01
A2–1U535	160–6211–00	671–0764–03	671–0764–04	MICROCKT,DGTL:CMOS,16 X 8 EPROM,PRGM	80009	160–6211–00
A2–1U535	160–6211–01	671–0764–05		IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128–15,PRGM 156–3298–00,DIP28.6	80009	160–6211–01
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U540	160–5698–00	671–0764–00	671–0764–01	MICROCKT,DGTL:16 X 8 EPROM,PRGM	80009	160–5698–00
A2–1U540	160–5698–01	671–0764–02	671–0764–02	MICROCKT,DGTL:16 X 8 EPROM,PRGM	80009	160–5698–01
A2–1U540	160–6212–00	671–0764–03	671–0764–04	MICROCKT,DGTL:CMOS,16 X 8 EPROM,PRGM	80009	160–6212–00
A2–1U540	160–6212–01	671–0764–05		IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128–15,PRGM 156–3298–00,DIP28.6	80009	160–6212–01
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U545	160–5699–00	671–0764–00	671–0764–01	MICROCKT,DGTL:16 X 8 EPROM,PRGM	80009	160–5699–00
A2–1U545	160–5699–01	671–0764–02	671–0764–02	MICROCKT,DGTL:16 X 8 EPROM,PRGM	80009	160–5699–01
A2–1U545	160–6213–00	671–0764–03	671–0764–04	MICROCKT,DGTL:CMOS,16 X 8 EPROM,PRGM	80009	160–6213–00
A2–1U545	160–6213–01	671–0764–05		IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128–15,PRGM 156–3298–00,DIP28.6	80009	160–6213–01
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2–1U551	160–5700–00	671–0764–00	671–0764–01	MICROCKT,DGTL:16 X 8 EPROM,PRGM	80009	160–5700–00
A2–1U551	160–5700–01	671–0764–02	671–0764–02	MICROCKT,DGTL:16 X 8 EPROM,PRGM	80009	160–5700–01
A2–1U551	160–6214–00	671–0764–03	671–0764–04	MICROCKT,DGTL:CMOS,16 X 8 EPROM,PRGM	80009	160–6214–00
A2–1U551	160–6214–01	671–0764–05		IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128–15,PRGM 156–3298–00,DIP28.6	80009	160–6214–01
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U555	156–0982–03			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0982–00;74LS374,DIP20.3,TUBE	80009	156–0982–03
A2–1U558	156–0982–03			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0982–00;74LS374,DIP20.3,TUBE	80009	156–0982–03
A2–1U562	160–4629–00	671–0764–00	671–0764–04	MICROCKT,DGTL:NMOS,32768 X EPROM,PRGM	80009	160–4629–00
A2–1U562	160–4629–01	671–0764–05		IC,MEMORY:NMOS,EPROM;32K X 8,300NS;27256–3,PRGM 156–1960–00,DIP28.6	80009	160–4629–01
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U566	156–1707–00			IC,DIGITAL:FTTL,GATE;QUAD 2–INPUT NAND;74F00,DIP14.3,TUBE	80009	156–1707–00
A2–1U570	156–2520–00			IC,DIGITAL:ASTTL,COUNTER;SYNCH 4–BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2–1U571	156–2520–00			IC,DIGITAL:ASTTL,COUNTER;SYNCH 4–BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2–1U574	160–4630–00	671–0764–00	671–0764–03	MICROCKT,DGTL:NMOS,32768 X 8 EPROM,PRGM	80009	160–4630–00
A2–1U574	160–4630–01	671–0764–04		IC,DIGITAL:NMOS,EPROM;32768 X 8 PRGM,W/3 STATE OUT	80009	160–4630–01
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U578	156–0316–04			IC,DIGITAL:ECL,TRANSLATOR;QUAD ECL TO TTL;10125,DIP16.3,TUBE	04713	MC10125P/L
A2–1U582	156–0295–02			IC,DIGITAL:ECL,GATE;TRIPLE 2–INPUT XOR/ XNOR;10107,DIP16.3,TUBE,SCRN	80009	156–0295–02
A2–1U588	156–0860–02			IC,DIGITAL:ECL,RECEIVER;TRIPLE LINE;10116,DIP16.3,TUBE,SCRN	80009	156–0860–02
A2–1U592	156–0860–02			IC,DIGITAL:ECL,RECEIVER;TRIPLE LINE;10116,DIP16.3,TUBE,SCRN	80009	156–0860–02
A2–1U602	156–2520–00			IC,DIGITAL:ASTTL,COUNTER;SYNCH 4–BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2–1U605	156–2331–00			IC,DIGITAL:LSTTL,COUNTER;8–BIT, WITH STORAGE REGISTER, 3–STATE;74LS590,DIP16.3,TUBE	01295	SN74LS590N3
A2–1U609	156–2065–00			IC,DIGITAL:ASTTL,LATCH;OCTAL D–TYPE TRANSPARENT, 3–STATE;74AS373,DIP20.3	01295	SN74AS373N
A2–1U612	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		
A2–1U618	156–1911–00			IC,DIGITAL:FTTL,FLIP FLOP;HEX D–TYPE, WITH /MR;74F174,DIP16.3,TUBE	04713	MC74F174S
A2–1U621	156–1957–00			IC,DIGITAL:FTTL,GATE;DUAL 4–INPUT NAND;74F20,DIP14.3,TUBE	04713	74F20 N
A2–1U625	156–1957–00			IC,DIGITAL:FTTL,GATE;DUAL 4–INPUT NAND;74F20,DIP14.3,TUBE	04713	74F20 N
A2–1U628	160–4636–00			IC,DIGITAL:CMOS,PLD;OTP,20G10,25NS,55MA, PRGM 156–3229–00;20G10–25,DIP24.3	80009	160–4636–00
				MOUNTING PARTS		
	136–0925–00			SOCKET,DIP::	91506	224–AG30D
				END MOUNTING PARTS		

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2–1U631	156–1704–00			IC,DIGITAL:FTTL,FLIP FLOP;OCTAL D–TYPE, 3–STATE;74F374,DIP20.3,TUBE	80009	156–1704–00
A2–1U635	160–5701–00	671–0764–00	671–0764–01	MICROCKT,DGTL:16 X 8 EPROM,PRGM	80009	160–5701–00
A2–1U635	160–5701–01	671–0764–02	671–0764–02	MICROCKT,DGTL:16 X 8 EPROM,PRGM	80009	160–5701–01
A2–1U635	160–6215–00	671–0764–03	671–0764–04	MICROCKT,DGTL:CMOS,16 X 8 EPROM,PRGM	80009	160–6215–00
A2–1U635	160–6215–01	671–0764–05	671–0764–05	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128–15,PRGM 156–3298–00,DIP28.6	80009	160–6215–01
A2–1U635	160–6215–02	671–0764–06		IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM 156–3298–00,DIP28.6	80009	160–6215–02
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U640	160–5702–00	671–0764–00	671–0764–01	MICROCKT,DGTL:16 X 8 EPROM,PRGM	80009	160–5702–00
A2–1U640	160–5702–01	671–0764–02	671–0764–02	MICROCKT,DGTL:16 X 8 EPROM,PRGM	80009	160–5702–01
A2–1U640	160–6216–00	671–0764–03	671–0764–04	MICROCKT,DGTL:CMOS,16 X 8 EPROM,PRGM	80009	160–6216–00
A2–1U640	160–6216–01	671–0764–05	671–0764–05	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128–15,PRGM 156–3298–00,DIP28.6	80009	160–6216–01
A2–1U640	160–6216–02	671–0764–06		IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM 156–3298–00,DIP28.6	80009	160–6216–02
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U645	160–5703–00	671–0764–00	671–0764–02	MICROCKT,DGTL:16 X 8 EPROM,PRGM	80009	160–5703–00
A2–1U645	160–6217–00	671–0764–03	671–0764–04	MICROCKT,DGTL:CMOS,16 X 8 EPROM,PRGM	80009	160–6217–00
A2–1U645	160–6217–01	671–0764–05	671–0764–05	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128–15,PRGM 156–3298–00,DIP28.6	80009	160–6217–01
A2–1U645	160–6217–02	671–0764–06		IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM 156–3298–00,DIP28.6	80009	160–6217–02
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U651	160–5704–00	671–0764–00	671–0764–01	MICROCKT,DGTL:16 X 8 EPROM,PRGM	80009	160–5704–00
A2–1U651	160–5704–01	671–0764–02	671–0764–02	MICROCKT,DGTL:16 X 8 EPROM,PRGM	80009	160–5704–01
A2–1U651	160–6218–00	671–0764–03	671–0764–04	MICROCKT,DGTL:CMOS,16 X 8 EPROM,PRGM	80009	160–6218–00
A2–1U651	160–6218–01	671–0764–05	671–0764–05	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128–15,PRGM 156–3298–00,DIP28.6	80009	160–6218–01
A2–1U651	160–6218–02	671–0764–06		IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM 156–3298–00,DIP28.6	80009	160–6218–02
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U655	156–0982–03			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0982–00;74LS374,DIP20.3,TUBE	80009	156–0982–03
A2–1U658	156–0982–03			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0982–00;74LS374,DIP20.3,TUBE	80009	156–0982–03
A2–1U661	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A2–1U666	156–0982–03			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0982–00;74LS374,DIP20.3,TUBE	80009	156–0982–03
A2–1U670	156–0982–03			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0982–00;74LS374,DIP20.3,TUBE	80009	156–0982–03
A2–1U676	156–3050–00			IC,MISC:	80009	156–3050–00
A2–1U679	160–4631–00	671–0764–00	671–0764–07	MICROCKT,DGTL:10 LOW OUT,ARRAY LOG- IC,PRGM	80009	160–4631–00
A2–1U679	160–4631–01	671–0764–07		IC,DIGITAL:CMOS,PLD;EEPLD,22V10,25NS, 33.3MHZ,90MA,PRGM 156–3784–00;22V10–25, DIP24.3,TUBE	80009	160–4631–01
				MOUNTING PARTS		
	136–0925–00			SOCKET,DIP::	91506	224–AG30D
				END MOUNTING PARTS		

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2–1U683	156–2626–00			IC,DIGITAL:ALSTTL,GATE;QUAD 2–INPUT NAND, OC;74ALS03,DIP14.3,TUBE	01295	74ALS03
A2–1U687	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		
A2–1U691	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		
A2–1U696	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		
A2–1U702	156–2520–00			IC,DIGITAL:ASTTL,COUNTER;SYNCH 4–BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2–1U705	160–3718–01			IC,DIGITAL:CMOS,PLD;OTP,20G10,25NS,55MA, PRGM 156–3229–00;20G10–25,DIP24.3	80009	160–3718–01
				MOUNTING PARTS		
	136–0925–00			SOCKET,DIP::	91506	224–AG30D
				END MOUNTING PARTS		
A2–1U709	160–4422–00			IC,DIGITAL:CMOS,PLD;EEPLD,16V8,25NS,90MA, PRGM 156–2983–00;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		
A2–1U712	156–2065–00			IC,DIGITAL:ASTTL,LATCH;OCTAL D–TYPE TRANS-PARENT, 3–STATE;74AS373,DIP20.3	01295	SN74AS373N
A2–1U718	156–1642–00			IC,DIGITAL:ECL,GATE;TRIPLE 2–3–2–INPUT OR/ NOR;10H105,DIP16.3	80009	156–1642–00
A2–1U721	160–4628–00	671–0764–00	671–0764–03	MICROCKT,DGTL:STTL,2048 X 4 PROM,PRGM	80009	160–4628–00
A2–1U721	160–4628–01	671–0764–04		IC,DIGITAL:STTL,PROM;2048 X 4,PRGM,82S185,DIP18	80009	160–4628–01
				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		
A2–1U725	156–1724–00			IC,DIGITAL:FTTL,GATES;QUAD 2–INPUT OR;74F32,DIP14.3,TUBE	04713	MC74F32ND
A2–1U728	156–1752–00			IC,DIGITAL:FTTL,GATE;TRIPLE 3–INPUT NAND;74F10,DIP14.3,TUBE	04713	MC 74F10N
A2–1U770	156–1723–00			IC,DIGITAL:FTTL,GATE;QUAD 2–INPUT AND;74F08,DIP14.3,TUBE	04713	MC74F08N
A2–1U773	156–2338–00			IC,DIGITAL:ASTTL,FLIP FLOP;DUAL D–TYPE;74AS74,DIP14.3,TUBE	80009	156–2338–00
A2–1U802	156–2520–00			IC,DIGITAL:ASTTL,COUNTER;SYNCH 4–BIT BINARY;74AS163,DIP16.3,TUBE	01295	SN74AS163N3ORJ4
A2–1U805	156–0067–13			IC,LINEAR:	80009	156–0067–13
A2–1U815	156–2487–00			IC,CONVERTER: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		
A2–1U818	156–2289–00			IC,DIGITAL:ECL,TRANSLATOR;QUAD TTL–TO–ECL;10H124,DIP16.3,TUBE	04713	MC10H124P

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2–1U821	156–2289–00			IC,DIGITAL:ECL,TRANSLATOR;QUAD TTL–TO–ECL;10H124,DIP16.3,TUBE	04713	MC10H124P
A2–1U825	156–2289–00			IC,DIGITAL:ECL,TRANSLATOR;QUAD TTL–TO–ECL;10H124,DIP16.3,TUBE	04713	MC10H124P
A2–1U828	156–2289–00			IC,DIGITAL:ECL,TRANSLATOR;QUAD TTL–TO–ECL;10H124,DIP16.3,TUBE	04713	MC10H124P
A2–1U831	156–1704–00			IC,DIGITAL:FTTL,FLIP FLOP;OCTAL D–TYPE, 3–STATE;74F374,DIP20.3,TUBE	80009	156–1704–00
A2–1U835	160–5707–00	671–0764–00	671–0764–01	MICROCKT,DGTL:2048 X 8 REG PROM,PRGM	80009	160–5707–00
A2–1U835	160–5707–01	671–0764–02	671–0764–02	MICROCKT,DGTL:2048 X 8 REG,PROM,PRGM	80009	160–5707–01
A2–1U835	160–6219–00	671–0764–03	671–0764–04	MICROCKT,DGTL:CMOS,16 X 8 EPROM,PRGM	80009	160–6219–00
A2–1U835	160–6219–01	671–0764–05	671–0764–05	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128–15,PRGM 156–3298–00,DIP28.6	80009	160–6219–01
A2–1U835	160–6219–02	671–0764–06		IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM 156–3298–00,DIP28.6	80009	160–6219–02
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U840	160–5708–00	671–0764–00	671–0764–01	MICROCKT,DGTL:2048 X 8 PROM,PRGM	80009	160–5708–00
A2–1U840	160–5708–01	671–0764–02	671–0764–02	MICROCKT,DGTL:2048 X 8 REG,PROM,PRGM	80009	160–5708–01
A2–1U840	160–6220–00	671–0764–03	671–0764–04	MICROCKT,DGTL:CMOS,16 X 8 EPROM,PRGM	80009	160–6220–00
A2–1U840	160–6220–01	671–0764–05	671–0764–05	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128–15,PRGM 156–3298–00,DIP28.6	80009	160–6220–01
A2–1U840	160–6220–02	671–0764–06		IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM 156–3298–00,DIP28.6	80009	160–6220–02
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U845	160–5709–00	671–0764–00	671–0764–01	MICROCKT,DGTL:2048 X 8 REG PROM,PRGM	80009	160–5709–00
A2–1U845	160–5709–01	671–0764–02	671–0764–02	MICROCKT,DGTL:2048 X 8 REG,PROM,PRGM	80009	160–5709–01
A2–1U845	160–6221–00	671–0764–03	671–0764–04	MICROCKT,DGTL:CMOS,16 X 8 EPROM,PRGM	80009	160–6221–00
A2–1U845	160–6221–01	671–0764–05	671–0764–05	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128–15,PRGM 156–3298–00,DIP28.6	80009	160–6221–01
A2–1U845	160–6221–02	671–0764–06		IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM 156–3298–00,DIP28.6	80009	160–6221–02
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U851	160–5710–00	671–0764–00	671–0764–01	MICROCKT,DGTL:2048 X 8 REG PROM,PRGM	80009	160–5710–00
A2–1U851	160–5710–01	671–0764–02	671–0764–02	MICROCKT,DGTL:2048 X 8 REG,PROM,PRGM	80009	160–5710–01
A2–1U851	160–6222–00	671–0764–03	671–0764–04	MICROCKT,DGTL:CMOS,16 X 8 EPROM,PRGM	80009	160–6222–00
A2–1U851	160–6222–01	671–0764–05	671–0764–05	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128–15,PRGM 156–3298–00,DIP28.6	80009	160–6222–01
A2–1U851	160–6222–02	671–0764–06		IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM 156–3298–00,DIP28.6	80009	160–6222–02
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U855	156–0982–03			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0982–00;74LS374,DIP20.3,TUBE	80009	156–0982–03
A2–1U858	156–0982–03			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0982–00;74LS374,DIP20.3,TUBE	80009	156–0982–03
A2–1U862	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A2–1U865	156–1722–00			IC,DIGITAL:FTTL,GATE;HEX INV;74F04,DIP14.3,TUBE	04713	MC74F04ND
A2–1U870	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

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
				END MOUNTING PARTS		
A2–1U875	156–0983–03			IC,PROCESSOR:NMOS,MICROPROCES-SOR;8–BIT;Z80B,DIP40.6	56708	Z80BCPUDS
				MOUNTING PARTS		
	136–0757–00			SOCKET,DIP:	09922	DILB40P–108
				END MOUNTING PARTS		
A2–1U881	160–4632–00	671–0764–00	671–0764–00	MICROCKT,DGTL:NMOS,65536 X 8 PROM,PRGM	80009	160–4632–00
A2–1U881	160–4632–01	671–0764–01	671–0764–04	MICROCKT,DGTL:STTL,LOGIC ARRAY,PRGM	80009	160–4632–01
A2–1U881	160–4632–02	671–0764–05	671–0764–06	IC,MEMORY:NMOS,EPROM;32K X 8,300NS;27256–3,PRGM 156–1960–00,DIP28.6	80009	160–4632–02
A2–1U881	160–4632–03	671–0764–07		IC,MEMORY:NMOS,EPROM;32K X 8,300NS;27256–3,PRGM 156–1960–00,DIP28.6	80009	160–4632–03
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A2–1U887	156–1632–00			MICROCKT,DGTL:CMOS,2048 X 8 SRAM	80009	156–1632–00
				MOUNTING PARTS		
	136–0751–00			SOCKET DIP::	09922	DILB24P108
				END MOUNTING PARTS		
A2–1U891	160–5993–00	671–0764–00	671–0764–04	MICROCKT,DGTL:CMOS,1024 X 8 PROM,PRGM	80009	160–5993–00
A2–1U891	160–5993–01	671–0764–05		IC,DIGITAL:CMOS,PROM;1024 X 8,PRGM 156–2951–XX,7C281–45,DIP24	80009	160–5993–01
				MOUNTING PARTS		
	136–0925–00			SOCKET,DIP::	91506	224–AG30D
				END MOUNTING PARTS		
A2–1U896	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		
A2–1U912	156–1173–00			IC,LINEAR:BIPOLAR,VOLTAGE REFERENCE;POS-ITIVE,2.5V,1.0%,40PPM,SERIES;MC1403U,DIP08.3	80009	156–1173–00
A2–1U966	156–0316–04			IC,DIGITAL:ECL,TRANSLATOR;QUAD ECL TO TTL;10125,DIP16.3,TUBE	04713	MC10125P/L
A2–2	119–2323–02	B010100	B010224	OVEN ASSEMBLY:	80009	119–2323–02
A2–2	119–2323–03	B010225		OVEN ASSEMBLY:TSG300	80009	119–2323–03
				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
	211–0661–00			SCR,ASSEM WSHR:4–40 X 0.25,PNH,STL,CD PL,POZ,MACHINE (QUANTITY 2)	01536	821–01655–024
	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	119–2323–02		CAP,FXD,CER DI:220PF,5%,50V	80009	283–5025–00
A2–2C8	283–5025–00			CAP,FXD,CER DI:220PF,5%,50V	80009	283–5025–00
A2–2C15	283–5000–00	119–2323–02		CAP,FXD,CERAMIC:MLC;10PF,5%,50V,NPO, 1206;SMD,8MM 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,CERAMIC: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

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A2–2CR14	152–0269–01			DIODE,SIG:,VVC;C4=33PF,5%,C4/C20=2;SMV1263–1,DO–7,T&R	04713	SMV1263–1
A2–2P12	131–2002–00			CONN,BOX::	TK1483	TKO–05254–103
A2–2Q10	151–5001–00	119–2323–02	119–2323–02	TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AMPLIFIER;MMBT3904L,TO–236/SOT–23, 8MM T&R	80009	151–5001–00
A2–2Q10	151–5035–00	119–2323–03		TRANSISTOR,SIG:BIPOLAR,NPN;25V,30MA, 650MHZ,AMPLIFIER;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	671–0765–00	B010100	B010213	CIRCUIT BD ASSY:OUTPUT	80009	671–0765–00
A3	671–0765–01	B010214	B010456	CIRCUIT BD ASSY:OUTPUT	80009	671–0765–01
A3	671–0765–02	B010457		CIRCUIT BD ASSY:OUTPUT	80009	671–0765–02
A3C130	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C140	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C150	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C160	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C170	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C210	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C215	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C223	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C240	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C260	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C270	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C275	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C280	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C285	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C310	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C313	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C322	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C324	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C325	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C340	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C350	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C360	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C370	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C382	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C384	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C386	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C388	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C392	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C394	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C396	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C398	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C410	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C425	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C432	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C434	283–0780–00			CAP,FXD,MICA DI:125PF,1%,500V	00853	D155F1250F0
A3C435	283–0775–00			CAP,FXD,MICA DI:1764 PF,1%,500V	80009	283–0775–00
A3C440	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C442	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A3C445	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C450	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C460	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C480	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C510	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C513	283–0672–00			CAP,FXD,MICA DI:200PF,1%,500V	80009	283–0672–00
A3C515	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C524	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C528	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C530	283–0644–00			CAP,FXD,MICA DI:150PF,1%,500V	80009	283–0644–00
A3C533	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C534	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C537	283–0625–00			CAP,FXD,MICA DI:220PF,1%,500V	80009	283–0625–00
A3C538	283–0638–00			CAP,FXD,MICA DI:130PF,1%,500V	80009	283–0638–00
A3C540	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C545	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C550	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C560	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C570	283–0615–00			CAP,FXD,MICA DI:33PF,5%,500V	80009	283–0615–00
A3C572	283–0779–00	671–0765–00	671–0765–01	CAP,FXD,MICA DI:27 PF,2%,500V	80009	283–0779–00
A3C572	283–0636–01	671–0765–02		CAP,FXD,MICA DI:36PF,1.%,500V,TAPE & AMMO PACK	80009	283–0636–01
A3C573	283–0644–00			CAP,FXD,MICA DI:150PF,1%,500V	80009	283–0644–00
A3C575	281–0284–00			CAP,VAR,CER DI:2.2–34PF,250V	80009	281–0284–00
A3C580	281–0284–00			CAP,VAR,CER DI:2.2–34PF,250V	80009	281–0284–00
A3C585	281–0284–00			CAP,VAR,CER DI:2.2–34PF,250V	80009	281–0284–00
A3C615	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C619	283–0615–00			CAP,FXD,MICA DI:33PF,5%,500V	80009	283–0615–00
A3C634	283–0688–00			CAP,FXD,MICA DI:464PF,1%,300V	80009	283–0688–00
A3C635	283–0631–00			CAP,FXD,MICA DI:95PF,1%,500V	80009	283–0631–00
A3C636	283–0596–00			CAP,FXD,MICA DI:528PF,1%,300V	80009	283–0596–00
A3C637	283–0784–00			CAP,FXD,MICA DI:40PF,2%,500V	80009	283–0784–00
A3C638	281–0153–00			CAP,VAR,AIR DI:1.7–10PF,250V	80009	281–0153–00
A3C645	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C648	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C650	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C655	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C660	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C670	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C682	283–0648–00			CAP,FXD,MICA DI:10PF,+/–0.5PF,500V	80009	283–0648–00
A3C684	283–0768–00			CAP,FXD,MICA DI:132 PF,1%,500V	80009	283–0768–00
A3C686	283–0648–00			CAP,FXD,MICA DI:10PF,+/–0.5PF,500V	80009	283–0648–00
A3C710	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C712	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C715	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C718	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C730	283–0788–00			CAP,FXD,MICA DI:267PF,1%,500V	80009	283–0788–00
A3C731	281–0810–00			CAP,FXD,CERAMIC:MLC;5.6PF,+/–0.5PF,100V, 0.100 X 0.170;AXIAL,MI	04222	SA101A5R6DAA
A3C735	281–0810–00			CAP,FXD,CERAMIC:MLC;5.6PF,+/–0.5PF,100V, 0.100 X 0.170;AXIAL,MI	04222	SA101A5R6DAA
A3C739	283–0631–00			CAP,FXD,MICA DI:95PF,1%,500V	80009	283–0631–00
A3C740	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C750	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C755	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C760	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C770	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C780	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
A3C810	283–0051–00			CAP,FXD,CER DI:0.0033UF,5%,100V	80009	283–0051–00
A3C811	283–0594–00			CAP,FXD,MICA DI:0.001UF,1%,100V	80009	283–0594–00
A3C817	283–0223–00			CAP,FXD,CER DI:3PF,+/–5PF,50V	TK1134	835XXXCOJO309D
A3C818	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C822	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C824	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C828	283–0648–00			CAP,FXD,MICA DI:10PF,+/–0.5PF,500V	80009	283–0648–00
A3C830	283–0631–00			CAP,FXD,MICA DI:95PF,1%,500V	80009	283–0631–00
A3C838	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C839	283–0648–00			CAP,FXD,MICA DI:10PF,+/–0.5PF,500V	80009	283–0648–00
A3C840	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C850	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C856	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C860	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C870	281–0775–01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C918	290–0990–00			CAP,FXD,ELCTLT:10UF,20%,50V	24165	502D437
A3C922	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C926	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C930	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C935	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C950	290–0973–00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3CR270	152–0141–02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO–35,T&R	80009	152–0141–02
A3CR275	152–0141–02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO–35,T&R	80009	152–0141–02
A3CR325	152–0322–00			DIODE,SIG:SCHTKY,;15V,410MVF AT 1MA,1.2PF;5082–2811,T&R	80009	152–0322–00
A3CR610	152–0141–02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO–35,T&R	80009	152–0141–02
A3CR616	152–0141–02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO–35,T&R	80009	152–0141–02
A3CR618	152–0141–02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO–35,T&R	80009	152–0141–02
A3J335	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131–0608–00
A3J380	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 4)	80009	131–0608–00
A3J480	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 26)	80009	131–0608–00
A3J510	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131–0608–00
A3J660	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131–0608–00
A3J920	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 20)	80009	131–0608–00
A3J940	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 26)	80009	131–0608–00
A3J960	131–0608–00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 26)	80009	131–0608–00
A3K380	148–0079–00			RELAY,REED:2 FORM A,COIL 5 VDC 200 OHM, CONTACTS 28 VDC 110 MA	80009	148–0079–00
A3K480	148–0079–00			RELAY,REED:2 FORM A,COIL 5 VDC 200 OHM, CONTACTS 28 VDC 110 MA	80009	148–0079–00
A3L420	114–0411–00			COIL,RF:VARIABLE,0.9UH–1.0UH	80009	114–0411–00
A3L475	108–0734–00			COIL,RF:FIXED,163NH	TK1345	108–0734–00
A3L530	120–1180–00			TRANSFORMER,RF:VARIABLE	80009	120–1180–00
A3L535	114–0364–00			COIL,RF:VARIABLE,1.42–1.68UH	80009	114–0364–00
A3L630	114–0366–00			COIL,RF:VARIABLE,2.40–2.70UH,Q MIN 190 @ 2.6 UH, POT CORE	54937	114–0366–00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A3L635	114–0366–00			COIL,RF:VARIABLE,2.40–2.70UH,Q MIN 190 @ 2.6 UH, POT CORE	54937	114–0366–00
A3L685	108–0734–00			COIL,RF:FIXED,163NH	TK1345	108–0734–00
A3P130	131–3693–00			CONN,DIN:PCB,;FEMALE,RTANG,3 X 32,0.1 CTR,0.504 MLG X 0.104 TAIL,W/BD RETENTION;,,	80009	131–3693–00
				MOUNTING PARTS		
	210–0405–00			NUT,PLAIN,HEX:2–56 X 0.188,BRS CD PL	73743	12157–50
	211–0185–00			SCREW,MACHINE:2–56 X 0.438,PNH,STL	TK0435	ORDER BY DESCR
				END MOUNTING PARTS		
A3P335	131–0993–02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1–850100–O
A3P380	131–0993–05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100–5
A3P510	131–0993–02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1–850100–O
A3P660	131–0993–05			BUS,CONDUCTOR:SHUNT ASSEMBLY,GREEN	00779	850100–5
A3Q270	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AMPLIFIER;2N3904,TO–92 EBC	80009	151–0190–00
A3Q275	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AMPLIFIER;2N3904,TO–92 EBC	80009	151–0190–00
A3Q615	151–0220–00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA, 400MHZ,AMPLIFIER;2N3906(SEL),TO–92 EBC	80009	151–0220–00
A3Q730	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AMPLIFIER;2N3904,TO–92 EBC	80009	151–0190–00
A3Q735	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AMPLIFIER;2N3904,TO–92 EBC	80009	151–0190–00
A3Q810	151–0254–00			TRANSISTOR,SIG:BIPOLAR,NPN;30V,500MA, 125MHZ,AMPLIFIER,DARLINGTON;MPSA14,TO–92 EBC	80009	151–0254–00
A3Q813	151–0220–00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA, 400MHZ,AMPLIFIER;2N3906(SEL),TO–92 EBC	80009	151–0220–00
A3Q815	151–0367–01			TRANSISTOR:SELECTED	TK0040	151–0367–01
A3Q830	151–0220–00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA, 400MHZ,AMPLIFIER;2N3906(SEL),TO–92 EBC	80009	151–0220–00
A3Q835	151–0220–00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA, 400MHZ,AMPLIFIER;2N3906(SEL),TO–92 EBC	80009	151–0220–00
A3Q838	151–0103–02			TRANSISTOR,SIG:BIPOLAR,NPN;DUPLICATE OF 151–0103–00,DO NOT USE;2N2219A,TO–39	80009	151–0103–02
A3Q910	151–0367–01			TRANSISTOR:SELECTED	TK0040	151–0367–01
A3Q915	151–0367–01			TRANSISTOR:SELECTED	TK0040	151–0367–01
A3R170	315–0102–00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315–0102–00
A3R172	315–0102–00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315–0102–00
A3R173	315–0272–00			RES,FXD,FILM:2.7K OHM,5%,0.25W	80009	315–0272–00
A3R322	321–0793–07			RES,FXD,FILM:37.5 OHM 0.1%,0.125W TC=T9	24546	NE55E37R5B
A3R324	322–3207–00			RES,FXD,FILM:1.4K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K4
A3R340	315–0102–00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315–0102–00
A3R370	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R410	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
A3R412	321–0347–00			RES,FXD,FILM:40.2K OHM,1%,0.125W,TC=T0	80009	321–0347–00
A3R417	307–0540–00			RES NTWK,FXD,FI:(5)1K OHM,2%,0.7W	91637	CSC06A–01–102G
A3R432	307–0110–00			RES,FXD,CMPSN:3 OHM,5%,0.25W	80009	307–0110–00
A3R433	321–0793–07			RES,FXD,FILM:37.5 OHM 0.1%,0.125W TC=T9	24546	NE55E37R5B
A3R434	322–3085–00			RES,FXD:METAL FILM;75 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 75E0
A3R440	315–0150–00			RES,FXD,FILM:15 OHM,5%,0.25W	80009	315–0150–00
A3R442	307–0110–00			RES,FXD,CMPSN:3 OHM,5%,0.25W	80009	307–0110–00
A3R475	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R476	322–3110–00			RES,FXD,FILM:137 OHM,1%,0.2W,TC=T0	91637	CCF50–2G137R0F
A3R478	322–3110–00			RES,FXD,FILM:137 OHM,1%,0.2W,TC=T0	91637	CCF50–2G137R0F
A3R480	307–0650–00			RES NTWK,FXD,FI:9,2.7K OHM,5%,0.150W	11236	750–101–R2.7K

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A3R515	315–0163–00			RES,FXD,FILM:16K OHM,5%,0.25W	80009	315–0163–00
A3R530	322–3213–00			RES,FXD,FILM:1.62K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K62
A3R532	322–3213–00			RES,FXD,FILM:1.62K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K62
A3R534	322–3193–00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A3R536	322–3126–00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	80009	322–3126–00
A3R538	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
A3R560	315–0102–00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315–0102–00
A3R611	315–0203–00			RES,FXD,FILM:20K OHM,5%,0.25W	80009	315–0203–00
A3R612	315–0302–00			RES,FXD,FILM:3K OHM,5%,0.25W	80009	315–0302–00
A3R613	315–0202–00			RES,FXD,FILM:2K OHM,5%,0.25W	80009	315–0202–00
A3R614	315–0150–00			RES,FXD,FILM:15 OHM,5%,0.25W	80009	315–0150–00
A3R615	315–0103–00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315–0103–00
A3R616	322–3289–00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322–3289–00
A3R617	322–3260–00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 4K99
A3R618	321–0348–00			RES,FXD,FILM:41.2K OHM,1%,0.125W,TC=T0	80009	321–0348–00
A3R638	311–0644–00			RES,VAR,NONWW:TRMR,20K OHM,0.5W	80009	311–0644–00
A3R640	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R645	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R650	315–0511–00			RES,FXD,FILM:510 OHM,5%,0.25W	80009	315–0511–00
A3R660	315–0272–00			RES,FXD,FILM:2.7K OHM,5%,0.25W	80009	315–0272–00
A3R670	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R672	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R675	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R687	322–3110–00			RES,FXD,FILM:137 OHM,1%,0.2W,TC=T0	91637	CCF50–2G137R0F
A3R688	322–3110–00			RES,FXD,FILM:137 OHM,1%,0.2W,TC=T0	91637	CCF50–2G137R0F
A3R710	322–3289–00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322–3289–00
A3R711	322–3193–00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A3R712	322–3250–00			RES,FXD:METAL FILM;3.92K OHM,1%,0.2W, TC=100 PPM;AXIAL,T&R,SMALL BODY	91637	CCF50–2F39200F
A3R713	322–3193–00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A3R714	315–0511–00			RES,FXD,FILM:510 OHM,5%,0.25W	80009	315–0511–00
A3R715	322–3126–00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	80009	322–3126–00
A3R717	322–3289–00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322–3289–00
A3R718	322–3126–00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	80009	322–3126–00
A3R730	321–0076–00			RES,FXD,FILM:60.4 OHM,1%,0.125W,TC=T0	80009	321–0076–00
A3R731	321–0018–00			RES,FXD,FILM:15.0 OHM,1%,0.125W,TC=T0	80009	321–0018–00
A3R732	322–3373–00			RES,FXD,FILM:75K OHM,1%,0.2W,TC=T0	80009	322–3373–00
A3R733	322–3221–00			RES,FXD,FILM:1.96K OHM,1%,0.2W,TC=T0	91637	CCF50–2F19600F
A3R734	322–3097–00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 100E
A3R735	322–3193–00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A3R736	322–3193–00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A3R737	322–3193–00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A3R738	322–3216–00			RES,FXD,FILM:1.74K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K74
A3R739	315–0242–00			RES,FXD,FILM:2.4K OHM,5%,0.25W	80009	315–0242–00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A3R740	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R742	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R744	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R745	307–0841–00			RES NTWK,FXD,FI:(4)10 OHM,10%,0.3W	91637	CSC08A–03–100G
A3R750	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R752	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R754	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R755	307–0841–00			RES NTWK,FXD,FI:(4)10 OHM,10%,0.3W	91637	CSC08A–03–100G
A3R756	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R760	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R762	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R764	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R765	307–0841–00			RES NTWK,FXD,FI:(4)10 OHM,10%,0.3W	91637	CSC08A–03–100G
A3R766	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R767	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R768	307–0841–00			RES NTWK,FXD,FI:(4)10 OHM,10%,0.3W	91637	CSC08A–03–100G
A3R770	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R772	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R774	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R775	307–0841–00			RES NTWK,FXD,FI:(4)10 OHM,10%,0.3W	91637	CSC08A–03–100G
A3R780	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R811	315–0106–00			RES,FXD,FILM:10M OHM,5%,0.25W	01121	CB1065
A3R813	315–0103–00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315–0103–00
A3R814	315–0111–00			RES,FXD,FILM:110 OHM,5%,0.25W	80009	315–0111–00
A3R815	322–3207–00			RES,FXD,FILM:1.4K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K4
A3R816	322–3126–00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	80009	322–3126–00
A3R817	322–3264–00			RES,FXD,FILM:5.49K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 5K49
A3R818	315–0150–00			RES,FXD,FILM:15 OHM,5%,0.25W	80009	315–0150–00
A3R819	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
A3R830	311–0634–00			RES,VAR,NONWW:TRMR,500 OHM,0.5W	80009	311–0634–00
A3R831	315–0150–00			RES,FXD,FILM:15 OHM,5%,0.25W	80009	315–0150–00
A3R832	315–0150–00			RES,FXD,FILM:15 OHM,5%,0.25W	80009	315–0150–00
A3R833	315–0242–00			RES,FXD,FILM:2.4K OHM,5%,0.25W	80009	315–0242–00
A3R834	315–0150–00			RES,FXD,FILM:15 OHM,5%,0.25W	80009	315–0150–00
A3R836	322–3132–00			RES,FXD,FILM:232 OHM,1%,0.2W,TC=T0	80009	322–3132–00
A3R837	322–3085–00			RES,FXD:METAL FILM;75 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 75E0
A3R838	315–0221–00			RES,FXD,FILM:220 OHM,5%,0.25W	80009	315–0221–00
A3R839	322–3085–00			RES,FXD:METAL FILM;75 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 75E0
A3R842	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A3R844	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R845	307–0841–00			RES NTWK,FXD,FI:(4)10 OHM,10%,0.3W	91637	CSC08A–03–100G
A3R852	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R854	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R855	307–0841–00			RES NTWK,FXD,FI:(4)10 OHM,10%,0.3W	91637	CSC08A–03–100G
A3R862	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R864	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R865	307–0841–00			RES NTWK,FXD,FI:(4)10 OHM,10%,0.3W	91637	CSC08A–03–100G
A3R866	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R867	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R868	307–0841–00			RES NTWK,FXD,FI:(4)10 OHM,10%,0.3W	91637	CSC08A–03–100G
A3R872	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R874	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R875	307–0841–00			RES NTWK,FXD,FI:(4)10 OHM,10%,0.3W	91637	CSC08A–03–100G
A3R912	321–0644–00			RES,FXD,FILM:100K OHM,0.25%,0.125W,TC=T9	80009	321–0644–00
A3R913	321–0340–00			RES,FXD,FILM:34.0K OHM,1%,0.125W,TC=T0	80009	321–0340–00
A3R914	322–3222–00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 2K00
A3R915	322–3222–00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 2K00
A3R916	322–3294–00			RES,FXD,FILM:11.3K OHM,1%,0.2W,TC=T0	80009	322–3294–00
A3R918	322–3306–00			RES,FXD:METAL FILM;15K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 15K0
A3R934	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3R936	307–1318–00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307–1318–00
A3TP110	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A3TP115	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A3TP140	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A3TP145	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A3TP160	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A3TP190	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A3TP325	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A3TP410	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A3TP420	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A3TP540	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A3TP545	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A3TP625	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A3TP660	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A3TP720	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A3TP780	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A3TP935	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A3TP950	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL-LAR	26364	104–01–02
A3U180	156–1998–00			IC,DIGITAL:ALSTTL,FLIP FLOP;OCTAL D–TYPE, W/CLEAR;74ALS273,DIP20.3	01295	SN74ALS273
A3U220	156–1911–00			IC,DIGITAL:FTTL,FLIP FLOP;HEX D–TYPE, WITH /MR;74F174,DIP16.3,TUBE	04713	MC74F174S
A3U225	156–1911–00			IC,DIGITAL:FTTL,FLIP FLOP;HEX D–TYPE, WITH /MR;74F174,DIP16.3,TUBE	04713	MC74F174S
A3U230	160–5866–00			MICROCKT,DGTL:NMOS,131072 X 8 EPROM,PRGM	80009	160–5866–00
				MOUNTING PARTS		
	136–0963–00			SKT,PL–IN ELEK:MICROCKT,32 PIN	00779	2–644018–3
				END MOUNTING PARTS		
A3U240	160–5868–00			MICROCKT,DGTL:CMOS,1K X 8 REG PROM,PRGM	80009	160–5868–00
				MOUNTING PARTS		
	136–0925–00			SOCKET,DIP::	91506	224–AG30D
				END MOUNTING PARTS		
A3U245	160–5869–00			MICROCKT,DGTL:NMOS,131072 X 8 EPROM,PRGM	80009	160–5869–00
				MOUNTING PARTS		
	136–0963–00			SKT,PL–IN ELEK:MICROCKT,32 PIN	00779	2–644018–3
				END MOUNTING PARTS		
A3U260	156–1722–00			IC,DIGITAL:FTTL,GATE;HEX INV;74F04,DIP14.3,TUBE	04713	MC74F04ND
A3U280	156–0956–02			IC,DIGITAL:LSTTL,BUFFER/DRIVER;DUPLICATE OF 156–0956–00;74LS244,DIP20.3,TUBE	80009	156–0956–02
A3U285	156–0956–02			IC,DIGITAL:LSTTL,BUFFER/DRIVER;DUPLICATE OF 156–0956–00;74LS244,DIP20.3,TUBE	80009	156–0956–02
A3U290	156–0956–02			IC,DIGITAL:LSTTL,BUFFER/DRIVER;DUPLICATE OF 156–0956–00;74LS244,DIP20.3,TUBE	80009	156–0956–02
A3U295	156–0956–02			IC,DIGITAL:LSTTL,BUFFER/DRIVER;DUPLICATE OF 156–0956–00;74LS244,DIP20.3,TUBE	80009	156–0956–02
A3U310	156–0784–02			IC,DIGITAL:LSTTL,COUNTER;DUPLICATE OF 156–0784–00;74LS163,DIP16.3,TUBE	80009	156–0784–02
A3U315	156–1367–00			IC,CONVERTER:CMOS,D/A;8 BIT,400NS,CUR-RENT OUT,MPU COMPATIBLE,MULTIPLY-ING;AD7524JN,DIP16.3	80009	156–1367–00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A3U325	156–0158–07			IC,LINEAR:BIPOLAR,OP–AMP;DUPLICATE OF 156–0158–00,DO NOT USE;MC1458P1,DIP08.3	80009	156–0158–07
A3U330	160–5867–00			MICROCKT,DGTL:NMOS,65536 X 8 EPROM,PRGM	80009	160–5867–00
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A3U350	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A3U360	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A3U430	156–3548–00			IC,CONVERTER:BIPOLAR,D/A;12 BIT,20MHZ,4 LSB,CURRENT OUT,LATCHED;TDC1012N7C, DIP24.6	80009	156–3548–00
				MOUNTING PARTS		
	136–0751–00			SOCKET DIP::	09922	DILB24P108
				END MOUNTING PARTS		
A3U440	156–1704–00			IC,DIGITAL:FTTL,FLIP FLOP;OCTAL D–TYPE, 3–STATE;74F374,DIP20.3,TUBE	80009	156–1704–00
A3U450	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A3U460	156–0865–02			IC,DIGITAL:LSTTL,FLIP FLOP;DUPLICATE OF 156–0865–00;74LS273,DIP20.3,TUBE	80009	156–0865–02
A3U475	156–1640–00			IC,DIGITAL:ECL,RECEIVER;TRIPLE LINE;10H116,DIP16.3,TUBE	80009	156–1640–00
A3U510	156–1324–00			IC,LINEAR:BIPOLAR,COMPARATOR;TTL,20NS, COMPLEMENTARY OUTPUT,W/STROBES;LM361N, DIP14.3	27014	LM361N/GLAA054
A3U515	156–1335–00			IC,DIGITAL:LSTTL,MULTIVIBRATOR;DUAL RETRIG MONOSTABLE;96LS02,DIP16.3	80009	156–1335–00
A3U550	160–5933–00			MICROCKT,DGTL:CMOS,32768 X 8,12NS,PRGM	80009	160–5933–00
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A3U560	160–5934–00			MICROCKT,DGTL:CMOS,32768 X 8,12NS,PRGM	80009	160–5934–00
				MOUNTING PARTS		
	136–0755–00			SOCKET,DIP:	09922	DILB28P–108
				END MOUNTING PARTS		
A3U620	156–1173–00			IC,LINEAR:BIPOLAR,VOLTAGE REFERENCE;POS- ITIVE,2.5V,1.0%,40PPM,SERIES;MC1403U,DIP08.3	80009	156–1173–00
A3U630	156–3019–00			IC,LINEAR:BIPOLAR,VOLTAGE REF- ERENCE;1.235V,1.0%,150PPM,SHUNT,MICRO- POWER;LM385BZ–1.2,TO–92	27014	LM385BZ–1.2
A3U645	156–1639–00			IC,DIGITAL:ECL,FLIP FLOP;DUAL D–TYPE MAS- TER–SLAVE;10H131,DIP16.3,TUBE	80009	156–1639–00
A3U650	156–1639–00			IC,DIGITAL:ECL,FLIP FLOP;DUAL D–TYPE MAS- TER–SLAVE;10H131,DIP16.3,TUBE	80009	156–1639–00
A3U655	156–0368–03			IC,DIGITAL:ECL,TRANSLATOR;QUAD TTL–TO– ECL;10124,DIP16.3,TUBE	80009	156–0368–03
A3U670	156–1640–00			IC,DIGITAL:ECL,RECEIVER;TRIPLE LINE;10H116,DIP16.3,TUBE	80009	156–1640–00
A3U710	156–1272–00			IC,LINEAR:BIPOLAR,OP–AMP;DUAL,HIGH OUT- PUT DRIVE,LOW NOISE;NE5532N,DIP08.3	80009	156–1272–00
A3U715	156–0158–07			IC,LINEAR:BIPOLAR,OP–AMP;DUPLICATE OF 156–0158–00,DO NOT USE;MC1458P1,DIP08.3	80009	156–0158–07
A3U740	156–1639–00			IC,DIGITAL:ECL,FLIP FLOP;DUAL D–TYPE MAS- TER–SLAVE;10H131,DIP16.3,TUBE	80009	156–1639–00
A3U750	156–1639–00			IC,DIGITAL:ECL,FLIP FLOP;DUAL D–TYPE MAS- TER–SLAVE;10H131,DIP16.3,TUBE	80009	156–1639–00
A3U755	156–1639–00			IC,DIGITAL:ECL,FLIP FLOP;DUAL D–TYPE MAS- TER–SLAVE;10H131,DIP16.3,TUBE	80009	156–1639–00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A3U760	156–1639–00			IC,DIGITAL:ECL,FLIP FLOP;DUAL D–TYPE MASTER–SLAVE;10H131,DIP16.3,TUBE	80009	156–1639–00
A3U770	156–1639–00			IC,DIGITAL:ECL,FLIP FLOP;DUAL D–TYPE MASTER–SLAVE;10H131,DIP16.3,TUBE	80009	156–1639–00
A3U810	156–0356–01			IC,LINEAR:OPNL AMPL,CHECKED	02735	CA3080TX
A3U840	156–1639–00			IC,DIGITAL:ECL,FLIP FLOP;DUAL D–TYPE MASTER–SLAVE;10H131,DIP16.3,TUBE	80009	156–1639–00
A3U850	156–1639–00			IC,DIGITAL:ECL,FLIP FLOP;DUAL D–TYPE MASTER–SLAVE;10H131,DIP16.3,TUBE	80009	156–1639–00
A3U855	156–1639–00			IC,DIGITAL:ECL,FLIP FLOP;DUAL D–TYPE MASTER–SLAVE;10H131,DIP16.3,TUBE	80009	156–1639–00
A3U860	156–1639–00			IC,DIGITAL:ECL,FLIP FLOP;DUAL D–TYPE MASTER–SLAVE;10H131,DIP16.3,TUBE	80009	156–1639–00
A3U870	156–1639–00			IC,DIGITAL:ECL,FLIP FLOP;DUAL D–TYPE MASTER–SLAVE;10H131,DIP16.3,TUBE	80009	156–1639–00
A4	671–0572–00	B010100	B010144	CIRCUIT BD ASSY:PWR SPLY	80009	671–0572–00
A4	671–0572–01	B010145	B010248	CIRCUIT BD ASSY:PWR SPLY	80009	671–0572–01
A4	671–0572–02	B010249	B010348	CIRCUIT BD ASSY:PWR SPLY	80009	671–0572–02
A4	671–0572–03	B010349	B010481	CIRCUIT BD ASSY:PWR SPLY	80009	671–0572–03
A4	671–0572–04	B010482	B010534	CIRCUIT BD ASSY:PWR SPLY	80009	671–0572–04
A4	671–0572–05	B010535	B010573	CIRCUIT BD ASSY:PWR SPLY	80009	671–0572–05
A4	671–0572–06	B010574	B019999	CIRCUIT BD ASSY:PWR SPLY	80009	671–0572–06
A4	671–1906–05	B020000	B020565	CIRCUIT BD ASSY:PWR SPLY,GERMANY ORDERS	80009	671–1906–05
A4	671–1906–07	B020566		CIRCUIT BD ASSY:PWR SPLY	80009	671–1906–07
				ATTACHED PARTS		
	175–0675–00	671–1906–05		WIRE,ELECTRICAL:STRD,18 AWG,300V RMS,BLACK,CROSSLINKED PVC,UL 1430	23499	H0104047
	210–0201–00	671–1906–05		TERMINAL,LUG:0.12 ID,LOCKING,BRZ TIN PL	86928	A373–157–2
				END ATTACHED PARTS		
A4C5	285–1246–00	671–1906–05		CAP,FXD,PPR DI:0.022UF,20%,250VAC	80009	285–1246–00
A4C6	285–1246–00	671–1906–05		CAP,FXD,PPR DI:0.022UF,20%,250VAC	80009	285–1246–00
A4C105	283–0238–00	671–1906–05		CAP,FXD,CER DI:0.01UF,10%,50V	80009	283–0238–00
A4C120	283–0024–00	671–1906–05		CAP,FXD,CER DI:0.1UF,+80–20%,50V	05397	C330C10YZ5U1CA
A4C130	283–0032–00	671–1906–05		CAP,FXD,CER DI:470PF,5%,500V	80009	283–0032–00
A4C140	283–0177–00	671–1906–05		CAP,FXD,CER DI:1UF,+80–20%,25V	04222	SR303E105ZAA
A4C141	283–0177–00	671–1906–05		CAP,FXD,CER DI:1UF,+80–20%,25V	04222	SR303E105ZAA
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	671–0572–05	CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM(0.492 X 1.180);RADIAL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1301–00
A4C142	290–1069–00	671–1906–05		CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C143	290–1069–00	671–1906–05		CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C144	290–1069–00	671–1906–05		CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C145	283–0177–00	671–1906–05		CAP,FXD,CER DI:1UF,+80–20%,25V	04222	SR303E105ZAA
A4C150	290–1302–00	671–1906–05		CAP,FXD,ALUM:,;1000UF,20%,35V,12.5 X 30MM(0.492 X 1.180);RADIAL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1302–00
A4C151	283–0032–00	671–1906–05		CAP,FXD,CER DI:470PF,5%,500V	80009	283–0032–00
A4C152	290–1302–00	671–1906–05		CAP,FXD,ALUM:,;1000UF,20%,35V,12.5 X 30MM(0.492 X 1.180);RADIAL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1302–00
A4C160	290–0942–00	671–1906–05		CAP,FXD,ELCTLT:100UF,+100–10%,25V	24165	672D107H025CG2C
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	671–0572–05	CAP,FXD,ALUM:;47UF,+50–20%,25V,6 X 11MM;RADIAL	55680	UVX1V470MPA
A4C162	290–0942–00	671–1906–05		CAP,FXD,ELCTLT:100UF,+100–10%,25V	24165	672D107H025CG2C
A4C169	283–0423–00	671–0572–00	671–0572–05	CAP,FXD,CER DI:0.22UF,+80–20%,50V	04222	MD015E224ZAA
A4C170	290–0943–00	671–1906–05		CAP,FXD,ALUM:;47UF,+50–20%,25V,6 X 11MM;RADIAL	55680	UVX1V470MPA

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A4C172	290–0943–00	671–1906–05		CAP,FXD,ALUM:;47UF,+50–20%,25V,6 X 11MM;RADIAL	55680	UVX1V470MPA
A4C180	283–0177–00	671–1906–05		CAP,FXD,CER DI:1UF,+80–20%,25V	04222	SR303E105ZAA
A4C182	283–0177–00	671–1906–05		CAP,FXD,CER DI:1UF,+80–20%,25V	04222	SR303E105ZAA
A4C200	283–0024–00	671–1906–05		CAP,FXD,CER DI:0.1UF,+80–20%,50V	05397	C330C10YZ5U1CA
A4C220	283–0177–00	671–1906–05		CAP,FXD,CER DI:1UF,+80–20%,25V	04222	SR303E105ZAA
A4C222	283–0005–00	671–1906–05		CAP,FXD,CER DI:0.01UF,+100–0%,250V	04222	SR30VE103ZAA
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	671–0572–05	CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM(0.492 X 1.180);RADIAL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1301–00
A4C225	290–1069–00	671–1906–05		CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C230	283–0177–00	671–1906–05		CAP,FXD,CER DI:1UF,+80–20%,25V	04222	SR303E105ZAA
A4C241	290–1034–00	671–0572–00	671–0572–03	CAP,FXD,ALUM:;330UF,20%,25V,13 X 25MM;RADIAL	TK1424	CEUFM1E331
A4C241	290–1302–00	671–0572–04	671–0572–05	CAP,FXD,ALUM:,;1000UF,20%,35V,12.5 X 30MM(0.492 X 1.180);RADIAL,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;RADIAL	TK1424	CEUFM1E331
A4C250	290–1302–00	671–0572–04	671–0572–05	CAP,FXD,ALUM:,;1000UF,20%,35V,12.5 X 30MM(0.492 X 1.180);RADIAL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1302–00
A4C253	290–1069–00	671–1906–05		CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C254	290–1069–00	671–1906–05		CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C258	290–1069–00	671–0572–00	671–0572–03	CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C258	290–1301–00	671–0572–04	671–0572–05	CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM(0.492 X 1.180);RADIAL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1301–00
A4C269	283–0423–00	671–0572–00	671–0572–05	CAP,FXD,CER DI:0.22UF,+80–20%,50V	04222	MD015E224ZAA
A4C270	283–0423–00	671–0572–00	671–0572–05	CAP,FXD,CER DI:0.22UF,+80–20%,50V	04222	MD015E224ZAA
A4C320	283–0423–00	671–0572–00	671–0572–05	CAP,FXD,CER DI:0.22UF,+80–20%,50V	04222	MD015E224ZAA
A4C320	283–0177–00	671–1906–05		CAP,FXD,CER DI:1UF,+80–20%,25V	04222	SR303E105ZAA
A4C321	283–0005–00	671–0572–01	671–0572–05	CAP,FXD,CER DI:0.01UF,+100–0%,250V	04222	SR30VE103ZAA
A4C324	290–1069–00	671–1906–05		CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
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	671–0572–05	CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM(0.492 X 1.180);RADIAL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1301–00
A4C325	290–1069–00	671–1906–05		CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C350	283–0177–00	671–1906–05		CAP,FXD,CER DI:1UF,+80–20%,25V	04222	SR303E105ZAA
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	671–0572–05	CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM(0.492 X 1.180);RADIAL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1301–00
A4C358	290–1069–00	671–1906–05		CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
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	671–0572–05	CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM(0.492 X 1.180);RADIAL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1301–00
A4C360	290–1069–00	671–1906–05		CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
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	671–0572–05	CAP,FXD,ALUM:;47UF,+50–20%,25V,6 X 11MM;RADIAL	55680	UVX1V470MPA
A4C365	290–0943–00	671–1906–05		CAP,FXD,ALUM:;47UF,+50–20%,25V,6 X 11MM;RADIAL	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	671–0572–05	CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM(0.492 X 1.180);RADIAL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1301–00
A4C370	290–1069–00	671–1906–05		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
A4C371	283–0423–00	671–0572–00	671–0572–05	CAP,FXD,CER DI:0.22UF,+80–20%,50V	04222	MD015E224ZAA
A4C415	283–0268–00	671–0572–00	671–0572–05	CAP,FXD,CER DI:0.015UF,20%,50V	80009	283–0268–00
A4C415	283–0221–00	671–1906–05		CAP,FXD,CER DI:0.47UF,20%,50V	04222	SR305C474MAA
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	671–0572–05	CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM(0.492 X 1.180);RADIAL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1301–00
A4C464	290–1069–00	671–1906–05		CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
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	671–0572–05	CAP,FXD,ALUM:,;2700UF,20%,10V,12.5 X 30MM(0.492 X 1.180);RADIAL,LOWIMP,1.95A RIPPLE,BULK	80009	290–1301–00
A4C475	290–1069–00	671–1906–05		CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C476	290–1069–00	671–1906–05		CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C480	290–1069–00	671–1906–05		CAP,FXD,ELCTLT:1000UF,20%,6.3V	80009	290–1069–00
A4C500	285–1329–00	671–1906–05		CAP,FXD,PLASTIC:METALIZED FILM;680PF,10%, 1600V,POLYPROPYLENE,.70X.43; RADIAL,T/A	80009	285–1329–00
A4C521	283–0672–00	671–0572–00	671–0572–05	CAP,FXD,MICA DI:200PF,1%,500V	80009	283–0672–00
A4C521	283–0103–00	671–1906–05		CAP,FXD,CER DI:180PF,5%,500V	80009	283–0103–00
A4C525	285–1196–00	671–0572–00	671–0572–05	CAP,FXD,PPR DI:0.01UF,20%,250V	80009	285–1196–00
A4C540	285–1329–00	671–0572–00	671–0572–05	CAP,FXD,PLASTIC:METALIZED FILM;680PF,10%, 1600V,POLYPROPYLENE,.70X.43; RADIAL,T/A	80009	285–1329–00
A4C548	285–1331–00	671–0572–00	671–0572–05	CAP,FXD,MTLZD:0.47UF,5%,400V	TK1573	MKS4 .47/400/5
A4C575	283–0005–00	671–0572–01	671–0572–05	CAP,FXD,CER DI:0.01UF,+100–0%,250V	04222	SR30VE103ZAA
A4C575	283–0359–00	671–1906–05		CAP,FXD,CER DI:1000PF,10%,200V	04222	SR212A102KAA
A4C620	283–0211–00	671–1906–07		CAP,FXD,CER DI:0.1UF,10%,200V	80009	283–0211–00
A4C621	283–0051–00	671–0572–00	671–0572–05	CAP,FXD,CER DI:0.0033UF,5%,100V	80009	283–0051–00
A4C621	283–0210–00	671–1906–05		CAP,FXD,CER DI:0.0056UF,20%,100V	04222	SR301C562MAA
A4C648	285–1187–00	671–0572–00	671–0572–05	CAP,FXD,MTLZD:0.47 UF,10%,100 V	05292	PMT 3R .47K 100
A4C648	283–0177–00	671–1906–05		CAP,FXD,CER DI:1UF,+80–20%,25V	04222	SR303E105ZAA
A4C650	283–0177–00	671–1906–05		CAP,FXD,CER DI:1UF,+80–20%,25V	04222	SR303E105ZAA
A4C656	290–0844–00	671–0572–00	671–0572–05	CAP,FXD,ELCTLT:100UF,+75–20%,35WVDC	24165	513D107M035CC4D
A4C656	290–0942–00	671–1906–05		CAP,FXD,ELCTLT:100UF,+100–10%,25V	24165	672D107H025CG2C
A4C700	285–1421–00	671–1906–05		CAP,FXD,PLASTIC:1.0UF,10%,400V	80009	285–1421–00
A4C717	290–0804–00	671–0572–00	671–0572–05	CAP,FXD,ELCTLT:10UF,+50–20%,25V	80009	290–0804–00
A4C717	290–0943–00	671–1906–05		CAP,FXD,ALUM:;47UF,+50–20%,25V,6 X 11MM;RADIAL	55680	UVX1V470MPA
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	671–0572–00	671–0572–05	CAP,FXD,CER DI:0.22UF,+80–20%,50V	04222	MD015E224ZAA
A4C727	283–0024–00	671–1906–05		CAP,FXD,CER DI:0.1UF,+80–20%,50V	05397	C330C10YZ5U1CA
A4C730	285–1196–00	671–0572–00	671–0572–05	CAP,FXD,PPR DI:0.01UF,20%,250V	80009	285–1196–00
A4C820	285–1252–00	671–1906–05		CAP,FXD,PLASTIC:0.15UF,10%,250VAC	D5243	F1772–415–2000
A4C830	285–1196–00	671–0572–00	671–0572–05	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	671–0572–00	671–0572–05	CAP,FXD,MTLZD:0.22UF,250V,X	80009	285–1323–00
A4CR150	152–0884–00	671–1906–05		SEMICOND DVC,DI:16 AMP,35V,TO–220,AC PKG	04713	MBR1635
A4CR160	152–0884–00	671–1906–05		SEMICOND DVC,DI:16 AMP,35V,TO–220,AC PKG	04713	MBR1635
A4CR169	152–0198–00	671–0572–00	671–0572–05	DIODE,RECT:,;200V,3A,125A IFSM,1VF AT 3A,SAFETY CONTROLLED;1N5624	05828	1N5624
A4CR170	152–0066–00	671–0572–00	671–0572–05	DIODE,RECT:,;400V,1A,IFSM=30A,1.2VF,2US;GP10 G/1N5060,T&R,SAFETY CONTROLLED	05828	GP10G–020
A4CR170	152–0601–01	671–1906–05		SEMICOND DVC,DI:RECTIFIER,SI,150V,1A,35NS	04713	MUR115RL
A4CR180	152–0601–01	671–1906–05		SEMICOND DVC,DI:RECTIFIER,SI,150V,1A,35NS	04713	MUR115RL

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A4CR215	152–0066–00	671–0572–00	671–0572–05	DIODE,RECT:,;400V,1A,IFSM=30A,1.2VF,2US;GP10 G/1N5060,T&R,SAFETY CONTROLLED	05828	GP10G–020
A4CR269	152–0198–00	671–0572–00	671–0572–05	DIODE,RECT:,;200V,3A,125A IFSM,1VF AT 3A,SAFETY CONTROLLED;1N5624	05828	1N5624
A4CR320	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
	342–0563–00			INSULATOR,PLATE:TRANSISTOR,FIBERGLASS REINFORCED SILICON RUBBER	18565	69–11–8805–1674
	210–0586–00	671–0572–00	671–0572–05	NUT,PL,ASSEM WA:4–40 X 0.25,STL CD PL	78189	211–041800–00
	214–2953–00	671–0572–00	671–0572–05	HEAT SINK,XSTR:TO–220,AL	80009	214–2953–00
	211–0012–00	671–1906–05		SCREW,MACHINE:4–40 X 0.375,PNH,STL	93907	ORDER BY DESCR
	214–4293–01	671–1906–05		HEAT SINK:COPPER	80009	214–4293–01
				END MOUNTING PARTS		
A4CR340	152–0601–01	671–0572–00	671–0572–05	SEMICOND DVC,DI:RECTIFIER,SI,150V,1A,35NS	04713	MUR115RL
A4CR348	152–0601–01	671–0572–00	671–0572–05	SEMICOND DVC,DI:RECTIFIER,SI,150V,1A,35NS	04713	MUR115RL
A4CR369	152–0066–00	671–0572–00	671–0572–05	DIODE,RECT:,;400V,1A,IFSM=30A,1.2VF,2US;GP10 G/1N5060,T&R,SAFETY CONTROLLED	05828	GP10G–020
A4CR500	152–1085–00	671–1906–05		SEMICOND DVC,DI:RECT,SI,1000V,1A	80009	152–1085–00
A4CR545	152–0897–00	671–0572–00	671–0572–05	DIODE,RECT:,FAST RCVRY;1000V,1.5A, 300NS,SOFT RCVRY;BYV96E,T&R	80009	152–0897–00
A4CR556	152–0400–00	671–0572–00	671–0572–05	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
	342–0563–00			INSULATOR,PLATE:TRANSISTOR,FIBERGLASS REINFORCED SILICON RUBBER	18565	69–11–8805–1674
	214–2953–00	671–0572–00	671–0572–05	HEAT SINK,XSTR:TO–220,AL	80009	214–2953–00
	214–4115–00	671–0572–00	671–0572–05	HEAT SINK:COPPER	80009	214–4115–00
	211–0012–00	671–1906–05		SCREW,MACHINE:4–40 X 0.375,PNH,STL	93907	ORDER BY DESCR
	214–4293–01	671–1906–05		HEAT SINK:COPPER	80009	214–4293–01
				END MOUNTING PARTS		
A4CR600	152–0601–01	671–1906–05		SEMICOND DVC,DI:RECTIFIER,SI,150V,1A,35NS	04713	MUR115RL
A4CR640	152–0841–00	671–0572–00	671–0572–05	DIODE,RECT:,ULTRA FAST;1KV,100NS;BYT–12P–1000,TO–220	80009	152–0841–00
A4CR640	152–1085–00	671–1906–05		SEMICOND DVC,DI:RECT,SI,1000V,1A	80009	152–1085–00
A4CR648	152–0864–00	671–0572–00	671–0572–05	DIODE,RECT:,ULTRA FAST;150V,2A,25NS, IFSM=50A,SOFT REC;BYV–150	80009	152–0864–00
A4CR648	152–0601–01	671–1906–05		SEMICOND DVC,DI:RECTIFIER,SI,150V,1A,35NS	04713	MUR115RL
A4CR649	152–0864–00	671–0572–00	671–0572–05	DIODE,RECT:,ULTRA FAST;150V,2A,25NS, IFSM=50A,SOFT REC;BYV–150	80009	152–0864–00
A4CR649	152–0601–01	671–1906–05		SEMICOND DVC,DI:RECTIFIER,SI,150V,1A,35NS	04713	MUR115RL
A4CR651	152–0581–00	671–0572–00	671–0572–05	DIODE,RECT:SCHTKY,;20V,1A,.450VF,25A IFSM;1N5817	80009	152–0581–00
A4CR651	152–0601–01	671–1906–05		SEMICOND DVC,DI:RECTIFIER,SI,150V,1A,35NS	04713	MUR115RL
A4CR820	152–0750–00	671–0572–00	671–0572–05	DIODE,RECT:,FAST RCVRY;BRIDGE,600V,3A, IFSM=125A,250NS,SAFETY CONTROLLED; RKBPC606	80009	152–0750–00
A4CR820	152–0848–00	671–1906–05		SEMICOND DVC,DI:RECT BRDG,600V,2A,FAST RCVY	80009	152–0848–00
A4DS670	150–1017–00	671–0572–00	671–0572–05	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
A4E820	119–0181–00	671–1906–05		ARSR,ELEC SURGE:230,GAS FILLED,+/–15%	25088	B1–A230T
A4E920	119–0181–00	671–1906–05		ARSR,ELEC SURGE:230,GAS FILLED,+/–15%	25088	B1–A230T
A4F940	159–0023–00			FUSE,CARTRIDGE:3AG,2A,250V,SLOW BLOW (FOR 90–132VAC OPERATION)	71400	MDX2

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A4F940	159–0019–00			FUSE,CARTRIDGE:3AG,1A,250V,SLOW BLOWSA-FETY CONTROLLED	71400	MDL 1
				(FOR 180–250VAC OPERATION)		
				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		
A4FL950	119–3835–00	671–1906–05		FILTER,RFI:3A,250V,400HZ W/PC TERMINALS	TK2133	FN 326–3/02
A4J160	131–0608–00	671–0572–00	671–0572–05	TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 34)	80009	131–0608–00
A4J160	131–3364–00	671–1906–05		CONN,HDR:	53387	2534–6002UB
A4J310	131–0608–00	671–0572–00	671–0572–05	TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 2)	80009	131–0608–00
A4J370	131–0608–00	671–1906–05		TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 2)	80009	131–0608–00
A4J390	131–0608–00	671–1606–05		TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131–0608–00
A4J500	131–0608–00	671–1906–05		TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 2)	80009	131–0608–00
A4J556	131–0608–00	671–0572–00	671–0572–05	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
A4J800	131–0608–00	671–1906–05		TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 2)	80009	131–0608–00
A4J810	131–0608–00	671–0572–00	671–0572–05	TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131–0608–00
A4J810	131–0608–00	671–1906–05		TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 2)	80009	131–0608–00
A4J820	131–0608–00	671–1906–05		TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 2)	80009	131–0608–00
A4L150	108–1262–00	671–1906–05		COIL,RF:FXD,100UH,10%,Q=30,SRF 8.2MHZ,DCR 0.23 OHM,I MAX 0.75ARADIAL LEAD	80009	108–1262–00
A4L162	108–1262–00	671–1906–05		COIL,RF:FXD,100UH,10%,Q=30,SRF 8.2MHZ,DCR 0.23 OHM,I MAX 0.75ARADIAL LEAD	80009	108–1262–00
A4L230	108–0554–00			COIL,RF:FIXED,5UH,+/–20%	TK1345	108–0554–00
A4L258	108–0554–00	671–1906–05		COIL,RF:FIXED,5UH,+/–20%	TK1345	108–0554–00
A4L261	108–1262–00	671–0572–00	671–0572–05	COIL,RF:FXD,100UH,10%,Q=30,SRF 8.2MHZ,DCR 0.23 OHM,I MAX 0.75ARADIAL LEAD	80009	108–1262–00
A4L358	108–0554–00	671–0572–00	671–0572–05	COIL,RF:FIXED,5UH,+/–20%	TK1345	108–0554–00
A4L361	108–1262–00	671–0572–00	671–0572–05	COIL,RF:FXD,100UH,10%,Q=30,SRF 8.2MHZ,DCR 0.23 OHM,I MAX 0.75ARADIAL LEAD	80009	108–1262–00
A4L520	108–1448–00	671–0572–00	671–0572–05	COIL,RF:TOROID,1MH,+/–30%,AWG #20,PKG 0.65 DIA X 0.6	TK1345	108–1448–00
A4L700	120–1654–00	671–1906–05		TRANSFORMER,PWR:8MH,1.5A,COMMON MODE	TK1601	62911–003
A4L770	108–0205–00	671–0572–00	671–0572–05	COIL,RF:,INDUCTOR;FXD,1MH.5%,2.12 OHMS,FERRITE CORE;	76493	8209
A4LF950	119–1946–00	671–0572–00	671–0576–05	FILTER,RFI:1A,250V,400HZ W/PC TERMINAL	S4307	FN326–1/02–K–D–T
A4P390	131–0993–02	671–1906–05		BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1–850100–O
A4P500	131–0993–02	671–1906–05		BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1–850100–O
A4P556	131–0993–02	671–0572–00	671–0572–05	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
A4P800	131–0993–02	671–1906–05		BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1–850100–O
A4P810	198–5780–00	671–1906–05		WIRE SET,ELEC:SPG1000	80009	198–5780–00
A4Q100	151–0188–00	671–1906–05		TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA, 250MHZ,AMPLIFIER;2N3906,TO–92 EBC	80009	151–0188–00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A4Q127	151–0528–00			THYRISTOR,PWR:BIPOLAR,SCR;50V,16A RMS,PHASE CONTROL;2N6400,TO–220	80009	151–0528–00
A4Q200	151–0190–00	671–1906–05		TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AMPLIFIER;2N3904,TO–92 EBC	80009	151–0190–00
A4Q215	151–0435–00	671–0572–00	671–0572–05	TRANSISTOR:DARLINGTON,PNP,SI,TO–92	80009	151–0435–00
A4Q250	151–1171–00	671–1906–05		TRANSISTOR,PWR:MOS,N–CH;50V,12A,0.12 OHM;BUZ71A/IRFZ22/MTP15N05E,TO–220	80009	151–1171–00
				MOUNTING PARTS		
	210–0586–00	671–1906–05		NUT,PL,ASSEM WA:4–40 X 0.25,STL CD PL	78189	211–041800–00
	210–1178–00	671–1906–05		WASHER,SHLDR:	80009	210–1178–00
	211–0097–00	671–1906–05		SCREW,MACHINE:4–40 X 0.312,PNH,STL	93907	ORDER BY DESCR
	214–3478–00	671–1906–05		HEAT SINK,XSTR:TO–202,AL	30161	5773B
	342–0563–00	671–1906–05		INSULATOR,PLATE:TRANSISTOR,FIBERGLASS REINFORCED SILICON RUBBER	18565	69–11–8805–1674
				END MOUNTING PARTS		
A4Q638	151–0908–00	671–0572–00	671–0572–05	TRANSISTOR,PWR:BIPOLAR,NPN;500V VCEO, 1000V VCEV,5A,SWITCHING;MJH16002A,TO–218	80009	151–0908–00
A4Q638	151–0870–00	671–1906–05		TRANSISTOR,PWR:	80009	151–0870–00
				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
	342–0354–00			INSULATOR,PLATE:TRANSISTOR	55285	7403–09FR–52
	211–0097–00	671–0572–00	671–0572–05	SCREW,MACHINE:4–40 X 0.312,PNH,STL	93907	ORDER BY DESCR
	214–2953–00	671–0572–00	671–0572–05	HEAT SINK,XSTR:TO–220,AL	80009	214–2953–00
	211–0012–00	671–1906–05		SCREW,MACHINE:4–40 X 0.375,PNH,STL	93907	ORDER BY DESCR
	214–2953–00	671–1906–05		HEAT SINK,XSTR:TO–220,AL (QUANTITY 2)	80009	214–2953–00
				END MOUNTING PARTS		
A4Q648	151–0323–00	671–1906–05		TRANSISTOR,PWR:BIPOLAR,NPN;80V,4.0A, 2.0MHZ,AMPLIFIER;2N5192,TO–126	80009	151–0323–00
A4Q650	151–0323–00	671–1906–05		TRANSISTOR,PWR:BIPOLAR,NPN;80V,4.0A, 2.0MHZ,AMPLIFIER;2N5192,TO–126	80009	151–0323–00
A4Q660	151–0190–00	671–0572–00	671–0572–05	TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AMPLIFIER;2N3904,TO–92 EBC	80009	151–0190–00
A4Q667	151–0750–00	671–0572–00	671–0572–05	TRANSISTOR,SIG:BIPOLAR,NPN;400V,300MA, 20MHZ,AMPLIFIER;MPSA44,TO–92 EBC	80009	151–0750–00
A4Q717	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA, 250MHZ,AMPLIFIER;2N3906,TO–92 EBC	80009	151–0188–00
A4Q727	151–0190–00	671–0572–00	671–0572–05	TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA, 300MHZ,AMPLIFIER;2N3904,TO–92 EBC	80009	151–0190–00
A4Q741	151–0324–00			TRANSISTOR,PWR:BIPOLAR,PNP;80V,4.0A, 2.0MHZ,AMPLIFIER;2N5195,TO–126	80009	151–0324–00
A4Q750	151–0323–00	671–0572–00	671–0572–05	TRANSISTOR,PWR:BIPOLAR,NPN;80V,4.0A, 2.0MHZ,AMPLIFIER;2N5192,TO–126	80009	151–0323–00
A4Q755	151–0188–00	671–0572–00	671–0572–05	TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA, 250MHZ,AMPLIFIER;2N3906,TO–92 EBC	80009	151–0188–00
A4R100	322–3177–00	671–1906–05		RES,FXD:METAL FILM;681 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	91637	CCF50–2G681R0F
A4R105	322–3235–00	671–1906–05		RES,FXD:METAL FILM;2.74K OHM,1%,0.2W, TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 2K74
A4R110	322–3106–00	671–1906–05		RES,FXD,FILM:124 OHM,1%,0.2W, TC=100PPM,SMALL BODY,T&R	80009	322–3106–00
A4R120	315–0101–00	671–0572–00	671–0572–05	RES,FXD,FILM:100 OHM,5%,0.25W	80009	315–0101–00
A4R120	322–3193–00	671–1906–05		RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A4R121	322–3235–00	671–1906–05		RES,FXD:METAL FILM;2.74K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 2K74
A4R125	322–3231–00	671–1906–05		RES,FXD,FILM:2.49K OHM,1%,0.2W,TC=T0	80009	322–3231–00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A4R130	322–3258–00	671–1906–05		RES,FXD:METAL FILM;4.75K OHM,1%,0.2W, TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322–3258–00
A4R135	322–3289–00	671–1906–05		RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322–3289–00
A4R140	322–3193–00	671–1906–05		RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K00
A4R150	322–3385–00	671–1906–05		RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 100K
A4R151	301–0105–00	671–1906–05		RES,FXD,FILM:1M OHM,5%,0.50W	19701	5053CX1M000J
A4R152	322–3289–00	671–1906–05		RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322–3289–00
A4R153	322–3378–00	671–1906–05		RES,FXD,FILM:84.5K OHM,1%,0.2W,TC=T0	91637	CCF50–2F84501F
A4R215	315–0272–00	671–0572–00	671–0572–05	RES,FXD,FILM:2.7K OHM,5%,0.25W	80009	315–0272–00
A4R216	315–0472–00	671–0572–00	671–0572–05	RES,FXD,FILM:4.7K OHM,5%,0.25W	80009	315–0472–00
A4R222	315–0101–00	671–1906–05		RES,FXD,FILM:100 OHM,5%,0.25W	80009	315–0101–00
A4R225	301–0680–00	671–0572–00	671–0572–05	RES,FXD,FILM:68 OHM,5%,0.5W	80009	301–0680–00
A4R250	315–0220–00	671–1906–05		RES,FXD,FILM:22 OHM,5%,0.25W	80009	315–0220–00
A4R255	322–3289–00	671–1906–05		RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322–3289–00
A4R260	308–0742–00	671–1906–05		RES,FXD,WW:0.24 OHM,5%,2W	75042	BWH–R2400J
A4R314	315–0202–00	671–0572–00	671–0572–05	RES,FXD,FILM:2K OHM,5%,0.25W	80009	315–0202–00
A4R314	322–3224–00	671–1906–05		RES,FXD,FILM:2.1K OHM,1%,0.2W,TC=T0	91637	CCF50–2F21000F
A4R315	315–0152–00	671–0572–00	671–0572–05	RES,FXD,FILM:1.5K OHM,5%,0.25W	80009	315–0152–00
A4R315	322–3210–00	671–1906–05		RES,FXD:METAL FILM;1.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 1K50
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	671–0572–05	RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=T0	80009	322–3254–00
A4R316	322–3097–00	671–1906–05		RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 100E
A4R320	315–0101–00	671–1906–05		RES,FXD,FILM:100 OHM,5%,0.25W	80009	315–0101–00
A4R321	315–0100–00	671–0572–01	671–0572–05	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	671–0572–00	671–0572–05	RES,FXD,FILM:1K OHM,5%,0.25W	80009	315–0102–00
A4R416	322–3123–00	671–1906–05		RES,FXD:METAL FILM;187 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322–3123–00
A4R510	311–0978–00	671–0572–00	671–0572–05	RES,VAR,NONWW:TRMR,250 OHM,0.5W	80009	311–0978–00
A4R510	311–0609–00	671–1906–05		RES,VAR,NONWW:TRMR,2K OHM,0.5W	80009	311–0609–00
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	671–0572–06	RES,FXD,CMPSN:200K OHM,5%,1W	80009	303–0204–00
A4R575	315–0100–00	671–0572–01	671–0572–05	RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A4R600	308–0555–00	671–1906–05		RES,FXD,WW:5 OHM,5%,3W	80009	308–0555–00
A4R614	315–0152–00	671–0572–00	671–0572–05	RES,FXD,FILM:1.5K OHM,5%,0.25W	80009	315–0152–00
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	671–0572–05	RES,FXD,FILM:649 OHM,1%,0.2W,TC=T0	80009	322–3175–00
A4R615	322–3285–00	671–1906–05		RES,FXD,FILM:9.09K OHM,1%,0.2W,TC=T0	80009	322–3285–00
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	671–0572–00	671–0572–05	RES,FXD,FILM:1.8K OHM,5%,0.25W	80009	315–0182–00
A4R617	322–3289–00	671–1906–05		RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322–3289–00
A4R619	315–0103–00	671–0572–00	671–0572–05	RES,FXD,FILM:10K OHM,5%,0.25W	80009	315–0103–00
A4R619	322–3289–00	671–1906–05		RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322–3289–00
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	671–0572–05	RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=T0	80009	322–3254–00
A4R620	322–3235–00	671–1906–05		RES,FXD:METAL FILM;2.74K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 2K74
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

