TEKTRONIX®

# DM 505
# DIGITAL
# MULTIMETER

INSTRUCTION MANUAL

Tektronix®
COMMITTED TO EXCELLENCE

# DM 505
# DIGITAL
# MULTIMETER

## INSTRUCTION MANUAL

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

Serial Number _____

070-2692-00

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## WARRANTY

This Tektronix product is warranted against defective materials and workmanship, under normal use, for a period of one year from date of initial shipment. Tektronix will repair or replace, at its option, those products determined to be defective within the warranty period and returned, freight prepaid, to a Tektronix Service Center. There is no implied warranty for fitness of purpose.

Please direct all requests for service or replacement parts to the nearest Tektronix Service Center or Field Office; include the type or part number of the product and its serial number.



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# OPERATORS SAFETY SUMMARY

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this 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.

### 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.

### As Marked on Equipment


DANGER — High voltage.


Protective ground (earth) terminal.


ATTENTION — refer to manual.

### Power Source

This product is intended to operate in a power module connected to 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 module power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. 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 Fuse

To avoid fire hazard, use only the fuse specified in the parts list for your product, and which is identical in type, voltage rating, and current rating.

Refer fuse replacement to qualified service personnel.

### Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this product in an atmosphere of explosive gases 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

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.

# SERVICING 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.

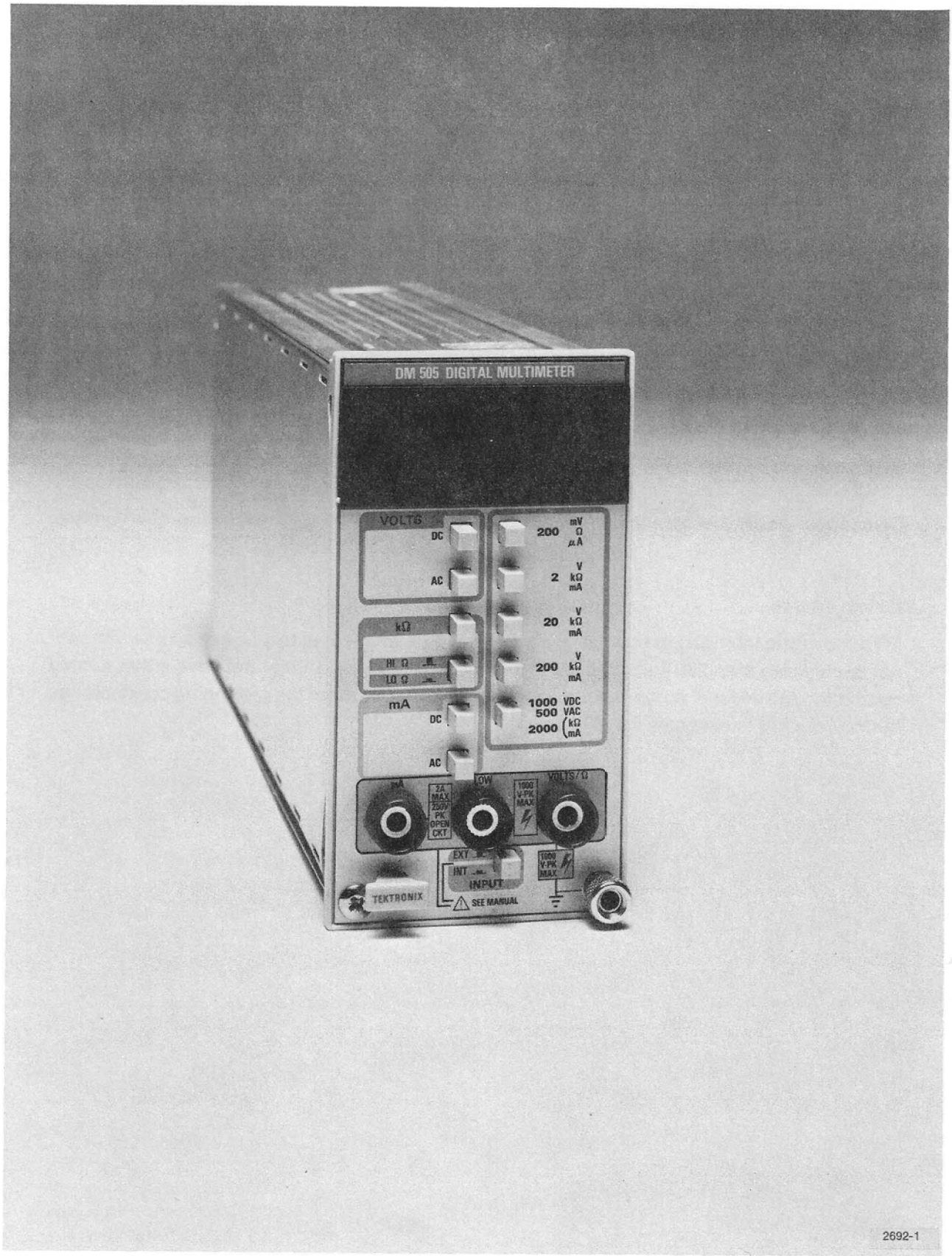
**Use Care When Servicing With Power On**

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 in a power module connected to 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.




**DM 505 Digital Multimeter.**

# SPECIFICATION

## Introduction

The DM 505 Digital Multimeter measures resistance, dc or ac voltage, and dc or ac current. The AC functions respond to the average value of an ac current or voltage and the readout displays the sinusoidal rms value. In the resistance mode of operation, the HI Ω—LO Ω pushbutton selects either of two full-scale probe tip voltages.

The front panel pushbuttons select the functions and ranges. The INPUT pushbutton selects front panel connector input (EXT) for current, voltage and resistance measurements, or rear interface connector input (INT) for voltage and resistance measurements. The readout is a 3 1/2 digit display using seven-segment LED. The decimal point is automatically positioned by the range pushbuttons. The polarity signs for dc voltage and dc current measurements are also displayed automatically. A blinking display indicates overrange except on the 1000 V dc and 500 V ac ranges. The reading rate is approximately three readings per second.

## Performance Conditions

The electrical characteristics are valid only if the DM 505 has been calibrated at an ambient temperature between +21° C and +25° C and is operating at an ambient temperature between 0° C and +50° C, unless otherwise noted.

Items listed in the Performance Requirements column of the Electrical Characteristics are verified by completing the Performance Check in this manual. Items listed in the Supplemental Information column are not verified in this manual. They are either explanatory notes or performance characteristics for which no limits are specified.

## ELECTRICAL CHARACTERISTICS
## Front Panel

**Table 1-1**

**DC VOLTMETER**

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| Accuracy for the 200 mV, 2 V, 20 V, 200 V, and 1000 V ranges: | | |
| +18° C to +28° C | | |
| 200 mV to 200 V ranges | ±(0.1% of reading + 0.05% of full scale) | |
| 1000 V range | ±(0.1% of reading + 0.1% of full scale) | |
| 0° C to +18° C, +28° C to +50° C | | |
| 200 mV to 200 V ranges | ±(0.2% of reading + 0.1% of full scale) | |
| 1000 V range | ±(0.2% of reading + 0.2% of full scale) | |
| Common Mode Rejection | ≥100 dB at dc.<br>≥80 dB at 50 to 60 Hz. | Verified with 1 kΩ unbalance at the LOW terminal. |
| Normal Mode Rejection Ratio | ≥50 dB at 50 and 60 Hz ±0.2 Hz. | (Clock frequency: 20.48 kHz ±1%.) |
| Maximum Resolution | | 100 μV |
| Response Time | | <0.5 second to rated accuracy. |
| Input Resistance | | 10 MΩ ±0.5%. |

Table 1-1 (cont)

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| Maximum Input Voltage | | |
| VOLTS/Ω to LOW | | 1000 V peak. |
| VOLTS/Ω to Ground | | 1000 V peak. |
| LOW to Ground | | 1000 V peak. |

Table 1-2

AC VOLTMETER

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| Accuracy for the 200 mV, 2 V, 20 V, 200 V and 500 V ranges: | | |
| +18°C to +28°C | | |
| 200 mV to 200 V ranges | | |
| 45 Hz-10 kHz sine wave | ±(0.5% of reading + 0.1% of full scale) | |
| 25-45 Hz, 10-20 kHz sine wave | ±(1% reading + 0.1% of full scale) | |
| 500 V range | | |
| 25 Hz-10 kHz sine wave | ±(1% of reading + 0.4% of full scale) | |
| 0°C to +18°C, +28°C to +50°C | | |
| 200 mV to 200 V ranges | | |
| 45 Hz-10 kHz sine wave | ±(1% of reading + 0.15% of full scale) | |
| 25-45 Hz, 10-20 kHz sine wave | ±(1.5% of reading + 0.15% of full scale) | |
| 500 V range | | |
| 25 Hz-10 kHz sine wave | ±(1.5% of reading +0.6% of full scale) | |
| Common Mode Rejection Ratio | ≥50 dB at 50 to 60 Hz. | Verified with 1 kΩ unbalance at the LOW connector. |
| Maximum Resolution | | 100 μV. |
| Response Time | | <1.5 seconds, within specified accuracy on measurements within any one range. |
| Input Impedance | | 10 MΩ ±0.5% paralleled by less than 130 pF. |
| Maximum Input Voltage | | |
| VOLTS/Ω to LOW | | 500 V ac rms or 600 V dc, not to exceed 1000 V peak. |
| VOLTS/Ω to Ground | | 500 V ac rms or 600 V dc, not to exceed 1000 V peak. |
| LOW to Ground | | 500 V ac rms or 600 V dc, not to exceed 1000 V peak. |
| Maximum Volt-Hz Product | | $10^7$ V·Hz. |

**Table 1-3**

**OHMMETER**

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| Accuracy for the 200 Ω, 2 kΩ, 20 kΩ 200 kΩ, and 2000 kΩ ranges: | | |
| +18°C to +28°C | | |
| 200 Ω range | ±(0.5% of reading + 0.1% of full scale + 0.1 Ω) | |
| 2 kΩ to 2000 kΩ ranges | ±(0.5% of reading + 0.05% of full scale + 0.1 Ω) | |
| 0°C to +18°C, +28°C to +50°C | | |
| 200 Ω range | ±(0.9% of reading + 0.15% of full scale + 0.1 Ω) | |
| 2 kΩ to 200 kΩ ranges | ±(0.9% of reading + 0.1% of full scale + 0.1 Ω) | |
| 2000 kΩ range | ±(0.9% of reading + 0.15% of full scale + 0.1 Ω) | |
| Response Time | | <0.5 second, within specified accuracy on measurements within any one range. |
| Maximum Input Volts | | 130 V dc indefinitely; 250 V ac for 1/2 hour. |
| Maximum Resolution | | 0.1 Ω. |
| Maximum Open Circuit Voltage Developed | | Approximately +6 V. |

**Table 1-4**

**DC AMMETER**

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| Accuracy for the 200 μA, 2 mA, 20 mA, 200 mA and 2000 mA ranges: | | |
| +18°C to +28°C | ±(0.3% of reading + 0.05% of full scale) | |
| 0°C to +18°C, +28°C to +50°C | ±(0.4% of reading + 0.1% of full scale) | |
| Response Time | | <0.5 second. |
| Maximum Open Circuit Input Voltage | | |
| mA to LOW | | 250 V peak. |

Table 1-4 (cont)

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| Maximum Floating Voltage | | |
| mA to Ground | | 1000 V peak. |
| Low to Ground | | 1000 V peak. |
| Maximum Resolution | | 0.1 μA. |

Table 1-5

AC AMMETER

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| Accuracy for the 200 μA, 2 mA, 20 mA, 200 mA, and 2000 mA ranges: | | |
| 45 Hz to 10 kHz | | |
| +18°C to +28°C | ±(0.7% of reading + 0.1% of full scale) | |
| 0°C to +18°C, +28°C to +50°C | ±(1.25% of reading + 0.1% of full scale) | |
| Frequency Limit | | Useable to 20 kHz. |
| Response Time | | <1.5 seconds, within specified accuracy for measurements within any one range. |
| Maximum Open Circuit Input Voltage | | |
| mA to LOW | | 250 V peak. |
| Maximum Floating Voltage | | |
| mA to Ground | | 1000 V peak. |
| LOW to Ground | | 1000 V peak. |
| Maximum Resolution | | 0.1 μA. |

## ELECTRICAL CHARACTERISTICS
## Rear Interface

Table 1-6

DC VOLTMETER

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| Accuracy for the 200 mV, 2 V, 20 V, 200 V and 1000 V ranges: | | |
| +18°C to +28°C | | |
| 200 mV to 200 V ranges | ±(0.1% of reading + 0.05% of full scale) | |
| 1000 V range | ±(0.1% of reading + 0.1% of full scale) | |



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Table 1-6 (cont)

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| 0°C to +18°C, +28°C to +50°C | | |
| 200 mV to 200 V ranges | ±(0.2% of reading + 0.1% of full scale) | |
| 1000 V range | ±(0.2% of reading + 0.2% of full scale) | |
| Maximum Resolution | | 100 μV. |
| Response Time | | <0.5 second to rated accuracy. |
| Input Resistance | | 10 MΩ ±0.5%. |
| Maximum Input Voltage | | |
| Pin 28B to Pin 28A | | 200 V peak. |
| Pin 28B to Ground | | 200 V peak. |
| Pin 28A to Ground | | 200 V peak. |

Table 1-7

AC VOLTMETER

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| Accuracy for the 200 mV, 2 V, 20 V, 200 V and 500 V ranges: | | |
| +18°C to +28°C | | |
| 200 mV to 2 V ranges | | |
| 45 Hz-10 kHz sine wave | ±(0.5% of reading + 0.1% of full scale) | |
| 25-45 Hz, 10-20 kHz sine wave | ±(1% of reading + 0.1% of full scale) | |
| 20 V to 200 V ranges | | |
| 25 Hz-20 kHz sine wave | ±(1% of reading + 0.1% of full scale) | |
| 500 V range (max. input: 200 V) | | |
| 25 Hz-10 kHz sine wave | ±(1% of reading + 0.4% of full scale) | |
| 0°C to +18°C, +28°C to +50°C | | |
| 200 mV to 2 V ranges | | |
| 45 Hz-10 kHz sine wave | ±(1% of reading + 0.15% of full scale) | |
| 25-45 Hz, 10-20 kHz sine wave | ±(1.5% of reading + 0.15% of full scale) | |
| 20 V to 200 V range | | |
| 25 Hz-20 kHz sine wave | ±(1.5% of reading + 0.15% of full scale) | |
| 500 V range (max. input: 200 V) | | |
| 25 Hz-10 kHz sine wave | ±(1.5% of reading + 0.6% of full scale) | |

Table 1-7 (cont)

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| Maximum Resolution | | 100 $\mu$V |
| Response Time | | <1.5 seconds, within specified accuracy on measurements within any one range. |
| Maximum Input Voltage | | |
| Pin 28B to Pin 28A | | 200 V peak. |
| Pin 28B to Ground | | 200 V peak. |
| Pin 28A to Ground | | 200 V peak. |
| Maximum Volt-Hz Product | | $10^7$ V·Hz. |

Table 1-8

OHMMETER

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| Accuracy for the 200 Ω, 2 kΩ, 20 kΩ, 200 kΩ, and 2000 kΩ ranges: | | |
| +18°C to +28°C | | |
| 200 Ω range | ±(0.5% of reading + 0.1% of full scale + 0.8 Ω) | |
| 2 kΩ to 2000 kΩ ranges | ±(0.5% of reading + 0.05% of full scale + 0.8 Ω) | |
| 0°C to +18°C, +28°C to +50°C | | |
| 200 Ω range | ±(0.9% of reading + 0.15% of full scale + 0.8 Ω) | |
| 2 kΩ to 200 kΩ ranges | ±(0.9% of reading + 0.1% of full scale + 0.8 Ω) | |
| 2000 kΩ range | ±(0.9% of reading + 0.15% of full scale + 0.8 Ω) | |
| Response Time | | <0.5 second, within specified accuracy on measurements within any one range. |
| Maximum Input Volts | | 130 V dc indefinitely.<br>200 V peak for 1/2 hour. |
| Maximum Resolution | | 0.1 Ω. |
| Maximum Open Circuit Voltage | | Approximately +6 V. |

Table 1-9

MISCELLANEOUS

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| Power Consumption | | Approximately 8 W. |
| Reading Rate | | 3 per second. |
| Over-range | | Flashing display (except 1000 V dc and 500 V ac ranges). |
| Calibration Interval | | 1000 hours or six months, whichever occurs first. |
| Warm-up Time | | 30 minutes (60 minutes after storage in high humidity environment). |

## ENVIRONMENTAL CHARACTERISTICS

Table 1-10

DM 505 ONLY[a]

| Characteristics | Description | |
|---|---|---|
| Temperature | | |
| Operating | 0° C to +50° C[b] | Test to MIL-T-28800B, class 5 with exceptions.[d] |
| Non-operating | −55° C to +75° C | |
| Humidity | | |
| Operating | +30° C and +50° C at 90%, +5 −0%[b] | Test to MIL-T-28800B, class 5 with exceptions.[e] |
| Non-operating | +30° C to +60° C at 90%, +5 −0% | |
| Altitude | | |
| Operating | 4.5 km (15,000 ft.)[b] | Test to MIL-T-28800B, class 3. |
| Non-Operating | 15 km (50,000 ft.) | |
| Vibration | | |
| Operating | 0.64 mm (0.025") disp., 5-55-5 Hz[a/c] (sine wave) 75 min. total. | Test to MIL-T-28800B, class 3. |
| Shock | | |
| Non-operating | 50 g (1/2 sine) 11 ms[a/c] 18 shocks | Test to MIL-T-28800B, class 3. |
| Bench Handling | | |
| Operating | 45° or 4" or equilibrum,[a/c] whichever occurs first. | Test to MIL-T-28800B, class 3. |

Table 1-10 (cont)

| Characteristics | Description | |
|---|---|---|
| E.M.C. | | |
| Operating | 30 Hz to 1 GHz[b] | Test to MIL-T-28800B, class 3. |
| Electrical Discharge | | |
| Operating | 20 kV max.[b] | Charge applied to each protruding area of the product under test except the input terminals. |
| Transportation | | Qualified under National Safe Transit Association Preshipment Test Procedures, Project 1A-B-1 and Project 1A-B-2. |

[a] **See Table 1-11 for system environmental characteristics.**

[b] **With power module.**

[c] **Without power module.**

[d] **Temperature: During low temperature test MIL-T-28800B, paragraph 4.5.5.1.3(b) for class 5, steps 4 and 5 shall be performed before step 2. Also, the instrument shall not be operating during step 6, paragraph 4.5.5.1.3(e), class 5. While operating, condensed moisture shall not be present on class 5 instruments. Drying of the instrument for this class may be performed in a suitable chamber, if necessary.**

[e] **Humidity: The 20 V ac and 200 V ac ranges shall be derated to ±2.5% of reading +2 counts. Note: All performance requirements are met while operating at 90-95% relative humidity at +30°C and +50°C with on hour warmup.**

Table 1-11

TM 500 SYSTEMS

| Characteristics | TM 501 | TM 503 | TM 504 | TM 506 | TM 515 |
|---|---|---|---|---|---|
| Temperature | | | | | |
| Operating | Meets same test standards as plug-in. | | | | |
| Non-operating | Meets same test standards as plug-in. | | | | |
| Humidity | | | | | |
| Operating | Meets same test standards as plug-in. | | | | |
| Non-operating | Meets same test standards as plug-in. | | | | |
| Altitude | | | | | |
| Operating | Meets same test standards as plug-in. | | | | |
| Non-operating | Meets same test standards as plug-in. | | | | |



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Table 1-11 (cont)

| Characteristics | TM 501 TM 503 TM 504 TM 506 | TM 515 |
|---|---|---|
| Vibration | | |
| Operating | 0.26 mm (0.010 in) disp., 10-55 Hz (sine wave) 75 min. total | 0.38 mm (0.015 in) disp. 10-55 Hz (sine wave) 75 min. |
| Shock | | |
| Operating | 20 g (1/2 sine) 11 ms 18 shocks | 30 g (1/2 sine) 11 ms, 18 shocks |
| Bench Handling | | |
| Operating | Meets same test standards as plug-in. | |
| Electrical Discharge | | |
| Operating | Meets same test standards as plug-in. | |
| Transportation | | |
| Vibration | Meets same test standards as plug-in. | |
| Package Drop | Meets same test standards as plug-in. | |

## PHYSICAL CHARACTERISTICS

Table 1-12

| Characteristics | Description |
|---|---|
| Finish | Anodized aluminum panel and chassis. |
| Net Weight | 2.2 lbs (exclusive of probes) (1 kg). |
| Overall Dimensions | 2.633 in (66.8 mm) W X 11.240 in (285.3 mm) D X 4.961 in (125.9 mm) H. |

# OPERATING INSTRUCTIONS

## Installation Instructions

The DM 505 is calibrated and ready to use when received. It operates in one compartment of a TM 500-series power module. Refer to the power module instruction manual for line voltage requirements and power module operation.

**CAUTION**

*Turn the power module off before inserting the plug-in; otherwise, damage may occur to the plug-in circuitry.*

Check to see that the plastic barriers on the interconnecting jack of the selected power module compartment match the cut-outs in the DM 505 circuit board edge connector. Align the DM 505 chassis with the upper and lower guides (see Fig. 2-1) of the selected compartment. Push the DM 505 in and press firmly to seat the circuit board in the interconnecting jack. Pull out the power switch on the power module. One or more characters in the LED display should now be visible.

To remove the DM 505, pull on the release latch (located in the lower left corner) until the interconnecting jack disengages and the DM 505 slides out.

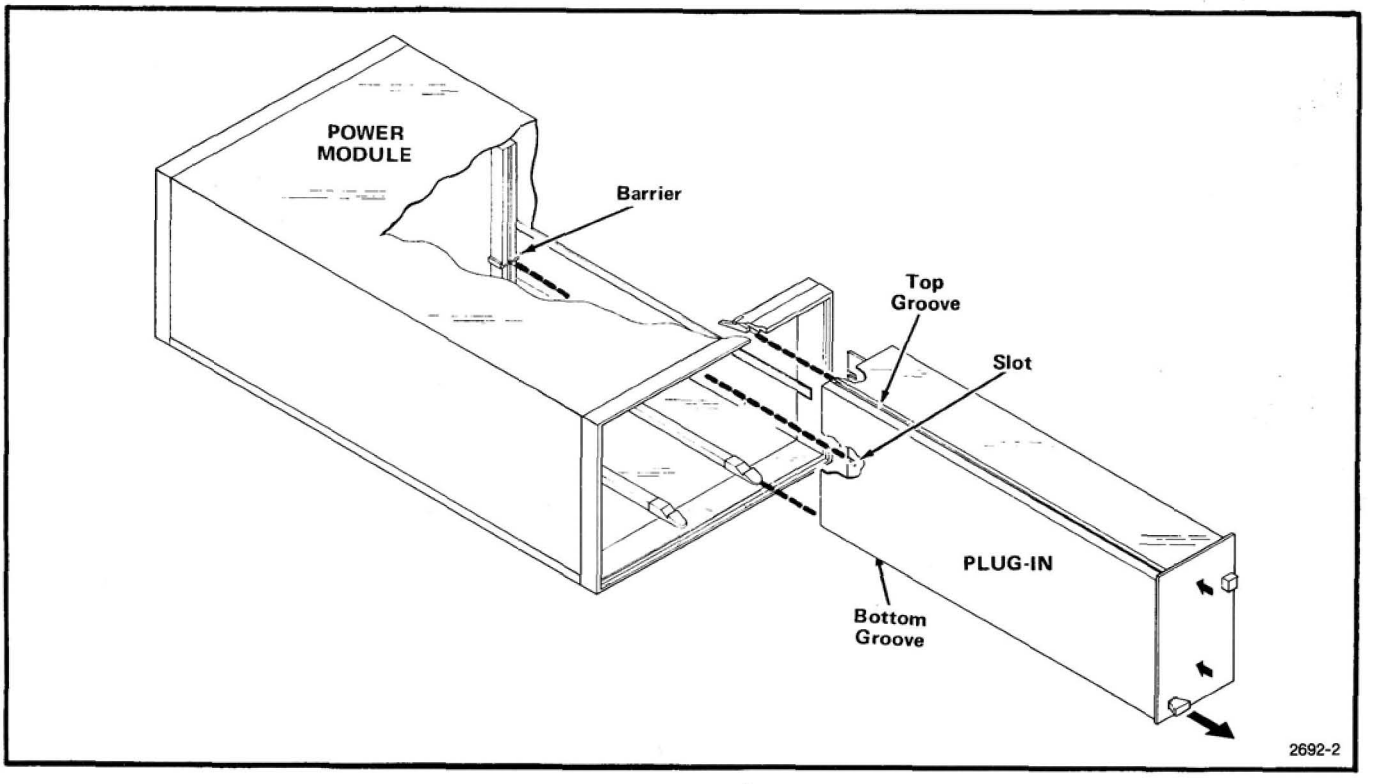



**Fig. 2-1. DM 505 Installation and removal.**

## CONTROLS AND CONNECTORS

### DISPLAY

**(1) Display**

3 1/2 digit LED readout with decimal point automatically positioned by the range pushbuttons.

### VOLTS

**(2) VOLTS DC pushbutton**

Selects dc voltage function.

**(3) VOLTS AC pushbutton**

Selects ac voltage function.

### RESISTANCE

**(4) kΩ pushbutton**

Selects resistance function.

**(5) HI Ω—LO Ω**

Pushbutton in selects full scale probe tip voltage of 0.2 V in all ranges. Pushbutton out selects full scale probe tip voltage of 2 V except in the 200 Ω range which is 0.2 V.

### CURRENT

**(6) mA DC pushbutton**

Selects dc current function.

**(7) mA AC pushbutton**

Selects ac current function.

### CONNECTORS ⚠

Refer to Input Connections in the Operating Instructions.

**(8) mA Connector**

Use with LOW input connector for current measurements.

**(9) LOW Connector**

Common input connector for all measurements.

**(10) VOLTS/Ω Connector**

Use with LOW input connector for voltage and resistance measurements.

**(11) Ground Binding Post**

Chassis ground.

### RANGE SELECTION

**(12) Range Select Pushbuttons**

Select the desired measurement range.

**(13) Release Latch**

Pull to remove plug-in.

**(14) INPUT EXT-INT Pushbutton** ⚠

Refer to Input Connections in the Operating Instructions.

Pushbutton out (EXT) selects front panel input connectors; pushbutton in (INT) selects rear interface input terminals for dc and ac volts and resistance measurements only.

## OPERATORS FAMILIARIZATION

### General Operating Information

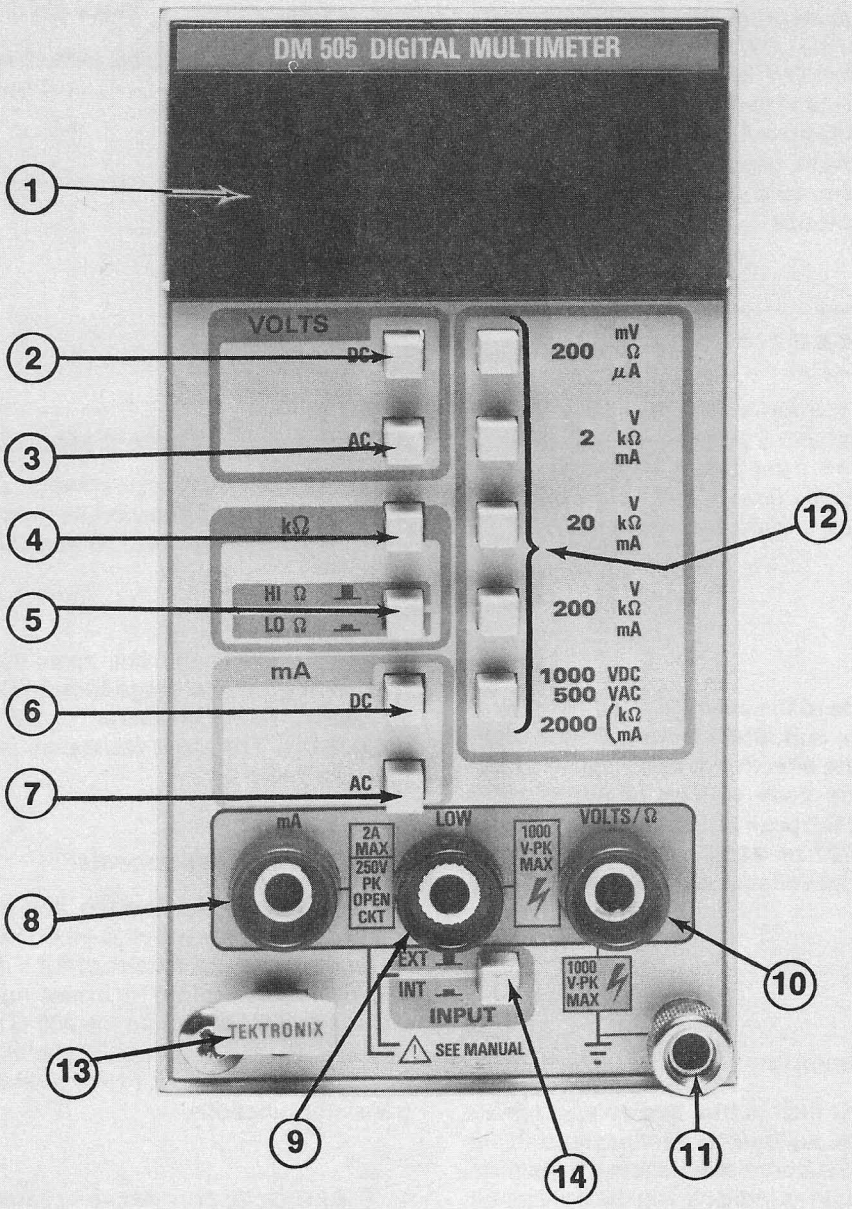
With the DM 505 properly installed in the power module, allow thirty minutes warmup time for operation to specified accuracy. Select the desired measurement function and range. When the value of the quantity being measured is unknown, select the highest range first. Decrease the range setting until the display blinks to indicate over-range. Then change the range pushbutton to the next higher range. This method obtains maximum resolution.

**WARNING**

*To avoid shock hazard from voltages measured by the DM 505:*

1. *Avoid all contact with the voltage source being measured.*
2. *Disconnect probes from circuit under test before disconnecting probes from the DM 505, or before removing the DM 505 from the power module.*

# CONTROLS AND CONNECTORS




2692-3

Fig. 2-2. Front panel controls and connectors.

## Input Connections ⚠

The INPUT EXT-INT pushbutton selects front panel or rear interface input.

