TEK INSTRUCTION MANUAL

Part No. 070-4662-00
Product Group 12

067-1158-00
4691 TEST FIXTURE

Please Check for
CHANGE INFORMATION
at the Rear of This Manual

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WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

MANUAL REVISION STATUS

PRODUCT: 067-1158-00 4691 Test Fixture

This manual supports the following versions of this product: Serial Numbers B010100 and up.

	DESCRIPTION
MAR 1983	Original Issue
MAY 1984	Revised: pages i, ii, 4-1, 4-2, 5-1.

CONTENTS

ILLUSTRATIONS

PREFACE

ABOUT THIS MANUAL

This manual is for the 4691 Service Technician who is troubleshooting or training on the 4691 Test Fixture circuit board (also known as the Threshold Voltage Test Generator or TV Generator). This manual describes how the Threshold Voltage (TV) Test Generator works and describes where in the 4691 Service Manual to refer to adjustment and operating procedures.

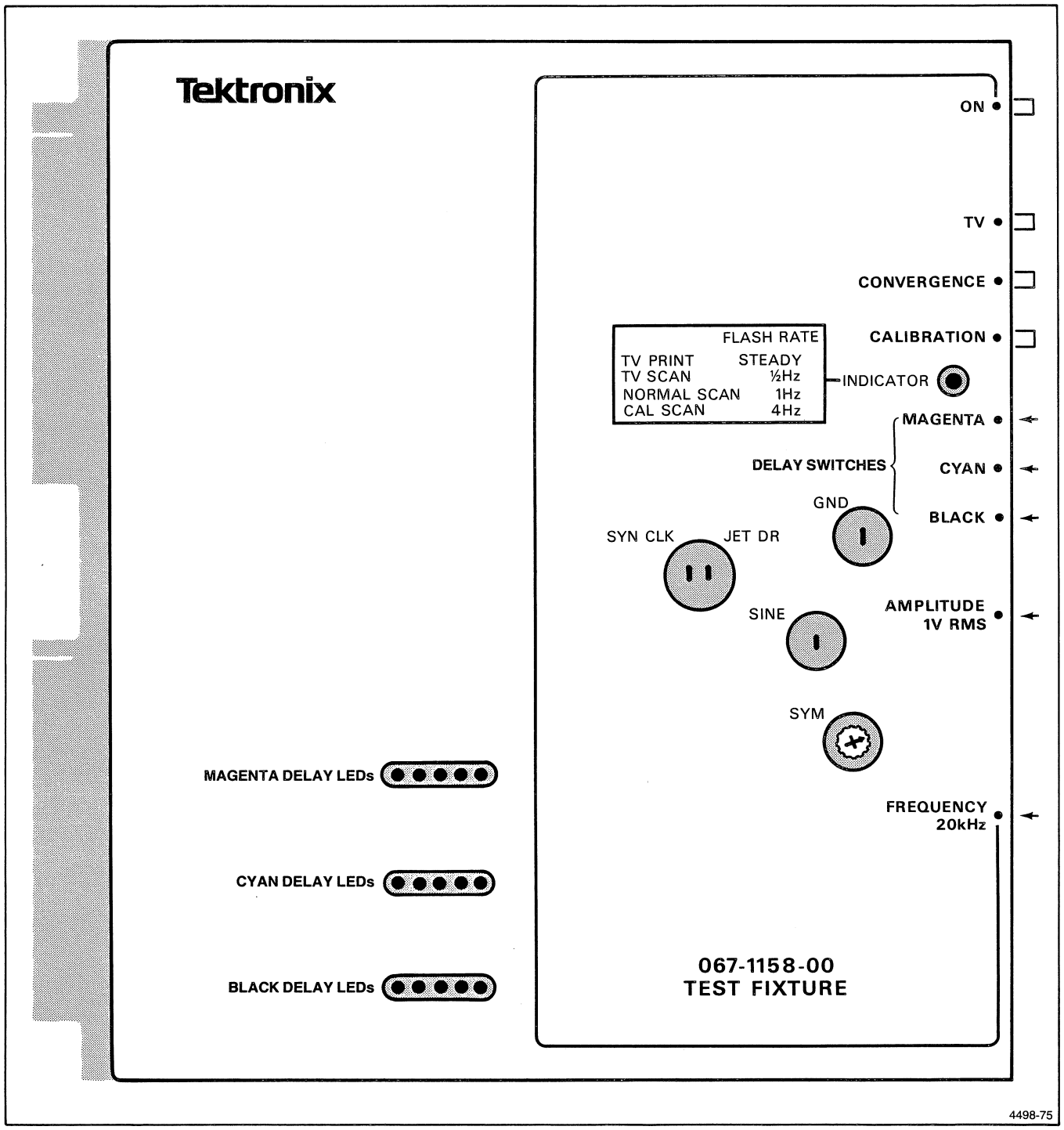


Figure 1-1. 4691 Test Fixture.

Section 1

INTRODUCTION

The 4691 Test Fixture (Threshold Voltage or TV Generator) is designed to emulate the 4691 Interface circuit board, which it replaces during troubleshooting tests. It also provides a quick procedure to vertically align (or converge) the 4691 Color Graphics Copier's ink jet heads. Finally, the Test Fixture provides a qualitative analysis of the copier's ink jet delivery system in a graphical form.

Rotary switches enable the copier's ink jet heads (except the yellow, which is not adjustable) to be easily aligned (or converged) vertically. LEDs on the 4691 Test Fixture indicate the proper setting of the DIP switches on the 4691 Interface circuit board. In practice, the technician simply runs the convergence procedure (found in Section 8 of the 4691 Service Manual) and adjusts the three DELAY rotary switches on the 4691 Test Fixture until proper adjustment is obtained. Then, the DIP switches on the 4691 Interface circuit board are set to match the LEDs on the 4691 Test Fixture.

Ink jet head analysis is obtained by sweeping the ink jet head driver voltage with an increasing voltage at discrete frequencies, about 40 Hertz apart, beginning at five KHz and continuing to 40 KHz. This "spectrum analysis" of each ink jet head, which is printed on paper, can be analyzed to detect clogs, air bubbles, lack of air pressure or ink, etc.

Section 2

THEORY OF OPERATION

INTRODUCTION

The Threshold Voltage Test is designed to diagnose the cause of ink jet head problems.

The Threshold Voltage Test performs a "spectrum analysis" of the copier's ink system. The fundamental principle of the Threshold Voltage Test is that it requires a higher ink jet head voltage to cause printing when the resonance frequency of the particle or air bubble in the ink system is reached. The ink jet heads are designed so that for each printing signal frequency, a certain minimum drive voltage is required to cause the ink jet head to squirt a drop of ink. This minimum drive voltage is the "threshold voltage." Normally, there is a linear, but gradually increasing, relationship between the threshold voltage and the printing signal frequency. So, if we can graph the printing voltage amplitude on the vertical axis and the frequency of the printing signal on the horizontal axis, a relatively smooth, linear printing pattern should result as shown by the lower portion of the printing pattern shown in Figure 2-1. However, if a foreign particle or air bubble is in the ink system, the particle or bubble will absorb energy from the ink jet head drive voltage. The maximum energy absorption occurs at the resonance frequency of the particle or bubble. Studies have shown that nearly all air bubbles and foreign particles resonate between 5 KHz and 40 KHz. Figure 2-2 shows an example of an air bubble in the ink system. Notice the "notch" at approximately 13.75 KHz. This air bubble has absorbed enough energy from the drive voltage so that printing does not occur until the ink jet head drive voltage reaches nearly 130 volts when the printing signal is around 13.75 KHz. Without the air bubble, that particular ink jet head would have required only 60 or 70 volts to print at that frequency. Remember, that each ink jet head requires a slightly different threshold voltage for each frequency (different signature), but the principle is still the same. Also, each air bubble will resonate at a different frequency, so do not attempt to categorize problems on the basis of frequency and/or voltage measurements.

Figure 2-1 shows the other parameters of the Threshold Voltage Test pattern. The printing signal is swept in 40 Hz steps, starting at 5 KHz and for each 40 Hz step, the ink jet head drive voltage is swept (increased) from 0 (at the bottom of the pattern, shown by the horizontal line) to a pre-determined upper limit. For example, notice that on Figure 2-1 at 20 KHz, the upper ink jet head drive voltage is set at 180 volts. Printing, however, started at about 90 to 100 volts at that frequency. Also notice that when the printing frequency reached 6.25 KHz, the upper limit voltage was increased slightly, causing a "stair-step" effect shown in Figure 2-1. Each stair-step indicates a 1.25 KHz range. Finally, upper limit voltages are set low at the lower frequencies to prevent damage to the ink jet heads.

It must be realized that an infinite number of test pattern variations might occur depending upon the size and location of a foreign particle or air bubble. Therefore, some interpretation of the test pattern might be necessary in some cases. However, generally you are looking for a straight threshold voltage pattern (lower portion of the printing pattern shown in Figure 2).

Refer to Appendix H of the 4691 Service Manual for interpretation of the Threshold Voltage Test Patterns.

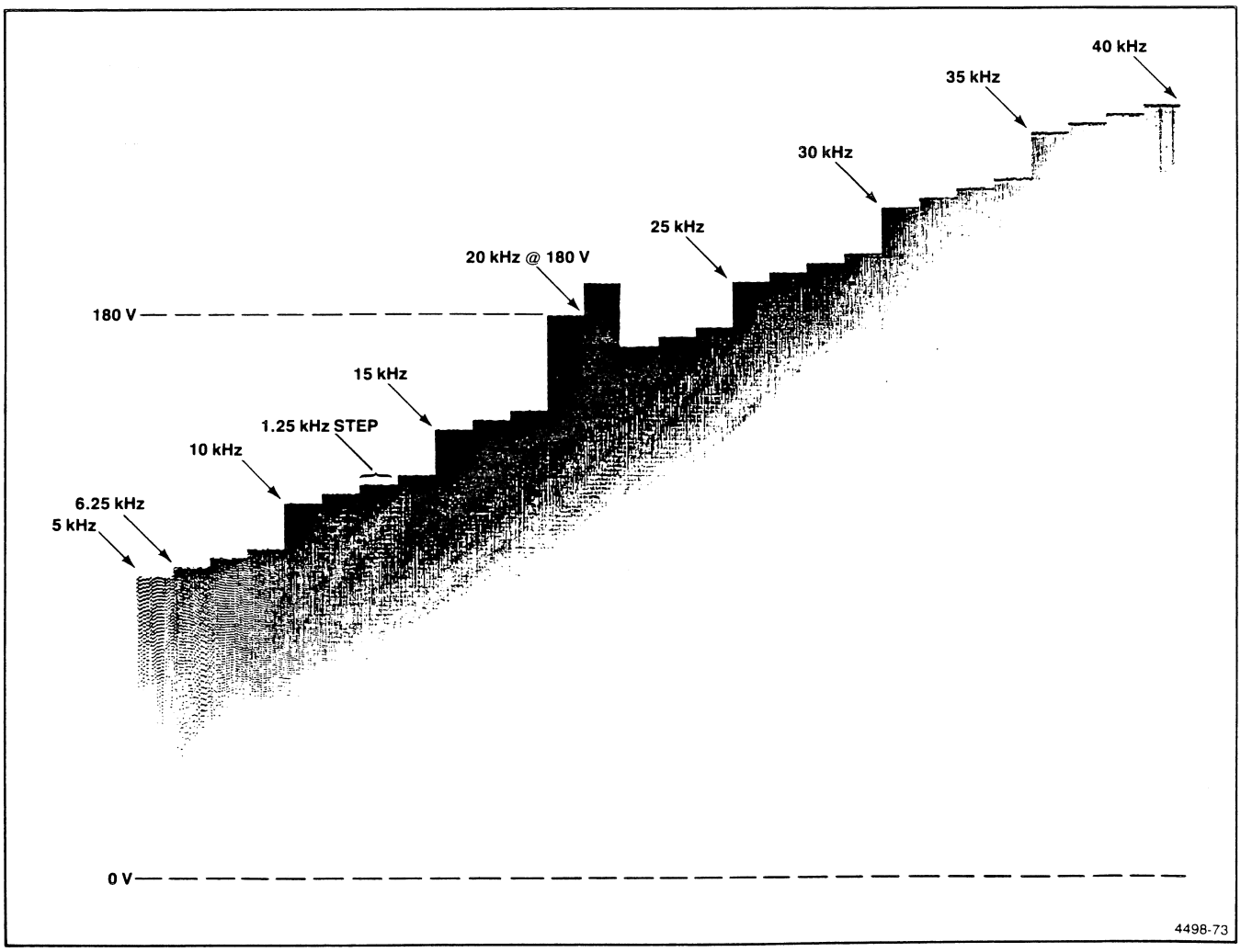


Figure 2-1. Threshold Voltage Test Pattern with "Good Working Head."

