

# Instruction Manual

**Tektronix**

**DM 504A**  
**Auto Ranging Digital Multimeter**  
**070-6945-00**

**Warning**

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

**Please check for change information at the rear of this manual.**

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## WARRANTY

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; or c) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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**Grounding the Product**

When installed in the power module, this product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. 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.

# SPECIFICATION

## Instrument Description

The DM504A Digital Multimeter measures dc and ac voltage and current, resistance, and temperature. Temperature measurements are made using a Tektronix P6602 temperature probe or equivalent platinum resistance temperature probe. The ac functions are true rms responding. In the 20M ohm, 200K ohms and 2K ohms ranges a "diode measurement indicator" illuminates indicating that  $V_{max}$  is adequate for diode testing. In the 200 ohms range a "beeper indicator" illuminates indicating that a beeper will sound for measurements of less than 10 ohms. All measurement ranges, except temperature, diode measurement and beeper, can be automatically or manually selected.

The readout is a 4-1/2-digit display in all ranges except temperature and beeper. The decimal point is automatically adjusted according to the operating range of the instrument. Polarity indication is automatic.

## Performance Conditions

The electrical characteristics are valid only if the DM 504A has been calibrated at a temperature between +21 °C and +25 °C and is operating at an ambient temperature between 0 °C and +50 °C. Items listed in the Performance Requirements column of the Electrical Characteristics are verified by completing the Performance Check in the Calibration Section of the *DM 504A Service Manual*. Items listed in the Supplemental Information column are not verified in the service manual. They are either explanatory notes or performance characteristics for which no limits are specified.

## ELECTRICAL CHARACTERISTICS

Table 1-1  
DC VOLTMETER

Characteristics	Performance Requirements	Supplemental Information
Accuracy for 200 mV, 2V, 20V, 200V, and 1000V ranges		Automatic or manual ranging
+18 °C to 28 °C		
200 mV range	+/- (0.05% of reading + 0.02% of full scale)	
2V range	+/- (0.05% of reading + 0.01% of full scale)	
20V range	+/- (0.05% of reading + 0.02% of full scale)	
200V range	+/- (0.05% of reading + 0.01% of full scale)	
1000V range	+/- (0.05% of reading + 0.02% of full scale)	

Table 1-2(cont)

Characteristics	Performance Requirements	Supplemental Information
0 °C to 18 °C, 28 °C to 50 °C	+/- (0.8% of reading +0.11% of full scale)	
200 mV to 200V range		Input signal must be between 10% and 100% of full scale. For signals <25% and 10 kHz-20 kHz add 4.1% additional error
30 Hz to 20 kHz		
500V range		Input signal must be between 100V and 500V
60 Hz to 20 kHz	+/- (0.9% of reading +0.1% of full scale)	
40 Hz to 60 Hz	+/- (1.3% of reading +0.1% of full scale)	
Common Mode Rejection Ratio	≥+60 dB at 50 or 60 Hz	With a 1 kΩ unbalance
Maximum Resolution		10 μV
Response Time		<2 seconds
Input Impedance		10 MΩ +/-0.5% paralleled by <100 pF
Maximum Input Voltage		
VOLTS/Ω/TEMP to LOW		500V AC RMS or 600V DC, not to exceed 1000V peak
VOLTS/Ω/TEMP to GND		1000V peak
LOW to GND		1000V peak
Crest Factor		5 at full scale on all ranges except 500V (500V = 2)

**Table 1-4  
DC AMMETER**

Characteristics	Performance Requirements	Supplemental Information	
Accuracy for 200 $\mu$ A, 2 mA, 20 mA, 200 mA, and 2000 mA ranges		Automatic or manual ranging	
+18 °C to 28 °C	+/- (0.1% of reading +0.01% of full scale)		
0 °C to 18 °C, 28 °C to 50 °C	+/- (0.3% of reading +0.025% of full scale)		
Response Time		<1 second	
Input resistance		Range	Resistance
		200 $\mu$ A	1.0 k $\Omega$
		2 mA	100.0 $\Omega$
		20 mA	10.2 $\Omega$
		200 mA	1.2 $\Omega$
		2000 mA	0.26 $\Omega$
Maximum open circuit input voltage (mA to LOW)		250V peak	
Maximum input current		2A any range	
Maximum floating voltage			
mA to GND		1000V peak	
LOW to GND		1000V peak	
Maximum Resolution		10 nA	



