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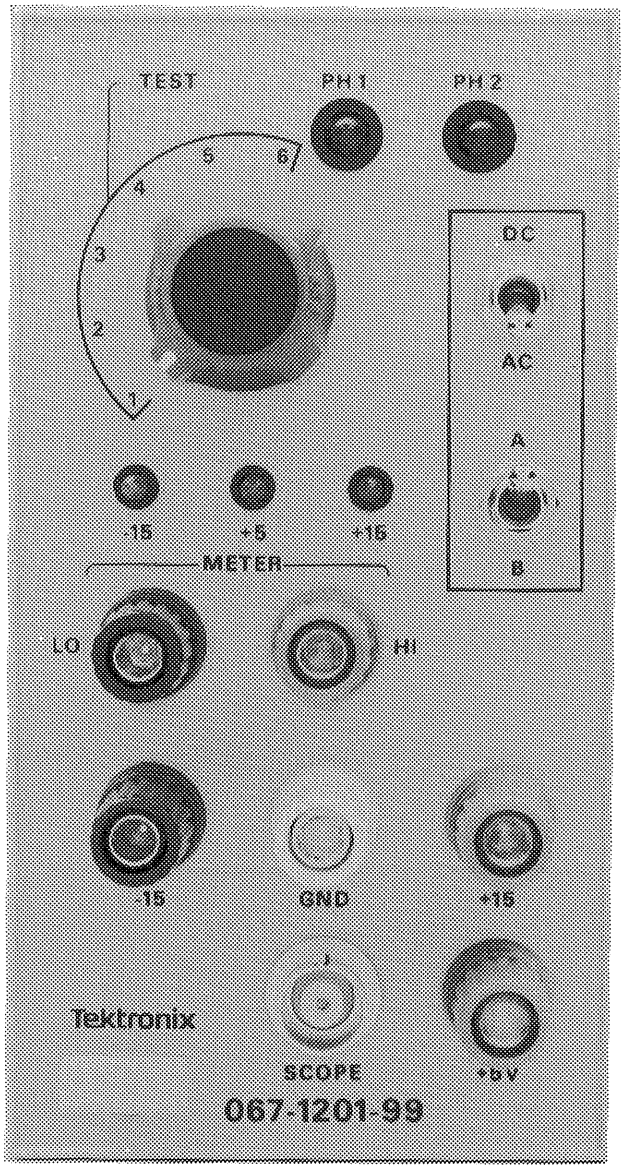
Instructions

TM 500 POWER MODULE TESTER AND UTILITY POWER SUPPLY 067-1201-99



061-3001-00
Product Group 75

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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

INTRODUCTION

The plug-in's primary purpose is to test TM 500 series power modules (mainframes). It is also useful as a limited performance power supply for breadboard or student use.

In its primary function as a test unit, it checks the integrity of mainframe power supply components. It does not check "interface" connections; these checks (when applicable) may be made with a simple ohmmeter or continuity tester. This note also includes instructions for mainframe tests using the plug-in.

As a utility power supply, the unit supplies the following voltages:

1. +5 V dc nominal at 1 amp. Suitable for TTL or similar logic, and compatible displays. (Type 7805 regulator).
2. +15 V dc and −15 V dc rated at 400 mA, with short circuit protection. The common of these supplies is grounded. Output voltage and current limiting are not variable.

NOTE

When using this unit as a power supply, set the rotary switch to position 3 and the AC/DC switch to the DC position.

POWER MODULE (MAINFRAME) TEST PROCEDURES

Introduction

Since the TM 500 power modules do not contain regulated supplies, test procedures are intended simply to assure that power supply components are functional; that is, that they have neither failed catastrophically, nor suffered appreciable degradation. Although test limits are given, they are intended as maintenance guidelines rather than formal specifications. The mainframe contains no adjustments and doesn't require calibration.

Circuit Description

1. **±33.5 V dc supplies.** These dc supplies consist of a pair of transformer windings (equivalent to a tapped winding) feeding a full wave bridge rectifier which is followed by filter capacitors and bleeder resistors. Since there is no regulation circuitry, the plus and minus voltages increase and decrease as the primary line voltage increases and decreases. When the line voltage is at its nominal value and there is no external load on the supply, the dc voltages are nominally plus and minus 33.5 V. The effect of load current is to decrease dc output voltage and increase peak-to-peak ripple voltage. These supplies are connected in parallel to all compartments.

2. **NPN and PNP pass transistors.** The pass transistors are isolated units whose collector, emitter, and base leads are brought to the interface connector, allowing each plug-in to utilize them as desired. In this test unit, the NPN is used as a series regulator in the +15 V supply and the PNP as a series regulator in the −15 V supply. There is a separate pair of transistors for each compartment.

3. **25 V ac rms floating windings.** Each compartment has two such windings supplied to it; they are secondary windings of the main power transformer. They should be connected so that pins 1A, 5A, and 13A are in phase. This allows their voltages to be additive when series-connected. The test unit connects pins 1A and 13A to ground and compares the phase of 1B and 13B to the phase of 5B. The test unit also half-wave rectifies both floating windings. One winding produces a positive voltage and the other a negative voltage. These voltages are substituted for the ±33.5 V supplies when the AC/DC switch is in the AC position, allowing a test of voltage and current capacity.

4. **+12 V dc supply.** This supply consists of a pair of transformer windings (equivalent to a tapped winding) feeding a 2-diode full wave rectifier, followed by a filter capacitor and bleeder resistor. This supply is connected in parallel to all standard (low power) compartments. The common is isolated from ground in the mainframe by a one-kilohm resistor but is grounded by the TM 500 plug-ins.

The high power compartment (far right compartment) of a TM 504 or TM 506) has a separate 12 V supply for itself which may or may not be grounded by the plug-in.

