

# **+5 VOLTS POWER SUPPLY (UPGRADED) MODULE SERVICE MANUAL ADDENDUM**

**TO THE DAS 9100 SERIES SERVICE MANUAL  
(PART NUMBERS 062-5848-00, 01 AND UP)**

The 062-5848-00 manual set is a package consisting of loose leaf binders with manuals and addenda. Each manual and addendum in the set has its own part number starting with the prefix 070.

This addendum contains service information about the upgraded +5 Volts Power Supply Module for the DAS 9100 Series Mainframes (including DAS9119). All DAS mainframes will use the upgraded +5 V power supply, 020-0707-01, as well as the previous model, 020-0707-00.

Refer to the *DAS 9100 Series Service Manual* for information on other DAS products, including mainframes, instrument modules, probes, and options.

**NOTE**

*An 020-0707-01 part number includes the 062-0296-01 power supply and the 070-3630-01 Instructions sheet. Order the 062-0296-01 part number to receive the power supply only.*

**How To Use This Addendum.** This addendum is organized similarly to the *DAS 9100 Series Service Manual*: sections in the addendum correspond to the sections in the service manual. You can either leave the addendum whole and place it in one of the service manual binders, or you can separate the sections and insert them after the corresponding section in the main manual.

NOTE: You can order an extra service manual binder (Vol. III) by requesting P/N 016-0769-00.

**PLEASE CHECK FOR CHANGE INFORMATION  
AT THE REAR OF THIS MANUAL.**

## WARNING

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

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## **OPERATOR'S SAFETY SUMMARY**

*See the Operator's Safety Summary at the front of the DAS 9100 Series Service Manual.*

## **SERVICE SAFETY SUMMARY (FOR QUALIFIED SERVICE PERSONNEL ONLY)**

*See the Service Safety Summary at the front of the DAS 9100 Series Service Manual.*



## INTRODUCTION AND SPECIFICATIONS

This document provides instructions for maintaining the DAS 9100 Series +5 V Power Supply module. At least one +5 V Power Supply is installed in each DAS 9100 Series mainframe. Additional modules can be ordered as options. Option 03 adds one additional +5 V Power Supply: Option 04 adds two +5 V Power Supplies.

### DESCRIPTION

The +5 V Power Supply is a plug-in module providing +5 V operating power for two contiguous module bus slots. If more than two modules are used, more power must be added as specified under mainframe Options 03 and 04 (see *DAS 9100 Series Service Manual*).

### SPECIFICATIONS

#### PERFORMANCE CONDITIONS

Instrument characteristics given in this section are valid under the following conditions:

- The mainframe must be operating as a part of an appropriately configured instrument system.
- The instrument system must be in an operating environment whose limits are described in this section.
- The instrument system must have been calibrated at an ambient temperature of between +20°C and +30°C after a 30 minute warmup.

Any applicable conditions not listed above but unique to a particular characteristic are expressly stated as part of the characteristic.

#### ENVIRONMENTAL SPECIFICATIONS

The environmental specifications for the DAS 9100 Series +5 V Power Supply Module meet, or exceed, those specified for the operation of the DAS 9109 mainframe.

The non-operating environmental specifications for this instrument are those stated for a Class V instrument in Tektronix Standard 062-2853-00, including the specifications pertaining to the transportation of the packed instrument.

## SAFETY SPECIFICATIONS

The safety specifications for the operation of this instrument meet, or exceed, those specified for the operation of the DAS 9109 mainframe.

## ELECTRICAL SPECIFICATIONS

**Table 1-1**  
**+5 V POWER SUPPLY MODULE (EACH)**  
**DAS9129 AND DAS9109 ELECTRICAL SPECIFICATIONS: MAINFRAME POWER**

Characteristic	Performance Requirements	Supplemental Information
Input Power		±160 V unregulated @ ≈1 A +5.0 V ref @ <2 mA +11.3 V unregulated @ 50 mA
Output Power		
Voltage	+5.0 V, ±3%	
Ripple	50 mV, max., p-p	
Current		22 A, max., cont. 1.0 A, min.
Overload Protection		Current limited above 22 A and below 25 A
Over-voltage Protection		Above 6.3 V.



## OPTIONS

No options are planned for the DAS 9100 Series +5 V Power Supply module.

## OPERATING INSTRUCTIONS

Refer to the *DAS 9100 Operator's Manual* for operating instructions. There are no controls or connectors on the +5 V Power Supply module that are controlled by the operator.



## THEORY OF OPERATION GENERAL

The +5 V module (assembly number A45) supplies +5 V at 22 A, which is sufficient to drive two instrument modules. The module cannot be operated without a Main Power Supply board since the Main Power Supply provides both the clock and the +5 V reference for the +5 V module. Any component numbers in the +5 V power supply circuit description are assumed to have A45A1 as a preface unless otherwise stated.

The +5 V module operates like the +12 V side of the Main Power Supply. Figure 4-1 is a block diagram of the +5 Volt Power Supply.

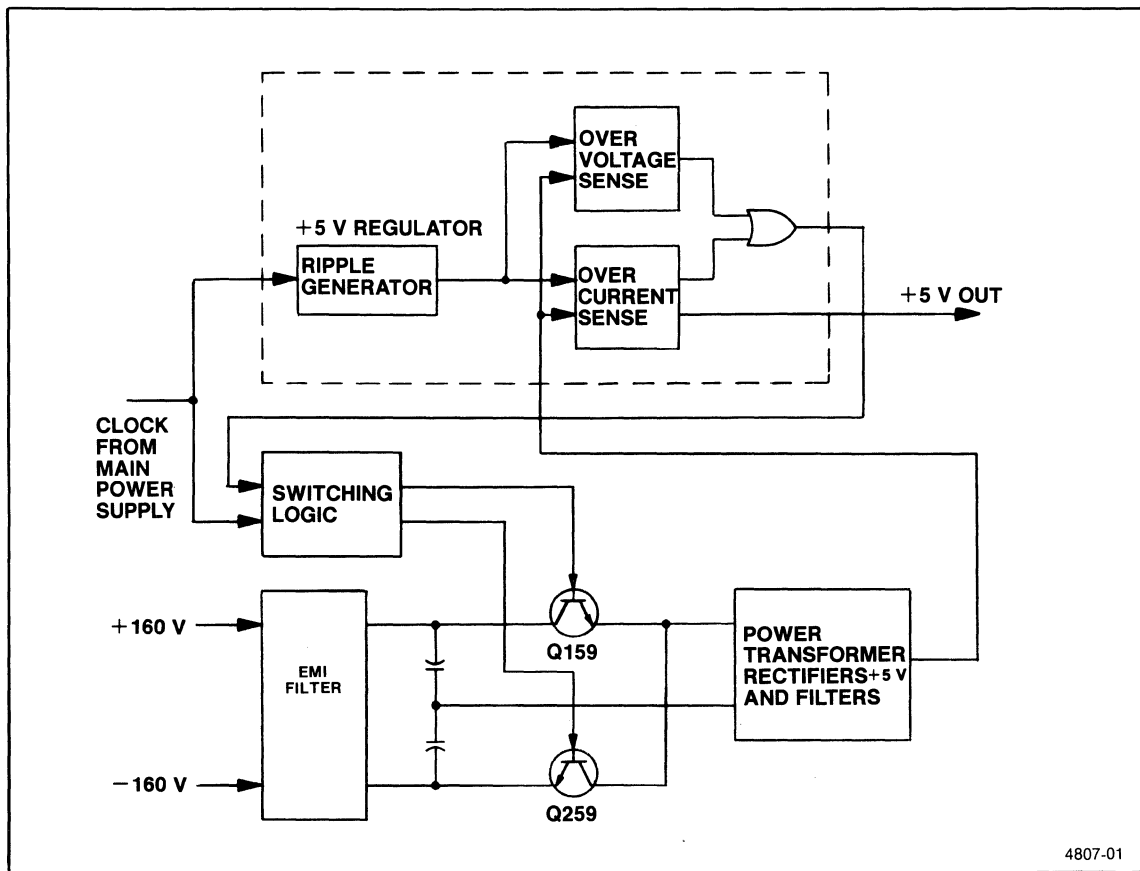


Figure 4-1.+5 V Power Supply block diagram.

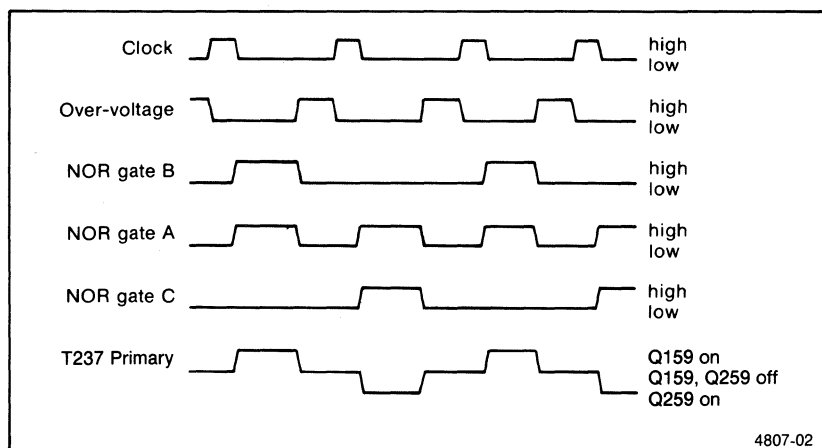
### +5 VOLT POWER SUPPLY CIRCUITRY 7

#### Power Supply Clock

The clock is provided by the Main Power Supply and is used to control the switching logic and the +5 V regulators.

**Switching Logic**

The switching logic drives switches Q159 and Q259 to provide pulsed dc to transformer T448. The switching is designed to provide pulse width modulation for the switches as a means of voltage regulation. The clocked flip-flop U120B is a divide-by-two that writes alternate 1s and 0s to triple-input NOR gate U124B and the inverse to triple-input NOR gate U124C. Flip-flop U124A is set by a rising edge from the over-voltage or over-current sensors in the +5 V sense circuit, and is reset by a rising edge from the clock. The output of the RS flip-flop is sent to inputs of all the triple-input NOR gates in package U124. The clock is also sent to all three NOR gates. A timing diagram showing the relationships between the clock line, the over-voltage or over-current line, and the three NOR gates is shown in Figure 4-2.