**Table 1-6  
TEMPERATURE**

<b>Characteristics</b>	<b>Performance Required</b>	<b>Supplemental Information</b>
Accuracy -62 °C +230 °C		Using a Tektronix P6602 temperature probe.
+18 °C to +28 °C ambient		
Probe calibrated to instrument	+/-0.6 °C from -62 °C to +150 °C +/-1.6 °C from +150 °C to +230 °C	Probe/DMM calibration performed at 0°C and 100°C.
Any probe	+/-3.5 °C from -62 °C to +150 °C +/-6 °C from +150 °C to +230 °C	
0 °C to + 18 °C, +28 °C to +50 °C ambient		
Probe calibrated to instrument	+/-1.5 °C from -62 °C to +150 °C +/-2.5 °C from +150 °C to +230 °C	Probe/DMM Calibration performed at 0°C and 100°C.
Any Probe	+/-4.5 °C from -62 °C to +150 °C +/-7 °C from 150 °C to +230 °C	

**Table 1-7  
MISCELLANEOUS**

<b>Characteristics</b>	<b>Performance Requirement</b>	<b>Supplemental Information</b>
Power consumption		Less than 8W
Reading rate		>2.0 times per second.
Over-range indication		Flashing display
Warm-up time		30 minutes (60 minutes after storage in high humidity environment)

Table 1-8(cont)

Characteristics	Description	Supplemental Information
E.M.C. Operating	30 Hz to 1 GHz <sup>5</sup>	Meets or exceeds MIL-T-28800D, class 3.
Electrical Discharge Operating	20 kV maximum <sup>5</sup>	No MIL-T-28800D equivalent. Charge applied to each protruding area of the front panel except the input connectors.
Transportation	Package Vibration 1 inch (25 mm) peak to peak at 270 RPM for 1 hour. Package Drop 10 drops from 3 feet (91 cm).	Qualified under National Safe Transit Association Preshipment Test Procedures project: 1A-B-1 and 1A-B-2.

Table 1-9  
TM500 Systems  
ENVIRONMENTAL SPECIFICATIONS

Characteristics	TM 501	TM 503(A)	TM 504	TM506(A)	TM 515
Temperature Operating Non-operating	Meets same test standards as plug-in.				
Humidity Operating Non-operating	Meets same test standards as plug-in.				
Altitude Operating Non-operating	Meets same test standards as plug-in.				
Vibration Operating	0.26 mm (0.010 inch) displacement, 10-55 Hz (sine wave). 75 minutes total			0.38 mm (0.015 inch) displacement, 10-55 Hz (sine wave). 75 minutes total.	

<sup>5</sup> With power module.

# OPERATING INSTRUCTIONS

## Installation and Removal

The DM 504A is calibrated and ready for use when received. It operates in any compartment of a TM 500 series power module. See the power module instruction manual for line voltage requirements and power module operation. Figure 2-1 shows the DM 504A installation and removal procedure.

### CAUTION

*Turn the power off before inserting the DM 504A. Otherwise, arcing may occur at the rear interface connectors, reducing their useful life and damage may be done to the plug-in circuitry.*

Before installing the DM 504A in the power module, check to see that the plastic barriers on the interconnecting jack of the selected power module compartment match the cutouts in the DM 504A circuit board edge connector.

Align the DM 504A chassis with the upper and lower guides of the selected compartment. Press the DM 504A in and firmly seat the circuit board in the interconnecting jack.

To remove the DM 504A, pull the release latch (located in the lower left corner of the front panel) until the interconnecting jack disengages and the DM 504A slides out.

Check that the DM 504A is fully inserted in the power module. Pull the power switch on the power module. One or more characters in the LED display should now be visible.