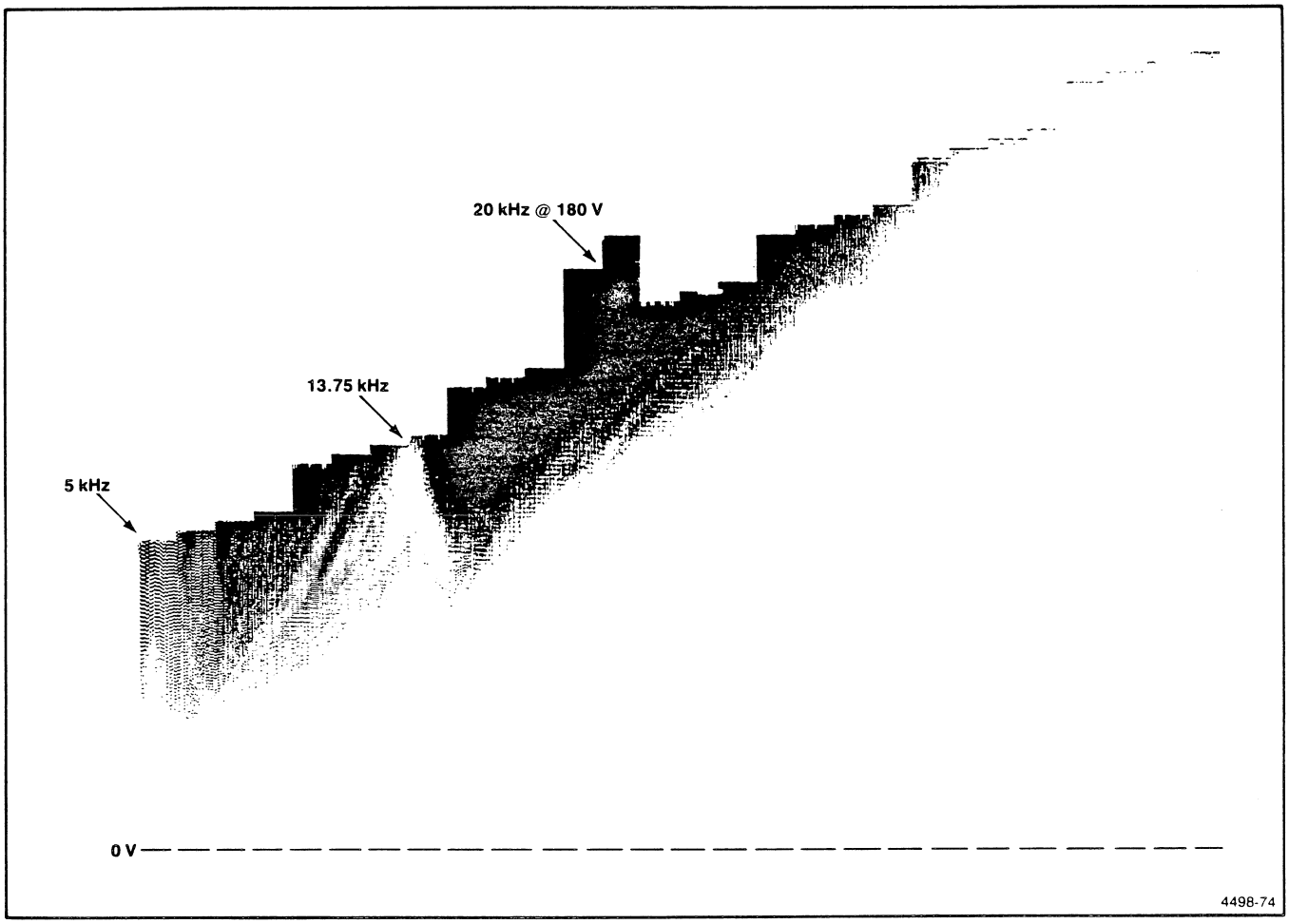


Figure 2-2. Threshold Voltage Test Pattern for an Ink Jet Head Containing an Air Bubble.

CIRCUIT DESCRIPTIONS

GENERAL

Figure 2-3 shows a block diagram for the 4691 Test Fixture. Also, refer to the Schematics in Section 6 when reading this description.

Data Source Select allows image information to be furnished from either the 4691 CPU circuit board or the Parallel Interface circuit board. A combination of the rear panel TEST/OPERATE and the TEST PATTERN SELECT/START switches determine the data source through the Data Source Select. The selected image information is then sent to the Dot Time Delay where each color is delayed by two values. The first value is a fixed amount which allows for the offset of the heads with respect to the circumference and the second value is a variable amount which is controllable by the Dot Control Shift Register, which allows for slight misalignment of the heads. The Dot Control Shift Register is controlled by the DOT CONTROL switches which are debounced and modified under software control by the processor.

From the Dot Time Delay, the color gates are sent to the Ink Control Switch where the the analog JETDRV signal is gated to the BUFFER/DRIVERS. From there the color signal is sent to the Ink Jet Head Driver circuit board and the ink jet heads. The analog JETDRV signal is a rough sinewave which is amplitude controlled by the processor and is derived from the Voltage Controlled Oscillator (VCO). Control input for the VCO comes from either a phase detector which locks the VCO output at 20 KHz during normal operation or from the Sweep Controller which is under computer control and used during CAL and TEST Modes.

DATA SOURCE SELECT

The Data Source Select selects color signals from either the Parallel Interface or the CPU internal test patterns. The multiplexor is controlled by a combination of the address lines (bus).

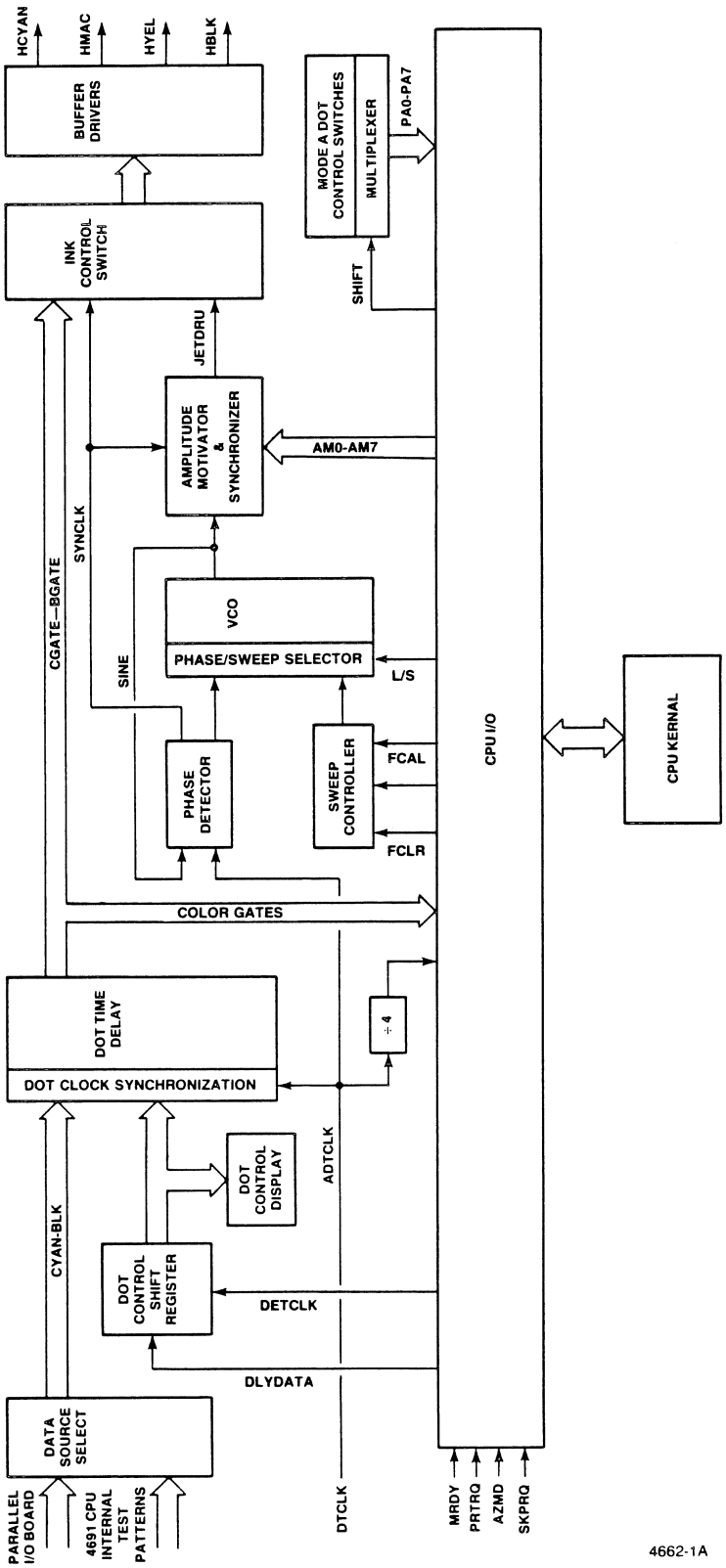


Figure 2-3. 4691 Test Fixture Block Diagram.

DOT TIME DELAY

The Dot Time Delay actually consists of four separate circuits - one for each color (yellow, magenta, cyan, and black. The first stage of each circuit provides synchronization with DTCLK (data clock). Then the remainder of each circuit is a fixed time delay whose value depends upon the physical location of the ink jet heads with respect to the drum at index time. The yellow ink jet head is the reference ink jet head and its delay time was set at zero (no delay). The outputs of each of the other three Dot Time Delays are determined by variable length shift registers which are set by the CPU Processor. This allows the ink jet heads to be electrically converged in the vertical direction.