**Figure 4-2. +5 V Power Supply switching logic.**

Each of the NOR gates in U124 drives a switching transistor. If NOR gate B is high, current flows from tap 2 to tap 3 of T237, through Q234 to ground. Likewise, if NOR gate C is high, current flows from tap 2 to tap 1 and through Q133 to ground. When the over-voltage or over-current line is set, all of the NOR gates outputs are low. This situation makes Q234 and Q133 non-conducting and Q134 conducting, which shorts the transformer out across diodes CR133 and CR234. The short means no current will flow through T237, as can be seen in Figure 4-2.

**Switches**

The secondaries of transformer T237 drive the bases of switching transistors Q159 and Q259. When current flows from tap 2 to tap 3 of the base drive transformer T237, Q159 is turned on and Q259 is left off. Q159 then conducts current from the +160 V supply through the primary of T448 to charge capacitors C359, C459, C353 and C453. When the current to the base drive transformer is turned off, both drive transistors are turned off so no current flows through the primary of the power transformer. When transistor Q259 is turned on, capacitors C359, C459, C353 and C453 are discharged to -160 V through the primary of transformer T448. Then both drive transistors are again turned off and the cycle repeats.

The support components for the switches include the following:

- Resistors R259 and R451, which bleed off capacitors C353, C453, C359 and C459.
- Resistor R257 and capacitor C258, which damp any ringing from the inductance of the primary of transformer T448 when both drive transistors turn off.
- Diodes CR249 and CR351, which limit the back EMF from the transformer primary inductance to the supply voltages ( $\pm 160$  V) to protect the driving transistors.
- Diodes CR250, CR251, CR252, and CR253, which keep the driving transistors from saturating, allowing them to turn off fast.
- Capacitors C252 and C353, which bypass diodes CR252 and CR253 during turn-off.

#### EMI Filter

When driving transistors Q159 and Q259 switch at high frequencies, they force high frequency interference into the supplying lines. Since this interference can disrupt other devices connected to the same line supply, it must be filtered out. T155, L133, C137, C143, C140, and R140 are an EMI filter to block this interference before it gets to the supply line.

#### +5 V Supply

This block is a standard full-wave rectifier with the exception of resistors R331 and R315 and capacitors C232 and C305. These components act as snubbers to restrict ringing when the diodes switch. L308, L319, L329, C309, C425, and C429 act as a standard LC filter. Diode CR406 prevents the output from being reversed.

#### +5 V Sense

The outputs of comparators U112A and D and U112B form an OR gate. If the +5 V line goes over-voltage or draws too much current, this OR gate goes high; otherwise the output, pin 1 of U112B, will be low. U112B is an inverting buffer with its non-inverting terminal tied to the +5 V reference. The output is used to set flip-flop U120A.

A ripple generator is tied to the non-inverting pins of the over-voltage and over-current sensors. The ripple generator consists of comparator U112C, an inverting buffer; Q219, which is controlled by the comparator; Q218, a constant current source; and capacitor C210. When Q219 is turned on by the clock being high, C210 is charged high. When Q219 is turned off by the clock, the charge on C210 is drained through Q218. This causes a downward voltage ramp. The ramp wave across C210 is voltage divided by R116 and R217 to produce a 200 mV peak-to-peak waveform. The ripple waveform is applied to the non-inverting side of both the over-voltage and over-current sensors to prevent the comparators from free-running, and to provide for a small amount of ripple at the output. It also keeps the over-voltage and/or over-current control in sync with the clock rate.

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The over-voltage sensor built around U112D has an input from pin 5 of P400. This input ties to the +5 V supply bus to sense if the voltage gets too high. If this line should be disconnected, R305 prevents the output from going totally out of regulation. R207 matches impedance to the comparator. C218 provides loop compensation. The non-inverting input of U112D goes to the +5 V reference and is coupled through a capacitor to the ripple generator.

The over-current sensor, U112A, looks at the voltage drop across resistor R414 through resistors R208, R209, and R410, which form a voltage divider. The non-inverting input of the comparator is biased by the ripple generator. C409 removes noise.

Transistor Q113 can be used to force the +5 V regulator's wired OR gate to trigger at the inverse of the power supply clock for power-up testing and troubleshooting. See the *Maintenance: Troubleshooting section* of this manual for more information.

### Over-Voltage Protection (OVP)

For over-voltage protection, all +5 V power supplies are shut down when any +5 V power supply rises above 6.2 volts.

Zenor diode VR218 conducts when the +5 V supply rises causing Q225 to conduct. When Q225 is on, Q224 saturates and the P.S. Clock line from the main power supply is raised to +11.3 V and no longer pulses. All +5 V power supplies are then shut down.

The main power supply is not affected, however, when the +5 V power supplies are shut down.

# VERIFICATION AND ADJUSTMENT PROCEDURES

## INTRODUCTION

This section of the addendum contains only functional check procedures. These procedures, along with the test setup information at the beginning of the section, allows a qualified technician to verify the operation of the +5 V Power Supply (Upgraded).

**Functional Check Procedures.** These tests verify that the device being tested is operational or that repair is necessary. The procedures exercise the main interfaces of the device and check its internal features. These tests can be used to determine whether repair is necessary.

**Test Setup Information.** The procedures in this section require some test equipment, setups and general information. This information and a list of suggested test equipment is presented at the beginning of the functional check.

## FUNCTIONAL CHECK PROCEDURES

### +5 V POWER SUPPLY FUNCTIONAL CHECK

Refer to the beginning of the *Verification and Adjustments Procedures* section of the *DAS 9100 Series Service Manual* set-up instructions. The functional check for the +5 V Power Supply verifies the presence and accuracy of the voltage provided by the supply.

You will need the following equipment to perform this procedure:

- DAS 9100 mainframe (containing the +5 V supply to be tested)
- Main Extender Board (in the DAS Service Maintenance Kit)
- Digital multimeter (or any dc volt measuring device)
- Oscilloscope with probe
- Two DAS instrument modules

Refer to the *Operating Information* section of the *DAS 9100 Series Manual* for procedures covering installation of instrument modules. Refer to the beginning of this *Verification and Adjustment Procedures* section of the *DAS 9100 Series Service manual* for instructions for installing the Main Extender Board.

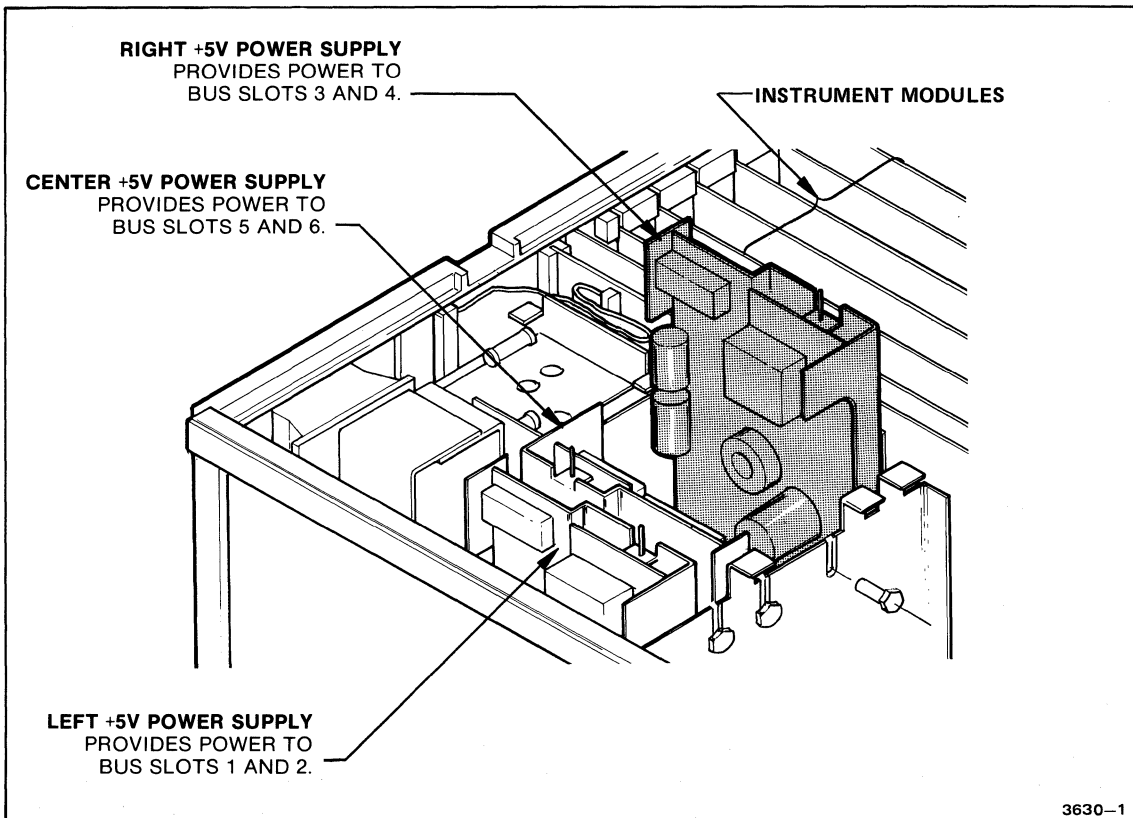
**(1) Setup for the Functional Check**

The following procedures bring the voltage supplied by the +5 V Power Supply module out of the mainframe so they can be measured. The procedure is designed so that access to the power supply compartment of the mainframe is unnecessary.

1. Turn off the mainframe.
2. Set the Main Extender Board to accept a standard instrument module. Install the extender board in one of the slots powered by the +5 V supply being tested (see Figure 5-1).
3. Install one of the DAS instrument modules on top of the extender board. Install the other instrument module in the other slot powered by the +5 V supply (see Figure 5-1).

**CAUTION**

*Do not install or remove any electrical module or sub-assembly in a DAS mainframe while the power is on. Doing so will probably damage the module or sub-assembly.*



**Figure 5-1. Bus slots powered by each +5 V Power Supply (upgraded) Module.**



## **(2) Verifying Voltage Accuracy**

The following procedures check the accuracy of the +5 V supply voltage.

1. Turn on the mainframe. The power-up self-test should pass. Examine the LEDs at the top foremost corner of the extender board. All LEDs should be lit; they indicate the presence of +12 V, +6 V, -5 V, and -12 V (from the main power supply) and +5 V (from the supply being tested).
2. Using the digital multimeter, verify the accuracy of the +5 V supply. The voltage can be measured on the main extender board on the +5 V pin in the upper right-hand corner. The voltage should be between +4.85 V and +5.15 V.