Three input connectors provide front panel measurement connections. The VOLTS/Ω and LOW input connectors are used for ac or dc voltage or resistance measurements. The mA and LOW input connectors are used for ac or dc current measurements. Rear interface pins 28B (HI) and 28A (LO) are used for rear interface voltage and resistance measurements. Normal measurement conditions are with the LOW terminal ungrounded. A connection between the LOW input connector and the ground terminal may be made to reference the input to the DM 505 chassis ground. Use caution, as the LOW terminal is then connected to earth ground through the power module three-wire power cord. False readings may be obtained due to ground loops.

**CAUTION**

*The maximum input voltage is 1 kV peak at the front panel connectors and 200 V peak at the rear interface connectors. The front panel VOLTS/Ω and LOW connectors may be floated at 1 kV maximum above ground, the rear input connector 200 V.*

## Sine-wave Response

The DM 505 responds to the average value of an ac or dc current or voltage and the readout displays the sinusoidal rms value. The effective or rms value of a sine-wave is 0.707 times the peak voltage or current. The average value is 0.636 of the peak value. The scale factor of the DM 505 is 0.636/0.707 or 0.9. To obtain the average value of a sinusoidal input voltage or current, multiply the DM 505 readout by 0.9.

## DC Voltage Measurements

Press the VOLTS DC pushbutton and an appropriate range button. Apply the voltage to be measured to the LOW and VOLTS/Ω input connectors. Observe the maximum input voltage ratings as indicated on the front panel. The readout displays a + if the input to the VOLTS/Ω connector is positive with respect to the LOW input connector. A − is displayed if the input at the LOW input connector is the more positive. With the LOW and VOLTS/Ω input connectors shorted, the display reads zero ± one count.

## DC Current Measurements

Press the mA DC pushbutton and an appropriate range button. Connect the dc current to be measured to the LOW and mA input connectors. Conventional current flowing into the mA connector and out of the LOW connector (or electron flow into the LOW connector and out of the mA connector) indicates a + on the display. The input resistance in the current mode is listed in Table 2-1.

**Table 2-1**

**CURRENT MODE INPUT RESISTANCE**

| Range | Approximate Resistance |
|---|---|
| 200 μA | 1001 Ω |
| 2 mA | 100.4 Ω |
| 20 mA | 10.25 Ω |
| 200 mA | 1.2 Ω |
| 2000 mA | 0.25 Ω |

## AC Voltage and Current Measurements

For ac voltage measurements, press the VOLTS AC pushbutton and an appropriate range button. Connect the unknown voltage to the LOW and VOLTS/Ω input connectors.

To measure ac current, press the mA AC pushbutton and an appropriate range button. Connect the unknown ac current to be measured to the mA and LOW input connectors. The input resistance in the current mode is listed in Table 2-1.

## Resistance Measurements

Press the kΩ pushbutton and an appropriate range button. Also, press the HI Ω—LO Ω button for a maximum full-scale probe-tip voltage of 0.2 V. Release the HI Ω—LO Ω button (out position) for a maximum full-scale probe-tip voltage of 2 V (except on the 200 Ω range which is 0.2 V). The low probe-tip voltage is useful for making in-circuit measurements without forward-biasing silicon diodes or transistor junctions.

The kΩ mode provides an accurate constant current at the LOW and VOLTS/Ω input connectors. Refer to Table 2-1 for the value of current and maximum voltages across the input terminals for full scale display readings (instrument not over-ranged). The maximum (open circuit) voltage available from the VOLTS/Ω terminal to the LOW terminal in the resistance mode is about +6 V.

Table 2-2

OHMMETER SOURCE CURRENT AND VOLTAGE

| Function | Range | Source Current | V Max at Full Scale |
|---|---|---|---|
| HI Ω | 200 Ω | 1 mA | 0.2 V |
| | 2 kΩ | 1 mA | 2.0 V |
| | 20 kΩ | 100 μA | 2.0 V |
| | 200 kΩ | 10 μA | 2.0 V |
| | 2000 kΩ | 1 μA | 2.0 V |
| LO Ω | 200 Ω | 1 mA | 0.2 V |
| | 2 kΩ | 100 μA | 0.2 V |
| | 20 kΩ | 10 μA | 0.2 V |
| | 200 kΩ | 1 μA | 0.2 V |
| | 2000 kΩ | .1 μA | 0.2 V |

## 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.

# THEORY OF OPERATION

## Introduction

The basic circuitry of the DM 505 consists of an analog-to-digital (A/D) converter, display decoders and drivers, a clock, and power supplies (see the Block Diagram in the Diagrams section at the back of this manual). These sections form a digital voltmeter that measures 1.999 Vdc full scale. A gain switch in the A/D converter allows measurement of 199.9 mV full scale. An attenuator enables measurement of 19.99, 199.9, and 1000 Vdc full scale. Ac voltages are measured by passing the input signal through a precision rectifier circuit that converts ac voltages to dc (an ac converter). Resistances are measured by forcing a known current from the ohms converter through the unknown resistance and measuring the voltage across the unknown resistance. Low resistance current shunts permit measurement of ac and dc currents.

*NOTE*

*In the following descriptions, the numbered diamond by each title refers to the corresponding circuit diagram in the Diagrams section of this manual.*

## Attenuator and Input Switching ◇1

With the INPUT EXT-INT pushbutton in the EXT position, the input is measured at the front panel connectors. Resistances and voltages are measured between the VOLTS/Ω and LOW connectors and current is measured between the mA and LOW connectors. In the INT position, switch S3 A,B selects the input at rear interface pins 28B (HI) and 28A (LO) for rear interface measurement of resistances and voltages. The front panel input impedance is 10 MΩ paralleled by less than 100 pF.

The VOLTS/Ω and LOW input connectors are connected across R1312, a voltage divider. An input measured from the junction of R1312A and R1312B is attenuated by a factor of 100. On the 1 kVdc scale, the input is measured from the junction of R1312B and R1312C and is attenuated by a factor of 1000. Capacitors C1312, C1313, and C1311 compensate the attenuator for accurate ac signal measurement. Capacitor C1313 is adjusted at 10 kHz for a flat frequency response.

One solder-in shield and two additional shields attached just inside the side covers shunt stray capacitance across the attenuator to ground when measuring floating ac voltages.

## AC Converter ◇1

In the VOLTS AC mode, dc input voltages are blocked by capacitor C1114. The input of U1321 is protected against excessive input voltages by R1424, CR1421, and CR1422. Ac signals are buffered by unity gain amplifier U1321 and applied to the active rectifier circuit U1211, which has high-speed diodes, CR1221 and CR1222, in the feedback loop. This circuit configuration eliminates the dc voltage drop of the diodes. The half-wave rectified ac is filtered by three-pole filter R1221, C1222, R1222, C1211, R1220, and C1221 to provide ripple-free dc voltage to the A/D converter. The active rectifier and filter respond to the average value of an ac signal, but the circuit gain is calibrated to produce a dc output equivalent to the rms value of a sine-wave input.

The basic gain of the ac converter is adjusted by R1322 for the 2 Vac range and R1323 fine-trims the gain for 200 mVac range. Integrated circuit U1211 has feed-forward compensation provided by C1212, C1213, and R1216 to obtain maximum bandwidth. Both the 20 Vac and 200 mVac ranges use U1211 at a gain 10 times the gain on the other ranges. The 500 Vac range connects R1423 as an additional attenuator to accommodate larger input voltages. Dc feedback for U1211 is provided by the network consisting of R1223, R1224, and C1223. Dc offset for U1211 is provided by R1321, the AC ZERO ADJ.

## Ohms Converter ◇1

The ohms converter consists of precision current source Q1311 and floating current mirror U1311 (see Fig. 3-1). Transistor Q1311 generates a relatively low temperature coefficient current, by mirroring the voltage from zener diode VR1211 across R1215 and R1213. The current at the collector of Q1311B is approximately 1 mA and is adjusted by R1213, the HI Ω ADJ. This reference current from Q1311B appears at the inverting terminal of U1311. The output of Q1311 sources current through R1304 to stabilize the reference current. In the HI Ω position, the output of U1311 is elevated 10 V above its input. In the LO Ω position, S2-H connects R1305 and R1413 in parallel with R1304, lowering the output voltage of U1311 and reducing the reference current to U1311 pin 2 by a factor of 10. Table 3-1 lists the values of source current for the resistance ranges in the HI Ω and LO Ω positions. Resistor R1413 adjusts the LO Ω reference current to one-tenth of the HI Ω reference current.

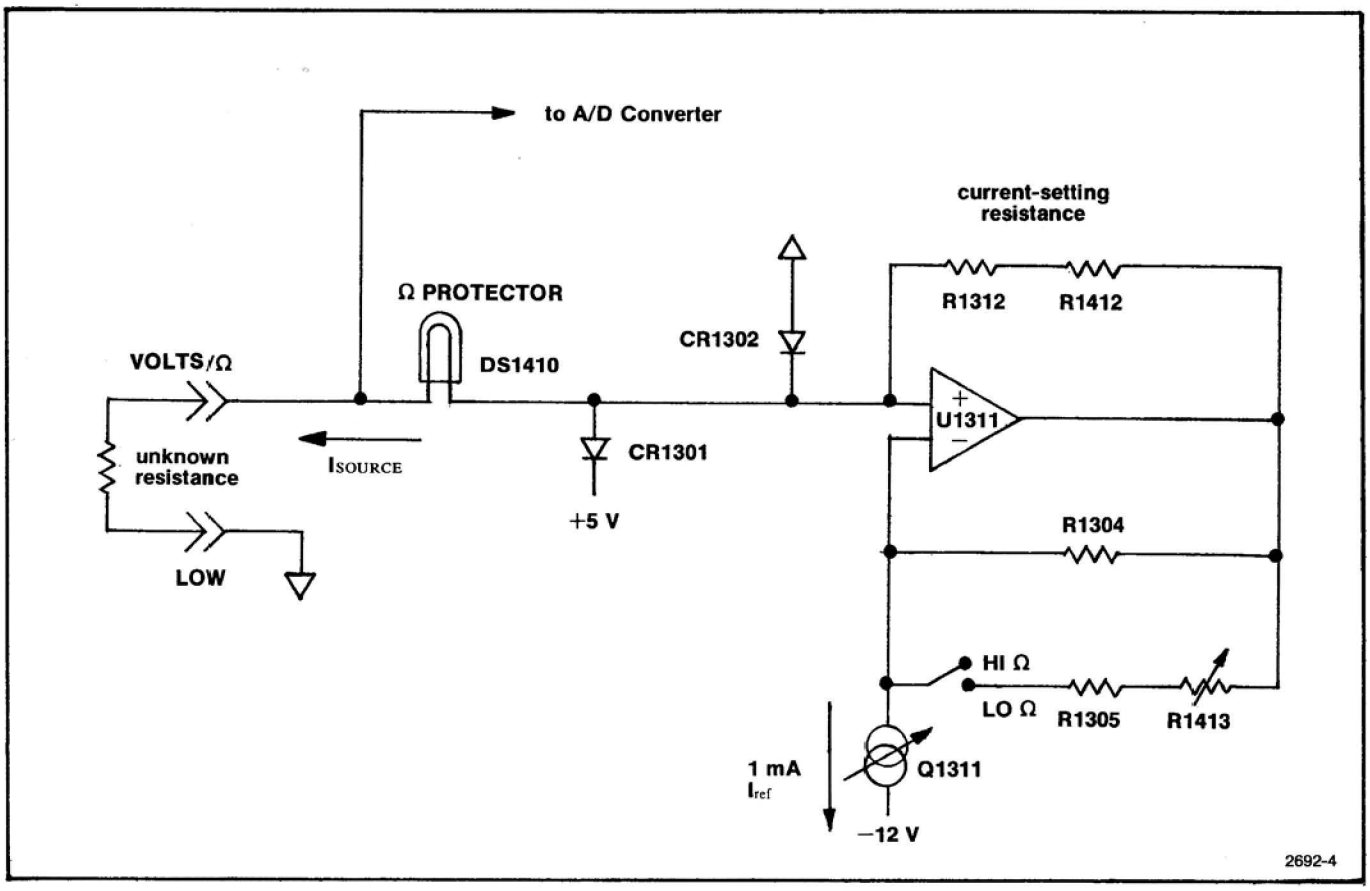



Fig. 3-1. Simplified diagram of the ohms converter.

Table 3-1

OHMS CONVERTER SOURCE CURRENT AND MAXIMUM FULL-SCALE VOLTAGE

| Switch Positions | Range | Current-Setting Resistance | I Through Unknown Resistance | V Across Current Setting Resistance[a] | V Across Unknown Resistance (Full-Scale)[b] |
|---|---|---|---|---|---|
| LO Ω | 200 Ω[c] | 10 kΩ | 1 mA | 10 V | 0.2 V |
| LO Ω | 2 kΩ[c] | 10 kΩ | 100 μA | 1 V | 0.2 V |
| LO Ω | 20 kΩ[c] | 100 kΩ | 10 μA | 1 V | 0.2 V |
| LO Ω | 200 kΩ[c] | 1 MΩ | 1 μA | 1 V | 0.2 V |
| LO Ω | 2000 kΩ[c] | 10 MΩ | 0.1 μA | 1 V | 0.2 V |
| HI Ω | 200 Ω[c] | 10 kΩ | 1 mA | 10 V | 0.2 V |
| HI Ω | 2 kΩ | 10 kΩ | 1 mA | 10 V | 2 V |
| HI Ω | 20 kΩ | 100 kΩ | 100 μA | 10 V | 2 V |
| HI Ω | 200 kΩ | 1 MΩ | 10 μA | 10 V | 2 V |
| HI Ω | 2000 kΩ | 10 MΩ | 1 μA | 10 V | 2 V |

[a] I unknown resistance x R current setting resistance.

[b] I unknown resistance x R range.

[c] U1201 has 10X gain.

The output voltage of U1311 is applied across sections of the attenuator R1312 (and R1412 for the 200 kΩ range) which serves as a current setting resistance. The voltage across R1312 and R1412 is equal to the voltage across R1304. The current through R1312 flows through lamp DS1410 and out the VOLTS/Ω terminal through the unknown resistance. The range switches select sections of the attenuator so that different values of current can be sourced out of the VOLTS/Ω terminal. The voltage developed across the unknown resistance is then measured by the A/D converter.

Diodes CR1301 and CR1302 and lamp DS1410 protect the ohms converter from excessive dc and ac input voltages. If an excessive voltage is applied to a resistance range, the voltage is clamped by CR1302 and CR1301 and appears across lamp DS1410. As the filament of DS1410 warms up, the resistance of the filament increases, limiting the current through the diode clamps. DS1410 is rated to handle 125 V rms indefinitely and 250 V rms for a limited time. Voltages in excess of these ratings cause DS1410 to act as a fuse. Diode CR1301 also limits the open circuit voltage at the VOLTS/Ω input connector to approximately +6 V.

### Current Shunts ◇1

The current shunts in the DM 505 consist of R1425, R1426, and thick-film resistor network R1521, connected between the mA and LOW input terminals. These resistors convert the input current to a voltage for measurement by the DM 505 circuitry. The maximum full scale voltage developed across the current shunts at the maximum full scale current is 0.2 volt. In the dc current mode, this voltage is switched directly to the A/D converter. In the ac current mode, the current shunt voltage is first routed through the ac converter. The current shunts are protected by the diodes in CR1621. If the voltage across the current shunts exceeds approximately 1.2 V, the diodes in CR1621 begin conducting, shunting current around the resistors. The maximum voltage drop across the current shunts in an overload condition is approximately 1.5 V. An input current exceeding 2 A opens fuse F1521.

### Power Supplies ◇1

The DM 505 measures voltages up to 1 kV peak above chassis ground (200 V peak above ground at the rear interface input). Isolation is accomplished with power transformer T1001, which is powered from the 25 Vac floating windings 13A and 13B of the power module. Transformer T1001 converts the 25 Vac to a secondary output of 47 V rms, center-tapped, across pins 7 to 9, and 12 V rms across pins 10 to 12. The 47 V rms is rectified by CR1111 and filtered by capacitors C1012 and C1111 to provide approximately + and − 26 V unregulated. The positive voltage across C1012 is regulated to +15.75 V by U1022, and shunt resistors R1122 and R1021. Resistor R1021 adjusts the output voltage for the minimum +15.75 V required for proper ohms converter operation. The negative voltage across C1111 is regulated to −12 V by U1121. The current pulled from each of these supplies is approximately 40 mA. Capacitor C1021 equalizes unbalanced capacitance between the secondary windings of T1001, pins 7, 8, and 9. Capacitor C1021 reduces any 60 Hz common mode signal appearing between the front panel input terminals of the DM 505 and chassis ground.

The 12 V rms from the secondary of T1001, pins 10 to 12, is rectified by CR1011 to provide approximately +12 V unregulated to the display anode drivers. The +12 V across C1011 is regulated to +5 V by U1021.

### Clock ◇2

The clock signals for U1303 are generated by U1301, a free-running multivibrator with a frequency determined by C1203, R1205, R1204, and R1202. CLOCK FREQ ADJ R1202 sets the clock frequency to 20.48 kHz, a multiple of the line frequency. Components of 50 Hz or 60 Hz at the input terminals are rejected since they are of equal magnitude during the up and down portions of the measurement cycle.

### Analog to Digital Converter ◇2

Integrated circuit U1201 comprises the analog section of the analog-to-digital (A/D) converter and U1303 contains the necessary control logic. The A/D converter in the DM 505 operates on the charge balancing principle. The input voltage is converted to a current that charges capacitor C1101 in an integrator circuit. Charging continues until the capacitor voltage crosses a fixed threshold level. Then a reference current larger than the maximum input current is subtracted from the input current and the capacitor discharges until the threshold level is crossed again. This process is repeated until the measurement interval is over. During the measurement interval, a counter in U1303 accumulates clock pulses from clock generator U1301 when only the input signal is applied to the integrator, and subtracts clock pulses when both the input signal and the reference current are applied to the integrator, resulting in a net count proportional to the input voltage. This conversion occurs in U1201 and is controlled by U1303. Refer to Fig. 8-2 in the Diagrams section.

Integrated circuit U1201 also contains automatic zeroing circuitry. Between meaurement intervals, the input of U1201 is switched to ground and an auto-zero voltage, related to the offset voltages in U1201, is stored across auto-zero capacitor C1102. This auto-zero voltage is converted to a current and subtracted from the input current at the integrator so that errors due to offset

voltages and ground offsets are compensated. The reference voltage for U1201 is supplied by a temperature stable diode, VR1201. Resistors R1111 and R1112 (the 2 Vdc ADJ) convert the reference voltage to a reference current for the integrator. The gain of the integrator is switchable from one to ten by placing R1210, R1211, and R1301 in parallel with R1212. This gain increases the integrator input current derived from the input signal by a factor of ten. Resistor R1210 allows the total parallel resistance to be closely trimmed for proper gain for the 200 mVdc range. Resistor R1113 and low-leakage diodes CR1113 and CR1112 provide input protection for U1201. Capacitor C1201 and resistor R1113 increase the normal mode rejection of U1201. Transistor Q1201 and DC ZERO ADJ resistor R1104 set the dc zero of U1201. Integrated circuit U1201 receives commands from U1303 via two digital lines called "measure-zero" (U1201, pin 3) and "up-down" (U1201, pin 4). The "up-down" line controls the direction of counting and integration. The "measure-zero" line determines whether the input of U1201 receives the input signal or is connected to ground. Integrated circuit U1201 provides an output to U1303 through a "comparator" line (U1201, pin 5). The comparator line signals the counter in U1303 when the integrator has passed the threshold. The outputs of U1303 control the display through the display driver circuitry.

A detailed description of the operation of the A/D converter follows.

The 20.48 kHz clock frequency from U1301 is divided by the time base counter into groups of 6144 pulses. Measurement takes place for 4096 of these pulses and automatic zeroing takes place for 2048 pulses.

During the auto zero interval, the input of the buffer amplifier is grounded. The buffer offset current also offsets the output of the integrator. The offset at the integrator output passes through R1103 to the plus input of the auto-zero amplifier. The output of the unity gain auto-zero amplifier compensates for this offset current at the summing node (pin 9) at the integrator input. The reference current through R1111 and R1112 from the reference voltage source is applied for four clock cycles and disconnected for the next four cycles by the U/D control logic. The reference current is connected to R1112 when the up-down logic is low. Equilibrium for the entire integrating and auto-zero system is obtained when the sum of the average currents at the integrator summing junction equals zero. Capacitor C1102 charges to the equilibrium voltage and maintains this voltage at the auto-zero amplifier input during the measurement interval when the switch from the integrator output is open. See Fig. 3-2 for functional timing during the auto-zero interval. The fifty percent duty cycle of the up-down counter is overridden at the start of the auto-zero interval. This override period permits the output of the integrator to come to $V_{strg}$ and C1102 to assume this voltage.

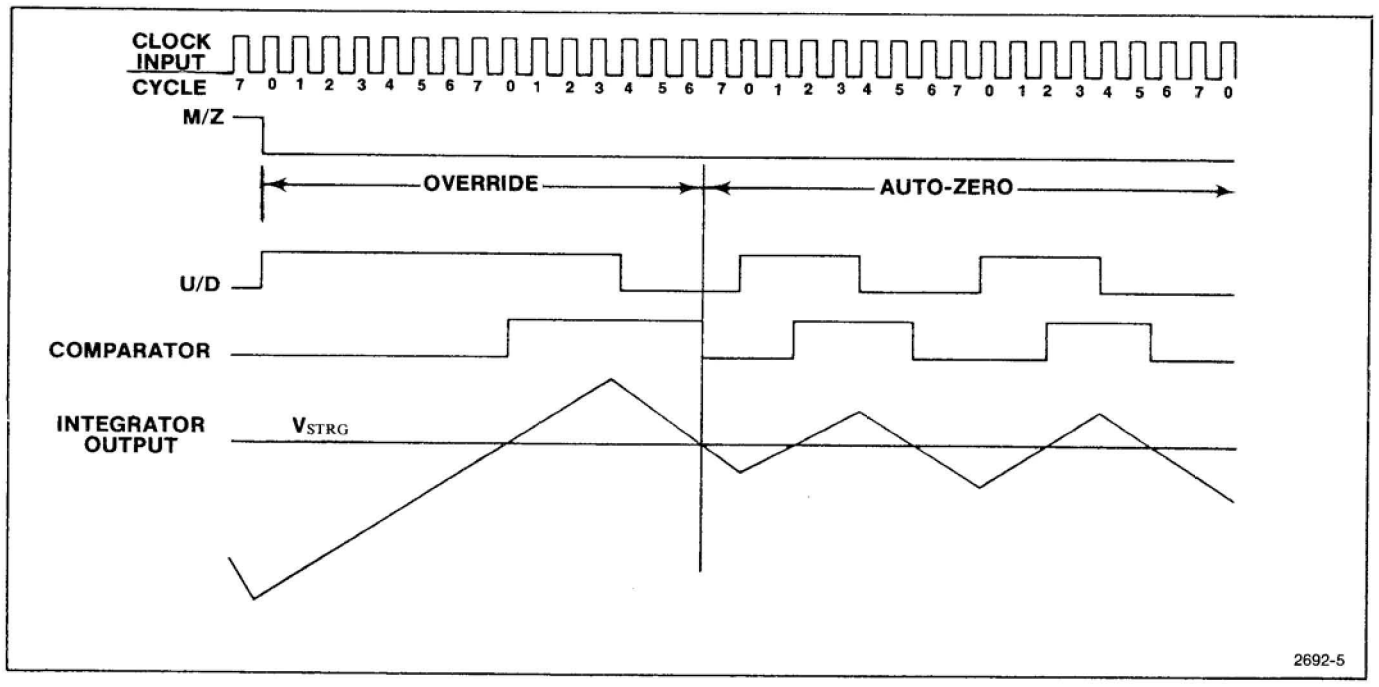



Fig. 3-2. Auto-zero timing intervals.

Upon completion of the 2048 clock pulse auto-zero interval, the measurement interval commences. The measure-zero logic switches the analog input voltage to the buffer input and disconnects the integrator output from the auto-zero amplifier input. The additional current resulting at the summing junction of the integrator causes the integrator output voltage to move away from the equilibrium voltage obtained during auto-zero interval and maintained during the measurement interval by C1102. The comparator senses and transmits this deviation to the control logic. The control logic changes the duty cycle of the reference voltage in an attempt to re-establish equilibrium at the integrator summing junction. The up-down logic is "up" (integrator output voltage is also up) for one clock cycle and "down" for seven cycles when the comparator output was high during the preceding set of eight clock cycles. This is shown as duty cycle A in Fig. 3-3. When the comparator output is low in clock cycle seven, the up-down logic is up for seven cycles and down for one cycle during the following eight clock cycles. This is shown as duty cycle B. Figure 3-3 shows the result of these actions on the integrator output.

A counter in U1303, synchronous with the up-down logic, increments by each clock pulse when the up-down logic is "up" and decrements by each clock pulse when the up-down logic is "down". The net count increases by six counts for each B duty cycle and decreases by six counts for each A duty cycle, to a maximum count of about 3100. This counting procedure is reversed for negative input voltages.

The polarity of the input voltage is determined by the state of the up-down logic when the bcd counter state is zero. This information is stored in a flip-flop and loaded into the static latch once each measure-zero cycle.

The bcd counter accumulates a number of counts proportional to the input voltage during the measure interval while the control logic works to maintain equilibrium. Equilibrium is achieved in steps and usually a residual voltage remains at the end of the measurement cycle. This residual voltage is compensated for by a short override interval at the beginning of the auto-zero period. The counter continues until the integrator output equals the auto-zero equilibrium voltage and the up-down logic is "down". The bcd counter is now put on hold and its contents loaded into the latches. The counter is then cleared and the multiplexer sends the measurement result, digit by digit, to the output data buffers.

## Display Driver Circuitry ◇2

Integrated circuit U1301, pins 13, 14, 15, and 16, provides bcd output of digits in parallel form, multiplexed by digit. The bcd digit signals are decoded by U1501 and applied to the cathodes of seven-segment LED U1002, U1101, and U1102. The segments of these LED are connected in parallel to U1501. Digit strobes from U1303, pins 1, 2, 3, and 4 are inverted by U1302 A, B, C, and D and applied to the anodes of the LED by Q1402, Q1403, Q1404,

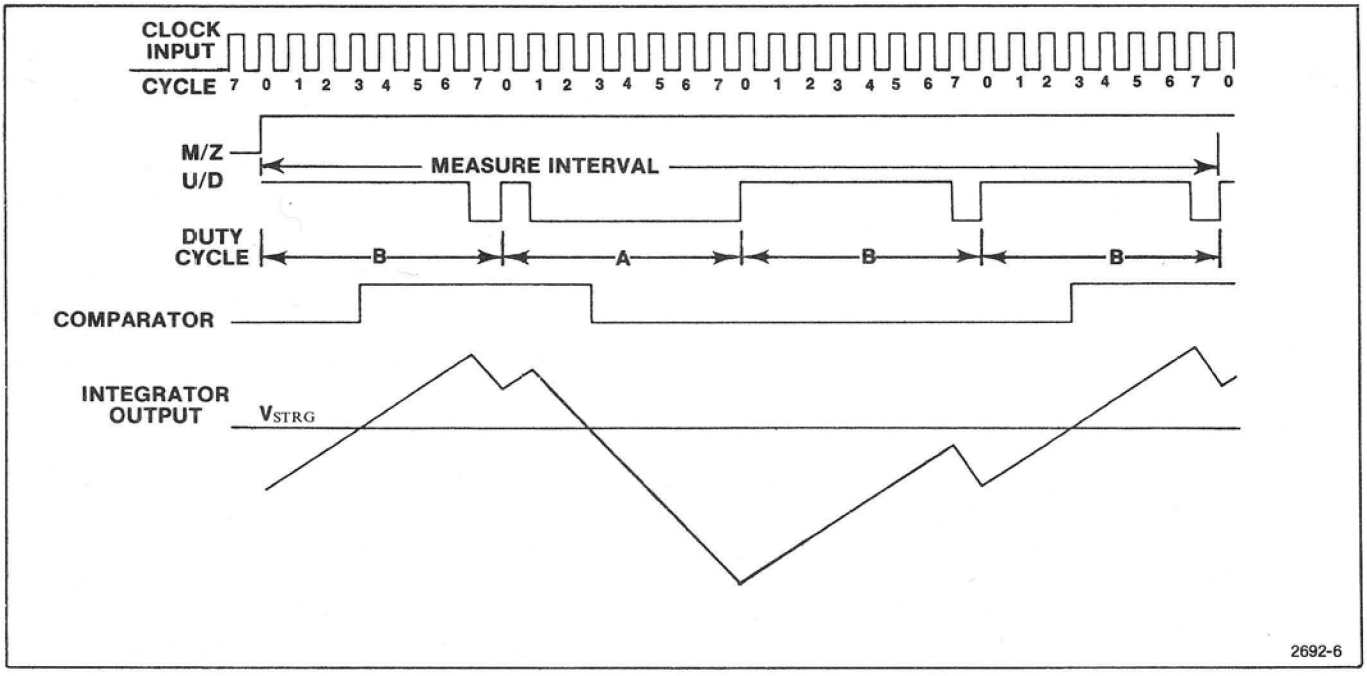



Fig. 3-3. Measurement interval timing.

and Q1405. The segment information at the cathode of each LED is displayed as its anode is strobed high. The display is strobed in the following order: digit 1, 3, 2, and 4. Digit 1 is the least significant and digit 4 is the most significant (1 or 0). The digit strobes are also routed through sections of the range switches to provide decimal point information to the display. Transistor Q1507 controls the most significant digit, U1001.

The sign is enabled by switches S2K and S2B, which connect the sign anodes (U1001 pins 1, 6, and 7) to +12 V. The cathode of the negative segment of the sign (pin 4) is hard-wired low through R1601. The sign of the input from U1303, pin 5, is buffered through U1302E to the cathodes of the positive segments of the sign (U1001, pins 3 and 5). If the sign has been enabled by S2K or S2B, a positive sign will be displayed when pins 3 and 5 are low.

# CALIBRATION PROCEDURE

## Introduction

This section consists of a Performance Check which verifies the electrical specifications listed in Section 1, and an Adjustment procedure which provides a sequential adjustment of internal controls. This procedure should be used to restore the instrument performance to the electrical specifications listed in Section 1 of the manual.

## Test Equipment Requirements

Below is a list of equipment required to verify operation as specified. Other equipment may be substituted when suitable.