DOT CONTROL SHIFT REGISTER

The Dot Control Shift Register accepts clocked serial dot delay information (DLYDATA) from the CPU Kernal (via the CPU I/O) and presents it in parallel format to both the Dot Control Display LEDs, which provide the operator with a visual indication of the Dot Control Switches and the Dot Time Delay (described earlier).

DOT CONTROL DISPLAY

The Dot Control Display consists of 15 LEDs which show the delay for each color except yellow. The operator uses these LEDs to set the DOT CONTROL switches on the 4691 Interface circuit board (removed during test and adjustment).

PHASE DETECTOR

The Phase Detector compares the VCO output frequency (20 KHz) to the DTCLK signal (actually ADTCLK-1). If the two signals differ, a dc output correction voltage corrects the VCO. In addition, the Phase Detector produces a squarewave reference frequency which is used by both the Amplitude Modulator and Synchronizer and the Ink Control Switch to synchronize color information to the derived clock (JETDRV).

SWEEP CONTROLLER

The Sweep Controller consists of a counter controlled by the CPU Kernal and a digital-to-analog (D-to-A) converter. The Sweep Controller generates a dc voltage (DAC) for the VCO. The D-to-A converter can be cleared, incremented, or forced to 20 KHz under control of the CPU Kernal.

VOLTAGE CONTROLLED OSCILLATOR (VCO)

The VCO generates a constant amplitude sinewave signal, which will be amplitude modulated and applied to the ink jet heads. The output frequency of the VCO is determined by a control voltage from either the Phase Detector or the Sweep Controller. An input multiplexor (Phase/Sweep Selector) under CPU Kernal control determines which control signal is applied to the VCO.

AMPLITUDE MODULATOR AND SYNCHRONIZER

The VCO sinewave signal is modulated under CPU Kernal control to produce the signal JETDRV. Amplitude information for the converter is changed only during minus zero crossings by SYNCLK. This guarantees that only integral sinewaves are generated at the JETDRV test point.

INK CONTROL SWITCHES

These switches gate the JETDRV signal to the Buffers/Drivers as required by the color gate signals to produce ink delivery in the desired pattern.

BUFFERS/DRIVERS

The Buffers/Drivers are unity gain amplifiers for the ink jet head drive signals and provide circuit board isolation and drive capability.

MODE AND DOT CONTROL SWITCHES

The Mode and Dot Control Switches circuit block consists of the ON, TV, CONVERGENCE, CALIBRATION, and the three DELAY switches. The switch data is multiplexed and transmitted to the CPU Kernal. The multiplexor is controlled by SHIFT (Pin 10 of U271).

CPU I/O

The CPU I/O consists of a PIA containing two eight-bit input ports and a VIA containing two eight-bit output ports. The CPU I/O permits the CPU Kernal to communicate with various chips within the 4691 Test Fixture.

CPU KERNAL

The CPU Kernal consists of a 6504 NMOS microprocessor, 128 bytes of RAM, and 2K bytes of ROM.

4691 Test Fixture Firmware Description/Operation

Mainline. Circuit operation begins when the CPU circuit board releases the RESET signal to 4691 Test Fixture CPU Kernal. The CPU Kernal turns off all interrupts, clears out Decimal Mode, and sets up the stack to the top of RAM (00FF hex). It then proceeds to set the I/O ports and performs a RAM check. If a RAM should fail, a binary one will be displayed in the BLACK DOT DELAY LEDs. When the RAM checks all right, a ROM check is performed. If a ROM fails, a binary two is displayed in the BLACK DOT DELAY LEDs.

After the initial self-tests have been performed, the CPU Kernal sets up the variables necessary for operation. This includes setting the frequency of the D/A to zero and enabling the interrupts. The CPU Kernal begins a circular scan of flags generated by the interrupt routine. The first item in the scan is a check of the main INDICATOR LED. Next, a check is made of the various switches to see if a particular test has been operator-selected. If a test is selected, the routine jumps to the test routine. When the test is completed, the scan begins again.

Calibrate Mode. In the Calibrate Mode, the CPU Kernal clears the frequency control D/A and forces the high order bit to a one. This causes the D/A to assert its mid-range value. The LOCK/SWEEP control line is set to the sweep position, which disables the phase-locked control of the dot clock and substitutes the digital-to-analog sweep controller. The flash rate of the INDICATOR LED is quadrupled to indicate that Flash Mode is active, and the multiplying DAC is set to mid-range, which is the calibration amplitude. The CPU Kernal waits for a switch to be pressed and then exits to the circular scanner.

TV Test Mode. When the TV Test Mode is indicated, the CPU Kernal halves the flash rate for the INDICATOR LED to indicate that TV Test has been selected. The CPU Kernal checks that the 4691 bus signals are valid to perform a TV Test (i.e. MRDY is low and PRTRQ is high (see Figure 2-4). Next, a variable called TESTFLG is set to zero and any pending skip request interrupts are cleared. The skip request interrupt is then enabled. The CPU Kernal waits for PRTRQ from the 4691 bus to go low indicating that the operator has requested a test pattern. If the variable TESTFLG has been set to 80 by the interrupt routine, the Parallel Interface circuit board generates the pattern needed for the TV Test. If not, the routine turns off the INDICATOR LED and waits for the current image to end and return to the circular scanner.

NOTE

> The Parallel Interface circuit board generates a signal on the SKIPRQ line just prior to PRTRQ going low which indicates to the 4691 Test Fixture that either the pattern for the TV Test or the Alignment Test is about to be generated. This interlocks the Parallel Interface circuit board and the 4691 Test Fixture circuit board together.

If we assume that the correct signals for the TV Test have been received, the CPU Kernal will turn off the timer interrupt, turn on the INDICATOR LED, and turn on the sweep control. The CPU Kernal checks the paper size status line to set up variables for either A or B size paper. Finally, the PRTRQ interrupt is enabled to catch a positive going edge (end of image) which is used to terminate the routine if the front panel STOP COPY switch is pressed or if the 4691 copier should have some other failure.

The 4691 Test Fixture then begins to generate the image by setting a mask to look for the yellow gate and setting the amplitude to zero. As soon as the yellow gate is detected, the maximum amplitude value allowed for the given frequency is output as a reference line. The CPU Kernal waits for the divided by four clock to toggle and when it does, the CPU Kernal outputs a value of zero. Each subsequent divided by four clock will cause the amplitude to be increased according to a "look-up" table in ROM. When the maximum amplitude is reached, the output will be held at zero. The maximum value is variable depending on the frequency, and is also a method of distinguishing frequency steps.

When the maximum value is reached, the color mask is set for the magenta gate, and the process is repeated until the proper number of lines have been generated. The process then repeats again with the cyan and black gates substituted for the yellow and magenta gates.

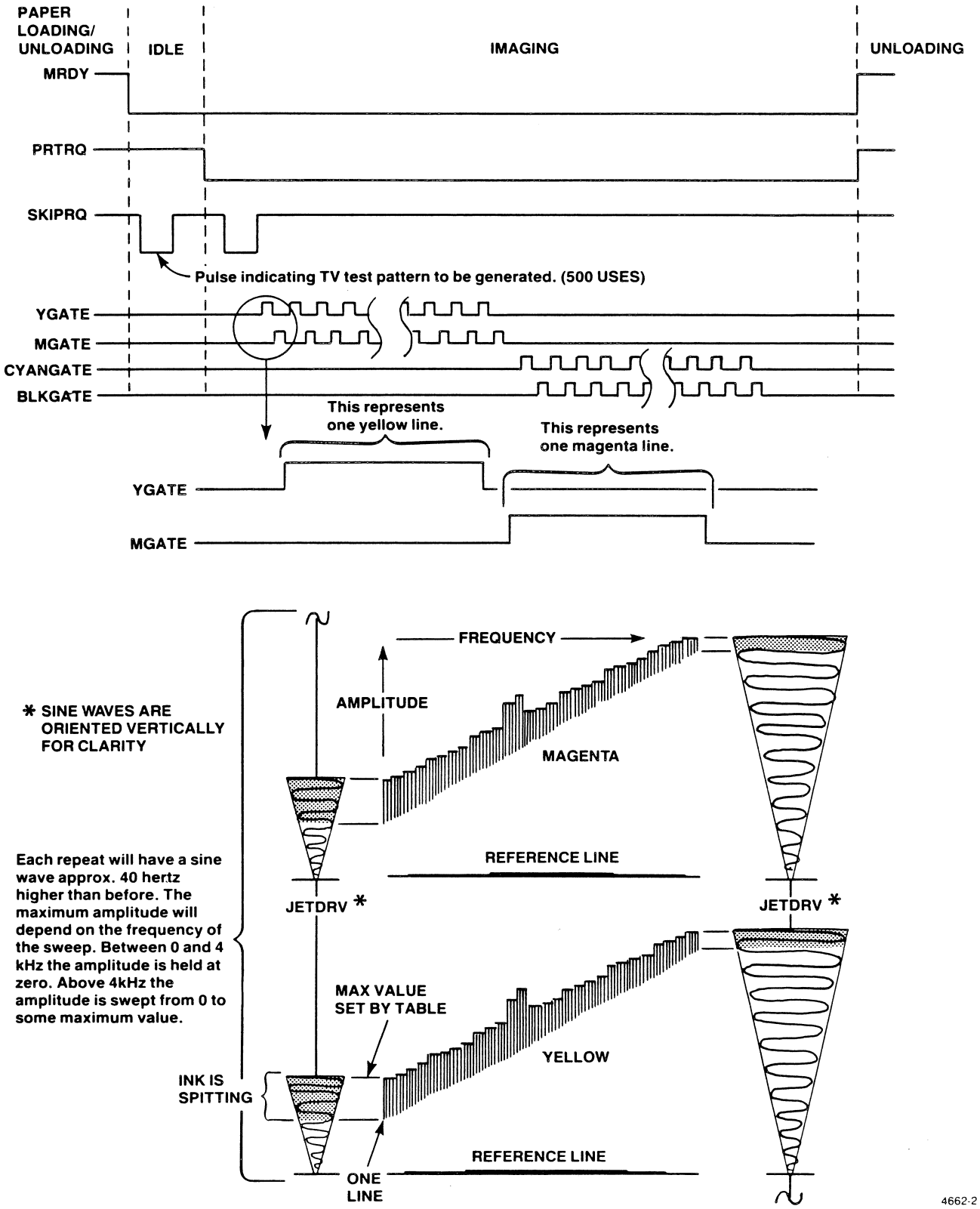


Figure 2-4. 4691 Test Fixture Timing Diagram.

Background Interrupt Routine. The background interrupt routine performs several functions, all under the direction of the mainline program (described earlier). The first thing to be checked is the skip request interrupt. If the skip request is detected, the background interrupt routine begins looking for the SKIPRQ line to return high while counting the time the line is low. The time the line is low is used to determine if a TV Test pattern is going to be generated and the value of TESTFLG is set accordingly.

Next, the PRTRQ (print request) interrupt is checked to see if the print has been aborted. If the print has been aborted, a complete power-up restart is started. The timer interrupt is checked to see if it is time to toggle the INDICATOR LED and, finally, the switches are scanned to see if they have been operator-changed. If the DELAY switches have been changed, the interrupt routine debounces and processes the data and updates the delays and LEDs accordingly. If the CONTROL switches have been changed, the routine debounces them and presents the data to the circular scanner to be acted upon.