The test unit uses the 12 V dc supply as the raw voltage which is regulated by the Type 7805 5 V regulator.

The unrectified voltage from these windings is connected to pins 5A and 5B. Except for the phase comparison previously described, these connections are not checked. Any winding failure will be detected in the check of the 12 V supply. Lack of ac voltage at pins 5A and 5B, when the 12 V dc supply is working, would be due to a broken run or connector.

GENERAL INSTRUCTIONS

1. Two external load resistances are required. The recommended wattage ratings are the minimum required for adequate performance. At these wattage ratings, the surface temperature under load may be too great for safe handling. Therefore, the loads should be encased or shielded. As an alternative, a wattage rating five to ten times the minimum value will produce lower surface temperatures. The loads are:

a. 30 ohms, 10 W minimum; used with +15 V and −15 V supplies.

b. 5 ohms, 5 W minimum; used with +5 V supply.

2. The HI and LO meter terminals are for connection to an external test meter. In some tests, the HI terminal is positive relative to the LO terminal, and in some it is negative. The unit is designed for use with an autopolarity DVM having an input resistance of at least 10 megohms. The DM 502A is a good choice for this application.

3. The BNC connector in parallel with the HI meter terminal is for use with an oscilloscope. It is expected that an oscilloscope will be used to monitor ripple voltage on certain tests. These are low frequency tests and the bandwidth of the instrument is not important. The scope will be used mostly ac-coupled and should have a calibrated vertical scale and time base. If an oscilloscope is not available, checkout can be accomplished with the meter.

4. Several of the bused supply terminals have multiple connections:

a. +33.5 V, pins 12A and 12B
b. −33.5 V, pins 8A and 8B
c. ±33.5 V common, pins 9A and 9B
d. +12 V, pins 2A and 2B
e. +12 V common, pins 3A, 3B, 4A, and 4B

The circuit board for the 067-1201-99 parallels each of these sets. However, a given plug-in may use only one contact. The test unit can show the compartment to be good, whereas one contact of a pair may be broken or have an open run, producing trouble with some particular plug-in unit other than the test unit.

5. In most instances, steps 3, 4, 8, and 10 of the power module test procedures are necessary in only one compartment of a mainframe. However, it is possible that another compartment would lack voltage due to a broken run or contact. Step 12 should always be performed in a high power compartment (far right of TM 504 or TM 506) as well as at least one of the standard compartments.

DETAILED TEST PROCEDURE

1.—NPN Short/Leakage

Presets:

Meter Switch	Position 1
AC/DC Selector	AC
A/B Selector	A
External Load	Disconnected

Procedure:

Check to see that +15 V indicator LED is extinguished and that the meter reading drifts down to zero (or nearly zero) as the output filter capacitor in the +15 V supply discharges. A residual reading greater than 10 mV indicates that the NPN pass transistor in the mainframe is leaky (or shorted) from collector to emitter.

A base-emitter short will result in a loss of regulation (reduced output voltage) in Step 4. This will cause the +15 V indicator light to dim. Another symptom of a base-emitter short is that the output voltage of the +15 V supply goes to zero more rapidly than normal when switching from position 2 to position 1.

NPN base-collector leakage will be evidenced by an output voltage (+15 V supply) greater than normal in position 2 or 3. A base-collector short should produce the same symptom and will also result in a blown fuse F1 in position 1. Fuse F1 will also blow if the NPN collector is shorted to the chassis.

2.—NPN Beta

Presets:

Meter Switch	Position 2
AC/DC Selector	AC
A/B Selector	A
External Load	30 ohm load connected to +15 V

Procedure:

CAUTION

Surface temperature of test load resistors may become too hot for safe handling. Refer to general instruction no. 1.

The meter displays a voltage which is proportional to the base current of the NPN pass transistor in this mainframe compartment. A high reading means low beta, and a low reading means high beta. Consider replacement of any tran-

sistor that shows a reading greater than 3.0 V. Removing the external load should cause the reading to reduce to a much smaller value.

A zero (or extremely low) reading may be due to low output from the +15 V supply. Check raw dc and pass transistor.

3.—+33.5 V dc Supply (unloaded)

Presets:

Meter Switch	Position 3
AC/DC Selector	DC
A/B Selector	A
External Load	Disconnected

Procedure:

The meter displays the raw dc voltage supplied by the mainframe to pins 12A and 12B, and the scope displays the ripple voltage. If a variable autotransformer is available, set the primary line voltage to the center value of the tap in use. Refer to Table 1 for the appropriate values. Inadequate performance is most likely due to a defective rectifier or filter capacitor in the +33.5 V supply. A defective power transformer is another possibility. If no voltage is present, a blown fuse in the mainframe or in the test unit is a possibility.

4—+33.5 V dc Supply (loaded)

Procedure:

CAUTION

Surface temperature of test load resistors may become too hot for safe handling. Refer to general instruction no. 1.

With the controls still set as in Step 3, connect the 30 ohm load to the +15 V supply. There will be a decrease in the dc voltage displayed by the meter, and an increase in the peak-to-peak ripple displayed by the oscilloscope. Refer to Table 2. Inadequate performance is likely due to the same causes listed above.

5.—AC Winding (pins 13A/13B)

Procedure:

With the controls still set as in Step 4 (and with the 30 ohm load still connected) set the AC/DC switch to the AC position. There will be a further decrease in the dc voltage displayed by the meter, and an increase in the peak-to-peak ripple displayed by the oscilloscope. Typical value is 22-28 V, with a peak-to-peak ripple of 6-11 V. The ripple voltage is a function of the filter capacitors in the test unit and will be fairly constant. See Table 1 and Table 2 for other considerations. (The ripple frequency will also change from 120 Hz to 60 Hz.) These changes are due to the half wave rectifier and the smaller filter capacitor in the test unit. Disconnect the 30 ohm load; the dc voltage should increase to approximately 32-35 V. Return the AC/DC switch to the DC position. Failure to supply adequate voltage in this step implies that the ac winding connected to pins 13A and 13B is defective.