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A4R622	322–3248–00	671–0572–04	671–0572–05	RES,FXD,FILM:3.74K OHM,1%,0.2W,TC=T0	80009	322–3248–00
A4R622	322–3235–00	671–1906–05		RES,FXD:METAL FILM;2.74K OHM,1%,0.2W, TC=100 PPM;AXIAL,T&R,SMALL BODY	57668	CRB20 FXE 2K74
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	671–0572–05	RES,FXD,FILM:1.15K OHM,1%,0.2W,TC=T0	80009	322–3199–00
A4R625	322–3237–00	671–1906–05		RES,FXD,FILM:2.87K OHM,1%,0.2W,TC=T0	80009	322–3237–00
A4R630	308–0755–00	671–0572–00	671–0572–05	RES,FXD,WW:0.75 OHM,5%,2W	91637	CPF–1–0R75JT1
A4R630	308–0679–00	671–1906–05		RES,FXD:0.51 OHM,5%,2W	91637	CPF–2–0R51JT1
A4R647	301–0274–00	671–0572–00	671–0572–05	RES,FXD,FILM:270K OHM,5%,0.5W	80009	301–0274–00
A4R665	315–0332–00	671–0572–00	671–0572–05	RES,FXD,FILM:3.3K OHM,5%,0.25W	80009	315–0332–00
A4R666	315–0473–00	671–0572–00	671–0572–05	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	671–0572–06	RES,FXD,CMPSN:1M OHM,5%,1W	01121	GB1055
A4R700	315–0472–00	671–1906–05		RES,FXD,FILM:4.7K OHM,5%,0.25W	80009	315–0472–00
A4R701	315–0472–00	671–1906–05		RES,FXD,FILM:4.7K OHM,5%,0.25W	80009	315–0472–00
A4R717	315–0183–00	671–0572–00	671–0572–05	RES,FXD,FILM:18K OHM,5%,0.25W	80009	315–0183–00
A4R717	322–3314–00	671–1906–05		RES,FXD:METAL FILM;18.2K OHM,1%,0.2W, TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322–3314–00
A4R718	315–0221–00	671–0572–00	671–0572–05	RES,FXD,FILM:220 OHM,5%,0.25W	80009	315–0221–00
A4R720	322–3265–00	671–1906–05		RES,FXD:METAL FILM;5.62K OHM,1%,0.2W, TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322–3265–00
A4R722	315–0103–00	671–0572–00	671–0572–05	RES,FXD,FILM:10K OHM,5%,0.25W	80009	315–0103–00
A4R722	322–3289–00	671–1906–05		RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322–3289–00
A4R723	307–0863–00	671–0572–00	671–0572–05	RES,THERMAL:10 OHM,10%,NTC	80009	307–0863–00
A4R731	315–0473–00	671–0572–00	671–0572–05	RES,FXD,FILM:47K OHM,5%,0.25W	80009	315–0473–00
A4R742	322–3335–00	671–1906–05		RES,FXD,FILM:30.1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 30K1
A4R743	322–3393–00	671–1906–05		RES,FXD:METAL FILM;121K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SMALL BODY	80009	322–3393–00
A4R746	303–0750–00	671–0572–00	671–0572–05	RES,FXD,CMPSN:75 OHM,5%,1W	80009	303–0750–00
A4R746	308–0223–00	671–1906–05		RES,FXD,WW:35 OHM,5%,3W	80009	308–0223–00
A4R747	303–0750–00	671–0572–00	671–0572–05	RES,FXD,CMPSN:75 OHM,5%,1W	80009	303–0750–00
A4R765	301–0105–00	671–0572–00	671–0572–05	RES,FXD,FILM:1M OHM,5%,0.50W	19701	5053CX1M000J
A4R766	322–3439–00	671–0572–00	671–0572–05	RES,FXD,FILM:365K OHM,1%,0.2W,TC=T0	80009	322–3439–00
A4R767	322–3439–00	671–0572–00	671–0572–05	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	671–0572–05	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
A4R822	301–0106–00	671–1906–05		RES,FXD,FILM:10M OHM,5%,0.50W	80009	301–0106–00
A4R830	301–0154–00	671–0572–00	671–0572–05	RES,FXD,FILM:150K OHM,5%,0.5W	80009	301–0154–00
A4R831	301–0154–00	671–0572–00	671–0572–05	RES,FXD,FILM:150K OHM,5%,0.5W	80009	301–0154–00
A4R845	301–0474–00	671–1906–05		RES,FXD,FILM:470K OHM,5%,0.5W	01121	EB4745
A4R865	301–0474–00	671–1906–05		RES,FXD,FILM:470K OHM,5%,0.5W	01121	EB4745
A4R921	303–0204–00	671–1906–05		RES,FXD,CMPSN:200K OHM,5%,1W	80009	303–0204–00
A4RT820	307–1610–00	671–1906–05		RES,THERMAL:2.5 OHM +/–15%,7 AMP,0.600 D X 0.250 THK,RADIAL LEAD, NTC	80009	307–1610–00
A4RT920	307–1610–00	671–1906–05		RES,THERMAL:2.5 OHM +/–15%,7 AMP,0.600 D X 0.250 THK,RADIAL LEAD, NTC	80009	307–1610–00
A4RV820	307–0449–00	671–0572–00	671–0572–05	RES,V SENSITIVE:1900PF,100A,130V,METAL OXD SAFETY CONTROLLED	03508	V130LA20A
A4RV920	307–0449–00	671–0572–00	671–0572–05	RES,V SENSITIVE:1900PF,100A,130V,METAL OXD SAFETY CONTROLLED	03508	V130LA20A
A4S930	260–1849–07	671–0572–00	671–0572–05	SWITCH,PUSH:DPST,4A,250VAC	80009	260–1849–07
A4S930	260–2443–00	671–1906–05		SWITCH,PUSH:POWER,DPST,6A,250VAC	80009	260–2443–00
				ATTACHED PARTS		
	366–1160–00			PUSH BUTTON:CHARCOAL,0.523 X 0.253 X 0.43	80009	366–1160–00
	200–2735–00	671–0572–00	671–0572–05	COVER,POWER SW:BLACK,POLYCARBONATE	TK2165	ORDER BY DESCR
	210–0001–00	671–0572–00	671–0572–05	WASHER,LOCK:#2 INTL,0.013 THK,STL	77900	1202–00–00–0541C

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
				(QUANTITY 2)		
	210–0405–00	671–0572–00	671–0572–05	NUT,PLAIN,HEX:2–56 X 0.188,BRS CD PL	73743	12157–50
				(QUANTITY 2)		
	211–0022–00	671–0572–00	671–0572–05	SCREW,MACHINE:2–56 X 0.188,PNH,STL	TK0435	ORDER BY DESCR
				(QUANTITY 2)		
				END ATTACHED PARTS		
A4T1	120–1897–00	671–1906–05		XFMR,RF,PWR:	80009	120–1897–00
A4T2	120–1889–00	671–1906–05		TRANSFORMER,RF:	80009	120–1889–00
A4T440	120–1782–00	671–0572–00	671–0572–05	TRANSFORMER,RF:	80009	120–1782–00
A4TP133	214–4085–00	671–0572–00	671–0572–05	TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL- LAR	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 BRASS,W/ RED NYLON COL- LAR	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 BRASS,W/ RED NYLON COL- LAR	26364	104–01–02
A4TP150	214–4085–00	671–1906–05		TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL- LAR	26364	104–01–02
A4TP173	214–4085–00	671–0572–00	671–0572–05	TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL- LAR	26364	104–01–02
A4TP180	214–4085–00	671–1906–05		TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL- LAR	26364	104–01–02
A4TP182	214–4085–00	671–1906–05		TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL- LAR	26364	104–01–02
A4TP341	214–4085–00	671–0572–00	671–0572–05	TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL- LAR	26364	104–01–02
A4TP350	214–4085–00	671–0572–00	671–0572–05	TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COL- LAR	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 BRASS,W/ RED NYLON COL- LAR	26364	104–01–02
A4U150	156–2558–00	671–1906–05		IC,LINEAR:BIPOLAR,VOLTAGE REGULATOR;POS- ITIVE,12V,1.5A,2%;MC7812ACT,TO–220	80009	156–2558–00
				MOUNTING PARTS		
	210–0586–00	671–1906–05		NUT,PL,ASSEM WA:4–40 X 0.25,STL CD PL	78189	211–041800–00
	210–1178–00	671–1906–05		WASHER,SHLDR:	80009	210–1178–00
	211–0097–00	671–1906–05		SCREW,MACHINE:4–40 X 0.312,PNH,STL	93907	ORDER BY DESCR
	214–3478–00	671–1906–05		HEAT SINK,XSTR:TO–202,AL	30161	5773B
	342–0563–00	671–1906–05		INSULATOR,PLATE:TRANSISTOR,FIBERGLASS REINFORCED SILICON RUBBER	18565	69–11–8805–1674
				END MOUNTING PARTS		
A4U152	156–2559–00	671–1906–05		IC,LINEAR:BIPOLAR,VOLTAGE REGULATOR;NEG- ATIVE,–12V,1.5A,2%;MC7912ACT,TO–220	80009	156–2559–00
				MOUNTING PARTS		
	210–0586–00	671–1906–05		NUT,PL,ASSEM WA:4–40 X 0.25,STL CD PL	78189	211–041800–00
	210–1178–00	671–1906–05		WASHER,SHLDR:	80009	210–1178–00
	211–0097–00	671–1906–05		SCREW,MACHINE:4–40 X 0.312,PNH,STL	93907	ORDER BY DESCR
	214–3478–00	671–1906–05		HEAT SINK,XSTR:TO–202,AL	30161	5773B
	342–0563–00	671–1906–05		INSULATOR,PLATE:TRANSISTOR,FIBERGLASS REINFORCED SILICON RUBBER	18565	69–11–8805–1674
				END MOUNTING PARTS		
A4U176	156–3633–00	671–0572–00	671–0572–05	IC,LINEAR:BIPOLAR,VOLTAGE REGULATOR;POS- ITIVE,12V,1A,3%,LOW DROPOUT;LM2940CT–12, TO–220	80009	156–3633–00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
				MOUNTING PARTS		
	210–0586–00	671–0572–00	671–0572–05	NUT,PL,ASSEM WA:4–40 X 0.25,STL CD PL	78189	211–041800–00
	210–1178–00	671–0572–00	671–0572–05	WASHER,SHLDR:	80009	210–1178–00
	211–0097–00	671–0572–00	671–0572–05	SCREW,MACHINE:4–40 X 0.312,PNH,STL	93907	ORDER BY DESCR
	214–2953–00	671–0572–00	671–0572–05	HEAT SINK,XSTR:TO–220,AL	80009	214–2953–00
	342–0563–00	671–0572–00	671–0572–05	INSULATOR,PLATE:TRANSISTOR,FIBERGLASS REINFORCED SILICON RUBBER	18565	69–11–8805–1674
				END MOUNTING PARTS		
A4U200	156–4104–00	671–1906–05		IC,LINEAR:	80009	156–4104–00
A4U215	156–3217–00	671–0572–00	671–0572–05	IC,MISC:	80009	156–3217–00
A4U276	156–2559–00	671–0572–00	671–0572–05	IC,LINEAR:BIPOLAR,VOLTAGE REGULATOR;NEGATIVE,–12V,1.5A,2%;MC7912ACT,TO–220	80009	156–2559–00
				MOUNTING PARTS		
	210–0586–00	671–0572–00	671–0572–05	NUT,PL,ASSEM WA:4–40 X 0.25,STL CD PL	78189	211–041800–00
	210–1178–00	671–0572–00	671–0572–05	WASHER,SHLDR:	80009	210–1178–00
	211–0097–00	671–0572–00	671–0572–05	SCREW,MACHINE:4–40 X 0.312,PNH,STL	93907	ORDER BY DESCR
	214–2953–00	671–0572–00	671–0572–05	HEAT SINK,XSTR:TO–220,AL	80009	214–2953–00
	342–0563–00	671–0572–00	671–0572–05	INSULATOR,PLATE:TRANSISTOR,FIBERGLASS REINFORCED SILICON RUBBER	18565	69–11–8805–1674
				END MOUNTING PARTS		
A4U370	156–2558–00	671–1906–05		IC,LINEAR:BIPOLAR,VOLTAGE REGULATOR;POSITIVE,12V,1.5A,2%;MC7812ACT,TO–220	80009	156–2558–00
A4U410	156–1631–00			IC,LINEAR: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,LINEAR:BIPOLAR,COMPARATOR;DUPLICATE OF 156–1225–00,DO NOT USE;LM393N,DIP08.3	80009	156–1225–01
A4U722	156–2524–00	671–0572–00	671–0572–03	IC,LINEAR:	12969	UC3842N
A4U722	156–4236–00	671–0572–04		IC,LINEAR:	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	671–0572–00	671–0572–05	DIODE,ZENER:,;20V,5%,0.4W;1N968B,DO–35 OR 7,TR	80009	152–0304–00
A4W810	198–5653–00	671–0572–00	671–0572–05	WIRE SET,ELEC:	80009	198–5653–00
A6	671–0763–00			CIRCUIT BD ASSY:BNC	80009	671–0763–00
A6J9	131–3074–00			CONN,HDR:PCB,;MALE,STR,2 X 10,0.1 CTR,0.318 MLG X 0.110 TAIL,30 GOLD	80009	131–3074–00
A6L1	108–0655–00			COIL,RF:FIXED,63NH	80009	108–0655–00
A8	671–2811–00	B020000		CIRCUIT BD ASSY:DIG P EMI	80009	671–2811–00
				MOUNTING PARTS		
	211–0008–00			SCREW,MACHINE:4–40 X 0.25,PNH,STL (QUANTITY 2)	93907	ORDER BY DESCR
	407–4237–00			BRKT,FR PANEL:FILTER	80009	407–4237–00
				END MOUNTING PARTS		
A8C1	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C2	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C3	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C4	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C5	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C6	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C7	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C8	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C9	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C10	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C11	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A8C12	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C13	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C14	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C15	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C16	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C17	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C18	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C19	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C20	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C21	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C22	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C51	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C52	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C53	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C54	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C55	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C56	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C57	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C58	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C59	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C60	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C61	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C62	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C63	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C64	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C65	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C66	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C67	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C68	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C69	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C70	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C71	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8C72	283–0107–01			CAP,FXD,CER DI:51PF,5%,200V	04222	SR292A510JAAAP1
A8J1	131–5267–00			CONN,HDR:PCB,;MALE,STR,2 X 40,0.1 CTR,0.235 MLG X 0.110 TAIL,30GOLD	53387	DHY2072001A1057E
A8J2	131–3396–00			CONN,DSUB:	80009	131–3396–00
A8J51	131–5267–00			CONN,HDR:PCB,;MALE,STR,2 X 40,0.1 CTR,0.235 MLG X 0.110 TAIL,30GOLD	53387	DHY2072001A1057E
A8J52	131–3396–00			CONN,DSUB:	80009	131–3396–00
A8L1	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L2	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L3	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L4	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L5	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L6	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L7	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L8	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L9	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L10	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L11	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L51	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L52	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L53	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L54	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L55	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L56	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L57	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L58	120–0487–00			XFMR,TOROID:	80009	120–0487–00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A8L59	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L60	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A8L61	120–0487–00			XFMR,TOROID:	80009	120–0487–00
A9	671–2812–00			CIRCUIT BD ASSY:FRONT PANEL EMI *MOUNTING PARTS*	80009	671–2812–00
	211–0008–00			SCREW,MACHINE:4–40 X 0.25,PNH,STL (QUANTITY 4) *END MOUNTING PARTS*	93907	ORDER BY DESCR
A9C2	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C3	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C4	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C5	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C6	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C7	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C8	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C9	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C10	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C11	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C12	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C13	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C14	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C15	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C16	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C17	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C18	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C19	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C20	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C21	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C22	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C23	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C24	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C25	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C26	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C27	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C28	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C29	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C30	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C31	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C32	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C33	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C34	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C35	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C36	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C37	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C38	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C39	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9C40	283–0197–00			CAP,FXD,CER DI:470PF,5%,50V	05397	C320C471J5G5CA
A9FL1	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL2	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL3	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL4	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL5	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL6	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL7	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL8	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL9	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL10	119–4225–00			FILTER,EMI:	80009	119–4225–00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
A9FL11	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL12	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL13	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL14	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL15	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL16	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL17	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL18	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL19	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL20	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL21	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL22	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL23	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL24	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL25	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL26	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL27	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL28	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL29	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL30	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL31	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL32	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL33	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL34	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL35	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL36	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL37	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL38	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9FL39	119–4225–00			FILTER,EMI:	80009	119–4225–00
A9P109	131–5267–00			CONN,HDR:PCB,;MALE,STR,2 X 40,0.1 CTR,0.235 MLG X 0.110 TAIL,30GOLD	53387	DHY2072001A1057E
A9P219	131–4822–00			CONN,BOX:	00779	1–102585–2
B100	119–2068–00	B010100	B010214	FAN,TUBEAXIAL:24VDC,20CFM,60 X 60 MM 4800RPM, SAFETY CONTROLLED	TK1960	TFDD6024RXA
B100	119–2068–01	B010215		FAN,TUBEAXIAL:	80009	119–2068–01
J1	131–0955–03			CONN,RF JACK:	80009	131–0955–03
J2	131–0955–03			CONN,RF JACK:	80009	131–0955–03
J3	131–0955–03			CONN,RF JACK:	80009	131–0955–03
				ATTACHED PARTS		
	210–0255–00			TERMINAL,LUG:0.391 ID,LOCKING,BRS CD PL	12327	ORDER BY DESCR
				END ATTACHED PARTS		
J4	131–0955–03			CONN,RF JACK:	80009	131–0955–03
J5	131–0955–03			CONN,RF JACK:	80009	131–0955–03
J6	131–0955–03			CONN,RF JACK:	80009	131–0955–03
J7	131–0955–03			CONN,RF JACK:	80009	131–0955–03
				ATTACHED PARTS		
	210–0255–00			TERMINAL,LUG:0.391 ID,LOCKING,BRS CD PL	12327	ORDER BY DESCR
				END ATTACHED PARTS		
J8	131–0955–03			CONN,RF JACK:	80009	131–0955–03
				ATTACHED PARTS		
	210–0255–00			TERMINAL,LUG:0.391 ID,LOCKING,BRS CD PL	12327	ORDER BY DESCR
				END ATTACHED PARTS		
J10	131–5358–00	B020000		CONN,DSUB FLTR:	80009	131–5358–00
W109	174–1495–00	B010100	B019999	CA ASSY,SP,ELEC:20,28 AWG,3.0 L,RIBBON	80009	174–1495–00
W109	174–2187–00	B020000		CA ASSY,SP,ELEC:40,28 AWG,4.5 L,RIBBON,2 X 20,0.1 CTR,RCPT X 2 X 17,0.1 CTR,RCPT (A1J217 & A2–1J109)	80009	174–2187–00

Component Number	Tektronix Part Number	Serial / Assembly Number Effective	Discontinued	Name & Description	Mfr. Code	Mfr. Part Number
W160	174–0034–00			CA ASSY,SP,ELEC:28 AWG,3.0 L,RIBBONSAFETY CONTROLLED	80009	174–0034–00
				(A2–1J988 &A4J160, STANDARD ONLY)		
W480	174–1460–00			CA ASSY,SP,ELEC:26,28 AWG,10.0 L	80009	174–1460–00
				(A3J480 TO REMOTE)		
				MOUNTING PARTS		
	131–0890–00			SCREW LOCK:4–40 X 0.312 L HEX HD,STLCD PL	71468	D 20418–2
				(QUANTITY 2)		
				END MOUNTING PARTS		
W920	174–0333–00			CA ASSY,SP,ELEC:20,26 AWG,2.5 L,RIBBON	80009	174–0333–00
				(A3J920 & A6J9)		
				MOUNTING PARTS		
	131–0890–00			SCREW LOCK:4–40 X 0.312 L HEX HD,STLCD PL	71468	D 20418–2
				(QUANTITY 2)		
				END MOUNTING PARTS		
W940	174–1339–00	B010100	B019999	CA ASSY,SP,ELEC:26,28 AWG,3.0 L	80009	174–1339–00
W940	174–2359–00	B020000		CA ASSY,SP,ELEC:26,28 AWG,1.375 L	80009	174–2359–00
				(A3J940 TO DIGITAL OUT 2, STANDARD ONLY)		
W960	174–1339–00			CA ASSY,SP,ELEC:26,28 AWG,3.0 L	80009	174–1339–00
				(A3J960 TO DIGITAL OUT 1)		

Diagram and Circuit Board Illustrations

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:

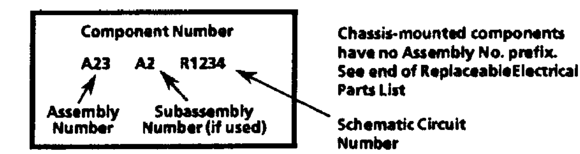
Capacitors:
Values one or greater are in picofarads (pF).
Values less than one are in microfarads (μF).
Resistors = Ohms (Ω).

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, and lookup table for the schematic diagram.

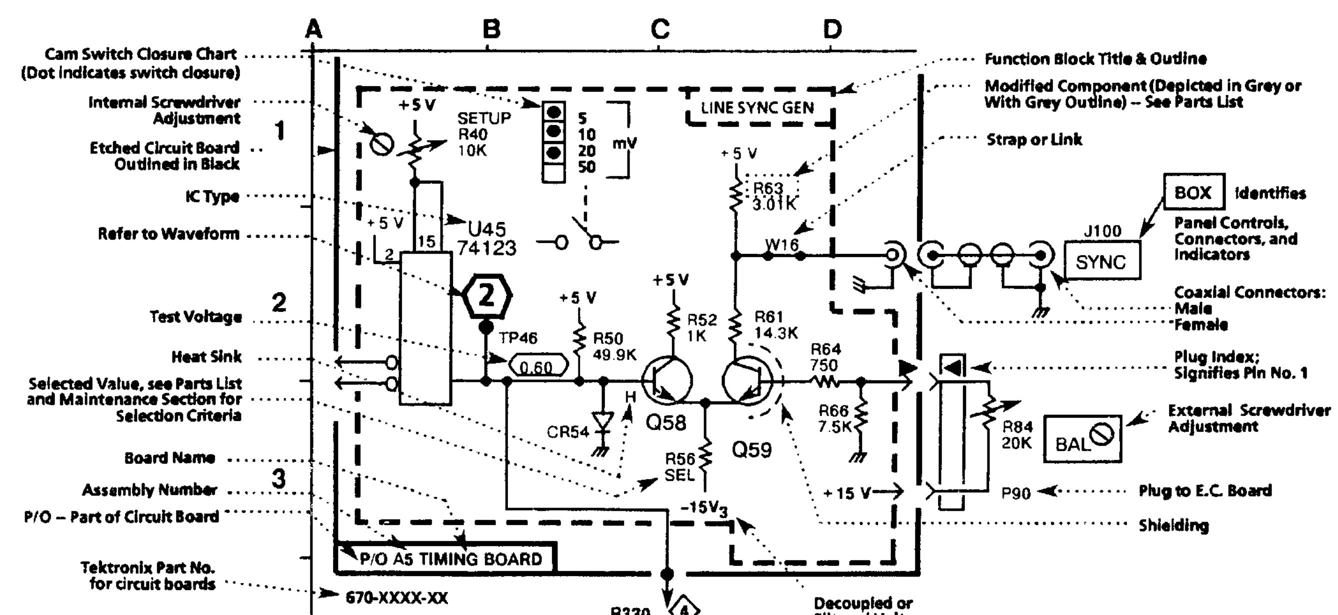
The Replaceable Electrical Parts List is arranged by assembly number in numerical sequence; the components are listed by component number. Example:



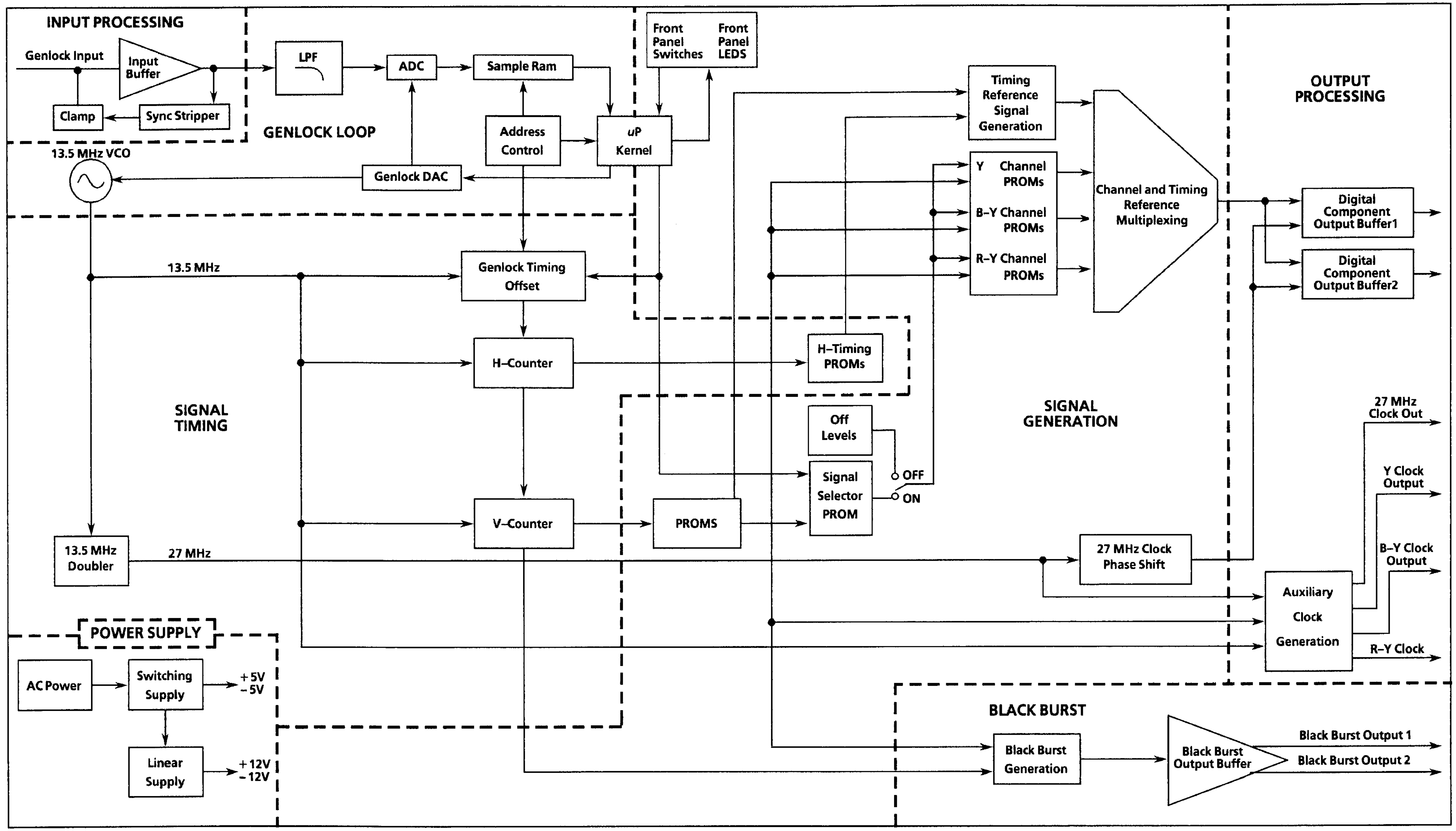
Grid Coordinates

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.

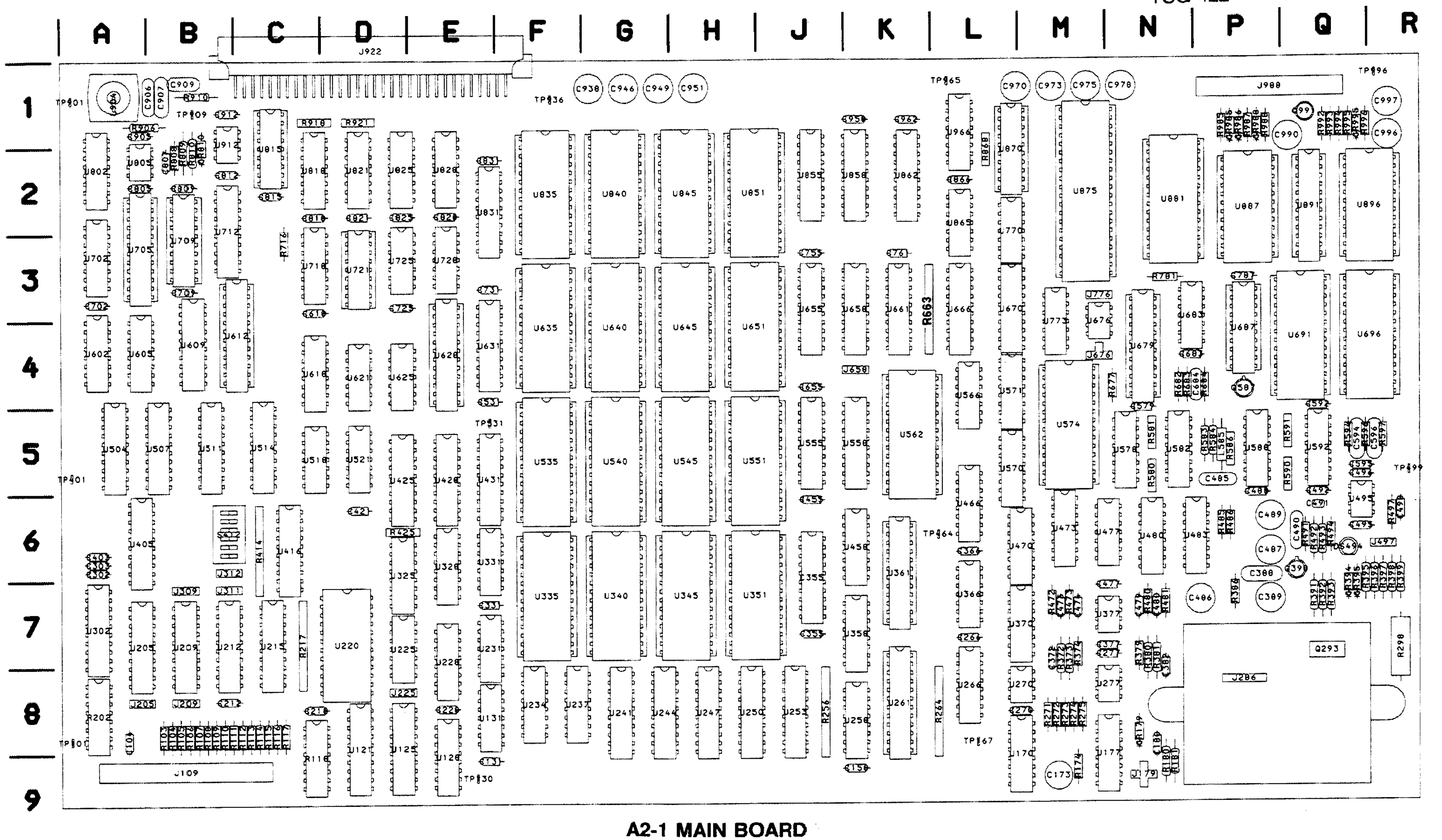
When more than one schematic diagram is used to illustrate the circuitry on a circuit board, the circuit board illustration may only appear opposite the first diagram; the lookup table will list the diagram number of other diagrams that the other circuitry appears on.



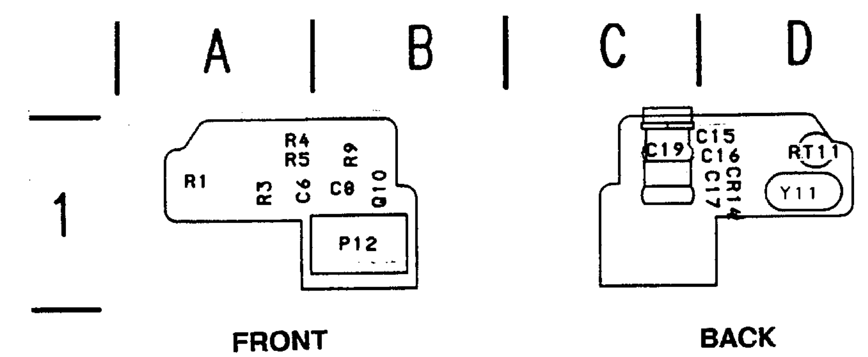
SYNC GENERATOR 5



TSG-422 BLOCK DIAGRAM



A2-1 MAIN BOARD



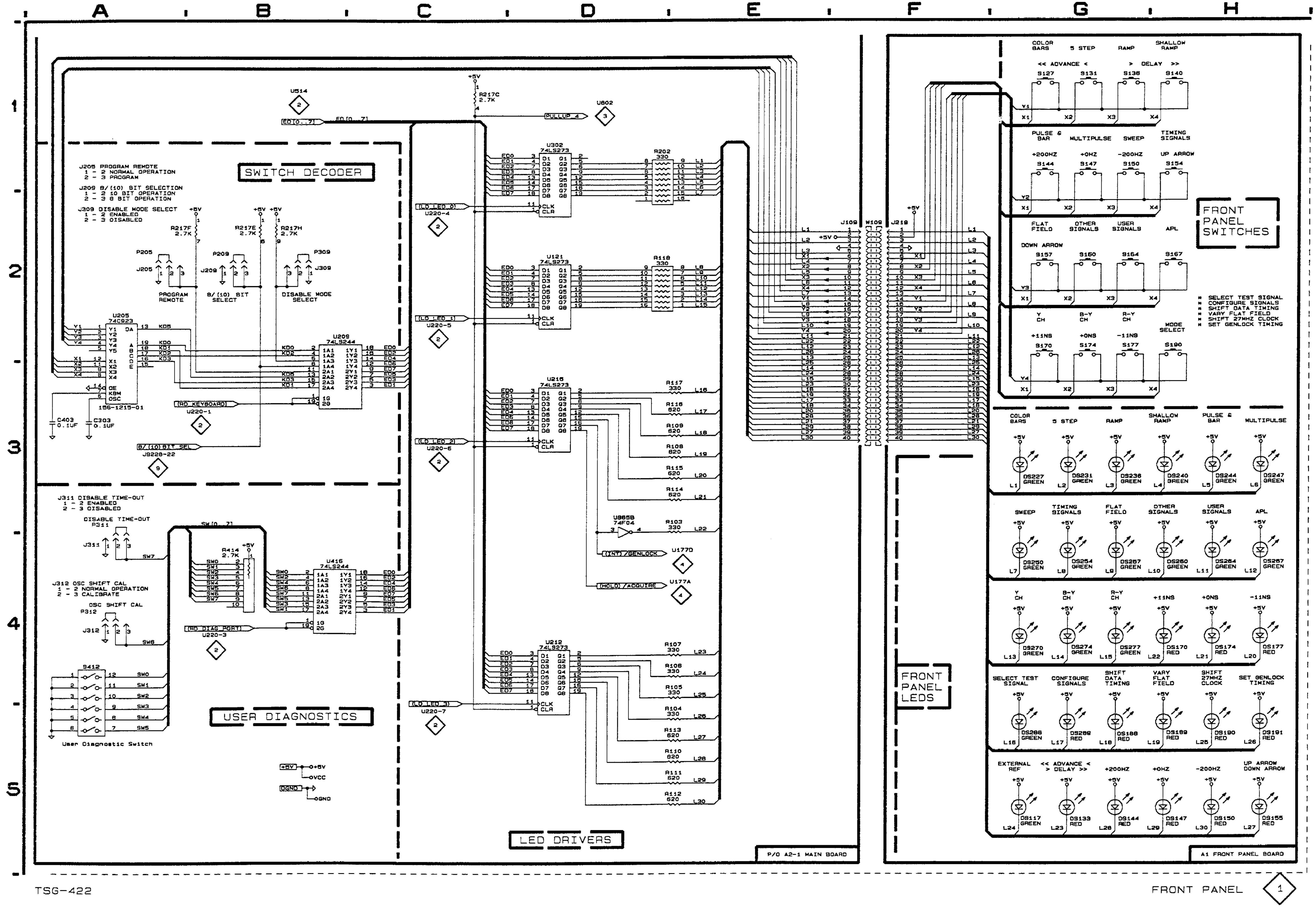
A2-2 OVEN BOARD

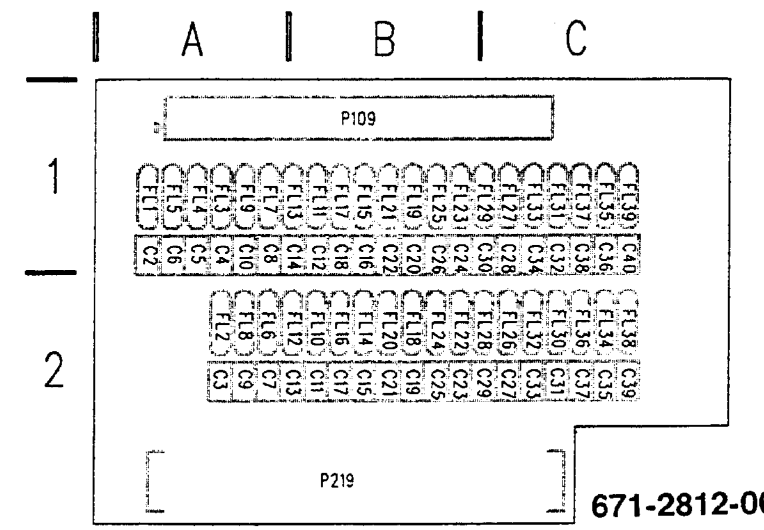
MAIN BOARD SCHEMATIC DIAGRAM <1> LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

ASSEMBLY A2-1. *Partial Assembly A2-1 also shown on Schematics 2, 3, 4, 5, 6, 7, 8, and 9.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSEMBLY A2-1		
C303	A3	A6
C403	A3	A6
J109	F2	B9
J205	A2	B8
J209	B2	B8
J309	B2	B7
J311	A4	C7
J312	A4	C7
R103	E3	B8
R104	E5	B8
R105	E4	B8
R106	E4	B8
R107	E4	B8
R108	E3	B8
R109	E3	B8
R110	E5	B8
R111	E5	C8
R112	E5	C8
R113	E5	C8
R114	E3	C8
R115	E3	C8
R116	E3	C8
R117	E3	C8
R113	E5	C8
R114	E3	C8
R115	E3	C8
R116	E3	C8
R117	E3	C8
R118	D2	D9
R202	D1	A8
R217E	B2	C7
R217F	B2	C7
R217H	B2	C7
R414	B4	C6
S412	A4	C6
U121	D2	D9
U205	A2	B7
U209	B2	B7
U212	D4	C7
U215	D3	C7
U302	D1	A7
U416	B4	C6
U865B	D3	K3
W109	F2	
ASSEMBLY A1		
DS117	G5	
DS133	G5	
DS144	G5	
DS147	H5	
DS150	H5	
DS155	H5	
DS170	H4	
DS174	H4	
DS177	H4	
DS188	G5	
DS189	H5	
DS190	H5	
DS191	H5	
DS227	G3	
DS231	G3	
DS236	G3	
DS240	H3	
DS244	H3	
DS247	H3	
DS250	G4	
DS254	G4	
DS257	G4	
DS260	H4	
DS264	H4	
DS267	H4	
DS270	G4	
DS274	G4	
DS277	G4	
DS288	G5	
DS289	G5	
J219	F1	
S127	G1	
S131	G1	
S136	G1	
S140	H1	
S144	G1	
S147	G1	
S150	G1	
S154	H1	
S157	G2	
S170	G2	
S174	G2	
S177	G2	
S190	H2	


SWITCH DECODER
USER DIAGNOSTICS
LED DRIVERS
FRONT PANEL SWITCHES
FRONT PANEL LEDS
P/O A2-1 MAIN BOARD
A1 FRONT PANEL BOARD
TSG-422
FRONT PANEL
1



A9 FRONT PANEL EMI BOARD

FRONT PANEL EMI FILTER BOARD
SCHEMATIC DIAGRAM <1>a LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

ASSEMBLY A9.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C2	B2	A1
C3	C1	A2
C4	D1	A1
C5	E1	A1
C6	F1	A1
C7	C1	A2
C8	D1	A1
C9	E1	A2
C10	F1	A1
C11	C2	B2
C12	D2	B1
C13	E2	B2
C14	F2	B1
C15	C2	B2
C16	D2	B1
C17	E2	B2
C18	F2	B1
C19	C3	B2
C20	D3	B1
C21	E3	B2
C22	F3	B1
C23	C3	B2
C24	D3	B1
C25	E3	B2
C26	F3	B1
C27	C4	C2
C28	D4	C1
C29	E4	C2
C30	F4	C1
C31	C4	C2

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C32	D4	C1
C33	E4	C2
C34	F4	C1
C35	C5	C2
C36	D5	C1
C37	E5	C2
C38	F5	C1
C39	D5	C2
C40	E5	C1
FL1	B2	A1
FL2	C1	A2
FL3	D1	A1
FL4	E1	A1
FL5	F1	A1
FL6	C1	A2
FL7	D1	A1
FL8	E1	A2
FL9	F1	A1
FL10	C2	B2
FL11	D2	B1
FL12	E2	B2
FL13	F2	B1
FL14	C2	B2
FL15	D2	B1
FL16	E2	B2
FL17	F2	B1
FL18	C3	B2
FL19	D3	B1
FL20	E3	B2

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
FL21	F3	B1
FL22	C3	B2
FL23	D3	B1
FL24	E3	B2
FL25	F3	B1
FL26	C4	C2
FL27	D4	C1
FL28	E4	C2
FL29	F4	B1
FL30	C4	C2
FL31	D4	C1
FL32	E4	C2
FL33	F4	C1
FL34	C5	C2
FL35	D5	C1
FL36	E5	C2
FL37	F5	C1
FL38	D5	C2
FL39	E5	C1
J109	A2	B1
P219	H2	B3

TSG 422

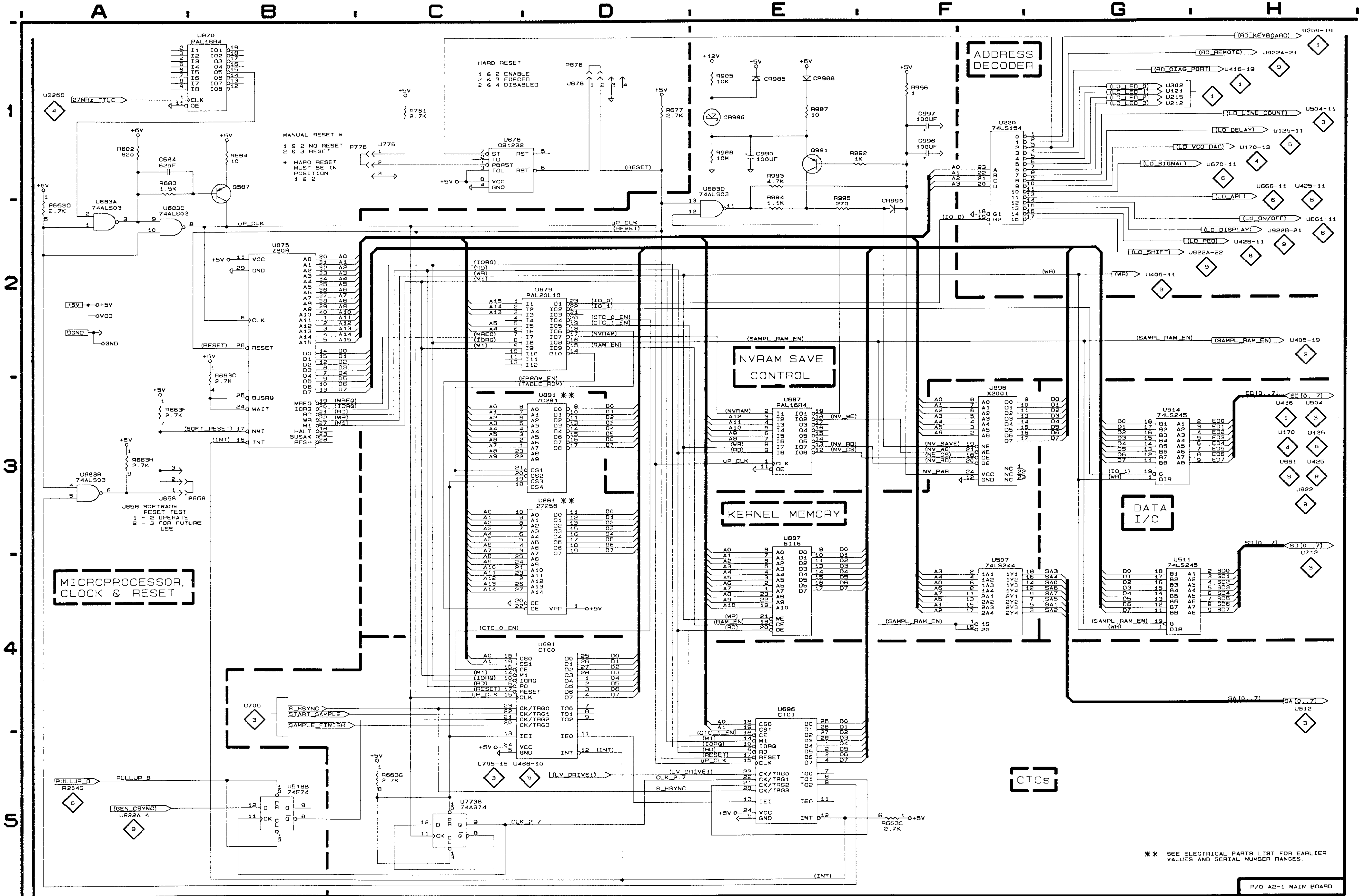
FRONT PANEL EMI FILTER A9 1 a

MAIN BOARD
SCHEMATIC DIAGRAM <2> LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

ASSEMBLY A2-1. *Partial Assembly A2-1 also shown on Schematics 1, 3, 4, 5, 6, 7, 8, and 9.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C684	A1	N4	U220	F1	D7
C990	E1	O2	U507	F4	B5
C996	F1	P2	U511	G4	B5
C997	F1	P1	U514	G3	C5
CR985	E1	N1	U676	C1	M4
CR986	E1	N1	U679	D2	M4
CR988	E1	N1	U683A	A2	N4
CR995	F2	P1	U683B	A3	N4
J658	A3	J4	U683C	A2	N4
J676	D1	M4	U683D	E2	N4
J776	C1	M3	U687	E3	N4
			U691	C4	O4
Q587	B1	N5			
Q991	E1	O1	U696	E4	P4
			U773B	C5	L4
R663C	B2	K4	U870	B1	L2
R663D	A2	K4	U875	B2	L2
R663E	F5	K4			
R663F	A3	K4	U881	D3	M2
			U887	E3	N2
R663G	C5	K4	U891	D3	O2
R663H	A3	K4	U896	F3	P2
R677	D1	M4			
R682	A1	M4			
R683	A1	N4			
R684	B1	N4			
R781	C1	M3			
R985	E1	N1			
R987	E1	N1			
R988	E1	O1			
R992	E1	O1			
R993	E1	O1			
R994	E2	O1			
R995	E2	O1			
R996	F1	P1			



TSG-422

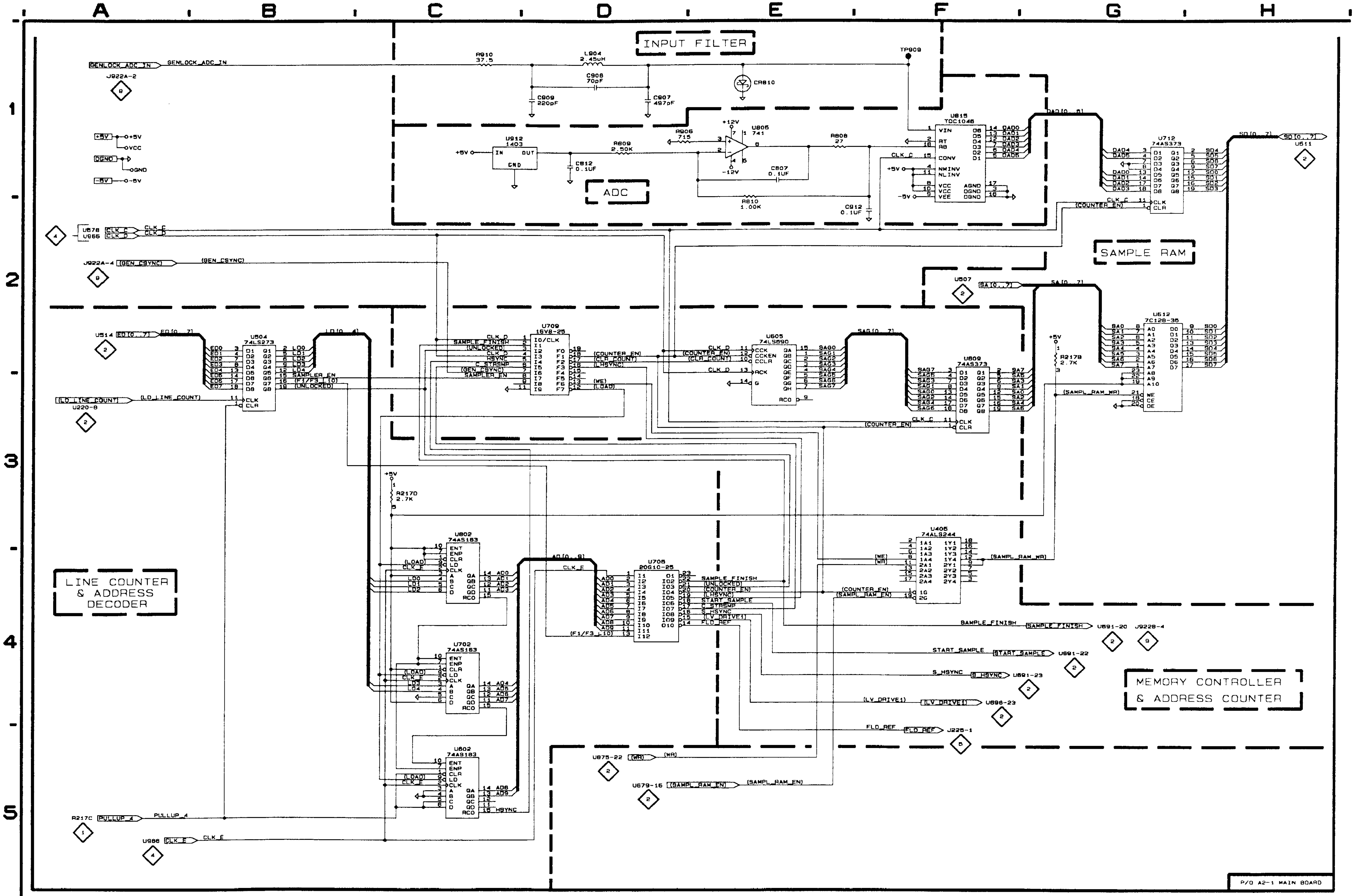
MICROPROCESSOR KERNEL 2

MAIN BOARD
SCHEMATIC DIAGRAM <3> LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

ASSEMBLY A2-1. *Partial Assembly A2-1 also shown on Schematics 1, 2, 4, 5, 6, 7, 8, and 9.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C807	E1	B2
C812	D1	C2
C906	D1	B1
C907	D1	B1
C909	D1	B1
C912	F2	C1
CR810	E1	B2
L904	D1	A1
R217B	G2	C7
R217D	C3	C7
R808	E1	B2
R809	D1	B2
R810	E1	B2
R906	D1	B1
R910	C1	B1
TP909	F1	B1
U405	F3	B6
U504	B2	A5
U602	C5	A4
U605	E2	B4
U609	F2	B4
U612	G2	C4
U702	C4	A3
U705	D4	B3
U709	D2	B3
U712	G1	C3
U802	C3	A2
U805	E1	B2
U815	F1	C2
U912	C1	C2



TSG-422

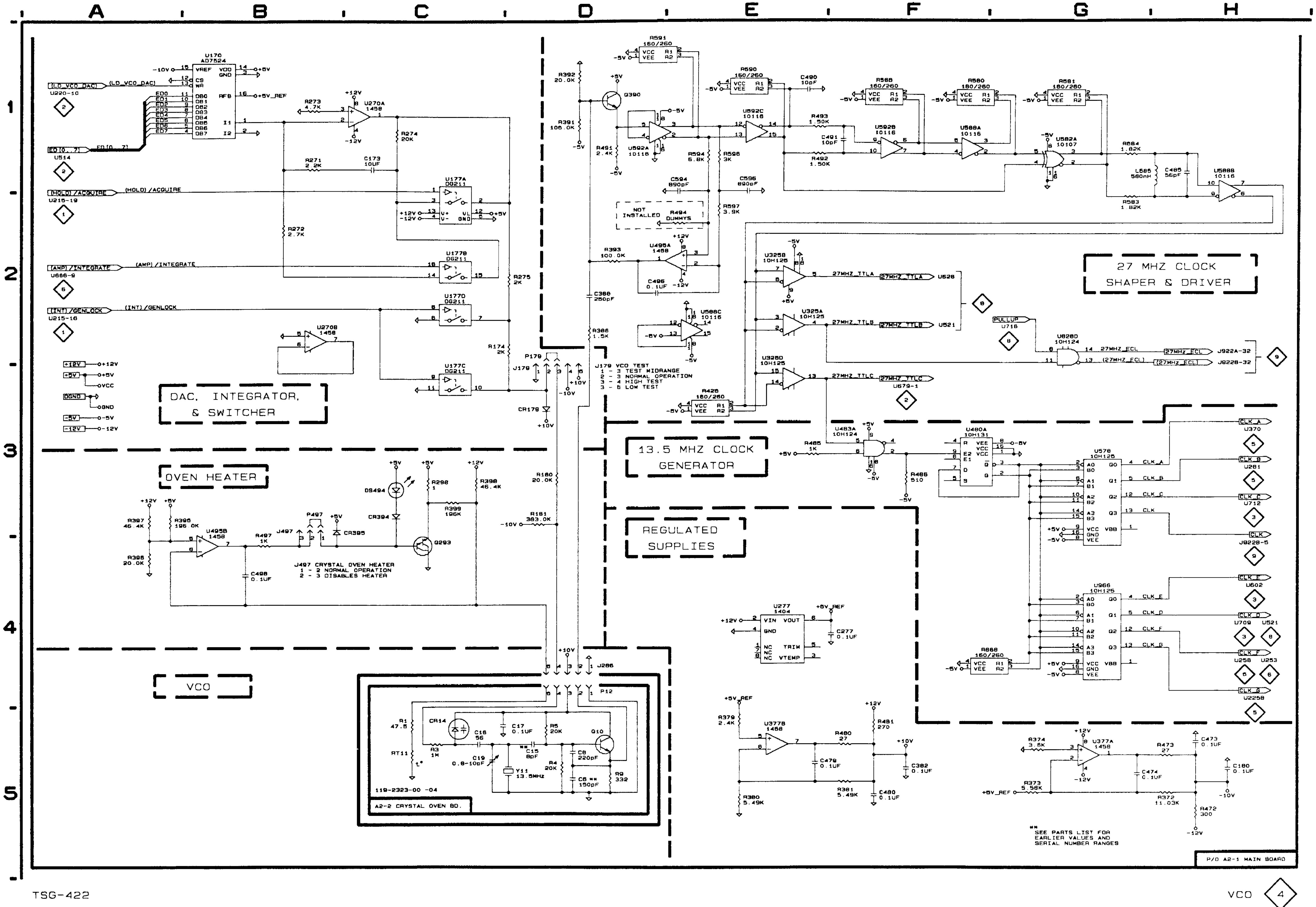
GENLOCK DATA ACQUISITION CONTROLLER 3

MAIN BOARD
SCHEMATIC DIAGRAM <4> LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

ASSEMBLY A2-1. *Partial Assembly A2-1 also shown on Schematics 1, 2, 3, 5, 6, 7, 8, and 9.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSEMBLY A2-1		
C173	C1	L9
C180	H5	M9
C277	F4	M7
C382	F5	M8
C388	D2	N7
C473	H5	L7
C474	G5	L7
C479	E5	M7
C480	F5	M7
C485	H1	N5
C490	E1	O6
C491	F1	O6
C496	D2	P6
C498	B4	P6
C594	E1	O5
C596	E1	P5
CR179	D3	M8
CR394	C3	O7
CR395	B3	P7
DS494	C3	O6
J179	D3	M9
J286	D4	N8
J497	B3	P6
L585	H1	N5
Q293	C4	O8
Q390	D1	O7
R174	D2	L9
R180	D3	M9
R181	D3	M9
R271	B1	L8
R272	B2	L8
R273	B1	L8
R274	C1	L8
R275	D2	L8
R298	C3	P8
R372	H5	L8
R373	G5	L8
R374	G5	L8
R379	E5	M8
R380	E5	M8
R381	F5	M8
R386	D2	N7
R391	D1	O7
R392	D1	O7
R393	D2	O7
R395	A3	P7
R396	A4	P7
R397	A3	P7
R398	C3	P7
R399	C3	P7
R425	E3	E6
R472	H5	L7
R473	H5	L7
R480	F5	M7
R485	E3	N6
R486	F3	N6
R491	D1	O6
R492	E1	O6
R493	E1	O6
R494	E2	O6
R497	B4	P6
R580	F1	M6
R581	G1	M5
R583	G2	N5
R584	G1	N5
R586	F1	N5
R590	E1	O6
R591	D1	O5
R594	E1	O5
R596	E1	P5
R597	E2	P5
R868	F4	K2
U170	B1	L9
U177A	C1	M9
U177B	C2	M9
U177C	C3	M9
U177D	C2	M9
U270A	C1	L8
U270B	B2	L8
U277	E4	M8
U325A	E2	E7
U325B	E2	E7
U325D	E3	E7
U377A	G5	M7
U377B	E5	M7
U480A	F3	M6
U483A	F3	N6
U495A	E2	P6
U495B	B4	P6
U578	G3	M5
U582A	G1	M5
U588A	F1	N5
U588B	H1	N5
U588C	E2	N5
U592A	D1	O5
U592B	F1	O5
U592C	E1	O5
U966	G4	K2
ASSEMBLY A2-2		
C6	D5	A1
C8	D5	B1
C15	D5	D1
C16	C5	D1
C17	D5	D1
C19	C5	C1
CR14	C5	D1
P12	D4	B1
Q10	D5	B1
R1	C5	A1
R3	C5	A1
R4	D5	A1
R5	D5	A1
R9	D5	B1
RT11	C5	D1
Y11	D5	D1

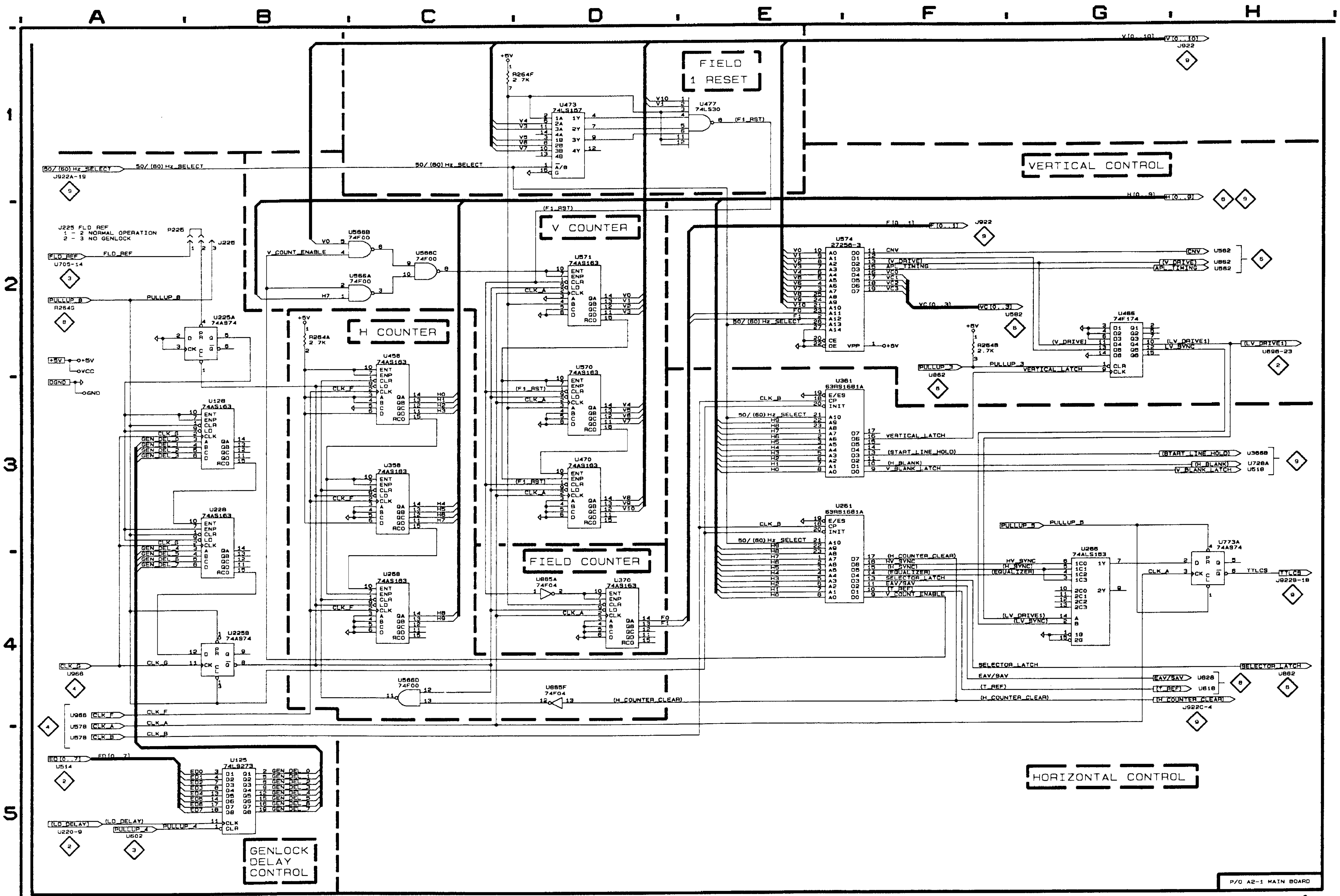

DAC, INTEGRATOR, & SWITCHER
OVEN HEATER
VCO
13.5 MHZ CLOCK GENERATOR
REGULATED SUPPLIES
27 MHZ CLOCK SHAPER & DRIVER
J497 CRYSTAL OVEN HEATER
1 - 2 NORMAL OPERATION
2 - 3 DISABLES HEATER
J179 VCO TEST
1 - 3 TEST MIDRANGE
2 - 3 NORMAL OPERATION
3 - 4 HIGH TEST
3 - 5 LOW TEST
A2-2 CRYSTAL OVEN BD.
119-2323-00 -04
** SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES
P/O A2-1 MAIN BOARD
TSG-422
VCO 4

MAIN BOARD
SCHEMATIC DIAGRAM <5> LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

ASSEMBLY A2-1. *Partial Assembly A2-1 also shown on Schematics 1, 2, 3, 4, 6, 7, 8, and 9.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
J225	B2	E8
R217C	B5	C7
R264A	B2	K8
R264B	F2	K8
R264F	C1	K8
U125	B5	E9
U128	B3	E9
U225A	B2	E7
U225B	B4	E7
U228	B3	E8
U258	C4	J8
U261	E3	J8
U266	G4	K8
U358	C3	J7
U361	E3	J7
U370	D4	L7
U458	C2	J6
U466	G2	K6
U470	D3	L6
U473	D1	L6
U477	E1	M6
U566A	C2	K5
U566B	C2	K5
U566C	C2	K5
U566D	C4	K5
U570	D3	L5
U571	D2	L5
U574	E2	L5
U773A	H4	L4
U865A	D4	K3
U865F	D4	K3



TSG-422

H & V TIMING 5

MAIN BOARD
SCHEMATIC DIAGRAM <6> LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

ASSEMBLY A2-1. *Partial Assembly A2-1 also shown on Schematics 1, 2, 3, 4, 5, 7, 8, and 9.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
R264C	E4	K8
U234	B4	F8
U237B	B4	G8
U241	C5	G8
U244	E5	H8
U247	F5	H8
U250	G5	I8
U253	B5	I8
U355	E3	I7
U555	G2	I5
U558	E3	J5
U562	D3	J5
U655	G2	I4
U658	E2	J4
U661	B1	J4
U666	B2	K4
U670	B3	L4
U770B	C3	L3
U855	G1	I2
U858	E2	J2
U862	C1	J2
U865C	F1	K3
U865D	F3	K3
U865E	F2	K3

TSG-422

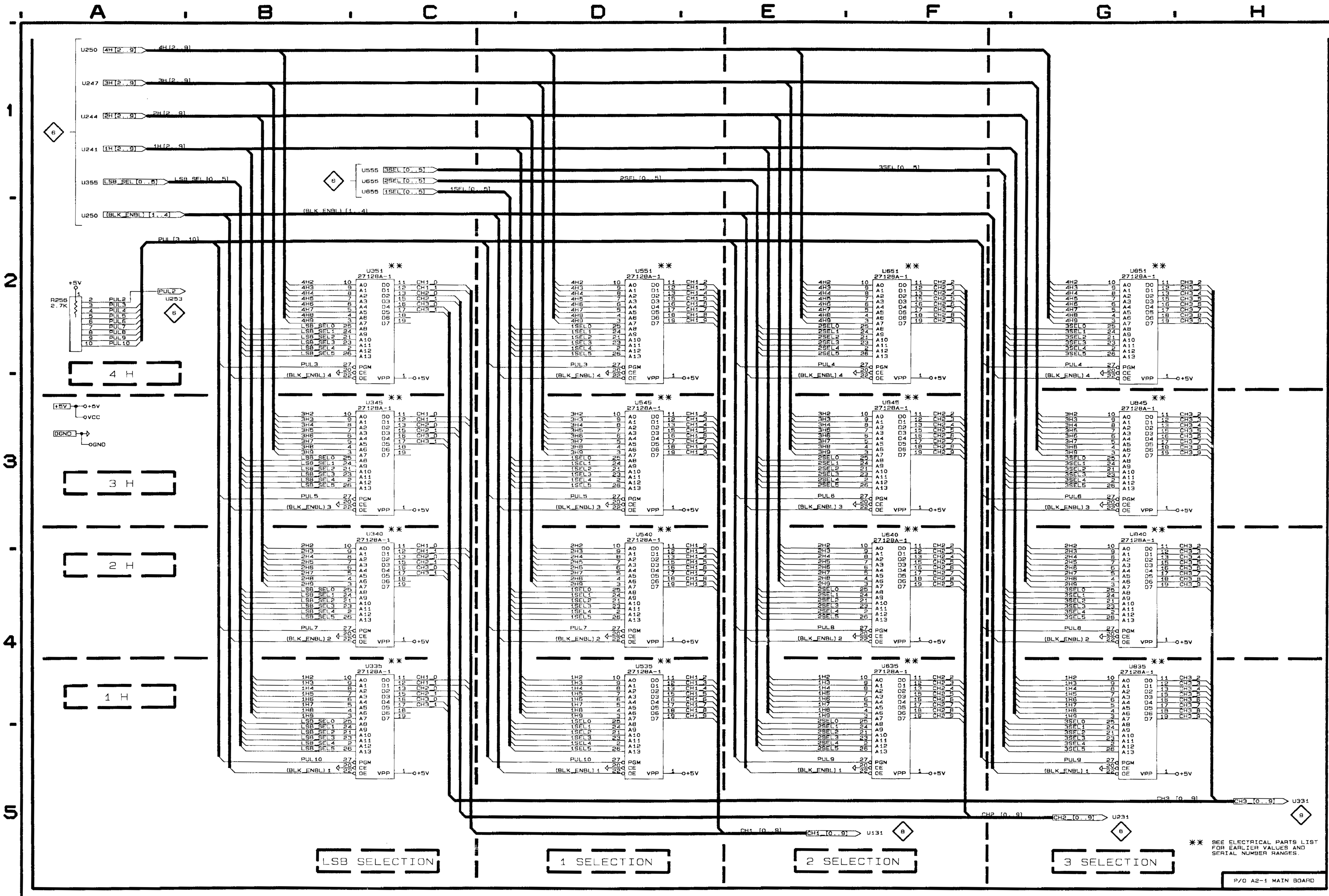
SIGNAL SELECTION 6

MAIN BOARD
SCHEMATIC DIAGRAM <7> LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

ASSEMBLY A2-1. *Partial Assembly A2-1 also shown on Schematics 1, 2, 3, 4, 5, 6, 8, and 9.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
R256	A2	I8
U335	C4	F7
U340	C3	G7
U345	C3	H7
U351	C2	I7
U535	D4	F5
U540	D3	G5
U545	D3	H5
U551	D2	I5
U635	F4	F4
U640	F3	G4
U645	F3	H4
U651	F2	I4
U835	G4	F2
U840	G3	G2
U845	G3	H2
U851	G2	I2