Section 3
REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

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.

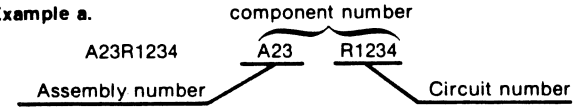
ABBREVIATIONS

Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER (column one of the Electrical Parts List)

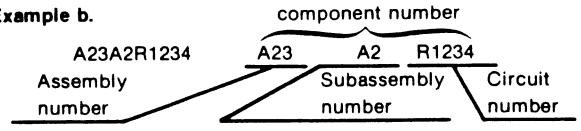
A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:

Example a.



Read: Resistor 1234 of Assembly 23

Example b.



Read: Resistor 1234 of Subassembly 2 of Assembly 23

Only the circuit number will appear on the diagrams and circuit board illustrations. Each diagram and circuit board illustration is clearly marked with the assembly number. Assembly numbers are also marked on the mechanical exploded views located in the Mechanical Parts List. The component number is obtained by adding the assembly number prefix to the circuit number.

The Electrical Parts List is divided and arranged by assemblies in numerical sequence (e.g., assembly A1 with its subassemblies and parts, precedes assembly A2 with its subassemblies and parts).

Chassis-mounted parts have no assembly number prefix and are located at the end of the Electrical Parts List.

TEKTRONIX PART NO. (column two of the Electrical Parts List)

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

SERIAL/MODEL NO. (columns three and four of the Electrical Parts List)

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

NAME & DESCRIPTION (column five of the Electrical Parts List)

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

MFR. CODE (column six of the Electrical Parts List)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

MFR. PART NUMBER (column seven of the Electrical Parts List)

Indicates actual manufacturers part number.

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00779	AMP INC	P O BOX 3608	HARRISBURG PA 17105
01121	ALLEN-BRADLEY CO	1201 SOUTH 2ND ST	MILWAUKEE WI 53204
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP	13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49	DALLAS TX 75265
02735	RCA CORP SOLID STATE DIVISION	ROUTE 202	SOMERVILLE NJ 08876
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 GROUP	5005 E MCDOWELL RD	PHOENIX AZ 85008
05397	UNION CARBIDE CORP MATERIALS SYSTEMS DIV	11901 MADISON AVE	CLEVELAND OH 44101
05464	INDUSTRIAL ELECTRONIC ENGINEERS INC	7720 LEMONA AVE	VAN NUYS CA 91405
07716	TRW INC TRW ELECTRONICS COMPONENTS TRW IRC FIXED RESISTORS/BURLINGTON	2850 MT PLEASANT AVE	BURLINGTON IA 52601
11236	CTS OF BERNE INC	406 PARR ROAD	BERNE IN 46711
13454	CRYSTEK CRYSTALS CORP	1000 CRYSTAL DR	FT MYERS FL 33901
14552	MICRO/SEMICONDUCTOR CORP	2830 S FAIRVIEW ST	SANTA ANA CA 92704
14752	ELECTRO CUBE INC	1710 S DEL MAR AVE	SAN GABRIEL CA 91776
15238	ITT SEMICONDUCTORS A DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORP	500 BROADWAY P O BOX 168	LAWRENCE MA 01841
18324	SIGNETICS CORP	811 E ARQUES	SUNNYVALE CA 94086
19701	MEPCO/ELECTRA INC A NORTH AMERICAN PHILIPS CO	P O BOX 760	MINERAL WELLS TX 76067
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS DIV MILITARY PRODUCTS GROUP	515 FISHING CREEK RD	NEW CUMBERLAND PA 17070-3007
24355	ANALOG DEVICES INC	RT 1 INDUSTRIAL PK P O BOX 280	NORWOOD MA 02062
27014	NATIONAL SEMICONDUCTOR CORP	2900 SEMICONDUCTOR DR	SANTA CLARA CA 95051
31918	ITT SCHADOW INC	8081 WALLACE RD	EDEN PRAIRIE MN 55343
32293	INTERSIL INC	10900 N TANTAU AVE	CUPERTINO CA 95014
32997	BOURNS INC TRIMPOT DIV	1200 COLUMBIA AVE	RIVERSIDE CA 92507
34335	ADVANCED MICRO DEVICES	901 THOMPSON PL	SUNNYVALE CA 94086
34576	ROCKWELL INTERNATIONAL CORP SEMICONDUCTOR PRODUCTS DIV	4311 JAMBOREE RD PO BOX C M/S 501-300	NEWPORT BEACH CA 92658-8902
50434	HEWLETT-PACKARD CO OPTOELECTRONICS DIV	640 PAGE MILL RD	PALO ALTO CA 94304
54473	MATSUSHITA ELECTRIC CORP OF AMERICA	ONE PANASONIC WAY	SECAUCUS NJ 07094
55680	NICHICON /AMERICA/ CORP	927 E STATE PKY	SCHAUMBURG IL 60195
57668	ROHM CORP	16931 MILLIKEN AVE	IRVINE CA 92713
57924	BOURNS INC NETWORKS DIV		
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1	----- -----			CIRCUIT BD ASSY:TV PATTERN GENERATOR (NOT REPLACEABLE)		
A1	----- -----			CIRCUIT BD ASSY:TV PATTERN GENERATOR (NOT REPLACEABLE)		
A1C5	290-0804-00			CAP,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULB1E100TAAANA
A1C7	283-0421-00			CAP,FXD,CER DI:0.1UF,+80-20%,50V	04222	MD015C104MAA
A1C17	290-0804-00			CAP,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULB1E100TAAANA
A1C43	290-0804-00			CAP,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULB1E100TAAANA
A1C45	283-0421-00			CAP,FXD,CER DI:0.1UF,+80-20%,50V	04222	MD015C104MAA
A1C127	290-0804-00			CAP,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULB1E100TAAANA
A1C139	290-0804-00			CAP,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULB1E100TAAANA
A1C151	290-0804-00			CAP,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULB1E100TAAANA
A1C155	290-0782-00			CAP,FXD,ELCTLT:4.7UF,+75-10%,35VDC	55680	ULB1V4R7TAAANA
A1C157	290-0746-00			CAP,FXD,ELCTLT:47UF,+50-10%,16V	54473	ECE-A6V47L
A1C159	290-0804-00			CAP,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULB1E100TAAANA
A1C163	290-0746-00			CAP,FXD,ELCTLT:47UF,+50-10%,16V	54473	ECE-A6V47L
A1C169	290-0782-00			CAP,FXD,ELCTLT:4.7UF,+75-10%,35VDC	55680	ULB1V4R7TAAANA
A1C195	290-0755-00			CAP,FXD,ELCTLT:100UF,+50%-10%,10V	54473	ECE-A10V100L
A1C271	283-0421-00			CAP,FXD,CER DI:0.1UF,+80-20%,50V	04222	MD015C104MAA
A1C279	283-0421-00			CAP,FXD,CER DI:0.1UF,+80-20%,50V	04222	MD015C104MAA
A1C305	290-0804-00			CAP,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULB1E100TAAANA
A1C327	290-0804-00			CAP,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULB1E100TAAANA
A1C337	290-0804-00			CAP,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULB1E100TAAANA
A1C338	281-0765-00			CAP,FXD,CER DI:100PF,5%,100V	04222	MA101A101JAA
A1C339	281-0765-00			CAP,FXD,CER DI:100PF,5%,100V	04222	MA101A101JAA
A1C343	290-0804-00			CAP,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULB1E100TAAANA
A1C344	281-0765-00			CAP,FXD,CER DI:100PF,5%,100V	04222	MA101A101JAA
A1C345	281-0765-00			CAP,FXD,CER DI:100PF,5%,100V	04222	MA101A101JAA
A1C348	290-0804-00			CAP,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULB1E100TAAANA
A1C355	290-0804-00			CAP,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULB1E100TAAANA
A1C417	283-0421-00			CAP,FXD,CER DI:0.1UF,+80-20%,50V	04222	MD015C104MAA
A1C451	283-0421-00			CAP,FXD,CER DI:0.1UF,+80-20%,50V	04222	MD015C104MAA
A1C463	283-0421-00			CAP,FXD,CER DI:0.1UF,+80-20%,50V	04222	MD015C104MAA
A1C471	283-0421-00			CAP,FXD,CER DI:0.1UF,+80-20%,50V	04222	MD015C104MAA
A1C479	283-0421-00			CAP,FXD,CER DI:0.1UF,+80-20%,50V	04222	MD015C104MAA
A1C523	283-0421-00			CAP,FXD,CER DI:0.1UF,+80-20%,50V	04222	MD015C104MAA
A1C527	290-0804-00			CAP,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULB1E100TAAANA
A1C537	290-0804-00			CAP,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULB1E100TAAANA
A1C547	290-0804-00			CAP,FXD,ELCTLT:10UF,+50-10%,25V	55680	ULB1E100TAAANA
A1C548	283-0330-00			CAP,FXD,CER DI:100PF,5%,50V	05397	C320C101J5R5CA
A1C563	283-0421-00			CAP,FXD,CER DI:0.1UF,+80-20%,50V	04222	MD015C104MAA
A1C583	283-0175-00			CAP,FXD,CER DI:10PF,5%,200V	05397	C312C100D2G5CA 8
A1C723	283-0421-00			CAP,FXD,CER DI:0.1UF,+80-20%,50V	04222	MD015C104MAA
A1C727	283-0421-00			CAP,FXD,CER DI:0.1UF,+80-20%,50V	04222	MD015C104MAA
A1C735	283-0421-00			CAP,FXD,CER DI:0.1UF,+80-20%,50V	04222	MD015C104MAA
A1C737	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A1C745	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A1C839	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A1C845	285-0597-00			CAP,FXD,PLASTIC:0.001UF,1%,100V	14752	410B1B102F
A1CR485	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR487	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR627	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR628	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR641	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR643	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1DS309	150-1077-00			LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R
A1DS310	150-1077-00			LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1DS311	150-1077-00			LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R
A1DS312	150-1077-00			LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R
A1DS313	150-1077-00			LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R
A1DS319	150-1077-00			LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R
A1DS320	150-1077-00			LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R
A1DS321	150-1077-00			LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R
A1DS322	150-1077-00			LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R
A1DS323	150-1077-00			LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R
A1DS329	150-1077-00			LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R
A1DS330	150-1077-00			LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R
A1DS331	150-1077-00			LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R
A1DS332	150-1077-00			LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R
A1DS333	150-1077-00			LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R
A1DS875	150-1001-02			LT EMITTING DIO:RED,660NM,50MA MAX	50434	HLMP3000
A1L57	108-0728-00			COIL,RF:FIXED,116UH	80009	108-0728-00
A1L65	108-0728-00			COIL,RF:FIXED,116UH	80009	108-0728-00
A1L95	108-0728-00			COIL,RF:FIXED,116UH	80009	108-0728-00
A1R11	307-0597-00			RES NTWK,FXD,FI:7,6.8K OHM,2%,1.0W	57924	4308R-101-682
A1R13	307-0446-00			RES NTWK,FXD,FI:10K OHM,20%,(9)RES	11236	750-101-R10K
A1R21	307-0597-00			RES NTWK,FXD,FI:7,6.8K OHM,2%,1.0W	57924	4308R-101-682
A1R25	307-0597-00			RES NTWK,FXD,FI:7,6.8K OHM,2%,1.0W	57924	4308R-101-682
A1R29	307-0597-00			RES NTWK,FXD,FI:7,6.8K OHM,2%,1.0W	57924	4308R-101-682
A1R111	307-0741-00			RES NTWK,FXD,FI:7,3.3K OHM,2%,0.19W EACH	11236	750-81-R3.3K
A1R121	307-0741-00			RES NTWK,FXD,FI:7,3.3K OHM,2%,0.19W EACH	11236	750-81-R3.3K
A1R129	307-0741-00			RES NTWK,FXD,FI:7,3.3K OHM,2%,0.19W EACH	11236	750-81-R3.3K
A1R213	307-0446-00			RES NTWK,FXD,FI:10K OHM,20%,(9)RES	11236	750-101-R10K
A1R225	307-0741-00			RES NTWK,FXD,FI:7,3.3K OHM,2%,0.19W EACH	11236	750-81-R3.3K
A1R233	307-0446-00			RES NTWK,FXD,FI:10K OHM,20%,(9)RES	11236	750-101-R10K
A1R255	315-0391-00			RES,FXD,FILM:390 OHM,5%,0.25W	57668	NTR25J-E390E
A1R256	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R315	307-0790-00			RES NTWK,FXD,FI:5,220 OHM 2%,0.15W	11236	750-61-R220
A1R325	307-0790-00			RES NTWK,FXD,FI:5,220 OHM 2%,0.15W	11236	750-61-R220
A1R335	307-0790-00			RES NTWK,FXD,FI:5,220 OHM 2%,0.15W	11236	750-61-R220
A1R387	315-0304-00			RES,FXD,FILM:300K OHM,5%,0.25W	57668	NTR25J-E300K
A1R411	307-0637-00			RES NTWK,FXD,FI:5,2K OHM,2%,0.125W	01121	206A202
A1R421	307-0637-00			RES NTWK,FXD,FI:5,2K OHM,2%,0.125W	01121	206A202
A1R429	307-0637-00			RES NTWK,FXD,FI:5,2K OHM,2%,0.125W	01121	206A202
A1R431	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R433	315-0105-00			RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
A1R435	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R437	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R439	315-0105-00			RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
A1R441	315-0105-00			RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
A1R443	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R445	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R447	315-0105-00			RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
A1R453	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R457	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R475	315-0332-00			RES,FXD,FILM:3.3K OHM,5%,0.25W	57668	NTR25J-E03K3
A1R529	321-0155-00			RES,FXD,FILM:402 OHM,1%,0.125W,TC=T0	07716	CEAD402R0F
A1R530	321-0269-00			RES,FXD,FILM:6.19K OHM,1%,0.125W,TC=T0	07716	CEAD61900F
A1R531	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R533	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R541	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R543	315-0332-00			RES,FXD,FILM:3.3K OHM,5%,0.25W	57668	NTR25J-E03K3
A1R545	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R547	315-0105-00			RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
A1R553	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1R626	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W,TC=T0	19701	5033ED1K00F
A1R629	321-0194-00			RES,FXD,FILM:1.02K OHM,1%,0.125W,TC=T0	07716	CEAD10200F
A1R633	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R645	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R655	315-0220-00			RES,FXD,FILM:22 OHM,5%,0.25W	19701	5043CX22R00J
A1R721	321-0257-00			RES,FXD,FILM:4.64K OHM,1%,0.125W,TC=T0	19701	5043ED4K640F
A1R722	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W,TC=T0	19701	5033ED1K00F
A1R723	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W,TC=T0	19701	5033ED1K00F
A1R724	321-0257-00			RES,FXD,FILM:4.64K OHM,1%,0.125W,TC=T0	19701	5043ED4K640F
A1R728	321-0340-00			RES,FXD,FILM:34.0K OHM,1%,0.125W,TC=T0	19701	5043ED34K00F
A1R731	311-1568-00			RES,VAR,NONWW:TRMR,50 OHM,0.5W	32997	3352T-1-500
A1R733	315-0820-00			RES,FXD,FILM:82 OHM,5%,0.25W	57668	NTR25J-E82E0
A1R741	315-0823-00			RES,FXD,FILM:82K OHM,5%,0.25W	57668	NTR25J-E82K
A1R745	315-0823-00			RES,FXD,FILM:82K OHM,5%,0.25W	57668	NTR25J-E82K
A1R747	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R749	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R751	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
A1R753	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
A1R757	307-0637-00			RES NTWK,FXD,FI:5,2K OHM,2%,0.125W	01121	206A202
A1R763	307-0637-00			RES NTWK,FXD,FI:5,2K OHM,2%,0.125W	01121	206A202
A1R765	307-0637-00			RES NTWK,FXD,FI:5,2K OHM,2%,0.125W	01121	206A202
A1R770	307-0637-00			RES NTWK,FXD,FI:5,2K OHM,2%,0.125W	01121	206A202
A1R775	315-0131-00			RES,FXD,FILM:130 OHM,5%,0.25W	19701	5043CX130R0J
A1R826	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K
A1R827	321-0343-00			RES,FXD,FILM:36.5K OHM,1%,0.125W,TC=T0	07716	CEAD36501F
A1R828	311-1283-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	32997	3329S-L58-103
A1R837	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R851	311-1284-00			RES,VAR,NONWW:TRMR,20K OHM,0.5W	32997	3329S-L58-203
A1SW860	260-1777-00			SWITCH,ROTARY:16 POSN,28VDC,100MA	00779	53137-1
A1SW865	260-1777-00			SWITCH,ROTARY:16 POSN,28VDC,100MA	00779	53137-1
A1SW870	260-1777-00			SWITCH,ROTARY:16 POSN,28VDC,100MA	00779	53137-1
A1SW885	260-1039-00			SWITCH,PUSH:DT,1A,25VDC,3 BUTTON	31918	ORDER BY DESCR
A1TP75	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	22526	48283-036
A1TP253	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A1TP259	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A1TP551	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A1TP553	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A1TP651	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A1TP655	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A1TP731	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A1TP745	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A1U105	156-0469-02			MICROCKT,DGTL:3/8 LINE DCDR,SCRN	01295	SN74LS138NP3
A1U117	156-1570-00			MICROCKT,DGTL:NMOS,PRDM PRPHL INTFC,SCRN	34335	P8255AB
A1U227	156-0529-02			MICROCKT,DGTL:DATA SELECTOR,SCRN	01295	SN74LS257NP3
A1U239	156-1878-00			MICROCKT,DGTL:127-BIT STATIC SHF RGTR,SCRN	04713	MC14562BPD
A1U245	156-1878-00			MICROCKT,DGTL:127-BIT STATIC SHF RGTR,SCRN	04713	MC14562BPD
A1U251	156-1878-00			MICROCKT,DGTL:127-BIT STATIC SHF RGTR,SCRN	04713	MC14562BPD
A1U271	156-1539-00			MICROCKT,DGTL:NMOS,6522,I/D PORT W/TIMER	34576	R6522AP
A1U279	160-1839-00			MICROCKT,DGTL:2048 X 8 EPROM PRGM	80009	160-1839-00
A1U305	156-1879-00			MICROCKT,DGTL:1-TO-64-BIT VAR LENGTH SHF RG TR,SCRN	04713	MC14557BPD
A1U317	156-1879-00			MICROCKT,DGTL:1-TO-64-BIT VAR LENGTH SHF RG TR,SCRN	04713	MC14557BPD
A1U327	156-1879-00			MICROCKT,DGTL:1-TO-64-BIT VAR LENGTH SHF RG TR,SCRN	04713	MC14557BPD
A1U337	156-1191-01			MICROCKT,LINEAR:DUAL BI-FET OP-AMP,8 DIP	80009	156-1191-01
A1U343	156-1191-01			MICROCKT,LINEAR:DUAL BI-FET OP-AMP,8 DIP	80009	156-1191-01