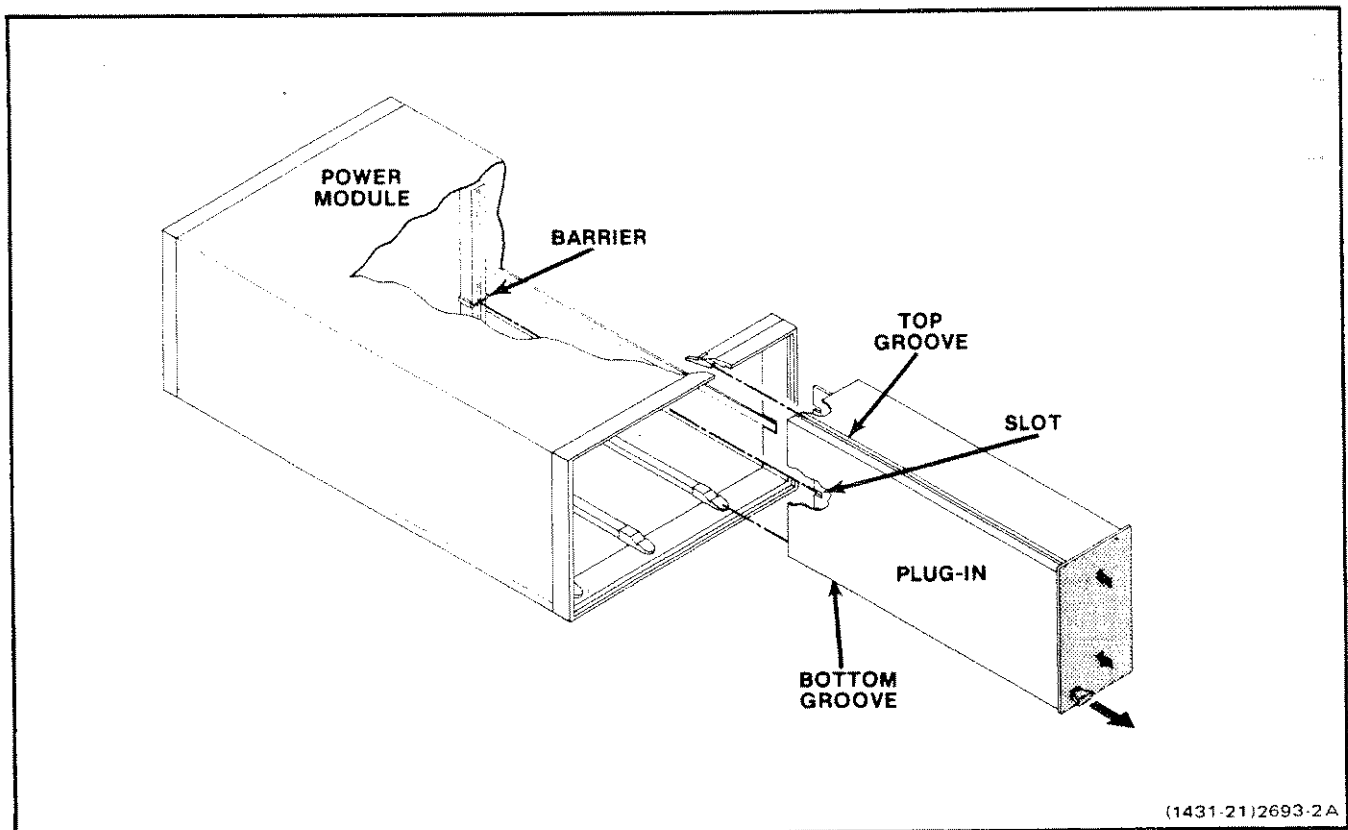


Fig. 2-1. Installation and removal.