**Table 4-1**

**LIST OF TEST EQUIPMENT REQUIREMENTS**

| Description | Performance Requirements | Applications | Example |
|---|---|---|---|
| TM 500 Power Module | | All steps | TEKTRONIX TM 501, TM 503, TM 504, TM 506 |
| Dc voltage source | 0 V to 1 kV within ±0.01% | Dc voltage accuracy check<br>Dc common mode rejection check<br>2 Vdc range adjustment<br>200 mVdc range adjustment | Fluke Model 341A Voltage Calibrator |
| Ac voltage source | 0V to 500 Vrms, 25 Hz to 20 kHz, within ±0.05% | Ac voltage accuracy check<br>Dc common mode rejection check<br>Dc normal mode rejection check<br>Ac common mode rejection check<br>2 Vac range adjustment<br>200 mVac range adjustment<br>10 kHz ac adjustment | Fluke Model 5200A Ac Voltage Calibrator and Fluke Model 5215A Power Amplifier |
| Resistance standard | 0 Ω to 2 MΩ, within ±0.05% | Ohms accuracy check<br>HI Ω adjustment<br>LO Ω adjustment | Electro Scientific Industries Model DB62 Decade Resistance Box |
| Dc current source | 0 A to 2 A, within ±0.02% | Dc current accuracy check | Valhalla Scientific Inc. Model 2500 AC-DC Current Calibrator |
| Ac current source | 0 A to 2 A, 45 Hz to 10 kHz, within ±0.15% | Ac current accuracy check | Same as for dc current |
| 1 kΩ resistor | 1% tolerance, 1/8 watt | Dc common mode rejection check<br>Ac common mode rejection check | Tektronix Part No. 321-0193-00 |
| Voltmeter | 0 to +20 V, 1 mV resolution | +15.75 V supply adjustment | TEKTRONIX DM 501A, DM 502, DM 502A |
| Counter | 20.48 kHz, within ±0.25% | Clock frequency adjustment | TEKTRONIX DC 504, Digital Counter |

Table 4-1 (cont)

| Description | Performance Requirements | Applications | Example |
|---|---|---|---|
| 1 ea bnc male to dual binding post connector | | Dc common mode rejection check<br>Ac common mode rejection check | Tektronix Part No. 103-0035-00 |
| 4 ea bnc female to dual banana connector | | Dc common mode rejection check<br>Dc normal mode rejection check<br>Ac common mode rejection check<br>All accuracy checks | Tektronix Part No. 103-0090-00 |
| 1 ea bnc female to clip lead adapter | | Dc common mode rejection check<br>Ac common mode rejection check | Tektronix Part No. 013-0076-00 |
| 2 ea coaxial cable with bnc connectors | 50 Ω impedance | For connection to instrument under test | Tektronix Part No. 012-0057-01 |
| 1 ea dual banana shorting bar | | Dc zero adjustment<br>Ac zero adjustment | |
| Flexible Extender Cable | | Adjustments | Tektronix Part No. 067-0645-02 |
| X1 Probe | | Clock frequency adjustment | Tektronix Part No. 010-6101-01 |



@

# PERFORMANCE CHECK

## Introduction

This procedure checks the electrical characteristics of the DM 505 that appear in the Specification portion of this manual. If the instrument fails to meet the requirements given in this Performance Check, the Adjustment procedure should be performed.

The electrical characteristics in this section are valid only if the DM 505 is calibrated at an ambient temperature between +21° C and +25° C and operated at an ambient temperature between 0° C and +50° C.

Tolerances that are specified in this Performance Check apply to the instrument under test and do not include test equipment error. For convenience, many steps in this procedure check the performance of this instrument at only one value in the specified performance range. Any value, with appropriate limits, within the specified range may be substituted.

If the rear interface input is to be used, the rear interface accuracy specifications for ac and dc voltages and resistances may be checked using a TM 500-series Option 2 power module. Instructions and accuracy tables for rear interface performance check are given following this procedure.

## Preliminary Procedure

1. Ensure that all power switches are off and that the power module and all test equipment are adapted for the line voltage available.

2. Install the DM 505 in the power module and connect the power module and test equipment to the line voltage source.

3. Turn on the power module and all test equipment and allow at least 30 minutes for warm-up (60 minutes after storage in a high humidity environment).

**WARNING**

*Dangerous voltages may be encountered in the following steps. Caution must be exercised. Do not contact the output connectors of the voltage calibrator, the input terminals of the DM 505 or the internal circuitry of the DM 505. The knob setscrews of some voltage calibrators have been known to be at a high voltage potential; check the setscrews with a voltmeter before handling the knobs.*

## FRONT PANEL PERFORMANCE CHECK PROCEDURE

For the following sections of the Performance Check, set the INPUT EXT-INT pushbutton to the out (EXT) position.

### 1. Check the Dc Voltage Accuracy

a. Set the dc voltage calibrator to 0 V and connect the dc voltage calibrator through the necessary adapters and the 50 Ω coaxial cable to the VOLTS/Ω and LOW input connectors.

b. Press the VOLTS DC button and set the calibrator voltages and the DM 505 range pushbuttons as listed in Table 4-2.

**Table 4-2**

**DC VOLTAGE ACCURACY**

| DM 505 Range Button | Dc Calibrator Voltage | Display Limits | |
|---|---|---|---|
| | | +18° C to +28° C | 0 to +18° C, +28° C to +50° C |
| 200 mV | 180.000 mV | 179.7 to 180.3 | 179.4 to 180.6 |
| 2 V | 1.80000 V | 1.797 to 1.803 | 1.794 to 1.806 |
| 20 V | 18.0000 V | 17.97 to 18.03 | 17.94 to 18.06 |
| 200 V | 180.000 V | 179.7 to 180.3 | 179.4 to 180.6 |
| 1000 V | 1000.00 V | 998 to 1002 | 996 to 1004 |

c. CHECK—that the DM 505 display reads within the limits for the ambient temperature as listed in Table 4-2.

d. Set the dc calibrator output voltage to 0 V and disconnect it from the DM 505.

## 2. Check Ac Voltage Accuracy

a. Set the ac voltage calibrator to 0 V and connect the ac voltage calibrator (and power amplifier, as needed) to the VOLTS/Ω and LOW input connectors through the coaxial cable and necessary adapters.

b. Press the VOLTS AC button. Press the range buttons and set the ac calibrator voltage and frequency as listed in Table 4-3.

c. CHECK—that the DM 505 display reads within the limits for the ambient temperature as listed in Table 4-3.

d. Set the ac calibrator output voltage to 0 V and disconnect it from the DM 505.

## 3. Check Common Mode Rejection (Dc Mode)

a. Connect the bnc female to dual banana connector to the VOLTS/Ω and LOW connectors.

b. Connect the bnc male to dual binding post connector to the bnc female connector attached to the DM 505 front panel.

c. Connect the 1 kΩ resistor between the binding posts on the dual binding post connector.

d. Connect the red clip lead of the bnc female to clip lead adapter to the red binding post and the black clip lead to the DM 505 ground binding post.

e. Connect the bnc female connector through a coaxial cable to the dc voltage calibrator.

f. Press the VOLTS DC and 200 mV pushbuttons.

**Table 4-3**

**AC VOLTAGE ACCURACY**

| DM 505 Range Button | Ac Calibrator | | Display Limits | |
|---|---|---|---|---|
| | Frequency | Voltage, rms | +18° C to +28° C | 0 to +18° C, +28° C to +50° C |
| 200 mV | 25-45 Hz, 10 kHz-20 kHz | 180.000 mV | 178.0 to 182.0 | 177.0 to 183.0 |
| 2 V | | 1.80000 V | 1.780 to 1.820 | 1.770 to 1.830 |
| 20 V | | 18.0000 V | 17.80 to 18.20 | 17.70 to 18.30 |
| 200 V | | 180.000 V | 178.0 to 182.0 | 177.0 to 183.0 |
| 200 mV | 45 Hz-10 kHz | 180.000 mV | 178.9 to 181.1 | 177.9 to 182.1 |
| 2 V | | 1.80000 V | 1.789 to 1.811 | 1.779 to 1.821 |
| 20 V | | 18.0000 V | 17.89 to 18.11 | 17.79 to 18.21 |
| 200 V | | 180.000 V | 178.9 to 181.1 | 177.9 to 182.1 |
| 500 V | 25 Hz-10 kHz | 500.000 V | 493 to 507 | 489 to 511 |

g. Set the dc voltage calibrator for an output of 100 Vdc.

h. CHECK—that the display reads ≤01.0.

i. Set the dc voltage calibrator to 0 V and reconnect the coaxial cable to the ac voltage calibrator.

j. Set the ac voltage calibrator for an output of 50 Vac rms at 50 to 60 Hz.

k. CHECK—that the display reads ≤7.2.

l. Set the ac voltage calibrator output to 0 V and disconnect it from the DM 505.

*NOTE*

*If the DM 505 does not display the correct readings as stated in step 3 parts h and k, perform Clock Adjustment of the Adjustment procedure and repeat the above Common Mode Rejection Check (Dc Mode).*

## 4. Check Common Mode Rejection (Ac Mode)

a. Connect the bnc female to dual banana connector to the VOLTS/Ω and LOW connectors.

b. Connect the bnc male to dual binding post connector to the bnc connector attached to the DM 505 front panel.

c. Connect the 1 kΩ resistor between the binding posts on the dual binding post connector.

d. Connect the red clip lead of the female bnc to clip lead adapter to the red binding post and the black clip lead to the DM 505 ground binding post.

e. Connect the female bnc connector through a coaxial cable to the ac voltage calibrator.

f. Press the VOLTS AC and 200 mV pushbuttons.

g. Set the ac voltage calibrator for an output of 5 Vac rms at 50 Hz to 60 Hz ±0.2 Hz.

h. CHECK—that the maximum display reading is ≤22.4.

i. Set the ac voltage calibrator output to 0 V and disconnect it from the DM 505.

## 5. Check Normal Mode Rejection (Dc Mode)

a. Connect the bnc female to dual banana connector to the VOLTS/Ω and LOW connectors.

b. Attach the bnc connector through a coaxial cable to the ac voltage calibrator.

c. Press the VOLTS DC and 200 mV pushbuttons.

d. Set the AC Calibrator for 0.224V AC at 50Hz ±0.2Hz or 60Hz ±0.2Hz.

e. CHECK—that the maximum display reading is ≤1.0.

f. Set the ac calibrator output to 0 V and disconnect it from the DM 505.

## 6. Check Ohms Accuracy

a. Connect the resistance standard to the VOLTS/Ω and LOW connectors.

b. Press the kΩ pushbutton. Make each measurement in the following table with the HI Ω-LO Ω button in the LO (in) and the HI (out) positions.

c. CHECK—that the display reads within the limits for the ambient temperature as listed in Table 4-4.

d. Remove all connections to the DM 505.

## 7. Check Dc Current Accuracy

a. Connect the current calibrator output through a coaxial cable and necessary adapters to the mA and LOW connectors. Connect the dc voltage calibrator output through a coaxial cable and adapters to the current calibrator input.

b. Press the mA DC button and set the DM 505 range buttons and current source output as listed in Table 4-5.

c. CHECK—that the display reads within the limits for the ambient temperature as listed in Table 4-5.

d. Set the dc current source to 0 A and disconnect it from the DM 505.

**Table 4-4**

**OHMS ACCURACY**

| DM 505 Range Button | Resistance Standard | Display Limits | |
|---|---|---|---|
| | | +18°C to +28°C | 0 to +18°C, +28°C to +50°C |
| 200 Ω | 180.000 Ω | 178.8 to 181.2 | 177.9 to 182.1 |
| 2 kΩ | 1.80000 kΩ | 1.790 to 1.810 | 1.781 to 1.819 |
| 20 kΩ | 18.0000 kΩ | 17.90 to 18.10 | 17.81 to 18.19 |
| 200 kΩ | 180.000 kΩ | 179.0 to 181.0 | 178.1 to 181.9 |
| 2000 kΩ | 1800.00 kΩ | 1790 to 1810 | 1780 to 1820 |

**Table 4-5**

**DC CURRENT ACCURACY**

| DM 505 Range Button | Dc Current Source | Display Limits | |
|---|---|---|---|
| | | +18°C to +28°C | 0 to +18°C, +28°C to +50°C |
| 200 μA | 180.000 μA | 179.4 to 180.6 | 179.0 to 181.0 |
| 2 mA | 1.80000 mA | 1.794 to 1.806 | 1.790 to 1.810 |
| 20 mA | 18.0000 mA | 17.94 to 18.06 | 17.90 to 18.10 |
| 200 mA | 180.000 mA | 179.4 to 180.6 | 179.0 to 181.0 |
| 2000 mA | 1800.00 mA | 1794 to 1806 | 1790 to 1810 |

### 8. Check Ac Current Accuracy

a. Connect the current calibrator output through a coaxial cable and the necessary adapters to the mA and LOW connectors. Connect the ac voltage calibrator output through a coaxial cable and adapters to the current calibrator input.

b. Press the mA AC button and set the DM 505 range buttons and the current source output, as shown in Table 4-6, at any frequency from 45 Hz to 10 kHz.

c. CHECK—that the display reads within the limits for the ambient temperature as listed in Table 4-6.

d. Set the current source to 0 A and disconnect it from the DM 505.

## REAR INTERFACE PERFORMANCE CHECK PROCEDURE

To verify instrument accuracy of resistance and ac and dc voltage modes via the DM 505 rear interface, follow the steps outlined in the Performance Check procedure for the front panel input, but apply voltages and resistances to rear interface pins 28B (HI) and 28A (LO). Access to the rear interface input pins 28A (LO) and 28B (HI) is most easily made using a TM 500-series Option 2 power module. Press the INPUT EXT-INT pushbutton (INT position) to select rear interface input. Substitute Tables 4-7, 4-8, and 4-9 for the appropriate tables listed in the Performance Check procedure.

*NOTE*

*The input cable fixture from the calibrating sources to the rear interface pins will have to be modified to accommodate accuracy checks via the rear interface.*

**Table 4-6**

**AC CURRENT ACCURACY**

| DM 505 Range Button | Ac Current Source | Display Limits | |
|---|---|---|---|
| | | +18° C to +28° C | 0 to +18° C, +28° C to +50° C |
| 200 μA | 180.000 μA | 178.5 to 181.5 | 177.5 to 182.5 |
| 2 mA | 1.80000 mA | 1.785 to 1.815 | 1.775 to 1.825 |
| 20 mA | 18.0000 mA | 17.85 to 18.15 | 17.75 to 18.25 |
| 200 mA | 180.000 mA | 178.5 to 181.5 | 177.5 to 182.5 |
| 2000 mA | 1800.00 mA | 1785 to 1815 | 1775 to 1825 |

**Table 4-7**

**DC VOLTAGE ACCURACY FOR REAR INTERFACE**

| DM 505 Range Button | Dc Calibrator Voltage | Display Limits | |
|---|---|---|---|
| | | +18° C to +28° C | 0 to +18° C, +28° C to +50° C |
| 200 mV | 180.000 mV | 179.7 to 180.3 | 179.4 to 180.6 |
| 2 V | 1.80000 V | 1.797 to 1.803 | 1.794 to 1.806 |
| 20 V | 18.0000 V | 17.97 to 18.03 | 17.94 to 18.06 |
| 200 V | 180.000 V | 179.7 to 180.3 | 179.4 to 180.6 |
| 1000 V (max. input 200 V peak) | 180.000 V | 178 to 182 | 177 to 183 |

Table 4-8

AC VOLTAGE ACCURACY FOR REAR INTERFACE

| DM 505 Range Button | Ac Calibrator | | Display Limits | |
|---|---|---|---|---|
| | Frequency | Voltage, rms | +18° C to +28° C | 0 to +18° C, +28° C to +50° C |
| 200 mV<br>2 V | 25-45 Hz,<br>10 kHz-20 kHz | 180.000 mV<br>1.80000 V | 178.0 to 182.0<br>1.780 to 1.820 | 177.0 to 183.0<br>1.770 to 1.830 |
| 200 mV<br>2 V | 45 Hz - 10 kHz | 180.000 mV<br>1.80000 V | 178.9 to 181.1<br>1.789 to 1.811 | 177.9 to 182.1<br>1.779 to 1.821 |
| 20 V<br>200 V<br>(max. input<br>200 V peak) | 25 Hz-20 kHz | 18.0000 V<br>140.000 V | 17.80 to 18.20<br>138.4 to 141.6 | 17.70 to 18.30<br>137.6 to 142.4 |
| 500 V<br>(max. input<br>200 V peak) | 25 Hz-10 kHz | 140.000 V | 136 to 144 | 135 to 145 |

Table 4-9

OHMS ACCURACY FOR REAR INTERFACE

| DM 505 Range Button | Resistance Standard | Display Limits | |
|---|---|---|---|
| | | +18° C to +28° C | 0 to +18° C, +28° C to +50° C |
| 200 Ω | 180.000 Ω | 178.1 to 181.9 | 177.3 to 182.7 |
| 2 kΩ | 1.80000 kΩ | 1.789 to 1.811 | 1.781 to 1.819 |
| 20 kΩ | 18.0000 kΩ | 17.90 to 18.10 | 17.82 to 18.18 |
| 200 kΩ | 180.000 kΩ | 179.0 to 181.0 | 178.2 to 181.8 |
| 2000 kΩ | 1800.00 kΩ | 1790 to 1810 | 1781 to 1819 |

# ADJUSTMENTS

## Introduction

This procedure need not be performed unless the instrument fails to meet the performance requirements of the electrical characteristics listed in the Specification section. Adjustment is generally required after a repair has been made or after long time intervals in which normal aging of components may affect instrument accuracy.

To ensure instrument accuracy, check the calibration every 1000 hours of operation or every six months if used infrequently.

Tektronix, Inc. provides complete instrument repair and calibration at local Field Service Centers and at the Factory Service Center. Contact your local Tektronix Field Office or representative for further information.

## Test Equipment Required

Test equipment used for adjustment of the DM 505 is listed in the beginning of the Calibration section. All test equipment is assumed to be correctly calibrated and operating within specifications.

## Preparation

Connect the DM 505 to the power module via the flexible plug-in extender. To gain access to the adjustments, remove the left side cover of the DM 505 by pulling the rear of the side cover outward from the instrument. Then remove the large metal shield attached to a standoff in the center of the instrument. If desired, most adjustments may be made through the holes in the metal shields using an insulated adjustment tool. Adjustment locations are shown in the illustration located in the pullout pages at the rear of this manual.

Connect the test equipment and the power module to a suitable line voltage source. Turn on the power module and the test equipment; allow at least 30 minutes for equipment warm up and stabilization. Set the INPUT EXT-INT to the out (EXT) position. Make adjustments at an ambient temperature of +21°C to +25°C. Perform adjustments in the order given, since some adjustments interact with others. Interactions are noted in the procedure. Refer to the adjustment location page (in the Diagrams and Illustrations section).

## PROCEDURE

### 1. Adjust the +15.75 V Supply

a. Set the voltmeter to the 20 Vdc range.

b. Connect the voltmeter positive lead to the DM 505 +15.75 V test point and the negative lead to TP1521 (LO).

c. EXAMINE—that the voltmeter reads +15.75 Vdc ±0.08 V.

d. ADJUST—R1021, the +15.75 V ADJ, for a voltmeter reading of +15.75 V ±0.05 V.

e. Disconnect the voltmeter from the DM 505.

### 2. Adjust the Clock Frequency

a. Set the counter to Frequency, 10 Hz Resolution, and Display Time fully ccw.

b. Connect the counter input lead to the CLK test point. A X1 probe may be used, if desired.

c. EXAMINE—that the counter reads 20.68 kHz to 20.28 kHz.

d. ADJUST—R1202, CLOCK FREQ ADJ, for a frequency of 20.48 kHz ±0.05 kHz.

e. Disconnect the counter.

### 3. Adjust Dc Zero

a. Press the VOLTS DC button and the 200 mV range button.

b. Short the VOLTS/Ω and LOW input connectors together with the dual banana plug shorting bar.

c. EXAMINE—that the DM 505 display reads 00.0 ±0.1.

d. ADJUST—R1104, DC ZERO ADJ, for a display reading of 00.0 ±0.

e. Press the 2 V range button.

f. EXAMINE—that the DM 505 display reads .000 ±0.001.

g. ADJUST—R1104 for a display reading of .000.

*NOTE*

*Best results will be obtained with R1104 set mid-way in the range for which both the 200 mV and 2 V DC scales read 0.*

h. INTERACTION—this adjustment affects the AC VOLTMETER zero and most other full-scale adjustments.

i. Disconnect the short between the VOLTS/Ω and LOW input connectors.

### 4. Adjust the 2 Vdc Range

a. Press the VOLTS DC button and the 2 V range button.

b. Set the dc voltage calibrator to 1.900 V.

c. Connect the calibrator positive lead to the VOLTS/Ω connector and the negative lead to the LOW input connector.

d. EXAMINE—that the DM 505 display reads 1.900 ±0.003.

e. ADJUST—R1112, the 2 VDC ADJ, for a display reading of 1.900 ±0.001.

f. INTERACTION—this adjustment affects the 200 mV dc range, the HI and LO Ω and both AC V range adjustments.

g. Set the dc voltage calibrator output to 0 V and disconnect it from the DM 505.

### 5. Adjust the 200 mVdc Range

a. Set the dc voltage calibrator to 0.190 V.

b. Press the VOLTS DC button and the 200 mV range button.

c. Connect the voltage calibrator positive lead to the VOLTS/Ω connector and the negative lead to the LOW connector.

d. EXAMINE—that the DM 505 display reads 190.0 ±0.3.

e. ADJUST—R1210, .2 VDC ADJ, for a reading of 190.0 ±0.1.

f. INTERACTION—this adjustment affects the 200 mVac and LO Ω range adjustments.

g. Set the voltage calibrator output to 0 V and disconnect it from the DM 505.

### 6. Adjust the HI Ω

a. Press the kΩ button, the HI Ω button and the 2 kΩ range button.

b. Set the resistance standard to 1.900 kΩ.

c. Connect the resistance standard to the VOLTS/Ω and LOW input connectors.

d. EXAMINE—that the DM 505 display reads 1.900 ±0.011.

e. ADJUST—R1213, the HI Ω ADJ for a display reading of 1.900 ±0.001.

f. INTERACTION—this adjustment affects the LO Ω range adjustment.

g. Continue to the next step.

### 7. Adjust the LO Ω

a. Press the kΩ button, the LO Ω button and the 2 kΩ range button.

b. EXAMINE—that the DM 505 display reads 1.900 ±0.011.

c. ADJUST—R1413, the LO Ω ADJ, for a display reading of 1.900 ±0.001.

d. Disconnect the resistance standard.

### 8. Adjust the Ac Zero

a. Press the VOLTS AC button, and the 200 mV range button.

b. Short the VOLTS/Ω and LOW input connectors together using the dual banana plug shorting bar.

c. EXAMINE—that the DM 505 display reads 00.0 ±0.2.

d. ADJUST—R1321, the AC ZERO ADJ, for a display reading of 00.0. Wait about three seconds and verify the reading.

e. Press the 2 V range button.

f. EXAMINE—that the DM 505 display reads .000 ±0.002.

g. ADJUST—R1321 for a display reading of .000.

h. INTERACTION—this adjustment affects the 200 mVac and 2 Vac range adjustments.

i. Disconnect the short between the VOLTS/Ω and LOW input connectors.

### 9. Adjust the 2 V Ac Range

a. Press the VOLTS AC button and the 2 V range button.

b. Set the ac voltage calibrator to 1.900 V at 100 Hz.

c. Connect the ac voltage calibrator to the VOLTS/Ω and LOW connectors.

d. EXAMINE—that the DM 505 display reads 1.900 ±0.012.

e. ADJUST—R1322, the 2 VAC ADJ, for a display reading of 1.900 ±0.001.

f. INTERACTION—this adjustment affects the 200 mVac and 10 kHz ac adjustments.

g. Set the ac voltage calibrator output to 0 V and disconnect it from the DM 505.

### 10. Adjust the 200 mVac Range

a. Press the VOLTS AC button and the 200 mV range button.

b. Set the ac voltage calibrator to 0.190 Vac at 100 Hz.

c. Connect the ac voltage calibrator to the VOLTS/Ω and LOW input connectors.

d. EXAMINE—that the DM 505 display reads 190.0 ±1.2.

e. ADJUST—R1323, the .2 VAC ADJ, for a display reading of 190.0 ±0.1.

f. INTERACTION—this adjustment affects the 10 kHz ac adjustment.

g. Set the ac voltage calibrator output to 0 V and disconnect it from the DM 505.

### 11. Adjust the 10 kHz Ac

Remove the right side cover from the DM 505. Perform this adjustment with both side shields on the instrument using a plastic adjustment tool with a small metal blade.

a. Connect the output ground terminal of the ac voltage calibrator to the DM 505 LOW input connector. Connect the output HI terminal of the calibrator to the DM 505 VOLTS/Ω input connector.

b. Press the VOLTS AC button and the 20 V range button.

c. Set the ac voltage calibrator to 19.00 V at a frequency of 10 kHz.

d. EXAMINE—that the DM 505 display reads 19.00 ±0.12. Verify the reading with the adjustment tool removed from the DM 505.

e. ADJUST—C1313, the 10 kHz AC ADJ, for a display reading of 19.00 ±0.01.

**CAUTION**

*C1313 is made of glass and is fragile. Do not turn the slug past its stop.*

f. Set the ac voltage calibrator output to 0 V and disconnect it from the DM 505.

# MAINTENANCE

There are no special preventive maintenance procedures that apply to the DM 505. Refer to the power module instruction manual for general preventive maintenance procedures and instructions.

Tektronix, Inc. provides complete instrument repair and calibration at local Field Service Centers and at the Factory Service Center. Contact your local Tektronix Field Office or representative for further information.

## Recalibration

To ensure accurate measurements, check the calibration of this instrument after each 1000 hours of operation or every six months if used infrequently. In addition, replacement of components may necessitate recalibration of the affected circuits. Complete adjustment instructions are given in the Calibration section.

## Obtaining Replacement Parts

Most electrical and mechanical parts can be ordered 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.

**Ordering Parts.** When ordering replacement parts from Tektronix, Inc., it is important that all of the following information be included to ensure receiving the proper parts.

1. Instrument type (include modification or option numbers).

2. Instrument serial numbe

3. A description of the part (i lectrical, include circuit number).

4. Tektronix part number.

## Heat Sink Removal and Replacement

Use a screwdriver or other suitable tool to spread the spring tabs holding U1021 in the heat sink. Use care not to spring the tabs beyond their elastic limit. Remove the regulator. Reverse this procedure to install the heat sink. After replacing the heat sink, make certain the heat sink firmly grips U1021, to ensure adequate heat dissipation.

## Troubleshooting Aids

**Troubleshooting Charts.** As an aid in locating problem areas, troubleshooting charts are provided for the DM 505. These charts are located in the foldout pages in the Diagrams and Illustrations section.

**Diagrams.** Complete circuit diagrams are located in the foldout pages in the Diagrams and Illustrations section. The portions of the circuit mounted on circuit boards are enclosed by a solid line. The circuit number of each component in this instrument is shown on a diagram. See the first page of the Diagrams and Illustrations section for definitions of the symbols and reference designators used on the diagrams.

**Circuit Board Illustrations.** In conjunction with each circuit diagram is a circuit board illustration. Each component shown on a diagram is also identified on the circuit board illustration by its circuit number. A table is provided with each diagram listing components by circuit number. The table also lists the component grid locations on both the diagram and circuit board illustrations.

**Adjustment Locations Illustration.** To aid in locating test points and adjustable components, the adjustment locations pullout page (normally used with the Adjustment procedure) permit rapid location of test points and adjustments.

**Troubleshooting 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.

## 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 5-1 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 capable of generating or holding a static charge should be allowed on the work station surface.

5. Keep the component leads shorted together whenever possible.

6. Pick up components by the body, never by the leads.

7. Do not slide the components over any surface.

8. Avoid handling components in areas that have a floor or work-surface covering capable of generating a static charge.

9. Use a soldering iron that is connected to earth ground.

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

**Table 5-1**

**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.)**



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# OPTIONS

None available at this time.

# REPLACEABLE ELECTRICAL PARTS

## PARTS ORDERING INFORMATION

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

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

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

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

### LIST OF ASSEMBLIES

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

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

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

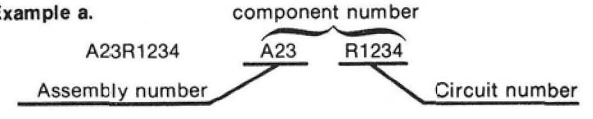
### ABBREVIATIONS

Abbreviations conform to American National Standard Y1.1.

