

# Instruction Manual



**1720/1721**  
**Vectorscope (S/N B060000 & Above)**  
**070-5846-07**

**Warning**

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

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# Table of Contents

Table of Contents .....	i
<b>General Safety Summary .....</b>	<b>viii</b>
<b>Preface .....</b>	<b>x</b>
<b>Section 1 Introduction and Specification .....</b>	<b>1-1</b>
Accessories .....	1-2
Standard Accessories .....	1-2
Optional Accessories .....	1-2
Options .....	1-2
CRT Options .....	1-2
Power Cord Options .....	1-2
Safety Information .....	1-3
Specifications .....	1-3
<b>Section 2 Operating Instructions .....</b>	<b>2-1</b>
Front-Panel Controls and Indicators .....	2-1
INPUT .....	2-2
GAIN .....	2-2
PHASE .....	2-3
DISPLAY .....	2-3
MISCELLANEOUS .....	2-3
Rear-Panel Connectors .....	2-4
BNC Connectors .....	2-4
Subminiature D-Type Connectors .....	2-5
Power Input .....	2-6
Miscellaneous .....	2-6
Using the 1720/1721 in Auxiliary Mode .....	2-6
INPUT Switching .....	2-7
REF Switching .....	2-7
LINE SELECT .....	2-7
STORE .....	2-7
RECALL .....	2-7
Measurement Applications .....	2-14
Color Measurements .....	2-14
Functional Use of the Vector Graticule .....	2-18
Measurement of Color Bars .....	2-18
Differential Gain and Phase Measurements .....	2-20
X Y Measurements .....	2-22
Making Stereo Audio Phase Measurements .....	2-22
Looking at Incidental Carrier Phase Modulation .....	2-23
<b>Service Safety Summary .....</b>	<b>s-1</b>
<b>Section 3 Installation .....</b>	<b>3-1</b>
Packaging .....	3-1
Electrical Installation .....	3-1

Power Source .....	3-1
Mains Frequency and Voltage Ranges .....	3-1
Operating Options .....	3-1
X Y INPUT Connector .....	3-1
Auxiliary Connector .....	3-3
Mechanical Installation .....	3-4
Cabinetizing .....	3-4
Securing the Instrument in its Cabinet .....	3-6
Rack Mounting .....	3-7
Custom Installation .....	3-9
<b>Section 4 Theory of Operation .....</b>	<b>4-1</b>
Overview .....	4-1
Block Diagram .....	4-2
Video Input .....	4-2
Luminance Processing .....	4-2
Microprocessor .....	4-2
Gain Cell .....	4-3
Chrominance Processing .....	4-3
Demodulators .....	4-4
Output Amplifiers .....	4-4
CRT Blanking .....	4-4
Circuit Descriptions .....	4-5
<b>DIAGRAM 1 INPUT AND DEFLECTION AMPLIFIERS .....</b>	<b>4-5</b>
Video Input Amplifiers .....	4-5
Gain Cell .....	4-6
<b>DIAGRAM 2 SUBCARRIER REGENERATOR .....</b>	<b>4-6</b>
Reference Switch .....	4-7
Luminance and Chrominance Amplifiers .....	4-8
Sync Separator .....	4-8
Bowes Oscillator .....	4-8
Back Porch Sample .....	4-8
Loop Phase Detector and Amplifier .....	4-8
Quadrature Phase Detector and Amplifier .....	4-9
Burst Clamp .....	4-9
Lock Detector and Bandwidth Switch .....	4-9
Error Amplifier .....	4-9
PAL Phasing .....	4-10
VCXO .....	4-10
<b>DIAGRAM 3 DEMODULATOR .....</b>	<b>4-11</b>
V-Axis Switcher .....	4-11
Chrominance Demodulators .....	4-12
Sync Tip Chrominance Clamp .....	4-12
Demodulator Output Filters and Amplifiers .....	4-12
Vector Center Dot Position Clamp .....	4-12
<b>DIAGRAM 4 DEFLECTION AMPLIFIER .....</b>	<b>4-13</b>
XY Input Amps .....	4-14
Deflection Amplifiers .....	4-14
Center Dot Comparators .....	4-14
CRT Blanking .....	4-14
<b>DIAGRAM 5 MICROPROCESSOR .....</b>	<b>4-15</b>

Microprocessor .....	4-15
DIAGRAM 6 CONTROL CIRCUIT .....	4-17
Z-Axis Control .....	4-18
Trace Rotation .....	4-18
Graticule Illumination .....	4-18
Post Regulators .....	4-18
DIAGRAM 7 LOW VOLTAGE POWER SUPPLY .....	4-19
Line Rectifier and Filter .....	4-19
Pulse Width Modulator .....	4-20
Output Filters .....	4-21
Error Amplifier .....	4-21
Feedback Transformer Driver and Peak Detector .....	4-21
Output HV Shutdown .....	4-21
DIAGRAM 8 HIGH VOLTAGE POWER SUPPLY .....	4-22
HV Osc and Error Amp .....	4-22
Power Supply Outputs .....	4-23
Focus Amplifier .....	4-23
Grid Drive Circuit .....	4-23
Z-Axis Amplifier .....	4-23
<b>Section 5 Checks and Adjustments .....</b>	<b>5-1</b>
Recommended Equipment List .....	5-1
Electrical Instruments .....	5-1
Auxiliary Equipment .....	5-3
Performance Check Procedure Short-Form Reference .....	5-5
Performance Check Procedure .....	5-6
Adjustment Procedure .....	5-17
Signal Connections .....	5-18
Adjustment Procedure Short-Form Reference .....	5-19
Long-Form Adjustment Procedure .....	5-20
<b>Section 6 Maintenance .....</b>	<b>6-1</b>
Preventive Maintenance .....	6-1
Cleaning .....	6-1
Visual Inspection .....	6-2
Static-Sensitive Components .....	6-2
Performance Checks and Readjustments .....	6-3
Troubleshooting .....	6-4
Foldout Pages .....	6-4
Parts Lists .....	6-5
Major Assembly Interconnection .....	6-5
General Troubleshooting Techniques .....	6-6
Specific Troubleshooting Procedures .....	6-8
Power Supply .....	6-8
Troubleshooting Procedure .....	6-8
Introduction .....	6-8
Low Volts Supply .....	6-9
High Volts Supply .....	6-12
Serial Port and LED Driver Diagnostics .....	6-14
Corrective Maintenance .....	6-15
Obtaining Replacement Parts .....	6-15
Mechanical Disassembly/Assembly .....	6-15

Bezel Removal .....	6-16
Graticule Light Removal and Replacement .....	6-17
CRT Removal .....	6-18
Replacement of the CRT .....	6-18
Removing the Rear Panel .....	6-19
Removing the Front Panel Circuit Board .....	6-19
Removing the Main Board .....	6-20
Removing the Power Supply Board .....	6-22
Repackaging .....	6-23
Identification Tag .....	6-23
Repackaging for Shipment .....	6-23
<b>Section 7 Options .....</b>	<b>7-1</b>
Options .....	7-1
CRT Options .....	7-1
Power Cord Options .....	7-1
Field Upgrade Kits .....	7-1
Cabinets .....	7-1
Plain Cabinet (1700F00) .....	7-2
Carrying Case (1700F02) .....	7-2
Side-by-Side Rack Adapter (1700F05) .....	7-2
DC Power Supply .....	7-2
DC Power Supply Field Upgrade Kit (1700F10) .....	7-2
Battery Pack (BP1) .....	7-2
Ordering .....	7-2
<b>Section 8 Replaceable Electrical Parts .....</b>	<b>8-1</b>
Parts Ordering Information .....	8-1
Using the Replaceable Electrical Parts List .....	8-1
<b>Section 9 Diagrams/Circuit Board Illustrations .....</b>	<b>9-1</b>
<b>Section 10 Replaceable Mechanical Parts .....</b>	<b>10-1</b>



## List of Figures

Figure 2-1: Control and indicator locations. . . . .	2-1
Figure 2-2: 1720/1721 rear panel. . . . .	2-5
Figure 2-3: Signal connection for the Operator's Checkout Procedure. . . . .	2-9
Figure 2-4: 1720/1721 typical vector display. . . . .	2-10
Figure 2-5: Modulated staircase waveform shown on a 1721. . . . .	2-10
Figure 2-6: Color bar and modulated staircase signals both displayed on a 1721. . . . .	2-11
Figure 2-7: Connection for using black burst signal for External Reference. . . . .	2-12
Figure 2-8: 1720/1721 test circle display. . . . .	2-12
Figure 2-9: NTSC standard color phase Vector diagram. . . . .	2-15
Figure 2-10: PAL standard color phase Vector diagram. . . . .	2-15
Figure 2-11: Partial 1720 graticule showing the 75% amplitude burst target. . . . .	2-16
Figure 2-12: Partial 1721 graticule showing the 75% amplitude burst target. . . . .	2-17
Figure 2-13: Fine detail of the 1720 graticule magenta target. . . . .	2-18
Figure 2-14: Fine detail of the 1721 graticule target. . . . .	2-19
Figure 2-15: Simulated 1720 graticule showing the relationship between amplitudes on the I and Q modulation axes and the location of the color vector targets. . . . .	2-19
Figure 2-16: Simulation of a 1721 graticule showing the relationship between amplitudes on the U and V axes and the locations of the color vector targets. . . . .	2-20
Figure 2-17: A simulation of a part of the 1720 graticule showing the differential phase and gain measurement scales with approximately 10° differential Phase (dP). . . . .	2-21
Figure 2-18: Simulation of the 1721 Differential Gain and Phase graticule showing approximately 10% differential Gain (dG). . . . .	2-22
Figure 3-1: Plug jumper locations.. . . .	3-2
Figure 3-2: 1720/1721 REMOTE connector pins with their functions. . . . .	3-3
Figure 3-3: 1720/1721 AUXILIARY connector pins with their functions. . . . .	3-4
Figure 3-4: 1700F00 plain cabinet. . . . .	3-5
Figure 3-5: 1700F02 portable cabinet. . . . .	3-6
Figure 3-6: Cabinet securing screws. . . . .	3-7
Figure 3-7: 1700F05 rack adapter. . . . .	3-7
Figure 3-8: 1700F05 rack adapter adjustment. . . . .	3-8
Figure 3-9: 1720/1721 and 1700F06 blank panel. . . . .	3-8
Figure 3-10: Typical custom installation showing the console. . . . .	3-9
Figure 4-1: Simple block diagram of a 1720/1721 Vectorscope. . . . .	4-3

Figure 4-2: Block diagram of the Phase Lock Loop .....	4-7
Figure 5-1: Rear view of Remote plug connections.. .....	5-4
Figure 5-2: Loop-through connection of black burst signal to both EXT REF and CH-B. ..	5-7
Figure 5-3: Using the vector graticule -3 dB markings to measure bandwidth. ....	5-8
Figure 5-4: Signal connection for checking CH-A/CH-B phase matching. ....	5-10
Figure 5-5: Rear-panel XY INPUT connector showing inputs.. .....	5-14
Figure 5-6: Audio frequency XY display. ....	5-15
Figure 5-7: Adjustment and test point locations for 1720/1721 Vectorscope. ....	5-17
Figure 5-8: Starting connections for the adjustment procedure. ....	5-18
Figure 5-9: Test points and adjustment locations for the $\pm 11.8V$ supplies. ....	5-21
Figure 6-1: Circuit board assembly locations .....	6-5
Figure 6-2: Multiple pin connectors used in the 1720/1721 Waveform Monitors .....	6-6
Figure 6-3: Screws that need to be removed to remove the bezel. ....	6-17
Figure 6-4: Screws that need to be removed to remove the rear panel .....	6-19
Figure 6-5: Screws that hold the Front Panel circuit board (A2) in place. ....	6-20
Figure 6-6: Screws holding the main circuit board (A3) in place. ....	6-21
Figure 6-7: Screws holding the Power Supply circuit board (A1) in place. ....	6-22
Figure 6-8: Repackaging .....	6-23

## List of Tables

Table 1-1: Signal Input .....	1-4
Table 1-2: Vector Mode .....	1-5
Table 1-3: XY Mode .....	1-7
Table 1-4: CRT Display .....	1-7
Table 1-5: Power Source .....	1-8
Table 1-6: Environmental Characteristics .....	1-8
Table 1-7: Certification .....	1-9
Table 1-8: Physical Characteristics .....	1-9
Table 3-1: Internal Jumper Selection .....	3-2
Table 3-2: AUXILIARY Connector Pin Assignments .....	3-4
Table 4-1: U613 Switching Control Outputs .....	4-16
Table 5-1: Performance Check Procedure Short-Form Reference .....	5-5
Table 5-2: Adjustment Procedure Short-Form Reference .....	5-19
Table 6-1: Static Susceptibility .....	6-2
Table 6-2: Power Supply Fault Symptoms .....	6-9
Table 6-3: Low Volts Supply Voltages .....	6-9
Table 6-4: Control Circuit Test Points .....	6-11
Table 6-5: High Volts Supply Fault Symptoms .....	6-12
Table 6-6: High Voltage Oscillator Test Points .....	6-13

# General Safety Summary

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

*Only qualified personnel should perform service procedures.*

## **To Avoid Fire or Personal Injury**

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

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

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

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

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

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

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

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

**Do Not Operate in Wet/Damp Conditions.**

**Do Not Operate in an Explosive Atmosphere.**

**Keep Product Surfaces Clean and Dry.**

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

**Symbols and Terms**

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



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



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

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

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

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

CAUTION indicates a hazard to property including the product.

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



# Preface

This manual documents the TEKTRONIX 1720/1721 Vectorscope. Information that applies to all instruments in the series refers to the 1720/1721. Information that applies to only specific instruments within the series refers to the model numbers of those instruments (i.e., 1720, 1721).

The information in this manual is intended for instrument operators and service technicians. Operators are assumed to be familiar with basic television terms and measurements. Qualified service technicians are also assumed to be familiar with television terms and measurements, and have moderate experience with analog and logic circuits.

**Section 1, Introduction and Specification**, includes a general description of the instrument followed by the Specifications. The Specifications include references to the corresponding Performance check steps.

**Section 2, Operating Instructions**, familiarizes the user with the front- and rear- panel controls, connectors, and indicators; includes an operator's checkout procedure; and includes other operator familiarization information.

**Section 3, Installation**, includes electrical and mechanical installation information. The electrical installation information includes adjustments and operational changes available with the instrument. The mechanical installation information includes rackmounting, custom installation, and portable use.

**Section 4, Theory of Operation**, provides an overall block diagram description and detailed circuit descriptions. Read the block diagram description for an overview of the instrument. The detailed circuit descriptions should be used with the block diagram and schematic diagrams in the foldout pages for specific information about individual circuits.

**Section 5, Checks and Adjustments**, includes the Performance Check Procedure and the Adjustment Procedure. The Performance Check Procedure is used to verify that the instrument's performance is within its specifications, and the Adjustment Procedure is used to adjust the instrument to meet its specifications. The procedures are preceded by a list of recommended test equipment. Each procedure has a short form listing of the individual steps.

**Section 6, Maintenance**, includes preventive, troubleshooting, and corrective information.

**Section 7, Options**, contains summaries of available instrument options. Additional information concerning options is included in appropriate places throughout the manual.

**Section 8, Replaceable Electrical Parts**, includes ordering information and part numbers for all replaceable electrical parts.

**Section 9, Diagrams**, contains servicing illustrations. These include adjustment locations, circuit board part locations, a block diagram, schematic diagrams, and waveforms. Parts locating tables are included that cross-reference the circuit board illustrations and the schematic diagrams.

**Section 10, Replaceable Mechanical Parts**, includes ordering information and part numbers for all replaceable mechanical parts. This parts list is referenced to an exploded view mechanical drawing. Also included are lists of standard and optional accessories.







# **Introduction and Specifications**



# Section 1

## Introduction and Specifications

The TEKTRONIX 1720/1721 is an 8-1/2"-wide by 5-1/4"-high Vectorscope, weighing 8-1/2 pounds. Both the 1720 (System M, NTSC) and the 1721 (System I, B, etc., PAL) versions can be powered from an ac source or, with the addition of a field upgrade kit (1700F10), from 12 Vdc. The crt occupies approximately two-thirds of the front-panel area, with the control panel taking up the remainder of the space. Operation is controlled by a Microprocessor that polls the front-panel switches. Front-panel switches are momentary-touch type with lighted functional indicators. Some of the switches are also used to select special functions, which are accessed by holding the switches in until the Microprocessor recognizes the request.

The signal is displayed on a bright crt capable of displaying one line per frame. It is of the mesh-type, for better geometry, and uses an internal graticule to reduce parallax. Variable graticule scale illumination provides even lighting over the usable graticule area without hot spots or voids, to improve measurement accuracy and the quality of display pictures. Option 74 provides a P4 (white) phosphor tube.

Composite video signals, for the Channel A and B Inputs and the External Reference Signal Input, are brought in through high impedance bridging loop-throughs, in order to protect the integrity of the signal paths. The input switching allows for the display of Channel A, Channel B, or both inputs. Synchronization can be either internal or external.

The 1720/1721 offers a choice of individual displays of vectors or XY or both. The XY display, with accompanying graticule scale, allows this vectorscope to be used for stereo audio monitoring. In addition to the usual color bar amplitude and phase relationships, the vector display can also be used to make differential gain and phase measurements. The 1721 has the +V display that is used to check PAL system color encoders. Full 360° phase shift and a test circle are also included in these vectorscopes.

Stereo audio input for XY display is balanced line through the rear-panel REMOTE connector.

The 1720/1721, through the Auxiliary function, reacts to Store and Recall commands from a companion 1730-Series Waveform Monitor, when the two are interconnected. This provides for storing of up to four front-panel setups that can be recalled when the Waveform Monitor Recall button is pressed, or a valid 1730-Series Remote ground closure occurs. The Auxiliary function can also take advantage of the blanking strobe, from the waveform monitor, to unblank the vectorscope crt for a line select display.

## Accessories

The 1720/1721 is shipped with a set of accessories that are needed for its installation or day-to-day operation. These are the “Standard Accessories.” They are physically packaged in a small, cardboard carton within the packing box.

In addition to the Standard Accessories, there are other accessory items that can be purchased from Tektronix, Inc., which will either enhance operation or help to customize the installation. The following list of accessories is divided into these two categories. Part numbers for the standard accessories can be found at the end of the Replaceable Mechanical Parts list.

### Standard Accessories

- 1 1720/1721 Instruction Manual.
- 1 Power Cable Assembly.
- 1 Spare Cartridge Fuse (3AG 2A, 250 V, Fast Blow).
- 3 Replacement Scale Illumination Bulbs (Tektronix P/N 150-0168-00 or ANSI #73).
- 1 Auxiliary Control Cable, for use with a 1730-Series Waveform Monitor.

### Optional Accessories

- 1700F00, Plain Cabinet (painted silver grey)
- 1700F02, Portable Cabinet (painted silver grey)
- 1700F05, Side-by-Side Rack Adapter
- 1700F06, Blank Half-Rack-Width Panel

## Options

**CRT Options** Standard instruments are shipped with a P31 (green) phosphor crt installed. Option 74 instruments are shipped with a P4 (white) phosphor crt installed.

**Power Cord Options** Any of the power cord options described in Section 7 can be ordered for the 1720/1721. If no power cord option is ordered, instruments are shipped with a North American 125 V power cord and one replacement fuse.

## Safety Information

1720/1721 instruments are intended to operate from an ac power source that will not apply more than 250 V rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor is essential for safe operation.

The 1720/1721 was tested for compliance in a cabinet. To ensure continued compliance, the instrument will need to be enclosed in a cabinet that is equivalent to the Factory Upgrade Kits that are listed as Optional Accessories for the 1720/1721. Drawings of the available cabinets are contained in the Installation Instructions (Section 3).

## Specifications

The Performance Requirements listed here apply over an ambient operating temperature range of 0 to 50° C and are valid only when the instrument is calibrated at 25° ±5° C, following a minimum warm-up period of 20 minutes.

Procedure and the list of test equipment required to verify Performance Requirements are located in Section 5.

**Table 1-1: Signal input**

Characteristics	Performance requirement	Supplemental information	Step number
Return loss (75 $\Omega$ ) Video inputs (CH A, CH B) EXT REF	At least 40 dB from 50 kHz to 6 MHz.	Loop-through terminated in 75 $\Omega$ . Input in use or not in use, instrument power on or off, all deflection factor settings.	11
Crosstalk between channels		Greater than 70 dB of isolation between channels. Measured at $F_{SC}$ between Channel A, Channel B, and EXT REF.	
Loop-through isolation		Greater than 70 dB of isolation between loop-throughs. Measured at $F_{SC}$ between Channel A, Channel B, and EXT REF.	
Input requirements	Stable display with composite video, or black burst with 286 mV (300 mV PAL) burst $\pm 6$ dB.		3
DC input impedance (unterminated)	Greater than 15 k $\Omega$		
EXT REF input		Composite video (can be CW subcarrier if two internal jumpers are moved).	
Absolute maximum input voltage		$\pm 12$ VDC plus peak AC	
Maximum operating input voltage		Peak AC + DC should be within +8.0 V and -5.6 V for proper operation.	

**Table 1-2: Vector mode**

Characteristic	Performance requirement	Supplemental information	Step number
Chrominance processing characteristics Nominal subcarrier frequency ( $F_{sc}$ ) NTSC PAL		3.579545 MHz. 4.43361875 MHz.	
Chrominance bandwidth Upper -3 dB point Lower -3 dB point	$F_{sc} + 500$ kHz, $\pm 100$ kHz $F_{sc} - 500$ kHz, $\pm 100$ kHz		4
Display Vector phase accuracy Vector gain accuracy Quadrature phasing	$\pm 1.25$	Measured with color bar signal Typically, $\pm 2.5\%$ Typically, $\pm 0.5^\circ$	5 5

Table 1-2: Vector mode (cont.)

Characteristic	Performance requirement	Supplemental information	Step number
Subcarrier regenerator		Subcarrier regenerator freeruns in absence of appropriate signal. Reference can be burst of either displayed signal or external reference signal.	
NTSC pull-in range PAL pull-in range	$\pm 50$ Hz of $F_{sc}$ $\pm 10$ Hz of $F_{sc}$	PAL units are tested to 10 Hz, but typically lock to within 50 Hz.	6
Pull-in time		Within 1 second, with subcarrier frequency within 50 Hz (10 Hz for PAL) of $F_{sc}$ .	6
Phase shift with subcarrier frequency change (NTSC) Phase shift with subcarrier frequency change (PAL)	$\pm 2^\circ$ from $F_{sc}$ to ( $F_{sc} + 50$ Hz) or $F_{sc}$ to ( $F_{sc} - 50$ Hz) $\pm 2^\circ$ from $F_{sc}$ to ( $F_{sc} + 10$ Hz) or $F_{sc}$ to ( $F_{sc} - 10$ Hz)		6
Phase shift with burst amplitude change	$\pm 2^\circ$ from nominal burst amplitude to $\pm 6$ dB.		6
Phase shift with input channel change	$\pm 0.5^\circ$	With EXT REF selected.	7
Phase shift with VAR GAIN control	$\pm 1^\circ$ as gain varies from 3 dB to -6 dB.		7
Phase control range		$360^\circ$ continuous rotation.	
Burst jitter	$< 0.5^\circ$	With 140 IRE (1 V PAL) composite video input. INT or EXT referenced.	7
Display characteristics		Measured with 140 IRE (1 V PAL) linearity signal (5 step, 10 step, or ramp) with 40 IRE (300 mV PAL) of subcarrier.	8
Differential phase Differential gain	$\pm 1^\circ$ $\pm 1\%$		
Position control range, horizontal Position control range, vertical	At least .25" (6 mm) from center. At least .25" (6 mm) from center.		9
Clamp stability	0.0156" (0.4 mm) or less.	Center spot movement with PHASE control rotation.	9
Variable GAIN range	+14 dB to -6 dB of 75% color bar preset gain.	+5 to -0.5 amplitude.	10

**Table 1-3: XY Mode**

Characteristic	Performance requirement	Supplemental information	Step number
Input		DC Coupled differential inputs through rear-panel REMOTE connector.	
Input amplitude	2 to 9 V <sub>p-p</sub>	Adjustable full scale deflection 0 dBm to +12 dBm for 600Ω system. Factory set to 0 dBm. Specification verified during calibration.	
Maximum input voltage	±15 V peak signal plus DC.		
Frequency response	DC to greater than 500 kHz.	3 dB point.	14
High gain mode	DC to greater than 100 kHz.	3 dB point. Not a differential input, minus inputs must be grounded.	14
X and Y input phase matching	Less than a trace width of separation at 20 kHz.	Single ended. Phase matching may be improved, above 20 kHz, by adjusting C484.	13

**Table 1-4: CRT Display**

Characteristic	Performance requirement	Supplemental information	Step number
CRT viewing area		80 X 100 mm.	
Accelerating Potential		15.75 kV	
Trace rotation range	Greater than ±1° from horizontal.	Total adjustment range is typically 8°.	12
Graticule		Internal vector, variable scale illumination.	

**Table 1-5: Power source**

Characteristic	Performance requirement	Supplemental information	Step number
Mains voltage ranges	90 - 250 V.	Continuous range from 90 to 250 VAC.	2
Mains frequency range	48 - 66 Hz.		
Power consumption		0.7 A maximum, 0.35 A (21.4 Watts) typical.	



**Table 1-6: Environmental Characteristics**

<b>Characteristic</b>	<b>Supplemental information</b>
Temperature Non-operating Operating	-55 to +75 °C 0 to +50 °C
Altitude Non-operating Operating	To 50,000 feet To 15,000 feet
Vibration - operating	15 minutes each axis at 0.015 inch, frequency varied from 10-55-10 Hz in 1-minute cycles with instrument secured to vibration platform. Ten minutes each axis at any resonant point or at 55 Hz if no resonant point is found.
Shock - non-operating	30 g's, 1/2 sine, 11 ms duration, 3 shocks per surface (18 total).
Transportation	Qualified under NTSC Test Procedure 1A, Category II (30-inch drop).
Humidity	Will operate at 95% relative humidity for up to five days. Do not operate with visible moisture on the circuit boards

**Table 1-7: Physical Characteristics**

<b>Characteristic</b>	<b>Supplemental information</b>
Dimensions Height Width Length	5.25 inches (133.4 mm). 8.5 inches (215.9 mm) 10.125 inches (460.4 mm)
Weight	8.5 lbs (3.8 kg).

**Table 1-8: Certifications and Compliances**

<b>Category</b>	<b>Standards or description</b>
EC Declaration of Conformity - EMC	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

**Table 1-8: Certifications and Compliances (cont.)**

Category	Standards or description
Australia/New Zealand Declaration of Conformity - EMC	Complies with EMC provision of Radiocommunications Act per the following standard(s): AS/NZS 2064.1/2 Industrial, Scientific, and Medical Equipment: 1992 AS/NZS 3548 Information Technology Equipment: 1995
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.
EC Declaration of Conformity - Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Union: Low Voltage Directive 73/23/EEC, amended by 93/68/EEC EN 61010-1 Safety requirements for electrical equipment for measurement control and laboratory use.
U.S. Nationally Recognized Testing Laboratory Listing	UL1244 Standard for electrical and electronic measuring and testing equipment.
Canadian Certification	CAN/CSA C22.2 No. 231 CSA safety requirements for electrical and electronic measuring and test equipment.
Additional Compliance	IEC61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use.
Installation (Overvoltage) Category	CAT II As defined in IEC 1010-1, Annex J.
Pollution Degree	Pollution Degree 2 As defined in IEC 1010-1. Rated for indoor use only.
Safety Certification Compliance	Temperature, operating: 0 to 50° C.
Altitude (maximum operating)	2,000 meters.
Equipment Type	Test and measuring.
Safety Class	Class I (as defined in IEC 1010-1, Annex H) - grounded product.



# Operating Instructions



# Section 2

## Operating Instructions

These instructions provide information about the front-panel controls, rear-panel connectors, the Operator's Familiarization/Checkout Procedures, and discussions about vector and audio measurements using the 1720/1721.

### Front-Panel Controls and Indicators

The front-panel controls and indicators consist of momentary contact push-button switches, variable controls, and backlit switch selections. See Figure 2-1 for the control and indicator locations.

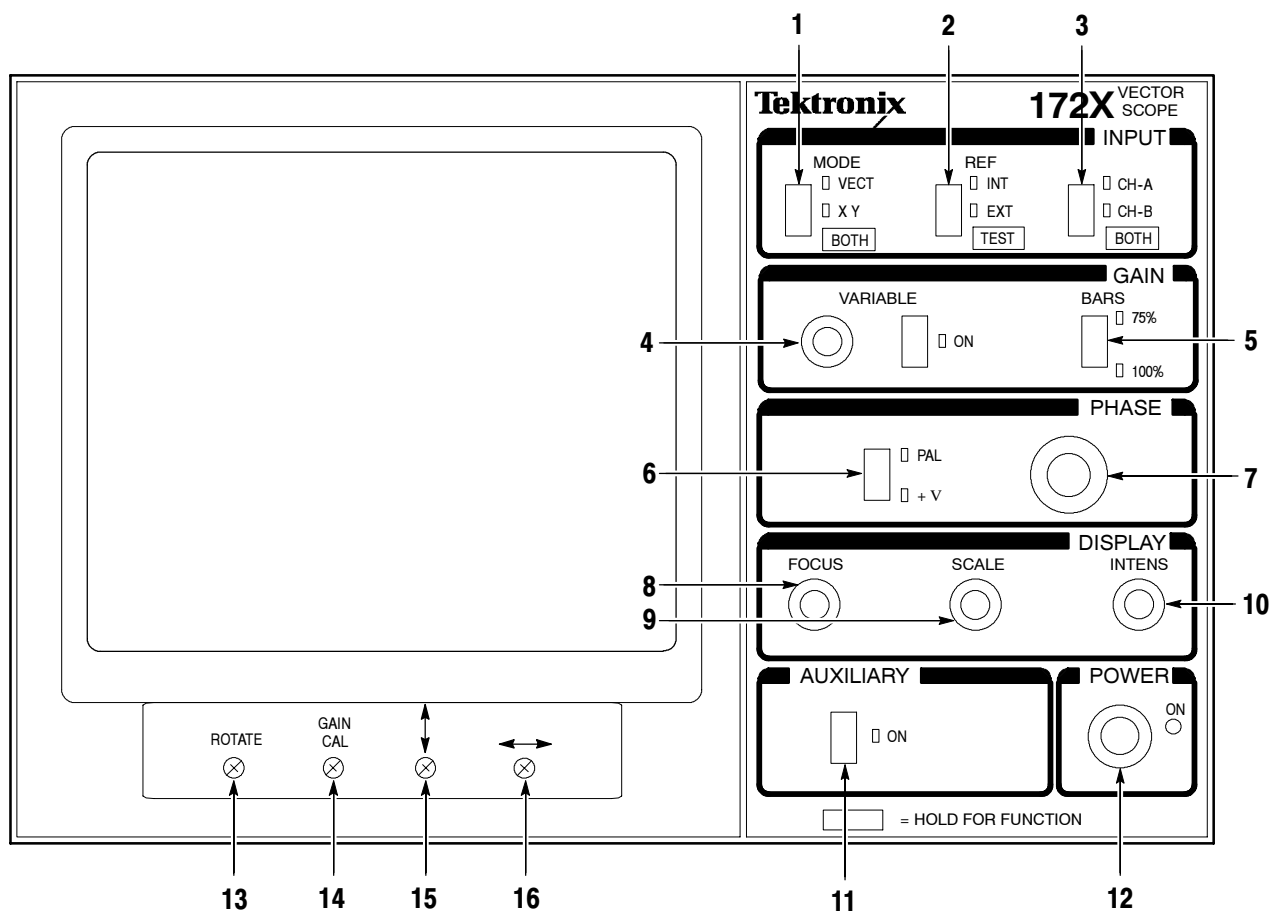


Figure 2-1: Control and indicator locations.

There are three push-button switches, located in the INPUT block, that have an extra function. The extra function is accessed by holding the switch down for approximately one second. The operating selection reverts to the top of the listed functions when the push button is repushed to exit this extra function, with the exception of TEST, which reverts to its original state when exiting.

## INPUT

### 1. MODE

A momentary push-button switch that toggles between the vector and XY displays. These two functions have back lighted nomenclature with rectangular indicators.

Holding this button in switches the MODE to a display of both vector and XY modes. In this mode both the VECT and XY nomenclature and rectangular indicators light up to indicate that the 1720/1721 has been switched to this mode of operation.

### 2. REF

A momentary push-button switch that toggles between INT and EXT sync references. These two functions have back lighted nomenclature with rectangular indicators.

Holding this button in switches the REF to an unlocked display of subcarrier and enables the V-axis switcher, if a signal containing a subcarrier reference signal is applied to the selected input. TEST nomenclature, framed by a blue box, lights up when the 1720/1721 is switched to this mode.

### 3. CH-A CH-B

Momentary contact push-button switch that toggles the input between Channels A and B. Back lighted nomenclature, with rectangular indicators, light to show which is selected for display.

Holding this button in switches the INPUT to a display of both A and B Inputs. This display requires an external sync reference. Both the CH-A and CH-B indicators light when the 1720/1721 has been switched to this dual input mode.

## GAIN

### 4. VARIABLE

A momentary contact push-button switch that toggles between VARIABLE gain ON and off. The VARIABLE control adjusts amplifier input gain so that any input signal between 0.5 V and 2.0 V peak-to-peak can be displayed. Control has no detent, action is continuous. Back lighted nomenclature, with rectangular indicators, lights up red to indicate that display gain is uncalibrated.

## 5. BARS

A momentary contact push-button switch that toggles between correct gain for displaying 75% and 100% amplitude color bar signals, using a single set of vector targets. Burst targets for both 75% and 100% amplitude color bars are on the graticule. Back lighted nomenclature, with rectangular indicators, lights to indicate that the 1720/1721 is set up to measure color bars.

## PHASE

### 6. PAL/+V (PAL Only)

A momentary contact push-button switch that selects either PAL ( $\pm V$ ) or +V only for the phase displays. +V overlays +V with -V on the +V Axis for alternate line comparisons. Back lighted nomenclature, with rectangular indicators, lights to indicate that either standard PAL or overlaid + and -V is being displayed.

### 7. (control)

A continuously-variable control with 360° range to set the phase of the decoder reference.

## DISPLAY

### 8. FOCUS

A 270° rotation potentiometer that is adjusted for display definition.

### 9. SCALE

A 270° rotation potentiometer that controls the level of graticule illumination.

### 10. INTENS

A 270° rotation potentiometer that controls display brightness.

## MISCELLANEOUS

### 11. AUXILIARY

Toggles between AUXILIARY and independent operation. In the AUXILIARY mode, a Line Strobe (to blank the 1720/1721 crt, for line selection) and data to actuate the front-panel setup is accepted from a companion 1730-Series. Back lighted nomenclature and a rectangular indicator both light to indicate that the instrument is under AUXILIARY control.

### 12. POWER

Turns on and off external power to the 1720/1721. Contains a mechanical indicator that indicates the status of the POWER switch, even when the mains power is disconnected or shut down from another location.

### 13. ROTATE

A 270° rotation screwdriver adjustment that aligns the display with the graticule.

### 14. GAIN CAL

A 270° rotation screwdriver adjustment that sets the amplifier gains in the Vector Mode.

### 15. VERT POS

A 270° screwdriver-adjustable, variable control that provides limited vertical positioning of the display.

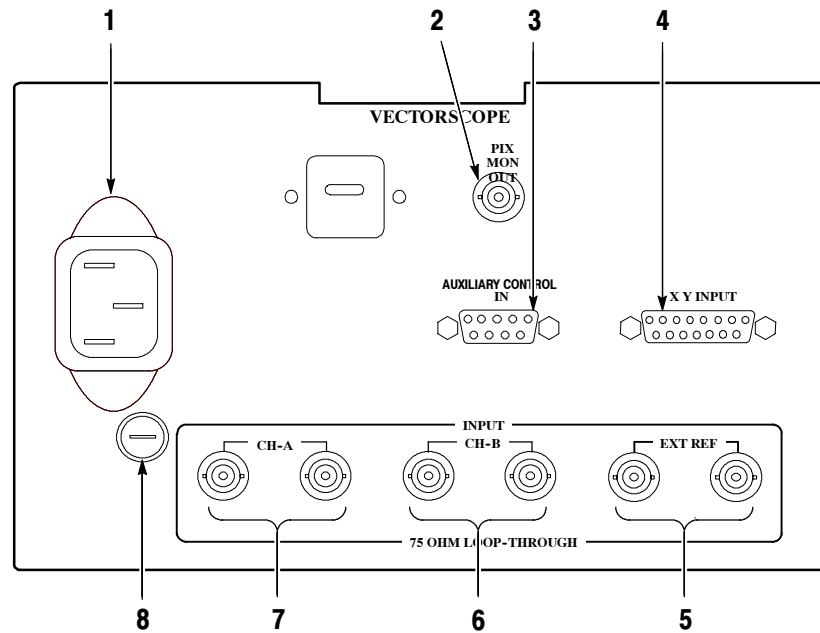
### 16. HORIZ POS

A 270° screwdriver-adjustable, variable control that provides limited horizontal positioning of the display.

## Rear-Panel Connectors

Signal input, power input, Auxiliary Control In, XY Input, and Demod Out are all located on the 1720/1721 rear panel. Because of the similarity of the 1730-Series to the 1720/1721 rear panel, the word **VECTORSCOPE** appears at the top of the panel. See Figure 2-2 for locations of rear-panel connectors.





**Figure 2-2: 1720/1721 rear panel.**

### 1. AC POWER

A standard ac plug receptacle for the 120 or 220 Vac power mains. Plug is compatible with any of the three power cord options available for the 1720/1721 Vectorscope.

### 2. DEMOD OUT

A  $75\Omega$  output of the demodulated R-Y signal that can be fed into a companion 1730-Series to provide a horizontal sweep of demodulated video.

### 3. AUXILIARY

A 9-pin connector used to interface with the 1730-Series. Auxiliary control consists of a signal line (Line Strobe) and a serial interface. The serial interface allows the 1720/1721 to operate in conjunction with the 1730-Series Store/Recall function.

### 4. XY INPUT

A 15-pin connector that is used for the differential input of a stereo audio signal that is to be displayed in the XY mode. One set of inputs can be configured for high gain single-ended input. Internal jumpers must be repositioned for this type of input. See Section 3 (Installation) for more information.

**5. EXT REF**

A bridging loop-through input (compensated for 75Ω) for synchronizing signals. As factory shipped, the input signal may be black burst or composite video. Changing a pair of internal plug jumpers makes it possible to use CW Subcarrier as an external reference; however, horizontal (line) sync must be present on the CH-A INPUT for synchronization. External reference is selected by the front-panel REF switch.

**6. CH-B**

A bridging loop-through input for composite video signal, compensated for 75Ω. The input signal for display is selected by the front-panel INPUT switch.

**7. CH-A**

A bridging loop-through input for composite video signal, compensated for 75Ω. The input signal for display is selected by the front-panel INPUT switch.

**8. AC FUSE**

A holder for an F-type cartridge fuse which is the instrument ac mains supply fuse.

## Using the 1720/1721 in AUXILIARY Mode

When the serial interface AUXILIARY cable (between the 1720/1721 and a 1730-Series) is connected, the 1720/1721 can be operated in the AUXILIARY mode. The 1720/1721 AUXILIARY mode allows the Input and Reference switching to follow the similar switches on the waveform monitor. For example, when the 1730-Series INPUT switch is changed from A to B, the 1720/1721 INPUT switch will also change to B. Even though the vectorscope switching (INPUT and REF) follows the waveform monitor, the vectorscope INPUT and REF switches remain active so that they can be changed without changing the waveform monitor switching. The following functions can be controlled by the 1730-Series in AUXILIARY mode:

INPUT switching

REFerence switching

LINE SELECT

STORE and RECALL

### **INPUT Switching**

INPUT switching allows the 1730-Series to select any of the three inputs (CH-A, CH-B, or BOTH) when AUXILIARY is ON. Note that the 1720/1721 INPUT

switch can be used independently, even though the instrument is in the AUXILIARY mode.

**REF Switching** REF switching allows the 1730-Series to select either INT or EXT reference. It will not switch to TEST when the 1730-Series is switched to CAL. Reference will automatically be switched to EXT if the INPUT is switched to BOTH (from either waveform monitor or vectorscope). If the 1720/1721 REF switch is in TEST, the 1730-Series switching will not take it out of that mode.

**LINE SELECT** The 1720/1721 normal operation is full field. When it is used in AUXILIARY, the 1730-Series LINE SELECT switching controls the display on the vectorscope. It should be noted that the 1720/1721 has no line selection capability when it is not connected to a 1730-Series Waveform Monitor.

**STORE** The current state of the front panel can be stored, in AUXILIARY mode, by executing the 1730-Series STORE command. When the 1730-Series STORE button is pushed, the 1720/1721 front-panel indicators will blink to acknowledge that the command was received. The current front-panel configuration will now be stored in the 1720/1721 NOVRAM as soon as one of the 1730-Series RECALL buttons is pushed.

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**NOTE.** Use caution to retain desired 1730-Series stored configurations. Read the STORE and RECALL SETUP instructions in Section 2 of the 1730-Series Instruction manual before proceeding.

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Note that the indicators also blink when the 1720/1721 is not in AUXILIARY; however, the front-panel configuration is not stored and the 1720/1721 front panel will not change when that stored function (on the 1730-Series) is recalled.

**RECALL** When the 1720/1721 is in the AUXILIARY mode and contains stored front-panel configurations, it reacts to 1730-Series RECALLs. When one of these RECALL buttons is pushed, the stored front-panel configurations of both instruments will be recalled. All front-panel controls remain active during AUXILIARY mode, and can be used to make changes in current front-panel configurations.

During AUXILIARY operation, the 1720/1721 front-panel indicators continue to accurately display its current status.

## OPERATOR'S CHECKOUT PROCEDURE

The following procedure is provided as an aid in obtaining a display on the 1720/1721 Vectorscope, and may be used as a check of basic instrument operation. Only instrument functions are checked in this procedure. All checks can be made with a cabinet on and it is necessary to have all internal jumpers in the factory-set position.

When a complete check of the instrument performance to specification is desired, a qualified service technician should make the Performance Check in Section 5 of this manual.

This procedure requires a source of composite video and composite sync signals. A TEKTRONIX 1410 Series Television Test Signal Generator mainframe with Sync, Color Bar, and Linearity modules was used in preparing this procedure.

### 1. Initial Setup

#### 1720/1721 Vectorscope

MODE	VECT
REF	INT
INPUT	CH A
VARIABLE	off
BARS	75%
PAL/+V	PAL (1721 only)
PHASE	Will be set later
FOCUS	Will be set later
SCALE	Counterclockwise
INTENS	Counterclockwise
POWER	OFF

Connect the color bar signal to the CH-A INPUT and terminate the remaining side of the loop-through input with a 75Ω termination. Connect the modulated staircase signal to the CH-B INPUT, then loop through to the EXT REF and terminate in 75Ω. See Figure 2-3.

Set up the signal sources for the following composite video signals:

Full Field Color Bars

75% Ampl. 7.5% Setup -- NTSC

75% Ampl. 0% Setup -- PAL

Modulated Staircase

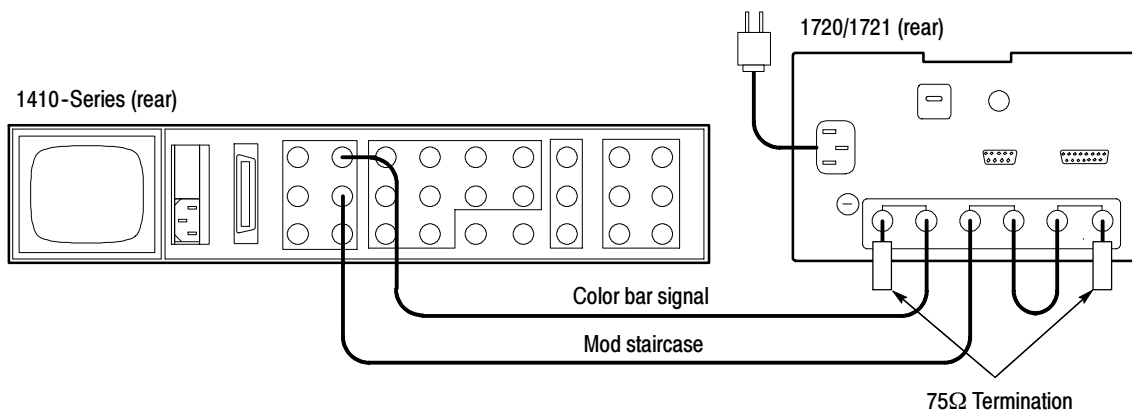
(Flat Field, 10 Step)

Black Burst Signal

(Sync and Burst only)

If the XY operation of the 1720/1721 is to be checked, an audio signal is required. See the following:

Audio Signal: (About 2 V between 1 and 100 kHz.)



**Figure 2-3: Signal connection for the Operator's Checkout Procedure.**

**2. Apply Power**

Connect the instrument to a suitable ac power source and push the POWER switch. Check that the indicator in the center of the switch is indicating that POWER is ON.

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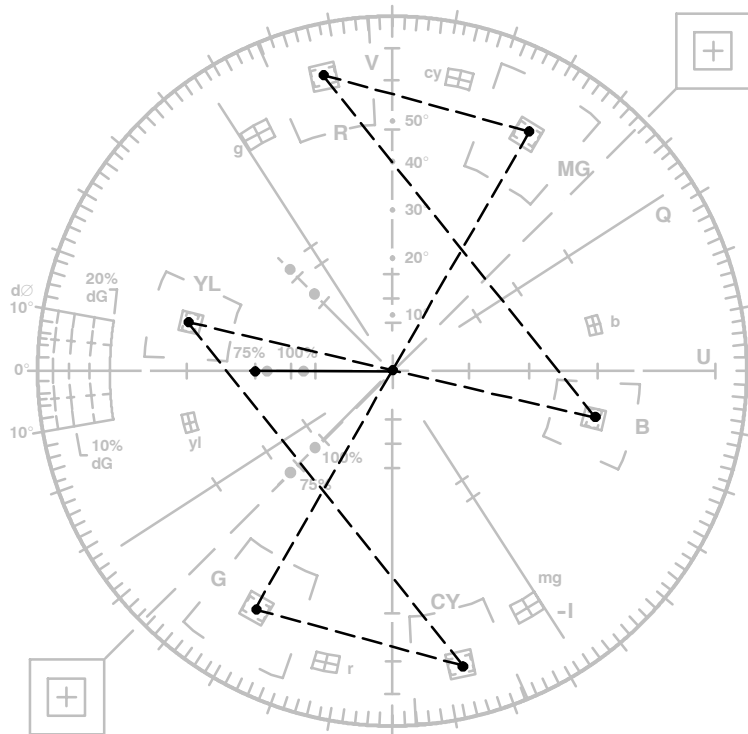
**NOTE.** Do not set any of the front-panel screwdriver controls until after the instrument warms up (at least 20 minutes).

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Rotate the SCALE control clockwise and check that the graticule illuminates.

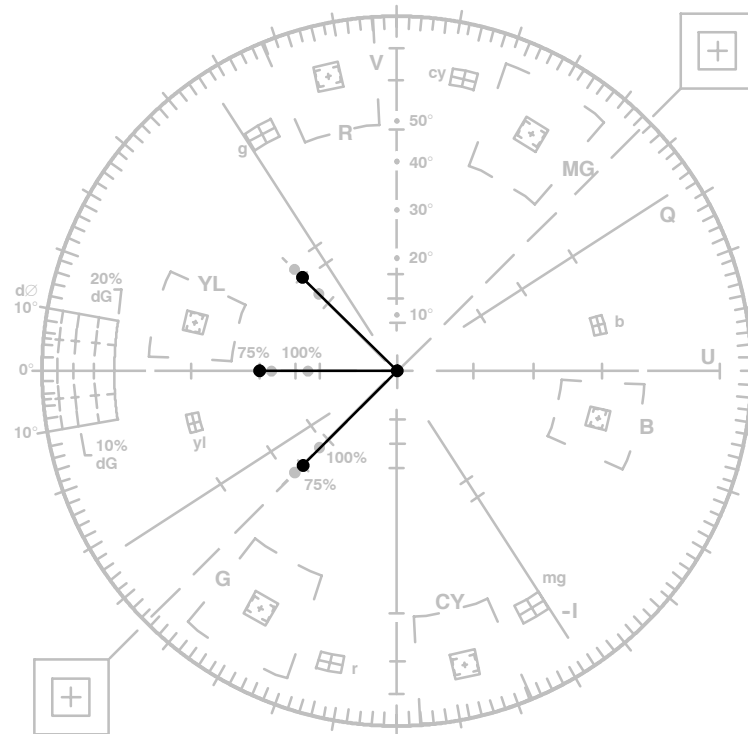
**3. Obtain Display**

Adjust the INTENS and FOCUS controls for the desired brightness and a well-defined vector display. Use the PHASE control to place the vector tips and burst(s) on their targets. See Figure 2-4.



**Figure 2-4: 1720/1721 typical vector display.**

Adjust the SCALE illumination control for the desired brightness. Note that the internal waveform graticule should be illuminated.

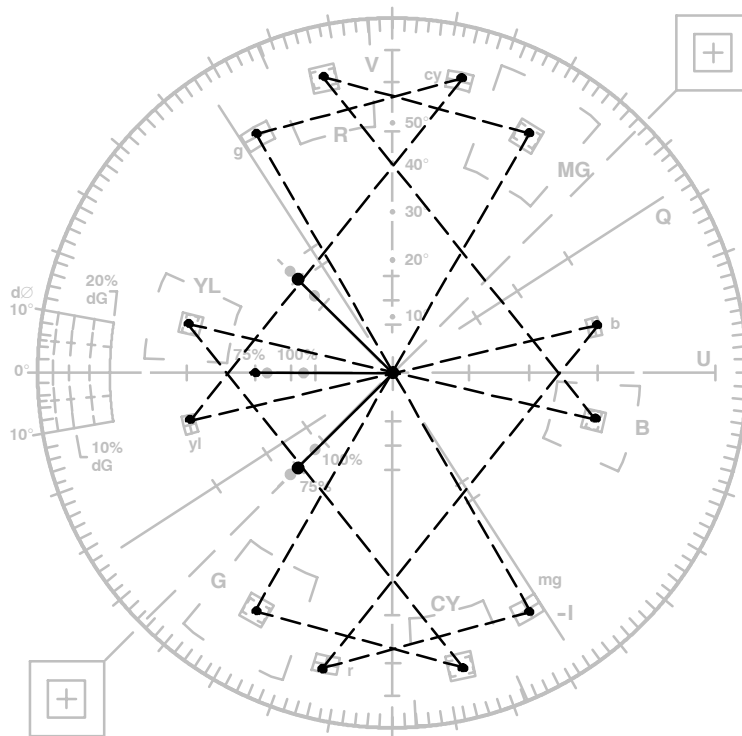


**Figure 2-5: Modulated staircase waveform shown on a 1721. A 1720 would have what would appear to be an intensified burst.**

#### 4. Select Input

Select the Channel B input for a display of the modulated staircase signal. See Figure 2-5.