6—PNP Short/Leakage

Presets:

Meter Switch	Position 4
AC/DC Selector	AC
A/B Selector	A
External Load	Disconnected

Procedure:

Check to see that the −15 V indicator LED is extinguished and that the meter reading drifts down to zero (or nearly zero) as the output filter capacitor in the −15 V supply discharges. A residual reading greater than 10 mV indicates that the PNP pass transistor in this mainframe compartment has excessive leakage or may be shorted from collector to emitter.

A base-emitter short will result in a loss of regulation (reduced output voltage) in Step 9. This will cause the −15 V indicator light to dim.

Another symptom of a base-emitter short is that the output voltage of the −15 V supply goes to zero more rapidly than normal when switching from position 5 to position 4.

PNP base-collector leakage will be evidenced by an output voltage (−15 V supply) greater than normal in positions 5 or 6. A base-collector short should produce the same symptom and will also result in a blown fuse in position 4. Fuse F2 will also blow if the PNP collector is shorted to the chassis.

7—PNP Beta

Presets:

Meter Switch	Position 5
AC/DC Selector	AC
A/B Selector	A
External Load	30 ohm load connected to −15 V

Procedure:

The meter displays voltage which is proportional to the base current of the PNP pass transistor in this mainframe compartment. A high reading means low beta, and a low reading means high beta. Consider replacement of any transistor that shows a reading greater than 3.0 V. Removing the external load should cause the reading to reduce to a much smaller value.

CAUTION

Surface temperature of test load resistors may become too hot for safe handling. Refer to general instruction no. 1.

A zero (or extremely low) reading may be due to low output from the −15 V supply. Check raw dc and pass transistor.

8— −33.5 V dc Supply (unloaded)

Presets:

Meter Switch	Position 6
AC/DC Selector	DC
A/B Selector	A
External Load	Disconnected

Procedure:

The meter displays the raw voltage supplied by the mainframe to pins 8A and 8B, and the scope displays the ripple voltage. If a variable autotransformer is available, set the primary line voltage to the center value of the tap in use. Refer to Table 1 for the appropriate values. Inadequate performance is most likely due to a defective rectifier or filter capacitor in the −33.5 V supply. A defective power transformer is another possibility. If no voltage is present, a blown fuse in the mainframe or in the test unit is a possibility.

9— −33.5 V dc Supply (loaded)

Procedure:

CAUTION

Surface temperature of test load resistors may become too hot for safe handling. Refer to general instruction no. 1.

With the controls still set as in Step 8, connect the 30 ohm load to the −15 V supply. There will be a decrease in the dc voltage displayed by the meter, and an increase in the peak-to-peak ripple displayed by the oscilloscope. Refer to Table 2. Inadequate performance is likely due to the same causes listed above.

10—AC Winding (pins 1A and 1B)

Procedure:

With the controls still set as in Step 8 (and with the 30 ohm load still connected), throw the AC/DC switch to the AC position. There will be a further decrease in the dc voltage displayed by the meter, and an increase in the peak-to-peak ripple displayed by the oscilloscope. Typical value is 22-28 V, with a peak-to-peak ripple of 6-11 V. The ripple voltage is a function of the filter capacitors in the test unit, and will be fairly constant. See Table 1 and Table 2 for other considerations. (The ripple frequency will also change from 120 Hz to 60 Hz.) These changes are due to the half wave rectifier and the smaller filter capacitor in the test unit. Disconnect the 30 ohm load; the dc voltage should increase to approximately 32-35 V. Return the AC/DC switch to the DC position. Failure to supply adequate voltage in this step implies that the ac winding connected to pins 1A and 1B is defective.

11—Phasing of AC Windings

By now, both ac floating windings supplied to the compartment have been checked for adequate voltage and current. If their phasing relative to each other and to the windings connected to pins 5A and 5B is correct, DS1 and DS2 will be extinguished. If DS2 is lit, reverse the transformer leads to pins 1A and 1B. If DS1 is lit, reverse the transformer leads to pins 13A and 13B.

12— +12 V dc Supply

Presets:

Meter Switch	Position 1
AC/DC Selector	AC or DC
A/B Selector	B
External Load	Disconnected

Procedure:

The meter displays the raw 12 V dc voltage supplied to pins 2A and 2B. Refer to Table 3 for proper values.

CAUTION

Surface temperature of test load resistors may become too hot for safe handling. Refer to general instruction no. 1.

Connect the 5 ohm load to the +5 V supply. There will be a decrease in dc voltage displayed by the meter, and an increase in peak-to-peak ripple displayed by the oscilloscope, as shown by Table 4. Inadequate performance is probably due to a defective diode or filter capacitor in the mainframe supply. A defective transformer winding or a blown fuse is another possibility. This completes the tests for this compartment.

Table 1

TM 501	TM 503	TM 504	TM 506	TM 515
34.3 ± 0.5	33.3 ± 0.5	33.5 ± 0.5	33.6 ± 0.5	33.7 ± 0.5

Plus and minus 33.5 V dc bused supplies. Typical no load voltage at 60 Hz, and with line voltage adjusted for center of range. These voltages are quite dependent on line voltage and are sensitive to line voltage waveform distortion.

