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TM 501
POWER MODULE

INSTRUCTION MANUAL

Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97077

Serial Number _____

070-1304-01
Product Group 75

First Printing MAY 1972
Revised JUN 1985

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INSTRUMENT SERIAL NUMBERS

Each instrument has a serial number on a panel insert, tag, or stamped on the chassis. The first number or letter designates the country of manufacture. The last five digits of the serial number are assigned sequentially and are unique to each instrument. Those manufactured in the United States have six unique digits. The country of manufacture is identified as follows:

B000000	Tektronix, Inc., Beaverton, Oregon, USA
100000	Tektronix Guernsey, Ltd., Channel Islands
200000	Tektronix United Kingdom, Ltd., London
300000	Sony/Tektronix, Japan
700000	Tektronix Holland, NV, Heerenveen, The Netherlands

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OPERATORS SAFETY SUMMARY

Terms In This Manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

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

Terms As Marked on Equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

Symbols In This Manual



This symbol indicates where applicable cautionary or other information is to be found.

Symbols As Marked on Equipment



DANGER — High voltage.



Protective ground (earth) terminal.



ATTENTION — refer to manual.

Power Source

This product is intended to operate from a power source that will not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

Grounding the Product

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

Danger Arising From Loss of Ground

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

Use the Proper Power Cord

Use only the power cord and connector specified for your product.

Use only a power cord that is in good condition.

For detailed information on power cords and connectors, see maintenance section.

Refer cord and connector changes to qualified service personnel.

Use the Proper Fuse

To avoid fire hazard, use only the fuse of correct type, voltage rating and current rating as specified in the parts list for your product.

Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this product in an explosive atmosphere unless it has been specifically certified for such operation.

Do Not Remove Covers or Panels

To avoid personal injury, do not remove the product covers or panels. Do not operate the product without the covers and panels properly installed.

Do Not Operate Without Covers (for TM 500 plug-ins only)

To avoid personal injury, do not operate this product without covers or panels installed. Do not apply power to the plug-in via a plug-in extender.

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SERVICE SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

Refer also to the preceding Operators Safety Summary.

Do Not Service Alone

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

Use Care When Servicing With Power On

Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch exposed connections and components while power is on.

Disconnect power before removing protective panels, soldering, or replacing components.

Power Source

This product is intended to operate from a power source that will not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

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TM 501 Power Module.

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SPECIFICATION

INTRODUCTION

Description

The TM 501 is a single compartment module compatible with all TM 500 plug-ins. It provides unregulated dc and ac supplies and non-dedicated power transistors for plug-in usage. Option 2 rear interface allows interconnection of special features with external devices through the back panel.

Performance Conditions

The values listed below are valid only when the instrument is operated at an ambient temperature between 0° C and 50° C.

Table 1-1

ELECTRICAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information
SUPPLIES		
+33.5 Vdc		
Tolerance[a]		+23.7 V to +40.0 V
PARD (Periodic and Random Deviation)		≤2.5 Vpp
Maximum load		350 mA
Maximum load di/dt		10 mA/μs
−33.5 Vdc		
Tolerance[a]		−23.7 V to −40.0 V
PARD		≤2.5 Vpp
Maximum load		350 mA
Maximum load di/dt		10 mA/μs
+11.5 Vdc		
Tolerance[a]		+7.6 V to +16.0 V
PARD		≤2.5 Vpp
Maximum load		1.3 A
Maximum load di/dt		20 mA/μs
25 Vac (2 each)		
Range		25.0 Vrms +10%, −15% floating
Maximum load		25 VAC
Maximum floating voltage		350 V peak

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Table 1-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
17.5 Vac[b]		
Range		With a grounded center tap 20.5 Vrms +10%, −20%
Maximum load		30 VA
Maximum plug-in power drawn from mainframe[c]		35 Wdc or 75 VAac
Combined power drawn sharing limitation[c]		VAac +2.1 (Wdc) ⩽ VAac
Fuse data		
+33.5 Vdc		2.5 A, 3 AG, fast blow
−33.5 Vdc		2.5 A, 3 AG, fast blow
+11.5 Vdc		7.5 A, 3 AG, fast blow
SERIES PASS TRANSISTORS		
Type		One each NPN or PNP
Maximum dissipation		7.5 W each, 15 W total
SOURCE POWER REQUIREMENTS		
Voltage ranges		Selectable 100 V, 110 V, 120 V, 200 V, 220 V, and 240 V nominal line ±10%
Line frequency		48 Hz to 440 Hz
Max power consumption		Approximately 120 W
Fuse data		
100 V, 110 V, 120 V ranges		0.6A slow blow
200 V, 220 V, 240 V ranges		0.3A med blow
MISCELLANEOUS		
Maximum recommended plug-in power dissipation		10 to 15 W

[a] Worst case; low line-full load and high line-no load values including PARD.

[c] At nominal line voltage.

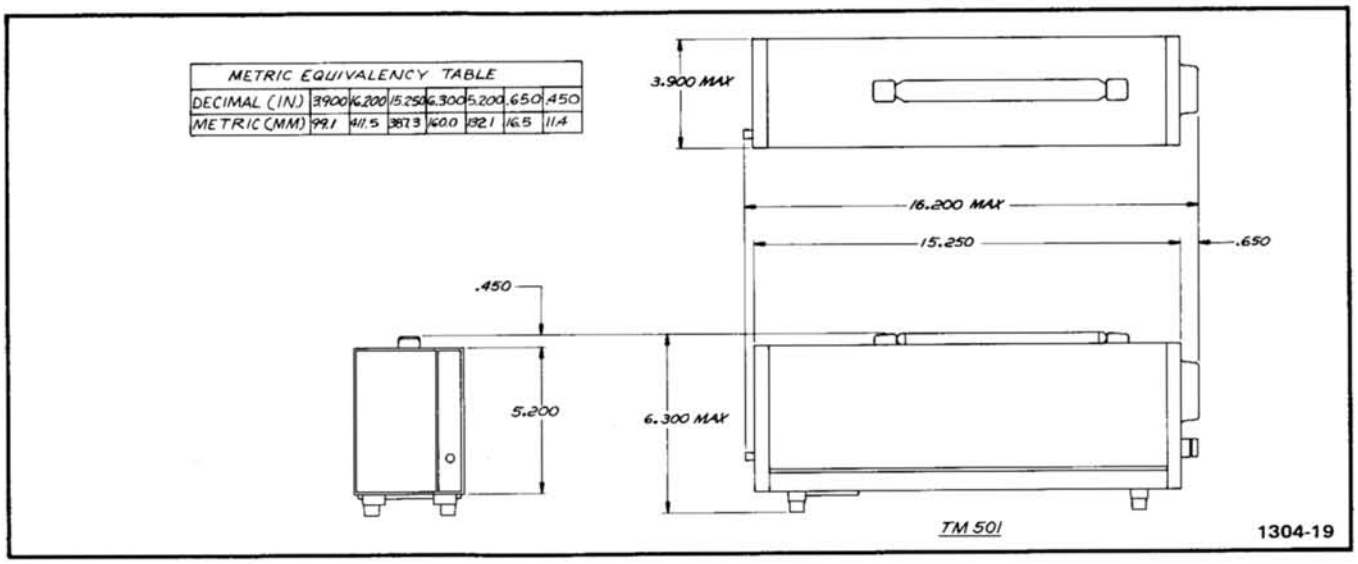
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Table 1-2

PHYSICAL CHARACTERISTICS

Characteristics	Supplemental Information
ENVIRONMENTAL[a]	
Overall	Meets or exceeds MIL-T-28800B, class 5 requirements with exception for vibration, shock, and EMC.
Temperature	
Operating	0°C to +50°C
Non-operating	−40°C to +75°C
Humidity	90-95% RH for 5 days cycled to +50°C.
Altitude	
Operating	4.6 km (15,000 ft)
Non-operating	15 km (50,000 ft)
Vibration	0.26 mm (0.010"), 10 Hz to 55 Hz, 75 minutes.
Shock	20 g's (1/2 sine), 11 ms, 18 shocks
Bench handling	45°, 4", or equilibrium whichever occurs first
Transportation	Qualified under National Safe Transit Association Preshipment Test Procedures 1A-B-1 and 1A-B-2.
MECHANICAL	
Net weight	6.0 lbs (4.3 kg)
Overall dimensions	6.0 in (15.2 cm)H,3.9 in (9.9 cm)W, 15.3 in (38.9 cm)L

[a] **With plug-ins. Some plug-ins require additional limitations.**



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OPERATING INSTRUCTIONS

GENERAL

Installation

For full installation instructions refer to the procedure at the end of this section.

Power Source

The TM 501 is designed to operate from a power source with its neutral at or near earth (ground) potential with a separate safety-earth conductor. It is not intended for operation from two phases of a multi-phase system.

Power Usage

The TM 501 may require up to 30 watts at the upper limits of high line voltage ranges. Actual power consumption depends on the particular plug-in and operating mode selected.

Loading Considerations. The power capability of the TM 501 can best be used by carefully planning the plug-in configuration, the external loads, and the resulting power distributions. Optimum conditions may be obtained by:

1. Dissipating as much power as possible in the external loads.

2. Operating the system in an ambient temperature near 25° C.

The plug-in is provided access to a pair of heat-sinked, series-pass transistors, one NPN and the other PNP. These transistors enable the plug-in to operate in power ranges not possible if the power were to be dissipated in the plug-in.

Operating Temperatures

The TM 501 can be operated in an ambient air temperature of 0° C to 50° C.

Since the TM 501 can be stored in temperatures between −40° C and +75° C, allow the instrument's chassis to return to within the operating limits before applying power.

Module Installation

CAUTION

Turn the Power Module off before inserting the plug-in; otherwise damage may occur to the plug-in circuitry.

1. Check the location of the white plastic barrier keys on the TM 501 interconnecting jack to ensure that their locations match the slots in the edge of the plug-in module's circuit board.

2. Align the plug-in module chassis with the upper and lower guides of the selected compartment. Push the module in and press firmly to seat the circuit board in the interconnecting jack. (Remove the plug-in module by pulling on the white release latch in the lower left corner of each module.)

Turn-on Procedure

After completing the installation procedure, found at the end of this section, and installing the plug-in, pull the POWER switch on the right side of the TM 501. Some plug-ins have independent power switches, usually labeled OUTPUT, controlling application of mainframe power to the plug-in. Press this button to activate the plug-in.

BUILDING A SYSTEM

Family Compatibility

Mechanically, the plug-in modules are very similar to other Tektronix product families. However, they are not electrically compatible. Therefore, the TM 501 interface has barriers on the mating connectors between pins 6 and 7 to ensure that incompatible modules cannot be inserted. See Fig. 2-1. A compatible module will have a matching slot between pins 6 and 7 of its main circuit board edge connector. This slot and barrier combination is the primary keying assignment.

TM 500-compatible plug-in modules are also identified by the white color of the release latch.