Push in and hold the INPUT button until both the CH-A and CH-B indicators are lit, and check for a display of both vectors and modulated staircase. See Figure 2-6.



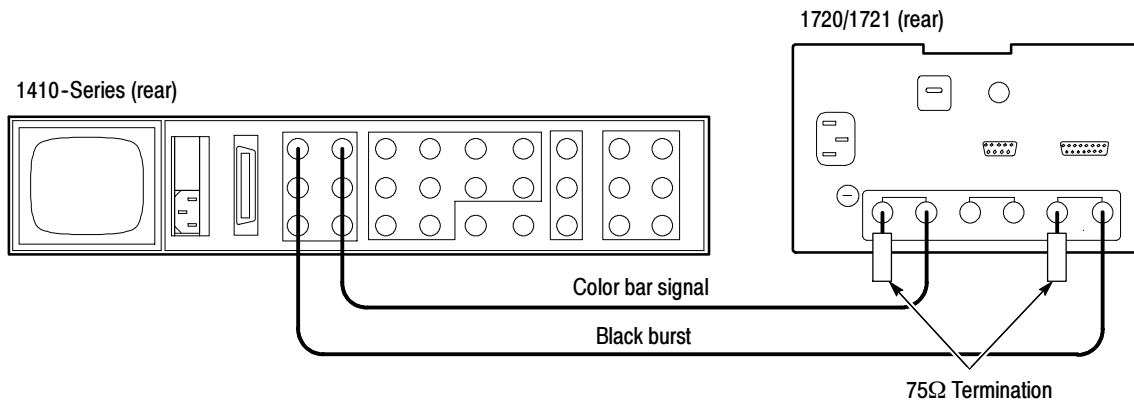
**Figure 2-6: Color bar and modulated staircase signals both displayed on a 1721.**

Briefly push the INPUT button and check that the CH-A indicator is the only one lit and that only a vector display is present.

#### 5. Select Reference

Connect the black burst signal to the EXT REF loop-through input and terminate in 75Ω. See Figure 2-7.



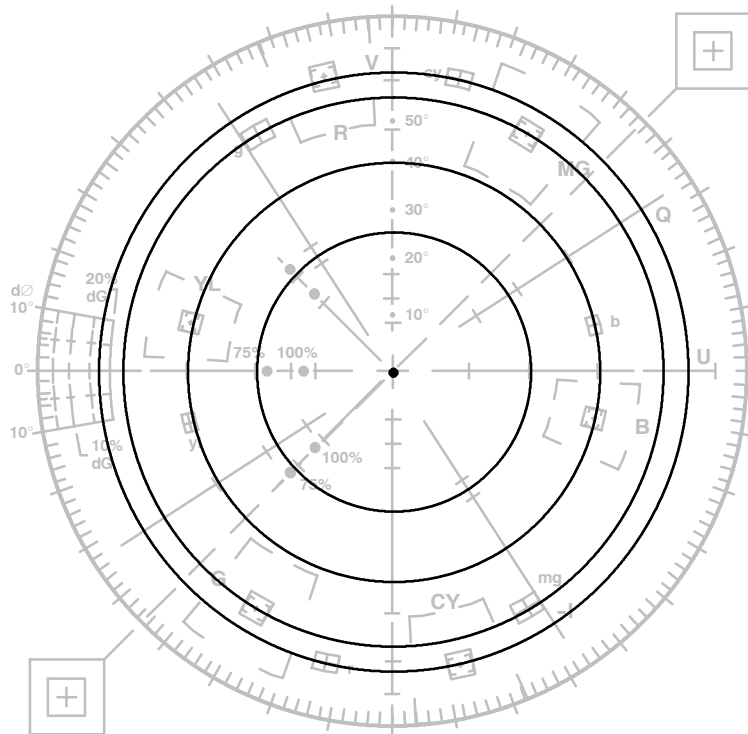


**Figure 2-7: Connection for using black burst signal for External Reference.**

Push the REF button and check that the front-panel EXT indicator lights. Check for a stable display of vectors (CH-A INPUT).

Push and hold the REF button until the front-panel TEST indicator lights. Check for a test circle display. See Figure 2-8.

Leave the 1720/1721 REF in TEST.



**Figure 2-8: 1720/1721 test circle display.**

**6. Position Center Dot**

Use a small screwdriver to adjust the vertical and horizontal positioning controls. Check that there is sufficient range to move the dot through the geographic center of the display (the graticule center target). It should be noted that the amount of adjustment range varies from instrument to instrument.

Adjust the positioning controls to place the center dot at the exact center of the graticule.

**7. Set Gain**

With the test circle displayed, use a screwdriver to adjust the GAIN CAL fully clockwise and check that the outer circle is outside of the outer (Red and Cyan) graticule targets.

Set the GAIN CAL fully counterclockwise and check that the outer circle is inside of the outer (Red or Cyan) graticule targets.

Set the GAIN CAL so that the outer circle passes through the outer (Red and Cyan) graticule targets.

## 8. Variable

With the test circle displayed, push the VARIABLE push button and check that the VARIABLE ON indicator lights.

Rotate the VARIABLE control fully clockwise and check that the display increases in size.

Rotate the VARIABLE control fully counterclockwise and check that the outer circle is inside the outer (Red and Cyan) targets.

Push the VARIABLE push button and check that the test circle is on the outer targets and that the front-panel VARIABLE ON indicator is off.

## 9. Check the Rotation of the Display

Variations in the earth's magnetic field may make adjustment of the ROTATE control necessary at installation time or whenever the instrument is moved.

Connect the audio signal, through the XY INPUT connector on the rear panel, to the +X input (pin 3). Set the 1720/1721 MODE to XY. Set up the audio signal amplitude for a horizontal trace that is long enough to reach across the graticule compass rose.

Check that the sweep is a straight line parallel to the horizontal axis. If not, adjust the ROTATE adjustment until the sweep is parallel to the horizontal axis.

## 10. Check XY Mode

Connect the audio signal to both pins 3 and 7 of the rear-panel XY INPUT. Set the 1720/1721 MODE to XY. Adjust the audio signal amplitude to place the diagonal trace on the 45° graticule line. Adjust audio signal amplitude so that the ends of the trace fall on the target (+) marks.

## 11. Check Dual Mode

Select INPUT A. With the color bar composite video signal connected to the CH-A INPUT and the audio signal connected to the XY INPUT (pins 3 and 7) push and hold the MODE push button until both VECT and XY are lit. Check for a display of both vectors and the XY lissajous.

# Measurement Applications

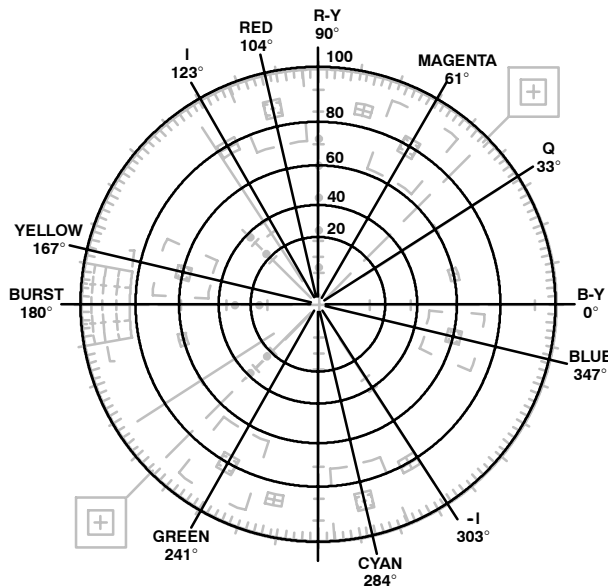
The 1720/1721 is unique in that it is a vectorscope capable of making both chrominance and XY measurements. The information that follows is intended to guide both new and experienced users through simple and complex measurement techniques. The information is divided by major topics, which are then subdivided into specific measurements.

**Color Measurements**

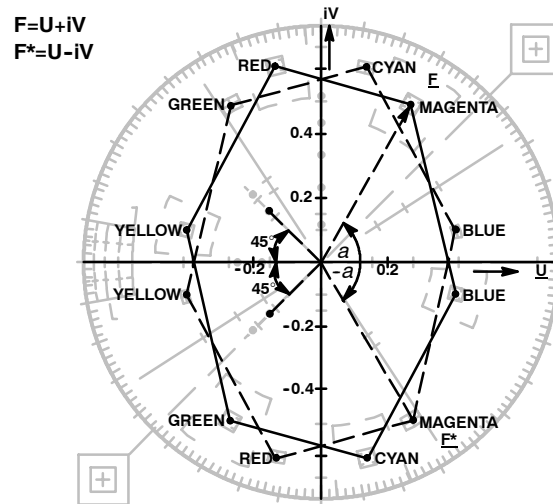
In color television, the visual sensation of color is described in terms of three qualities: luminance, hue, and saturation.

**Luminance.** Luminance is brightness as perceived by the eye. As the eye is most sensitive to green and least to blue light of equal energy, green is a bright color and blue is a dark color as conveyed by the luminance signal to monochrome TV receivers.

**Chrominance.** Chrominance is measured in terms of hue and amplitude. Hue is the attribute of color perception that determines whether the color is red, blue, green, etc. White, black, and gray are not considered hues. Hue is presented on the vectorscope crt as a phase angle and not in terms of wavelength. For example, red, having a wavelength of 610 millimicrons, is indicated as 104° on the standard color phase vector diagram when the burst is at 180° for NTSC or 135° for PAL. The standard color phase vector diagram is shown in Figure 2-9 for NTSC and Figure 2-10 for PAL.



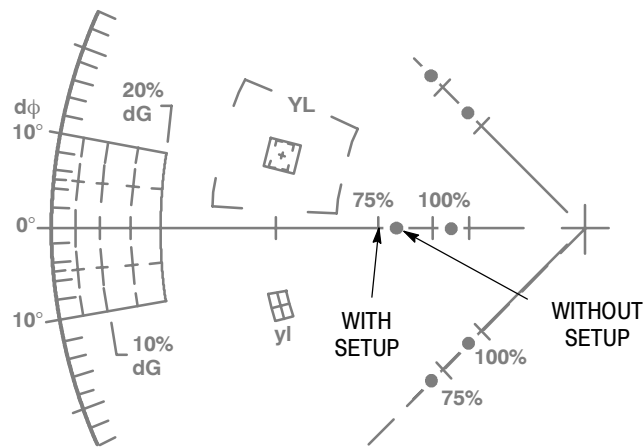
**Figure 2-9: NTSC standard color phase Vector diagram.**



**Figure 2-10: PAL standard color phase Vector diagram.**

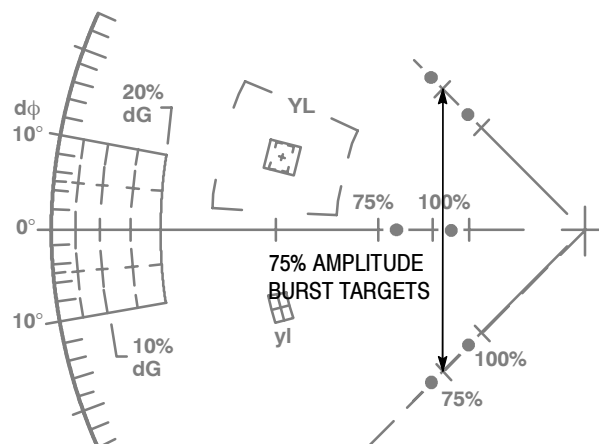
Saturation is the degree to which a color (or hue) is diluted by white light in order to distinguish between vivid and weak shades of the same hue. For example, vivid red is highly saturated and pastel red has little saturation. Because saturation is a product of both luminance and chrominance amplitudes, and a vectorscope can only measure chrominance amplitude, the radial distance from the center to the end of the color vector is chrominance amplitude. If burst vector amplitude corresponds to the 75% amplitude marking (see Figure 2-11 for NTSC and Figure 2-12 for PAL), the colors represented by the vectors when they are within the targets are of 75% amplitude.

If burst vector amplitude corresponds to the 100% marking and the chrominance vectors are within the target, the color amplitude is 100%.



**Figure 2-11: Partial 1720 graticule showing the 75% amplitude burst target, with and without setup compensation.**

**Encoding.** The hue and color amplitude information in the color television system is carried on a single subcarrier frequency: 3.579545 MHz for NTSC and 4.43361875 MHz for PAL. These signals, in modulated subcarrier form, are called chrominance. The hue information is carried by the subcarrier phase; the color amplitude information is carried by means of amplitude modulation with the subcarrier suppressed. A subcarrier which supplies phase information is required for demodulation. No picture chrominance signals are present during the horizontal blanking interval and a sample of the subcarrier, used by decoders for a reference (called burst), is provided within this interval.



**Figure 2-12: Partial 1721 graticule showing the 75% amplitude burst target.**

**Decoding.** To recover the hue information, phase demodulators are employed in the vectorscope. The phase reference is the color subcarrier, which is regenerated by an oscillator in the instrument. The oscillator is locked in both phase and frequency to the incoming color burst signal. The vectorscope displays the relative phase and amplitude of the chrominance signal on polar coordinates. To identify these coordinates, the vector graticule (see Figure 2-11 for NTSC and Figure 2-12 for PAL) has points that correspond to the proper phase and amplitude of the three primary colors and their complements, which are related to the 180° burst vector for NTSC and the 135° burst vector for PAL. The coordinates for the primary colors (red, blue, and green) and their complements (cyan, yellow, and magenta), when the burst vector is at 225° for PAL, are identified with lower case abbreviations.

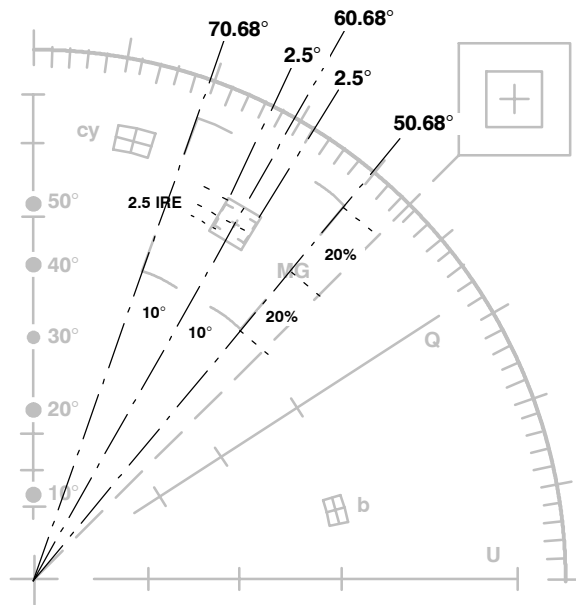
Any errors in the color encoding, video tape recording, or transmission processes which change these phase or amplitude relationships causes color errors on the television receiver picture. The polar-coordinate-type of display, such as that obtained on the 1720/1721, has proven to be the best method for portraying these errors.

## Functional Use of the Vector Graticule

### Measurement of Color Bars

The polar display permits measurements of hue in terms of the relative phase of the chrominance signal with respect to the color burst. Relative amplitude of chrominance to burst is expressed in terms of the displacement from center (radial dimension of amplitude) towards the color point which corresponds to 75% (or 100%) amplitude for the color being measured.

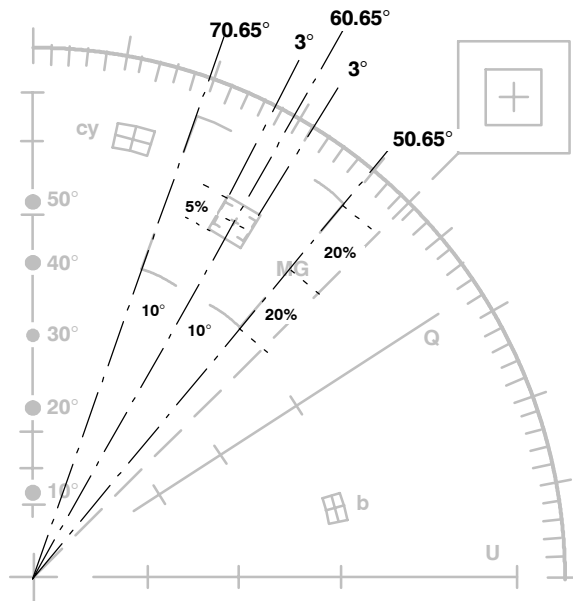
On the 1720 graticule, each chrominance vector terminates in a system of graticule targets in the form of two boxes (a small box inside a large box). See Figure 2-13. The dimensions of the large boxes represent  $\pm 10^\circ$  centered on the exact chrominance phase, and  $\pm 20\%$  of chrominance amplitude centered around 100% of standard amplitude. The dimensions of the smaller boxes represent  $\pm 2.5^\circ$  and  $\pm 2.5$  IRE.



**Figure 2-13: Fine detail of the 1720 graticule magenta target.**

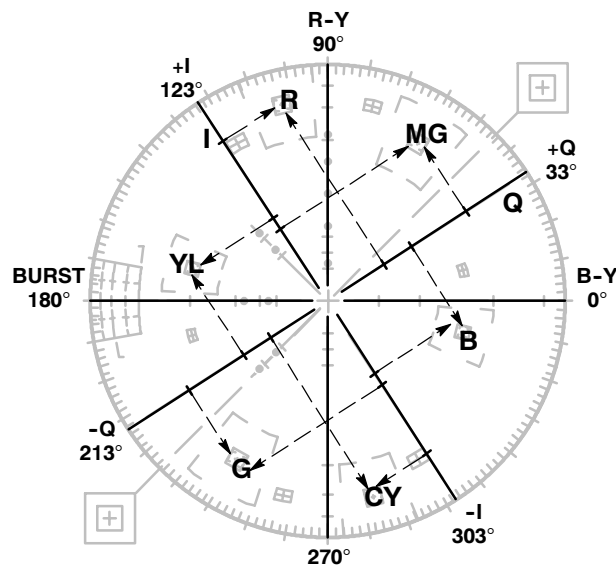
On the 1721 graticule, each chrominance vector related to the +V burst terminates in targets that are in the shape of two boxes (a small box inside a large box). See Figure 2-14. The large box represents  $\pm 10^\circ$  centered on the exact chrominance phase and  $\pm 20\%$  of chrominance amplitude centered around 100% standard amplitude. The dimensions of the inner target represent  $\pm 3^\circ$  and  $\pm 5\%$  of chrominance amplitude; the vectors associated with the -V burst terminate in the smaller targets.



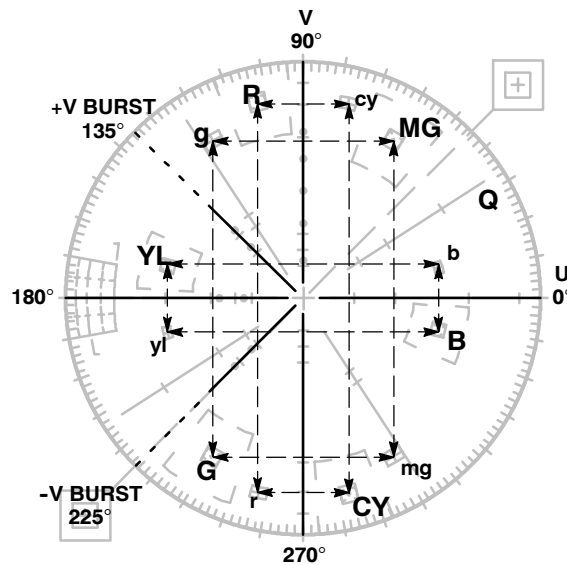


**Figure 2-14: Fine detail of the 1721 graticule target.**

On the 1720, the small marks at intervals along the I and Q axes denote the amplitudes of the chrominance components (see Figure 2-15). On the 1721, the small marks at intervals along the U and V axes denote the amplitudes of the U and V chrominance components (see Figure 2-16).



**Figure 2-15: Simulated 1720 graticule showing the relationship between amplitudes on the I and Q modulation axes and the location of the color vector targets.**

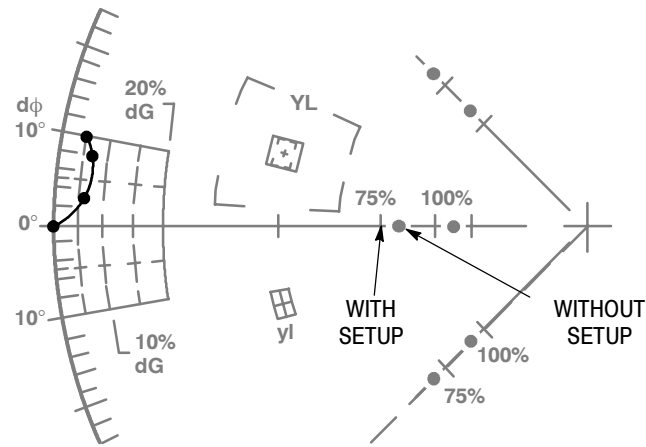


**Figure 2-16: Simulation of a 1721 graticule showing the relationship between amplitudes on the U and V axes and the locations of the color vector targets.**

The horizontal and vertical axes of the vector graticule contain markings for checking Vector Mode bandwidth. A subcarrier frequency sine wave whose amplitude places it on the outer compass rose is used as a reference. When the frequency is changed the diameter of the circle should reduce. At a point equal to 70% of full amplitude (3 dB), there are gaps in the horizontal and vertical axes. This calibration aid makes it possible to check the -3 dB points of the demodulator output amplifiers.

### **Differential Gain and Phase Measurements**

The two major distortions that affect the signal are differential gain and differential phase. They are chrominance non-linearities caused by luminance amplitude variations. Both can be measured on the vectorscope. Differential gain is a change in color subcarrier amplitude due to a change in the luminance signal while the hue of the original signal is held constant. In the reproduced picture, saturation will be distorted in the areas between the light and dark portions of the scene. Differential phase is a phase change of the chrominance signal, caused by a change in the luminance signal, while the original chrominance signal amplitude is held constant. In the reproduced picture, the hue will vary with the scene brightness. Differential gain and differential phase may occur separately or together.

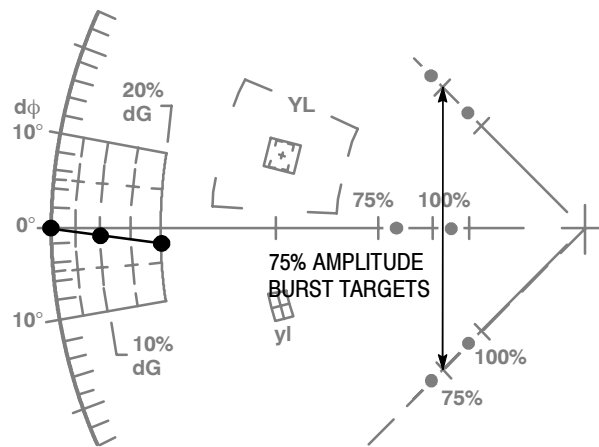


**Figure 2-17: A simulation of a part of the 1720 graticule showing the differential phase and gain measurement scales with approximately 10° differential Phase (dP).**

Differential gain (dG) and differential phase (dφ) measurements can be made using the graticule markings located at the outer edge of the B-Y axis (1720) or -U axis (1721). See Figure 2-18 for a differential gain measurement illustration and Figure 2-17 for a differential phase measurement illustration.

High Resolution Differential Phase Measurement -- The DEMOD OUT from the 1720/1721 can be used to drive one of the inputs to a 1730-Series Waveform Monitor for improved measurement resolution. This measurement requires a modulated ramp or staircase signal with the 1720/1721 gain normalized so the chrominance amplitude is on the compass rose.

The 1730-Series must have the DC REST OFF and the VERTICAL GAIN at X5. Once these conditions are set up, using 1 LINE SWEEP makes each major vertical division of the 1730-Series graticule equal to 2°, when referenced to the sweep origin.



**Figure 2-18: Simulation of the 1721 Differential Gain and Phase graticule showing approximately 10 % differential Gain (dG).**

## X Y Measurements

Any oscilloscope, including vectorscopes that have identical X and Y amplifiers, can be used to make accurate stereo audio phase measurements. When identical signals of equal amplitude are input, the resultant display will be a lissajous pattern, whose opening is relative to the phase error between the signals. If there is no phase error between signals, the display will be a diagonal line, at a 45° angle. When the signals are not equal in phase, the pattern will have its axis on the diagonal but be displayed as an ellipse. As long as the amplitude of the signals remains the same, the amount of opening in the ellipse (up to 90°) is a relative measure of the phase difference. At 90° the display is a circle; errors greater than 90° cause the axis to rotate by 90°.

### Making Stereo Audio Phase Measurements

The graticule for the 1720/1721 has scales for measurement of stereo audio phase. The dashed diagonal line is the measurement axis for errors less than 90°, it is terminated in amplitude targets that correspond to the length of X and Y axes. The boxes, surrounding the crosshairs, are equal to amplitude errors of 1/2 and 1 dB, respectively.

The upper half of the Y axis has markings, in 10° increments, for measurement of the elliptical waveform that occurs when there is a phase error. Both the X and Y axes have -3 dB markings making it easy to check the bandpass of the amplifiers. The 3 dB points are minor breaks in the line about 30% of the distance from the graticule circle to the graticule center.

In order to make this type of measurement it is essential that the input signal amplitudes be equalized. This is easily accomplished by applying only one

signal at a time and adjusting its gain to correspond to the appropriate axis (horizontal to the X axis and vertical to the Y axis).

Once both signal gains are normalized they can be displayed in the XY Mode and the relative stereo phase measured.

### **Looking at Incidental Carrier Phase Modulation**

The High-Gain X and Y inputs of the 1720/1721 can be used to look at ICPM (Incidental Carrier Phase Modulation). ICPM is a change in carrier phase with a signal level change. It will show up as apparent differences between measurements made in synchronous and envelope detection modes. On home receivers, with envelope detectors, the picture will be unaffected if the visual transmitter has been adjusted using envelope detection when there is appreciable ICPM. However, ICPM can show up in the home receivers audio as intercarrier buzz.

ICPM can be looked at by applying the Video and Quadrature Outputs from a demodulator to the 1720/1721 X and Y Inputs. The Quadrature Output drives the High-Gain X Input and the Video Output drives the High-Gain Y Input. The resulting display will be vertical when ICPM is minimum, and tilted when ICPM is present.

---

**NOTE.** *This is not a definitive measurement, but does provide a way of determining if ICPM is present in the signal.*

---



## Warning

*The following servicing instructions are for use only by qualified personnel. To avoid personnel injury, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so. Refer to General Safety Summary and Service Safety Summary prior to performing any service.*





# Service Safety Summary

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

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

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

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

To avoid electric shock, do not touch exposed connections.





# Installation



## Section 3 Installation

**Packaging** The shipping carton and pads provide protection for the instrument during transit, they should be retained in case subsequent shipment becomes necessary. Repackaging instructions can be found in Section 6 (Maintenance) of this manual.

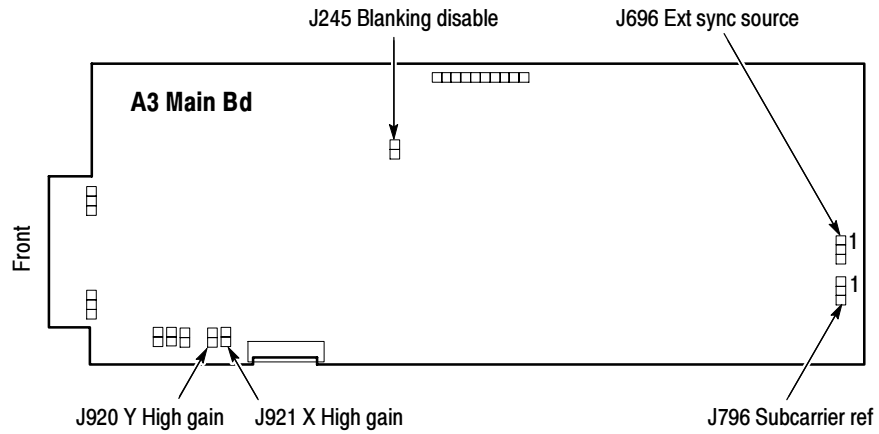
### Electrical Installation

**Power Source** This instrument is intended to operate from a single-phase power source with one current-carrying conductor at or near earth-ground (the neutral conductor). Only the Line conductor is fused for over-current protection. Systems that have both current-carrying conductors live with respect to ground (such as phase-to-phase in multiphase systems) are not recommended as power sources.

**Mains Frequency and Voltage Ranges** All members of the 1700-Series instrument line operate over a frequency range of 48 to 66 Hz, at any mains voltage between 90 Vac and 250 Vac. These newer versions of the 1730-Series instruments *do not* require any internal changes to select their operating voltage range.

**Operating Options** Not all installations are identical. In order to make operation of the 1720/1721 Vectorscope as flexible as possible there are internal jumpers that can be changed to provide operating flexibility. For example, it is possible to select CW Subcarrier for EXT REF instead of Composite Video or Black Burst. The factory preset position is indicated by a box printed on the etched circuit board. Table 3-1 details these internal jumper selections. Be sure that all operators are aware of changes, to prevent unnecessary trouble reports, if any of these jumpers are placed in the optional position. See Figure 3-1 for location of the internal plug jumpers.

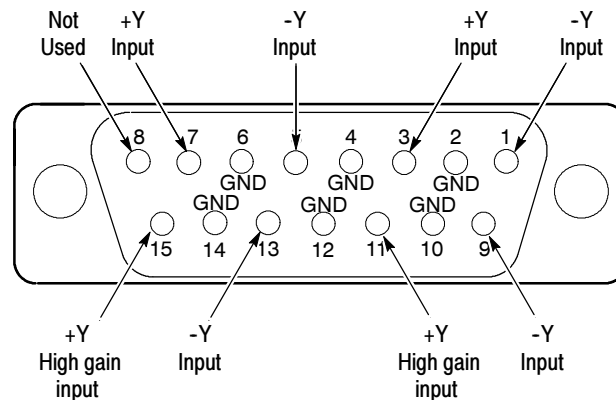
**X Y INPUT Connector** The rear-panel XY INPUT connector is a 15-pin, sub-miniature, D-type connector that provides input to the Horizontal and Vertical (X and Y) Amplifiers. They are balanced (differential), dc-coupled, high impedance (>20 k $\Omega$ ), unterminated inputs provided for audio applications. If ac coupling is desired, external capacitors are required. These inputs are factory calibrated for 0 dBm in 600 $\Omega$  but can be adjusted for any 600 $\Omega$  system between 0 and 12 dBm. See Figure 3-2.



**Figure 3-1: Plug jumper locations. A small arrow on the board, next to the plug jumper, denotes pin 1.**

**Table 3-1: Internal Jumper Selection**

Jumper Number	Name	Position	Purpose
A3J696	External Sync Source (EXT REF Input) Converted to CW Subcarrier Input	1-2	EXT REF (factory preset)
		2-3	CH-A INPUT
A3J796	Subcarrier Reference	1-2	EXT REF (factory preset)
		2-3	CW Subcarrier applied to EXT REF INPUT
A3J920	Y Input High Gain	Out	Balanced 600Ω input (factory preset)
		In	Single-ended high gain mode
A3J921	X Input High Gain	Out	Balanced 600Ω input (factory preset)
		In	Single-ended high gain mode
A3J245	Blanking Disable	Out	Normal Blanking (factory preset)
		In	CRT Blanking disabled
A3A1 J100	Light Enable	1-2	Lights Enabled (factory preset)
		2-3	Lights Disabled



**Figure 3-2: Rear panel XY INPUT connector showing pins with their functions.**

0 dBm is equal to 1 mW or 2.19 V peak-to-peak in 600Ω.

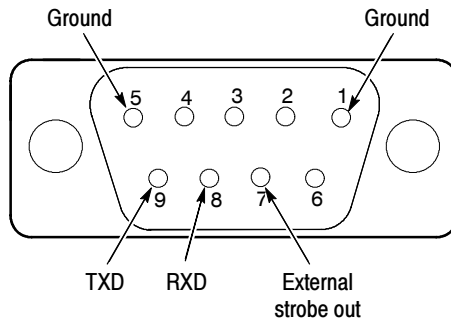
12 dBm is equal to 15.8 mW or 8.72 V peak-to-peak in 600Ω.

Inputs can be driven single-ended by driving either the + or - X and Y inputs with the opposite polarity inputs grounded.

In addition, a single-ended, high-gain mode can be used for other, primarily non-audio, applications. It can be accessed by installing plug jumpers on J920 and J921 (on the Main board, see Table 3-1) and inputting the signal on the +X and +Y inputs with the -X and -Y inputs grounded.

### Auxiliary Connector

The rear-panel AUXILIARY connector is a 9-pin, D-type connector. It is used to control the display from a companion 1730-Series Waveform Monitor. Line and Field selection information is provided to the vectorscope over the bus that is contained in this interface. Figure 3-3 and Table 3-2 show the AUXILIARY connector pin assignments.



**Figure 3-3: View of the 1720/1721 rear panel showing AUXILIARY connector pins with their functions.**

**Table 3-2: AUXILIARY Connector Pin Assignments**

Pin #	Use
2-3-4-6	No connection.
1-5	Ground.
7	External Strobe In for Line Select blanking.
8	RXD (Receive Data) 1730-Series communication to the 1720/1721.
9	TXD (Transmit Data) 1720/1721 return communication to 1730-Series.

## Mechanical Installation

### Cabinetizing

All qualification testing for the 1720/1721 was performed in a 1700F00 cabinet. To guarantee compliance with specifications, the instrument should be operated in a cabinet. The plain cabinet, 1700F00, is shown in Figure 3-4.

The portable cabinet, 1700F02, is shown in Figure 3-5. The 1700F02 has a handle, four feet, a flip-up stand, and a front cover. This F02 cabinet is compatible with the TEKTRONIX BP1 battery pack, which can be used as a dc power source. The hole sizes and spacing are different from those of the 1700F00.

All of the 1700-Series metal cabinets, which are available from Tektronix as Optional Accessories, provide the proper electrical environment for the instrument. They supply adequate shielding, minimize handling damage, and reduce dust accumulation within the instrument.



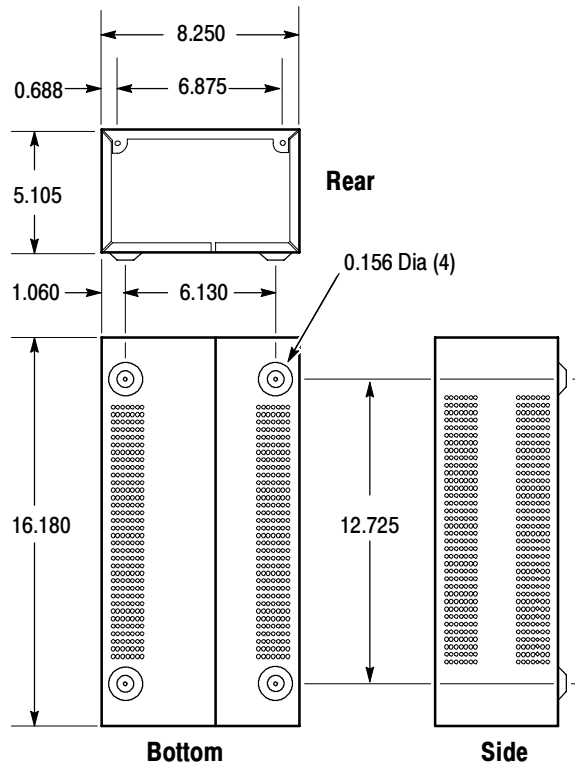


Figure 3-4: 1700F00 plain cabinet.

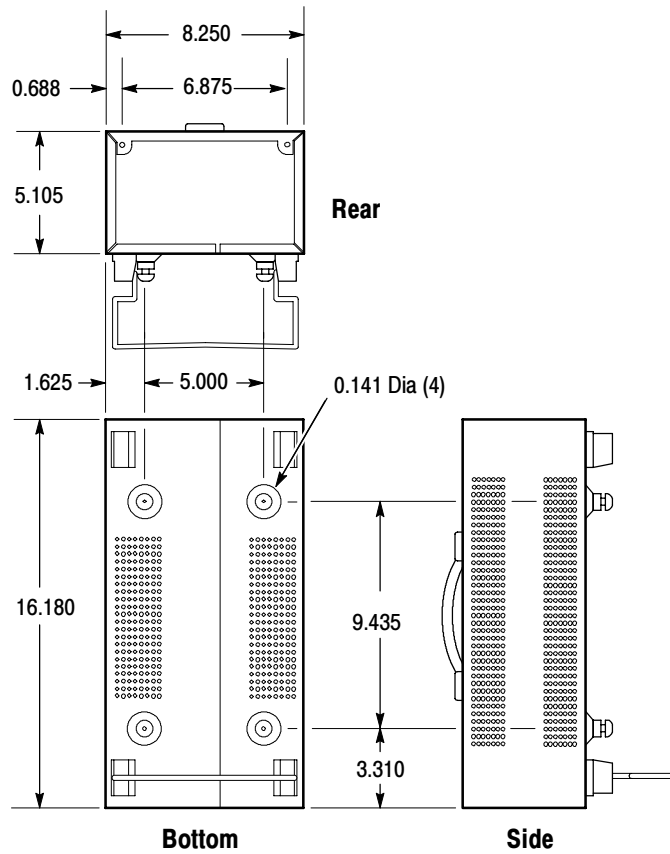


Figure 3-5: 1700F02 portable cabinet.

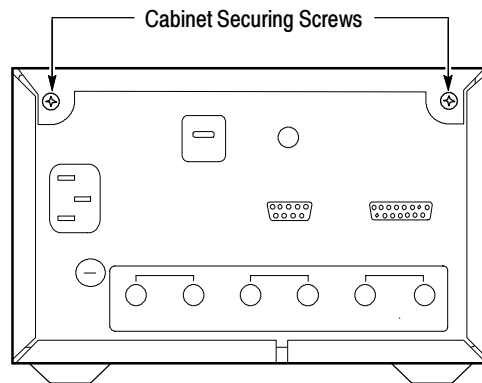
### Securing the Instrument in its Cabinet



**WARNING.** Cabinet Mounting Screws

*Do not attempt to carry a cabinetized instrument without installing the mounting screws. Without the mounting screws there is nothing to hold the instrument in the cabinet if it is tipped forward.*

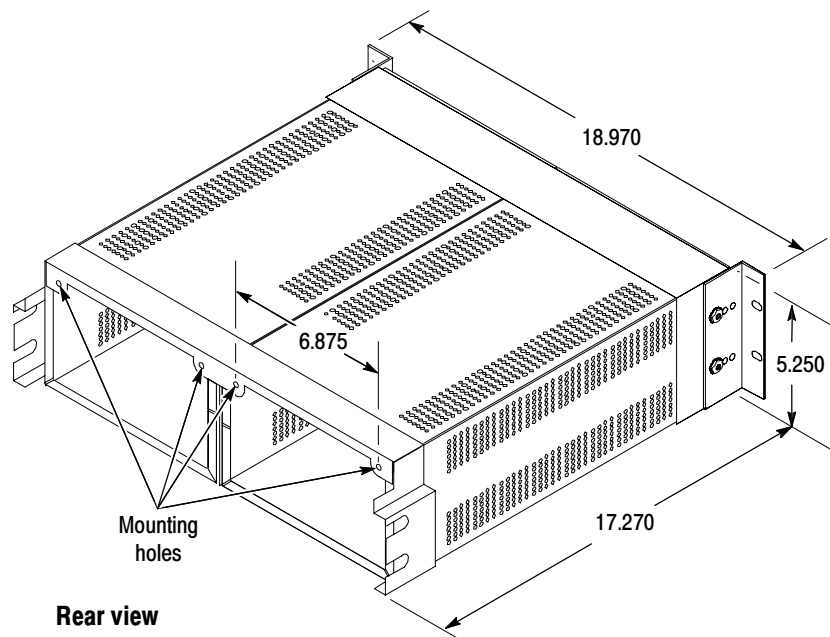
The instrument is secured to the cabinet by two 6-32 Pozidrive® screws, located in the upper corners of the rear panel. See Figure 3-6.



**Figure 3-6: Cabinet securing screws.**

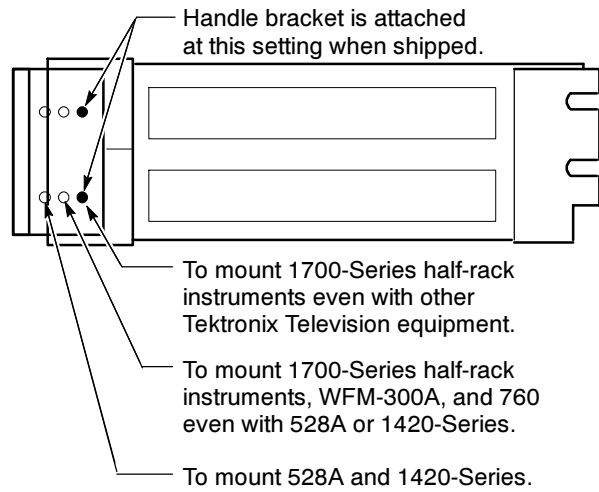
**Rack Mounting**

The optional 1700F05 side-by-side rack adapter, shown in Figure 3-7, consists of two attached cabinets. It can be used to mount the 1720/1721 and another half-rack width instrument in a standard 19-inch rack.



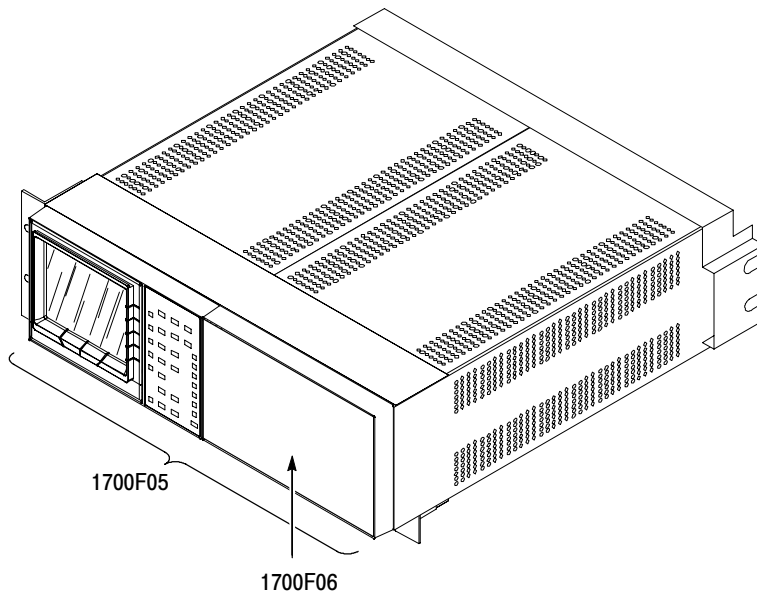
**Figure 3-7: 1700F05 rack adapter.**

The rack adapter is adjustable, so the 1720/1721 can be more closely aligned with other equipment in the rack. See Figure 3-8.



**Figure 3-8: 1700F05 rack adapter adjustment.**

If only one section of the rack adapter is used, a 1700F06 Blank Panel can be inserted in the unused section. See Figure 3-9. The rack adapter and panel are available through your local Tektronix field office or representative.

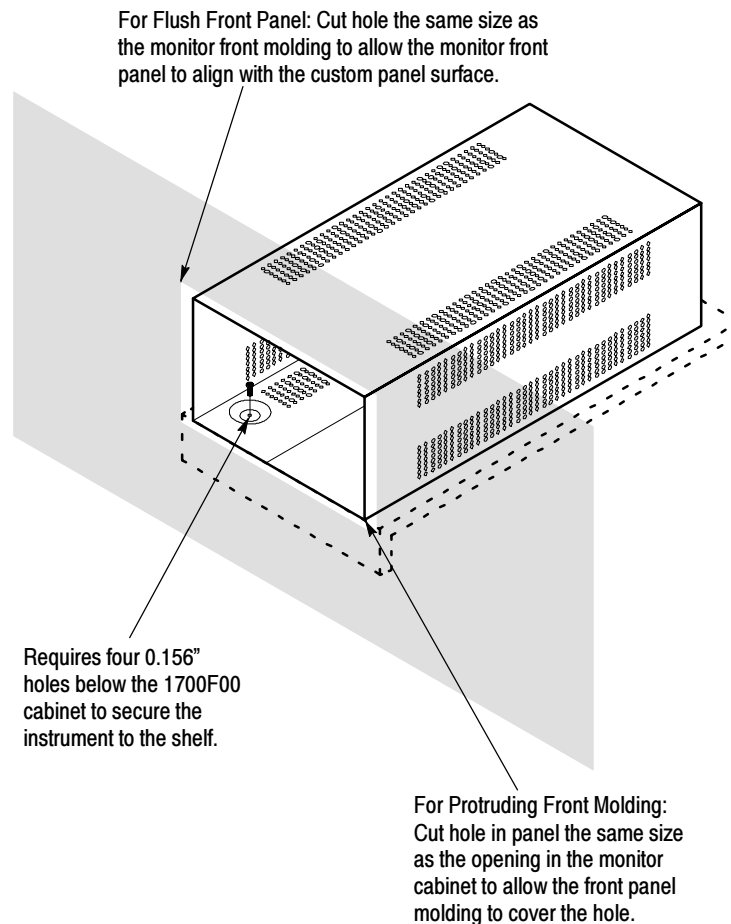


**Figure 3-9: 1720/1721 and 1700F06 blank panel.**

**Custom Installation**

For applications such as consoles, the instrument can be mounted with front molding flush or protruding from the console. In both cases, allow approximately 3 inches of rear clearance for BNC and power-cord connections.

To mount the 1720/1721 safely, attach it to a shelf strong enough to hold its weight. Install the mounting screws through the four 0.156-inch diameter holes in the bottom of the 1700F00 cabinet. See Figure 3-10.



**Figure 3-10: Typical custom installation showing the console.**





# Theory of Operation





## Section 4

# Theory of Operation

The material in this section is subdivided into general description, which is supported by the main block diagram and simplified block diagrams, and detailed circuit descriptions that use the schematic diagrams as illustrations. A thorough understanding of the instrument starts with a knowledge of how the major circuit blocks fit together, which is then followed up by knowledge of the individual circuit functions.

### Overview

The simplified block diagram shown in Figure 4-1 and the following paragraphs are intended to introduce the 1720/1721 Vectorscope in the broadest of terms. A full scale discussion of operation follows this overview.

The 1720/1721 is a special purpose oscilloscope, designed to display the variations of phase in the NTSC or PAL color television signal. Color signals, input through the rear-panel bridging loop-through connectors, are displayed on the crt in a Cartesian plot. An added feature makes it possible to compare two-channel audio signals. Audio signals are brought in through the rear-panel X Y INPUT connector for an XY display of phases used for stereo encoding of the audio signal.

Front-panel mode switching is accomplished by push-button switches whose status is being constantly polled by a Microprocessor. The Microprocessor controls gains and switching functions to make specific measurements.

The composite video signal from either the Channel A or B input is first separated into its chrominance and luminance components. The luminance component is used to generate the clamp signals used in the display of the chrominance information and for synchronizing vectorscope operation. The gain of the chrominance signal is adjusted prior to input to the Demodulators, for quadrature demodulation. The demodulated output is filtered and clamped (at H-Sync rate) by clamped amplifiers. The Output Amplifiers match signal impedance and drive the crt deflection plates.

In addition to being demodulated and displayed, the chrominance signal can be used to provide the internal subcarrier sample (in the INT REF position) to the Subcarrier Regenerator; External Reference, when selected, is through the rear-panel bridging loop-through EXT REF input. The regenerated subcarrier can be phase shifted, by up to 360°, using the front-panel PHASE control. For PAL applications, a 180° flip-flop is employed to reverse the phase of every

other line so that the +V and -V signals can be overlaid for phase matching applications.

The regenerated subcarrier, used for demodulation, is applied directly to the B-Y (U) Demodulator and delayed by 90° (quadrature phased) for the R-Y (V) Demodulator. The B-Y (U) Demodulator drives the Horizontal Output Amplifier; the R-Y (V) Demodulator drives the Vertical Amplifier.

The rear-panel X Y INPUT connector provides an input for audio signals, which can be displayed as XY signals for stereo comparisons. Identical amplifiers provide high input impedance and drive the Vertical and Horizontal Output Amplifiers.

If there is no signal, the Center Dot Blanking circuit blanks the crt to prevent it from being damaged by the non-deflected center dot.

## Block Diagram

This description uses the 1720/1721 Block Diagram, which is located at the beginning of the Diagram section (Section 9). The diagram can be folded out and viewed while reading this description.

### Video Input

Video signals are input through identical input amplifiers to normalize gain and provide impedance matching. An external reference can be used for both luminance- and chrominance-related functions. If composite video or black burst is used for the External Reference, no additional processing is required. When CW Subcarrier is used, the luminance reference is taken from the video input, and the chrominance reference is attenuated from the subcarrier input through the External Reference.

### Luminance Processing

The sync signals used by the vectorscope are contained in the luminance information from the video inputs. The composite video signal through the Luminance Amplifier drives a sync separator, whose output is used to drive a Bowes Oscillator that regenerates H Sync. The H Sync also generates Sample Pulses and the Clamp signals, that activate the Burst Switches, and provide the line rate control signal for the V-Axis Switcher.

### Microprocessor

The Microprocessor polls the front panel to determine changes in status. Current status is stored in Nonvolatile Random Access Memory (NOVRAM), which makes it possible to return to the same front-panel condition should power be interrupted. If the 1720/1721 is being used as an auxiliary instrument to a 1730-Series Waveform Monitor, any stored vectorscope front-panel setup data is also in the NOVRAM. Based on the front-panel conditions, the Microprocessor generates controlling signals that are used throughout the 1720/1721. The

front-panel indicators are driven by the Microprocessor so that they will mirror the current measurement criteria.