## **(3) Verifying Maximum Voltage Ripple**

The next steps verify that the voltage ripple on the supply is within the maximum ripple specification. These steps assume the voltage accuracy has just been verified, so the +5 V supply can be measured on the extender board.

1. Disconnect the digital multimeter from the extender board.
2. AC-couple the oscilloscope. Set the oscilloscope to a convenient scale for measuring 50 mV peak-to-peak.
3. Using the oscilloscope, verify that the ripple on the supply voltage does not exceed specifications. The voltage can be measured at the +5 V pin on the upper right-hand corner of the main extender board. The ripple should be less than or equal to 50 mV peak-to-peak.

This completes the +5 V Power Supply functional check. Turn off the mainframe before removing the Main Extender Board or any instrument modules. There are no adjustments required for the +5 V Power Supply.

## **+5 V POWER SUPPLY PERFORMANCE CHECK**

There is no performance check procedure for the DAS +5 V power supplies. The functional check, given previously, verifies all of the performance requirements of the supplies. There are no adjustments required on DAS + 5V power supplies.



## MAINTENANCE: GENERAL INFORMATION

Tektronix maintains repair and recalibration facilities at its local Field Service Centers and the Factory Service Center. For further information or assistance, contact your local Tektronix Field Office or representative.

### MAINTENANCE PRECAUTIONS

#### SOLDERING

Most of the components in the module are soldered in place. If it is necessary to replace a soldered part, use a 15 W soldering iron to prevent heat damage to the circuit board or components. Excessive heat will lift circuit runs on the circuit board.

The flux in the solder may leave a residue on the circuit board that can provide a high resistance leakage path and affect instrument operation. Be sure to clean off this residue. Isopropyl alcohol may be used.

#### STATIC PRECAUTIONS



*Static discharge can damage any semiconductor in this instrument.*

This module contains electrical components that are susceptible to damage from static discharge. See Table 6-1 for the relative susceptibility of various classes of semiconductors. Static voltages of 1—30 kV are common in unprotected environments.

#### **Observe the following precautions to avoid damage:**

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

- 9. Use a soldering iron that is connected to earth ground.
- 10. Use only special anti-static suction-type or wick-type desoldering tools.

**NOTE**

*Damage to electrical components may not be immediately apparent. Always follow the precautionary measures listed above when handling static-sensitive components.*

**Table 6-1  
RELATIVE SUSCEPTIBILITY OF SEMICONDUCTORS  
TO STATIC DISCHARGE DAMAGE**

<b>Semiconductor Class</b>	<b>Danger Voltage<sup>a</sup></b>
MOS or CMOS	100 - 500 V
ECL	200 - 500 V
Schottky signal diodes	250 V
Schottky TTL	500 V
High-frequency bipolar transistors	400 - 600 V
JFETs	600 - 800 V
Linear microcircuits	400 - 1000 V
Low-power Schottky TTL	1200 V

<sup>a</sup>Voltage discharged from a 100 pF capacitor through a resistance of 100 Ω.

**TEST EQUIPMENT REQUIRED FOR MAINTENANCE**

Test equipment required to service the module is listed under *Troubleshooting Equipment* in the *Maintenance: Troubleshooting* section of this manual.

**TOOLS REQUIRED FOR MAINTENANCE**

The following tools are those most often needed when servicing the module:

Tool	Tektronix Part No.
<ol style="list-style-type: none"> <li>1. Soldering iron, (15 W)</li> <li>2. Rosin core solder, 60/40</li> <li>3. Isopropyl alcohol</li> <li>4. Lint-free dust cloth</li> <li>5. Soft-bristle brush</li> <li>6. IC extractor</li> <li>7. Desolder tool</li> <li>8. Solder wick</li> <li>9. Magnetic screwdrivers, 7 inch shank and 4 inch shank</li> <li>10. POZIDRIV-type magnetic bits, 2 inch and 1 inch</li> <li>11. TORX-type magnetic bit, size T-20</li> <li>12. Angled tweezers, 6 inch</li> <li>13. Long-nose pliers</li> <li>14. 1/4 inch combination open/box wrench</li> <li>15. Plastic alignment tool, 5 inch</li> <li>16. Fiber adjustment tool, 9 inch</li> <li>17. Open-end wrench, 7/16 inch</li> <li>18. Allen wrenches, 0.050 inch, 1/16 inch and 5/64 inch</li> <li>19. Circuit board ejector</li> </ol>	<p style="text-align: center;">003-0866-00</p> <p style="text-align: center;">214-3154-00</p>

## DISASSEMBLY/INSTALLATION PROCEDURES

**WARNING**

*Dangerous electric-shock hazards inside the mainframe may be exposed when the covers are removed. Be sure power is off and the power cord is disconnected before removing the covers. After the covers are removed, wait five minutes AFTER the warning lamp on the capacitor bracket board stops flashing before proceeding. Disassembly procedures should only be attempted by qualified service personnel.*

Reassembly procedures are the reverse of the disassembly procedures in most cases. Separate reassembly instructions are provided only when necessary.

Unless otherwise noted, screws mentioned in the text are the pan-head, POZIDRIV type. Size specifications are provided for most screws.

In the following procedures, directional terms (top, bottom, left, right, etc.) are based on the assumption that the DAS is in a normal, upright position and the user is facing the front of the instrument.

### GENERAL DISASSEMBLY PRECAUTIONS

**CAUTION**

*DO NOT attempt any disassembly or installation procedures if power is on.*

*DO NOT* disconnect connectors from the back of the mainframe by pulling on the cables; pull only on the connectors.

*DO NOT* remove connectors between circuit boards by pulling on the wires; pull only on the connectors.

*DO NOT* press or pull on components when manipulating circuit boards.

*GUARD* against static discharge damage by following the precautions listed in Maintenance Precautions in this section.

## REMOVING PANELS AND COVERS

### Top Panel

Figure 6-1 illustrates how to remove the top panel and the module compartment cover.

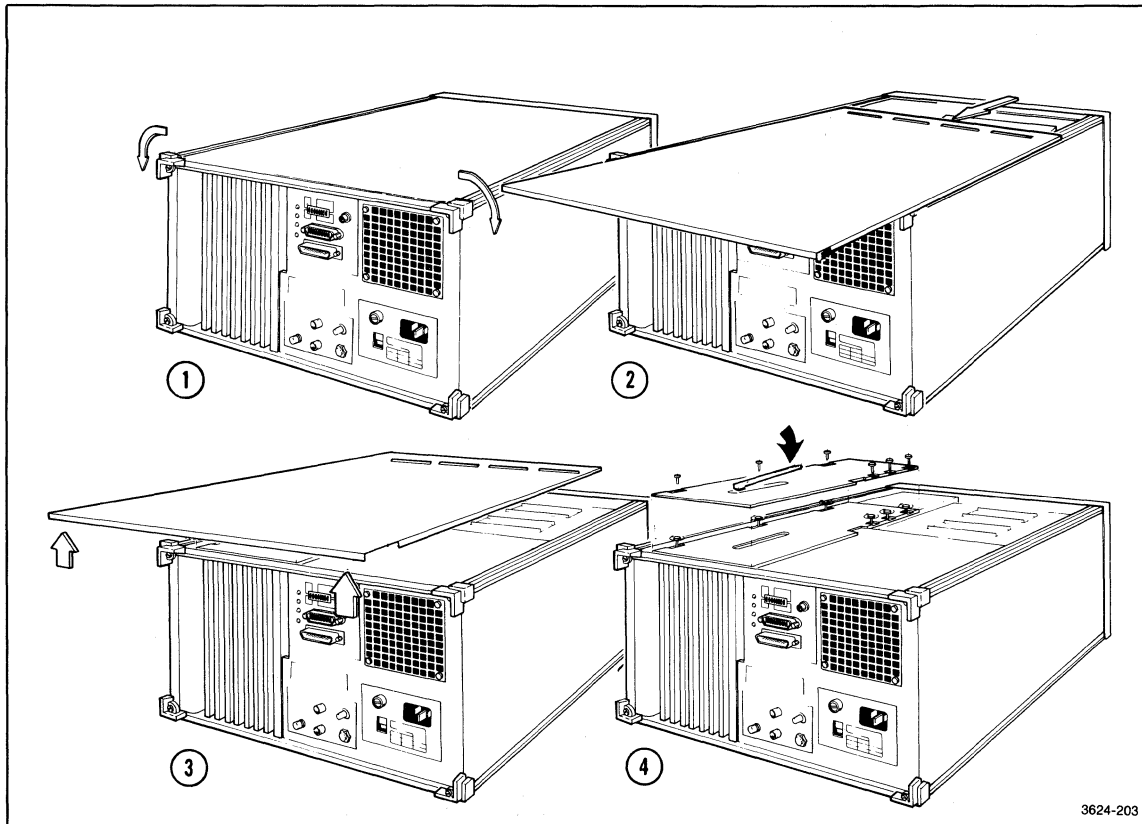


Figure 6-1. Top panel and module compartment cover removal.

1. Loosen the two large slotted screws in the upper corners of the back panel. Rotate the brackets behind these screws until they no longer block the edge of the top panel.
2. Press backward on the ridges at the front of the top panel. Simultaneously, pull on the rear edge until the front edge disengages.
3. Lift the panel up and off the mainframe.
4. Loosen the slotted-head screws that secure the module compartment cover until approximately 1/4 inch of each screw is exposed. Grasp the front edge of the cover and lift it off the mainframe.

## INSTALLING/REMOVING +5 V POWER SUPPLY MODULES

### WARNING

*Hazardous voltages may be exposed when the + 5 V Power Supply modules are installed. Be sure power is off and the power cord is disconnected. After power-down, wait five minutes AFTER the warning lamp on the capacitor bracket board stops flashing before starting this procedure. This will allow the filtering capacitors to discharge.*

### +5 V Power Supply Module Removal

Refer to Figure 6-2. This basic procedure applies to all three +5 V power supply modules.

1. Unplug the unit.
2. Remove the top panel and power supply cover (explained above). Wait five minutes after the warning lamp on the capacitor bracket board stops flashing before proceeding to next step.
3. Loosen the two 1/4 inch hex head screws securing the module to the frame. (It is not necessary to remove the screws.)
4. Lift the module up and out.