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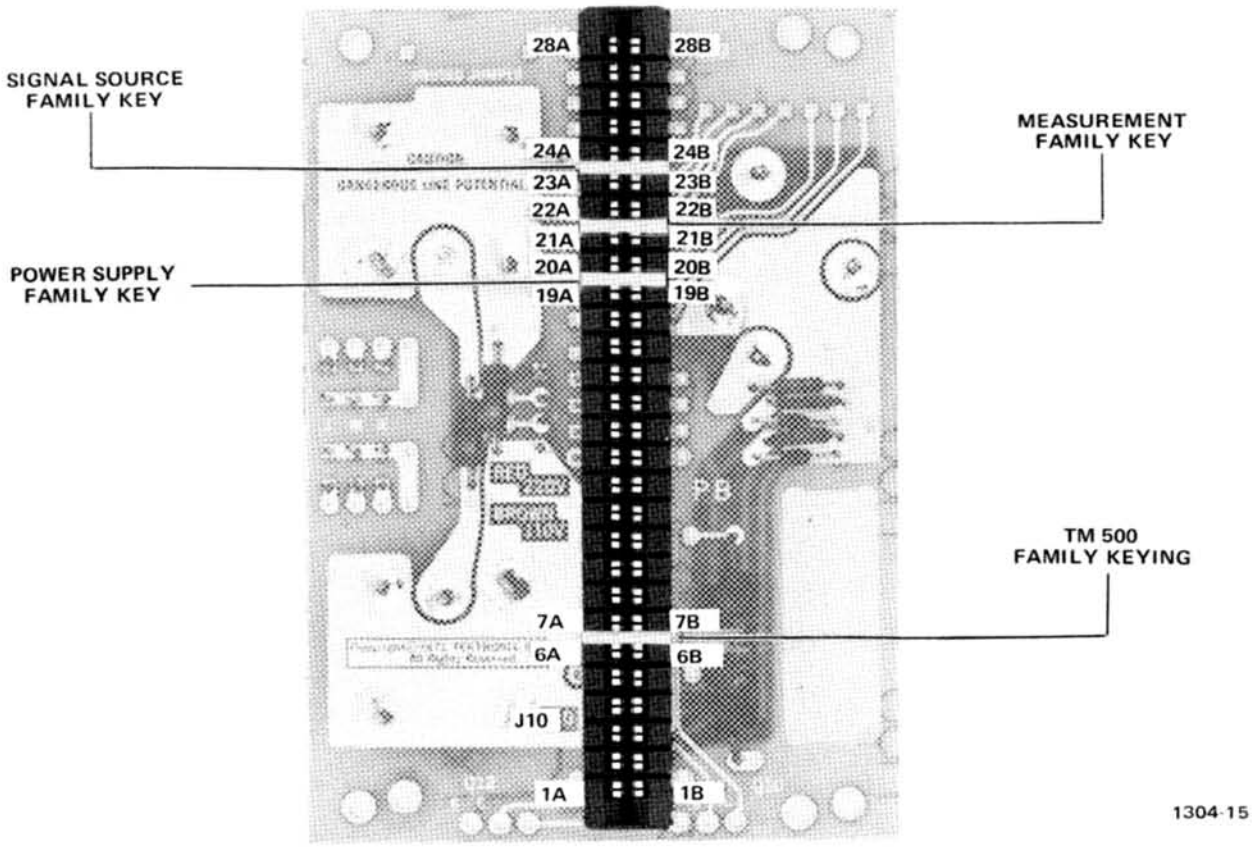


Fig. 2-1. Keying assignments for family functions. One of many possible sequence combinations.

Customizing the Interface

The modularity of this instrumentation system provides for many different functions to be performed by the plug-in modules. Specific functions are grouped into families or classes, of which there may be several plug-in module members. For instance, some classes are Power Supplies, Signal Sources, Measurement, and so forth. Each modular member of a functional family will have a second slot peculiar to its family assignment located in its edge connector. The TM 501 user can "program" the Power Module to accept only members of that family by installing a second barrier in the interface connector to match the module's slot location. For extra barriers, order Tektronix Part No. 214-1593-02.

Jumper wires can be used to further specialize the interface. Compartments can be made to "talk" to each other by connecting jumpers on the back side of the interface board, using pins 14 through 28 (A-side and B-side both) of the interconnecting jacks. See the following description of Option 2. Refer to each plug-in module's Manual for the I/O assignments of each pin at the rear interface. Once having made interconnections of a specialized nature, it is recommended that barriers be installed on the interconnecting jacks to ensure module compatiblity with the customized wiring.

Rear Panel

The rear subpanel has a connector mounting plate for BNC and multi-pin connector mountings. Customer or factory-installed connectors and wiring (see following description of Option 2) could provide external access to the interface for external I/O control. This feature makes the TM 500 Series Modular Instrumentation System very flexible in bench-top or rackmounted systems.

Option 2. This factory-installed option adds 25-mil square-pin connectors to the rear of the interconnecting jacks at all pin locations from pins 14A and B through pins 28A and B. This will keep the interface flexible by making it easy and fast to change customized wiring using prepared wires with square-pin receptacles and long-nose pliers or tweezers. It also protects the circuit board from damage by repeated soldering and unsoldering of jumper wires. This option also adds one BNC connector and one 50-pin connector to the rear panel. These connectors are not pre-wired. Instead, prepared jumpers, coaxial cables, and interconnection jack barriers are included in a kit. This gives a system designer as much flexibility as possible.

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INSTALLATION AND PRE-TURN ON PROCEDURE

Check the rear panel markings. If the factory settings are compatible with the available line voltage and frequency, insert the desired plug-ins. If a change is needed, refer a qualified service person to the procedure in the Maintenance section of this manual.

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MAINTENANCE

GENERAL

Introduction

This section of the manual is meant to support the entire TM 500 Series family of modules with a general coverage of the most commonly-needed service information pertinent to preventive maintenance, troubleshooting, ordering parts, and replacing components and sub-assemblies.

Cabinet Removal

WARNING

Dangerous potentials exist at several points throughout the system. When the system must be operated with the cabinet removed, do not touch exposed connections or components. Some transistors have voltage present on their cases. Disconnect power before cleaning the system or replacing parts.

Two screws secure the cabinet to the TM 501 frame. Remove them and lift the cabinet straight up. Do not operate the system with the cabinet removed any longer than necessary for troubleshooting and calibration. Reinstall the cabinet to protect the interior from dust and to remove personnel shock hazards.

Cleaning

CAUTION

Avoid using chemical cleaning agents which might damage plastic parts. Avoid chemicals containing benzene, toluene, xylene, acetone, or similar solvents.

Exterior. Loose dust may be removed with a soft cloth or a dry brush. Water and a mild detergent may be used. However, abrasive cleaners should not be used.

Interior. Cleaning the interior of a unit should precede calibration since the cleaning processes could alter the settings of calibration adjustments. Use low-velocity compressed air to blow off accumulated dust. Hardened dirt can be removed with a soft brush, cotton-tipped swab, or a cloth dampened in a solution of water and mild detergent.

Preventive Maintenance

Preventive maintenance steps performed on a regular basis will enhance the reliability of the instrumentation systems. However, periodic checks of the semiconductors in the absence of a malfunction are not recommended as preventive maintenance measures. See the semiconductor checking information under Troubleshooting Techniques which follow. A convenient time to perform preventive maintenance is just before instrument calibration.

Calibration

To ensure accurate signal generation and measurement, the performance of individual units comprising the system should be checked periodically. Refer to the Instruction Manual for each unit for complete calibration and verification procedures.

TROUBLESHOOTING AIDS

Introduction

The following is provided to augment information contained elsewhere in this and other TM 500 series family manuals when troubleshooting becomes necessary.

Circuit Description

Each manual has a section devoted to explaining circuit operating theory. Used with the schematics, this can be a powerful analytic tool.

Diagrams

Block diagrams and detailed circuit schematics are located on foldout pages in the service section of most of the TM 500 Series family manuals. The schematic diagrams show the component values and assigned circuit reference numbers of each part necessary to the circuit design. Usually the first page of the service section defines the circuit symbols and reference designators used in that particular instrument. Major circuits are usually identifiable by a series of component numbers. Important waveforms and voltages may be shown within the diagrams or on adjoining aprons. Those portions of the circuits located on circuit boards are enclosed with a grey tint outline.

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Cam Switch Charts

Cam switches shown on the diagrams are coded on charts to located the cam number of the switch contact in the complete switch assembly, counting from the front, or knob end, toward the rear of the switch. The charts also indicate with a solid dot when each contact is closed.

Circuit Board Illustrations

Line illustrations showing component locations keyed with a grid scheme for each circuit board are usually placed on the back of a foldout page and sequenced as close as possible to an associated schematic. The GRID LOC columns, located near the Parts Location Grid, keys each component to easy location on the board.

Component and Wiring Color Codes

Colored stripes or dots on electrical components signify electrical values, tolerances, etc., according to EIA standards. Components not color-coded usually have information printed on the body. The wiring coding follows the same EIA standards with the exception of the ac power cord of the Power Modules. It is coded like this:

Power Cord Conductor Identification

Conductor	Color	Alternate Color
Ungrounded (Line)	Brown	Black
Grounded (Neutral)	Blue	White
Grounding (Earthing)	Green-Yellow	Green-Yellow

Testing Equipment

Generally, a wide-band oscilloscope, a probe, and a multimeter are all that is needed to perform basic waveform and voltage checks for diagnostic purposes. The calibration procedures in the manual for each plug-in module list specific test equipment and the features necessary to adequately check out that particular module.

TROUBLESHOOTING TECHNIQUES

Introduction

This troubleshooting procedure is arranged in an order which checks the simple trouble possibilities before proceeding to extensive troubleshooting.

Control Settings

Incorrect control settings can indicate a trouble that does not exist. If there is any question about the correct function or operation of any control, see the Operating Instructions section of the manual for the instrument involved.

System and Associated Equipment

Before proceeding with troubleshooting the TM 500 Series system, check that the instruments in the system are operating correctly. Check for proper interconnection between the power module and the plug-in modules. Check the line voltage at the power source. Check that the signal is properly connected and that the interconnecting cables and signal source are not defective.

The associated plug-in modules can be checked for proper operation quickly by substituting other like units known to be operating properly. If the trouble persists after substitution, then the power module is probably at fault. Moving a properly operating plug-in from compartment to compartment will help determine if one or more compartments have a problem.

Visual Check

Inspect the portion of the system in which the trouble is suspected. Many troubles can be located by visual clues such as unsoldered connections, broken wires, damaged circuit board, damaged components, etc.

Instrument Calibration

Check the calibration of the suspected plug-in module or the affected circuit if the trouble is obviously in a certain circuit. The trouble may only be a result of misadjustment or may be corrected by re-calibration. Complete calibration instructions are given in the manual for each instrument in the system.

Circuit Isolation

Note the trouble symptoms. These often identify the circuit in which the trouble is located. When trouble symptoms appear in more than one circuit, check the affected circuits by making waveform and voltage measurements.

Incorrect operation of all circuits often means trouble in the power supplies. Using a multimeter, check first for correct voltages of the individual regulated supplies according to the plug-in module schematics and calibration procedures. Then check the unregulated supplies of the power modules. Defective components elsewhere in the instruments can appear as power supply problems. In these instances, suspected circuits should be disconnected from apparently bad power supplies one at a time to narrow the search.

Voltages and Waveforms

Often defective components can be located by using waveform and voltage indications when they appear on

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the schematic or in the calibration procedures. Such waveforms and voltage labels are typical indications and will vary between instruments. To obtain operating conditions similar to those used to take these readings, refer to the first diagram in the service sections.

Component Checking

If a component cannot be disconnected from its circuit, then the effects of the associated circuitry must be considered when evaluating the measurement. Except for soldered-in transistors and integrated circuits, most components can be lifted at one end from the circuit board.

Transistors and IC's. Turn the power switch off before removing or replacing any semiconductor.

A good check of transistor operation is actual performance under operating conditions. A transistor can most effectively be checked by substituting a new component for it (or one which has been checked previously). However, be sure that circuit conditions are not such that a replacement transistor might also be damaged. If substitute transistors are not available, use a dynamic tester. Static-type testers are not recommended, since they do not check operation under simulated operating conditions. A suction-type desoldering tool must be used to remove soldered-in transistors; see component replacement procedure for details.

Integrated circuits can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of the circuit description is essential to troubleshooting circuits using IC's. Operating waveforms, logic levels, and other operating information for the IC's are given in the circuit description information of the appropriate manual. Use care when checking voltages and waveforms around the IC's so that adjacent leads are not shorted together. A convenient means of clipping a test probe to the 14- and 16-pin in-line IC's is with an integrated circuit test clip. This device also doubles as an extraction tool.

Diodes. Do not use an ohmmeter that has a high internal current. High currents may damage the diode.