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1U348	156-1878-00			MICROCKT,DGTL:127-BIT STATIC SHF RGTR,SCRN	04713	MC14562BPD
A1U351	156-1878-00			MICROCKT,DGTL:127-BIT STATIC SHF RGTR,SCRN	04713	MC14562BPD
A1U355	156-0645-02			MICROCKT,DGTL:HEX INV ST NAND GATES,SCRN	04713	SN74LS14NDS
A1U385	156-0058-02			MICROCKT,DGTL:HEX INV,SCRN	18324	N7404(NB OR FB)
A1U417	156-0651-02			MICROCKT,DGTL:8-BIT PRL-OUT SER SHF RGTR	01295	SN74LS164NP3
A1U427	156-0651-02			MICROCKT,DGTL:8-BIT PRL-OUT SER SHF RGTR	01295	SN74LS164NP3
A1U451	156-0366-02			MICROCKT,DGTL:DUAL D FLIP-FLOP,SCREENED	02735	CD4013BFX
A1U455	156-0704-01			MICROCKT,LINEAR:CMOS,PHASE LOCK LOOP SCRN	04713	MC14046BCPDS
A1U463	156-0382-02			MICROCKT,DGTL:QUAD 2 INP NAND GATE BURN	18324	N74LS00NB
A1U523	156-0545-01			MICROCKT,DGTL:12 BIT BINARY CNTR,SCRN	02735	CD4040BFX
A1U527	156-0931-01	B010100	B010199	MICROCKT,DGTL:QUAD D FF,SCREENED	27014	MM74C175J
A1U527	156-0931-00	B010200		MICROCKT,DGTL:CMOS,QUAD D FF	04713	MC14175BCL
A1U537	156-0515-04			MICROCKT,DGTL:TPL 2 CHAN MUX,CHK	80009	156-0515-04
A1U549	156-1126-01			MICROCKT,LINEAR:VOLTAGE COMPARATOR,SELECTED	01295	LM311JG4
A1U555	156-0865-02			MICROCKT,DGTL:OCTAL D FF W/CLEAR,SCRN	01295	SN74LS273NP3
A1U563	156-0956-02			MICROCKT,DGTL:OCTAL BFR W/3 STATE OUT,SCRN	01295	SN74LS244NP3
A1U567	156-0956-02			MICROCKT,DGTL:OCTAL BFR W/3 STATE OUT,SCRN	01295	SN74LS244NP3
A1U571	156-0427-04			MICROCKT,DGTL:PERIPHERAL INTERFACE ADPTR	04713	MC6821LD
A1U579	156-1482-00			MICROCKT,DGTL:NMOS,8-BIT MICROPRC,8K ADDRES SING	34576	R6504(P OR C)
A1U587	156-0716-01			MICROCKT,DGTL:128 X 8 STATIC RAM,SCREENED	80009	156-0716-01
A1U623	156-0967-00			MICROCKT,LINEAR:D/A CONVERTER	24355	AD561J
A1U637	156-0515-04			MICROCKT,DGTL:TPL 2 CHAN MUX,CHK	80009	156-0515-04
A1U649	156-1191-01			MICROCKT,LINEAR:DUAL BI-FET OP-AMP,8 DIP	80009	156-1191-01
A1U655	156-1367-00			MICROCKT,LINEAR:CMOS,8 BIT BFR MULT	24355	AD11/297
A1U663	156-0680-02			MICROCKT,DGTL:DUAL J-K F-F,W/CLEAR,SEL	27014	MM74C107JA+
A1U727	156-1200-01			MICROCKT,LINEAR:OPERATIONAL AMPL,QUAD BIFET	80009	156-1200-01
A1U737	156-1885-00			MICROCKT,LINEAR:VOLTAGE CONTROLLED OSCILLAT OR	32293	ICL8038BCJD
A1VR259	152-0279-00			SEMICOND DVC,DI:ZEN,SI,5.1V,5%,0.4W,DO-7	14552	TD3810989
A1VR743	152-0149-00			SEMICOND DVC,DI:ZEN,SI,10V,5%,0.4W,DO-7	15238	Z5406
A1VR830	152-0149-00			SEMICOND DVC,DI:ZEN,SI,10V,5%,0.4W,DO-7	15238	Z5406
A1W9	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	22526	48283-036
A1Y395	158-0014-00			XTAL UNIT,QTZ:1MHZ,+/-0.005%	13454	158-0014-00