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

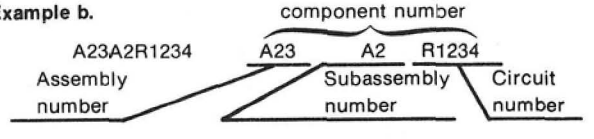
A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:

**Example a.**




**Read: Resistor 1234 of Assembly 23**

**Example b.**




**Read: Resistor 1234 of Subassembly 2 of Assembly 23**

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

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

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

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

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

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

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

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

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

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

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

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

*Indicates actual manufacturers part number.*

# CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

| Mfr. Code | Manufacturer | Address | City, State, Zip |
|---|---|---|---|
| 00853 | SANGAMO ELECTRIC CO., S. CAROLINA DIV. | P O BOX 128 | PICKENS, SC 29671 |
| 01121 | ALLEN-BRADLEY COMPANY | 1201 2ND STREET SOUTH | MILWAUKEE, WI 53204 |
| 03508 | GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT | ELECTRONICS PARK | SYRACUSE, NY 13201 |
| 04713 | MOTOROLA, INC., SEMICONDUCTOR PROD. DIV. | 5005 E MCDOWELL RD,PO BOX 20923 | PHOENIX, AZ 85036 |
| 14752 | ELECTRO CUBE INC. | 1710 S. DEL MAR AVE. | SAN GABRIEL, CA 91776 |
| 19396 | ILLINOIS TOOL WORKS, INC. PAKTRON DIV. | 900 FOLLIN LANE, SE | VIENNA, VA 22180 |
| 19647 | CADDOCK ELECTRONICS INC. | 3127 CHICAGO AVENUE | RIVERSIDE, CA 92507 |
| 24546 | CORNING GLASS WORKS, ELECTRONIC COMPONENTS DIVISION | 550 HIGH STREET | BRADFORD, PA 16701 |
| 50522 | MONSANTO CO., ELECTRONIC SPECIAL PRODUCTS | 3400 HILLVIEW AVENUE | PALO ALTO, CA 94304 |
| 54473 | MATSUSHITA ELECTRIC, CORP. OF AMERICA | 1 PANASONIC WAY | SECAUCUS, NJ 07094 |
| 55210 | GETTIG ENG. AND MFG. COMPANY | PO BOX 85, OFF ROUTE 45 | SPRING MILLS, PA 16875 |
| 55680 | NICHICON/AMERICA/CORP. | 6435 N PROESEL AVENUE | CHICAGO, IL 60645 |
| 56289 | SPRAGUE ELECTRIC CO. | | NORTH ADAMS, MA 01247 |
| 71400 | BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO. | 2536 W. UNIVERSITY ST. | ST. LOUIS, MO 63107 |
| 71744 | CHICAGO MINIATURE LAMP WORKS | 4433 RAVENSWOOD AVE. | CHICAGO, IL 60640 |
| 72982 | ERIE TECHNOLOGICAL PRODUCTS, INC. | 644 W. 12TH ST. | ERIE, PA 16512 |
| 73138 | BECKMAN INSTRUMENTS, INC., HELIPOT DIV. | 2500 HARBOR BLVD. | FULLERTON, CA 92634 |
| 73899 | JFD ELECTRONICS COMPONENTS CORP. | PINETREE ROAD | OXFORD, NC 27565 |
| 80009 | TEKTRONIX, INC. | P O BOX 500 | BEAVERTON, OR 97077 |
| 91418 | RADIO MATERIALS COMPANY, DIV. OF P.R. MALLORY AND COMPANY, INC. | 4242 W BRYN MAWR | CHICAGO, IL 60646 |
| 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 |
|---|---|---|---|---|---|---|
| A10 | 670-6013-00 | | | CKT BOARD ASSY:MAIN | 80009 | 670-6013-00 |
| A11 | 670-6014-00 | | | CKT BOARD ASSY:DISPLAY | 80009 | 670-6014-00 |
| | | | | A10 MAIN CKT BOARD ASSY | | |
| A10 | 670-6013-00 | | | CKT BOARD ASSY:MAIN | 80009 | 670-6013-00 |
| A10C1011 | 290-0845-00 | | | CAP.,FXD,ELCTLT:330UF,-10 + 50%,25WVDC | 55680 | 25ULA330 |
| A10C1012 | 290-0844-00 | | | CAP.,FXD,ELCTLT:100UF,-10 + 75%,35WVDC | 54473 | ECE-A35V100L |
| A10C1021 | 283-0109-00 | | | CAP.,FXD,CER DI:27PF,5%,1000V | 56289 | 20C376 |
| A10C1022 | 281-0775-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 72982 | 8005D9AABZ5U104M |
| A10C1101 | 285-1101-00 | | | CAP.,FXD,PLSTC:0.022UF,10%,200V | 19396 | 223K02PT485 |
| A10C1102 | 285-1102-00 | | | CAP.,FXD,PLSTC:0.1UF,20%,100V | 19396 | PT720B104M |
| A10C1103 | 281-0763-00 | | | CAP.,FXD,CER DI:47PF,10%,100V | 72982 | 8035D9AADC1G470K |
| A10C1111 | 290-0846-00 | | | CAP.,FXD,ELCTLT:47UF,-10 + 75%,35WVDC | 54473 | ECE-A35V47LU |
| A10C1112 | 290-0134-00 | | | CAP.,FXD,ELCTLT:22UF,20%,15V | 56289 | 150D226X0015B2 |
| A10C1114 | 285-1077-00 | | | CAP.,FXD,PLSTC:0.10UF,20%,600V | 14752 | 230B1F104 |
| A10C1121 | 281-0775-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 72982 | 8005D9AABZ5U104M |
| A10C1123 | 290-0415-00 | | | CAP.,FXD,ELCTLT:5.6UF,10%,35V | 56289 | 150D565X9035B2 |
| A10C1201 | 285-1101-00 | | | CAP.,FXD,PLSTC:0.022UF,10%,200V | 19396 | 223K02PT485 |
| A10C1202 | 290-0415-00 | | | CAP.,FXD,ELCTLT:5.6UF,10%,35V | 56289 | 150D565X9035B2 |
| A10C1203 | 283-0626-00 | | | CAP.,FXD,MICA D:1800PF,5%,500V | 00853 | D195E182J0 |
| A10C1207 | 281-0773-00 | | | CAP.,FXD,CER DI:0.01UF,10%,100V | 72982 | 8005H9AADW5R103K |
| A10C1211 | 290-0267-00 | | | CAP.,FXD,ELCTLT:1UF,20%,35V | 56289 | 162D105X0035CD2 |
| A10C1212 | 281-0537-00 | | | CAP.,FXD,CER DI:0.68PF,20%,600V | 80009 | 281-0537-00 |
| A10C1213 | 281-0786-00 | | | CAP.,FXD,CER DI:150PF,10%,100V | 72982 | 8035D2AADX5P151K |
| A10C1214 | 281-0773-00 | | | CAP.,FXD,CER DI:0.01UF,10%,100V | 72982 | 8005H9AADW5R103K |
| A10C1215 | 290-0723-00 | | | CAP.,FXD,ELCTLT:150UF,20%,6V | 56289 | 196D157X0006PE3 |
| A10C1217 | 281-0773-00 | | | CAP.,FXD,CER DI:0.01UF,10%,100V | 72982 | 8005H9AADW5R103K |
| A10C1221 | 290-0188-00 | | | CAP.,FXD,ELCTLT:0.1UF,10%,35V | 56289 | 162D104X9035BC2 |
| A10C1222 | 290-0301-00 | | | CAP.,FXD,ELCTLT:10UF,10%,20V | 56289 | 150D106X9020B2 |
| A10C1223 | 290-0134-00 | | | CAP.,FXD,ELCTLT:22UF,20%,15V | 56289 | 150D226X0015B2 |
| A10C1300 | 281-0773-00 | | | CAP.,FXD,CER DI:0.01UF,10%,100V | 72982 | 8005H9AADW5R103K |
| A10C1301 | 281-0773-00 | | | CAP.,FXD,CER DI:0.01UF,10%,100V | 72982 | 8005H9AADW5R103K |
| A10C1302 | 281-0773-00 | | | CAP.,FXD,CER DI:0.01UF,10%,100V | 72982 | 8005H9AADW5R103K |
| A10C1303 | 281-0773-00 | | | CAP.,FXD,CER DI:0.01UF,10%,100V | 72982 | 8005H9AADW5R103K |
| A10C1304 | 281-0773-00 | | | CAP.,FXD,CER DI:0.01UF,10%,100V | 72982 | 8005H9AADW5R103K |
| A10C1311 | 283-0627-00 | | | CAP.,FXD,MICA D:0.0033UF,5%,500V | 00853 | D195E332J0 |
| A10C1312 | 283-0434-00 | | | CAP.,FXD,CER DI:26.5PF,2%,100DV | 91418 | OBD |
| A10C1313 | 281-0241-00 | | | CAP.,VAR,GL DI:1.0-6.5PF,750V | 73899 | VCJ722B |
| A10C1321 | 290-0848-00 | | | CAP.,FXD,ELCTLT:47UF,+100-20%,16WVDC | 56289 | 502D OBD |
| A10C1322 | 281-0773-00 | | | CAP.,FXD,CER DI:0.01UF,10%,100V | 72982 | 8005H9AADW5R103K |
| A10C1323 | 281-0786-00 | | | CAP.,FXD,CER DI:150PF,10%,100V | 72982 | 8035D2AADX5P151K |
| A10C1401 | 281-0773-00 | | | CAP.,FXD,CER DI:0.01UF,10%,100V | 72982 | 8005H9AADW5R103K |
| A10C1422 | 281-0773-00 | | | CAP.,FXD,CER DI:0.01UF,10%,100V | 72982 | 8005H9AADW5R103K |
| A10C1501 | 281-0815-00 | | | CAP.,FXD,CER DI:0.027UF,20%,50V | 72982 | 8005D9AABW5R273M |
| A10C1511 | 281-0786-00 | | | CAP.,FXD,CER DI:150PF,10%,100V | 72982 | 8035D2AADX5P151K |
| A10C1621 | 283-0429-00 | | | CAP.,FXD,CER DI:270PF,20%,2000V | 91418 | HK0271M2021R0 |
| A10CR1011 | 152-0488-00 | | | SEMICOND DEVICE:SILICON,200V,1500MA | 80009 | 152-0488-00 |
| A10CR1111 | 152-0488-00 | | | SEMICOND DEVICE:SILICON,200V,1500MA | 80009 | 152-0488-00 |
| A10CR1112 | 153-0057-00 | | | SEMICOND DVC,SE:SILICON,40 PIV,200MA,SEL | 80009 | 153-0057-00 |
| A10CR1113 | 153-0057-00 | | | SEMICOND DVC,SE:SILICON,40 PIV,200MA,SEL | 80009 | 153-0057-00 |
| A10CR1221 | 152-0322-00 | | | SEMICOND DEVICE:SILICON,15V,HOT CARRIER | 80009 | 152-0322-00 |
| A10CR1222 | 152-0322-00 | | | SEMICOND DEVICE:SILICON,15V,HOT CARRIER | 80009 | 152-0322-00 |
| A10CR1301 | 152-0246-00 | | | SEMICOND DEVICE:SILICON,400PIV,200MA | 80009 | 152-0246-00 |
| A10CR1302 | 152-0246-00 | | | SEMICOND DEVICE:SILICON,400PIV,200MA | 80009 | 152-0246-00 |
| A10CR1421 | 152-0246-00 | | | SEMICOND DEVICE:SILICON,400PIV,200MA | 80009 | 152-0246-00 |
| A10CR1422 | 152-0246-00 | | | SEMICOND DEVICE:SILICON,400PIV,200MA | 80009 | 152-0246-00 |
| A10CR1621 | 152-0488-00 | | | SEMICOND DEVICE:SILICON,200V,1500MA | 80009 | 152-0488-00 |

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|---|---|---|---|---|---|---|
| A10DS1410 | 150-0131-00 | | | LAMP,INCAND:120V,0.025A | 71744 | 120PS |
| A10F1521 | 159-0021-00 | | | FUSE,CARTRIDGE:3AG,2A,250V,FAST-BLOW | 71400 | AGC 2 |
| A10Q1201 | 151-0190-00 | | | TRANSISTOR:SILICON,NPN | 80009 | 151-0190-00 |
| A10Q1311 | 151-0232-00 | | | TRANSISTOR:SILICON,NPN,DUAL | 80009 | 151-0232-00 |
| A10Q1402 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 04713 | 2N2907A |
| A10Q1403 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 04713 | 2N2907A |
| A10Q1404 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 04713 | 2N2907A |
| A10Q1405 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 04713 | 2N2907A |
| A10Q1406 | 151-0302-00 | | | TRANSISTOR:SILICON,NPN | 80009 | 151-0302-00 |
| A10Q1507 | 151-0281-00 | | | TRANSISTOR:SILICON,NPN | 03508 | X16P4039 |
| A10R1021 | 311-1565-00 | | | RES.,VAR,NONWIR:250 OHM,20%,0.50W | 73138 | 91A R250 |
| A10R1101 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| A10R1102 | 315-0393-00 | | | RES.,FXD,CMPSN:39K OHM,5%,0.25W | 01121 | CB3935 |
| A10R1103 | 315-0184-00 | | | RES.,FXD,CMPSN:180K OHM,5%,0.25W | 01121 | CB1845 |
| A10R1104 | 311-1555-00 | | | RES.,VAR,NONWIR:100K OHM,20%,0.5W | 73138 | 91-77-0 |
| A10R1111 | 321-1642-06 | | | RES.,FXD,FILM:72.3K OHM,0.25%,0.125W | 91637 | MFF1816C72301C |
| A10R1112 | 311-1559-00 | | | RES.,VAR,NONWIR:10K OHM,20%,0.50W | 73138 | 91A-10001M |
| A10R1113 | 303-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,1W | 01121 | GB1055 |
| A10R1122 | 315-0202-00 | | | RES.,FXD,CMPSN:2K OHM,5%,0.25W | 01121 | CB2025 |
| A10R1201 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| A10R1202 | 311-1559-00 | | | RES.,VAR,NONWIR:10K OHM,20%,0.50W | 73138 | 91A-10001M |
| A10R1203 | 315-0200-00 | | | RES.,FXD,CMPSN:20 OHM,5%,0.25W | 01121 | CB2005 |
| A10R1204 | 321-0255-00 | | | RES.,FXD,FILM:4.42K OHM,1%,0.125W | 91637 | MFF1816G44200F |
| A10R1205 | 321-0306-00 | | | RES.,FXD,FILM:15K OHM,1%,0.125W | 91637 | MFF1816G15001F |
| A10R1206 | 315-0683-00 | | | RES.,FXD,CMPSN:68K OHM,5%,0.25W | 01121 | CB6835 |
| A10R1208 | 315-0201-00 | | | RES.,FXD,CMPSN:200 OHM,5%,0.25W | 01121 | CB2015 |
| A10R1209 | 321-0182-00 | | | RES.,FXD,FILM:768 OHM,1%,0.125W | 91637 | MFF1816G768R0F |
| A10R1210 | 311-1564-00 | | | RES.,VAR,NONWIR:500 OHM,20%,0.50W | 73138 | 91A R500 |
| A10R1211 | 321-0187-00 | | | RES.,FXD,FILM:866 OHM,1%,0.125W | 91637 | MFF1816G866R0F |
| A10R1212 | 321-0385-04 | | | RES.,FXD,FILM:100K OHM,0.1%,0.125W | 91637 | MFF1816D10002B |
| A10R1213 | 311-1563-00 | | | RES.,VAR,NONWIR:1K OHM,20%,0.50W | 73138 | 91A R1K |
| A10R1214 | 315-0911-00 | | | RES.,FXD,CMPSN:910 OHM,5%,0.25W | 01121 | CB9115 |
| A10R1215 | 321-1617-06 | | | RES.,FXD,FILM:5.85K OHM,0.25%,0.125W | 91637 | MFF1816C58500C |
| A10R1216 | 315-0106-00 | | | RES.,FXD,CMPSN:10M OHM,5%,0.25W | 01121 | CB1065 |
| A10R1218 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| A10R1220 | 315-0754-00 | | | RES.,FXD,CMPSN:750K OHM,5%,0.25W | 01121 | CB7545 |
| A10R1221 | 315-0752-00 | | | RES.,FXD,CMPSN:7.5K OHM,5%,0.25W | 01121 | CB7525 |
| A10R1222 | 315-0753-00 | | | RES.,FXD,CMPSN:75K OHM,5%,0.25W | 01121 | CB7535 |
| A10R1223 | 315-0753-00 | | | RES.,FXD,CMPSN:75K OHM,5%,0.25W | 01121 | CB7535 |
| A10R1224 | 315-0753-00 | | | RES.,FXD,CMPSN:75K OHM,5%,0.25W | 01121 | CB7535 |
| A10R1225 | 321-0641-00 | | | RES.,FXD,FILM:1.8K OHM,1%,0.125W | 91637 | MFF1816G18000F |
| A10R1226 | 321-0222-00 | | | RES.,FXD,FILM:2K OHM,1%,0.125W | 91637 | MFF1816G20000F |
| A10R1227 | 321-0222-00 | | | RES.,FXD,FILM:2K OHM,1%,0.125W | 91637 | MFF1816G20000F |
| A10R1228 | 321-0097-00 | | | RES.,FXD,FILM:100 OHM,1%,0.125W | 91637 | MFF1816G100R0F |
| A10R1301 | 321-0289-00 | | | RES.,FXD,FILM:10K OHM,1%,0.125W | 91637 | MFF1816G10001F |
| A10R1302 | 315-0512-00 | | | RES.,FXD,CMPSN:5.1K OHM,5%,0.25W | 01121 | CB5125 |
| A10R1304 | 321-0289-07 | | | RES.,FXD,FILM:10K OHM,0.1%,0.125W | 91637 | MFF1816C10001B |
| A10R1305 | 315-0102-00 | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| A10R1311 | 315-0102-03 | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| A10R1312A,B,C | 307-0644-00 | | | RES.,NTWK,FXD FI:10K,90K,9.9 MEG OHM | 19647 | 1776-81 |
| A10R1321 | 311-1556-00 | | | RES.,VAR,NONWIR:50K OHM,20%,0.50W | 73138 | 91A R50K |
| A10R1322 | 311-1566-00 | | | RES.,VAR,NONWIR:200 OHM,20%,0.50W | 73138 | 91-88-0 |
| A10R1323 | 311-1566-00 | | | RES.,VAR,NONWIR:200 OHM,20%,0.50W | 73138 | 91-88-0 |
| A10R1324 | 315-0102-00 | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| A10R1325 | 321-0821-00 | | | RES.,FXD,FILM:2.12K OHM,1%,0.125W | 91637 | MFF1816G21200F |
| A10R1326 | 321-1313-07 | | | RES.,FXD,FILM:18.0K OHM,0.1%,0.125W | 91637 | CMF110X216C180 |
| A10R1327 | 321-0222-07 | | | RES.,FXD,FILM:2K OHM,0.1%,0.125W | 91637 | MFF1816C20000B |

| Component No. | Tektronix Part No. | Serial/Model No. Eff | Dscont | Name & Description | Mfr Code | Mfr Part Number |
|---|---|---|---|---|---|---|
| A10R1328 | 321-0222-07 | | | RES.,FXD,FILM:2K OHM,0.1%,0.125W | 91637 | MFF1816C20000B |
| A10R1329 | 315-0102-00 | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| A10R1400 | 315-0152-00 | | | RES.,FXD,CMPSN:1.5K OHM,5%,0.25W | 01121 | CB1525 |
| A10R1401 | 315-0152-00 | | | RES.,FXD,CMPSN:1.5K OHM,5%,0.25W | 01121 | CB1525 |
| A10R1402 | 315-0152-00 | | | RES.,FXD,CMPSN:1.5K OHM,5%,0.25W | 01121 | CB1525 |
| A10R1403 | 315-0152-00 | | | RES.,FXD,CMPSN:1.5K OHM,5%,0.25W | 01121 | CB1525 |
| A10R1404 | 315-0152-00 | | | RES.,FXD,CMPSN:1.5K OHM,5%,0.25W | 01121 | CB1525 |
| A10R1405 | 315-0152-00 | | | RES.,FXD,CMPSN:1.5K OHM,5%,0.25W | 01121 | CB1525 |
| A10R1406 | 315-0152-00 | | | RES.,FXD,CMPSN:1.5K OHM,5%,0.25W | 01121 | CB1525 |
| A10R1407 | 315-0152-00 | | | RES.,FXD,CMPSN:1.5K OHM,5%,0.25W | 01121 | CB1525 |
| A10R1408 | 315-0472-00 | | | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W | 01121 | CB4725 |
| A10R1409 | 315-0472-00 | | | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W | 01121 | CB4725 |
| A10R1411 | 315-0472-00 | | | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W | 01121 | CB4725 |
| A10R1412 | 321-0807-07 | | | RES.,FXD,FILM:900K OHM,0.1%,0.125W | 24546 | NE55E9003B |
| A10R1413 | 311-1566-00 | | | RES.,VAR,NONWIR:200 OHM,20%,0.50W | 73138 | 91-88-0 |
| A10R1414 | 315-0102-00 | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| A10R1421 | 315-0392-00 | | | RES.,FXD,CMPSN:3.9K OHM,5%,0.25W | 01121 | CB3925 |
| A10R1423 | 321-0126-07 | | | RES.,FXD,FILM:200 OHM,0.1%,0.125W | 91637 | MFF1816C200R0B |
| A10R1424 | 305-0223-00 | | | RES.,FXD,CMPSN:22K OHM,5%,2W | 01121 | HB2235 |
| A10R1425 | 321-0754-07 | | | RES.,FXD,FILM:900 OHM,0.1%,0.125W | 91637 | MFF1816C900R0B |
| A10R1426 | 321-0895-07 | | | RES.,FXD,FILM:90 OHM,0.1%,0.125W | 91637 | MFF1816C90R00B |
| A10R1501 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| A10R1502 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| A10R1503 | 301-0511-00 | | | RES.,FXD,CMPSN:510 OHM,5%,0.50W | 01121 | EB5115 |
| A10R1504 | 301-0511-00 | | | RES.,FXD,CMPSN:510 OHM,5%,0.50W | 01121 | EB5115 |
| A10R1505 | 301-0511-00 | | | RES.,FXD,CMPSN:510 OHM,5%,0.50W | 01121 | EB5115 |
| A10R1506 | 301-0511-00 | | | RES.,FXD,CMPSN:510 OHM,5%,0.50W | 01121 | EB5115 |
| A10R1507 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| A10R1508 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| A10R1509 | 315-0681-00 | | | RES.,FXD,CMPSN:680 OHM,5%,0.25W | 01121 | CB6815 |
| A10R1521A,B,C | 307-0400-00 | | | RES.,FXD,FILM:10 OHM,0.1% | 80009 | 307-0400-00 |
| A10R1601 | 315-0821-00 | | | RES.,FXD,CMPSN:820 OHM,5%,0.25W | 01121 | CB8215 |
| A10R1602 | 301-0511-00 | | | RES.,FXD,CMPSN:510 OHM,5%,0.50W | 01121 | EB5115 |
| A10R1603 | 301-0511-00 | | | RES.,FXD,CMPSN:510 OHM,5%,0.50W | 01121 | EB5115 |
| A10R1604 | 301-0511-00 | | | RES.,FXD,CMPSN:510 OHM,5%,0.50W | 01121 | EB5115 |
| A10R1605 | 315-0511-00 | | | RES.,FXD,CMPSN:510 OHM,5%,0.25W | 01121 | CB5115 |
| A10S1 | 260-1954-00 | | | SWITCH,PUSH:5 BTN,6 POLE,RANGE | 80009 | 260-1954-00 |
| A10S2 | 260-1955-00 | | | SWITCH,PUSH:6 BTN,2/4 POLE,FUNCTION | 80009 | 260-1955-00 |
| A10S3 | 260-1953-00 | | | SWITCH,PUSH:1 BTN,2 POLE,INPUT | 80009 | 260-1953-00 |
| A10T1001 | 120-1245-00 | | | XFMR,PWR,SDN&SU: | 80009 | 120-1245-00 |
| A10U1021 | 156-1263-00 | | | MICROCIRCUIT,LINEAR:VOLTAGE REGULATOR | 80009 | 156-1263-00 |
| A10U1022 | 156-1262-00 | | | MICROCIRCUIT,LINEAR:VOLTAGE REGULATOR | 80009 | 156-1262-00 |
| A10U1121 | 156-1264-00 | | | MICROCIRCUIT,LINEAR:VOLTAGE REGULATOR | 80009 | 156-1264-00 |
| A10U1201 | 156-1268-00 | | | MICROCIRCUIT,LINEAR:A/D CONVERTER | 80009 | 156-1268-00 |
| A10U1211 | 156-0105-00 | | | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 80009 | 156-0105-00 |
| A10U1301 | 156-0402-01 | | | MICROCIRCUIT,LI:TIMER | 80009 | 156-0402-01 |
| A10U1302 | 156-0093-01 | | | MICROCIRCUIT,DI:HEX.INVERTER | 80009 | 156-0093-01 |
| A10U1303 | 156-0476-00 | | | MICROCIRCUIT,DI:DIG SECT OF A/D SYSTEM | 80009 | 156-0476-00 |
| A10U1311 | 156-1134-00 | | | MICROCIRCUIT,LINEAR:OPERATIONAL AMPLIFIER | 80009 | 156-1134-00 |
| A10U1321 | 156-1134-00 | | | MICROCIRCUIT,LINEAR:OPERATIONAL AMPLIFIER | 80009 | 156-1134-00 |
| A10U1501 | 156-0128-00 | | | MICROCIRCUIT,DI:SGL BCD TO 7-SEG DCDR/DRVR | 80009 | 156-0128-00 |
| A10VR1201 | 152-0317-00 | | | SEMICOND DEVICE:ZENER,0.25W,6.2V,5% | 80009 | 152-0317-00 |
| A10VR1202 | 152-0168-00 | | | SEMICOND DEVICE:ZENER,0.4W,12V,5% | 80009 | 152-0168-00 |
| A10VR1211 | 152-0317-00 | | | SEMICOND DEVICE:ZENER,0.25W,6.2V,5% | 80009 | 152-0317-00 |
| A10W1606 | 131-0566-00 | | | LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L | 55210 | L-2007-1 |

| Component No. | Tektronix Part No. | Serial/Model No. Eff | Dscont | Name & Description | Mfr Code | Mfr Part Number |
|---|---|---|---|---|---|---|
| | | | | A11 DISPLAY CKT BOARD ASSY | | |
| A11 | 670-6014-00 | | | CKT BOARD ASSY:DISPLAY | 80009 | 670-6014-00 |
| A11R1001 | 315-0301-00 | | | RES.,FXD,CMPSN:300 OHM,5%,0.25W | 01121 | CB3015 |
| A11R1002 | 315-0301-00 | | | RES.,FXD,CMPSN:300 OHM,5%,0.25W | 01121 | CB3015 |
| A11U1001 | 150-1066-00 | | | LAMP,LED RDOUT:ORANGE,6 SEG,+/-1 | 50522 | MAN 4605 |
| A11U1002 | 150-1053-00 | | | LAMP,LED RDOUT:ORANGE,7 SEG,0.4 DIGIT | 50522 | MAN4610A |
| A11U1101 | 150-1053-00 | | | LAMP,LED RDOUT:ORANGE,7 SEG,0.4 DIGIT | 50522 | MAN4610A |
| A11U1102 | 150-1053-00 | | | LAMP,LED RDOUT:ORANGE,7 SEG,0.4 DIGIT | 50522 | MAN4610A |

# DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

## Symbols

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

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

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

Abbreviations are based on ANSI Y1.1-1972.

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

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

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

## Component Values

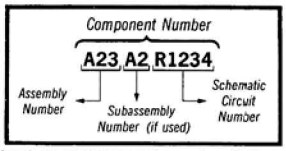
Electrical components shown on the diagrams are in the following units unless noted otherwise:

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

## 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).

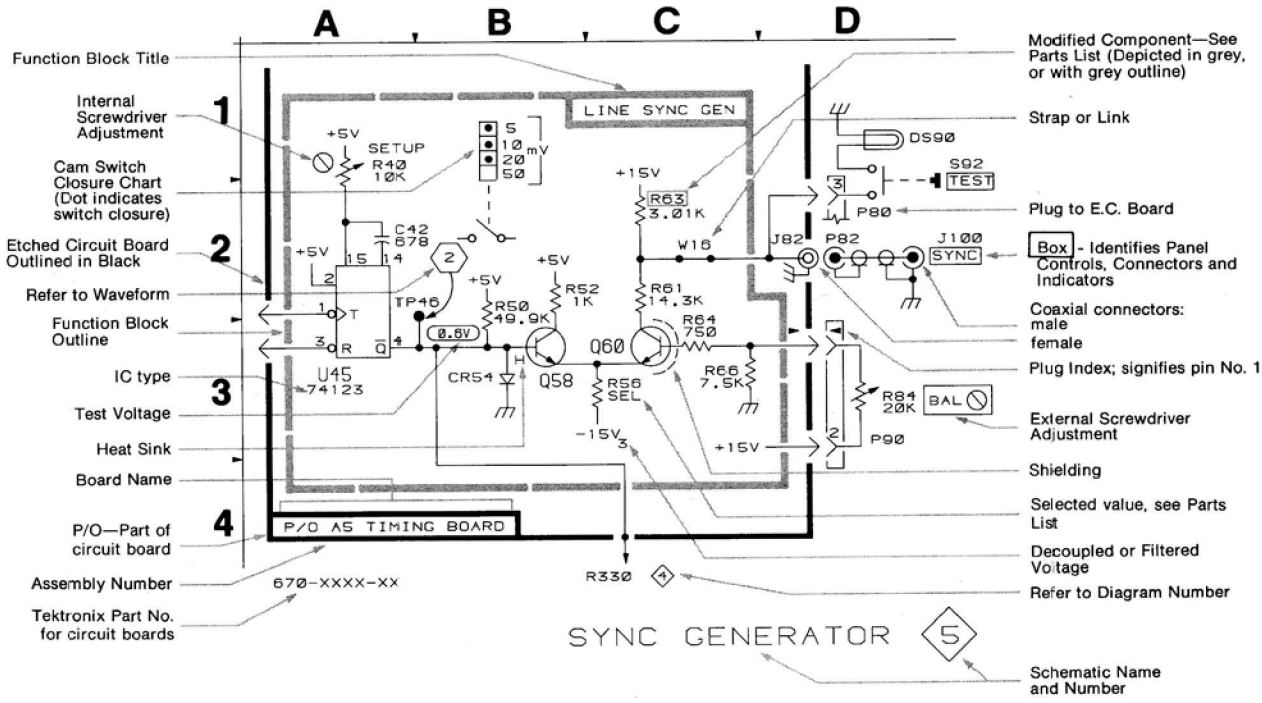
**COMPONENT NUMBER EXAMPLE**




Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

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.