A diode may be checked for an open or shorted condition by measuring the resistance between terminals. With an ohmmeter scale having an internal source of between 800 mV, and 3 V, the resistance should be very high in one direction and very low when the leads are reversed.

Resistors. Check the resistors with an ohmmeter. Resistor tolerances are given in the Electrical Parts List in every manual. Resistors do not normally need to be replaced unless the measured value varies widely from the specified value.

Capacitors. A leaky or shorted capacitor can be detected by checking resistance with an ohmmeter on the highest scale. Use an ohmmeter that will not exceed the voltage rating of the capacitor. The resistance reading should be high after initial charge of the capacitor. An open capacitor can best be detected with a capacity meter, or by checking whether it passes ac-signals.

PARTS ORDERING AND REPLACING

Ordering

Obtaining Replacement Parts. Most electrical and mechanical parts can be obtained through your local Tektronix field office or representative. However, you should be able to obtain many of the standard electronic components from a local commercial source in your area. Before you purchase or order a part from a source other than Tektronix Inc., please check the electrical parts list for the proper value, rating, tolerance and description.

Special Parts. Some parts are manufactured or selected by Tektronix, Inc. to satisfy particular requirements, or are manufactured for Tektronix, Inc., to our specifications. Most of the mechanical parts used in this system have been manufactured by Tektronix, Inc. Order all special parts directly from the local Tektronix Field Office or representative.

Ordering Procedure. When ordering replacement parts from Tektronix, Inc., please include the following minimum information:

1. Instrument Type (PS 501, SG 502, DC 501, etc.)

2. Instrument Serial Number (For example, B010251)

3. A description of the part (if electrical include the circuit number)

4. Tektronix part number.

Please do not return any instruments or parts before receiving directions from Tektronix, Inc.

A listing of Tektronix Field Offices, Service Center and Representatives can be found in the Tektronix Product Catalog and Supplements.

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Replacing

The exploded view drawings with the Mechanical Parts List, located to the rear of most manuals, may be especially helpful when disassembling or reassembling individual components or sub-assemblies.

Circuit Boards. If a circuit board is damaged beyond repair, either the entire assembly including all soldered-on components, or the board only, can be replaced.

To remove or replace a board, proceed as follows:

1. Disconnect all leads connected to the board (both soldered lead connections and solderless pin connections).

2. Remove all screws holding the board to the chassis or other mounting surface. Some boards may be held fast by plastic mounting clips around the board edges. For these, push the mounting clips away from the circuit board edges to free the board. Also, remove any knobs, etc., that would prevent the board from being lifted out of the instrument.

3. Lift the circuit board out of the unit. Do not force or bend the board.

4. To replace the board, reverse the order of removal. Use care when replacing pin connectors. If forced into place incorrectly positioned, the pin connectors may be damaged.

Transistors and IC's. Transistors and IC's should not be replaced unless they are actually defective. If removed from their sockets during routine maintenance, return them to their original sockets. Unnecessary replacement or switching of semiconductor devices may affect the calibration of the instruments. When a transistor is replaced, check the operation of the part of the instrument that may be affected.

Replacement semiconductors should be of the original type or a direct replacement. Figure 3-1 shows the lead configurations of the semiconductors used in this instrument system. When removing soldered-in transistors, use a suction-type desoldering tool to remove the solder from the holes in the circuit board.

Static-Sensitive Components

CAUTION

Static discharge can damage any semiconductor component in this instrument.

This instrument contains electrical components that are susceptible to damage from static discharge. See Table 3-1 for relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

Observe the following precautions to avoid damage:

1. Minimize handling of static-sensitive components.

2. Transport and store static-sensitive components or assemblies in their original containers, on a metal rail, or on conductive foam. Label any package that contains static-sensitive assemblies or components.

3. Discharge the static voltage from your body by wearing a wrist strap while handling these components. Servicing static-sensitive assemblies or components should be performed only at a static-free work station by qualified service personnel.

4. Nothing capableable 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.

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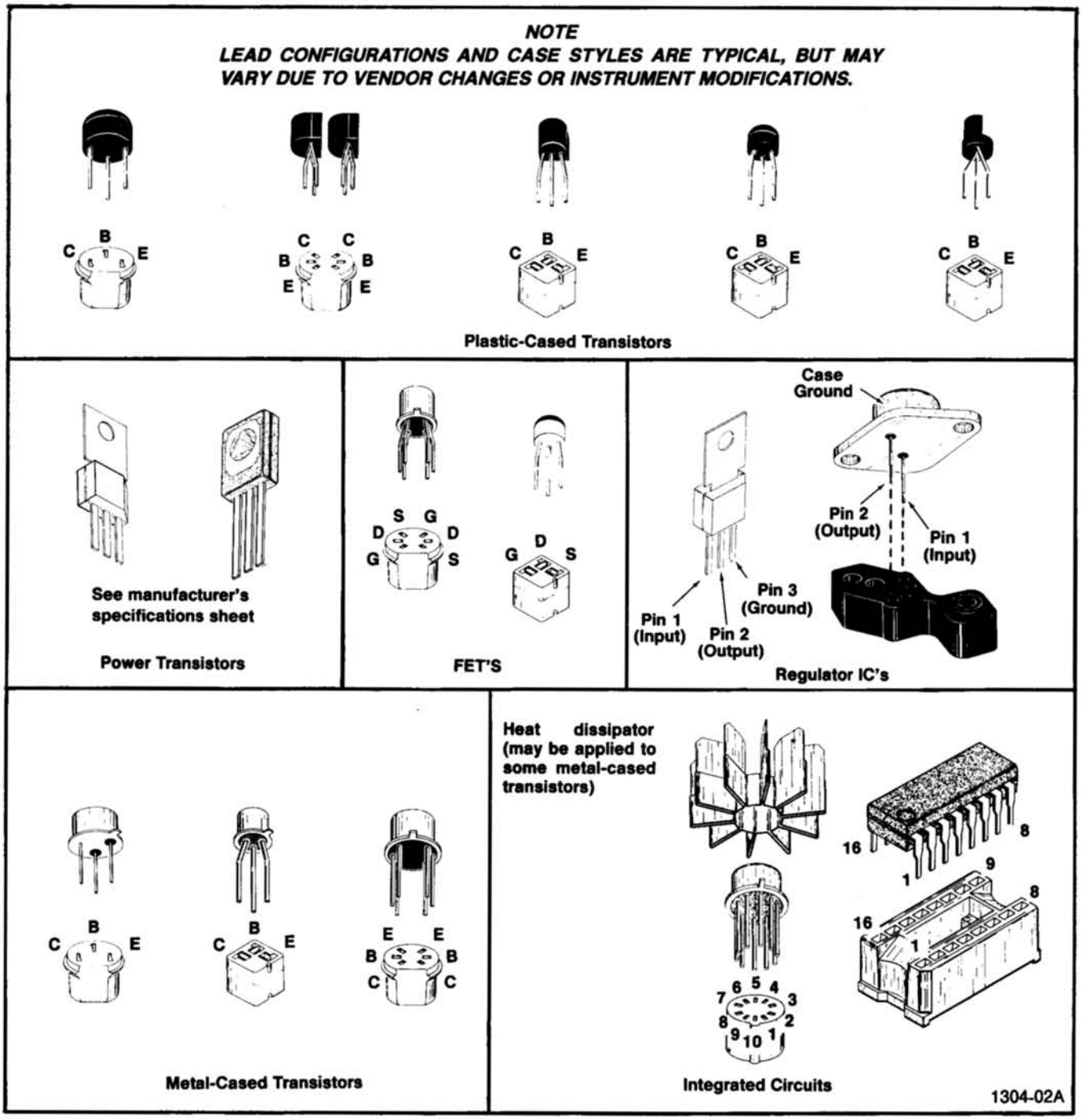


Fig. 3-1. Semiconductor device lead configuration found in the TM 500 family.

10. Use only special antistatic suction type or wick type desoldering tools.

Test Equipment

Before using any test equipment to make measurements on static-sensitive components or assemblies, be certain that any voltage or current supplied by the test equipment does not exceed the limits of the component to be tested.

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Table 3-1

RELATIVE SUSCEPTIBILITY TO STATIC DISCHARGE DAMAGE

Semiconductor Classes	Relative Susceptibility Levels[a]
MOS or CMOS microcircuits or discretes, or linear microcircuits with MOS inputs (Most Sensitive)	1
ECL	2
Schottky signal diodes	3
Schottky TTL	4
High-frequency bipolar transistors	5
JFETs	6
Linear Microcircuits	7
Low-power Schottky TTL	8
TTL (Least Sensitive)	9

[a] **Voltage equivalent for levels:**

1 = 100 to 500 V
2 = 200 to 500 V
3 = 250 V
4 = 500 V
5 = 400 to 600 V
6 = 600 to 800 V
7 = 400 to 1000 V (est.)
8 = 900 V
9 = 1200 V

(Voltage discharged from a 100 pF capacitor through a resistance of 100 ohms.)

Interconnecting Pins. To replace a pin that is mounted on a circuit board, first disconnect any pin connectors. Then, unsolder the damaged pin and pull it out of the board with a pair of pliers. Be careful not to damage the wiring on the board with too much heat. Ream out the hole in the circuit board with a 0.031-inch drill. Remove the ferrule from the new interconnecting pin and press the new pin into the hole in the circuit board. Position the pin in the same manner as the old pin and solder it in. If the old pin was bent at an angle to mate with a connector, bend the new pin to match the associated pins.

NOTE

A pin replacement kit including necessary tools, instructions, and replacement pins is available from Tektronix, Inc. Order Tektronix Part No. 040-0542-00.

Cam Switches. Repair of cam-type switches should be undertaken only by experienced maintenance personnel. Switch alignment and spring tension of the contacts must be carefully maintained for proper operation of the switch. For assistance, contact your local Tektronix Field Office or representative.

NOTE

A cam-type switch repair kit including necessary tools, instructions, and replacement contacts is available from Tektronix, Inc. Order Tektronix Part No. 040-0541-00.

The cam-type switches consist of rotating cam drums which are turned by front-panel knobs, and sets of spring-leaf contacts mounted on adjacent circuit boards. The contacts are actuated by lobes on the cams. These switches can be dissembled for inspection, cleaning, repair, or replacement as follows:

1. Remove the screws which hold the metal cover on the switch, and lift the cover off the switch. The switch is now open for inspection or cleaning.

2. To completely remove a switch from the circuit board, first remove any knobs or shaft extensions. Loosen the coupling at the potentionmeter at the rear of the switch, and pull the long shaft out of the switch assembly.

3. Remove the screws (from the opposite side of the circuit board) that holds the cam drum to the board.

4. To remove the cam drum from the front support block, remove the retaining ring from the shaft on the front of the switch and slide the cam drum out of the support block. Be careful not to lose the small detent roller.

5. To replace defective switch contacts, follow the instructions given in the switch repair kit.

6. To re-install the switch assembly, reverse the above procedure.

Pushbutton Switches. The pushbutton switches are not repairable and should be replaced as a unit if defective. Use a suction-type desoldering tool to remove solder from the circuit board when removing these switches.

Incandescent Bulbs. Most of these light bulbs are mounted on the sub-panel using plastic sleeve stand-offs. Unsolder the lead wires and pull the bulb out of the sleeve from the rear of the sub-panel.

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Light-Emitting Diodes. LED's used as indicators are mounted on the sub-panels with plastic sleeve sockets similar to the incandescent bulb mountings or they are soldered directly to a sub-assembly and so mounted that they protrude through holes in the panel. In these cases, the sub-assembly must be exposed and the anode and cathode lead orientations carefully noted before unsoldering the defective LED. See Fig. 3-2 for LED lead identifying information.

Power Transformer. Replace the transformer only with a Tektronix direct replacement transformer. Refer to the exploded view drawing at the rear of the Power Module manuals for disassembly of the rear panel to expose the power transformer. Refer to the schematic diagram color-coding information for correct wiring. After replacement check out the power supply voltages before installing a plug-in module.