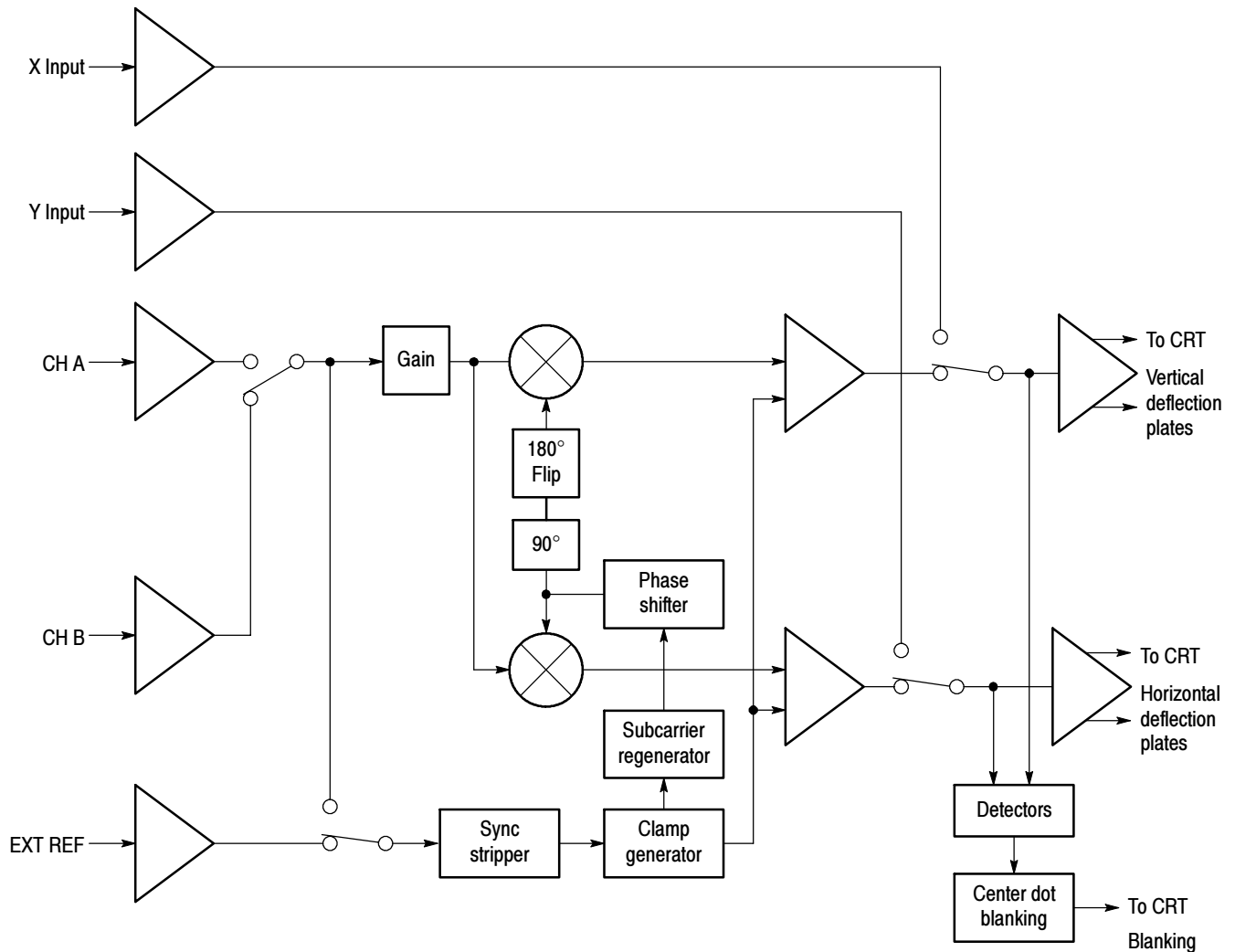


Figure 4-1: Simple block diagram of a 1720/1721 Vectorscope.

### Gain Cell

The gain cell uses front-panel VAR GAIN and GAIN CAL settings and switching signals from the Microprocessor to adjust the chrominance gain prior to demodulation. Gain cell chrominance is clamped to ground at sync tip time for a stable reference level.

### Chrominance Processing

Chrominance from the incoming video signal, either internal or from the External Reference, is conditioned by the Chrominance Amplifier and applied to the Phase Detector at burst time (Burst Gate signal). The chrominance input to

the Quad Phase Detector is delayed by  $90^\circ$ . The chrominance signal is compared to the regenerated subcarrier from the VCXO with the output low-pass filtered and buffered. The Phase Detector output is clamped and supplied to the Error Amplifier, which provides an output voltage to correct the VCXO should it be off frequency.

The Quad Phase Detector compares the burst chrominance to  $90^\circ$  phase-shifted subcarrier, with the output low-pass filtered and buffered. The resulting signal is a pulse, when burst is present, that clamps the Phase Detector output. It is also checked for phase lock and, if unlocked, an output is supplied to the Error Amplifier to increase its bandwidth for a faster locking. When the TEST (Cal Mode) is enabled, the Error Amplifier is forced into an unlocked state to provide the test circles.

The regenerated subcarrier from the VCXO can be phase shifted up to  $360^\circ$  by a goniometer (front-panel PHASE control) whose output is buffered prior to input to the Demodulators. The amplitude of the regenerated subcarrier is fed back to the VCXO through an Automatic Gain Control circuit.

The V-Axis Switcher takes the output of the Phase Detector H Sync and generates an alternate line signal. The resulting alternate line signal is used to control the input switching to the Quad Phase Detector. In PAL (1721) instruments, an additional signal, from the Microprocessor, is used by the V-Axis Switcher to control the Quad Phase input to the R-Y Demodulator.

### **Demodulators**

The 1720/1721 employs quadrature demodulation, which consists of delaying the regenerated subcarrier by  $90^\circ$  to the R-Y (U) Demodulator. In the 1721, an additional  $180^\circ$  phase shift is achieved by switching the regenerated subcarrier to the -input of the demodulator. The incoming chrominance is compared to the regenerated subcarrier and the output is low-pass filtered and amplified. Center Dot clamping is used to keep the effects of chrominance from distorting the display center dot.

### **Output Amplifiers**

The Vertical and Horizontal Deflection Amplifiers do double duty. They are used to output both the vector display and the XY display. The input of the amplifiers is checked for the presence of a signal over a certain amplitude, and the resulting output is one input to the CRT Blanking circuit. X and Y signals are input through balanced amplifiers, that can be converted to single-ended high gain inputs. Input switching is controlled by the Microprocessor and front-panel switching.

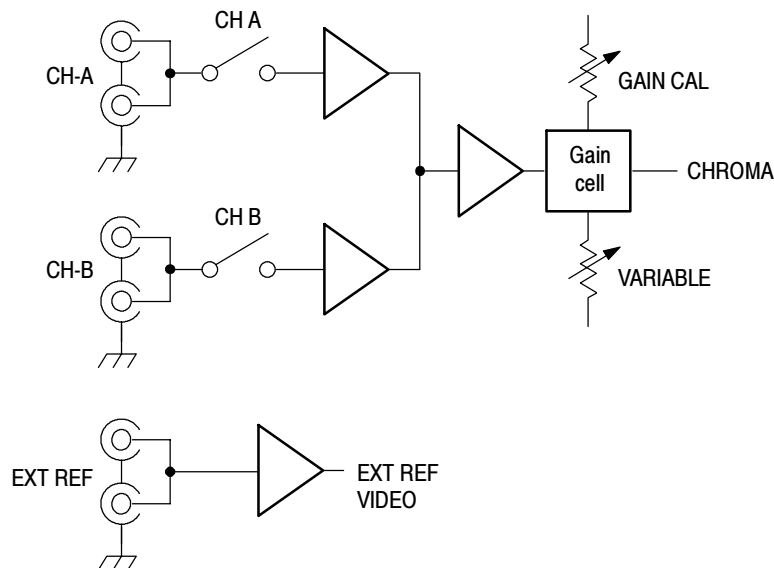
### **CRT Blanking**

CRT blanking takes inputs from the front-panel INTENSITY control, the Microprocessor, and the Center Dot Comparators to generate the blanking signal. In addition, in the Auxiliary mode of operation, a line select strobe from a companion 1730-Series can drive the blanking amplifier to unblank only the line or lines that are selected with the waveform monitor's line selector.

## Circuit Descriptions

The following descriptions are divided by diagram number and then further subdivided by logical circuit blocks. The descriptions follow the order of the diagrams in Section 9. Individual diagrams can be folded out and consulted while studying these descriptions.

### DIAGRAM 1 INPUT AND DEFLECTION AMPLIFIERS



Video signal input to the 1720/1721 Vectorscope is through high-impedance bridging loop-through inputs. Gain is normalized by the Input Amplifiers prior to being input to the Gain Cell. The amount of amplification provided by the Gain Cell is controlled by the Gain Cal, Variable, and the choice of 75% or 100% amplitude color bars.

The External Reference input is also a high impedance bridging loop-through, which is dc coupled to a unity gain operational amplifier.

#### Video Input Amplifiers

The Channel A and Channel B input buffers are ac coupled (C199 and C497), grounded base amplifiers with Q297 and Q493 as the active elements. Q391 is a saturating switch that shunts current away from the Channel B input when Channel A is being displayed. Q296 serves the same purpose when Channel B is being displayed. R594 and C198 are adjustments that match the phases and gains of Channel A and Channel B. They modify the input resistance of Channel B and the input capacitance of Channel A. Signal current flows through either CR297 or CR496 (depending on channel selection) into the summing

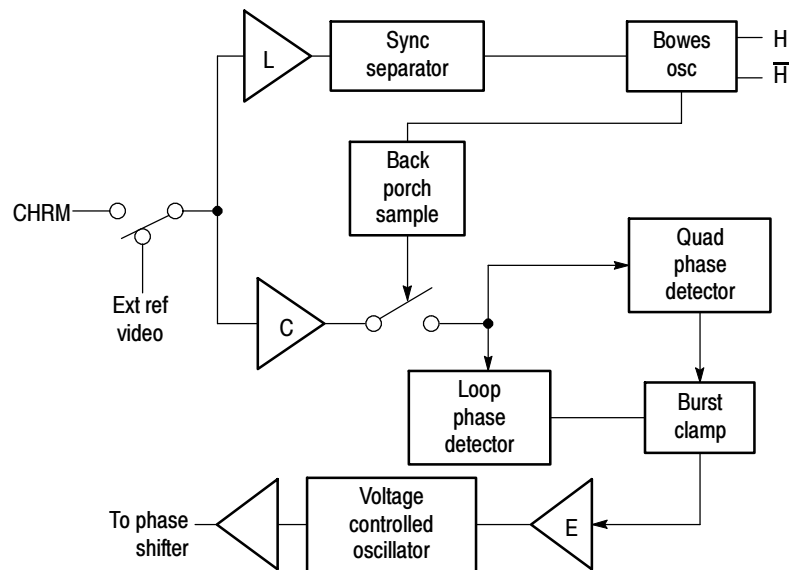
junction of a differential amplifier (Q293 and Q292) that drives the Output Amplifier (Q192). The feedback resistor that sets the gain is R293.

The External Reference Input Amplifier is nearly identical to the channel inputs and provides a signal to the reference switch. R994 is the input resistor and R992 is the feedback resistor, the combination of which sets the gain to 1.

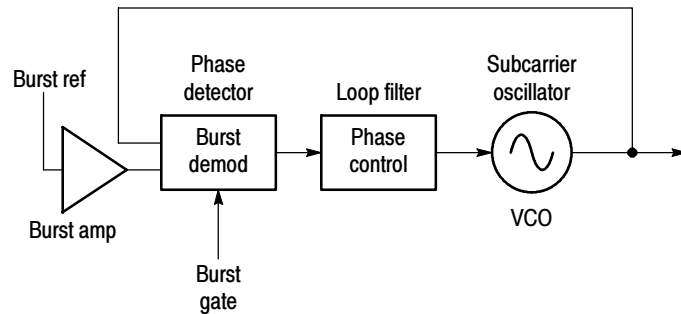
**Gain Cell**

The Gain Cell, whose output is chrominance, consists of U184, U383, Q385, and Q490. A band-pass filtered (L185 - C185) signal is fed into pin 6 of U184. U184 consists of a current source, differential amplifier pair, and a pair of transistors connected as diodes. U383 consists of four transistors connected in a cross-coupled gain cell arrangement with a transistor used as a heater to keep U383 at the same temperature as U184. The diode-connected pair in U184 is a current-to-voltage converter that drives the gain cell transistors in U383. U380 is an operational amplifier that drives the gain port of the Gain Cell. U274 is a Microprocessor-controlled switch that enables the Variable Gain, Gain Cal, and the 75% or 100% color bar amplitude gain settings.

**DIAGRAM 2 SUBCARRIER REGENERATOR**



Incoming signal, from the Input Amplifiers, is amplified and fed to the Luminance and Chrominance Amplifiers. Output of the Luminance Amplifier drives the Sync Separator, which generates the H Sync used throughout the Vector-scope, and the Back Porch Sample that enables the Phase Lock Loop.



**Figure 4-2: Block diagram of the Phase Lock Loop.**

The heart of the Subcarrier Regenerator is a phase lock loop. See Figure 4-2. The Subcarrier Oscillator (VCXO) is a voltage-controlled oscillator that freeruns near the reference subcarrier frequency. The Burst Demodulator is a mixer that detects phase differences between the reference input and the Subcarrier Oscillator during burst time. The difference output is an error signal proportional to the phase difference detected.

The error signal drives the Phase Lock Control, which is a low-pass filter to remove high-frequency ac components in the error signal. The filter has two bandwidths, a wide one to search for the unlocked signals, and a narrow one to maintain stable phase lock once the signal has been captured.

The Phase Lock Control loop filter completes the loop by controlling the Subcarrier Oscillator. If the input reference changes, the oscillator will follow. For the 1721, the PAL Phase Lock Control block samples every burst.

### Reference Switch

U889 is a Quad CMOS switch that selects the appropriate input signal for the Sync Separator and the Subcarrier Regenerator. In normal operation, both the sync and subcarrier sources follow the front-panel Reference switch and are driven by A or B when Internal is selected, or by the EXT REF input when External is selected. When J696 is in the 2 and 3 position, the Sync Separator is always driven by the A or B input, even when External Reference is selected. This mode should be used if CW Subcarrier is used as the Reference for a composite video input signal. It will ensure that the clamp pulses are synchronous with the incoming video.

The two remaining switches in U889 allow the reference signal to pass to the Subcarrier Regenerator only during burst time. In NTSC, with W986 installed, the two switches both close during every back porch, allowing every burst to pass to the two phase detectors. In PAL, with W987 installed and U986 removed, the Loop Phase Detector, U646, receives every burst and the Quadrature Phase Detector, U854, receives every other burst.

### **Luminance and Chrominance Amplifiers**

The reference signal is ac-coupled through a tuned circuit, C791 and L791, to drive the Chroma Amplifier, Q794 and Q795. Luminance is removed and in normal operation the chrominance is amplified by about three times. With J796 in the 2 and 3 position (External CW Subcarrier input), the gain is changed to slightly less than one.

The reference signal is dc-coupled to the inverting Luminance Amplifier, Q693, which has unity gain and removes much of the chrominance. The collector of Q693 drives the Sync Separator.

### **Sync Separator**

The Sync Separator strips off and processes the sync from the luminance signal to control the timing circuitry. The Sync Stripper receives its input through C685 and R686 into the base of Q685, a summing junction. Q685 and Q680 form an operational amplifier that inverts the sync signal and clips it near the sync tip. Amplifier gain, which is high at sync tip time, is set by the combination of R686 ( $R_i$ ) and R682 ( $R_f$ ). During non-sync time (active video) CR680 and CR681 are both on, shunting Q680 to reduce amplifier gain and limit saturation so that the response to the next sync transition will be rapid.

During sync time a clamp circuit consisting of Q681 and Q688 maintains the output of the operational amplifier at about +5 V. The output is fed back to maintain the proper level. Q681 and CR682 are a current source that is on during sync tip. At the end of sync time, when Q680 goes low, CR682 is pulled down and Q681 shuts off.

Q780 outputs negative-going sync that has any remaining noise greatly reduced. The output of Q780 is fed back, through CR781, to the clamp circuit, Q688.

### **Bowes Oscillator**

The Bowes Oscillator, Q880 and Q781, is triggered by the leading edge of sync. It accepts triggers only at H intervals, during the vertical interval, to avoid triggering on the wrong equalizing pulses. In the absence of sync the oscillator freeruns so that sample pulses are always available for clamping. The output at the collector of Q781 is negative-going and lasts for approximately 4.5  $\mu$ s to provide horizontal sync to the rest of the instrument.

### **Back Porch Sample**

U884A is a one-shot that provides a negative-going pulse at its output (pin 4) that controls the sampling of burst. It is triggered by the trailing edge of sync and its Q output (pin 13) is a 4  $\mu$ s long, positive-going, back porch pulse that is NANDed with the output of flip-flop U774B, which is clocked at a line rate. The output of the gate (U876C, pin 8) is a negative-going pulse that occurs every other back porch.

### **Loop Phase Detector and Amplifier**

U646 is the Subcarrier Regenerator (Phase Lock) Loop Phase Detector. It is a balanced demodulator, whose carrier input is driven by the VCXO CW sine wave. Its signal input is driven by burst chrominance from the Chroma



Reference Amplifier. The output of this phase detector is an ac multiplication of the input signals, which occurs only during the time that both of the input signals are present. The average dc output level is proportional to the difference in phase between the inputs.

The output is filtered to remove any chrominance and harmonics and drives U640, which is a non-inverting, high-gain operational amplifier.

### **Quadrature Phase Detector and Amplifier**

The Quadrature Phase Detector is similar to the Loop Phase Detector, except that the carrier input signal is phase shifted by  $90^\circ$  by a network consisting of L750, C548, and R647. This results in the output of the Quadrature Phase Detector being maximum when the output of the Loop Phase Detector is zero. Since Loop Phase Detector output is zero (phases are matched) during burst, the Quadrature Phase Detector provides a large-amplitude pulse occurring only during burst time. Q732 inverts and amplifies the output pulse to drive the Burst Clamp and Lock Detector.

### **Burst Clamp**

At burst time, C738 is charged by current through R734. The direction and amount of current is determined by the output of the Loop Phase Detector Amplifier, U640, with respect to ground (through R734 and Q733). The voltage developed across R734 is the input voltage seen by the Error Amplifier.

### **Lock Detector and Bandwidth Switch**

The Subcarrier Regenerator has two different bandwidths. Wide bandwidth is for fast lock-up and a large pull-in range. Once locked, the loop goes into a narrow-bandwidth mode, which provides a stable reference with very little phase jitter.

Q836 is turned on at every burst pulse, keeping C737 discharged and the output of U734B at a low level. If burst is missing or not locked, Q836 is off during burst time and C737 charges slowly negative until the output of U734B is high enough to turn on the Bandwidth Switch transistor, Q632.

Q632 is off when subcarrier is locked to incoming burst. If the subcarrier is not locked, U734B saturates Q632 and grounds a portion of the Error Amplifier feedback to allow the Error Amplifier to rapidly change the bias on the VCXO varicap CR235 and quickly bring the loop back into lock.

### **Error Amplifier**

U734A is a non-inverting amplifier whose RC feedback network acts as a low-pass filter to determine the Subcarrier Regenerator loop response. Any input voltage to U734A is amplified and biases the VCXO varicap, CR235.

The Loop Balance control, R534, adjusts the Phase Locked Loop dc offset so that there is no phase shift when burst amplitude changes.

### **PAL Phasing**

The Subcarrier Regenerator in the 1721 Vectorscope samples alternate lines and locks to every other burst. Alternate line sampling can be defeated by moving W987 to the W986 position, but the +V mode may not be properly phased and there will be more phase jitter.

The Quadrature Phase Detector receives every other burst from the Reference Switch. When first trying to lock, this may be either a positive- or negative-going, demodulated burst, since U774B has received no phasing information yet. If the negative bursts are being received, the minus input (pin 3) of the PAL Phasing Comparator (U348) will be zero on one line with negative-going burst pulses on the next line. Since the reference voltage, to the comparator (pin 2), is a positive voltage the comparator output will remain high and the Preset (pin 10) of U774B will not be affected.

If the positive-going burst pulses are initially being received by the Quadrature Phase Detector, pin 3 of U348 will be zero during one line and there will be a positive-going burst pulse on the next line. This positive burst pulse will cross the comparator threshold and its output will be negative pulses to preset U774B. The flip-flop will be rephased, and negative-going bursts will be gated to the Quadrature Phase Detector.

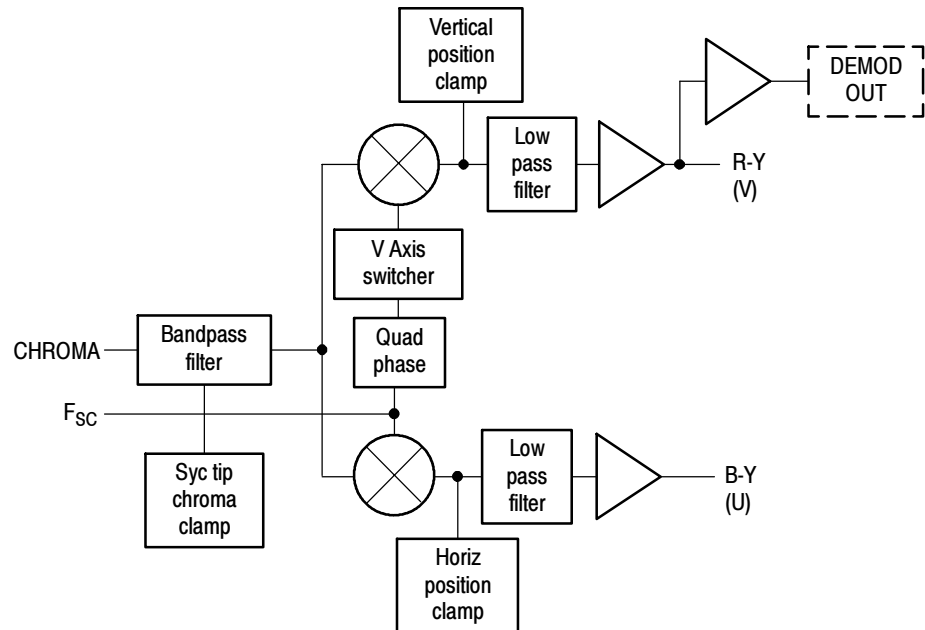
### **VCXO**

The VCXO is a phase-locked, voltage-controlled, crystal oscillator with automatic gain control (AGC). It generates a sine wave at subcarrier frequency (3.579545 MHz for NTSC, 4.433619 MHz for PAL), controlled by crystal Y129 and varicap CR235. The frequency is stabilized by dc feedback from the Error Amp, U734, which changes the varicap bias when there is a frequency error.

The output is shaped into a sine wave by a Pi filter consisting of C337, L337, and C336, to drive the Phase Detectors and the Phase Shifter. The Phase Shifter is a goniometer, which is a variable capacitance device that shifts the phase of the display through 360°. Subcarrier Amplifier Q434 amplifies the goniometer output and drives the Chrominance Demodulators and the AGC Amplifier, Q334.

The subcarrier amplitude at the collector of Q434 is rectified by CR428 and stored in C328. The dc level on C328 controls the bias of Q222 through Q334 to correct for any fluctuations in amplitude. The bias current for Q222 is inversely proportional to the stored level on C328. If the amplitude rises, Q334 reduces the gain; if the amplitude goes down, the gain increases, thus stabilizing subcarrier amplitude.

## DIAGRAM 3 DEMODULATOR



Incoming chrominance is band-pass filtered, clamped at sync tip time, and compared to the phase shifted regenerated subcarrier signal for demodulation. Subcarrier signal is quadrature shifted ( $90^\circ$ ) before input to the R-Y (V) demodulator. In addition, for PAL applications, and any time the front-panel selected Test Circle is enabled, a V-Axis switcher shifts the subcarrier input by  $180^\circ$  for alternate lines.

Output signal from the Demodulators is low-pass filtered and amplified prior to driving the Horizontal and Vertical Output Amplifiers. The output of the R-Y (V) Demodulator is also available through the rear-panel Demodulator Output.

### V-Axis Switcher

The V-Axis Switcher reroutes the V-Axis Demodulator carrier input on alternate lines. In both the 1720 and the 1721, V-axis switching is enabled when the TEST function is selected from the front panel. In the 1721, V-axis switching is also enabled when the +V/PAL switch is in the +V position.

V-axis switching provides a display of the PAL signal that overlays the -V lines on the +V lines. The resulting display appears as though only the +V signal is displayed, similar to an NTSC display. This display is used to evaluate relative differences between the +V and -V lines. This same operation occurs when the signal is decoded in a PAL television receiver.

The Microprocessor enables V-axis switching by pulling the Preset input of U774A (a D-type flip-flop) high, which allows the horizontal sync, clock pulses to toggle its outputs at a line rate. The D input is controlled by another flip-flop,

U774B (on Diagram 2), which has identified the +V lines (for PAL) in the Subcarrier Regenerator.

The flip-flop outputs drive Q552 and Q553. A high output turns on the corresponding transistor to shunt the signal at its collector to ground. This alternately grounds and drives the + and - carrier inputs on the V Demodulator with subcarrier to demodulate the -V lines 180° away from the +V lines.

### **Chrominance Demodulators**

The Chrominance Demodulators, U467 and U659, are double-balanced demodulators, whose outputs are voltages proportional to the phase difference between the signal input (pins 1 and 4) and the carrier input (pins 8 and 10). The signal inputs are driven by chrominance from the Gain Cell (Diagram 1). The carrier inputs are driven by a continuous sine wave, at subcarrier frequency, from the Subcarrier Regenerator (Diagram 2). The subcarrier rate sine wave drives the B-Y Demodulator directly and is delayed by 90° in the Quad Phase circuit (L451, C451) before driving the carrier input to the B-Y Demodulator. The V-Axis Switching circuit, when operating, determines which carrier input of the R-Y Demodulator is driven by subcarrier.

The demodulator gains are set by the R-Y Gain (R460) and the B-Y Gain (R655). The bias is controlled by the Center Dot Position Clamp circuits. R666 provides a small percentage of the Y signal into the X signal to be used as part of the orthogonality adjustment.

### **Sync Tip Chrominance Clamp**

Q353 is driven to saturation during horizontal sync time, when Q353 is saturated any residual subcarrier present in the signal is grounded to provide a clean, zero carrier reference for the demodulator position clamps.

### **Demodulator Output Filters and Amplifiers**

A four-pole, active, low-pass filter (Q564 and Q371 for the R-Y and Q764 and Q664 for the B-Y) removes the high-frequency components of the demodulation process. These filters determine the bandwidth of the vector mode signal path to control the risetime and delay of the demodulated signal.

Q570, Q571, and Q372 (for the R-Y) and Q670, Q671, and Q672 (for the B-Y) are inverting operational amplifiers with a gain of about 15. The amplifier outputs, to drive the Deflection Amplifiers, are from high impedance emitter followers Q372 (R-Y) and Q670 (B-Y).

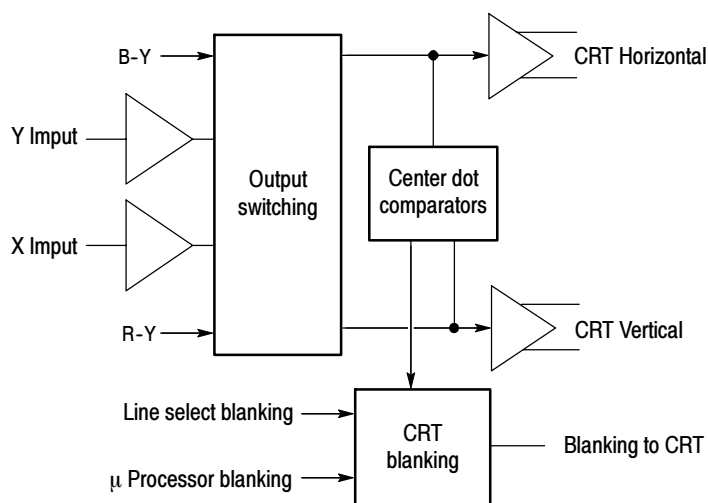
### **Vector Center Dot Position Clamp**

The R-Y Demodulator output is also fed back through R462 to a clamp circuit consisting of U361 and Q362. U361 is an operational transconductance amplifier used in a sample-and-hold circuit. The demodulated R-Y chrominance drives the negative input (pin 2), while a voltage, controlled by the Vector Vertical Position control (R355), is the reference level to the positive input (pin 3).

The B-Y Demodulator output is also fed back through R763 to a clamp circuit consisting of U757 and Q761. U757 is an operational transconductance amplifier used in a sample-and-hold circuit. The demodulated B-Y chrominance drives the negative input (pin 2), while a voltage, controlled by the Vector Horizontal Position control (R653), is reference level to the positive input (pin 3).

During the middle of horizontal sync time, a pulse is applied to the bias pin of the amplifier (pin 5), which turns the device on and transfers the voltage levels on the - inputs to the storage capacitors C362 (for R-Y) and C761 (for B-Y). The stored levels are applied through source followers Q362 (R-Y) and Q761 (B-Y) to the bias inputs (pin 5) of Demodulators U467 (R-Y) and U659 (B-Y). This changes the output bias current of the demodulator to change the demodulated signal dc level, which is the dc level for the Deflection Amplifier (Diagram 1).

## DIAGRAM 4 DEFLECTION AMPLIFIER



External X and Y signals are input through the rear-panel sub-miniature D-type XY INPUT connector. Output switching selects either the R-Y and B-Y or XY for amplification and display by the Horizontal and Vertical Deflection Amplifiers. Driving signals for the Deflection Amplifiers are also input, as active driving signals for the Center Dot Comparators, to provide blanking when the crt beam is not deflected away from center screen.

CRT blanking signals from Line Select, and the Microprocessor are combined with the vectorscope's H rate sync to provide the blanking signal to the grid circuit.

### **XY Input Amps**

U942 is a Quad Operational Amplifier. U942A and B are Balanced Differential Input Amplifiers, intended for audio use. In a 600 $\Omega$  system, R846 and R948 can be adjusted to normalize signals from 0 dBm to +12 dBm (2 V p-to-p to 9 V p-to-p). The input impedance is greater than 20 k $\Omega$  to ground.

J920 and J921 can be installed so that the plus inputs of the X and Y amplifiers are connected to the high gain X and Y ports. These ports are provided for special non-audio applications where a higher gain may be needed.

U942D and C drive the X and Y Deflection Amplifiers through a Microprocessor-controlled switch, U585. A small amount of Y signal is fed through R847 to the X Amplifier for the orthogonality adjustment.

### **Deflection Amplifiers**

The Vertical Deflection Amplifier consists of Q580 and Q581 (a differential pair) with Q480 and Q481 (grounded base amplifiers) that speed up the amplifiers by minimizing the miller capacitance on Q580 and Q581. CR474, CR476, CR484, and CR486 prevent Q480 and Q481 from saturating when the amplifier is overdriven by large signals. Q474 and Q576 are the current source for the differential pair. The Horizontal Deflection Amplifier is similar in operation to the Vertical Deflection Amplifier.

The orthogonality control feeds Y signals into the -input of the Horizontal Deflection Amplifier. Both the vector and XY circuits feed +2% Y signals into the X signal, for use in orthogonality compensation. Adjusting the orthogonality control cancels out some or all of the Y signal in the X Amplifier. The effect of this control is to change the deflection angle between the X and Y axis to compensate for crt geometry.

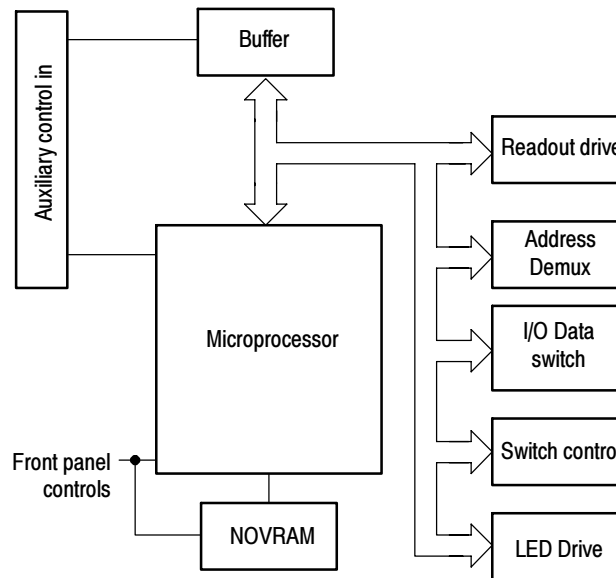
### **Center Dot Comparators**

U446 is a quad comparator with open collector outputs that are tied together. When both the X and Y signals are close to 0 V (no signal with only a center dot), the output of all the comparators is high and C349 discharges in the positive direction toward ground. If either the X or Y signal is away from 0 V, the output of at least one of the comparators will be low (-6 V), charging C349.

### **CRT Blanking**

The output of the comparators drives a common base stage, Q541. When the collector of Q541 is high, the crt is blanked. P245 can be installed to disable the crt blanking. Q343 is turned on by the H pulse to unblank the crt long enough for the center dot to be visible if there is no signal. When the base of Q540 is pulled high the crt is blanked. Q424, when turned off by the Microprocessor, blanks the crt during dynamic switching between the XY and VECT modes. The line select blanking signal originates in the 1730-Series when it is a companion to the 1720/ 1721. When Line Sel Blank is high, the crt is blanked and the line select brightup circuitry is enabled. The line select blanking signal is low during the selected line to unblank the crt for that line. Q248 enables the brightup circuitry. CR137 and C239 keep the brightup circuitry enabled during the time that the Line Sel Blank is low to unblank the crt during the selected line.

## DIAGRAM 5 MICROPROCESSOR



Operation of the 1720/1721 is controlled by the Microprocessor. It controls switching operation by either polling the front-panel switches, or in response to stored/recalled front-panel configurations (Auxiliary Input from a companion 1730-Series).

In addition, the Microprocessor drives the front-panel indicator light-emitting diodes through a light driver.

A Non-Volatile Random Access Memory (NOVRAM) retains the current operating state in the event of power interruption, including operator power down.

### Microprocessor

The 1720/1721 is controlled by a ROM-based Microprocessor. U613 is an 8-bit Microcontroller that operates either with U624 (early serial numbers, a 4k X 8 EPROM) or contains its own masked ROM. Pins 32 through 39 of U613 (AD0-AD7) is a multiplexed address and data bus. U620 de-multiplexes the lower address bus for program code retrieval, in early serial numbers. U613 controls switching in response to front-panel keyboard action. Front-panel switches are ground closures and are buffered by U311, an octal buffer. When the front panel is to be read, pin 17 of U613 goes low to enable U311, which outputs the front-panel key status to the data bus. In addition, a serial bus structure, through U818A, is input to U613 through pin 10. This is the Auxiliary bus for operation with a companion 1730-Series.

U315 and U319 are the front-panel LED drivers. The front-panel LEDs light when the light driver outputs are low. In addition, U319 pins 6, 9, and 12 are

control lines (75%, 100%, and Variable) for instrument switching functions. Other switching control lines are output directly from U613, ports 1 and 3. See Table 4-1.

**Table 4- 1: U613 Switching Control Outputs**

U613 PIN #	CONDITION	FUNCTION
3	High	Channel A Input Selected for Display
4	High	Channel B Input Selected for Display
5	High	Internal Reference Selected
	Low	External Reference Selected
6	High	Vector Display Selected
7	High	X Y Display Selected
8	High	Test Circle Display Selected
12	Low	CRT Blanked for Real Time Switching
13	High	PAL (+V Switcher Off) Selected (1720 Default Mode)
	Low	+V (+V Switcher On) Selected

U818B is a buffer to isolate the Auxiliary port Transmit Data (TXD) from the Microprocessor.

U613 pin 15 is the enable for buffer U818C, which allows the line select blanking pulse from the companion 1730-Series to pass in Auxiliary mode. The line select blanking pulse drives Q248 and Q540 in the crt Blanking circuit located on Diagram 4.

U818D inverts the ALE pulse from the Microprocessor (pin 30) to clock U620 to de-multiplex the address lines of the Low Address/Data bus.

U405 is the NOVRAM used to retain the current front-panel status and the front-panel status for the Stored Recalls (Auxiliary). Data is written in and read out through pins 3 and 4; pin 1 of U613 controls data in and out. Pin 2 of U613 provides the serial clock. Pin 14 provides the chip enable. These three lines (Clock, Read/Write, and Chip Enable) are active when:

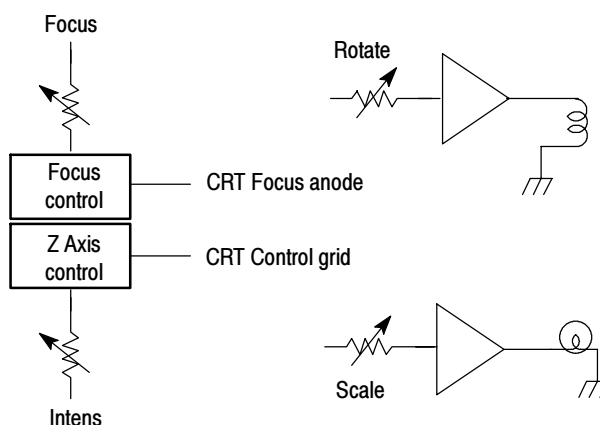
1. Power is turned on.
2. Any front-panel switch is pressed.



3. In Auxiliary, when a Store or Recall is requested from the companion 1730-Series.

U505 is the Power Down Detection circuit. It detects the loss of instrument power in time for the NOVRAM (U405) to execute a save operation. When the +5 V supply drops a few hundred millivolts, pin 7 is pulled low, which causes U405 to Store its current status. The front-panel and Auxiliary (Store/Recall) data is saved in a matter of milliseconds when the power starts to drop below safe operating levels for the NOVRAM. U508 is a three-terminal regulator operating from the +15 V supply that comes onto the circuit board from the Power Supply circuit board. As soon as the +15 V raises enough to provide a +5 V output from U508, U405 recalls the data saved so that it will be available to the Microprocessor when all supplies are up to their operating tolerances.

## DIAGRAM 6 CONTROL CIRCUIT



Blanking signals are input to an intensity switching matrix along with a dc voltage level set by the front-panel INTENS control. Focus level, for the crt focus anode, is set by regulating the current through a transistor current source. The amount of focus current through the transistor depends on the setting of the front-panel FOCUS control. The effects of small variations in the magnetic field surrounding the instrument are compensated for by an adjustable magnetic field placed around the crt bulb. Scale Illumination for the crt face plate is set by controlling the output amplitude of a triangle generator that drives the scale illumination bulbs.

### Z-Axis Control

U440 is a transistor array with two of the transistors connected as a differential current switch. The static output current (pin 8) is set by the front-panel INTENSITY control using Q342 as a current source. The blanking signal is input to the switch through pin 9. When pin 9 goes high the current output (pin 8) is shut off and the Z-Axis Amplifier (Diagram 5) blanks the crt.

In Line Select mode (which requires an external blanking pulse, input through the Auxiliary connector, from a 1730-Series or other source) the intensity setting has to change to brighten up the line(s). This is accomplished by increasing the current through the current source (Q342). U341A is an open collector dual comparator that goes low when the Line Select Blanking occurs, which allows current in R241 to add to the current in Q342, the current source.

The Focus control operation must also control two different display criteria. In the normal mode of operation the Focus voltage will be selected by the control setting only, Q241 is off. When a line select unblanking pulse occurs, U341B turns on and additional current flows through Q241. R244, the LS Focus adjustment, is adjusted for optimum focus in Line Select at the normal display focus setting.

### **Trace Rotation**

Trace rotation is necessary to compensate for changes in the magnetic field surrounding the 1720/1721. Q254 and Q256 are emitter followers that provide the Trace Rotation current to a coil located inside the crt shield, around the tube. Current amplitude and polarity are controlled by the front-panel ROTATE screwdriver adjustment.

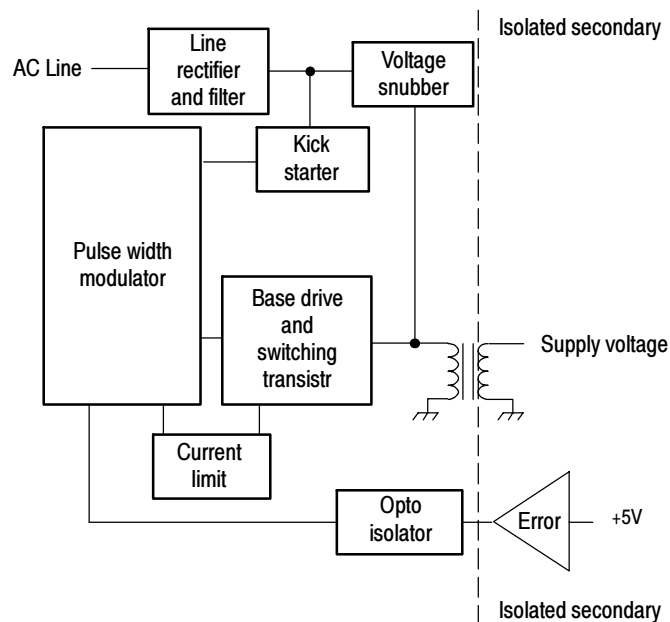
### **Graticule Illumination**

U344A is a triangle generator whose output is compared to the front-panel SCALE control output level by U344B (a comparator). The output of U344B is a 6.5 kHz square wave, the duty cycle of which is controlled by the front-panel SCALE ILLUM control. U344B drives saturating switch Q246, which applies the square wave to the graticule lights, DS402 and DS802. L146 and C147 serve as a low-pass filter to keep noise off the +15 V supply.

### **Post Regulators**

The + and -15 V supplies generated on the Power Supply circuit board are further regulated to meet the on-board needs of the 1720/1721 Main (A3) circuit board. U164 and U172 are the post regulators for the -11.8 V and +11.8 V supplies. R259 is the -11.8 V Adjust and R267 is the +11.8 V Adjust.

## DIAGRAM 7 LOW VOLTAGE POWER SUPPLY



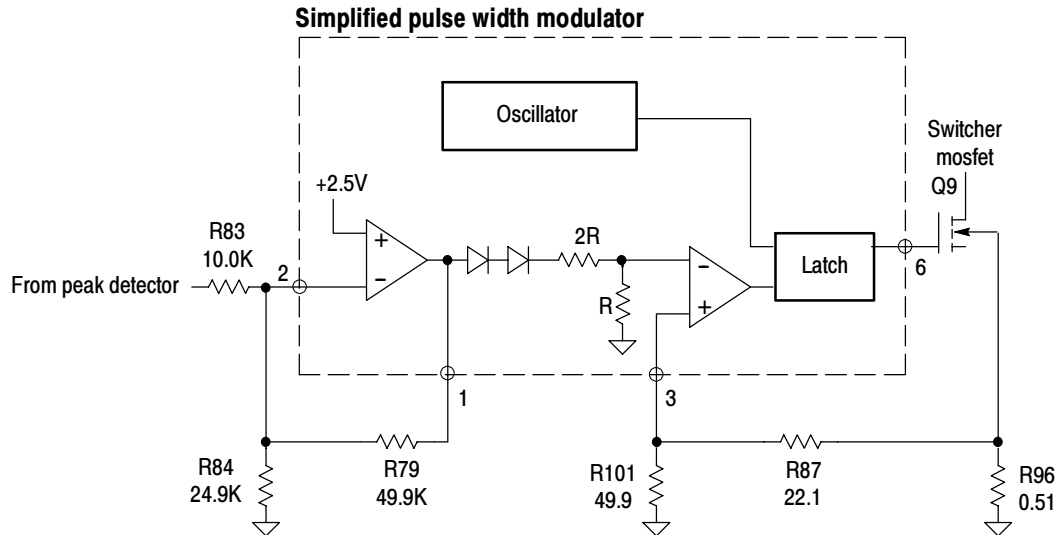
The Low Voltage Power Supply converts the mains line voltage (90-250 VAC) to supply the power requirements of the instrument. The voltages supplied by the Low Voltage Power Supply are +40 V,  $\pm 15$  V, and +5 V.

The Low Voltage Power Supply is called a Flyback Switcher. When switcher mosfet Q9 is turned on, its drain voltage drops to approximately 0 V. The current through the 350  $\mu$ H primary winding of T3 begins ramping up. The voltages present at all secondaries is such that the rectifier diodes are reverse biased. Energy is being stored in the magnetic field of T3. When Q9 turns off, the drain voltage “flies back” in a positive direction. Current now flows in all of the secondary windings and supplies power.

### Line Rectifier and Filter

The input line voltage is filtered by the rear-panel connector to reduce the electrical noise conducted into or out of the instrument. R89 limits the initial charging current through the rectifier diodes and C54. CR21, CR22, CR23, and CR24 form a bridge rectifier. C54 filters the 110 to 350 VDC rectifier output. L4 filters the switching noise produced by the switcher. R102 reduces the circulating current in the parallel circuit consisting of L4 and C44. DS4, R93, and R94 form a line voltage indicator. R91 and R92 charge C42. C42 provides power to U5 until the primary housekeeping winding provides power through CR17.

## Pulse Width Modulator



U5 is a current-mode pulse width modulator (PWM). A current-mode PWM uses two feedback loops. The inner current-feedback loop directly controls the switcher mosfet peak current. The outer voltage-feedback loop programs the inner loop peak current trip point.

U5 pin 2 is the inverting input of an internal op-amp. The non-inverting input is set to 2.5 V by an internal voltage reference. Current from the peak detector flows through R83, R84, and R76. R84 provides a 100  $\mu$ A offset. The voltage at U5 pin 1 will vary in order to maintain U5 pin 2 at 2.5 V.

The voltage at U5 pin 1 is modified by an internal circuit and sets the trip point of the internal comparator. U5 pin 3 is the external input to the comparator. R88 and C52, connected to U5 pin 4, set the internal oscillator to 80 kHz.

The circuit works as follows: The oscillator resets the latch and U5 pin 6 goes high, turning the switcher mosfet on. The current through the switcher mosfet increases, causing the voltage across R96 to increase. This voltage is divided by R87 and R101, and is applied to the comparator (pin 3). When the voltage at U5 pin 3 reaches the comparator trip point, the latch toggles and the switcher mosfet is turned off. This process is repeated at an 80 kHz rate.

C58 increases the PWM noise immunity by rolling the internal op-amp frequency response. R82 holds the switcher mosfet off as the circuit is powering up. R81 slows the turn-on of the switcher mosfet while CR27 speeds up the turn off.

## Output Filters

The three output windings supply four output voltages. Each output is rectified by a single diode and filtered by an LC pi filter.

**Error Amplifier**

The Error Amplifier regulates the +5 V output by feeding an error signal to the Pulse Width Modulator. VR1 is a 2.5 V shunt regulator containing an op-amp and a voltage reference. The +5 V is divided by R69 and R70 to provide 2.5 V to VR1, with fine adjustment provided by R99. C40 and R71 determine the gain and frequency response of VR1. VR4 controls overshoot of the +5 V at power up. R98 and CR26 provide a minimum operating current for VR1. R68 decouples C39 from VR1. Overvoltage protection for the +5V supply is provided by a crowbar circuit formed by Q11, VR3, R13, and R14.

**Feedback Transformer Driver and Peak Detector**

The 80 kHz sawtooth waveform at U3 pin 3 trips comparator U3. U3 pin 1 then feeds a trigger pulse to one-shot U4. U4 pin 13 outputs a 300 ns pulse to the 130 mA current source consisting of Q7 and Q8. When Q8 turns on, T2 pin 2 is pulled down until CR15 (Error Amplifier) is forward biased. The negative going pulse at T2 pin 2 is peak detected by CR16 and C46. The dc voltage present at the anode of CR16 feeds the pulse width modulator and the Output HV Shutdown circuit. CR29 resets T2 between pulses.

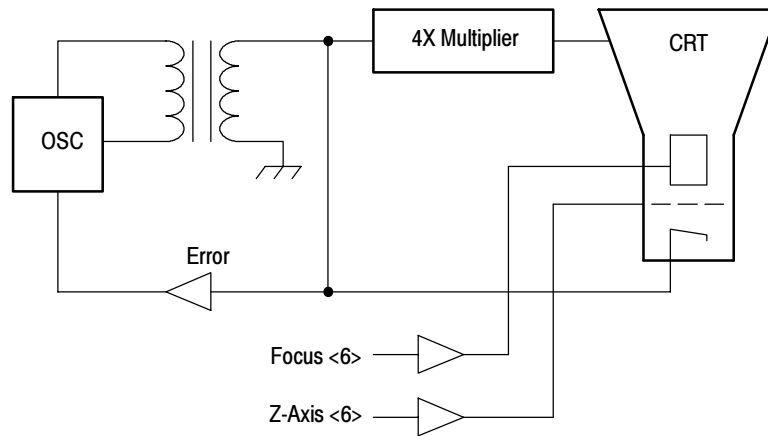
**Output HV Shutdown**

If the +5 V is below 4.9 V, the Error Amplifier will cause the Peak Detector output to go below 2.9 V. The output of comparator U3B will pull low and shutdown pulse width modulator U5. C47 and R96 delay the operation of U3B long enough for the power supply to power up. If the +5 V does not reach 4.9 V within 50 ms of power up, U3B will shut down the switcher. The power supply will then cycle on and off every couple of seconds.

**Over Voltage Protection**

Over voltage protection is provided on the +5 V output by a crowbar circuit composed of Q1, VR3, R13, and R14. If the +5 V output exceeds approximately +5.5 V, VR3 will start to conduct. When VR3 is drawing enough current through R13 to raise SCR Q11 gate voltage above its cathode by approximately 0.7 V, Q11 will turn on. This shorts the +5 V output to ground, forcing the primary circuit into current limit.

## DIAGRAM 8 HIGH VOLTAGE POWER SUPPLY



The High Voltage Power Supply generates the heater, cathode, control grid, focus anode, and post accelerating potentials required to display the outputs of the Vertical and Horizontal Output Amplifiers.

### HV Osc and Error Amp

The High Voltage Power Supply is generated by a sine-wave oscillator and step-up transformer. Q6 and T1 are the principal elements of an Armstrong oscillator running at about 22 kHz. Error Amplifier U2 regulates the +100 V output and keeps the High Voltage Power Supply constant under varying load conditions by controlling the base current to Q6. The +100 V output is regulated directly, while the High Voltage Power Supply is indirectly regulated through a current feedback circuit.

R48, C16, R60, and R63 form the High Voltage Power Supply current feedback circuit. As the current from the High Voltage Power Supply is increased, the voltage to the + side of the Error Amplifier (U2) increases, which increases the base drive to Q6, the HV Osc. This current feedback compromises the regulation of the +100 V supply to keep the high voltage constant with varying intensities.

C66 and Q10 are a start delay circuit that holds the Error Amplifier output low, through CR30, until C66 is charged. Delaying the start of the high voltage oscillator allows the Low Voltage Power Supply to start, unencumbered by the load from the high voltage oscillator.

### Power Supply Outputs

CR4 is the high voltage rectifier. Filter capacitors C3, C4, and C8 work with CR4 to provide -2530 V to the crt cathode. U1 is a four-times multiplier providing +11 kV to the crt anode.

### Focus Amplifier

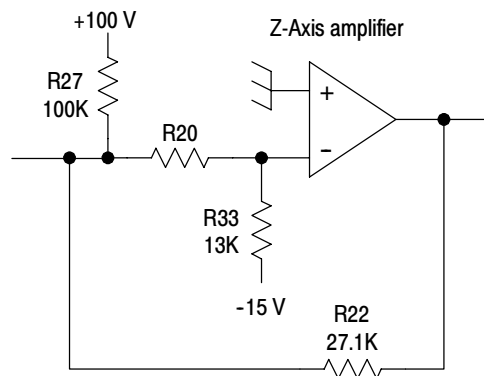
Q1 and Q2 form an operational amplifier that sets the voltage at the bottom of the focus divider. The front-panel FOCUS pot determines the voltage at the bottom of the focus divider. The Center Focus control, R11, is set for optimum beam focus, as viewed on the crt, with the front-panel FOCUS control set to mid range. Once the Center Focus adjustment has been set, adjusting the front-panel FOCUS control changes the voltage at the bottom end of the divider and, consequently, the voltage on the crt focus anode.

### Grid Drive Circuit

The cathode of the crt is at a -2530 V potential with the grid coupled to the Z-Axis Amplifier by the grid drive circuit. The grid is approximately 75 V negative with respect to the cathode. The 200 V p-p sine wave present at the cathode of CR8 is input to the Grid Drive circuit where it is clipped for use as crt control grid bias.