Table 2

TM 501	TM 503	TM 504	TM 506	TM 515
⩾28.0 V	⩾29.5 V	⩾31.5 V	⩾31.6 V	⩾30.5 V
⩽2.6 V	⩽1.4 V	⩽650 mV	⩽600 mV	⩽600 mV

Plus and minus 33.5 V dc bused supplies. Dc voltage with 500 mA load (upper) and peak-to-peak ripple with 500 mA load (lower). These are approximate worst-case values at 60 Hz and with line voltage adjusted for center of range. At 50 Hz, ripple will increase by about 25% with a corresponding decrease in dc voltage. (Dc voltage will decrease by about 60% of the increase in peak-to-peak ripple.) The dc voltage is quite sensitive to line voltage, including waveform distortion.

Table 3

TM 501	TM 503	TM 504	TM 506	TM 515
12.8 ± 0.5	11.7 ± 0.5	13.2 ± 0.5	13.7 ± 0.5	14.0 ± 0.5
N/A	N/A	13.2 ± 0.5	13.7 ± 0.5	N/A

12 V dc supply. Typical no load voltage at 60 Hz and with line voltage adjusted for center of range. These voltages are quite dependent on line voltage and are sensitive to line voltage waveform distortion. Upper number is supply bused to standard compartments. Lower number is for high power compartment.

Table 4

TM 501	TM 503	TM 504	TM 506	TM 515
⩾9.3 V	⩾9.7 V	⩾11.7 V	⩾12.5 V	⩾12.2 V
N/A	N/A	⩾11.7 V	⩾12.5 V	N/A
⩽1.8 V	⩽1.0 V	⩽600 mV	⩽600 mV	⩽600 mV
N/A	N/A	⩽600 mV	⩽600 mV	N/A

12 V dc supply. Dc voltage and peak-to-peak ripple with 1.0 A load. First row is dc voltage at standard compartment; second row is dc voltage at higher power compartment; third row is peak-to-peak ripple at standard compartment; fourth row is peak-to-peak ripple at high power compartment. These are approximate worst-case values at 60 Hz and with line voltage adjusted for center of range. At 50 Hz, ripple will increase by about 25% with a corresponding decrease in dc voltage. (Dc voltage will decrease by about 60% of the increase in peak-to-peak ripple.) The dc voltage is quite sensitive to line voltage, including waveform distortion.

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

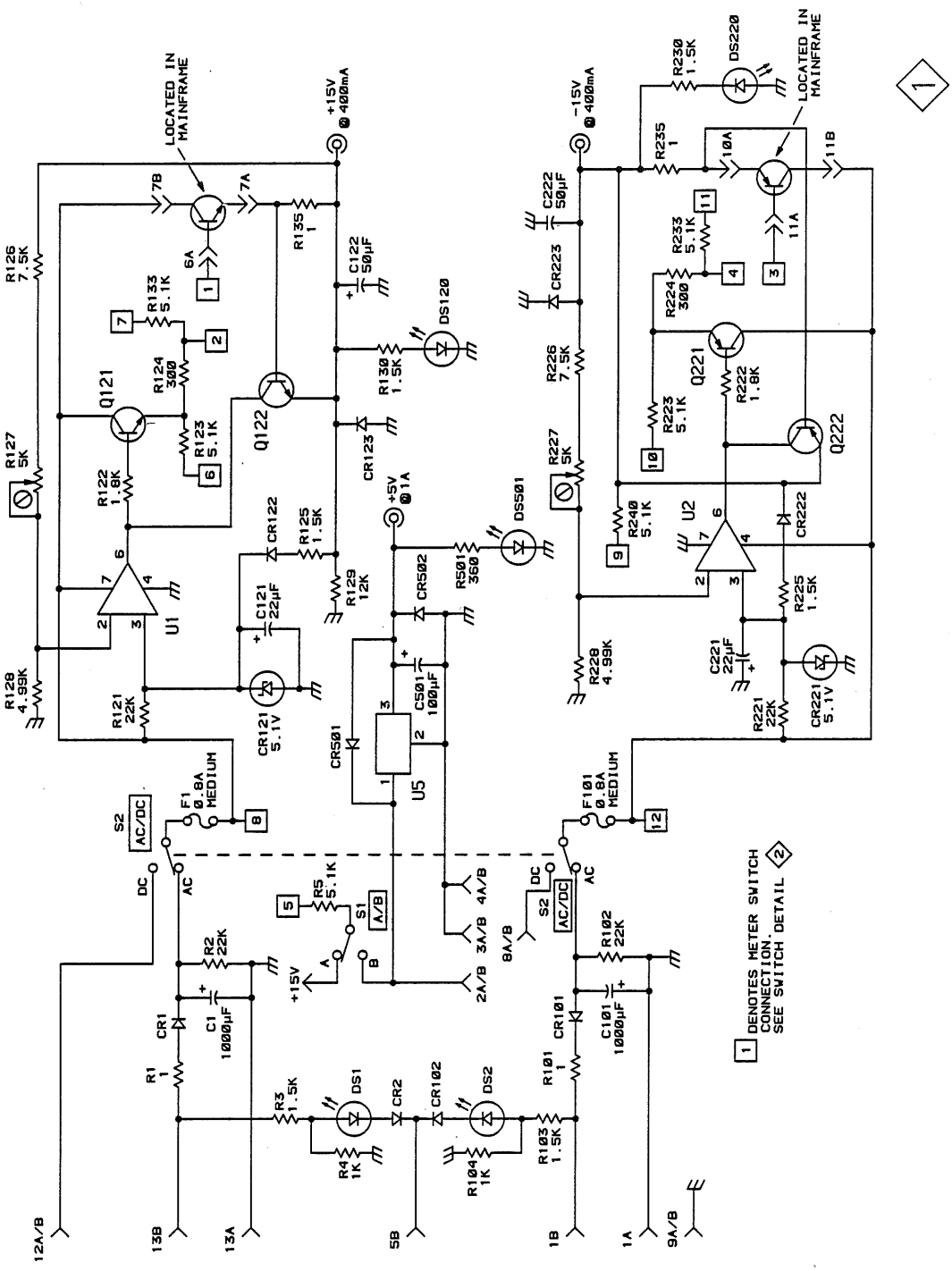
CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC. SEMICONDUCTOR GROUP	P.O. BOX 5012	DALLAS, TX 75222
02735	RCA CORPORATION, SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
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
09353	C AND K COMPONENTS, INC.	103 MORSE STREET	WATERTOWN, MA 02172
14193	CAL-R, INC.	1601 OLYMPIC BLVD.	SANTA MONICA, CA 90404
14433	ITT SEMICONDUCTORS	3301 ELECTRONICS WAY P O BOX 3049	WEST PALM BEACH, FL 33402
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
50522	MONSANTO CO., ELECTRONIC SPECIAL PRODUCTS	3400 HILLVIEW AVENUE	PALO ALTO, CA 94304
55680	NICHICON/AMERICA/CORP.	6435 N PROESEL AVENUE	CHICAGO, IL 60645
56289	SPRAGUE ELECTRIC CO.	87 MARSHALL ST.	NORTH ADAMS, MA 01247
71400	BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
72619	DIALIGHT, DIV. AMPEREX ELECTRONIC	203 HARRISON PLACE	BROOKLYN, NY 11237
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	PHILADELPHIA, PA 19108
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601