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

FIGURE AND INDEX NUMBERS

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

INDENTATION SYSTEM

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

1 2 3 4 5 Name & Description

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

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

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

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

ABBREVIATIONS

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

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
09922	BURNDY CORP	RICHARDS AVE	NORWALK CT 06852
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS DIV MILITARY PRODUCTS GROUP	515 FISHING CREEK RD	NEW CUMBERLAND PA 17070-3007
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61101

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	----- -----			1	CKT BOARD ASSY:TV GENERATOR		
-2	136-0729-00			3	.SKT,PL-IN ELEK:MICROCKT,16 CONTACT	09922	DILB16P-108T
-3	136-0751-00			1	.SKT,PL-IN ELEK:MICROCKT,24 PIN	09922	DILB24P108
-4	131-0993-00			1	.BUS,CONDUCTOR:SHUNT ASSEMBLY,BLACK	22526	65474-005
-5	366-1559-00			4	.PUSH BUTTON:SIL GY,0.18 SQ X 0.43	80009	366-1559-00
-6	384-0531-00			8	SPACER,POST:0.656 L,0.25 DIA,NYLON	80009	384-0531-00
					(ATTACHING PARTS)		
-7	211-0008-00			9	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
-8	200-2896-00			1	COVER,CKT BOARD:W/SILK SCREENING	80009	200-2896-00
					(ATTACHING PARTS)		
-9	211-0008-00			9	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
					STANDARD ACCESSORIES		
	070-4662-00			1	MANUAL,TECH:INSTR,4691	80009	070-4662-00

FIG. 1 EXPLODED VIEW

Section 4

CALIBRATING THE 4691 TEST FIXTURE

1. Ensure that the copier's POWER switch is OFF.

2. Remove the Interface circuit board from the copier's card cage (see Section 7 in the 4691 Service Manual for instructions on removing this circuit board).

3. Install the Extender circuit board in the slot formerly occupied by the Interface circuit board.

4. Install the 4691 Test Fixture into the Extender circuit board.

5. Ensure that the Test Fixture's ON/OFF switch is in the OFF (out) position (see Figure 1-1) and the MAG, CYAN, and BLK DELAY switches are set to zero.

6. Turn the copier's POWER switch ON. The test fixture will now perform a RAM and ROM test. If the INDICATOR LED fails to light and the BLACK DELAY LEDs indicate the number 1 (in binary), RAM fail has occurred. If the BLACK DELAY LEDs indicate a number 2 (in binary), a ROM failure has occurred.

7. Check that the INDICATOR LED is flashing at a once per second rate. This indicates that the test fixture is in an idle mode scanning the test fixture switches. The MAG, CYAN, and BLK DELAY LEDs indicate the print delay for each color (refer to the Convergence Procedure in Section 8 of the 4691 Service Manual).

8. Turn the MAG, CYAN, and BLK DELAY rotary switches and notice that the MAG, CYAN, and BLK DELAY LEDs follow the switches.

9. Push in the CALIBRATION switch and the ON switch. The test fixture is now in the CAL Mode and the INDICATOR LED should flash at a four times per second rate.

10. Connect an oscilloscope (1V/Div, 10 uS/Div) between SYNCLK (TP553) and ground (TP655, see Figure 1-1).

11. Adjust R731 (SYM, or symmetry) to obtain a square-wave at TP553 (SYNCLK).

12. Adjust R828 (FREQ, or frequency) to obtain a period of 50 uS plus or minus 1 uS.

13. Move the signal lead of the oscilloscope to TP745 (SINE) and notice that the sinewave has little distortion.

14. Move the oscilloscope's signal lead to TP651 (JETDRV).

15. Adjust R851 (AMPLITUDE) for a p-p voltage of 3.30 volts (1.0 volt rms).

16. Push the ON/OFF switch to release it to the out (OFF) position.

NOTE

The 4691 Test Fixture is now adjusted. If the Threshold Voltage Test is desired, proceed to Step 9 in Section 5 of this manual.

17. Turn the copier's POWER switch OFF.

18. Remove the 4691 Test Fixture and the Extender circuit board and replace the Interface circuit board (removed in Step 2).

This completes the adjustment of the 4691 Test Fixture.

Section 5

USING THE TEST FIXTURE TO CALIBRATE THE COPIER

1. Ensure that the copier's POWER switch is OFF.

2. Remove the Interface circuit board from the copier's card cage (see Section 7 in the 4691 Service Manual for instructions on removing this circuit board).

3. Install the Extender circuit board in the slot formerly occupied by the Interface circuit board.

4. Install the 4691 Test Fixture into the Extender circuit board.

5. Ensure that the Test Fixture's ON/OFF switch is in the OFF (out) position (see Figure 1-1) and the MAG, CYAN, and BLK DELAY switches are set to zero.

6. Turn the copier's POWER switch ON. The test fixture will now perform a RAM and ROM test. If the INDICATOR LED fails to light and the BLACK DELAY LEDs indicate the number 1 (in binary), RAM fail has occurred. If the BLACK DELAY LEDs indicate a number 2 (in binary), a ROM failure has occurred.

7. Check that the INDICATOR LED is flashing at a once per second rate. This indicates that the test fixture is in an idle mode scanning the test fixture switches. The MAG, CYAN, and BLK DELAY LEDs indicate the print delay for each color (refer to the Convergence Procedure in Section 8 of the 4691 Service Manual).

8. Push the ON/OFF switch to release it to the out (OFF) position.

9. Push in the TV switch and then the ON switch. Observe that the INDICATOR LED flashes at a once per two second rate. This indicates that the test fixture is waiting for the start of the Threshold Voltage Test pattern.

10. Set the copier's rotary five-position TEST PATTERN SELECT switch to three and press the TEST START switch. The INDICATOR LED will turn on steady when the copier starts printing the Threshold Voltage pattern. The printing takes about two minutes on A size paper or about four minutes on B size paper. If the INDICATOR LED fails to light, the wrong test pattern has been selected.

NOTE

Once the Threshold Voltage test pattern has started, the test fixture switches are deactivated. To abort the test, press the copier's front panel STOP COPY switch.

11. Refer to Appendix H of the 4691 Service Manual for interpretation of the Threshold Voltage test pattern.

12. After the test pattern has been printed and you wish to restore the copier to normal operation, push the ON/OFF switch to release it to the out (OFF) position.

13. Turn the copier's POWER switch OFF.

18. Remove the 4691 Test Fixture and the Extender circuit board and replace the Interface circuit board (removed in Step 2).

This completes the operation of the 4691 Test Fixture.

Section 6
SCHEMATICS

Symbols and Reference Designators

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).

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.

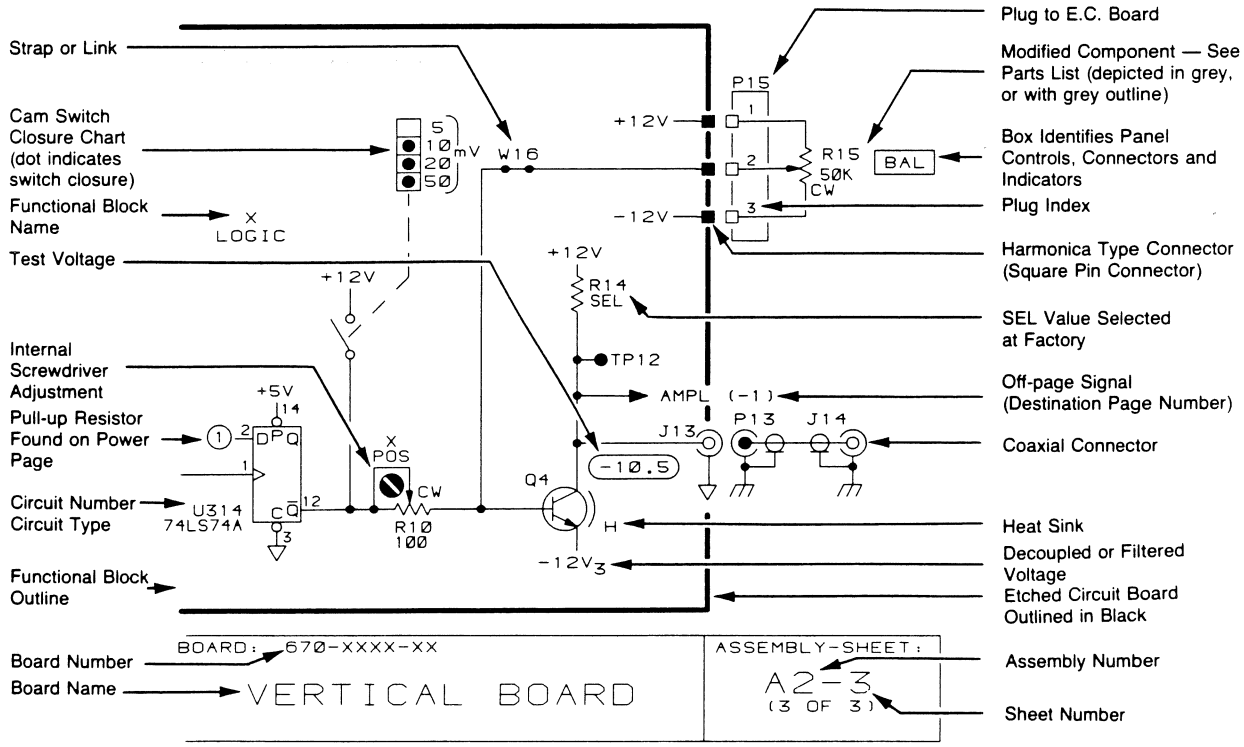
Abbreviations are based on ANSI Y1.1-1972. Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc., are:

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.