**The following special symbols may appear on the diagrams:**



# Table 8-1
# REAR INTERFACE CONNECTOR ASSIGNMENTS

| Output or Input | Pin B | | Pin A | Output or Input |
|---|---|---|---|---|
| Hi Input | 28 | | 28 | Lo Input |
| | 27 | | 27 | |
| | 26 | | 26 | |
| | 25 | | 25 | |
| | 24 | | 24 | |
| | 23 | | 23 | |
| | 22 | | 22 | |
| | 21 | | 21 | |
| | 20 | | 20 | |
| | 19 | | 19 | |
| | 18 | DM Barrier Slot | 18 | |
| | 17 | | 17 | |
| | 16 | | 16 | |
| | 15 | | 15 | |
| | 14 | | 14 | |
| 25 Vac | 13 | | 13 | 25 Vac |
| | 12 | | 12 | |
| | 11 | | 11 | |
| | 10 | | 10 | |
| Chassis Gnd | 9 | | 9 | Chassis Gnd |
| | 8 | | 8 | |
| | 7 | TM 500 Barrier Slot | 7 | |
| | 6 | | 6 | |
| | 5 | | 5 | |
| | 4 | | 4 | |
| | 3 | | 3 | |
| | 2 | | 2 | |
| | 1 | | 1 | |
| | B | Rear View of Plug-In | A | |

2692-18

# DM505 SIMPLIFIED BL

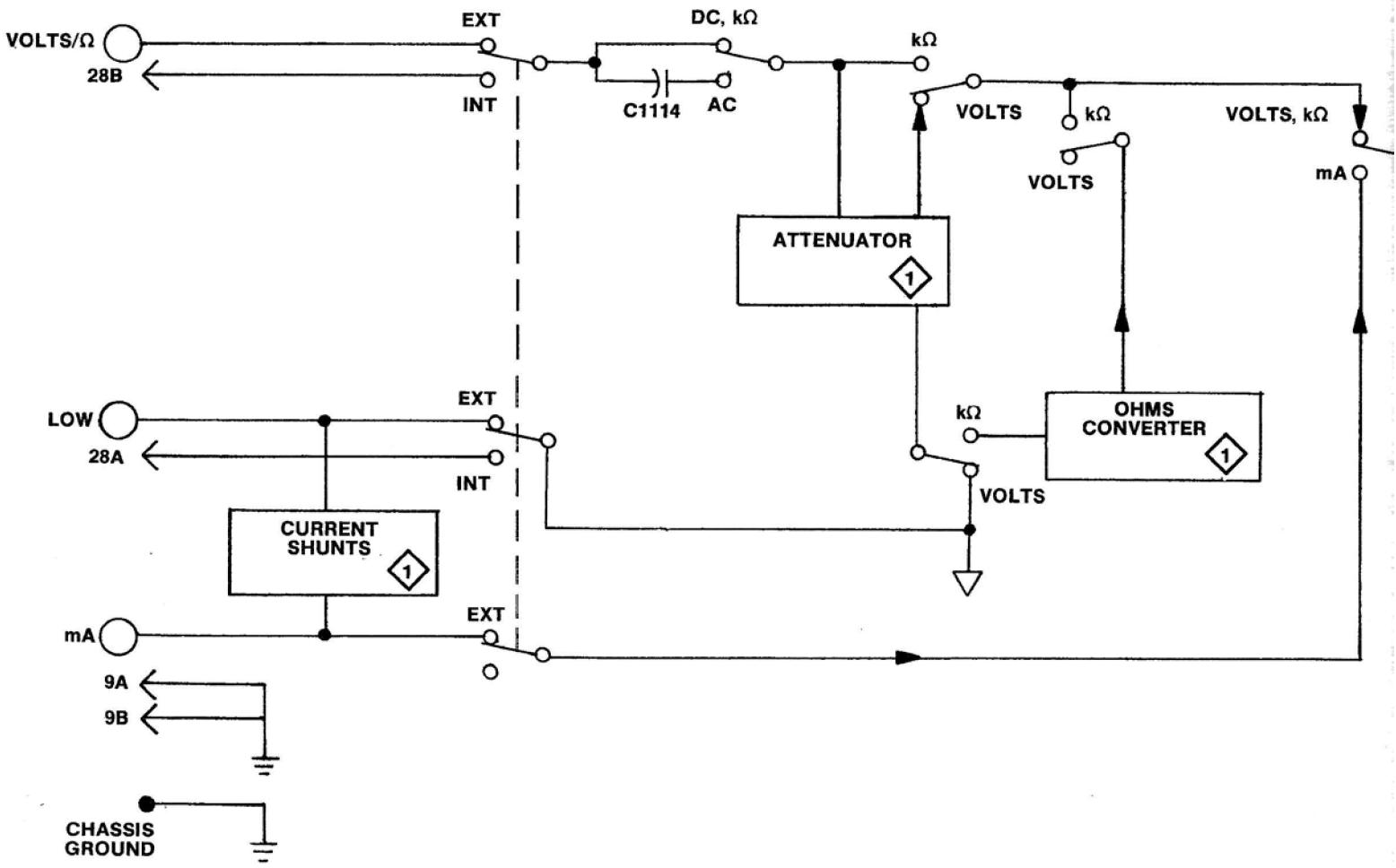
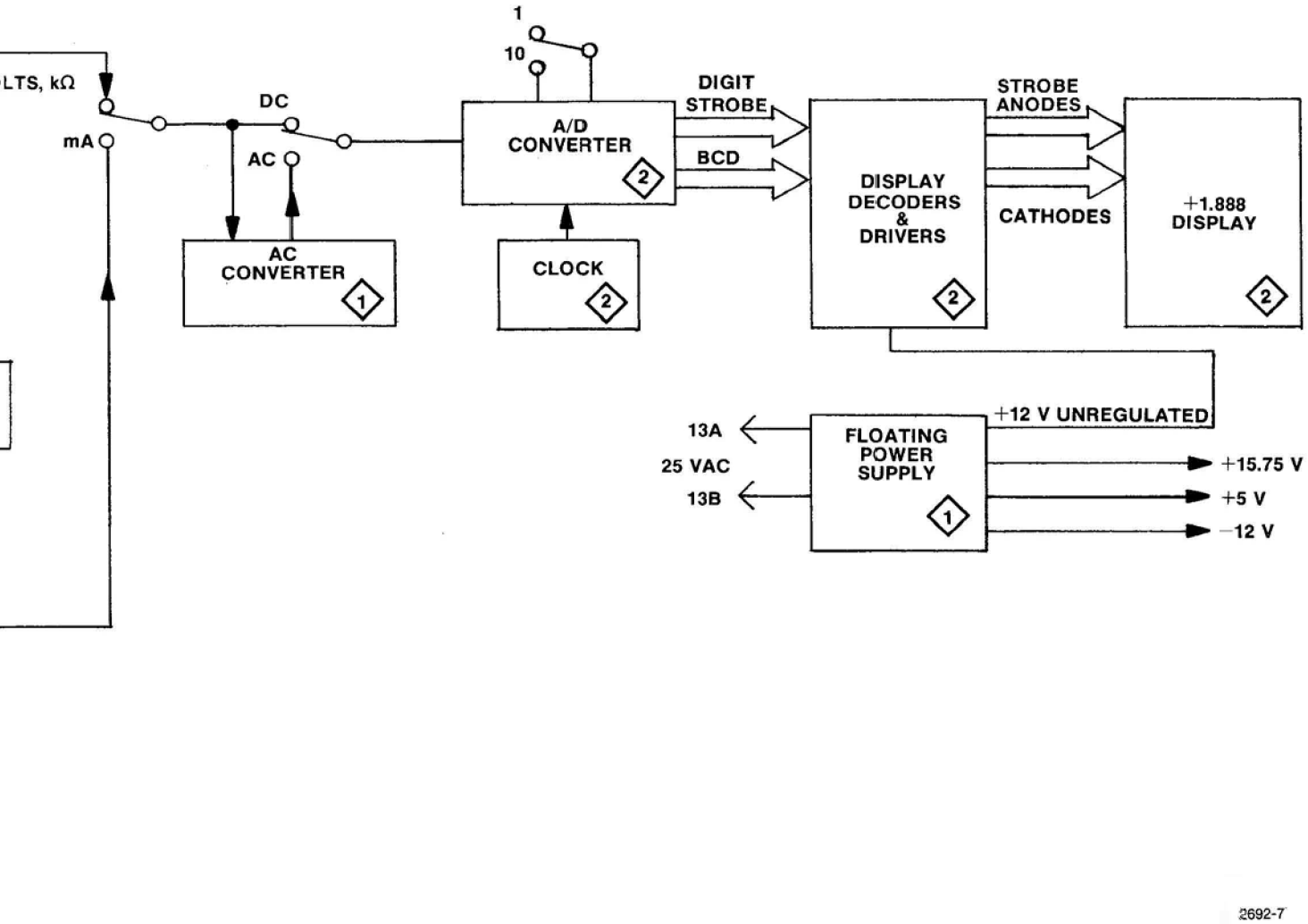



Fig. 8-1.

@

# ED BLOCK DIAGRAM




2692-7

Fig. 8-1.

@

# REAR INTERFACE CONNECTIONS

### Functions Available at Rear Connector

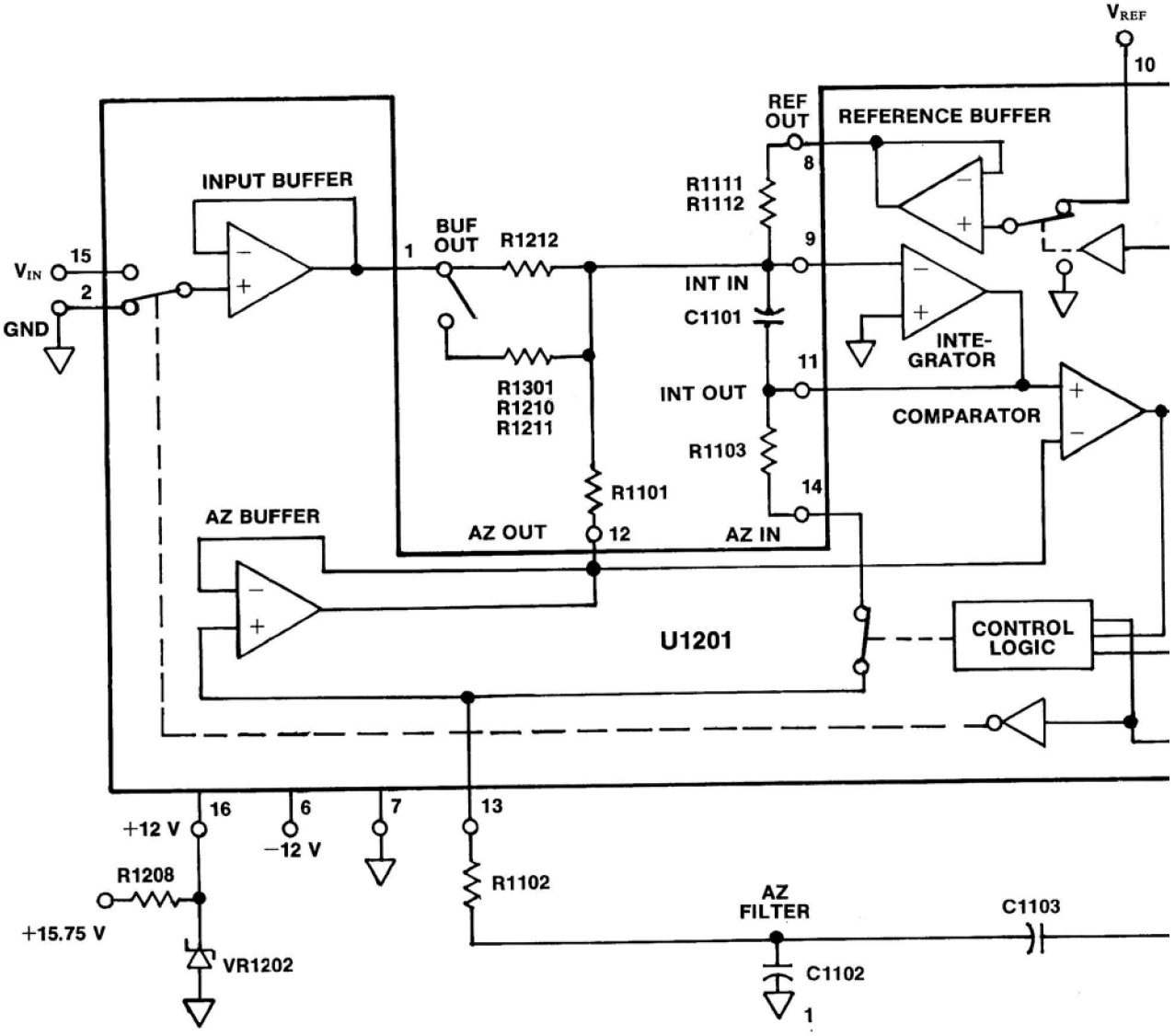
A slot between pins 17 and 18 on the rear connector identifies the DM 505 as a member of the digital multimeter family. Insert a barrier in the corresponding position of the power module jack to prevent other than digital multimeter plug-ins from being used in that compartment. This protects the plug-in if specialized connections are made to that compartment. Consult the Building a System section of the power module manual for further information.

### High and Low Input (contacts 28B and 28A)

Voltages and resistances can be applied directly through the rear interface circuit board contacts. Comparisons can be made between front panel and rear interface measurement sources by using the INPUT EXT-INT pushbutton located on the front panel. Do not exceed the maximum specified input voltage listed in the Specifications section. Also note that the accuracy is derated for some functions when applied at the rear interface inputs. This information is also noted in the Specifications section.

@

# A/D CONVERTER BLOC

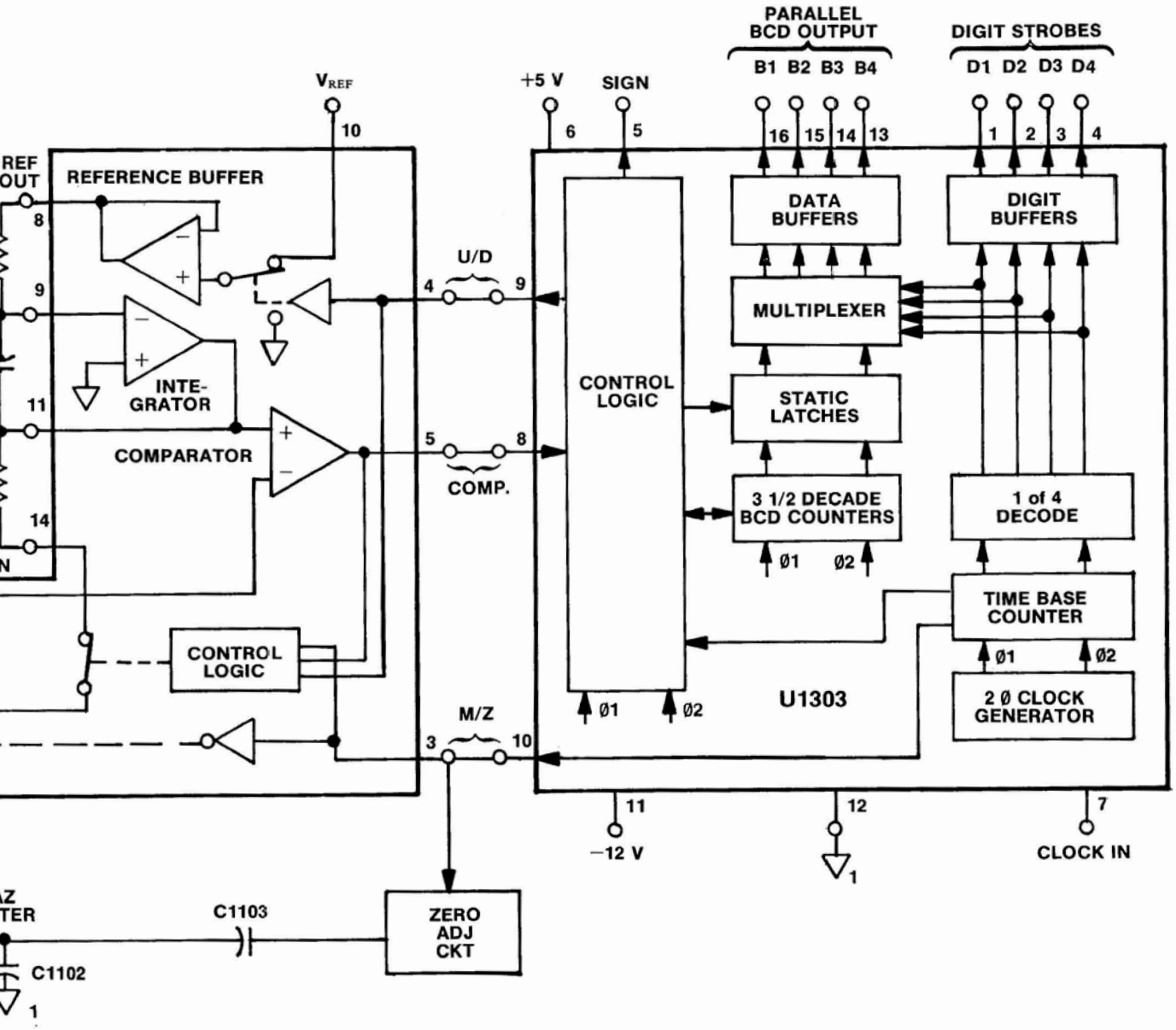



SWITCH STATES ARE FOR A LOGIC "0"

Fig. 8-2.

@

# CONVERTER BLOCK DIAGRAM



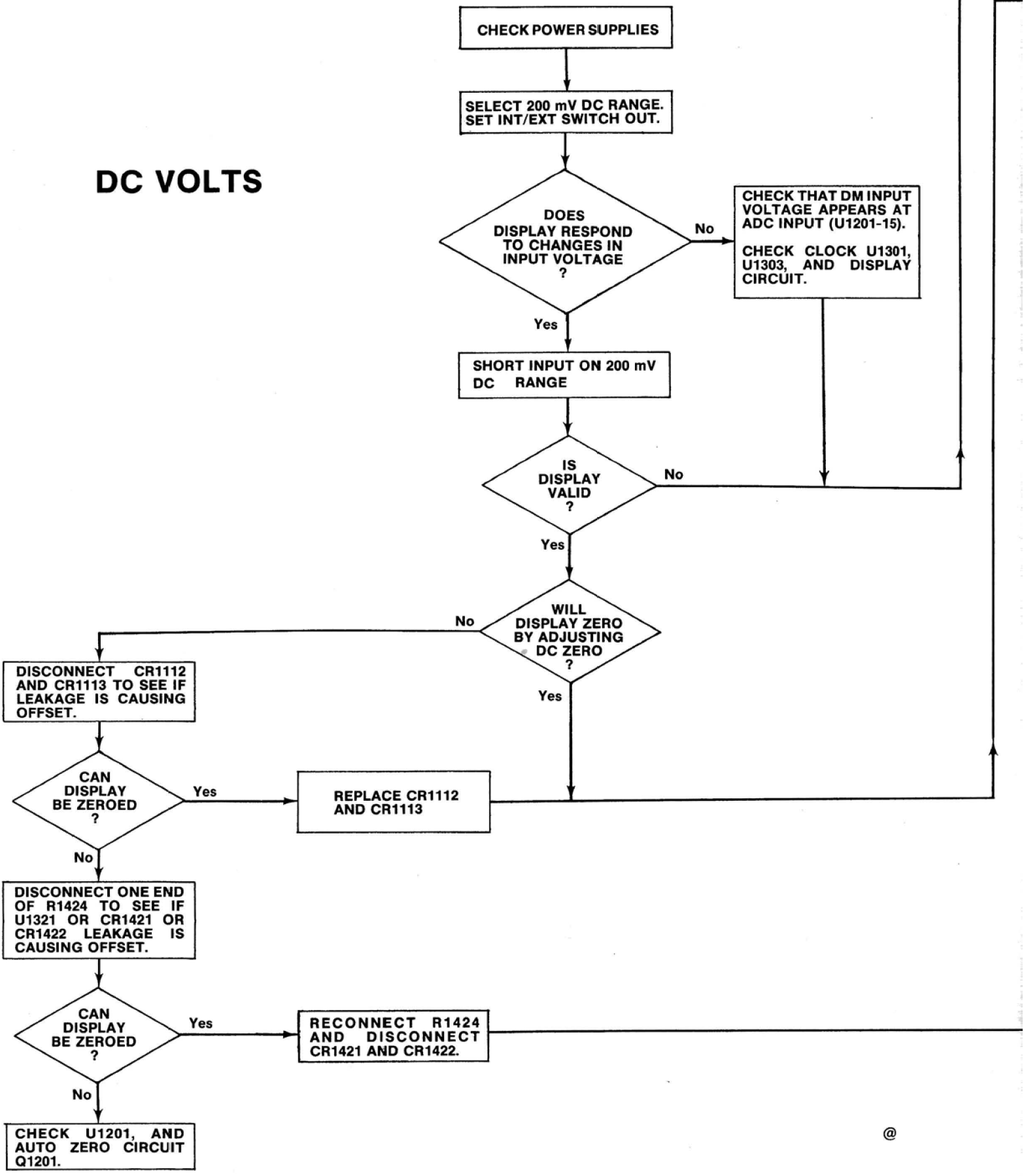

SWITCH STATES ARE FOR A LOGIC "0" AT U/D AND M/Z INPUTS.

2692-8

Fig. 8-2.

@

# DC VOLTS


CHECK POWER SUPPLIES
SELECT 200 mV DC RANGE. SET INT/EXT SWITCH OUT.
DOES DISPLAY RESPOND TO CHANGES IN INPUT VOLTAGE ?
No
CHECK THAT DM INPUT VOLTAGE APPEARS AT ADC INPUT (U1201-15).
CHECK CLOCK U1301, U1303, AND DISPLAY CIRCUIT.
Yes
SHORT INPUT ON 200 mV DC RANGE
IS DISPLAY VALID ?
No
Yes
WILL DISPLAY ZERO BY ADJUSTING DC ZERO ?
No
Yes
DISCONNECT CR1112 AND CR1113 TO SEE IF LEAKAGE IS CAUSING OFFSET.
CAN DISPLAY BE ZEROED ?
Yes
REPLACE CR1112 AND CR1113
No
DISCONNECT ONE END OF R1424 TO SEE IF U1321 OR CR1421 OR CR1422 LEAKAGE IS CAUSING OFFSET.
CAN DISPLAY BE ZEROED ?
Yes
RECONNECT R1424 AND DISCONNECT CR1421 AND CR1422.
No
CHECK U1201, AND AUTO ZERO CIRCUIT Q1201.

@

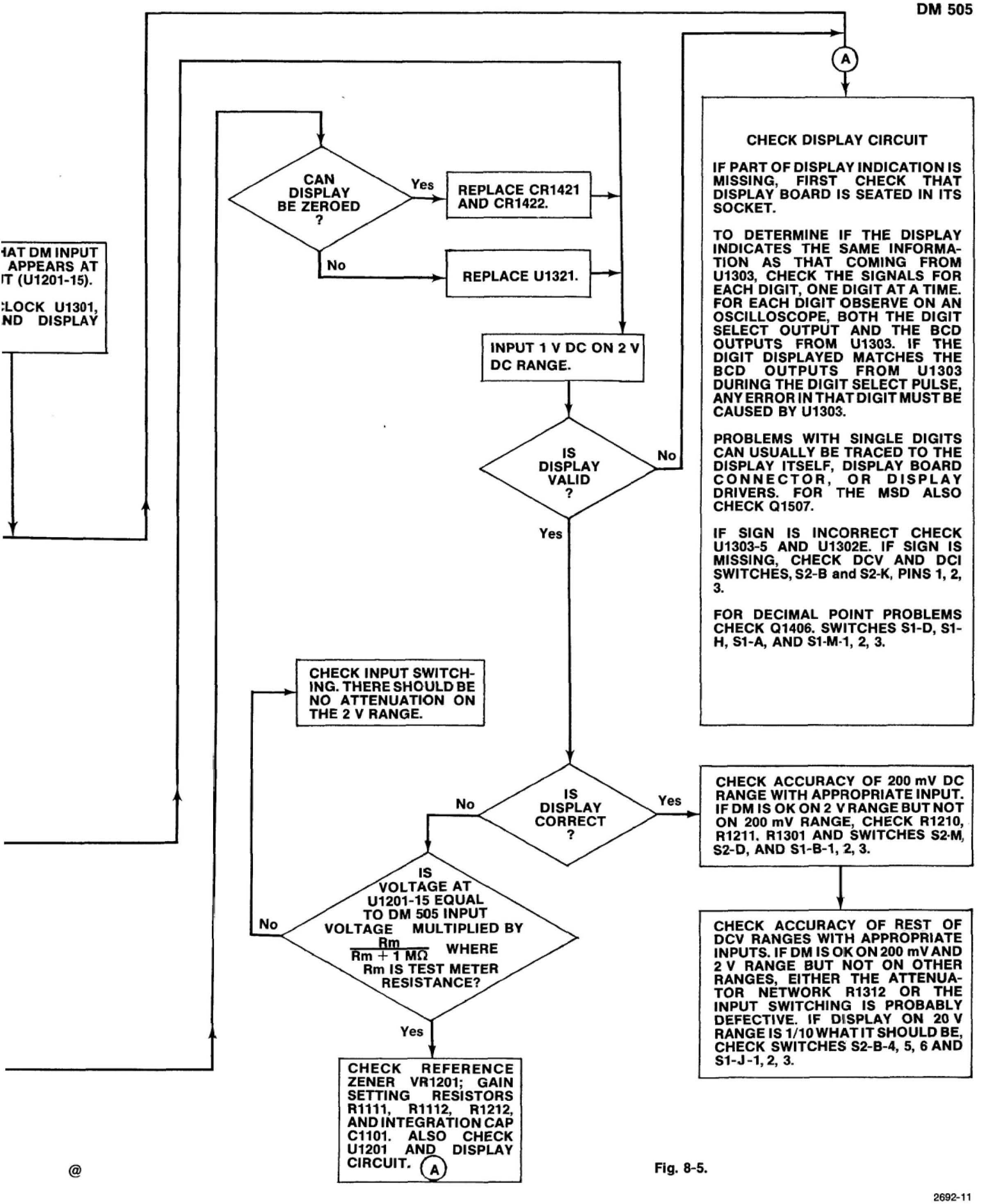

HAT DM INPUT APPEARS AT IT (U1201-15).
CLOCK U1301, ND DISPLAY
CAN DISPLAY BE ZEROED ?
Yes
REPLACE CR1421 AND CR1422.
No
REPLACE U1321.
INPUT 1 V DC ON 2 V DC RANGE.
IS DISPLAY VALID ?
No
Yes
A
CHECK DISPLAY CIRCUIT
IF PART OF DISPLAY INDICATION IS MISSING, FIRST CHECK THAT DISPLAY BOARD IS SEATED IN ITS SOCKET.
TO DETERMINE IF THE DISPLAY INDICATES THE SAME INFORMATION AS THAT COMING FROM U1303, CHECK THE SIGNALS FOR EACH DIGIT, ONE DIGIT AT A TIME. FOR EACH DIGIT OBSERVE ON AN OSCILLOSCOPE, BOTH THE DIGIT SELECT OUTPUT AND THE BCD OUTPUTS FROM U1303. IF THE DIGIT DISPLAYED MATCHES THE BCD OUTPUTS FROM U1303 DURING THE DIGIT SELECT PULSE, ANY ERROR IN THAT DIGIT MUST BE CAUSED BY U1303.
PROBLEMS WITH SINGLE DIGITS CAN USUALLY BE TRACED TO THE DISPLAY ITSELF, DISPLAY BOARD CONNECTOR, OR DISPLAY DRIVERS. FOR THE MSD ALSO CHECK Q1507.
IF SIGN IS INCORRECT CHECK U1303-5 AND U1302E. IF SIGN IS MISSING, CHECK DCV AND DCI SWITCHES, S2-B and S2-K, PINS 1, 2, 3.
FOR DECIMAL POINT PROBLEMS CHECK Q1406. SWITCHES S1-D, S1-H, S1-A, AND S1-M-1, 2, 3.
CHECK INPUT SWITCHING. THERE SHOULD BE NO ATTENUATION ON THE 2 V RANGE.
IS DISPLAY CORRECT ?
No
Yes
CHECK ACCURACY OF 200 mV DC RANGE WITH APPROPRIATE INPUT. IF DM IS OK ON 2 V RANGE BUT NOT ON 200 mV RANGE, CHECK R1210, R1211. R1301 AND SWITCHES S2-M, S2-D, AND S1-B-1, 2, 3.
CHECK ACCURACY OF REST OF DCV RANGES WITH APPROPRIATE INPUTS. IF DM IS OK ON 200 mV AND 2 V RANGE BUT NOT ON OTHER RANGES, EITHER THE ATTENUATOR NETWORK R1312 OR THE INPUT SWITCHING IS PROBABLY DEFECTIVE. IF DISPLAY ON 20 V RANGE IS 1/10 WHAT IT SHOULD BE, CHECK SWITCHES S2-B-4, 5, 6 AND S1-J-1, 2, 3.
IS VOLTAGE AT U1201-15 EQUAL TO DM 505 INPUT VOLTAGE MULTIPLIED BY Rm / (Rm + 1 MΩ) WHERE Rm IS TEST METER RESISTANCE?
No
Yes
CHECK REFERENCE ZENER VR1201; GAIN SETTING RESISTORS R1111, R1112, R1212, AND INTEGRATION CAP C1101. ALSO CHECK U1201 AND DISPLAY CIRCUIT.
A

Fig. 8-5.

# DC CURRENT

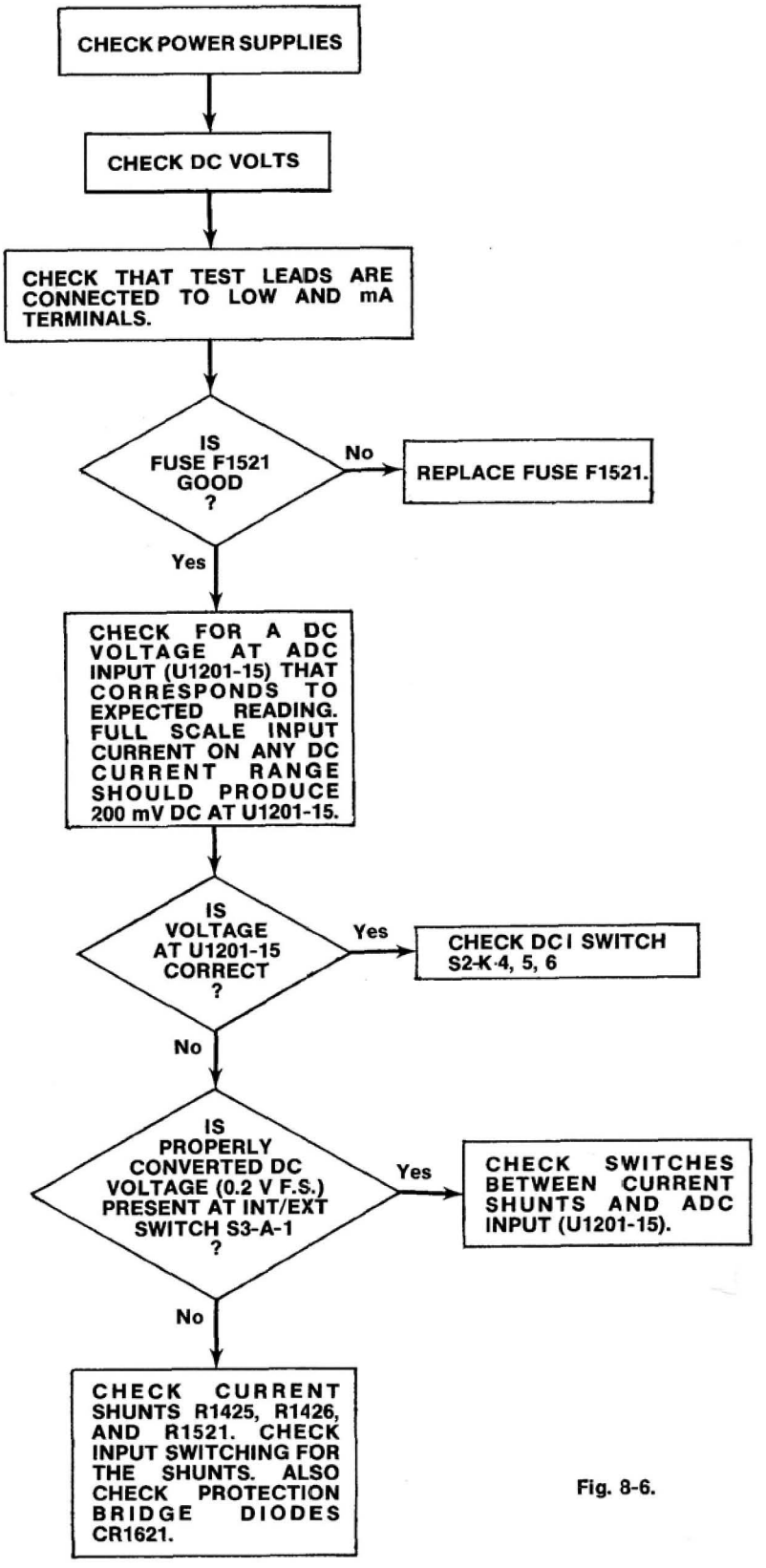



Fig. 8-6.