TSG-422

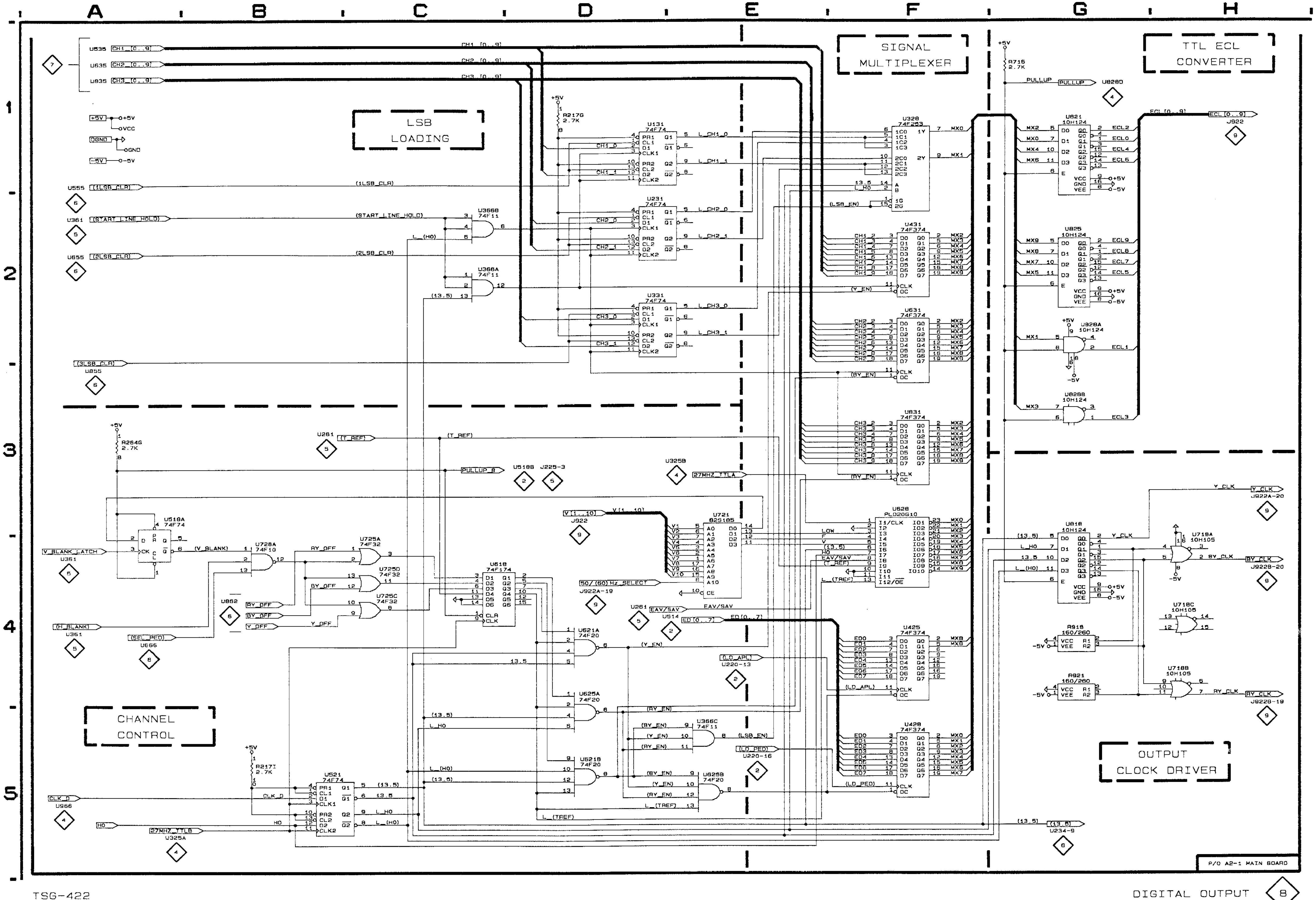
TEST SIGNAL MEMORY 7

MAIN BOARD
SCHEMATIC DIAGRAM <8> LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

ASSEMBLY A2-1. *Partial Assembly A2-1 also shown on Schematics 1, 2, 3, 4, 5, 6, 7, and 9.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
R217G	D1	C7
R217I	B5	C7
R264G	A3	K8
R716	G1	C3
R918	G4	D1
R921	G4	D1
U131	D1	F8
U231	D2	F7
U328	F1	E7
U331	D2	F6
U366A	C2	K7
U366B	C2	K7
U366C	E5	K7
U425	F4	E6
U428	F5	E6
U431	F2	F6
U518	A4	D5
U521	B5	D5
U618	C4	D4
U621A	D4	D4
U621B	D5	D4
U625A	D4	E4
U625B	E5	E4
U628	F3	E4
U631	F2	F4
U718A	H4	D3
U718B	H4	D3
U718C	H4	D3
U721	E3	D3
U725A	C4	E3
U725C	C4	E3
U725D	C4	E3
U728A	B4	E3
U818	G4	D2
U821	G1	D2
U825	G2	E2
U828	G2	E2
U831	F3	F2

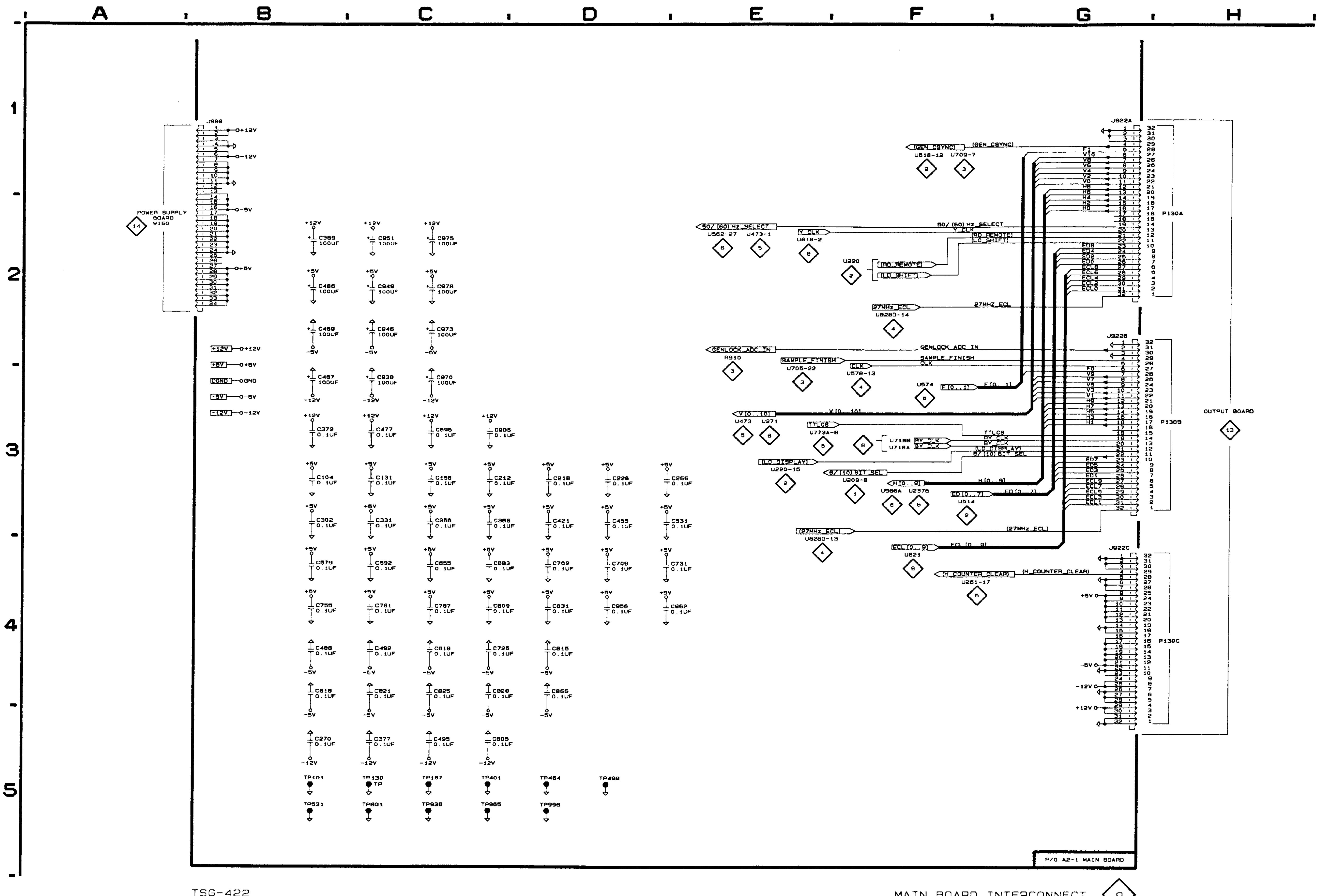

SIGNAL MULTIPLEXER
TTL ECL CONVERTER
LSB LOADING
CHANNEL CONTROL
OUTPUT CLOCK DRIVER
P/O A2-1 MAIN BOARD
TSG-422
DIGITAL OUTPUT
8

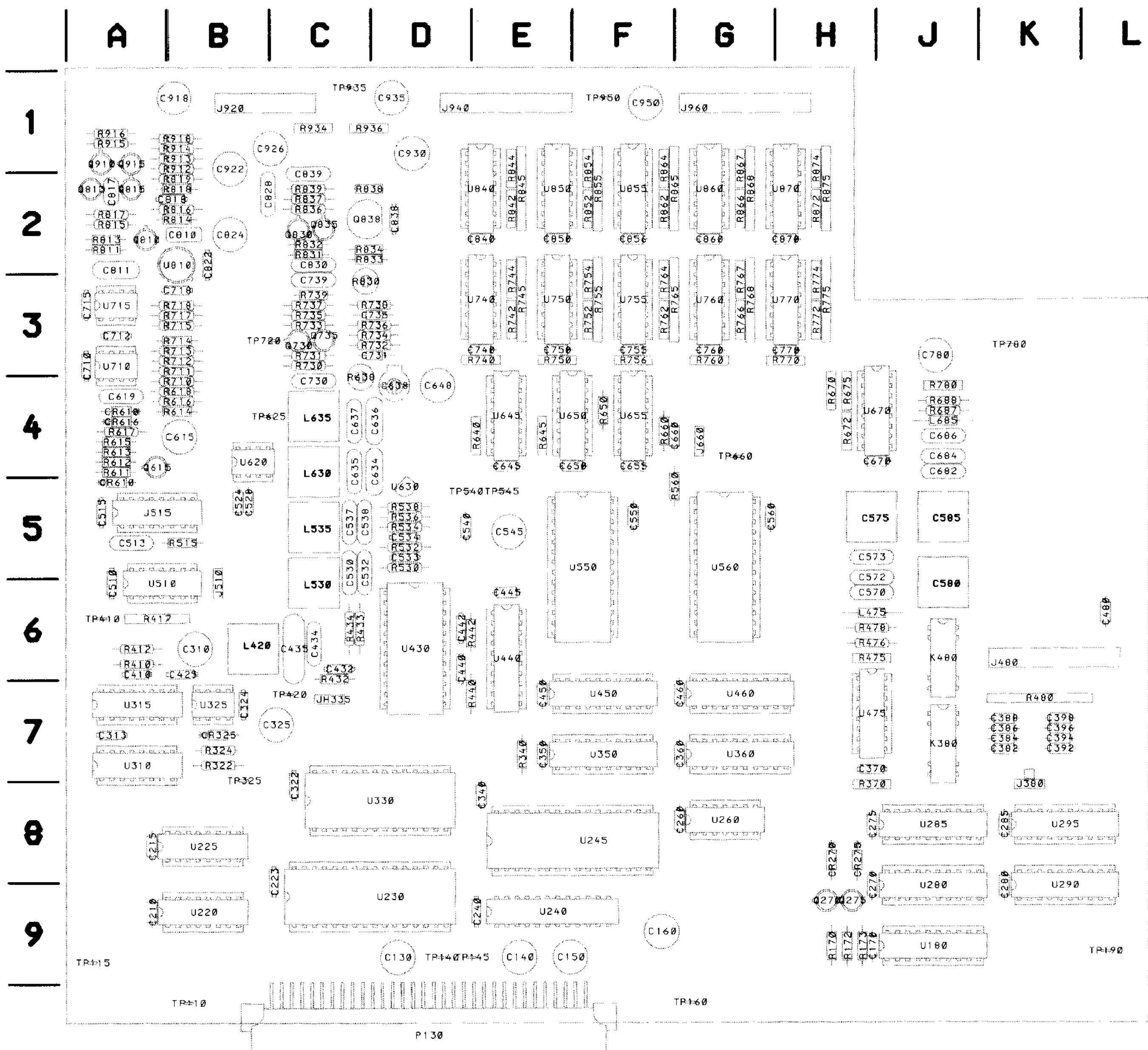
MAIN BOARD
SCHEMATIC DIAGRAM <9> LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

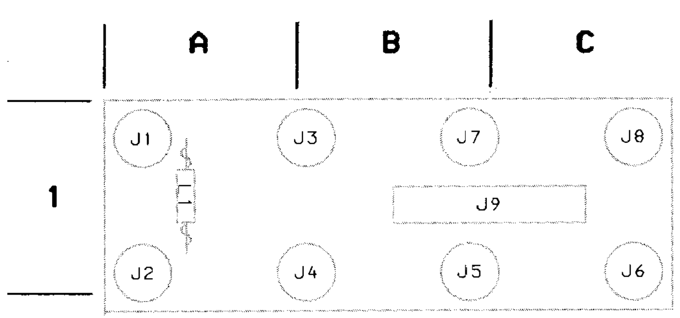
ASSEMBLY A2-1. *Partial Assembly A2-1 also shown on Schematics 1, 2, 3, 4, 5, 6, 7, and 8.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C104	B3	A8	C815	D4	C2
C131	C3	F9	C818	B4	D2
C158	C3	J9	C821	C4	D2
C212	C3	C8	C825	C4	E2
C218	D3	D8	C828	C4	E2
C228	D3	E8	C831	D4	F2
C266	D3	K7	C866	D4	K2
C270	B5	L8	C905	C3	B1
C302	B3	A6	C938	C3	G1
C331	C3	F7	C946	C2	G1
C355	C3	I7	C949	C2	G1
C366	C3	K6	C951	C2	H1
C372	B3	L8	C958	D4	J1
C377	C5	M7	C962	D4	J1
C389	B2	N7	C970	C3	L1
C421	D3	D6	C973	C2	L1
C455	D3	I6	C975	C2	L1
C477	C3	M7	C978	C2	M1
C486	B2	N7			
C487	B3	N6	J922A	G1	D1
			J922B	G2	D1
C488	B4	N6	J922C	G4	D1
C489	B2	N6	J988	B1	O1
C492	C4	O6			
C495	C5	P6	TP101	B5	A9
			TP130	C5	E9
C531	D3	F5	TP167	C5	K9
C579	B4	M5	TP401	C5	A5
C592	C4	O5			
C595	C3	P5	TP464	D5	K6
			TP499	D5	P5
C618	C4	D3	TP531	B5	F5
C655	C4	I4	TP901	C5	A1
C683	C4	N4			
C702	D4	A3	TP936	C5	F1
			TP965	C5	K1
C709	D4	B3	TP996	D5	P1
C725	C4	E3			
C731	D4	F3			
C755	B4	I3			
C761	C4	J3			
C787	C4	N3			
C805	C5	B2			
C809	C4	B2			


TSG-422
MAIN BOARD INTERCONNECT
9
P/O A2-1 MAIN BOARD
POWER SUPPLY BOARD W160
OUTPUT BOARD
J988
J922A
J922B
J922C
P130A
P130B
P130C



A3 OUTPUT BOARD



A6 BNC BOARD

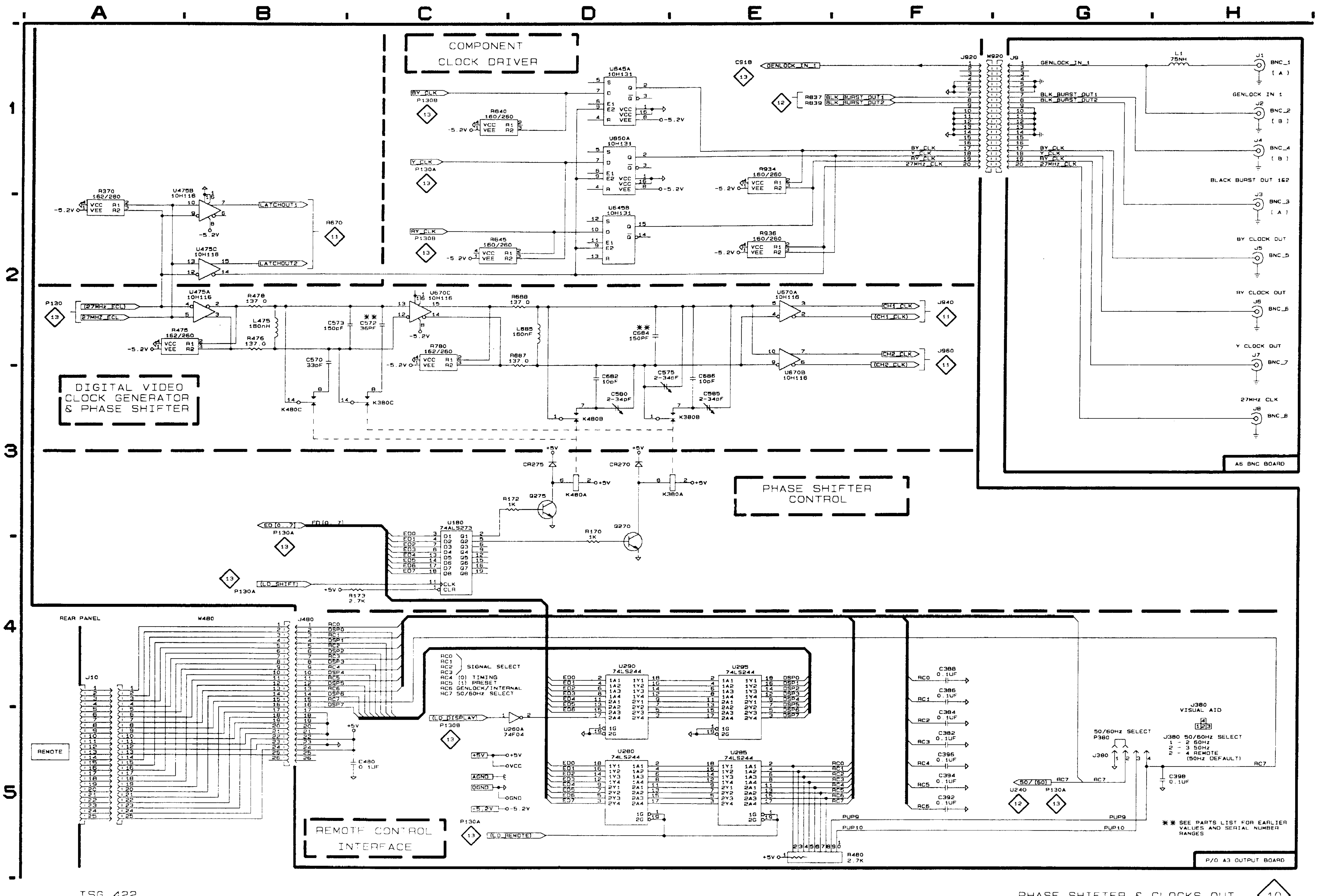
OUTPUT BOARD
SCHEMATIC DIAGRAM <10> LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

ASSEMBLY A3. *Partial Assembly A3 also shown on Schematics 11, 12, and 13.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSEMBLY A3		
C382	D4	J8
C384	D4	J7
C386	D4	J7
C388	D4	J7
C392	D5	K8
C394	D5	K7
C396	D5	K7
C398	E5	K7
C480	F5	K6
C570	B2	I6
C572	C2	I6
C573	C2	I6
C575	D3	H5
C580	D3	J6
C585	E3	J5
C682	D3	I5
C684	D2	I5
C686	E3	I4
CR270	D3	H9
CR275	D3	H9
J380	E5	J8
J480	F4	J7
J920	F1	B1
K380A	D3	J7
K380B	D3	J7
K380C	C3	J7
K480A	D3	I7
K480B	D3	I7
K480C	B3	I7
L475	B2	I6
L685	D2	I4
P380	E4	
Q270	D4	H9
Q275	C3	H9
R170	D4	H9
R172	C3	H9
R173	A4	I9
R370	A2	I8
R475	A2	I7

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
R480	C5	J7
R476	B2	I6
R478	B2	I6
R480	C5	J7
R640	C1	E4
R645	C2	E4
R687	D2	I4
R688	D2	I4
R780	C2	I4
R934	E1	C1
R936	E2	D1
U180	B3	I9
U260A	A4	G8
U280	B5	I9
U285	C5	I8
U290	B4	K9
U295	C4	K8
U475A	B2	I7
U475B	B2	I7
U475C	B2	I7
U645A	D1	E4
U645B	D2	E4
U650A	D1	F4
U670A	E2	I4
U670B	E2	I4
U670C	C2	I4
W480	F4	
W920	F1	
ASSEMBLY A6		
J1	H1	A1
J2	H1	A1
J3	H2	B1
J4	H1	B1
J5	H2	B1
J6	H2	C1
J9	G1	B1
J7	H3	B1
J8	H3	C1
L1	H1	A1

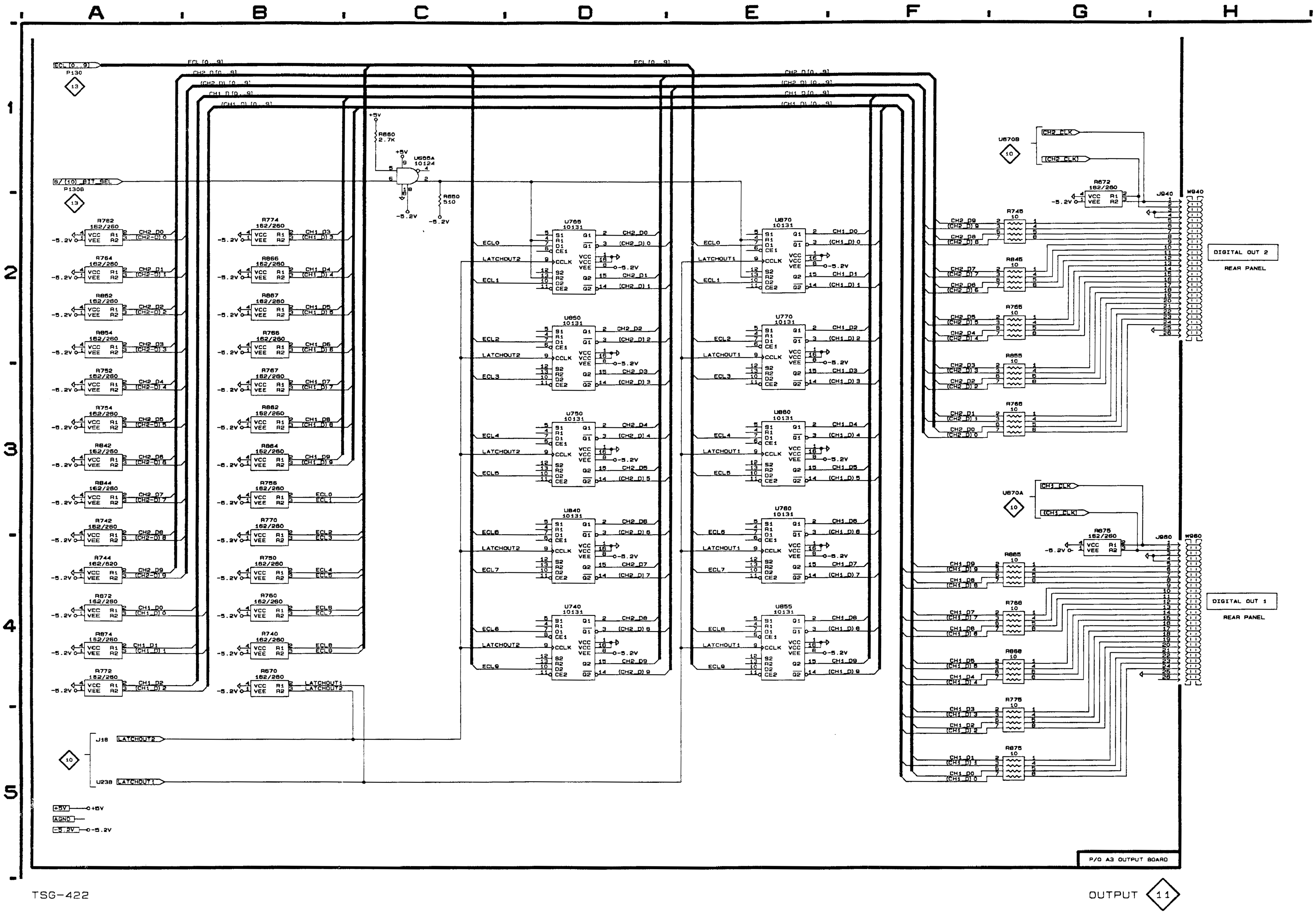

COMPONENT CLOCK DRIVER
DIGITAL VIDEO CLOCK GENERATOR & PHASE SHIFTER
PHASE SHIFTER CONTROL
REMOTE CONTROL INTERFACE
A6 BNC BOARD
P/O A3 OUTPUT BOARD
** SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES
TSG 422
PHASE SHIFTER & CLOCKS OUT
10

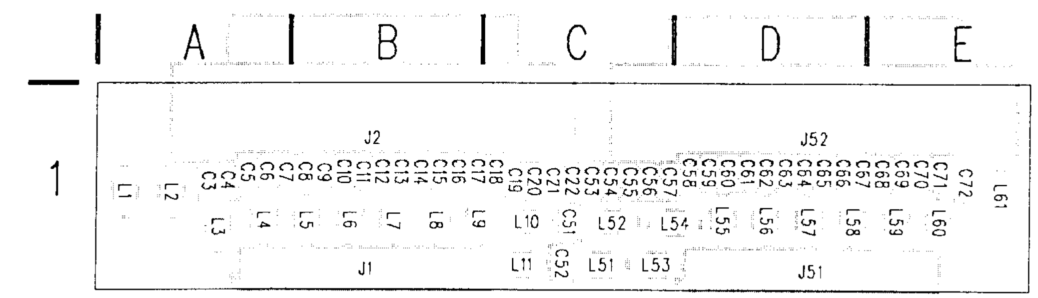
OUTPUT BOARD
SCHEMATIC DIAGRAM <11> LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

ASSEMBLY A3. *Partial Assembly A3 also shown on Schematics 10, 12, and 13.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
J940	H2	E1	R852	A2	F2
J960	H4	G1	R854	A2	F2
			R855	G3	F2
R650	C2	F4	R862	B3	G2
R660	C1	G4			
R670	B4	H4	R864	B3	G2
R672	G2	H4	R865	G4	G2
			R866	B2	G2
R675	G4	H4	R867	B2	G2
R740	B4	E4			
R742	A3	E3	R868	G4	G2
R744	A4	E3	R872	A4	H2
			R874	A4	H2
R745	G2	E3	R875	G5	H2
R750	B4	F4			
R752	A3	F3	U655A	C1	F4
R754	A3	F3	U740	D4	E3
			U750	D3	F3
R755	G2	F3	U755	D2	F3
R756	B3	F4			
R760	B4	G4	U760	E3	G3
R762	A2	G3	U770	E2	H3
			U840	D3	E2
R764	A2	G3	U850	D2	F2
R765	G3	G3			
R766	B2	G3	U855	E4	F2
R767	B3	G3	U860	E3	G2
			U870	E2	H2
R768	G4	G3			
R770	B3	H4	W940	H2	
R772	A4	H3	W960	H4	
R774	B2	H3			
R775	G5	H3			
R842	A3	E2			
R844	A3	E2			
R845	G2	E2			


P/O A3 OUTPUT BOARD
DIGITAL OUT 2
REAR PANEL
DIGITAL OUT 1
REAR PANEL
TSG-422
OUTPUT 11



671-2811-00

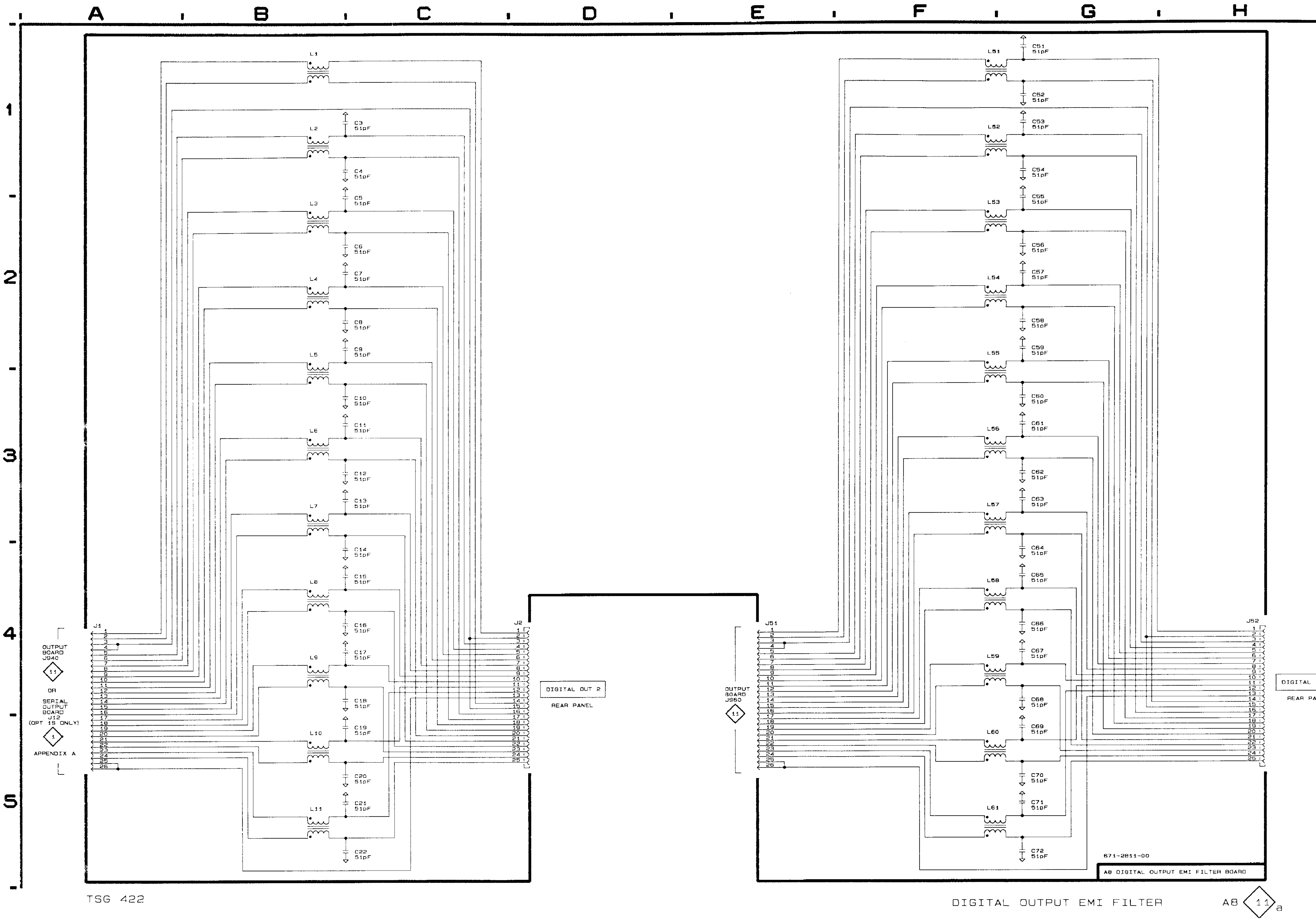
A8 DIGITAL PARALLEL EMI FILTER BOARD

DIGITAL PARALLEL EMI FILTER BOARD SCHEMATIC DIAGRAM <11>a LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

ASSEMBLY A8.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C3	B1	A1	C56	G2	C1	L4	B2	A1
C4	B1	A1	C57	G2	C1	L5	B2	B1
C5	B2	A1	C58	G2	D1	L6	B3	B1
C6	B2	A1	C59	G2	D1	L7	B3	B1
C7	B2	A1	C60	G3	D1	L8	B4	B1
C8	B2	B1	C61	G3	D1	L9	B4	B1
C9	B2	B1	C62	G3	D1	L10	B5	C1
C10	B3	B1	C63	G3	D1	L11	B5	C1
C11	B3	B1	C64	G4	D1	L51	F1	C1
C12	B3	B1	C65	G4	D1	L52	F1	C1
C13	B3	B1	C66	G4	D1	L53	F2	C1
C14	B4	B1	C67	G4	D1	L54	F2	C1
C15	B4	B1	C68	G4	E1	L55	F2	D1
C16	B4	B1	C69	G5	E1	L56	F3	D1
C17	B4	B1	C70	G5	E1	L57	F3	D1
C18	B4	C1	C71	G5	E1	L58	F4	D1
C19	B5	C1	C72	G5	E1	L59	F4	E1
C20	B5	C1				L60	F5	E1
C21	B5	C1	J1	A4	B2	L61	F5	E1
C22	B5	C1	J2	D4	B1			
			J51	E4	D2			
C51	G1	C1	J52	H4	D1			
C52	G1	C1						
C53	G1	C1	L1	B1	A1			
C54	G1	C1	L2	B1	A1			
C55	G2	C1	L3	B2	A1			



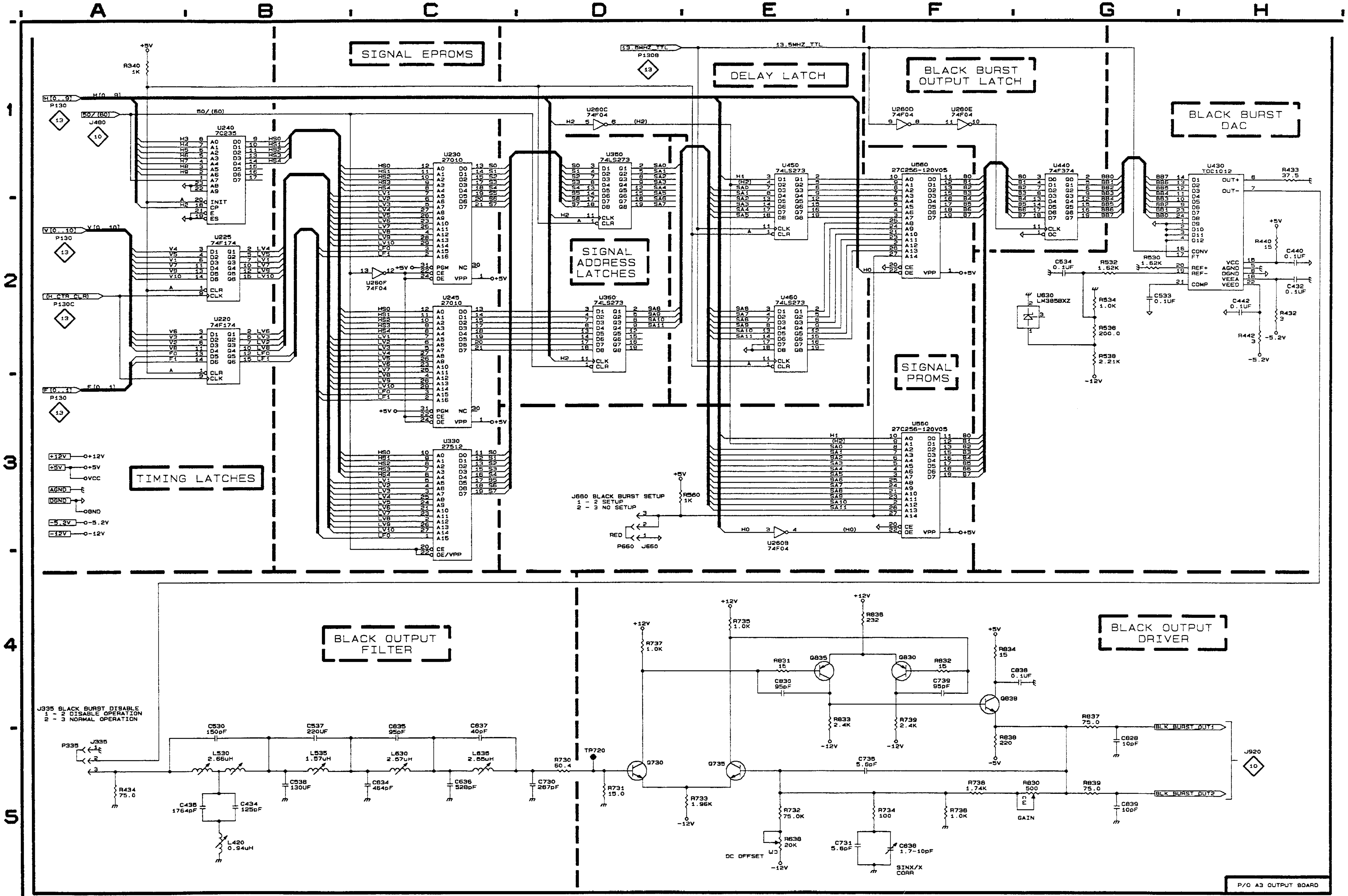
A
B
C
D
E
F
G
H
1
2
3
4
5
J1
J2
J51
J52
OUTPUT BOARD J940
OR
SERIAL OUTPUT BOARD J12 (OPT 1S ONLY)
APPENDIX A
DIGITAL OUT 2
REAR PANEL
OUTPUT BOARD J950
DIGITAL OUT 1
REAR PANEL
671-2811-00
A8 DIGITAL OUTPUT EMI FILTER BOARD
TSG 422
DIGITAL OUTPUT EMI FILTER
A8 11 a

OUTPUT BOARD
SCHEMATIC DIAGRAM <12> LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

ASSEMBLY A3. *Partial Assembly A3 also shown on Schematics 10, 11, and 13.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C432	H2	C7
C434	B5	C6
C435	B5	C6
C440	H2	E7
C442	H2	E6
C530	B5	D6
C533	G2	D6
C534	G2	D5
C537	B5	D5
C538	B5	D5
C634	C5	D5
C635	C5	D5
C636	C5	D4
C637	C5	D4
C638	F5	D4
C730	D5	C4
C731	F5	D4
C735	F5	D3
C739	F4	C3
C828	G5	C2
C830	E4	C3
C838	G4	D2
C839	G5	C2
J335	A5	C7
J660	D3	G4
L420	B5	B6
L530	A5	C6
L535	B5	C5
L630	C5	C5
L635	C5	C4
P335	A5	
P660	D3	
Q730	D5	C3
Q735	E5	C3
Q830	F4	C2
Q835	E4	C2
Q838	F4	D2
R340	A1	E7
R432	H2	C7
R433	H1	D6
R434	A5	D6
R440	H2	E7
R442	H2	E6
R530	G2	D6
R532	G2	D6
R534	G2	D5
R536	G2	D5
R538	G2	D5
R560	D3	G5
R638	E5	D4
R730	D5	C4
R731	D5	C4
R732	E5	D4
R733	E5	C3
R734	F5	D3
R735	E4	C3
R736	F5	D3
R737	D4	C3
R738	F5	D3
R739	F4	C3
R830	G5	D3
R831	E4	C3
R832	F4	C3
R833	E4	D3
R834	F4	D3
R836	F4	C2
R837	G4	C2
R838	F5	D2
R839	G5	C2
TP720	D5	C3
U220	B2	B9
U225	B2	B8
U230	C1	D9
U240	B1	F9
U245	C2	F8
U260B	E3	G8
U260C	D1	G8
U260D	F1	G8
U260E	F1	G8
U260F	C2	G8
U330	C3	D8
U350	D1	F8
U360	D2	G8
U430	H1	D6
U440	G1	E7
U450	E1	F7
U460	E2	G7
U550	F3	F6
U560	F1	G6
U630	G2	D5



TSG-422

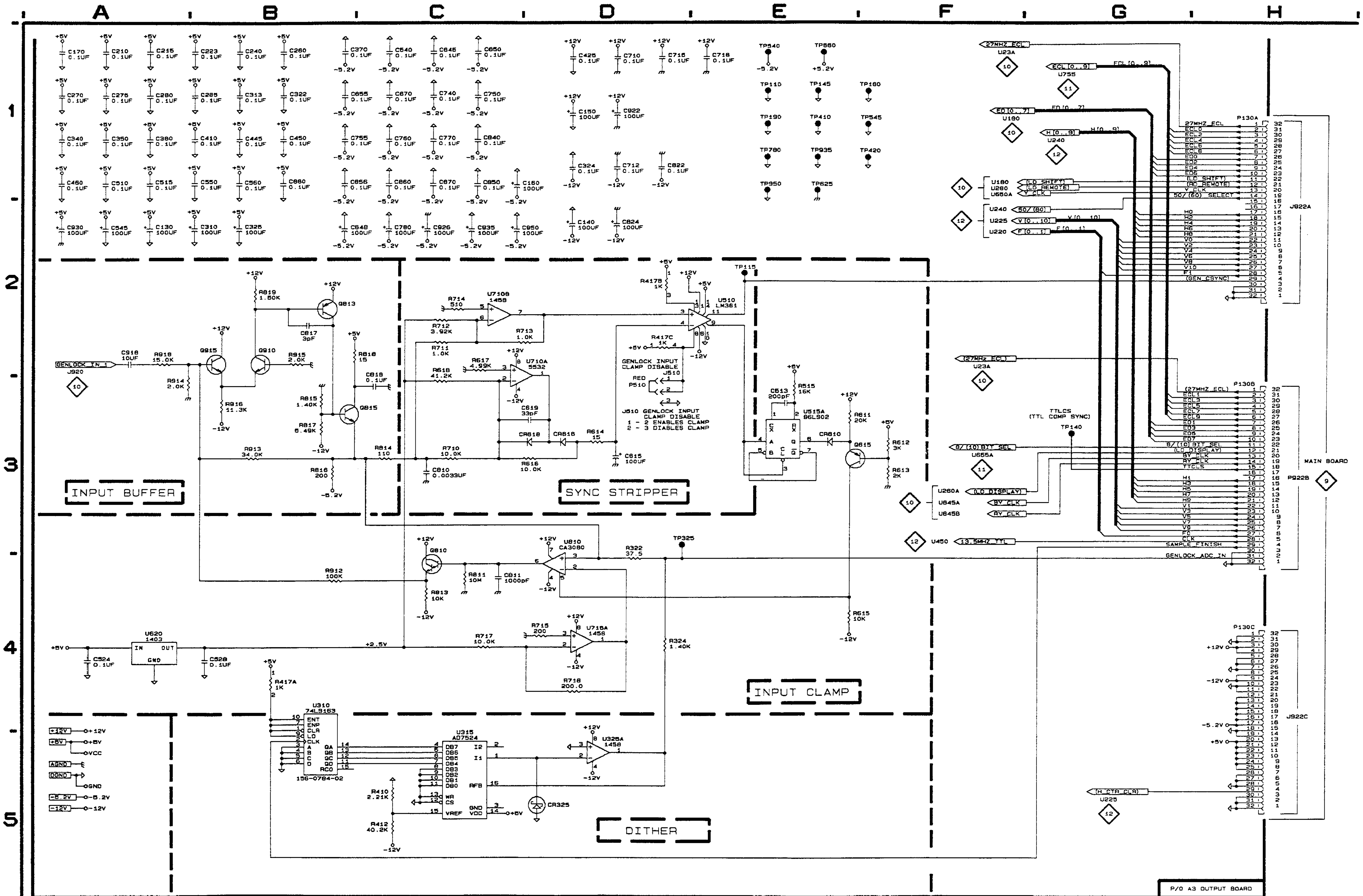
BLACK BURST OUTPUT & DATA GENERATION 12

OUTPUT BOARD
SCHEMATIC DIAGRAM <13> LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

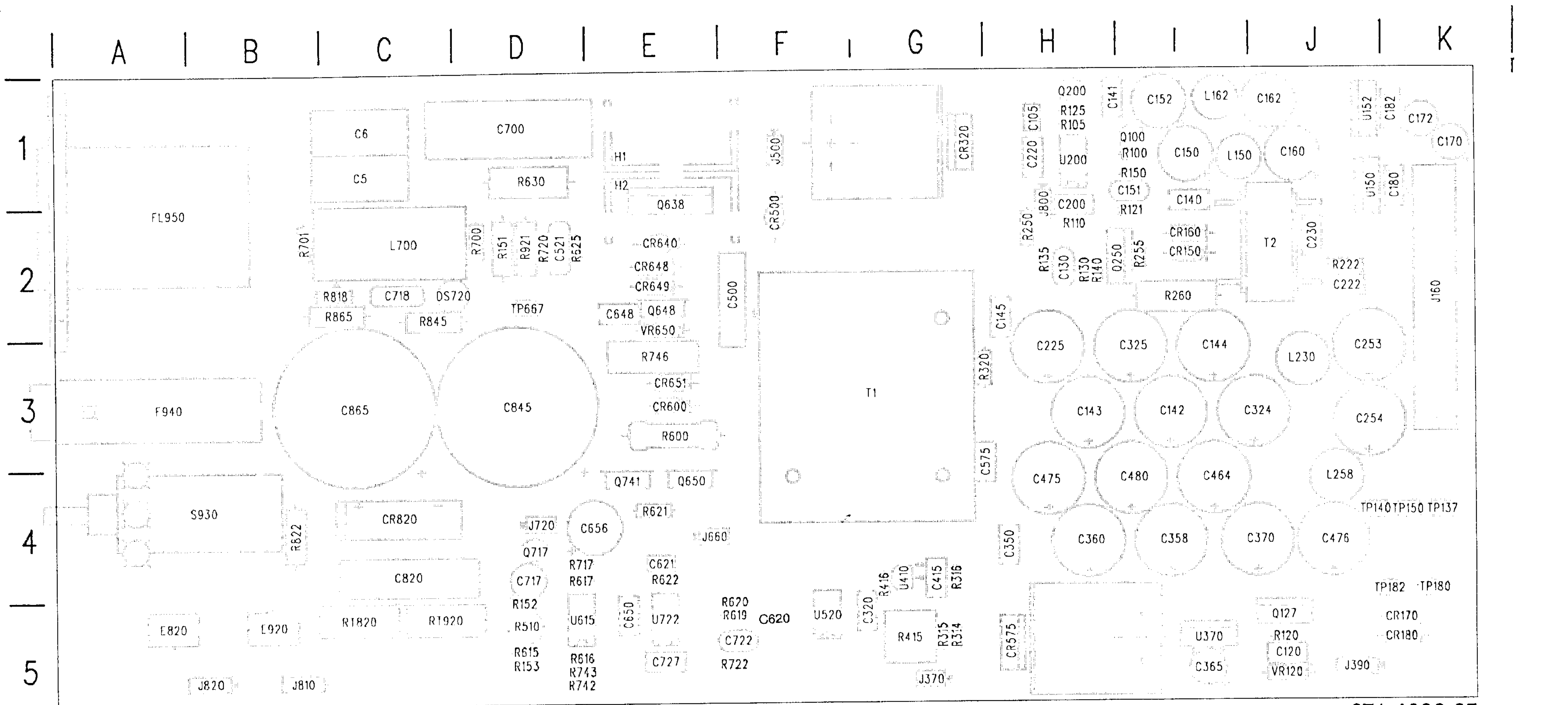
ASSEMBLY A3. *Partial Assembly A3 also shown on Schematics 10, 11, and 12.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C160	C1	G9
C170	A1	I9
C210	A1	B9
C215	A1	B8
C223	B1	C9
C240	B1	E9
C260	B1	G8
C270	A1	I9
C275	A1	I8
C280	A1	J9
C285	B1	J8
C310	B2	B6
C313	B1	A7
C322	B1	C8
C324	D1	C7
C325	B2	C7
C340	A1	E8
C350	A1	E7
C360	A1	G7
C370	B1	I8
C410	B1	A7
C425	D1	B7
C445	B1	E6
C450	B1	E7
C460	A1	G7
C510	A1	A6
C513	E3	A5
C515	A1	A5
C524	A4	B5
C528	B4	C5
C540	C1	E5
C545	A2	E5
C550	B1	F5
C560	B1	H5
C615	D3	B4
C619	D3	A4
C645	C1	E5
C648	B2	D4
C650	C1	F5
C655	B1	F5
C660	B1	G4
C670	C1	I5
C710	D1	A4
C712	D1	A3
C715	D1	A3
C718	E1	B3
C740	C1	E4
C750	C1	F4
C755	B1	F4
C760	C1	G4
C770	C1	H4
C780	C2	I4
C810	C3	B2
C811	C4	A3
C817	B2	A2
C818	C3	B2
C822	D1	B3
C824	D2	B2
C840	C1	E2
C850	C1	F2
C856	B1	F2
C860	C1	G2
C870	C1	H2
C918	A2	B1
C922	D1	B2
C926	C2	C2
C930	A2	D2
C935	C2	D1
C950	C2	F1
CR325	D5	B7
CR610	E3	A5
CR616	D3	A4
CR618	D3	A4
J510	D2	B6
P130A	H1	D10
P130B	H3	D10
P130C	H4	D10
P510	D2	
Q615	E3	B5
Q810	C4	A2
Q813	B2	A2
Q815	B3	A2
Q910	B2	A2
Q915	B2	A2
R322	D4	B8
R324	D4	B8
R410	C5	A7
R412	C5	A7
R417A	B4	B6
R417B	D2	B6
R417C	D2	B6
R515	E3	B5
R611	E3	A5
R612	F3	A5
R613	F3	A5
R614	D3	B4
R615	E4	A4
R616	D3	B4
R617	C2	A4
R618	C3	B4
R710	C3	B4
R711	C2	B4
R712	C2	B4
R713	C2	B4
R714	C2	B3
R715	D4	B3
R717	C4	B3
R718	D4	B3
R811	C4	A3
R813	C4	A2
R814	C3	B2
R815	B3	A2
R816	B3	B2
R817	B3	A2
R818	B2	B2
R819	B2	B2
R912	B4	B2
R913	B3	B2
R914	A3	B2
R915	B2	A2
R916	B3	A1
R918	A2	B1
TP110	E1	B10
TP115	E2	A10
TP140	G3	D10
TP145	E1	E10
TP160	F1	G10
TP190	E1	K9
TP325	D3	B8
TP410	E1	A6
TP420	F1	C7
TP540	E1	E5
TP545	F1	E5
TP625	E1	C4
TP660	E1	G5
TP780	E1	J3
TP935	E1	C1
TP950	E1	F1
U310	B4	A8
U315	C5	A7
U325A	D5	B7
U510	E2	B6
U515A	E3	B5
U620	A4	C5
U710A	C2	A4
U710B	C2	A4
U715A	D4	A3
U810	D4	B3



TSG-422

GENLOCK INPUT 13



A4 POWER SUPPLY BOARD

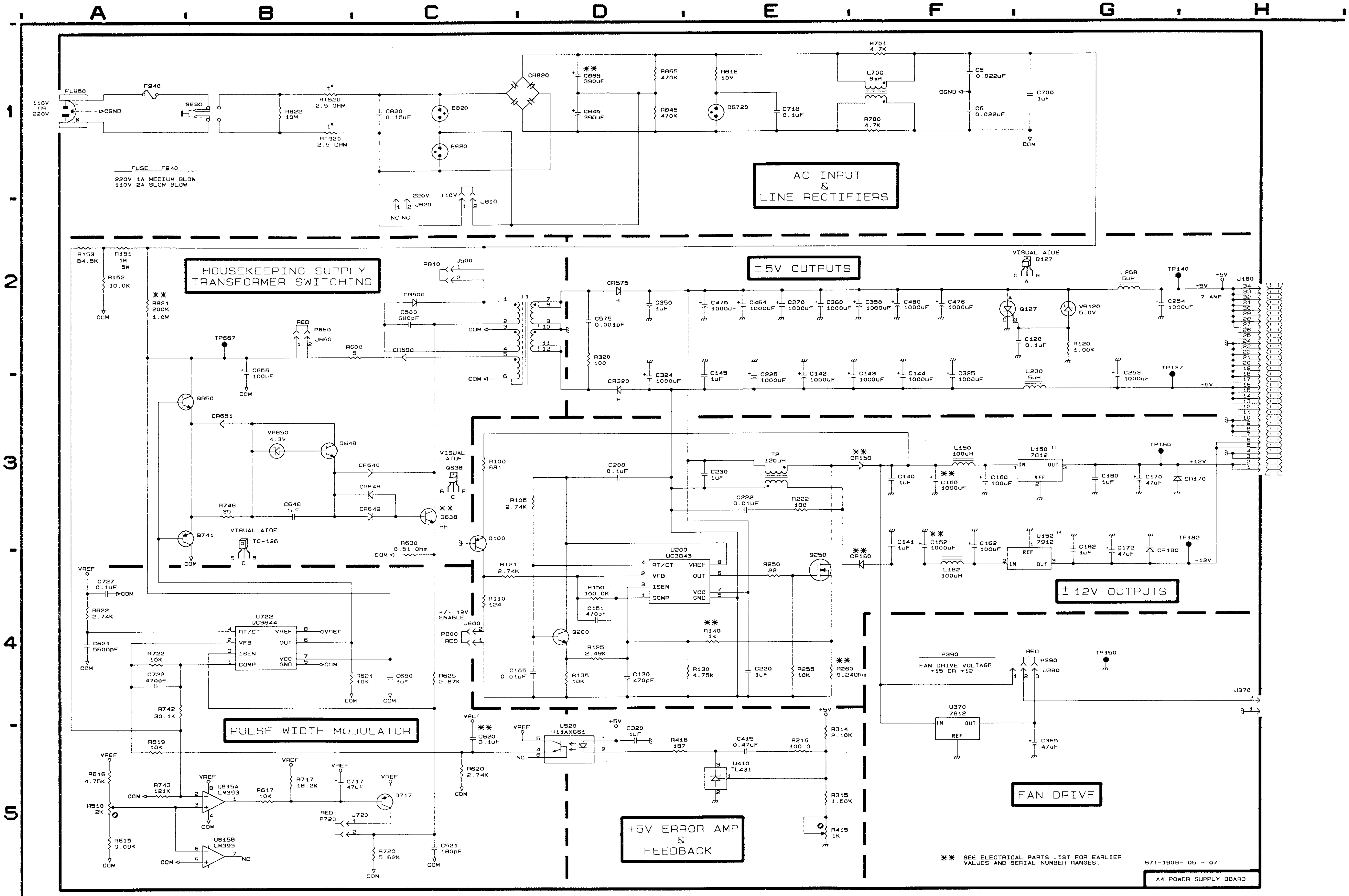
671-1906-05

Static Sensitive Devices
See Maintenance Section

POWER SUPPLY BOARD (ASSEMBLY A4) SCHEMATIC DIAGRAM <14> (SN B020000 AND ABOVE) LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

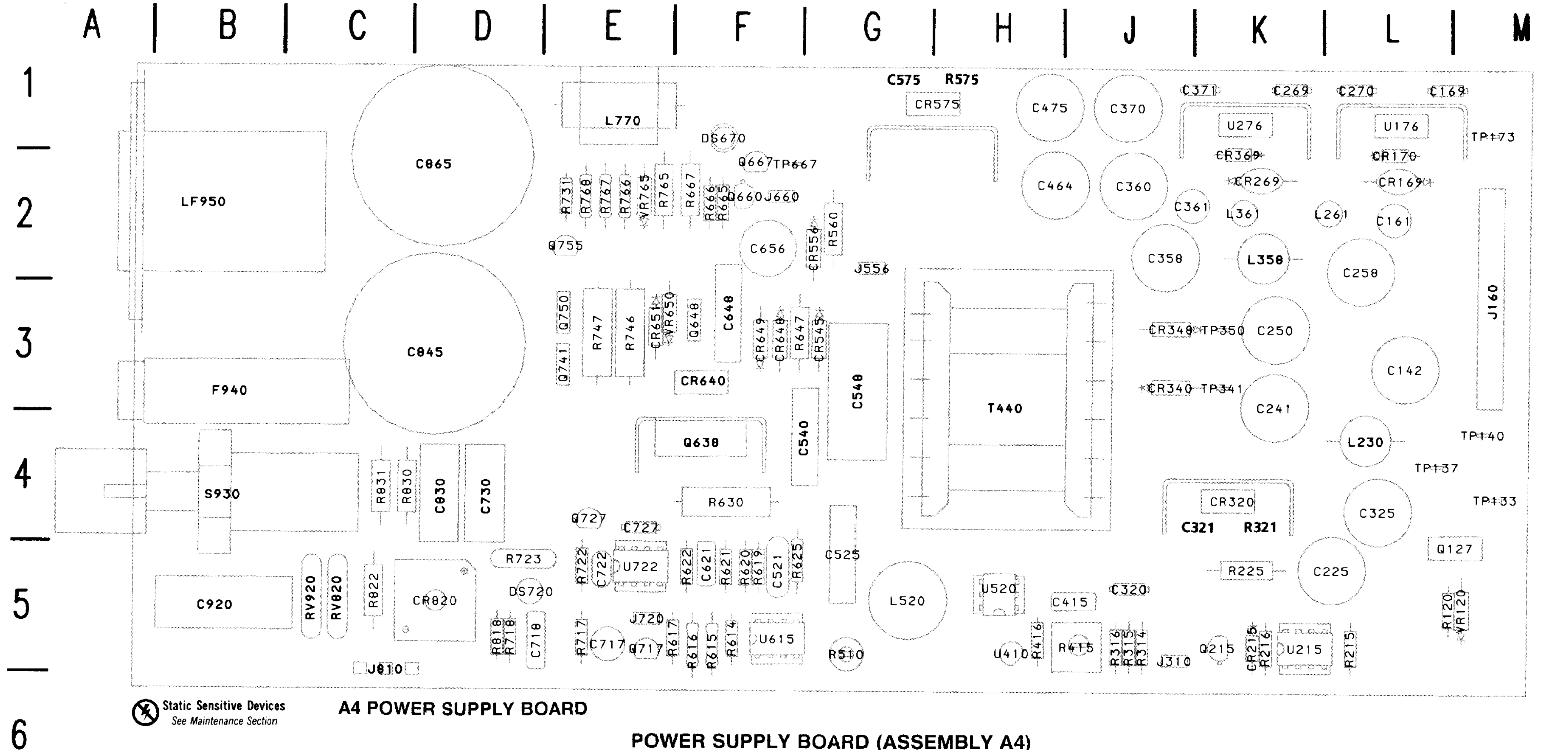
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C5	F1	C1
C6	F1	C1
C105	D4	H1
C120	G2	J5
C130	D4	H2
C140	F3	I2
C141	F3	I1
C142	E3	I3
C143	F3	H3
C144	F3	I3
C145	E3	H2
C150	F3	I1
C151	D4	I1
C152	F3	I1
C160	F3	J1
C162	F3	J1
C170	G3	K1
C172	G4	K1
C180	G3	K1
C182	G4	K1
C200	D3	H2
C220	E4	H1
C222	E3	J2
C225	E3	H3
C230	E3	J2
C253	G3	J3
C254	G2	J3
C320	D5	G5
C324	D3	I3
C325	F3	I3
C350	D2	H4
C358	F2	I4
C360	E2	H4
C365	G5	I5
C370	E2	I4
C415	E5	G4
C464	E2	I4
C475	E2	H4
C476	F2	J4
C480	F2	I4
C500	C2	F2
C521	C5	D2
C575	D2	H4
C620	C5	F5
C621	A4	E4
C648	B3	E2
C650	C4	E5
C656	B2	D4
C700	G1	D1
C717	B5	D4
C718	E1	C2
C722	A4	F5
C727	A4	E5
C820	C1	C4
C845	D1	D3
C865	D1	C3
CR150	F3	I2
CR160	F4	I2
CR170	G3	K5
CR180	G4	K5
CR320	D3	G1
CR500	C2	F2
CR575	D2	H5
CR600	C2	E3
CR640	C3	E2
CR648	C3	E2
CR649	C3	E2
CR651	B3	E3
CR820	C1	C4
DS720	E1	D2
E820	C1	A5
E920	C1	B5
F940	A1	B3
FL950	A1	A2
J160	H2	K1
J370	H4	G5
J390	F4	J5
J500	C2	F1
J660	B2	E4
J720	B5	D4
J800	C4	H1
J810	C2	B5
J820	C2	B5
L150	F3	I1
L162	F4	I1
L230	G3	J3
L258	G2	J4
L700	F1	C2
P390	G4	
P660	B2	
P720	B5	
P800	C4	
P810	C2	
Q100	C3	H1
Q127	F2	J5
Q200	D4	H1
Q250	E4	H2
Q638	C3	E2
Q648	B3	E2
Q650	A3	E4
Q717	C5	D4
Q741	A3	E4
R100	C3	I1
R105	D3	H1
R110	C4	H2
R120	G2	J5
R121	C4	I2
R125	D4	H1
R130	E4	H2
R135	D4	H2
R140	E4	H2
R150	D4	I1
R151	A2	D2
R152	A2	D5
R153	A2	D5
R222	E3	J2
R250	E4	H2
R255	E4	I2
R260	E4	I2
R314	E5	G5
R315	E5	G5
R316	E5	G4
R320	D2	H3
R415	E5	G5
R416	D5	G4
R510	A5	D5
R600	B2	E3
R615	A5	D5
R616	A5	D5
R617	B5	D4
R619	A5	F5
R620	C5	F5
R621	B4	E4
R622	A4	E4
R625	C4	D2
R630	C4	D1
R700	F1	D2
R701	F1	B2
R717	B5	D4
R720	C5	D2
R722	A4	F5
R742	A4	D5
R743	A5	D5
R746	B3	E3
R818	E1	C2
R822	B1	B4
R845	D1	C2
R865	D1	C2
R921	A2	D2
RT820	B1	C5
RT920	B1	C5
S930	A1	B4
T1	C2	G3
T2	E3	I2
TP137	G3	K4
TP140	G2	J4
TP150	G4	K4
TP180	G3	K4
TP182	H3	J4
TP667	B2	D2
U150	G3	J2
U152	F4	K1
U200	D4	H1
U370	F4	I5
U410	E5	G4
U520	D5	F5
U615A	B5	E5
U615B	B5	E5
U722	B4	E5
VR120	G2	J5
VR650	B3	E2



TSG 422

POWER SUPPLY 14

S/N: B020000 AND ABOVE



Static Sensitive Devices
See Maintenance Section

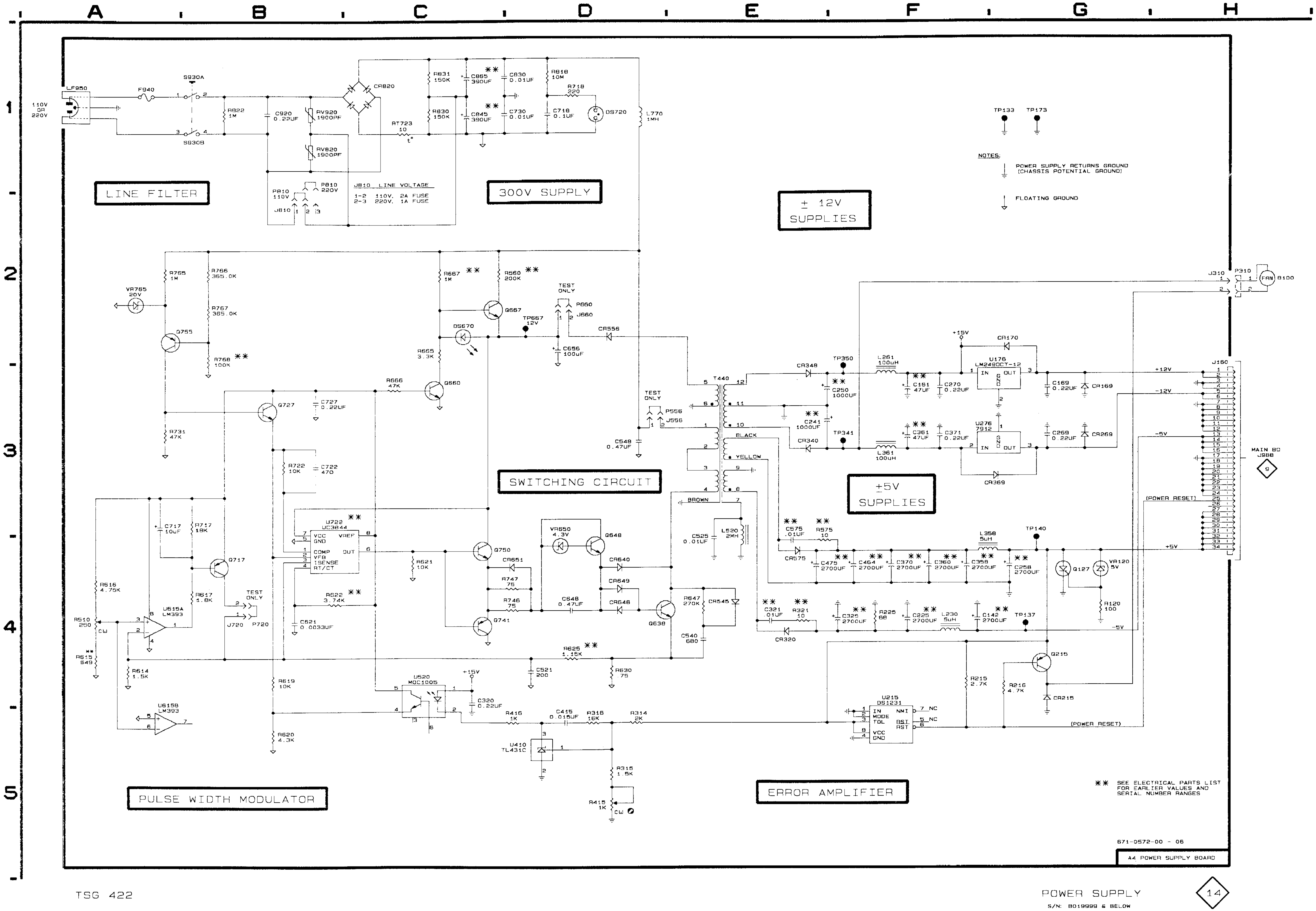
A4 POWER SUPPLY BOARD

POWER SUPPLY BOARD (ASSEMBLY A4)
SCHEMATIC DIAGRAM <14> (SN B019999 AND BELOW) LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
B100	H2	CHASSIS
C142	G4	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	C5	J5
C321 *	E4	K5
C325	E4	L4
C358	F4	J2
C360	F4	J2
C361	F3	J2
C370	F4	J1
C371	F3	K1
C415	D5	J5
C464	F4	H2
C475	E4	H1
C521	D4	F5
C525	E4	G5
C540	E4	F4
C548	D3	G3
C575 *	E4	G1
C621	B4	F5
C648	D4	F3
C656	D2	F2
C717	A3	E5
C718	D1	D5
C722	B3	E5
C727	B3	E4
C730	D1	D4
C830	D1	D4
C845	C1	D3
C865	C1	D2
C920	B1	B5
C950	B3	
C970	B1	
CR169	G3	L2
CR170	G2	L1
CR215	G5	K5
CR269	G3	K2
CR320	D4	K4
CR340	E3	J3
CR348	E3	J3
CR369	G3	K1
CR545	E4	G3
CR556	D2	G2
CR575	D4	H1
CR640	D4	F3
CR648	D4	F3
CR649	D4	F3
CR651	D4	E3
CR820	C1	D5
DS670	C2	F1
DS720	D1	D5
F940	A1	B3
J160	H3	M3
J310	H2	J5
J556	E3	G2
J660	D2	F2
J720	B4	E5
J810	B2	C5
L230	F4	L4
L261	F3	L2
L358	G4	K2
L361	F3	K2
L520	E3	G5
L770	D1	E1
LF950	A1	B2
P310	H2	
P556	E3	
P660	D2	
P720	B4	
P810	B2	
Q127	G4	M5
Q215	G4	K5
Q638	E4	F4
Q648	D4	F3
Q660	C3	F2
Q667	D2	F2
Q717	B4	E5
Q727	B3	E4
Q741	C4	E3
Q750	C4	E3
Q755	A2	E2
R120	G4	L5
R215	F4	L5
R216	G4	K5
R225	F4	K5
R314	D5	J5
R315	D5	J5
R316	D5	J5
R321 *	E4	K5
R415	D5	J5
R416	D5	H5
R510	A4	G5
R560	D2	G2
R575 *	E4	H1
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	B3	E5
R718	D1	D5
R722	B3	E5
R731	A3	E2
R746	D4	E3
R747	D4	E3
R765	A2	E2
R766	B2	E2
R767	B2	E2
R768	B2	E2
R818	D1	D5
R822	B1	B3
R830	C1	C4
R831	C1	C4
RT723	C1	D5
RV820	B1	B3
RV920	B1	C5
S930A	B1	B4
S930B	B1	B4
T440	E3	H3
TP133	G1	M4
TP137	G4	L4
TP140	G4	M4
TP173	G1	M1
TP341	F3	K3
TP350	F3	K3
TP667	D2	F2
U176	G3	L1
U215	F5	K5
U276	G3	K1
U410	D5	H5
U520	C5	H5
U615A	A4	F5
U615B	A5	F5
U722	B3	E5
VR120	G4	M5
VR650	D4	E3
VR765	A2	E2

* See Parts List for Serial Number Ranges.


LINE FILTER
300V SUPPLY
± 12V SUPPLIES
SWITCHING CIRCUIT
+5V SUPPLIES
PULSE WIDTH MODULATOR
ERROR AMPLIFIER
110V OR 220V
J810 LINE VOLTAGE
1-2 110V, 2A FUSE
2-3 220V, 1A FUSE
NOTES:
POWER SUPPLY RETURNS GROUND (CHASSIS POTENTIAL GROUND)
FLOATING GROUND
MAIN BD J988
TEST ONLY
(POWER RESET)
** SEE ELECTRICAL PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES
671-0572-00 - 06
A4 POWER SUPPLY BOARD
TSG 422
POWER SUPPLY
S/N: B019999 & BELOW
14

Replaceable Mechanical Parts

Section 10
Replaceable Mechanical Parts

This section contains a list of the components that are replaceable for the TSG-422. 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 benifit 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 confrom 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
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
80112	G. C. ELECTRONICS COMPANY, A DIVISIO N OF HYDROMETALS, INC.	3225 EXPOSITION PLACE	LOS ANGELES, CA 90018
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
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61108–5181
95987	BRADY/WECKESSER MFG CO	4444 WEST IRVING PARK RD	CHICAGO IL 60641
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)		
TK1373	PATELEC–CEM (ITALY)	10156 TORINO	VAICENTALLO 62/45S ITALY
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	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1–1	200–3742–00	B010100	B019999	1	COVER,TOP:	80009	200–3742–00
	200–3742–01	B020000		1	COVER,TOP:TSG422	80009	200–3742–01
					MOUNTING PARTS		
–2	211–0559–00	B010100	B019999	13	SCREW,MACHINE:6–32 X 0.375,FLH,100 DEG,STL	TK0435	1593–300
	211–0541–00	B020000		15	SCREW,MACHINE:6–32 X 0.25,FLH,100 DEG,STL	93907	ORDER BY DESCR
					END MOUNTING PARTS		
–3	—— ——	B010327		1	CIRCUIT BD ASSY:SERIAL OUTPUT		
					(SEE A7 REPL, APPENDIX A, OPTION 1S ONLY)		
					MOUNTING PARTS		
–4	211–0244–00	B010327	B019999	6	SCR,ASSEM WSHR:4–40 X 0.312,PNH STL	TK0858	211–0244–00
	211–0008–00	B020000		6	SCREW,MACHINE:4–40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					(OPTION 1S ONLY)		
–5	385–0149–00	B010327		2	SPACER,POST:0.625 L W/4–40 THD EA END,NYL	TK0588	ORDER BY DESCR
					(OPTION 1S ONLY)		
					END MOUNTING PARTS		
–6	—— ——			1	CIRCUIT BD ASSY:MAIN		
					(SEE A2–1 REPL)		
					MOUNTING PARTS		
–7	211–0244–00	B010100	B019999	10	SCR,ASSEM WSHR:4–40 X 0.312,PNH STL	TK0858	211–0244–00
	211–0008–00	B020000		10	SCREW,MACHINE:4–40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					(STANDARD ONLY)		
	211–0244–00	B010327	B019999	6	SCR,ASSEM WSHR:4–40 X 0.312,PNH STL	TK0858	211–0244–00
	211–0008–00	B020000		6	SCREW,MACHINE:4–40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					(OPTION 1S ONLY)		
–8	129–1349–00	B010327		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		
–8	407–4248–00	B020600		2	BRCKET,GROUND:	80009	407–4248–00
–9	—— ——			1	PANEL,FRONT:		
					(SEE A1 REPL)		
–10	378–0269–00			1	FILTER,AIR:	80009	378–0269–00
–11	213–0216–00			1	THUMBSCREW:10–32 X 0.85,0.375 OD HD,SST	80009	213–0216–00
					MOUNTING PARTS		
–12	354–0025–00			1	RING,RETAINING:EXTERNAL,U/O 0.187 DIA SFT	79136	5555–18
					END MOUNTING PARTS		
–13	426–2116–01			1	FRAME,FRONT:	80009	426–2116–01
					MOUNTING PARTS		
–14	213–0760–00			4	SCREW,TPG,TF:8–32 X 0.875,SPCL TAPTITE,FILH,STL	72228	ORDER BY DESCR
					END MOUNTING PARTS		
	407–4237–00	B020000		1	BRKT,FR PANEL:FILTER	80009	407–4237–00
–15	337–3286–01	B010100	B019999	1	SHIELD,PWR SPLY:LOW VOLTAGE	80009	337–3286–01
	337–3787–00	B020000		1	SHIELD,PROT:ALUMINUM	80009	337–3787–00
					MOUNTING PARTS		
–16	211–0244–00	B010100	B019999	3	SCR,ASSEM WSHR:4–40 X 0.312,PNH STL	TK0858	211–0244–00
	211–0008–00	B020000		3	SCREW,MACHINE:4–40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					END MOUNTING PARTS		
–17	—— ——			1	CIRCUIT BD ASSY:PWR SPLY		
					(SEE A4 REPL)		
					MOUNTING PARTS		
–18	211–0244–00	B010100	B019999	3	SCR,ASSEM WSHR:4–40 X 0.312,PNH STL	TK0858	211–0244–00
	211–0008–00	B020000		3	SCREW,MACHINE:4–40 X 0.25,PNH,STL	93907	ORDER BY DESCR
–19	210–0586–00	B010100	B019999	2	NUT,PL,ASSEM WA:4–40 X 0.25,STL CD PL	78189	211–041800–00
	337–3796–00	B020000		1	SHIELD,ELEC:LINE FILTER,ALUMINUM	80009	337–3796–00
–20	211–0025–00			2	SCREW,MACHINE:4–40 X 0.375,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
					END MOUNTING PARTS		

Fig. & Index No.	Tektronix Part No.	Serial Number Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
–21	––––– –––––			1	FAN,TUBEAXIAL:24VDC,20CFM,60 X 60 MM 4800RPM, SAFETY CONTROLLED		
					(SEE B100 REPL)		
					MOUNTING PARTS		
–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	83385	ORDER BY DESCR
					END MOUNTING PARTS		
–24	407–3379–01			1	BRKT,FAN MTG:ALUMINUM	80009	407–3379–01
					MOUNTING PARTS		
–25	211–0559–00			1	SCREW,MACHINE:6–32 X 0.375,FLH,100 DEG,STL	TK0435	1593–300
					END MOUNTING PARTS		
–26	––––– –––––			1	CIRCUIT BD ASSY:BNC		
					(SEE A6 REPL)		
–27	––––– –––––			1	CIRCUIT BD ASSY:OUTPUT		
					(SEE A3 REPL)		
					MOUNTING PARTS		
–28	211–0244–00	B010100	B019999	8	SCR,ASSEM WSHR:4–40 X 0.312,PNH STL	TK0858	211–0244–00
	211–0008–00	B020000		8	SCREW,MACHINE:4–40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					END MOUNTING PARTS		
–29	426–2115–00			2	FRAME SECTION:SIDE	80009	426–2115–00
					MOUNTING PARTS		
–30	213–0760–00			4	SCREW,TPG,TF:8–32 X 0.875,SPCL TAPTITE,FILH,STL	72228	ORDER BY DESCR
					END MOUNTING PARTS		
–31	210–0863–00			1	WSHR,LOOP CLAMP:0.091 ID U/W 0.5 W CLP,STLCD PL	95987	C191
–32	343–0003–00			1	CLAMP,LOOP:0.25 ID,PLASTIC	06915	E4 CLEAR ROUND
–33	200–3649–00	B010100	B010124	1	COVER,BOTTOM:	80009	200–3649–00
	200–3649–01	B010125	B010323	1	COVER,BOTTOM:	80009	200–3649–01
	200–3649–02	B010324	B019999	1	COVER,BOTTOM:ALUMINUM	80009	200–3649–02
	200–3649–03	B020000		1	COVER,BOTTOM:ALUMINUM	80009	200–3649–03
	220–0863–00	B010125	B010323	3	NUT BLOCK:4–40 X 0.312,BRASS	80009	220–0863–00
					MOUNTING PARTS		
	211–0244–00	B010125	B010323	6	SCR,ASSEM WSHR:4–40 X 0.312,PNH STL	TK0858	211–0244–00
					END MOUNTING PARTS		
	134–0026–00	B010324		3	BUTTON,PLUG:U/W 0.375 HOLE	80112	1711–M
					(STANDARD ONLY)		
–34	211–0177–00			1	SCREW,MACHINE:4–40 X 0.312,PNH,STL	TK0435	ORDER BY DESCR
–35	351–0104–00			1	SL SECT,DWR EXT:12.625 X 2.25	06666	C–720–2
					MOUNTING PARTS		
–36	212–0158–00			8	SCREW,MACHINE:8–32 X 0.375,PNH,STL	83486	ORDER BY DESCR
					END MOUNTING PARTS		
–37	351–0751–00	B010100	B010164	1	TRK,SL OUT SECT:STATIONARY & INTERMEDIATE	80009	351–0751–00
	351–0751–01	B010165		1	TRK,SL OUT SECT:STATIONARY &INTERMEDIATE	80009	351–0751–01
					STANDARD ACCESSORIES		
–38	161–0066–00			1	CABLE ASSY,PWR,:3,18AWG,98 L,SVT,GREY/BLK,60 DEG C,IEC BME X STR,IEC RCPT,10A/125V	80009	161–0066–00
					(STANDARD ONLY)		
	070–7022–01			1	MANUAL,TECH:INSTR,TSG422	80009	070–7022–01
					OPTIONAL ACCESSORIES		
–39	161–0066–09			1	CABLE ASSY,PWR,:3,0.75MM SQ,220V,99.0 L	80009	161–0066–09
					(OPTION A1 EUROPEAN ONLY)		
–40	161–0066–10			1	CABLE ASSY,PWR,:	TK1373	24230
					(OPTION A2 UNITED KINGDOM ONLY)		
–41	161–0066–11			1	CABLE ASSY,PWR,:3,0.75MM,240V,96.0 L	80009	161–0066–11
					(OPTION A3 AUSTRALIAN ONLY)		

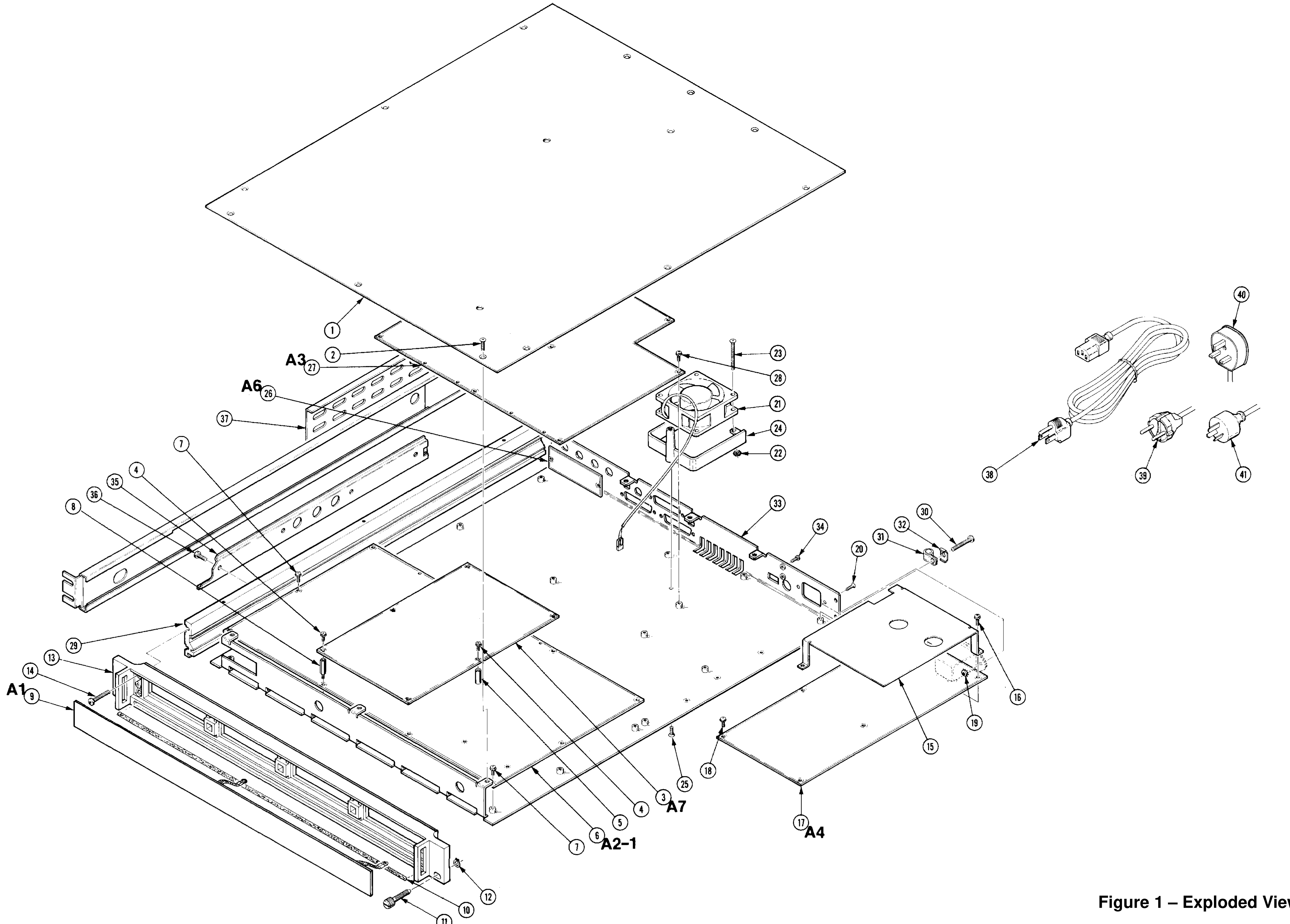


Figure 1 – Exploded View

Appendices

APPENDIX A
SERIAL DIGITAL VIDEO — OPTION 1S [1]

INTRODUCTION

Option 1S adds Serial Digital Video to the TSG-422 DIGITAL COMPONENT Generator. There are three new BNC connectors on the rear panel (see Fig. A-1), each providing serial DIGITAL COMPONENT video code (CCIR 601), in scrambled NRZI format.