Option 2

This factory installed option adds 25-mil square pin connectors to the rear of the interconnecting jacks at all pin locations from pins 14A and B. This will keep the interface flexible by making it easy and fast to change customized wiring using prepared wires with square pin receptacles. It also protects the circuit board from damage by repeating soldering and unsoldering of jumper wires. This option also adds one BNC connector and one 50-pin connector to the rear panel. These connectors are not prewired in order to give a system designer as much flexibility as possible. Instead, prepared jumpers, coax cables, and interconnection jack barriers are included in the TM 501.

System Design Directions.

1. Plan the plug-in location based on the front-panel controls and operator convenience as well as interface connections.

2. Plan the wiring between interconnecting jacks and to the rear panel connectors carefully before starting assembly. A mating rear panel 50-pin connector and cover are provided for external cabling.

NOTE

There are no pin assignments for the rear panel connectors, due to the great variety of possible connections.

When high frequency or fast digital signals are involved, plan the wires so as to minimize crossstalk. Make allowance for the possible need to make auxiliary ground connections.

The 50-pin rear panel connector may be easier to connect if it is removed from the rear panel and remounted after connections are made. Remove the top rear cabinet piece for ease of access.

If more than 50 pins are needed, an AMP HD-22 series connector with 104 pins may be mounted in the same cut out. It is suggested that these parts be obtained directly from AMP Inc., Harrisburg, PA or their distributors. For further application information, contact Tektronix' TM 500 Marketing Group, Beaverton, OR.

3. Pin assignments for individual plug-ins will be found in the appropriate instruction manual.

4. Install an interconnection jack barrier at the appropriate location on the interconnection jack. Refer back to operating instructions for keying assignments for family functions.

5. Select and install the wires (hook-up or coax) following the guidelines in the Wire Use part of these instructions.

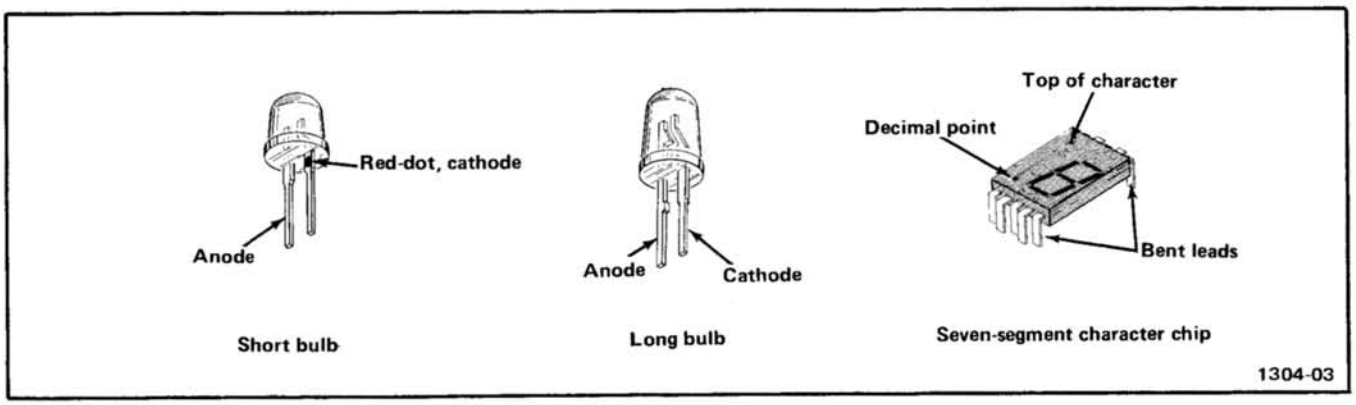


Fig. 3-2. Light emitting diode (LED) lead orientation illustration.

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6. Wires or cables which may be at large potential differences should be dressed or bundled so as to avoid contact. Keep all interface wiring away from the TM 506 primary line wiring.

7. There is an empty cut-out which will mount the standard IEC digital interface connector. The connector is not supplied with this option.

Wire Use.

1. Hook up wire with square-pin receptacle on both ends. These may be used for low frequency or dc circuits where impedance levels and crossstalk are not a problem. The wire is supplied in four lengths for connection between compartments (adjacent or nonadjacent) or between a compartment and the rear panel. For connection to the rear panel, cut to length then tin and solder the end going to the rear panel.

2. Coaxial wire with square pin receptacles on both ends. These are used for connections which require shielding or which must maintain a 50 Ω characteristic impedance. The outer conductor should be connected to either chassis ground or circuit ground. Plug-in lines which require coax leads usually have a specified ground pin assignment. If necessary, establish auxiliary ground connections at the appropriate wire ends. The coaxial wire is supplied in four lengths for connection between compartments (adjacent or non-adjacent) or between a compartment and the rear panel. For connection to the rear panel, cut to length then tin and solder the end going to the rear panel.

Packaging Information

A list of standard accessories (and part numbers) is located in the Replaceable Mechanical Parts list.

If the Tektronix instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing owner (with address) and the name of an individual at your firm that can be contacted. Include the complete instrument serial number and a description of the service required.

Save and re-use the package in which your instrument was shipped. If the original packaging is unfit for use or not available, repackage the instrument as follows:

Surround the instrument with polyethylene sheeting to protect the finish of the instrument. Obtain a carton of corrugated cardboard of the correct carton strength and having inside dimensions of no less than 6 inches more than the instrument dimensions. Cushion the instrument by tightly packing 3 inches of dunnage or urethane foam between carton and instrument on all sides. Seal the carton with shipping tape or an industrial stapler.

The carton test strength for this instrument is 200 pounds per square inch.

INSTALLATION PROCEDURE

Due to regional variations in the power source line voltage the TM 501 has selectable transformer primary taps. The taps are located on the interface board and are implemented by using the appropriate selector block. See Figs. 3-3, 3-4, and 3-5.

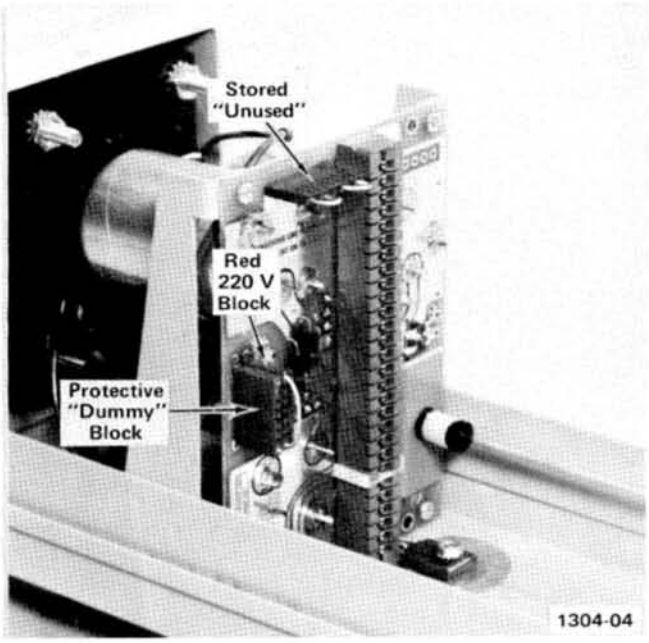


Fig. 3-3. 220 V Selector block in service.

NOTE

On later serial numbers, the selector blocks are located on the back side of the circuit board.

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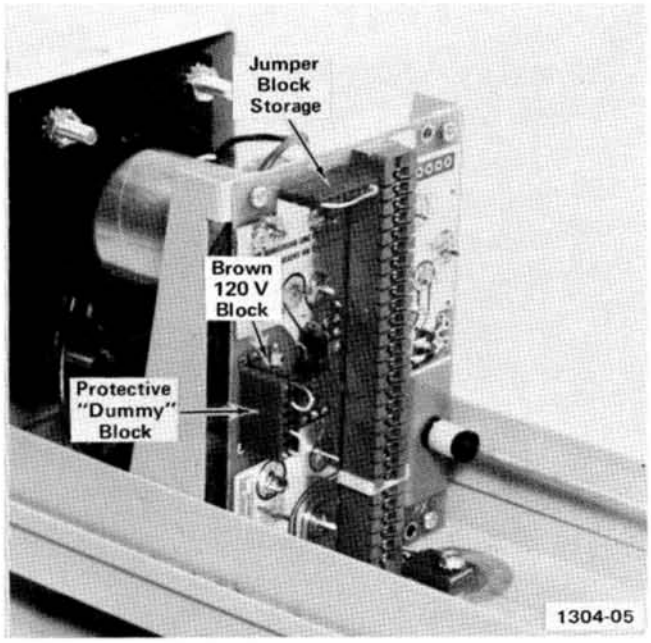


Fig. 3-4. 120 V Selector block in service.

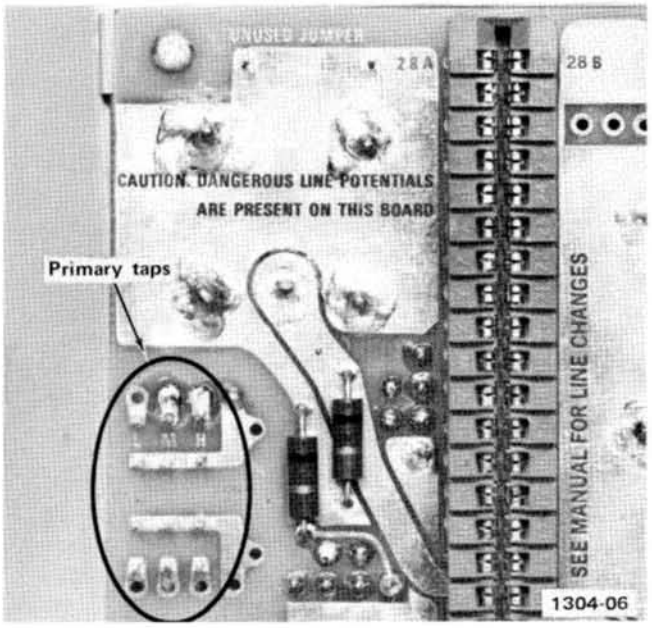


Fig. 3-5. Primary taps locations.

Table 3-2 shows which position the selector block should be in for specific line voltages. The brown selector block should be used for nominal line voltages of 120 V, and the red selector block for 220 V nominal line voltages. For example, if the power source is 120 V nominal and found to be exactly 115 V then the brown selector should be used on the high (H) primary taps.

Table 3-2

UNIVERSAL TRANSFORMER (SN B040000 - up)

Line Selector Block Position	Regulating Ranges	
	120 Volts Nominal	220 Volts Nominal
L	90 VAC to 110 VAC	180 VAC to 220 VAC
M	99 VAC to 121 VAC	198 VAC to 242 VAC
H	108 VAC to 132 VAC	216 VAC to 264 VAC
Line Fuse Data	0.6 Slow-blow	0.3 med-blow

STANDARD TRANSFORMER (SN B039999 - below)

Line Selector Block Position	Regulating Ranges
L Do not use	Internally Disconnected
M (110 V Nominal)	99 VAC to 121 VAC
H (120 V Nominal)	108 VAC to 132 VAC

To determine how the TM 501 is set and if a change is necessary, the following procedure should be used:

1. Determine what the actual line voltage of the power source is and note.

2. Remove the two hold-down screws on the top of the dust cover cabinet and lift off.

3. Locate and determine the position of the line selector block.

4. Using the above noted line voltage and Table 3-2, determine if a change is necessary.

5. If a change is necessary place the selector block on the appropriate taps. If no change is needed go on to the next step.