The sine wave from the cathode of CR8 is coupled through R47 to a clipping circuit consisting of CR5 and CR6. Clipping level for the positive excursion of the sine wave is set by the crt Bias adjustment, R58. The negative clipping level is set by the front-panel INTENSITY control through the Z-Axis Amplifier. The clipped sine wave is coupled through C11 to a rectifier made up of CR1 and CR3. The rectified, clipped sine wave is the crt control grid bias voltage. C9 couples the blanking signal from the Z-Axis Amplifier to the crt control grid. DS1 and DS2 limit the crt grid to cathode voltage at instrument turn on or off. DS3 limits the crt heater to cathode voltage.

### Z-Axis Amplifier

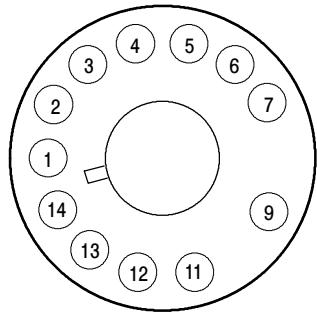


This is an inverting amplifier with negative feedback. R22 is the feedback resistor while R7, R20, and R23 act to maintain the summing junction at +5 V. Without any Z-Axis input current, the amplifier output is approximately +10 V. Negative Z-Axis input current will cause the output to go positive.

Q5 is a current amplifier feeding the output stage. Q3 and Q4 form a push-pull output stage. Q3 acts as a 2.7 mA constant current pull-up, while Q4 is the

pull-down transistor. C6 speeds up the amplifier by coupling ac signals to the base of Q3. CR2 and R41 protect the amplifier during crt arcing.

**CRT** The pinout for the CRT is shown in Figure 4-3.



Pin	Description
1.....	Filament (f)
2.....	Cathode (k)
3.....	GRID (g1)
4.....	FOCUS (g3)
5.....	ASTIG (g4)
6.....	GEOM (g5)
7.....	VERT PLATE (y2)
9.....	VERT PLATE (y1)
11.....	HORIZ PLATE (x2)
12.....	1st ANODE (g2)
13.....	HORIZ PLATE (x1)
14.....	Filament (f)

**Figure 4-3: Pinout of the CRT Socket**





# **Checks and Adjustments**



## Section 5

# Checks and Adjustments

Checks and adjustments are two separate procedures. The first, a Performance Check, is used to determine compliance with the Performance Requirements in the Specification. The Specification in Section 1 contains numerical references to the procedure. The second procedure is the Adjustment Procedure, which provides adjustment instructions for the instrument that will return it to operation within the written Specification (Section 1).

In both procedures, front- and rear-panel controls and connectors for the instrument under test are fully capitalized (e.g., VARIABLE GAIN). Control and connector names on test equipment and internal adjustments for the instrument under test are initial capitalized (e.g., Time/Div, Geometry, etc.).

Limits, tolerances, and waveforms given in this section are guides to adjustments and checks, and are not instrument specifications unless they are listed as Performance Requirements in the Specification (Section 1).

## Recommended Equipment List

The following equipment is recommended for use in the Performance Check and Adjustment Procedures for this instrument. Other equipment may be substituted; however, care must be used to ensure that the accuracy of the substituted equipment does not compromise the results of a particular procedure step.

### Electrical Instruments

#### 1. Test Oscilloscope

Vertical Amplifier: 30 MHz Bandwidth, 1 mV Sensitivity.

Time Base: 10 ns/div to 5 ms/div sweep speeds, triggering to 5 MHz.

For example: a TEKTRONIX TAS 465 Oscilloscope. Also 10X probes, P6106 (Tektronix Part No. 010-6106-03).

#### 2. Television Signal Generator

Color test signals for the television standard of the monitor to be tested: color bar signal, linearity staircase and variable APL, and black burst signal.

For example: NTSC TEKTRONIX 1410 with Option AA and Option AB (modified SPG2 and TSG7) and TSG3.

PAL TEKTRONIX 1411 with Option AA and Option AB (modified SPG12 and TSG11) and TSG13.

PAL-M TEKTRONIX 1412 with Option AA and Option AB (modified SPG22 and TSG21) and TSG23.

The 1410, 1411, and 1412 Option AA are mainframes with modified SPG2, 12, and 22 Sync Generators with the added features of: Variable Subcarrier Frequency ( $\pm 20$  Hz,  $\pm 50$  Hz for the 1410;  $\pm 5$  Hz,  $\pm 10$  Hz for the 1411 and 1412), Variable Burst amplitude, Variable Sync amplitude, and SCH unlock.

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**NOTE.**

*The 1410 Series generators with standard SPG and TSG modules can be used, but this will not allow all checks and adjustments to be made.*

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The 1410, 1411, and 1412 Option AB are mainframes with modified TSG7, 11, and 21 Color Bar Generators that more accurately control output amplitudes of the standard 75% amplitude bars.

The Signal Generator mainframes can be ordered with one or both options (AA and AB).

The TSG3, 13, and 23 are Modulated Staircase Generators with variable APL.

**3. Leveled Sine Wave Generator, 50 kHz to 10 MHz**

For example: A TEKTRONIX SG503 Leveled Sine Wave Generator installed in a TEKTRONIX TM500 Series Power Module. Flatness  $\pm 1\%$ , 250 kHz to 50 MHz. The flatness can be calibrated (a chart made of variations) with the TEKTRONIX Peak-to-Peak Detector (015-0408-00).

**4. Function Generator, -10 V pulse at 1 kHz**

For example: A TEKTRONIX FG501A Function Generator installed in a TEKTRONIX TM500 Series Power Supply Module.

**5. Voltmeter, 0 to >100 Vdc; accuracy,  $\pm 0.1\%$**

For example: A TEKTRONIX DM504A in a TM500 Series Power Module.

**6. Power Module (required for Items 3, 4, and 5)**

For powering and housing TEKTRONIX DM504A, SG503A, FG501A.

For example: A TEKTRONIX TM506 Power Module.

**7. Variable Autotransformer**

For example: General Radio Metered Auto Transformer W10MT3W. If 220 Volt operation must be checked, a conversion transformer or appropriate 220 V autotransformer is needed.

**8. Spectrum Analyzer with Tracking Generator**

Bandwidth  $\geq$  10 MHz and sensitivity to 50 dB.

For example:

TEKTRONIX 2712 Opt 04

## Auxiliary Equipment

**9. RF Bridge**

Range, at least 46 dB loss sensitivity, 50 kHz to 10 MHz.

For example: Wide Band Engineering Part No. A57TLSCR

**10. 75 $\Omega$  Precision High Frequency End Line Termination, for use with the RF Bridge.**

At least 0.25% DC accuracy, with return loss of 46 dB or greater, up to 30 MHz.

For example: Wide Band Engineering Part No. A56T75B

**11. 75 $\Omega$  Terminators (three required; two should be feed-through types)**

For example: End-line, 75 $\Omega$  terminator (Tektronix Part No. 011-0102-00), and a feed-through, 75 $\Omega$  terminator (Tektronix Part No. 011-0103-02).

**12. 75 $\Omega$  Coaxial Cable**

For example: 42 inch RG59U (Tektronix Part No. 012-0159-00).

**13. Alligator Clip to BNC Adapter (Qty. 2)**

For example: Tektronix Part No. 013-0076-00.

**14. Dual Input Coupler**

Matched BNC cable-T for making phase comparisons between two inputs.  
Matched length of the two arms within  $\pm 0.1$  inch.

For example: Tektronix Part No. 067-0525-02.

**15. Precision 50 $\Omega$  Coaxial Cable**

Tektronix Part No. 012-0482-00 (used with the TEKTRONIX SG503).

**16. 50 $\Omega$  to 75 $\Omega$  Minimum Loss Attenuator**

Tektronix Part No. 011-0057-00.

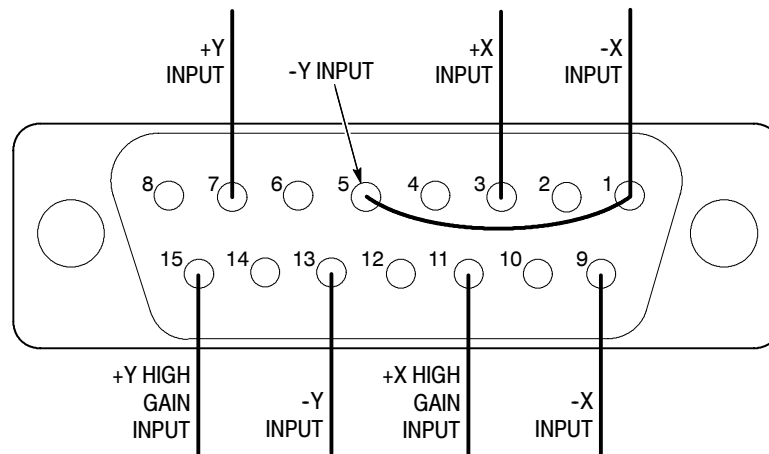
**17. Female to Female BNC adapter**

Tektronix Part No. 103-0028-00

**18. XY Input Connector Parade Display Test Connector**

Fifteen-pin, subminiature D-type connector (for example: Tektronix Part No. 131-0459-00), modified to input signals for XY checks and adjustments. See Figure 5-1.

Soldered-in wires need to be long enough to permit shorting together.



**Figure 5-1: Rear view of XY INPUT plug connections. Note that High Gain inputs are shown even though they are not normally used in these procedures.**

## Performance Check Procedure Short-Form Reference

The short-form reference table is intended for those who are familiar with the complete Performance Check procedure. Step and page numbers provide easy cross-reference to the long-form procedure on the following pages.

**Table 5-1: Performance Check Procedure Short-Form Reference**

Step #	Step Name	Step Requirement	Page #
1	Preliminary Setup	Initial equipment connections and control settings.	5-6
2	Check Power Supply Operation	Stable operation over an ac input range of 90 - 250 V.	5-6
3	Check Synchronization	Stable display with composite video or black burst with 40 IRE (300 mV PAL and PAL-M) sync $\pm 6$ dB.	5-6
4	Check Demodulator Channel Bandwidth	Upper -3 dB point: $F_{SC} + (400 \text{ kHz to } 600 \text{ kHz})$ . Lower -3 dB point: $F_{SC} - (400 \text{ kHz to } 600 \text{ kHz})$ .	5-7
5	Check Color Bar Decoding Accuracy	Vector Phase accuracy within $\pm 1.25^\circ$ . Vector Gain accuracy typically within $\pm 1.25$ IRE (NTSC or PAL-M) or $\pm 2.5\%$ (PAL).	5-8
6	Check Subcarrier Regenerator Performance	Pull in range: $F_{SC} \pm 50 \text{ Hz}$ ( $\pm 10 \text{ Hz}$ for PAL or PAL-M). Pull-in time less than 1 second. Phase shift at these frequency offsets is within $\pm 2^\circ$ . Phase shift with $\pm 6$ dB burst amplitude within $\pm 2^\circ$ .	5-9
7	Check Phase Accuracy	Phase shift with signal input channel change less than $0.5^\circ$ . Phase shift with +3 to -6 dB VAR GAIN change: less than $1^\circ$ . Burst jitter: less than $0.5^\circ$ .	5-9
8	Check Amplifier Linearity	Differential Phase: $\leq 1^\circ$ , Differential Gain: $\leq 1\%$ , (Measured with a 140 IRE (1 V PAL) linearity signal (5-step, 10-step, or ramp) with a 40 IRE (300 mV PAL) subcarrier.	5-10
9	Check Chrominance Vector Clamp Performance	Clamp stability: $1/64''$ (0.4 mm) or less center dot movement as the PHASE control is rotated throughout its range. Position Control range: at least $1/4''$ (6 mm) from the center at either limit.	5-11
10	Check Variable Gain	Input subcarrier signals between 29.5 IRE and 147 IRE (0.210 and 1.05 V for PAL and PAL-M) can be adjusted to the burst amplitude.	5-11
11	Check Return Loss	Return loss for each input: at least 40 dB from 50 kHz to 6 MHz (instrument on or off, input in use or not, for any deflection factor setting).	5-12
12	Check Trace Rotation Range	Range greater than $\pm 1^\circ$ from horizontal.	5-13
13	Check XY Input Phase Matching	Less than a trace width of separation at 100 kHz.	5-14
14	Check XY Frequency Response	The -3 dB point at 500 kHz or greater in standard mode; 100 kHz or more in High Gain mode.	5-15

## Performance Check Procedure

### 1. Preliminary Setup

- a. Connect the variable autotransformer to the AC power connector. Turn Power On and set the autotransformer for the voltage shown by the rear-panel Line Voltage Selector switch.
- b. Connect a composite color bar signal with 100% Peak White Bar and 75% amplitude color bars through the CH-B INPUT and terminate the opposite side of the loop-through with a 75 $\Omega$  terminator.
- c. Turn on the 1720/1721 and set the controls as follows:

INTENSITY	As desired.
FOCUS	As desired.
SCALE	As desired.
MODE	VECT
REF	INT
INPUT	CH-B
VARIABLE	Off
BARS	75%
AUXILIARY	Off

### 2. Check Power Supply Operation

**REQUIREMENT** - Stable operation over an ac input range of 90 - 250 V.

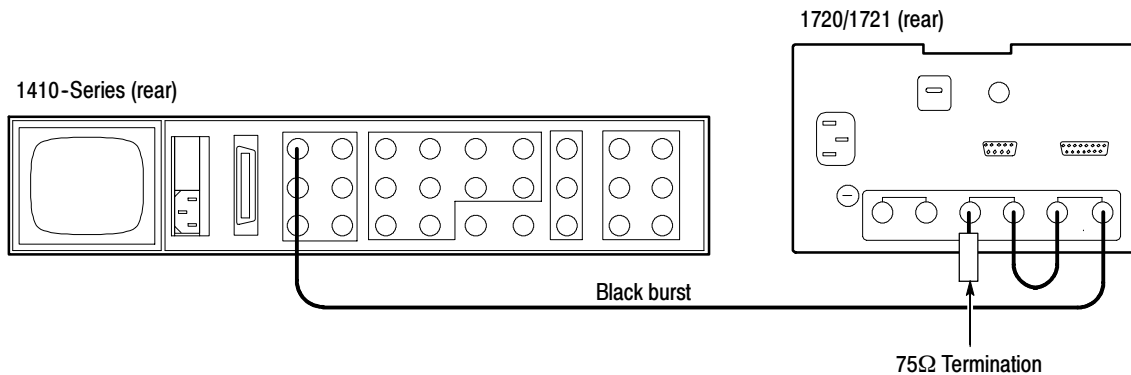
- a. Turn on the 1720/1721 and adjust the controls for a useable display.
- b. Vary the autotransformer from low-line to high-line voltage (90 - 132 V for 110 V, or 180 - 250 V for 220 V operation).
- c. **CHECK** - for stable operation over the voltage range.

### 3. Check Synchronization

**REQUIREMENT** - Stable display with composite video or black burst with 40 IRE (300 mV PAL and PAL-M) sync  $\pm$ 6 dB.

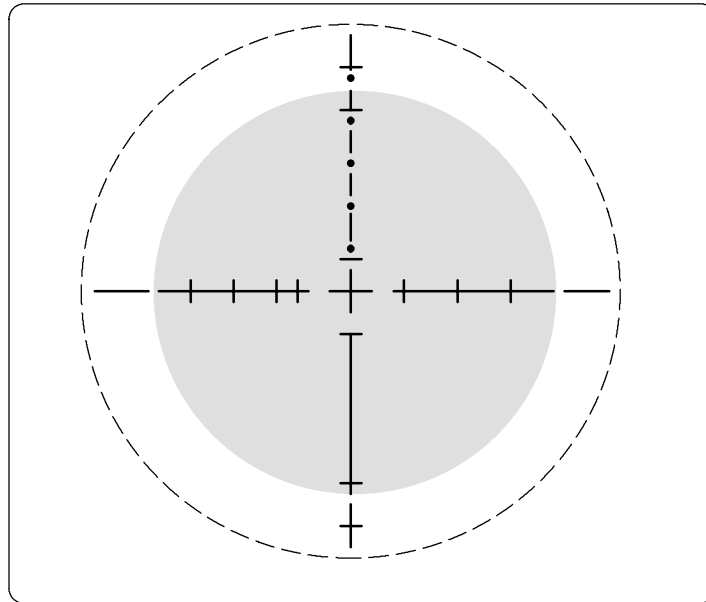
- a. Disconnect the color bar signal and loop-through connect the black burst output from the 1410 (1411 or 1412) SPG2 Mod AA as shown in Figure 5-2.





**Figure 5-2: Loop-through connection of black burst signal to both EXT REF and CH-B.**

- b. Use the 1720/1721 PHASE control to place the burst vector tip(s) on the graticule target(s).
  - c. Remove the 75Ω terminator from CH-B.
  - d. **CHECK** - for stable display in both EXT and INT reference modes.
  - e. Triple terminate CH-B, using three 75Ω terminators.
  - f. **CHECK** - for a stable display in both EXT and INT reference modes.
  - g. Disconnect the black burst signal and remove two of the terminators from CH-B. Remove the cable that connects CH-B and EXT.
4. Check Demodulator Channel Bandwidth
- REQUIREMENT** - Upper -3 dB point:  $F_{SC} + (400 \text{ kHz to } 600 \text{ kHz})$ .  
Lower -3 dB point:  $F_{SC} - (400 \text{ kHz to } 600 \text{ kHz})$ .
- a. Set the 1720/1721 MODE to VECTOR and REF to EXT.
  - b. Connect the Leveled Sine Wave Generator to the CH-B INPUT.
  - c. Adjust the Sine Wave Generator frequency to 3.58 MHz NTSC and PAL-M (4.43 MHz PAL). Adjust the Sine Wave Generator amplitude so that the circle overlays the vector graticule circle.
  - d. Decrease the Sine Wave Generator frequency until the perimeter of the circle touches the -3 dB (70%) point gaps on the vertical graticule axis. See Figure 5-3.



**Figure 5-3: Using the vector graticule -3 dB markings to measure bandwidth. Amplitude is set to the compass rose at the center frequency, and then as the frequency is increased or decreased the total deflection reduces to the openings, at the shaded inner circle, on the axes lines.**

- e. **CHECK** - that the frequency readout on the Sine Wave Generator is between 2.98 to 3.18 MHz NTSC and PAL-M (3.83 to 4.03 PAL).
  - f. Repeat parts c. and d. for the horizontal graticule axis.
  - g. Increase the Sine Wave Generator frequency until the perimeter of the circle touches the -3 dB (70%) point gaps on the vertical graticule axis.
  - h. **CHECK** - that the frequency readout on the Sine Wave Generator is between 3.98 to 4.18 MHz NTSC and PAL-M (4.83 to 5.03 PAL).
  - i. Repeat steps g. and h. for the horizontal graticule axis.
5. Check Color Bar Decoding Accuracy
- REQUIREMENT** - Vector Phase accuracy within  $\pm 1.25^\circ$ . Vector Gain accuracy typically within  $\pm 1.25$  IRE (NTSC or PAL-M) or  $\pm 2.5\%$  (PAL).
- a. Set the 1720/1721 REF to INT.
  - b. Connect the color bar to the CH-B INPUT and terminate the remaining side of the loop-through with a  $75\Omega$  terminator. Display the signal in VECT MODE and adjust the PHASE control to place the vector dots in their graticule targets.

- c. **CHECK** - that all of the vectors fall within  $\pm 1.25^\circ$  and  $\pm 1.25$  IRE (NTSC and PAL-M), or  $\pm 1.25^\circ$  and  $\pm 2.5\%$  (PAL) of the target centers. These specifications represent one-half the dimension from the center cross of a vector target to the edge of the small inner box.

*Perform steps d. and e. for the 1721 only:*

- d. Select the +V VECT MODE.
- e. **CHECK** - that the Burst vectors can be overlaid with the PHASE control.

## 6. Check Subcarrier Regenerator Performance

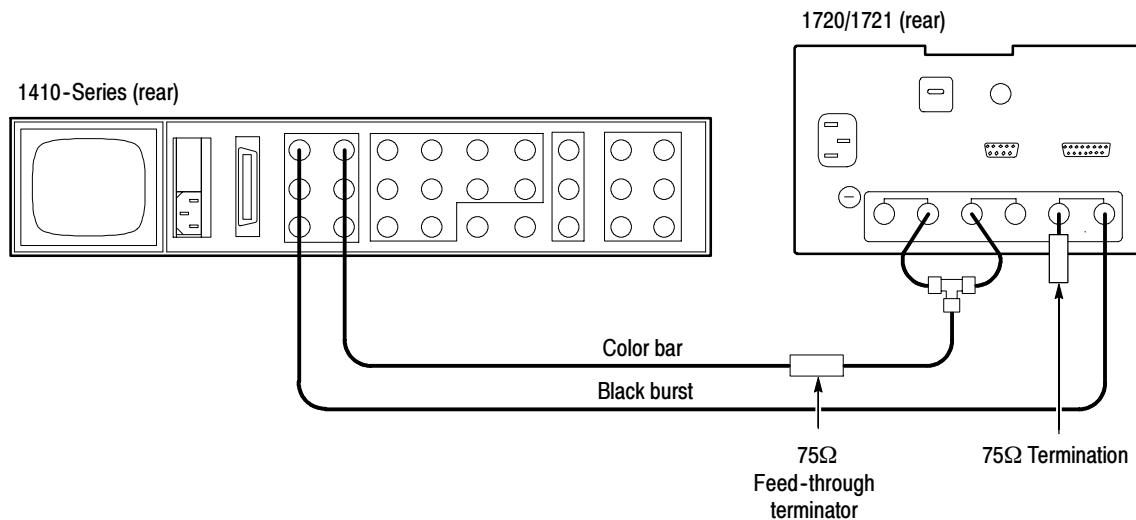
**REQUIREMENT** - Pull in range:  $F_{SC} \pm 50$  Hz ( $\pm 10$  Hz for PAL or PAL-M). Pull-in time less than 1 second. Phase shift at these frequency offsets is within  $\pm 2^\circ$ . Phase shift with  $\pm 6$  dB burst amplitude within  $\pm 2^\circ$ .

- a. Connect the color bar signal to the CH-B INPUT. Display the signal in VECT MODE.
- b. Change the generator's subcarrier frequency by  $\pm 50$  Hz ( $\pm 10$  Hz for PAL and PAL-M).
- c. **CHECK** - that the 1720/1721 locks to the generator within 1 second at these frequencies.
- d. **CHECK** - that the vectorscope display does not change by more than  $\pm 2^\circ$  at these frequencies.
- e. Change the 1410-Series MOD AA output to black burst and vary the Burst Amplitude + and -6 dB from the calibrated amplitude (1/2 to 2X amplitude).
- f. **CHECK** - that the 1720/1721 burst vector phase does not change by more than  $\pm 2^\circ$  within the + and -6 dB range.

## 7. Check Phase Accuracy

**REQUIREMENT** - Phase shift with signal input channel change less than  $0.5^\circ$ . Phase shift with +3 to -6 dB VAR GAIN change: less than  $1^\circ$ . Burst jitter: less than  $0.5^\circ$ .

- a. See Figure 5-4. Connect the color bar through a  $75\Omega$  feed-through terminator and a dual input coupler to the CH-A INPUT and CH-B. Connect the black burst signal to the EXT REF loop-through and terminate in  $75\Omega$ . Select EXT REF. Alternately select INPUT A and B in the VECT MODE.



**Figure 5-4: Signal connection for checking CH-A/CH-B phase matching.**

- b. **CHECK** - that the CH-A to CH-B phase match is within  $\pm 0.5^\circ$ .
  - c. Remove the black burst signal from the EXT REF INPUT. Move the connection from CH-A to the EXT REF. Alternately display INPUT B with INT and EXT REF.
  - d. **CHECK** - that there is less than  $0.5^\circ$  burst jitter with either INT or EXT REF.
  - e. Disconnect the color bar signal from the dual input coupler and apply the linearity staircase signal, with 40 IRE subcarrier (280 mV PAL and PAL-M). Display the signal in VECT MODE. Set the Staircase vector dot to the left horizontal graticule line with the PHASE control.
  - f. Rotate the VARIABLE control until the staircase vector is one-third longer (+3 dB) and to the point that the vector has been decreased to one-half of the original vector length (-6 dB).
  - g. **CHECK** - that there is less than  $1^\circ$  phase change over this range.
8. Check Amplifier Linearity
- REQUIREMENT** - Differential Phase:  $\leq 1^\circ$ , Differential Gain:  $\leq 1\%$ , (Measured with a 140 IRE (1 V PAL) linearity signal (5-step, 10-step, or ramp) with a 40 IRE (300 mV PAL) subcarrier.
- a. Display the modulated staircase in VECT MODE. With the PHASE control, position the vector dot (representing the subcarrier on the

staircase) to the burst cross on the horizontal graticule axis. Use the small dot on the -U axis for PAL and PAL-M.

- b. Turn on the VARIABLE switch and use the VARIABLE control to place dots at the outer graticule circle.
- c. **CHECK** - that dots are overlaid to  $\pm 1^\circ$  in phase, and  $\pm 1\%$  in gain.

#### 9. Check Chrominance Vector Clamp Performance

**REQUIREMENT** - Clamp stability:  $1/64''$  (0.4 mm) or less center dot movement as the PHASE control is rotated throughout its range. Position Control range: at least  $1/4''$  (6 mm) from the center at either limit.

- a. Connect the color bar signal to the CH-B INPUT and terminate remaining side of loop-through with a  $75\Omega$  terminator.
- b. **CHECK** - that the center dot of the vector display moves less than  $1/64''$  (0.4 mm) as the PHASE control is rotated.
- c. **CHECK** - while varying both screwdriver position controls throughout their range, that the range of each control is greater than + and -  $1/4''$  (6 mm) from the centered position.
- d. Return the vector display to the centered position.

#### 10. Check Variable Gain

**REQUIREMENT** - Input subcarrier signals between 29.5 IRE and 147 IRE (0.210 and 1.05 V for PAL and PAL-M) can be adjusted to the burst amplitude.

- a. Connect the Black Burst output of the Television Signal Generator to the 1720/1721 CH-B INPUT connector. **DO NOT** terminate this loop-through connector.
- b. Press the 1720/1721 VARIABLE push button, and turn the VARIABLE gain control.
- c. **CHECK** - that the burst vector can be adjusted to its 75% amplitude target.
- d. Terminate the open side of the CH-B loop-through with three  $75\Omega$  terminators.
- e. Turn the VARIABLE gain control.
- f. **CHECK** - that the burst vector can be adjusted to the compass rose.

- g. Disconnect the Black Burst signal and the terminators from the 1720/1721.

## 11. Return Loss

**Requirement** - Video Inputs:  $\geq 40$  dB to 6 MHz. Power on or off..

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**NOTE.** *Return Loss Check:*

*The Return Loss Check needs to be done only if repairs have been made on the Input circuitry.*

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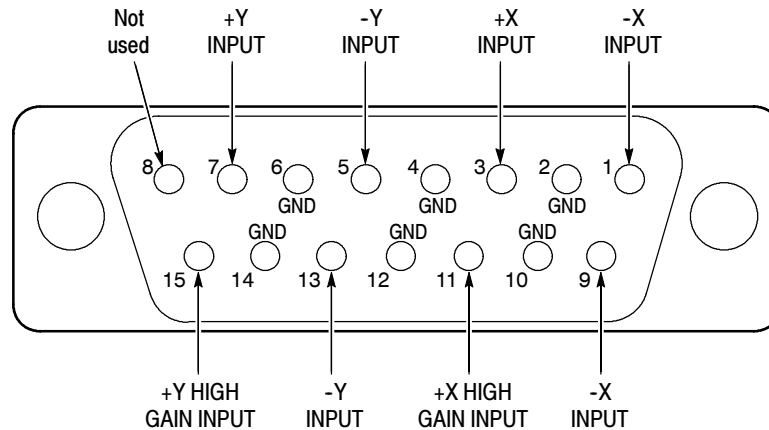
- a. Connect a precision  $50\Omega$  cable from the spectrum analyzer RF Input to the RF Output on the RF Bridge.
- b. Connect a precision  $50\Omega$  cable from the spectrum analyzer TG Output to the RF Input on the RF Bridge.
- c. Select Demod/TG on the spectrum analyzer. Turn on the tracking generator and set the tracking generator fixed level to 0.00 dBm.
- d. Set the spectrum analyzer Span/Div to 1 MHz and the Resolution Bandwidth to 30 kHz.
- e. Set the spectrum analyzer Vertical Scale to 10 dB.
- f. Set the spectrum analyzer Reference Level to the first major division down from the top on the analyzer display.
- g. Remove one of the cables from the RF Bridge.
- h. Set the spectrum analyzer Frequency to 5 MHz and turn the Marker on. Set the Marker to 6 MHz.
- i. Reconnect the cable to the RF Bridge.
- j. **Note** - the Reference Level Readout.
- k. Adjust the spectrum analyzer External Attenuation Amplitude (on the 2712 Input menu) by the amount noted in part j. of this step. Note: The Reference Level Readout should now be 0.00 dBm.
- l. Connect the precision high-frequency terminator to the Device Under Test connector on the RF Bridge.
- m. **Check** - that the frequency response from 0 MHz to 6 MHz is  $\geq 40$  dBm.
- n. Return the spectrum analyzer frequency marker to 6 MHz if it was moved.

- o. Remove the precision high-frequency terminator from the RF Bridge.
- p. Connect the male-to-male bnc adapter to the Device Under Test connector on the RF Bridge.
- q. Connect the Device Under Test connector on the RF Bridge to the 1720-Series CH-A INPUT. Terminate the CH-A loop-through with the same precision high-frequency terminator used in step o.
- r. Select CH-A INPUT.
- s. **Check** - that the Reference Level Readout on the spectrum analyzer is  $\geq 40$  dBm, with the instrument on and off.
- t. Repeat parts q. through s. for each Input channel (CH-B and EXT REF).
- u. Remove all cables and terminators from the 1720-Series.

## 12. Check Trace Rotation Range

**REQUIREMENT** - Range greater than  $\pm 1^\circ$  from horizontal.

- a. Connect the Function Generator output to pin 3 (+X) of the 1720/1721 rear-panel XY INPUT connector, using an alligator clip to bnc adapter. Connect the red alligator clip to pin 3. See Figure 5-5.
- b. Connect the black alligator clip to pins 1 and 5.
- c. Set the Function Generator to produce a sinewave output.
- d. Adjust the Function Generator amplitude for a displayed trace on the horizontal axis that is greater than the width of the graticule compass rose.
- e. If necessary, use a small screwdriver and adjust the 1720/1721 vertical positioning to place the trace on the horizontal axis.
- f. Use a small screwdriver to adjust the 1720/1721 ROTATE from end to end.



**Figure 5-5: Rear-panel XY INPUT connector showing inputs.**

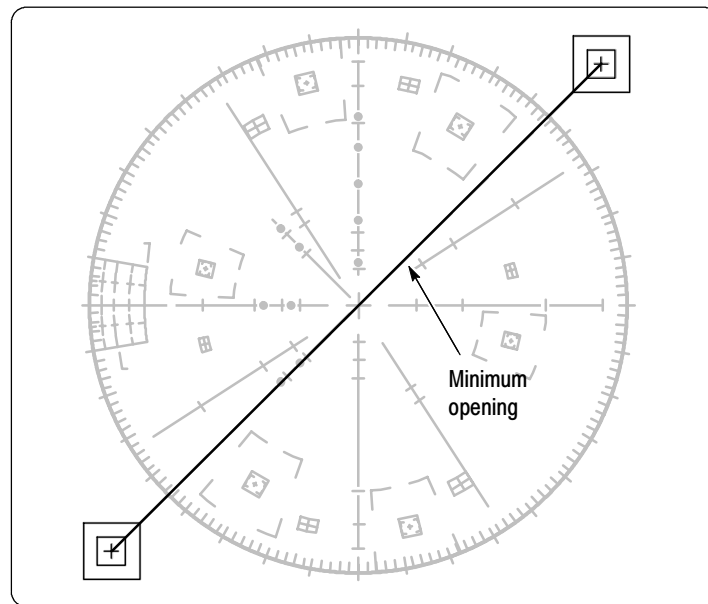
- g. CHECK** - that either end of the trace can be moved  $>1^\circ$  (one-half minor division on the compass rose) either direction from horizontal.
- h.** Set ROTATE so that the trace is on the horizontal axis.

**13. Check XY Input Phase Matching**

**REQUIREMENT** - Less than a trace width of separation at 100 kHz.

- a.** Connect the Function Generator output to both pins 3 (+X) and 7 (+Y) of the XY INPUT connector, using the red alligator clip. Leave the black alligator clip connected to pins 1 and 5. See Figure 5-5.
- b.** Set the Function Generator frequency to 10 kHz and adjust its amplitude so that the trace extends between the targets (+) on the diagonal line.
- c.** Set the Audio Signal Generator frequency to 100 kHz.
- d. CHECK** - that there is a trace width or less separation in the diagonal display. See Figure 5-6.





**Figure 5-6: Audio frequency XY display.**

#### 14. Check XY Frequency Response

**REQUIREMENT** - The  $-3$  dB point at 500 kHz or greater in standard mode; 100 kHz or more in High Gain mode.

- a. Connect the Function Generator, using the red alligator clip, to pin 3 (+X) of the 1720/1721 rear-panel XY INPUT connector. Leave the black alligator clip connected to pins 1 and 5. See Figure 5-5.
- b. Set the Function Generator frequency to 50 kHz and set its amplitude for a display the width of the compass rose.
- c. Set the Function Generator frequency to 500 kHz.
- d. **CHECK** - that the display reaches the  $-3$  dB gaps in the horizontal axis or beyond. See Figure 5-3.
- e. Move the Function Generator output to pin 7 (+Y) of the 1720/1721 rear-panel XY INPUT connector.
- f. Set the Function Generator to 50 kHz and set its amplitude for a display the height of the compass rose.
- g. Set the Function Generator frequency to 500 kHz.
- h. **CHECK** - that the display reaches the  $-3$  dB gaps in the vertical axis or beyond.

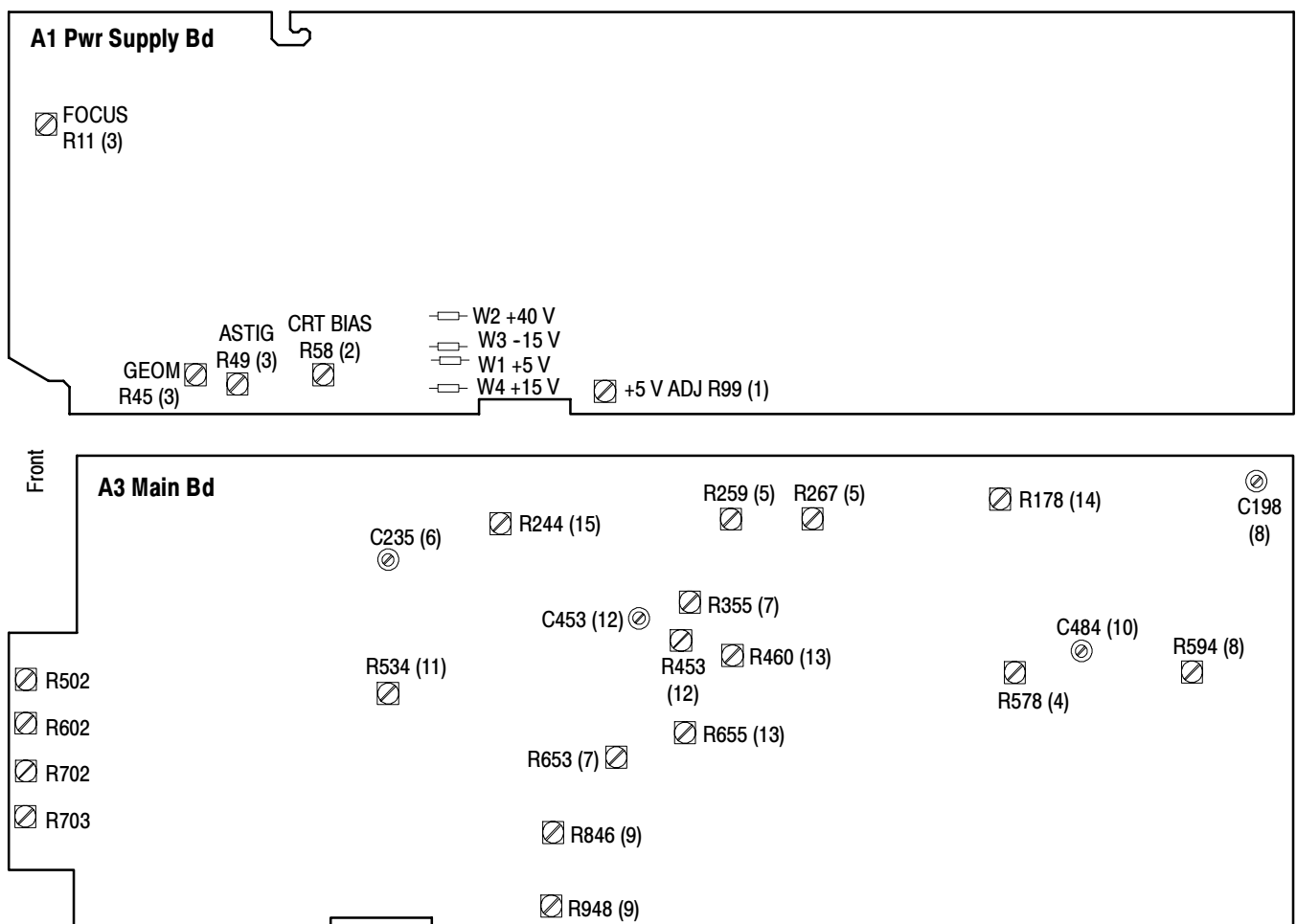
*Perform parts i. through p. only if internal jumpers J920 and J921 (Main board) are set to High Gain mode.*

- i.** Connect the Function Generator output to pin 11 (+X HIGH GAIN) and ground pin 9 (+X) of the 1720/1721 rear-panel XY INPUT connector. See Figure 5-5.
- j.** Set the Function Generator frequency to approximately 10 kHz and adjust its amplitude for a display equal to the width of the graticule compass rose.
- k.** Set the Function Generator to 100 kHz.
- l.** **CHECK** - that the display reaches the -3 dB gaps in the horizontal axis or beyond.
- m.** Connect the Function Generator to pin 15 (+Y HIGH GAIN) and ground pin 13 (-Y) of the 1720/1721 rear-panel XY INPUT connector.
- n.** Set the Function Generator frequency to approximately 10 kHz and adjust its amplitude for a display equal to the height of the graticule compass rose.
- o.** Set the Function Generator to 100 kHz.
- p.** **CHECK** - that the display reaches the -3 dB gaps in the vertical axis or beyond.

## Adjustment Procedure

This procedure is divided into two parts. The first, a short form, is an outline of the full procedure. The full procedure is more detailed and is intended to lead a technician through each step. The short form can be used as a short cut for those familiar with the instrument calibration or an index of steps in the longer form.

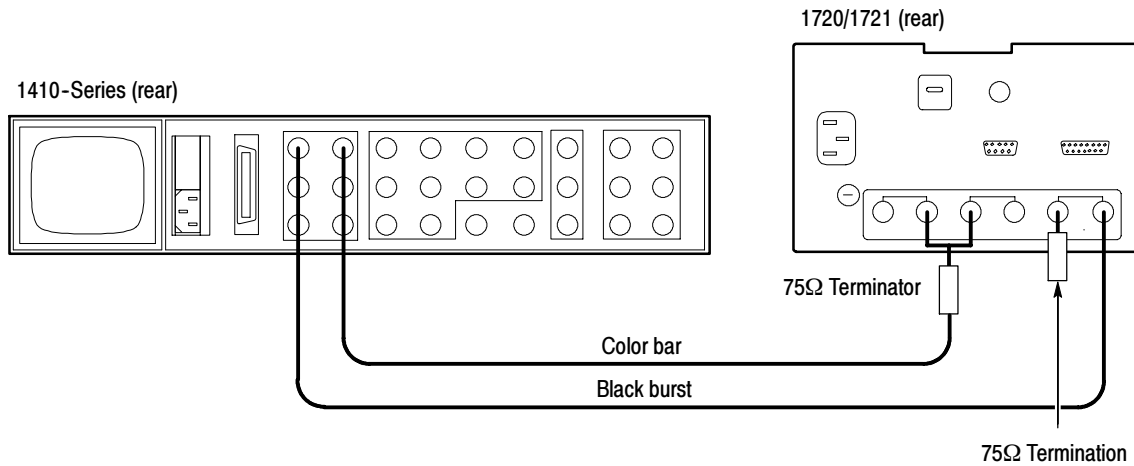
Figure 5-7 shows the adjustment locations. (Note that R453 +V Overlay is only in the PAL and PAL-M, 1721 Vectorscopes.) This illustration also contains the step number of the adjustment as a cross-reference.



**Figure 5-7: Adjustment and test point locations for 1720/1721 Vectorscope. Numbers in parentheses correspond to adjustment steps.**

### Signal Connections

Connect the black burst signal to the 1720/1721 EXT REF INPUT. Connect the color bar signal to the 1720/1721 CH-A INPUT and CH-B INPUT through a dual input coupler with an in-line 75Ω terminator. See Figure 5-8.



**Figure 5-8: Starting connections for the adjustment procedure.**

Connect the Function Generator to the 1720/1721 XY INPUT. See Figure 5-1 for a diagram of how to hook up the 15-pin D-type connector to calibrate the 1720/1721 Vectorscope. Set the Function Generator frequency to 50 kHz.

**Front-Panel Presets**

Preset the 1720/1721 front panel as follows:

MODE	VECT
REF	INT
INPUT	CH-A
VARIABLE	Off
BARS	75%
AUXILIARY	Off
PAL/+V (1721 Only)	PAL
INTENSITY	As desired.
FOCUS	As desired.
SCALE	As desired.

Allow 20 minutes of warm-up time, at normal room temperature (approximately 25° C), before making any adjustments to the instrument.

**Adjustment Procedure Short-Form Reference**

The short-form reference table is intended for those who are familiar with the complete Adjustment procedure. Step and page numbers provide easy cross-reference to the long-form procedure on the following pages.

**Table 5-2: Adjustment Procedure Short-Form Reference**

<b>Step #</b>	<b>Step Name</b>	<b>Adjusted Components</b>	<b>Page #</b>
1	<b>Adjust +5 V</b>	R99	5-20
2	<b>Adjust CRT Bias</b>	R58	5-20
3	<b>Adjust Geometry, Focus and Astigmatism</b>	R45, R11, R49	5-20
4	<b>Adjust Trace Rotation and Orthogonality</b>	R578	5-20
5	<b>Adjust On- Board Regulated Power Supplies</b>	R259, R267	5-21
6	<b>Adjust Lock-In Phase</b>	C235	5-22
7	<b>Adjust Center Dot Overlay and Vector Position</b>	R355, R653	5-22
8	<b>Adjust Phase and Gain Match</b>	C198, R594	5-22
9	<b>Adjust X and Y Gains</b>	R846, R948	5-22
10	<b>Adjust XY Phasing</b>	C484	5-23
11	<b>Adjust Loop DC Balance</b>	R534	5-23
12	<b>Adjust Quad Phase and +V Balance</b>	C453, R453	5-23
13	<b>Adjust R-Y and B-Y Gains</b>	R460, R655	5-24
14	<b>Adjust 100% Gain</b>	R178	5-24
15	<b>Adjust Line Select Focus</b>	R244	5-25

## Long-Form Adjustment Procedure

See the Front-Panel Presets and Signal Connections in the Adjustment Procedure introduction for the correct settings of the front-panel controls and the correct signal connections for this procedure. Figure 5-7 shows the adjustment locations.

### 1. Adjust +5 V

- a. Connect the DMM negative lead to TP1 (GND) and the positive lead to W1 (+5V).
- b. ADJUST - R99 (+5V ADJ) for  $+5.0 \text{ V} \pm 0.5\text{V}$ .

### 2. Adjust CRT Bias

- a. Turn the intensity control fully counterclockwise.
- b. Adjust R58 (CRT BIAS) so that the display is just extinguished.

### 3. Adjust Geometry, Focus and Astigmatism

- a. Adjust R45 (GEOM) for  $35\text{V} \pm 1\text{V}$  at pin 1 of J3.
- b. Set the FOCUS control on the front panel so that it is approximately at the center of its rotation.
- c. Adjust R11 (CTR FOCUS) and R49 (ASTIG) for a clearly-defined vector display.

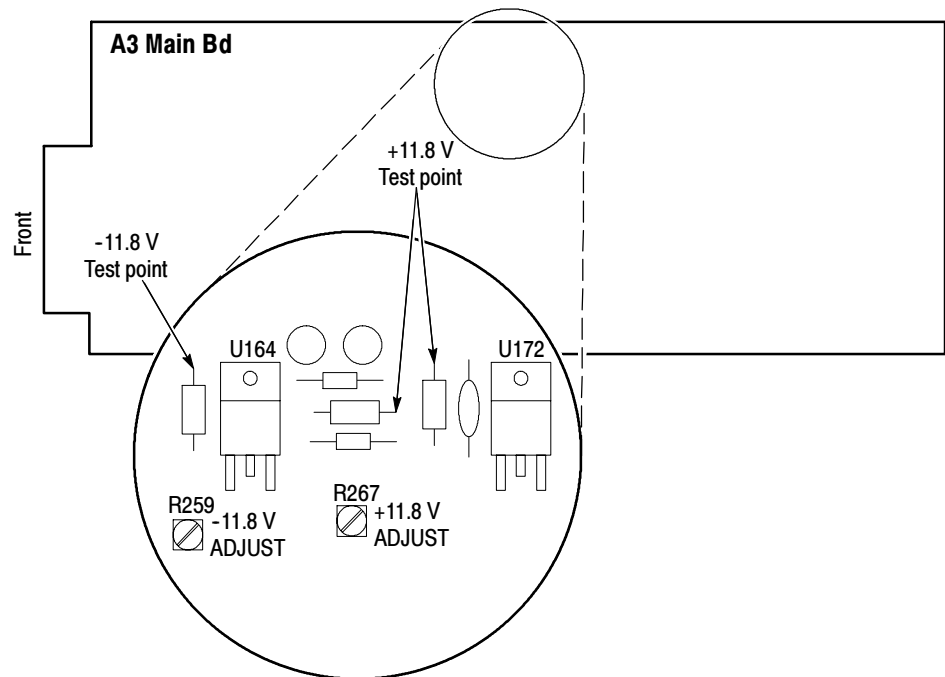
### 4. Adjust Trace Rotation and Orthogonality

- a. Switch the 1720/1721 MODE to XY.
- b. Connect the Function Generator red clip lead to pin 3 (+X) on the rear panel X Y INPUT connector. Connect the Function Generator black clip lead to X Y INPUT pins 1 (-X) and 5 (-Y).
- c. Set the Function Generator for a 1 kHz sinewave output, and adjust the amplitude for a line equal to the compass rose width.
- d. Adjust the front-panel ROTATE screwdriver adjustment for a level trace across the crt's X axis.
- e. Move the Function Generator red clip lead from pin 3 to pin 7 (+Y) on the rear-panel X Y INPUT.
- f. Adjust the Function Generator amplitude for a line length equal to the height of the compass rose.

- g. **Adjust R571** (Orthogonality) on the Main board for a straight vertical line parallel to the Y axis.
- h. Disconnect the Function Generator from the 1720/1721.

## 5. Adjust On-Board Regulated Power Supplies

- a. Connect the voltmeter ground lead to one of the rear-panel ground lugs and the active lead to the -11.8 V test point. See Figure 5-9.



**Figure 5-9: Test points and adjustment locations for the  $\pm 11.8\text{V}$  supplies**

- b. **Adjust R259** (-11.8 V ADJ) for -11.78 to -11.82 volts.
- c. Connect the voltmeter active lead to the +11.8 V test point. See Figure 5-9.
- d. **Adjust R267** (+11.8 V ADJ) for +11.78 to +11.82 volts.

## 6. Adjust Lock-In Phase

- a. Connect the Television Signal Generator output to the 1720/1721 Vectorscope as shown in Fig. 5-8.
- b. Set the 1720/1721 INPUT to CH-B, MODE to VECTOR, and REF to INT.

- c. Change the Television Signal Generator's subcarrier frequency by -50 Hz for NTSC and PAL-M (-10 Hz for PAL).
- d. Connect the voltmeter ground lead to one of the rear-panel ground lugs, and the active lead to pin 1 of U734.
- e. **Adjust C235** for a locked display and a voltmeter reading of 0.5 V for NTSC and PAL-M (1 V for PAL).
- f. Change the generator's subcarrier frequency by +50 Hz for NTSC and PAL-M (+10 Hz for PAL) and check for a locked display.
- g. Return the generator to subcarrier frequency.

#### 7. Adjust Center Dot Overlay and Vector Position

- a. Disconnect the Television Signal Generator output from the CH-B INPUT.
- b. Change the 1720/1721 MODE to BOTH.
- c. **Adjust R355** (Vector Vertical Position) for the best dot overlay.
- d. **Adjust R653** (Vector Horizontal Position) for the best dot overlay.
- e. Change the 1720/1721 MODE to VECTOR.
- f. Adjust the 1720/1721 front-panel horizontal and vertical position controls to center the dot at the graticule center mark.

#### 8. Adjust Phase and Gain Match

- a. Connect the Television Signal Generator color bar output through a 75 $\Omega$  feed through termination and dual-input connector to both the CH-A and CH-B inputs.
- b. Set INPUT to BOTH (hold INPUT switch until both the A and B indicators light).
- c. Set the front-panel GAIN CAL to midrange.
- d. **Adjust C198** (Channel A Input Compensation) and **R594** (Gain Match) for the best gain and phase match of the two vector displays.

#### 9. Adjust X and Y Gains

- a. Set the Function Generator for a 1 kHz sinewave output, and adjust the output voltage to the desired level, between 2 V and 9 V. (The 1720/1721 is shipped at 2.19 Volts.)



- b. Connect the Function Generator red clip lead to pin 7 (+Y) on the rear-panel X Y INPUT connector. Connect the Function Generator black clip lead to pins 1 (-X) and 5 (-Y).
- c. **Adjust R846** (Y Gain) for a Y axis display equal to the vertical distance between the centers of the dB boxes.
- d. Move the Function Generator red clip lead from pin 7 to pin 3 (+X) on the rear-panel X Y INPUT.
- e. **Adjust R948** (X Gain) for a display amplitude equal to the horizontal distance between the centers of the dB boxes.
- f. Connect the Function Generator red clip lead to both pin 7 (+Y) and pin 3 (+X) on the rear-panel X Y INPUT. Leave the Function Generator black clip lead connected to pins 1 (-X) and 5 (-Y).
- g. **Check** that the ends of the trace are within the  $\frac{1}{2}$  dB boxes.

#### 10. Adjust XY Phasing

- a. Leave the Function Generator connected as in part f. of the preceding step.
- b. Set the Function Generator frequency to 100 kHz.
- c. **Adjust C484** (VHF Comp) for minimum opening in the diagonal trace.