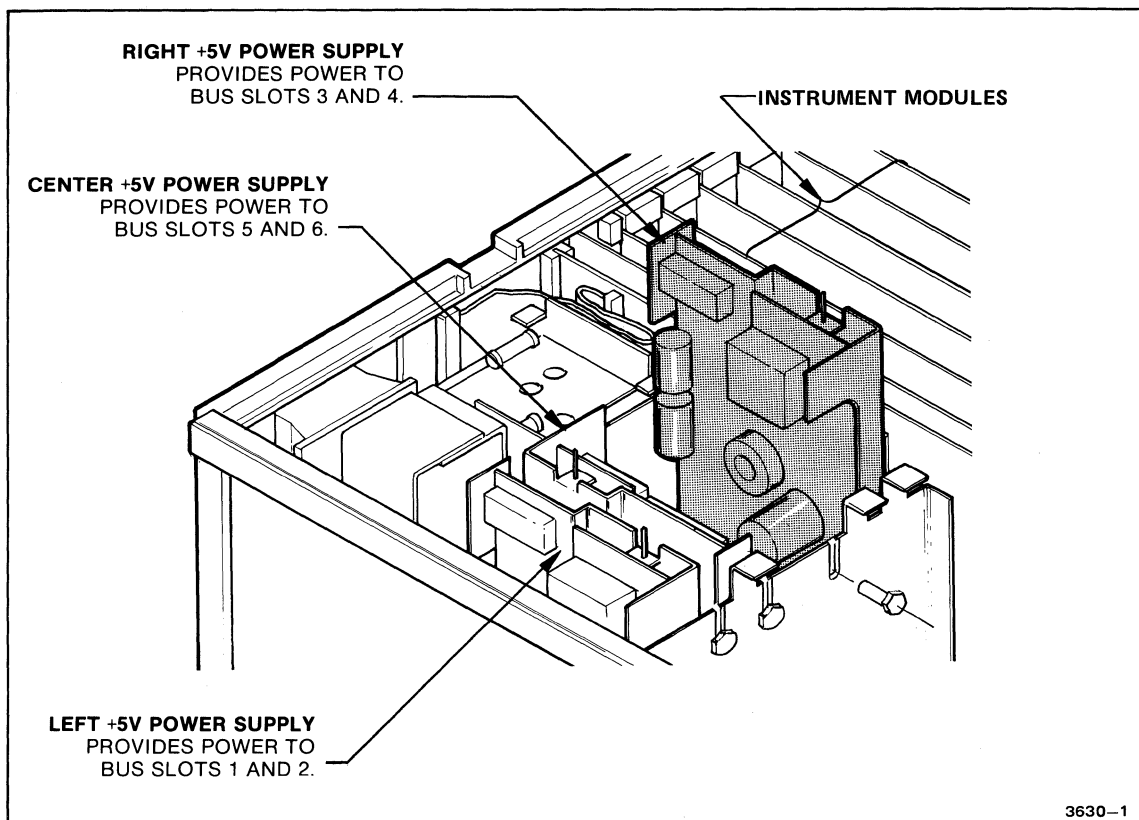
### +5 V Power Supply Module Installation

Figure 6-2 shows the required orientation of +5 V power supply modules in the left, center, and right positions. The modules in the left and right slots have the same placement; the center module has the reverse orientation.

1. Unplug the unit.
2. Remove the top panel and the power supply cover. Wait five minutes after the warning lamp on the capacitor bracket board stops flashing before proceeding to the next step.

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3. Slide the +5 V power supply module into the mainframe in the appropriate position (left, center, or right). The position is determined by which instrument module bus slots require power. Be sure to install the module in the correct orientation.
4. Carefully align the connector on the power supply with the pins on the interconnect board. Press down firmly. Do not press on components.
5. Secure the module to the frame with the two hex-head screws. Do not over-tighten the screws.



**Figure 6-2. Removing a +5 V power supply module.**(This figure shows the Monochrome DAS. The Color DAS is similar.)

## INTERIOR CLEANING

### **WARNING**

*Hazardous voltages may be exposed during interior cleaning of the DAS. Be sure power is off and the power cord is disconnected. After power-down, wait five minutes AFTER the warning lamp on the capacitor bracket board stops flashing before starting this procedure. This will allow the filtering capacitors to discharge.*



Internal cleaning should be done with a dry, low-velocity stream of air. A soft bristle brush is useful for cleaning around components. If a liquid must be used for minor internal cleaning, use isopropyl alcohol.

Should the interior of the module be so dirty as to require a thorough cleaning, it can be washed according to the wash procedure below.

**CAUTION**

*DO NOT use a freon-based cleaner for cleaning the circuit boards. Freon will destroy aluminum capacitors.*

*DO NOT use fluorocarbon-base spray cleaners or silicon spray lubricants on switches or switch contacts. These sprays may damage the circuit board material or plastic parts, and leave a dust-collecting residue. If necessary, New Improved NO NOISE<sup>®</sup> may be used as a lubricant.*

1. Disassemble the module to the point that all areas requiring washing are easily accessible. During disassembly, refer to the *Disassembly/Installation Procedures* described earlier in this section.
2. Spray-wash components with a 5% solution of mild detergent and water. (Kelite, or equivalent, is a usable mild detergent).
3. Thoroughly rinse components with clean water.
4. Blow-dry components with low velocity air.
5. Spray all switch contact areas and connectors with isopropyl alcohol, wait 60 seconds, then blow dry with low velocity air.
6. Heat all components in an oven or compartment using circulating air at +51 to +65°C (+125 to +150°F).

## INSPECTION

Inspect the module for broken connections, frayed wires, poorly seated components, leaking capacitors, damaged hardware, and heat damaged components.

Repair any obvious problems. However, take particular care if you find any heat damaged parts. Overheating usually indicates other circuit problems. To prevent a recurrence of the damage, find and correct the cause of the overheating (see the *Maintenance: Troubleshooting* section).

## CORRECTIVE MAINTENANCE

### OBTAINING REPLACEMENT PARTS

All electrical and mechanical replaceable parts for the instrument can be obtained through your Tektronix Field Office or representative. However, many of the standard electrical components can be obtained locally. Before purchasing an ordinary part, check the Replaceable Parts List for value, tolerance, rating, and description.

**WARNING**

*Check the parts list before replacing electrical components. If the part is called out as screened or burned-in, the replacement part must also be screened or burned-in or the repair may not be effective.*

**NOTE**

*When selecting replacement parts, remember that the physical size and shape of a component may affect its performance in the instrument. All replaceable parts should be direct replacements unless it is known that a different component will not adversely affect instrument performance.*

Most of the mechanical parts and some of the electrical parts in this instrument are manufactured by Tektronix. Some parts are manufactured or selected by Tektronix to satisfy particular requirements, or are manufactured to certain specifications for Tektronix. To determine the manufacturer of a part, refer to the Parts List Cross Index of Code Number to Manufacturer. This is found in the Replaceable Parts List.

When ordering replacement parts from Tektronix, include the following information:

1. Instrument type
2. Instrument serial number
3. A description of the part (if electrical, include the component number)
4. Tektronix part number

## MAINTENANCE: TROUBLESHOOTING

### TROUBLESHOOTING: GENERAL INFORMATION

The following equipment is required to troubleshoot the +5 V Power Supply Module:

- DAS mainframe
- DAS 9100 Service Maintenance Kit
- 2 Channel Oscilloscope, with probes

#### The +5 V Power Supply Module Chart (Figure 7-1 and 7-2)

Troubleshoot a +5 V Power Supply Module as follows:

1. Each +5 V Power Supply Module powers 2 slots in the mainframe's instrument module section. Remove the modules powered by the supply under test, if they have not already been removed.
2. Use the +5 V Power Supply Extender Board (from the DAS Service Maintenance Kit) to raise the supply to a convenient level above the DAS mainframe. No special connections are required to use this extender.
3. Connect a 5  $\Omega$ , 5 W (or greater) resistor between the +5 V pin and the ground of J400 on the extender. (A minimum load of 1 A must be drawn from the supply for proper operation.)

# Maint. Troubleshooting—+5 V Power Supply Addendum

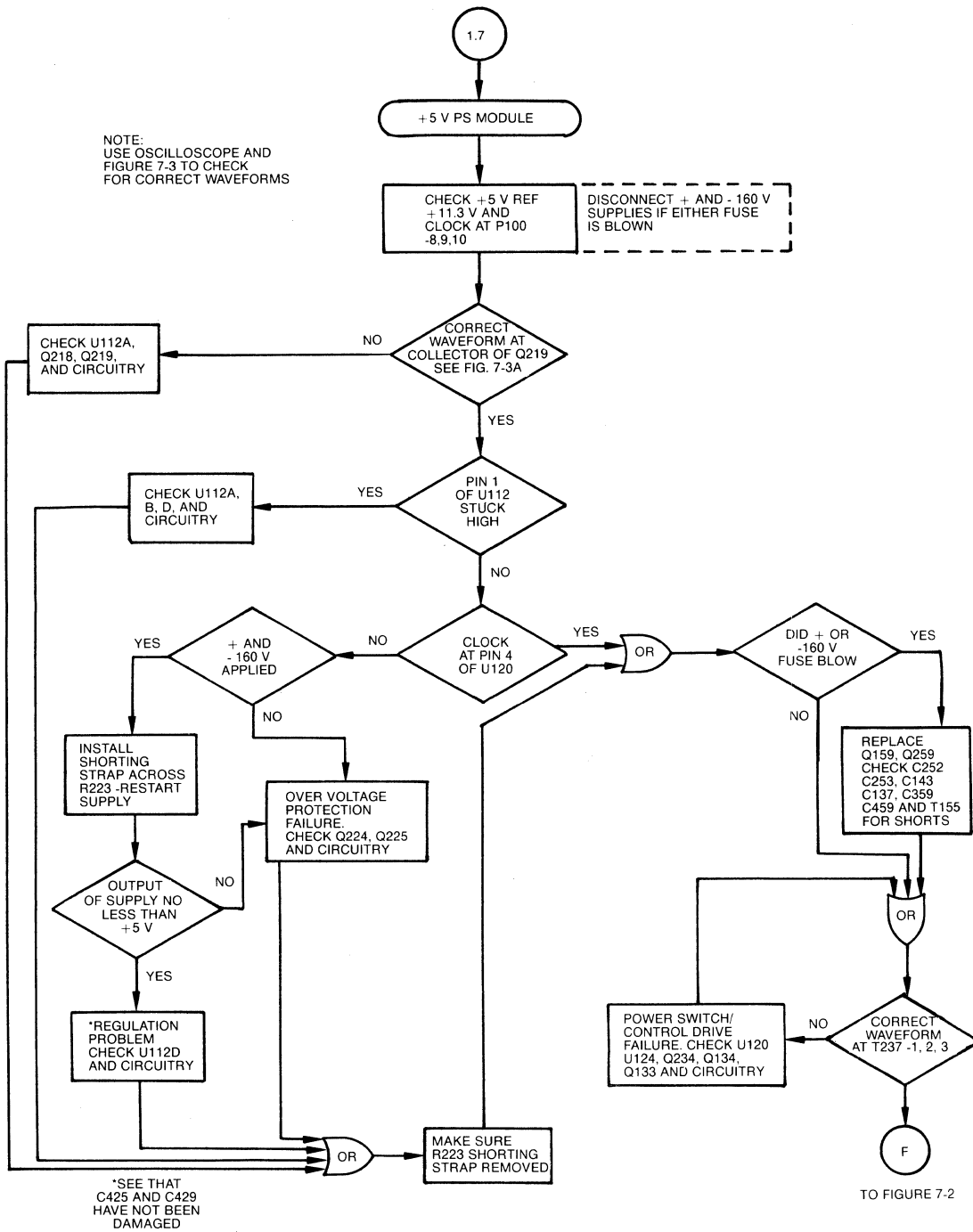


Figure 7-1. +5 V Power Supply (Upgraded) Troubleshooting Chart - Power Supply Failure.