6. Replace the cabinet and hold-down screws.

7. After completing change record new setting on back panel (see Fig. 3-6).

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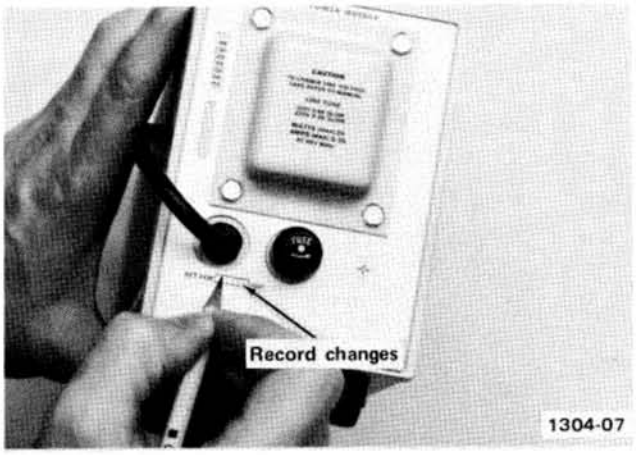


Fig. 3-6. Record line voltage setting.

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OPTIONS

Option 2. Information about this option may be found in the following sections:

Section 2 - Operating Instructions

Section 3 - Maintenance

Section 7 - Replaceable Mechanical Parts

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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.

SPECIAL NOTES AND SYMBOLS

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

ITEM NAME

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

ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

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CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00213	NYTRONICS COMPONENTS GROUP INC SUBSIDIARY OF NYTRONICS INC	ORANGE ST	DARLINGTON SC 29532
01121	ALLEN-BRADLEY CO	1201 SOUTH 2ND ST	MILWAUKEE WI 53204
01963	CHERRY ELECTRICAL PRODUCTS CORP	3600 SUNSET AVE	WAUKEGAN IL 60085
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT	W GENESEE ST	AUBURN NY 13021
04713	MOTOROLA INC SEMICONDUCTOR GROUP	5005 E MCDOWELL RD	PHOENIX AZ 85008
14099	SEMTECH CORP	652 MITCHELL ROAD	NEWBURY PARK CA 91320
19701	MEPCO/ELECTRA INC A NORTH AMERICAN PHILIPS CO	P O BOX 760	MINERAL WELLS TX 76067
31781	EDAC INC	20 RAILSIDE RD	DON MILLS ONT CAN M3A 1A4
56289	SPRAGUE ELECTRIC CO	87 MARSHALL ST	NORTH ADAMS MA 01247
59660	TUSONIX INC	2155 N FORBES BLVD	TUCSON, ARIZONA 85705
59821	CENTRALAB INC SUB NORTH AMERICAN PHILIPS CORP	7158 MERCHANT AVE	EL PASO TX 79915
71400	MCGRAW-EDISON CO BUSSMANN MFG DIV	502 EARTH CITY PLAZA P O BOX 14460	ST LOUIS MO 63178
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077

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Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1	670-2023-00			CIRCUIT BD ASSY:INTERFACE (STANDARD ONLY)	80009	670-2023-00
A1	670-3404-00			CIRCUIT BD ASSY:INTERFACE (OPTION 02 ONLY)	80009	670-3404-00
A1C2	283-0022-00			CAP,FXD,CER DI:0.02UF,+100-0%,1400V	59660	3888531Z5U0203Z
A1C10	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	59660	855-558Z5V0203Z
A1C12	290-0577-00			CAP,FXD,ELCTLT:2000UF,T100-10%,50V	56289	68D10504
A1C22	290-0577-00			CAP,FXD,ELCTLT:2000UF,T100-10%,50V	56289	68D10504
A1C30	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A1C32	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A1C35	290-0578-00			CAP,FXD,ELCTLT:6000UF,+100-10%,12V	56289	68D10429
A1C40	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	59660	855-558Z5V0203Z
A1CR10	152-0488-00			SEMICOND DVC,DI:RECT,SI,200V,0.5A	04713	SDA317
A1CR30	152-0198-00	B010100	B039999	SEMICOND DVC,DI:RECT,SI,200V,3A,A249	03508	1N5624
A1CR30	152-0198-02	B040000		SEMICOND DVC,DI:RECT,SI,200V,3A,A249G	14099	SS4986
A1CR32	152-0198-00	B010100	B039999	SEMICOND DVC,DI:RECT,SI,200V,3A,A249	03508	1N5624
A1CR32	152-0198-02	B040000		SEMICOND DVC,DI:RECT,SI,200V,3A,A249G	14099	SS4986
A1J10	131-1078-00			CONN,RCPT,ELEC:CKT BD,28/56 CONTACT	31781	303-056-520-301
A1Q10	151-0373-00			TRANSISTOR:PNP,SI,TO-127	04713	SJE925
A1Q12	151-0349-00			TRANSISTOR:NPN,SI,SELECTED,TO-127	04713	SJE924
A1R3	308-0704-00			RES,FXD,MM:8.8 OHM,5%,5M	00213	1550S-8.8-5
A1R12	301-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.5M	19701	5053CX2K000J
A1R22	301-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.5M	19701	5053CX2K000J
A1R30	302-0102-00			RES,FXD,CMPSN:1K OHM,10%,0.5M	01121	EB 1021
A1R35	315-0511-00			RES,FXD,CMPSN:510 OHM,5%,0.25M	19701	5043CX510R0J
F2	159-0043-00			FUSE,CARTRIDGE:3AG,0.6A,250V,25SEC (FOR 120 VOLT OPERATION)	71400	MDL 6/10
F2	159-0029-00			FUSE,CARTRIDGE:3AG,0.3A,250V,20SEC (FOR 220 VOLT OPERATION)	71400	MDL 3/10
S2	260-1222-00			SWITCH,PP:DPDT,40A,250AC,PUSH-PULL	01963	E79-96A
T1	120-0790-00	B010100	B039999	XFMR,PWR,STPDN:	80009	120-0790-00
T1	120-0791-00	B040000	B069999	XFMR,PWR,STPDN:	80009	120-0791-00
T1	120-0791-01	B070000		XFMR,PWR,STPDN:	80009	120-0791-01

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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:

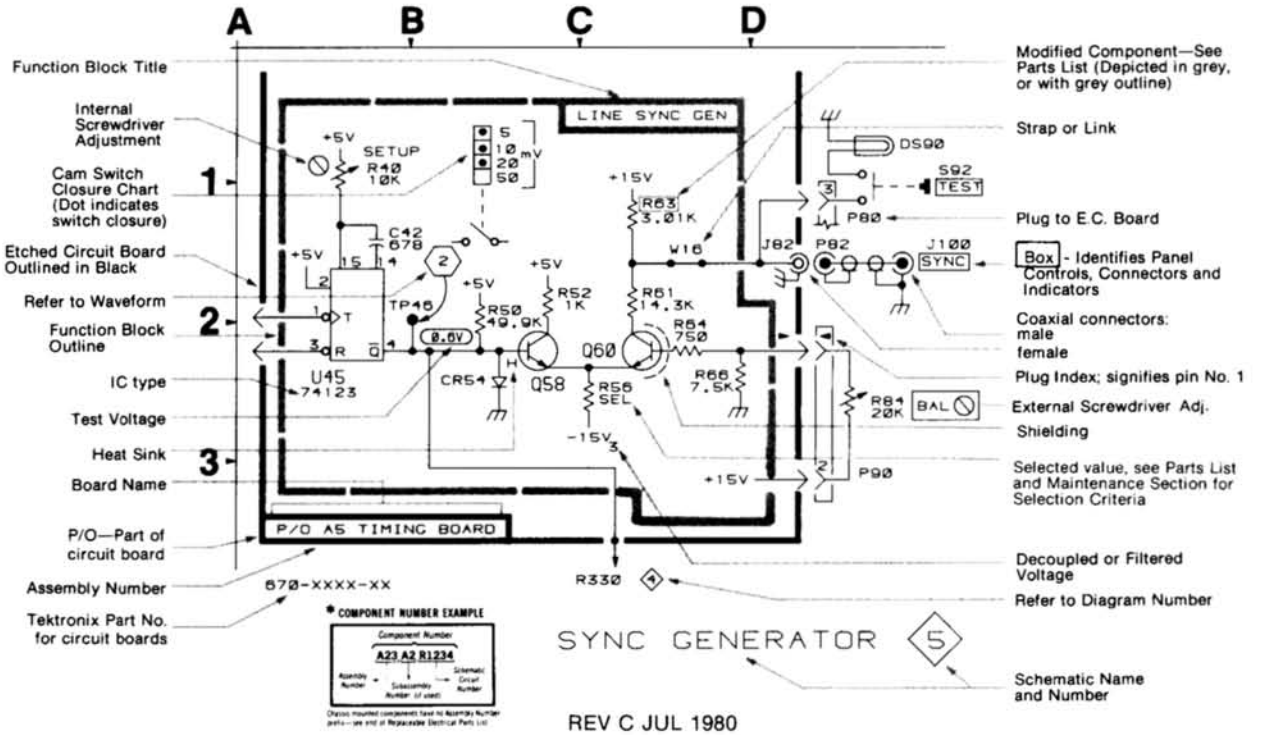
Capacitors = Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF).
Resistors = Ohms (Ω).

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

Assembly Numbers and Grid Coordinates

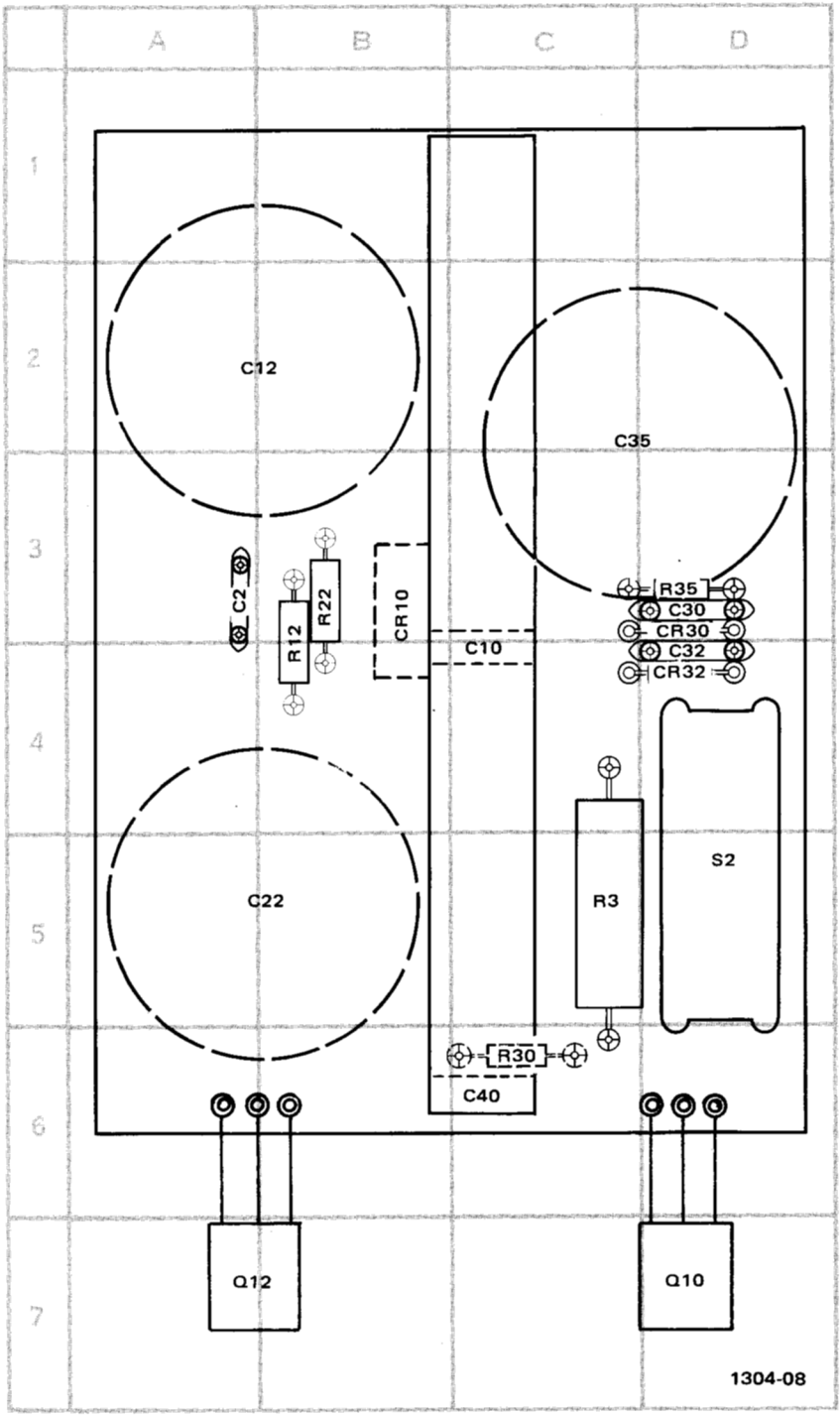
Each assembly in the instrument is assigned an assembly number (e.g., A20). The assembly number appears on the circuit board outline on the diagram, in the title for the circuit board component location illustration, and in the lookup table for the schematic diagram and corresponding component locator 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.