2692-12

# OHMS

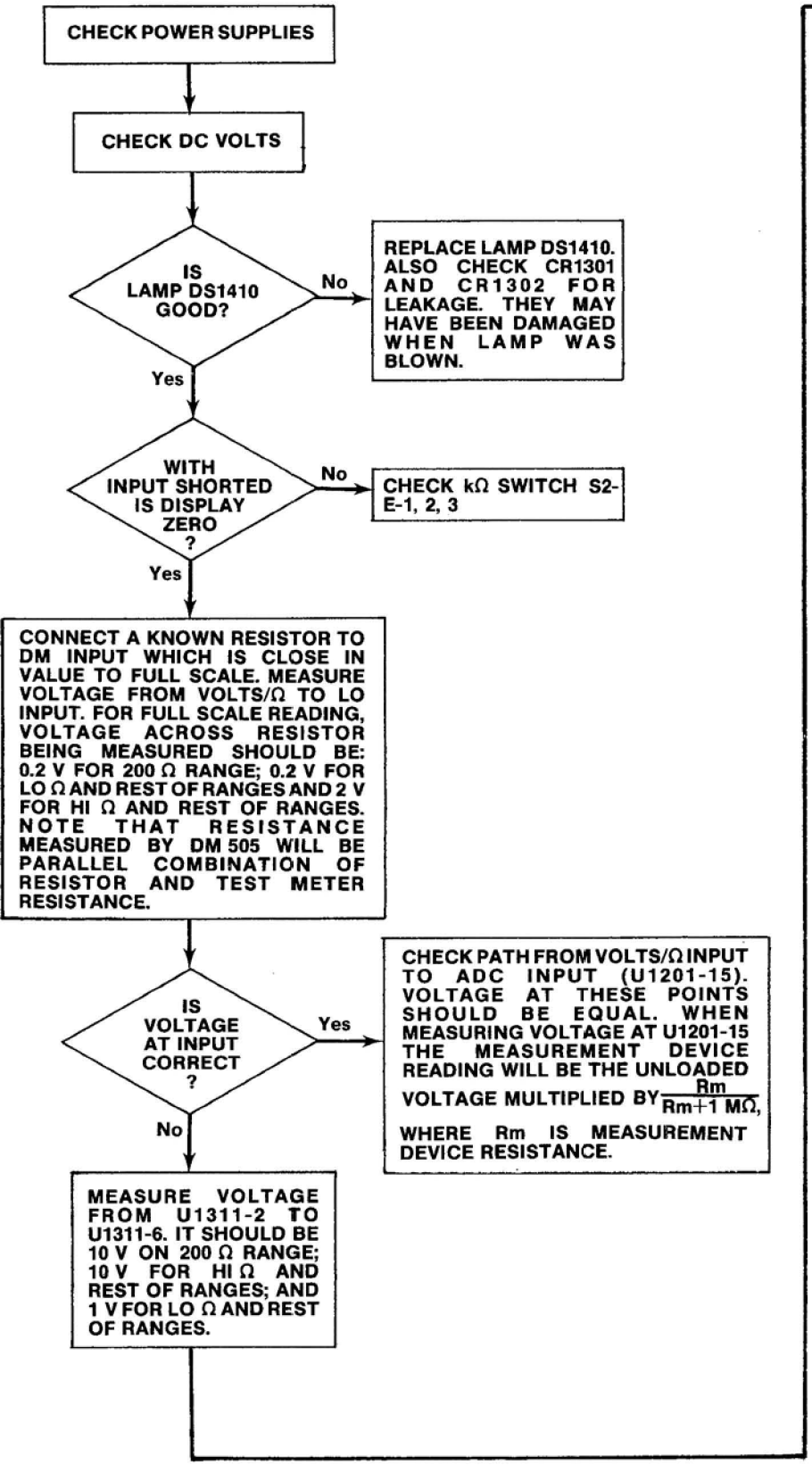
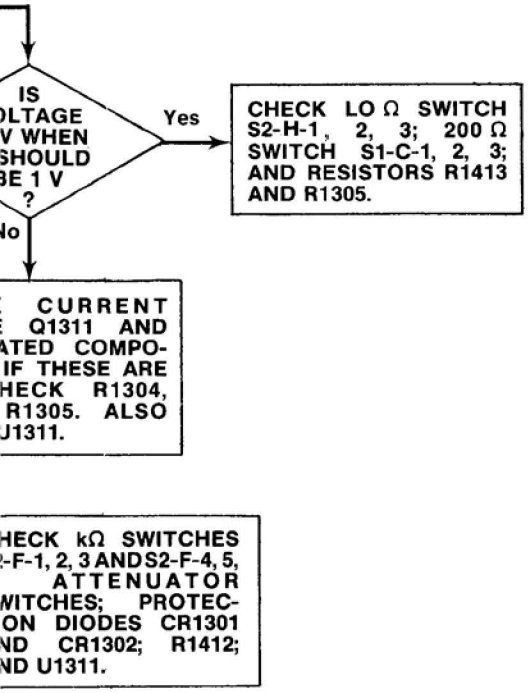



Fig. 8-7.

2692-13


IS
OLTAGE
V WHEN
SHOULD
BE 1 V
?
Yes
CHECK LO Ω SWITCH S2-H-1, 2, 3; 200 Ω SWITCH S1-C-1, 2, 3; AND RESISTORS R1413 AND R1305.
No
CURRENT
Q1311 AND
ATED COMPO-
IF THESE ARE
HECK R1304,
R1305. ALSO
J1311.
HECK kΩ SWITCHES
-F-1, 2, 3 ANDS2-F-4, 5,
ATTENUATOR
WITCHES; PROTEC-
ON DIODES CR1301
ND CR1302; R1412;
ND U1311.

# AC VOLTS

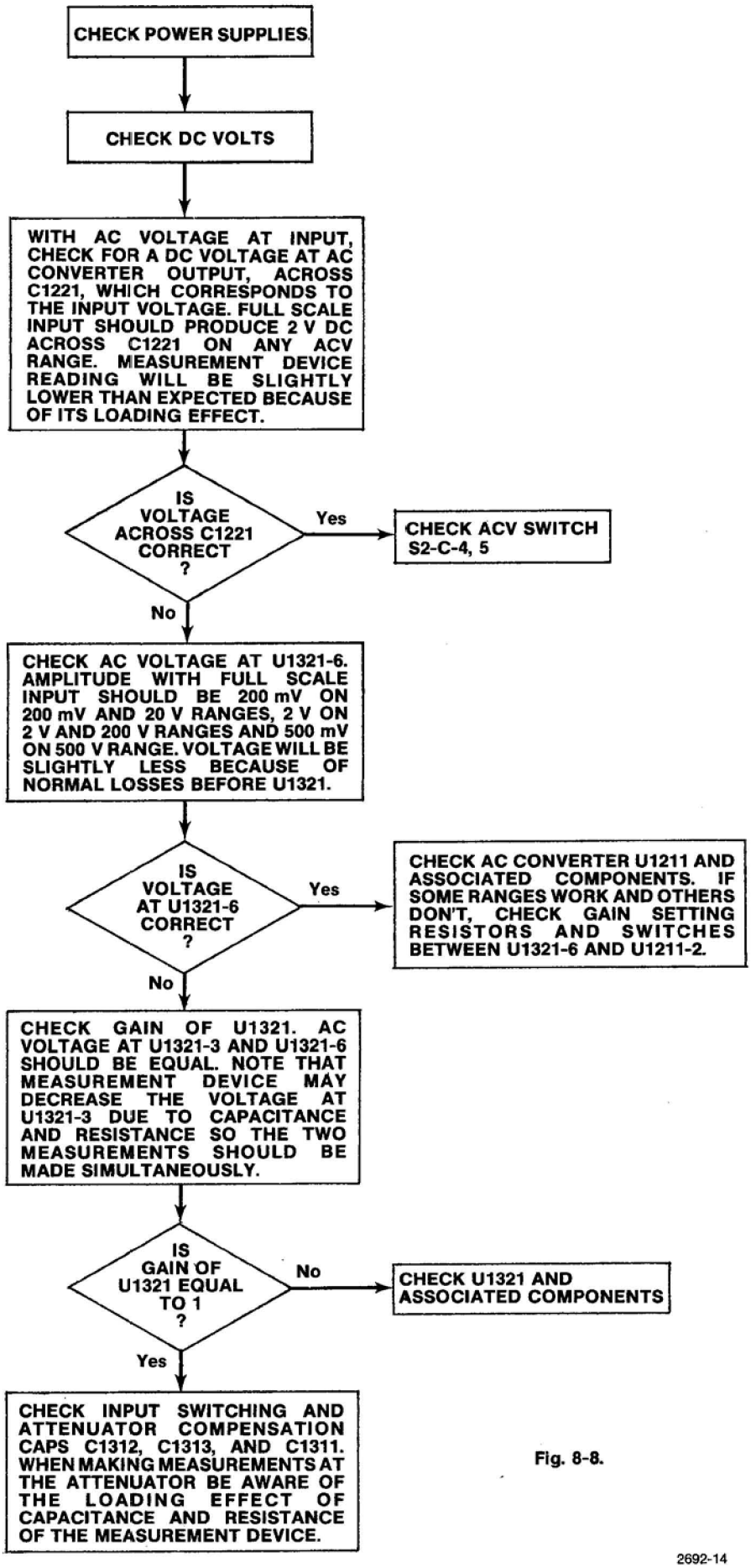



Fig. 8-8.

### MISCELLANEOUS NOTES

INABILITY TO ZERO MAY BE CAUSED BY LEAKY U1211 INPUTS OR LEAKY C1215. IF ZERO CAN BE SET ON 200 mV AND 2 V RANGE BUT IS OFF ON 20 V RANGE C1021 ( ◇1 B6 ) MAY BE WRONG VALUE.

AN ABNORMALLY LOW DISPLAY INDICATION AT 20 kHz ON 200 mV AND 2 V RANGE CAN BE CAUSED BY U1211 BEING DEFECTIVE.

AMPLITUDE NONLINEARITY CAN BE CAUSED BY LEAKY FEEDBACK DIODES CR1221 AND CR1222.

2692-14

@

# ADJUSTMENT LOCATIONS

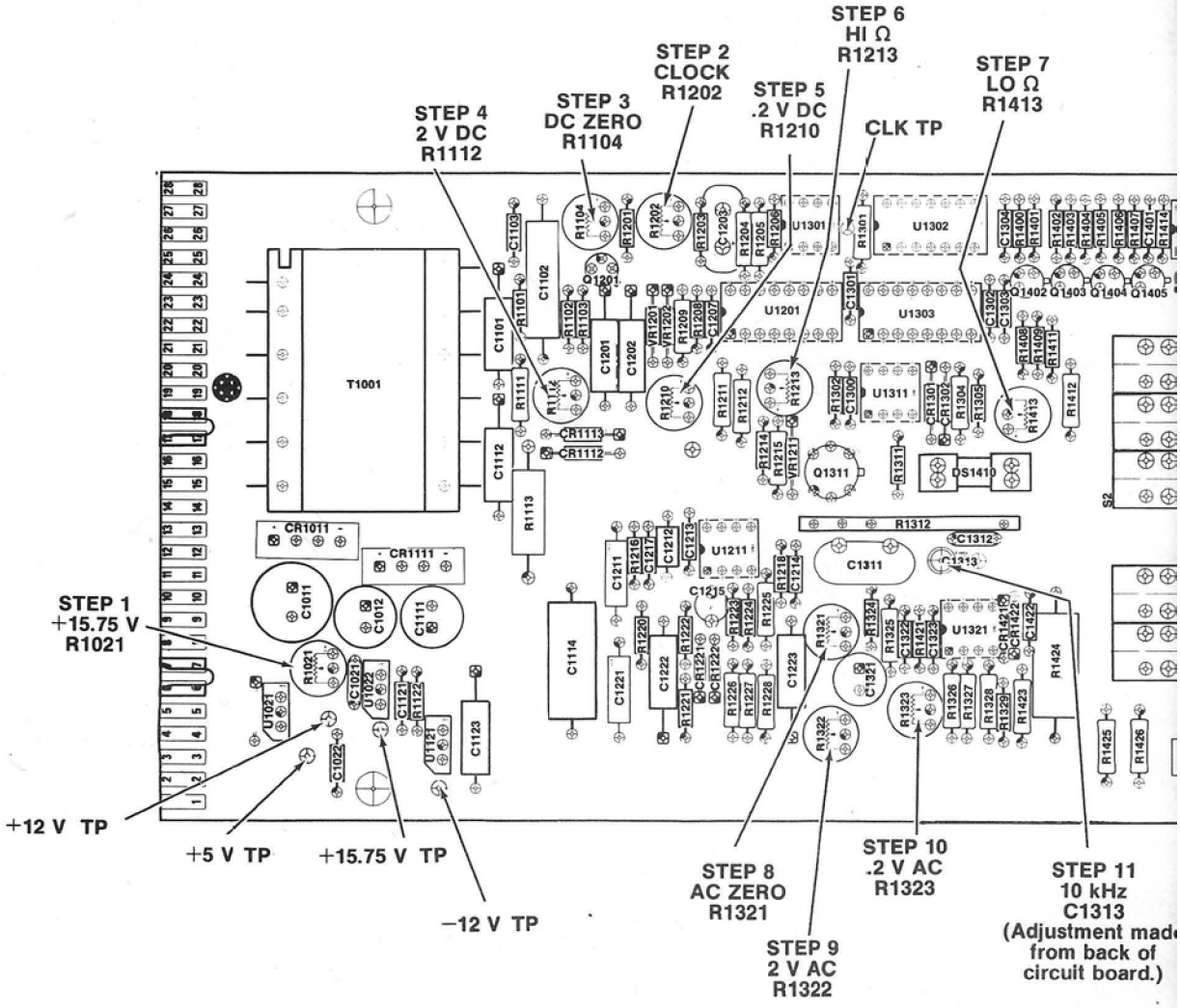
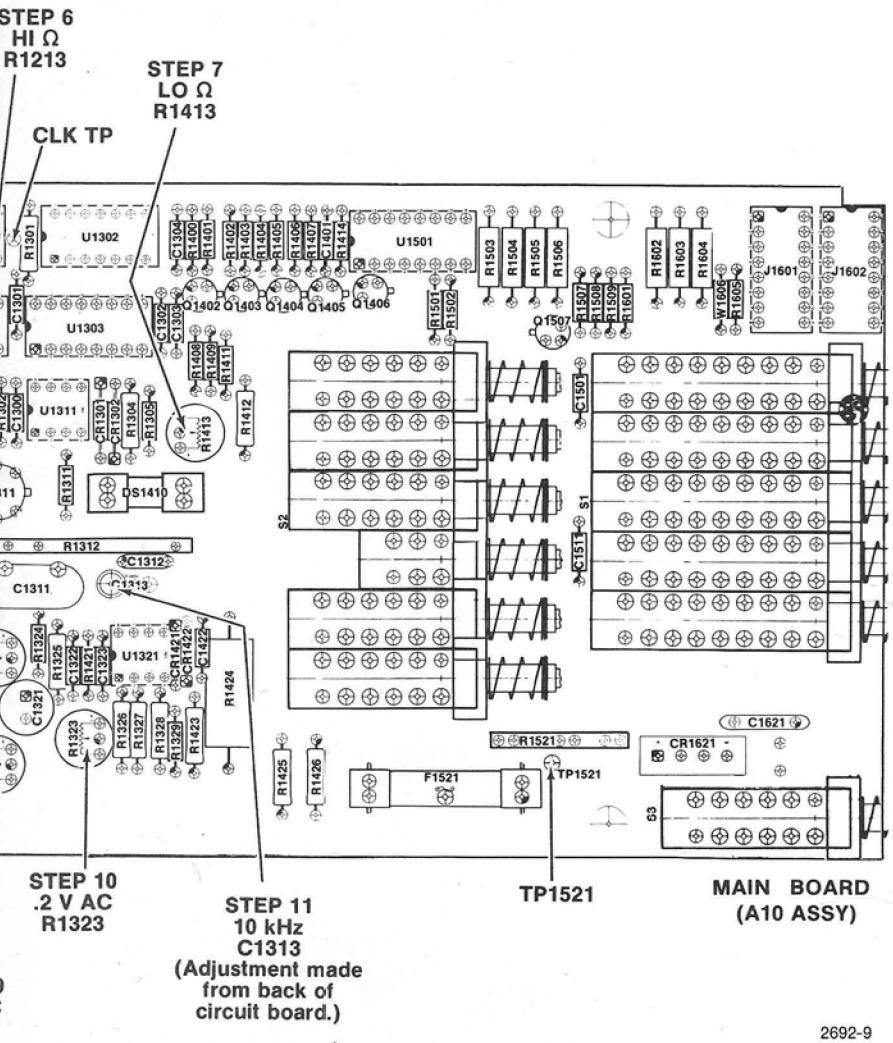



Fig. 8-3.

# T LOCATIONS




2692-9



-3.

# POWER SUPPLIES

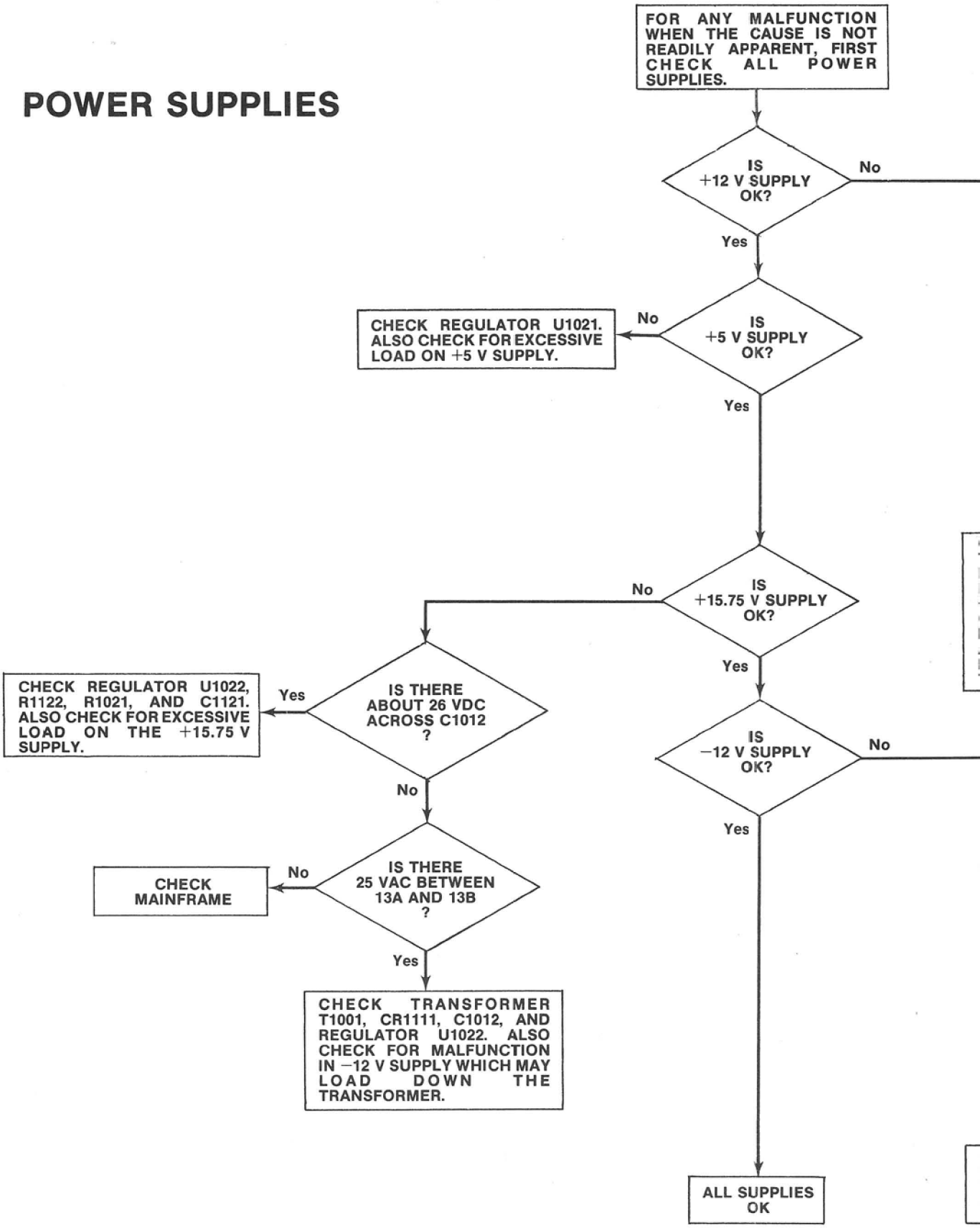



Fig. 8-4.

@

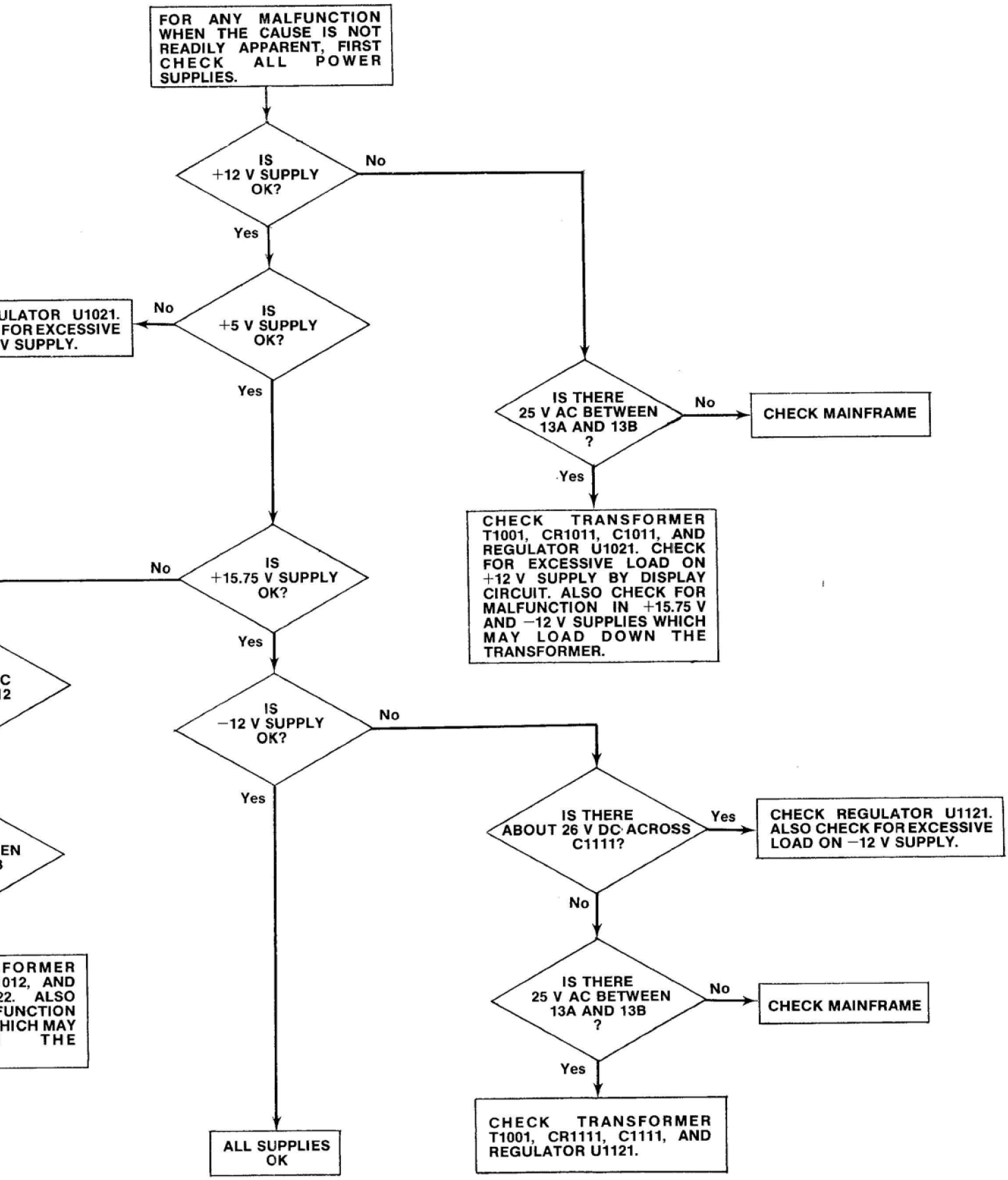
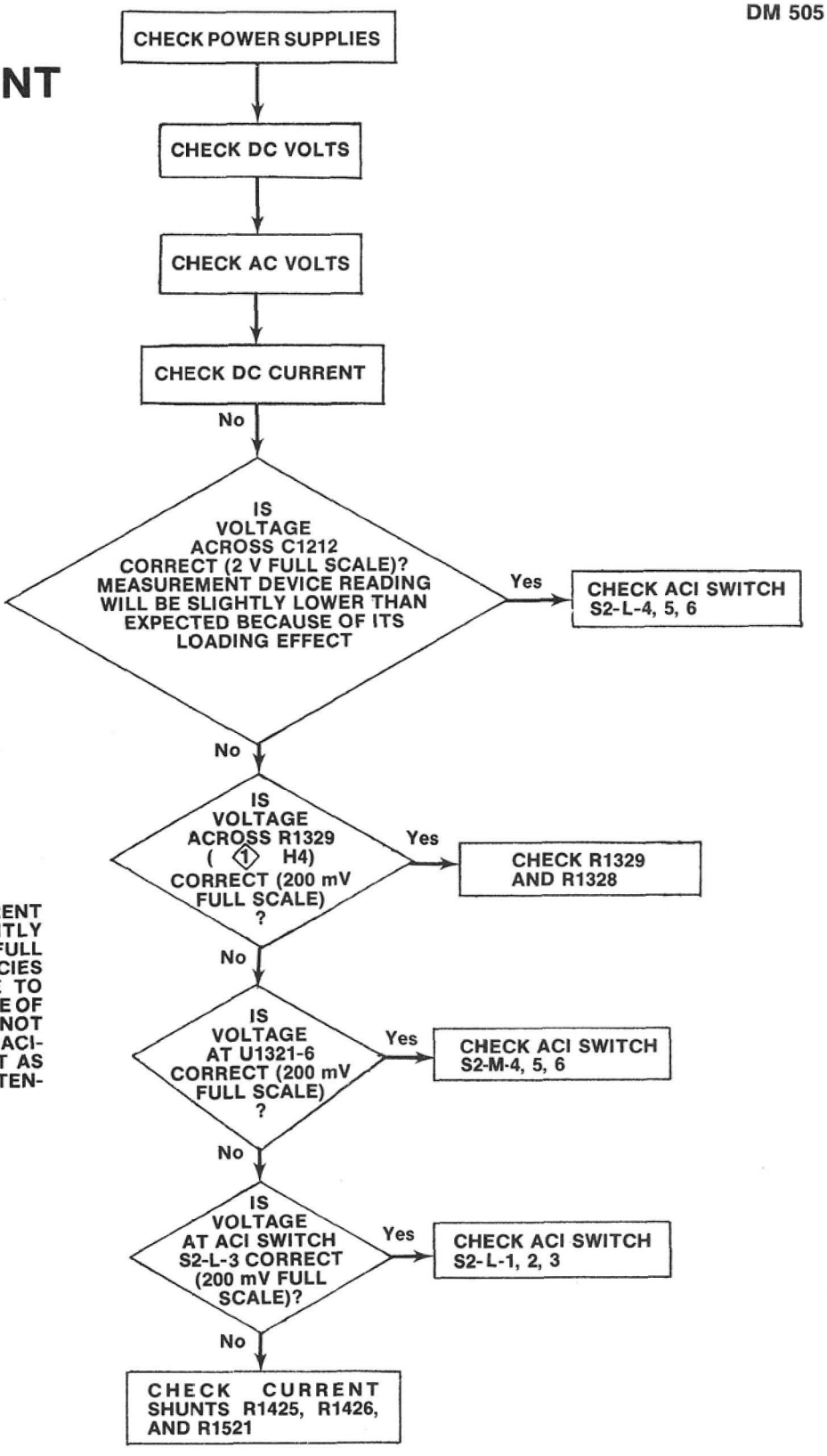

FOR ANY MALFUNCTION WHEN THE CAUSE IS NOT READILY APPARENT, FIRST CHECK ALL POWER SUPPLIES.
IS +12 V SUPPLY OK?
No
Yes
IS +5 V SUPPLY OK?
No
Yes
ULATOR U1021.
FOR EXCESSIVE
V SUPPLY.
IS THERE 25 V AC BETWEEN 13A AND 13B ?
No
CHECK MAINFRAME
Yes
CHECK TRANSFORMER T1001, CR1011, C1011, AND REGULATOR U1021. CHECK FOR EXCESSIVE LOAD ON +12 V SUPPLY BY DISPLAY CIRCUIT. ALSO CHECK FOR MALFUNCTION IN +15.75 V AND −12 V SUPPLIES WHICH MAY LOAD DOWN THE TRANSFORMER.
IS +15.75 V SUPPLY OK?
No
Yes
C
12
EN
FORMER
012, AND
22. ALSO
FUNCTION
HICH MAY
THE
IS −12 V SUPPLY OK?
No
Yes
IS THERE ABOUT 26 V DC ACROSS C1111?
Yes
CHECK REGULATOR U1121. ALSO CHECK FOR EXCESSIVE LOAD ON −12 V SUPPLY.
No
IS THERE 25 V AC BETWEEN 13A AND 13B ?
No
CHECK MAINFRAME
Yes
CHECK TRANSFORMER T1001, CR1111, C1111, AND REGULATOR U1121.
ALL SUPPLIES OK

Fig. 8-4.