#### 11. Adjust Loop DC Balance

- a. Connect the black burst signal to CH-A INPUT. Do not terminate.
- b. Switch INPUT to CH-A and MODE to VECT.
- c. Use the 1720/1721 PHASE control to place color burst directly on the burst axis. Color burst amplitude will be twice normal length because it is unterminated.
- d. With one end-line and two feed-through terminators, triple terminate the open side of the CH-A INPUT loop-through. The color burst amplitude should now be 50% of normal.
- e. **Adjust R534** (Loop Balance) to return the color burst vector to its axis.
- f. Repeat steps c. through e. as necessary.

#### 12. Adjust Quad Phase and +V Balance

- a. Reconnect the color bar signal to both CH-A and CH-B INPUTs.

- b. Hold the REF switch in until the TEST indicator lights.
- c. Set the front-panel GAIN CAL to midrange.
- d. Position the center dot directly under the graticule center mark (+).
- e. **Adjust C453** (Quad Phase) and **R453** (+V Bal) for the best overlay of the test circles.

### 13. Adjust R-Y and B-Y Gains

- a. Check to see that the center dot is directly under the graticule center mark (+).
- b. **Adjust R460** (R-Y Gain) to place the outer circle directly over the RED and CYAN (R and CY) targets.
- c. **Adjust R655** (B-Y Gain) to place the inner bright circle directly through the BLUE and YELLOW (B and Y) targets.

### 14. Adjust 100% Gain

- a. Select 100% Amplitude Color Bars from the Television Test Signal Generator.
- b. Push the 1720/1721 100% BARS button.
- c. **Adjust R178** (100% Gain) so that the test circle passes through the center of the RED and CYAN targets.

## 15. Adjust Line Select Focus

*With a 1730-Series Waveform Monitor:*

- a. Connect an Auxiliary cable between the 1720/1721 and a 1730-Series of the same color standard.
- b. loop-through connect the color bar signal to both the waveform monitor and the 1720/1721.
- c. Set the 1730-Series Waveform Monitor for line select and display one line from the active part of the field (after the vertical interval).
- d. Push the 1720/1721 AUXILIARY button.
- e. **Adjust R244** (LS Focus) for the best 1720/1721 display.

*Without a 1730-Series Waveform Monitor:*

- f. Connect the output of the Function Generator to pin 7 of the 1720/1721 rear-panel AUXILIARY connector.
- g. Set the Function Generator for a narrow, negative-going, 10 V, 1 kHz pulse.
- h. Connect the color bars output from the Television Test Signal Generator to the 1720/1721 and terminate in  $75\Omega$ .
- i. Set the 1720/1721 for VECT and adjust INTENS and FOCUS for the best display.
- j. Push the 1720/1721 AUXILIARY button.
- k. **Adjust R244** (LS Focus) for the best 1720/1721 display.





# Maintenance



## Section 6 Maintenance

This section contains instructions for preventive maintenance, general troubleshooting, Serial Port and LED Driver diagnostics, and corrective maintenance. If the instrument does not function properly, troubleshooting and corrective measures should be taken immediately to circumvent additional problems.

### Preventive Maintenance

Preventive maintenance consists of cleaning, visual inspection, performance checking, and, if needed, readjustment. The preventive maintenance schedule established for the instrument should be based on the environment in which it is operated and the amount of use. Under average conditions, scheduled preventive maintenance should be performed every 2000 hours of operation.

#### Cleaning

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**NOTE.** *Cleaning Rosin:*

*A 2% RMA flux content solder is recommended for making repairs in this instrument. Cleaning of rosin residue is not recommended. Most cleaning solvents tend to reactivate the rosin and spread it under components where it may cause corrosion under humid conditions. The rosin residue, if left alone, does not exhibit these corrosive properties.*

---

The instrument should be cleaned often enough to prevent dust or dirt from accumulating. Dirt acts as a thermal insulating blanket that prevents effective heat dissipation, and can provide high-resistance electrical leakage paths between conductors or components in a humid environment.

**Exterior.** Clean the dust from the outside of the instrument by wiping with a soft cloth or small brush. A brush is especially useful to remove dust from around the selector buttons, knobs, and connectors. Hardened dirt may be removed with a cloth dampened in water that contains a mild detergent. Abrasive cleaners should not be used.

**Crt.** Clean the crt protective shield, light filter, and crt face with a soft, lint-free cloth dampened in denatured alcohol.

**Interior.** Clean the interior of the instrument by loosening the accumulated dust with a dry, soft brush. Once the dirt is loosened remove it with low-pressure air

(high-velocity air can damage some parts). Hardened dirt or grease may be removed with a cotton-tipped applicator dampened with a solution of mild detergent and water. Abrasive cleaners should not be used. If the circuit board assemblies must be removed for cleaning, follow the instructions for removal/replacement under the heading of Corrective Maintenance.

After cleaning, allow the interior to thoroughly dry before applying power to the instrument.




---

**CAUTION.** *Cleaning fluids:*

*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.*

---

**Visual Inspection**

After cleaning, carefully check the instrument for defective connections, damaged parts, and improperly seated transistors or integrated circuits. The remedy for most visible defects is obvious; however, if heat-damaged parts are discovered, determine the cause of overheating before replacing the damaged part, to prevent additional damage.

Periodic checks of the transistors and integrated circuits are not recommended. The best measure of performance is the actual operation of the component in the circuit.

**Static-Sensitive Components**

This instrument contains electrical components that are susceptible to damage from static discharge. Static voltages 1 kV to 30 kV are common in unprotected environments. Table 6-1 shows the relative static discharge susceptibility of various semiconductor classes.

**Table 6-1: Static Susceptibility**

Relative Susceptibility Levels		Voltage
1	CMOS	100V - 500V
2	ECL	200V - 500V
3	SCHOTTKY SIGNAL DIODES	250 V
4	SCHOTTKY TTL	500 V
5	HF BIPOLAR TRANSISTORS	400 to 600 V
6	JFETS	600 to 800 V



**Table 6-1: (Cont.)Static Susceptibility**

Relative Susceptibility Levels		Voltage
7	LINEAR $\mu$ CIRCUITS	400 to 1000 V est.
8	LOW POWER SCHOTTKY TTL	900 V
9	TTL	1200 V

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 components or assemblies.
3. Discharge the static voltage from your body, by wearing a wrist grounding strap, while handling these components. Servicing static-sensitive assemblies or components should be done 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 the 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, or wick-type desoldering tools.

### **Performance Checks and Readjustments**

Instrument performance should be checked after each 2000 hours of operation, or every 12 months, if used intermittently. This will help to ensure maximum performance and assist in locating defects that may not be apparent during regular operation. The Performance Check Procedure and the Adjustment Procedure are in Section 5.

## Troubleshooting

The material contained here is general and is not intended to cover specific cases. Note that the manual itself is considered a troubleshooting aid, and as such a brief discussion of its content is in order.

The procedural information that appears as General Troubleshooting Techniques should be familiar to most technicians; however, a quick review may save some time and reduce “wheel spinning.”

### Foldout Pages

The foldout pages at the back of the manual contain significant information useful for troubleshooting the instrument. Block and schematic diagrams, circuit board illustrations, and parts locating charts are found there.

**Diagrams.** Schematic diagrams are the most often used troubleshooting aids. The circuit number and electrical value of each component is shown on the diagram. The first tabbed page has definitions of the symbology used on the schematic diagrams. Refer to the Replaceable Electrical Parts list for a complete description of each component. Circuits that are mounted on circuit boards or assemblies are enclosed in a border, with the name and assembly number shown on the border.

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***NOTE.*** *Change Information:*

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

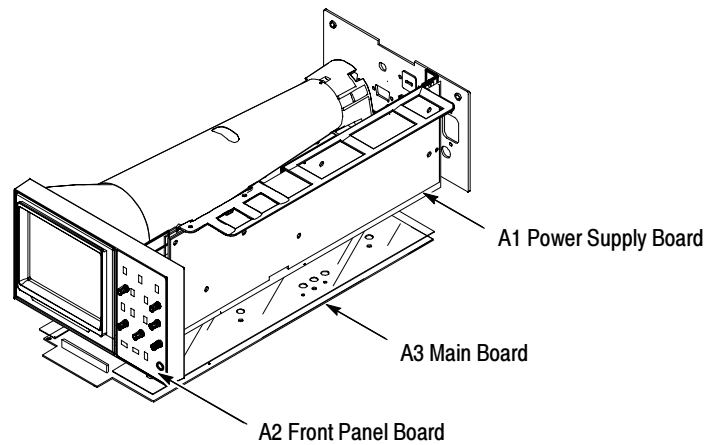
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**Circuit Board Illustrations.** Electrical components, connectors, and test points are identified on circuit board illustrations, which are located on the back of a preceding schematic diagram.

**Parts Locating Charts.** Generally, components that are mounted on etched circuit boards are assigned circuit numbers according to their geographic location within the assembly, beginning with the lowest numbers at the upper left corner. The schematic diagrams are assigned location grids, and a parts locating chart (for each schematic diagram) gives grid locations of components on that schematic.

**Adjustment Locations.** The circuit board illustrations have the adjustments and test points called out as a calibration and troubleshooting aid.

**Assembly and Circuit Numbering.** The circuit board assemblies are assigned assembly numbers. Figure 6-1 shows the circuit board assembly locations for this instrument.



**Figure 6-1: Circuit board assembly locations**

## Parts Lists

There are two separate parts lists in this manual. The Replaceable Electrical Parts list is in Section 8, which precedes the schematic diagrams and circuit board illustrations. The Replaceable Mechanical Parts list (Section 10), accompanied by exploded view drawings, follows the schematic diagrams and circuit board illustrations.

**Replaceable Electrical Parts.** This list is arranged by assembly as designated in ANSI Standard Y32.16-1975. The list begins with the part numbers for the major assemblies (etched circuit boards). Each circuit board is identified by an A# (assembly number).

The circuit numbers of the individual components in the parts list is made up by combining the assembly number with the individual circuit number. EXAMPLE: R117 on Assembly (circuit board) A3 is listed in the Replaceable Electrical Parts list as A3R117.

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**NOTE.** *Check Parts Lists:*

*Always consult the parts list and “Change Information” for part numbers and descriptions before ordering replacement parts. Some parts may have been replaced in an individual instrument.*

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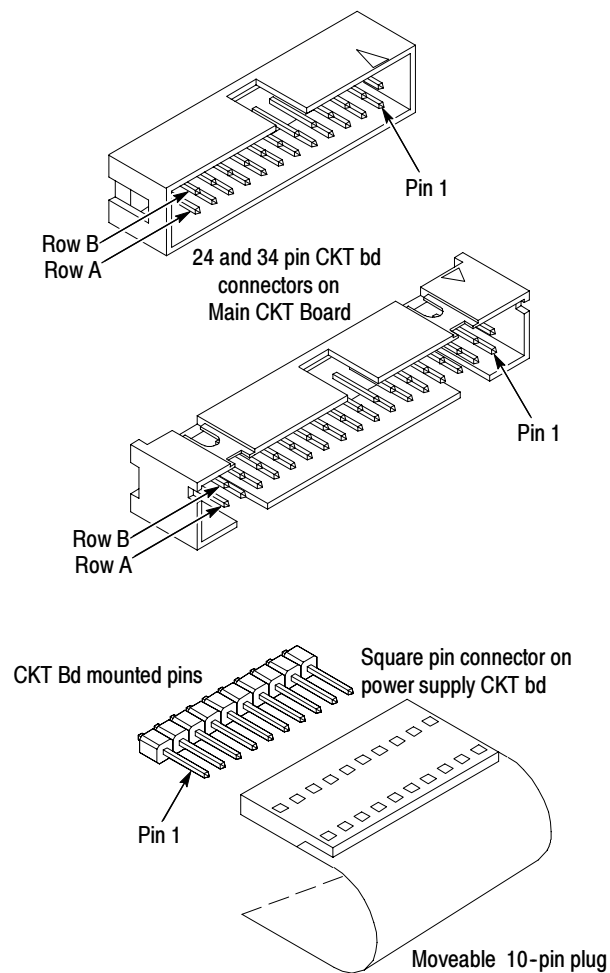
**Replaceable Mechanical Parts.** This list is arranged so that it corresponds to the exploded view drawings for major instrument components. The list and exploded view drawings comprise Section 10 of this manual. An Accessories Illustration and accompanying parts list is also included in this section.

## Major Assembly Interconnection

Signals and power supply voltages are passed through the instrument with a system of interconnecting cables. The connector holders on these cables have

numbers that identify terminal connectors; numerals are used from 2 up. A triangular key symbol is used to identify pin 1 on the circuit board and the connector to assist in aligning the connector with correct square pins. Figure 6-2 shows the numbering scheme (and the triangular marking) on the connector and the marking on the etched circuit board.

A pin replacement kit including necessary tools, instructions, and replacement pins is available from Tektronix, Inc. Contact a Tektronix field office or representative for assistance in ordering this kit.



**Figure 6-2: Multiple pin connectors used in the 1720/1721 Waveform Monitors**

### General Troubleshooting Techniques

The following procedure is designed to assist in isolating problems, which in turn expedites repairs and minimizes down time.

1. Ensure that the malfunction exists in the instrument. This is done by making sure that the instrument is operating as intended by Tektronix (see Operating

Instructions in Section 2), and by being sure that a malfunction has not occurred down stream from the vectorscope.

2. Determine and evaluate all trouble symptoms. This is accomplished by isolating the problem to a general area such as an assembly. The block diagram is a valuable aid in signal tracing and circuit isolation.



---

**CAUTION.** *Probes and Meter Leads:*

*Use extreme care when probing with meter leads or probes, because of the high component density and limited access within the instrument. The inadvertent movement of leads or a probe could cause a short circuit or transient voltages capable of destroying components.*

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3. Determine the nature of the problem. Attempt to make the determination of whether the instrument is out of calibration or if there has been a component failure. Once the type of failure has been determined, proceed on to identify the functional area most likely at fault.
4. Visually inspect the suspect assembly for obvious defects. Most commonly these will be broken or loose components, improperly seated components, overheated or burned components, chafed insulation, etc. Repair or replace all obvious defects. In the case of overheated components, determine the cause of overheating and correct the cause before re-applying power.
5. Use successive electrical checks to locate the source of the problem. The primary tool for problem isolation is the oscilloscope. Use the Performance Check Procedure (located in Section 5) to determine if a circuit is operating within specifications. At times it may be necessary to change a calibration adjustment to determine if a circuit is operational, but since this can destroy instrument calibration, care should be exercised. Before changing an adjustment, note its position so that it can be returned to its original setting.
6. Determine the extent of the repair. If the necessary repair is complex, it may be advisable to contact your local Tektronix field office or representative before continuing. If the repair is minor, such as replacing a component, see the parts list for replacement information. Removal and replacement procedures for the assemblies can be found under Corrective Maintenance.



---

**CAUTION.** *Removing Components:*

*Always remove the assembly from the instrument prior to attempting to replace a soldered-in component. See Corrective Maintenance for the correct procedure.*

---

## Specific Troubleshooting Procedures

Two areas of the the 1720/1721 instrument require specific troubleshooting methods. The power supply can not be worked on safely without using an Isolation Transformer and following a specific troubleshooting procedure.

The Serial Port (Auxiliary Input) and the LED Driver circuits have specific diagnostic routines. These should be followed to isolate problems quickly.

### Power Supply

The power supply is of the high-efficiency type and requires a specific troubleshooting procedure and an isolation transformer to avoid personal danger or instrument damage.

The 1720/1721 power supply presents special troubleshooting problems, if a fault occurs. Besides having a sizeable area where dangerous potentials can be contacted, the type of circuitry employed can not be troubleshot by conventional means.



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**WARNING.** *Read Instructions:*

*Do not attempt to troubleshoot the 1720/1721 power supply without reading these instructions.*

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### Troubleshooting Procedure

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**NOTE.** *Read Theory of Operation:*

*A review of the power supply Theory of Operation is recommended before attempting repairs.*

---

The equipment needed to troubleshoot the power supply:

- Digital Multimeter (DMM), with a diode check function
- Oscilloscope
- 0 to 20 VDC Variable Power Supply
- Clip Lead - to short across a component
- High Voltage Probe,  $\geq 1 \text{ G}\Omega$  input resistance

### Introduction

The Troubleshooting Procedure for the Power Supply (Assembly A1) is split into two sections, the Low Volts and High Volts Supplies. Start the procedure by

determining which section of the power supply the problem is in. Apply ac power and turn on the power supply. From Table 6-2, determine which symptom the power supply exhibits and refer to the corresponding procedure.

**Table 6-2: Power Supply Fault Symptoms**

Symptom	Procedure
Line fuse open	Rectifier/Switcher Check (Low Volts)
Power Supply cycles OFF/ON	Output Check (Low Volts), or High Voltage Oscillator Check (High Volts)
Does not power up	Control Circuit Check (Low Volts)
+5 V not regulating	Error Amplifier Check (Low Volts)
Improper CRT display	High Volts Supply

## Low Volts Supply

**NOTE.** *Low Volts Supply Load:*

*A 20 $\Omega$ , 2 watt resistor should be used as a load for the Low Volts Supply. Disconnect J4 and connect the 20 $\Omega$  resistor between W1 (+5 V) and TP1 (secondary ground).*

### 1. Preliminary Checks

- a. A properly functioning and loaded Low Volts supply will output the voltages listed in Table 6-3. Use the DMM to measure the voltages between TP1 and the voltage test points. If the supply is not regulating properly, continue with the procedure.

**Table 6-3: Low Volts Supply Voltages**

Test Point	Voltage Range
W1 - (+5 V)	+4.88 to +5.12 V
W4 - (+15 V)	+14.0 to +16.0 V
W3 - (-15 V)	-14.0 to -16.0 V
W2 - (+40 V)	+39.0 to +41.0 V

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**NOTE.** *Low Volts Supply Power Connection:*

*The Low Volts power supply troubleshooting is performed without applying ac power.*

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- b. Disconnect ac power from the instrument. Disconnect the instrument from the Power Supply by removing the jumper from J4.
- c. Use the digital multimeter to measure the voltage between TP2 and the tab (drain) of Q9. Check that the voltage is near 0 V.



---

**CAUTION.** *Dangerous Voltages:*

*Do not proceed until the drain of Q9 is near 0 V. Dangerous voltage potentials are present in the circuit until the capacitors discharge.*

---

## 2. Rectifier/Switcher Check

- a. Use the digital multimeter to measure the voltage between TP2 and the tab (drain) of Q9. Be sure the voltage is near 0 V before proceeding.
- b. Unsolder and lift one end of R102.
- c. With the negative lead of the digital multimeter connected to TP2 and the positive lead connected to the tab of Q9, measure the circuit resistance. A resistance of less than 20 k $\Omega$  indicates a shorted mosfet (Q9). If the mosfet is shorted, replace it and perform the Control Circuit Check.
- d. Using the digital multimeter diode test function, test CR21, CR22, CR23, and CR24 for shorts. Diode replacements must be fast reverse recovery (300 ns) types to reduce conducted noise.
- e. Reconnect the lifted end of R102.

## 3. Output Check

- a. Connect the negative output from the 20 VDC Power Supply to TP1. Connect the positive output to W4 (+15 V). The circuit should draw less than 20 mA. Excessive current draw can be caused by CR11 or U2 (High Volts power supply).
- b. Connect the negative output from the 20 VDC Power Supply to TP1. Connect the positive output to W2 (+40 V). The circuit should draw less than 20 mA. Excessive current draw can be caused by CR14 or Q6 (High Volts power supply).



- c. Connect the positive output from the 20 VDC Power Supply to TP1. Connect the negative output to W3 (-15 V). The circuit should draw less than 20 mA. Excessive current draw can be caused by CR12.
- d. Connect the negative output from the 5 VDC Power Supply to TP1. Connect the positive output to W1 (+5 V). The circuit should draw less than 20 mA. Excessive current draw can be caused by CR13 or Q1 and Q2 (High Volts power supply).

#### 4. Control Circuit Check

- a. Connect the negative output from the 20 VDC Power Supply to TP2. Connect the positive output to the cathode of CR17. Short C47 with a clip lead. Connect the oscilloscope probe ground to TP2.
- b. Table 6-4 lists the signal present in a properly functioning control circuit.

**Table 6-4: Control Circuit Test Points**

Circuit Location	Signal
U5, pin 1	Approximately 5 VDC
U5, pin 2	Approximately 2 VDC
U5, pin 3	0 V
U5, pin 4	80 kHz triangle wave, 2 V p-p
U5, pin 6	80 kHz square wave, 18 V p-p
U3, pin 1	80 kHz square wave, 5 V p-p
U3, pin 2	2.1 VDC
U3, pin 6	2.9 VDC
U3, pin 7	Approximately 5 VDC
U4, pin 13	80 kHz repetition rate, 300 ns width, approximately 3 V p-p
Q8, collector	80 kHz repetition rate, 400 ns width, switching from 5 V to approximately 2 V

- c. Remove the clip lead from across C47.

#### 5. Error Amplifier Check

- a. Connect the negative output from the variable DC power supply to TP1. Connect the positive output to W1 (+5 V).

- b. Connect the negative output of another variable DC power supply to TP1. Connect the positive output to W4 (+15 V). Set the variable power supply to 20 VDC.
- c. Connect the digital multimeter between TP1 and the cathode of CR15.
- d. Set the variable DC power supply connected to W1 (+5 V) to 4.8 V. The cathode of CR15 should be approximately 20 V.
- e. Set the variable DC power supply connected to W1 (+5 V) to 5.2 V. The cathode of CR15 should be approximately 2 V.
- f. If this check did not reveal the cause for the +5 V supply not regulating, refer to the Output Check and the Control Circuit Check.

### High Volts Supply

#### 1. Preliminary Checks

- a. Table 6-5 lists the High Volts Supply fault symptoms and procedures.

**Table 6-5: High Volts Supply Fault Symptoms**

Symptom	Procedure
Unable to focus CRT using the front-panel control	Focus Amplifier Check
Unable to adjust CRT intensity using the front-panel control	Z-Axis Amplifier Check Grid Drive Check
No CRT display	High Voltage Oscillator Check CRT Voltage Check

- b. Load the Low Volts Supply with the instrument, or with the 20Ω resistor as detailed at the beginning of the Troubleshooting Procedure.

#### 2. Focus Amplifier Check

- a. Unsolder and lift one end of R24.
- b. Power up the power supply.
- c. Using the digital multimeter, measure the voltage between TP1 and the collector of Q1. It should be approximately -140 V.
- d. Reconnect the lifted end of R24.

### 3. Z-Axis Amplifier Check

- a. Unsolder and lift one end of R8.
- b. Power up the power supply.
- c. Using the digital multimeter, measure the voltage between TP1 and the collector of Q4. It should be approximately +10 V.
- d. Short together the base and emitter of Q5. The collector of Q4 should be approximately +100 V.
- e. Reconnect the lifted end of R8.

### 4. Grid Drive Check

- a. Turn off the power supply. Use the diode check on the digital multimeter to test CR1, CR2, CR3, CR5, and CR6 for shorts.
- b. Power up the power supply.
- c. Using the digital multimeter, measure the voltage between TP1 and the cathode of CR5. It should vary between approximately +75 and +200 V as R58 (CRT Bias) is adjusted.
- d. Connect the oscilloscope probe to the anode of CR5 and the probe ground to TP1. The signal should be a clipped sine wave of +75 to +200 V p-p.

### 5. High Voltage Oscillator Check

- a. Connect the oscilloscope probe to T1 pin 3 (Q6 collector) and the probe ground to TP1. Power up the supply. The signal should be a +60 V p-p, 22 kHz sine wave.
- b. Check the voltages listed in Table 6-6 using the digital multimeter:

**Table 6-6: High Voltage Oscillator Test Points**

Circuit Location	Voltage
T1, pin 4	Approximately +40 V
T1, pin 13	Less than +2 V
U2, pin 2	Approximately +4.8 V
U2, pin 6	+4 to +11 V
CR9, cathode	Approximately +100 V

## 6. CRT Voltage Check

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**NOTE.** *High Voltage Probe:*

*This check requires a high voltage probe having an input resistance of 1 G $\Omega$  or more.*

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- a. Connect the high voltage probe ground to TP1.
- b. Load the Low Volts supply with the instrument, or with a 20 $\Omega$ , 2 watt resistor loading the 5 V supply.
- c. Power up the power supply.
- d. Use the high voltage probe to measure the voltage at the anode of CR4. It should be approximately -2530 V.
- e. Measure the voltage at the anode end of CR3. It should be 50-150 V more negative than the reading from the anode of CR4.

### Serial Port and LED Driver Diagnostics

A non-destructive diagnostic program is built into the 1720/1721. All that is required to perform these diagnostics is a male, 9-pin, sub-miniature D-type connector with pins 8 and 9 connected together. The procedure contained here will isolate non-operating front-panel indicators, and open or shorted receive or transmit lines in the serial interface.

1. Turn off instrument POWER.
2. Install the male, sub-miniature D-type connector on the rear-panel AUXILIARY connector.
3. Hold in the AUXILIARY and POWER switches until all front-panel indicators light. This step checks:
  - a. LEDs and LED Drivers
  - b. Interface continuity (RXD in and TXD out)

When all indicators are lit there is continuity from the Microprocessor, out through the TXD Buffer, and back through the RXD Buffer. If all front-panel indicators do not light, check indicator or Driver. If indicators blink, check RXD Buffer (U818A) or TXD Buffer (U818B).

4. Remove the male connector from the rear-panel AUXILIARY connector and check for blinking indicators. This step checks for shorted RXD and TXD lines.

If lights remain on, the RXD and TXD lines are shorted together.

5. Turn off POWER. This ends the Diagnostic Procedure. When the 1720/1721 is powered up again it will be operating in the normal vector-scope configuration.

## Corrective Maintenance

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**NOTE. Solder:**

*A 2% RMA flux content solder is recommended for making repairs in this instrument. Cleaning of rosin residue is not recommended. Most cleaning solvents tend to reactivate the rosin and spread it under components where it may cause corrosion under humid conditions. The rosin residue, if left alone, does not exhibit these corrosive properties.*

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**NOTE. Warranty Repairs:**

*No repair should be attempted during the warranty period.*

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### Obtaining Replacement Parts

Replacement parts are available through the local Tektronix, Inc., field office or representative. However, many common electronic parts are available through local sources. Using a local source, where possible, will eliminate shipping delays.

Changes to Tektronix instruments are sometimes made to accommodate improved components, as they become available, and to improve circuit performance. Therefore, it is important to include the following information when ordering parts:

1. Part Number
2. Instrument Type or Number
3. Serial Number
4. Modification or Option Number (if applicable)

If a part has been replaced with a new or improved part, the new part will be shipped if it is a direct replacement. If not directly replaceable the local Tektronix field office or representative will contact the customer concerning any changes. After any repair, circuit readjustment may be required.

## Mechanical Disassembly/Assembly

The instructions contained here are for disassembly. Re-assembly is performed by reversing the order of the steps used to disassemble the instrument.



**WARNING.** *Unplug Power Cord:*

*Before attempting any disassembly of the instrument be sure to disconnect the power cord.*

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**CAUTION.** *Rear Panel Screws:*

*Do not re-insert screws in the rear panel when the instrument is removed from the cabinet.*

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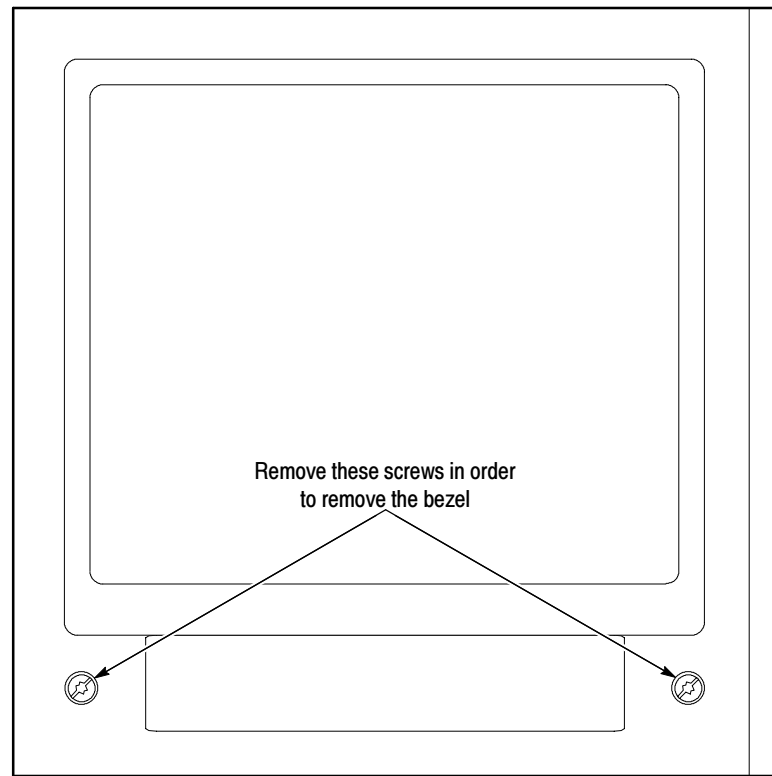
**NOTE.** *Screw Types:*

*All screws, unless otherwise noted, are TORX® screws and can be removed with a T15 screwdriver tip (Tektronix part number 003-0966-00). The exception is #2 Pozidrive® screws which can be removed with a #1 Pozidrive® tip (003-0443-00).*

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### Bezel Removal

1. Remove the two bezel screws. See Figure 6-3.
2. Grasping the bottom of the bezel, pull straight out and upward. There are two hinges at the top of the bezel that hold it in place. Once the bezel is at an approximate 45° angle with the front panel they will disengage.
3. To replace, reverse the procedure.



**Figure 6-3: Screws that need to be removed to remove the bezel.**

### Graticule Light Removal and Replacement

For graticule light removal and replacement, tweezers with curved, serrated tips are recommended. For example: Miltex PL312, 6-100 (equivalent to PL312), or PL317 (longer than PL312).



**CAUTION.** *Bulb Removal:*

*Needle-nosed pliers are not recommended.*

Replacement bulbs are supplied with this instrument as Standard Accessories. Additional bulbs can be purchased from Tektronix (see Replaceable Electrical Parts list) or from local electronics distribution sources.

1. Remove the bezel according to the preceding instructions.
2. To remove a bulb, position the tweezer tips on the thin, flat portion of the bulb (close to the plastic socket). Carefully pull the bulb straight out.

3. To install a bulb, hold it with the tweezers as described in step 2, position it in front of the socket and push the bulb with your finger until it snaps into place.
4. Replace the bezel.

## CRT Removal

### Removal of the CRT

1. Remove the bezel.



**WARNING.** *The CRT may retain a dangerous charge. Ground the conductor of the anode to discharge the CRT. Do not allow the conductor to touch your body or any circuitry.*

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2. Slide a screwdriver with an insulated handle under the anode cap on the side of the CRT, and ground the anode to the chassis, to discharge the CRT. DO NOT touch the metal shaft of the screwdriver while doing this. Disconnect the anode cap by prying it gently away from the CRT.
3. Disconnect J225 (trace rotation) on the Main board and push the connector through the hole in the board.



**WARNING.** *The crt is a high vacuum device and must be handled with care. Safety glasses, gloves, and protective clothing should always be worn when handling crts.*

---

4. The CRT can now be pulled straight out (some pressure may be needed). The CRT shield, along with the rubber manchet around its back, should come out with the CRT.

### Replacement of the CRT

1. If the CRT is to be replaced, remove the metal shield from the neck of the old CRT and place it around the neck of the new CRT, with the WARNING sticker towards the top of the instrument.. Ensure that the rubber manchet is on the back edge of the shield.
2. Slip the CRT part way back into position and feed the trace rotation wires (and plug) back through the hole in the Main board.





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**WARNING.** *The CRT may retain a dangerous charge. Ground the the anode connector to discharge the CRT. Do not allow the conductor to touch your body or any circuitry.*

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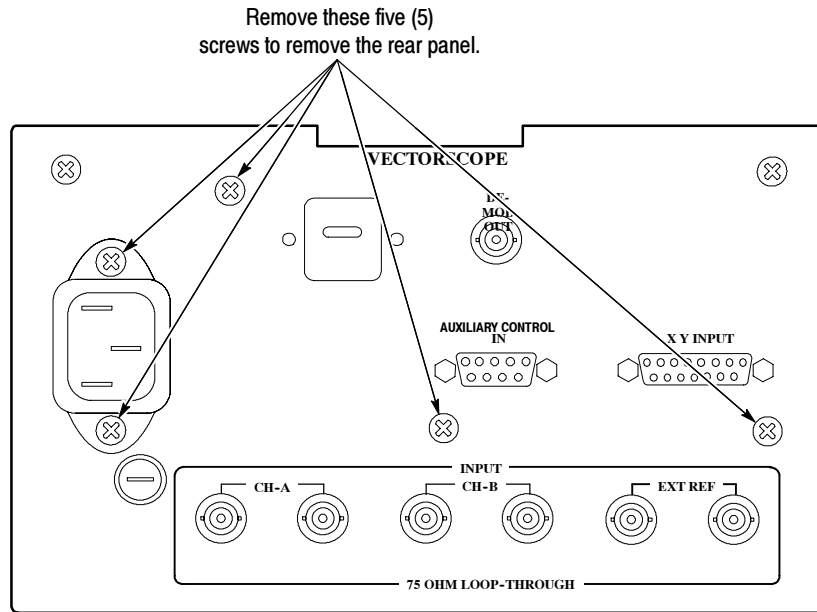
3. Use a screwdriver to ground the anode connector on the CRT to the chassis.
4. Slide the CRT into the instrument, guiding the rubber manchet on the end of the shield into the rear CRT support.
5. Align the socket on the A10 CRT Socket board with the pins and key on the CRT. Gently push the CRT and the socket board together until the CRT pins are fully seated in the socket.
6. Replace the trace rotation connector (J225, Main board), and snap the anode lead onto the anode connector on the side of the CRT. (To ensure the correct orientation of J225, the red lead is toward the front of the instrument.)
7. Wipe the faceplate of the CRT to remove fingerprints, then replace the bezel. If the fit is too tight to allow the bezel to go into position, or if the CRT has a loose fit after the bezel is completely tightened down, then the rear CRT support must be repositioned.

To reposition the rear CRT support, loosen the two nuts that hold the support in place. With the CRT and bezel in place, push the support towards the front of the instrument until it is snug against the rubber manchet on the rear of the CRT shield. Tighten the two support nuts.

8. Wipe off the faceplate of the crt to remove fingerprints.
9. Replace the bezel.

## Removing the Rear Panel

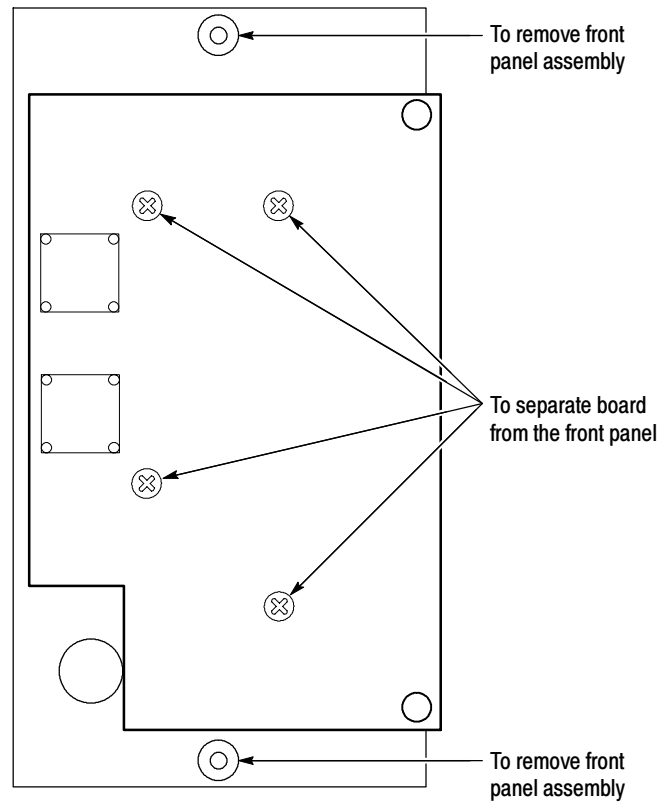
1. Remove the five rear screws. See Figure 6-4.
2. Unsolder the six bnc and one ground connection. (If 1700F10 Field Upgrade is installed, unsolder leads from the battery connector.)
3. Pull the rear panel free from the chassis; be careful not to pull the unsoldered wires.
4. To replace, reverse the procedure.



**Figure 6-4: Screws that need to be removed to remove the rear panel**

### Removing the Front Panel Circuit Board

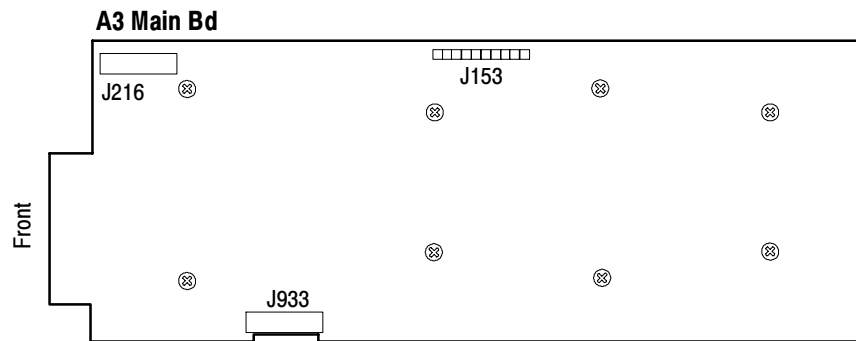
1. Remove the blue multiwire connector from J154.
2. Remove the two screws holding the board in place. See Figure 6-5 for locations.
3. Remove the board by slipping it through the front-panel opening.
4. To access the Front Panel board components:
  - a. Remove the knobs from the front.
  - b. Remove the four screws from the rear.
  - c. The board should now separate from the front panel making the components accessible.
5. To re-assemble, reverse the procedure.



**Figure 6-5: Screws that hold the Front Panel circuit board (A2) in place.**

## Removing the Main Board

1. Remove the plugs from the following connectors: J216 to the Front Panel board, J546 on the Power Supply board, the plug on the Phase Shifter (Assembly A4), and J225 on the Main board (the trace rotation leads to the crt).
2. Unsolder the leads to the six bnc connectors and three ground from the rear panel, the two horizontal crt leads (red and green), the R-Y out, and the two vertical crt leads (blue and brown).
3. Slip the crt and trace rotation lead through the appropriate holes in the Main board.
4. Remove the eight screws that are holding the board in place. See Figure 6-6 for their locations.



**Figure 6-6: Screws holding the main circuit board (A3) in place.**

5. Remove the board by sliding it toward the rear panel until the toe of the board clears the front, then lift out.
6. To replace the Main board, lay the board flat and slide it back into place.
7. To complete the replacement of the board, reverse the rest of the steps.

### Removing the Power Supply Board

1. Remove the plug from J546 on the Power Supply board; it is the connection to the Main board.
2. Remove the anode connection from the crt and discharge it to ground.




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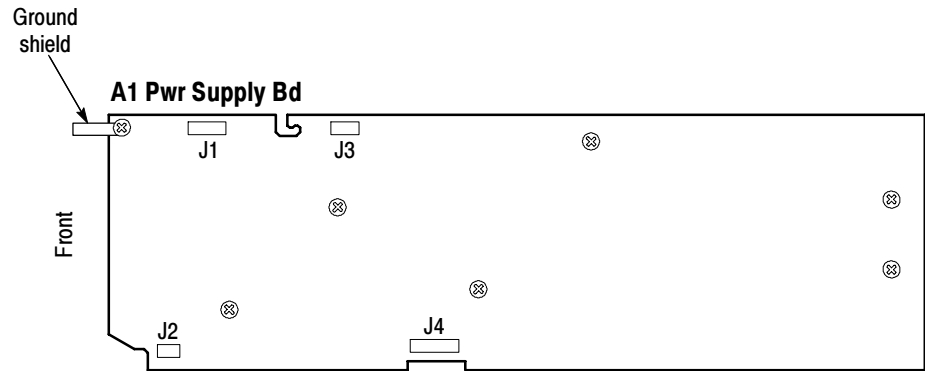
**WARNING.** *CRT Retained Charge Hazard:*

*The crt may retain a dangerous charge. Ground the conductor of the anode to discharge the crt. Do not allow the conductor to touch your body or any circuitry.*

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3. Unsolder the following connections: J122 pins 1 through 4, J133 pins 1 through 4, and J215 the focus lead. (If a 1700F10 Field Upgrade Kit is installed, unsolder leads to the rear-panel DC Connector.)
4. Disconnect the ac line filter from the rear panel by unscrewing its two mounting screws.
5. Use a #1 Pozidrive® tip to disconnect the power on/off switch from the front casting.
6. Remove the seven screws that are holding the Power Supply board down. See Figure 6-7.
7. Remove the board by sliding it forward and lifting it up.

8. To replace the board, reverse this procedure.



**Figure 6-7: Screws holding the Power Supply circuit board (A1) in place.**

## Repackaging

### Identification Tag

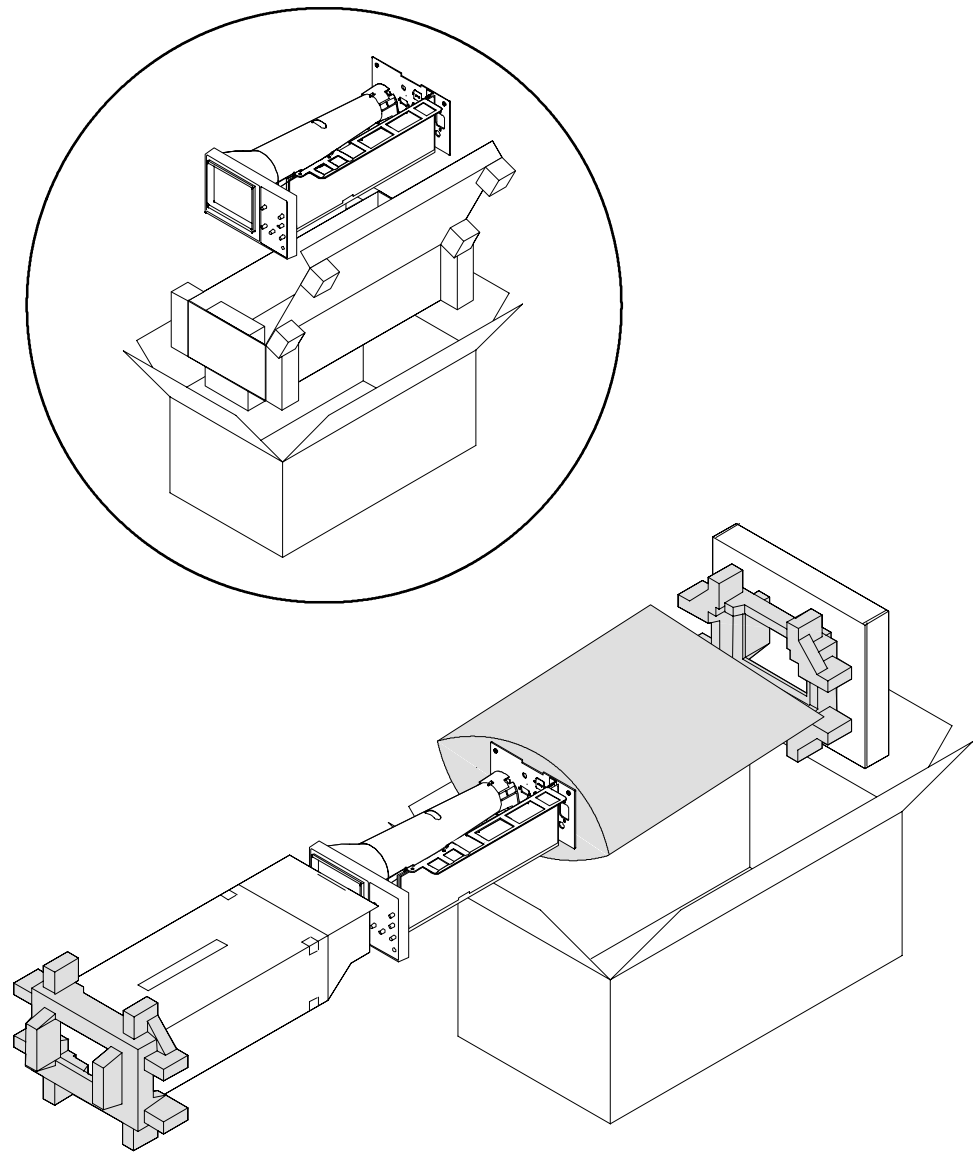
If the instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag to the instrument showing:

1. Owner (with complete address) and the name of the person at your firm that can be contacted.
2. Instrument serial number and a description of the service required.

### Repackaging for Shipment

Repackage the instrument in the original manner for maximum protection. If the original packaging materials are not in good condition or are unavailable, use the following procedure to repackage the instrument. See Figure 6-8.

1. Obtain a corrugated cardboard carton whose inside dimensions are at least six inches greater than the dimensions of the instrument to allow room for cushioning. The shipping carton should have a test strength of at least 275 pounds.
2. Surround the instrument with polyethylene sheeting to protect the finish.
3. Cushion the instrument on all sides by tightly packing dunnage or urethane foam between the carton and the instrument. Allow three inches on all sides for cushioning.
4. Seal the carton with shipping tape or an industrial stapler.



**Figure 6-8: Repackaging**



# Options





# Section 7

## Options

This section describes instrument options and customer-installable Field Upgrade Kits for the 1720/1721.

### Options

**CRT Options** The standard instrument is shipped with a P31 (green) phosphor crt installed. If Option 74 is ordered the instrument is shipped with a P4 (white) phosphor crt installed. The Option 74 crt part number is given at the end of the Replaceable Electrical Parts list.

**Power Cord Options** Any of the following power cord options can be ordered for the 1720/1721. If no power cord option is ordered, instruments are shipped with a North American 125 V power cord and one replacement fuse.

Option A1 Universal Europe 220V/16A Locking Power Plug (power cord and one replacement fuse)

Option A2 United Kingdom 240V/15A Power Plug (power cord and one replacement fuse)

Option A3 Australian 240V/10A Power Plug (power cord and one replacement fuse)

Option A4 North American 250V/18A Power Plug (power cord and one replacement fuse)

Option A5 Swiss 240V/6A Power Plug (power cord and one replacement fuse)

Unless otherwise specified, power cords for use in North America are UL listed and CSA certified. Option cords are approved by at least one test house acceptable in the country to which the product is shipped. Power cord part numbers are shown on the pull-out in Section 10.

### Field Upgrade Kits

**Cabinets** All of the Safety and EMI tests used to qualify the 1720/1721 were performed in a cabinet. There are two optional cabinets and a dual rack adapter available for

the installation of these instruments. Only a brief description is provided here, for more information contact a Tektronix field office or distributor. Dimensional cabinet drawings are located in Section 3 (Installation)

**Plain Cabinet (1700F00)**

This is a plain, silver-grey cabinet that is designed for permanent mounting. The pattern of ventilating holes in top, bottom, and sides provides adequate air circulation for any heat generated within the instrument. When being permanently mounted, care must be taken to allow the free circulation of air to and from these ventilating holes.

**Carrying Case (1700F02)**

This is a silver-grey, metal cabinet, with feet and carrying handle designed for portable applications. A TEKTRONIX BP1 can easily be mounted to this cabinet to provide a 12 Vdc power source for portable operation.

**Side-by-Side Rack Adapter (1700F05)**

This is a 19-inch, rack mounting adapter that accepts two 1700-Series instruments in a side-by-side configuration. Instrument cabinets are 1700F00 that are connected together for this installation. If only one 1700-Series instrument is to be installed in the Side-by-Side Rack Adapter, a blank panel (1700F06) can be installed for appearance, and air flow protection.

## Ordering

Any of these items can be ordered with the 1720/1721 instrument. In addition, these items are available, along with accessory items listed in this manual, from your nearest Tektronix field office or distributor. Be sure to include both the name and number of any Field Upgrade Kits ordered.



# **Replaceable Electrical Parts**



# Replaceable Electrical Parts

This section contains a list of the components that are replaceable for the 1720/1721. Use this list to identify and order replacement parts. There is a separate Replaceable Electrical Parts list for each instrument.