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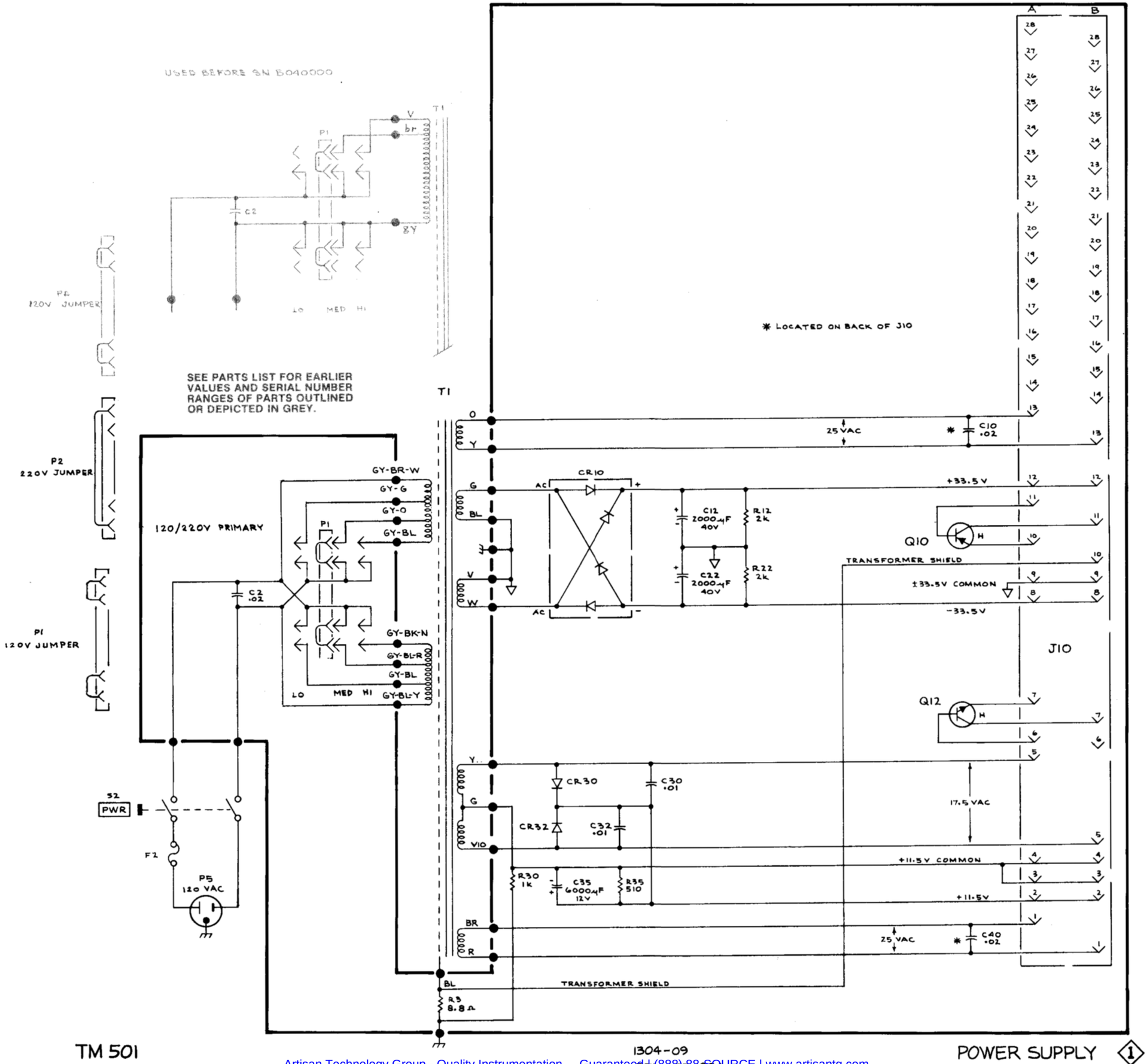
PARTS LOCATION GRID



CKT NO	GRID LOC
C2	A3
C10	C4
C12	B2
C22	B5
C30	D3
C32	D4
C35	C2
C40	C6
CR10	B3
CR30	D3
CR32	D4
Q10	D7
Q12	A7
R3	C5
R12	B3
R22	B3
R30	C6
R35	D3
S2	D5

NOTE: COMPONENTS SHOWN WITH DASHED LINES ARE LOCATED ON BACK SIDE OF BOARD.

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TM 501

1304-09
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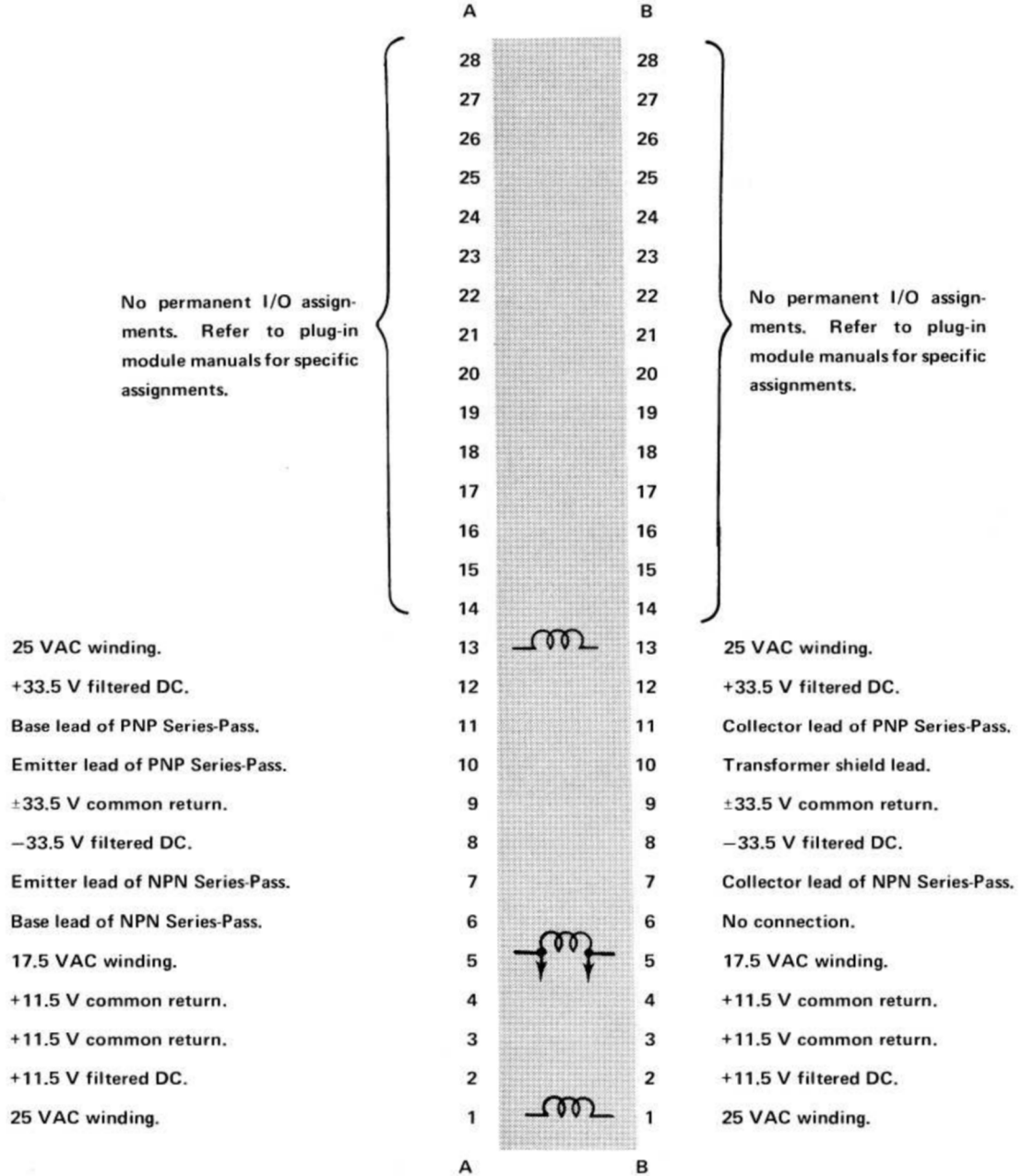
POWER SUPPLY 1

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POWER MODULE INTERFACE PIN ASSIGNMENTS

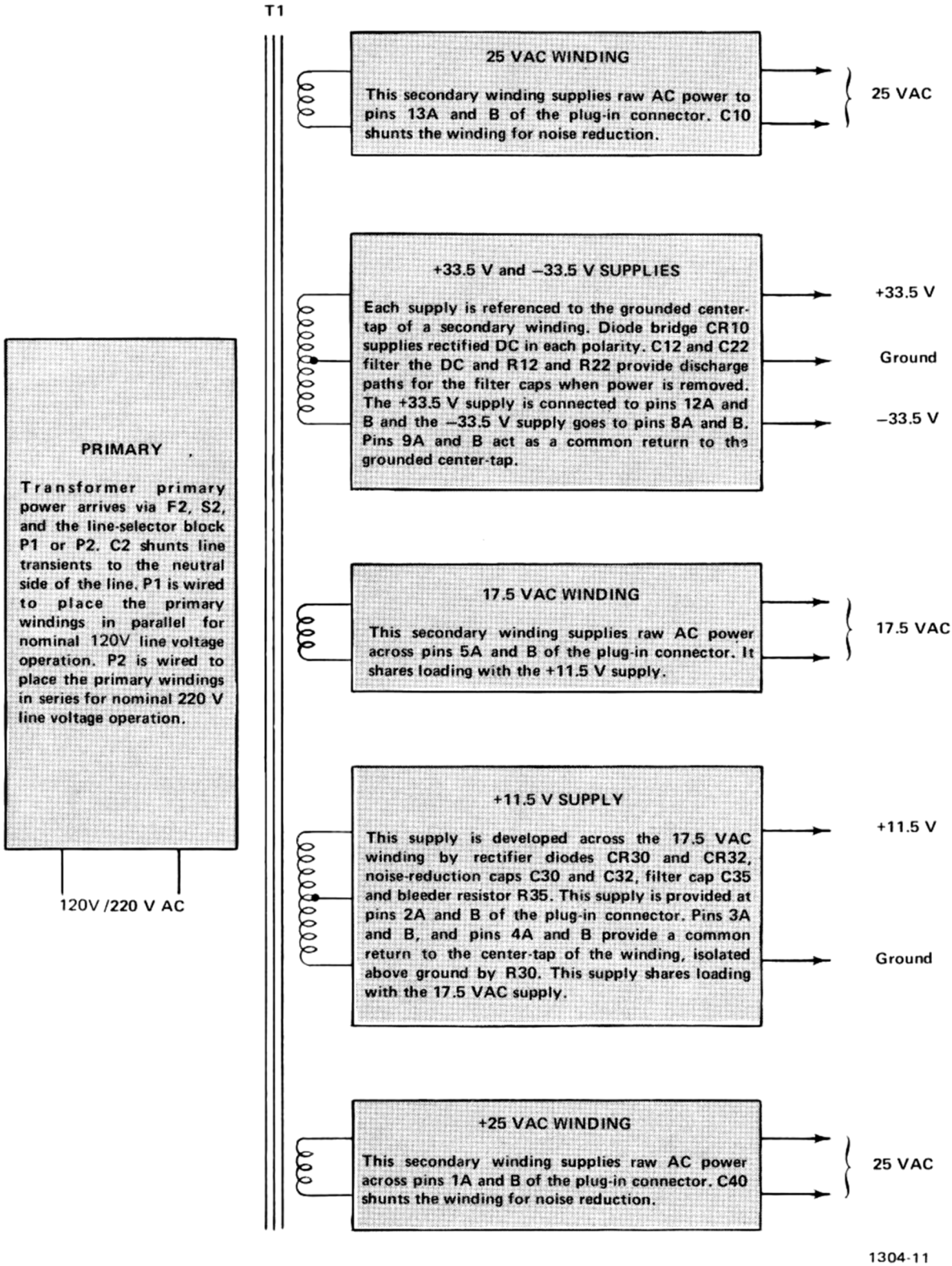
FRONT VIEW

TM 501



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DETAILED BLOCK DIAGRAM



1304-11

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REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