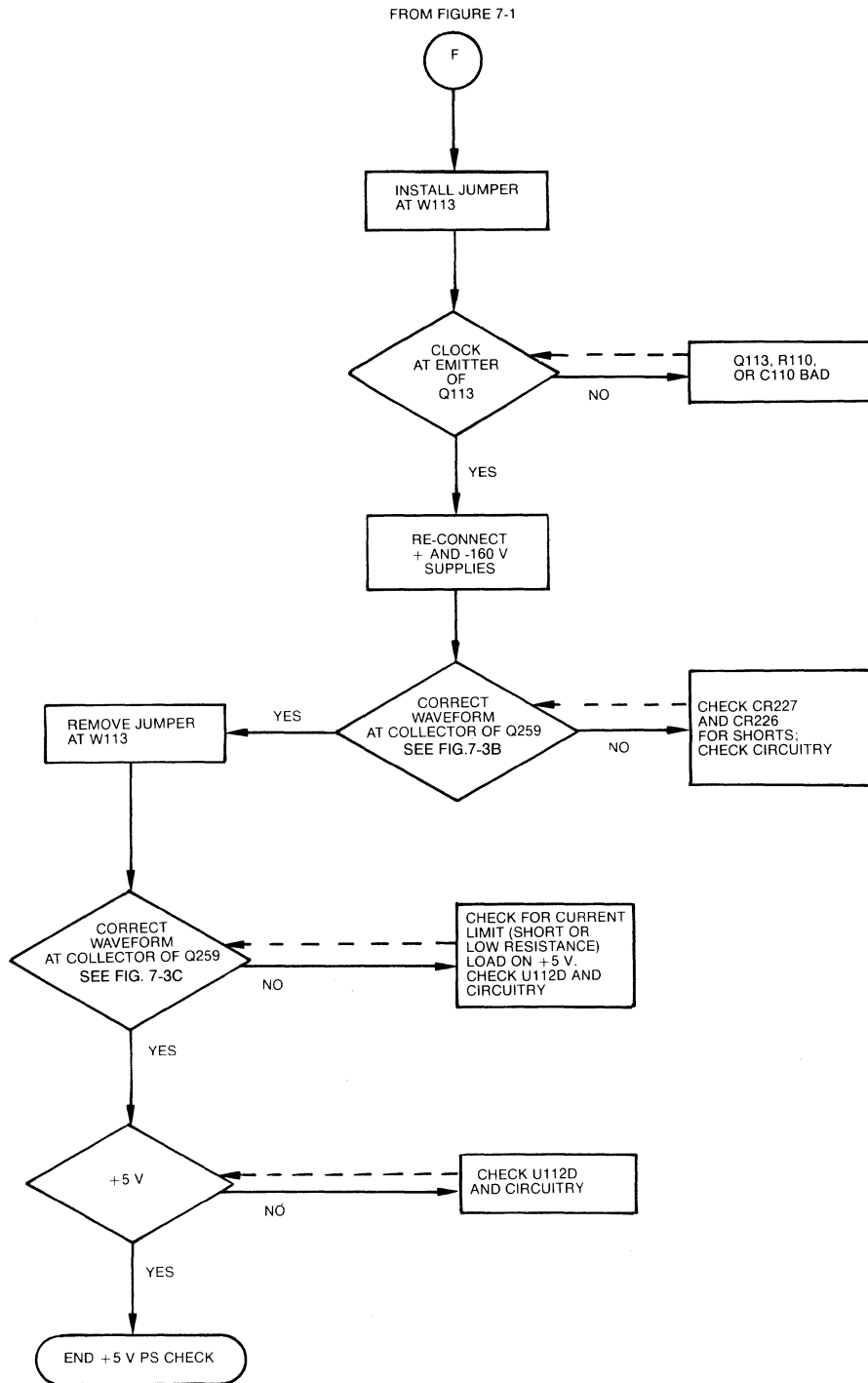
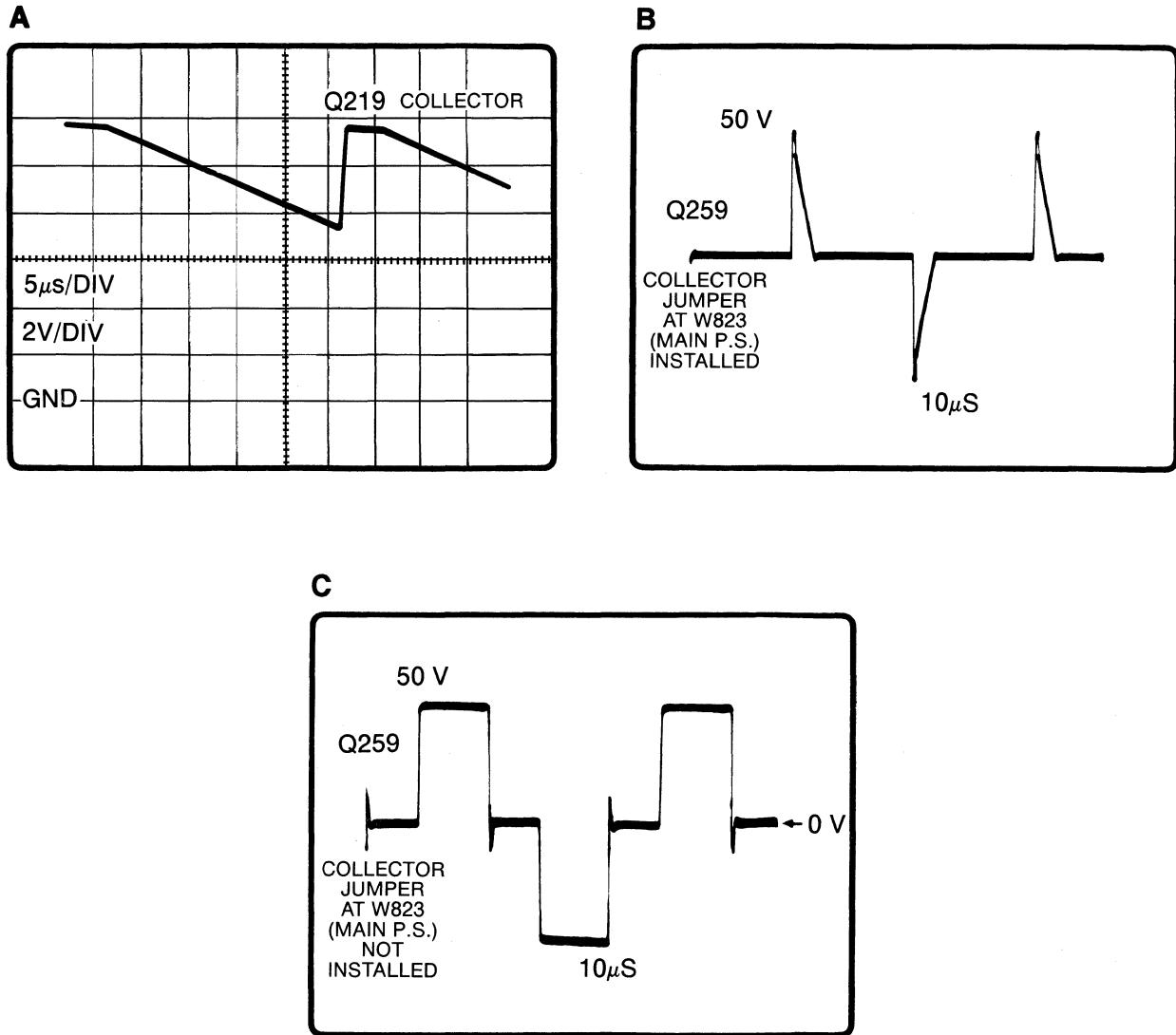


Figure 7-2. +5 V Power Supply (Upgraded) Troubleshooting Chart - Power Supply Failure.



4807-03

Figure 7-3. +5 V Power Supply (Upgraded) Waveforms for comparison.

## **MAINTENANCE: DIAGNOSTIC TEST DESCRIPTIONS**

See the *DAS 9100 Service Manual* section on troubleshooting for the diagnostics information.