Operation of the TSG-422 Opt 1S is nearly identical to the standard instrument. The only changes are:

- the addition of the pathological signals to the OTHER SIGNALS signal set and
- the DIGITAL OUT 2 signal is no longer identical to the DIGITAL OUT 1 signal.

Internally, there is one circuit board added to the instrument. It is located on the front of the instrument above the Main board. Externally they are three bncs added. They can be configured to output either the selected test signal or a digital black signal in both serial digital format.

For the serial signal, TRS-ID (Timing Reference Signal and Line ID) is added to the blanking time (between EAV and SAV), along with ancillary data. Fig. A-11 shows the range of the active video. The ancillary data includes TRS-ID information, Error Detection and Handling (EDH) flags[2], and embedded audio.[2] Fig. A-11 shows the range of the active video.

The parallel video from the Output board (A3) is applied to the Serial Output board, and a re-timed copy of the parallel data is then routed from the Serial Output board to the lower rear panel DIGITAL OUT 2 output. Therefore, the DIGITAL OUT 1 and DIGITAL OUT 2 outputs are no longer identical when serial is installed. The parallel data has been re-timed, also the TRS-ID, EDH, and audio information has been added to the signal. Additionally, the front panel ± 11 ns SHIFT DATA TIMING and SHIFT 27 MHz CLOCK features do not function for this output.

For more information on the serial signal, itself, please see the TSG-422 Serial Signal section of this Appendix beginning on page A-14.

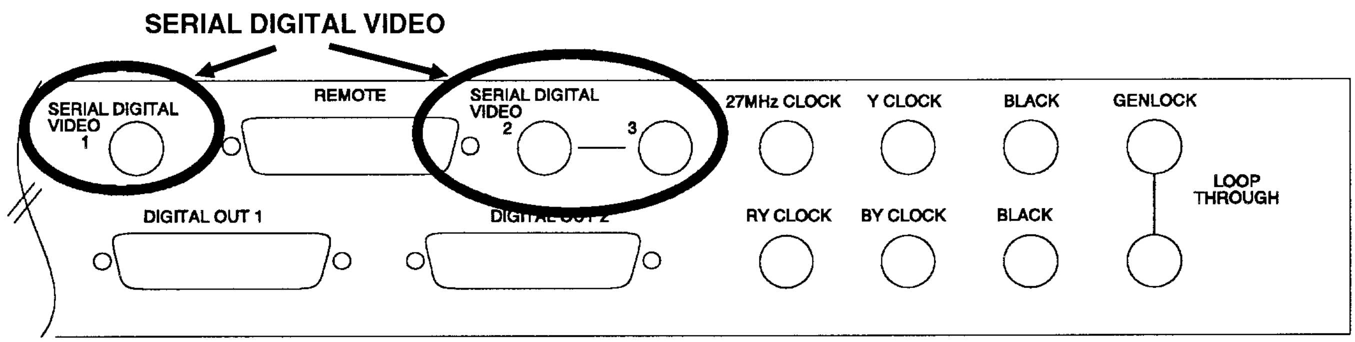


Fig. A-1. Rear panel of the TSG-422.

1 For serial numbers B010570 and above (B020566 and above for instrument shipped to Germany).

2 EDH and Embedded Audio are not available on this release of this instrument, but are planned for a future release. Please register your instrument so that you can be notified of firmware upgrades.

New Features

Pathological Signals [1]

In the same way the standard analog test signals check the performance of video equipment, the pathological signals check the performance of the serial digital equipment. Three new signals are added to the signal set:

- "Bit Slip" and Clock Test Recovery
- Test Equalizer
- Serial Matrix (A matrix of the two signals)

As a field sweep signal stresses the frequency response of a system, so the "bit slip" pathological signal stresses the recovery ability of the receiver's clock regenerator by sending a long, string of 0's.

The test equalizer signal is the highest frequency signal possible (alternating 1's and 0's).

These signals are available from the OTHER SIGNALS button on the front panel, as shown in Table A-1.

Table A-1. List of signals available under the OTHER SIGNALS button when pathological signals are installed.

SWITCH	SWITCH NAME	SIGNALS
OTHER SIGNALS	OTHER SIGNALS	Convergence Light Blue Ramp Digital Gray Measurement Matrix Test Equalizer (pathological) "Bit Slip" & Clock Recovery (pathological) Serial Matrix (pathological)

Digital Black [2]

Digital Black is defined as 040h for the Y channel and 200h for the B-Y and R-Y channels during active video. The three rear-panel SERIAL DIGITAL VIDEO BNCs can be configured as either test signal or digital black outputs, in any combination of the two.

Configuring Digital Black

W3, W23, and W4 are directly connected to the rear-panel SERIAL DIGITAL VIDEO BNCs. These wires can be connected to J3, J23, J4, J103, J123, or J104 in any order or combination to configure the instrument so it will be the most useful for a particular application. See Fig. A-2 for the location of the jumpers on the Serial Output board.

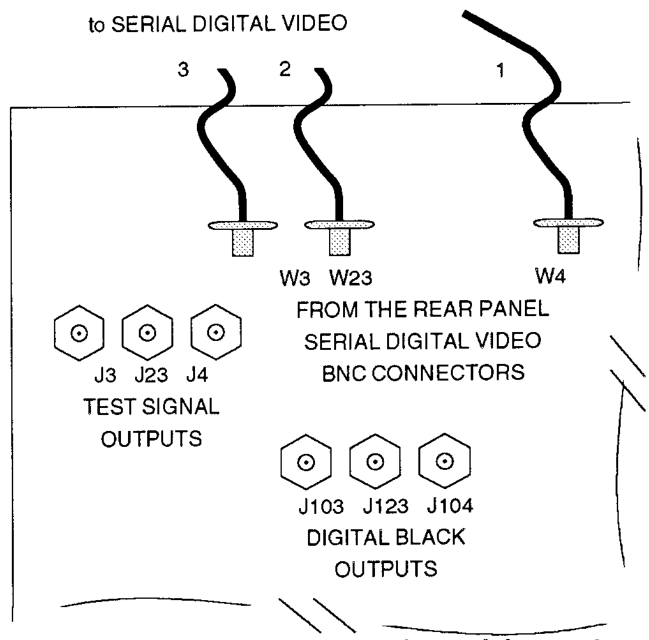


Fig. A-2. How to configure the serial outputs for either Test Signal or Black.

The TSG-422 is factory set for:

SERIAL DIGITAL VIDEO OUTPUT #	3	W3	J3	TEST SIGNAL
	2	W23	J23	TEST SIGNAL
	1	W4	J104	BLACK

1 Pathological signals are available on instruments with serial numbers B010505 and above.
2 Digital Black is available on instruments with Serial board part number 671-2244-06.

SPECIFICATIONS

The specifications for the SERIAL DIGITAL VIDEO output are shown in Table A-2. As with the specification 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. The specifications are valid when the instrument is calibrated between +20°C and +30°C.

Table A-2.
Specifications for the Serial Digital 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		CCIR 601 Component 525/625, 8-bit or 10-bit data, Scrambled NRZI, per SMPTE (draft T14.224).
Bit Rate		270 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[1]		Active picture CRC (0-AP-CRC), Full field CRC (0-FF-CRC), On lines 9 & 272 (525) or 5 & 318 (625). (See Table A-9 for details.)

1. EDH is not available on this release, but is planned for a future release. Please register your instrument so that you can be notified of firmware upgrades.

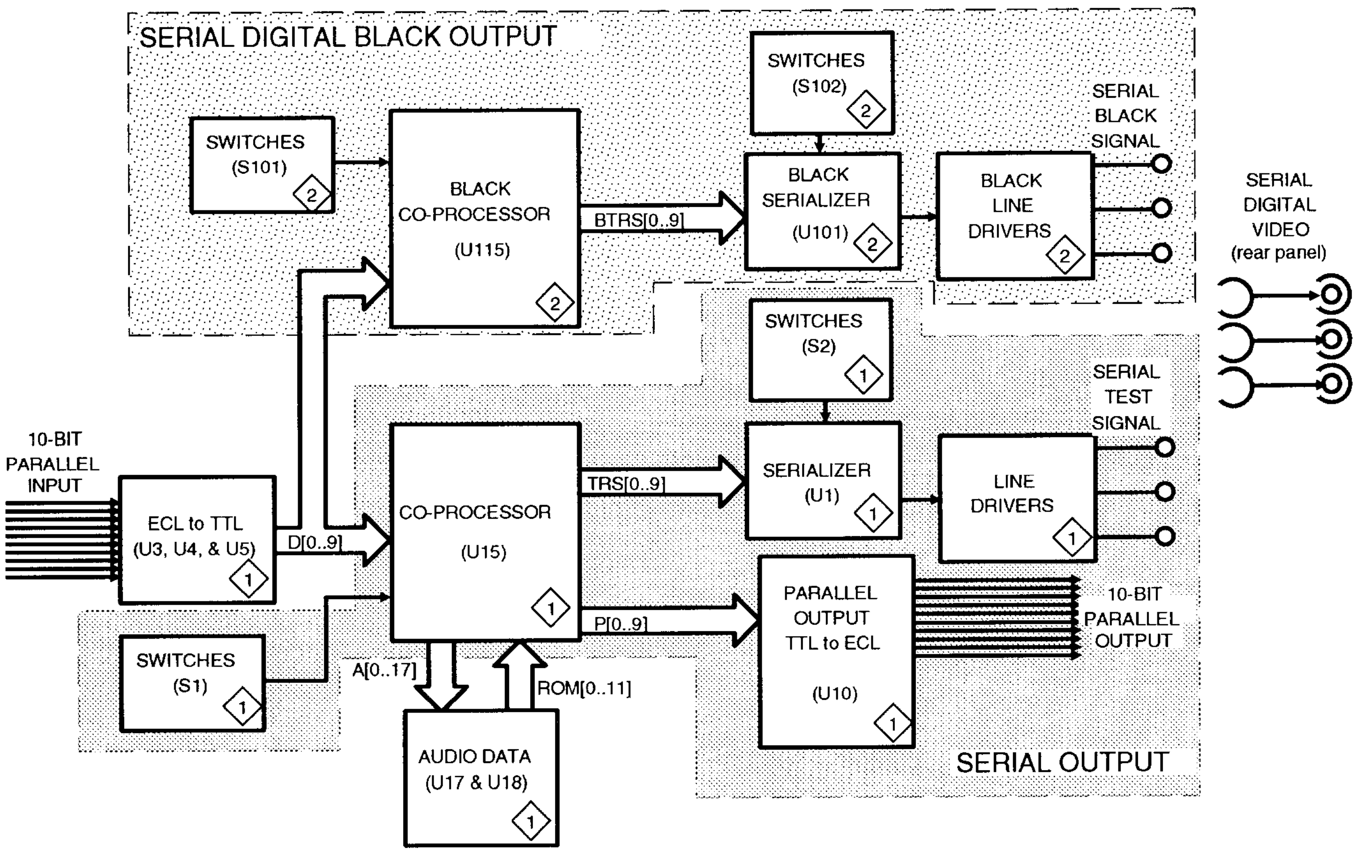


Fig. A-3.
Block Diagram of the TSG-422 Serial Output Board.

THEORY OF OPERATION

Fig. A-3 shows a basic block diagram of the TSG-422's Serial board.

A copy of the Parallel Output (from J940 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. 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]), 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 OUT 2 connector.

The data for the serial output path is applied to the serializer, U1. The serializer provides digital component 8-bit or 10-bit serial data in scrambled NRZI code, at a 270 Mb/s bit rate. The serial data stream is output at U1-3 and U1-4.

The serial data is applied to a push-pull amplifier, Q7 and Q11, which drives emitter followers Q9, Q2, Q8, and Q4. The push-pull 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 black level values. The B-Y and R-Y data channels are set with 200_h and data in the Y channel is replaced with 040_h. 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 then provides either 8-bit or 10-bit serial black in NRZI code at a 270 MHz rate. The serial data stream is output at pins 3 and 4.

The serial data is applied to a push-pull amplifier, Q107 and Q111, which drives emitter followers Q109, Q102, Q108, and Q104. The push-pull 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.

JUMPERS & SWITCHES

Table A-3. Switch S1 Operating Selections.
OFF = 1 = OPEN
ON = 0 = CLOSED

SWITCH	NAME	SWITCH POSITION	DESCRIPTION	FACTORY SETTING
1	8 or 10 Bit Resolution	closed open	8 bits 10 bits	open
2				
3	System Configuration	closed open	Normal Operation. Debug (Service use only).	closed
4				
5	EDH Disable[1]	closed open	EDH Disabled EDH Enabled	open
6	Insert EDH Error[1]	closed open	Insert EDH Errors. Normal Operation.	open
7				
8				
9				
10				

1. EDH and Audio Data must be enabled first. Neither are functioning on early releases but are planned for future releases. Please register your instrument to be notified of firmware upgrades.

Table A-4. Switch S101 (Black) Operating Selections.
OFF = 1 = OPEN
ON = 0 = CLOSED

SWITCH NAME		SWITCH POSITION	DESCRIPTION	FACTORY SETTING
1	8 or 10 Bit Resolution	closed open	8 bits 10 bits	open
2				open
3	System Configuration	closed open	Normal Operation. Debug (Service use only).	closed
4				open
5	EDH Disable[1]	closed open	EDH Disabled EDH Enabled	open
6	Insert EDH Error[1]	closed open	Insert EDH Errors. (Both FF-CRC and AP-CRC errors.) Normal Operation.	open
7				open
8	Black Enable	open closed	Enable Digital Black Output. Disable Digital Black Output (Test Signal Output only).	open
9				open
10				open

1. EDH is not functioning on early releases, but is planned for future releases. Please register your instrument to be notified of firmware upgrades.

Table A-5. Jumper Operating Selections.
All these jumpers are for internal use ONLY.
Please leave the jumpers in their factory set positions.
ALL jumpers must be set to the same pins.

JUMPER	NAME	DESCRIPTION	FACTORY SET POSITION
J1 <1>	Standard Selection	1-2 — 4:2:2 2-3 — NTSC	1-2
J13 <1>	Standard Selection	1-2 — 4:2:2 2-3 — NTSC	1-2
J101 <2>	Standard Selection	1-2 — 4:2:2 2-3 — NTSC	1-2
J113 <2>	Standard Selection	1-2 — 4:2:2 2-3 — NTSC	1-2

Table A-6. Switch S2 Operating Selections.

SWITCH	NAME	DESCRIPTION	FACTORY SET POSITION
S2-1	RSE	Open: Selects Composite operating frequency for serializer VCO. Closed: Selects Component operating frequency for serializer VCO.	CLOSED
S2-2	TN1	Open: Normal Closed: Test	OPEN
S2-3	not used		
S2-4	not used		

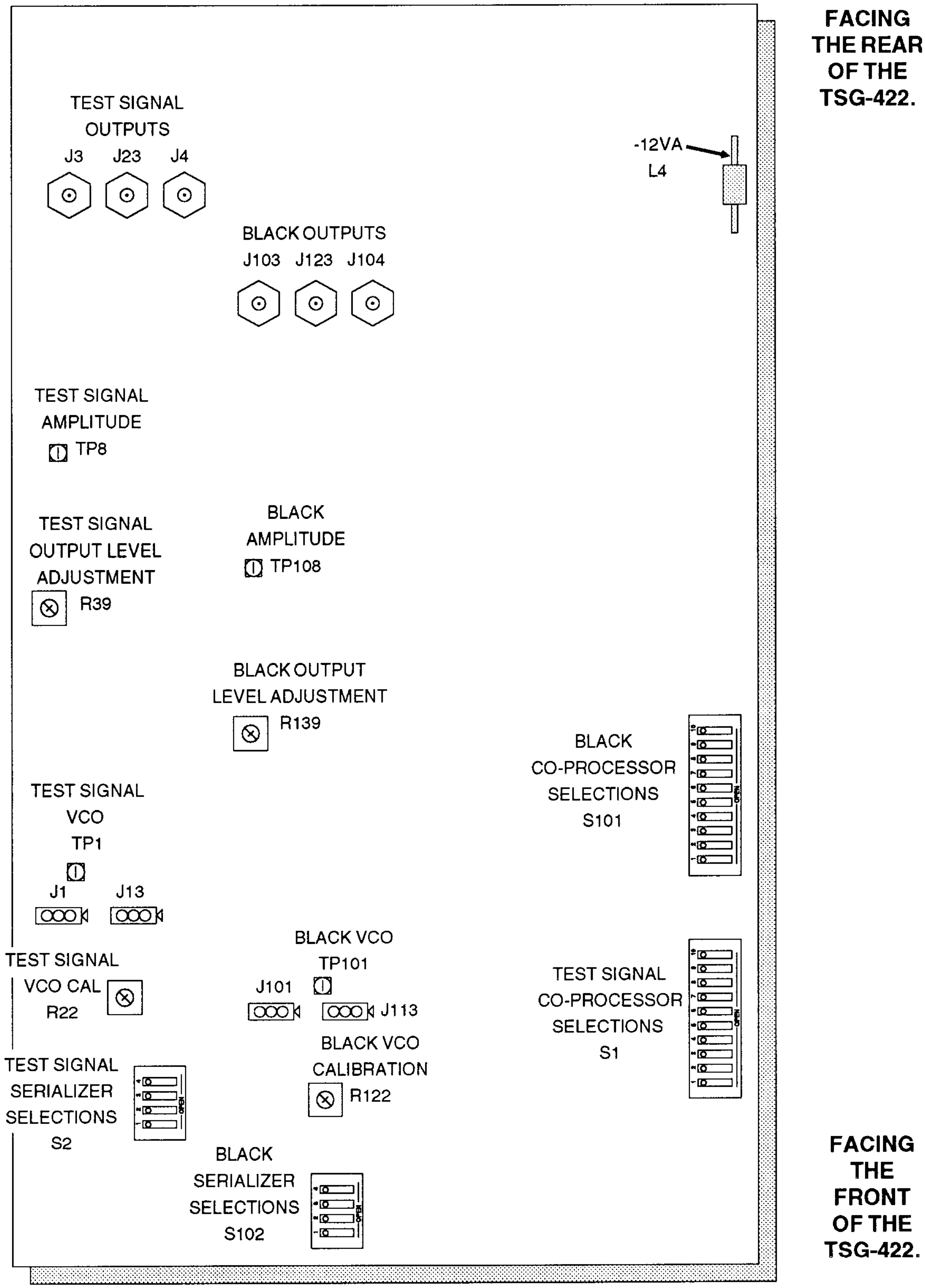


Fig. A-4. Location of User-adjustable jumpers and switches on the Serial Output board.

Table A-7. Switch S102 Operating Selections.

SWITCH	NAME	DESCRIPTION	FACTORY SET POSITION
S2-1	RSE	open: Selects Composite operating frequency for serializer VCO. closed: Selects Component operating frequency for serializer VCO.	closed
S2-2	TN1	open: Normal closed: Test	open
S2-3	not used		
S2-4	not used		

MAINTENANCE

Two parts on the TSG-422 Serial Output board require special handling during removal. U15 and U115 need a special tool for removal from their socket: AMP Extraction Tool part number 821590-1 for high pressure TIN chip carrier socket. See Fig. A-5. (Any other tool designed for this purpose and this size chip can be used.)

Follow the directions provided with the extraction tool for its use.

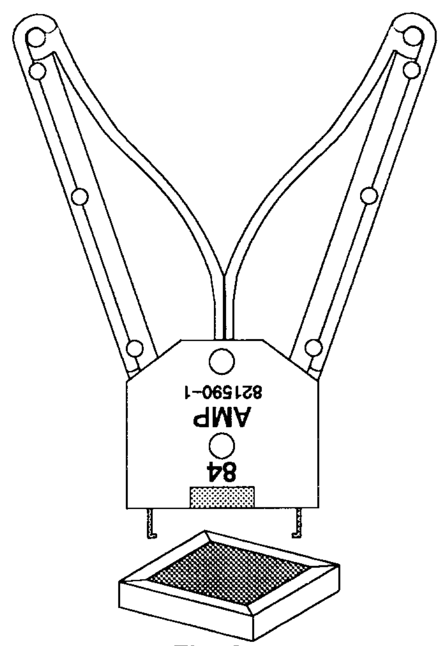


Fig. A-5.
Special tool required to remove U15 from its holder.

PERFORMANCE CHECK & ADJUSTMENT PROCEDURE

REQUIRED TEST EQUIPMENT

Due to the higher frequency of the serial digital output, the test oscilloscope mainframe and plug-ins used to test it must have a much higher bandwidth than for the standard instrument. A 1 GHz Tektronix 11403A mainframe with a 1 GHz Tektronix 11A72 Dual trace plug-in is recommended for testing the option 1S Serial Output.

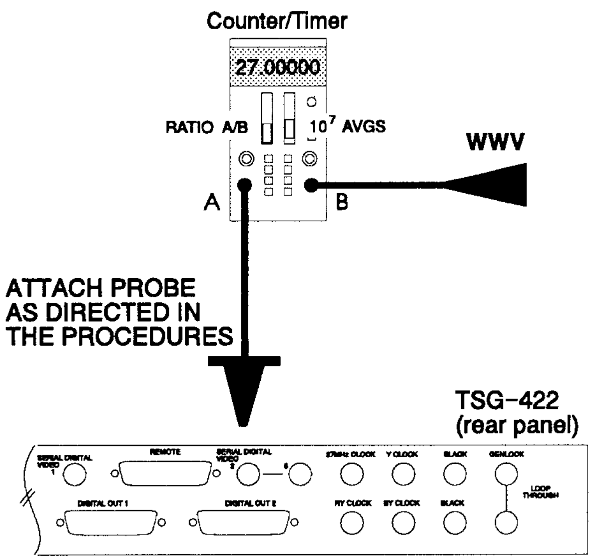


Fig. A-6. Setup to Check the Serial VCO Frequency.

PERFORMANCE CHECK PROCEDURES

A-1. Check VCO Frequencies

a. Connect the equipment as shown in Fig. A-6. Connect the probe to TP1 on the Serial Output board.

b. Make sure that S2-2 is in the OFF (OPEN) position.

c. Set the DC503 (Counter/Timer) AVGS to 10^7.

d. **CHECK** — that the frequency at TP1 is 27.0 MHz ± 100 kHz.

e. Connect the probe to TP101 on the Serial Output board.

f. Make sure that S102-2 is in the OFF (OPEN) position.

g. Set the DC503 (Counter/Timer) AVGS to 10^7.

h. **CHECK** — that the frequency at TP101 is 27.0 MHz ± 100 kHz.

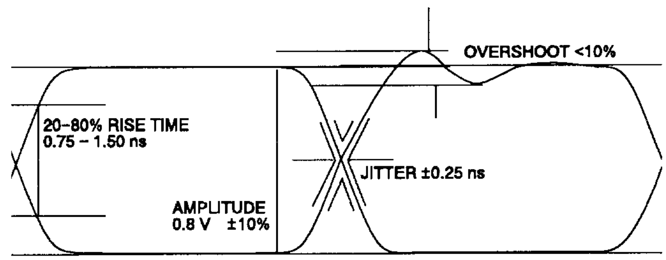


Fig. A-7. Eye pattern specs for the serial signal. Displays the amplitude, jitter, overshoot, and rise and fall times.

A-2. Check Serial Digital Output Amplitude

a. Connect the equipment as shown in Fig. A-8.

b. Connect W3, W23, and W4 to J3, J23, and J4.

c. Press the AUTOSET button on the oscilloscope to give a starting point for triggering and adjusting the signal.

d. In the ***WAVEFORM HORIZONTAL DESC*** menu, set the ***Display Type*** to: ***VARIABLE PERSISTENT***. This adjustment should result in the outline of the eye pattern displayed on the screen. The eye pattern should be similar to Fig. A-7.

e. Set the oscilloscope to view the signal at 100 mV/Div and 2 ns/Div. Trigger from the main window, on the positive slope (+).

f. **CHECK** — using the oscilloscope cursors (horizontal bar) that the signal amplitude, not including undershoot or overshoot, is between 720 and 880 mV_{p-p}.

g. Repeat this procedure for the other two SERIAL TEST SIGNAL outputs.

h. Connect W3, W23, and W4 to J103, J123, and J104.

i. Repeat these procedures for the Serial Digital Black signals.

A-3. Check SERIAL DIGITAL Output Rise and Fall Times

a. Connect the equipment as shown in Fig. A-8.

b. Connect W3, W23, and W4 to J3, J23, and J4.

c. In the ***WAVEFORM HORIZONTAL DESC*** menu, set the ***Display Type*** to: ***NORMAL***.

d. From the oscilloscope's ***MEASUREMENTS*** menu timing selections, select ***RISE*** and ***FALL***.

e. Set the ***RISE*** time menu as shown:

Tracking	Both
Proximal	20%
Distal	80%
Left Limit & Right Limit	Set to bracket the transition to be measured. Transition should change color between proximal and distal cursors.

f. From the oscilloscope's ***TRIGGER*** menu, set the slope to "+".

g. **CHECK** — that the rise time is between 0.75 and 1.50 ns.

h. Change the slope to "—", from the ***TRIGGER*** menu.

i. Select ***FALL*** from the ***MEASUREMENTS*** menu.

j. **CHECK** — that the fall time is between 0.75 and 1.50 ns.

k. Repeat this procedure for the other two SERIAL TEST SIGNAL Outputs.

l. Connect W3, W23, and W4 to J103, J123, and J104.

m. Repeat these procedures for the Serial Digital Black signals.

A-4. Check Serial Digital Output Overshoot and Undershoot

a. Connect the equipment as shown in Fig. A-8.

b. Connect W3, W23, and W4 to J3, J23, and J4.

c. Select ***OVERSHOOT*** and ***UNDERSHOOT*** from the ***MEASUREMENTS*** menu.

d. Select from the ***OVERSHOOT*** menu:

Left Limit	0%
Right Limit	100%
Tracking	Both
Time Mode	Relative

e. Set the ***TRIGGER SLOPE*** to "+".

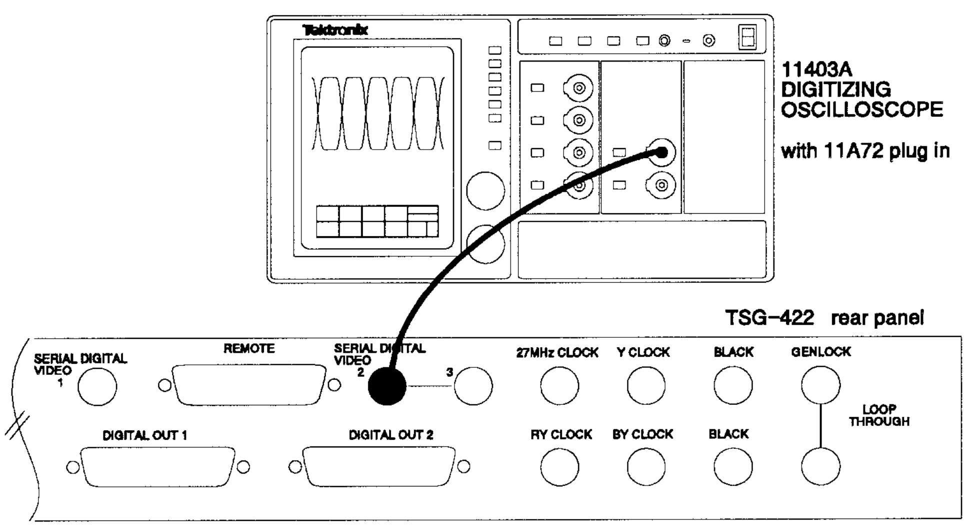


Fig. A-8.
Setup to check the Serial Digital Output:
Amplitude, Rise & Fall Times, Overshoot & Undershoot, and DC Level.

f. **CHECK** — that the measured overshoot is less than 10%.

g. Set the ***TRIGGER SLOPE*** to "—".

h. Select ***UNDERSHOOT***.

i. **CHECK** — that the measured undershoot is less than 10%.

j. Repeat this procedure for the other two SERIAL TEST SIGNAL Outputs.

k. Connect W3, W23, and W4 to J103, J123, and J104.

l. Repeat these procedures for the Serial Digital Black signals.

A-5. Check Serial Digital Output DC Level

a. Connect the equipment as shown in Fig. A-8.

b. Connect W3, W23, and W4 to J3, J23, and J4.

c. Select ***MID*** from the ***MEASUREMENTS*** menu.

d. From the ***MID*** menu select:

Left Limit	0%
Right Limit	100%
Time Mode	Relative

e. **CHECK** — that the measured ***MID*** point is 0 V ± 0.5 V.

f. Repeat this procedure for the other two SERIAL TEST SIGNAL Outputs.

g. Connect W3, W23, and W4 to J103, J123, and J104.

h. Repeat these procedures for the Serial Digital Black signals.

ADJUSTMENT PROCEDURE

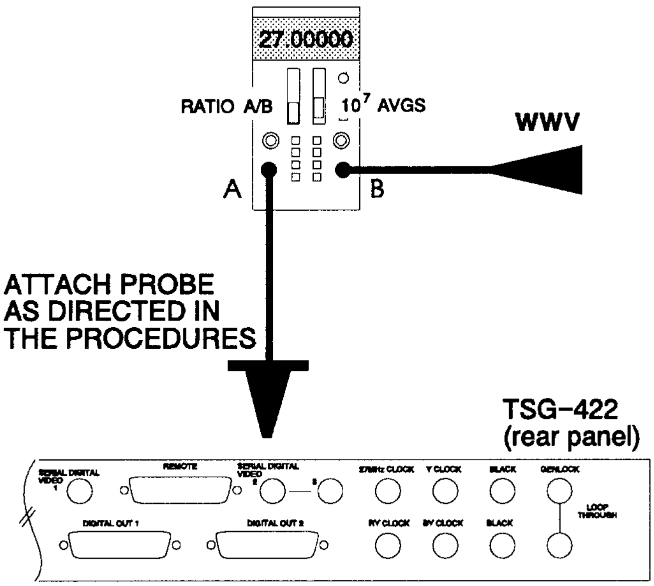


Fig. A-9. Setup to Adjust the Serial VCO Frequency.

A-6. Adjust VCO Test Signal 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 to ON (CLOSED).

d. **ADJUST** — R22 on the Serial Output board for a frequency of approximately 27.0 MHz.

e. Set S2-2 to OFF (OPEN) and set the Counter/Timer's AVGS to 10^7.

f. **CHECK** — that the frequency at TP1 is 27.0 MHz ± 100 kHz.

g. Repeat the above procedures until the frequency is within spec.

A-7. Adjust VCO Digital Black 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 to ON (CLOSED).

d. **ADJUST** — R122 on the Serial Output board for a frequency of approximately 27.0 MHz.

e. Set S2-2 to OFF (OPEN) and set the Counter/Timer's AVGS to 10^7.

f. **CHECK** — that the frequency at TP101 is 27.0 MHz ± 100 kHz.

g. Repeat the above procedures until the frequency is within spec.

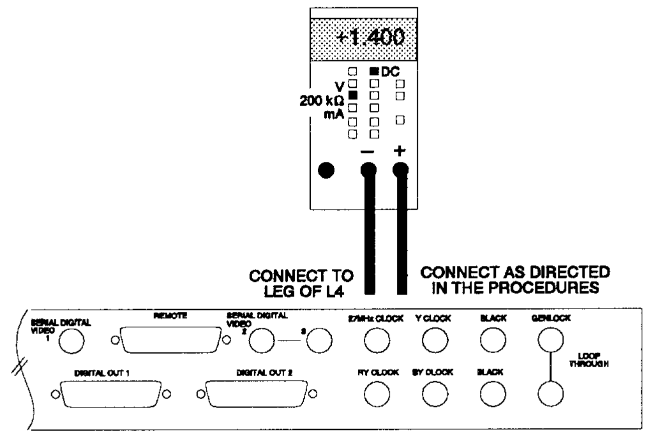


Fig. A-10.
Setup to adjust the Serial Digital Video Output Amplitude.

A-8. 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.

A-9. 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 TP8 and -12VA.

This ends the calibration portion of the Adjustment Procedure. Now do a complete Performance Check to re-verify all specifications.

THE TSG-422 SERIAL SIGNAL (MORE INFORMATION)

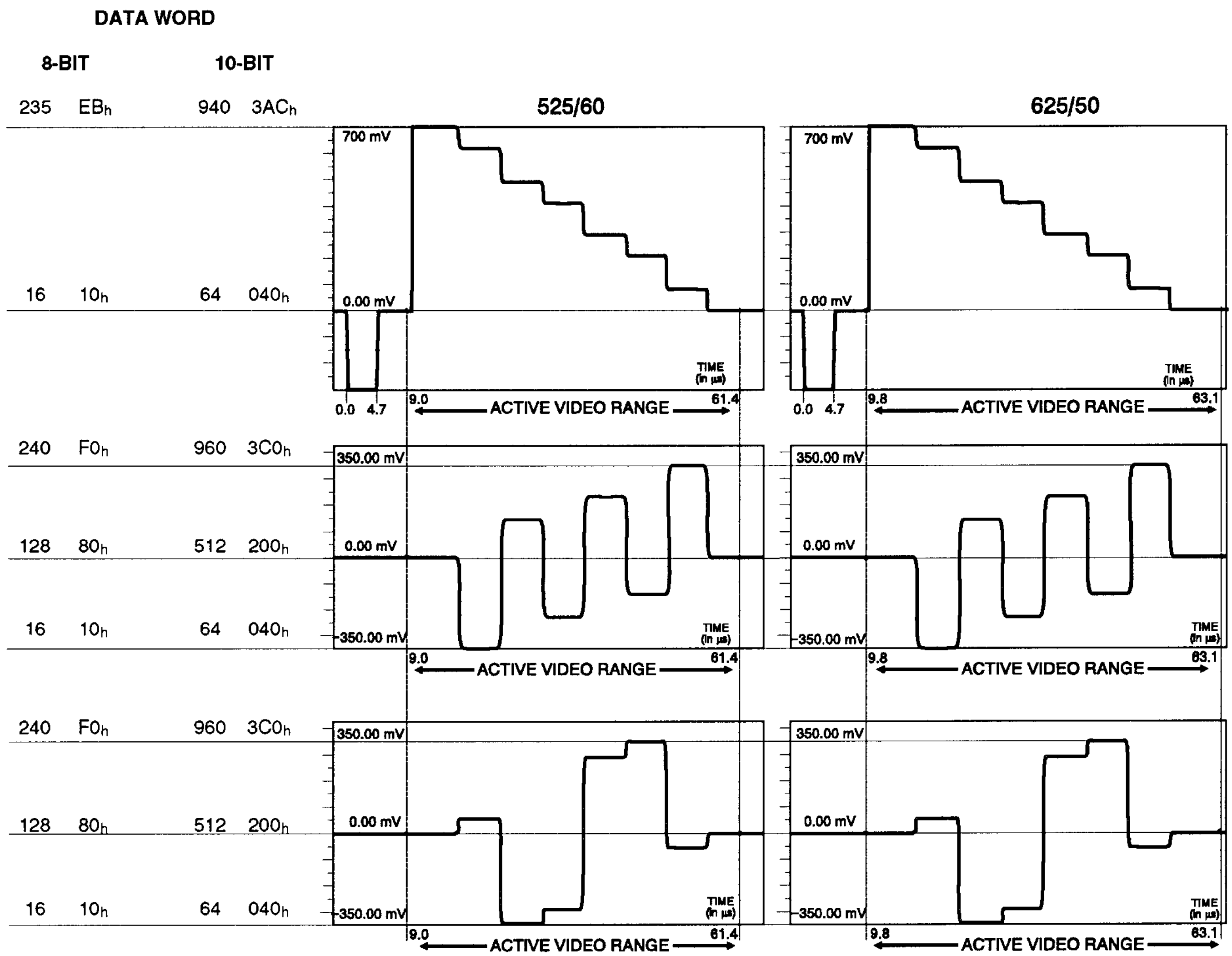


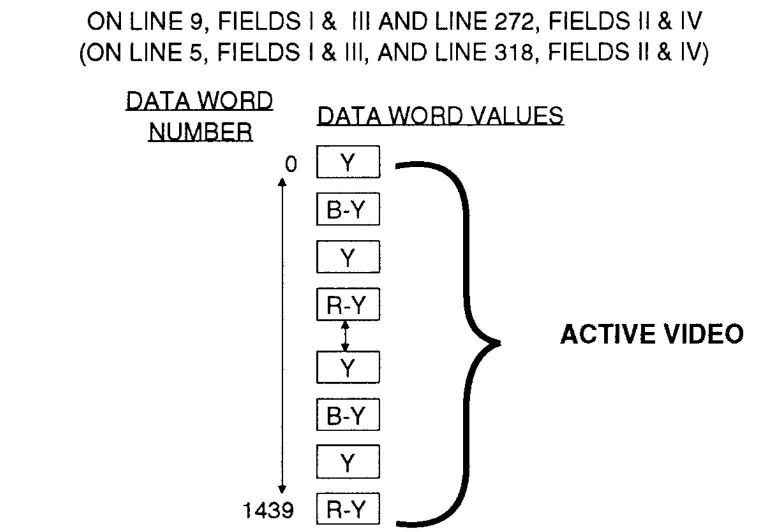
Fig. A-11.
Component Analog to Component Digital Timing and Amplitude Relationships.

Ancillary Data Structure

The Ancillary Data is divided into three main types: TRS-ID, Auxillary Data, and EDH Ancillary Data. Fig. A-12 shows a line of data with all possible types of ancillary data active. The Figures and Tables on the following pages give a more detailed breakdown of what is in the Ancillary Data packets and where it is located.

(The Auxillary Data can contain embedded audio, among other things.)

See Page A-18 for TRS-ID and page A-19 for EDH information.



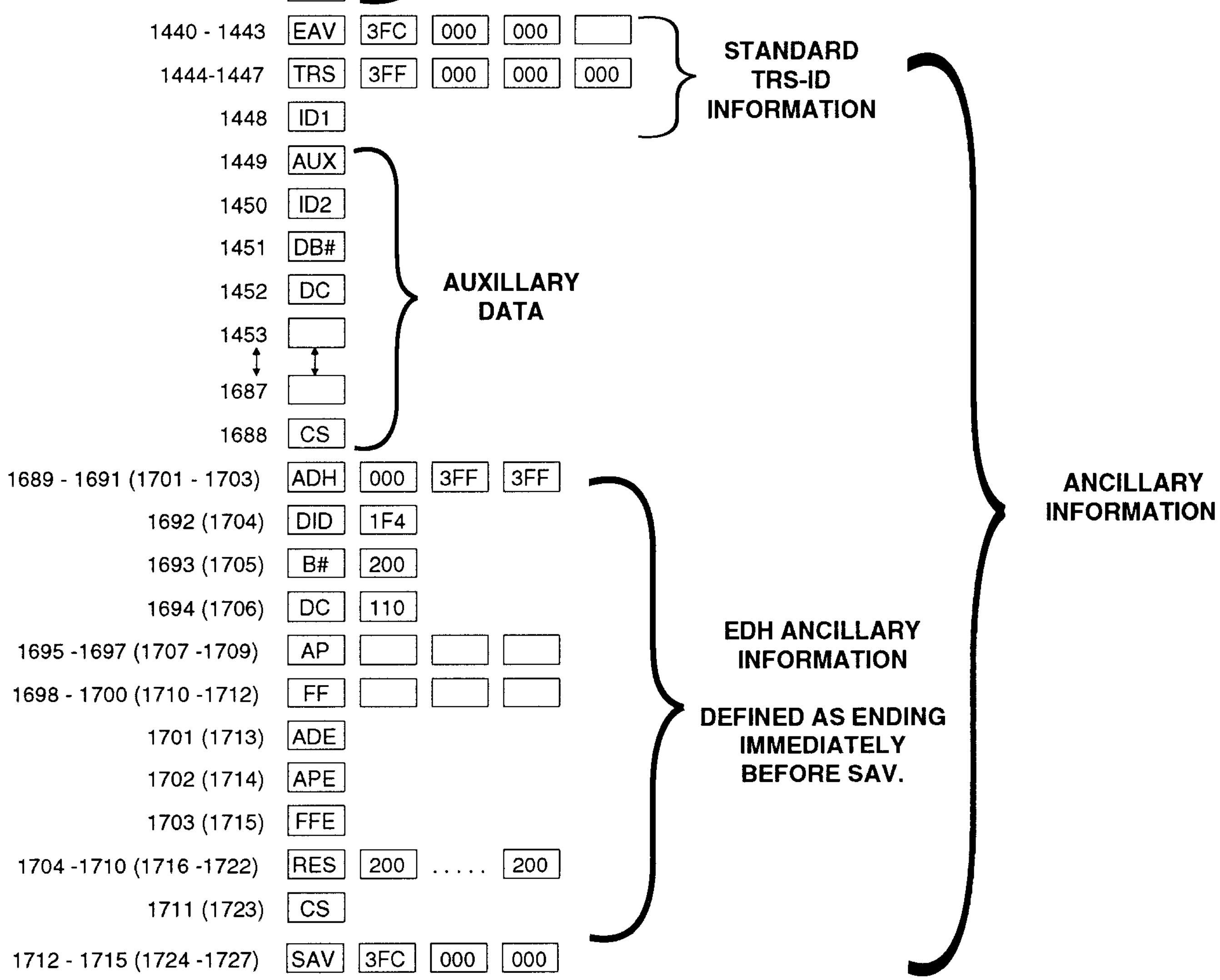


Fig. A-12. Ancillary Data Structure. (625 system)

Location and Values for TRS-ID Data & Auxillary Data

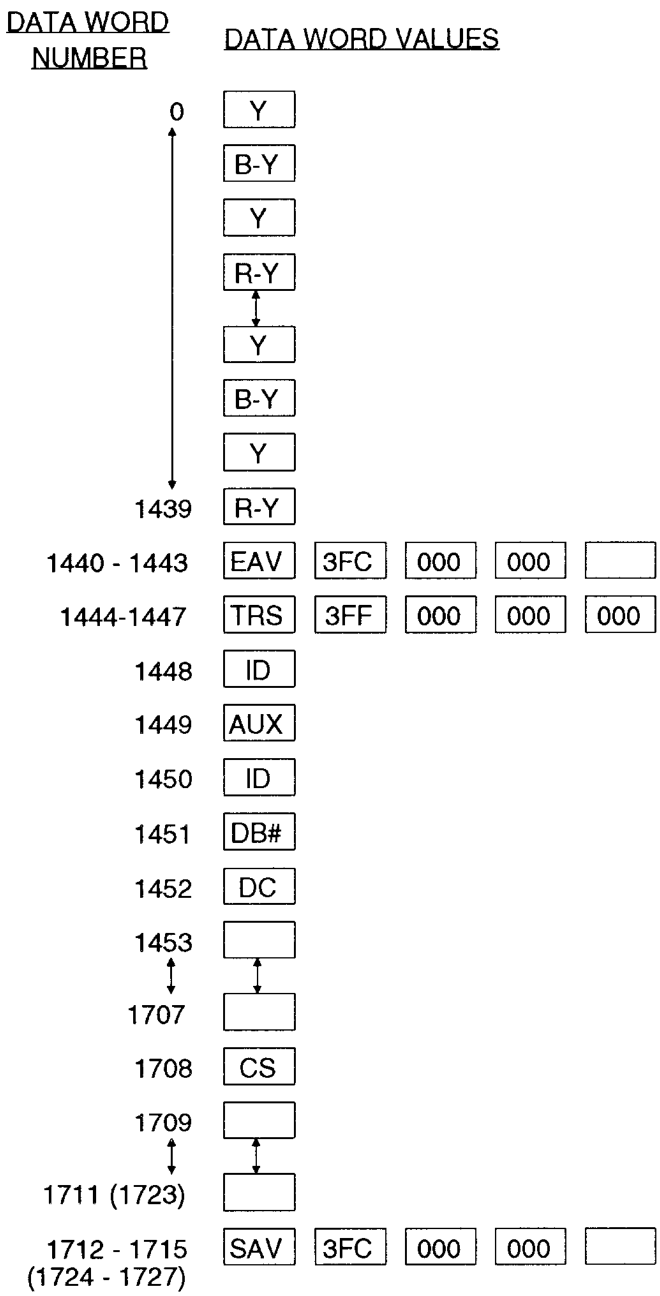


Fig. A-13. Data packet information for 525/60 system.
Numbers in ( ) are for 625/50 system.

Refer to Fig. A-13 for the bit placement.

Standard CCIR 601 Data

Y, B-Y, R-Y — Active video data values. Y is luminance, and B-Y & R-Y are color difference channels.

EAV — End of Active Video. A CCIR 601 control signal four data word long. Defined as 3FC$_h$, 000$_h$, 000$_h$, xxx$_h$. See Table 3-2 (Specifications Section) for the value of xxx$_h$.

SAV — Start of Active Video. A CCIR 601 control signal 4 words long. Defined as 3FC$_h$, 000$_h$, 000$_h$, xxx$_h$. See Table 3-2 (Specifications Section) for the value of xxx$_h$.

TRS-ID Data

TRS — Timing Reference Signal. Defined 4 word code (3FF$_h$, 000$_h$, 000$_h$, 000$_h$) that tells the serial signal where it is located on the data line.

ID (1448) — Line ID. Tells which field/line is being transmitted. See Table A-8 on page A-18 for the values.

Auxillary Data

AUX — Auxiliary Data Flag indicates the presence of non-video data.

ID (1450) — Data ID. Indicates the type of auxilary data.

DB# — Data Block Number. Distinguishes the different types of data that share the same data ID number.

DC — Data Count. Indicates the number of data words included in this block.

CS — Checksum. Used to check the validity of the data ID and the user's data.

Table A-8. Definition of TRS and ID Data Words.

	b9 msb	b8	b7	b6	b5	b4	b3	b2	b1	b0 lsb
TRS, word 1, Sample 1444	1	1	1	1	1	1	1	1	1	1
TRS, word 2, Sample 1445	0	0	0	0	0	0	0	0	0	0
TRS, word 3, Sample 1446	0	0	0	0	0	0	0	0	0	0
TRS, word 4, Sample 1447	0	0	0	0	0	0	0	0	0	0
Line Number ID, Sample 1448	**Parity**		**Line Number**					**Field Number**		
Line 1, Field 1	0	1	0	0	0	0	1	0	0	0
Line 2, Field 1	0	1	0	0	0	1	0	0	0	0
Line 3, Field 1	1	0	0	0	0	1	1	0	0	0
Line n, Field 1	$\overline{P}$	P	m	m	m	m	m	0	0	0
Line 30, Field 1	1	0	1	1	1	1	0	0	0	0
Line >30, Field 1	0	1	1	1	1	1	1	0	0	0
Line n, Field 2	$\overline{P}$	P	m	m	m	m	m	0	0	1
Line n, Field 3	$\overline{P}$	P	m	m	m	m	m	0	1	0
Line n, Field 4	$\overline{P}$	P	m	m	m	m	m	0	1	1
Line n, Field 5 (625 only)	$\overline{P}$	P	m	m	m	m	m	1	0	0
Line n, Field 6 (625 only)	$\overline{P}$	P	m	m	m	m	m	1	0	1
Line n, Field 7 (625 only)	$\overline{P}$	P	m	m	m	m	m	1	1	0
Line n, Field 8 (625 only)	$\overline{P}$	P	m	m	m	m	m	1	1	1
Not Used	X	X	0	0	0	0	0	X	X	X

Table A-9. Definitions for Error Data Handling (EDH).
For 525 Line 9 Field I & III and Line 272 Field II & IV
For 625 Line 5 Fields I & III and Line 318 Fields II & IV

Data Word & Description start with sample 1689 (1701)	bits										525 #	625 #
	9	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**		
Anc Data Header	0	0	0	0	0	0	0	0	0	0	1689	1701
Anc Data Header	1	1	1	1	1	1	1	1	1	1	1690	1702
Anc Data Header	1	1	1	1	1	1	1	1	1	1	1691	1703
Data ID	0	1	1	1	1	1	0	1	0	0	1692	1704
Block Number	1	0	0	0	0	0	0	0	0	0	1693	1705
Data Count	0	1	0	0	0	1	0	0	0	0	1694	1706
APL[1]	$\overline{P}$[7]	P(7)	AP-CRC[8] bits 5-0						0	0	1695	1707
APM[1]	$\overline{P}$	P	AP-CRC bits 11-6						0	0	1696	1708
APH[1]	$\overline{P}$	P	V[6]	0	AP-CRC bits 15-12				0	0	1697	1709
FFL[2]	$\overline{P}$	P	FF-CRC[9] bits 5-0						0	0	1698	1710
FFM[2]	$\overline{P}$	P	FF-CRC bits 11-6						0	0	1699	1711
FFH[2]	$\overline{P}$	P	V	0	FF-CRC bits 15-12				0	0	1700	1712
AN STAT[3]	$\overline{P}$	P	0	an ues (10)	an ida (11)	an idh (12)	an eda (13)	an edh (14)	0	0	1701	1713
AP STAT[4]	$\overline{P}$	P	0	ap ues	ap ida	ap idh	ap eda	ap edh	0	0	1702	1714
FF STAT[5]	$\overline{P}$	P	0	ff ues	ff ida	ff idh	ff eda	ff edh	0	0	1703	1715
reserved (7 words)	1	0	0	0	0	0	0	0	0	0	1704	1716
Checksum	$\overline{8}$	8	7	6	5	4	3	2	1	0	1711	1723

(1) APL, APM, & APH — Active Picture Low, Middle, and High. Includes samples 0-1439

(2) FFL, FFM, & FFH — Full Field Low, Middle, and High. Includes all samples in all lines except lines 9-11 & 272-274 (5-7 & 318-320).

(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. V = 1, if valid CRC is calculated.

(7) P & $\overline{P}$ — Even Parity.

(8) AP-CRC — Active Picture Cyclic Redundancy Code. 16-bit code derived from all of the bits in the active picture.

(9) FF-CRC — Full Field Cyclic Redundancy Code. A 16-bit code derived from all bits in the field, except transition lines.

(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. A non-transmission error is 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.

REPLACEABLE ELECTRICAL PARTS LIST

PARTS ORDERING INFORMATION

Replaceable parts are available from or through your local Tektronix, Inc., field office or representative.

It is important, when ordering parts, to include the following information in your order. Part number, instrument type and number, serial number, and modification number if applicable.

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

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

LIST OF ASSEMBLIES

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

CROSS INDEX–MFR. CODE NUMBER TO MANUFACTURER

The Mfr. Code Number to Manufacturer index for the Electrical Parts List is located immediately after this page. The Cross Index provides codes, names, and addresses of manufacturers of components listed in the Electrical Parts List.

ABBREVIATIONS

Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER

(Column 1 of the Electrical Parts List)

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

Example A. A23R1234

component

A23 R1234

Assembly Number

Circuit Number

Read: Resistor 1234 of Assembly 23

Example B. A23A2R1234

component

A23 A2 R1234

Assembly Number

Subassembly Number

Circuit Number

Read: Resistor 1234 of Subassembly 2 of Assembly 23

Only the circuit number will appear on the diagrams and circuit board illustrations. Each diagram and circuit board illustration is clearly marked with the assembly number. Assembly numbers are also marked on the mechanical exploded views located in the Mechanical Parts List. The component number is obtained by adding the assembly number prefix to the circuit number.

The Electrical Parts List is divided and arranged by assemblies in numerical sequence (e.g., assembly A1 with its sub assemblies and parts, precedes assembly 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 of the Electrical Parts List)

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

SERIAL/ASSEMBLY NO.

(Column 3 and 4 of the Electrical Parts List)

Column 3 indicates the serial or assembly number at which the part was first used. Column 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 of the Electrical Parts List)

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6–1 can be utilized where possible. The Mechanical Subparts are shown as *ATTACHED PARTS* / *END ATTACHED PARTS* or *MOUNTING PARTS* / *END MOUNTING PARTS* in column 5.

MFR. CODE

(Column 6 of the Electrical Parts List)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross–reference can be found immediately after this page.)

MFR. PART NUMBER

(Column 7 of the Electrical Parts List)

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	DU PONT E I DE NEMOURS AND CO INC DU PONT ELECTRONICS DEPT	515 FISHING CREEK RD	NEW CUMBERLAND PA 17070-3007
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

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A7	671-2244-00	B010327	B010348	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2244-00
A7	671-2244-01	B010349	B010365	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2244-01
A7	671-2244-02	B010366	B010412	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2244-02
A7	671-2244-03	B010413	B010481	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2244-03
A7	671-2244-04	B010482	B010569	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2244-04
A7	671-2244-07	B010570		CIRCUIT BD ASSY:SERIAL OUTPUT (FOR ALL COUNTRIES EXCEPT GERMANY)	80009	671-2244-07
A7	671-2244-05	B020000	B020565	CIRCUIT BD ASSY:SERIAL OUTPUT	80009	671-2244-05
A7	671-2244-07	B020566		CIRCUIT BD ASSY:SERIAL OUTPUT (FOR GERMANY ONLY)	80009	671-2244-07
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	671-2244-00	671-2244-03	CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C7	283-0177-05	671-2244-04		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A7C8	281-0775-01	671-2244-00	671-2244-03	CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C8	283-0177-05	671-2244-04		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A7C9	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C10	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C11	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C12	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C13	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C14	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C15	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C16	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C17	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C18	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C19	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C20	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C21	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C22	290-0167-00	671-2244-00	671-2244-05	CAP,FXD,ELCTLT:10UF,20%,15V	05397	T110B106M015AS
A7C22	290-0973-01	671-2244-06		CAP,FXD,ELCTLT:100UF,20%,25VDC	55680	UVX1E101MPA1TA
A7C23	290-0167-00			CAP,FXD,ELCTLT:10UF,20%,15V	05397	T110B106M015AS
A7C25	281-0775-01	671-2244-00	671-2244-03	CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C25	283-0177-05	671-2244-04		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A7C26	290-0267-00			CAP,FXD,ELCTLT:1UF,20%,35V	05397	T320A105M035AS
A7C27	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C28	281-0775-01	671-2244-00	671-2244-03	CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C28	131-4566-00	671-2244-04	671-2244-05	BUS,CONDUCTOR:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A7C28	281-0765-00	671-2244-06		CAP,FXD,CER DI:100PF,5%,100V	04222	SA102A101JAA
A7C29	281-0775-01	671-2244-00	671-2244-03	CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C29	131-4566-00	671-2244-04	671-2244-05	BUS,CONDUCTOR:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A7C29	281-0757-00	671-2244-06		CAP,FXD,CER DI:10PF,20%,100V TUBULAR,MI	80009	281-0757-00
A7C30	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C31	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C32	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C33	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C34	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C35	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C36	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C37	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C38	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C39	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C40	290-0973-01	671-2244-06		CAP,FXD,ELCTLT:100UF,20%,25VDC	55680	UVX1E101MPA1TA
A7C41	290-0167-00	671-2244-06		CAP,FXD,ELCTLT:10UF,20%,15V	05397	T110B106M015AS
A7C42	281-0775-01	671-2244-06		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C43	281-0775-01	671-2244-06		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C44	281-0861-00	671-2244-04	671-2244-05	CAP,FXD,CER DI:270PF,5%,50V	04222	SA101A271JAA
A7C44	281-0775-01	671-2244-06		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A7C45	283-0785-01	671-2244-06		CAP,FXD,MICA DI:250PF,1%,500V,TAPE & AMMO P ACK	09023	CDA15FD251F03
A7C46	281-0775-01	671-2244-06		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C47	290-0973-01	671-2244-06		CAP,FXD,ELCTLT:100UF,20%,25VDC	55680	UVX1E101MPA1TA
A7C48	281-0775-01	671-2244-06		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C49	281-0756-00	671-2244-06		CAP,FXD,CER DI:2.2PF,+/-0.5PF,200V	04222	SA102A2R2DAA
A7C50	281-0756-00	671-2244-06		CAP,FXD,CER DI:2.2PF,+/-0.5PF,200V	04222	SA102A2R2DAA
A7C51	281-0756-00	671-2244-06		CAP,FXD,CER DI:2.2PF,+/-0.5PF,200V	04222	SA102A2R2DAA
A7C101	283-0644-01	671-2244-06		CAP,FXD,MICA DI:150PF,1%,500V	80009	283-0644-01
A7C103	283-0604-00	671-2244-06		CAP,FXD,MICA DI:304PF,2%,500V	80009	283-0604-00
A7C104	290-0167-00	671-2244-06		CAP,FXD,ELCTLT:10UF,20%,15V	05397	T110B106M015AS
A7C107	283-0177-05	671-2244-06		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A7C108	283-0177-05	671-2244-06		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A7C125	283-0177-05	671-2244-06		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A7C126	290-0267-00	671-2244-06		CAP,FXD,ELCTLT:1UF,20%,35V	05397	T320A105M035AS
A7C127	281-0775-01	671-2244-06		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C128	281-0765-00	671-2244-06		CAP,FXD,CER DI:100PF,5%,100V	04222	SA102A101JAA
A7C129	281-0757-00	671-2244-06		CAP,FXD,CER DI:10PF,20%,100V TUBULAR,MI	80009	281-0757-00
A7C139	281-0775-01	671-2244-06		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C141	290-0167-00	671-2244-06		CAP,FXD,ELCTLT:10UF,20%,15V	05397	T110B106M015AS
A7C142	281-0775-01	671-2244-06		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C143	281-0775-01	671-2244-06		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C144	281-0775-01	671-2244-06		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C145	283-0785-01	671-2244-06		CAP,FXD,MICA DI:250PF,1%,500V,TAPE & AMMO P ACK	09023	CDA15FD251F03
A7C146	281-0775-01	671-2244-06		CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A7C147	281-0791-00	671-2244-06		CAP,FXD,CER DI:270PF,10%,100V	04222	SA102C271KAA
A7C149	281-0756-00	671-2244-06		CAP,FXD,CER DI:2.2PF,+/-0.5PF,200V	04222	SA102A2R2DAA
A7C150	281-0756-00	671-2244-06		CAP,FXD,CER DI:2.2PF,+/-0.5PF,200V	04222	SA102A2R2DAA
A7C151	281-0756-00	671-2244-06		CAP,FXD,CER DI:2.2PF,+/-0.5PF,200V	04222	SA102A2R2DAA
A7J1	131-0608-00			TERMINAL,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	671-2244-00	671-2244-05	CONN,HDR:PCB,;MALE,RTANG,1 X 36,0.1 CTR,0.2 30 MLG X 0.090 TAIL,30 GOLD,STACKABLE;,,	22526	65521-136
A7J5	131-1426-00	671-2244-00	671-2244-05	CONN,HDR:PCB,;MALE,RTANG,1 X 36,0.1 CTR,0.2 3 MLG X 0.195 TAIL,GOLD,STACKABLE;,,	22526	65524-136
A7J5	131-3364-00	671-2244-06		CONN,HDR:	53387	2534-6002UB
A7J6	131-0608-00	671-2244-00	671-2244-05	TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 26)	80009	131-0608-00
A7J6	131-3362-00	671-2244-06		CONN,HDR:	53387	2526-6002UB
A7J12	131-0608-00	671-2244-00	671-2244-05	TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 26)	80009	131-0608-00
A7J12	131-3362-00	671-2244-06		CONN,HDR:	53387	2526-6002UB
A7J13	131-0608-00			TERMINAL,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
A7J101	131-0608-00	671-2244-06		TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A7J103	131-0391-00	671-2244-06		CONN,RF JACK:	80009	131-0391-00
A7J104	131-0391-00	671-2244-06		CONN,RF JACK:	80009	131-0391-00
A7J113	131-0608-00	671-2244-06		TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY 3)	80009	131-0608-00
A7J123	131-0391-00	671-2244-06		CONN,RF JACK:	80009	131-0391-00
A7L1	108-1341-00			COIL,RF:FXD,180NH,10%,0.1 OHM,1100MA MI AXI AL LEADS	80009	108-1341-00
A7L2	108-1263-00	671-2244-06		COIL,RF:FXD,10UH, 10%,Q=70,SRF 27 MHZ,DCR 0 .043 OHM,I MAX 2.1ARADIAL LEAD	80009	108-1263-00
A7L3	108-0413-00			COIL,RF:FIXED,0.4UH	80009	108-0413-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A7L4	108-0215-00	671-2244-06		COIL,RF:FIXED,1.1UH	TK1345	108-0215-00
A7L5	108-1263-00	671-2244-00	671-2244-05	COIL,RF:FXD,10UH, 10%,Q=70,SRF 27 MHZ,DCR 0 .043 OHM,I MAX 2.1ARADIAL LEAD	80009	108-1263-00
A7L101	108-1341-00	671-2244-06		COIL,RF:FXD,180NH,10%,0.1 OHM,1100MA MI AXI AL LEADS	80009	108-1341-00
A7L103	108-0413-00	671-2244-06		COIL,RF:FIXED,0.4UH	80009	108-0413-00
A7P1	131-0993-02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1-850100-0
A7P13	131-0993-02			BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1-850100-0
A7P101	131-0993-02	671-2244-06		BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1-850100-0
A7P113	131-0993-02	671-2244-06		BUS,CONDUCTOR:SHUNT ASSEMBLY,RED	00779	1-850100-0
A7Q1	151-0190-00	671-2244-00	671-2244-01	TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ ,AMPLIFIER;2N3904,TO-92 EBC	80009	151-0190-00
A7Q2	151-0472-00	671-2244-00	671-2244-05	TRANSISTOR,SIG:BIPOLAR,NPN;14V,80MA,1.0GHZ, AMPLIFIER;NE41632B,TO-92 EBC	80009	151-0472-00
A7Q2	151-0965-00	671-2244-06		TRANSISTOR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPLIFIER;MPS571,TO-92 BEC	80009	151-0965-00
A7Q3	151-0472-00	671-2244-00	671-2244-05	TRANSISTOR,SIG:BIPOLAR,NPN;14V,80MA,1.0GHZ, AMPLIFIER;NE41632B,TO-92 EBC	80009	151-0472-00
A7Q3	151-0965-00	671-2244-06		TRANSISTOR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPLIFIER;MPS571,TO-92 BEC	80009	151-0965-00
A7Q4	151-0472-00	671-2244-00	671-2244-05	TRANSISTOR,SIG:BIPOLAR,NPN;14V,80MA,1.0GHZ, AMPLIFIER;NE41632B,TO-92 EBC	80009	151-0472-00
A7Q4	151-0965-00	671-2244-06		TRANSISTOR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPLIFIER;MPS571,TO-92 BEC	80009	151-0965-00
A7Q7	151-0720-00			TRANSISTOR,SIG:BIPOLAR,NPN;25V,50MA,650MHZ, AMPLIFIER;MPSH10,TO-92 BEC	80009	151-0720-00
A7Q8	151-0472-00	671-2244-00	671-2244-05	TRANSISTOR,SIG:BIPOLAR,NPN;14V,80MA,1.0GHZ, AMPLIFIER;NE41632B,TO-92 EBC	80009	151-0472-00
A7Q8	151-0965-00	671-2244-06		TRANSISTOR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPLIFIER;MPS571,TO-92 BEC	80009	151-0965-00
A7Q9	151-0472-00	671-2244-00	671-2244-05	TRANSISTOR,SIG:BIPOLAR,NPN;14V,80MA,1.0GHZ, AMPLIFIER;NE41632B,TO-92 EBC	80009	151-0472-00
A7Q9	151-0965-00	671-2244-06		TRANSISTOR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPLIFIER;MPS571,TO-92 BEC	80009	151-0965-00
A7Q10	151-0139-00			TRANSISTOR,SIG:BIPOLAR,NPN;15V,50MA,600MHZ, AMPLIFIER,DUAL;MD918,TO-77	80009	151-0139-00
A7Q11	151-0720-00			TRANSISTOR,SIG:BIPOLAR,NPN;25V,50MA,650MHZ, AMPLIFIER;MPSH10,TO-92 BEC	80009	151-0720-00
A7Q12	151-0188-00	671-2244-06		TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ ,AMPLIFIER;2N3906,TO-92 EBC	80009	151-0188-00
A7Q102	151-0965-00	671-2244-06		TRANSISTOR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPLIFIER;MPS571,TO-92 BEC	80009	151-0965-00
A7Q103	151-0965-00	671-2244-06		TRANSISTOR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPLIFIER;MPS571,TO-92 BEC	80009	151-0965-00
A7Q104	151-0965-00	671-2244-06		TRANSISTOR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPLIFIER;MPS571,TO-92 BEC	80009	151-0965-00
A7Q107	151-0720-00	671-2244-06		TRANSISTOR,SIG:BIPOLAR,NPN;25V,50MA,650MHZ, AMPLIFIER;MPSH10,TO-92 BEC	80009	151-0720-00
A7Q108	151-0965-00	671-2244-06		TRANSISTOR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPLIFIER;MPS571,TO-92 BEC	80009	151-0965-00
A7Q109	151-0965-00	671-2244-06		TRANSISTOR,SIG:BIPOLAR,NPN;10V,80MA,6.0GHZ, AMPLIFIER;MPS571,TO-92 BEC	80009	151-0965-00
A7Q110	151-0139-00	671-2244-06		TRANSISTOR,SIG:BIPOLAR,NPN;15V,50MA,600MHZ, AMPLIFIER,DUAL;MD918,TO-77	80009	151-0139-00
A7Q111	151-0720-00	671-2244-06		TRANSISTOR,SIG:BIPOLAR,NPN;25V,50MA,650MHZ, AMPLIFIER;MPSH10,TO-92 BEC	80009	151-0720-00
A7Q112	151-0188-00	671-2244-06		TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ ,AMPLIFIER;2N3906,TO-92 EBC	80009	151-0188-00
A7R1	322-3322-00			RES,FXD,FILM:22.1K OHM,1%,0.2W,TC=TO	80009	322-3322-00