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

FIGURE AND INDEX NUMBERS

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

INDENTATION SYSTEM

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

1 2 3 4 5 Name & Description

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

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

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

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

ABBREVIATIONS

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

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CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00779	AMP INC	P O BOX 3608	HARRISBURG PA 17105
07707	USM CORP SUB OF EMHART INDUSTRIES INC USM FASTENER DIV	510 RIVER RD	SHELTON CT 06484
12136	P H C INDUSTRIES INC	1643 HADDON AVE	CAMDEN NJ 08103
12327	FREEWAY CORP	9301 ALLEN DR	CLEVELAND OH 44125
13511	AMPHENOL CADRE DIV BUNKER RAMO CORP		LOS GATOS CA
16428	BELDEN CORP ELECTRONIC DIV	2200 US HWY 27 SOUTH P O BOX 1980	RICHMOND IN 47374
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS	30 HUNTER LANE	CAMP HILL PA 17011
26365	GRIES REPRODUCER CO DIV OF COATS AND CLARK INC	125 BEECHWOOD AVE	NEW ROCHELLE NY 10802
28520	HEYCO MOLDED PRODUCTS	147 MICHIGAN AVE P O BOX 160	KENILWORTH NJ 07033
31781	EDAC INC	20 RAILSIDE RD	DON MILLS ONT CAN M3A 1A4
45722	USM CORP., PARKER-KALON FASTENER DIV		CAMPBELLSVILLE, KY 42718
70485	ATLANTIC INDIA RUBBER WORKS INC	571 W POLK ST	CHICAGO IL 60607
70903	BELDEN CORP	2000 S BATAVIA AVE	GENEVA IL 60134
71468	ITT CANNON ELECTRIC DIV INTERNATIONAL TELEPHONE AND TELEGRAPH CO	666 E DYER RD	SANTA ANA CA 92702
73743	FISCHER SPECIAL MFG CO	446 MORGAN ST	CINCINNATI OH 45206
75915	LITTELFUSE INC	800 E NORTHWEST HWY	DES PLAINES IL 60016
77900	SHAKEPROOF DIV OF ILLINOIS TOOL WORKS	SAINT CHARLES RD	ELGIN IL 60120
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIVISION	ST CHARLES ROAD	ELGIN IL 60120
78471	TILLEY MFG CO	2730 SPRING ST P O BOX 5766	REDWOOD CITY CA 94063
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077
83309	ELECTRICAL SPECIALITY CO SUBSIDIARY OF BELDEN CORP	213 E HARRIS AVE	SOUTH SAN FRANCISCO CA 94080
83385	MICRODOT MANUFACTURING INC GREER-CENTRAL DIV	3221 W BIG BEAVER RD	TROY MI 48098
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
86928	SEASTROM MFG CO INC	701 SONORA AVE	GLENDALE CA 91201
91500	ASHEVILLE-SCHOONMAKER MICA CO	910 JEFFERSON AVE P O BOX 318	NEWPORT NEWS VA 23607
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61101
TK0435	LEWIS SCREW CO	4114 S PEORIA	CHICAGO IL 60609
TK0502	CONNOR SPRING AND MFG CO	9400 NE COLFAX	PORTLAND OR 97220

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Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	390-0272-00	B010100	B059999	1	COVER,PWR SPLY:WRAPAROUND	80009	390-0272-00
	390-0272-01	B060000		1	COVER,PWR SPLY:WRAPAROUND	80009	390-0272-01
					(ATTACHING PARTS)		
-2	211-0622-00			2	SCREW,MACHINE:6-32 X 0.188,TRH,SST,POZ	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-3	367-0171-00			2	.HANDLE,CARRYING:6.5 L,BLUE VINYL	12136	845R372140370
-4	210-0586-00	B010100	B059999	2	.NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
	210-0783-00	B060000		2	.RIVET,BLIND:0.357 L X 0.125 OD,AL	07707	AD-44-ABS
-5	210-0958-00	B010100	B059999	2	.WASHER,FLAT:0.115 ID X 0.025 THK,STL CD PL	78471	ORDER BY DESCR
	210-0993-00	B060000		2	.WSHR,FLAT:0.143ID X 0.051THK,BRS,0.740D	86928	ORDER BY DESCR
-6	210-0012-00	B010100	B059999	2	.WASHER,LOCK:0.384 ID,INTL,0.022 THK,STL	77900	1220-02-00-0541C
	390-0272-00			1	.COVER,PWR SPLY:WRAPAROUND	80009	390-0272-00
-7	384-1158-00			1	KNOB:11.293 L X 0.125 OD,AL	80009	384-1158-00
-8	376-0127-00			1	CPLG,SHAFT,FLEX:0.055 & 0.326 ID,DELRIN	80009	376-0127-00
-9	----- -----			1	SWITCH,PUSH-PUL:(SEE S2 REPL)		
-10	358-0216-00			1	GROMMET,PLASTIC:GRAY,ROUND,0.257 ID	80009	358-0216-00
-11	333-1530-00			1	PANEL,FRONT:	80009	333-1530-00
					(ATTACHING PARTS)		
-12	211-0022-00			2	SCREW,MACHINE:2-56 X 0.188,PNH,STL	83385	ORDER BY DESCR
					(END ATTACHING PARTS)		
-13	351-0334-00	B010100	B029999	1	GUIDE,PL-IN UNI:UPPER,BLACK DELRIN,1.0 L	80009	351-0334-00
	351-0379-01	B030000		1	GUIDE,PL-IN UNI:UPPER,AL	80009	351-0379-01
					(ATTACHING PARTS)		
-14	213-0254-00			1	SCR,TPG,TF:2-32 X 0.25,SPCL TYPE,FLH,STL	45722	ORDER BY DESCR
					(END ATTACHING PARTS)		
-15	351-0286-00	B010100	B019999	1	GUIDE,PL-IN UNI:BOTTOM,BLK DELRIN	80009	351-0286-00
	351-0286-01	B020000	B039999	1	GUIDE,PL-IN UNI:BOTTOM,BLK DELRIN	80009	351-0286-01
	351-0286-02	B040000	B059999	1	GUIDE,PL-IN UNI:BOTTOM,BLK DELRIN	80009	351-0286-02
	351-0286-04	B060000	B082889	1	GUIDE,PL-IN UNI:LOWER,BLACK NYLON	80009	351-0286-04
	351-0286-07	B082890		1	GUIDE,PL-IN UNI:LOWER,NYLON	80009	351-0286-07
					(ATTACHING PARTS)		
-16	211-0101-00	B010100	B082889	1	SCREW,MACHINE:4-40 X 0.250,FLH,100 DG,STL	83385	ORDER BY DESCR
	213-0814-00	B082890		1	SCREW,TPG,TR:4-20,0.25L,PLASTITE,FLH,STL	83486	240-000-204081
					(END ATTACHING PARTS)		
-17	348-0187-00			4	FOOT,CABINET:BLACK POLYURETHANE	80009	348-0187-00
					(ATTACHING PARTS)		
-18	211-0551-00			1	SCREW,MACHINE:6-32 X 0.562,PNH,STL	83385	ORDER BY DESCR
					(END ATTACHING PARTS)		
-19	348-0026-00			2	HINGE BLOCK,STA:LEFT,GRAY ZYTEL	80009	348-0026-00
-20	348-0027-00			2	HINGE BLOCK,STA:RIGHT,GRAY ZYTEL	80009	348-0027-00
-21	348-0303-00			1	FLIP-STAND,CAB.:2.375 H,SST	TK0502	ORDER BY DESCR
-22	131-1018-00	B010100	B019999	1	CONTACT,ELEC:PLUG-IN GND,CU BE	80009	131-1018-00
	131-1254-01	B020000	B075079	1	CONTACT,ELEC:GROUNDING,BE AL,HT TR	80009	131-1254-01
					(ATTACHING PARTS)		
	211-0008-00	B010100	B075079	1	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
-23	210-0586-00	B010100	B075079	1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-24	- ---- -----			1	CKT BOARD ASSY:INTERFACE(SEE A1 REPL)		
					(ATTACHING PARTS)		
-25	213-0088-00			4	SCREW,TPG,TF:4-24 X 0.25,TYPE B,PNH,STL	83385	ORDER BY DESCR
-26	211-0012-00	B010100	B077419	2	SCREW,MACHINE:4-40 X 0.375,PNH,STL,CD PL	83385	ORDER BY DESCR
					(STANDARD ONLY)		
	211-0098-00	B077420		2	SCREW,CAP:4-40 X 0.375,BTN HD,STL	TK0428	ORDER BY DESCR
					(STANDARD ONLY)		
	211-0012-00	B010100	B078539	2	SCREW,MACHINE:4-40 X 0.375,PNH,STL,CD PL	83385	ORDER BY DESCR
					(OPTION 02 ONLY)		
	211-0098-00	B078540		2	SCREW,CAP:4-40 X 0.375,BTN HD,STL	TK0428	ORDER BY DESCR
					(OPTION 02 ONLY)		
-27	342-0136-00			2	INSLTR,MSHR:0.191D X 0.0025THK,MICA,0.812OD	91500	B52600F013
-28	210-0071-00			2	MSHR,SPR TNSN:0.148 ID X 0.025 THK,SPR STL	78189	4706-05-01-0531
-29	210-0586-00	B010100	B077419	2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(STANDARD ONLY)		
	220-0601-00	B077420		1	NUT,PLAIN,CAP:4-40 X 0.25 HEX,BRS NP	73743	93261-03
					(STANDARD ONLY)		
	210-0586-00	B010100	B078539	2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(OPTION 02 ONLY)		
	220-0601-00	B078540		1	NUT,PLAIN,CAP:4-40 X 0.25 HEX,BRS NP	73743	93261-03