## REFERENCE INFORMATION

### +5 V POWER SUPPLY MODULE (UPGRADED)

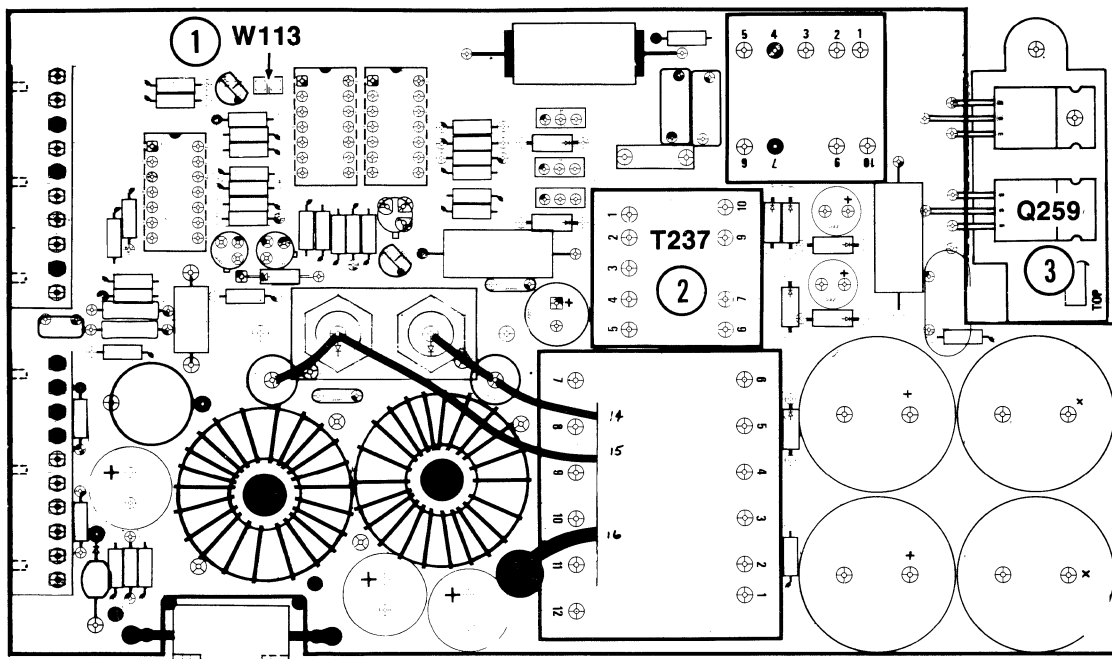


Figure 9-1. +5 V Power Supply board (A45A1) test point locations.

1. **W113.** These two pins can be shorted together to disable the +5 V sense circuitry. Shorting these pins together causes the supply to switch at the same rate as the power supply clock. Short these pins together, when testing the supply after repair, to avoid catastrophic failures in the  $\pm 160$  V sections of the supply.
2. **Pins 1, 2, and 3 of T237.** Under normal operation, pins 1 and 3 of this transformer should show a push/pull wave form for the high-voltage drivers. Pins 2 of T237 should show the turnoff pulses for the high-voltage drivers.
3. **Collector of Q259.** Under normal operation, this point should show a symmetrical switching waveform centered around ground.



# REPLACEABLE ELECTRICAL PARTS

## PARTS ORDERING INFORMATION

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

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

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

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

### LIST OF ASSEMBLIES

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

### CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

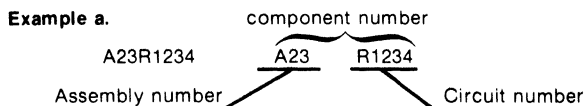
The Mfr. Code Number to Manufacturer index for the Electrical Parts List is located immediately after this page. The Cross Index provides codes, names and addresses of manufacturers of components listed in the Electrical Parts List.

### ABBREVIATIONS

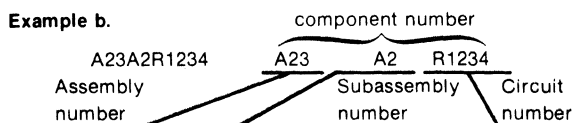
Abbreviations conform to American National Standard Y1.1.

### COMPONENT NUMBER (column one of the Electrical Parts List)

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



Read: Resistor 1234 of Assembly 23



Read: Resistor 1234 of Subassembly 2 of Assembly 23

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

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

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

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

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

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

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

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

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

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

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

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

Indicates actual manufacturers part number.

## Replaceable Electrical Parts—+5V Power Supply Addendum

### CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000FG	RIFA WORLD PRODUCTS INC.	7625 BUSH LAKE RD P.O. BOX 35263	MINNEAPOLIS, MN 55435
00853	SANGAMO ELECTRIC CO., S. CAROLINA DIV.	P.O. BOX 128	PICKENS, SC 29671
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01281	TRW ELECTRONIC COMPONENTS, SEMICONDUCTOR OPERATIONS	14520 AVIATION BLVD.	LAWNDALE, CA 90260
02113	COILCRAFT INC.	1102 SILVER LAKE RD.	CARY, IL 60013
03508	GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT	ELECTRONICS PARK	SYRACUSE, NY 13201
04222	AVX CERAMICS, DIVISION OF AVX CORP.	P O BOX 867	MYRTLE BEACH, SC 29577
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD, PO BOX 20923	PHOENIX, AZ 85036
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
14433	ITT SEMICONDUCTORS	3301 ELECTRONICS WAY P O BOX 3049	WEST PALM BEACH, FL 33402
19396	ILLINOIS TOOL WORKS, INC. PAKTRON DIV.	900 FOLLIN LANE, SE	VIENNA, VA 22180
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
56289	SPRAGUE ELECTRIC CO.	87 MARSHALL ST.	NORTH ADAMS, MA 01247
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601
T0020	UNITED CHEMI-CON INC.	1128 LEXINGTON AUYE.	ROCHESTER, NY 14606

## Replaceable Electrical Parts—+5V Power Supply Addendum

Ckt No.	Tektronix	Serial/Model No.		Name & Description	Mfr	Mfr Part Number
	Part No.	Eff	Dscont		Code	
C110	281-0809-00			CAP.,FXD,CER DI:200PF,5%,100V	04222	GC101A201J
C116	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
C137	285-1192-00			CAP.,FXD,PPR DI:0.0022UF,20%,250VAC	000FG	PME271Y422
C140	283-0189-00			CAP.,FXD,CER DI:0.1UF,20%,400V	56289	5C40X5R104M400B
C143	283-0189-00			CAP.,FXD,CER DI:0.1UF,20%,400V	56289	5C40X5R104M400B
C205	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	2C20Z5U105Z025B
C206	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
C207	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
C210	285-1142-00			CAP.,FXD,PLSTC:0.01UF,1%,200VDC	19396	103F02PP580
C218	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
C220	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
C232	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	56289	1C10Z5U223M050B
C234	290-0770-00			CAP.,FXD,ELCTLT:100UF,+50-10%,25V	56289	502D230
C252	290-0944-00			CAP.,FXD,ELCTLT:220UF,+50-10%,10V	T0020	SM10VB-2200
C253	290-0944-00			CAP.,FXD,ELCTLT:220UF,+50-10%,10V	T0020	SM10VB-2200
C258	283-0659-00			CAP.,FXD,MICA D:1160PF,2%,500V	00853	D195F1161G0
C305	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	56289	1C10Z5U223M050B
C309	290-0877-00			CAP.,FXD,ELCTLT:1200UF,+100-10%,6.3V	56289	672D128H6R3DS2C
C353	290-1029-00			CAP.,FXD,ELCTLT:220UF,20%,250V		
C359	290-1029-00			CAP.,FXD,ELCTLT:220UF,20%,250V		
C409	281-0770-00			CAP.,FXD,CER DI:0.001UF,20%,100V	04222	MA101C102MAA
C425	290-0877-00			CAP.,FXD,ELCTLT:1200UF,+100-10%,6.3V	56289	672D128H6R3DS2C
C429	290-0877-00			CAP.,FXD,ELCTLT:1200UF,+100-10%,6.3V	56289	672D128H6R3DS2C
C453	290-1029-00			CAP.,FXD,ELCTLT:220UF,20%,250V		
C459	290-1029-00			CAP.,FXD,ELCTLT:220UF,20%,250V		
CR133	152-0400-00			SEMICONV DEVICE:SILICON,400V,1A	80009	152-0400-00
CR226	152-0640-00			SEMICONV DEVICE:SILICON,35V,30A,DO-4	01281	SD-4101
CR227	152-0640-00			SEMICONV DEVICE:SILICON,35V,30A,DO-4	01281	SD-4101
CR234	152-0400-00			SEMICONV DEVICE:SILICON,400V,1A	80009	152-0400-00
CR249	152-0400-00			SEMICONV DEVICE:SILICON,400V,1A	80009	152-0400-00
CR250	152-0400-00			SEMICONV DEVICE:SILICON,400V,1A	80009	152-0400-00
CR251	152-0400-00			SEMICONV DEVICE:SILICON,400V,1A	80009	152-0400-00
CR252	152-0066-00			SEMICONV DEVICE:SILICON,400V,750MA	14433	LG4016
CR253	152-0066-00			SEMICONV DEVICE:SILICON,400V,750MA	14433	LG4016
CR351	152-0400-00			SEMICONV DEVICE:SILICON,400V,1A	80009	152-0400-00
CR406	152-0198-00			SEMICONV DEVICE:SILICON,200V,3A	03508	1N5624
L133	108-0808-00			COIL,RF:FIXED,500UH	80009	108-0808-00
L308	108-0974-00			COIL,RF:FIXED,4UH	80009	108-0974-00
L319	108-0911-00			COIL,RF:FIXED,65UH	80009	108-0911-00
L329	108-0911-00			COIL,RF:FIXED,65UH	80009	108-0911-00
Q113	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q133	151-0390-00			TRANSISTOR:SILICON,NPN	04713	SPS3414
Q134	151-0391-00			TRANSISTOR:SILICON,PNP	80009	151-0391-00
Q159	151-0632-00			TRANSISTOR:SILICON,NPN	04713	SJE1946
Q218	151-0302-00			TRANSISTOR:SILICON,NPN	07263	S038487
Q219	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q224	151-0302-00			TRANSISTOR:SILICON,NPN	07263	S038487
Q225	151-0503-00			SCR:SILICON,TO-92	04713	SCR5138
Q234	151-0390-00			TRANSISTOR:SILICON,NPN	04713	SPS3414
Q259	151-0632-00			TRANSISTOR:SILICON,NPN	04713	SJE1946
R110	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R113	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R114	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R116	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R125	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R126	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725

## Replaceable Electrical Parts— +5V Power Supply Addendum

Ckt No.	Tektronix	Serial/Model No.		Name & Description	Mfr	Mfr Part Number
	Part No.	Eff	Dscont		Code	
R127	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R128	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R140	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R206	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R207	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R208	321-0164-00			RES.,FXD,FILM:499 OHM,1%,0.125W	91637	MFF1816G499R0F
R209	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R216	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R217	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R218	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R221	315-0101-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB1015
R222	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R223	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R224	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R225	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R226	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R228	308-0344-00			RES.,FXD,WW:18.2 OHM,1%,3W	91637	RS2B-18R20F-TR
R257	303-0471-00			RES.,FXD,CMPSN:470 OHM,5%,1W	01121	GB4715
R259	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R305	315-0101-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB1015
R307	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R315	306-0150-00			RES.,FXD,CMPSN:15 OHM,10%,2W	01121	HB1501
R331	306-0150-00			RES.,FXD,CMPSN:15 OHM,10%,2W	01121	HB1501
R405	315-0101-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB1015
R408	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R410	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R414	308-0818-00			RES.,FXD,WW:0.005 OHM,3%,10W	91637	RH10-89/.005 3%
R451	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
T155	120-1449-00			XFMR,COM MODE:	02113	P104
T237	120-1119-01			TRANSFORMER,RF:BASE DRIVE	80009	120-1119-01
T448	120-1518-00			TRANSFORMER,RF:STPDN,HV PWR CONVERTER	80009	120-1518-00
U112	156-0411-01			MICROCIRCUIT,LI:QUAD,COMPARATOR,SGL SPLY	27014	LM339N
U120	156-0366-02			MICROCIRCUIT,DI:DUAL D FLIP-FLOP,CHK	80009	156-0366-02
U124	156-0575-03			MICROCIRCUIT,DI:3 INPUT NOR GATE,SELECTED	80009	156-0575-03
VR218	152-0175-00			SEMICONV DEVICE:ZENER,0.4W,5.6V,5%	04713	SZG35008

# DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

## Symbols

Graphic symbols and class designation letters are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The overline on a signal name indicates that the signal performs its intended function when it is in the low state.