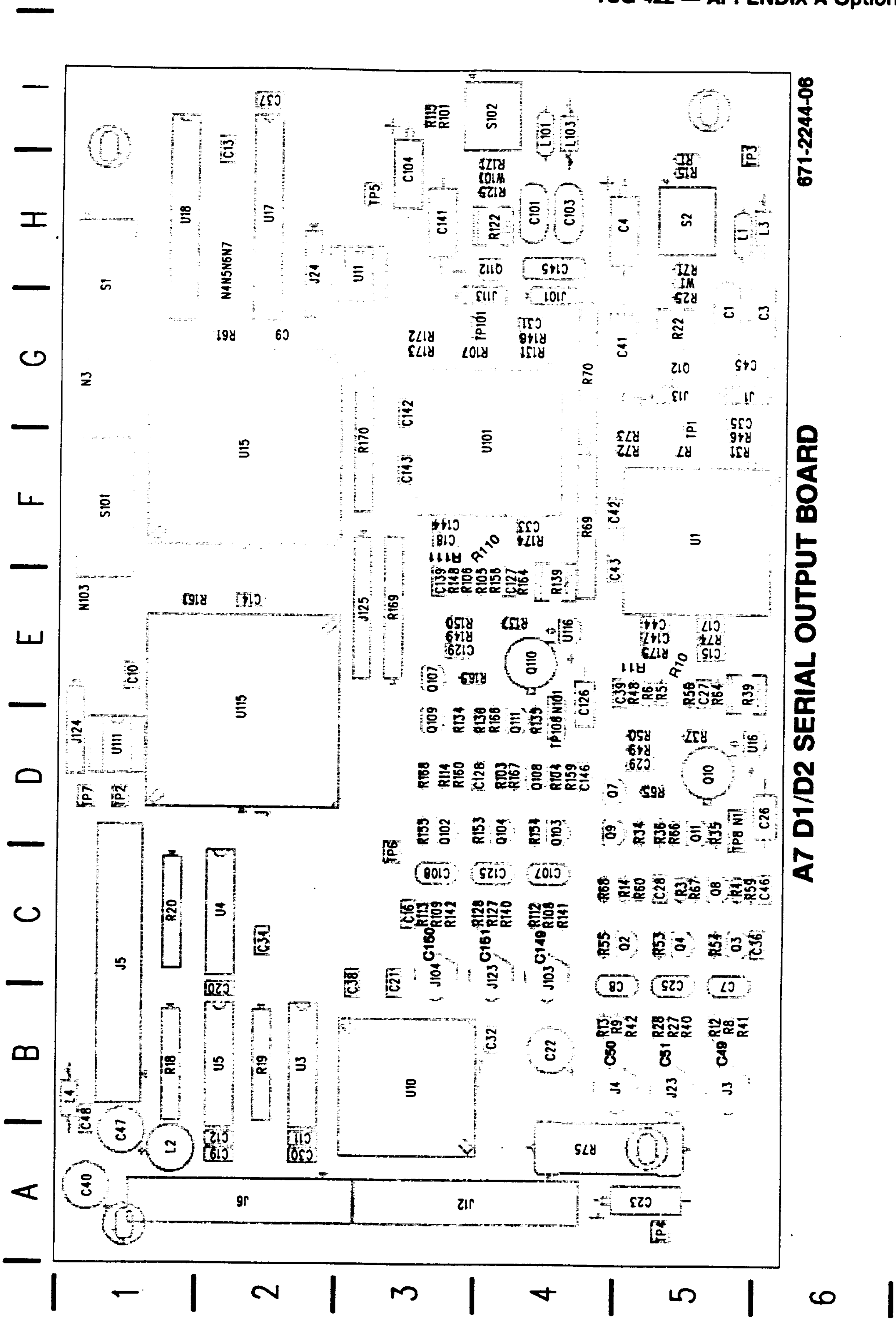
Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A7R2	311-0609-00	671-2244-00	671-2244-02	RES,VAR,NONWW:TRMR,2K OHM,0.5W	80009	311-0609-00
A7R2	311-0633-00	671-2244-03	671-2244-05	RES,VAR,NONWW:TRMR,5K OHM,0.5W	32997	3329H-L58-502
A7R3	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A7R4	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A7R5	322-3068-00			RES,FXD,FILM:49.9 OHM,1%,0.2W,TC=T0	80009	322-3068-00
A7R6	322-3068-00			RES,FXD,FILM:49.9 OHM,1%,0.2W,TC=T0	80009	322-3068-00
A7R7	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	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	322-3193-00	671-2244-05	671-2244-05	RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A7R10	322-3114-00	671-2244-06		RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	91637	CCF50-2-G1500F
A7R11	322-3114-00	671-2244-06		RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	91637	CCF50-2-G1500F
A7R12	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A7R13	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A7R14	322-3085-00	671-2244-00	671-2244-05	RES,FXD,FILM:75 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 75E0
A7R14	322-3068-00	671-2244-06		RES,FXD,FILM:49.9 OHM,1%,0.2W,TC=T0	80009	322-3068-00
A7R15	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	80009	322-3289-00
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
A7R22	311-0609-00	671-2244-00	671-2244-02	RES,VAR,NONWW:TRMR,2K OHM,0.5W	80009	311-0609-00
A7R22	311-0633-00	671-2244-03	671-2244-05	RES,VAR,NONWW:TRMR,5K OHM,0.5W	32997	3329H-L58-502
A7R22	311-2234-00	671-2244-06		RES,VAR,TRMR:CERMET;5K OHM,20%,0.5W,0.197 SQ,TOP ADJUST;T&R	TK1450	GF06UT 5K
A7R23	322-3215-00	671-2244-00	671-2244-05	RES,FXD,FILM:1.69K OHM,1%,0.2W,TC=T0	91637	CCF50-2F16900F
A7R25	322-3220-00	671-2244-00	671-2244-05	RES,FXD,FILM:1.91K OHM,1%,0.2W,TC=T0	80009	322-3220-00
A7R25	322-3318-00	671-2244-06		RES,FXD,FILM:20K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 20K0
A7R27	322-3082-00			RES,FXD,FILM:69.8 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 69E8
A7R28	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A7R29	307-0675-00	671-2244-00	671-2244-05	RES NTWK,FXD,FI:(9),1K OHM,2%,1.25W	11236	750-101-R1K OHM
A7R31	322-3130-00	671-2244-00	671-2244-05	RES,FXD,FILM:221 OHM,1%,0.2W,TC=T0	80009	322-3130-00
A7R31	322-3114-00	671-2244-06		RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	91637	CCF50-2-G1500F
A7R32	322-3216-00	671-2244-00	671-2244-05	RES,FXD,FILM:1.74K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K74
A7R33	322-3211-00	671-2244-00	671-2244-05	RES,FXD,FILM:1.54K OHM,1%,0.2W,TC=T0	80009	322-3211-00
A7R34	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A7R35	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A7R36	322-3058-00	671-2244-00	671-2244-05	RES,FXD,FILM:39.2 OHM,1%,0.2W,TC=T0	80009	322-3058-00
A7R36	322-3068-00	671-2244-06		RES,FXD,FILM:49.9 OHM,1%,0.2W,TC=T0	80009	322-3068-00
A7R37	322-3066-00	671-2244-00	671-2244-05	RES,FXD,FILM:47.5 OHM,1%,0.2W,TC=T0	09969	CCF502G47R50F
A7R37	322-3089-00	671-2244-06		RES,FXD,FILM:82.5 OHM,1%.0.2W,TC=T0	80009	322-3089-00
A7R39	311-1007-00	671-2244-00	671-2244-05	RES,VAR,NONWW:TRMR,20 OHM,20%,0.5W	80009	311-1007-00
A7R39	311-2224-00	671-2244-06		RES,VAR,NONWW:TRMR,20 OHM,20%,0.5W LINEARTAPE & REEL	80009	311-2224-00
A7R40	322-3135-00	671-2244-00	671-2244-03	RES,FXD,FILM:249 OHM,1%,0.2W,TC=T0	80009	322-3135-00
A7R40	322-3114-00	671-2244-04		RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	91637	CCF50-2-G1500F
A7R41	322-3135-00	671-2244-00	671-2244-03	RES,FXD,FILM:249 OHM,1%,0.2W,TC=T0	80009	322-3135-00
A7R41	322-3114-00	671-2244-04		RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	91637	CCF50-2-G1500F
A7R42	322-3135-00	671-2244-00	671-2244-03	RES,FXD,FILM:249 OHM,1%,0.2W,TC=T0	80009	322-3135-00
A7R42	322-3114-00	671-2244-04		RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	91637	CCF50-2-G1500F
A7R43	307-0717-00	671-2244-00	671-2244-05	RES NTWK,FXD,FI:4,100 OHM,2%,0.3W EACH	80009	307-0717-00
A7R44	307-0717-00	671-2244-00	671-2244-05	RES NTWK,FXD,FI:4,100 OHM,2%,0.3W EACH	80009	307-0717-00
A7R45	307-0717-00	671-2244-00	671-2244-05	RES NTWK,FXD,FI:4,100 OHM,2%,0.3W EACH	80009	307-0717-00
A7R46	322-3130-00	671-2244-00	671-2244-05	RES,FXD,FILM:221 OHM,1%,0.2W,TC=T0	80009	322-3130-00
A7R46	322-3114-00	671-2244-06		RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	91637	CCF50-2-G1500F
A7R47	322-3117-00	671-2244-00	671-2244-05	RES,FXD,FILM:162 OHM,1%,0.2W,TC=T0	80009	322-3117-00
A7R48	322-3114-00	671-2244-00	671-2244-03	RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	91637	CCF50-2-G1500F
A7R48	322-3058-00	671-2244-04	671-2244-05	RES,FXD,FILM:39.2 OHM,1%,0.2W,TC=T0	80009	322-3058-00
A7R48	322-3001-00	671-2244-06		RES,FXD,FILM:10 OHM,1%,0.2W,TC=T0	80009	322-3001-00
A7R49	322-3068-00			RES,FXD,FILM:49.9 OHM,1%,0.2W,TC=T0	80009	322-3068-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A7R50	322-3068-00			RES,FXD,FILM:49.9 OHM,1%,0.2W,TC=T0	80009	322-3068-00
A7R53	322-3001-00			RES,FXD,FILM:10 OHM,1%,0.2W,TC=T0	80009	322-3001-00
A7R54	322-3001-00			RES,FXD,FILM:10 OHM,1%,0.2W,TC=T0	80009	322-3001-00
A7R55	322-3001-00			RES,FXD,FILM:10 OHM,1%,0.2W,TC=T0	80009	322-3001-00
A7R56	322-3068-00			RES,FXD,FILM:49.9 OHM,1%,0.2W,TC=T0	80009	322-3068-00
A7R57	322-3147-00	671-2244-00	671-2244-05	RES,FXD,FILM:332 OHM,1%,0.2W,TC=T0	80009	322-3147-00
A7R58	322-3147-00	671-2244-00	671-2244-05	RES,FXD,FILM:332 OHM,1%,0.2W,TC=T0	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	671-2244-00	671-2244-05	RES,FXD,FILM:200 OHM,0.5%,0.2W,TC=T0	91637	CCF501G200R0D
A7R60	322-3147-00	671-2244-06		RES,FXD,FILM:332 OHM,1%,0.2W,TC=T0	80009	322-3147-00
A7R61	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A7R64	322-3058-00	671-2244-00	671-2244-05	RES,FXD,FILM:39.2 OHM,1%,0.2W,TC=T0	80009	322-3058-00
A7R64	322-3089-00	671-2244-06		RES,FXD,FILM:82.5 OHM,1%.0.2W,TC=T0	80009	322-3089-00
A7R65	322-3001-00	671-2244-06		RES,FXD,FILM:10 OHM,1%,0.2W,TC=T0	80009	322-3001-00
A7R66	322-3001-00	671-2244-06		RES,FXD,FILM:10 OHM,1%,0.2W,TC=T0	80009	322-3001-00
A7R67	322-3001-00	671-2244-06		RES,FXD,FILM:10 OHM,1%,0.2W,TC=T0	80009	322-3001-00
A7R68	322-3001-00	671-2244-06		RES,FXD,FILM:10 OHM,1%,0.2W,TC=T0	80009	322-3001-00
A7R69	307-0888-00	671-2244-06		RES NTWK,FXD,FI:5,1K OHM,2%,1.5W	80009	307-0888-00
A7R70	307-0888-00	671-2244-06		RES NTWK,FXD,FI:5,1K OHM,2%,1.5W	80009	307-0888-00
A7R71	322-3295-00	671-2244-06		RES,FXD,FILM:11.5K OHM,1%,0.2W,TC=T0	80009	322-3295-00
A7R72	322-3147-00	671-2244-06		RES,FXD,FILM:332 OHM,1%,0.2W,TC=T0	80009	322-3147-00
A7R73	322-3147-00	671-2244-06		RES,FXD,FILM:332 OHM,1%,0.2W,TC=T0	80009	322-3147-00
A7R74	322-3193-00	671-2244-06		RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A7R101	322-3322-00	671-2244-06		RES,FXD,FILM:22.1K OHM,1%,0.2W,TC=T0	80009	322-3322-00
A7R103	322-3097-00	671-2244-06		RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A7R104	322-3097-00	671-2244-06		RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A7R105	322-3068-00	671-2244-06		RES,FXD,FILM:49.9 OHM,1%,0.2W,TC=T0	80009	322-3068-00
A7R106	322-3068-00	671-2244-06		RES,FXD,FILM:49.9 OHM,1%,0.2W,TC=T0	80009	322-3068-00
A7R107	322-3193-00	671-2244-06		RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A7R108	322-3082-00	671-2244-06		RES,FXD,FILM:69.8 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 69E8
A7R109	322-3082-00	671-2244-06		RES,FXD,FILM:69.8 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 69E8
A7R110	322-3114-00	671-2244-06		RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	91637	CCF50-2-G1500F
A7R111	322-3114-00	671-2244-06		RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	91637	CCF50-2-G1500F
A7R112	322-3193-00	671-2244-06		RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A7R113	322-3193-00	671-2244-06		RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A7R114	322-3068-00	671-2244-06		RES,FXD,FILM:49.9 OHM,1%,0.2W,TC=T0	80009	322-3068-00
A7R115	322-3289-00	671-2244-06		RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	80009	322-3289-00
A7R122	311-2234-00	671-2244-06		RES,VAR,TRMR:CERMET;5K OHM,20%,0.5W,0.197 SQ,TOP ADJUST;T&R	TK1450	GF06UT 5K
A7R125	322-3318-00	671-2244-06		RES,FXD,FILM:20K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 20K0
A7R127	322-3082-00	671-2244-06		RES,FXD,FILM:69.8 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 69E8
A7R128	322-3193-00	671-2244-06		RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A7R131	322-3114-00	671-2244-06		RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	91637	CCF50-2-G1500F
A7R134	322-3097-00	671-2244-06		RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A7R135	322-3097-00	671-2244-06		RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A7R136	322-3068-00	671-2244-06		RES,FXD,FILM:49.9 OHM,1%,0.2W,TC=T0	80009	322-3068-00
A7R137	322-3089-00	671-2244-06		RES,FXD,FILM:82.5 OHM,1%.0.2W,TC=T0	80009	322-3089-00
A7R139	311-2224-00	671-2244-06		RES,VAR,NONWW:TRMR,20 OHM,20%,0.5W LINEARTAPE & REEL	80009	311-2224-00
A7R140	322-3114-00	671-2244-06		RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	91637	CCF50-2-G1500F
A7R141	322-3114-00	671-2244-06		RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	91637	CCF50-2-G1500F
A7R142	322-3114-00	671-2244-06		RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	91637	CCF50-2-G1500F
A7R146	322-3114-00	671-2244-06		RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	91637	CCF50-2-G1500F
A7R148	322-3001-00	671-2244-06		RES,FXD,FILM:10 OHM,1%,0.2W,TC=T0	80009	322-3001-00
A7R149	322-3068-00	671-2244-06		RES,FXD,FILM:49.9 OHM,1%,0.2W,TC=T0	80009	322-3068-00
A7R150	322-3068-00	671-2244-06		RES,FXD,FILM:49.9 OHM,1%,0.2W,TC=T0	80009	322-3068-00
A7R153	322-3001-00	671-2244-06		RES,FXD,FILM:10 OHM,1%,0.2W,TC=T0	80009	322-3001-00
A7R154	322-3001-00	671-2244-06		RES,FXD,FILM:10 OHM,1%,0.2W,TC=T0	80009	322-3001-00
A7R155	322-3001-00	671-2244-06		RES,FXD,FILM:10 OHM,1%,0.2W,TC=T0	80009	322-3001-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A7R156	322-3068-00	671-2244-06		RES,FXD,FILM:49.9 OHM,1%,0.2W,TC=T0	80009	322-3068-00
A7R159	322-3135-00	671-2244-06		RES,FXD,FILM:249 OHM,1%,0.2W,TC=T0	80009	322-3135-00
A7R160	322-3147-00	671-2244-06		RES,FXD,FILM:332 OHM,1%,0.2W,TC=T0	80009	322-3147-00
A7R161	322-3193-00	671-2244-06		RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A7R164	322-3089-00	671-2244-06		RES,FXD,FILM:82.5 OHM,1%.0.2W,TC=T0	80009	322-3089-00
A7R165	322-3001-00	671-2244-06		RES,FXD,FILM:10 OHM,1%,0.2W,TC=T0	80009	322-3001-00
A7R166	322-3001-00	671-2244-06		RES,FXD,FILM:10 OHM,1%,0.2W,TC=T0	80009	322-3001-00
A7R167	322-3001-00	671-2244-06		RES,FXD,FILM:10 OHM,1%,0.2W,TC=T0	80009	322-3001-00
A7R168	322-3001-00	671-2244-06		RES,FXD,FILM:10 OHM,1%,0.2W,TC=T0	80009	322-3001-00
A7R169	307-0888-00	671-2244-06		RES NTWK,FXD,FI:5,1K OHM,2%,1.5W	80009	307-0888-00
A7R170	307-0888-00	671-2244-06		RES NTWK,FXD,FI:5,1K OHM,2%,1.5W	80009	307-0888-00
A7R171	322-3295-00	671-2244-06		RES,FXD,FILM:11.5K OHM,1%,0.2W,TC=T0	80009	322-3295-00
A7R172	322-3147-00	671-2244-06		RES,FXD,FILM:332 OHM,1%,0.2W,TC=T0	80009	322-3147-00
A7R173	322-3147-00	671-2244-06		RES,FXD,FILM:332 OHM,1%,0.2W,TC=T0	80009	322-3147-00
A7R174	322-3193-00	671-2244-06		RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A7R175	322-3097-00	671-2244-06		RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A7S1	260-2272-00			SWITCH,ROCKER:SPST,2.5A,28V	81073	76SB10S
A7S2	260-1965-00			SWITCH,ROCKER:(4)SPST,125MA,30VDC	80009	260-1965-00
A7S101	260-2272-00	671-2244-06		SWITCH,ROCKER:SPST,2.5A,28V	81073	76SB10S
A7S102	260-1965-00	671-2244-06		SWITCH,ROCKER:(4)SPST,125MA,30VDC	80009	260-1965-00
A7TP1	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COLLAR	26364	104-01-02
A7TP2	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COLLAR	26364	104-01-02
A7TP3	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COLLAR	26364	104-01-02
A7TP4	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COLLAR	26364	104-01-02
A7TP5	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COLLAR	26364	104-01-02
A7TP6	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COLLAR	26364	104-01-02
A7TP7	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COLLAR	26364	104-01-02
A7TP8	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COLLAR	26364	104-01-02
A7TP101	214-4085-00	671-2244-06		TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COLLAR	26364	104-01-02
A7TP108	214-4085-00	671-2244-06		TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRASS,W/ RED NYLON COLLAR	26364	104-01-02
A7U1	156-4132-00	671-2244-00	671-2244-01	IC,MISC:ECL,ENCODER;PARALLEL DATA TO SERIAL DATA TRANSMISSION;SBX1601A,PGA37	80009	156-4132-00
A7U1	156-4132-01	671-2244-02		IC,MISC:	80009	156-4132-01
				MOUNTING PARTS		
	136-1159-00			SOCKET,PGA:	80009	136-1159-00
				END MOUNTING PARTS		
A7U3	156-2290-00			IC,DIGITAL:ECL,TRANSLATOR;QUAD ECL-TO-TTL;1 0H125,DIP16.3,TUBE	80009	156-2290-00
A7U4	156-2290-00			IC,DIGITAL:ECL,TRANSLATOR;QUAD ECL-TO-TTL;1 0H125,DIP16.3,TUBE	80009	156-2290-00
A7U5	156-2290-00			IC,DIGITAL:ECL,TRANSLATOR;QUAD ECL-TO-TTL;1 0H125,DIP16.3,TUBE	80009	156-2290-00
A7U10	156-5966-00			MICROCKT,DGTL:BIPOLAR,10-BIT VIDEO LINE DRI VER,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	671-2244-00	671-2244-00	IC,MEMORY:CMOS,PROM;64K X 1,PRGM,SERIAL CON FIGURATION;DIP08.3	80009	160-8589-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A7U11	160-8723-00	671-2244-01	671-2244-05	IC,MEMORY:CMOS,PROM,64K X 1,SERIAL CONFIGUA TION,PRGM 156-4088-00,DIP08.3	80009	160-8723-00
A7U11	160-8723-01	671-2244-06	671-2244-06	IC,MEMORY:CMOS,PROM,64K X 1,SERIAL CONFIGUR ATION,PRGM 156-4088-00,DIP08.3	80009	160-8723-01
A7U11	160-8723-02	671-2244-07		IC,MEMORY:CMOS,PROM;64K X 1,SERIAL,PRGM 156 -4088-00	80009	160-8723-02
				MOUNTING PARTS		
	136-0727-00			SKT,PL-IN ELEK:MICROCKT,8 CONTACT	09922	DILB8P-108
				END MOUNTING PARTS		
A7U14	156-5966-00	671-2244-00	671-2244-05	MICROCKT,DGTL:BIPOLAR,10-BIT VIDEO LINE DRI VER,SMPTE RP-125 COMPATIBLE	80009	156-5966-00
				MOUNTING PARTS		
	136-0959-00	671-2244-00	671-2244-05	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	671-2244-00	671-2244-00	IC,DIGITAL:CMOS,PLD;FPGA,3030,100 CLB,80 IO B,74 I/O,70MHZ;3030-70,PLCC84,TUBE	80009	156-6147-00
A7U15	156-6357-00	671-2244-01	671-2244-05	IC,DIGITAL:CMOS,PLD;FPGA,3090,320 CLB,144 I OB,70 I/O,100 MHZ;3090-100,PLCC84,TUBE	80009	156-6357-00
A7U15	156-6495-00	671-2244-06		IC,DIGITAL:CMOS,PLD;FPGA,3090,320 CLB,144 I OB,74 I/O,125 MHZ;3090-125,PLCC84,TUBE	80009	156-6495-00
				MOUNTING PARTS		
	136-0965-00			SOCKET,PLCC:PCB,;84,0.05 CTR,0.360 H X 0.12 5 TAIL,TIN,0.055-0.075 SHOULDER HEIGHT	80009	136-0965-00
				END MOUNTING PARTS		
A7U16	156-1529-00			IC,LINEAR:BIPOLAR,VOLTAGE REGULATOR;POSITIV E,ADJUSTABLE,100MA,5%;LM317LZ,TO-92	80009	156-1529-00
A7U101	156-4132-01	671-2244-06		IC,MISC:	80009	156-4132-01
				MOUNTING PARTS		
A7U101	136-1159-00	671-2244-06		SOCKET,PGA:	80009	136-1159-00
				END MOUNTING PARTS		
A7U111	160-9522-00	671-2244-06	671-2244-06	IC,MEMORY:CMOS,PROM;64K X 1,SERIAL	80009	160-9522-00
A7U111	160-9522-01	671-2244-07		IC,MEMORY:CMOS,PROM;64K X 1,SERIAL,PRGM 156 -4088-00	80009	160-9522-01
				MOUNTING PARTS		
	136-0727-00	671-2244-06		SKT,PL-IN ELEK:MICROCKT,8 CONTACT	09922	DILB8P-108
				END MOUNTING PARTS		
A7U115	156-6495-00	671-2244-06		IC,DIGITAL:CMOS,PLD;FPGA,3090,320 CLB,144 I OB,74 I/O,125 MHZ;3090-125,PLCC84,TUBE	80009	156-6495-00
				MOUNTING PARTS		
	136-0965-00	671-2244-06		SOCKET,PLCC:PCB,;84,0.05 CTR,0.360 H X 0.12 5 TAIL,TIN,0.055-0.075 SHOULDER HEIGHT	80009	136-0965-00
				END MOUNTING PARTS		
A7U116	156-1529-01	671-2244-06		IC,LINEAR:BIPOLAR,VOLTAGE REGULATOR;POSITIV E,ADJUSTABLE,100MA,5%;LM317LZ,TO-92 T&A	80009	156-1529-01
A7W1	131-4566-00	671-2244-06		BUS,CONDUCTOR:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A7W101	131-4566-00	671-2244-06		BUS,CONDUCTOR:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A7XU17	136-1038-00			SOCKET,DIP:	00779	2-641873-1
A7XU18	136-1038-00			SOCKET,DIP:	00779	2-641873-1
W3	174-2576-00			CABLE ASSY,RF:75 OHM COAX,18.25 L,9-2 (A7J3 TO SERIAL OUT)	80009	174-2576-00
W4	174-2576-00			CABLE ASSY,RF:75 OHM COAX,18.25 L,9-2 (A7J4 TO SERIAL OUT)	80009	174-2576-00
W12	174-2578-00	B010327	B019999	CA ASSY,SP,ELEC:25,28 AWG,14.375 L,RIBBON,F EMALE	80009	174-2578-00
W12	174-3028-00	B020000		CABLE,RIBBON:26,28 AWG,14.0 L (A7J12 TO DIGITAL OUT 2)	80009	174-3028-00
W23	174-2576-00			CABLE ASSY,RF:75 OHM COAX,18.25 L,9-2 (A7J23 TO SERIAL OUT)	80009	174-2576-00
W160	174-2545-00			CA ASSY,SP,ELEC:34,28 AWG,8.125 L RIBBON (A4J160 TO A2-1J988 & A7J5)	80009	174-2545-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
W940	174-2575-00			CA ASSY,SP,ELEC:26,28 AWG,14.375 L,RIBBON (A3J940 TO A7J6)	80009	174-2575-00



A7 D1/D2 SERIAL OUTPUT BOARD

D1/D2 SERIAL OUTPUT BOARD (671-2244-06) SCHEMATIC DIAGRAM <1> LOOKUP CHART

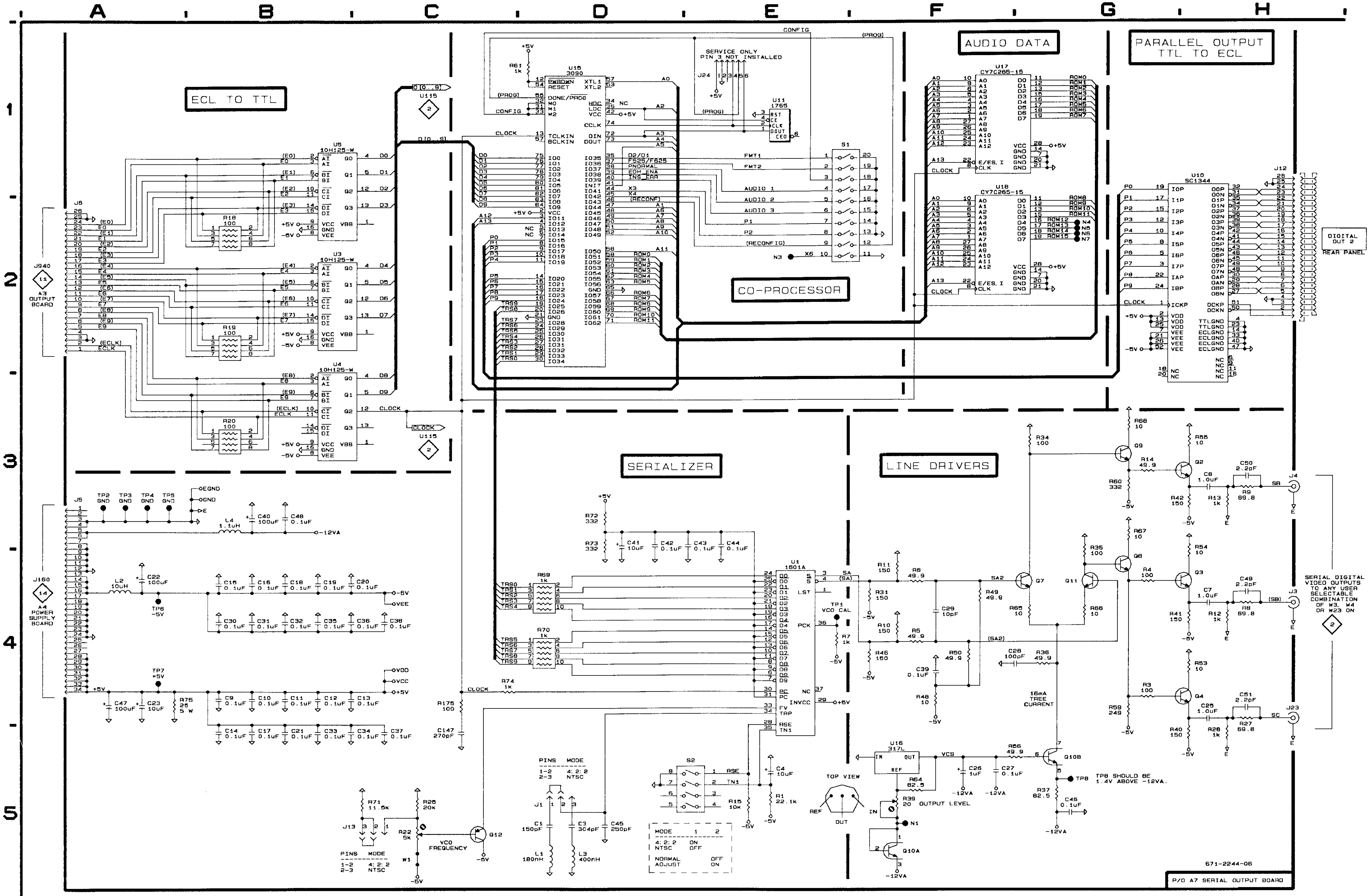
The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

ASSEMBLY A7.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C1	D5	G5
C3	D5	G6
C4	E5	H5
C7	H4	C5
C8	H3	C5
C9	B4	G2
C10	B4	E1
C11	B4	A2
C12	B4	A2
C13	B4	H2
C14	B5	E2
C15	B4	E5
C16	B4	C3
C17	B5	E5
C18	B4	F3
C19	B4	A2
C20	B4	C2
C21	B5	B3
C22	A4	B4
C23	A4	A5
C25	H4	C5
C26	F5	D6
C27	F5	E5
C28	G4	C5
C29	F4	D5
C30	B4	A2
C31	B4	G4
C32	B4	B4
C33	B5	F4
C34	B5	C2
C35	B4	G5
C36	B4	C6
C37	C5	I2
C38	C4	B3
C39	F4	E5
C40	B3	A1
C41	D3	G5
C42	D3	F5
C43	E3	E5
C44	E3	E5
C45	D5	G5
C46	G5	C6
C47	A4	A1
C48	B3	A1
C49	H4	B5
C50	H3	B5
C51	H4	B5
C147	C5	E5

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
J1	D5	G5
J3	H4	B5
J4	H3	B5
J5	A3	B1
J6	A2	A3
J12	H1	A4
J13	C5	G5
J23	H4	B5
J24	E1	H2
L1	D5	H5
L2	A4	B1
L3	D5	H6
L4	B3	A1
Q2	G3	C5
Q3	G4	C5
Q4	G4	C5
Q7	G4	D4
Q8	G4	C5
Q9	G3	D4
Q10A	F5	D5
Q10B	G5	D5
Q11	G4	D5
Q12	C5	G5
R1	E5	I5
R3	G4	C5
R4	G4	C5
R5	F4	E5
R6	F4	E5
R7	E4	F5
R8	H4	B5
R9	H3	B5
R10	F4	E5
R11	F4	E5
R12	H4	B5
R13	H3	B4
R14	G3	C5
R15	E5	H5
R18	B2	B1
R19	B2	B2
R20	B3	D1
R22	C5	G5
R25	C5	H5
R27	H4	B5
R28	H5	B5
R31	F4	F5
R34	G3	D5
R35	G3	D5
R36	G4	D5
R37	G5	D5
R39	F5	E5

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
R40	H5	B5
R41	H4	B5
R42	H3	B5
R46	F4	G5
R48	F4	E5
R49	F4	D5
R50	F4	D5
R53	H4	C5
R54	H3	C5
R55	H3	C4
R56	F5	E5
R59	G4	C6
R60	G3	C5
R61	D1	G2
R64	F5	E5
R65	G4	D5
R66	G4	D5
R67	G3	C5
R68	G3	C4
R69	D4	F4
R70	D4	F4
R71	C5	H5
R72	D3	F5
R73	D3	G5
R74	C4	E5
R75	A4	A4
R175	C4	E5
S1	E1	H1
S2	D5	H5
TP1	E4	F5
TP2	A3	D1
TP3	A3	H6
TP4	A3	A5
TP5	A3	H3
TP6	A4	C3
TP7	A4	D1
TP8	G5	C6
U1	E4	F6
U3	B2	B2
U4	B3	C1
U5	B1	B1
U10	G1	B4
U11	E1	H3
U15	D1	F1
U16	F5	D5
U17	F1	I2
U18	F2	I1
W1	C5	H5



TSG 422 OPTION 1S

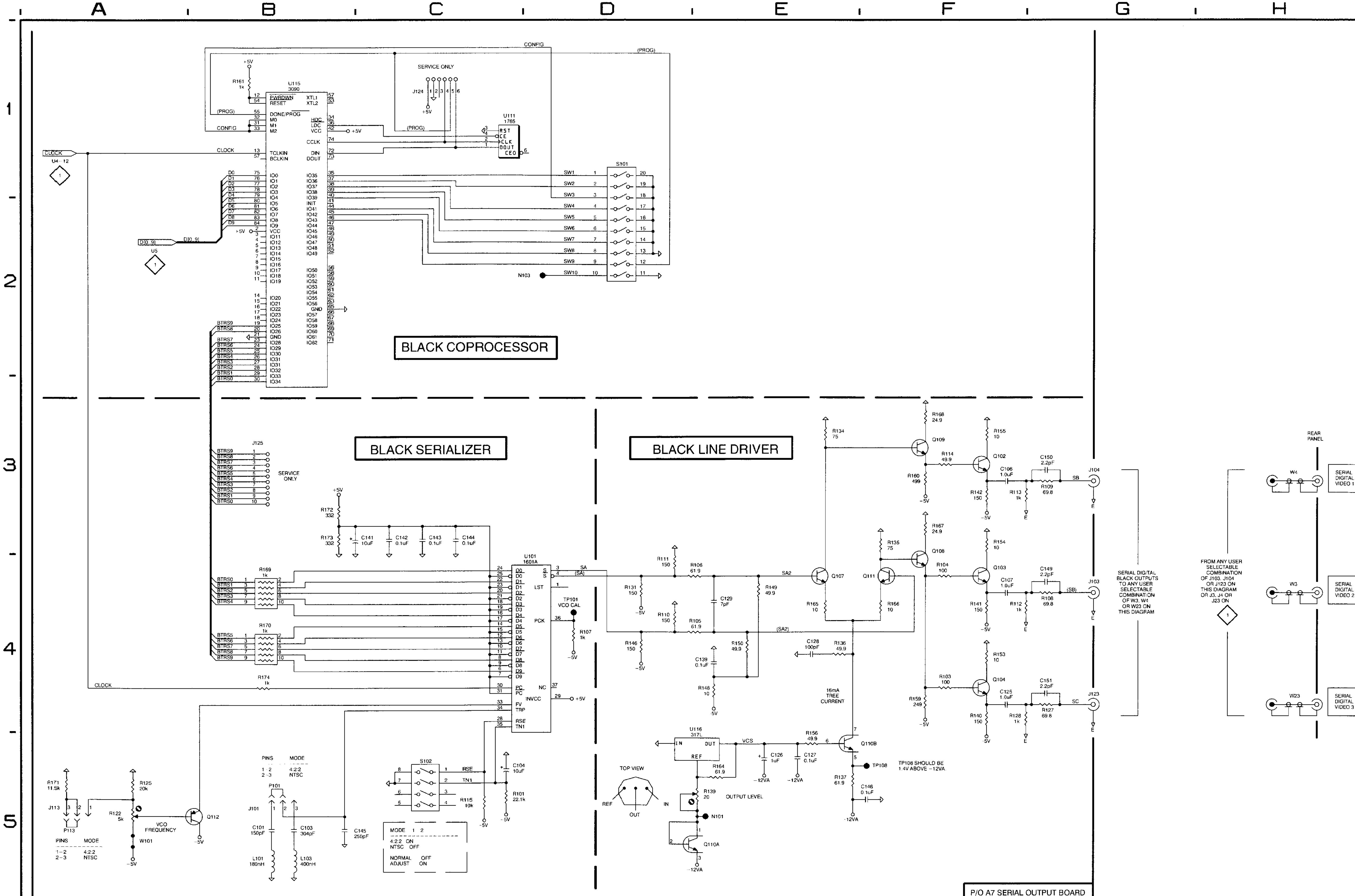
SERIAL OUTPUT A7 1

D1/D2 SERIAL OUTPUT BOARD (671-2244-06)
SCHEMATIC DIAGRAM <2> LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

ASSEMBLY A7.

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
N101	E5	E4
N103	D2	E1
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
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



TSG 422 OPTION 1S

SERIAL DIGITAL BLACK OUTPUT A7 2

D1/D2 SERIAL OUTPUT BOARD (671-2244-00-05) SCHEMATIC DIAGRAM <1> LOOKUP CHART

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

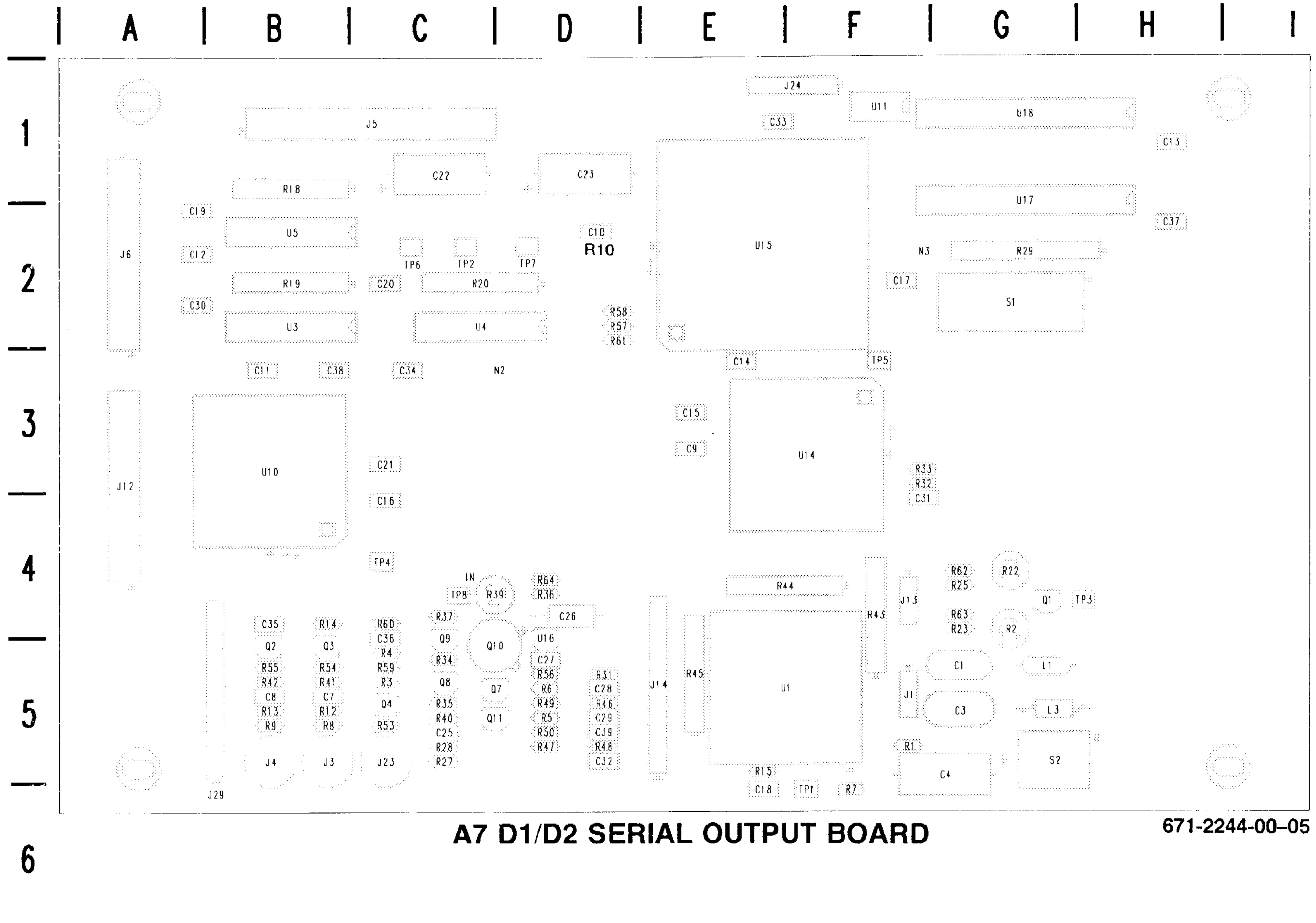
ASSEMBLY A7.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
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
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

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
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
R10 **	A4	D2
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

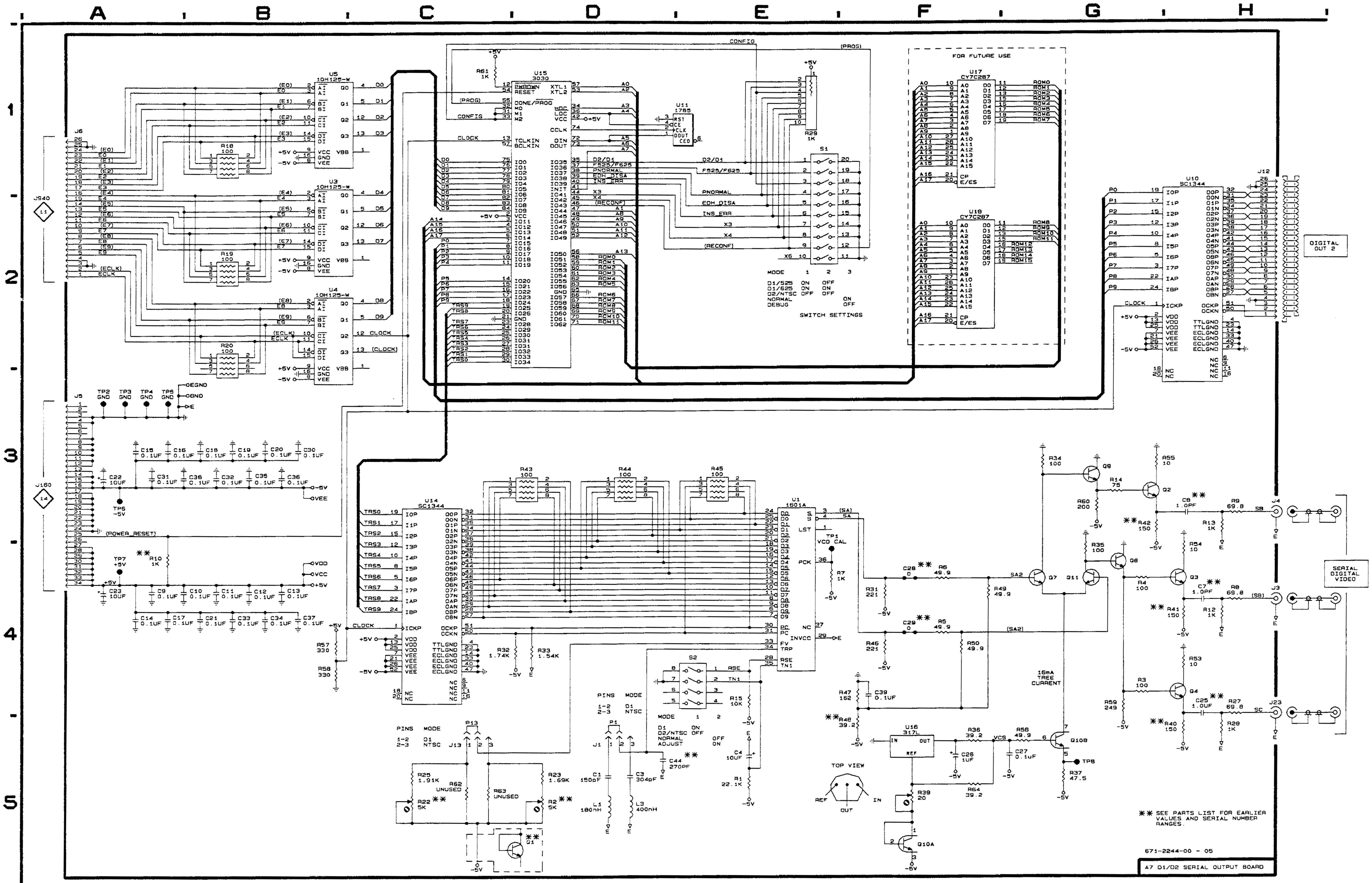
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
R43	D3	F4
R44	D3	E4
R45	E3	E5
R46	F4	D5
R47	F4	D5
R48	F5	D5
R49	F4	D5
R50	F4	D5
R53	H4	C5
R54	H4	B5
R55	H3	B5
R56	G5	D5
R57	B4	D2
R58	B4	D2
R59	G4	C5
R60	G3	C4
R61	C1	D2
R62	C5	G4
R63	C5	G4
R64	F5	D4
S1	F1	G2
S2	E4	G5
TP1	E4	F6
TP2	A3	C2
TP3	A3	H4
TP4	A3	C4
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.



A7 D1/D2 SERIAL OUTPUT BOARD

671-2244-00-05



TSG-422 OPTION 1S

SERIAL OUTPUT A7 1

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
Television Systems

MANUAL CHANGE INFORMATION

Date: 11/4/92 | Change Reference: M78647

Product: TSG-422 Digital Component Generator | Manual Part No: 070-7022-00

DESCRIPTION

Reference M78647

BLACK COLOR FRAMING

REASONS FOR CHANGE:

- Add Black Color Framing for the analog BLACK output.

CHANGES:

- The following parts have changed in the Replaceable Electrical Parts List in Section 8:

	OLD PART	NEW PART	DESCRIPTION	EFFECTIVE SERIAL #
A2-1	671-0764-06	671-0764-07	CIRCUIT BOARD ASSY: MAIN	
A2-1U881	160-4632-02	160-4632-03	MICROCKT,DGTL STTL, LOGIC ARRAY, PRGM	B010570 B020566

- Current Software Versions:

V 1.7

- Changes to the Schematics:

No schematic changes.

- Changes to the text of the Manual:

1. Section 3 Specifications page 3-8
   Remove the asterisk from Table 3-6.
   Black Burst will now maintain correct color framing.

2. Section 3 Specifications page 3-14
   Add the following to Table 3-8 Genlock Function:

Characteristics	Performance Requirements	Supplemental Information	Per. Step Check #
Color Framing Decisions	Will be correct for input SC/H error of $0^\circ \pm 20^\circ$.		12a & 22a

3. Section 5 Performance Checks and Adjustment Procedures page 5-2
Add the following pieces of equipment to the list of needed test equipment:

19. NTSC Master Sync Generator
Stable sync and burst generator with SC/H of $0^\circ \pm 5^\circ$
Example: Tektronix TSG 130A

20. PAL Master Sync Generator
Stable sync and burst generator with SC/H of $0^\circ \pm 5^\circ$
Example: Tektronix TSG 131A

4. Section 5 Performance Checks and Adjustment Procedures page 5-6
Add the following Performance Check after # 12:

1-a. Color Framing Decisions
Correct for SC/H Input Error of $0^\circ \pm 20^\circ$

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

b. Make sure that the TSG-422 is set for 525/60 operation. (J380 on the Output board in the 1-2 position.)

c. Display the SC/H of both CH A (genlock input) and CH B1 (Black Burst output) on the 1780R vectorscope.

d. Set the Subcarrier Phase control on the 1410 so that the SC/H phase of CH A is 0°.

e. **CHECK** — that the burst vector for CH B1 is on the 0°.

f. Adjust the subcarrier phase of the genlock input $\pm 20^\circ$.

g. **CHECK** — that the burst vector for CH B1 stays at 0°.

h. Adjust the subcarrier phase of the genlock input 180°.

i. **CHECK** — that the burst vector for CH B1 jumps 180°.

j. Adjust the subcarrier phase of the genlock input $\pm 20^\circ$.

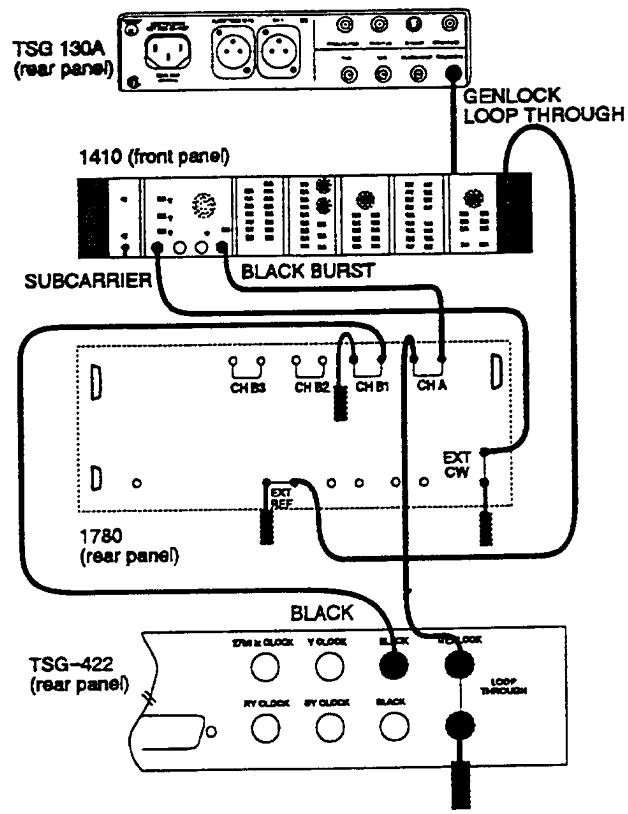


Fig. 5-4a. Setup to check the Color Framing. (NTSC)

k. **CHECK** — that the burst vector for CH B1 stays at 180°.

l. Return the subcarrier phase of the genlock input to 0°.

m. **CHECK** — that the burst vector for CH B1 jumps 180° back to 0°.

5. Section 5 Performance Checks and Adjustment Procedures page 5-11
Add the following Performance Check after # 22:

2-a. Color Framing Decisions
Correct for SC/H Input Error of 0° ± 20°

a. Connect the equipment as shown in Fig. 5-8a.

b. Make sure that the TSG-422 is set for 625/50 operation. (J380 on the Output board in the 2-3 position.)

c. Display the SC/H of both CH A (genlock input) and CH B1 (Black Burst output) on the 1781R vectorscope.

d. Set the Subcarrier Phase control on the 1411 so that the SC/H phase of CH A is 0°.

e. **CHECK** — that the burst vector for CH B1 is on the 0°.

f. Adjust the subcarrier phase of the genlock input ± 20°.

g. **CHECK** — that the burst vector for CH B1 stays at 0°.

h. Adjust the subcarrier phase of the genlock input 180°.

i. **CHECK** — that the burst vector for CH B1 jumps 180°.

j. Adjust the subcarrier phase of the genlock input ± 20°.

k. **CHECK** — that the burst vector for CH B1 stays at 180°.

l. Return the subcarrier phase of the genlock input to 0°.

m. **CHECK** — that the burst vector for CH B1 jumps 180° back to 0°.

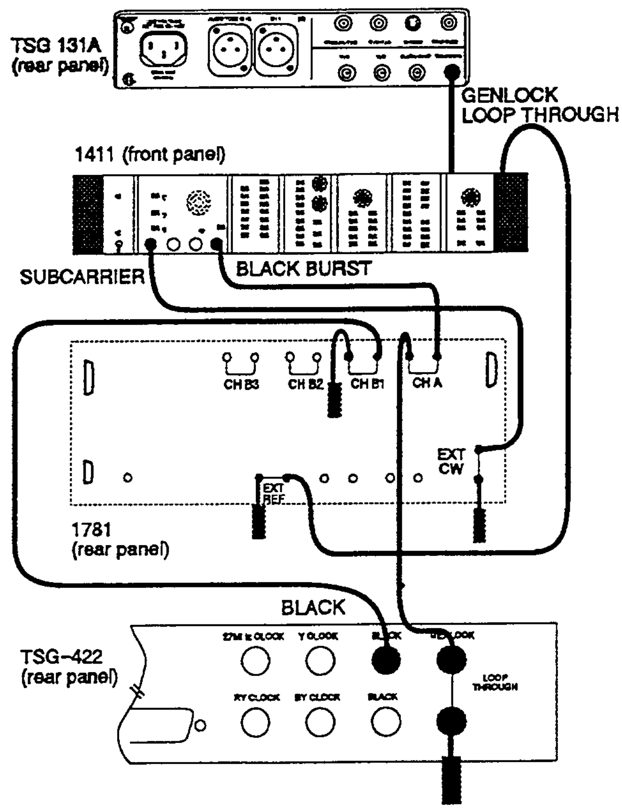


Fig. 5-8a. Setup to check the Color Framing. (PAL)

EFF S/N: B030000

TEXT, PARTS LIST, and SCHEMATIC CHANGES

SECTION 6 THEORY OF OPERATION
POWER SUPPLY DESCRIPTION
REPLACE the power supply description **WITH THE FOLLOWING:**

POWER SUPPLY ⟨14⟩

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	0.8 Amps max
+5V	7 Amps max
-5V	6 Amps max
-12V	0.8 Amps max

The maximum power is limited by the maximum current in the primary of T1. This is also the only current limit for the +/- 5V supplies, as they have no secondary current limit. The +/-12V supplies are current limited on the secondaries by the +/- 12V linear regulators, U150 and U152, and the secondary ±14.5 pulse width modulator, U200.

The power inductor, T1, is driven by switching the voltage to its primary winding on and off at a rate of approximately 60 kHz. T1 is not used as a transformer, but as an energy storage device; the energy is stored in the primary during the first half of the switching cycle, while voltage is being applied. On the second half of the switching cycle, voltage to the primary is switched off and the energy stored in T1 is transferred to the secondaries. Regulation is accomplished by feedback from the +5V supply to the Pulse Width Modulator controlling voltage to the primary. This varies the length of time that voltage 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, overvoltage protection (crowbar) on the +5V 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 (≤ 200 ms).

WARNING

All primary voltages are referenced to a floating ground, not chassis ground. An isolation transformer or a differential amplifier is therefore required for troubleshooting the circuitry in the primary and the Pulse Width Modulator, and in the supporting circuits.

INPUT, AC TO DC CONVERTER, and VOLTAGE DOUBLER

This circuitry filters and rectifies the input ac voltage, charging capacitors C845 and C865 to approximately 320VDC.

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, P810 is used to select between 110V and 220V operation. If J810 is placed on P820, for 220V operation, 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, P810 is placed on J810 (for 110V 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.

E920 and E820 limit voltage surges on the input which might pass the line filter, while R865 and R845 discharge C865 and C845 when the power is off. DS720 and associated parts form a relaxation oscillator, so DS720 blinks when the instrument is powered up. L700, C5, C6, and C700 form a filter to keep noise developed by the Power Supply from getting onto C865 and C845 and out the line cord.

KICK STARTER, HOUSEKEEPING SUPPLY

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. When the power supply is first turned on, C656 charges through R921. When the charge across C656 reaches approximately 16V, U722 begins to switch Q638 on and off through the base drive circuitry (Q648, and associated circuits).

The power to maintain the +16V charge on C656 is now provided by the housekeeping winding of T1, pins 5 and 6, through CR600. If there is insufficient power to maintain the charge on C656 for any reason, such as the removal of P660, then the charge on C656 is quickly depleted. U722 will turn off when the voltage on C656 drops to approximately 10V. Then, C656 will slowly charge again through R921, and the kick start sequence will be repeated. P660 may be used as a troubleshooting jumper, to trigger and verify the kick start sequence before applying power to T1 through P500.

POWER INDUCTOR OPERATION

The heart of this power supply is T1, the multi-winding power inductor. The operation of T1 is as follows (see Fig. 6–20). Inductor T1 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 320V) 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 current is flowing in the primary.

The primary current builds as a linear ramp, storing the energy in T1 according to the relationship $E = 1/2\ Li^2$, 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 T1 then causes the voltages in the secondaries to reverse polarities, and CR575 and CR320 to turn on.

The current in the secondaries linearly ramps down as the energy which was stored in T1's primary is delivered to the load, charging the output capacitors.

When all of the energy which was stored in T1 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 T1, this is called discontinuous flyback operation. At low line voltages or high loads all the power in inductor T1 may not be transferred to the load during the second half of the cycle, in which case the diodes will not be off when Q638 turns back on. In that case there will also be some energy still stored in T1 at the end of the cycle (at low line or high load).

Load regulation is provided by sensing the +5V 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 +5V goes too high, U722 narrows the pulse width. This reduces the amount of energy stored in T1, and therefore the amount transferred to the load, so the +5V goes down. Contrariwise, when the +5V is too low, the pulse width is increased, increasing the amount of energy stored in T1 and then transferred to the load, so the voltage goes up.

Jumper P500 is included for troubleshooting. Removing P500 will interrupt power to T1, which will allow inspection of U722 and the Q638 base drive circuits. Once U722 and Q638 have checked out, high voltage can be applied to T1.

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 +5V output to vary the width of the pulse which controls Q638, as mentioned above. This regulates the secondary voltages throughout variations such as input voltage, output load, and temperature.

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 (internal to U722), which is controlled by the +5V output (see Fig. 6-21). 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, ramps 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 is accomplished automatically without voltage feedback. As the input voltage increases, 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 the slope of the ramp, 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 before variations in output voltage can occur.

Load regulation is accomplished by sensing the output voltage of the +5V supply and comparing it to a 2.5V reference (internal to U410). U410 is a band-gap reference set to function as an error amp. Pin 3 of U410 is the error signal; this signal is coupled to U722 through opto-isolator U520. If the load increases, the signal at U722-2 drops in voltage. This causes U722 to increase the pulse width, and thus the current and power through T1.

On the other hand, if the load decreases, the +5V increases momentarily. The output pulse width then decreases along with the current in T1, and less power is transferred to the secondaries. In this way, the +5V is kept constant through changes in the load.

CURRENT LIMIT

Current limit is provided for the primary circuit by the internal circuitry of U722. If the ramp voltage at U722-2 ever reaches 1V, the output drive pulse ends. This shuts Q638 off, so no further voltage is supplied. Thus, the maximum primary current in T1 is limited to approximately 2.5 Amps, which corresponds to a maximum power level of approximately 140 Watts.

As the supply goes into current limit, U615A and Q717 come into play. U722-1 provides an indication of the peak current in T1. This voltage is fed to the inverting input of comparator U615A and compared to a fixed voltage set by divider R616, R615, and R510. R510 is an output power adjustment set so trip point will be approximately 115 Watts. If U722-1 goes high enough to trip U615A-1 low, then C717 will start to charge. If the current limit condition persists long enough for the charge on C717 to reach 700 or 800 mV, U615B trips and 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. Jumper P720 is included for troubleshooting; its removal will disable the current limit shutdown circuits.

BASE DRIVE and SNUBBER

Q638 is a high (1000V) blocking voltage power transistor. To prevent transistor failure and ensure proper operation, Q638-base must have a large forward current during the on-time and a reverse base-emitter current during turn-off. The pulse from U722-6 turns FET Q648 on and current flows through R746, CR649, and into the base of Q638. The current level is set by R746. Thus Q638 turns on and 320 volts appears across T1, pins 1 and 2. When the pulse from U722-6 ends, Q648 turns off and the collector current of Q638 flows out the base of Q638 through CR648, and quickly turns Q638 off. CR640 forms what is called a Baker Clamp to keep Q638 out of hard saturation and a slow turn-off. When Q638 is turned off, a voltage spike appears at its 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 voltage rating of Q638, a snubber circuit limits the spike to approximately twice the rectified line voltage. CR500, C500, and the winding on T1, pins 3 and 4, make up the snubber circuit.

SECONDARY CIRCUITS

The secondary circuits all work in the same manner. As mentioned earlier, during the first half of the cycle, CR575 and CR320 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 T1 to charge up the capacitors in the secondaries.

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

GENERATION of 12 VOLTS

The ±12 V supplies are generated with a secondary PWM and regulator composed of U200, Q250, T2, and the associated circuits. This secondary PWM is free-running with respect to the primary PWM at a frequency of approximately 60 kHz. The frequency is set by R105 and C105. Q250 is controlled by U200 to switch +5V and –5V (10 volts total) across T2 during the first half of the switching cycle. During the second half of the cycle, the voltage across T2 reverses and CR150 and CR160 turn on, causing a charge to build up on C150 and C152. The voltage on C150 is regulated by U200 to be approximately +14.5V, and the voltage on C152 will follow at approximately –14.5V. The 14.5 volts is then filtered by L150 and L162, respectively, and applied to the three-terminal linear regulators (U150 and U152) to derive the +12V and –12V outputs.

R260 senses the current in T2 and feeds it back as a voltage to U200-3. Q200 applies part of the ramp voltage on U200-4 through R125 to U200-3 for better noise immunity.

Q100 is in the voltage feedback path for the +14.5 volts and acts as a level shifter to get the voltage feedback signal to a level referenced at +2.5V with respect to U200-5. U200-5 is at –5V with respect to ground. P800 disables the operation of U200 and turns Q250 off. With U200 disabled, the ±14.5V outputs will go to ±5 volts. Jumper P800 is provided for troubleshooting. Its removal will disable the ±12V PWM, which may be necessary for diagnosis or repair of the primary portion of the power supply.

OVERVOLTAGE PROTECTION

Overvoltage protection is provided on the +5V output by a crowbar circuit composed of Q127, VR120, and R120. If the +5V output exceeds approximately +5.5V, VR120 will start to conduct. When VR120 is drawing enough current through R120 to raise SCR Q127's gate voltage above its cathode by approximately 0.7V, Q127 will turn on. This shorts the +5V output to ground, forcing the primary circuit into current limit.

SECTION 8 REPLACEABLE ELECTRICAL PARTS LIST

ADD:

A3C1	281-0775-01	CAP,FXD,CER DI:0.1 UF,20%,50V
A3C2	281-0775-01	CAP,FXD,CER DI:0.1 UF,20%,50V
A3C3	281-0775-01	CAP,FXD,CER DI:0.1 UF,20%,50V
A3C4	281-0775-01	CAP,FXD,CER DI:0.1 UF,20%,50V
A3C11	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C12	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C13	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C14	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C15	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C16	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C17	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C18	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C19	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C20	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C21	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C22	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C23	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C24	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C25	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C26	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C27	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C28	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C29	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C30	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C33	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V

A3C34	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C35	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C36	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C37	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C38	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C39	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C40	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C41	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C42	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C43	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C44	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C45	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C46	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C47	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C48	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C49	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C50	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C51	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C52	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C53	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3C54	283-0154-01	CAP,FXD,CER DI:22PF,5%,50V
A3FL1	119-4472-00	FILTER,RF:EMI/RFI;50V,500 MA
A3FL2	119-4472-00	FILTER,RF:EMI/RFI;50V,500 MA
A3FL3	119-4472-00	FILTER,RF:EMI/RFI;50V,500 MA
A3FL4	119-4472-00	FILTER,RF:EMI/RFI;50V,500 MA
A3FL5	119-4472-00	FILTER,RF:EMI/RFI;50V,500 MA
A3FL6	119-4472-00	FILTER,RF:EMI/RFI;50V,500 MA
A3J52	131-3396-00	CONN,DSUB:PCB,FEMALE,RTANG,25 POS
A3J53	131-3396-00	CONN,DSUB:PCB,FEMALE,RTANG,25 POS
A3J941	131-0608-00	TERMINAL,PIN:(QTY 26) (REPLACES J960, kinda)
A3R1	322-3085-00	RES,FXD,FILM:75 OHM,1%,0.2W
A3R2	322-3085-00	RES,FXD,FILM:75 OHM,1%,0.2W
A3R3	322-3085-00	RES,FXD,FILM:75 OHM,1%,0.2W
A3R4	322-3085-00	RES,FXD,FILM:75 OHM,1%,0.2W
A3R375	307-1318-00	RES,NTWK,FXD,FI:162 OHM X 2/260 OHM X 2,2%,0.125W
A4C481	290-1301-00	CAP,FXD,ALUM:2700 UF
A4C942	283-0000-04	CAP,FXD,CER DI:0.001 UF,+100 -0%,500V
A4CR575	152-0884-00	SEMICOND DEV:DI
		MOUNTING PARTS
	211-0097-00	SCREW, MACHINE
	342-0354-00	INSULATOR, PLATE:GRAY
--	214-4562-00	HEAT SINK:
		END MOUNTING PARTS
A4R215	322-3001-00	RES,FXD,FILM:10 OHM,1%,0.2W
A4R718	322-3356-00	RES,FXD,FILM:49.9K OHM,1%.0.2W
A4R922	315-0101-00	RES,FXD,FILM:100 OHM,5%.0.25W

Date: 2/2/93	Group Code 20	Change Reference: M75729
Product: TSG422		Manual Part No: 070-7022-00

CHANGE TO READ:

A3	671-2859-00	CKT BD ASSY:OUTPUT BOARD
A4	671-2388-00	CKT BD ASSY:POWER SUPPLY BOARD
A3C684	283-0644-01	CAP,FXD,MICA DI:150PF,1%,500V
A3R170	322-3193-00	RES,FXD,FILM:1K OHM,1%,0.2W
A3R172	322-3193-00	RES,FXD,FILM:1K OHM,1%,0.2W
A3R173	322-3234-00	RES,FXD,FILM:2.67K OHM,1%,0.2W
A3R340	322-3193-00	RES,FXD,FILM:1K OHM,1%,0.2W
A3R412	322-3347-00	RES,FXD,FILM:40.2K OHM,1%,0.2W
A3R440	322-3018-00	RES,FXD,FILM:15 OHM,1%,0.2W
A3R515	322-3208-00	RES,FXD,FILM:15.8K OHM,1%,0.2W
A3R560	322-3193-00	RES,FXD,FILM:1K OHM,1%,0.2W
A3R611	322-3318-00	RES,FXD,FILM:20K OHM,1%,0.2W
A3R612	322-3239-00	RES,FXD,FILM:3.01K OHM,1%,0.2W
A3R613	322-3222-00	RES,FXD,FILM:2K OHM,1%,0.2W
A3R614	322-3018-00	RES,FXD,FILM:15 OHM,1%,0.2W
A3R615	322-3289-00	RES,FXD,FILM:10K OHM,1%,0.2W
A3R618	322-3348-00	RES,FXD,FILM:41.2K OHM,1%,0.2W
A3R638	311-2236-00	RES,VAR,TRMR:CERMET,20K OHM,20%,0.5W
A3R650	322-3165-00	RES,FXD,FILM:511 OHM,1%,0.2W
A3R660	322-3234-00	RES,FXD,FILM:2.67K OHM,1%,0.2W
A3R714	322-3165-00	RES,FXD,FILM:511 OHM,1%,0.2W
A3R730	322-3076-00	RES,FXD,FILM:60.4 OHM,1%,0.2W
A3R731	322-3018-00	RES,FXD,FILM:15 OHM,1%,0.2W
A3R739	322-3230-00	RES,FXD,FILM:2.43K OHM,1%,0.2W
A3R813	322-3289-00	RES,FXD,FILM:10K OHM,1%,0.2W
A3R814	322-3101-00	RES,FXD,FILM:110 OHM,1%,0.2W
A3R818	322-3018-00	RES,FXD,FILM:15 OHM,1%,0.2W
A3R830	311-2230-00	RES,VAR,TRMR:CERMET,500 OHM,20%,0.5W
A3R831	322-3018-00	RES,FXD,FILM:15 OHM,1%,0.2W
A3R832	322-3018-00	RES,FXD,FILM:15 OHM,1%,0.2W
A3R833	322-3230-00	RES,FXD,FILM:2.43K OHM,1%,0.2W
A3R834	322-3018-00	RES,FXD,FILM:15 OHM,1%,0.2W
A3R838	322-3130-00	RES,FXD,FILM:221 OHM,1%,0.2W
A3R912	322-3385-00	RES,FXD,FILM:100K OHM,1%,0.2W
A3R913	322-3340-00	RES,FXD,FILM:34K OHM,1%,0.2W
A3U810	156-0912-01	IC,LINEAR:BIPOLAR,OP-AMP,CA3080E/LM3080N
A4C105	283-0051-02	CAP,FXD,CER DI:0.0033 UF,5%,100V
A4C130	283-0197-00	CAP,FXD,CER DI:470 PF,5%,50V
A4C142	290-1301-00	CAP,FXD,ALUM:2700 UF
A4C143	290-1301-00	CAP,FXD,ALUM:2700 UF
A4C144	290-1301-00	CAP,FXD,ALUM:2700 UF
A4C145	283-0024-02	CAP,FXD,CER DI:0.1 UF,+80 -20%,50V
A4C150	290-1302-00	CAP,FXD,ALUM:1000 UF
A4C151	283-0197-00	CAP,FXD,CER DI:470 PF,5%,50V
A4C152	290-1302-00	CAP,FXD,ALUM:1000 UF

Date: 2/2/93	Group Code 20	Change Reference: M75729		
Product: TSG422		Manual Part No: 070–7022–00		

A4C160	290–0943–02	CAP,FXD,ELCTLT:47 UF,20%,25V
A4C162	290–0943–02	CAP,FXD,ELCTLT:47 UF,20%,25V
A4C170	290–0943–02	CAP,FXD,ELCTLT:47 UF,20%,25V
A4C180	283–0024–02	CAP,FXD,CER DI:0.1 UF,+80 –20%,50V
A4C182	283–0024–02	CAP,FXD,CER DI:0.1 UF,+80 –20%,50V
A4C200	283–0024–02	CAP,FXD,CER DI:0.1 UF,+80 –20%,50V
A4C222	283–0000–04	CAP,FXD,CER DI:0.001 UF,+100 –0%,500V
A4C225	290–1301–00	CAP,FXD,ALUM:2700 UF
A4C253	290–1301–00	CAP,FXD,ALUM:2700 UF
A4C254	290–1301–00	CAP,FXD,ALUM:2700 UF
A4C320	283–0024–02	CAP,FXD,CER DI:0.1 UF,+80 –20%,50V
A4C325	290–1301–00	CAP,FXD,ALUM:2700 UF
A4C350	283–0024–02	CAP,FXD,CER DI:0.1 UF,+80 –20%,50V
A4C358	290–1301–00	CAP,FXD,ALUM:2700 UF
A4C360	290–1301–00	CAP,FXD,ALUM:2700 UF
A4C365	290–0943–02	CAP,FXD,ELCTLT:47 UF,20%,25V
A4C370	290–1301–00	CAP,FXD,ALUM:2700 UF
A4C415	283–0024–02	CAP,FXD,CER DI:0.1 UF,+80 –20%,50V
A4C464	290–1301–00	CAP,FXD,ALUM:2700 UF
A4C475	290–1301–00	CAP,FXD,ALUM:2700 UF
A4C480	290–1301–00	CAP,FXD,ALUM:2700 UF
A4C521	283–0084–02	CAP,FXD,CER DI:270 PF,5%,1000V
A4C575	283–0000–04	CAP,FXD,CER DI:0.001 UF,+100 –0%,500V
A4C621	283–0051–02	CAP,FXD,CER DI:0.0033 UF,5%,100V
A4C717	283–0177–05	CAP,FXD,CER DI:1.0 UF,+80 –20%,25V
A4C722	283–0197–00	CAP,FXD,CER DI:470 PF,5%,50V
A4C845	290–1293–00	CAP,FXD,ALUM:390 UF
A4C865	290–1293–00	CAP,FXD,ALUM:390 UF
A4CR150	152–0670–00	SEMICOND DEV:DI
A4CR160	152–0670–00	SEMICOND DEV:DI
A4CR820	152–0497–00	DIODE:RECT BRIDGE
A4E820	119–0181–00	ARSR,ELEC SURGE
A4E920	119–0181–00	ARSR,ELEC SURGE
A4Q648	151–1171–00	TRANSISTOR,PWR,PWR;BUZ71A
A4Q717	151–0188–05	TRANSISTOR,SIG
A4R100	322–3178–00	RES,FXD,FILM:698 OHM,1%,0.2W
A4R105	322–3280–00	RES,FXD,FILM:8.06K OHM,1%.0.2W
A4R110	322–3106–00	RES,FXD,FILM:124 OHM,1%,0.2W
A4R260	308–0742–00	RES,FXD,WW:0.24 OHM,5%,2W
A4R415	311–2231–00	RES,VAR,TRMR:1K OHM,20%,0.5W
A4R510	311–2232–00	RES,VAR,TRMR:2K OHM,20%,0.5W
A4RT820	307–0746–00	RES,THERM:5 OHM
A4VR120	152–0279–00	DIODE, ZENER:5.1V

Date: 2/2/93	Group Code 20	Change Reference: M75729
Product: TSG422		Manual Part No: 070-7022-00

DELETE:

A3J960

A4C140
A4C141
A4C324
A4C476
A4C648
A4Q650
A4Q741
A4RT920

A8 Output Filter board and all associated parts

SECTION 10 REPLACEABLE MECHANICAL PARTS LIST

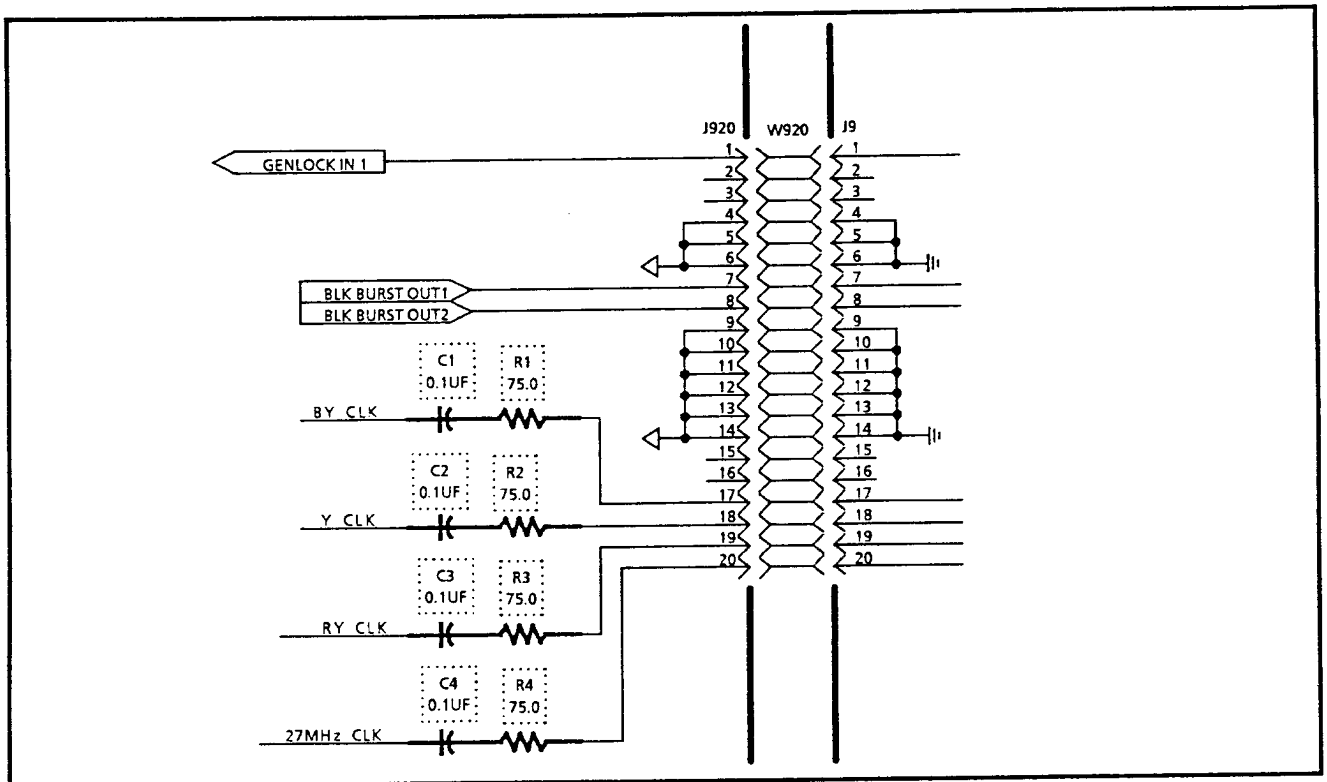
CHANGE TO READ:

1-1	200-4115-00	1 COVER, TOP
-29	426-2487-00	2 FRAME SECTION
-33	200-3649-04	1 COVER, BOTTOM

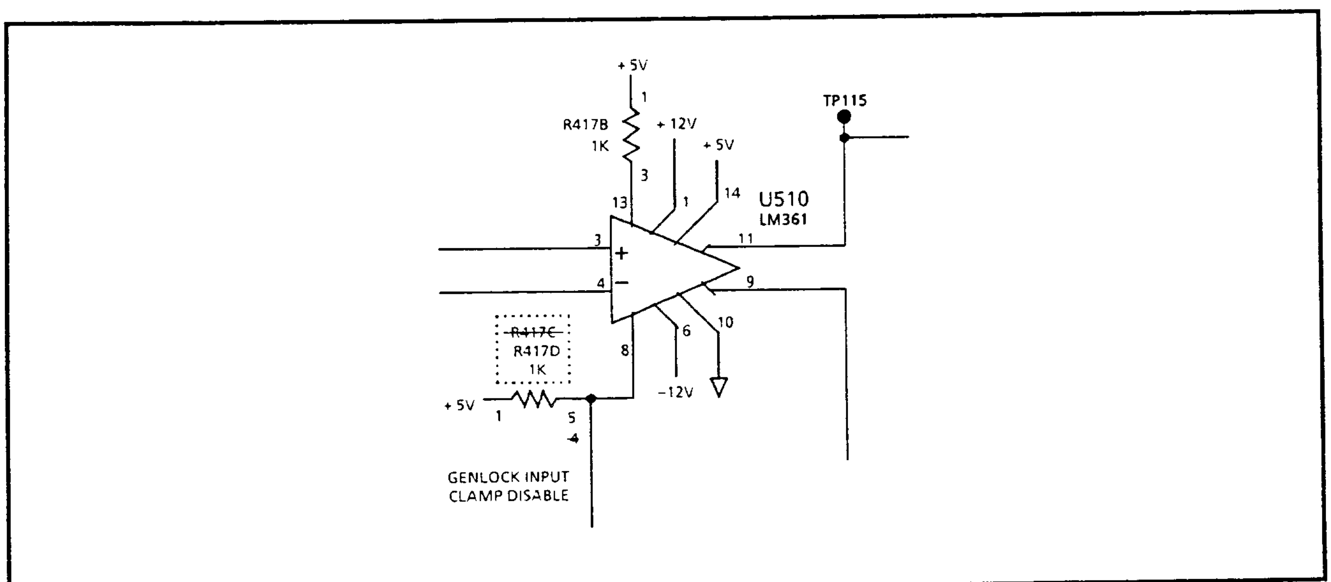
Circuitry changes and added parts are shown on the following pages:

Date: 2/2/93 | Group Code 20 | Change Reference: M75729

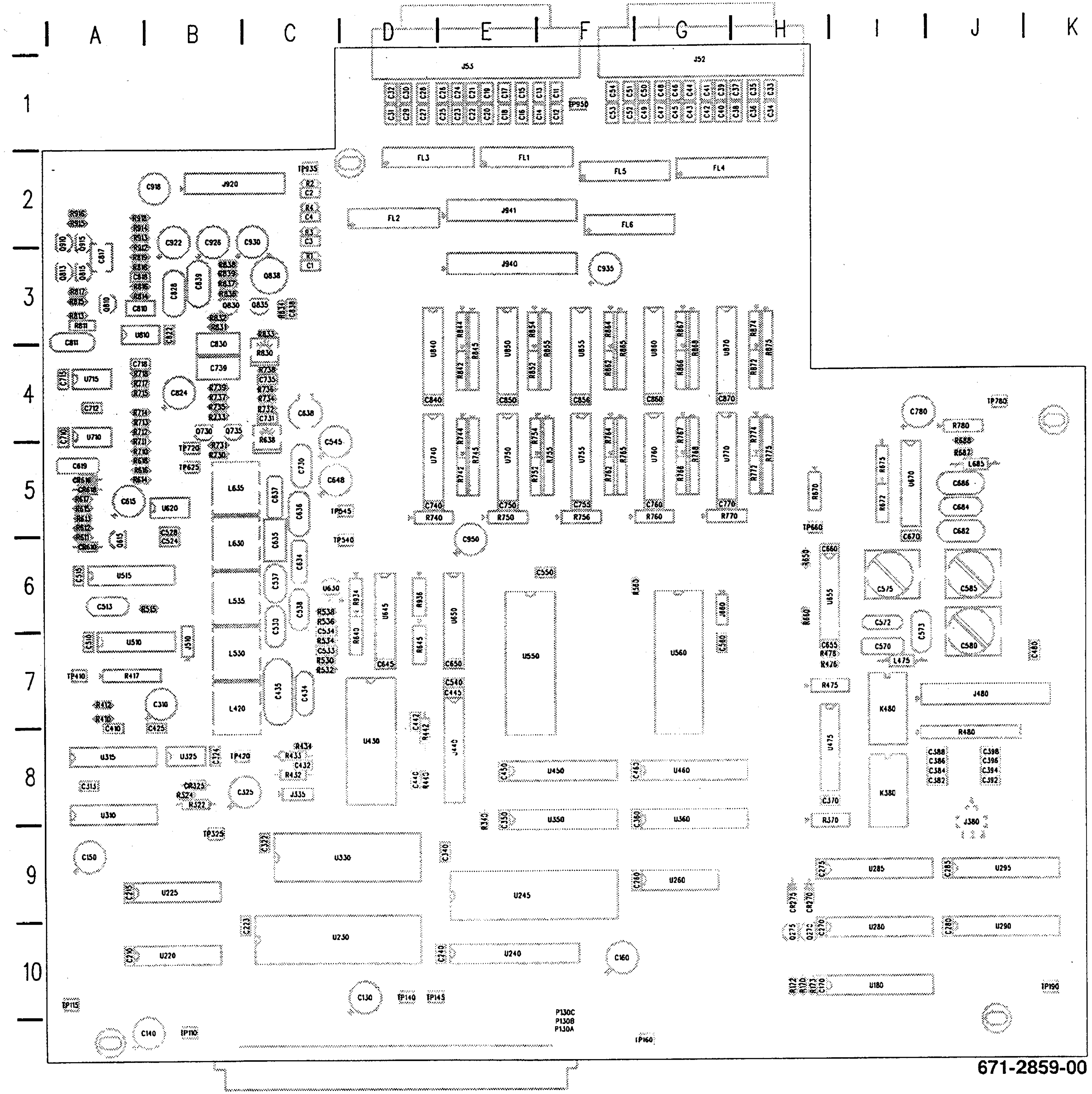
Product: TSG422 | Manual Part No: 070-7022-00



Part of A3 schematic 10, showing added parts.