@

# AC CURRENT




**NOTE: THE DM 505 AC CURRENT READING WILL BE SLIGHTLY HIGHER (4 TO 6 COUNTS) FOR FULL SCALE AT HIGHER FREQUENCIES (1 k TO 10 kHz). THIS IS DUE TO VERY LOW SOURCE IMPEDANCE OF CURRENT SHUNTS, WHICH IS NOT AFFECTED BY STRAY CAPACITANCE TO THE SAME EXTENT AS AC VOLTAGES FROM THE ATTENUATOR NETWORK.**

Fig. 8-9.

# PARTS LOCATION GRID

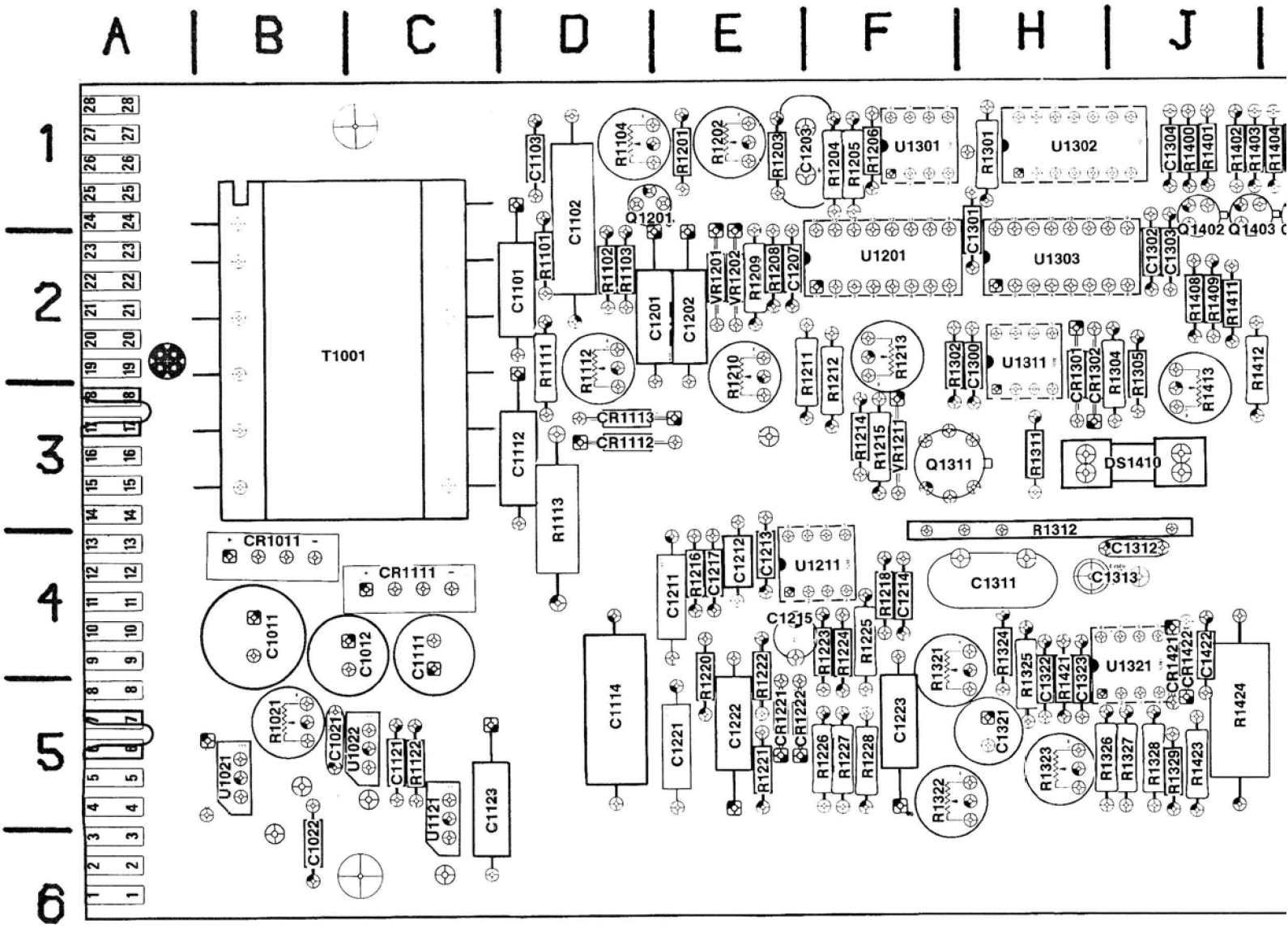
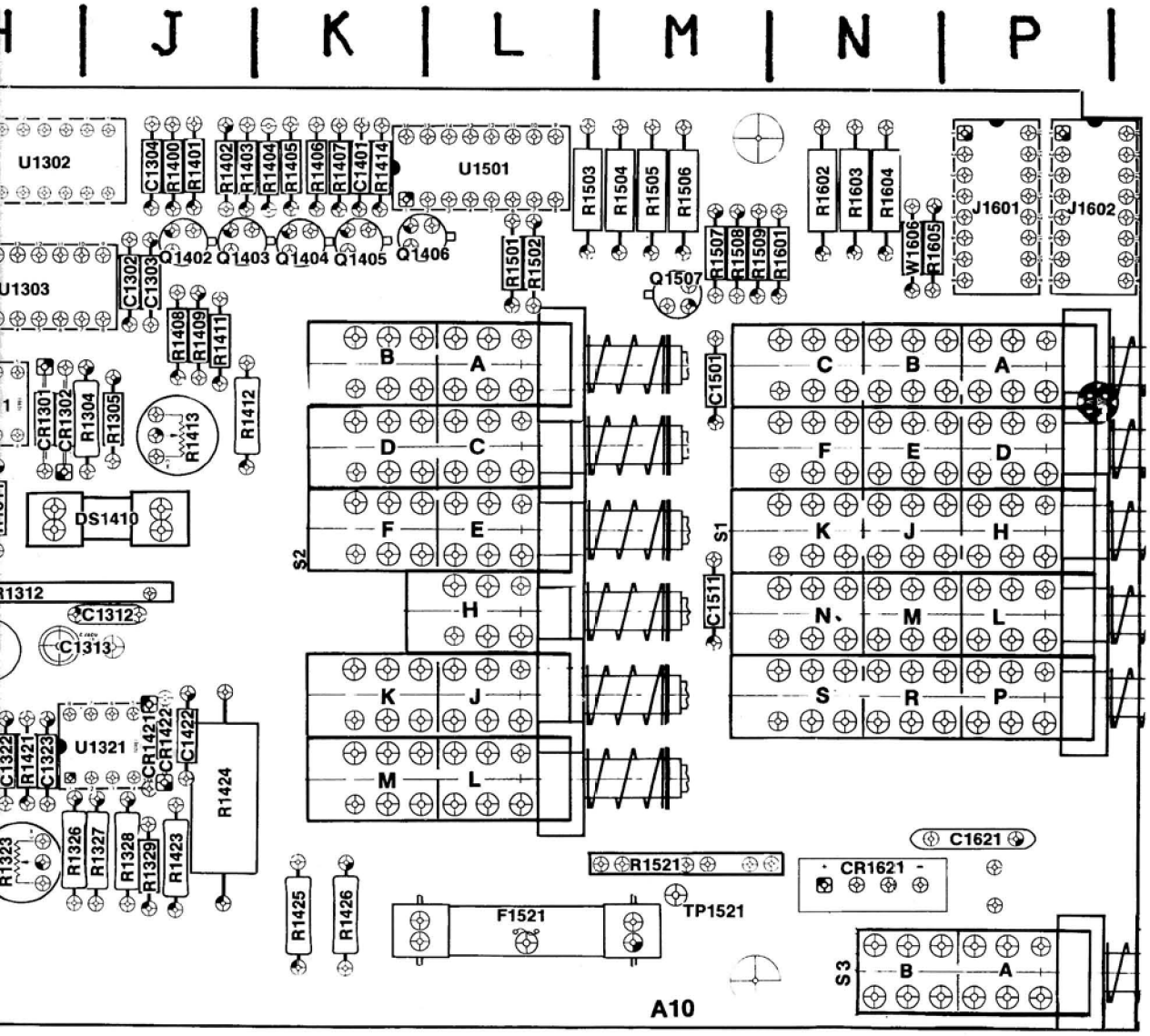



Fig. 8-10. Main Board (A10).

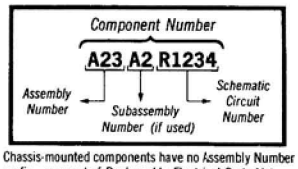
# ATION GRID




2692-16

ain Board (A10).

**COMPONENT NUMBER EXAMPLE**




Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

**Static Sensitive Devices**
*See Maintenance Section*

@

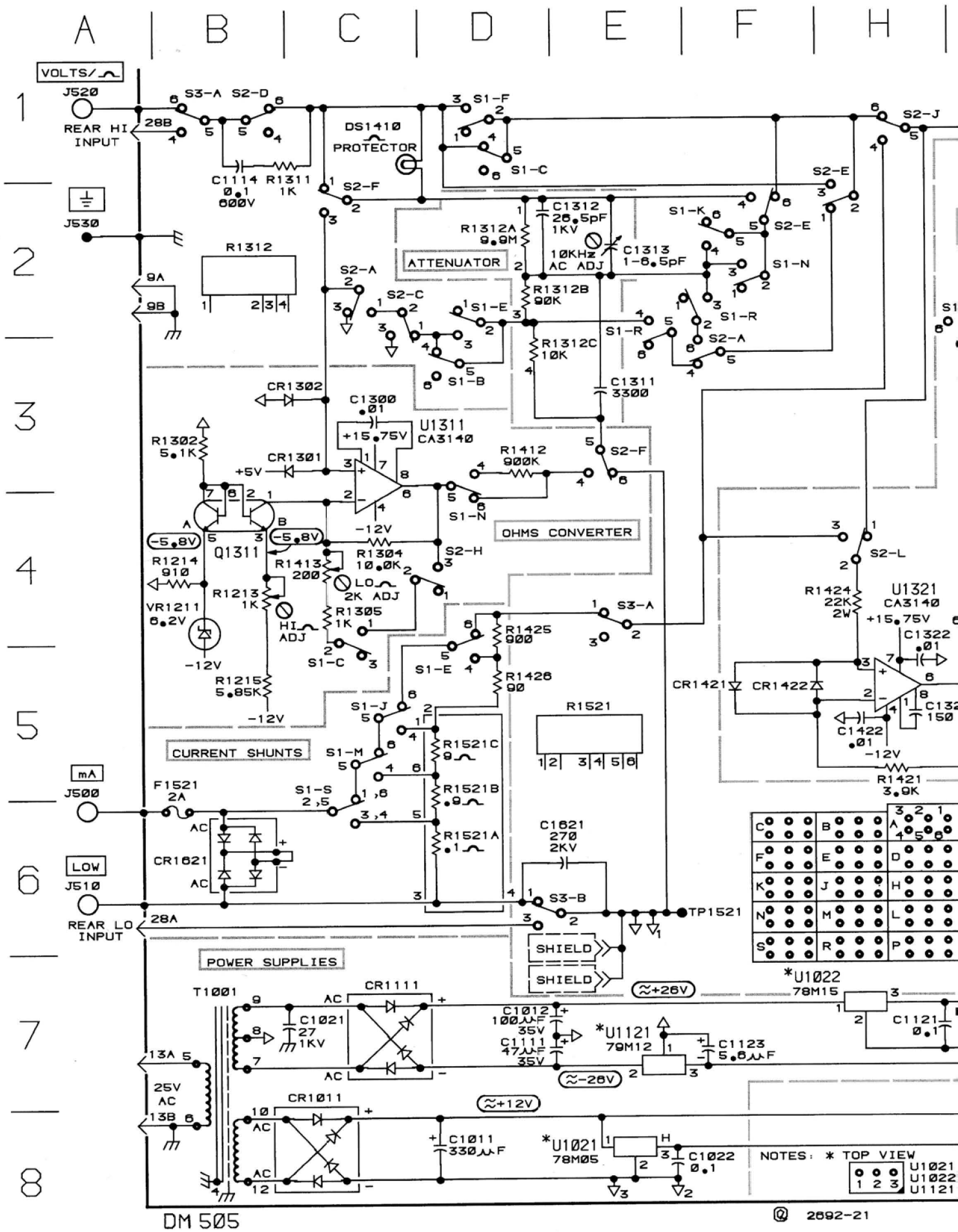
# Table 8-2
# COMPONENT REFERENCE CHART

P/O A10 ASSY — Power Supplies & Input Conditioning ①

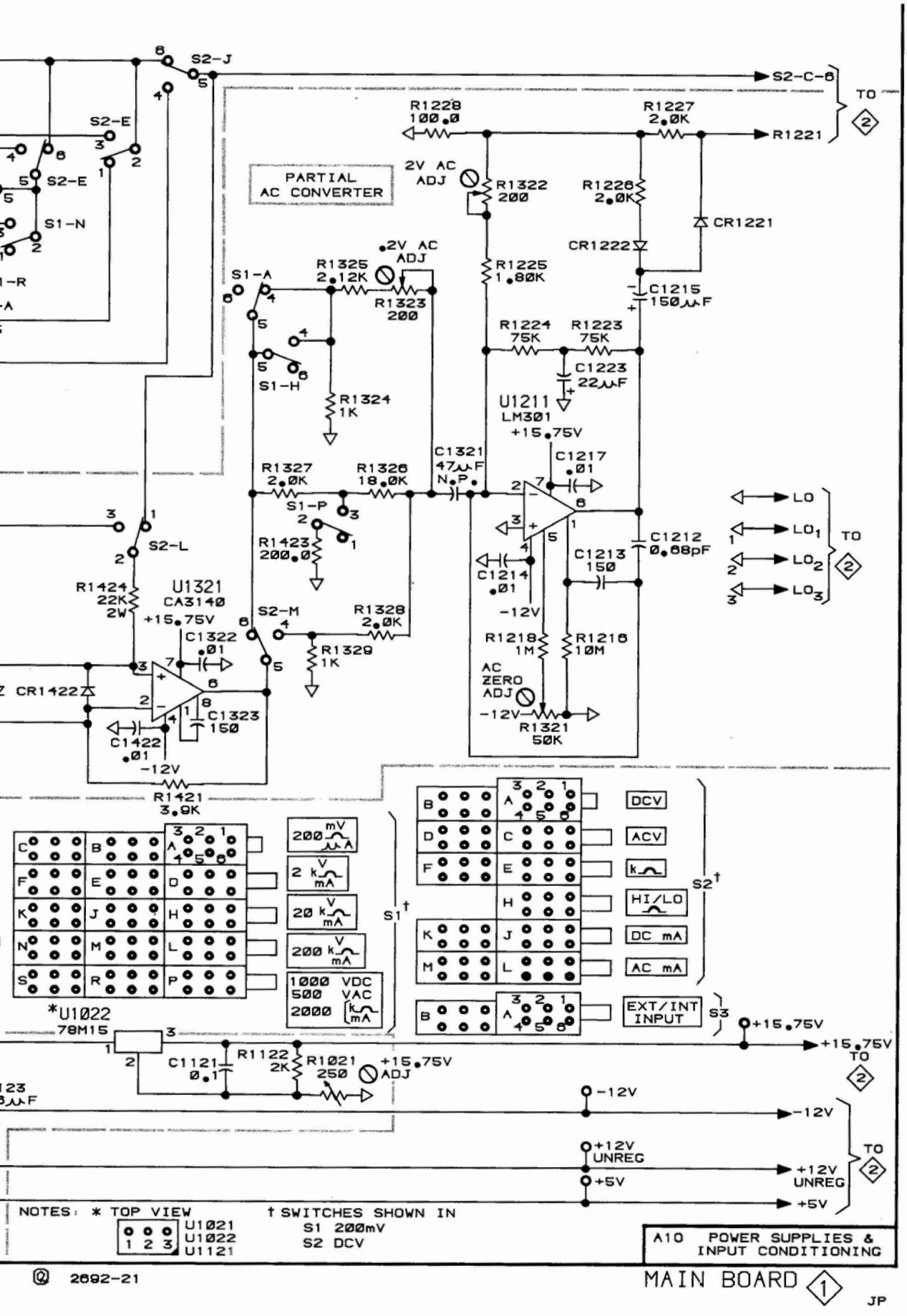
| Circuit Number | Schematic Location | Board Location |
|---|---|---|
| C1011 | D8 | B4 |
| C1012 | D7 | C4 |
| C1021 | B7 | B5 |
| C1022 | E8 | B6 |
| C1111 | D7 | C4 |
| C1114 | B1 | D5 |
| C1121 | H7 | C5 |
| C1123 | F7 | C5 |
| C1212 | L4 | E4 |
| C1213 | L4 | E4 |
| C1214 | K4 | F4 |
| C1215 | L2 | E4 |
| C1217 | L4 | E4 |
| C1223 | L3 | F5 |
| C1300 | C3 | H2 |
| C1311 | E3 | H4 |
| C1312 | D2 | J4 |
| C1313 | E2 | J4 |
| C1321 | K4 | H5 |
| C1322 | H5 | H5 |
| C1323 | H5 | H5 |
| C1422 | H5 | J4 |
| C1621 | E6 | P5 |
| CR1011 | C8 | B4 |
| CR1111 | C7 | C4 |
| CR1221 | M2 | E5 |
| CR1222 | L2 | E5 |
| CR1301 | B3 | H2 |
| CR1302 | B3 | H2 |
| CR1421 | F5 | J4 |
| CR1422 | F5 | J4 |
| CR1621 | B6 | N5 |
| DS1410 | C1 | J3 |
| F1521 | B5 | L5 |
| J500 | A5 | CHASSIS |
| J510 | A6 | CHASSIS |
| J520 | A1 | CHASSIS |
| J530 | A2 | CHASSIS |
| Q1311 | B4 | F3 |
| R1021 | J7 | B5 |
| R1122 | J7 | C5 |
| R1213 | B4 | F2 |
| R1214 | B4 | F3 |
| R1215 | B5 | F3 |
| R1216 | L5 | E4 |
| R1218 | L5 | F4 |
| R1223 | L3 | F4 |
| R1224 | K3 | F4 |
| R1225 | K2 | F4 |
| R1226 | L2 | F5 |
| R1227 | L1 | F5 |
| R1228 | K2 | F5 |
| R1302 | B3 | F2 |
| R1304 | C4 | J2 |
| R1305 | C4 | J2 |
| R1311 | B1 | H3 |
| R1312A | D2 | H4 |
| R1312B | D2 | H4 |
| R1312C | D3 | H4 |
| R1321 | L5 | F4 |
| R1322 | K2 | F5 |
| R1323 | K2 | H5 |
| R1324 | J3 | H4 |
| R1325 | J2 | H5 |
| R1326 | J4 | H5 |
| R1327 | J4 | J5 |
| R1328 | J5 | J5 |
| R1329 | J5 | J5 |
| R1412 | D3 | J2 |
| R1413 | C4 | J3 |
| R1421 | H5 | H5 |
| R1423 | J4 | J5 |
| R1424 | H4 | J5 |
| R1425 | D4 | K5 |
| R1426 | D5 | K5 |
| R1521A | D6 | M5 |
| R1521B | D5 | M5 |
| R1521C | D5 | M5 |
| S1-A | J3 | P2 |
| S1-B | D3 | N2 |
| S1-C | D1 | N2 |
| S1-C | C5 | N2 |
| S1-E | D5 | N3 |
| S1-E | D2 | N3 |
| S1-F | D1 | N3 |
| S1-H | J3 | P3 |
| S1-J | C5 | N3 |
| S1-K | F2 | N3 |
| S1-M | C5 | N4 |
| S1-N | D4 | N4 |
| S1-N | F2 | N4 |
| S1-P | J4 | P4 |
| S1-R | E3 | N4 |
| S1-R | F2 | N4 |
| S1-S | C5 | N4 |
| S2-A | F3 | L2 |
| S2-A | C2 | L2 |
| S2-C | C2 | L3 |
| S2-D | B1 | K3 |
| S2-E | H2 | L3 |
| S2-E | F2 | L3 |
| S2-F | E3 | K3 |
| S2-F | C2 | K3 |
| S2-H | D4 | L4 |
| S2-J | H1 | L4 |
| S2-L | H4 | L5 |
| S2-M | J5 | K5 |
| S3-A | E4 | P6 |
| S3-A | B1 | P6 |
| S3-B | D6 | N6 |
| T1001 | B7 | B2 |
| TP1521 | F6 | M5 |
| U1021 | E8 | B5 |
| U1022 | H6 | C5 |
| U1121 | E7 | C5 |
| U1211 | L4 | F4 |
| U1311 | C3 | H2 |
| U1321 | H5 | J4 |
| VR1211 | B4 | F3 |

P/O A10 ASSY also shown on ②

2692-19

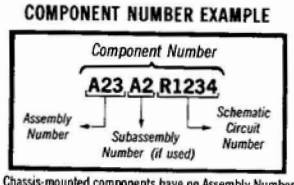

A
B
C
D
E
F
H
1
2
3
4
5
6
7
8
VOLTS/
J520
REAR HI INPUT
28B
S3-A
S2-D
C1114 0.1 600V
R1311 1K
DS1410 PROTECTOR
S1-F
S1-C
S2-F
S2-J
S2-E
J530
R1312
9A
9B
ATTENUATOR
R1312A 9.9M
C1312 26.5pF 1KV
10KHz AC ADJ
C1313 1-6.5pF
S1-K
S1-N
S1-R
R1312B 90K
R1312C 10K
S2-A
S2-C
S1-E
S1-B
C1311 330Ø
CR1302
C1300 .01
U1311 CA3140
+15.75V
R1302 5.1K
CR1301
+5V
R1412 900K
-12V
R1304 10.0K
S2-H
OHMS CONVERTER
-5.8V
Q1311
R1214 910
R1413 200
LO 2K ADJ
R1213 1K
VR1211 6.2V
HI ADJ
R1305 1K
S1-C
R1215 5.85K
R1425 900
R1426 90
S1-E
S1-J
S1-M
S1-S
R1521
R1521C 9
R1521B .9
R1521A .1
CURRENT SHUNTS
mA
J500
F1521 2A
CR1621
LOW
J510
REAR LO INPUT
28A
C1621 270 2KV
S3-B
TP1521
SHIELD
SHIELD
POWER SUPPLIES
T1001
CR1111
C1021 27 1KV
C1012 100µF 35V
C1111 47µF 35V
*U1121 79M12
C1123 5.6µF
≈+26V
≈-26V
13A
25V AC
13B
CR1011
≈+12V
C1011 330µF
*U1021 78M05
C1022 .1
*U1022 78M15
C1121 .1
S2-L
R1424 22K 2W
U1321 CA3140
+15.75V
C1322 .01
CR1421
CR1422
C1422 .01
C132 150
R1421 3.9K
NOTES: * TOP VIEW
U1021
U1022
U1121
DM 505
@ 2692-21

F | H | J | K | L | M




Static Sensitive Devices
*See Maintenance Section*

**COMPONENT NUMBER EXAMPLE**




Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

# PARTS LOCATION GRID

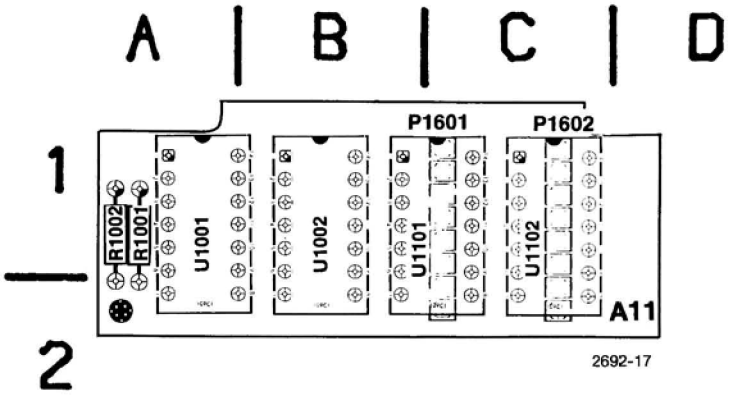
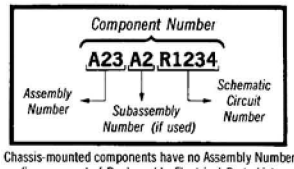



Fig. 8-11. Display Board (A11).

Static Sensitive Devices
*See Maintenance Section*

**COMPONENT NUMBER EXAMPLE**




Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

# Table 8-3
# COMPONENT REFERENCE CHART

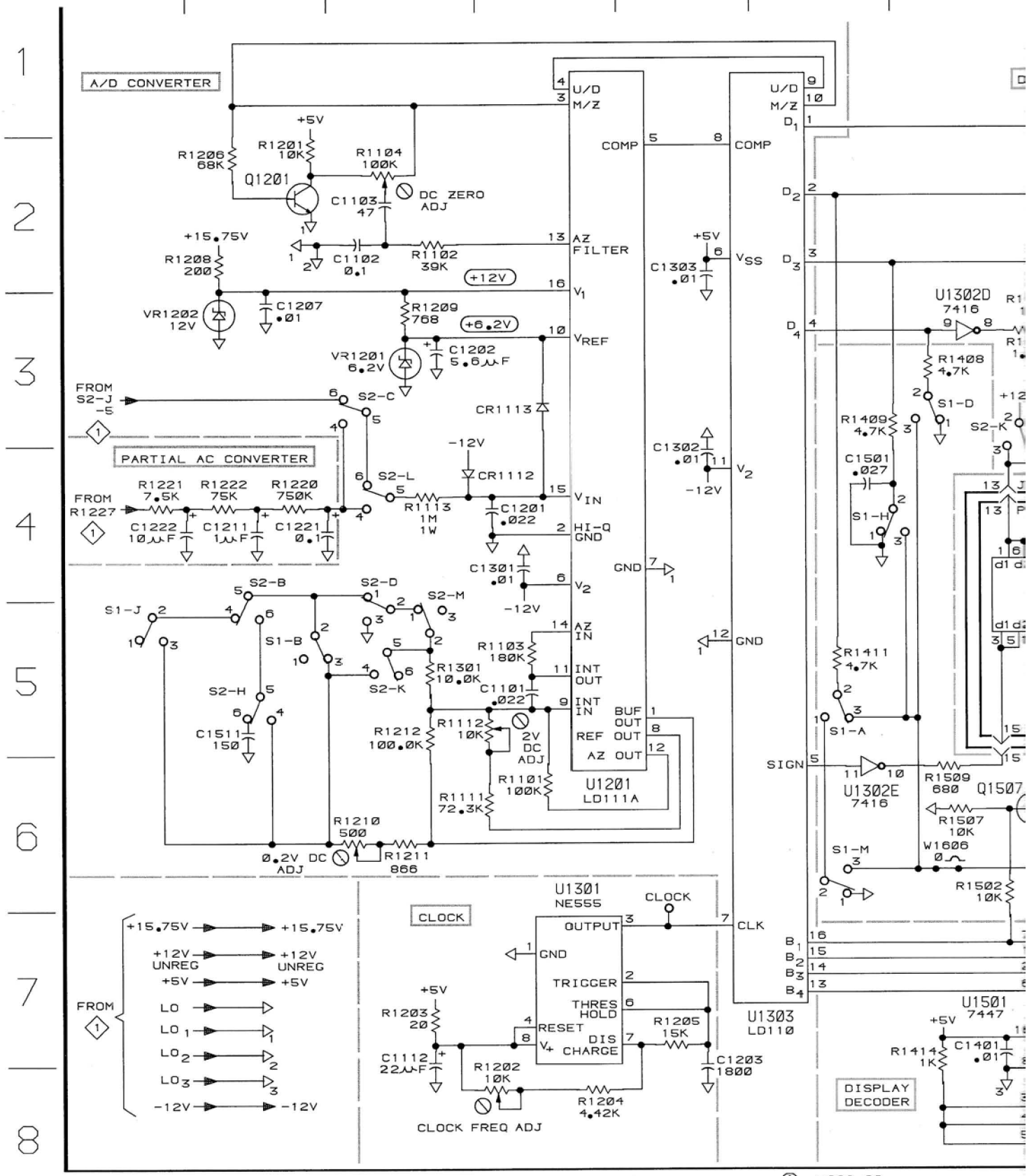
| P/O A10 ASSY | REFER TO FIG. 8-10 | A/D & DISPLAY ◇2 |
|---|---|---|

| Circuit Number | Schematic Location | Board Location | Circuit Number | Schematic Location | Board Location |
|---|---|---|---|---|---|
| C1101 | D5 | D2 | R1401 | M1 | J1 |
| C1102 | C2 | D1 | R1402 | K2 | J1 |
| C1103 | C2 | D1 | R1403 | L2 | J1 |
| C1112 | C7 | D3 | R1404 | H3 | K1 |
| C1201 | D4 | D2 | R1405 | J3 | K1 |
| C1202 | C3 | E2 | R1406 | J2 | K1 |
| C1203 | E8 | E1 | R1407 | L2 | K1 |
| C1207 | B3 | E2 | R1408 | H3 | J2 |
| C1211 | B4 | E4 | R1409 | F3 | J2 |
| C1221 | B4 | E5 | R1411 | F5 | J2 |
| C1222 | A4 | E5 | R1414 | H7 | K1 |
| C1301 | D4 | H2 | R1501 | J6 | L2 |
| C1302 | E4 | J2 | R1502 | H6 | L2 |
| C1303 | E2 | J2 | R1503 | J8 | L1 |
| C1304 | M2 | J1 | R1504 | J7 | M1 |
| C1401 | H7 | K1 | R1505 | J7 | M1 |
| C1501 | F4 | M2 | R1506 | J7 | M1 |
| C1511 | B5 | M4 | R1507 | H6 | M2 |
| | | | R1508 | J6 | M2 |
| CR1112 | C4 | D3 | R1509 | H6 | M2 |
| CR1113 | D3 | D3 | R1601 | J6 | N2 |
| | | | R1602 | J7 | N1 |
| J1601 | K5 | P1 | R1603 | J8 | N1 |
| J1602 | K4 | P1 | R1604 | J8 | N1 |
| | | | R1605 | J6 | N1 |
| Q1201 | B2 | D1 | | | |
| Q1402 | M2 | J2 | S1-A | F5 | P2 |
| Q1403 | L2 | J2 | S1-B | B5 | N2 |
| Q1404 | J2 | K2 | S1-D | H3 | P3 |
| Q1405 | K2 | K2 | S1-H | F4 | P3 |
| Q1406 | J6 | K2 | S1-J | A5 | N3 |
| Q1507 | H6 | M2 | S1-M | F6 | N4 |
| | | | S2-B | J4 | K2 |
| R1101 | D6 | D2 | S2-B | B5 | K2 |
| R1102 | C2 | D2 | S2-C | C3 | L3 |
| R1103 | D5 | D2 | S2-D | C4 | K3 |
| R1104 | C2 | D1 | S2-H | B5 | L4 |
| R1111 | D6 | D2 | S2-K | C5 | K4 |
| R1112 | D5 | D2 | S2-K | H3 | K4 |
| R1113 | C4 | D3 | S2-L | C4 | L5 |
| R1201 | B2 | E1 | S2-M | C5 | K5 |
| R1202 | D8 | E1 | | | |
| R1203 | C7 | E1 | U1201 | D6 | F2 |
| R1204 | D8 | F1 | U1301 | D7 | F1 |
| R1205 | E7 | F1 | U1302A | L1 | H1 |
| R1206 | B2 | F1 | U1302B | K2 | H1 |
| R1208 | B2 | E2 | U1302C | J2 | H1 |
| R1209 | C3 | E2 | U1302D | H3 | H1 |
| R1210 | C6 | E3 | U1302E | F6 | H1 |
| R1211 | C6 | F3 | U1303 | F7 | H2 |
| R1212 | C5 | F3 | U1501 | H7 | L1 |
| R1220 | B4 | E5 | | | |
| R1221 | A4 | E5 | VR1201 | C3 | E2 |
| R1222 | B4 | E5 | VR1202 | B3 | E2 |
| R1301 | C5 | H1 | | | |
| R1400 | M2 | J1 | W1606 | H6 | N1 |