Abbreviations are based on ANSI Y1.1-1972.

Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc. are:

- Y14.15, 1966 Drafting Practices.
- Y14.2, 1973 Line Conventions and Lettering.
- Y10.5, 1968 Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

American National Standard Institute  
1430 Broadway  
New York, New York 10018

## Component Values

Electrical components shown on the diagrams are in the following units unless noted otherwise:

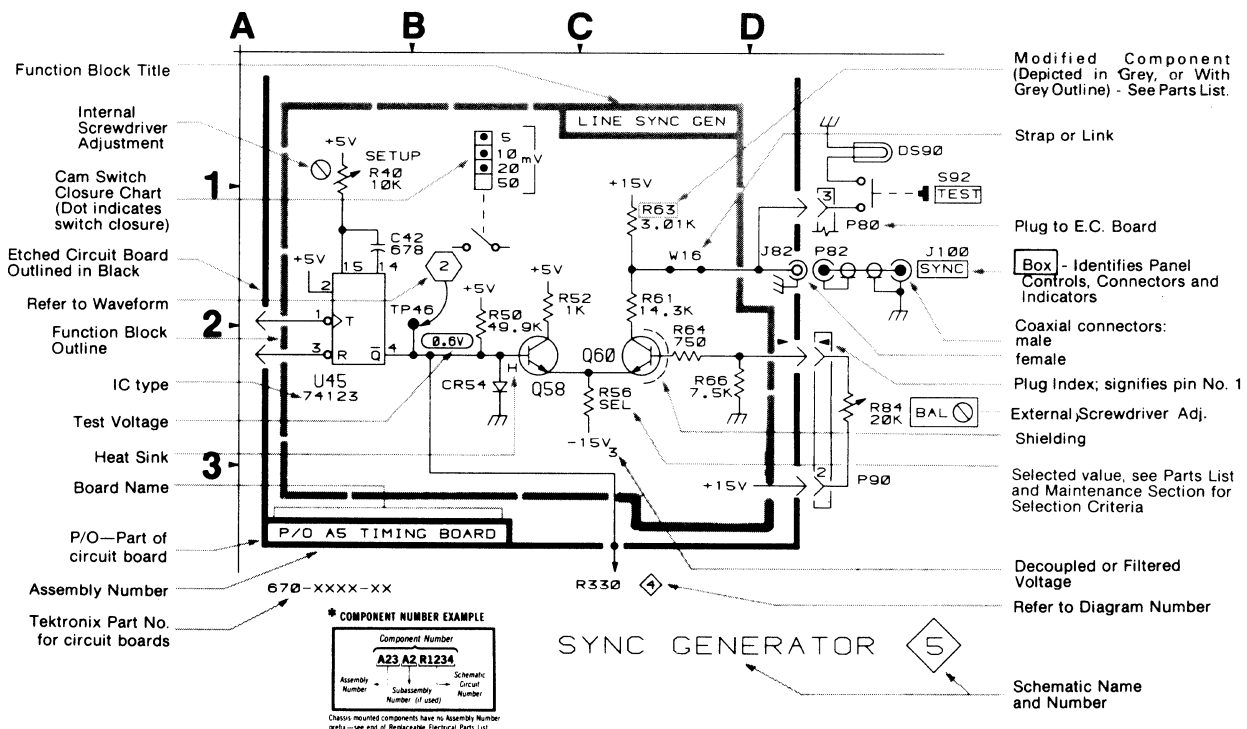
- Capacitors = Values one or greater are in picofarads (pF).  
Values less than one are in microfarads ( $\mu$ F).
- Resistors = Ohms ( $\Omega$ ).

———— The information and special symbols below may appear in this manual. ————

## Assembly Numbers and Grid Coordinates

Each assembly in the instrument is assigned an assembly number (e.g., A20). The assembly number appears on the circuit board outline on the diagram, in the title for the circuit board component location illustration, and in the lookup table for the schematic diagram and corresponding component locator illustration. The Replaceable Electrical Parts list is arranged by assemblies in numerical sequence; the components are listed by component number \*(see following illustration for constructing a component number).

The schematic diagram and circuit board component location illustration have grids. A lookup table with the grid coordinates is provided for ease of locating the component. Only the components illustrated on the facing diagram are listed in the lookup table. When more than one schematic diagram is used to illustrate the circuitry on a circuit board, the circuit board illustration may only appear opposite the first diagram on which it was illustrated; the lookup table will list the diagram number of other diagrams that the circuitry of the circuit board appears on.



+5 V Power Supply Addendum

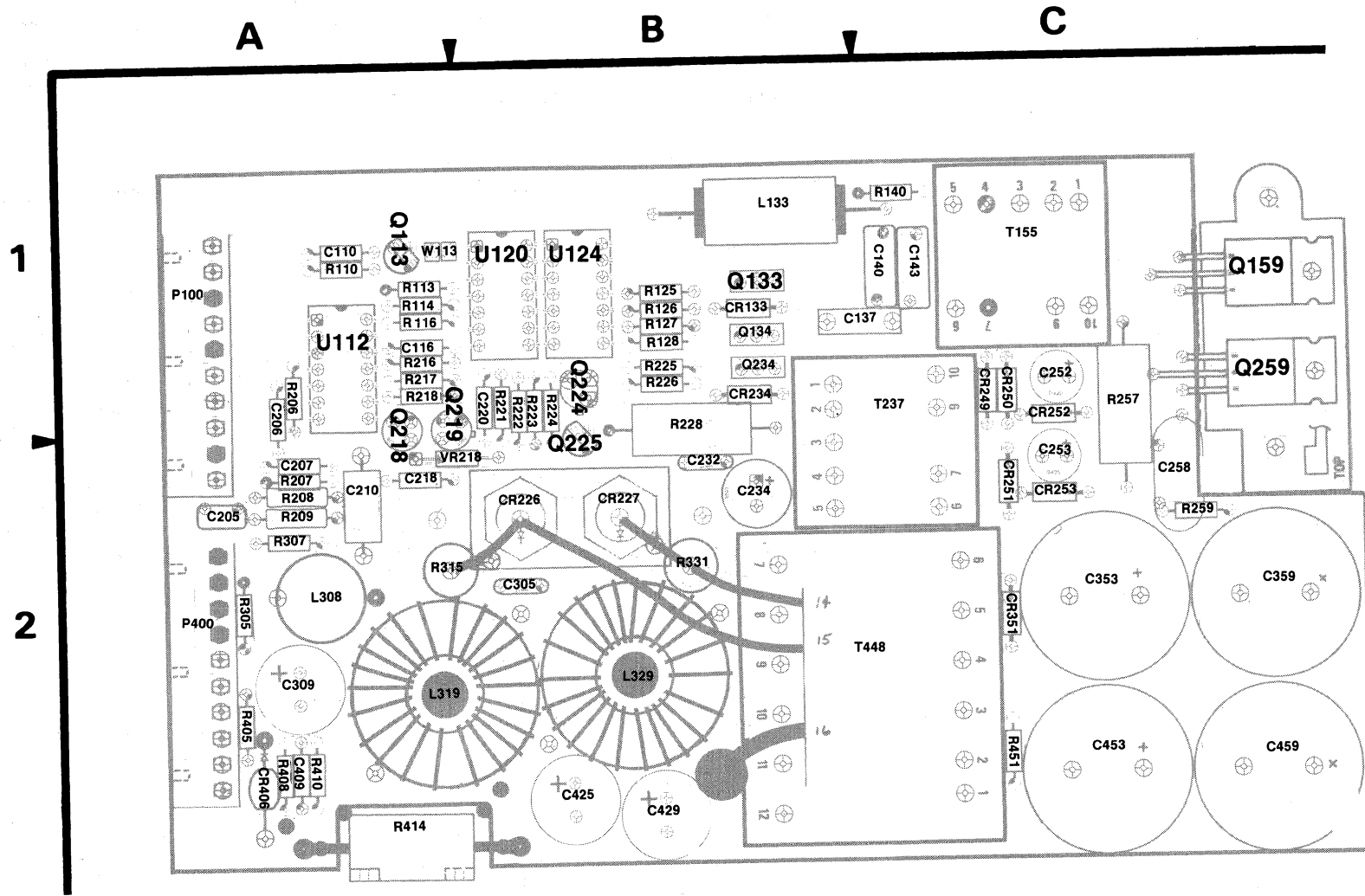
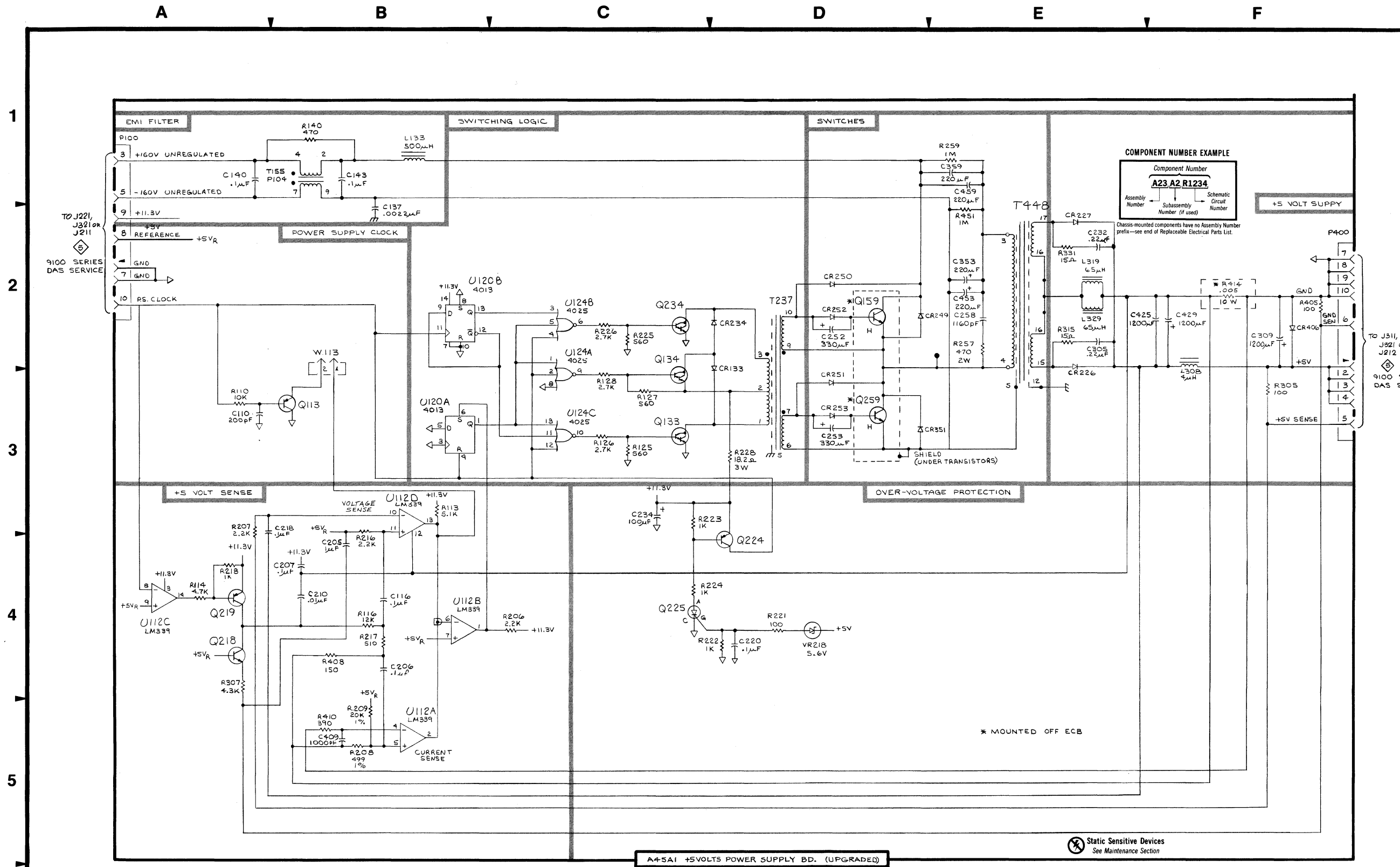