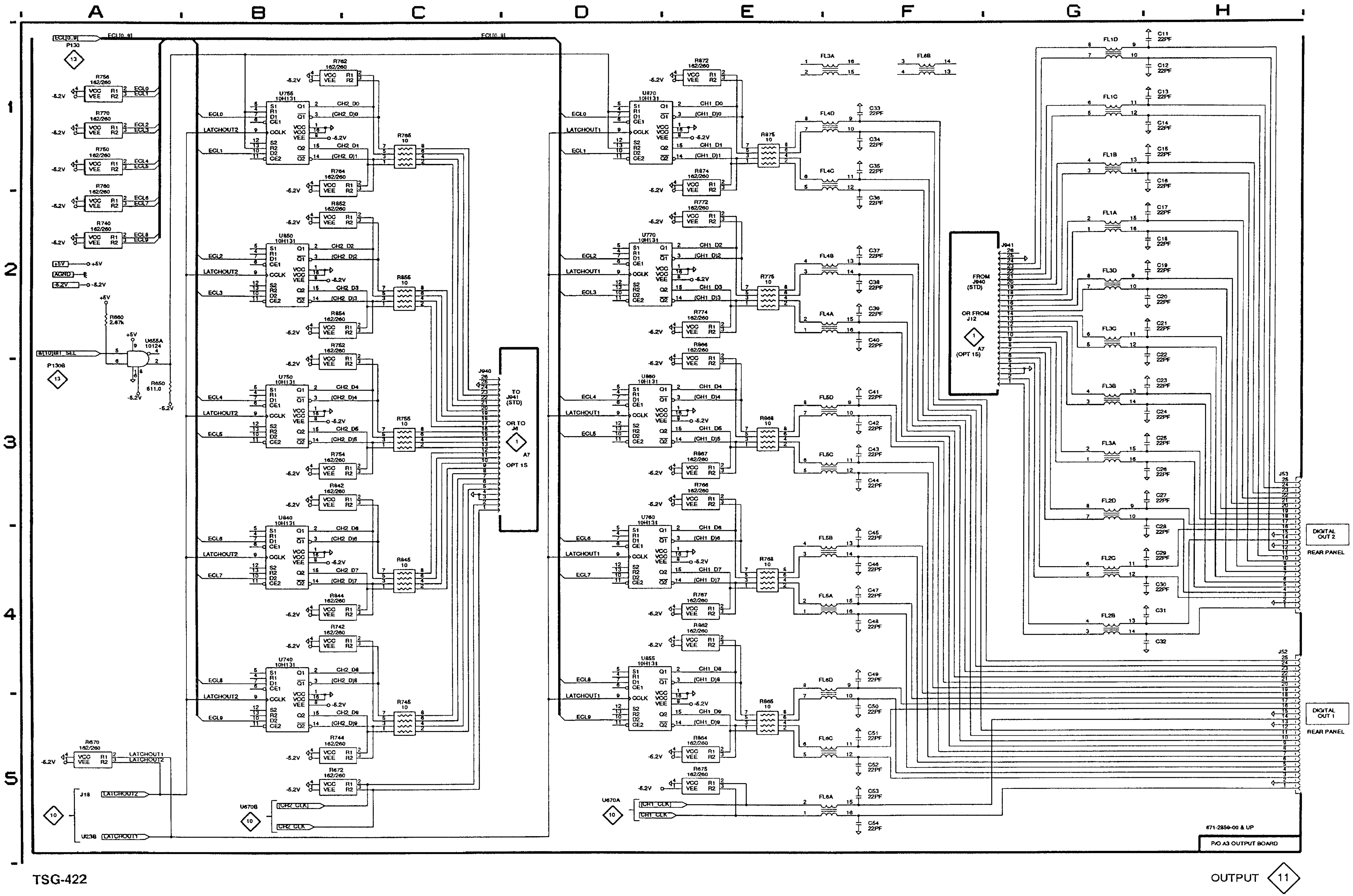


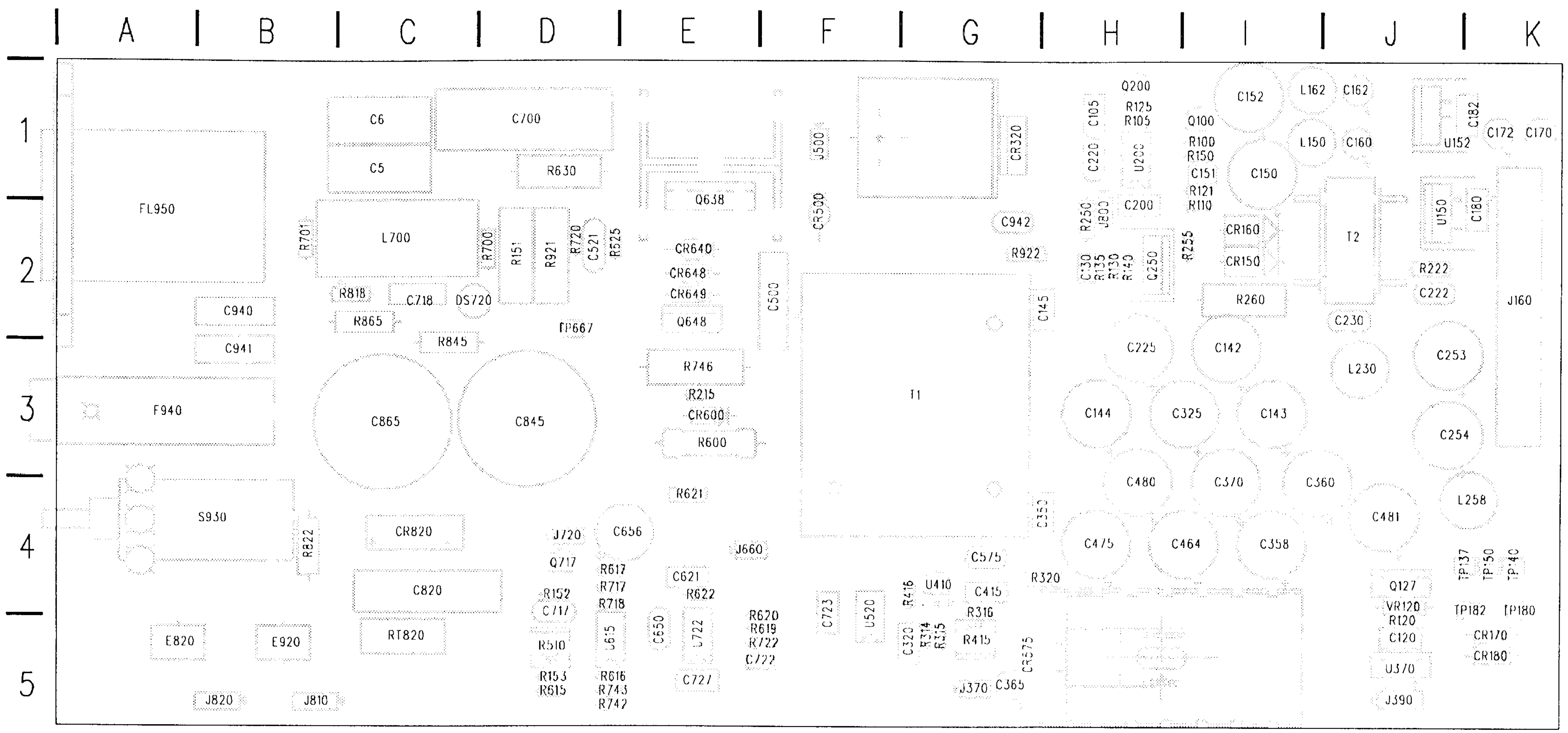
Part of A3 schematic 13, showing circuit change.



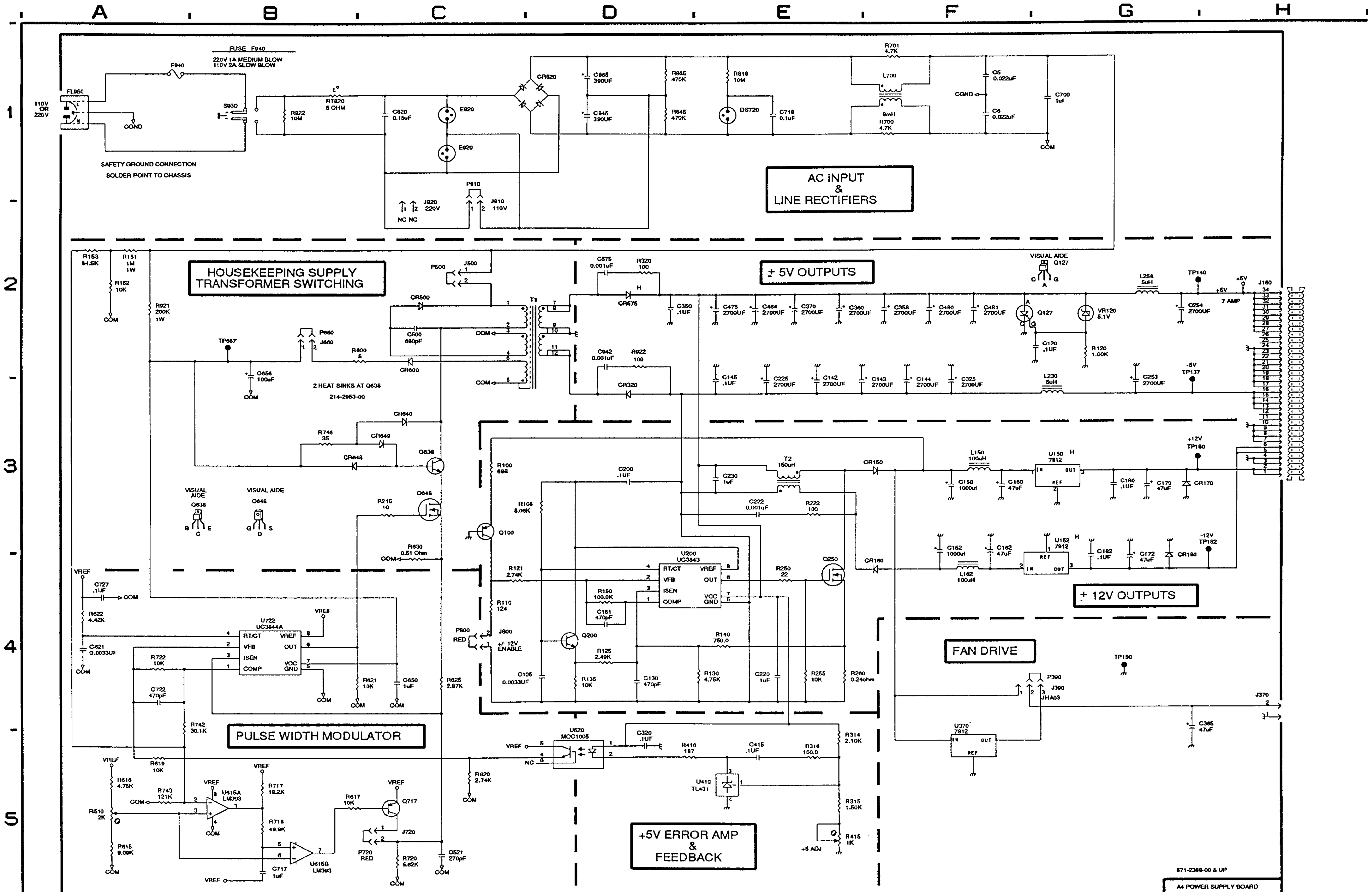
671-2859-00

A3 OUTPUT BOARD
M75729
PAGE 11 OF 14


TSG-422
OUTPUT 11



A4 POWER SUPPLY BOARD 671-2388-00



TSG-422

POWER SUPPLY 14

Tektronix MANUAL CHANGE INFORMATION Group Code 20

Date: 3/5/93 Change Reference: M79344

Product: TSG-422 Manual Part No: 070-7022-00

DESCRIPTION

Eff S/N: B030651

TEXT, ELECTRICAL PARTS LIST and SCHEMATIC CHANGES

SECTION 3 SPECIFICATIONS

Page 3–14, Table 3–8 Genlock Functions
CHANGE Sync Lock Jitter entry **TO READ:**

Sync Lock Jitter B030651 and above	≤ 0.75 ns.	(0.3° at F_{SC} = 3.58 MH_Z, Typical) (0.5° AT F_{SC} = 4.43 MH_Z, Typical)	9, 19
B030641 – B030650	≤ 0.5 ns.	(0.5° at F_{SC})	
B030640 and below	≤ 2 ns.	(2.5° at F_{SC} = 3.58 MH_Z) (3.25° AT F_{SC} = 4.43 MH_Z) Measured at nominal signal conditions.	

SECTION 8 ELECTRICAL PARTS LIST

CHANGE TO READ:

A2-1	671-0764-09	CKT BD ASSY:MAIN BOARD
A2-1U881	160-4632-05	IC,DIGITAL:CMOS,EPROM;32768 X 8,27C256,PRGM

Tektronix

MANUAL CHANGE INFORMATION

Group Code 20

Date: 3/18/93 Change Reference: M79084 Rev A

Product: TSG–422 Manual Part No: 070–7022–00

DESCRIPTION

Ef S/N: B030641

TEXT, ELECTRICAL PARTS LIST and SCHEMATIC CHANGES

SECTION 1 INTRODUCTION
Page 1–1, DIGITAL SIGNAL GENERATION

ADD to the list of test signals **AS FOLLOWS:**

- SMPTE Bars (60 Hz only)
- Super Black
- Mod Ramp
- SDI EQ (Option 1S only)
- SDI PLL (Option 1S only)

SECTION 2 OPERATING INSTRUCTIONS
Page 2–3, Table 2–2. Signals available in the Test Signal Mode

ADD SMPTE BARS **to the COLOR BARS entry**
ADD Mod Ramp **to the RAMP entry**
ADD Super Black **to the FLAT FIELD entry**
ADD SDI EQ and SDI PLL **to the OTHER SIGNALS entry**

SECTION 3 SPECIFICATIONS
Page 3–11, Table 3–7 Test Signal Generator – Test Signals

ADD THE FOLLOWING:

SMPTE Bars (60 Hz)			
Color Bars		See Fig. 3–48.	
Reverse Blue Bars		See Fig. 3–49.	
IYQB		See Fig. 3–50.	
Field Timing		Color Bars first 161 active lines per field; Reverse Blue Bars for 20 lines; IYQB for the last 60 lines of field.	
Super Black		See Fig. 3–51.	

Date: 3/18/93	Group Code 20	Change Reference: M79084 Rev A	
Product: TSG–422		Manual Part No: 070–7022–00	

Mod Ramp (60 H_Z) Luminance Amplitude Chrominance Amplitude Phase		See Fig. 3–52. 0 to 700 mV 285.7 mV (40 IRE) 180°	
Mod Ramp (50 H_Z) Luminance Amplitude Chrominance Amplitude Phase		See Fig. 3–53. 0 to 700 mV 280.0 mV 60.7°	
SDI EQ (Opt 1S)		See Fig. 3–54. C=300h Y=198h	
SDI PLL (Opt 1S)		See Fig. 3–55. C=200h Y=110h	

Page 3–14, Table 3–8 Genlock Functions
CHANGE Sync Lock Jitter entry **TO READ:**

Sync Lock Jitter B030641 and above B030640 and below	 ≤0.5 ns. ≤2 ns.	 (0.5° at F_{SC}) (2.5° at F_{SC} = 3.58 MH_Z) (3.25° AT F_{SC} = 4.43 MH_Z) Measured at nominal signal conditions.	9, 19

Page 3–36, **ADD THE FOLLOWING** new test signal waveforms:

Date: 3/18/93 Group Code 20 Change Reference: M79084 Rev A

Product: TSG–422 Manual Part No: 070–7022–00

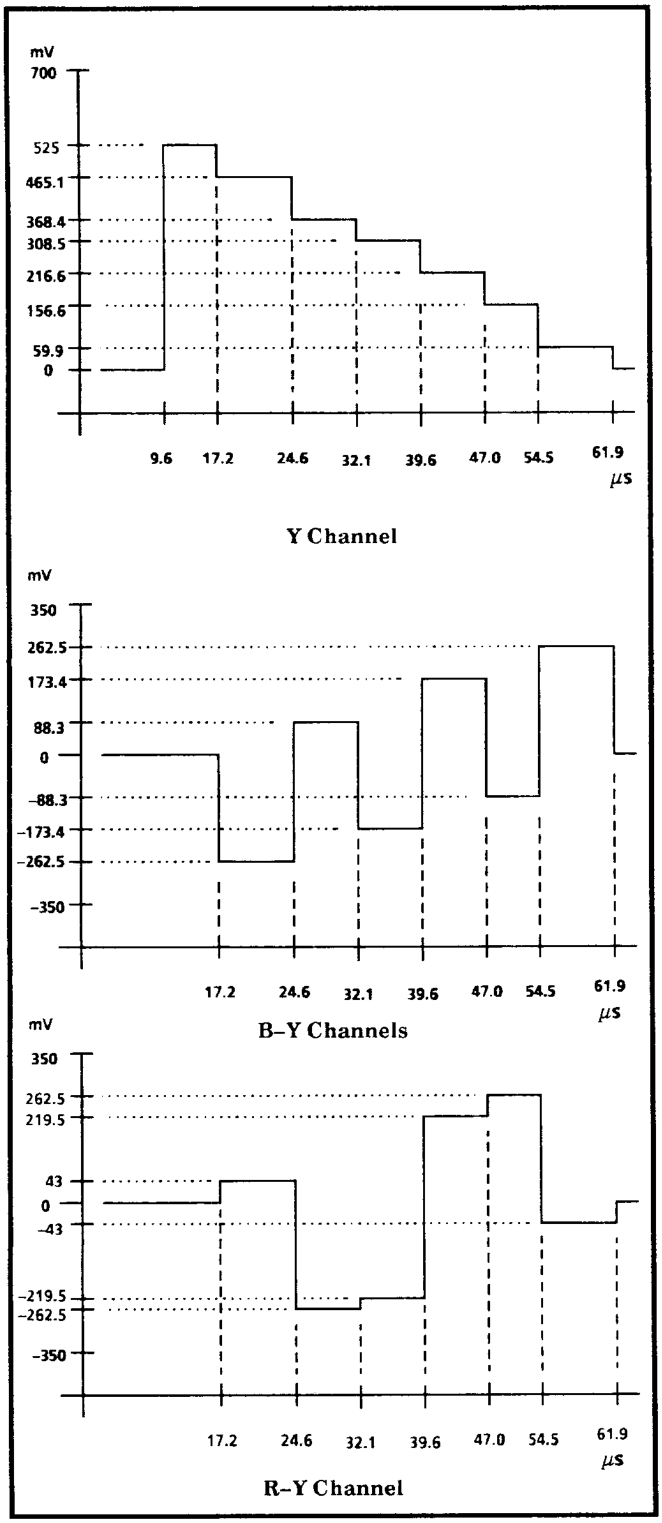


Fig. 3-48. Color bars for SMPTE BARS (EIA).

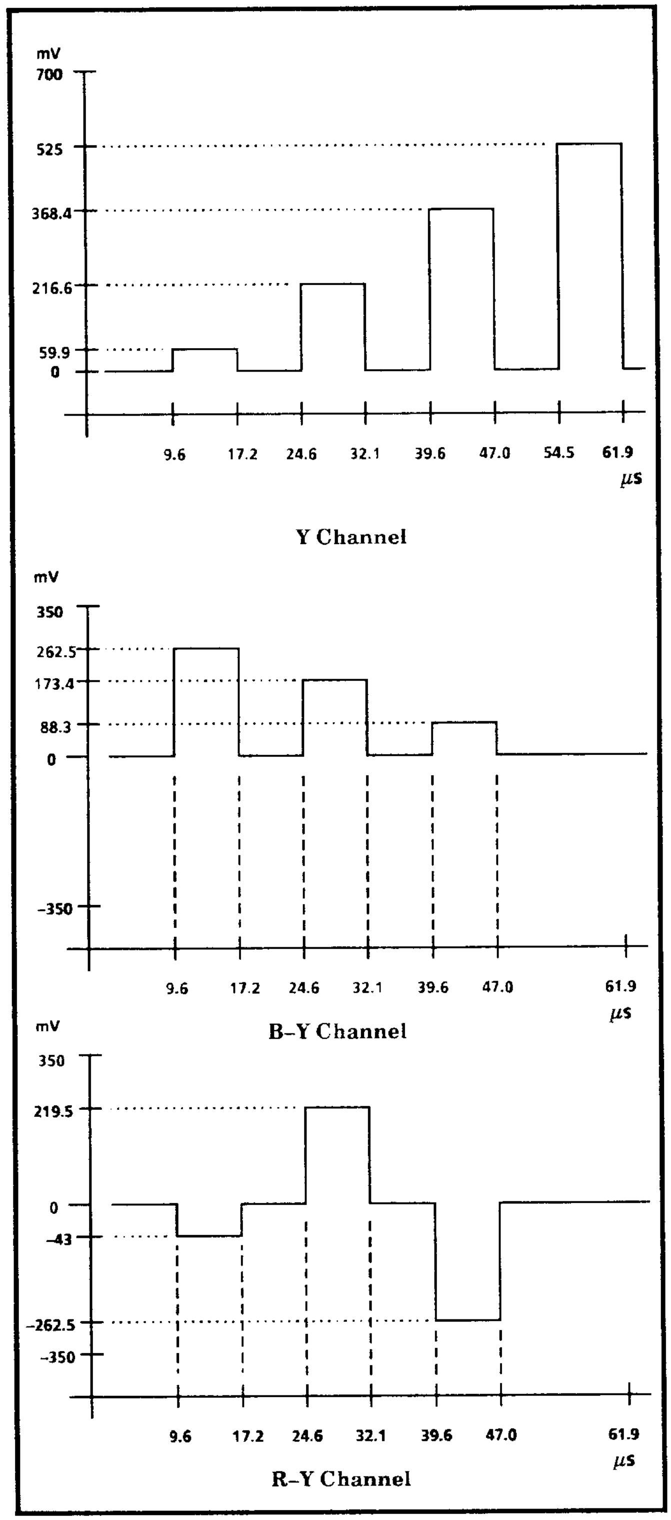


Fig. 3-49. Reverse Blue Bars for SMPTE BARS.

Date: 3/18/93	Group Code 20
Change Reference: M79084 Rev A	
Product: TSG–422	Manual Part No: 070–7022–00

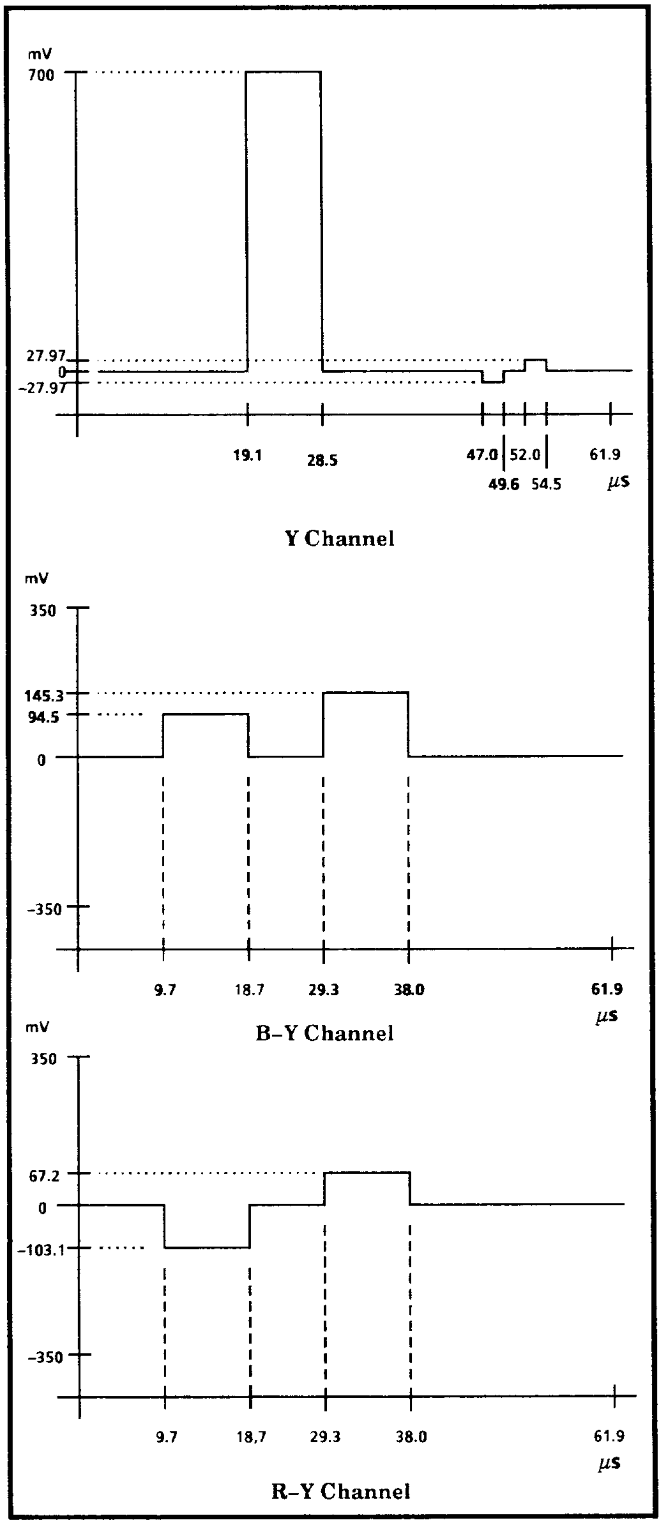


Fig. 3-50. IYQB for SMPTE BARS.

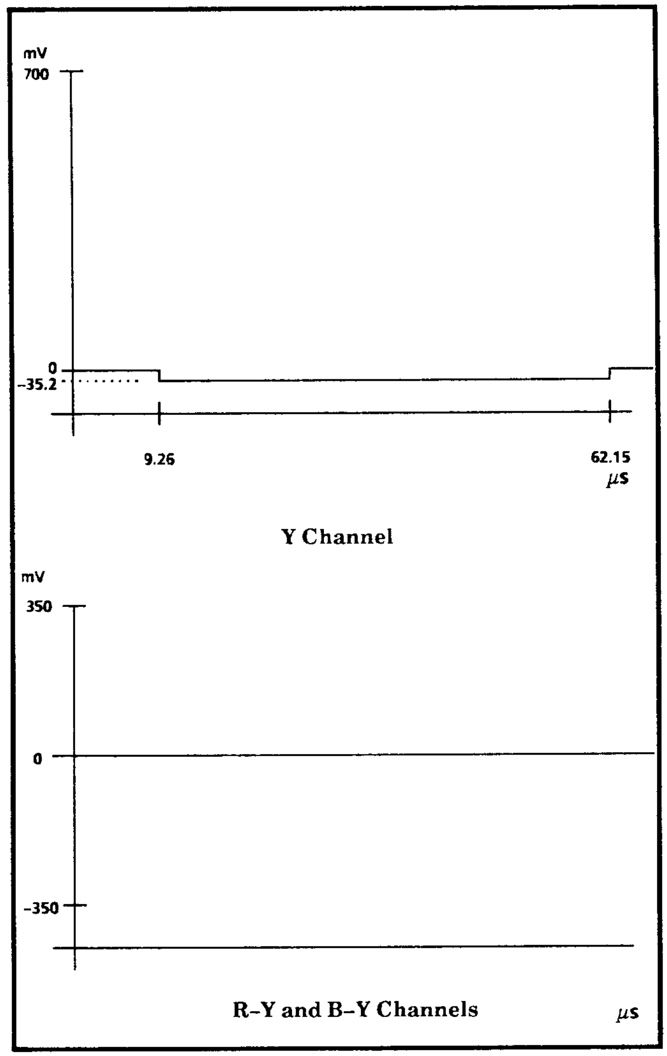


Fig. 3-51. Super Black.

Date: 3/18/93	Group Code 20	Change Reference: M79084 Rev A
Product: TSG–422		Manual Part No: 070–7022–00

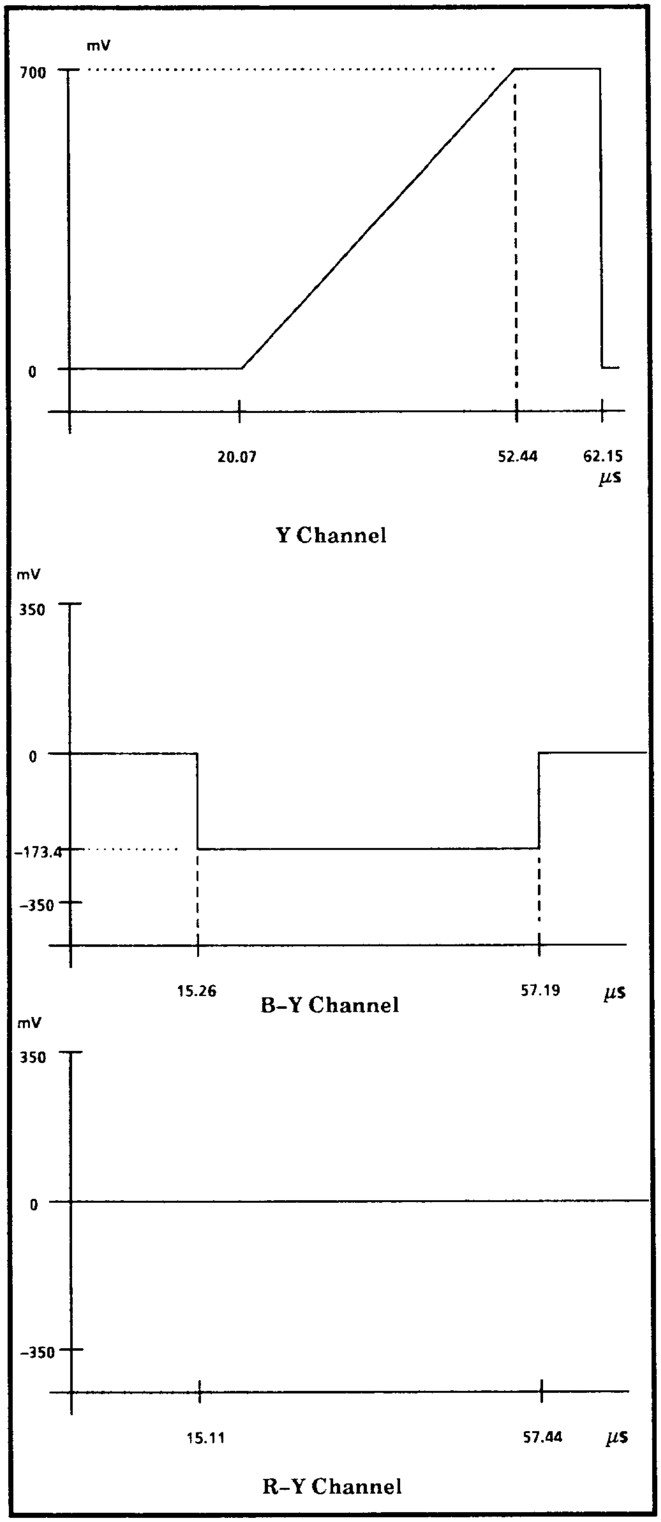


Fig. 3-52. Mod Ramp (60 Hz).

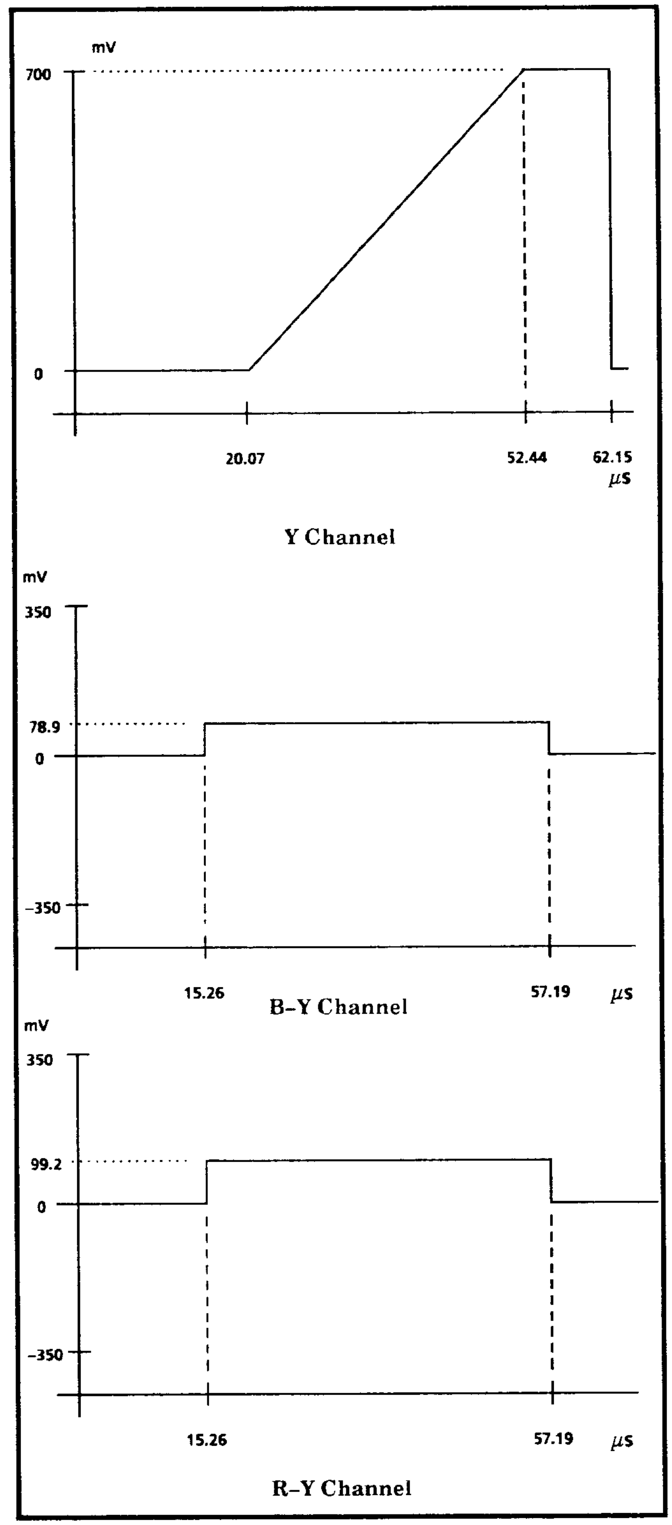


Fig. 3-53. Mod Ramp (50 Hz) .

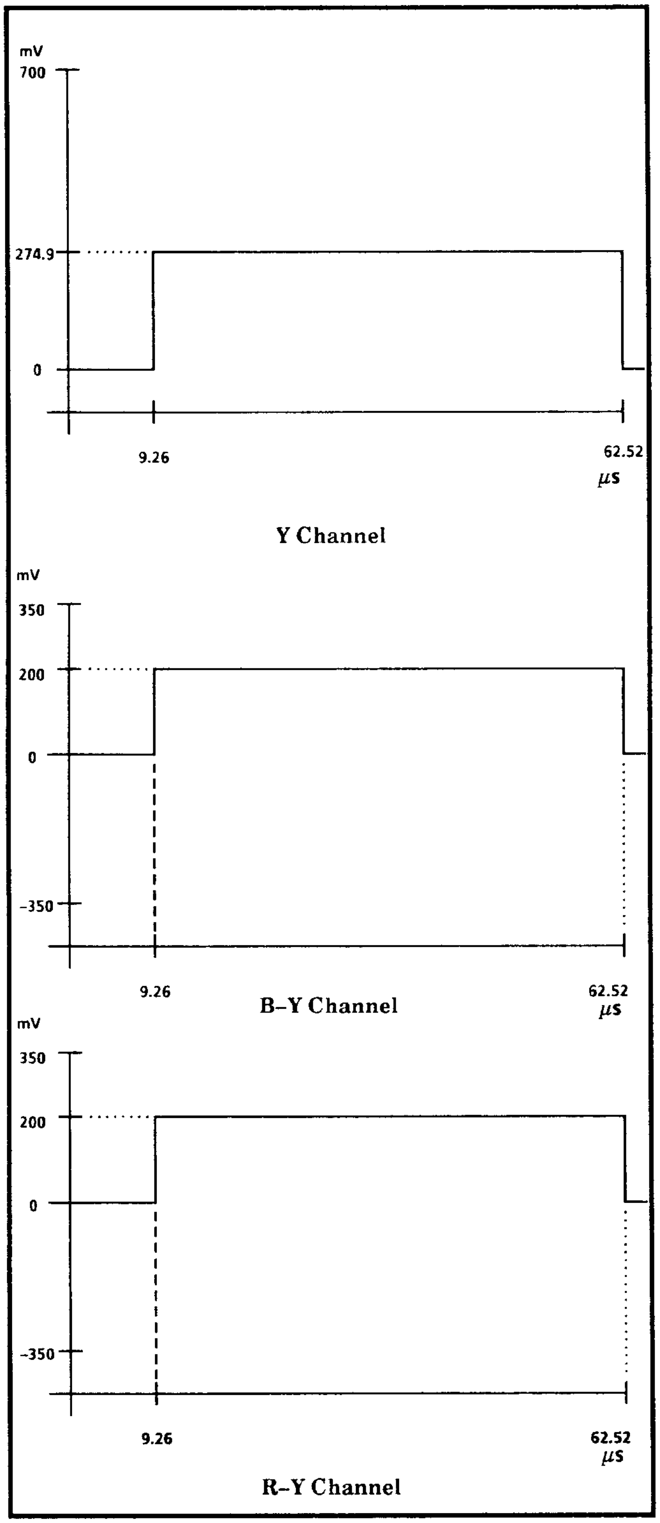


Fig. 3-54. SDI EQ.

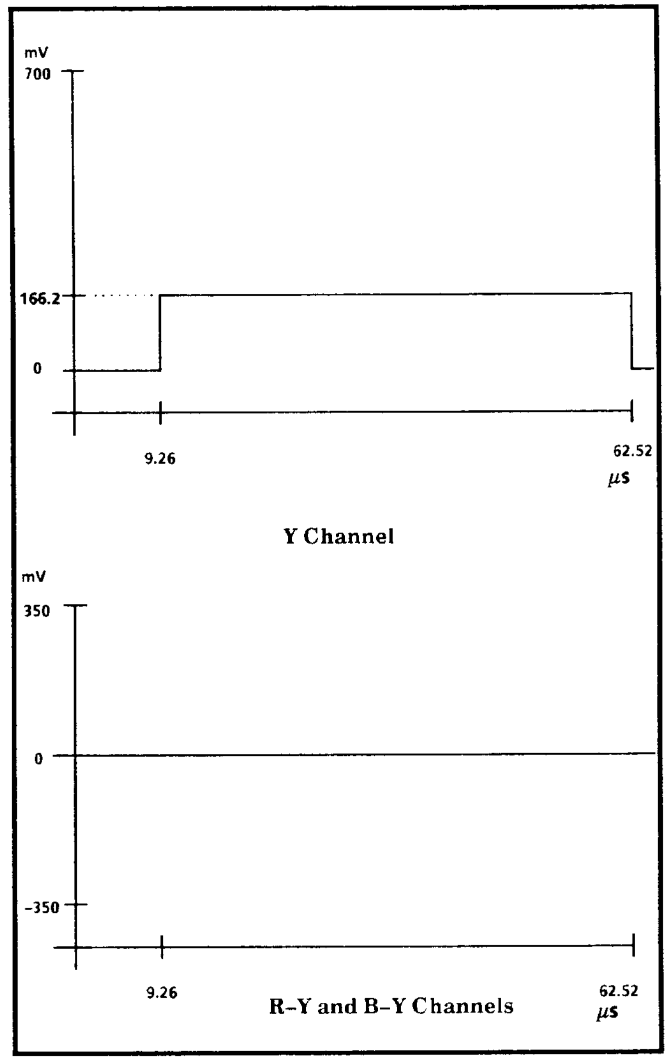


Fig. 3-55. SDI PLL.

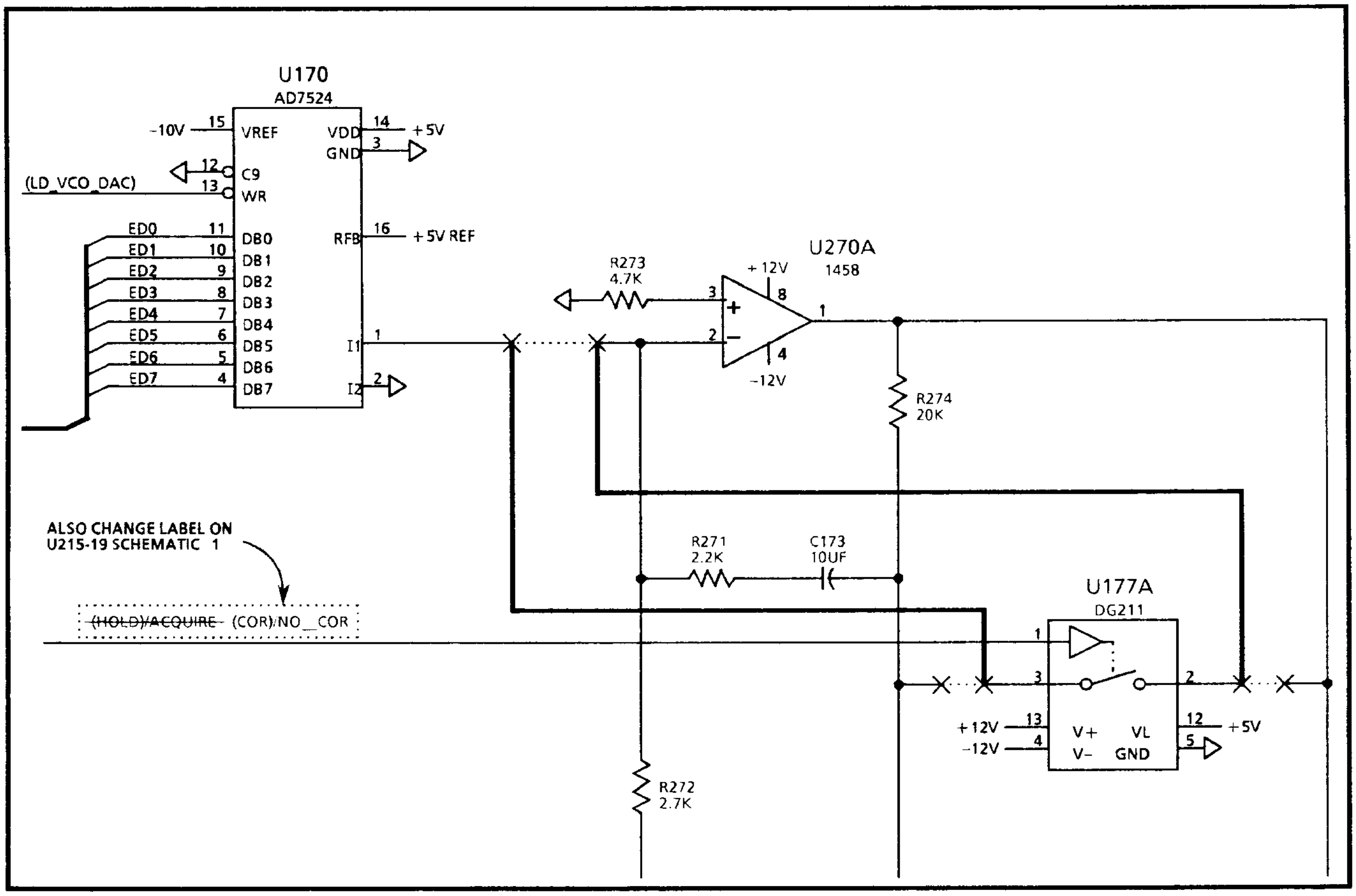
SECTION 8 REPLACEABLE ELECTRICAL PARTS LIST

CHANGE TO READ:

A2-1	671-0764-08	CKT BD ASSSY:MAIN BOARD
A2-1U335	160-6207-03	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2-1U340	160-6208-03	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2-1U345	160-6209-03	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2-1U351	160-6210-00	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2-1U535	160-6211-02	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2-1U540	160-6212-02	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2-1U545	160-6213-02	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2-1U551	160-6214-02	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2-1U562	160-4629-02	IC,DIGITAL:CMOS,EPROM;32768 X 8,27C256,PRGM
A2-1U635	160-6215-03	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2-1U640	160-6216-03	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2-1U645	160-6217-03	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2-1U651	160-6218-03	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2-1U835	160-6219-03	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2-1U840	160-6220-03	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2-1U845	160-6221-03	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2-1U851	160-6222-03	IC,MEMORY:CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2-1U881	160-4632-04	IC,DIGITAL:CMOS,EPROM;32768 X 8,27C256,PRGM
A2-1U891	160-5993-02	IC,DIGITAL:CMOS,PROM;1024 X 8 PRGM 7C281

Connection change shown on the following partial schematic

Date: 3/18/93	Group Code 20	Change Reference: M79084 Rev A
Product: TSG–422		Manual Part No: 070–7022–00



Part of A2–1 Schematic 4 showing connection change for U177A.

Tektronix	**MANUAL CHANGE INFORMATION**	Group Code 20
	Date: 4/1/93	Change Reference: M78271
Product: TSG 422		Manual Part No: 070-7022-00

DESCRIPTION

Eff S/N: B030730

APPENDIX A OPTION 1S SERIAL DIGITAL OUTPUT

ELECTRICAL PARTS LIST and SCHEMATIC CHANGES

CHANGE TO READ:

A7	671-2244-08	CKT BD ASSY: SERIAL DIGITAL OUTPUT BOARD (OPT 1S ONLY)
A7C29	281-0808-00	CAP,FXD,CER DI:MLC,7 PF,20%,100V
A7C129	281-0808-00	CAP,FXD,CER DI:MLC,7 PF,20%,100V
A7R5	322-3077-00	RES,FXD,FILM:61.9 OHM,1%,0.2W
A7R6	322-3077-00	RES,FXD,FILM:61.9 OHM,1%,0.2W
A7R34	322-3085-00	RES,FXD,FILM:75 OHM,1%,0.2W
A7R35	322-3085-00	RES,FXD,FILM:75 OHM,1%,0.2W
A7R37	322-3077-00	RES,FXD,FILM:61.9 OHM,1%,0.2W
A7R60	322-3164-00	RES,FXD,FILM:499 OHM,1%,0.2W
A7R64	322-3077-00	RES,FXD,FILM:61.9 OHM,1%,0.2W
A7R67	322-3039-00	RES,FXD,FILM:24.9 OHM,1%,0.2W
A7R68	322-3039-00	RES,FXD,FILM:24.9 OHM,1%,0.2W
A7R105	322-3077-00	RES,FXD,FILM:61.9 OHM,1%,0.2W
A7R106	322-3077-00	RES,FXD,FILM:61.9 OHM,1%,0.2W
A7R134	322-3085-00	RES,FXD,FILM:75 OHM,1%,0.2W
A7R135	322-3085-00	RES,FXD,FILM:75 OHM,1%,0.2W
A7R137	322-3077-00	RES,FXD,FILM:61.9 OHM,1%,0.2W
A7R160	322-3164-00	RES,FXD,FILM:499 OHM,1%,0.2W
A7R164	322-3077-00	RES,FXD,FILM:61.9 OHM,1%,0.2W
A7R167	322-3039-00	RES,FXD,FILM:24.9 OHM,1%,0.2W
A7R168	322-3039-00	RES,FXD,FILM:24.9 OHM,1%,0.2W
A7Q7	151-0965-00	TRANSISTOR,SIG:BIPOLAR,NPN,6 GHZ;MPS571
A7Q11	151-0965-00	TRANSISTOR,SIG:BIPOLAR,NPN,6 GHZ;MPS571
A7Q107	151-0965-00	TRANSISTOR,SIG:BIPOLAR,NPN,6 GHZ;MPS571
A7Q111	151-0965-00	TRANSISTOR,SIG:BIPOLAR,NPN,6 GHZ;MPS571

Tektronix
/Television Systems

MANUAL CHANGE INFORMATION

Date: 4-26-93 Change Reference: M79488

Product: TSG-422 Digital Component Generator Manual Part No: 070-7022-00

DESCRIPTION

Add Embedded Audio to Serial Digital

REASONS FOR CHANGE:

- Add Embedded Audio to Serial Digital

CHANGES:

- The following parts have changed in the Replaceable Electrical Parts List in Appendix A:

	OLD PART	NEW PART	DESCRIPTION	EFFECTIVE SERIAL #
A7	671-2244-08	671-2244-09	CKT BOARD, SERIAL OUTPUT	B030763
A7U11	160-8723-02	160-8723-03	IC, MEMORY	B030763
A7U15	156-6495-00	156-6674-00	IC, MEMORY	B030763
A7U17	NEW	160-9693-00	IC, MEMORY	B030763
A7U18	NEW	160-9694-00	IC, MEMORY	B030763
A7R16	NEW	322-3193-00	RES, FXD 1K OHM	B030763

The rest of the part numbers associated with A7 are given in the parts list in Appendix A.

- Changes to the Schematics:

Update the current schematics in Appendix A, with the new schematics given in the new Appendix A.

- Changes to the text of the Manual:

1. Section 2 Operating Instructions
   Add the following note to page 2-4

NOTE

To save a new setup in either Configure Signals Mode or Set Genlock time, cycle the MODE SELECTION button until the TSG-422 is in Select Test Signal mode. This automatically saves the settings.

2. Appendix A Option 1S Serial Digital Output
   Update Appendix A with the text given on the following pages.

APPENDIX A
SERIAL DIGITAL VIDEO — OPTION 1S [1]

INTRODUCTION

Option 1S adds Serial Digital Video to the TSG-422 DIGITAL COMPONENT Generator. There are three new BNC connectors on the rear panel (see Fig. A-1), each providing serial DIGITAL COMPONENT video code (CCIR 601), in scrambled NRZI format.

Operation of the TSG-422 Opt 1S is nearly identical to the standard instrument. The only changes are:

- the addition of the pathological signals to the OTHER SIGNALS signal set and
- the DIGITAL OUT 2 signal is no longer identical to the DIGITAL OUT 1 signal.

Internally, there is one circuit board added to the instrument. It is located on the front of the instrument above the Main board. Externally they are three bncs added. They can be configured to output either the selected test signal or a digital black signal in both serial digital format.

For the serial signal, TRS-ID (Timing Reference Signal and Line ID) is added to the blanking time (between EAV and SAV), along with ancillary data. Fig. A-11 shows the range of the active video. The ancillary data includes TRS-ID information, Error Detection and Handling (EDH) flags, and embedded audio.[2] Fig. A-11 shows the range of the active video.

The parallel video from the Output board (A3) is applied to the Serial Output board, and a re-timed copy of the parallel data is then routed from the Serial Output board to the lower rear panel DIGITAL OUT 2 output. Therefore, the DIGITAL OUT 1 and DIGITAL OUT 2 outputs are no longer identical when serial is installed. The parallel data has been re-timed, also the TRS-ID, EDH, and audio information has been added to the signal. Additionally, the front panel ± 11 ns SHIFT DATA TIMING and SHIFT 27 MHz CLOCK features do not function for this output.

For more information on the serial signal, itself, please see the TSG-422 Serial Signal section of this Appendix beginning on page A-14.

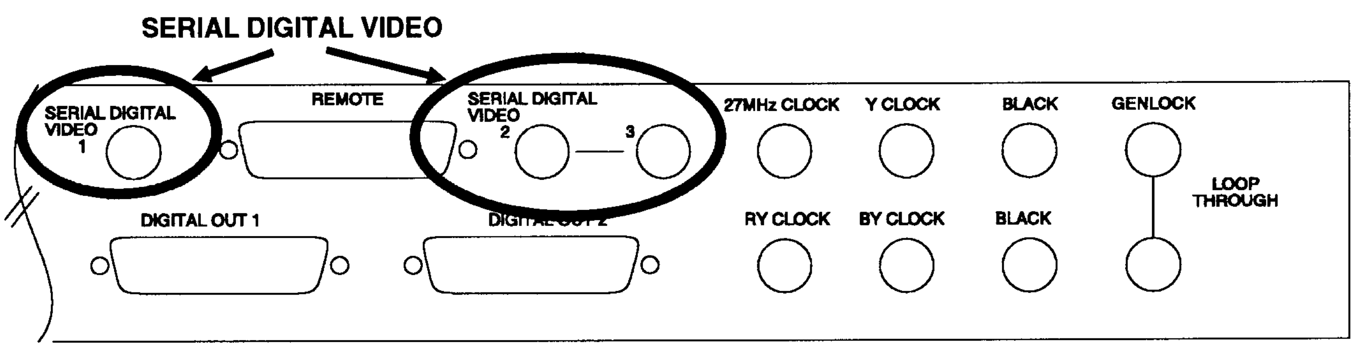


Fig. A-1. Rear panel of the TSG-422.

1 For serial numbers B010570 and above (B020566 and above for instrument shipped to Germany).
2 Embedded Audio is avaiable in instrument with serial nunbers B030763 and above.

New Features

Pathological Signals [1]

In the same way the standard analog test signals check the performance of video equipment, the pathological signals check the performance of the serial digital equipment. Three new signals are added to the signal set:

- "Bit Slip" and Clock Test Recovery
- Test Equalizer
- Serial Matrix (A matrix of the two signals)

As a field sweep signal stresses the frequency response of a system, so the "bit slip" pathological signal stresses the recovery ability of the receiver's clock regenerator by sending a long, string of 0's.

The test equalizer signal is the highest frequency signal possible (alternating 1's and 0's).

These signals are available from the OTHER SIGNALS button on the front panel, as shown in Table A-1.

Table A-1. List of signals available under the OTHER SIGNALS button when pathological signals are installed.

SWITCH	SWITCH NAME	SIGNALS
OTHER SIGNALS	OTHER SIGNALS	Convergence Light Blue Ramp Digital Gray Measurement Matrix Test Equalizer (pathological) "Bit Slip" & Clock Recovery (pathological) Serial Matrix (pathological)

Digital Black [2]

Digital Black is defined as 040h for the Y channel and 200h for the B-Y and R-Y channels during active video. The three rear-panel SERIAL DIGITAL VIDEO BNCs can be configured as either test signal or digital black outputs, in any combination of the two.

Configuring Digital Black

W3, W23, and W4 are directly connected to the rear-panel SERIAL DIGITAL VIDEO BNCs. These wires can be connected to J3, J23, J4, J103, J123, or J104 in any order or combination to configure the instrument so it will be the most useful for a particular application. See Fig. A-2 for the location of the jumpers on the Serial Output board.

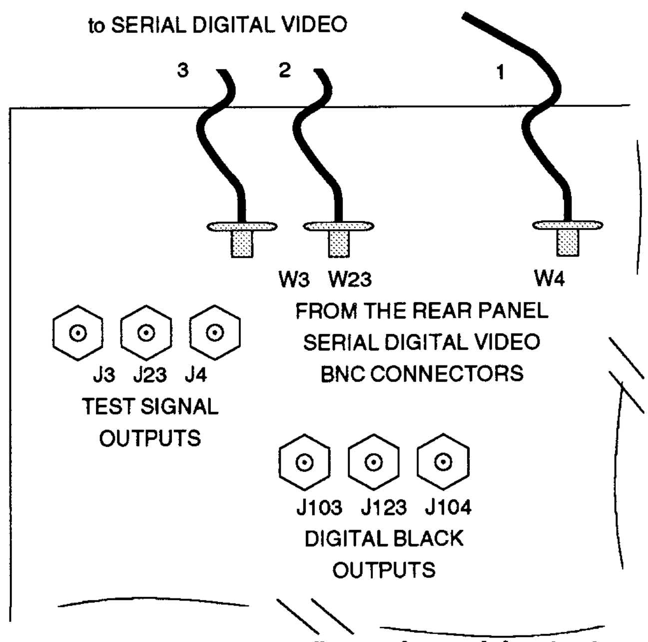


Fig. A-2. How to configure the serial outputs for either Test Signal or Black.

The TSG-422 is factory set for:

SERIAL DIGITAL VIDEO OUTPUT #				
	3	W3	J3	TEST SIGNAL
	2	W23	J23	TEST SIGNAL
	1	W4	J104	BLACK

1 Pathological signals are available on instruments with serial numbers B010505 and above.
2 Digital Black is available on instruments with Serial board part number 671-2244-06.

SPECIFICATIONS

The specifications for the SERIAL DIGITAL VIDEO output are shown in Table A-2. As with the specification 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. The specifications are valid when the instrument is calibrated between +20°C and +30°C.

Table A-2.
Specifications for the Serial Digital 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		CCIR 601 Component 525/625, 8-bit or 10-bit data, Scrambled NRZI, per SMPTE (draft T14.224).
Bit Rate		270 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 (0-AP-CRC), Full field CRC (0-FF-CRC), On lines 9 & 272 (525) or 5 & 318 (625). (See Table A-9 for details.)

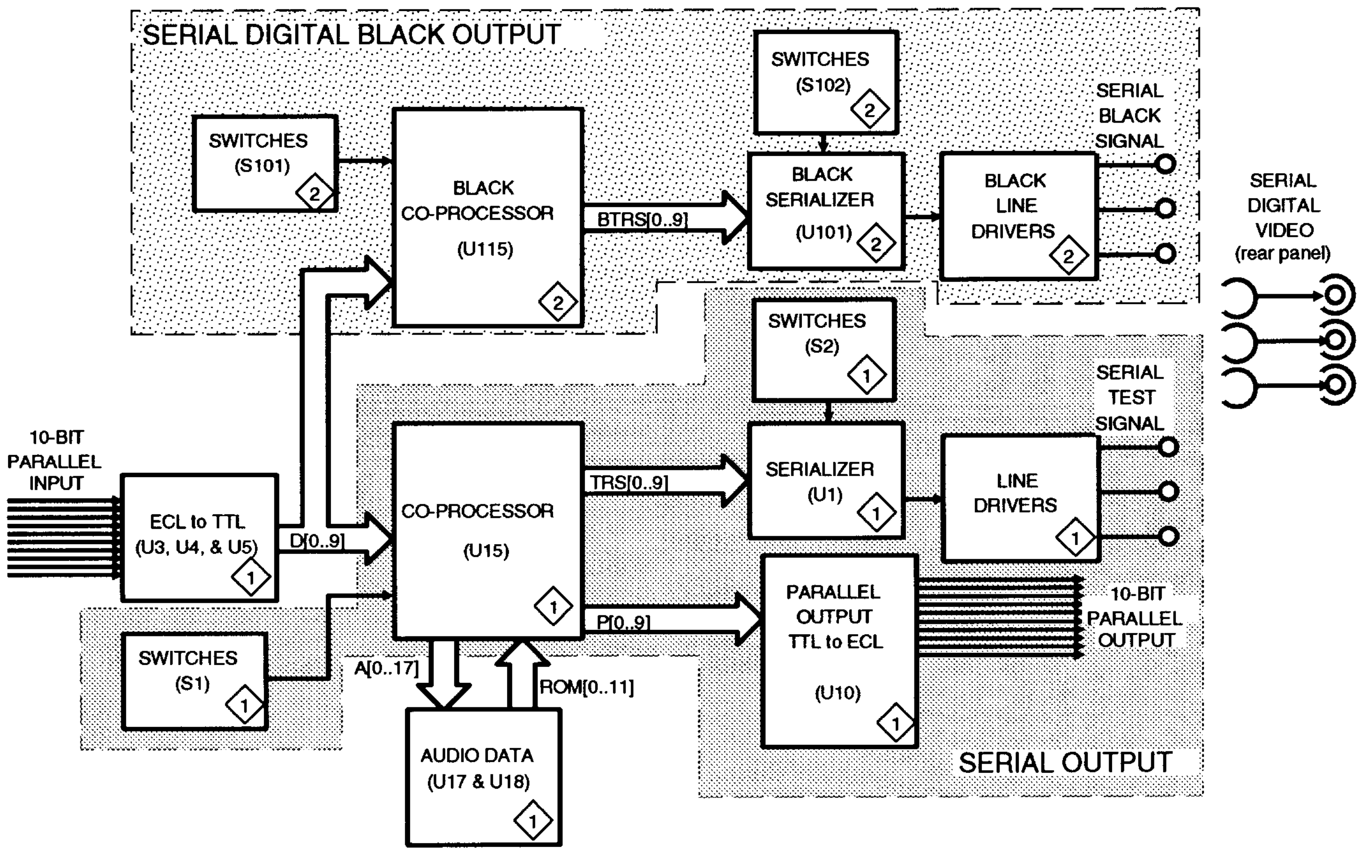


Fig. A-3.
Block Diagram of the TSG-422 Serial Output Board.

THEORY OF OPERATION

Fig. A-3 shows a basic block diagram of the TSG-422's Serial board.

A copy of the Parallel Output (from J940 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. The Co-processor calculates the EDH status, and sets the appropriate EDH flags. It also inserts the TRS-ID and audio data from U17 and U18. The Co-processor then outputs two sets of the parallel data: one for the parallel output path (P[0..9]), 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 OUT 2 connector.

The data for the serial output path is applied to the serializer, U1. The serializer provides digital component 8-bit or 10-bit serial data in scrambled NRZI code, at a 270 Mb/s bit rate. The serial data stream is output at U1-3 and U1-4.

The serial data is applied to a push-pull amplifier, Q7 and Q11, which drives emitter followers Q9, Q2, Q8, and Q4. The push-pull 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 black level values. The B-Y and R-Y data channels are set with 200_h and data in the Y channel is replaced with 040_h. 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 then provides either 8-bit or 10-bit serial black in NRZI code at a 270 MHz rate. The serial data stream is output at pins 3 and 4.

The serial data is applied to a push-pull amplifier, Q107 and Q111, which drives emitter followers Q109, Q102, Q108, and Q104. The push-pull 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.

JUMPERS & SWITCHES

Table A-3. Switch S1 Operating Selections.
OFF = 1 = OPEN
ON = 0 = CLOSED

SWITCH	NAME	SWITCH POSITION			DESCRIPTION	FACTORY SETTING
1	8 or 10 Bit Resolution	1	2			1=open 2=open
2		open open closed closed	open closed open closed		Normal Operation Disable EDH insertion Insert Error (Format error and ESP flags set) 8-bit format on serial and parallel output ports.	
3	Debug	closed open			Normal Operation. Debug (Service use only).	closed
4	Embedded Audio Selections	4	5	6		4=open 5=open 6=open
5 6		open open open open closed closed closed closed	open open closed closed open open closed closed	open closed open closed open closed open closed	Transmit 1 KHz on all channels. Transmit 800 Hz on all channels. Transmit 1 KHz on CH3 and CH4 only. Transmit 800 Hz on CH3 and CH4 only. Transmit 1 KHz on CH1 and CH2 only. Transmit 800 Hz on CH1 and CH2 only. Transmit 0 Hz on all channels. Audio disabled.	
7					unused	
8					unused	
9					unused	
10	Emphasis	open closed			No emphasis. 50/15 µs emphasis.	open

Table A-4. Switch S101 (Black) Operating Selections.
OFF = 1 = OPEN
ON = 0 = CLOSED

SWITCH NAME		SWITCH POSITION	DESCRIPTION	FACTORY SETTING
1	8 or 10 Bit Resolution	closed open	8 bits 10 bits	open
2			unused	open
3	System Configuration	closed open	Normal Operation (must be in this postion of power-up). Debug (Service use only).	closed
4			unused	open
5	EDH Disable	closed open	EDH Disabled EDH Enabled	open
6	Insert EDH Error	closed open	Insert EDH Errors. (Both FF-CRC and AP-CRC errors.) Normal Operation.	open
7			unused	open
8	Black Enable	open closed	Enable Digital Black Output. (0 IRE) Disable Digital Black Output (Test Signal Output).	open
9			unused	open
10			unused	open

Table A-5. Jumper Operating Selections.
All these jumpers are for internal use ONLY.
Please leave the jumpers in their factory set positions.
ALL jumpers must be set to the same pins.

JUMPER	NAME	DESCRIPTION	FACTORY SET POSITION
J1 <1>	Standard Selection	1-2 — 4:2:2 2-3 — NTSC	1-2
J13 <1>	Standard Selection	1-2 — 4:2:2 2-3 — NTSC	1-2
J101 <2>	Standard Selection	1-2 — 4:2:2 2-3 — NTSC	1-2
J113 <2>	Standard Selection	1-2 — 4:2:2 2-3 — NTSC	1-2

Table A-6. Switch S2 Operating Selections.

SWITCH	NAME	DESCRIPTION	FACTORY SET POSITION
S2-1	RSE	Open: Selects Composite operating frequency for serializer VCO. Closed: Selects Component operating frequency for serializer VCO.	CLOSED
S2-2	TN1	Open: Normal Closed: Test	OPEN
S2-3	not used		
S2-4	not used		

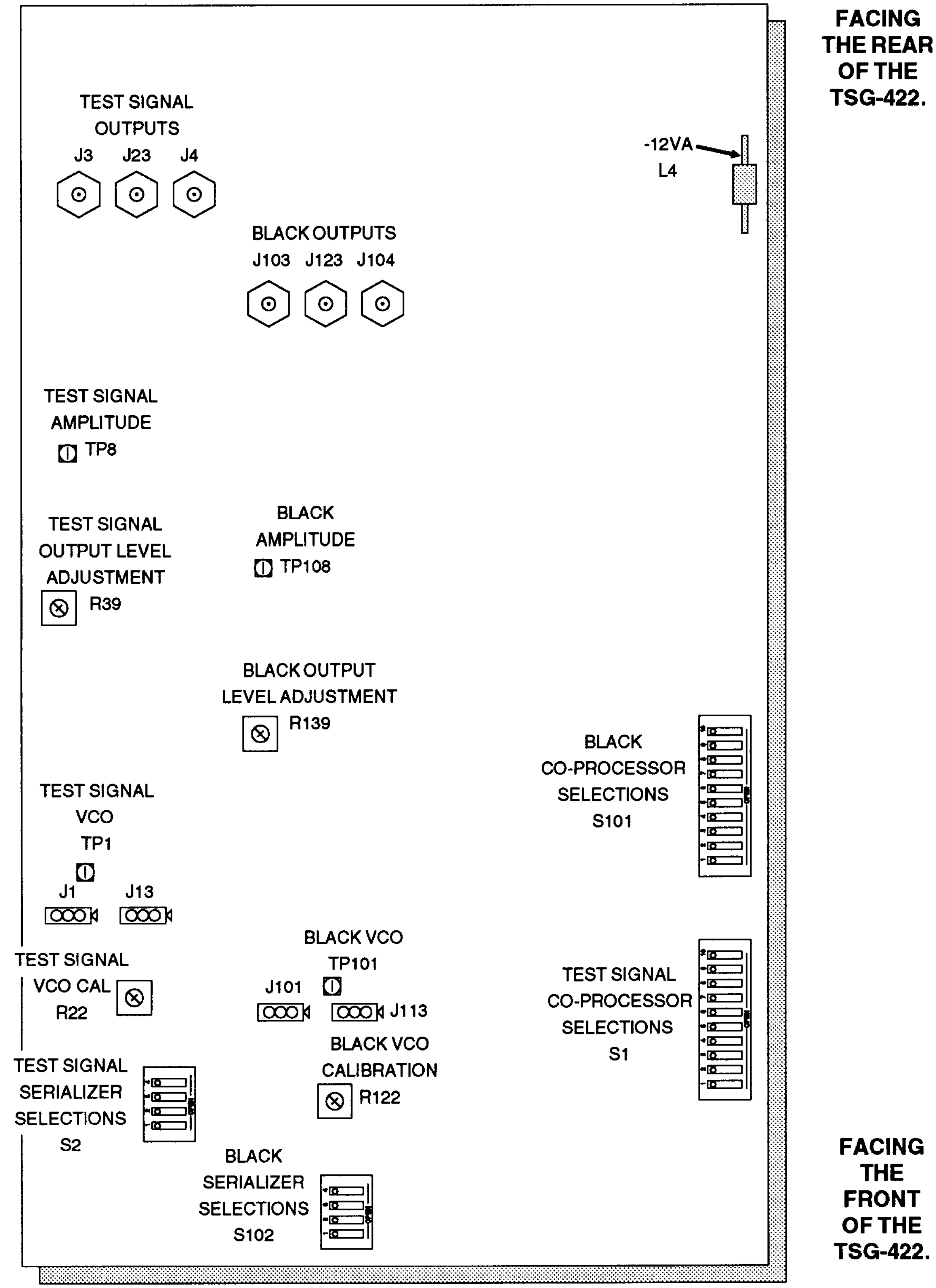


Fig. A-4. Location of User-adjustable jumpers and switches on the Serial Output board.

Table A-7. Switch S102 Operating Selections.

SWITCH	NAME	DESCRIPTION	FACTORY SET POSITION
S2-1	RSE	open: Selects Composite operating frequency for serializer VCO. closed: Selects Component operating frequency for serializer VCO.	closed
S2-2	TN1	open: Normal closed: Test	open
S2-3	not used		
S2-4	not used		

MAINTENANCE

Two parts on the TSG-422 Serial Output board require special handling during removal. U15 and U115 need a special tool for removal from their socket: AMP Extraction Tool part number 821590-1 for high pressure TIN chip carrier socket. See Fig. A-5. (Any other tool designed for this purpose and this size chip can be used.)

Follow the directions provided with the extraction tool for its use.

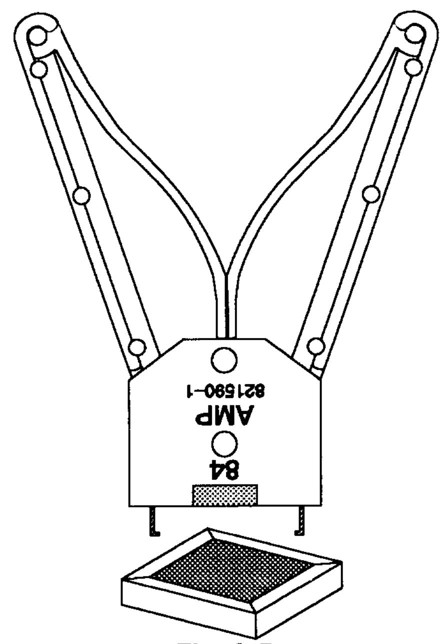


Fig. A-5.
Special tool required to remove U15 from its holder.