## Parts Ordering Information

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

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest circuit improvements. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

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

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

## Using the Replaceable Electrical Parts List

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

### **Cross Index- Mfr. Code Number to Manufacturer**

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

### **Abbreviations**

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

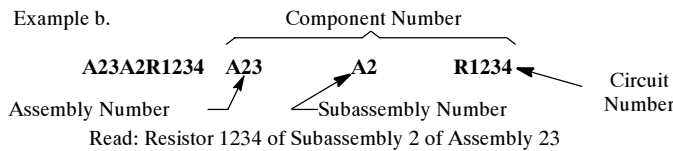
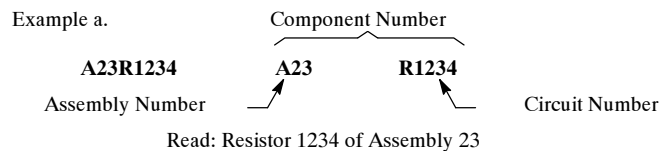
**List of Assemblies**

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

**Column Descriptions**

**Component No.  
(Column 1)**

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



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

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

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

**Tektronix Part No.  
(Column 2)**

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

**Serial/Assembly No.  
(Column 3 and 4)**

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

**Name and Description  
(Column 5)**

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

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

**Mfr. Code (Column 6)** Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

**Mfr. Part No. (Column 7)** Indicates actual manufacturer's part number.

## Cross Index - Mfr. Code Number To Manufacturer

Mfr. code.	Manufacturer	Address	City, state, zip code
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP	13500 N CENTRAL EXPY PO BOX 655303	DALLAS TX 75262-5303
04222	AVX/KYOCERA 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
09023	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO	2652 DALRYMPLE ST	SANFORD NC 27330
09969	DALE ELECTRONICS INC	EAST HIGHWAY 50 P O BOX 180	YANKTON SD 57078
0GV52	SCHAFFNER EMC INC	9-B FADEM ROAD	SPRINGFIELD, NJ 07081
0H1N5	TOSHIBA MARCON ELECTRONICS AMERICA CORPORATION	998 FIRST EDGE DRIVE	VERNON HILLS IL 60061
0JR03	ZMAN MAGNETICS INC	7633 S 180th	KENT WA 98032
0J260	COMTEK MANUFACTURING OF OREGON (METALS)	PO BOX 4200	BEAVERTON OR 97076-4200
0J9R2	HARISON ELECTRIC CO LTD	ASAHIMACHI 5-CHOME IMABARI	EHIME JAPAN
0LUA3	PHILIPS COMPONENTS	100 PROVIDENCE PIKE	SLATERSVILLE, RI 02876
2K262	BOYD CORP	6136 NE 87th AVE PO BOX 20038	PORTLAND OR 97220
11236	CTS CORPORATION RESISTOR NETWORKS DIVISION	406 PARR ROAD	BERNE IN 46711-9506
11502	IRC, INC	PO BOX 1860	BOONE NC 28607-1860
12697	CLAROSTAT MFG CO INC	12055 ROJAS DRIVE SUITE K	EL PASO, TX 79936
12954	MICROSEMI CORP - SCOTTSDALE	8700 E THOMAS RD P O BOX 1390	SCOTTSDALE AZ 85252
12969	MICROSEMI CORPORATION WATERTOWN DIVISION	530 PLEASANT STREET	WATERTOWN MA 02172
13103	THERMALLOY CO INC	2021 W VALLEY VIEW LN PO BOX 810839	DALLAS TX 75381
14552	MICROSEMI CORP	2830 S FAIRVIEW ST	SANTA ANA CA 92704-5948
15454	KETEMA RODAN DIVISION	2900 BLUE STAR STREET	ANAHEIM CA 92806-2591
17856	SILICONIX INC	2201 LAURELWOOD RD	SANTA CLARA CA 95054-1516
18796	MURATA ELECTRONICS NORTH AMERICA INC. STATE COLLEGE OPERATIONS	1900 W COLLEGE AVE	STATE COLLEGE PA 16801-2723
20093	ELECTRICAL INDUSTRIES SUB OF NORTH AMERICAN PHILLIPS CORP	691 CENTRAL AVE	MURRAY HILL NJ 07974-1507
22526	BERG ELECTRONICS INC (DUPONT)	857 OLD TRAIL RD	ETTERS PA 17319
24226	GOWANDA ELECTRONICS CORP	NO 1 INDUSTRIAL PL	GOWANDA NY 14070-1409
24546	DALE ELECTRONICS A VISHAY INTERTECHNOLOGY INC CO	550 HIGH ST	BRADFORD PA 16701-3737
26364	COMPONENTS CORP	6 KINSEY PLACE	DENVILLE NJ 07834-2611
27014	NATIONAL SEMICONDUCTOR CORP	2900 SEMICONDUCTOR DR	SANTA CLARA CA 95051-0606
31918	ITT CANNON SWITCH PRODUCTS	8081 WALLACE RD	EDEN PRAIRIE MN 55344-8798
32997	BOURNS INC TRIMPOT DIV	1200 COLUMBIA AVE	RIVERSIDE CA 92507-2114
33095	SPECTRUM CONTROL INC	8061 AVONIA ROAD	FAIRVIEW, PA 16415



Mfr. code.	Manufacturer	Address	City, state, zip code
33096	COLORADO CRYSTAL CORP	2303 W 8TH ST	LOVELAND CO 80537-5268
34361	OMRON ELECTRONICS INC.	2105 HAMILTON AVE SUITE 160	SAN JOSE, CA 95125
34371	HARRIS SEMICONDUCTOR SEMICONDUCTOR SECTOR	MS 58-71 PO BOX 883	MELBOURNE, FL 32902-0883
48726	UNITRODE INTEGRATED CIRCUITS CORP (UICC)	7 CONTINENTAL BLVD PO BOX 399	MERRIMACK NH 03054-0399
50139	ALLEN-BRADLEY CO ELECTRONIC COMPONENTS	1414 ALLEN BRADLEY DR	EL PASO TX 79936
50434	HEWLETT-PACKARD CO OPTOELECTRONICS DIV	370 W TRIMBLE RD	SAN JOSE CA 95131-1008
51406	MURATA ELECTRONICS NORTH AMERICA INC HEADQUARTERS AND GEORGIA OPERATIONS	2200 LAKE PARK DR	SMYRNA GA 30080
52769	SPRAGUE-GOODMAN ELECTRONICS INC	1700 SHAMES DRIVE	WESTBURY, NY 11590
53387	3M COMPANY ELECTRONIC PRODUCTS DIV	3M AUSTIN CENTER	AUSTIN TX 78769-2963
55335	JKL COMPONENTS CORP	13343 PAXTON STREET	PACOIMA CA 91331
55680	NICHICON /AMERICA/ CORP	927 E STATE PKY	SCHAUMBURG IL 60195-4526
56501	THOMAS & BETTS CORP	1555 LYNNFIELD RD	MEMPHIS, TN
56845	DALE ELECTRONICS INC	2300 RIVERSIDE BLVD PO BOX 74	NORFOLK NE 68701-2242
57668	ROHM CORPORATION	15375 BARRANCA PARKWAY SUITE B207	IRVINE CA 92718
59660	TUSONIX INC	7741 N BUSINESS PARK DR PO BOX 37144	TUCSON AZ 85740-7144
60395	XICOR INC	851 BUCKEYE CT	MILPITAS CA 95035-7408
61429	FOX ELECTRONICS DIV OF FOX ELECTRONICS INC	5842 CORPORATION CIRCLE	FOR MEYERS FL 33905
61935	SCHURTER INC	1016 CLEGG COURT	PETALUMA CA 94952-1152
65654	CHRISTIANA INDUSTRIES CORP	6500 N CLARK ST	CHICAGO, IL 60626
71400	BUSSMANN DIV OF COOPER INDUSTRIES INC	114 OLD STATE RD PO BOX 14460	ST LOUIS MO 63178
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
75498	MULTICOMP INC	3005 SW 154TH TERRACE #3	BEAVERTON OR 97006
76493	BELL INDUSTRIES INC JW MILLER DIV	306 E ALONDRA BLVD PO BOX 2859	GARDENA, CA 90247-1059
7X318	KASO PLASTICS INC	11015 A NE 39th	VANCOUVER WA 98662
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
83701	ELECTRONIC DEVICES INC	21 GREY OAKS AVE	YONKERS NY 10710-3205
8X345	NORTHWEST SPRING MFG CO	5858 WILLOW LANE	LAKE OSWEGO, OR 97035
91637	DALE ELECTRONICS INC	2064 12TH AVE PO BOX 609	COLUMBUS NE 68601-3632
9M860	ELECTRONIC SUB ASSEMBLY MFG CORP (ESAM)	930 SE M STREET PO BOX 376	GRANTS PASS OR 97526-3248
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609-3320
TK0515	EVOX-RIFA INC	100 TRI-STATE INTERNATIONAL SUITE 290	LINCOLNSHIRE IL 60015
TK0891	MICONICS	1 FAIRCHILD AVE	PLAINVIEW NY 11803
TK0974	SANGSHIN CORP	26830 PACIFIC HWY SOUTH	KENT WA 98031
TK1462	YAMAICHI ELECTRONICS CO LTD 2ND FLOOR NEW KYOEI BLDG 17-11	3-CHROME SHIBAURA MINATO-KU	TOKYO JAPAN

## Replaceable Electrical Parts

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<b>Mfr. code.</b>	<b>Manufacturer</b>	<b>Address</b>	<b>City, state, zip code</b>
TK1617	CRAFT FACTORY PLASTICS	17145 SW ALEXANDER	ALOHA OR 97007
TK1727	PHILIPS NEDERLAND BV AFD ELONCO	POSTBUS 90050	5600 PB EINDHOVEN THE NETHERLANDS
TK1743	UNITRODE (UK) LTD	6 CRESSWELL PARK BLACKHEATH	LONDON SE 3 9RD ENGLAND
TK1913	WIMA THE INTER-TECHNICAL GROUP IND	2269 SAW MILL RIVER ROAD PO BOX 127	ELMSFORD NY 10523
TK1919	AMERICAN KSS INC	2620 AUGUSTINE DR SUITE 100	SANTA CLARA CA 95054
TK2058	TDK CORPORATION OF AMERICA	1600 FEEHANVILLE DRIVE	MOUNT PROSPECT, IL 60056
TK2073	TOKYO AMERICA INC	565 W GULF ROAD	ARLINGTON HEIGHTS IL 60005
TK2469	UNITREK CORPORATION	3000 LEWIS & CLARK WAY SUITE #2	VANCOUVER WA 98601
0JR04	TOSHIBA AMERICA INC ELECTRONICS COMPONENTS DIV	9775 TOLEDO WAY	IRVINE CA 92718

## Replaceable Electrical Parts

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A1	671-2890-10	B050000	B059999	CIRCUIT BD ASSY:POWER SUPPLY	80009	671289010
A1	671-2890-11	B060000	B066636	CIRCUIT BD ASSY:POWER SUPPLY	80009	671289011
A1	671-2890-12	B066637		CIRCUIT BD ASSY:POWER SUPPLY (1720 ONLY)	80009	671289012
A1	671-2890-10	B050000	B059999	CIRCUIT BD ASSY:POWER SUPPLY	80009	671289010
A1	671-2890-11	B060000	B066737	CIRCUIT BD ASSY:POWER SUPPLY	80009	671289011
A1	671-2890-12	B066738		CIRCUIT BD ASSY:POWER SUPPLY (1721/1721PM/1721PN ONLY)	80009	671289012
A2	670-9384-00	B050000	B059999	CIRCUIT BD ASSY:FRONT PNL,NTSC/PAL-M	80009	670938400
A2	670-9384-01	B060000		CIRCUIT BD ASSY:FRONT PNL,NTSC/PAL-M (1720/1721PM ONLY)	80009	670938401
A2	670-9528-00	B050000	B059999	CIRCUIT BD ASSY:FRONT PNL,PAL	80009	670952800
A2	670-9528-01	B060000		CIRCUIT BD ASSY:FRONT PNL,PAL (1721/1721PN ONLY)	80009	670952801
A3	672-1227-07	B050000	B059999	CIRCUIT BD ASSY:MAIN	80009	672122707
A3	672-1227-09	B060000	B065974	CIRCUIT BD ASSY:MAIN	80009	672122709
A3	672-1227-10	B065975	B068300	CIRCUIT BD ASSY:MAIN	80009	672122710
A3	672-1227-12	B068301		CIRCUIT BD ASSY:MAIN (1720 ONLY)	80009	672122712
A3	672-1228-08	B050000	B059999	CIRCUIT BD ASSY:MAIN	80009	672122808
A3	672-1228-09	B060000	B066272	CIRCUIT BD ASSY:MAIN	80009	672122809
A3	672-1228-10	B066273	B077736	CIRCUIT BD ASSY:MAIN	80009	672122810
A3	672-1228-12	B077737		CIRCUIT BD ASSY:MAIN (1721 ONLY)	80009	672122812
A3	672-0224-07	B050000	B059999	CIRCUIT BD ASSY:MAIN	80009	672022407
A3	672-0224-08	B060000	B066272	CIRCUIT BD ASSY:MAIN	80009	672022408
A3	672-0224-09	B066273	B077736	CIRCUIT BD ASSY:MAIN	80009	672022409
A3	672-0224-11	B077737		CIRCUIT BD ASSY:MAIN (1721PM ONLY)	80009	672022411
A3	672-1433-04	B050000	B059999	CIRCUIT BD ASSY:MAIN	80009	672143304
A3	672-1433-05	B060000	B066272	CIRCUIT BD ASSY:MAIN	80009	672143305
A3	672-1433-06	B066273	B077736	CIRCUIT BD ASSY:MAIN	80009	672143306
A3	672-1433-08	B077737		CIRCUIT BD ASSY:MAIN (1721PN ONLY)	80009	672143308
A3A1	671-1796-01			CIRCUIT BD ASSY:GRATICULE LIGHT	80009	671179601
A4	119-1606-05			PHASE SHIFTER:NTSC (1720 ONLY)	80009	119160605
A4	119-1763-05			PHASE SHIFTER:PAL (1721/1721PM/1721PN ONLY)	80009	119176305
A10	671-3637-00			CIRCUIT BD ASSY:CRT SOCKET BD	80009	671363700
A11	671-3761-00			CKT BD ASSY:SERIAL FILTER	80009	671376100
A1	671-2890-10	B050000	B059999	CIRCUIT BD ASSY:POWER SUPPLY	80009	671289010
A1	671-2890-11	B060000	B066636	CIRCUIT BD ASSY:POWER SUPPLY	80009	671289011
A1	671-2890-12	B066637		CIRCUIT BD ASSY:POWER SUPPLY (1720 ONLY)	80009	671289012
A1	671-2890-10	B050000	B059999	CIRCUIT BD ASSY:POWER SUPPLY	80009	671289010
A1	671-2890-11	B060000	B066737	CIRCUIT BD ASSY:POWER SUPPLY	80009	671289011
A1	671-2890-12	B066738		CIRCUIT BD ASSY:POWER SUPPLY (1721/1721PM/1721PN ONLY)	80009	671289012
A1C1	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C2	283-0021-00			CAP,FXD,CER DI:0.001UF,20%,5000V	TK2058	TCK45YS3H102M-A

## Replaceable Electrical Parts

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A1C3	283-0261-00			CAP,FXD,CER DI:0.01UF,20%,4000V	18796	DHR28Z5U103M4KV
A1C4	283-0261-00			CAP,FXD,CER DI:0.01UF,20%,4000V	18796	DHR28Z5U103M4KV
A1C5	285-1341-01			CAP,FXD,PLASTIC:MTLZD FILM;0.1UF,20%,100V,POLYEST	TK1913	MKS 2 0.1UF 20%
A1C6	281-0771-00			CAP,FXD,CER DI:2200PF,20%,200V	04222	SA102C222MAA
A1C7	285-1470-00			CAP,FXD,PLASTIC:MTLZD FILM;330PF,1600VDC/500VAC, POLYPROPYLENE,11 X18	TK1913	FKP1 330/1600/5
A1C8	283-0261-00			CAP,FXD,CER DI:0.01UF,20%,4000V	18796	DHR28Z5U103M4KV
A1C9	283-0261-00			CAP,FXD,CER DI:0.01UF,20%,4000V	18796	DHR28Z5U103M4KV
A1C10	281-0563-00			CAP,FXD,CERAMIC:MLC;0.47UF,20%,50V,0.150 X0.290	04222	SA305E474MAA
A1C11	283-0021-00			CAP,FXD,CER DI:0.001UF,20%,5000V	TK2058	TCK45YS3H102M-A
A1C12	281-0707-00			CAP,FXD,CER DI:15000PF,10%,200V	04222	MA302C153KAA
A1C13	281-0707-00			CAP,FXD,CER DI:15000PF,10%,200V	04222	MA302C153KAA
A1C14	281-0707-00			CAP,FXD,CER DI:15000PF,10%,200V	04222	MA302C153KAA
A1C15	285-1341-01			CAP,FXD,PLASTIC:MTLZD FILM;0.1UF,20%,100V,POLYEST	TK1913	MKS 2 0.1UF 20%
A1C16	290-1311-00			CAP,FXD,ALUM:10UF,20%,50V,ESR=1.4 OHM (100KHZ,20C),5X11MM,105C,5000HRS	55680	UPL1H100MDH1TD
A1C17	285-1341-01			CAP,FXD,PLASTIC:MTLZD FILM;0.1UF,20%,100V,POLYEST	TK1913	MKS 2 0.1UF 20%
A1C18	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C19	290-1310-00			CAP,FXD,ALUM:10UF,20%,160V,ESR=24.9 OHM (120HZ,20C),LS=0.200 INCH,13X20MM,105C,5000HRS	0H1N5	CEJSM2C100M
A1C20	281-0707-00			CAP,FXD,CER DI:15000PF,10%,200V	04222	MA302C153KAA
A1C21	281-0707-00			CAP,FXD,CER DI:15000PF,10%,200V	04222	MA302C153KAA
A1C22	281-0563-00			CAP,FXD,CERAMIC:MLC;0.47UF,20%,50V,0.150 X0.290	04222	SA305E474MAA
A1C23	285-1328-00			CAP,FXD,PLASTIC:MTLZD FILM;0.01UF,5%,2000V,POLY-PROPYLENE,1.25X.95	TK1913	FKP1 .01/2000/5
A1C24	290-1310-00			CAP,FXD,ALUM:10UF,20%,160V,ESR=24.9 OHM (120HZ,20C),LS=0.200 INCH,13X20MM,105C,5000HRS	0H1N5	CEJSM2C100M
A1C25	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C27	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C28	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C29	290-1267-00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C30	290-1267-00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C31	290-1267-00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C32	290-1267-00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C33	290-1310-00			CAP,FXD,ALUM:10UF,20%,160V,ESR=24.9 OHM (120HZ,20C),LS=0.200 INCH,13X20MM,105C,5000HRS	0H1N5	CEJSM2C100M
A1C34	290-1310-00			CAP,FXD,ALUM:10UF,20%,160V,ESR=24.9 OHM (120HZ,20C),LS=0.200 INCH,13X20MM,105C,5000HRS	0H1N5	CEJSM2C100M
A1C35	290-1267-00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C36	290-1267-00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C37	290-1267-00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C38	290-1267-00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C39	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C40	281-0772-00			CAP,FXD,CERAMIC:MLC;4700PF,10%,100V,0.100 X	04222	SA101C472KAA
A1C41	281-0563-00			CAP,FXD,CERAMIC:MLC;0.47UF,20%,50V,0.150 X0.290	04222	SA305E474MAA
A1C42	290-1267-00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C43	281-0563-00			CAP,FXD,CERAMIC:MLC;0.47UF,20%,50V,0.150 X 0.290	04222	SA305E474MAA

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A1C44	285-1331-00			CAP,FXD,MTLZD:0.47UF,5%,400V	TK1913	MKS4 .47/400/5
A1C45	281-0563-00			CAP,FXD,CERAMIC:MLC;0.47UF,20%,50V,0.150 X 0.290	04222	SA305E474MAA
A1C46	283-0005-03			CAP,FXD,CER DI:0.01 UF,+80-20%,250V	04222	SR30VE103ZAATR2
A1C47	281-0563-00	671-2890-10	671-2890-11	CAP,FXD,CERAMIC:MLC;0.47UF,20%,50V,0.150 X 0.290	04222	SA305E474MAA
A1C47	283-0059-00	671-2890-12		CAP,FXD,CERAMIC:MLC;1.0 UF,20%,50V,0.150 X 0.290	04222	SA305E474MAA
A1C48	281-0809-00			CAP,FXD,CERAMIC:MLC;200 PF,5%,100V,0.100 X 0.170	04222	SA101A201JAA
A1C49	281-0775-01			CAP,FXD,CERAMIC:MLC;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C50	281-0563-00			CAP,FXD,CERAMIC:MLC;0.47UF,20%,50V,0.150 X 0.290	04222	SA305E474MAA
A1C51	281-0773-00			CAP,FXD,CERAMIC:MLC;0.01UF,10%,100V	TK1743	CGB103KEX
A1C52	281-0773-00			CAP,FXD,CERAMIC:MLC;0.01UF,10%,100V	TK1743	CGB103KEX
A1C53	285-1437-00			CAP,FXD,PLASTIC:100PF,5%,1600VDC/500VAC	TK1913	FKP1/100/1600/5
A1C54	290-1275-00			CAP,FXD,ALUM:330UF,20%,400V,35X35MM,105C	55680	LGQ2G331MHSC
A1C56	285-1246-00			CAP,FXD,PPR DI:0.022UF,20%,250VAC	TK0515	PME 289 MB 5220
A1C57	285-1222-00			CAP,FXD,PLASTIC:0.068UF,20%,250V	TK0515	PME 271 M 568
A1C58	281-0809-00			CAP,FXD,CERAMIC:MLC;200 PF,5%,100V,0.100 X 0.170	04222	SA101A201JAA
A1C59	281-0775-01			CAP,FXD,CERAMIC:MLC;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C60	281-0775-01			CAP,FXD,CERAMIC:MLC;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C61	281-0768-00			CAP,FXD,CER DI:470PF,20%,100V	04222	SA101A471KAA
A1C65	285-1301-01			CAP,FXD,MTLZD:0.47UF,10%,50VTAPE & AMMO PACK	TK1913	MKS 2 .47/50 OR
A1C66	290-1311-00			CAP,FXD,ALUM:10UF,20%,50V,ESR=1.4 OHM (100KHZ,20C),5X11MM,105C,5000HRS	55680	UPL1H100MDH1TD
A1CR1	152-0061-00			DIODE,SIG:200V,0.1A,700NS,4.0PF	12969	PV122
A1CR2	152-0061-00			DIODE,SIG:200V,0.1A,700NS,4.0PF	12969	PV122
A1CR3	152-0061-00			DIODE,SIG:200V,0.1A,700NS,4.0PF	12969	PV122
A1CR4	152-0409-00			DIODE,RECT:FAST RCVRY;12KV,10MA,250NS	83701	CRVT150
A1CR5	152-0061-00			DIODE,SIG:200V,0.1A,700NS,4.0PF	12969	PV122
A1CR6	152-0061-00			DIODE,SIG:200V,0.1A,700NS,4.0PF	12969	PV122
A1CR7	152-0400-00			DIODE,RECT:FAST RCVRY,400V,1A,200NS,1N4936,DO-41	04713	1N4936RL
A1CR8	152-0400-00			DIODE,RECT:FAST RCVRY,400V,1A,200NS,1N4936,DO-41	04713	1N4936RL
A1CR9	152-0400-00			DIODE,RECT:FAST RCVRY,400V,1A,200NS,1N4936,DO-41	04713	1N4936RL
A1CR10	152-0400-00			DIODE,RECT:FAST RCVRY,400V,1A,200NS,1N4936,DO-41	04713	1N4936RL
A1CR11	152-0814-00			DIODE,RECT:ULTRA FAST;150V,3A,1.1VF,30NS	0LUA3	BYV28-150
A1CR11	152-0400-00	671-2890-10	671-2890-11	DIODE,RECT:FAST RCVRY,400V,1A,200NS,1N4936,DO-41	04713	1N4936RL
A1CR11	152-0808-00	671-2890-12		DIODE,RECT:ULTRA FAST;150V,3A,1.1VF,30NS	0LUA3	BYV28-150
A1CR12	152-0400-00			DIODE,RECT:FAST RCVRY,400V,1A,200NS,1N4936,DO-41	04713	1N4936RL
A1CR13	152-1191-00			DIODE,RECT:SCHTKY;100V,10A,150A IFSM,800MV AT 10A	04713	MBR10100
A1CR14	152-0400-00			DIODE,RECT:FAST RCVRY,400V,1A,200NS,1N4936,DO-41	04713	1N4936RL
A1CR15	152-0400-00			DIODE,RECT:FAST RCVRY,400V,1A,200NS,1N4936,DO-41	04713	1N4936RL
A1CR16	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A1CR17	152-0400-00			DIODE,RECT:FAST RCVRY,400V,1A,200NS,1N4936,DO-41	04713	1N4936RL
A1CR19	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A1CR20	152-0897-00			DIODE,RECT:FAST RCVRY;1000V,1.5A,300NS	0LUA3	BYV96E
A1CR21	152-1165-00			DIODE,RECT:ULTRA FAST;600V,4A,50NS	04713	MUR460RL
A1CR22	152-1165-00			DIODE,RECT:ULTRA FAST;600V,4A,50NS	04713	MUR460RL
A1CR23	152-1165-00			DIODE,RECT:ULTRA FAST;600V,4A,50NS	04713	MUR460RL
A1CR24	152-1165-00			DIODE,RECT:ULTRA FAST;600V,4A,50NS	04713	MUR460RL
A1CR25	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A1CR26	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A1CR27	152-0400-00			DIODE,RECT:FAST RCVRY,400V,1A,200NS,1N4936,DO-41	04713	1N4936RL
A1CR29	152-0400-00			DIODE,RECT:FAST RCVRY,400V,1A,200NS,1N4936,DO-41	04713	1N4936RL
A1CR30	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A1CR31	152-0400-00			DIODE,RECT:FAST RCVRY,400V,1A,200NS,1N4936,DO-41	04713	1N4936RL
A1DS1	150-0050-00			LAMP,GLOW:135V MAX,1.9MA,C2A-T,WIRE LEAD	0J9R2	NE-2Q-11R-T
A1DS2	150-0050-00			LAMP,GLOW:135V MAX,1.9MA,C2A-T,WIRE LEAD	0J9R2	NE-2Q-11R-T
A1DS3	150-0050-00			LAMP,GLOW:135V MAX,1.9MA,C2A-T,WIRE LEAD	0J9R2	NE-2Q-11R-T

## Replaceable Electrical Parts

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A1DS4	150-0050-00			LAMP,GLOW:135V MAX,1.9MA,C2A-T,WIRE LEAD	0J9R2	NE-2Q-11R-T
A1F1	159-0021-00			FUSE,CARTRIDGE:3AG,2A,250V,FAST BLOW	71400	AGC-2
	200-2264-00			*MOUNTING PARTS*		
	204-0906-00			CAP,FUSEHOLDER:3AG FUSES	61935	FEK 031 1666
				BODY,FUSEHOLDER:3AG & 5 X 20MM FUSES	61935	TYPE FAU 031.35
				*END MOUNTING PARTS*		
A1J1	131-5338-00			CONN,HDR:PCB/WIREWRAP;MALE,STR,1 X 7,0.15CTR,0.230 MLG X 0.285 TAIL,30 GOLD,SIDE BY SIDE STACK	22526	65561-107
A1J2	131-4794-00			CONN,HDR:PCB;MALE,STR,1 X 2,0.1 CTR,0.235 MLG X 0.112 TAIL,30GOLD,0.035 DIA PCB	53387	2402-6112 UB
A1J3	131-5337-00			CONN,HDR:PCB/WIREWRAP;MALE,STR,1 X 4,0.150	22526	65561-104
A1J4	131-3392-00			CONN,HDR:PCB;MALE,STR,1 X 10,0.1 CTR,0.230	00779	1-102844-1
A1J6	119-1946-00			FILTER,RFI:1A,250V,400HZ W/PC TERMINAL	0GV52	FX326-1/02-K-D-
A1L1	108-1412-00			INDUCTOR,FXD:POWER:4.7UH,20%,I<3.7A,RDC<0.017 OHM,Q>10,SRF>30MHZ,BOBBIN	TK2058	TSL0807-4R7M3R0
A1L2	108-1412-00			INDUCTOR,FXD:POWER:4.7UH,20%,I<3.7A,RDC<0.017 OHM,Q>10,SRF>30MHZ,BOBBIN	TK2058	TSL0807-4R7M3R0
A1L3	108-1412-00			INDUCTOR,FXD:POWER:4.7UH,20%,I<3.7A,RDC<0.017 OHM,Q>10,SRF>30MHZ,BOBBIN	TK2058	TSL0807-4R7M3R0
A1L4	108-0205-00			INDUCTOR,FXD:POWER:1MH,5%.IDC<400 MA,RDC<2.12 OHM,Q>47@0.25MHZ	76493	8209
A1Q1	151-0749-00			TRANSISTOR,SIG:BIPOLAR,PNP;400V,500MA,50MHZ,AMPL	04713	MPSA94
A1Q2	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A1Q3	151-0350-03			TRANSISTOR,SIG:BIPOLAR,PNP;150V,600MA,100MHZ	04713	2N5401RLRP
A1Q4	151-0347-02			TRANSISTOR,SIG:BIPOLAR,NPN;160V,600MA,100MHZ	04713	2N5551RLRP
A1Q5	151-0350-03			TRANSISTOR,SIG:BIPOLAR,PNP;150V,600MA,100MHZ	04713	2N5401RLRP
A1Q6	151-0476-00			TRANSISTOR,PWR:BIPOLAR,NPN;100V,3.0A,3.0MHZ,AMPL	04713	TIP31C
				*ATTACHED PARTS*		
	214-3848-00			HEAT SINK,SEMIC:XSTR,TO-220;ALUMINUM,CLIP-ON	13103	6043PB
				*END ATTACHED PARTS*		
A1Q7	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A1Q8	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A1Q9	151-1286-00			TRANSISTOR,PWR:MOS,N-CH;800V,4.0A,3.0 OHM	0LUA3	BUK456-800A
				*ATTACHED PARTS*		
	210-0406-00			NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
	211-0008-00			SCREW,MACHINE:4-40 X 0.25,PNH,STL	TK0435	ORDER BY DESCR
	214-3841-00			HEAT SINK,SEMIC:TRANSISTOR,TO-220;VERTICAL-MOUNT,(2)SOLDERABLE TABS,ALUM,BLACK ANODIZE	13103	6021PB
				*END ATTACHED PARTS*		
A1Q10	151-0350-03			XSTR,SIG:BIPOLAR,PNP;150V,600MA,100MHZ,AMPL	04713	2N5401RLRP
A1Q11	151-0528-00			THYRISTOR,PWR:BIPOLAR,SCR;50V,16A RMS,PHASE	0LUA3	BT152-400R
A1R1	303-0155-00			RES,FXD,CMPSN:1.5M OHM,5%,1W	50139	GB1555
A1R2	301-0225-02			RES,FXD,CMPSN:2.2M OHM,5%,0.5W	50139	EB2255
A1R3	303-0155-00			RES,FXD,CMPSN:1.5M OHM,5%,1W	50139	GB1555
A1R4	303-0155-00			RES,FXD,CMPSN:1.5M OHM,5%,1W	50139	GB1555
A1R5	303-0155-00			RES,FXD,CMPSN:1.5M OHM,5%,1W	50139	GB1555
A1R7	322-3385-00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10002F
A1R8	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A1R11	311-1256-00			RES,VAR,TRMR:CERMET;2.5M OHM,10%,0.5W,0.375	32997	3386F-1-255
A1R12	315-0471-03			RES,FXD,CMPSN:470 OHM,5%,0.25W	50139	CB4715
A1R13	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A1R14	322-3001-00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R20	322-3248-00			RES,FXD,FILM:3.74K OHM,1%,0.2W,TC=T0,T&R	91637	CCF50G37400F
A1R22	322-3329-00			RES,FXD,FILM:26.1K OHM,1%,0.2W,TC=T0MI	91637	CCF501G26101F
A1R24	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A1R25	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A1R26	322-3452-00			RES,FXD,FILM:499K OHM,1%,0.2W,TC=TOMI,SMALL	91637	CCF50-2-G4993FT
A1R27	322-3300-02			RES,FXD,FILM:13K OHM,0.5%,0.2W,TC=T2	91637	CCF501D13001D
A1R28	322-3344-00			RES,FXD,FILM:37.4K OHM,1%,0.2W,TC=TOMI	91637	CCF501G37401F
A1R29	315-0470-03			RES,FXD,CMPSN:47 OHM,5%,0.25W	50139	CB4705
A1R30	315-0103-03			RES,FXD,CMPSN:10K OHM,5%,0.25W	50139	CB1035
A1R31	322-3385-00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10002F
A1R32	322-3452-00			RES,FXD,FILM:499K OHM,1%,0.2W,TC=TOMI,SMALL	91637	CCF50-2-G4993FT
A1R33	322-3300-02			RES,FXD,FILM:13K OHM,0.5%,0.2W,TC=T2	91637	CCF501D13001D
A1R34	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A1R35	322-3162-00			RES,FXD:METAL FILM;475 OHM,1%,0.2W,TC=100 PPM	91637	CCF50G475R0F
A1R36	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A1R37	322-3034-00			RES,FXD:METAL FILM;22.1 OHM,1%,0.2W,TC=100 PPM	91637	CCF50-2-G22R10F
A1R38	315-0226-01			RES,FXD,CMPSN:22 M OHM,5%,0.25W	50139	CB2265
A1R39	315-0471-03			RES,FXD,CMPSN:470 OHM,5%,0.25W	50139	CB4715
A1R40	315-0103-03			RES,FXD,CMPSN:10K OHM,5%,0.25W	50139	CB1035
A1R41	322-3121-00			RES,FXD:METAL FILM;178 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G178R0F
A1R42	322-3402-00			RES,FXD:METAL FILM;150K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G15002F
A1R43	315-0471-03			RES,FXD,CMPSN:470 OHM,5%,0.25W	50139	CB4715
A1R44	315-0471-03			RES,FXD,CMPSN:470 OHM,5%,0.25W	50139	CB4715
A1R45	311-2239-00			RES,VAR,TRMR:CERMET;100K OHM,20%,0.5W,0.197	TK2073	GF06UT2 104 M L
A1R46	322-3001-00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R47	322-3385-00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10002F
A1R48	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=TOMI	91637	CCF501G30100F
A1R49	311-2239-00	671-2890-10	671-2890-10	RES,VAR,TRMR:CERMET;100K OHM,20%,0.5W,0.197	TK2073	GF06UT2 104 M L
A1R49	311-2236-00	671-2890-11		RES,VAR,TRMR:CERMET;20K OHM,20%,0.5W,0.197 SQ,SIDE ADJUST,T&R	TK2073	GF06UT2 203 M L20
A1R50	322-3001-00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R51	322-3260-00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0,T&R	91637	CCF501G49900F
A1R52	322-3001-00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R53	322-3001-00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R54	322-3260-00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0,T&R	91637	CCF501G49900F
A1R55	322-3322-00			RES,FXD:METAL FILM;22.1K OHM,1%,0.2W,TC=100	91637	CCF501G22101F
A1R56	322-3001-00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R57	322-3034-00			RES,FXD:METAL FILM;22.1 OHM,1%,0.2W,TC=100 PPM	91637	CCF50-2-G22R10F
A1R58	311-2239-00			RES,VAR,TRMR:CERMET;100K OHM,20%,0.5W,0.197	TK2073	GF06UT2 104 M L
A1R59	322-3485-07			RES,FXD,FILM:5K OHM,0.1%,0.2W,TC=T9	91637	CCF501C50000B
A1R60	322-3268-00			RES,FXD,FILM:6.04K OHM,1%,0.2W,TC=TOMI	91637	CCF501G60400F
A1R61	322-3034-00			RES,FXD:METAL FILM;22.1 OHM,1%,0.2W,TC=100 PPM	91637	CCF50-2-G22R10F
A1R62	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A1R63	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A1R64	322-3385-00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10002F
A1R65	322-3385-00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10002F
A1R66	322-3452-00			RES,FXD,FILM:499K OHM,1%,0.2W,TC=TOMI,SMALL	91637	CCF50-2-G4993FT
A1R67	322-3001-00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R68	322-3121-00			RES,FXD:METAL FILM;178 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G178R0F
A1R69	322-3289-07			RES,FXD,FILM:10K OHM,0.1%,0.2W,TC=T9,T&R	91637	CCF501C10001B
A1R70	322-3289-07			RES,FXD,FILM:10K OHM,0.1%,0.2W,TC=T9,T&R	91637	CCF501C10001B
A1R71	322-3418-00			RES,FXD:METAL FILM;221K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G22102F
A1R72	322-3001-00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R73	322-3001-00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R74	322-3260-00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0,T&R	91637	CCF501G49900F
A1R75	322-3260-00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0,T&R	91637	CCF501G49900F
A1R76	322-3248-00			RES,FXD,FILM:3.74K OHM,1%,0.2W,TC=T0,T&R	91637	CCF50G37400F
A1R77	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F

## Replaceable Electrical Parts

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A1R78	322-3248-00			RES,FXD,FILM:3.74K OHM,1%,0.2W,TC=T0,T&R	91637	CCF50G37400F
A1R79	322-3356-00			RES,FXD,FILM:49.9K OHM,1%,0.2W,TC=T0MI	91637	CCF501G49901F
A1R80	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A1R81	322-3121-00			RES,FXD:METAL FILM;178 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G178R0F
A1R82	322-3260-00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0,T&R	91637	CCF501G49900F
A1R83	322-3289-07			RES,FXD,FILM:10K OHM,0.1%,0.2W,TC=T9,T&R	91637	CCF501C10001B
A1R84	322-3315-00			RES,FXD,FILM:18.7K OHM,1%,0.2W,TC=T0MI	91637	CCF501G18701F
A1R85	322-3385-00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10002F
A1R86	308-0793-00			RES,FXD:0.51 OHM,5%,1WTC=150PPM/DEG C,MI	75042	BW20 .51OHM 5PE
A1R87	322-3034-00			RES,FXD:METAL FILM;22.1 OHM,1%,0.2W,TC=100 PPM	91637	CCF50-2-G22R10F
A1R88	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A1R89	307-0746-00			RES,THERMAL:5 OHM,10%,7A/DEG C	15454	SG200-S STRAI
A1R90	305-0242-00			RES,FXD,CMPSN:2.4K OHM,5%,2W	11502	GF-3 OR GS-3 24
A1R91	306-0104-00			RES,FXD,CMPSN:100K OHM,10%,2W	24546	FP42 OR FP2 100
A1R92	306-0104-00			RES,FXD,CMPSN:100K OHM,10%,2W	24546	FP42 OR FP2 100
A1R93	322-3402-00			RES,FXD:METAL FILM;150K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G15002F
A1R94	322-3402-00			RES,FXD:METAL FILM;150K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G15002F
A1R95	322-3256-00			RES,FXD,FILM:4.53K OHM,1%,0.2W,TC=T0MI	91637	CCF50-2-G4531FT
A1R96	322-3356-00			RES,FXD,FILM:49.9K OHM,1%,0.2W,TC=T0MI	91637	CCF501G49901F
A1R97	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A1R98	322-3289-07			RES,FXD,FILM:10K OHM,0.1%,0.2W,TC=T9,T&R	91637	CCF501C10001B
A1R99	311-2239-00			RES,VAR,TRMR:CERMET;100K OHM,20%,0.5W,0.197	TK2073	GF06UT2 104 M L
A1R101	322-3068-00			RES,FXD:METAL FILM;49.9 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G49R90F
A1R102	308-0290-00			RES,FXD,WW:8 OHM,5%,5W	91637	CW52-8R000J T/R
A1R103	322-3452-00			RES,FXD,FILM:499K OHM,1%,0.2W,TC=T0MI,SMALL	91637	CCF50-2-G4993FT
A1T1	120-1695-00			TRANSFORMER,PWR:HIGH VOLTAGE,FEEDBACK 3V, RESONANT 231V, 100V 1MA,2750V 3.3MA, 6.3V 86MA	75498	120-1695-00
A1T2	120-1945-00			TRANSFORMER,RF:PRI 8UH,2:7,ON-OFF,VERT MT,PC MT	OJR03	120-1945-00
A1T3	120-1944-00			TRANSFORMER,RF:PRI 88V,PRI 15V,SEC 40V AT0.385A,5V AT 2A,15V AT 0.80,IDED,PC MOUNT,1.45 X 1.7 X 1.17H	75498	129-2074-EC
A1TP1	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIAP CB,0.015 X 0.032 BRASS,W/RED NYLON COLLAR	26364	104-01-02
A1TP2	214-4085-00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIAP CB,0.015 X 0.032 BRASS,W/RED NYLON COLLAR	26364	104-01-02
A1U1	152-0900-00			MODULE,HV:7.5KVAC IN,15KVDC OUT,POTTED MODULE	51406	MSL2556
A1U2	156-0067-00			IC,LINEAR:BIPOLAR,OP-AMP	01295	UA741CP
A1U3	156-1225-00			IC,LINEAR:BIPOLAR,COMPTR;DUAL,OPEN COLL,300NS	01295	LM393P
A1U4	156-2761-01			IC,DIGITAL:HCMOS,MULTIVIBRATOR	OJR04	TC74HC221AP
A1U5	156-2524-00			IC,LINEAR:BIPOLAR,SW-REGULATOR CONTROLLER;PWM, CURRENT MODE,SINGLE TOTEM POLE OUTPUT	48726	UC3842N
A1VR1	156-1631-01			IC,LINEAR:BIPOLAR,VR;ADJUSTABLE,SHUNT,100MA,2.2%	01295	TL431CLPM
A1VR2	152-0195-00			DIODE,ZENER:5.1V,5%,0.4W	04713	MZ5523D
A1VR3	152-0195-00			DIODE,ZENER:5.1V,5%,0.4W	04713	MZ5523D
A1VR4	152-0149-00			DIODE,ZENER:10V,5%,0.4W	04713	1N961BRL
A1VR5	152-0287-00			DIODE,ZENER:110V,5%,0.4W	04713	1N986BRL
A1VR6	152-0287-00			DIODE,ZENER:110V,5%,0.4W	04713	1N986BRL
A1W1	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA0207
A1W2	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA0207
A1W3	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA0207
A1W4	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA0207
A2	670-9384-00	B050000	B059999	CIRCUIT BD ASSY:FRONT PNL,NTSC/PAL-M	80009	670938400
A2	670-9384-01	B060000		CIRCUIT BD ASSY:FRONT PNL,NTSC/PAL-M (1720/1721PM ONLY)	80009	670938401
A2	670-9528-00	B050000	B059999	CIRCUIT BD ASSY:FRONT PNL,PAL	80009	670952800



Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A2	670-9528-01	B060000		CIRCUIT BD ASSY:FRONT PNL,PAL (1721/1721PN ONLY) *ATTACHED PARTS*	80009	670952801
	352-0779-00			HOLDER,LED:PLASTIC *END ATTACHED PARTS*	80009	352077900
A2DS116	150-1109-00			DIODE,OPTO:LED;GRN,565NM,1.5MCD AT 20MA,0.1 X 0.3 INCH RECTANGLE INTENSITY & COLOR BINNED	50434	HLMP-0503 OPT S
A2DS118	150-1109-00			DIODE,OPTO:LED;GRN,565NM,1.5MCD AT 20MA,0.1 X 0.3 INCH RECTANGLE INTENSITY & COLOR BINNED	50434	HLMP-0503 OPT S
A2DS132	150-1109-00			DIODE,OPTO:LED;GRN,565NM,1.5MCD AT 20MA,0.1 X 0.3 INCH RECTANGLE INTENSITY & COLOR BINNED	50434	HLMP-0503 OPT S
A2DS133	150-1109-00			DIODE,OPTO:LED;GRN,565NM,1.5MCD AT 20MA,0.1 X 0.3 INCH RECTANGLE INTENSITY & COLOR BINNED	50434	HLMP-0503 OPT S
A2DS134	150-1109-00			DIODE,OPTO:LED;GRN,565NM,1.5MCD AT 20MA,0.1 X 0.3 INCH RECTANGLE INTENSITY & COLOR BINNED	50434	HLMP-0503 OPT S
A2DS146	150-1109-00			DIODE,OPTO:LED;GRN,565NM,1.5MCD AT 20MA,0.1 X 0.3 INCH RECTANGLE INTENSITY & COLOR BINNED	50434	HLMP-0503 OPT S
A2DS147	150-1109-00			DIODE,OPTO:LED;GRN,565NM,1.5MCD AT 20MA,0.1 X 0.3 INCH RECTANGLE INTENSITY & COLOR BINNED	50434	HLMP-0503 OPT S
A2DS227	150-1138-00			DIODE,OPTO:LED;RED,626NM,1MCD AT 20MA	50434	HLMP-0300
A2DS247	150-1109-00			DIODE,OPTO:LED;GRN,565NM,1.5MCD AT 20MA,0.1 X 0.3 INCH RECTANGLE INTENSITY & COLOR BINNED	50434	HLMP-0503 OPT S
A2DS249	150-1109-00			DIODE,OPTO:LED;GRN,565NM,1.5MCD AT 20MA,0.1 X 0.3 INCH RECTANGLE INTENSITY & COLOR BINNED	50434	HLMP-0503 OPT S
A2DS321	150-1109-00			DIODE,OPTO:LED;GRN,565NM,1.5MCD AT 20MA,0.1 X 0.3 INCH RECTANGLE INTENSITY & COLOR BINNED (1721 ONLY)	50434	HLMP-0503 OPT S
A2DS323	150-1109-00			DIODE,OPTO:LED;GRN,565NM,1.5MCD AT 20MA,0.1 X 0.3 INCH RECTANGLE INTENSITY & COLOR BINNED (1721 ONLY)	50434	HLMP-0503 OPT S
A2DS521	150-1109-00			DIODE,OPTO:LED;GRN,565NM,1.5MCD AT 20MA,0.1 X 0.3 INCH RECTANGLE INTENSITY & COLOR BINNED	50434	HLMP-0503 OPT S
A2J303	175-9773-01			CA ASSY,SP:RIBBON;IDC,34,28AWG,4.64L,2X17,0.1, RCPT,CTR PLZ X 2X17,0.1CTR,PCB,SMAE SIDE	TK1462	ORDER BY DESC
A2R203	307-0488-00			RES NTWK,FXD,FI:5 100 OHM,20%,0.75W	11236	750-61R100 OHM
A2R212	311-2287-00	670-9384-00	670-9384-00	RES,VAR,NONWWW:PNL,20K OHM,10%,0.5W	12697	CM45210
A2R212	311-2540-00	670-9384-01		RES,VAR,PNL:CP,20K OHM,20%,0.5W,LINEAR,W/ GROUNDING LUG,0.5 IN DIA	12697	311-2540-00
A2R212	311-2287-00	670-9528-00	670-9528-00	RES,VAR,NONWWW:PNL,20K OHM,10%,0.5W	12697	CM45210
A2R212	311-2540-00	670-9528-01		RES,VAR,PNL:CP,20K OHM,20%,0.5W,LINEAR,W/ GROUNDING LUG,0.5 IN DIA *ATTACHED PARTS*	12697	311-2540-00
	366-1701-01			KNOB:GY,0.127 ID X 0.392 OD X 0.4 H	80009	366170101
	214-4725-00	670-9384-01		SPRING:COMPRESSION SPRING,0.026,302 STAINLESS STEEL,0.313,+/-,0.0A0	8X345	214-4725-00
	214-4725-00	670-9528-01		SPRING:COMPRESSION SPRING,0.026,302 STAINLESS STEEL,0.313,+/-,0.0A0 *END ATTACHED PARTS*	8X345	214-4725-00
A2R232	307-0488-00			RES NTWK,FXD,FI:5 100 OHM,20%,0.75W	11236	750-61R100 OHM
A2R235	307-0488-00			RES NTWK,FXD,FI:5 100 OHM,20%,0.75W	11236	750-61R100 OHM
A2R412	311-2287-00	670-9384-00	670-9384-00	RES,VAR,NONWWW:PNL,20K OHM,10%,0.5W	12697	CM45210
A2R412	311-2540-00	670-9384-01		RES,VAR,PNL:CP,20K OHM,20%,0.5W,LINEAR,W/ GROUNDING LUG,0.5 IN DIA	12697	311-2540-00
A2R412	311-2287-00	670-9528-00	670-9528-00	RES,VAR,NONWWW:PNL,20K OHM,10%,0.5W	12697	CM45210

## Replaceable Electrical Parts

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A2R412	311-2540-00	670-9528-01		RES,VAR,PNL:CP,20K OHM,20%,0.5W,LINEAR,W/ GROUNDING LUG,0.5 IN DIA *ATTACHED PARTS*	12697	311-2540-00
	366-1701-01			KNOB:GY,0.127 ID X 0.392 OD X 0.4 H	80009	366170101
	214-4725-00	670-9384-01		SPRING:COMPRESSION SPRING,0.026,302 STAINLESS STEEL,0.313,+/-,0.0A0	8X345	214-4725-00
	214-4725-00	670-9528-01		SPRING:COMPRESSION SPRING,0.026,302 STAINLESS STEEL,0.313,+/-,0.0A0 *END ATTACHED PARTS*	8X345	214-4725-00
A2R429	311-2287-00	670-9384-00	670-9384-00	RES,VAR,NONWW:P NL,20K OHM,10%,0.5W	12697	CM45210
A2R429	311-2540-00	670-9384-01		RES,VAR,PNL:CP,20K OHM,20%,0.5W,LINEAR,W/ GROUNDING LUG,0.5 IN DIA	12697	311-2540-00
A2R429	311-2287-00	670-9528-00	670-9528-00	RES,VAR,NONWW:P NL,20K OHM,10%,0.5W	12697	CM45210
A2R429	311-2540-00	670-9528-01		RES,VAR,PNL:CP,20K OHM,20%,0.5W,LINEAR,W/ GROUNDING LUG,0.5 IN DIA *ATTACHED PARTS*	12697	311-2540-00
	366-1701-01			KNOB:GY,0.127 ID X 0.392 OD X 0.4 H	80009	366170101
	214-4725-00	670-9384-01		SPRING:COMPRESSION SPRING,0.026,302 STAINLESS STEEL,0.313,+/-,0.0A0	8X345	214-4725-00
	214-4725-00	670-9528-01		SPRING:COMPRESSION SPRING,0.026,302 STAINLESS STEEL,0.313,+/-,0.0A0 *END ATTACHED PARTS*	8X345	214-4725-00
A2R443	311-2287-00	670-9384-00	670-9384-00	RES,VAR,NONWW:P NL,20K OHM,10%,0.5W	12697	CM45210
A2R443	311-2540-00	670-9384-01		RES,VAR,PNL:CP,20K OHM,20%,0.5W,LINEAR,W/ GROUNDING LUG,0.5 IN DIA	12697	311-2540-00
A2R443	311-2287-00	670-9528-00	670-9528-00	RES,VAR,NONWW:P NL,20K OHM,10%,0.5W	12697	CM45210
A2R443	311-2540-00	670-9528-01		RES,VAR,PNL:CP,20K OHM,20%,0.5W,LINEAR,W/ GROUNDING LUG,0.5 IN DIA *ATTACHED PARTS*	12697	311-2540-00
	366-1701-01			KNOB:GY,0.127 ID X 0.392 OD X 0.4 H	80009	366170101
	214-4725-00	670-9384-01		SPRING:COMPRESSION SPRING,0.026,302 STAINLESS STEEL,0.313,+/-,0.0A0	8X345	214-4725-00
	214-4725-00	670-9528-01		SPRING:COMPRESSION SPRING,0.026,302 STAINLESS STEEL,0.313,+/-,0.0A0 *END ATTACHED PARTS*	8X345	214-4725-00
A2S108	260-2300-00			SWITCH,SIG:SPST;PUSH,MOM,NO,W/GROUND TERM, MANUAL INSERTION,100 GRAMS,SILVER,SEALED *ATTACHED PARTS*	34361	B3F1152
	366-0616-00			PUSH BUTTON:0.585 X 0.3 X 0.150 *END ATTACHED PARTS*	7X318	ORDER BY DESC
A2S125	260-2300-00			SWITCH,SIG:SPST;PUSH,MOM,NO,W/GROUND TERM, MANUAL INSERTION,100 GRAMS,SILVER,SEALED *ATTACHED PARTS*	34361	B3F1152
	366-0616-00			PUSH BUTTON:0.585 X 0.3 X 0.150 *END ATTACHED PARTS*	7X318	ORDER BY DESC
A2S142	260-2300-00			SWITCH,SIG:SPST;PUSH,MOM,NO,W/GROUND TERM, MANUAL INSERTION,100 GRAMS,SILVER,SEALED *ATTACHED PARTS*	34361	B3F1152
	366-0616-00			PUSH BUTTON:0.585 X 0.3 X 0.150 *END ATTACHED PARTS*	7X318	ORDER BY DESC
A2S222	260-2300-00			SWITCH,SIG:SPST;PUSH,MOM,NO,W/GROUND TERM, MANUAL INSERTION,100 GRAMS,SILVER,SEALED *ATTACHED PARTS*	34361	B3F1152
	366-0616-00			PUSH BUTTON:0.585 X 0.3 X 0.150 *END ATTACHED PARTS*	7X318	ORDER BY DESC