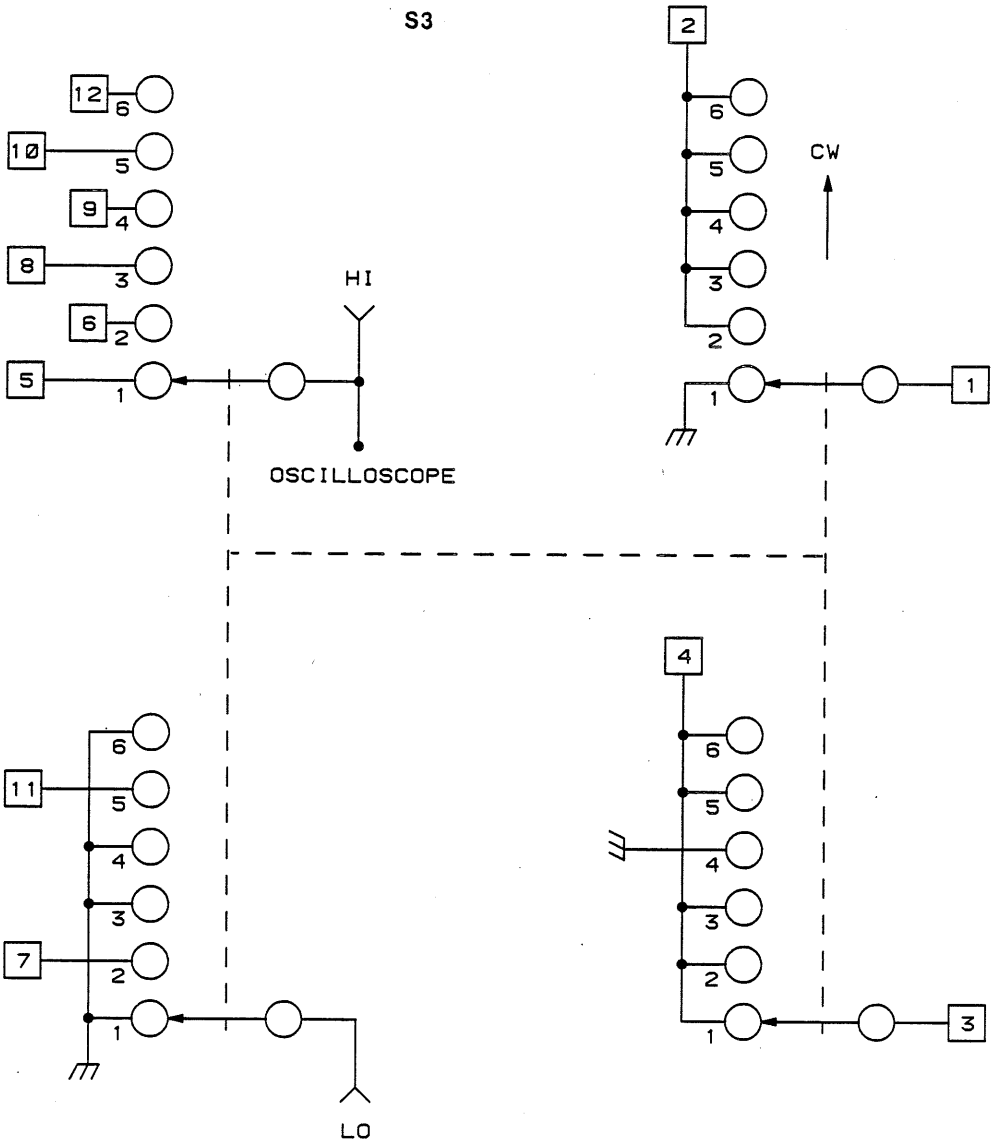
Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-8715-00			CKT BOARD ASSY:MAINFRAME TESTER	80009	670-8715-00
A1C1	290-0984-00			CAP.,FXD,ELCTLT: 1000UF,20%,50V	55680	TLB1H102M
A1C101	290-0984-00			CAP.,FXD,ELCTLT: 1000UF,20%,50V	55680	TLB1H102M
A1C121	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
A1C122	290-0117-00			CAP.,FXD,ELCTLT:50UF,+75-10%,50V	56289	30D506G050DD9
A1C221	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
A1C222	290-0117-00			CAP.,FXD,ELCTLT:50UF,+75-10%,50V	56289	30D506G050DD9
A1C501	290-0201-00			CAP.,FXD,ELCTLT:100UF,+75-10%,15V	56289	30D107G015DC9
A1CR1	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A1CR101	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A1CR102	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A1CR121	152-0279-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	04713	SZG35010RL
A1CR122	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A1CR123	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A1CR2	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A1CR221	152-0279-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	04713	SZG35010RL
A1CR222	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A1CR223	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A1CR501	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A1CR502	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A1F1	159-0018-00			FUSE,CARTRIDGE:3AG,0.8A,250V,SLOW-BLOW	71400	MDL 8/10
A1F101	159-0018-00			FUSE,CARTRIDGE:3AG,0.8A,250V,SLOW-BLOW	71400	MDL 8/10
A1Q121	151-0103-00			TRANSISTOR:SILICON,NPN	80009	151-0103-00
A1Q122	151-0302-00			TRANSISTOR:SILICON,NPN	07263	S038487
A1Q221	151-0134-00			TRANSISTOR:SILICON,PNP	80009	151-0134-00
A1Q222	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
A1R1	308-0677-00			RES.,FXD,WW:1 OHM,5%,2W	75042	BWH-1R000J
A1R101	308-0677-00			RES.,FXD,WW:1 OHM,5%,2W	75042	BWH-1R000J
A1R102	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
A1R103	301-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.5W	01121	EB1525
A1R104	301-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.50W	01121	EB1025
A1R121	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
A1R122	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
A1R123	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
A1R124	308-0076-00			RES.,FXD,WW:300 OHM,5%,3W	14193	SA30300 OHM 5%
A1R125	301-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.5W	01121	EB1525
A1R126	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
A1R127	311-1137-00			RES.,VAR,NONWIR:5K OHM,20%,0.50W	73138	72PX-67-0-502M
A1R128	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
A1R129	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
A1R130	301-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.5W	01121	EB1525
A1R133	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
A1R135	308-0677-00			RES.,FXD,WW:1 OHM,5%,2W	75042	BWH-1R000J
A1R2	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
A1R221	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
A1R222	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
A1R223	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
A1R224	308-0076-00			RES.,FXD,WW:300 OHM,5%,3W	14193	SA30300 OHM 5%
A1R225	301-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.5W	01121	EB1525
A1R226	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
A1R227	311-1137-00			RES.,VAR,NONWIR:5K OHM,20%,0.50W	73138	72PX-67-0-502M
A1R228	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
A1R230	301-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.5W	01121	EB1525