PERFORMANCE CHECK & ADJUSTMENT PROCEDURE

REQUIRED TEST EQUIPMENT

Due to the higher frequency of the serial digital output, the test oscilloscope mainframe and plug-ins used to test it must have a much higher bandwidth than for the standard instrument. A 1 GHz Tektronix 11403A mainframe with a 1 GHz Tektronix 11A72 Dual trace plug-in is recommended for testing the option 1S Serial Output.

To check the embedded audio to additonal test equipment is required:

1. A serial digital demultiplexer, SONY D1-AVD (BXPF-106C). The demux must be able to:

- check for the presence of embedded audio and
- have a separate digital audio output.

2. 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.

3. OPTIONAL: headphones to listen to the quality of the audio tone.

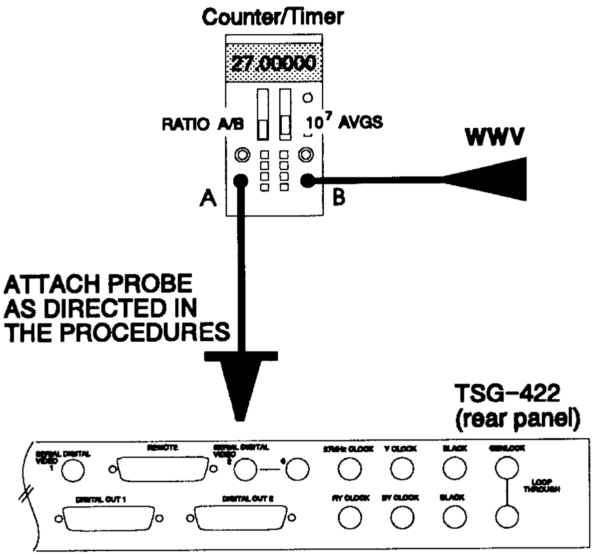


Fig. A-6. Setup to Check the Serial VCO Frequency.

PERFORMANCE CHECK PROCEDURES

A-1. Check VCO Frequencies

a. Connect the equipment as shown in Fig. A-6. Connect the probe to TP1 on the Serial Output board.

b. Make sure that S2-2 is in the OFF (OPEN) position.

c. Set the DC503 (Counter/Timer) AVGS to 10^{7}.

d. **CHECK** — that the frequency at TP1 is 27.0 MHz ± 100 kHz.

e. Connect the probe to TP101 on the Serial Output board.

f. Make sure that S102-2 is in the OFF (OPEN) position.

g. Set the DC503 (Counter/Timer) AVGS to 10^{7}.

h. **CHECK** — that the frequency at TP101 is 27.0 MHz ± 100 kHz.

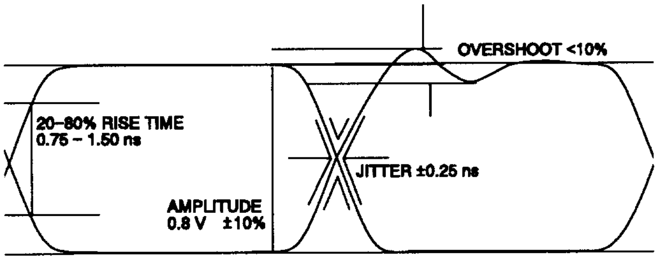


Fig. A-8. Eye pattern specs for the serial signal. Displays the amplitude, jitter, overshoot, and rise and fall times.

A-2. Check Serial Digital Output Amplitude

a. Connect the equipment as shown in Fig. A-8.

b. Connect W3, W23, and W4 to J3, J23, and J4.

c. Press the AUTOSET button on the oscilloscope to give a starting point for triggering and adjusting the signal.

d. In the ***WAVEFORM HORIZONTAL DESC*** menu, set the ***Display Type*** to: ***VARIABLE PERSISTENT***. This adjustment should result in the outline of the eye pattern displayed on the screen. The eye pattern should be similar to Fig. A-7.

e. Set the oscilloscope to view the signal at 100 mV/Div and 2 ns/Div. Trigger from the main window, on the positive slope (+).

f. **CHECK** — using the oscilloscope cursors (horizontal bar) that the signal amplitude, not including undershoot or overshoot, is between 720 and 880 $mV_{p\text{-}p}$.

g. Repeat this procedure for the other two SERIAL TEST SIGNAL outputs.

h. Connect W3, W23, and W4 to J103, J123, and J104.

i. Repeat these procedures for the Serial Digital Black signals.

A-3. Check SERIAL DIGITAL Output Rise and Fall Times

a. Connect the equipment as shown in Fig. A-8.

b. Connect W3, W23, and W4 to J3, J23, and J4.

c. In the ***WAVEFORM HORIZONTAL DESC*** menu, set the ***Display Type*** to: ***NORMAL***.

d. From the oscilloscope's ***MEASUREMENTS*** menu timing selections, select ***RISE*** and ***FALL***.

e. Set the ***RISE*** time menu as shown:

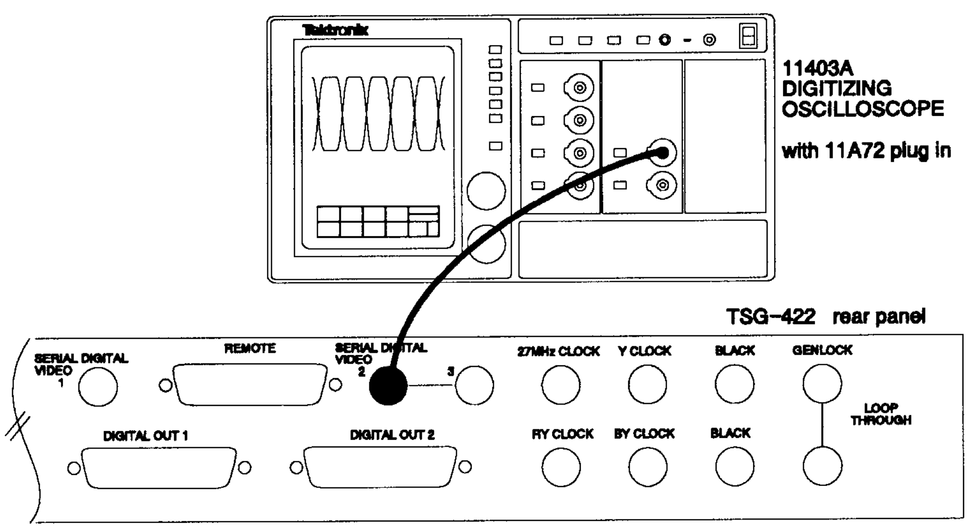


Fig. A-7.
Setup to check the Serial Digital Output:
Amplitude, Rise & Fall Times, Overshoot & Undershoot, and DC Level.

Tracking	Both
Proximal	20%
Distal	80%
Left Limit & Right Limit	Set to bracket the transition to be measured. Transition should change color between proximal and distal cursors.

f. From the oscilloscope's ***TRIGGER*** menu, set the slope to "+".

g. **CHECK** — that the rise time is between 0.75 and 1.50 ns.

h. Change the slope to "—", from the ***TRIGGER*** menu.

i. Select ***FALL*** from the ***MEASUREMENTS*** menu.

j. **CHECK** — that the fall time is between 0.75 and 1.50 ns.

k. Repeat this procedure for the other two SERIAL TEST SIGNAL Outputs.

l. Connect W3, W23, and W4 to J103, J123, and J104.

m. Repeat these procedures for the Serial Digital Black signals.

A-4. Check Serial Digital Output Overshoot and Undershoot

a. Connect the equipment as shown in Fig. A-8.

b. Connect W3, W23, and W4 to J3, J23, and J4.

c. Select ***OVERSHOOT*** and ***UNDERSHOOT*** from the ***MEASUREMENTS*** menu.

d. Select from the ***OVERSHOOT*** menu:

Left Limit	0%
Right Limit	100%
Tracking	Both
Time Mode	Relative

e. Set the ***TRIGGER SLOPE*** to "+".

f. **CHECK** — that the measured overshoot is less than 10%.

g. Set the ***TRIGGER SLOPE*** to "—".

h. Select ***UNDERSHOOT***.

i. **CHECK** — that the measured undershoot is less than 10%.

j. Repeat this procedure for the other two SERIAL TEST SIGNAL Outputs.

k. Connect W3, W23, and W4 to J103, J123, and J104.

l. Repeat these procedures for the Serial Digital Black signals.

A-5. Check Serial Digital Output DC Level

a. Connect the equipment as shown in Fig. A-8.

b. Connect W3, W23, and W4 to J3, J23, and J4.

c. Select ***MID*** from the ***MEASUREMENTS*** menu.

d. From the ***MID*** menu select:

Left Limit	0%
Right Limit	100%
Time Mode	Relative

e. **CHECK** — that the measured ***MID*** point is 0 V ± 0.5 V.

f. Repeat this procedure for the other two SERIAL TEST SIGNAL Outputs.

g. Connect W3, W23, and W4 to J103, J123, and J104.

h. Repeat these procedures for the Serial Digital Black signals.

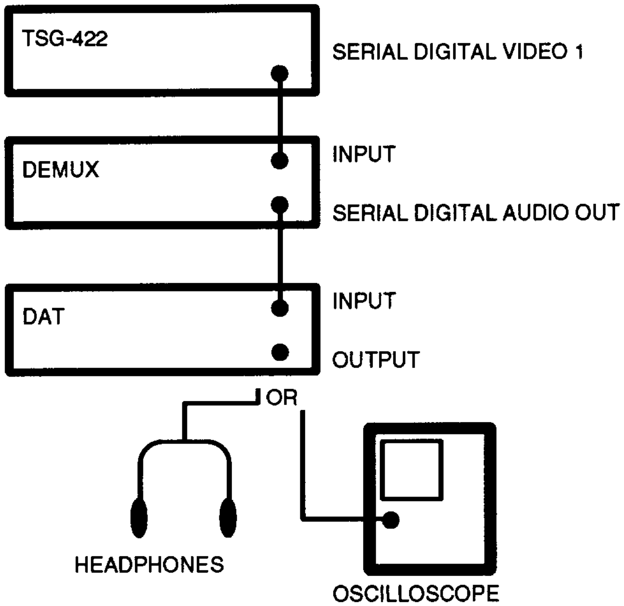


Fig. A-9. How to connect the test equipment to check the content of the embedded audio.

A-6. 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

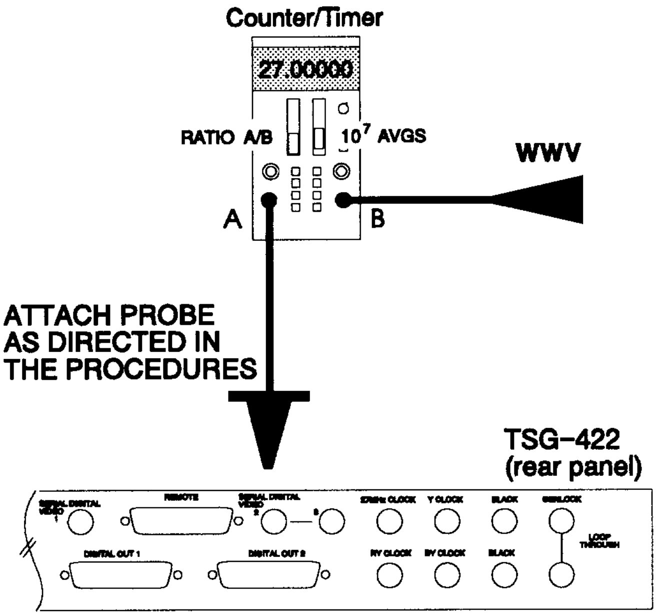


Fig. A-10. Setup to Adjust the Serial VCO Frequency.

A-7. Adjust VCO Test Signal 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 to ON (CLOSED).

d. **ADJUST** — R22 on the Serial Output board for a frequency of approximately 27.0 MHz.

e. Set S2-2 to OFF (OPEN) and set the Counter/Timer's AVGS to 10^7.

f. **CHECK** — that the frequency at TP1 is 27.0 MHz ± 100 kHz.

g. Repeat the above procedures until the frequency is within spec.

A-8. Adjust VCO Digital Black 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 to ON (CLOSED).

d. **ADJUST** — R122 on the Serial Output board for a frequency of approximately 27.0 MHz.

e. Set S2-2 to OFF (OPEN) and set the Counter/Timer's AVGS to 10^7.

f. **CHECK** — that the frequency at TP101 is 27.0 MHz ± 100 kHz.

g. Repeat the above procedures until the frequency is within spec.

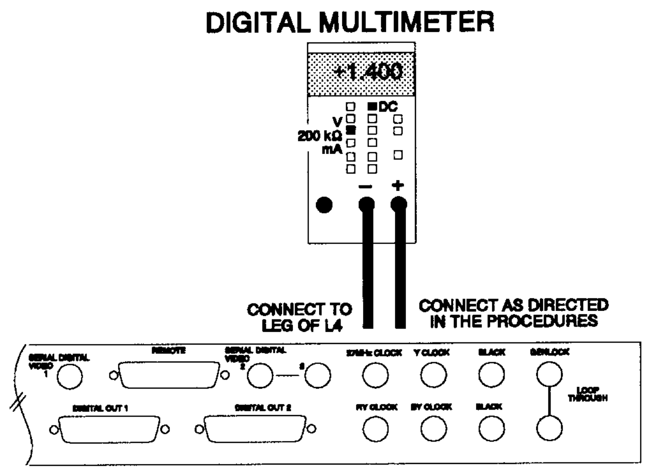


Fig. A-11.
Setup to adjust the Serial Digital Video Output Amplitude.

A-9. 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.

A-10. 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 TP8 and -12VA.

This ends the calibration portion of the Adjustment Procedure. Now do a complete Performance Check to re-verify all specifications.

Ancillary Data Structure

The Ancillary Data is divided into three main types: TRS-ID, Auxillary Data, and EDH Ancillary Data. Fig. A-12 shows a line of data with all possible types of ancillary data active. The Figures and Tables on the following pages give a more detailed breakdown of what is in the Ancillary Data packets and where it is located.

(The Auxillary Data can contain embedded audio, among other things.)

See Page A-18 for TRS-ID and page A-19 for EDH information.

ON LINE 9, FIELDS I & III AND LINE 272, FIELDS II & IV
(ON LINE 5, FIELDS I & III, AND LINE 318, FIELDS II & IV)

DATA WORD NUMBER	DATA WORD VALUES					
0	Y					ACTIVE VIDEO
	B-Y					
	Y					
	R-Y					
	Y					
	B-Y					
	Y					
1439	R-Y					
1440 - 1443	EAV	3FC	000	000		STANDARD TRS-ID INFORMATION
1444-1447	TRS	3FF	000	000	000	
1448	ID1					
1449	AUX					AUXILLARY DATA
1450	ID2					
1451	DB#					
1452	DC					
1453						
1687						
1688	CS					
1689 - 1691 (1701 - 1703)	ADH	000	3FF	3FF		EDH ANCILLARY INFORMATION DEFINED AS ENDING IMMEDIATELY BEFORE SAV.
1692 (1704)	DID	1F4				
1693 (1705)	B#	200				
1694 (1706)	DC	110				
1695 -1697 (1707 -1709)	AP					
1698 - 1700 (1710 -1712)	FF					
1701 (1713)	ADE					
1702 (1714)	APE					
1703 (1715)	FFE					
1704 -1710 (1716 -1722)	RES	200	.....	200		
1711 (1723)	CS					
1712 - 1715 (1724 -1727)	SAV	3FC	000	000		

ANCILLARY INFORMATION (data words 1440 – 1715 (1727))

Fig. A-12. Ancillary Data Structure. (625 system)

THE TSG-422 SERIAL SIGNAL (MORE INFORMATION)

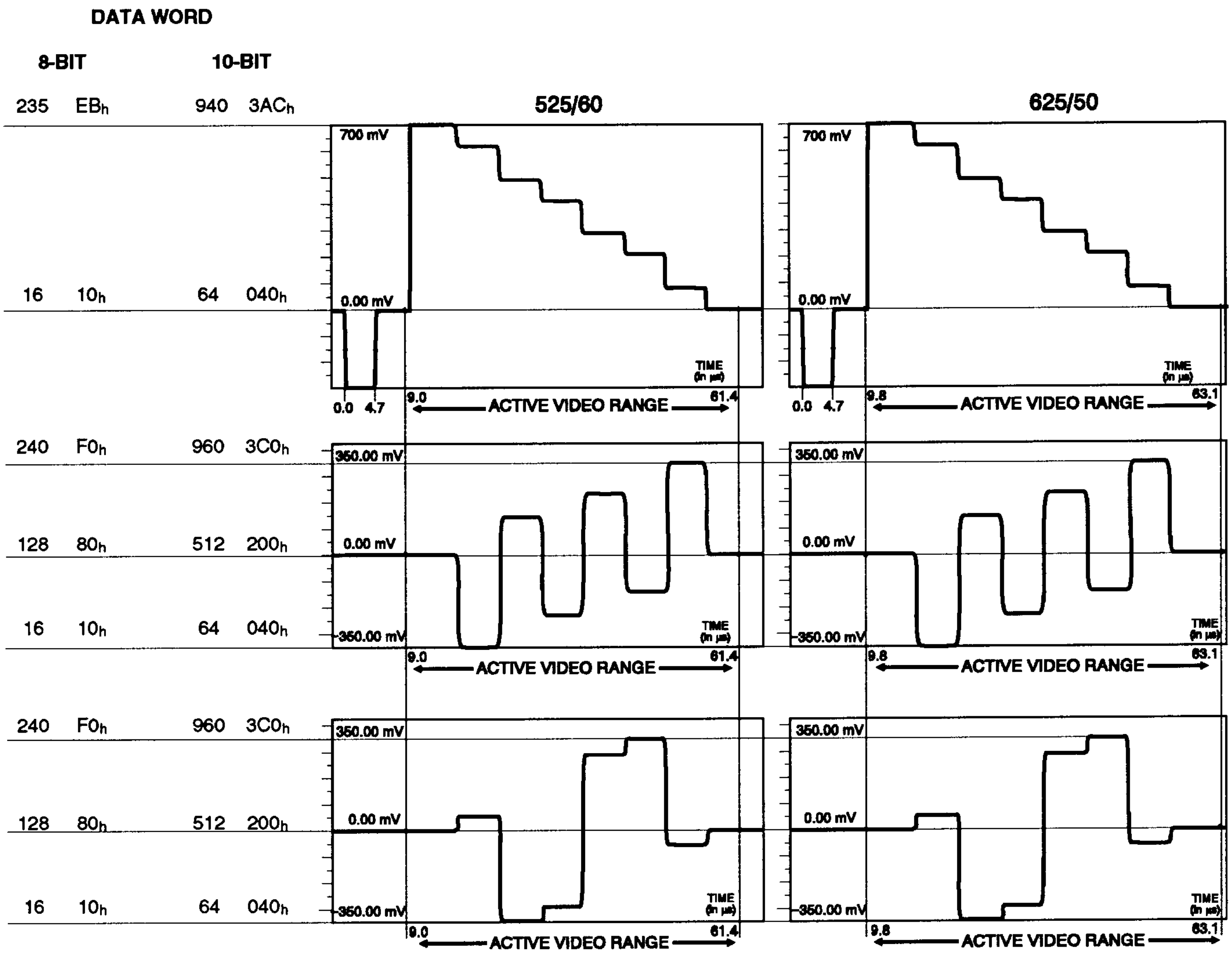


Fig. A-13.
Component Analog to Component Digital Timing and Amplitude Relationships.

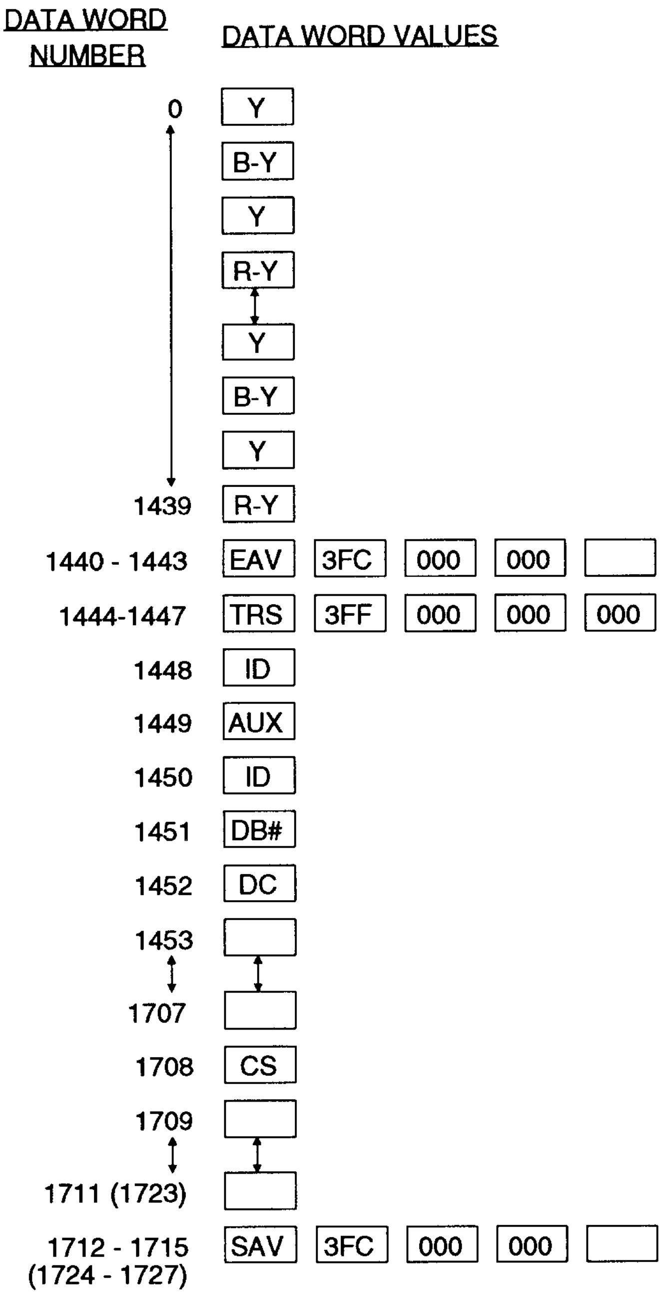


Fig. A-14. Data packet information for 525/60 system.
Numbers in ( ) are for 625/50 system.

Location and Values for TRS-ID Data & Auxillary Data

Refer to Fig. A-13 for the bit placement.

Standard CCIR 601 Data

Y, B-Y, R-Y — Active video data values. Y is luminance, and B-Y & R-Y are color difference channels.

EAV — End of Active Video. A CCIR 601 control signal four data word long. Defined as 3FC$_h$, 000$_h$, 000$_h$, xxx$_h$. See Table 3-2 (Specifications Section) for the value of xxx$_h$.

SAV — Start of Active Video. A CCIR 601 control signal 4 words long. Defined as 3FC$_h$, 000$_h$, 000$_h$, xxx$_h$. See Table 3-2 (Specifications Section) for the value of xxx$_h$.

TRS-ID Data

TRS — Timing Reference Signal. Defined 4 word code (3FF$_h$, 000$_h$, 000$_h$, 000$_h$) that tells the serial signal where it is located on the data line.

ID (1448) — Line ID. Tells which field/line is being transmitted. See Table A-8 on page A-18 for the values.

Auxillary Data

AUX — Auxiliary Data Flag indicates the presence of non-video data.

ID (1450) — Data ID. Indicates the type of auxilary data.

DB# — Data Block Number. Distinguishes the different types of data that share the same data ID number.

DC — Data Count. Indicates the number of data words included in this block.

CS — Checksum. Used to check the validity of the data ID and the user's data.

Table A-8. Definition of TRS and ID Data Words.

	b9 msb	b8	b7	b6	b5	b4	b3	b2	b1	b0 lsb
TRS, word 1, Sample 1444	1	1	1	1	1	1	1	1	1	1
TRS, word 2, Sample 1445	0	0	0	0	0	0	0	0	0	0
TRS, word 3, Sample 1446	0	0	0	0	0	0	0	0	0	0
TRS, word 4, Sample 1447	0	0	0	0	0	0	0	0	0	0
Line Number ID, Sample 1448	**Parity**		**Line Number**					**Field Number**		
Line 1, Field 1	0	1	0	0	0	0	1	0	0	0
Line 2, Field 1	0	1	0	0	0	1	0	0	0	0
Line 3, Field 1	1	0	0	0	0	1	1	0	0	0
Line n, Field 1	$\overline{P}$	P	m	m	m	m	m	0	0	0
Line 30, Field 1	1	0	1	1	1	1	0	0	0	0
Line >30, Field 1	0	1	1	1	1	1	1	0	0	0
Line n, Field 2	$\overline{P}$	P	m	m	m	m	m	0	0	1
Line n, Field 3	$\overline{P}$	P	m	m	m	m	m	0	1	0
Line n, Field 4	$\overline{P}$	P	m	m	m	m	m	0	1	1
Line n, Field 5 (625 only)	$\overline{P}$	P	m	m	m	m	m	1	0	0
Line n, Field 6 (625 only)	$\overline{P}$	P	m	m	m	m	m	1	0	1
Line n, Field 7 (625 only)	$\overline{P}$	P	m	m	m	m	m	1	1	0
Line n, Field 8 (625 only)	$\overline{P}$	P	m	m	m	m	m	1	1	1
Not Used	X	X	0	0	0	0	0	X	X	X

Table A-9. Definitions for Error Data Handling (EDH).
For 525 Line 9 Field I & III and Line 272 Field II & IV
For 625 Line 5 Fields I & III and Line 318 Fields II & IV

Data Word & Description start with sample 1689 (1701)	bits										525 #	625 #
	9	8	7	6	5	4	3	2	1	0		
Anc Data Header	0	0	0	0	0	0	0	0	0	0	1689	1701
Anc Data Header	1	1	1	1	1	1	1	1	1	1	1690	1702
Anc Data Header	1	1	1	1	1	1	1	1	1	1	1691	1703
Data ID	0	1	1	1	1	1	0	1	0	0	1692	1704
Block Number	1	0	0	0	0	0	0	0	0	0	1693	1705
Data Count	0	1	0	0	0	1	0	0	0	0	1694	1706
APL[1]	$\overline{P}$[7]	P(7)	AP-CRC[8] bits 5-0						0	0	1695	1707
APM[1]	$\overline{P}$	P	AP-CRC bits 11-6						0	0	1696	1708
APH[1]	$\overline{P}$	P	V[6]	0	AP-CRC bits 15-12				0	0	1697	1709
FFL[2]	$\overline{P}$	P	FF-CRC[9] bits 5-0						0	0	1698	1710
FFM[2]	$\overline{P}$	P	FF-CRC bits 11-6						0	0	1699	1711
FFH[2]	$\overline{P}$	P	V	0	FF-CRC bits 15-12				0	0	1700	1712
AN STAT[3]	$\overline{P}$	P	0	an ues (10)	an ida (11)	an idh (12)	an eda (13)	an edh (14)	0	0	1701	1713
AP STAT[4]	$\overline{P}$	P	0	ap ues	ap ida	ap idh	ap eda	ap edh	0	0	1702	1714
FF STAT[5]	$\overline{P}$	P	0	ff ues	ff ida	ff idh	ff eda	ff edh	0	0	1703	1715
reserved (7 words)	1	0	0	0	0	0	0	0	0	0	1704	1716
Checksum	$\overline{8}$	8	7	6	5	4	3	2	1	0	1711	1723

(1) APL, APM, & APH — Active Picture Low, Middle, and High. Includes samples 0-1439
(2) FFL, FFM, & FFH — Full Field Low, Middle, and High. Includes all samples in all lines except lines 9-11 & 272-274 (5-7 & 318-320).
(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. V = 1, if valid CRC is calculated.
(7) P & $\overline{P}$ — Even Parity.
(8) AP-CRC — Active Picture Cyclic Redundancy Code. 16-bit code derived from all of the bits in the active picture.
(9) FF-CRC — Full Field Cyclic Redundancy Code. A 16-bit code derived from all bits in the field, except transition lines.

(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. A non-transmission error is 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.

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-422 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-422.

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.

bit	1^{st} word x	2^{nd} word x+1	3^{rd} 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.

Sample Distribution of Audio Data on the TSG 422's Serial Signal

525/60 Audio Sample Distrobution.

Field 1: Line Number	Transmitted Samples/CH	Total	Field 2: Line Number	Transmitted Samples/CH	Total
1	4 samples/line	4			
2 - 8	3 samples/line	21	264 - 271	3 samples/line	24
9	4 samples/line	4	272	4 samples/line	4
10 -11	0 samples/line	0	273 - 274	0 samples/line	0
12 - 24	3 samples/line	39	275 - 287	3 samples/line	39
25	4 samples/line	4	288	4 samples/line	4
26 - 38	3 samples/line	39	289 - 301	3 samples/line	39
39	4 samples/line	4	302	4 samples/line	4
40 - 52	3 samples/line	39	303 - 315	3 samples/line	39
53	4 samples/line	4	316	4 samples/line	4
54 - 66	3 samples/line	39	317 - 329	3 samples/line	39
67	4 samples/line	4	330	4 samples/line	4
68 - 80	3 samples/line	39	331 - 343	3 samples/line	39
81	4 samples/line	4	344	4 samples/line	4
82 - 94	3 samples/line	39	345 - 357	3 samples/line	39
95	4 samples/line	4	358	4 samples/line	4
96 - 108	3 samples/line	39	359 - 371	3 samples/line	39
109	4 samples/line	4	372	4 samples/line	4
110 - 122	3 samples/line	39	373 - 385	3 samples/line	39
123	4 samples/line	4	386	4 samples/line	4
124 - 136	3 samples/line	39	387 - 399	3 samples/line	39
137	4 samples/line	4	400	4 samples/line	4
138 - 150	3 samples/line	39	401 - 413	3 samples/line	39
151	4 samples/line	4	414	4 samples/line	4
152 - 164	3 samples/line	39	415 - 427	3 samples/line	39
165	4 samples/line	4	428	4 samples/line	4
166 - 178	3 samples/line	39	429 - 441	3 samples/line	39
179	4 samples/line	4	442	4 samples/line	4
180 - 192	3 samples/line	39	443 - 455	3 samples/line	39
193	4 samples/line	4	456	4 samples/line	4
194 - 206	3 samples/line	39	457 - 469	3 samples/line	39
207	4 samples/line	4	470	4 samples/line	4
208 - 220	3 samples/line	39	471 - 483	3 samples/line	39
221	4 samples/line	4	484	4 samples/line	4

Field 1: Line Number	Transmitted Samples/CH	Total	Field 2: Line Number	Transmitted Samples/CH	Total
222 - 234	3 samples/line	39	485 - 497	3 samples/line	39
235	4 samples/line	4	498	4 samples/line	4
236 - 248	3 samples/line	39	499 - 511	3 samples/line	39
249	4 samples/line	4	512	4 samples/line	4
250 - 260	3 samples/line	33	513 - 525	3 samples/line	39
261*	3/4 samples/line	3			
262	3 samples/line	3			
263	4 samples/line	4			
Total Samples		803			798

* Line 261 has 4 samples in Field 1, 5, and 9. Three samples in the other fields.

625/50 Audio Sample Distrobution

Field 1: Line Number	Transmitted Samples/CH	Total	Field 2: Line Number	Transmitted Samples/CH	Total
			314	4 samples/line	4
1 - 5	3 samples/line	18	315 - 318	3 samples/line	12
6 - 7	0 samples/line	0	319 - 320	0 samples/line	0
8	4 samples/line	4	321	4 samples/line	4
9 - 18	3 samples/line	30	322 - 331	3 samples/line	30
19	4 samples/line	4	332	4 samples/line	4
20 - 29	3 samples/line	30	333 - 342	3 samples/line	30
30	4 samples/line	4	343	4 samples/line	4
31 - 40	3 samples/line	30	344 - 353	3 samples/line	30
41	4 samples/line	4	354	4 samples/line	4
42 - 51	3 samples/line	30	355 - 364	3 samples/line	30
52	4 samples/line	4	365	4 samples/line	4
53 - 62	3 samples/line	30	366 - 375	3 samples/line	30
63	4 samples/line	4	376	4 samples/line	4
64 - 73	3 samples/line	30	377 - 386	3 samples/line	30
74	4 samples/line	4	387	4 samples/line	4
75 - 84	3 samples/line	30	388 - 397	3 samples/line	30
85	4 samples/line	4	398	4 samples/line	4
86 - 95	3 samples/line	30	399 - 408	3 samples/line	30
96	4 samples/line	4	409	4 samples/line	4
97 - 106	3 samples/line	30	410 - 419	3 samples/line	30
107	4 samples/line	4	420	4 samples/line	4
108 - 117	3 samples/line	30	421 - 430	3 samples/line	30
118	4 samples/line	4	431	4 samples/line	4
119 - 128	3 samples/line	30	432 - 441	3 samples/line	30
129	4 samples/line	4	442	4 samples/line	4
130 - 139	3 samples/line	30	443 - 452	3 samples/line	30
140	4 samples/line	4	453	4 samples/line	4
141 - 150	3 samples/line	30	454 - 463	3 samples/line	30
151	4 samples/line	4	464	4 samples/line	4
152 - 161	3 samples/line	30	465 - 475	3 samples/line	30
162	4 samples/line	4	475	4 samples/line	4
163 - 172	3 samples/line	30	476 - 485	3 samples/line	30
173	4 samples/line	4	486	4 samples/line	4
174 - 183	3 samples/line	30	487 - 496	3 samples/line	30
184	4 samples/line	4	497	4 samples/line	4

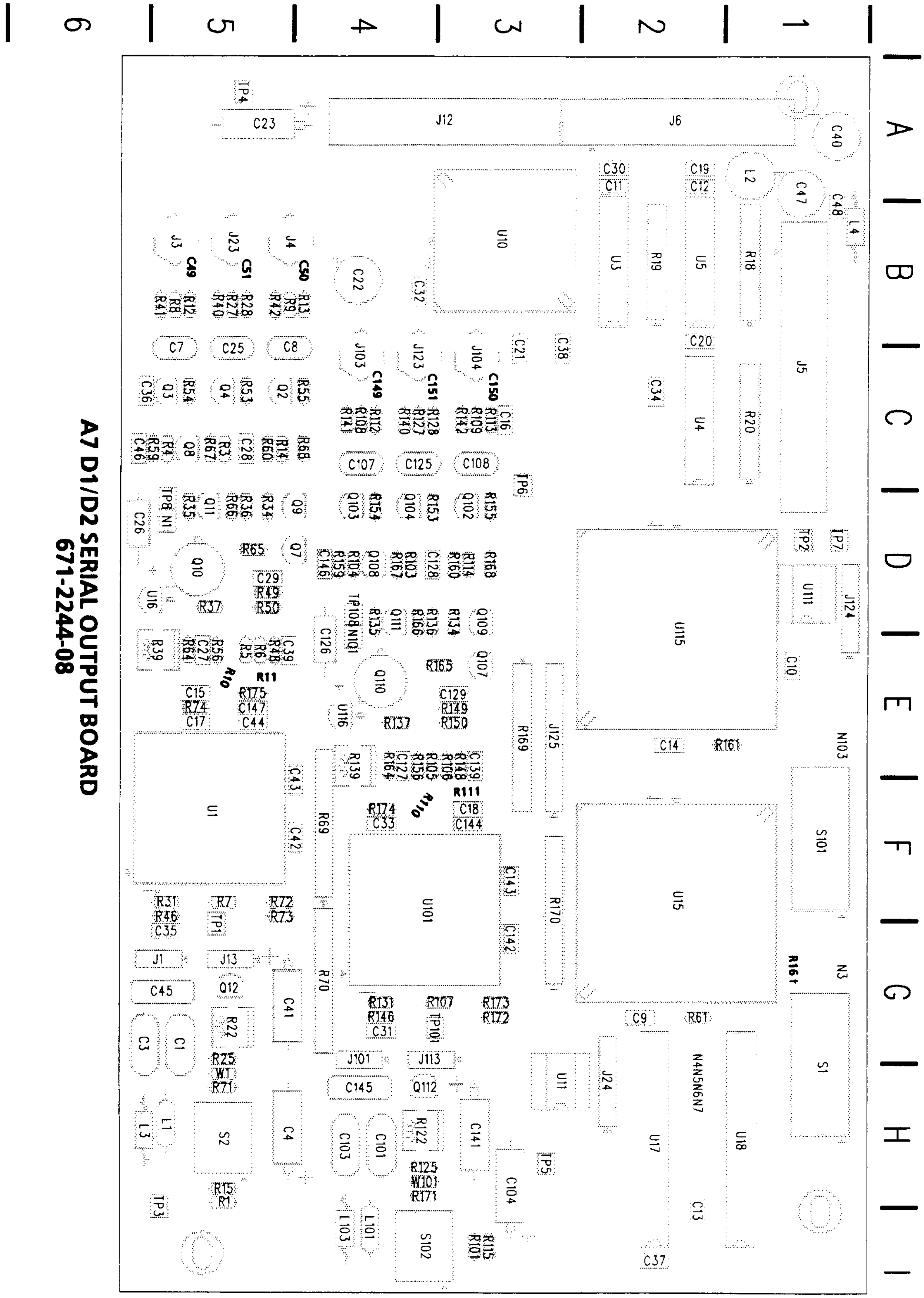
Field 1: Line Number	Transmitted Samples/CH	Total	Field 2: Line Number	Transmitted Samples/CH	Total
183 - 194	3 samples/line	30	498 - 507	3 samples/line	30
195	4 samples/line	4	508	4 samples/line	4
196 - 205	3 samples/line	30	509 - 518	3 samples/line	30
206	4 samples/line	4	519	4 samples/line	4
207 - 216	3 samples/line	30	520 - 529	3 samples/line	30
217	4 samples/line	4	530	4 samples/line	4
218 - 227	3 samples/line	30	531 - 539	3 samples/line	30
228	4 samples/line	4	540	4 samples/line	4
229 - 238	3 samples/line	30	541 - 551	3 samples/line	30
239	4 samples/line	4	552	4 samples/line	4
240 - 249	3 samples/line	30	553 - 562	3 samples/line	30
250	4 samples/line	4	563	4 samples/line	4
251 - 260	3 samples/line	30	564 - 573	3 samples/line	30
261	4 samples/line	4	574	4 samples/line	4
262 - 271	3 samples/line	30	575 - 584	3 samples/line	30
272	4 samples/line	4	585	4 samples/line	4
273 - 282	3 samples/line	30	586 - 595	3 samples/line	30
283	4 samples/line	4	596	4 samples/line	4
284 - 293	3 samples/line	30	597 - 606	3 samples/line	30
294	4 samples/line	4	607	4 samples/line	4
295 - 304	3 samples/line	30	608 - 617	3 samples/line	30
305	4 samples/line	4	618	4 samples/line	4
306 - 313	3 samples/line	24	619 - 625	3 samples/line	21
Total Samples		962			958

Audio Status Bits (S1-10 closed)

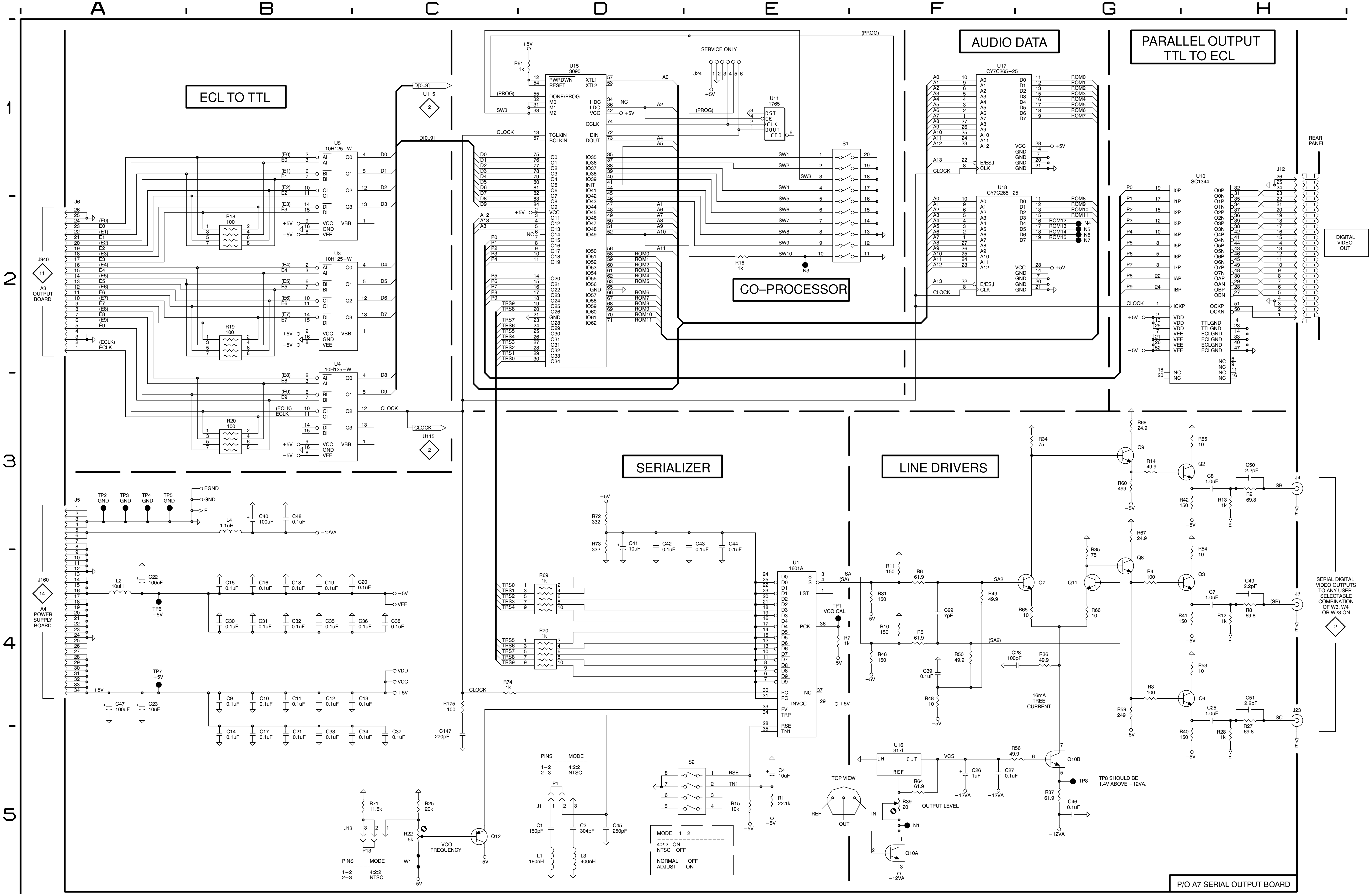
Byte	Bits	0	1	2	3	4	5	6	7	Description
0	0	1								Professional use of channel status & Z-bit
	1		0							Normal audio mode
	2 - 4			1	1	0				Encoded audio signal emphasis 50/15 us emphasis, override disable
	5						0			Source sampling frequency locked
	6 - 7							0	1	48 KHz sampling, override disabled.
1	0 - 3	0	0	0	1					Encoded channel mode - 2-channel mode, override disable
	4 - 7					0	0	0	1	Encoded user bits management - 192-bit block structure. Preamble "z" indicates the start of block.
2	0 - 2	0	0	0						Encoded use of auxiliary sample bits - 20 bit audio data.
	3 - 5				1	0	1			Encoded audio sample word length of Tx signal. - Maximum audio sample word length is 20 bits (default). Use of auxilary sample bits is not defined.
	6 - 7							0	0	Reserved but undefined.
3	0 - 7	0	0	0	0	0	0	0	0	Vector target byte from byte 1.
4	0 - 7	0	0	0	0	0	0	0	0	Digital audio reference signal (per AES11)
5	0 - 7	0	0	0	0	0	0	0	0	Reserved but undefined.
6	0 - 7	0	0	0	0	0	0	0	1	Alphanumeric channel - origin data, ASCII with odd parity.
7	0 - 7	0	0	0	0	0	0	0	1	
8	0 - 7	0	0	0	0	0	0	0	1	
9	0 - 7	0	0	0	0	0	0	0	1	
10	0 - 7	0	0	0	0	0	0	0	1	Alphanumeric channel - Destination data, ASCII, odd parity.
11	0 - 7	0	0	0	0	0	0	0	1	
12	0 - 7	0	0	0	0	0	0	0	1	
13	0 - 7	0	0	0	0	0	0	0	1	
14	0 - 7	0	0	0	0	0	0	0	0	Local sample address code.
15	0 - 7	0	0	0	0	0	0	0	0	
16	0 - 7	0	0	0	0	0	0	0	0	
17	0 - 7	0	0	0	0	0	0	0	0	
18	0 - 7	0	0	0	0	0	0	0	0	Time sample address code.
19	0 - 7	0	0	0	0	0	0	0	0	
20	0 - 7	0	0	0	0	0	0	0	0	
21	0 - 7	0	0	0	0	0	0	0	0	
22	0 - 7	0	0	0	0	0	0	0	0	Flag used to identify whether the information carried by the channel status data is reliable. All bits are reliable.
23	0 - 7	0	1	0	1	0	1	0	1	CRC (Channel status data cyclic redundancy check character) = 0xAA, lsb first

Audio Status Bits (S1-10 open)

Byte	Bits	0	1	2	3	4	5	6	7	Description
0	0	1								Professional use of channel status & Z-bit
	1		0							Normal audio mode
	2 - 4			1	0	0				Encoded audio signal, no emphasis, override disable
	5						0			Source sampling frequency locked
	6 - 7							0	1	48 KHz sampling, override disabled.
1	0 - 3	0	0	0	1					Encoded channel mode - 2-channel mode, override disable
	4 - 7					0	0	0	1	Encoded user bits management - 192-bit block structure. Preamble "z" indicates the start of block.
2	0 - 2	0	0	0						Encoded use of auxiliary sample bits - 20 bit audio data.
	3 - 5				1	0	1			Encoded audio sample word length of Tx signal. - Maximum audio sample word length is 20 bits (default). Use of auxilary sample bits is not defined.
	6 - 7							0	0	Reserved but undefined.
3	0 - 7	0	0	0	0	0	0	0	0	Vector target byte from byte 1.
4	0 - 7	0	0	0	0	0	0	0	0	Digital audio reference signal (per AES11)
5	0 - 7	0	0	0	0	0	0	0	0	Reserved but undefined.
6	0 - 7	0	0	0	0	0	0	0	1	Alphanumeric channel - origin data, ASCII with odd parity.
7	0 - 7	0	0	0	0	0	0	0	1	
8	0 - 7	0	0	0	0	0	0	0	1	
9	0 - 7	0	0	0	0	0	0	0	1	
10	0 - 7	0	0	0	0	0	0	0	1	Alphanumeric channel - Destination data, ASCII, odd parity.
11	0 - 7	0	0	0	0	0	0	0	1	
12	0 - 7	0	0	0	0	0	0	0	1	
13	0 - 7	0	0	0	0	0	0	0	1	
14	0 - 7	0	0	0	0	0	0	0	0	Local sample address code.
15	0 - 7	0	0	0	0	0	0	0	0	
16	0 - 7	0	0	0	0	0	0	0	0	
17	0 - 7	0	0	0	0	0	0	0	0	
18	0 - 7	0	0	0	0	0	0	0	0	Time sample address code.
19	0 - 7	0	0	0	0	0	0	0	0	
20	0 - 7	0	0	0	0	0	0	0	0	
21	0 - 7	0	0	0	0	0	0	0	0	
22	0 - 7	0	0	0	0	0	0	0	0	Flag used to identify whether the information carried by the channel status data is reliable. All bits are reliable.
23	0 - 7	1	1	1	1	0	0	0	0	CRC (Channel status data cyclic redundancy check character) = 0x0F, lsb first



A7 D1/D2 SERIAL OUTPUT BOARD
671-2244-08


ECL TO TTL
CO–PROCESSOR
AUDIO DATA
PARALLEL OUTPUT
TTL TO ECL
SERIALIZER
LINE DRIVERS
P/O A7 SERIAL OUTPUT BOARD

A7 D1/D2 SERIAL OUTPUT BOARD Component Locator

(with cross-references to schematic diagrams 1 and 2)

Comp No	Diag No	Diag Loc	Bd Loc	Comp No	Diag No	Diag Loc	Bd Loc	Comp No	Diag No	Diag Loc	Bd Loc	Comp No	Diag No	Diag Loc	Bd Loc	Comp No	Diag No	Diag Loc	Bd Loc	Comp No	Diag No	Diag Loc	Bd Loc
C1	1	D5	G5	C49	1	H4	B5	L4	1	B3	A1	R10	1	F4	E5	R73	1	D3	G5	R168	2	F3	D3
C3	1	D5	G6	C50	1	H3	B5	L101	2	B5	I4	R11	1	F4	E5	R74	1	C4	E5	R169	2	B4	E3
C4	1	E5	H5	C51	1	H4	B5	L103	2	B5	I4					R101	2	C5	I3	R170	2	B4	G3
C7	1	H4	C5	C101	2	B5	H4					R12	1	H4	B5	R103	2	F4	D4	R171	2	A5	H4
C8	1	H3	C5	C103	2	B5	H4	N1	1	F5	D5	R13	1	H3	B4	R104	2	F4	D4	R172	2	B3	G3
C9	1	B4	G2	C104	2	C5	H3	N3	1	E2	G1	R14	1	G3	C5	R105	2	D4	E4	R173	2	B3	G3
C10	1	B4	E1					N4	1	G2	G2	R15	1	E5	H5	R106	2	D4	E3	R174	2	B4	F4
C11	1	B4	A2	C107	2	F4	C4	N5	1	G2	H2	R16	1	E2	G1	R107	2	D4	G4	R175	1	C4	E5
C12	1	B4	A2	C108	2	F3	C3	N6	1	G2	H2	R18	1	B2	B1	R108	2	G4	C4				
C13	1	B4	H2	C125	2	F4	C4	N7	1	G2	H2	R19	1	B2	B2					S1	1	E1	H1
				C126	2	E5	D4	N101	2	E5	E4	R20	1	B3	D1	R109	2	G3	C3	S2	1	D5	H5
C14	1	B5	E2	C127	2	E5	E4	N103	2	D2	E1	R22	1	C5	G5	R110	2	D4	F4	S101	2	D1	F1
C15	1	B4	E5	C128	2	E4	D4					R25	1	C5	H5	R111	2	D4	F3	S102	2	C5	I3
C16	1	B4	C3	C129	2	E4	E3	P1	1	D5						R112	2	F4	C4				
C17	1	B5	E5	C139	2	E4	E3	P13	1	C5		R27	1	H4	B5	R113	2	F3	C3	TP1	1	E4	F5
C18	1	B4	F3	C141	2	B3	H3	P101	2	B5		R28	1	H5	B5	R114	2	F3	D3	TP2	1	A3	D1
C19	1	B4	A2	C142	2	C3	G3	P113	2	A5		R31	1	F4	F5	R115	2	C5	I3	TP3	1	A3	H6
C20	1	B4	C2									R34	1	G3	D5	R122	2	A5	H3	TP4	1	A3	A5
C21	1	B5	B3	C143	2	C3	F3	Q2	1	G3	C5	R35	1	G3	D5	R125	2	A5	H4	TP5	1	A3	H3
C22	1	A4	B4	C144	2	C3	F3	Q3	1	G4	C5	R36	1	G4	D5	R127	2	G4	C4	TP6	1	A4	C3
C23	1	A4	A5	C145	2	B5	H4	Q4	1	G4	C5	R37	1	G5	D5					TP7	1	A4	D1
				C146	2	F5	D4	Q7	1	G4	D4	R39	1	F5	E5	R128	2	F4	C4	TP8	1	G5	C6
C25	1	H4	C5	C147	1	C5	E5	Q8	1	G4	C5	R40	1	H5	B5	R131	2	D4	G4	TP101	2	D4	G4
C26	1	F5	D6	C149	2	G4	C4	Q9	1	G3	D4	R41	1	H4	B5	R134	2	E3	D3	TP108	2	F5	D4
C27	1	F5	E5	C150	2	G3	C3	Q10A	1	F5	D5					R135	2	F3	D4				
C28	1	G4	C5	C151	2	G4	C4	Q10B	1	G5	D5	R42	1	H3	B5	R136	2	E4	D4	U1	1	E4	F6
C29	1	F4	D5					Q11	1	G4	D5	R46	1	F4	G5	R137	2	E5	E4	U3	1	B2	B2
C30	1	B4	A2	J1	1	D5	G5	Q12	1	C5	G5	R48	1	F4	E5	R139	2	D5	E4	U4	1	B3	C1
C31	1	B4	G4	J3	1	H4	B5					R49	1	F4	D5	R140	2	F4	C4	U5	1	B1	B1
C32	1	B4	B4	J4	1	H3	B5	Q102	2	F3	D3	R50	1	F4	D5	R141	2	F4	C4	U10	1	G1	B4
C33	1	B5	F4	J5	1	A3	B1	Q103	2	F4	D4	R53	1	H4	C5	R142	2	F3	C3	U11	1	E1	H3
C34	1	B5	C2	J6	1	A2	A3	Q104	2	F4	D4	R54	1	H3	C5					U15	1	D1	F1
				J12	1	H1	A4	Q107	2	E4	E3	R55	1	H3	C4	R146	2	D4	G4	U16	1	F5	D5
C35	1	B4	G5	J13	1	C5	G5	Q108	2	F3	D4	R56	1	F5	E5	R148	2	E4	E3	U17	1	F1	I2
C36	1	B4	C6	J23	1	H4	B5	Q109	2	F3	D3	R59	1	G4	C6	R149	2	E4	E3	U18	1	F2	I1
C37	1	C5	I2					Q110A	2	D5	E4					R150	2	E4	E3	U101	2	C4	G4
C38	1	C4	B3	J24	1	E1	H2	Q110B	2	E5	E4	R60	1	G3	C5	R153	2	F4	D4	U111	2	C1	E1
C39	1	F4	E5	J101	2	B5	G4	Q111	2	F4	E4	R61	1	D1	G2	R154	2	F3	D4	U115	2	B1	D2
C40	1	B3	A1	J103	2	G4	C4	Q112	2	A5	H4	R64	1	F5	E5	R155	2	F3	D3	U116	2	D5	E4
C41	1	D3	G5	J104	2	G3	C3					R65	1	G4	D5	R156	2	E5	E4				
C42	1	D3	F5	J113	2	A5	G3	R1	1	E5	I5	R66	1	G4	D5	R159	2	F4	D4	W1	1	C5	H5
C43	1	E3	E5	J123	2	G4	C4	R3	1	G4	C5	R67	1	G3	C5	R160	2	F3	D3	W101	2	A5	H4
C44	1	E3	E5	J124	2	C1	E1	R4	1	G4	C5	R68	1	G3	C4								
				J125	2	B3	F3	R5	1	F4	E5	R69	1	D4	F4	R161	2	B1	E2				
C45	1	D5	G5					R6	1	F4	E5	R70	1	D4	F4	R164	2	E5	E4				
C46	1	G5	C6	L1	1	D5	H5	R7	1	E4	F5	R71	1	C5	H5	R165	2	E4	E4				
C47	1	A4	A1	L2	1	A4	B1	R8	1	H4	B5					R166	2	F4	D4				
C48	1	B3	A1	L3	1	D5	H6	R9	1	H3	B5	R72	1	D3	F5	R167	2	F3	D4				

Schematic Diagram <1> Component Locator Chart

Assembly A7. Partial Assembly A7 also shown on Diagram 2.

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram.

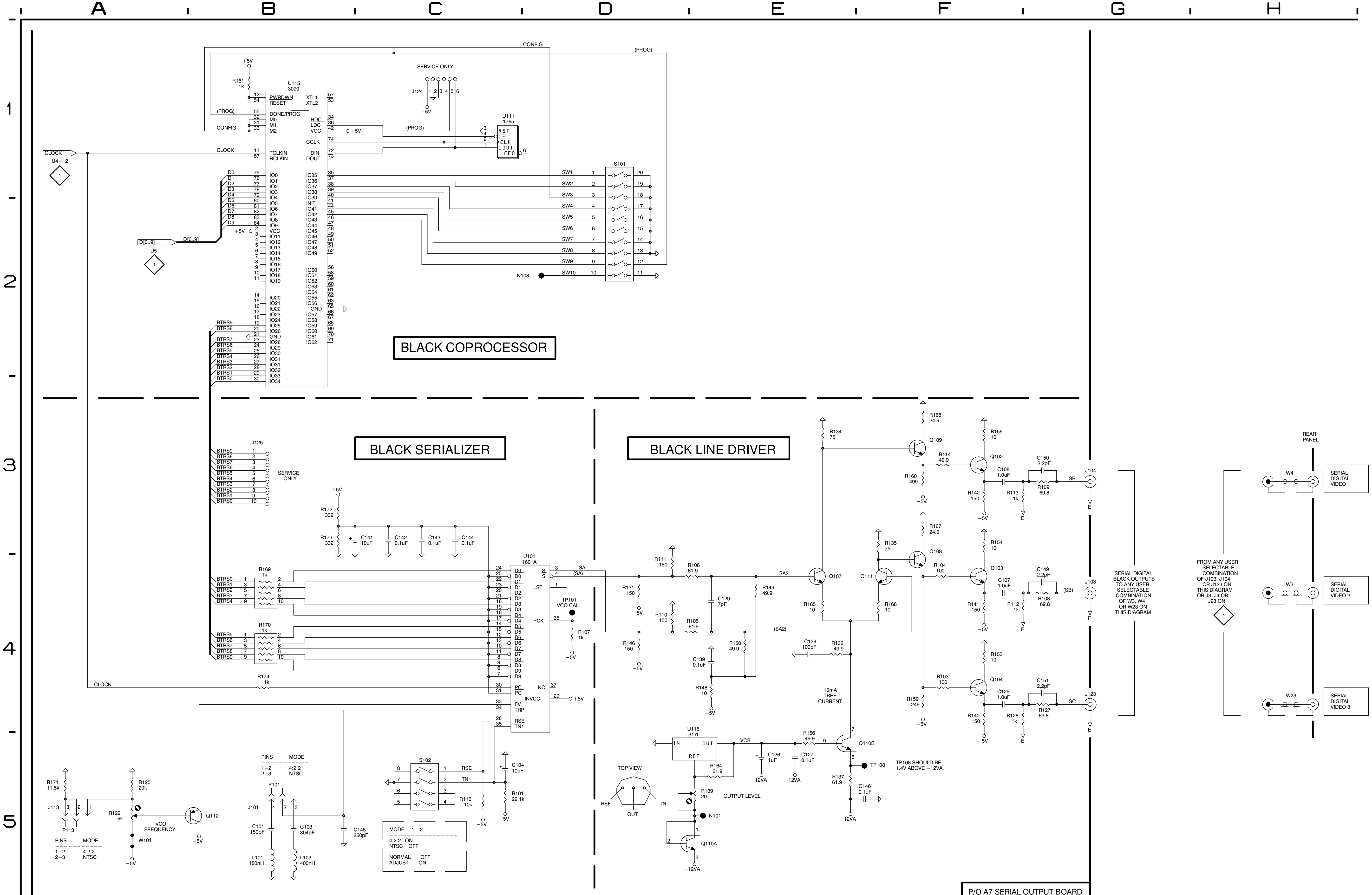
Comp No	Diag Loc	Bd Loc	Comp No	Diag Loc	Bd Loc	Comp No	Diag Loc	Bd Loc	Comp No	Diag Loc	Bd Loc	Comp No	Diag Loc	Bd Loc	Comp No	Diag Loc	Bd Loc	Comp No	Diag Loc	Bd Loc
C1	D5	G5	C29	F4	D5	C147	C5	E5	Q2	G3	C5	R16	E2	G1	R55	H3	C4			
C3	D5	G6							Q3	G4	C5				R56	F5	E5	TP5	A3	H3
C4	E5	H5	C30	B4	A2	J1	D5	G5	Q4	G4	C5	R18	B2	B1	R59	G4	C6	TP6	A4	C3
C7	H4	C5	C31	B4	G4	J3	H4	B5	Q7	G4	D4	R19	B2	B2				TP7	A4	D1
C8	H3	C5	C32	B4	B4	J4	H3	B5	Q8	G4	C5	R20	B3	D1	R60	G3	C5	TP8	G5	C6
			C33	B5	F4	J5	A3	B1				R22	C5	G5	R61	D1	G2			
C9	B4	G2	C34	B5	C2	J6	A2	A3	Q9	G3	D4	R25	C5	H5	R64	F5	E5	U1	E4	F6
C10	B4	E1							Q10A	F5	D5				R65	G4	D5	U3	B2	B2
C11	B4	A2	C35	B4	G5	J12	H1	A4	Q10B	G5	D5	R27	H4	B5	R66	G4	D5	U4	B3	C1
C12	B4	A2	C36	B4	C6	J13	C5	G5	Q11	G4	D5	R28	H5	B5				U5	B1	B1
C13	B4	H2	C37	C5	I2	J23	H4	B5	Q12	C5	G5	R31	F4	F5	R67	G3	C5	U10	G1	B4
			C38	C4	B3	J24	E1	H2				R34	G3	D5	R68	G3	C4			
C14	B5	E2	C39	F4	E5				R1	E5	I5	R35	G3	D5	R69	D4	F4	U11	E1	H3
C15	B4	E5				L1	D5	H5	R3	G4	C5				R70	D4	F4	U15	D1	F1
C16	B4	C3	C40	B3	A1	L2	A4	B1	R4	G4	C5	R36	G4	D5	R71	C5	H5	U16	F5	D5
C17	B5	E5	C41	D3	G5	L3	D5	H6	R5	F4	E5	R37	G5	D5				U17	F1	I2
C18	B4	F3	C42	D3	F5	L4	B3	A1	R6	F4	E5	R39	F5	E5	R72	D3	F5	U18	F2	I1
			C43	E3	E5							R40	H5	B5	R73	D3	G5			
C19	B4	A2	C44	E3	E5	N1	F5	D5	R7	E4	F5	R41	H4	B5	R74	C4	E5	W1	C5	H5
C20	B4	C2				N3	E2	G1	R8	H4	B5				R175	C4	E5			
C21	B5	B3	C45	D5	G5	N4	G2	G2	R9	H3	B5	R42	H3	B5						
C22	A4	B4	C46	G5	C6	N5	G2	H2	R10	F4	E5	R46	F4	G5	S1	E1	H1			
C23	A4	A5	C47	A4	A1	N6	G2	H2	R11	F4	E5	R48	F4	E5	S2	D5	H5			
			C48	B3	A1	N7	G2	H2				R49	F4	D5						
C25	H4	C5	C49	H4	B5				R12	H4	B5	R50	F4	D5	TP1	E4	F5			
C26	F5	D6				P1	D5		R13	H3	B4				TP2	A3	D1			
C27	F5	E5	C50	H3	B5	P13	C5		R14	G3	C5	R53	H4	C5	TP3	A3	H6			
C28	G4	C5	C51	H4	B5				R15	E5	H5	R54	H3	C5	TP4	A3	A5			

Schematic Diagram <2> Component Locator Chart

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram.

Assembly A7. Partial Assembly A7 also shown on Diagram 1.

Comp No	Diag Loc	Bd Loc	Comp No	Diag Loc	Bd Loc	Comp No	Diag Loc	Bd Loc
C101	B5	H4	Q102	F3	D3	R141	F4	C4
C103	B5	H4	Q103	F4	D4	R142	F3	C3
C104	C5	H3	Q104	F4	D4	R146	D4	G4
C107	F4	C4	Q107	E4	E3	R148	E4	E3
C108	F3	C3	Q108	F3	D4	R149	E4	E3
C125	F4	C4	Q109	F3	D3	R150	E4	E3
C126	E5	D4	Q110A	D5	E4	R153	F4	D4
C127	E5	E4	Q110B	E5	E4	R154	F3	D4
C128	E4	D4	Q111	F4	E4	R155	F3	D3
C129	E4	E3	Q112	A5	H4	R156	E5	E4
C139	E4	E3	R101	C5	I3	R159	F4	D4
C141	B3	H3	R103	F4	D4	R160	F3	D3
C142	C3	G3	R104	F4	D4	R161	B1	E2
C143	C3	F3	R105	D4	E4	R164	E5	E4
C144	C3	F3	R106	D4	E3	R165	E4	E4
C145	B5	H4	R107	D4	G4	R166	F4	D4
C146	F5	D4	R108	G4	C4	R167	F3	D4
C149	G4	C4	R109	G3	C3	R168	F3	D3
C150	G3	C3	R110	D4	F4	R169	B4	E3
C151	G4	C4	R111	D4	F3	R170	B4	G3
J101	B5	G4	R112	F4	C4	R171	A5	H4
J103	G4	C4	R113	F3	C3	R172	B3	G3
J104	G3	C3	R114	F3	D3	R173	B3	G3
J113	A5	G3	R115	C5	I3	R174	B4	F4
			R122	A5	H3			
J123	G4	C4				S101	D1	F1
J124	C1	E1	R125	A5	H4	S102	C5	I3
J125	B3	F3	R127	G4	C4			
			R128	F4	C4	TP101	D4	G4
L101	B5	I4	R131	D4	G4	TP108	F5	D4
L103	B5	I4	R134	E3	D3			
						U101	C4	G4
N101	E5	E4	R135	F3	D4	U111	C1	E1
N103	D2	E1	R136	E4	D4	U115	B1	D2
			R137	E5	E4	U116	D5	E4
P101	B5		R139	D5	E4			
P113	A5		R140	F4	C4	W101	A5	H4



TSG 422 OPTION 1S

SERIAL DIGITAL BLACK OUTPUT A7 2

Tektronix MANUAL CHANGE INFORMATION

Date: 8/18/93 **Change Reference:** M79593

Product(s): TSG 422 **Manual Part No:** 070–7022–00

DESCRIPTION

EFF S/N: B030872

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

REPLACEABLE ELECTRICAL PARTS LIST

CHANGE TO READ:

A7	671–2244–10	CKT BD ASSY:SERIAL DIGITAL OUTPUT BOARD
A7R5	322–3077–00	RES,FXD,FILM:61.9 OHM,1%,0.2W
A7R6	322–3077–00	RES,FXD,FILM:61.9 OHM,1%,0.2W
A7R22	311–2232–00	RES,VAR,TRMR:CERMET,2K OHM,20%,0.5W,0.197 SQ,TOP ADJUST
A7R34	322–3085–00	RES,FXD FILM:75 OHM,1%,0.2W
A7R35	322–3085–00	RES,FXD FILM:75 OHM,1%,0.2W
A7R60	322–3164–00	RES,FXD,FILM:499 OHM,1%,0.2W
A7R67	322–3039–00	RES,FXD,FILM:24.9 OHM,1%,0.2W
A7R68	322–3039–00	RES,FXD,FILM:24.9 OHM,1%,0.2W
A7R105	322–3077–00	RES,FXD,FILM:61.9 OHM,1%,0.2W
A7R106	322–3077–00	RES,FXD,FILM:61.9 OHM,1%,0.2W
A7R122	311–2232–00	RES,VAR,TRMR:CERMET,2K OHM,20%,0.5W,0.197 SQ,TOP ADJUST
A7R134	322–3085–00	RES,FXD FILM:75 OHM,1%,0.2W
A7R135	322–3085–00	RES,FXD FILM:75 OHM,1%,0.2W
A7R137	322–3077–00	RES,FXD,FILM:61.9 OHM,1%,0.2W
A7R160	322–3164–00	RES,FXD,FILM:499 OHM,1%,0.2W
A7R164	322–3077–00	RES,FXD,FILM:61.9 OHM,1%,0.2W
A7R167	322–3039–00	RES,FXD,FILM:24.9 OHM,1%,0.2W
A7R168	322–3039–00	RES,FXD,FILM:24.9 OHM,1%,0.2W
A7U11	160–9739–00	IC,MEMORY:CMOS,PROM,64K X 1,SERIAL,PRGM
A7U111	160–9740–00	IC,MEMORY:CMOS,PROM,64K X 1,SERIAL,PRGM

ADD:

A7R21	322–3164–00	RES,FXD,FILM:499 OHM,1%,0.2W
A7R121	322–3164–00	RES,FXD,FILM:499 OHM,1%,0.2W
A7R176	322–3139–00	RES,FXD,FILM:1K OHM,1%,0.2W
A7R177	322–3139–00	RES,FXD,FILM:1K OHM,1%,0.2W
A7R178	322–3139–00	RES,FXD,FILM:1K OHM,1%,0.2W
A7U117	156–4072–00	IC,MISC:BIPOLAR,PWR SUPPLY SUPERVISOR;MPU RESET GENERATOR

Date: 8/18/93	**Change Reference:** M79593
Product(s): TSG 422	**Manual Part No:** 070-7022-00

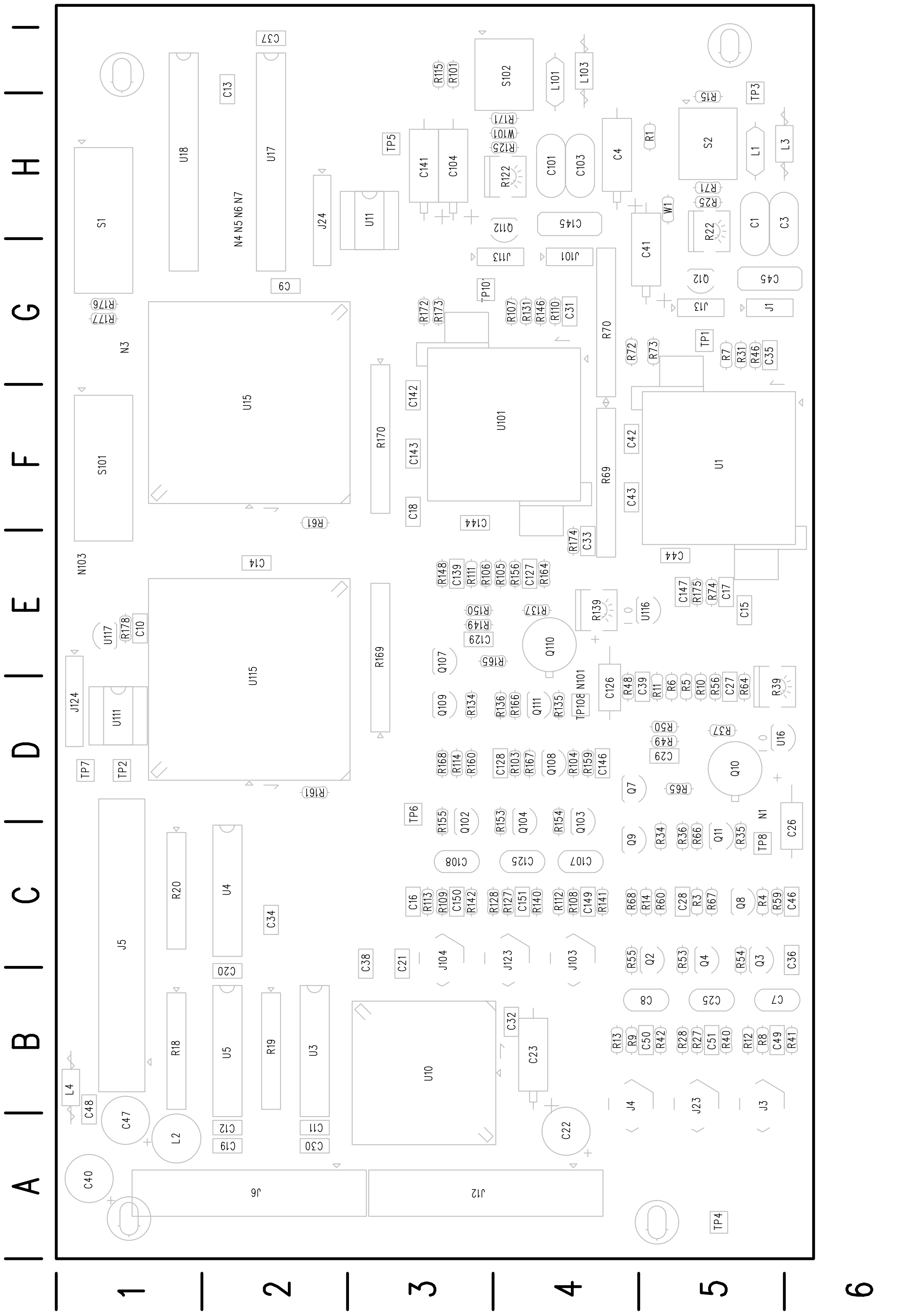
At A7U1 and A7U101 **ADD AS FOLLOWS:**

	ATTACHING PARTS
214–4582–00	HEAT SINK ASSY: IC,PGA;MOUNTING SHOE AND SPRING
214–4321–00	HEAT SINK,ELEC:
	END ATTACHING PARTS

DELETE:

A7R16
A7W1
A7W101

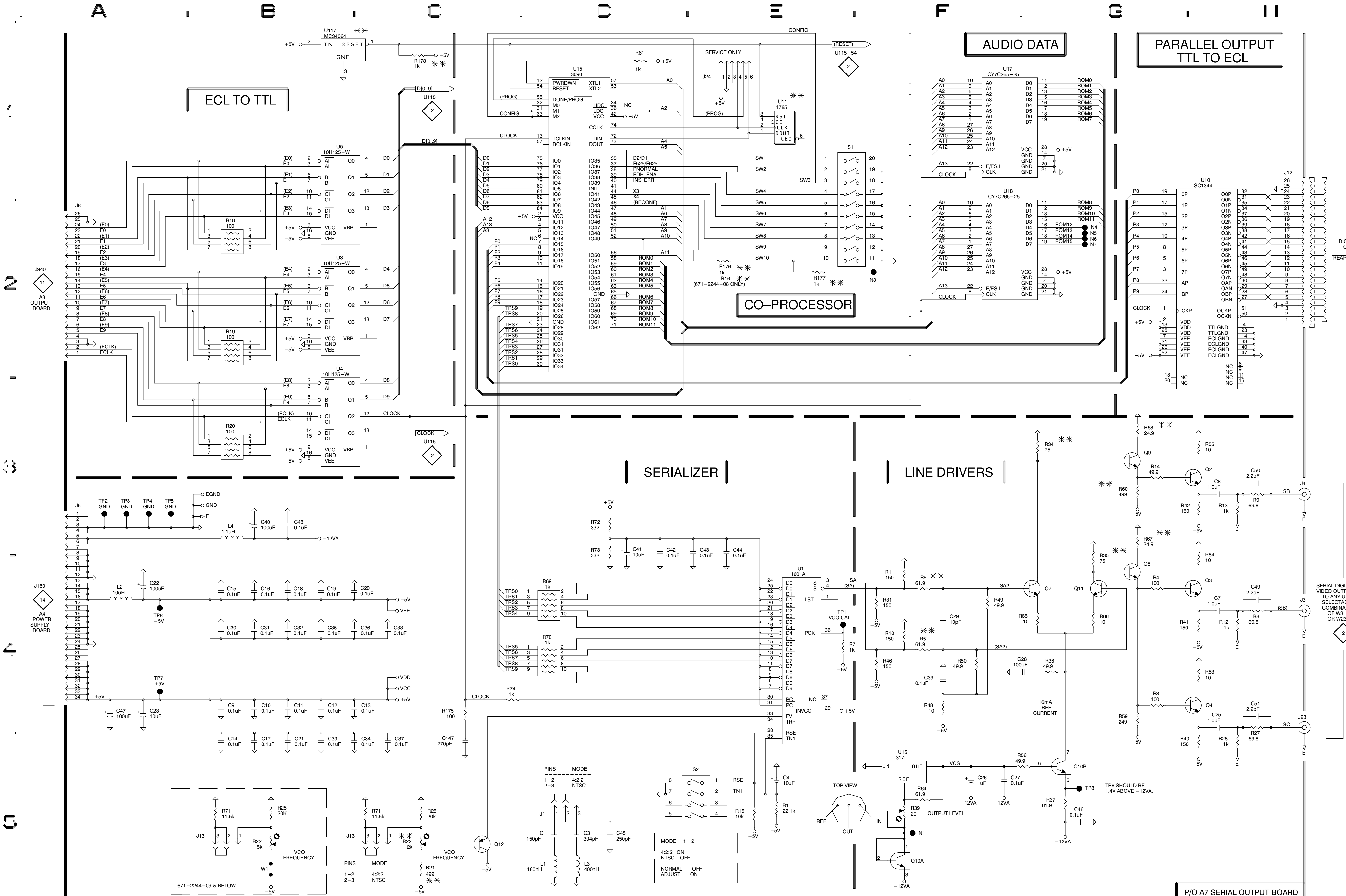
Added parts and circuitry changes are shown in the following schematics.