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A2S243	260-2300-00			SWITCH,SIG:SPST;PUSH,MOM,NO,W/GROUND TERM, MANUAL INSERTION,100 GRAMS,SILVER,SEALED *ATTACHED PARTS*	34361	B3F1152
	366-0616-00			PUSH BUTTON:0.585 X 0.3 X 0.150 *END ATTACHED PARTS*	7X318	ORDER BY DESC
A2S317	260-2300-00			SWITCH,SIG:SPST;PUSH,MOM,NO,W/GROUND TERM, MANUAL INSERTION,100 GRAMS,SILVER,SEALED (1721 ONLY) *ATTACHED PARTS*	34361	B3F1152
	366-0616-00			PUSH BUTTON:0.585 X 0.3 X 0.150 *END ATTACHED PARTS*	7X318	ORDER BY DESC
A2S518	260-2300-00			SWITCH,SIG:SPST;PUSH,MOM,NO,W/GROUND TERM, MANUAL INSERTION,100 GRAMS,SILVER,SEALED *ATTACHED PARTS*	34361	B3F1152
	366-0616-00			PUSH BUTTON:0.585 X 0.3 X 0.150 *END ATTACHED PARTS*	7X318	ORDER BY DESC
A3	672-1227-07	B050000	B059999	CIRCUIT BD ASSY:MAIN	80009	672122707
A3	672-1227-09	B060000	B065974	CIRCUIT BD ASSY:MAIN	80009	672122709
A3	672-1227-10	B065975	B068300	CIRCUIT BD ASSY:MAIN	80009	672122710
A3	672-1227-12	B068301		CIRCUIT BD ASSY:MAIN (1720 ONLY)	80009	672122712
A3	672-1228-08	B050000	B059999	CIRCUIT BD ASSY:MAIN	80009	672122808
A3	672-1228-09	B060000	B066272	CIRCUIT BD ASSY:MAIN	80009	672122809
A3	672-1228-10	B066273	B077736	CIRCUIT BD ASSY:MAIN	80009	672122810
A3	672-1228-12	B077737		CIRCUIT BD ASSY:MAIN (1721 ONLY)	80009	672122812
A3	672-0224-07	B050000	B059999	CIRCUIT BD ASSY:MAIN	80009	672022407
A3	672-0224-08	B060000	B066272	CIRCUIT BD ASSY:MAIN	80009	672022408
A3	672-0224-09	B066273	B077736	CIRCUIT BD ASSY:MAIN	80009	672022409
A3	672-0224-11	B077737		CIRCUIT BD ASSY:MAIN (1721PM ONLY)	80009	672022411
A3	672-1433-04	B050000	B059999	CIRCUIT BD ASSY:MAIN	80009	672143304
A3	672-1433-05	B060000	B066272	CIRCUIT BD ASSY:MAIN	80009	672143305
A3	672-1433-06	B066273	B077736	CIRCUIT BD ASSY:MAIN	80009	672143306
A3	672-1433-08	B077737		CIRCUIT BD ASSY:MAIN (1721PN ONLY) *ATTACHED PARTS*	80009	672143309
	337-0607-00			PLATE,ELEC SHLD:CIRCUIT BOARD (QUANTITY 2) *END ATTACHED PARTS*	0J260	337-0607-00
A3C134	281-0826-00			CAP,FXD,CERAMIC:MLC;2200PF,10%,100V,0.100 X	TK1743	CGB222KEX
A3C147	290-0770-01			CAP,FXD,ALUM:100UF,20%,63V,ESR=1.33 OHM (120HZ,20C),10 X 12MM,LS=5MM	55680	UVX1J101MPA1TD
A3C156	290-0974-03			CAP,FXD,ELCTL:10UF,20%,60VDC	55680	UVX1H100MAA1TD
A3C157	290-0974-03			CAP,FXD,ELCTL:10UF,20%,60VDC	55680	UVX1H100MAA1TD
A3C161	290-0974-03			CAP,FXD,ELCTL:10UF,20%,60VDC	55680	UVX1H100MAA1TD
A3C166	290-0974-03			CAP,FXD,ELCTL:10UF,20%,60VDC	55680	UVX1H100MAA1TD
A3C167	290-0974-00			CAP,FXD,ALUM:10UF,20%,50V,ESR=16.58 OHM (120HZ,20C)	55680	UVX1H100MAA
A3C169	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C183	283-0638-00	672-1227-07		CAP,FXD,MICA DI:130PF,1%,500V	TK0891	RDM15FD131F03
A3C183	283-0674-00	672-1228-08		CAP,FXD,MICA DI:85PF,1%,500V	TK0891	RDM15FD850F03
A3C183	283-0638-00	672-0224-07		CAP,FXD,MICA DI:130PF,1%,500V	TK0891	RDM15FD131F03
A3C188	281-0765-00			CAP,FXD,CER DI:100PF,5%,100V	04222	SA102A101JAA
A3C189	283-0648-01			CAP,FXD,MICA DI:10PF,5%,500V,TAPED & REELED	TK0891	RDM15CD100D03

## Replaceable Electrical Parts

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A3C198	281-0302-00			CAP,VAR,PLASTIC:1.2-4PF,100V	52769	GSX367
A3C199	290-0848-00			CAP,FXD,ALUM:47UF,20%,16V,ESR=7.05 OHM (120HZ,25C),10X12MM,RADIAL	0H1N5	CEBPM1E470M
A3C211	281-0775-01	672-1227-07	672-1227-07	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C211	283-0177-00	672-1227-09		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C211	281-0775-01	672-1228-08	672-1228-08	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C211	283-0177-00	672-1228-09		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C211	281-0775-01	672-0224-07	672-0224-07	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C211	283-0177-00	672-0224-08		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C211	281-0775-01	672-1433-04	672-1433-04	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C211	283-0177-00	672-1433-05		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C213	281-0775-01	672-1227-07	672-1227-07	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C213	283-0177-00	672-1227-09		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C213	281-0775-01	672-1228-08	672-1228-08	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C213	283-0177-00	672-1228-09		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C213	281-0775-01	672-0224-07	672-0224-07	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C213	283-0177-00	672-0224-08		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C213	281-0775-01	672-1433-04	672-1433-04	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C213	283-0177-00	672-1433-05		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C219	281-0775-01	672-1227-07	672-1227-07	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C219	283-0177-00	672-1227-09		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C219	281-0775-01	672-1228-08	672-1228-08	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C219	283-0177-00	672-1228-09		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C219	281-0775-01	672-0224-07	672-0224-07	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C219	283-0177-00	672-0224-08		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C219	281-0775-01	672-1433-04	672-1433-04	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C219	283-0177-00	672-1433-05		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C222	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C223	281-0862-00			CAP,FXD,CER:MLC;1000PF,20%,100V,X7R,0.100 X 0.170	04222	SA101C102MAA
A3C234	283-0597-00			CAP,FXD,MICA DI:470PF,10%,300V	TK0891	RDM15FD471K03
A3C235	281-0167-00			CAP,VAR,CER DI:9-45PF,200V	33095	53-717-001 D9-4
A3C236	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C237	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C239	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C246	281-0862-00			CAP,FXD,CER:MLC;1000PF,20%,100V,X7R,0.100 X 0.170	04222	SA101C102MAA
A3C250	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C251	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C256	281-0773-00			CAP,FXD,CERAMIC:MLC;0.01UF,10%,100V	TK1743	CGB103KEX
A3C257	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C278	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C290	281-0756-00			CAP,FXD,CER:MLC;2.2PF,+/-0.5PF,200V,NPO,0.100 X 0.170	04222	SA102A2R2DAA
A3C328	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C333	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C336	283-0698-00	672-1227-07		CAP,FXD,MICA DI:390PF,1%,500V	TK0891	RDM15FD391F03
A3C336	283-0598-00	672-1228-08		CAP,FXD,MICA DI:253PF,5%,500V	TK0891	RDM15FD2530J03
A3C336	283-0698-00	672-0224-07		CAP,FXD,MICA DI:390PF,1%,500V	TK0891	RDM15FD391F03
A3C337	283-0638-00	672-1227-07		CAP,FXD,MICA DI:130PF,1%,500V	TK0891	RDM15FD131F03
A3C337	283-0674-00	672-1228-08		CAP,FXD,MICA DI:85PF,1%,500V	TK0891	RDM15FD850F03
A3C337	283-0638-00	672-0224-07		CAP,FXD,MICA DI:130PF,1%,500V	TK0891	RDM15FD131F03
A3C339	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C344	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C346	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C347	281-0862-00			CAP,FXD,CER:MLC;1000PF,20%,100V,X7R,0.100 X 0.170	04222	SA101C102MAA
A3C348	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C349	290-0943-02	672-1227-07		CAP,FXD,ELCTLT:47UF,20%,25VTAPED & REELED	55680	UVX1E470MDA1TD

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A3C349	290-0943-02	672-1228-08		CAP,FXD,ELCTL:47UF,20%,25VTAPED & REELED	55680	UVX1E470MDA1TD
A3C349	290-0943-02	672-0224-07		CAP,FXD,ELCTL:47UF,20%,25VTAPED & REELED	55680	UVX1E470MDA1TD
A3C352	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C353	283-0638-00	672-1227-07		CAP,FXD,MICA DI:130PF,1%,500V	TK0891	RDM15FD131F03
A3C353	283-0674-00	672-1228-08		CAP,FXD,MICA DI:85PF,1%,500V	TK0891	RDM15FD850F03
A3C353	283-0638-00	672-0224-07		CAP,FXD,MICA DI:130PF,1%,500V	TK0891	RDM15FD131F03
A3C356	281-0773-00			CAP,FXD,CERAMIC:MLC;0.01UF,10%,100V	TK1743	CGB103KEX
A3C361	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C362	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C363	290-0943-02			CAP,FXD,ELCTL:47UF,20%,25VTAPED & REELED	55680	UVX1E470MDA1TD
A3C368	283-0725-01			CAP,FXD,MICA DI:214PF,1%,500V,TAPE & AMMO PACK	09023	CDA15FD(214)F03
A3C370	283-0677-01			CAP,FXD,MICA DI:82PF,1%,500V,TAPE & AMMO PACK	09023	CDA15ED820F03
A3C372	290-0943-02			CAP,FXD,ELCTL:47UF,20%,25VTAPED & REELED	55680	UVX1E470MDA1TD
A3C374	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C376	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C380	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C381	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C388	290-0746-00			CAP,FXD,ALUM:47UF,+50%-20%,16V,0.562 X0.351	55680	UVX1J470MPA
A3C389	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C394	281-0765-00			CAP,FXD,CER DI:100PF,5%,100V	04222	SA102A101JAA
A3C405	281-0775-01	672-1227-07	672-1227-07	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C405	283-0177-00	672-1227-09		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C405	281-0775-01	672-1228-08	672-1228-08	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C405	283-0177-00	672-1228-09		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C405	281-0775-01	672-0224-07	672-0224-07	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C405	283-0177-00	672-0224-08		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C405	281-0775-01	672-1433-04	672-1433-04	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C405	283-0177-00	672-1433-05		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C428	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C432	281-0862-00			CAP,FXD,CER:MLC;1000PF,20%,100V,X7R,0.100 X 0.170	04222	SA101C102MAA
A3C437	283-0790-00	672-1227-07		CAP,FXD,MICA DI:850PF,1%,500V	TK0891	RDM19FD851F03
A3C437	283-0689-00	672-1228-08		CAP,FXD,MICA DI:550PF,1%,300V	TK0891	RDM15FC551F03
A3C437	283-0790-00	672-0224-07		CAP,FXD,MICA DI:850PF,1%,500V	TK0891	RDM19FD851F03
A3C438	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C446	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C448	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C451	283-0633-00	672-1227-07		CAP,FXD,MICA DI:77PF,1%,100V	TK0891	RDM15ED770F03
A3C451	283-0636-00	672-1228-08		CAP,FXD,MICA DI:36PF,2%,500V,0.370 X 0.460;RADIAL	TK0891	RDM15ED360G03
A3C451	283-0633-00	672-0224-07		CAP,FXD,MICA DI:77PF,1%,100V	TK0891	RDM15ED770F03
A3C452	281-0826-00			CAP,FXD,CERAMIC:MLC;2200PF,10%,100V,0.100 X	TK1743	CGB222KEX
A3C453	281-0158-00			CAP,VAR,CER DI:7-45PF,100VWDC SUBMIN CER DISC TOP ADJ	59660	518-006 G 7-45
A3C457	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C461	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C468	283-0644-01			CAP,FXD,MICA DI:150PF,1%,500VTAPE & AMMO PACK	TK0891	ADVISE
A3C484	281-0184-00			CAP,VAR,PLASTIC:2-18PF,500VDC	TK1727	2222-809-05003
A3C492	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C497	290-0848-00			CAP,FXD,ALUM:47UF,20%,16V,ESR=7.05 OHM (120HZ,25C),10X12MM,RADIAL	0H1N5	CEBPM1E470M
A3C505	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C508	290-0748-00			CAP,FXD,ELCTL:10UF,+50-20%,25WVDC	0H1N5	CEUST1E100
A3C512	281-0775-01	672-1227-07	672-1227-07	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C512	283-0177-00	672-1227-09		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C512	281-0775-01	672-1228-08	672-1228-08	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C512	283-0177-00	672-1228-09		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA

## Replaceable Electrical Parts

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A3C512	281-0775-01	672-0224-07	672-0224-07	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C512	283-0177-00	672-0224-08		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C512	281-0775-01	672-1433-04	672-1433-04	CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C512	283-0177-00	672-1433-05		CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A3C513	290-0948-00			CAP,FXD,ELCTLT:3.3UF,20%,200V	80009	290094800
A3C520	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C523	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C532	281-0826-00			CAP,FXD,CERAMIC:MLC;2200PF,10%,100V,0.100 X	TK1743	CGB222KEX
A3C534	283-0628-01			CAP,FXD,MICA DI:410PF,1%,500VTAPE & AMMO PACK	09023	CDA15FD411F03
A3C536	283-0628-01			CAP,FXD,MICA DI:410PF,1%,500VTAPE & AMMO PACK	09023	CDA15FD411F03
A3C540	283-0645-01			CAP,FXD,MICA DI:790PF,1%,300V,TAPE & AMMO PACK	09023	CDA15FC791F03
A3C543	283-0645-01			CAP,FXD,MICA DI:790PF,1%,300V,TAPE & AMMO PACK	09023	CDA15FC791F03
A3C548	283-0796-00	672-1227-07		CAP,FXD,MICA DI:100PF,5%,500V	TK0974	DM10E101J5
A3C548	283-0639-00	672-1228-08		CAP,FXD,MICA DI:56PF,1%,500V	TK0891	RDM15ED560F03
A3C548	283-0796-00	672-0224-07		CAP,FXD,MICA DI:100PF,5%,500V	TK0974	DM10E101J5
A3C554	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C555	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C562	283-0644-01			CAP,FXD,MICA DI:150PF,1%,500VTAPE & AMMO PACK	TK0891	ADVISE
A3C576	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C591	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C592	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C593	290-0746-00			CAP,FXD,ALUM:47UF,+50%-20%,16V,0.562 X0.351	55680	UVX1J470MPA
A3C596	281-0756-00			CAP,FXD,CER:MLC;2.2PF,+/-0.5PF,200V,NPO,0.100 X 0.170	04222	SA102A2R2DAA
A3C616	290-0183-00			CAP,FXD,TANT:DRY;1UF,10%,35V,TANT OXIDE,0.151 X 0.317	12954	AT513A105K035N
A3C632	283-0027-02			CAP,FXD,CER DI:0.02UF,20%,50V	04222	SR595C203MAAAP1
A3C637	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C640	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C641	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C644	281-0862-00			CAP,FXD,CER:MLC;1000PF,20%,100V,X7R,0.100 X 0.170	04222	SA101C102MAA
A3C645	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C650	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C661	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C662	283-0644-01			CAP,FXD,MICA DI:150PF,1%,500VTAPE & AMMO PACK	TK0891	ADVISE
A3C664	283-0677-01			CAP,FXD,MICA DI:82PF,1%,500V,TAPE & AMMO PACK	09023	CDA15ED820F03
A3C665	283-0644-01			CAP,FXD,MICA DI:150PF,1%,500VTAPE & AMMO PACK	TK0891	ADVISE
A3C669	283-0725-01			CAP,FXD,MICA DI:214PF,1%,500V,TAPE & AMMO PACK	09023	CDA15FD(214)F03
A3C672	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C675	281-0762-00			CAP,FXD,CERAMIC:MLC;27PF,10%,100V,NPO,0.100	04222	SA102A270KAA
A3C684	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C685	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A3C686	283-0058-02			CAP,FXD,CER DI:0.027UF,10%,100V	04222	SR591C273KAAAP1
A3C709	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C718	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C732	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A3C733	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A3C734	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C737	283-0027-02			CAP,FXD,CER DI:0.02UF,20%,50V	04222	SR595C203MAAAP1
A3C738	283-0027-02			CAP,FXD,CER DI:0.02UF,20%,50V	04222	SR595C203MAAAP1
A3C741	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C743	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C748	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C750	281-0773-00			CAP,FXD,CERAMIC:MLC;0.01UF,10%,100V	TK1743	CGB103KEX
A3C751	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C752	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A3C761	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C764	290-0943-02			CAP,FXD,ELCTLT:47UF,20%,25VTAPED & REELED	55680	UVX1E470MDA1TD
A3C769	290-0943-02			CAP,FXD,ELCTLT:47UF,20%,25VTAPED & REELED	55680	UVX1E470MDA1TD
A3C776	281-0862-00			CAP,FXD,CERAMIC:MLC;1000PF,20%,100V,X7R,0.100 X 0.170	04222	SA101C102MAA
A3C777	281-0765-00			CAP,FXD,CER DI:100PF,5%,100V	04222	SA102A101JAA
A3C781	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C787	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C788	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C791	283-0638-00	672-1227-07		CAP,FXD,MICA DI:130PF,1%,500V	TK0891	RDM15FD131F03
A3C791	283-0674-00	672-1228-08		CAP,FXD,MICA DI:85PF,1%,500V	TK0891	RDM15FD850F03
A3C791	283-0638-00	672-0224-07		CAP,FXD,MICA DI:130PF,1%,500V	TK0891	RDM15FD131F03
A3C805	281-0819-00			CAP,FXD,CERAMIC:MLC;33 PF,5%,50V,0.100 X 0.170	04222	SA102A330JAA
A3C806	281-0819-00			CAP,FXD,CERAMIC:MLC;33 PF,5%,50V,0.100 X 0.170	04222	SA102A330JAA
A3C824	283-0788-01			CAP,FXD,MICA DI:267PF,1%,500V,TAPE & AMMO PACK	09023	CDA15FD(267)F03
A3C826	283-0796-01			CAP,FXD,MICA DI:100PF,5%,500V,TAPE & AMMO	09023	CDA10FD101J03
A3C832	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C836	283-0027-02			CAP,FXD,CER DI:0.02UF,20%,50V	04222	SR595C203MAAAP1
A3C838	281-0765-00			CAP,FXD,CER DI:100PF,5%,100V	04222	SA102A101JAA
A3C842	290-0974-03			CAP,FXD,ELCTLT:10UF,20%,60VDC	55680	UVX1H100MAA1TD
A3C844	290-0974-03			CAP,FXD,ELCTLT:10UF,20%,60VDC	55680	UVX1H100MAA1TD
A3C854	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C855	281-0862-00			CAP,FXD,CER:MCL;1000PF,20%,100V,X7R,0.100 X 0.170	04222	SA101C102MAA
A3C856	281-0759-00			CAP,FXD,CERAMIC:MLC;22PF,10%,100V,0.100 X 0.170	04222	SA102A220KAA
A3C872	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C873	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C881	283-0051-02			CAP,FXD,CER DI:0.0033UF,5%,100V,SQUARE,MI	TK2058	FK22COG2A332J-T
A3C885	283-0698-01			CAP,FXD,MICA DI:390PF,1%,500V,TAPE & AMMO PACK	09023	CDA15FD391F03
A3C898	290-0848-00			CAP,FXD,ALUM:47UF,20%,16V,ESR=7.05 OHM (120HZ,25C),10X12MM,RADIAL	0H1N5	CEBPM1E470M
A3C937	281-0765-00			CAP,FXD,CER DI:100PF,5%,100V	04222	SA102A101JAA
A3C938	281-0765-00			CAP,FXD,CER DI:100PF,5%,100V	04222	SA102A101JAA
A3C939	281-0765-00			CAP,FXD,CER DI:100PF,5%,100V	04222	SA102A101JAA
A3C940	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C946	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C949	281-0862-00			CAP,FXD,CER:MCL;1000PF,20%,100V,X7R,0.100 X 0.170	04222	SA101C102MAA
A3C952	281-0862-00			CAP,FXD,CER:MCL;1000PF,20%,100V,X7R,0.100 X 0.170	04222	SA101C102MAA
A3C971	281-0763-00			CAP,FXD,CER:MCL;47PF,10%,100V,0.100 X 0.170	04222	SA102A470KAA
A3C974	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C975	281-0861-00			CAP,FXD,CER DI:270PF,5%,50V	04222	SA101A271JAA
A3C976	281-0861-00			CAP,FXD,CER DI:270PF,5%,50V	04222	SA101A271JAA
A3C982	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C984	283-0785-01			CAP,FXD,MICA DI:250PF,1%,500V,TAPE & AMMO PACK	09023	CDA15FD251F03
A3C985	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A3C991	281-0765-00			CAP,FXD,CER DI:100PF,5%,100V	04222	SA102A101JAA
A3C992	281-0756-00			CAP,FXD,CER:MCL;2.2PF,+/-0.5PF,200V,NPO,0.100 X 0.170	04222	SA102A2R2DAA
A3C994	281-0756-00			CAP,FXD,CER:MCL;2.2PF,+/-0.5PF,200V,NPO,0.100 X 0.170	04222	SA102A2R2DAA
A3C995	283-0175-00	672-1227-10		CAP,FXD,CER:MCL;10PF,+/-5%,200V,SQ	04222	SA102A2R2DAA
A3C995	283-0175-00	672-1228-10		CAP,FXD,CER:MCL;10PF,+/-5%,200V,SQ	04222	SA102A2R2DAA
A3C995	283-0175-00	672-0224-09		CAP,FXD,CER:MCL;10PF,+/-5%,200V,SQ	04222	SA102A2R2DAA
A3CR137	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR152	152-0400-00			DIODE,RECT:FAST RCVRY;400V,1A,200NS	0LUA3	1N4936
A3CR157	152-0066-00			DIODE,RECT:400V,1A,IFSM=30A,1.2VF,2US	0LUA3	1N5060
A3CR162	152-0066-00			DIODE,RECT:400V,1A,IFSM=30A,1.2VF,2US	0LUA3	1N5060
A3CR166	152-0066-00			DIODE,RECT:400V,1A,IFSM=30A,1.2VF,2US	0LUA3	1N5060

## Replaceable Electrical Parts

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A3CR167	152-0066-00			DIODE,RECT:400V,1A,IFSM=30A,1.2VF,2US	0LUA3	1N5060
A3CR235	152-0269-01			DIODE,SIG:VVC;C4=33PF,5%,C4/C20=2	04713	SMV1263-1
A3CR236	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR242	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR248	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR297	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR357	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR358	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR428	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR438	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR474	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR476	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR484	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR486	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR496	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR518	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR519	152-0400-00			DIODE,RECT:FAST RCVR;400V,1A,200NS	0LUA3	1N4936
A3CR522	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR536	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR540	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR632	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR639	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR680	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR681	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR682	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR751	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR752	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR776	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR781	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR837	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR876	152-0141-02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3J153	175-9797-00			CA ASSY,SP:FLAT FLEX;FLX,10,27 AWG,2.5 L,1X10,BOX X STR,SLDR TAB,CONN NON PLZ	TK2469	175-9797-00
A3J216	131-3571-00			CONN,HDR::PCB;MALE,RTANG,2 X 17,0.1CTR,0.350 H X 0.120 TAIL,SHRD/4 SIDES,CTR PLZ,30 GOLD	TK1462	FAP-34-08-2-OAS
A3J245	131-4794-00			CONN,HDR:PCB;MALE,STR,1 X 2,0.1 CTR,0.235MLG X 0.112 TAIL,30GOLD,0.035 DIA PCB,SAFETY CONTROLLED	53387	2402-6112 UB
A3J428	131-0590-00			TERMINAL,PIN:PCB;MALE,STR,0.710 L,0.025 SQ,PHOS BRZ,50 GOLD	22526	47790-000
A3J696	131-4530-00			CONN,HDR:PCB;MALE,STR,1 X 3,0.1 CTR,0.230 MLG X 0.120 TAIL,30GOLD,BD RETENTION	00779	104344-1
A3J796	131-4530-00			CONN,HDR:PCB;MALE,STR,1 X 3,0.1 CTR,0.230 MLG X 0.120 TAIL,30GOLD,BD RETENTION	00779	104344-1
A3J915	131-4794-00			CONN,HDR:PCB;MALE,STR,1 X 2,0.1 CTR,0.235MLG X 0.112 TAIL,30GOLD,0.035 DIA PCB,SAFETY CONTROLLED	53387	2402-6112 UB
A3J916	131-4794-00			CONN,HDR:PCB;MALE,STR,1 X 2,0.1 CTR,0.235MLG X 0.112 TAIL,30GOLD,0.035 DIA PCB,SAFETY CONTROLLED	53387	2402-6112 UB
A3J917	131-4794-00			CONN,HDR:PCB;MALE,STR,1 X 2,0.1 CTR,0.235MLG X 0.112 TAIL,30GOLD,0.035 DIA PCB,SAFETY CONTROLLED	53387	2402-6112 UB
A3J920	131-4794-00			CONN,HDR:PCB;MALE,STR,1 X 2,0.1 CTR,0.235MLG X 0.112 TAIL,30GOLD,0.035 DIA PCB,SAFETY CONTROLLED	53387	2402-6112 UB
A3J921	131-4794-00			CONN,HDR:PCB;MALE,STR,1 X 2,0.1 CTR,0.235MLG X 0.112 TAIL,30GOLD,0.035 DIA PCB,SAFETY CONTROLLED	53387	2402-6112 UB
A3J933	131-3528-00			CONN,HDR::PCB;MALE,RTANG,2 X 12,0.1CTR,0.350 H X 0.112 TAIL,SHRD/4 SIDES,0.350 LONG,W/O LATCHES	56501	609-2407



Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A3L146	108-1262-00			INDUCTOR,FXD:POWER;100UH,10%,I<0.75A,RDC<0.23 OHM,Q>15,SRF>5.4MHZ,BOBBIN CORE	TK2058	TSL0807-101KR75
A3L185	108-0317-00			INDUCTOR,FXD:CUSTOM,PWR;15UH,10%,IDC<460MA,RDC<1.2 OHM,Q>55@2.5MHZ,SRF>30 MHZ,PWDRD IRON	0JR03	108-0317-00
A3L337	108-0317-00			INDUCTOR,FXD:CUSTOM,PWR;15UH,10%,IDC<460MA,RDC<1.2 OHM,Q>55@2.5MHZ,SRF>30 MHZ,PWDRD IRON	0JR03	108-0317-00
A3L353	108-0317-00			INDUCTOR,FXD:CUSTOM,PWR;15UH,10%,IDC<460MA,RDC<1.2 OHM,Q>55@2.5MHZ,SRF>30 MHZ,PWDRD IRON	0JR03	108-0317-00
A3L433	108-1344-00			INDUCTOR,FXD:POWER;3.9UH,10%,I<0.555A,RDC<0.32 OHM,Q>45,SRF>65MHZ	TK2058	SP0305-3R9K-2
A3L437	108-0317-00			INDUCTOR,FXD:CUSTOM,PWR;15UH,10%,IDC<460MA,RDC<1.2 OHM,Q>55@2.5MHZ,SRF>30 MHZ,PWDRD IRON	0JR03	108-0317-00
A3L451	108-0317-00			INDUCTOR,FXD:CUSTOM,PWR;15UH,10%,IDC<460MA,RDC<1.2 OHM,Q>55@2.5MHZ,SRF>30 MHZ,PWDRD IRON	0JR03	108-0317-00
A3L533	108-0317-00			INDUCTOR,FXD:CUSTOM,PWR;15UH,10%,IDC<460MA,RDC<1.2 OHM,Q>55@2.5MHZ,SRF>30 MHZ,PWDRD IRON	0JR03	108-0317-00
A3L642	108-1343-00			INDUCTOR,FXD:POWER;100UH,10%,I<0.165A,RDC<3.5 OHM,Q>60,SRF>5.5MHZ	TK2058	SP0305-101K
A3L750	108-0317-00			INDUCTOR,FXD:CUSTOM,PWR;15UH,10%,IDC<460MA,RDC<1.2 OHM,Q>55@2.5MHZ,SRF>30 MHZ,PWDRD IRON	0JR03	108-0317-00
A3L791	108-0317-00			INDUCTOR,FXD:CUSTOM,POWER;15UH,10%,IDC<460MA,RDC<1.2 OHM,Q>55@2.5MHZ,SRF>30 MHZ,PWDRD IRON	0JR03	108-0317-00
A3L845	108-1343-00			INDUCTOR,FXD:POWER;100UH,10%,I<0.165A,RDC<3.5 OHM,Q>60,SRF>5.5MHZ	TK2058	SP0305-101K
A3P245	131-0993-00			CONN,BOX:SHUNT;FEMALE,STR,1 X 2,0.1 CTR,0.385 H,30 GOLD,BLACK,JUMPER	22526	65474-006
A3P696	131-0993-00			CONN,BOX:SHUNT;FEMALE,STR,1 X 2,0.1 CTR,0.385 H,30 GOLD,BLACK,JUMPER	22526	65474-006
A3P796	131-0993-00			CONN,BOX:SHUNT;FEMALE,STR,1 X 2,0.1 CTR,0.385 H,30 GOLD,BLACK,JUMPER	22526	65474-006
A3P915	131-0993-00			CONN,BOX:SHUNT;FEMALE,STR,1 X 2,0.1 CTR,0.385 H,30 GOLD,BLACK,JUMPER	22526	65474-006
A3P916	131-0993-00			CONN,BOX:SHUNT;FEMALE,STR,1 X 2,0.1 CTR,0.385 H,30 GOLD,BLACK,JUMPER	22526	65474-006
A3P917	131-0993-00			CONN,BOX:SHUNT;FEMALE,STR,1 X 2,0.1 CTR,0.385 H,30 GOLD,BLACK,JUMPER	22526	65474-006
A3P920	131-0993-00			CONN,BOX:SHUNT;FEMALE,STR,1 X 2,0.1 CTR,0.385 H,30 GOLD,BLACK,JUMPER	22526	65474-006
A3P921	131-0993-00			CONN,BOX:SHUNT;FEMALE,STR,1 X 2,0.1 CTR,0.385 H,30 GOLD,BLACK,JUMPER	22526	65474-006
A3Q192	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q222	151-0198-00			TRANSISTOR,SIG:BIPOLAR,NPN;15V,50MA,600 MHZ,AMPL	04713	MPS918
A3Q241	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q246	151-0710-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,1.0A,50MHZ,AMPL	04713	MPSW01A
A3Q248	151-0223-00			TRANSISTOR,SIG:BIPOLAR,NPN;15V,500MA,SWITCHING	04713	MPS2369A
A3Q254	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q256	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q292	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q293	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q296	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q297	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q328	151-0198-00			TRANSISTOR,SIG:BIPOLAR,NPN;15V,50MA,600 MHZ,AMPL	04713	MPS918
A3Q333	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q334	151-0342-00			TRANSISTOR,SIG:BIPOLAR,PNP;60V,50MA,40MHZ,AMPL	04713	MPS4249
A3Q342	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q343	151-0223-00			TRANSISTOR,SIG:BIPOLAR,NPN;15V,500MA,SWITCHING	04713	MPS2369A
A3Q353	151-0223-00			TRANSISTOR,SIG:BIPOLAR,NPN;15V,500MA,SWITCHING	04713	MPS2369A

## Replaceable Electrical Parts

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A3Q362	151-1025-00			TRANSISTOR,SIG:JFET,N-CH;6V,15MA,4.5MS,AMPLIFIER	17856	J304
A3Q371	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q372	151-0195-00			TRANSISTOR,SIG:BIPOLAR,NPN;20V,100MA,150MHZ,AMPL	04713	MPS6521
A3Q385	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q391	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q424	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q434	151-0195-02			TRANSISTOR,SIG:BIPOLAR,NPN;25V,100MA,200MHZ,AMPL	04713	MPS6521
A3Q474	151-0195-02			TRANSISTOR,SIG:BIPOLAR,NPN;20V,100MA,150MHZ,AMPL	0JR04	2N3904
A3Q480	151-0347-00			TRANSISTOR,SIG:BIPOLAR,NPN;160V,600MA,100MHZ	0JR04	2N5551
A3Q481	151-0347-00			TRANSISTOR,SIG:BIPOLAR,NPN;160V,600MA,100MHZ	0JR04	2N5551
A3Q490	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q493	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q532	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q540	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q541	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q552	151-0223-07			XSTR,SIG:BIPOLAR,NPN;15V,500MA,SWITCHING	27014	PN2369A
A3Q564	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q570	151-0195-02			TRANSISTOR,SIG:BIPOLAR,NPN;25V,100MA,200MHZ,AMPL	04713	MPS6521
A3Q571	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q576	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q580	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q581	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q632	151-0223-00			TRANSISTOR,SIG:BIPOLAR,NPN;15V,500MA,SWITCHING	04713	MPS2369A
A3Q666	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q670	151-0195-00			TRANSISTOR,SIG:BIPOLAR,NPN;20V,100MA,150MHZ,AMPL	04713	MPS6521
A3Q671	151-0195-02			TRANSISTOR,SIG:BIPOLAR,NPN;20V,100MA,150MHZ,AMPL	04713	MPS6521
A3Q672	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q680	151-0195-02			TRANSISTOR,SIG:BIPOLAR,NPN;20V,100MA,150MHZ,AMPL	0JR04	2N3904
A3Q685	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q687	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q688	151-0195-02			TRANSISTOR,SIG:BIPOLAR,NPN;25V,100MA,200MHZ,AMPL	04713	MPS6521
A3Q693	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q732	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q733	151-0223-00			TRANSISTOR,SIG:BIPOLAR,NPN;15V,500MA,SWITCHING	04713	MPS2369A
A3Q761	151-1025-00			TRANSISTOR,SIG:JFET,N-CH;6V,15MA,4.5MS,AMPLIFIER	17856	J304
A3Q764	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q780	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q781	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q794	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q795	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q836	151-0223-00			TRANSISTOR,SIG:BIPOLAR,NPN;15V,500MA,SWITCHING	04713	MPS2369A
A3Q855	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q856	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q866	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q867	151-0347-00			TRANSISTOR,SIG:BIPOLAR,NPN;160V,600MA,100MHZ	0JR04	2N5551
A3Q868	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q874	151-0325-00			TRANSISTOR,SIG:BIPOLAR,PNP;15V,50MA,SWITCHING	27014	2N5771
A3Q880	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q884	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q896	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q897	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q966	151-0347-00			TRANSISTOR,SIG:BIPOLAR,NPN;160V,600MA,100MHZ	0JR04	2N5551
A3Q967	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A3Q975	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL	0JR04	2N3906
A3Q994	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A3R135	322-3230-00			RES,FXD,FILM:2.43K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50-2-G2431FT
A3R136	322-3318-00			RES,FXD,FILM:MET FILM;20K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20001F
A3R137	322-3314-00			RES,FXD:METAL FILM;18.2K OHM,1%,0.2W,TC=100	91637	CCF501G18201F
A3R138	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R142	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R143	322-3369-00			RES,FXD:METAL FILM;68.1K OHM,1%,0.2W,TC=100	57668	CRB20 FXE 68R1
A3R144	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R152	307-0023-00			RES,FXD,CMPSN:4.7 OHM,10%,0.5W	50139	EB47G1
A3R157	322-3172-00			RES,FXD,FILM:604 OHM,1%,0.2W,TC=T0MI	91637	CCF501G604ROF
A3R158	322-3258-00			RES,FXD:METAL FILM;4.75K OHM,1%,0.2W,TC=100	56845	CCF50-2-G4751FT
A3R166	322-3172-00			RES,FXD,FILM:604 OHM,1%,0.2W,TC=T0MI	91637	CCF501G604ROF
A3R167	322-3258-00			RES,FXD:METAL FILM;4.75K OHM,1%,0.2W,TC=100	56845	CCF50-2-G4751FT
A3R170	322-3299-00			RES,FXD,FILM:12.7K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G12701F
A3R171	322-3473-00			RES,FXD,FILM:825K OHM,1%,0.2W,TC=100PPM,MI	91637	CCF50-2F82502FT
A3R172	322-3281-00			RES,FXD:METAL FILM;8.25K OHM,1%,0.2W,TC=100	91637	CCF501G82500F
A3R173	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R174	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R175	322-3164-00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0MI	91637	CCF501G499ROF
A3R177	322-3296-00			RES,FXD,FILM:11.8K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G11801F
A3R178	311-2236-00			RES,VAR,TRMR:CERMET;20K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 203 M L
A3R181	322-3201-00			RES,FXD:METAL FILM;1.21K OHM,1%,0.2W,TC=100	91637	CCF501G12100F
A3R182	322-3114-00			RES,FXD:METAL FILM;150 OHM,1%,0.2W,TC=100 PPM	91637	CCF50-2-G1500F
A3R183	322-3147-00			RES,FXD:METAL FILM;332 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G332R0F
A3R184	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R185	322-3218-00			RES,FXD:METAL FILM;1.82K OHM,1%,0.2W,TC=100	91637	CCF501G18200F
A3R186	322-3273-00			RES,FXD:METAL FILM;6.81K OHM,1%,0.2W,TC=100	91637	CCF50-2-G68100F
A3R187	322-3265-00			RES,FXD:METAL FILM;5.62K OHM,1%,0.2W,TC=100	91637	CCF501G56200F
A3R189	322-3210-00			RES,FXD:METAL FILM;1.5K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G15000F
A3R190	322-3258-00			RES,FXD:METAL FILM;4.75K OHM,1%,0.2W,TC=100	56845	CCF50-2-G4751FT
A3R191	322-3258-00			RES,FXD:METAL FILM;4.75K OHM,1%,0.2W,TC=100	56845	CCF50-2-G4751FT
A3R194	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A3R198	322-3306-00			RES,FXD:METAL FILM;15K OHM,1%,0.2W,TC=100 PPM	91637	CCF50-2-G1502F
A3R212	307-0696-00			RES NTWK,FXD,FI:7,10K OHM,2%,0.15W EACH	11236	750-81R10KOHM
A3R221	322-3402-00			RES,FXD:METAL FILM;150K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G15002F
A3R222	322-3361-00			RES,FXD:METAL FILM;56.2K OHM,1%,0.2W,TC=100	91637	CCF50-2F56201F
A3R223	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R224	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G75R00F
A3R232	322-3393-00			RES,FXD:METAL FILM;121K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G12102F
A3R233	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A3R234	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G75R00F
A3R235	322-3322-00			RES,FXD:METAL FILM;22.1K OHM,1%,0.2W,TC=100	91637	CCF501G22101F
A3R236	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R237	322-3066-00			RES,FXD:METAL FILM;47.5 OHM,1%,0.2W,TC=100 PPM	09969	CCF502G47R50F
A3R238	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R239	322-3393-00			RES,FXD:METAL FILM;121K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G12102F
A3R240	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R241	322-3337-00			RES,FXD,FILM:31.6K OHM,1%,0.2W,TC=T0	91637	CCF502G31601FT
A3R242	322-3322-00			RES,FXD:METAL FILM;22.1K OHM,1%,0.2W,TC=100	91637	CCF501G22101F
A3R243	322-3396-00			RES,FXD,FILM:130K OHM,1%,0.2W,TC=T0MI,SMALL	91637	CCF50-2-G1303F
A3R244	311-2238-00			RES,VAR,TRMR:CERMET;50K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 503 M L
A3R245	322-3481-00			RES,FXD,FILM:1M OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G10003F
A3R246	322-3481-00			RES,FXD,FILM:1M OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G10003F
A3R247	322-3373-00			RES,FXD,FILM:75K OHM,1%,0.2W,TC=T0MI	91637	CCF501G75001F
A3R248	322-3418-00			RES,FXD:METAL FILM;221K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G22102F
A3R250	301-0101-00			RES,FXD,FILM:100 OHM,5%,0.5W	TK1727	SFR30 2322-182-

## Replaceable Electrical Parts

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A3R252	322-3198-00			RES,FXD,FILM:1.13K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G11300F
A3R253	322-3260-00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0	91637	CCF501G49900F
A3R254	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R255	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R259	311-2230-00			RES,VAR,TRMR:CERMET;500 OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 501 M L
A3R267	311-2230-00			RES,VAR,TRMR:CERMET;500 OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 501 M L
A3R280	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R281	322-3297-00			RES,FXD:METAL FILM;12.1K OHM,1%,0.2W,TC=100	91637	CCF501G12101F
A3R282	322-3293-00			RES,FXD:METAL FILM;11K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G11001F
A3R283	322-3185-00			RES,FXD:METAL FILM;825 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G825ROF
A3R284	322-3185-00			RES,FXD:METAL FILM;825 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G825ROF
A3R285	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R286	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	91637	CCF501G75000F
A3R287	322-3250-00			RES,FXD:METAL FILM;3.92K OHM,1%,0.2W,TC=100	91637	CCF50-2F39200F
A3R288	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G30100F
A3R289	322-3258-00			RES,FXD:METAL FILM;4.75K OHM,1%,0.2W,TC=100	56845	CCF50-2-G4751FT
A3R292	322-3265-00			RES,FXD:METAL FILM;5.62K OHM,1%,0.2W,TC=100	91637	CCF501G56200F
A3R293	322-3306-00			RES,FXD:METAL FILM;15K OHM,1%,0.2W,TC=100 PPM	91637	CCF50-2-G1502F
A3R294	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A3R295	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	91637	CCF501G75000F
A3R328	322-3339-00			RES,FXD:METAL FILM;33.2K OHM,1%,0.2W,TC=100	91637	CCF50-2-G3322FT
A3R331	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R332	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R333	322-3339-00			RES,FXD:METAL FILM;33.2K OHM,1%,0.2W,TC=100	91637	CCF50-2-G3322FT
A3R334	322-3473-00			RES,FXD,FILM:825K OHM,1%,0.2W,TC=100PPM,MI	91637	CCF50-2F82502FT
A3R341	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R342	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R343	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R346	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R347	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R348	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A3R353	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R354	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R355	311-2236-00			RES,VAR,TRMR:CERMET;20K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 203 M L
A3R356	322-3164-00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0MI	91637	CCF501G499ROF
A3R357	322-3281-00			RES,FXD:METAL FILM;8.25K OHM,1%,0.2W,TC=100	91637	CCF501G82500F
A3R358	322-3162-00			RES,FXD:METAL FILM;475 OHM,1%,0.2W,TC=100 PPM	91637	CCF50G475R0F
A3R362	322-3243-00			RES,FXD:METAL FILM;3.32K OHM,1%,0.2W,TC=100	91637	CCF50-1-G33200F
A3R363	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R368	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R369	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R381	322-3269-02			RES,FXD,FILM:6.19K OHM,0.2W,5%TAPED & REELED	91637	CCF501D61900D
A3R382	322-3269-02			RES,FXD,FILM:6.19K OHM,0.2W,5%TAPED & REELED	91637	CCF501D61900D
A3R383	322-3218-00			RES,FXD:METAL FILM;1.82K OHM,1%,0.2W,TC=100	91637	CCF501G18200F
A3R384	322-3261-00			RES,FXD,FILM:5.11K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50G5111FT
A3R385	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R386	322-3246-00			RES,FXD,FILM:3.57K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G35700F
A3R387	322-3285-00			RES,FXD,FILM:9.09K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G90900F
A3R388	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R389	322-3189-00			RES,FXD,FILM:909 OHM,1%,0.2W,TC=T0MI	91637	CCF501G909FOR
A3R390	322-3066-00			RES,FXD:METAL FILM;47.5 OHM,1%,0.2W,TC=100 PPM	09969	CCF502G47R50F
A3R395	322-3258-00			RES,FXD:METAL FILM;4.75K OHM,1%,0.2W,TC=100	56845	CCF50-2-G4751FT
A3R396	322-3258-00			RES,FXD:METAL FILM;4.75K OHM,1%,0.2W,TC=100	56845	CCF50-2-G4751FT
A3R397	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A3R424	322-3289-00	B068301		RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM (1720)	91637	CCF50G10001F
		B077737		(1721/1721PM/1721PN)		
A3R428	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R431	322-3185-00			RES,FXD:METAL FILM;825 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G825ROF
A3R432	322-3318-00			RES,FXD,FILM:MET FILM;20K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20001F
A3R433	322-3243-00			RES,FXD:METAL FILM;3.32K OHM,1%,0.2W,TC=100	91637	CCF50-1-G33200F
A3R441	322-3354-00			RES,FXD:METAL FILM;47.5K OHM,1%,0.2W,TC=100	91637	CCF501G47501F
A3R442	322-3322-00			RES,FXD:METAL FILM;22.1K OHM,1%,0.2W,TC=100	91637	CCF501G22101F
A3R443	322-3385-00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10002F
A3R444	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R445	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R446	322-3258-00			RES,FXD:METAL FILM;4.75K OHM,1%,0.2W,TC=100	56845	CCF50-2-G4751FT
A3R447	322-3385-00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10002F
A3R448	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R449	322-3293-00			RES,FXD:METAL FILM;11K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G11001F
A3R453	311-2238-00			RES,VAR,TRMR:CERMET;50K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 503 M L
A3R454	322-3218-00			RES,FXD:METAL FILM;1.82K OHM,1%,0.2W,TC=100	91637	CCF501G18200F
A3R455	322-3148-00	672-1227-07		RES,FXD,FILM:340 OHM,1%,0.2W,TC=T0MI	91637	CCF50-2F340R0F
A3R455	322-3157-00	672-1228-08		RES,FXD,FILM:422 OHM,1%,0.2W,TC=T0MI	57668	CRB20 FXE 422E
A3R455	322-3148-00	672-0224-07		RES,FXD,FILM:340 OHM,1%,0.2W,TC=T0MI	91637	CCF50-2F340R0F
A3R457	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R458	322-3357-00			RES,FXD,FILM:51.1K OHM,1%,0.2W,TC=T0TAPED &	91637	CCF501G51101F
A3R459	322-3177-02			RES,FXD,FILM:681 OHM,0.5%,0.2W,TC=T2	91637	CMF501D681ROD
A3R460	311-2231-00			RES,VAR,TRMR:CERMET;1K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 102 M L
A3R462	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R463	322-3201-00			RES,FXD:METAL FILM;1.21K OHM,1%,0.2W,TC=100	91637	CCF501G12100F
A3R464	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R465	322-3266-00			RES,FXD,FILM:5.76K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G57600F
A3R466	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R467	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A3R470	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	91637	CCF501G75000F
A3R471	322-3165-00			RES,FXD,FILM:511 OHM,1%,0.2W,TC=T0MI	91637	CCF501G511R0F
A3R472	322-3210-00			RES,FXD:METAL FILM;1.5K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G15000F
A3R474	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R483	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R484	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R486	322-3268-00			RES,FXD,FILM:6.04K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G60400F
A3R491	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R492	322-3210-00			RES,FXD:METAL FILM;1.5K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G15000F
A3R502	311-2269-00			RES,VAR,NONWW:TRMR,20K OHM,20%,0.5WLINEAR,MI	TK2073	GF06VT2 203 M L
A3R508	322-3254-00			RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF502G4321FT
A3R518	322-3322-00			RES,FXD:METAL FILM;22.1K OHM,1%,0.2W,TC=100	91637	CCF501G22101F
A3R522	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R528	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R530	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A3R534	311-2236-00			RES,VAR,TRMR:CERMET;20K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 203 M L
A3R536	322-3331-00			RES,FXD:METAL FILM;27.4K OHM,1%,0.2W,TC=100	57668	CRB20 FXE 27K4
A3R540	322-3254-00			RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF502G4321FT
A3R542	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R547	322-3130-00			RES,FXD:METAL FILM;221 OHM,1%,0.2W,TC=100 PPM	57668	RB20FX221E
A3R548	322-3293-00			RES,FXD:METAL FILM;11K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G11001F
A3R549	322-3130-00			RES,FXD:METAL FILM;221 OHM,1%,0.2W,TC=100 PPM	57668	RB20FX221E
A3R554	322-3148-00	672-1227-07		RES,FXD,FILM:340 OHM,1%,0.2W,TC=T0MI	91637	CCF50-2F340R0F
A3R554	322-3157-00	672-1228-08		RES,FXD,FILM:422 OHM,1%,0.2W,TC=T0MI	57668	CRB20 FXE 422E

## Replaceable Electrical Parts

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A3R554	322-3148-00	672-0224-07		RES,FXD,FILM:340 OHM,1%,0.2W,TC=TOMI	91637	CCF50-2F340R0F
A3R557	322-3162-00			RES,FXD:METAL FILM;475 OHM,1%,0.2W,TC=100 PPM	91637	CCF50G475R0F
A3R558	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R559	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R562	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R563	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R566	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R567	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=TOMI,SMALL BODY	91637	CCF501G30100F
A3R568	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A3R569	322-3164-00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=TOMI	91637	CCF501G499R0F
A3R570	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	91637	CCF501G75000F
A3R571	322-3246-00			RES,FXD,FILM:3.57K OHM,1%,0.2W,TC=TOMI,SMALL BODY	91637	CCF501G35700F
A3R574	322-3226-00			RES,FXD:METAL FILM;2.21K OHM,1%,0.2W,TC=100	91637	CCF501G22100F
A3R575	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R576	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R578	311-2236-00			RES,VAR,TRMR:CERMET;20K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 203 M L
A3R579	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R581	322-3181-00			RES,FXD,FILM:750 OHM,1%,0.2W,TC=TOMI	91637	CCF501G750R0F
A3R582	322-3181-00			RES,FXD,FILM:750 OHM,1%,0.2W,TC=TOMI	91637	CCF501G750R0F
A3R583	322-3326-00			RES,FXD,FILM:24.3K OHM,1%,0.2W,TC-TOMI	91637	CCF50-2F24301F
A3R593	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R594	311-2231-00			RES,VAR,TRMR:CERMET;1K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 102 M L
A3R595	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	91637	CCF501G75000F
A3R596	322-3305-00			RES,FXD,FILM:14.7K OHM,1%,0.2W,TC=TOMI,SMALL BODY	91637	CCF50-2-G1472FT
A3R602	311-2269-00			RES,VAR,NONWW:TRMR,20K OHM,20%,0.5WLINEAR,MI	TK2073	GF06VT2 203 M L
A3R603	322-3251-00			RES,FXD,FILM:4.02K OHM,1%,0.2W,TC=T0	91637	CCF501G40200F
A3R605	322-3402-00			RES,FXD:METAL FILM;150K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G15002F
A3R606	322-3402-00			RES,FXD:METAL FILM;150K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G15002F
A3R609	322-3281-00			RES,FXD:METAL FILM;8.25K OHM,1%,0.2W,TC=100	91637	CCF501G82500F
A3R616	307-0446-00			RES NTWK,FXD,FI:10K OHM,20%,(9)RES	11236	750-101-R10K
A3R631	322-3354-00			RES,FXD:METAL FILM;47.5K OHM,1%,0.2W,TC=100	91637	CCF501G47501F
A3R632	322-3339-00			RES,FXD:METAL FILM;33.2K OHM,1%,0.2W,TC=100	91637	CCF50-2-G3322FT
A3R633	322-3481-00			RES,FXD,FILM:1M OHM,1%,0.2W,TC=TOMI,SMALL BODY	91637	CCF501G10003F
A3R634	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10001F
A3R635	322-3250-00			RES,FXD:METAL FILM;3.92K OHM,1%,0.2W,TC=100	91637	CCF50-2F39200F
A3R636	322-3168-00			RES,FXD,FILM:549 OHM,1%,0.2W,TC=TOMI	91637	CCF50-2F549R0F
A3R637	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R638	322-3354-00			RES,FXD:METAL FILM;47.5K OHM,1%,0.2W,TC=100	91637	CCF501G47501F
A3R639	322-3258-00			RES,FXD:METAL FILM;4.75K OHM,1%,0.2W,TC=100	56845	CCF50-2-G4751FT
A3R642	322-3162-00			RES,FXD:METAL FILM;475 OHM,1%,0.2W,TC=100 PPM	91637	CCF50G475R0F
A3R643	322-3254-00			RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=TOMI,SMALL BODY	91637	CCF502G4321FT
A3R644	322-3235-00			RES,FXD:METAL FILM;2.74K OHM,1%,0.2W,TC=100	91637	CCF501G27400F
A3R645	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R646	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R647	322-3148-00	672-1227-07		RES,FXD,FILM:340 OHM,1%,0.2W,TC=TOMI,SMALL	91637	CCF50-2F340R0F
A3R647	321-0660-00	672-1228-08		RES,FXD,FILM:417 OHM,1%,0.125W,TC=T0	91637	CMF55116G417R0F
A3R647	322-3148-00	672-0224-07		RES,FXD,FILM:340 OHM,1%,0.2W,TC=TOMI	91637	CCF50-2F340R0F
A3R648	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R649	322-3162-00			RES,FXD:METAL FILM;475 OHM,1%,0.2W,TC=100 PPM	91637	CCF50G475R0F
A3R650	322-3273-00			RES,FXD:METAL FILM;6.81K OHM,1%,0.2W,TC=100	91637	CCF50-2-G68100F
A3R651	322-3281-00			RES,FXD:METAL FILM;8.25K OHM,1%,0.2W,TC=100	91637	CCF501G82500F
A3R652	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R653	311-2236-00			RES,VAR,TRMR:CERMET;20K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 203 M L
A3R654	322-3162-00			RES,FXD:METAL FILM;475 OHM,1%,0.2W,TC=100 PPM	91637	CCF50G475R0F
A3R655	311-2231-00			RES,VAR,TRMR:CERMET;1K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 102 M L