The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc.)
AT	Attenuator, fixed or variable
B	Motor
BT	Battery
C	Capacitor, fixed or variable
CB	Circuit breaker
CR	Diode, signal or rectifier
DL	Delay line
DS	Indicating device (lamp)
E	Spark Gap, Ferrite bead
F	Fuse
FL	Filter
H	Heat dissipating device (heat sink, heat radiator, etc.)
HR	Heater
HY	Hybrid circuit
J	Connector, stationary portion
K	Relay
L	Inductor, fixed or variable
M	Meter
P	Connector, movable portion
Q	Transistor or silicon-controlled rectifier
R	Resistor, fixed or variable
RT	Thermistor
S	Switch or contactor
T	Transformer
TC	Thermocouple
TP	Test point
U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
V	Electron tube
VR	Voltage regulator (zener diode, etc.)
W	Wirestrap or cable
Y	Crystal
Z	Phase shifter

The following special symbols may appear on the diagrams:



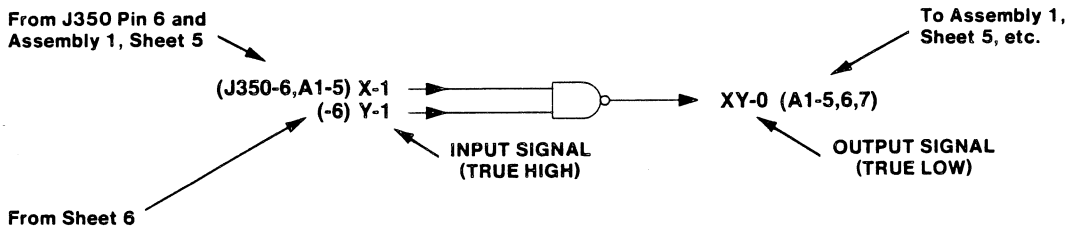
1. True High and True Low Signals

Signal names on the schematics are followed by -1 or a -0. A TRUE HIGH signal is indicated by -1, and a TRUE LOW signal is indicated by -0.

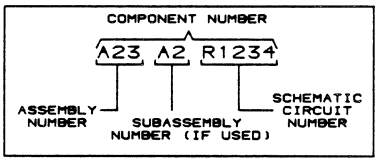
SIGNAL -1 = TRUE HIGH
SIGNAL -0 = TRUE LOW

2. Cross-References

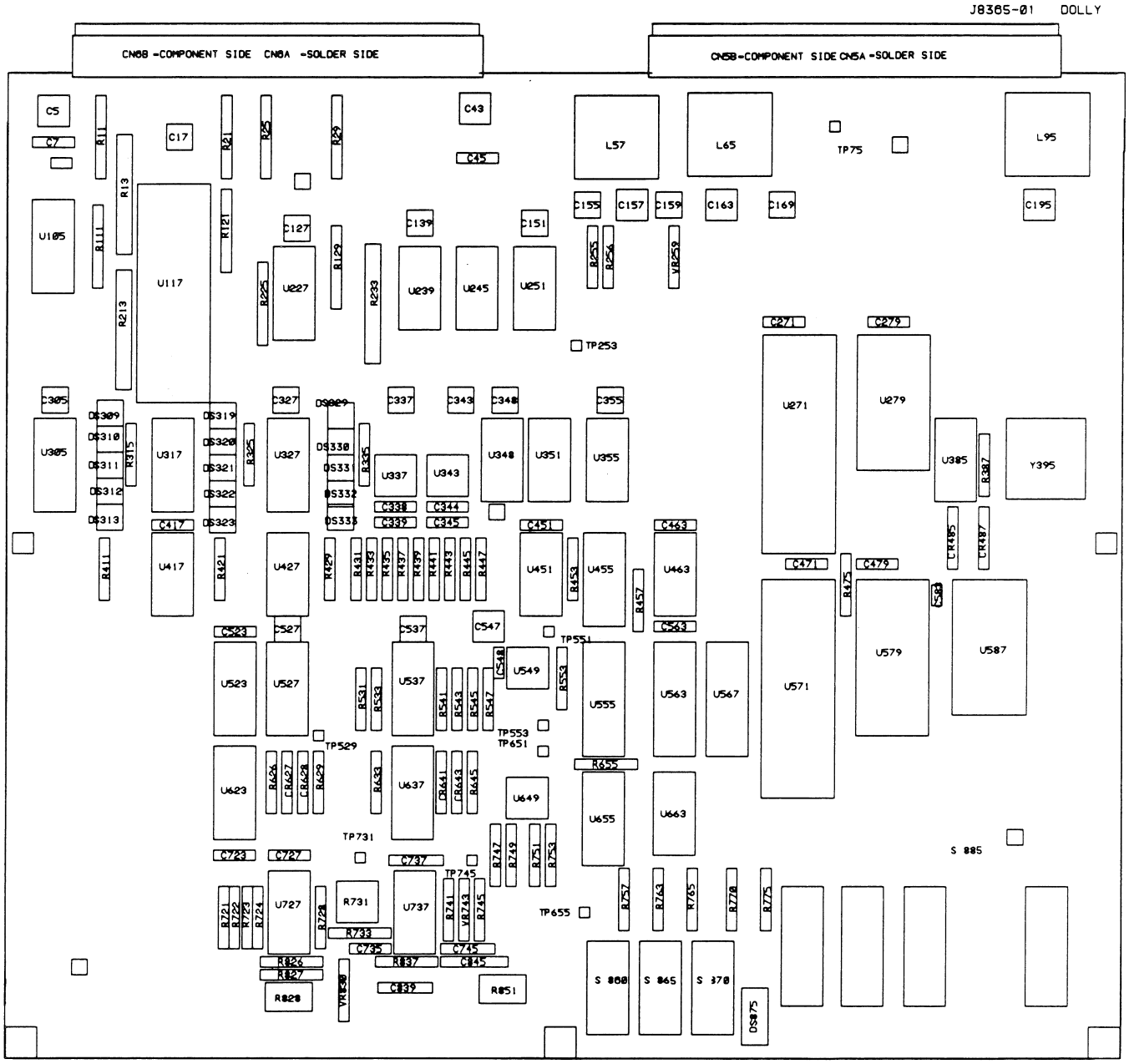
Schematic cross-references (from/to information) are included on the schematics. The "from" reference only indicates the signal "source," and the "to" reference lists all loads where the signal is used. All from/to information will be enclosed in parentheses.