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1R233	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
A1R235	308-0677-00			RES.,FXD,WW:1 OHM,5%,2W	75042	BWH-1R000J
A1R240	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
A1R3	301-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.5W	01121	EB1525
A1R4	301-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.50W	01121	EB1025
A1R5	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
A1R501	315-0361-00			RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
A1U1	156-1134-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	02735	CA3140EX
A1U2	156-1134-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	02735	CA3140EX
A1U5	156-0277-00			MICROCIRCUIT,LI:VOLTAGE REGULATOR	07263	MICROA7805UC

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
				CHASSIS PARTS		
DS1	150-1001-00			LT EMITTING DIO:RED,66ONM,100MA MAX	50522	MV5024
DS2	150-1001-00			LT EMITTING DIO:RED,66ONM,100MA MAX	50522	MV5024
DS120	150-1054-00			LT EMITTING DIO:GREEN,560NM,40MA	72619	558-0201-804
DS220	150-1054-00			LT EMITTING DIO:GREEN,560NM,40MA	72619	558-0201-804
DS501	150-1054-00			LT EMITTING DIO:GREEN,560NM,40MA	72619	558-0201-804
S1	260-0613-00			SWITCH,TOGGLE:SPDT,115V	09353	7101SHZQ1
S2	260-0834-00			SWITCH,TOGGLE:DPDT,5A,125VAC,0.25-40 THD	09353	U21-SHZQE
S3	262-0005-00			SWITCH,METER:	80009	262-0005-00


LOCATED IN MAINFRAME
+15V @ 400mA
-15V @ 400mA
+5V @ 1A
R126 7.5K
R127 5K
R128 4.99K
R121 22K
R122 1.8K
R123 5.1K
R124 300
R133 5.1K
R135 1
C122 50µF
R130 1.5K
DS120
Q121
Q122
CR123
CR122
R125 1.5K
R129 12K
C121 22µF
CR121 5.1V
U1
CR502
R501 360
DS501
CR501
C501 100µF
U5
F1 0.8A MEDIUM
S2 AC/DC
DC
AC
R5 5.1K
S1 A/B
+15V
R2 22K
C1 1000µF
CR1
R1 1
R3 1.5K
DS1
CR2
CR102
DS2
R4 1K
R104 1K
R103 1.5K
R101 1
CR101
C101 1000µF
R102 22K
F101 0.8A MEDIUM
R235 1
R230 1.5K
DS220
R233 5.1K
R224 300
R223 5.1K
R226 7.5K
R227 5K
R240 5.1K
R228 4.99K
C222 50µF
CR223
Q221
Q222
R222 1.8K
U2
CR222
R225 1.5K
C221 22µF
CR221 5.1V
R221 22K
12A/B
13B
13A
5B
1B
1A
9A/B
2A/B
3A/B
4A/B
8A/B
1 DENOTES METER SWITCH CONNECTION. SEE SWITCH DETAIL
2