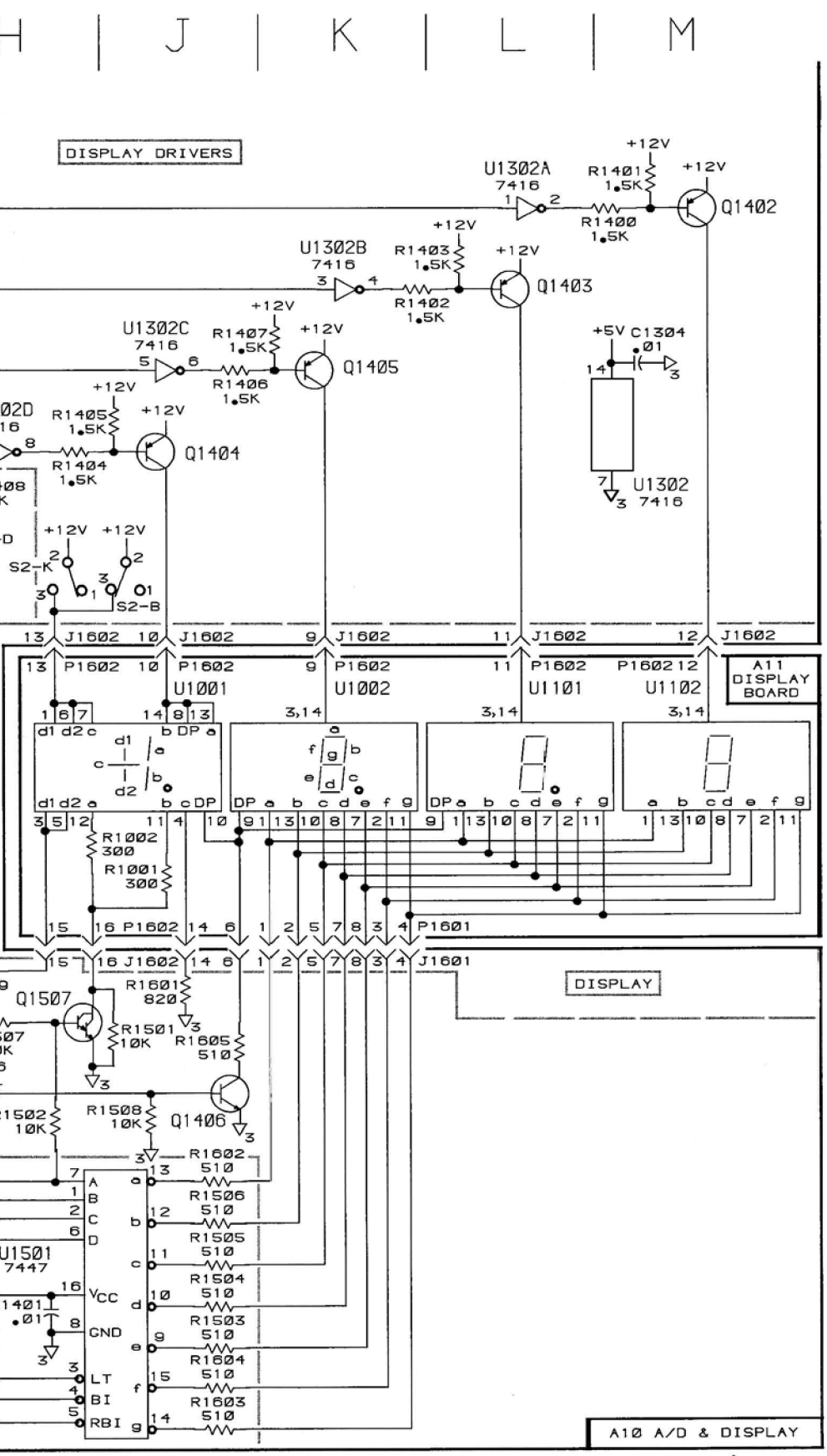
P/O A10 ASSY also shown on ◇1

| P/O A11 ASSY | | | | A/D & DISPLAY ◇2 | |
|---|---|---|---|---|---|
| P1601 | K5 | C1 | U1001 | J4 | A1 |
| P1602 | K4 | C1 | U1002 | K4 | B1 |
| | | | U1101 | M4 | B1 |
| R1001 | J5 | A1 | U1102 | L4 | C1 |
| R1002 | H5 | A1 | | | |

2692-20



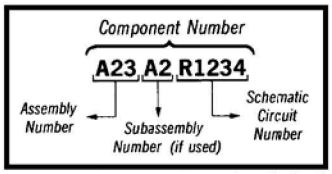

DM505




MAIN BOARD ◇2 JP

**Static Sensitive Devices**
*See Maintenance Section*

**COMPONENT NUMBER EXAMPLE**




Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

# REPLACEABLE MECHANICAL PARTS

## PARTS ORDERING INFORMATION

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

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

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

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

## SPECIAL NOTES AND SYMBOLS

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

## FIGURE AND INDEX NUMBERS

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

## INDENTATION SYSTEM

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

*1 2 3 4 5* *Name & Description*

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

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

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

## ITEM NAME

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

# ABBREVIATIONS

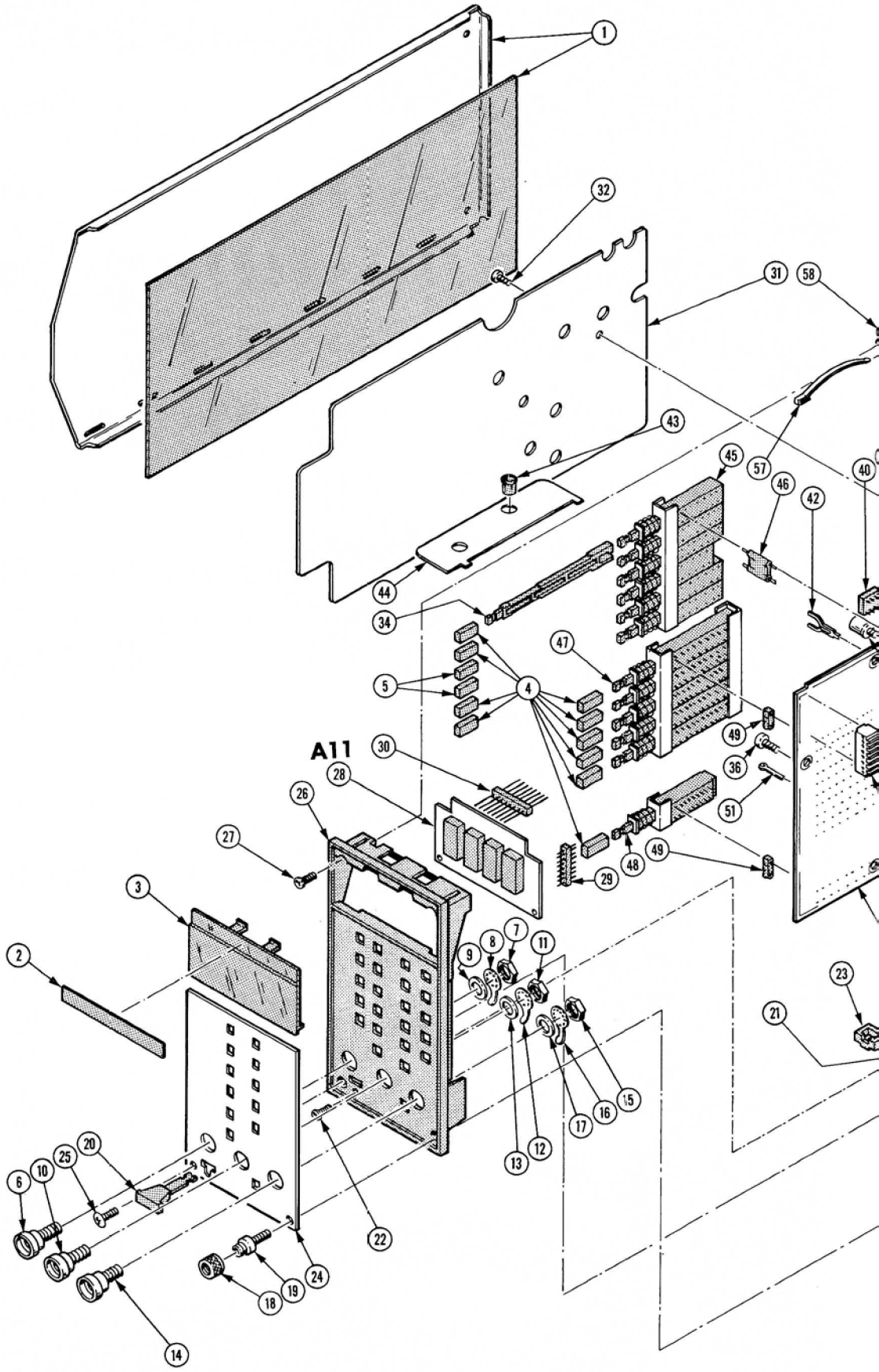
| | |
|---|---|
| " | INCH |
| # | NUMBER SIZE |
| ACTR | ACTUATOR |
| ADPTR | ADAPTER |
| ALIGN | ALIGNMENT |
| AL | ALUMINUM |
| ASSEM | ASSEMBLED |
| ASSY | ASSEMBLY |
| ATTEN | ATTENUATOR |
| AWG | AMERICAN WIRE GAGE |
| BD | BOARD |
| BRKT | BRACKET |
| BRS | BRASS |
| BRZ | BRONZE |
| BSHG | BUSHING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

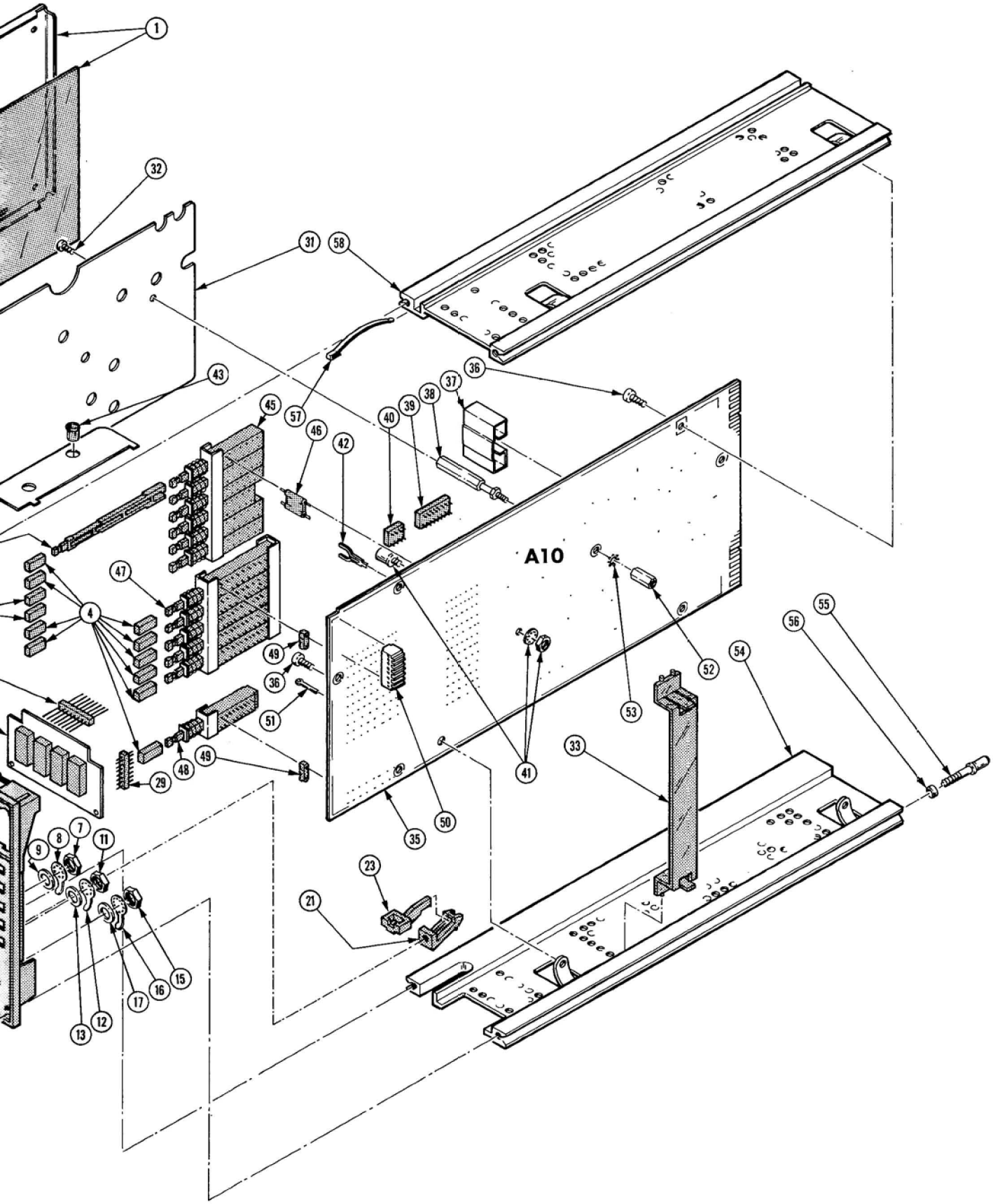
## CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

| Mfr. Code | Manufacturer | Address | City, State, Zip |
|---|---|---|---|
| 000BH | FAB-TEK | 17 SUGAR HALLOW ROAD | DANBURY, CT 06810 |
| 00779 | AMP, INC. | P O BOX 3608 | HARRISBURG, PA 17105 |
| 22526 | BERG ELECTRONICS, INC. | YOUK EXPRESSWAY | NEW CUMBERLAND, PA 17070 |
| 28520 | HEYMAN MFG. CO. | 147 N. MICHIGAN AVE. | KENILWORTH, NJ 07033 |
| 71590 | CENTRALAB ELECTRONICS, DIV. OF GLOBE-UNION, INC. | P O BOX 858 | FORT DODGE, IA 50501 |
| 73743 | FISCHER SPECIAL MFG. CO. | 446 MORGAN ST. | CINCINNATI, OH 45206 |
| 73803 | TEXAS INSTRUMENTS, INC., METALLURGICAL MATERIALS DIV. | 34 FOREST STREET | ATTLEBORO, MA 02703 |
| 78189 | ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION | ST. CHARLES ROAD | ELGIN, IL 60120 |
| 80009 | TEKTRONIX, INC. | P O BOX 500 | BEAVERTON, OR 97077 |
| 82647 | TEXAS INSTRUMENTS, INC., CONTROL PRODUCTS DIV. | 34 FOREST ST. | ATTLEBORO, MA 02703 |
| 83385 | CENTRAL SCREW CO. | 2530 CRESCENT DR. | BROADVIEW, IL 60153 |
| 86928 | SEASTROM MFG. COMPANY, INC. | 701 SONORA AVENUE | GLENDALE, CA 91201 |
| 87308 | N. L. INDUSTRIES, INC., SOUTHERN SCREW DIV. | P. O. BOX 1360 | STATESVILLE, NC 28677 |
| 93907 | CAMCAR SCREW AND MFG. CO. | 600 18TH AVE. | ROCKFORD, IL 61101 |

| 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 | 337-1399-07 | | | 2 | | SHIELD,ELEC:SIDE | 80009 | 337-1399-07 |
| -2 | 334-3315-00 | | | 1 | | MARKER,IDENT:MARKED DM505 MULTIMETER | 80009 | 334-3315-00 |
| -3 | 378-2030-00 | | | 1 | | LENS,LED DSPL:RED | 80009 | 378-2030-00 |
| -4 | 366-1559-00 | | | 10 | | PUSH BUTTON:GRAY | 80009 | 366-1559-00 |
| -5 | 366-1559-05 | | | 2 | | PUSH BUTTON:CHARCOAL GRAY | 80009 | 366-1559-05 |
| -6 | 136-0730-00 | | | 1 | | JACK,TIP:BLUE | 80009 | 136-0730-00 |
| | | | | | | (ATTACHING PARTS) | | |
| -7 | 210-0465-00 | | | 1 | | NUT,PLAIN,HEX.:0.25-32 X 0.375 INCH BRS | 73743 | 3095-402 |
| -8 | 210-0223-00 | | | 1 | | TERMINAL,LUG:0.25 INCH DIA,SE | 86928 | A313-136 |
| -9 | 210-0905-00 | | | 1 | | WASHER,FLAT:0.256 ID X 0.438 INCH OD,BRS | 83385 | OBD |
| | | | | | | - - - * - - - | | |
| -10 | 136-0498-00 | B010100 | B020289 | 1 | | JACK,TIP:BLACK | 80009 | 136-0498-00 |
| | 136-0731-00 | B020290 | | 1 | | JACK,TIP:BLACK | 80009 | 136-0731-00 |
| | | | | | | (ATTACHING PARTS) | | |
| -11 | 210-0465-00 | | | 1 | | NUT,PLAIN,HEX.:0.25-32 X 0.375 INCH BRS | 73743 | 3095-402 |
| -12 | 210-0223-00 | | | 1 | | TERMINAL,LUG:0.25 INCH DIA,SE | 86928 | A313-136 |
| -13 | 210-0905-00 | | | 1 | | WASHER,FLAT:0.256 ID X 0.438 INCH OD,BRS | 83385 | OBD |
| | | | | | | - - - * - - - | | |
| -14 | 136-0497-00 | B010100 | B020289 | 1 | | JACK,TIP:RED | 80009 | 136-0497-00 |
| | 136-0732-00 | B020290 | | 1 | | JACK,TIP:RED | 80009 | 136-0732-00 |
| | | | | | | (ATTACHING PARTS) | | |
| -15 | 210-0465-00 | | | 1 | | NUT,PLAIN,HEX.:0.25-32 X 0.375 INCH BRS | 73743 | 3095-402 |
| -16 | 210-0223-00 | | | 1 | | TERMINAL,LUG:0.25 INCH DIA,SE | 86928 | A313-136 |
| -17 | 210-0905-00 | | | 1 | | WASHER,FLAT:0.256 ID X 0.438 INCH OD,BRS | 83385 | OBD |
| | | | | | | - - - * - - - | | |
| -18 | 220-0633-00 | | | 1 | | NUT,PLAIN,KNURL:0.25-28 X 0.25 INCH L,BRS | 80009 | 220-0633-00 |
| -19 | 355-0170-00 | | | 1 | | STUD,SHOULDERED:6-32 X 0.40 INCH LONG | 80009 | 355-0170-00 |
| -20 | 366-1690-00 | | | 1 | | KNOB,LATCH: | 80009 | 366-1690-00 |
| -21 | 105-0719-00 | | | 1 | | LATCH,RETAINING:PLUG-IN | 80009 | 105-0719-00 |
| | | | | | | (ATTACHING PARTS) | | |
| -22 | 213-0113-00 | | | 1 | | SCR,TPG,THD FOR:2-32 X 0.312 INCH,PNH STL | 93907 | OBD |
| | | | | | | - - - * - - - | | |
| -23 | 105-0718-01 | | | 1 | | BAR,LATCH RLSE: | 80009 | 105-0718-01 |
| -24 | 333-2438-00 | | | 1 | | PANEL,FRONT: | 80009 | 333-2438-00 |
| | | | | | | (ATTACHING PARTS) | | |
| -25 | 211-0537-00 | | | 1 | | SCREW,MACHINE:6-32 X 0.375 INCH,TRH STL | 83385 | OBD |
| | | | | | | - - - * - - - | | |
| -26 | 386-4115-00 | | | 1 | | SUBPANEL,FRONT: | 80009 | 386-4115-00 |
| | | | | | | (ATTACHING PARTS) | | |
| -27 | 213-0192-00 | B010100 | B020289 | 2 | | SCR,TPG,THD FOR:6-32 X 0.50 INCH,PNH STL | 87308 | OBD |
| | 213-0789-00 | B020290 | | 2 | | SCREW,TPG,TF:6-32 X 0.375,TAPTITE,PNH | 93907 | OBD |
| | | | | | | - - - * - - - | | |
| -28 | ----- ----- | | | 1 | | CKT BOARD ASSY:DISPLAY(SEE A11 EPL) | | |
| -29 | 131-1857-00 | | | 1 | | . TERM. SET,PIN:36/0.025 SQ PIN,ON 0.1 CTRS | 22526 | 65500136 |
| -30 | 131-1934-00 | | | 1 | | . TERM. SET,PIN:1 X 36,0.1 CTR,0.9 L | 22526 | 65539-001 |
| -31 | 337-2616-00 | | | 2 | | SHIELD,ELEC:CIRCUIT BOARD | 80009 | 337-2616-00 |
| | | | | | | (ATTACHING PARTS | | |
| -32 | 211-0007-00 | | | 1 | | SCREW,MACHINE:4-40 X 0.188 INCH,PNH STL | 83385 | OBD |
| | | | | | | - - - * - - - | | |
| -33 | 407-2285-00 | | | 2 | | BRACKET,SHIELD:POLYCARBONATE | 80009 | 407-2285-00 |
| -34 | 384-1506-00 | | | 6 | | EXTENSION SHAFT:2.764 L X 0.187 OD | 80009 | 384-1506-00 |
| -35 | ----- ----- | | | 1 | | CKT BOARD ASSY:MAIN(SEE A10 EPL) | | |
| | | | | | | (ATTACHING PARTS) | | |
| -36 | 213-0146-00 | | | 4 | | SCR,TPG,THD FOR:6-20 X 0.313 INCH,PNH STL | 83385 | OBD |
| | | | | | | - - - * - - - | | |
| | ----- ----- | | | - | | . CKT BOARD ASSY INCLUDES: | | |
| -37 | 214-2518-01 | | | 1 | | . HEATSINK,XSTR:AL W/O TABS | 000BH | 332-012 |
| -38 | 129-0573-00 | | | 1 | | . SPACER,POST:0.188" HEX 1.627" L,AL | 80009 | 129-0573-00 |
| -39 | 136-0260-02 | | | 2 | | . SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE | 82647 | C9316-18 |
| -40 | 136-0514-00 | | | 1 | | . SOCKET,PLUG IN:MICROCIRCUIT,8 CONTACT | 73803 | CS9002-8 |
| -41 | ----- ----- | | | 1 | | . CAPACITOR:(SEE A10C1313 EPL) | | |
| -42 | 344-0154-00 | | | 4 | | . CLIP,ELECTRICAL:FOR 0.25 INCH DIA FUSE | 80009 | 344-0154-00 |
| -43 | 134-0151-00 | | | 2 | | . BUTTON,PLUG:0.25 MTG HOLEDIA,NYLON | 28520 | P250 |
| -44 | 337-2531-00 | | | 1 | | . SHIELD,ELEC:AC CONVERTER | 80009 | 337-2531-00 |
| -45 | ----- ----- | | | 1 | | . SWITCH,PUSH:(SEE A10S2 EPL) | | |

| Fig. & Index No. | Tektronix Part No. | Serial/Model No. Eff | Dscont | Qty | 1 2 3 4 5 | Name & Description | Mfr Code | Mfr Part Number |
|---|---|---|---|---|---|---|---|---|
| 1-46 | 361-0382-00 | | | 8 | | . SPACER,PB SW:BROWN,0.275 INCH LONG | 80009 | 361-0382-00 |
| -47 | ----- ----- | | | 1 | | . SWITCH,PUSH(SEE A1OS1 EPL) | | |
| -48 | ----- ----- | | | 1 | | . SWITCH,PUSH:(SEE A1OS3 EPL) | | |
| -49 | 361-0411-00 | | | 6 | | . SPACER,PUSH SW:0.13 W X 0.375 INCH L,PLSTC | 71590 | J64285-00 |
| -50 | 136-0632-00 | | | 2 | | . SOCKET,PLUG-IN:8 PIN,FEMALE | 00779 | 1-380949-8 |
| -51 | 214-0579-00 | | | 1 | | . TERM,TEST POINT:BRS CD PL | 80009 | 214-0579-00 |
| -52 | 220-0449-00 | | | 1 | | . NUT,SLEEVE:4-40 X 0.188 X 0.50" LONG | 80009 | 220-0449-00 |
| -53 | 210-0004-00 | | | 1 | | . WASHER,LOCK:#4 INTL,0.015THK,STL CD PL | 78189 | 1204-00-00-0541C |
| | 198-4215-00 | | | 1 | | WIRE SET,ELEC: | 80009 | 198-4215-00 |
| -54 | 426-0724-04 | B010100 | B020289 | 1 | | FR SECT,PLUG-IN:BOTTOM | 80009 | 426-0724-04 |
| | 426-0724-19 | B020290 | | 1 | | FR SECT,PLUG-IN:BOTTOM | 80009 | 426-0724-19 |
| -55 | 386-3657-01 | | | 2 | | SUPPORT,PLUG IN: | 93907 | OBD |
| -56 | 210-1270-00 | | | 2 | | WASHER,FLAT:0.141 ID X 0.04 THK,AL | 80009 | 210-1270-00 |
| -57 | 214-1061-00 | | | 1 | | SPRING,GROUND:FLAT | 80009 | 214-1061-00 |
| -58 | 426-1515-00 | | | 1 | | FR SECT,PLUG-IN:TOP | 80009 | 426-1515-00 |


A11


A10

| Fig. & Index No. | Tektronix Part No. | Serial/Model No. Eff | Dscont | Qty | 1 2 3 4 5 | Name & Description | Mfr Code | Mfr Part Number |
|---|---|---|---|---|---|---|---|---|
| | 070-2692-00 | | | 1 | | MANUAL,TECH:INSTRUCTION | 80009 | 070-2692-00 |
| | 003-0120-00 | | | 1 | | LEAD,TEST:PAIR | 80009 | 003-0120-00 |

## MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with the 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 the 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.

## SERVICE NOTE

Because of the universal parts procurement problem, some electrical parts in your instrument may be different from those described in the Replaceable Electrical Parts List. The parts used will in no way alter or compromise the performance or reliability of this instrument. They are installed when necessary to ensure prompt delivery to the customer. Order replacement parts from the Replaceable Electrical Parts List.

# CALIBRATION TEST EQUIPMENT REPLACEMENT

## Calibration Test Equipment Chart

This chart compares TM 500 product performance to that of older Tektronix equipment. Only those characteristics where significant specification differences occur, are listed. In some cases the new instrument may not be a total functional replacement. Additional support instrumentation may be needed or a change in calibration procedure may be necessary.

**Comparison of Main Characteristics**

| | | |
|---|---|---|
| DM 501 replaces 7D13 | | |
| PG 501 replaces 107 | PG 501 - Risetime less than 3.5 ns into 50 Ω. | 107 - Risetime less than 3.0 ns into 50 Ω. |
| 108 | PG 501 - 5 V output pulse; 3.5 ns Risetime | 108 - 10 V output pulse 1 ns Risetime |
| PG 502 replaces 107 | | |
| 108 | PG 502 - 5 V output | 108 - 10 V output |
| 111 | PG 502 - Risetime less than 1 ns; 10 ns Pretrigger pulse delay | 111 - Risetime 0.5 ns; 30 to 250 ns Pretrigger pulse delay |
| PG 508 replaces 114 | Performance of replacement equipment is the same or better than equipment being replaced. | |
| 115 | | |
| 2101 | | |
| PG 506 replaces 106 | PG 506 - Positive-going trigger output signal at least 1 V; High Amplitude output, 60 V. | 106 - Positive and Negative-going trigger output signal, 50 ns and 1 V; High Amplitude output, 100 V. |
| 067-0502-01 | PG 506 - Does not have chopped feature. | 0502-01 - Comparator output can be alternately chopped to a reference voltage. |
| SG 503 replaces 190, 190A, 190B | SG 503 - Amplitude range 5 mV to 5.5 V p-p. | 190B - Amplitude range 40 mV to 10 V p-p. |
| 191 | | |
| 067-0532-01 | SG 503 - Frequency range 250 kHz to 250 MHz. | 0532-01 - Frequency range 65 MHz to 500 MHz. |
| SG 504 replaces 067-0532-01 | SG 504 - Frequency range 245 MHz to 1050 MHz. | 0532-01 - Frequency range 65 MHz to 500 MHz. |
| 067-0650-00 | | |
| TG 501 replaces 180, 180A | TG 501 - Trigger output-slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time. | 180A - Trigger pulses 1, 10, 100 Hz; 1, 10, and 100 kHz. Multiple time-marks can be generated simultaneously. |
| 181 | | 181 - Multiple time-marks |
| 184 | TG 501 - Trigger output-slaved to market output from 5 sec through 100 ns. One time-mark can be generated at a time. | 184 - Separate trigger pulses of 1 and 0.1 sec; 10, 1, and 0.1 ms; 10 and 1 μs. |
| 2901 | TG 501 - Trigger output-slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time. | 2901 - Separate trigger pulses, from 5 sec to 0.1 μs. Multiple time-marks can be generated simultaneously. |

**NOTE: All TM 500 generator outputs are short-proof. All TM 500 plug-in instruments require TM 500-Series Power Module.**

REV B, JUN 1978

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COMMITTED TO EXCELLENCE

# MANUAL CHANGE INFORMATION

Date: 3-17-80 Change Reference: C2/380

Product: DM 505 Manual Part No.: 070-2692-00

## DESCRIPTION

TEXT CORRECTIONS

Page 4-5 Step 5. parts d. and e.

CHANGE TO READ:

d. Set the ac calibrator for 0.224 Vac rms at 50 Hz ±0.2 Hz or 60 Hz ±0.2 Hz.

e. CHECK--that the maximum display reading is ≤1.0.