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A3R656	322-3177-00			RES,FXD:METAL FILM;681 OHM,1%,0.2W,TC=100 PPM	91637	CCF50-2G681R0F
A3R657	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R658	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R661	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R662	322-3266-00			RES,FXD,FILM:5.76K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G57600F
A3R663	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R664	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R665	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R666	322-3266-00			RES,FXD,FILM:24.3K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50-2F24301F
A3R667	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A3R668	322-3210-00			RES,FXD:METAL FILM;1.5K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G15000F
A3R669	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R670	322-3164-00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0MI	91637	CCF501G499R0F
A3R671	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G30100F
A3R672	322-3246-00			RES,FXD,FILM:3.57K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G35700F
A3R674	322-3273-00			RES,FXD:METAL FILM;6.81K OHM,1%,0.2W,TC=100	91637	CCF50-2-G68100F
A3R675	322-3322-00			RES,FXD:METAL FILM;22.1K OHM,1%,0.2W,TC=100	91637	CCF501G22101F
A3R676	322-3354-00			RES,FXD:METAL FILM;47.5K OHM,1%,0.2W,TC=100	91637	CCF501G47501F
A3R677	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R680	322-3250-00			RES,FXD:METAL FILM;3.92K OHM,1%,0.2W,TC=100	91637	CCF50-2F39200F
A3R682	322-3473-00			RES,FXD,FILM:825K OHM,1%,0.2W,TC=100PPM,MI	91637	CCF50-2F82502FT
A3R683	322-3273-00			RES,FXD:METAL FILM;6.81K OHM,1%,0.2W,TC=100	91637	CCF50-2-G68100F
A3R684	322-3258-00			RES,FXD:METAL FILM;4.75K OHM,1%,0.2W,TC=100	56845	CCF50-2-G4751FT
A3R685	322-3385-00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10002F
A3R686	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G0001F
A3R687	322-3322-00			RES,FXD:METAL FILM;22.1K OHM,1%,0.2W,TC=100	91637	CCF501G22101F
A3R691	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G0001F
A3R692	322-3300-02			RES,FXD,FILM:13K OHM,0.5%,0.2W,TC=T2	91637	CCF501D13001D
A3R693	322-3318-00			RES,FXD,FILM:MET FILM;20K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20001F
A3R694	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R702	311-2269-00			RES,VAR,NONWW:TRMR,20K OHM,20%,0.5WLINEAR,MI	TK2073	GF06VT2 203 M L
A3R703	311-2269-00			RES,VAR,NONWW:TRMR,20K OHM,20%,0.5WLINEAR,MI	TK2073	GF06VT2 203 M L
A3R734	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R735	322-3446-00			RES,FXD,FILM:432K OHM,1%,0.2W,TC=T0MI,SMALL	91637	CCF50-2F43202F
A3R736	315-0275-00			RES,FXD,FILM:2.7M OHM,5%,0.25W	TK1727	SFR25 2322-181-
A3R737	322-3354-00			RES,FXD:METAL FILM;47.5K OHM,1%,0.2W,TC=100	91637	CCF501G47501F
A3R738	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R739	322-3318-00			RES,FXD,FILM:MET FILM;20K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20001F
A3R740	322-3169-00			RES,FXD:METAL FILM;562 OHM,1%,0.2W,TC=100 PPM	91637	CCF50-2F562R0F
A3R741	322-3169-00			RES,FXD:METAL FILM;562 OHM,1%,0.2W,TC=100 PPM	91637	CCF50-2F562R0F
A3R742	322-3235-00			RES,FXD:METAL FILM;2.74K OHM,1%,0.2W,TC=100	91637	CCF501G27400F
A3R743	322-3235-00			RES,FXD:METAL FILM;2.74K OHM,1%,0.2W,TC=100	91637	CCF501G27400F
A3R744	322-3162-00			RES,FXD:METAL FILM;475 OHM,1%,0.2W,TC=100 PPM	91637	CCF50G475R0F
A3R745	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R746	322-3273-00			RES,FXD:METAL FILM;6.81K OHM,1%,0.2W,TC=100	91637	CCF50-2-G68100F
A3R747	322-3281-00			RES,FXD:METAL FILM;8.25K OHM,1%,0.2W,TC=100	91637	CCF501G82500F
A3R748	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R749	322-3162-00			RES,FXD:METAL FILM;475 OHM,1%,0.2W,TC=100 PPM	91637	CCF50G475R0F
A3R750	322-3162-00			RES,FXD:METAL FILM;475 OHM,1%,0.2W,TC=100 PPM	91637	CCF50G475R0F
A3R752	322-3281-00			RES,FXD:METAL FILM;8.25K OHM,1%,0.2W,TC=100	91637	CCF501G82500F
A3R760	322-3243-00			RES,FXD:METAL FILM;3.32K OHM,1%,0.2W,TC=100	91637	CCF50-1-G33200F
A3R761	322-3201-00			RES,FXD:METAL FILM;1.21K OHM,1%,0.2W,TC=100	91637	CCF501G12100F
A3R762	322-3322-00			RES,FXD:METAL FILM;22.1K OHM,1%,0.2W,TC=100	91637	CCF501G22101F
A3R763	322-3322-00			RES,FXD:METAL FILM;22.1K OHM,1%,0.2W,TC=100	91637	CCF501G22101F
A3R764	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F

## Replaceable Electrical Parts

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A3R765	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R766	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R767	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	91637	CCF501G75000F
A3R768	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R770	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	91637	CCF501G75000F
A3R771	322-3165-00			RES,FXD,FILM:511 OHM,1%,0.2W,TC=T0MI	91637	CCF501G511R0F
A3R772	322-3154-00			RES,FXD:METAL FILM;392 OHM,1%,0.2W,TC=100 PPM	57668	RB20FX392E
A3R773	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R774	322-3154-00			RES,FXD:METAL FILM;392 OHM,1%,0.2W,TC=100 PPM	57668	RB20FX392E
A3R775	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R776	322-3243-00			RES,FXD:METAL FILM;3.32K OHM,1%,0.2W,TC=100	91637	CCF50-1-G33200F
A3R777	322-3335-00			RES,FXD,FILM:30.1K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G30101F
A3R780	322-3281-00			RES,FXD:METAL FILM;8.25K OHM,1%,0.2W,TC=100	91637	CCF501G82500F
A3R781	322-3250-00			RES,FXD:METAL FILM;3.92K OHM,1%,0.2W,TC=100	91637	CCF50-2F39200F
A3R782	322-3232-00			RES,FXD,FILM:2.55K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G25500F
A3R786	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R791	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A3R830	322-3226-00			RES,FXD:METAL FILM;2.21K OHM,1%,0.2W,TC=100	91637	CCF501G22100F
A3R831	322-3418-00			RES,FXD:METAL FILM;221K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G22102F
A3R832	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R833	322-3306-00			RES,FXD:METAL FILM;15K OHM,1%,0.2W,TC=100 PPM	91637	CCF50-2-G1502F
A3R834	322-3226-00			RES,FXD:METAL FILM;2.21K OHM,1%,0.2W,TC=100	91637	CCF501G22100F
A3R837	322-3168-00			RES,FXD,FILM:549 OHM,1%,0.2W,TC=T0MI	91637	CCF50-2F549R0F
A3R839	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A3R840	322-3318-00			RES,FXD,FILM:MET FILM;20K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20001F
A3R841	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R842	322-3314-00			RES,FXD:METAL FILM;18.2K OHM,1%,0.2W,TC=100	91637	CCF501G18201F
A3R843	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A3R845	322-3254-00			RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF502G4321FT
A3R846	311-2236-00			RES,VAR,TRMR:CERMET;20K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 203 M L
A3R847	322-3402-00			RES,FXD:METAL FILM;150K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G15002F
A3R848	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R849	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G30100F
A3R855	322-3235-00			RES,FXD:METAL FILM;2.74K OHM,1%,0.2W,TC=100	91637	CCF501G27400F
A3R856	322-3151-00			RES,FXD,FILM:365 OHM,1%,0.2W,TC=T0MI	91637	CCF501G365R0F
A3R857	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R858	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R868	322-3354-00			RES,FXD:METAL FILM;47.5K OHM,1%,0.2W,TC=100	91637	CCF501G47501F
A3R869	308-0549-00			RES,FXD,WW:6.3K OHM,1%,3W	91637	RS2B-B63000F
A3R870	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10000F
A3R871	322-3318-00			RES,FXD,FILM:MET FILM;20K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20001F
A3R872	322-3273-00			RES,FXD:METAL FILM;6.81K OHM,1%,0.2W,TC=100	91637	CCF50-2-G68100F
A3R873	322-3254-00	672-1227-07		RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF502G4321FT
A3R873	322-3270-00	672-1228-08		RES,FXD,FILM:6.34K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G63400FT
A3R873	322-3254-00	672-0224-07		RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF502G4321FT
A3R874	322-3154-00			RES,FXD:METAL FILM;392 OHM,1%,0.2W,TC=100 PPM	57668	RB20FX392E
A3R875	322-3189-00			RES,FXD,FILM:909 OHM,1%,0.2W,TC=T0MI	91637	CCF501G909FOR
A3R876	322-3258-00			RES,FXD:METAL FILM;4.75K OHM,1%,0.2W,TC=100	56845	CCF50-2-G4751FT
A3R877	322-3261-00			RES,FXD,FILM:5.11K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50G5111FT
A3R878	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R880	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R882	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R883	322-3262-00			RES,FXD,FILM:5.23K OHM,1%,0.2W,TC=T0	91637	CCF50G52300F
A3R884	322-3346-00			RES,FXD:METAL FILM;39.2K OHM,1%,0.2W,TC=100	91637	CCF50-2-G39201F
A3R885	322-3281-00			RES,FXD:METAL FILM;8.25K OHM,1%,0.2W,TC=100	91637	CCF501G82500F



Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A3R890	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R891	322-3269-02			RES,FXD,FILM:6.19K OHM,0.2W,5%TAPED & REELED	91637	CCF501D61900D
A3R892	322-3154-00			RES,FXD:METAL FILM;392 OHM,1%,0.2W,TC=100 PPM	57668	RB20FX392E
A3R893	322-3230-00			RES,FXD,FILM:2.43K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50-2-G2431FT
A3R894	322-3226-00			RES,FXD:METAL FILM;2.21K OHM,1%,0.2W,TC=100	91637	CCF501G22100F
A3R895	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A3R896	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G30100F
A3R921	322-3322-00			RES,FXD:METAL FILM;22.1K OHM,1%,0.2W,TC=100	91637	CCF501G22101F
A3R937	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A3R938	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A3R939	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A3R940	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R941	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R942	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R943	322-3318-00			RES,FXD,FILM:MET FILM;20K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20001F
A3R944	322-3314-00			RES,FXD:METAL FILM;18.2K OHM,1%,0.2W,TC=100	91637	CCF501G18201F
A3R945	322-3222-00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A3R946	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G30100F
A3R947	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R948	311-2236-00			RES,VAR,TRMR:CERMET;20K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 203 M L
A3R952	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R953	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R954	322-3177-02			RES,FXD,FILM:681 OHM,0.5%,0.2W,TC=T2	91637	CMF501D681ROD
A3R955	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R956	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R957	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R958	322-3151-00			RES,FXD,FILM:365 OHM,1%,0.2W,TC=T0MI	91637	CCF501G365ROF
A3R967	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A3R969	308-0549-00			RES,FXD,WW:6.3K OHM,1%,3W	91637	RS2B-B63000F
A3R971	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R972	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G75R00F
A3R975	322-3322-00			RES,FXD:METAL FILM;22.1K OHM,1%,0.2W,TC=100	91637	CCF501G22101F
A3R976	322-3281-00			RES,FXD:METAL FILM;8.25K OHM,1%,0.2W,TC=100	91637	CCF501G82500F
A3R984	322-3310-00			RES,FXD,FILM:16.5K OHM,1%,0.2W,TC=T0TAPED &	91637	CCF501G16501F
A3R990	322-3250-00			RES,FXD:METAL FILM;3.92K OHM,1%,0.2W,TC=100	91637	CCF50-2F39200F
A3R991	322-3051-00			RES,FXD:METAL FILM;33.2 OHM,1%,0.2W,TC=100 PPM	57668	CRB20FXE33E2
A3R992	322-3306-00			RES,FXD:METAL FILM;15K OHM,1%,0.2W,TC=100 PPM	91637	CCF50-2-G1502F
A3R994	322-3306-00			RES,FXD:METAL FILM;15K OHM,1%,0.2W,TC=100 PPM	91637	CCF50-2-G1502F
A3U164	156-1451-00			IC,LINER:BIPOLAR,VR;NEGATIVE,ADJUSTABLE,1.5A,4%	01295	LM337KC
A3U172	156-1161-00			IC,LINER:BIPOLAR,VR;POSITIVE,ADJUSTABLE,1.5A,4%	04713	LM317T
A3U184	156-0048-00			IC,LINER:BIPOLAR,TRANSISTOR ARRAY;(5),NPN, (1)DIFF PAIR,(3)IND,15V,50MA,300MHZ,AMPLIFIER	34371	CA3046
A3U274	156-1850-00			IC,MISC:CMOS,ANALOG SWITCH;QUAD	17856	DG211CJ
A3U311	156-0956-02			IC,DIGITAL:LSTTL,BUFFER/DRIVER	01295	SN74LS244N
A3U315	156-0913-02			IC,DIGITAL:LSTTL,FLIP FLOP	01295	SN74LS377N
A3U319	156-0913-02			IC,DIGITAL:LSTTL,FLIP FLOP	01295	SN74LS377N
A3U341	156-1225-01			IC,LINER:BIPOLAR,COMPARATOR	01295	LM393P
A3U344	156-1225-01			IC,LINER:BIPOLAR,COMPARATOR	01295	LM393P
A3U348	156-1126-00	672-1227-07		IC,LINER:BIPOLAR,COMPARATOR;OPEN COLL,200NS	01295	LM311P
A3U348	156-1126-00	672-0224-08		IC,LINER:BIPOLAR,COMPARATOR;OPEN COLL,200NS	01295	LM311P
A3U361	156-0912-01			IC,LINER:BIPOLAR,OP-AMP;TRANSCONDUCTANCE	27014	LM3080N
A3U380	156-0067-00			IC,LINER:BIPOLAR,OP-AMP	01295	UA741CP
A3U383	156-0048-00			IC,LINER:BIPOLAR,TRANSISTOR ARRAY;(5),NPN, (1)DIFF PAIR,(3)IND,15V,50MA,300MHZ,AMPLIFIER	34371	CA3046
A3U405	156-2029-00			IC,MEMORY:NMOS,NVRAM;16 X 16, SERIALDATA	60395	X2444D

## Replaceable Electrical Parts

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A3U440	156-0048-00			IC,LINEAR:BIPOLAR,TRANSISTOR ARRAY;(5),NPN, (1)DIFF PAIR,(3)IND,15V,50MA,300MHZ,AMPLIFIER	34371	CA3046
A3U446	156-0411-00			IC,LINEAR:BIPOLAR,COMPARATOR;QUAD,SGL SPLY,300NS	01295	LM339N
A3U467	156-2460-00			IC,MISC:BIPOLAR,MOD/DEMODO;BALANCED	04713	MC1496P
A3U505	156-1126-00			IC,LINEAR:BIPOLAR,COMPARATOR;OPEN COLL,200NS	01295	LM311P
A3U508	156-0991-00			IC,LINEAR:BIPOLAR,VR;POSITIVE,5.0V,100MA,5%	01295	UA78L05ACLP
A3U585	156-1850-00			IC,MISC:CMOS,ANALOG SWITCH;QUAD	17856	DG211CJ
A3U613	160-4202-01	B012271	B068300	MICROCKT,DGTL:NMOS,MICROCONT,8-BIT,PRGM8051, DIP40.6,062-8494-00 (1720)	80009	160420201
		B010790	B077736	(1721/1721PM/1721PN)		
	050-2297-02	B012271	B068300	MICROCOMPUTER REPLACEMENT KIT (1720)		
		B010790	B077736	(1721/1721PM/1721PN)		
	160-4202-02	B068301		IC,PROCESSOR:CMOS,MICROCONT;8-BIT,12MHZ(1720)		
		B077737		(1721/1721PM/1721PN)		
	136-0757-00			*MOUNTING PARTS* SKT,DIP:PCB;FEM,STR,2 X 20,40 POS,0.1 X 0.6 CTR,0.175 H X0.130 TAIL,BECU,TIN,ACCOM 0.008-0.015 X 0.014-0.022	00779	2-641606-3
				*END MOUNTING PARTS*		
A3U640	156-0742-00			IC,LINEAR:BIPOLAR,OP-AMP;HIGH SLEW RATE	01295	LM318P
A3U646	156-2460-00			IC,MISC:BIPOLAR,MOD/DEMODO;BALANCED	04713	MC1496P
A3U659	156-2460-00			IC,MISC:BIPOLAR,MOD/DEMODO;BALANCED	04713	MC1496P
A3U734	156-0158-00			IC,LINEAR:BIPOLAR,OP-AMP;DUAL	01295	MC1458P
A3U739	156-0742-00			IC,LINEAR:BIPOLAR,OP-AMP;HIGH SLEW RATE	01295	LM318P
A3U757	156-0912-01			IC,LINEAR:BIPOLAR,OP-AMP;TRANSCONDUCTANCE	27014	LM3080N
A3U774	156-0388-00			IC,DIGITAL:LSSTL,FLIP FLOP;DUAL D W/SET & CLR	01295	SN74LS74AN
A3U818	156-1373-01			IC,DIGITAL:LSSTL,BUFFER/DRIVER	01295	SN74LS125AN
A3U854	156-2460-00			IC,MISC:BIPOLAR,MOD/DEMODO;BALANCED	04713	MC1496P
A3U876	156-0382-00			IC,DIGITAL:LSSTL,GATE;QUAD 2-INPUT NAND	01295	SN74LS00N
A3U884	156-0733-04			IC,DIGITAL:LSSTL,MULTIVIBRATOR	04713	SN74LS221N
A3U889	156-1850-00			IC,MISC:CMOS,ANALOG SWITCH;QUAD	17856	DG211CJ
A3U942	156-1200-00			IC,LINEAR:BIFET,OP-AMP;QUAD	01295	TL074CN
A3U973	156-0742-00			IC,LINEAR:BIPOLAR,OP-AMP;HIGH SLEW RATE	01295	LM318P
A3VR182	152-0226-00			DIODE,ZENER:5.1V,5%,0.4W	14552	TD3810980
A3VR189	152-0486-00			DIODE,ZENER:6.2V,2%,0.4W	04713	SZG20008RL
A3VR449	152-0486-00			DIODE,ZENER:6.2V,2%,0.4W	04713	SZG20008RL
A3VR470	152-0688-00			DIODE,ZENER:2.4V,5%,0.4W	04713	1N4370A
A3VR766	152-0226-00			DIODE,ZENER:5.1V,5%,0.4W	14552	TD3810980
A3VR767	152-0688-00			DIODE,ZENER:2.4V,5%,0.4W	04713	1N4370A
A3VR894	152-0486-00			DIODE,ZENER:6.2V,2%,0.4W	04713	SZG20008RL
A3W986	131-0566-00	672-1227-07		BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA0207
A3W987	131-0566-00	672-1228-08		BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA0207
A3W987	131-0566-00	672-0224-07		BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA0207
A3Y129	158-0317-00	672-1227-07		XTAL UNIT,QTZ:3.579545MHZ, +/-0.003%,PARALLEL, CL=16PF,HC-49U-A	TK1919	HC-49/U 3.57954
A3Y129	158-0318-00	672-1228-08		XTAL UNIT,QTZ:4.433619MHZ, +/-0.003%,PARALLEL, CL=16PF,HC-49U-A	TK1919	HC-49/U 4.43361
A3Y129	158-0080-00	672-0224-07		XTAL UNIT,QTZ:3.575611MHZ 0.0035%, SERIES	33096	CCAT101449
A3Y707	158-0300-00			XTAL UNIT,QTZ:12.0 MHZ,50 PPM,SERIES	61429	FOX120X
				*MOUNTING PARTS*		
	253-0176-00			TAPE,PRESS SENS:VINYL FOAM,0.5 X 0.062,DOUBLE SIDED ADHESIVE	2K262	ORDER BY DESC
				*END MOUNTING PARTS*		
A3A1	671-1796-01			CIRCUIT BD ASSY:GRATICULE LIGHT	80009	671179601

Replaceable Electrical Parts

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A3A1DS100	150-0168-00			LAMP,INCAND:14V,0.08A,WEDGE BASE,T1.75 FOR SKT MT *MOUNTING PARTS*	55335	73W
	136-1119-01			SOCKET, LPHLDR:PCB,LAMPHOLDER,FEMALE,STR, SINGLE 0.404H X 0.218 TAIL TIN, T-1.75 WEDGE BASE *END MOUNTING PARTS*	65654	CIC 7500A-VALOX
A3A1DS200	150-0168-00			LAMP,INCAND:14V,0.08A,WEDGE BASE,T1.75 FOR SKT MT *MOUNTING PARTS*	55335	73W
	136-1119-01			SOCKET, LPHLDR:PCB,LAMPHOLDER,FEMALE,STR, SINGLE 0.404H X 0.218 TAIL TIN, T-1.75 WEDGE BASE *END MOUNTING PARTS*	65654	CIC 7500A-VALOX
A3A1DS300	150-0168-00			LAMP,INCAND:14V,0.08A,WEDGE BASE,T1.75 FOR SKT MT *MOUNTING PARTS*	55335	73W
	136-1119-01			SOCKET, LPHLDR:PCB,LAMPHOLDER,FEMALE,STR, SINGLE 0.404H X 0.218 TAIL TIN, T-1.75 WEDGE BASE *END MOUNTING PARTS*	65654	CIC 7500A-VALOX
A3A1J100	131-4530-00			CONN,HDR:PCB;MALE,STR,1 X 3,0.1 CTR,0.230 MLG X 0.120 TAIL,30GOLD,BD RETENTION	00779	104344-1
A3A1P100	131-0993-00			CONN,BOX:SHUNT;FEMALE,STR,1 X 2,0.1 CTR,0.385 H,30 GOLD,BLACK,JUMPER	22526	65474-006
A3A1P200	131-2790-00			CONN,HDR:PCB;MALE,RTANG,1 X 2,0.15CTR,0.230 MLG X 0.120 TAIL,30 GOLD	22526	65595-102
A3A1P800	131-2790-00			CONN,HDR:PCB;MALE,RTANG,1 X 2,0.15CTR,0.230 MLG X 0.120 TAIL,30 GOLD	22526	65595-102
A4	119-1606-05			PHASE SHIFTER:NTSC (1720 ONLY)	80009	119160605
A4	119-1763-05			PHASE SHIFTER:PAL (1721/1721PM/1721PN ONLY)	80009	119176305
A4C110	283-0788-01	119-1606-05		CAP,FXD,MICA DI:267PF,1%,500V,TAPE & AMMO PACK	09023	CDA15FD(267)F03
A4C110	283-0641-00	119-1763-05		CAP,FXD,MICA DI:180PF,1%,100V	TK0891	RDM15FD181F03
A4C120	281-0865-00	119-1606-05		CAP,FXD,CER DI:1000PF,5%,100V	04222	SA201A102JAA
A4C120	281-0863-00	119-1763-05		CAP,FXD,CERAMIC:MLC;240PF,5%,100V,0.100 X 0.170	04222	SA101A241JAA
A4C121	281-0861-00	119-1606-05		CAP,FXD,CER DI:270PF,5%,50V	04222	SA101A271JAA
A4C121	281-0776-00	119-1763-05		CAP,FXD,CERAMIC:MLC;120PF,5%,100V ,0.100 X0.170	04222	SA102A121JAA
A4C222	281-0797-00	119-1606-05		CAP,FXD,CERAMIC:MLC;15PF,10%,100V	04222	SA102A150KAA
A4C222	281-0811-00	119-1763-05		CAP,FXD,CERAMIC:MLC;10PF,10%,200V,0.100 X 0.170	04222	SA102A100KAA
A4C223	281-0933-00	119-1606-05		CAP,FXD,CER DI:43PF,5%,50WVDC	04222	SA102A430JAA
A4C223	281-0759-00	119-1763-05		CAP,FXD,CERAMIC:MLC;22PF,10%,100V,0.100 X 0.170	04222	SA102A220KAA
A4C231	283-0728-01	119-1606-05		CAP,FXD,MICA DI:120PF,1%,500V,TAPE & AMMO PACK	09023	CDA15FD121F03
A4C231	283-0728-01	119-1763-05		CAP,FXD,MICA DI:120PF,1%,500V,TAPE & AMMO PACK	09023	CDA15FD121F03
A4J100	131-0589-00			TERMINAL,PIN:PRESSFIT/PCB;MALE,STR,0.025 SQ,0.343 MLG X 0.122 TAIL,0.465 L,50 GOLD,W/FERRULE	22526	48283-087
A4J112	131-0589-00			TERMINAL,PIN:PRESSFIT/PCB;MALE,STR,0.025 SQ,0.343 MLG X 0.122 TAIL,0.465 L,50 GOLD,W/FERRULE (QUANTITY 3)	22526	48283-087
A4L122	108-1397-00			INDUCTOR,FXD:SIGNAL;10UH,5%,RDC<3.7 OHM	24226	10M 102J
A4L221	108-1397-00			INDUCTOR,FXD:SIGNAL;10UH,5%,RDC<3.7 OHM	24226	10M 102J
A4L230	108-1397-00			INDUCTOR,FXD:SIGNAL;10UH,5%,RDC<3.7 OHM	24226	10M 102J
A4Q100	151-5001-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0LUA3	PMBT3904 T/R
A4R100	307-0944-00			RES,FXD,FILM:470K OHM,5%,50V	50139	BCD4703JT
A4R123	322-3151-00	119-1606-05		RES,FXD,FILM:365 OHM,1%,0.2W,TC=T0MI	91637	CCF501G365ROF
A4R123	322-3166-00	119-1763-05		RES,FXD,FILM:523 OHM,1%,0.2W,TC=T0MI	91637	CCF501G523ROF
A4R220	322-3134-00	119-1606-05		RES,FXD,FILM:243 OHM,1%,0.2W,TC=T0MI	91637	CCF501G243ROF
A4R220	321-0142-00	119-1763-05		RES,FXD,FILM:294 OHM,1%,0.125W,TC=T0	TK1727	MR25 2322-151-2
A10	671-3637-00			CIRCUIT BD ASSY:CRT SOCKET BD	80009	671363700

## Replaceable Electrical Parts

Component number	Tektronix part number	Serial / Assembly number		Name & description	Mfr. code	Mfr. part number
		Effective	Discontinued			
A11	671-3761-00			CKT BD ASSY:SERIAL FILTER	80009	671376100
A11J2	131-3925-00			CONN,DSUB:PCB,FEMALE,RTANG,9 POS,0.112 CTR,0.318 MLG X 0.125 TAIL,4-40 THD INSERT,BD RETE	00779	747844-4
S1	260-2465-00			SWITCH,PUSH:0.4A,125VAC,W/SOLDER LUG,BUTTON *ATTACHED PARTS*	31918	(602844)
	174-2648-00			CA ASSY,SP:RIBBON,POWER SWITCH;MIXED/CRIMP,2,26 AWG,3.5 L,0.1 CTR 2 POS RCPT X 0.2 INCH CUT/STRIP *END ATTACHED PARTS*	TK2469	174-2648-00
V1	154-0983-00			ELECTRON TUBE:CRT,FINISHED,D14-375GH/983;A852B (1720 ONLY)	80009	154098300
V1	154-0984-00			ELECTRON TUBE:CRT,FINISHED,D14-375GH/984;A853B (1721/1721PM/1721PN ONLY)	80009	154098400
V1	154-0983-16			ELECTRON,TUBE:CRT,FINISHED,D14-375WA/983 (1720 OPTION 74 ONLY)	80009	154098316
V1	154-0984-16			ELECTRON,TUBE:CRT,FINISHED,D14-375WA/984 (1721/1721PM/1721PN OPTION 74 ONLY) *ATTACHED PARTS*	80009	154098416
	131-6014-00			CA ASSY,CRT:DISCRETE,ANODE LEAD;CRT,1,22 AWG,30KV,UL3239,58MM DIA A NODE X 1.9 L,0.125 *END ATTACHED PARTS*	20093	131-6014-00
W1	179-2997-01			WIRE HARNESS:DESCRETE,CRT ASSY 5,24AGW,5,26 AGW,1 X 4, 0.1 CTR & 1 X 7, RCPT X 1 X 4 & 1 X 7 CRT CABLE	9M860	179-2997-01
W3	174-3511-01			CA ASSY,SP:DISCRETE,CPD,4,24 AWG, 8.0L,1X7,0.1CTR & 2, 24 AWG, 8.5L X STRAIN RELIEF PCB H DEFLECTION LEADS *ATTACHED PARTS*	80009	174-3511-01
	343-0298-00			STRAP,RETAINING 0.25 DIA CABLE	85480	343029800
	344-0111-00			INSUL,SPREADER:DEFL LEADS,POLYPROPYLENE (QUANTITY 2) *END ATTACHED PARTS*	TK1617	NA



# **Diagrams/Circuit Board Illustrations**





# **Replaceable Mechanical Parts**





# Replaceable Mechanical Parts

This section contains a list of the components that are replaceable for the 1720/1721. Use this list to identify and order replacement parts. There is a separate Replaceable Mechanical Parts list for each instrument.

## Parts Ordering Information

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

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest circuit improvements. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

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

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

## Using the Replaceable Mechanical Parts List

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

### **Cross Index- Mfr. Code Number to Manufacturer**

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

### **Abbreviations**

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

**Chassis Parts** Chassis-mounted parts and cable assemblies are located at the end of the Replaceable Electrical Parts list.

## Column Descriptions

**Figure & Index No. (Column 1)** Items in this section are referenced by figure and index numbers to the illustrations.

**Tektronix Part No. (Column 2)** Indicates part number to be used when ordering replacement part from Tektronix.

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

**Qty (Column 5)** This indicates the quantity of mechanical parts used.

**Name and Description (Column 6)** An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification.

Following is an example of the indentation system used to indicate relationship.

1	2	3	4	5	Name & Description
					Assembly and/or Component
					Mounting parts for Assembly and/or Component
					*MOUNTING PARTS*/*END MOUNTING PARTS*
					Detail Part of Assembly and/or Component
					Mounting parts for Detail Part
					*MOUNTING PARTS*/*END MOUNTING PARTS*
					Parts of Detail Part
					Mounting parts for Parts of Detail Part
					*MOUNTING PARTS*/*END MOUNTING PARTS*

Mounting Parts always appear in the same indentation as the Item it mounts, while the detail parts are indented to the right. Indented items are part of and included with, the next higher indentation. **Mounting parts must be purchased separately, unless otherwise specified.**

**Mfr. Code (Column 7)** Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

**Mfr. Part Number (Column 8)** Indicates actual manufacturer's part number.

## Cross Index - Mfr. Code Number To Manufacturer

Mfr. code	Manufacturer	Address	City, state, zip code
06915	RICHCO	5825 N TRIPP AVE P.O. BOX 804238	CHICAGO, IL 60646
07416	NELSON NAME PLATE CO	3191 CASITAS	LOS ANGELES CA 90039-2410
09772	WEST COAST LOCKWASHER CO INC	16730 E JOHNSON DRIVE P O BOX 3588	CITY OF INDUSTRY, CA 91744
0J9P9	GEROME MFG CO INC	PO BOX 737 403 NORTH MAIN	NEWBERG, OR 97132
0KBZ5	MORELLIS Q & D PLASTICS	1812 16TH AVE	FOREST GROVE OR 97116
0KB01	STAUFFER SUPPLY	810 SE SHERMAN	PORTLAND OR 97214
12327	FREEWAY CORP	9301 ALLEN DR	CLEVELAND OH 44125-4632
22670	G M NAMEPLATE INC	2040 15TH AVE WEST	SEATTLE WA 98119-2728
24931	SPECIALTY CONNECTOR CO INC	2100 EARLYWOOD DR PO BOX 547	FRANKLIN IN 46131
2K262	BOYD CORP	6136 NE 87th AVE PO BOX 20038	PORTLAND OR 97220
34785	DEK INC	3480 SWENSON AVE	ST CHARLES IL 60174-3450
55335	JKL COMPONENTS CORP	13343 PAXTON STREET	PACOIMA CA 91331
56501	THOMAS & BETTS CORP	1555 LYNNFIELD RD	MEMPHIS, TN
60381	PRECISION INTERCONNECT	16640 SW 72ND AVE	PORTLAND OR 97224
71400	BUSSMANN DIV OF COOPER INDUSTRIES INC	114 OLD STATE RD PO BOX 14460	ST LOUIS MO 63178
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD	COLD SPRING KY 41076-9749
7X318	KASO PLASTICS INC	11015 A NE 39th	VANCOUVER WA 98662
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
80126	PACIFIC ELECTRICCORD CO	747 W REDONDO BEACH PO BOX 10	GARDENA CA 90247-4203
85471	BOYD CORP	13885 RAMOMA AVE	CHINO CA 91710
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61108-5181
S3109	FELLER U.S. CORPORATION	72 VERONICA AVE UNIT 4	SUMMERSET NJ 08873
TK0196	ALMAC-STROUM ELECTRONICS (DIST)	1885 NW 169TH PLACE	BEAVERTON OR 97006
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609-3320
TK0977	ELECTRICAL INSULATION SUPPLIERS	3549 NW YEON	PORTLAND, OR 97210
TK1151	QUALITY PLASTIC INC	2101 CRESTVIEW DR PO BOX 740	NEWBERG OR 97132-9518
TK1572	RAN-ROB INC	631 85TH AVE	OAKLAND CA 94621-1254
TK1935	ACCRA-FAB INC	11007 NE 37TH CIRCLE	VANCOUVER WA 98682
TK2364	ARROW/KIERULFF ELECTRONICS	1800 NW 167TH PLACE SUITE 145	BEAVERTON OR 97006
TK2548	XEROX BUSINESS SERVICES DIV OF XEROX CORPORATION	14181 SW MILLIKAN WAY	BEAVERTON OR 97077

## Replaceable Mechanical Parts

Fig. & index no.	Tektronix part no.	Serial number Effective	Dscont	Qty	Name & description	Mfr. code	Mfr. part no.
1-1	426-2102-00			1	FRAME,CRT:BEZEL *MOUNTING PARTS*	TK1151	ORDER BY DESC
-2	211-0690-02			2	SCREW,MACHINE:6-32 X 0.875,PNH,SST *END MOUNTING PARTS*	93907	B20-70430
-3	333-3306-00			1	PANEL,FRONT:1720	22670	ORDER BY DESC
-4	378-0258-00			1	FLTR,CONTRASTIN:GRAY,POLYCARBONATE	80009	378025800
-5	333-3302-01	B050000	B059999	1	PANEL,FRONT:MAIN	80009	333330201
	333-3302-02	B060000		1	PANEL,FRONT:MAIN FRONT PANEL,1720 (1720 ONLY)	80009	333-3302-02
	333-3303-01	B050000	B059999	1	PANEL,FRONT:1721	80009	333330301
	333-3303-02	B060000		1	PANEL,FRONT:FRONT PANEL,1721 (1721/1721PM/1721PN ONLY) *MOUNTING PARTS*	80009	333-3303-02
-6	211-0721-00			2	SCREW,MACH:6-32 X 0.375,PNH,STL,CDPL,T-15 TORX DR *END MOUNTING PARTS*	0KB01	ORDER BY DESC
-7	366-2068-00			1	KNOB:GRAY,0.46 ID X 0.588 OD X 0.6 H	7X318	ORDER BY DESC
-8	-----			1	PHASE SHIFTER: (SEE A4 REPL) *MOUNTING PARTS*		
-9	210-0580-00			1	NUT,PLAIN,HEX:0.312-32 X 0.375,BRS NP	73743	24030-101
-10	210-0519-00			1	WASHER,FLAT:0.312 ID X 0.44 OD X 0.016,AL	12327	ORDER BY DESC
-11	210-0048-00			1	WASHER,LOCK:0.32 ID INTL,0.015 THK,STL CD PL	09772	ORDER BY DESC
-12	210-1025-00			2	WASHER,FLAT:0.312 ID X 0.469 OD X 0.031,BRS *END MOUNTING PARTS*	12327	ORDER BY DESC
-13	-----			1	CIRCUIT BD ASSY:FRONT PNL (SEE A2 REPL) *MOUNTING PARTS*		
-14	211-0721-00			4	SCREW,MACH:6-32 X 0.375,PNH,STL,CDPL,T-15 TORX DR *END MOUNTING PARTS*	0KB01	ORDER BY DESC
-15	426-2101-01	B050000	B059999	1	FRAME SECT,CAB.:FRONT	TK1151	ORDER BY DESC
	426-2101-04	B060000		1	FRAME SECTION:FRAME SECTION,CABINET,FRONT *MOUNTING PARTS*	7X318	1350
-16	211-0721-00			3	SCREW,MACH:6-32 X 0.375,PNH,STL,CDPL,T-15 TORX DR *END MOUNTING PARTS*	0KB01	ORDER BY DESC
-17	-----			1	SWITCH,PUSH:0.4A,125VAC,W/SOLDER LUG,BUTTONW/ YELLOW INDICATOR (SEE S1 REPL) *MOUNTING PARTS*		
-18	210-0405-00			2	NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
-19	211-0100-00			2	SCREW,MACHINE:2-56 X 0.750,PNH,STL *END MOUNTING PARTS*	TK0435	ORDER BY DESC
-20	-----			1	CIRCUIT BD ASSY:MAIN (SEE A3 REPL) *MOUNTING PARTS*		
-21	211-0721-00			8	SCREW,MACH:6-32 X 0.375,PNH,STL,CDPL,T-15 TORX DR *END MOUNTING PARTS*	0KB01	ORDER BY DESC
-22	196-3146-00			6	CA ASSY,SP:FLAT FLEX,;FLX,27 AWG,1.0 L,PCB,TERM,STR BOTH ENDS	TK0196	FSN-1A,P OR K
-23	-----			1	CIRCUIT BD ASSY:GRATICULE LIGHT (SEE A3A1 REPL)		

## Replaceable Mechanical Parts

Fig. & index no.	Tektronix part no.	Serial number Effective	Dscont	Qty	Name & description	Mfr. code	Mfr. part no.
-24	337-3321-00			1	SHIELD,ELEC:CKT BD	85471	337-3321-00
-25	-----			1	CIRCUIT BD ASSY:POWER SUPPLY (SEE A1 REPL) *MOUNTING PARTS*		
-26	211-0721-00	B050000	B066156	7	SCREW,MACH:6-32 X 0.375,PNH,STL,CDPL,T-15 TORX DR	0KB01	ORDER BY DESC
	211-0721-00	B066157		6	SCREW,MACH:6-32 X 0.375,PNH,STL,CDPL,T-15 TORX DR	0KB01	ORDER BY DESC
	211-0720-01	B066157		1	SCREW,MACH:6-32 X 0.50,PNH,STL,TORX T-15 WITH SLOT (1720 ONLY)	0KB01	211-0720-01
	211-0721-00	B050000	B066408	7	SCREW,MACH:6-32 X 0.375,PNH,STL,CDPL,T-15 TORX DR	0KB01	ORDER BY DESC
	211-0721-00	B066409		6	SCREW,MACH:6-32 X 0.375,PNH,STL,CDPL,T-15 TORX DR	0KB01	ORDER BY DESC
	211-0720-01	B066409		1	SCREW,MACH:6-32 X 0.50,PNH,STL,TORX T-15 WITH SLOT (1721/1721PM/1721PN ONLY)	0KB01	211-0720-01
-27	337-3796-01			1	SHIELD,ELEC:0.032 BRASS,C26000,0.5 HARD	80009	337379601
-28	211-0014-00			2	SCREW,MACHINE:4-40 X 0.5,PNH,STL *END MOUNTING PARTS*	TK0435	ORDER BY DESC
-29	131-3573-00			1	CONN,PLUG,ELEC:MALE,W/LOCKING ADAPTER	80126	B-0779
-30	337-3257-00			2	SHIELD,CKT BD:LV PWR SUPPLY	2K262	ORDER BY DESC
-31	337-3931-00			1	SHIELD,ELEC:ALUMINUM	80009	337393100
-32	175-9872-01			1	CA ASSY,SP,ELEC:2,18 AWG,2.5 L,0-N	TK2364	175-9872-01
-33	333-3309-02	B050000	B059999	1	PANEL,REAR:1720	80009	333330902
	333-3309-03	B060000		1	PANEL,REAR:REAR PANEL,1720 *MOUNTING PARTS*	80009	333-3309-03
-34	211-0721-00			3	SCREW,MACH:6-32 X 0.375,PNH,STL,CDPL,T-15 TORX DR *END MOUNTING PARTS*	0KB01	ORDER BY DESC
-35	131-0106-02			7	CONN,RF JACK:BNC;50 OHM,FEMALE,STR,SLDR CUP/FRT PNL,0.520 MLG X0.403 TAIL,0.04 L SLDR CUP,0.380,D/1 FLAT	24931	28JR178-1
-36	210-0255-00			3	TERMINAL,LUG:0.391 ID,LOCKING,BRS CD PL	TK1572	ORDER BY DESC
-37	174-0335-01			1	LEAD,ELECTRICAL:22 AWG,9.75 L,9-N	80009	174033501
-38	174-0123-02			1	CABLE ASSY SP:ELEC,24,26 AWG,21.0 L, RIBBON *MOUNTING PARTS*	80009	174012302
-39	214-3903-01			2	SCREW,JACK:4-40 X 0.312 EXT THD,4-40 INT THD,0.188 HEX,STEEL,CADPLATE *END MOUNTING PARTS*	0KB01	214-3903-01
-40	-----			1	CKT BD ASSY:SERIAL FILTER (SEE A11 REPL) *MOUNTING PARTS*		
-41	214-3903-01			2	SCREW,JACK:4-40 X 0.312 EXT THD,4-40 INT THD,0.188 HEX,STEEL,CADPLATE *END MOUNTING PARTS*	0KB01	214-3903-01
-42	348-1464-00			1	MANCHET:CRT,END RUBBER MANCHET,31.5MM THK X 63MM OD,50.5 ID	80009	348146400
-43	407-4395-00			1	BRACKET,CRT:BACK,0.062,AL *MOUNTING PARTS*	80009	407439500
-44	210-0457-00			2	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL *END MOUNTING PARTS*	TK0435	ORDER BY DESC
-45	-----			1	CIRCUIT BD ASSY:CRT SOCKET BD (SEE A10 REPL)		
-46	346-0133-00			1	STRAP,TIEDOWN,E:14.0 X 0.091,NYLON	56501	TY234M EURO DIR
-47	337-4064-00	B050000	B066771	1	SHIELD, ELEC:MU-METAL CRT SHIELD	80009	337406400
	337-4087-00	B066772		1	SHIELD,ELEC:CRT,METAL (1720 ONLY)	0J9P9	337-4087-00
	337-4064-00	B050000	B066815	1	SHIELD, ELEC:MU-METAL CRT SHIELD	80009	337406400
	337-4087-00	B066816		1	SHIELD,ELEC:CRT,METAL (1721/1721PM/1721PN ONLY)	0J9P9	337-4087-00

# Replaceable Mechanical Parts

Fig. & index no.	Tektronix part no.	Serial number Effective	Dscont	Qty	Name & description	Mfr. code	Mfr. part no.
-48	334-1379-00			1	MARKER,IDENT:MKD HI VACUUM	07416	ORDER BY DESC
-49	386-4443-00	B050000	B066771	1	SUPPORT,SHIELD:CRT,FRONT,PLASTIC	80009	386444300
	386-6911-00			4	SUPPORT, SHIELD:CRT SHIELD SUPPORT,PLASTIC 1720 ONLY	7X318	1365
		B066772					
	386-4443-00	B050000	B066815	1	SUPPORT,SHIELD:CRT,FRONT,PLASTIC	80009	386444300
	386-6911-00			4	SUPPORT, SHIELD:CRT SHIELD SUPPORT,PLASTIC 1721 ONLY	7X318	1365
		B066816					
-50	-----			1	ELECTRON,TUBE:CRT,FINISHED (SEE V1 REPL)		
	253-0443-00	B050000	B066262	1	TAPE,PRESS SENS:0.75 W/POLYESTER BACKING	80009	253-0443-00
	253-0452-00	B066263		1	TAPE,PRESS SENS:0.375 NONCONDUCTIVE COMBO,WHITE P286, & BLACK P281,5.0 MIL, PRINTABLE, POLY, INS (1720 ONLY)	TK0977	P-281
	253-0443-00	B050000	B066465	1	TAPE,PRESS SENS:0.75 W/POLYESTER BACKING	80009	253-0443-00
	253-0452-00	B066466		1	TAPE,PRESS SENS:0.375 NONCONDUCTIVE COMBO,WHITE P286, & BLACK P281,5.0 MIL, PRINTABLE, POLY, INS (1721/1721PM/1721PN ONLY)	TK0977	P-281
-51	348-0171-00			1	GROMMET,PLASTIC:BLACK,U-SHAPED,0.276 ID	0KBZ5	NA
-52	343-0916-00	B050000	B066156	1	CLAMP,LOOP:0.5 ID,NYLON	34785	029-500
	343-0013-00	B066157		1	CLAMP,LOOP:0.375 ID,PLASTIC  (1720 ONLY)	06915	E6 CLEAR ROUND CABLE CLAMP
	343-0916-00	B050000	B066408	1	CLAMP,LOOP:0.5 ID,NYLON	34785	029-500
	343-0013-00	B066409		1	CLAMP,LOOP:0.375 ID,PLASTIC  (1721/1721PM/1721PN ONLY)	06915	E6 CLEAR ROUND CABLE CLAMP
-53	426-2103-07			1	FRAME, CHASSIS:ALUMINUM	80009	426-2103-07
-54	211-0720-01			2	SCREW,MACH:6-32 X 0.50,PNH,STL,TORX T-15 WITH SLOT	0KB01	211-0720-01
-55	129-1308-00	B066157		1	SPACER,POST 6-32 X 0.75 HEX,STL, CAD PL (1720 ONLY)	00570	129130800
	129-1308-00	B066409		1	SPACER,POST 6-32 X 0.75 HEX,STL, CAD PL (1721/1721PM/1721PN ONLY)	00570	129130800
					STANDARD ACCESSORIES		
	012-1422-01			1	CA ASSY,SP,ELEC:MLD,1720	60381	202M-2
	070-5846-05			1	MANUAL,TECH:INSTRUCTION,1720 SERIES VECTORSCOPE	TK2548	070-5846-05
	150-0168-00			3	LAMP,INCAND:14V,0.08A,WEDGE BASE,T1.75FOR SKT MT	55335	73W
	159-0021-00			1	FUSE,CARTRIDGE:3AG,2A,250V,FAST BLOW	71400	AGC-2
-56	174-0183-00			1	CA ASSY,SP,ELEC:9,26 AWG,12.0 L,RIBBON	TK0196	86054T
-57	161-0216-00			1	CABLE ASSY,PWR;-,3,18 AWG,2.5M L,BLACK (STANDARD ONLY)	80126	C7120-25M-BL
					OPTIONAL ACCESSORIES		
-58	161-0215-00			1	CABLE ASSY,PWR:3,0.75MU,2.5MM L,GREY (EUROPEAN OPTION A1 ONLY)	80126	0-5335-008-GY
-59	161-0066-10			1	CA ASSY,PWR:3,0.1MM SQ,250V/10A,2.5 METER,STR, IEC320,RCPT X 13A,FUSED UK PLUG(13A FUSE),UNITED KINGDOM,SAFTEY CONTROLLED (UNITED KINGDOM OPTION A2 ONLY)	S3109	BS/13-H05VVF3G0
-60	161-0066-11			1	CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 METER,STR, IEC320,RCPT,AUSTRALIA,SAFTEY CONTROLLED (AUSTRALIAN OPTION A3 ONLY)	S3109	198-000
-61	161-0212-00			1	CABLE ASSY,PWR:3,1.0MM SQ,220V,2.5 METERS (SWISS OPTION A5 ONLY)	5F520	86542000

**Replaceable Mechanical Parts**

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Fig. & index no.	Tektronix part no.	Serial number Effective	Dscont	Qty	Name & description	Mfr. code	Mfr. part no.
	016-0475-00			1	VIEWING HOOD:1740	80009	016047500
	200-3897-01			1	COVER,FRONT:1700F02,HOT STAMPED	80009	200389701
	-----			1	CAMERA,SCOPE:C9 (OPTION 20 ONLY)		
	-----			1	PLAIN CASE ASSY:1700F00		
	-----			1	PTD CASE ASSY:1700F02		
	-----			1	RACK ADAPTER:1700F05		
	-----			1	FILLER PANEL:1700F06		
	-----			1	DRAWER,UTILITY:1700F07		