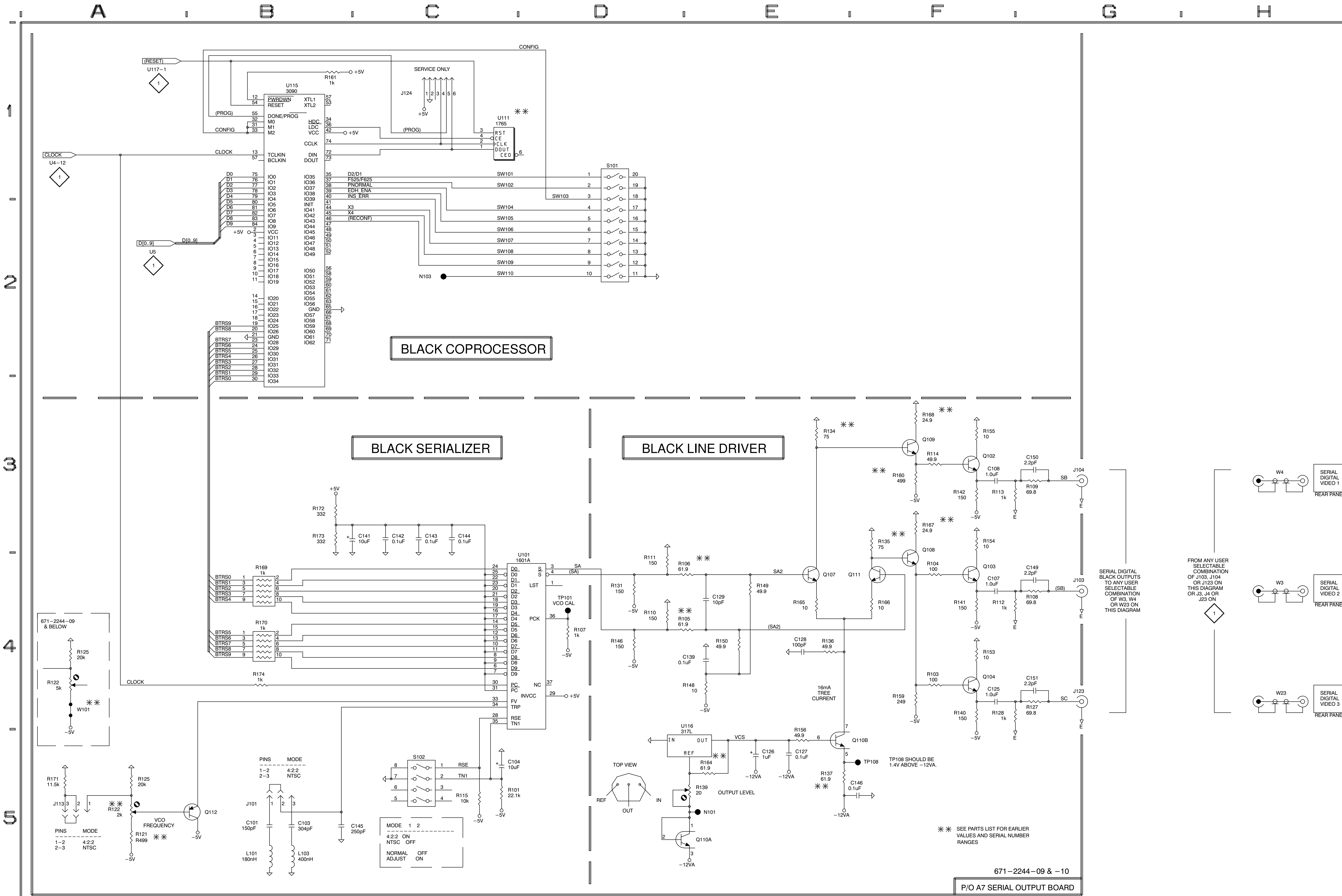


A7 Serial Digital Output Board

M79593

Page 3 of 6


ECL TO TTL
AUDIO DATA
PARALLEL OUTPUT
TTL TO ECL
CO–PROCESSOR
SERIALIZER
LINE DRIVERS
P/O A7 SERIAL OUTPUT BOARD


BLACK COPROCESSOR
BLACK SERIALIZER
BLACK LINE DRIVER
SERVICE ONLY
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES
TP108 SHOULD BE 1.4V ABOVE −12VA.
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
SERIAL DIGITAL VIDEO 1
SERIAL DIGITAL VIDEO 2
SERIAL DIGITAL VIDEO 3
REAR PANEL
671−2244−09 & −10
P/O A7 SERIAL OUTPUT BOARD

Tektronix **MANUAL CHANGE INFORMATION**

Date: 10/26/93 **Change Reference:** C1/1093

Product(s): TSG 422 **Manual Part No:** 070-7022-00

DESCRIPTION

TEXT CHANGES

SECTON 5 PERFORMANCE CHECKS & CALIBRATION PROCEDURES

On pages 5-16 through 5-18, **REMOVE** Performance Checks steps 30 through 34. Please refer to Appendix A for all Performance Checks for serial digital operation.

On pages 5-23, **REMOVE** calibration steps 8 and 9. Please refer to Appendix A for all Performance Checks for serial digital operation. Please refer to Appendix A for all Calibration procedures for serial digital operation.

Tektronix

MANUAL CHANGE INFORMATION

Date: 12/20/93 **Change Reference:** C2/1293

Product(s): TSG-422 **Manual Part No:** 070-7022-00

DESCRIPTION

TEXT CHANGES

UPDATE SERIAL DIGITAL VIDEO INFORMATION

REASONS FOR CHANGE:

Update serial digital video information for the TSG-422.

CHANGES:

Changes to the text of the Manual:

1. Appendix A Option 1S Serial Digital Output
   Update Appendix A with the text given on the following pages.

APPENDIX A
SERIAL DIGITAL VIDEO — OPTION 1S [1]

INTRODUCTION

Option 1S adds Serial Digital Video to the TSG-422 DIGITAL COMPONENT Generator. There are four new bnc connectors on the rear panel (see Fig. A-1), each providing serial digital component video (CCIR REC 656, SMPTE 259M), in scrambled NRZI format.

Operation of the TSG-422 Opt 1S is nearly identical to the standard instrument. The only changes are:

- Four serial digital output that can be configured as either Test Signal or Black.
- the addition of the SDI Check Field (also known as pathological signals SMPTE RP178) to the OTHER SIGNALS signal set

Internally, there is one circuit board added to the instrument. It is near the front of the instrument above the Main board. Externally there are four bncs added. Configure them to output either the selected test signal, a black signal, or any combination of the two in serial digital format.

For the serial signal, ancillary information is added during the blanking time (between EAV and SAV). The ancillary data includes Error Detection and Handling (per SMPTE RP 165) and embedded audio.[2]

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 routed from the Serial Output board to the lower rear panel DIGITAL OUT 2 output. Therefore, the DIGITAL OUT 1 and DIGITAL OUT 2 outputs are no longer identical when serial is installed. The parallel data has been retimed. Additionally, the front panel ± 11 ns SHIFT DATA TIMING and SHIFT 27 MHz CLOCK features do not function for this output.

For more information on the serial signal, itself, please see the TSG-422 Serial Signal section of this Appendix beginning on page A-16.

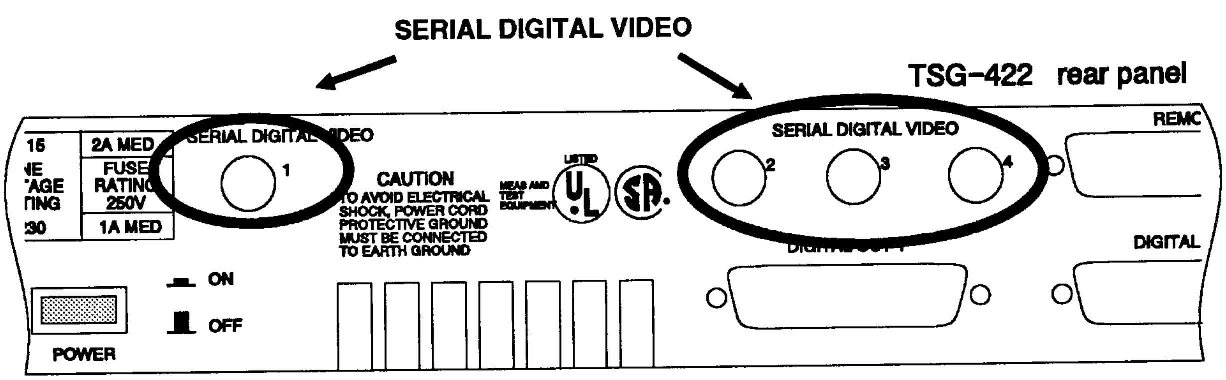


Fig. A-1. Rear panel of the TSG-422.

1 For serial numbers B010570 and above (B020566 and above for instrument shipped to Germany).
2 Embedded Audio is available in instrument with serial numbers B030763 and above.

New Features

SDI Signals [1]

In the same way the standard analog test signals check the performance of video equipment, the SDI signals check the performance of the serial digital transmission and reception equipment.

Three new signals (SDI Check Field per SMPTE RP 178) are added to the OTHER SIGNALS signal set. They include:

- "Bit Slip" and Clock Recovery Test
- Equalizer Test
- SDI Check Field (A matrix of the two signals)

The "bit slip" signal stresses the recovery ability of the receiver's clock regenerator by sending a long, string of twenty 0's followed by a single 1.

The equalizer test signal contains a maximum low frequency content. It repeats a string of nineteen 0's followed by two 1's.

The new complete list of signals available from the OTHER SIGNALS button on the front panel, is given in Table A-1.

Table A-1. List of signals available under the OTHER SIGNALS button.

SWITCH	SWITCH NAME	SIGNALS
OTHER SIGNALS	OTHER SIGNALS	Convergence Light Blue Ramp Digital Gray Measurement Matrix Test Equalizer (SDI) "Bit Slip" & Clock Recovery (SDI) Serial Matrix (SDI)

Digital Black [2]

Digital Black is defined as 040_h for the Y channel and 200_h for the B-Y and R-Y channels during active video. Embedded audio is not available on the black outputs. The four rear-panel SERIAL DIGITAL VIDEO bncs can be configured as either test signal, digital black outputs, or in any combination of the two.

Configuring Digital Black

There are four wires directly connected to the rear-panel SERIAL DIGITAL VIDEO bncs. These wires can be connected to J3, J23, J4, J103, J123, or J104 in any order or combination to configure the instrument so it will be the most useful for a particular application. See Fig. A-2 for the location of the jumpers on the Serial Output board.

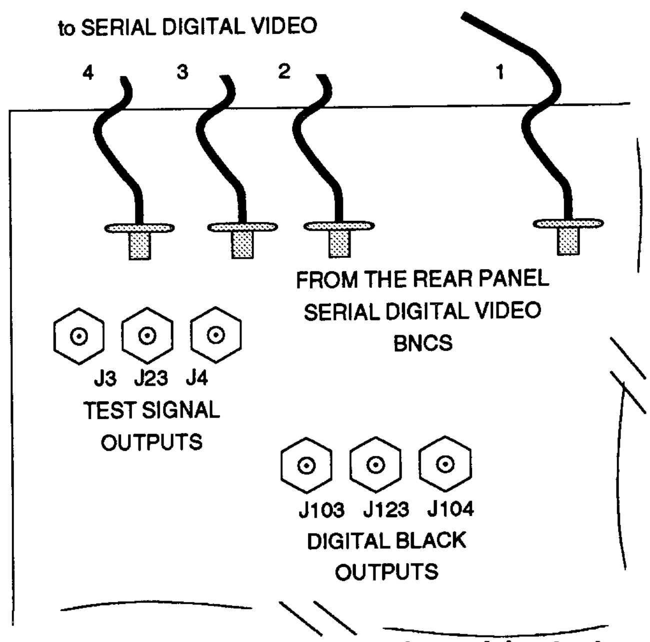


Fig. A-2. How to configure the serial outputs for either Test Signal or Black.

The TSG-422 is factory set for:

SERIAL DIGITAL VIDEO OUTPUT #		
4	J4	TEST SIGNAL
3	J3	TEST SIGNAL
2	J23	TEST SIGNAL
1	J104	BLACK

1 SDI signals are available on instruments with serial numbers B010505 and above.
2 Digital Black is available on instruments with Serial board part number 671-2244-06. (-06 and up)

SPECIFICATIONS

The specifications for the SERIAL DIGITAL VIDEO output are shown in Table A-2. As with the specification 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. The specifications are valid when the instrument is calibrated in a room with the ambient temperature between +20°C and +30°C.

Table A-2.
Specifications for the Serial Digital Output.

CHARACTERISTIC	PERFORMANCE REQUIREMENT	SUPPLEMENTAL INFORMATION
Connector		BNC
Number of Outputs	4	Selectable from test signal or digital black outputs. Separate drivers for each signal.
Digital Format		CCIR 601 Component 525/625, 8-bit or 10-bit data, Scrambled NRZI, per SMPTE 259M.
Bit Rate		270 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		75 Ω with return loss more than 15 dB, 5 to 270 MHz.
Video Signals	Per Table 3-4.	
Error Detection Ancillary Data		Active picture CRC (0-AP-CRC), Full field CRC (0-FF-CRC), On lines 9 & 272 (525) or 5 & 318 (625). (See Table A-8 for details.)
Embedded Audio		Only available on Test Signal outputs. Supports 20-bit 48 kHz synchronous audio conforming to Section 4.4A of SMPTE Proposed Document S17.100.

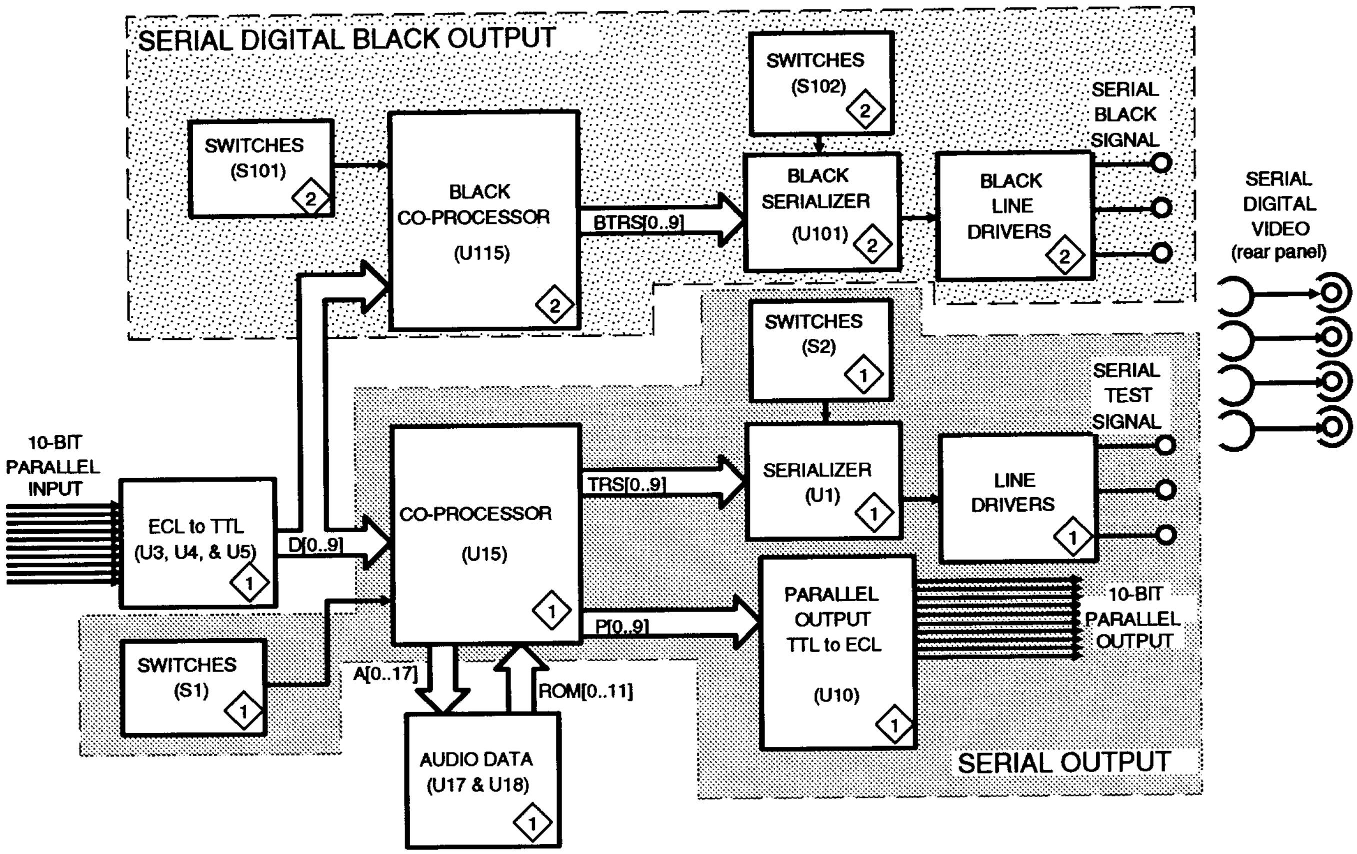


Fig. A-3.
Block Diagram of the TSG-422 Serial Output Board.

THEORY OF OPERATION

Fig. A-3 shows a basic block diagram of the TSG-422's Serial board.

A copy of the Parallel Output (from J940 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. The Co-processor calculates the EDH CRC (Cyclic Redundancy Code) used for error detection. It also inserts the audio data from U17 and U18. The Co-processor then outputs two sets of the parallel data: one for the parallel output path (P[0..9]), 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 OUT 2 connector.

The data for the serial output path is applied to the serializer, U1. The serializer provides digital component 8-bit or 10-bit serial data in scrambled NRZI code, at a 270 Mb/s bit rate. The serial data stream is output at U1-3 and U1-4.

The serial data is applied to a push-pull amplifier, Q7 and Q11, which drives emitter followers Q9, Q2, Q8, and Q4. The push-pull 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 SMPTE standard 259M 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 black level values. The B-Y and R-Y data channels are set to 200_h and data in the Y channel is replaced with 040_h. The EDH CRCs are calculated and inserted in the signal. The signal is then applied to the Black Serializer, U101. The serializer then provides 10-bit serial black in NRZI code at a 270 MHz rate. The serial data stream is output at pins 3 and 4.

The serial data is applied to a push-pull amplifier, Q107 and Q111, which drives emitter followers Q109, Q102, Q108, and Q104. The push-pull 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 SMPTE 259M standard for serial digital video.

JUMPERS & SWITCHES

Table A-3. Switch S1 Operating Selections.
OFF = 1 = OPEN
ON = 0 = CLOSED

<table>
<tr><th colspan="2">SWITCH NAME</th><th colspan="3">SWITCH POSITION</th><th>DESCRIPTION</th><th>FACTORY SETTING</th></tr>
<tr><td>1</td><td rowspan="2">8 or 10 Bit Resolution</td><td>1</td><td colspan="2">2</td><td rowspan="2">Normal Operation
Disable EDH insertion
Insert Error (Format error and ESP flags set)
8-bit format on serial and parallel output ports.</td><td rowspan="2">1=open
2=open</td></tr>
<tr><td>2</td><td>open
open
closed
closed</td><td colspan="2">open
closed
open
closed</td></tr>
<tr><td>3</td><td>Debug</td><td colspan="3">closed
open</td><td>Normal Operation.
Debug (Service use only).</td><td>closed</td></tr>
<tr><td>4</td><td rowspan="3">Embedded Audio Selections</td><td>4</td><td>5</td><td>6</td><td rowspan="3">Transmit 1 KHz on all channels.
Transmit 800 Hz on all channels.
Transmit 1 KHz on CH3 and CH4 only.
Transmit 800 Hz on CH3 and CH4 only.
Transmit 1 KHz on CH1 and CH2 only.
Transmit 800 Hz on CH1 and CH2 only.
Transmit 0 Hz on all channels.
Audio disabled.</td><td rowspan="3">4=open
5=open
6=open</td></tr>
<tr><td>5</td><td rowspan="2">open
open
open
open
closed
closed
closed
closed</td><td rowspan="2">open
open
closed
closed
open
open
closed
closed</td><td rowspan="2">open
closed
open
closed
open
closed
open
closed</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td></td><td colspan="3"></td><td>unused</td><td></td></tr>
<tr><td>8</td><td></td><td colspan="3"></td><td>unused</td><td></td></tr>
<tr><td>9</td><td></td><td colspan="3"></td><td>unused</td><td></td></tr>
<tr><td>10</td><td>Emphasis</td><td colspan="3">open
closed</td><td>No emphasis.
50/15 µs emphasis.</td><td>open</td></tr>
</table>

Table A-4. Switch S101 (Black) Operating Selections.
OFF = 1 = OPEN
ON = 0 = CLOSED

SWITCH NAME		SWITCH POSITION	DESCRIPTION	FACTORY SETTING
1	8 or 10 Bit Resolution	closed open	8 bits 10 bits	open
2			unused	open
3	System Configuration	closed open	Normal Operation (must be in this postion of power-up). Debug (Service use only).	closed
4			unused	open
5	EDH Disable	closed open	EDH Disabled EDH Enabled	open
6	Insert EDH Error	closed open	Insert EDH Errors. (Both FF-CRC and AP-CRC errors.) Normal Operation.	open
7			unused	open
8	Black Enable	open closed	Enable Digital Black Output. (0 IRE) Disable Digital Black Output (Test Signal Output).	open
9			unused	open
10			unused	open

**Table A-5. Jumper Operating Selections.
All these jumpers are for internal use ONLY.
Please leave the jumpers in their factory set positions.
ALL jumpers must be set to the same pins.**

JUMPER	NAME	DESCRIPTION	FACTORY SET POSITION
J1 <1>	Standard Selection	1-2 — 4:2:2 2-3 — NTSC	1-2
J13 <1>	Standard Selection	1-2 — 4:2:2 2-3 — NTSC	1-2
J101 <2>	Standard Selection	1-2 — 4:2:2 2-3 — NTSC	1-2
J113 <2>	Standard Selection	1-2 — 4:2:2 2-3 — NTSC	1-2

Table A-6. Switch S2 Operating Selections.

SWITCH	NAME	DESCRIPTION	FACTORY SET POSITION
S2-1	RSE	Open: Selects Composite operating frequency for serializer VCO. Closed: Selects Component operating frequency for serializer VCO.	CLOSED
S2-2	TN1	Open: Normal Closed: Test	OPEN
S2-3	not used		
S2-4	not used		

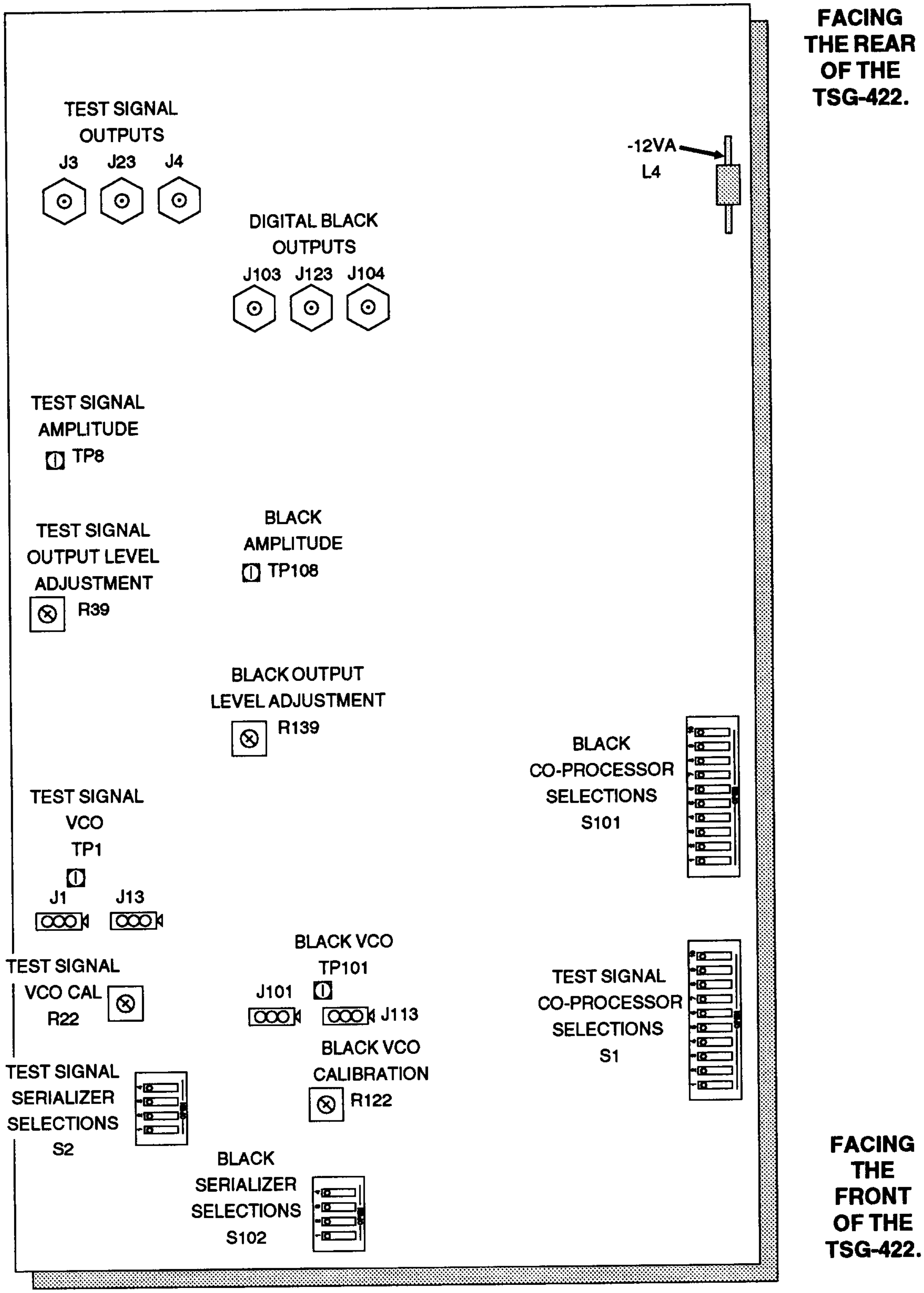


Fig. A-4. Location of User-adjustable jumpers and switches on the Serial Output board.

Table A-7. Switch S102 Operating Selections.

SWITCH	NAME	DESCRIPTION	FACTORY SET POSITION
S2-1	RSE	open: Selects Composite operating frequency for serializer VCO. closed: Selects Component operating frequency for serializer VCO.	closed
S2-2	TN1	open: Normal closed: Test	open
S2-3	not used		
S2-4	not used		

MAINTENANCE

Two parts on the TSG-422 Serial Output board require special handling during removal. U15 and U115 need a special tool for removal from their socket: AMP Extraction Tool part number 821590-1 for high pressure TIN chip carrier socket. See Fig. A-5. (Any other tool designed for this purpose and this size chip can be used.)

Follow the directions provided with the extraction tool for its use.

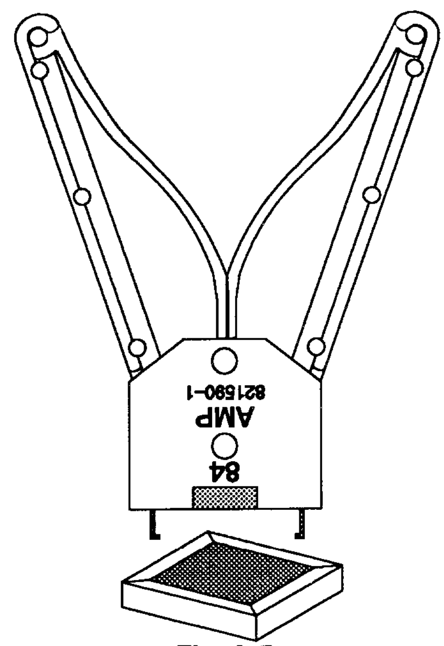


Fig. A-5.
Special tool required to remove U15 from its holder.

PERFORMANCE CHECK & ADJUSTMENT PROCEDURE

REQUIRED TEST EQUIPMENT

Due to the higher frequency of the serial digital output, the test oscilloscope mainframe and plug-ins used to test it must have a much higher bandwidth than for the standard instrument. A 1 GHz Tektronix 11403A mainframe with a 1 GHz Tektronix 11A72 Dual trace plug-in is recommended for testing the option 1S Serial Output.

To check the embedded audio the following additional test equipment is required:

1. A serial digital demultiplexer, (SONY BKPF-106C). The demux must be able to:

- check for the presence of embedded audio and
- have a separate digital audio output.

2. A digital to analog converter. A DAT (Digital Audio Tape) Recorder will work. It must be able to:

- accept ASE\EBU digital audio signal,
- have a output for headphones or speakers, and
- optionally, an output for an oscilloscope connection.

3. 50 to 75 Ohm Min. Loss Pad. Tektronix part number 011-0112-00.

4. 50 Ohm bnc cable. (An example is Tektronix part number 012-0076-00.)

5. OPTIONAL: headphones to listen to the quality of the audio tone.

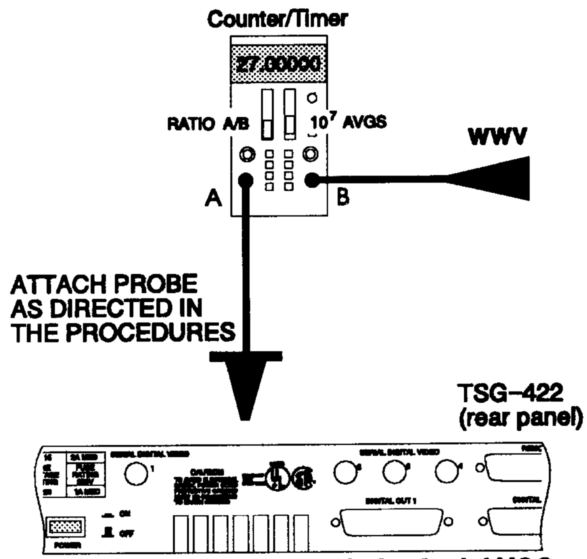


Fig. A-6. Setup to Check the Serial VCO Frequency.

PERFORMANCE CHECK PROCEDURES

1. **Check VCO Frequencies**

   a. Connect the equipment as shown in Fig. A-6. Connect the probe to TP1 on the Serial Output board.

   b. Make sure that S2-2 is in the OFF (OPEN) position.

   c. Set the DC503 (Counter/Timer) AVGS to 10^7.

   d. **CHECK** — that the frequency at TP1 is 27.0 MHz ± 100 kHz.

   e. Connect the probe to TP101 on the Serial Output board.

   f. Make sure that S102-2 is in the OFF (OPEN) position.

   g. Set the DC503 (Counter/Timer) AVGS to 10^7.

   h. **CHECK** — that the frequency at TP101 is 27.0 MHz ± 100 kHz.

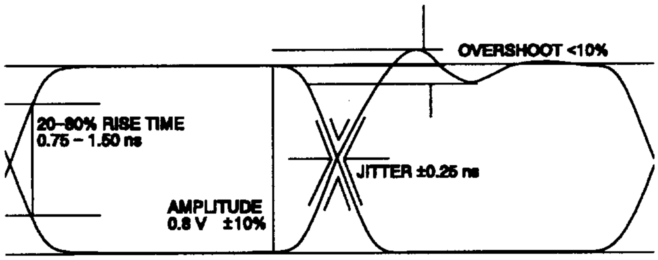


Fig. A-7. Eye pattern specs for the serial signal. Displays the amplitude, jitter, overshoot, and rise and fall times.

f. CHECK — using the oscilloscope cursors (horizontal bar) that the signal amplitude, not including undershoot or overshoot, is between 720 and 880 mV_{p-p}.

g. Repeat this procedure for the other two SERIAL TEST SIGNAL outputs.

h. Connect W3, W23, and W4 to J103, J123, and J104.

i. Repeat these procedures for the Serial Digital Black signals.

2. Check Serial Digital Output Amplitude

a. Connect the equipment as shown in Fig. A-7.

b. Connect W3, W23, and W4 to J3, J23, and J4.

c. Press the AUTOSET button on the oscilloscope to give a starting point for triggering and adjusting the signal.

d. In the ***WAVEFORM HORIZONTAL DESC*** menu, set the ***Display Type*** to: ***VARIABLE PERSISTENT***. This adjustment should result in the outline of the eye pattern displayed on the screen. The eye pattern should be similar to Fig. A-8.

e. Set the oscilloscope to view the signal at 100 mV/Div and 2 ns/Div. Trigger from the main window, on the positive slope (+).

3. Check SERIAL DIGITAL Output Rise and Fall Times

a. Connect the equipment as shown in Fig. A-7.

b. Connect W3, W23, and W4 to J3, J23, and J4.

c. In the ***WAVEFORM HORIZONTAL DESC*** menu, set the ***Display Type*** to: ***NORMAL***.

d. From the oscilloscope's ***MEASUREMENTS*** menu timing selections, select ***RISE*** and ***FALL***.

e. Set the ***RISE*** time menu as shown in the table on the next page.

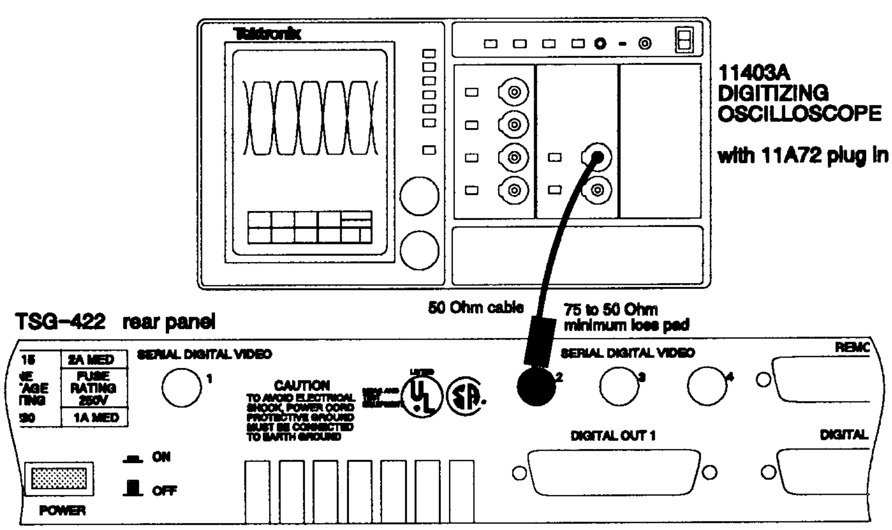


Fig. A-8.
Setup to check the Serial Digital Output:
Amplitude, Rise & Fall Times, Overshoot & Undershoot, and DC Level.

Tracking	Both
Proximal	20%
Distal	80%
Left Limit & Right Limit	Set to bracket the transition to be measured. Transition should change color between proximal and distal cursors.

f. From the oscilloscope's ***TRIGGER*** menu, set the slope to "+".

g. **CHECK** — that the rise time is between 0.75 and 1.50 ns.

h. Change the slope to "—", from the ***TRIGGER*** menu.

i. Select ***FALL*** from the ***MEASUREMENTS*** menu.

j. **CHECK** — that the fall time is between 0.75 and 1.50 ns.

k. Repeat this procedure for the other two SERIAL TEST SIGNAL Outputs.

l. Connect W3, W23, and W4 to J103, J123, and J104.

m. Repeat these procedures for the Serial Digital Black signals.

4. Check Serial Digital Output Overshoot and Undershoot

a. Connect the equipment as shown in Fig. A-7.

b. Connect W3, W23, and W4 to J3, J23, and J4.

c. Select ***OVERSHOOT*** and ***UNDERSHOOT*** from the ***MEASUREMENTS*** menu.

d. Select from the ***OVERSHOOT*** menu:

Left Limit	0%
Right Limit	100%
Tracking	Both
Time Mode	Relative

e. Set the ***TRIGGER SLOPE*** to "+".

f. **CHECK** — that the measured overshoot is less than 10%.

g. Set the ***TRIGGER SLOPE*** to "—".

h. Select ***UNDERSHOOT***.

i. **CHECK** — that the measured undershoot is less than 10%.

j. Repeat this procedure for the other two SERIAL TEST SIGNAL Outputs.

k. Connect W3, W23, and W4 to J103, J123, and J104.

l. Repeat these procedures for the Serial Digital Black signals.

5. Check Serial Digital Output DC Level

a. Connect the equipment as shown in Fig. A-7.

b. Connect W3, W23, and W4 to J3, J23, and J4.

c. Select ***MID*** from the ***MEASUREMENTS*** menu.

d. From the ***MID*** menu select:

Left Limit	0%
Right Limit	100%
Time Mode	Relative

e. **CHECK** — that the measured ***MID*** point is 0 V ± 0.5 V.

f. Repeat this procedure for the other two SERIAL TEST SIGNAL Outputs.

g. Connect W3, W23, and W4 to J103, J123, and J104.

h. Repeat these procedures for the Serial Digital Black signals.

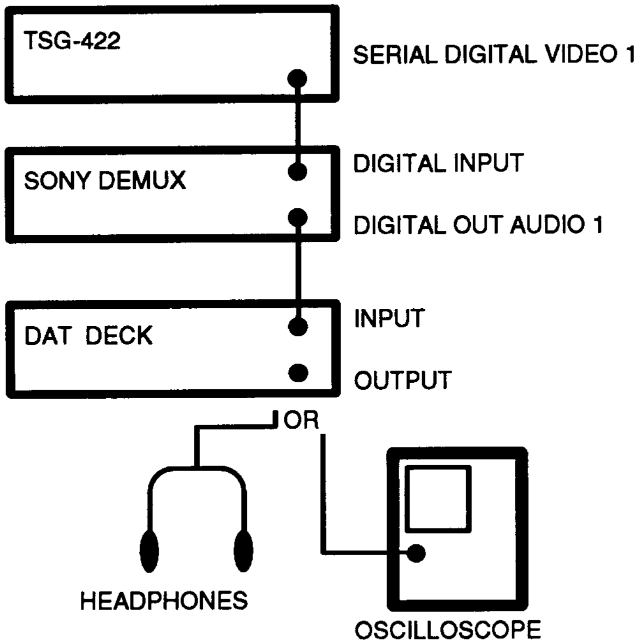


Fig. A-9. How to connect the test equipment to check the content of the embedded audio.

6. Check The Accuracy of the Embedded Audio

a. Connect the equipment as shown in Fig. A-9.

b. Ensure that DIGITAL INPUT 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 1KHz audio tone using either headphones or an oscilloscope.

g. Change S1-4 on the TSG-422 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-422's 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

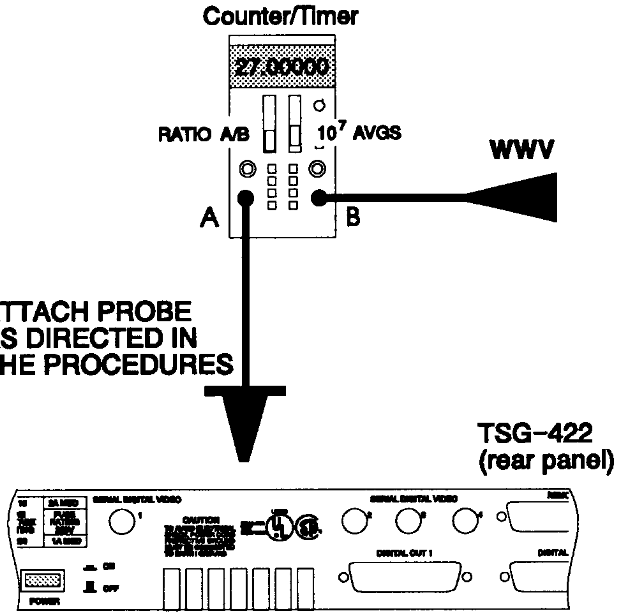


Fig. A-10. Setup to Adjust the Serial VCO Frequency.

1. Adjust VCO Test Signal Frequency

a. Connect the equipment as shown in Fig. A-10, 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 to ON (CLOSED).

d. **ADJUST** — R22 on the Serial Output board for a frequency of approximately 27.0 MHz.

e. Set S2-2 to OFF (OPEN) and set the Counter/Timer's AVGS to 10^7.

f. **CHECK** — that the frequency at TP1 is 27.0 MHz ± 100 kHz.

g. Repeat the above procedures until the frequency is within spec.

2. Adjust VCO Digital Black Frequency

a. Connect the equipment as shown in Fig. A-10, 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 to ON (CLOSED).

d. **ADJUST** — R122 on the Serial Output board for a frequency of approximately 27.0 MHz.

e. Set S2-2 to OFF (OPEN) and set the Counter/Timer's AVGS to 10^7.

f. **CHECK** — that the frequency at TP101 is 27.0 MHz ± 100 kHz.

g. Repeat the above procedures until the frequency is within spec.

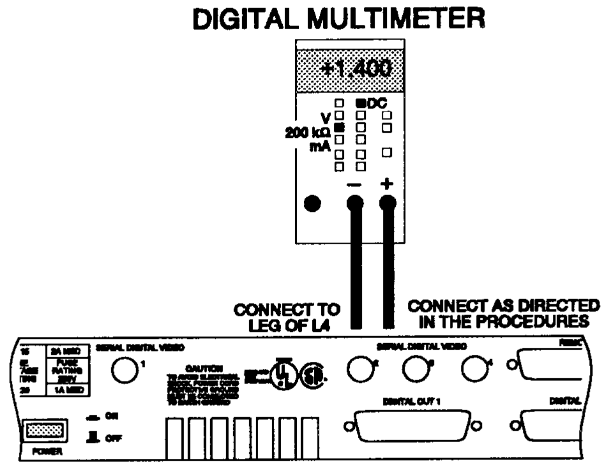


Fig. A-11.
Setup to adjust the Serial Digital Video Output Amplitude.

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-11.

b. **ADJUST** — R39 for 1.4 V between TP8 and -12VA.

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-11.

b. **ADJUST** — R139 for 1.4 V between TP8 and -12VA.

This ends the calibration portion of the Adjustment Procedure. Now do a complete Performance Check to reverify all specifications.

THE TSG-422 SERIAL SIGNAL (MORE INFORMATION)

Table A-8. Definitions for Error Data Handling (EDH).
(Following SMPTE RP-165)
For 525 Line 9 Field I & III and Line 272 Field II & IV
For 625 Line 5 Fields I & III and Line 318 Fields II & IV

Data Word & Description start with sample 1689 (1701)	bits										525 #	625 #
	9	8	7	6	5	4	3	2	1	0		
Anc Data Header	0	0	0	0	0	0	0	0	0	0	1689	Y 850
Anc Data Header	1	1	1	1	1	1	1	1	1	1	1690	C_r 425
Anc Data Header	1	1	1	1	1	1	1	1	1	1	1691	Y 851
Data ID	0	1	1	1	1	1	0	1	0	0	1692	C_b 426
Block Number	1	0	0	0	0	0	0	0	0	0	1693	Y 852
Data Count	0	1	0	0	0	1	0	0	0	0	1694	C_r 426
APL[1]	$\overline{P}$[7]	P(7)	AP-CRC[8] bits 5-0						0	0	1695	Y 853
APM[1]	$\overline{P}$	P	AP-CRC bits 11-6						0	0	1696	C_b 427
APH[1]	$\overline{P}$	P	V[6]	0	AP-CRC bits 15-12				0	0	1697	Y 854
FFL[2]	$\overline{P}$	P	FF-CRC[9] bits 5-0						0	0	1698	C_r 427
FFM[2]	$\overline{P}$	P	FF-CRC bits 11-6						0	0	1699	Y 855
FFH[2]	$\overline{P}$	P	V	0	FF-CRC bits 15-12				0	0	1700	C_b 428
AN STAT[3]	$\overline{P}$	P	0	an ues (10)	an ida (11)	an idh (12)	an eda (13)	an edh (14)	0	0	1701	Y 856
AP STAT[4]	$\overline{P}$	P	0	ap ues	ap ida	ap idh	ap eda	ap edh	0	0	1702	C_r 428
FF STAT[5]	$\overline{P}$	P	0	ff ues	ff ida	ff idh	ff eda	ff edh	0	0	1703	Y 857
reserved (7 words)	1	0	0	0	0	0	0	0	0	0	1704	C_b 429 - Cr 430
Checksum	$\overline{8}$	8	7	6	5	4	3	2	1	0	1711	Y 861

(1) APL, APM, & APH — Active Picture Low, Middle, and High. Includes samples 0-1439

(2) FFL, FFM, & FFH — Full Field Low, Middle, and High. Includes all samples in all lines except lines 9-11 & 272-274 (5-7 & 318-320).

(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. V = 1, if valid CRC is calculated.
(7) P & $\overline{\text{P}}$ — Even Parity.
(8) AP-CRC — Active Picture Cyclic Redundancy Code. 16-bit code derived from all of the bits in the active picture.
(9) FF-CRC — Full Field Cyclic Redundancy Code. A 16-bit code derived from almost bits in the field (in 525 it excludes lines 9 - 11 and part of 12 and 272 - 274 and part of 275).
(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. A non-transmission error is 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.

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 blanking.

There is a choice of several different types of audio for the TSG-422 to output: either 800 or 1000 Hz on all channels or one channel pair at a time. The embedded audio can also be disabled or all channels set to 0 Hz. The selection is made by S1-4, S1-5, and S1-6 on the Serial Output board. (See Table A-3 on page A-5 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-9. Table A-9 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-422.

The minimum buffer size required for the receiver is well under the standard requirement of 64 samples/channel.

Table A-9. Basic Structure of the Audio Signal.

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.

Sample Distribution of Audio Data on the TSG 422's Serial Signal

525/60 Audio Sample Distribution.

Field 1: Line Number	Transmitted Samples/CH	Total	Field 2: Line Number	Transmitted Samples/CH	Total
1	4 samples/line	4			
2 - 8	3 samples/line	21	264 - 271	3 samples/line	24
9	4 samples/line	4	272	4 samples/line	4
10 -11	0 samples/line	0	273 - 274	0 samples/line	0
12 - 24	3 samples/line	39	275 - 287	3 samples/line	39
25	4 samples/line	4	288	4 samples/line	4
26 - 38	3 samples/line	39	289 - 301	3 samples/line	39
39	4 samples/line	4	302	4 samples/line	4
40 - 52	3 samples/line	39	303 - 315	3 samples/line	39
53	4 samples/line	4	316	4 samples/line	4
54 - 66	3 samples/line	39	317 - 329	3 samples/line	39
67	4 samples/line	4	330	4 samples/line	4
68 - 80	3 samples/line	39	331 - 343	3 samples/line	39
81	4 samples/line	4	344	4 samples/line	4
82 - 94	3 samples/line	39	345 - 357	3 samples/line	39
95	4 samples/line	4	358	4 samples/line	4
96 - 108	3 samples/line	39	359 - 371	3 samples/line	39
109	4 samples/line	4	372	4 samples/line	4
110 - 122	3 samples/line	39	373 - 385	3 samples/line	39
123	4 samples/line	4	386	4 samples/line	4
124 - 136	3 samples/line	39	387 - 399	3 samples/line	39
137	4 samples/line	4	400	4 samples/line	4
138 - 150	3 samples/line	39	401 - 413	3 samples/line	39
151	4 samples/line	4	414	4 samples/line	4
152 - 164	3 samples/line	39	415 - 427	3 samples/line	39
165	4 samples/line	4	428	4 samples/line	4
166 - 178	3 samples/line	39	429 - 441	3 samples/line	39
179	4 samples/line	4	442	4 samples/line	4
180 - 192	3 samples/line	39	443 - 455	3 samples/line	39
193	4 samples/line	4	456	4 samples/line	4
194 - 206	3 samples/line	39	457 - 469	3 samples/line	39
207	4 samples/line	4	470	4 samples/line	4
208 - 220	3 samples/line	39	471 - 483	3 samples/line	39
221	4 samples/line	4	484	4 samples/line	4

Field 1: Line Number	**Transmitted Samples/CH**	Total	**Field 2: Line Number**	**Transmitted Samples/CH**	Total
222 - 234	3 samples/line	39	485 - 497	3 samples/line	39
235	4 samples/line	4	498	4 samples/line	4
236 - 248	3 samples/line	39	499 - 511	3 samples/line	39
249	4 samples/line	4	512	4 samples/line	4
250 - 260	3 samples/line	33	513 - 525	3 samples/line	39
261*	3/4 samples/line	3			
262	3 samples/line	3			
263	4 samples/line	4			
Total Samples		803			798

* Line 261 has 4 samples in Field 1, 5, and 9. Three samples in the other fields.

625/50 Audio Sample Distrobution

Field 1: Line Number	Transmitted Samples/CH	Total	Field 2: Line Number	Transmitted Samples/CH	Total
			314	4 samples/line	4
1 - 5	3 samples/line	18	315 - 318	3 samples/line	12
6 - 7	0 samples/line	0	319 - 320	0 samples/line	0
8	4 samples/line	4	321	4 samples/line	4
9 - 18	3 samples/line	30	322 - 331	3 samples/line	30
19	4 samples/line	4	332	4 samples/line	4
20 - 29	3 samples/line	30	333 - 342	3 samples/line	30
30	4 samples/line	4	343	4 samples/line	4
31 - 40	3 samples/line	30	344 - 353	3 samples/line	30
41	4 samples/line	4	354	4 samples/line	4
42 - 51	3 samples/line	30	355 - 364	3 samples/line	30
52	4 samples/line	4	365	4 samples/line	4
53 - 62	3 samples/line	30	366 - 375	3 samples/line	30
63	4 samples/line	4	376	4 samples/line	4
64 - 73	3 samples/line	30	377 - 386	3 samples/line	30
74	4 samples/line	4	387	4 samples/line	4
75 - 84	3 samples/line	30	388 - 397	3 samples/line	30
85	4 samples/line	4	398	4 samples/line	4
86 - 95	3 samples/line	30	399 - 408	3 samples/line	30
96	4 samples/line	4	409	4 samples/line	4
97 - 106	3 samples/line	30	410 - 419	3 samples/line	30
107	4 samples/line	4	420	4 samples/line	4
108 - 117	3 samples/line	30	421 - 430	3 samples/line	30
118	4 samples/line	4	431	4 samples/line	4
119 - 128	3 samples/line	30	432 - 441	3 samples/line	30
129	4 samples/line	4	442	4 samples/line	4
130 - 139	3 samples/line	30	443 - 452	3 samples/line	30
140	4 samples/line	4	453	4 samples/line	4
141 - 150	3 samples/line	30	454 - 463	3 samples/line	30
151	4 samples/line	4	464	4 samples/line	4
152 - 161	3 samples/line	30	465 - 475	3 samples/line	30
162	4 samples/line	4	475	4 samples/line	4
163 - 172	3 samples/line	30	476 - 485	3 samples/line	30
173	4 samples/line	4	486	4 samples/line	4
174 - 183	3 samples/line	30	487 - 496	3 samples/line	30
184	4 samples/line	4	497	4 samples/line	4

Field 1: Line Number	Transmitted Samples/CH	Total	Field 2: Line Number	Transmitted Samples/CH	Total
183 - 194	3 samples/line	30	498 - 507	3 samples/line	30
195	4 samples/line	4	508	4 samples/line	4
196 - 205	3 samples/line	30	509 - 518	3 samples/line	30
206	4 samples/line	4	519	4 samples/line	4
207 - 216	3 samples/line	30	520 - 529	3 samples/line	30
217	4 samples/line	4	530	4 samples/line	4
218 - 227	3 samples/line	30	531 - 539	3 samples/line	30
228	4 samples/line	4	540	4 samples/line	4
229 - 238	3 samples/line	30	541 - 551	3 samples/line	30
239	4 samples/line	4	552	4 samples/line	4
240 - 249	3 samples/line	30	553 - 562	3 samples/line	30
250	4 samples/line	4	563	4 samples/line	4
251 - 260	3 samples/line	30	564 - 573	3 samples/line	30
261	4 samples/line	4	574	4 samples/line	4
262 - 271	3 samples/line	30	575 - 584	3 samples/line	30
272	4 samples/line	4	585	4 samples/line	4
273 - 282	3 samples/line	30	586 - 595	3 samples/line	30
283	4 samples/line	4	596	4 samples/line	4
284 - 293	3 samples/line	30	597 - 606	3 samples/line	30
294	4 samples/line	4	607	4 samples/line	4
295 - 304	3 samples/line	30	608 - 617	3 samples/line	30
305	4 samples/line	4	618	4 samples/line	4
306 - 313	3 samples/line	24	619 - 625	3 samples/line	21
Total Samples		962			958

Audio Status Bits (S1-10 closed)

Byte	Bits	0	1	2	3	4	5	6	7	Description
0	0	1								Professional use of channel status & Z-bit
	1		0							Normal audio mode
	2 - 4			1	1	0				Encoded audio signal emphasis 50/15 us emphasis, override disable
	5						0			Source sampling frequency locked
	6 - 7							0	1	48 KHz sampling, override disabled.
1	0 - 3	0	0	0	1					Encoded channel mode - 2-channel mode, override disable
	4 - 7					0	0	0	1	Encoded user bits management - 192-bit block structure. Preamble "z" indicates the start of block.
2	0 - 2	0	0	0						Encoded use of auxiliary sample bits - 20 bit audio data.
	3 - 5				1	0	1			Encoded audio sample word length of Tx signal. - Maximum audio sample word length is 20 bits (default). Use of auxiliary sample bits is not defined.
	6 - 7							0	0	Reserved but undefined.
3	0 - 7	0	0	0	0	0	0	0	0	Vector target byte from byte 1.
4	0 - 7	0	0	0	0	0	0	0	0	Digital audio reference signal (per AES11)
5	0 - 7	0	0	0	0	0	0	0	0	Reserved but undefined.
6	0 - 7	0	0	0	0	0	0	0	1	Alphanumeric channel - origin data, ASCII with odd parity.
7	0 - 7	0	0	0	0	0	0	0	1	
8	0 - 7	0	0	0	0	0	0	0	1	
9	0 - 7	0	0	0	0	0	0	0	1	
10	0 - 7	0	0	0	0	0	0	0	1	Alphanumeric channel - Destination data, ASCII, odd parity.
11	0 - 7	0	0	0	0	0	0	0	1	
12	0 - 7	0	0	0	0	0	0	0	1	
13	0 - 7	0	0	0	0	0	0	0	1	
14	0 - 7	0	0	0	0	0	0	0	0	Local sample address code.
15	0 - 7	0	0	0	0	0	0	0	0	
16	0 - 7	0	0	0	0	0	0	0	0	
17	0 - 7	0	0	0	0	0	0	0	0	
18	0 - 7	0	0	0	0	0	0	0	0	Time sample address code.
19	0 - 7	0	0	0	0	0	0	0	0	
20	0 - 7	0	0	0	0	0	0	0	0	
21	0 - 7	0	0	0	0	0	0	0	0	
22	0 - 7	0	0	0	0	0	0	0	0	Flag used to identify whether the information carried by the channel status data is reliable. All bits are reliable.
23	0 - 7	0	1	0	1	0	1	0	1	CRC (Channel status data cyclic redundancy check character) = 0xAA, lsb first

Audio Status Bits (S1-10 open)

Byte	Bits	0	1	2	3	4	5	6	7	Description
0	0	1								Professional use of channel status & Z-bit
	1		0							Normal audio mode
	2 - 4			1	0	0				Encoded audio signal, no emphasis, override disable
	5						0			Source sampling frequency locked
	6 - 7							0	1	48 KHz sampling, override disabled.
1	0 - 3	0	0	0	1					Encoded channel mode - 2-channel mode, override disable
	4 - 7					0	0	0	1	Encoded user bits management - 192-bit block structure. Preamble "z" indicates the start of block.
2	0 - 2	0	0	0						Encoded use of auxiliary sample bits - 20 bit audio data.
	3 - 5				1	0	1			Encoded audio sample word length of Tx signal. - Maximum audio sample word length is 20 bits (default). Use of auxiliary sample bits is not defined.
	6 - 7							0	0	Reserved but undefined.
3	0 - 7	0	0	0	0	0	0	0	0	Vector target byte from byte 1.
4	0 - 7	0	0	0	0	0	0	0	0	Digital audio reference signal (per AES11)
5	0 - 7	0	0	0	0	0	0	0	0	Reserved but undefined.
6	0 - 7	0	0	0	0	0	0	0	1	Alphanumeric channel - origin data, ASCII with odd parity.
7	0 - 7	0	0	0	0	0	0	0	1	
8	0 - 7	0	0	0	0	0	0	0	1	
9	0 - 7	0	0	0	0	0	0	0	1	
10	0 - 7	0	0	0	0	0	0	0	1	Alphanumeric channel - Destination data, ASCII, odd parity.
11	0 - 7	0	0	0	0	0	0	0	1	
12	0 - 7	0	0	0	0	0	0	0	1	
13	0 - 7	0	0	0	0	0	0	0	1	
14	0 - 7	0	0	0	0	0	0	0	0	Local sample address code.
15	0 - 7	0	0	0	0	0	0	0	0	
16	0 - 7	0	0	0	0	0	0	0	0	
17	0 - 7	0	0	0	0	0	0	0	0	
18	0 - 7	0	0	0	0	0	0	0	0	Time sample address code.
19	0 - 7	0	0	0	0	0	0	0	0	
20	0 - 7	0	0	0	0	0	0	0	0	
21	0 - 7	0	0	0	0	0	0	0	0	
22	0 - 7	0	0	0	0	0	0	0	0	Flag used to identify whether the information carried by the channel status data is reliable. All bits are reliable.
23	0 - 7	1	1	1	1	0	0	0	0	CRC (Channel status data cyclic redundancy check character) = 0x0F, lsb first

Tektronix

MANUAL CHANGE INFORMATION

Date: 1/10/94 **Change Reference:** M79236

Product: All Television Products **Manual Part Number:** NA

Tektronix Television Division will no longer use electrolytic capacitors with 85° ratings. They are being replaced with 105° rated capacitors, for better long term reliability. All other ratings on the new capacitors are the same or better. If you need to order any of these caps, be sure to use the new part number.

ELECTRICAL PARTS LIST CHANGES

REPLACE		WITH	
100 UF	290–1100–00	290–1309–00	CAP,FXD,AL:100UF,20%,63V,RADIAL,105 DEG
10 UF	290–0974–03	290–1311–00	CAP,FXD,AL:10UF,20%,50V,5 X 11MM,105 DEG
10 UF	290–0990–01	290–1313–00	CAP,FXD,AL:10UF,20%,50V,8 X 11MM,105 DEG
2.2 UF	290–0758–00	290–1312–00	CAP,FXD,AL:2.2UF,20%,315V;10 X 125MM,105 DEG

Tektronix

MANUAL CHANGE INFORMATION

Date: 1/24/94 **Change Reference:** C3/194

Product(s): TSG–422 **Manual Part No:** 070-7022-00

DESCRIPTION

TEXT CHANGES

APPENDIX A, on page A-6, Table A-3, **CHANGE TO READ:**

Switch Name		Switch Position		Description	Factory Setting
1		1	2		1=open
2	8- or 10-bit Resolution	open	open	Normal Operation	2=open
		open	closed	Insert Error (Format error and ESP flags set)	
		closed	open	Disable EDH Insertion	
		closed	closed	8-bit format on serial and parallel ports	

Tektronix

MANUAL CHANGE INFORMATION

Date: 1/27/94 **Change Reference:** M80713

Product(s): TSG–422 **Manual Part No:** 070–7022–00

DESCRIPTION

EFF. S/N:B030981
OPT 1S VER 1.6

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

APPENDIX A OPTION 1S

Replaceable Electrical Parts List

CHANGE TO READ:

A7	671–2244–11	CIRCUIT BD ASSY: SERIAL DIGITAL OUTPUT
A7U11	160–9739–01	IC,MEMORY:CMOS,PROM;64K X 1,SERIAL,PRGM
A7U111	160–9740–01	IC,MEMORY:CMOS,PROM,64K X 1,SERIAL,PRGM

Tektronix MANUAL CHANGE INFORMATION

Date: 1/28/94 **Change Reference:** M80726

Product(s): TSG–422 **Manual Part No:** 070–7022–00

DESCRIPTION

EFF. S/N:B030981
VER 2.2

TEXT and ELECTRICAL PARTS LIST CHANGES

SECTION 3 SPECIFICATIONS

Page 3–13, Table 3–7 Test Signal Generator – Test Signals

CHANGE 500 kHz Bowtie and 2.5 MHz Bowtie entries **TO READ:**

500 kHz Bowtie Y Channel R–Y, B–Y Channels Amplitude Ver 2.2 and later Ver 2.1 and earlier		See Fig 3–35 500 kHz sine wave 502 kHz sine wave 350 mV 700 mV	
2.5 MHz Bowtie Y Channel R–Y, B–Y Channels Amplitude Ver 2.2 and later Ver 2.1 and earlier Timing Markers		See Fig 3–36 2.49 MHz 2.5 MHz 350 mV 700 mV 9 Timing markers. (Marker spacings indicate 20 ns delay or advance between channels.)	

ADD to end of Table 3–7 **AS FOLLOWS:**

Gamit Limit Test Y Channel Markers B–Y Channel R–Y Channel		See Fig 3–56 700 mV bar, 50% duration ±2 bits at ±10%, 30%, 50%, 70%,and 90% over limit. –209.3 mV ramp followed by +209.3 mV ramp 0 V	

Date: 1/28/94 **Change Reference:** M80726

Product(s): TSG–422 **Manual Part No:** 070–7022–00

Page 3–31, **ADD:**

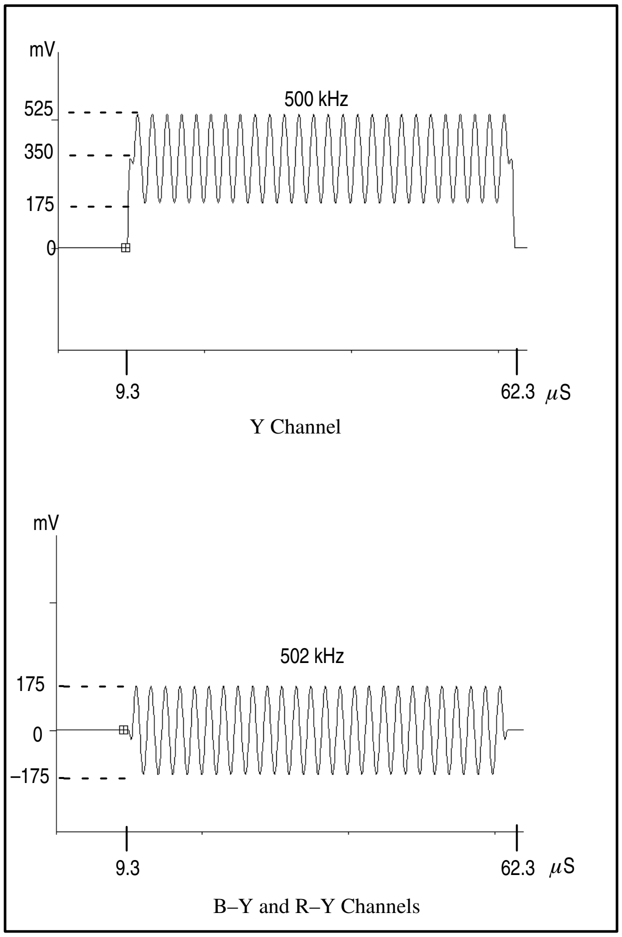


Fig. 3–35a. 500 kHz Bowtie (Ver 2.2 and above)

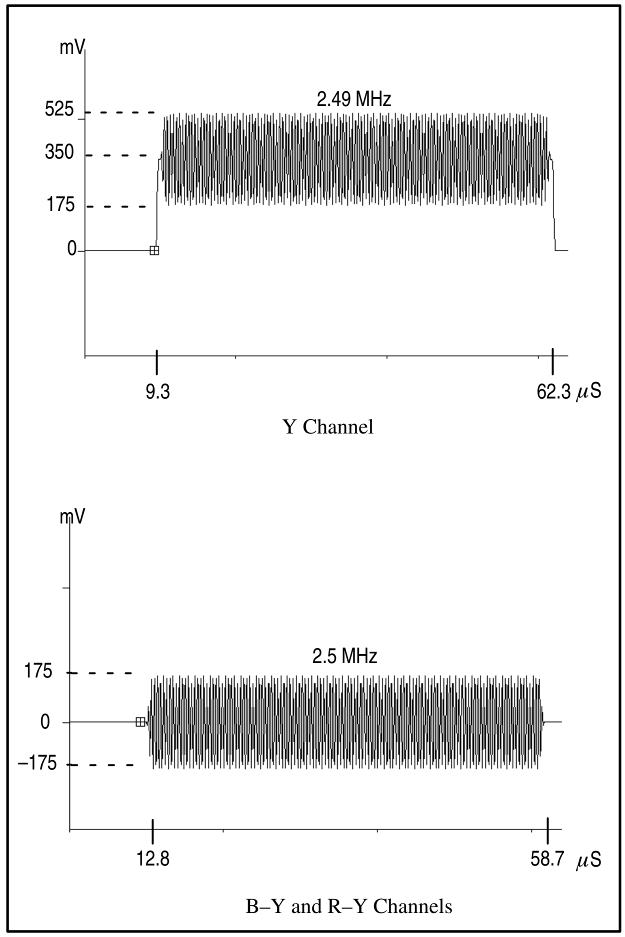


Fig. 3–36a. 2.5 MHz Bowtie (Ver 2.2 and above)

Date: 1/28/94	**Change Reference:** M80726
Product(s): TSG–422	**Manual Part No:** 070–7022–00

At end of Section 3 **ADD THE FOLLOWING:**

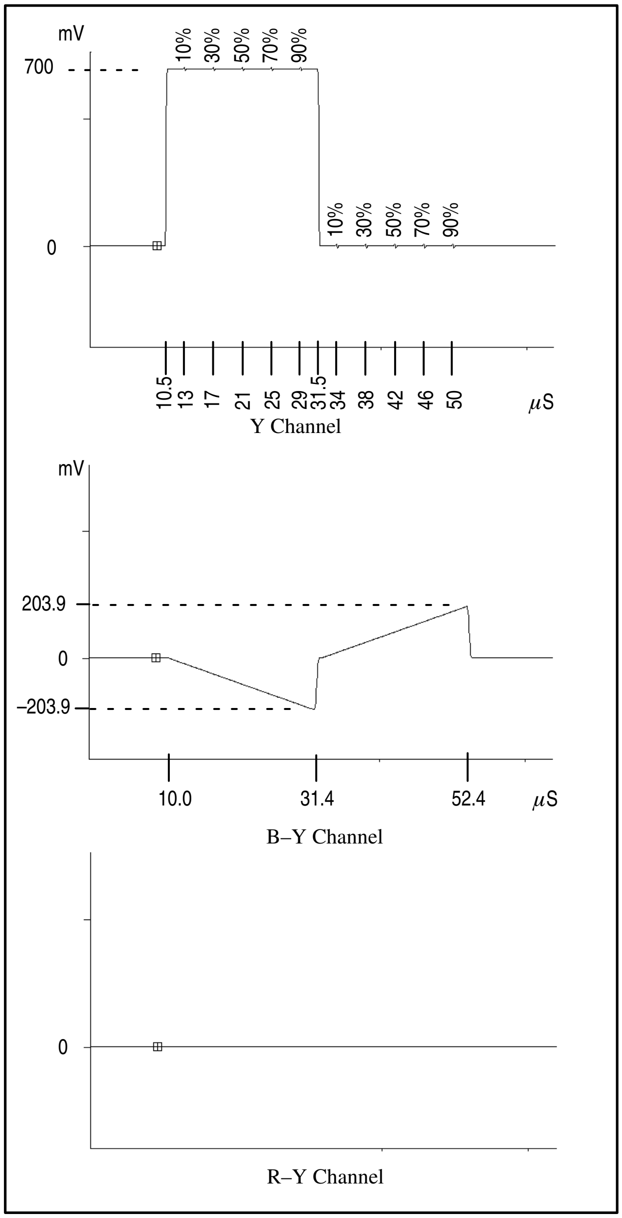


Fig. 3–56. Gamma Limit Test (Ver 2.2 and above)

Date: 1/28/94	**Change Reference:** M80726
Product(s): TSG–422	**Manual Part No:** 070–7022–00

SECTION 8 Replaceable Electrical Parts List

CHANGE TO READ:

A2–1	671–0764–10	CKT BD ASSY:MAIN BOARD
A2–1U335	160–6207–04	IC,MEMORY: CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2–1U340	160–6208–04	IC,MEMORY: CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2–1U345	160–6209–04	IC,MEMORY: CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2–1U351	160–6210–04	IC,MEMORY: CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2–1U535	160–6211–03	IC,MEMORY: CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2–1U540	160–6212–03	IC,MEMORY: CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2–1U545	160–6213–03	IC,MEMORY: CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2–1U551	160–6214–03	IC,MEMORY: CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2–1U562	160–4629–03	IC,DIGITAL:CMOS,EPROM;32768 X 8,27C256,PRGM
A2–1U574	160–4630–02	IC,DIGITAL:NMOS,EPROM;32768 X 8 PRGM,W/3 STATE OUT
A2–1U635	160–6215–04	IC,MEMORY: CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2–1U640	160–6216–04	IC,MEMORY: CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2–1U645	160–6217–04	IC,MEMORY: CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2–1U651	160–6218–04	IC,MEMORY: CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2–1U835	160–6219–04	IC,MEMORY: CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2–1U840	160–6220–04	IC,MEMORY: CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2–1U845	160–6221–04	IC,MEMORY: CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2–1U851	160–6222–04	IC,MEMORY: CMOS,EPROM;16K X 8,150NS,27C128,PRGM
A2–1U891	160–5993–03	IC,DIGITAL:CMOS,PROM;1024 X 8 PRGM

Tektronix

MANUAL CHANGE INFORMATION

Date: 5/18/94 **Change Reference:** M81178

Product: TSG 422 **Manual Part Number:** 070–7022–00

Effective SN: B031099

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

CHANGE TO READ:

A2–1	671–0764–11	CKT BD ASSY:MAIN BOARD
A2–1U574	160–4630–03	IC,MEMORY:CMOS,EPROM;32K X 8,W/3ST OUT;PRGM, 27C256–250

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

Tektronix

MANUAL CHANGE INFORMATION

Date: 5/30/95 **Change Reference:** M82523 REV 1

Product:	Manual P/N:	Effective S/N:
SPG170A	070–5965–00	B022188
SPG271	070–6814–00	B022574
TSG170A	070–5680–00	B044296
TSG170D	070–6943–00	B010895
TSG271	070–6304–00	B033558
TSG273	070–7956–00	B010301
TSG371	070–7707–00	B011162
TSG422	070–7022–00	B031482
TPG625	070–7248–00	B010378
TSG300	070–5722–00	B032150
TSG300E	070–8374–00	B032150

Replaceable Electrical Parts Changes

Replaceable Electrical Parts

In the TSG170A. TSG170D, and TSG370, **CHANGE TO READ:**

A2–1	670–9111–14	CKT BD ASSY:DIGITAL;WIRED (TSG170A ONLY)
A2–1	670–9111–15	CKT BD ASSY:DIGITAL;WIRED (TSG170A OPT 2J ONLY)
A2–1	670–9111–16	CKT BD ASSY:DIGITAL;WIRED (TSG170A OPT 1V ONLY)
A2–1	670–9111–59	CKT BD ASSY:DIGITAL;WIRED (TSG170D ONLY)
A2–1	670–9111–60	CKT BD ASSY:DIGITAL;WIRED (TSG170D OPT 1J ONLY)
A2–1	670–9111–61	CKT BD ASSY:DIGITAL;WIRED (TSG170D OPT 1V ONLY)
A2–1	670–9111–71	CKT BD ASSY:DIGITAL;WIRED (TSG370 ONLY)
A2–1R258	308–0677–00	RES,FXD,WW:1 OHM,5%,2W AXIAL LEAD

In the TSG300, TSG300E, and TSG370, **CHANGE TO READ:**

A2–1	670–9130–16	CKT BD ASSY:DIGITAL;WIRED (TSG300 OPT 01 ONLY)
A2–1	670–9130–17	CKT BD ASSY:DIGITAL;WIRED (TSG300 ONLY)
A2–1	670–9130–18	CKT BD ASSY:DIGITAL;WIRED (TSG300E ONLY)
A2–1R997	308–0677–00	RES,FXD,WW:1 OHM,5%,2W AXIAL LEAD

In the SPG170A **CHANGE TO READ:**

A2–1	670–9523–08	CKT BD ASSY:DIGITAL;WIRED (SPG170 ONLY)
A2–1	670–9523–09	CKT BD ASSY:DIGITAL;WIRED (SPG170 OPT 2J ONLY)
A2–1R338	308–0677–00	RES,FXD,WW:1 OHM,5%,2W AXIAL LEAD

In the SPG271, TSG271, TSG273, and TSG371 **CHANGE TO READ:**

A2–1	670–9905–18	CKT BD ASSY:DIGITAL;WIRED (TSG271 ONLY)
A2–1	670–9905–19	CKT BD ASSY:DIGITAL;WIRED (TSG271 OPT 03 ONLY)
A2–1	670–9905–33	CKT BD ASSY:DIGITAL;WIRED (TSG371 ONLY)
A2–1	670–9905–56	CKT BD ASSY:DIGITAL;WIRED (SPG271 ONLY)
A2–1	670–9905–57	CKT BD ASSY:DIGITAL;WIRED (SPG271 OPT 02 ONLY)
A2–1	670–9905–94	CKT BD ASSY:DIGITAL;WIRED (TSG273 ONLY)
A2–1R446	308–0677–00	RES,FXD,WW:1 OHM,5%,2W AXIAL LEAD

In the TSG422 **CHANGE TO READ:**

A2–1	671–0764–12	CKT BD ASSY:DIGITAL;WIRED (TSG422 ONLY)
A2–1R996	308–0677–00	RES,FXD,WW:1 OHM,5%,2W AXIAL LEAD

In the TPG625 **CHANGE TO READ:**

A2–1	671–0958–01	CKT BD ASSY:DIGITAL;WIRED (TPG625 ONLY)
A2–1R359	308–0677–00	RES,FXD,WW:1 OHM,5%,2W AXIAL LEAD