METER SWITCH DETAIL



2

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000CY	NORTHWEST FASTENER SALES, INC.	7923 SW CIRRUS DRIVE	BEAVERTON, OR 97005
45722	USM CORP., PARKER-KALON FASTENER DIV.		CAMPBELLSVILLE, KY 42718
58474	SUPERIOR ELECTRIC CO.	383 MIDDLE ST.	BRISTOL, CT 06010
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
74970	JOHNSON, E. F., CO.	299 10TH AVE. S. W.	WASECA, MN 56093
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
79807	WROUGHT WASHER MFG. CO.	2100 S. O BAY ST.	MILWAUKEE, WI 53207
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
89663	REESE, J. RAMSEY, INC.	71 MURRAY STREET	NEW YORK, NY 10007
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601
93907	TEXTRON INC. CAMCAR DIV	600 18TH AVE	ROCKFORD, IL 61101
95712	BENDIX CORP., THE ELECTRICAL COMPONENTS DIV., MICROWAVE DEVICES PLANT	HURRICANE ROAD	FRANKLIN, IN 46131

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-1	337-1399-04			2		SHIELD,ELEC:SIDE	80009	337-1399-04
-2	366-0500-00			1		KNOB:GRAY,4 SIDED	80009	366-0500-00
	213-0153-00			2		.SETSCREW:5-40 X 0.125,STL BK OXD,HEX	000CY	ORD BY DESCR
-3	—— ——			1		SWITCH,METER:(SEE S3 REPL)		
						**********(ATTACHING PARTS)**********		
-4	210-0590-00			1		NUT,PLAIN,HEX.:0.375-32 X 0.438" BRS	73743	2X28269-402
-5	210-0840-00			1		WASHER,FLAT:0.39 ID X 0.562 INCH OD,STL	89663	644R
-6	210-0012-00			1		WASHER,LOCK:INTL,0.384 ID,INTL,0.022 TH	78189	1220-02-00-0541C
						**********(END ATTACHING PARTS)**********		
-7	129-1022-00			1		POST,BDG,ELEC:CHARCOAL,5-WAY MINIATURE	58474	BP21 C
-8	129-0064-03			1		POST,BDG,ELEC:GREEN,5-WAY MINIATURE	58474	207784-G4
-9	129-0064-02					POST,BDG,ELEC:WHITE,5-WAY,MINIATURE	58474	207784-G5
						**********(ATTACHING PARTS)**********		
-10	210-0457-00			1		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	ORD BY DESCR
						**********(END ATTACHING PARTS)**********		
-11	366-1690-01			1		KNOB:SIL GY,0.53 W X 1.059 L,0.2	80009	366-1690-01
-12	105-0718-01			1		BAR,LATCH RLSE:	80009	105-0718-01
-13	105-0719-00			1		LATCH,RETAINING:PLUG-IN	80009	105-0719-00
						**********(ATTACHING PARTS)**********		
-14	213-0254-00			1		SCREW,TPG,TF:2-32 X 0.250,100 DEG,FLH	45722	ORD BY DESCR
						**********(END ATTACHING PARTS)**********		
-15	—— ——			1		SWITCH,TOGGLE:(SEE S2 REPL)		
						**********(ATTACHING PARTS)**********		
-16	210-0940-00			1		WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	ORD BY DESCR
						**********(END ATTACHING PARTS)**********		
-17	—— ——			1		SWITCH,TOGGLE:(SEE S1 REPL)		
						**********(ATTACHING PARTS)**********		
-18	210-0940-00			1		WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	ORD BY DESCR
						**********(END ATTACHING PARTS)**********		
-19	131-0352-00			1		CONNECTOR,RCPT,:BNC,FEMALE	95712	30310-1
-20	129-1023-00			3		POST,BDG,ELEC:RED,5-WAY,MINIATURE	58474	BP21 R
-21	333-3133-00			1		PANEL,FRONT:RIGHT	80009	333-3133-00
-22	386-2963-00			1		SUBPANEL,FRONT:	80009	386-2963-00
-23	200-3030-00			1		COVER,SUBPANEL:	80009	200-3030-00
						**********(ATTACHING PARTS)**********		
-24	213-0229-00			4		SCR,TPG,THD FOR:6-20 X0.375"100 DEG,FLH ST	93907	ORD BY DESCR
						**********(END ATTACHING PARTS)**********		
-25	214-1061-00			1		SPRING,GROUND:FLAT	80009	214-1061-00
-26	426-2051-00			1		FR SECT,PLUG-IN:TOP	80009	426-2051-00
						**********(ATTACHING PARTS)**********		
-27	211-0541-00			1		SCREW,MACHINE:6-32 X 0.25"100 DEG,FLH STL	83385	ORD BY DESCR
						**********(END ATTACHING PARTS)**********		
-28	—— ——			1		CKT BOARD ASSY:MAINFRAME TESTER(SEE A1 REP		
						**********(ATTACHING PARTS)**********		
-29	213-0146-00			4		SCR,TPG,THD FOR:6-20 X 0.313 INCH,PNH STL	83385	ORD BY DESCR
						**********(END ATTACHING PARTS)**********		
	—— ——					CKT BOARD ASSY INCLUDES:		
-30	344-0154-00			4		.CLIP,ELECTRICAL:FUSE,CKT BD MT	80009	344-0154-00
-31	—— ——			1		.MICROCIRCUIT,LI:(SEE U5 REPL)		
						.**********(ATTACHING PARTS)**********		
-32	210-0407-00			1		.NUT,PLAIN,HEX.:6-32 X 0.25 INCH,BRS	73743	3038-0228-402
-33	210-0006-00			1		.WASHER,LOCK:#6 INTL,0.018 THK,STL CD PL	78189	1206-00-00-0541C
						.**********(END ATTACHING PARTS)**********		
-34	426-0724-00			1		FR SECT,PLUG-IN:BOTTOM	80009	426-0724-00