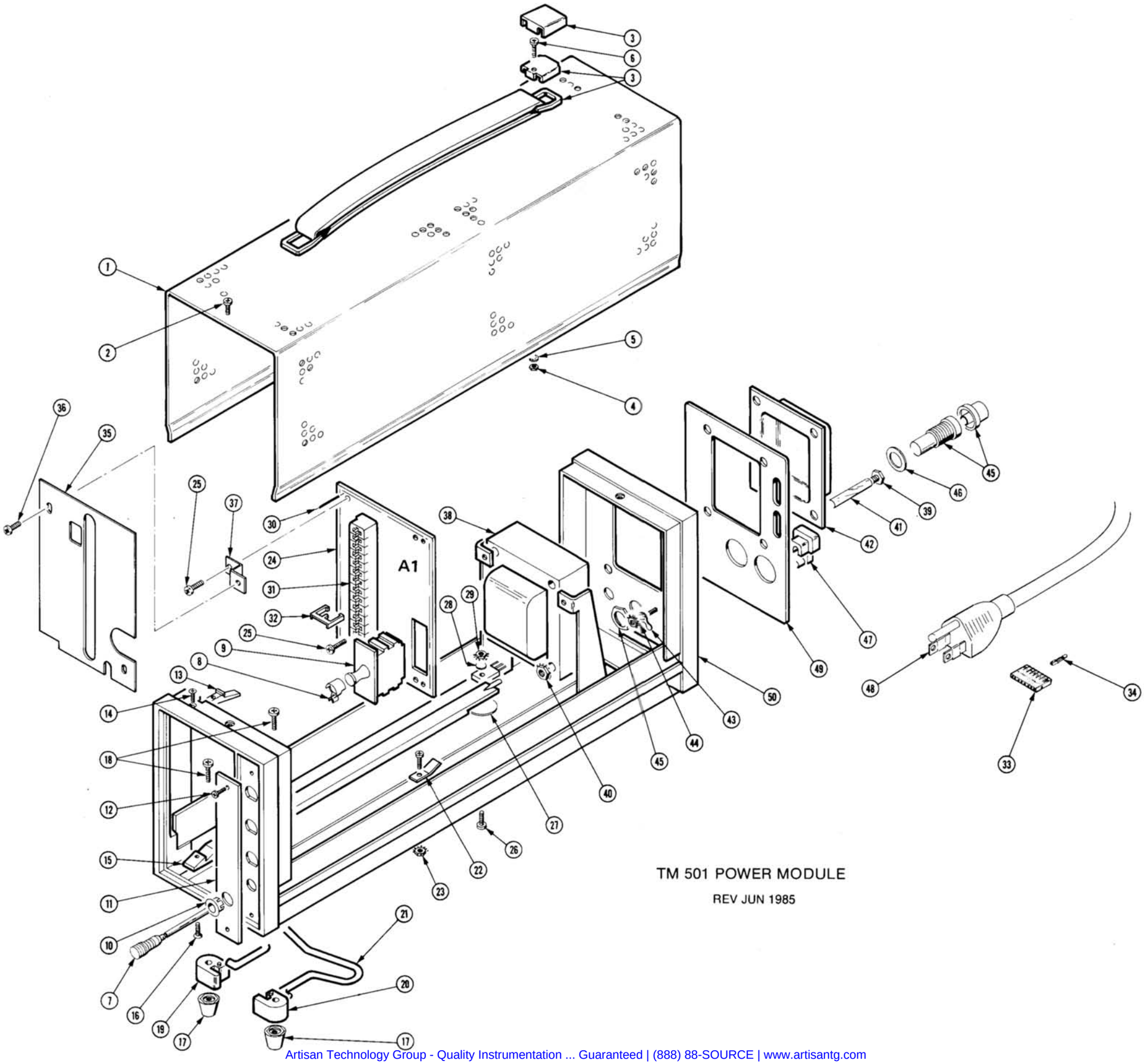
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Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-					(OPTION 02 ONLY) (END ATTACHING PARTS) CKT BOARD ASSY INCLUDES:		
-30	131-0608-00			14	.TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	22526	48283-036
	131-0608-00			46	.TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL .(OPTION 02 ONLY)	22526	48283-036
-31	131-1078-00			1	.CONN,RCPT,ELEC:CKT BD,28/56 CONTACT	31781	303-056-520-301
-32	214-1593-02			1	.KEY,CONN PLZN:CKT BOARD CONN	80009	214-1593-02
-33	131-1895-01			1	.LEAD,ELECTRICAL:22 AWG,1.5 L,8-2	80009	131-1895-01
-34	131-1896-00			1	.BUS,CONDUCTOR:8.22 AWG,1.5 L	80009	131-1896-00
	131-0707-00			6	.CONTACT,ELEC:22-26 AWG,BRS,CU BE GLD PL	22526	47439-000
-35	337-2912-00			1	SHIELD,ELEC:INTERFACE CKT BOARD (ATTACHING PARTS)	80009	337-2912-00
-36	211-0040-00			2	SCREW,MACHINE:4-40 X 0.25,BDGH,NYL (END ATTACHING PARTS)	26365	ORDER BY DESCR
-37	407-2763-00	B089890		2	BRACKET,CMPNT:SHIELD	80009	407-2763-00
-38	----- -----			1	TRANSFORMER:(SEE T1 REPL) (ATTACHING PARTS)		
-39	212-0576-00	B010100	B039999	4	SCREW,MACHINE:10-32 X 1.375,HEX HD,STL	83385	ORDER BY DESCR
	212-0517-00	B040000		4	SCREW,MACHINE:10-32 X 1.75,HEX HD,STL	83385	ORDER BY DESCR
	210-0812-00	B052090	B091899	4	WASHER,FLAT:0.188 ID X 0.031 THK,0.375	83309	ORDER BY DESCR
	210-0010-00	B091900		4	WASHER,LOCK:#10 INTL,0.02 THK,STL	77900	1210-00-00-0541C
	210-0206-00	B091900		1	TERMINAL,LUG:0.2 ID,LOCKING,BRZ TINNED	86928	A373-147-1
-40	220-0410-00			4	NUT,PL,ASSEM WA:10-32 X 0.375 HEX	78189	511-101800-50
-41	166-0226-00			4	INSUL SLVG,ELEC:0.187 ID X 1.125 L,MYLAR (END ATTACHING PARTS)	80009	166-0226-00
-42	200-0379-01	B010100	B094539	1	COVER,ELEC XFMR:2.5 X 3.0 X 0.625,STEEL	80009	200-0379-01
	200-0379-05	B094540		1	COVER,ELEC XFMR:2.5 X 3.0 X 0.625,STEEL	80009	200-0379-05
	334-2990-00	B094540		1	MARKER,IDENT:MKD CAUTION	80009	334-2990-00
-43	210-0201-00			1	TERMINAL,LUG:0.12 ID,LOCKING,BRZ TIN PL (ATTACHING PARTS)	86928	A373-157-2
-44	210-0586-00			1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL (END ATTACHING PARTS)	78189	211-041800-00
-45	352-0076-00	B010100	B049999	1	FUHLR,EXTR POST:3AG,20A,250V,PNL MT	75915	3420212-L
	352-0362-00	B050000		1	FUHLR,EXTR POST:3AG,20A,300V (ATTACHING PARTS)	75915	345603M/901-002
-46	210-0873-00			1	WASHER,FLAT:0.5 ID X 0.047 THK,RBR (END ATTACHING PARTS)	70485	ORDER BY DESCR
-47	358-0161-00			1	BSHG,STRAIN RLF:U/M 0.29 DIA CABLE,STRAIGHT	28520	1147 SR-5P-4
-48	161-0033-04	B010100	B082459	1	CABLE ASSY,PWR,:3,18 AWG,125V,84.0 L	16428	ORDER BY DESCR
	161-0033-25	B082460		1	CABLE ASSY,PWR,:3,18 AWG,125V,83.0 - 85.0 L SAFETY CONTROLLED	70903	KH902
	210-0201-00	B073290		1	TERMINAL,LUG:0.12 ID,LOCKING,BRZ TIN PL (ATTACHING PARTS)	86928	A373-157-2
	210-0586-00	B073290		1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL (END ATTACHING PARTS)	78189	211-041800-00
-49	333-1560-00			1	PANEL,REAR:	80009	333-1560-00
	333-1700-01			1	PANEL,REAR: (OPTION 02 ONLY)	80009	333-1700-01
	334-1377-00			1	MARKER,IDENT:MKD IDENTIFICATION NO. (OPTION 02 ONLY)	80009	334-1377-00
	131-0955-00			1	CONN,RCPT,ELEC:BNC,FEMALE (OPTION 02 ONLY)	13511	31-279
	210-0255-00			1	TERMINAL,LUG:0.391 ID,LOCKING,BRS CD PL (OPTION 02 ONLY)	12327	ORDER BY DESCR
	131-1344-00			1	CONN,PLUG,ELEC:D SERIES,50 CONT,MALE (OPTION 02 ONLY)	71468	DD-50P
-50	426-0876-00	B010100	B075079	1	FRAME ASSY,CAB.:	80009	426-0876-00
	426-0876-02	B075080		1	FRAME SECT,CAB.:	80009	426-0876-02
	334-3379-01	B080730		1	MARKER,IDENT:MARKED GROUND SYMBOL	80009	334-3379-01
	198-2070-00			1	WIRE SET,ELEC:	80009	198-2070-00
	131-2065-00	B084930		3	.TERM,QIK DISC.:18-22 AWG,BRASS TIN PLATED	00779	2-520181-2

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Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345	Name & Description	Mfr. Code	Mfr. Part No.
2-						STANDARD ACCESSORIES		
	070-1304-01			1		MANUAL,TECH:INSTR	80009	070-1304-01
						OPTION 02		
-1	131-1345-00			1		CONN,RCPT,ELEC:D SERIES,50 CONT,FEMALE	71468	DD-50S
-2	131-1319-00			1		SHLD,ELEC CONN:	71468	DD51216
-3	195-0993-00			6		LEAD,ELECTRICAL:22 AWG,15.0 L,9-4	80009	195-0993-00
-4	175-3301-00			6		CABLE ASSY,RF:50 OHM COAX,15.0 L,9-4	80009	175-3301-00
-5	214-1593-02			20		KEY,CONN PLZN:CKT BOARD CONN	80009	214-1593-02

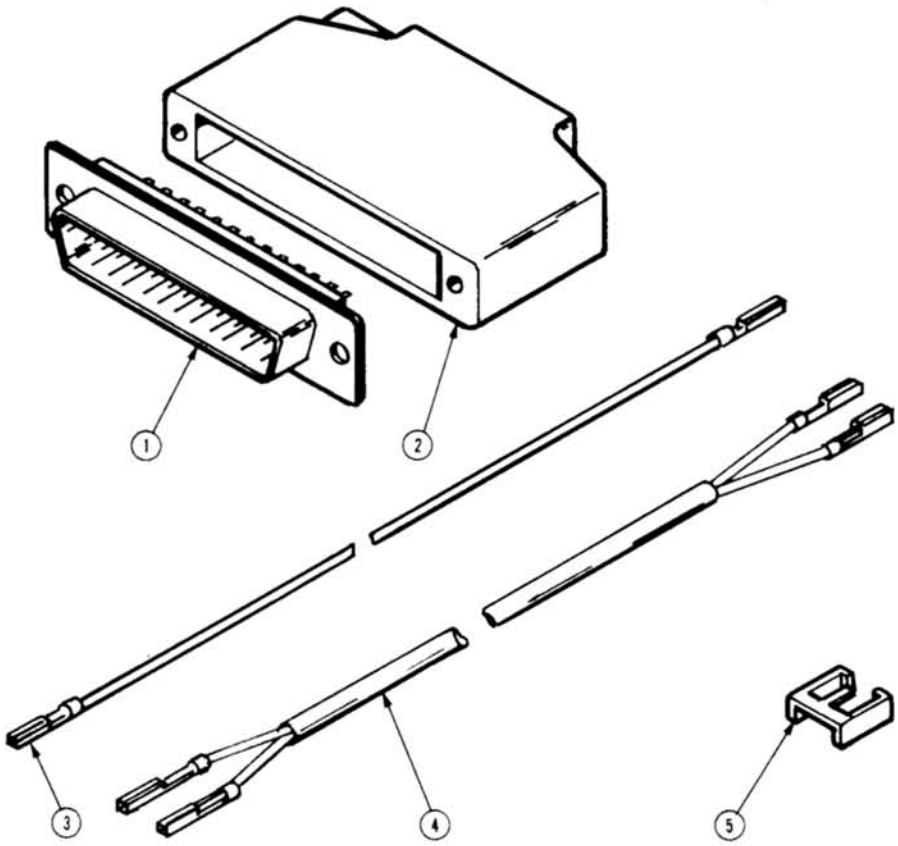
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