Figure 11-1. A45A1 Component Locations.

Table 11-1  
+5 V POWER SUPPLY (UPGRADED) 7 — ASSEMBLY A45  
+5 V POWER SUPPLY BD (UNGRADED)

CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEMATIC LOCATION	BOARD LOCATION
C110	A3	A1	Q234	C2	B1
C116	B4	A1	Q259	D3	C1
C137	B2	C1	R110	A3	A1
C140	A1	C1	R113	B3	A1
C143	B1	C1	R114	A4	A1
C205	B4	A2	R116	B4	A1
C206	B4	A1	R125	C3	B1
C207	B4	A2	R126	C3	B1
C210	B4	A2	R127	C3	B1
C218	B3	A2	R128	C3	B1
C220	D4	B1	R140	B1	C1
C232	E2	B2	R206	C4	A1
C234	C3	B2	R207	A3	A2
C252	D2	C1	R208	B5	A2
C253	D3	C2	R209	B5	A2
C258	E2	C2	R216	B3	A1
C305	E2	B2	R217	B4	A1
C309	F2	A2	R218	A4	A1
C353	E2	C2	R221	D4	B1
C359	E1	C2	R222	D4	B1
C409	B5	A2	R223	C3	B1
C425	F2	B2	R224	C4	B1
C429	F2	B2	R225	C2	B1
C453	E2	C2	R226	C2	B1
C459	E1	C2	R228	D3	B1
CR133	D3	B1	R257	E2	C1
CR226	E2	B2	R259	E1	C2
CR227	E2	B2	R305	F3	A2
CR234	D2	B1	R307	A4	A2
CR249	D2	C1	R315	E2	A2
CR250	D2	C1	R331	E2	B2
CR251	D3	C2	R405	F2	A2
CR252	D2	C1	R408	B4	A2
CR253	D3	C2	R410	B5	A2
CR351	D3	C2	R414	F2	A2
CR406	F2	A2	R451	E2	C2
L133	B1	B1	T155	B1	C1
L308	F3	A2	T237	D2	C1
L319	E2	A2	T448	E2	C2
L329	E2	B2	U112A	B5	A1
P100	A1	A1	U112B	B4	A1
P400	F2	A2	U112C	A4	A1
Q113	B3	A1	U112D	B3	A1
Q133	C3	B1	U120A	B3	B1
Q134	C3	B1	U120B	B2	B1
Q159	D2	C1	U124A	C3	B1
Q218	A4	A1	U124B	C2	B1
Q219	A4	A1	U124C	C3	B1
Q224	D4	B1	VR218	D4	A2
Q225	C4	B2	W113	B2	A1





A45A1 +5 V POWER SUPPLY (UPGRADED) 7

# REPLACEABLE MECHANICAL PARTS

## PARTS ORDERING INFORMATION

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

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

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

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

## ITEM NAME

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

## FIGURE AND INDEX NUMBERS

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

## INDENTATION SYSTEM

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

```

1 2 3 4 5           Name & Description
Assembly and/or Component
Attaching parts for Assembly and/or Component
    ---*---
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
    ---*---
Parts of Detail Part
Attaching parts for Parts of Detail Part
    ---*---

```

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

**Attaching parts must be purchased separately, unless otherwise specified.**

## ABBREVIATIONS

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

# Replaceable Mechanical Parts— +5V Power Supply Addendum

## CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
08530	RELIANCE MICA CORP.	342-39TH ST.	BROOKLYN, NY 11232
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
78189	ILLINOIS TOOL WORKS, INC.		
	SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153

**Replaceable Mechanical Parts— +5V Power Supply Addendum**

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont					
1-	620-0296-01			1		POWER SUPPLY:LOW VOLTAGE	80009	620-0296-01
-1	200-2269-00			1		.COVER,XSTR: ***** (ATTACHING PARTS)*****	80009	200-2269-00
-2	211-0511-00			2		.SCREW,MACHINE:6-32 X 0.500,PNH,STL,CD PL ***** (END ATTACHING PARTS)*****	83385	ORD BY DESCR
-3	342-0458-00			1		.INSULATOR,PLATE:TRANSISTOR,MICA	08530	OBD
-4	342-0449-01			1		.INSULATOR,PLATE:TRANSISTOR,ALUMINA,PRINTE	80009	342-0449-01
-5	-----			1		.(PART OF (620-0269-01) ***** (ATTACHING PARTS)*****		
-6	211-0116-00			4		.SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS ***** (END ATTACHING PARTS)*****	83385	ORD BY DESCR
-7	131-0608-00			2		.TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
-8	-----			2		.COIL,RF(SEE L319,L329 REPL) ***** (ATTACHING PARTS)*****		
-9	210-0586-00			2		.NUT,PL,ASSEM WA:4-40 X 0.25,STL,CD PL	78189	211-041800-00
-10	352-0725-00			2		.HOLDER,TOROID:PLASTIC	80009	352-0725-00
11	211-0020-00			2		.SCREW,MACHINE:4-40 X 1.125 INCH,PNH STL ***** (END ATTACHING PARTS)*****	83385	ORD BY DESCR
12	129-0826-00			2		.SPACER,POST:0.59 L,W/10-32 EXT THD ONE ***** (ATTACHING PARTS)*****	80009	129-0826-00
13	211-0504-00			2		.SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL ***** (END ATTACHING PARTS)*****	83385	ORD BY DESCR
14	214-3094-01			1		.HEAT SINK,DIODE:(2) D0-4 ***** (ATTACHING PARTS)*****	80009	214-3094-01
15	-----			2		.SEMICON,DEVICE:(SEE CR226,CR227 REPL) ***** (END ATTACHING PARTS)*****		
16	131-2264-00			2		.CONN,RCPT,ELEC:CKT BD,10 CONTACT,R ANGLE	80009	131-2264-00
17	220-0449-00			4		.NUT,SLEEVE:4-40 X 0.188 X 0.50" LONG	80009	220-0449-00
18	-----			1		.RES,FXD,WV:(SEE R414 REPL) ***** (ATTACHING PARTS)*****		
19	210-0405-00			2		.NUT,PLAIN,HEX:2-56 X 0.188,BRS,CD PL	73743	12157-50
20	210-0001-00			2		.WASHER,LOCK:#2 INTL,0.013 X 0.18 OD,STL	78189	1202-00-00-0541C
21	211-0030-00			2		.SCREW,MACHINE:2-56 X 0.25,FLH,82DEG,STL ***** (END ATTACHING PARTS)*****	83385	ORD BY DESCR
22	342-0683-00			1		.INSULATOR,PLATE:HEAT SINK		
23	210-0586-00			1		.NUT,PL,ASSEM WA:4-40 X 0.25,STL,CD PL	78189	211-041800-00
24	103-0079-00			1		.ADPTR,ELCTD PL:BRS ALBALOY PLATED ***** (ATTACHING PARTS)*****	80009	103-0079-00
25	210-0586-00			1		.NUT,PL,ASSEM WA:4-40 X 0.25,STL,CD PL ***** (END ATTACHING PARTS)*****	78189	211-041800-00
26	380-0632-01			1		.HSG,POWER SPLY:VDE	80009	380-0632-01
27	211-0289-00			1		.SCREW,SHOULDER:4-40 X 0.205 BRS CU-SN	80009	211-0289-00
						STANDARD ACCESSORIES		
	070-4807-00			1		MANUAL,TECH:SERVICE	80009	070-4807-00