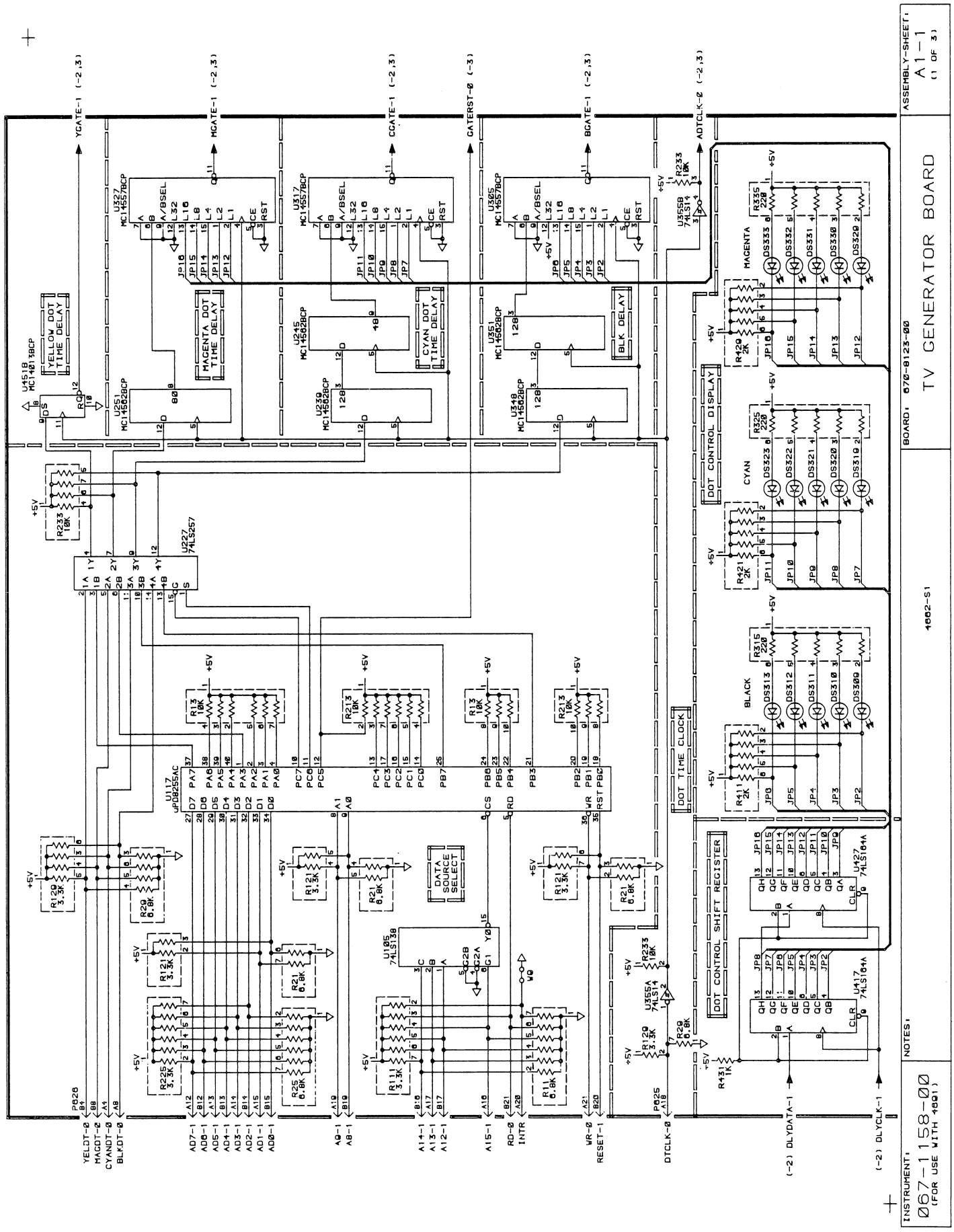


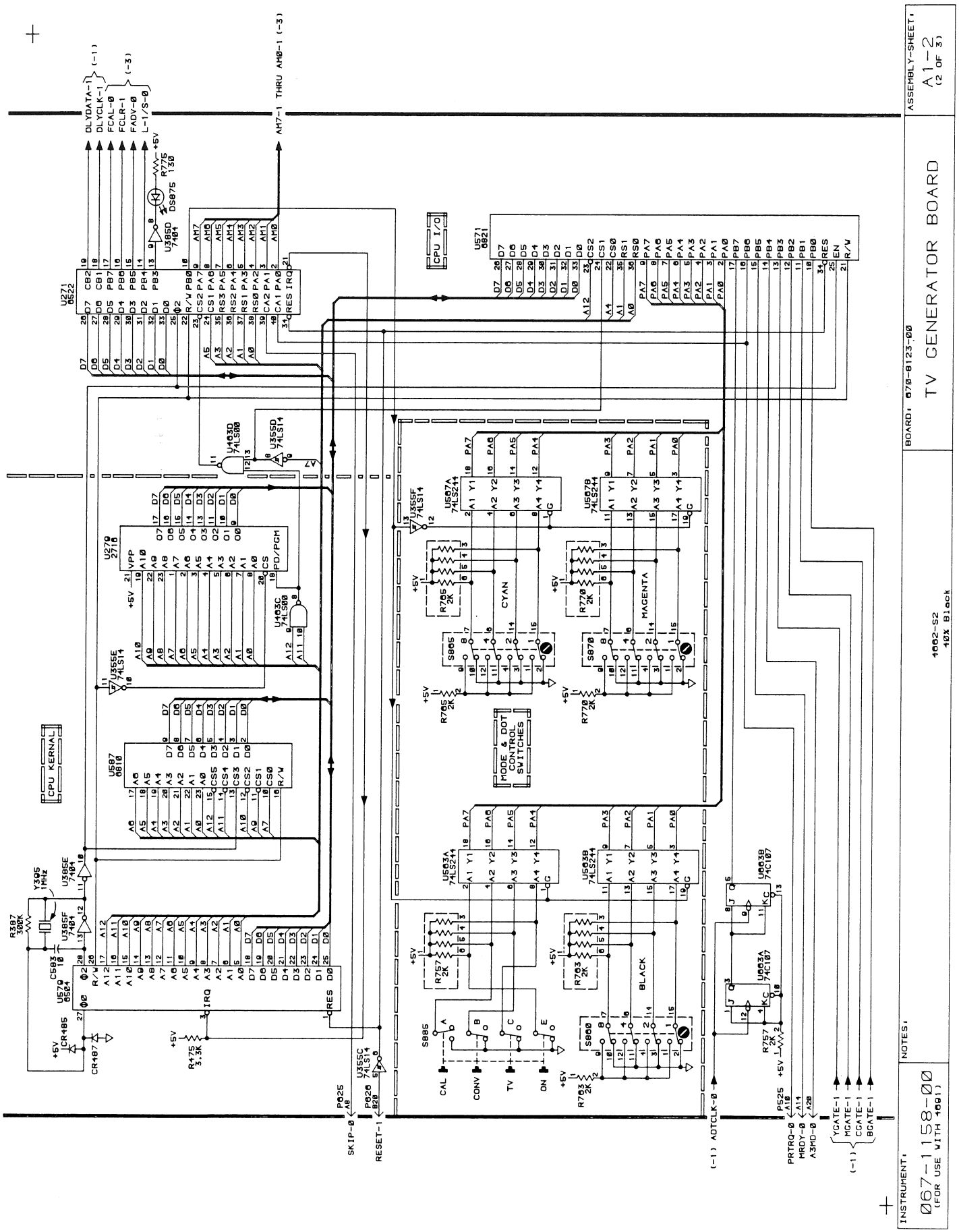
3. Component Number Example

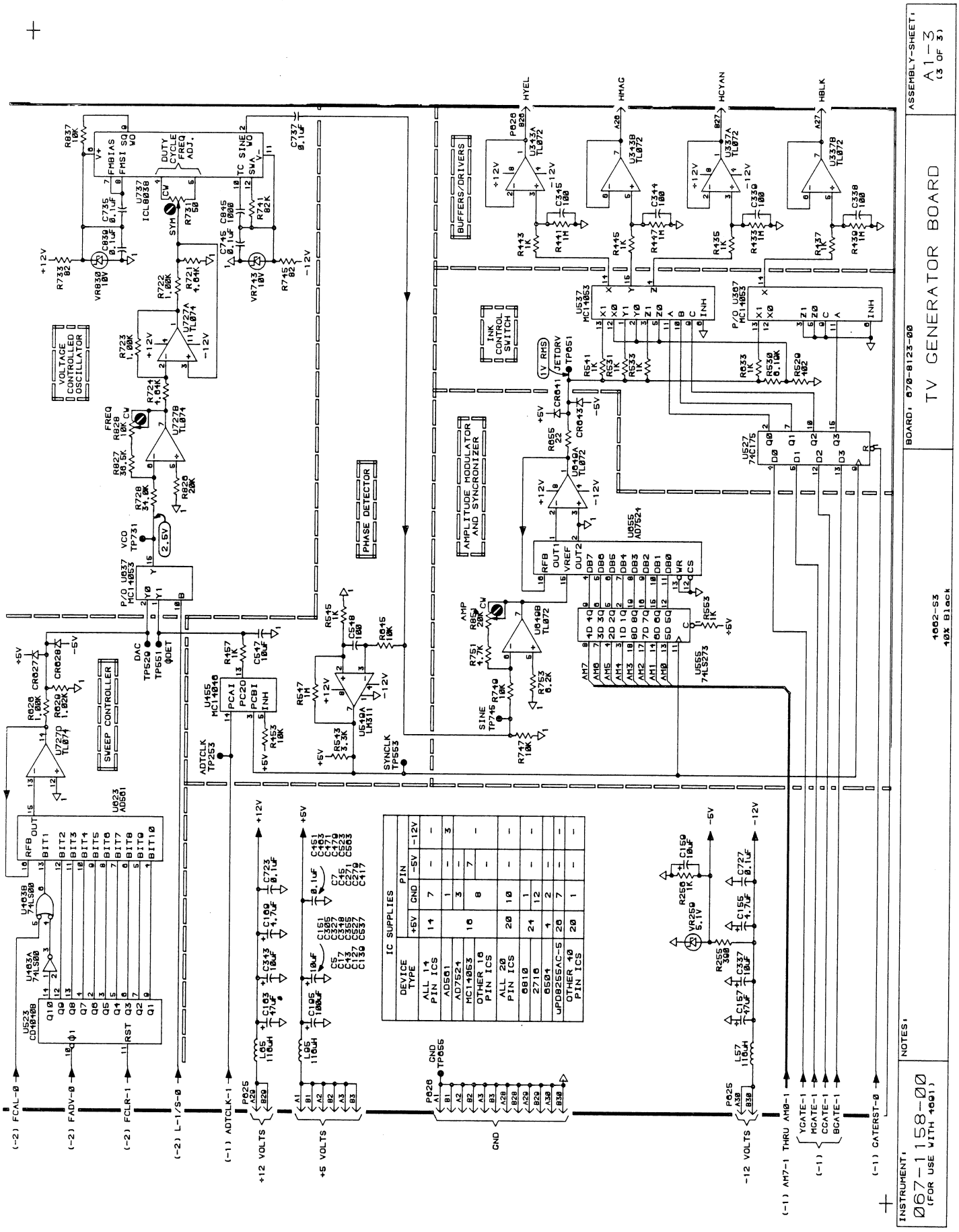


CHASSIS-MOUNTED COMPONENTS HAVE NO ASSEMBLY NUMBER PREFIX— SEE END OF REPLACEABLE ELECTRICAL PARTS LIST.


J8385-01 DOLLY
CN8B -COMPONENT SIDE CN8A -SOLDER SIDE
CN5B-COMPONENT SIDE CN5A -SOLDER SIDE
C5
C7
R11
R13
C17
R21
R25
R29
C43
C45
L57
L65
TP75
L95
U105
R111
R213
U117
R121
C127
R129
R225
U227
R233
C139
U239
C151
U245
U251
C155
C157
C159
C163
C169
C195
R255
R256
VR259
TP253
C271
C279
U271
U279
C305
U305
DS309
DS310
DS311
DS312
DS313
R315
U317
DS319
DS320
DS321
DS322
DS323
R325
C327
U327
DS329
DS330
DS331
DS332
DS333
R335
C337
U337
C338
C339
C343
U343
C344
C345
C348
U348
U351
C355
U355
U385
R387
Y395
C417
U417
R411
R421
U427
R429
R431
R433
R435
R437
R439
R441
R443
R445
R447
C451
U451
R453
U455
R457
C463
U463
C471
R475
C479
CR485
CR487
C483
U571
U579
U587
C523
U523
C527
U527
C537
U537
C547
C548
U549
R553
TP551
U555
C563
U563
U567
R531
R533
R541
R543
R545
R547
TP553
TP651
TP529
U623
R626
CR627
CR628
R629
R633
U637
CR641
CR643
R645
U649
R655
U655
U663
TP731
C723
C727
C737
TP745
R747
R749
R751
R753
S 885
R721
R722
R723
R724
U727
R728
R731
U737
R741
VR743
R745
TP655
R757
R763
R765
R770
R775
R733
C735
C745
R826
R827
R828
R837
C845
VR838
C839
R851
S 860
S 865
S 870
DS875


ASSEMBLY-SHEET: A1-1 (1 OF 3)
BOARD: 070-8123-00
TV GENERATOR BOARD
4662-S1
NOTES:
INSTRUMENT: 067-1158-00 (FOR USE WITH 4901)
YGATE-1 (-2,3)
MGATE-1 (-2,3)
CGATE-1 (-2,3)
GATERST-0 (-3)
BGATE-1 (-2,3)
ADTCLK-0 (-2,3)
YELLOW DOT TIME DELAY
MAGENTA DOT TIME DELAY
CYAN DOT TIME DELAY
BLK DELAY
DOT CONTROL DISPLAY
DOT TIME CLOCK
DOT CONTROL SHIFT REGISTER
DATA SOURCE SELECT
MAGENTA
CYAN
BLACK
YELDT-0
MAGDT-0
CYANDT-0
BLKDT-0
AD7-1
AD6-1
AD5-1
AD4-1
AD3-1
AD2-1
AD1-1
AD0-1
A9-1
A8-1
A14-1
A13-1
A12-1
A15-1
RD-0
INTR
WR-0
RESET-1
DTCLK-0
(-2) DLYDATA-1
(-2) DLYCLK-1


ASSEMBLY-SHEET:
A1-2
(2 OF 3)
BOARD: 070-8123-00
TV GENERATOR BOARD
1002-S2
10X Black
NOTES:
INSTRUMENT:
067-1158-00
(FOR USE WITH 4691)
CPU KERNAL
CPU I/O
MODE & DOT CONTROL SWITCHES
CYAN
MAGENTA
BLACK
CAL
CONV
TV
ON
DLYDATA-1
DLYCLK-1
FCAL-0
FCLR-1
FADY-0
L-1/S-0
AM7-1 THRU AM0-1 (-3)
SKIP-0
RESET-1
(-1) ADTCLK-0
PRTRQ-0
HRDY-0
A3MD-0
YGATE-1
MGATE-1
CGATE-1
BGATE-1


TV GENERATOR BOARD
BOARD: 670-8123-00
ASSEMBLY-SHEET: A1-3 (3 OF 3)
INSTRUMENT: 067-1158-00 (FOR USE WITH 4691)
NOTES:
VOLTAGE CONTROLLED OSCILLATOR
BUFFERS/DRIVERS
INK CONTROL SWITCH
PHASE DETECTOR
AMPLITUDE MODULATOR AND SYNCRONIZER
SWEEP CONTROLLER
DUTY CYCLE FREQ ADJ.
HYEL
HMAG
HCYAN
HBLK
(-2) FCAL-0
(-2) FADV-0
(-2) FCLR-1
(-2) L-1/S-0
(-1) ADTCLK-1
+12 VOLTS
+5 VOLTS
GND
-12 VOLTS
(-1) AM7-1 THRU AM0-1
YGATE-1
MGATE-1
CGATE-1
BGATE-1
(-1) GATERST-0
IC SUPPLIES
DEVICE TYPE
PIN
+5V
GND
-5V
-12V
ALL 14 PIN ICS
AD581
AD7524
MC14053
OTHER 16 PIN ICS
ALL 20 PIN ICS
6810
2716
6504
uPD8255AC-5
OTHER 40 PIN ICS