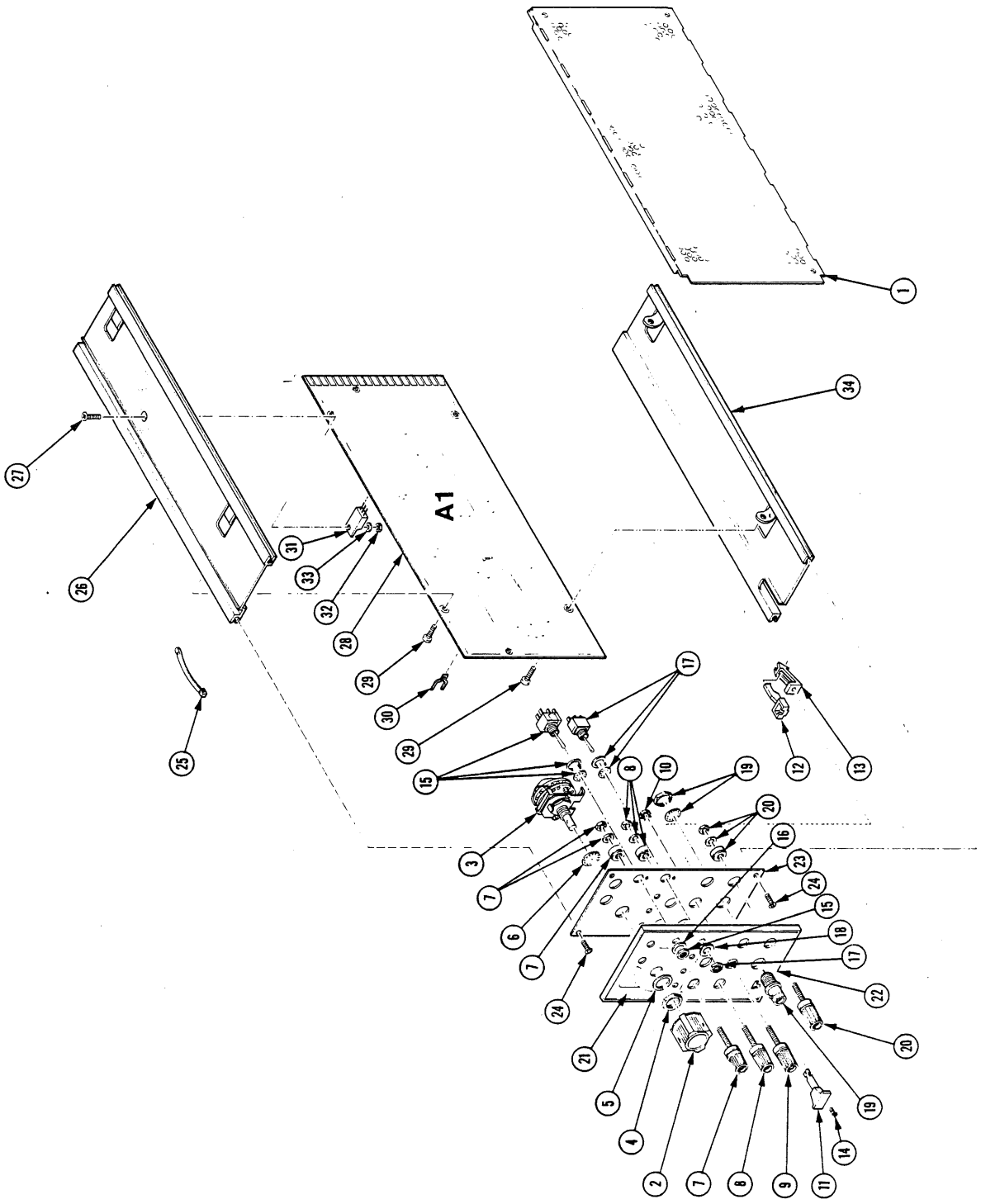


FIG.1 EXPLODED

ACCESSORIES

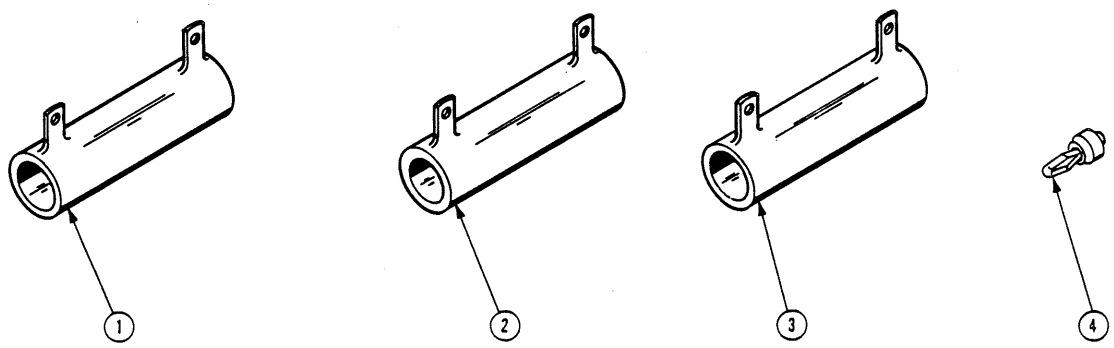


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
						STANDARD ACCESSORIES		
	061-3001-00			1		MANUAL,TECH:INSTR	80009	061-3001-00
-1	308-0184-00			4		RES.,FXD,WW:	91637	HL2506Z-14
-2	308-0188-00			1		RES.,FXD,WW:3 OHM,5%,25W	91637	HL2502Z63 OHM
-3	308-0205-00			1		RES.,FXD,WW:	91637	HL2502Z62R000J
-4	134-0066-00			4		PLUG,TIP:MALE,5/8 INCH LONG	74970	108-0754-066

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.