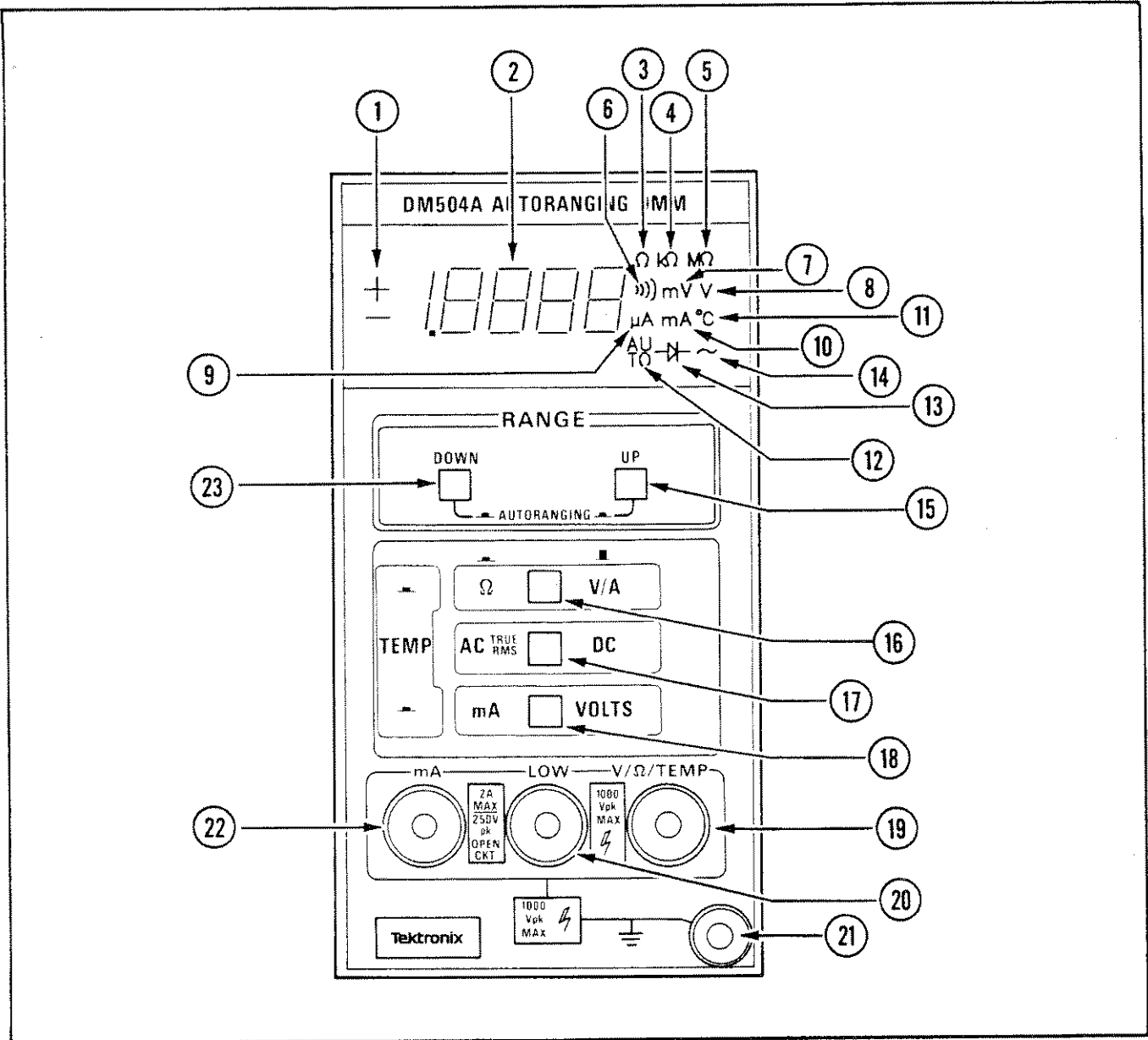


Fig. 2-2. Front Panel controls and connectors.

The beeper range can be selected by pressing the DOWN button when the instrument is in the 200 $\Omega$  range. The readout is limited to 3-1/2 digits in the beeper range. When the DM 504A is in the beeper mode, it produces a continuous tone when it measures resistance values below 10 $\Omega$ . This feature can be useful when making continuity measurements. The measurement rate is up to 8 readings/second in the beeper range.

In the 2 k $\Omega$ , 200 k $\Omega$ , and 20 M $\Omega$  ranges, the diode symbol in the display illuminates to indicate that you can make diode measurements. The source current is 1 mA in the 2 k $\Omega$  range, 10  $\mu$ A in the 200 k $\Omega$  range, and 0.1  $\mu$ A in the 20 M $\Omega$  range.

### Current Measurements

$\Omega$ - V/A	Button out
AC - DC	Button pushed in (AC) or button out for (DC)
mA - VOLTS	Button in

In the ac mode, the RMS value of the ac current is measured. Connect the ac or dc current to be measured to the mA and LOW input connectors. Observe the maximum voltage ratings. Use the UP or DOWN buttons to select the current measurement range or autoranging. The current measured is displayed by the 4-1/2-digit readout. Polarity is measured with respect to the LOW input connector.

### Temperature Measurements

$\Omega$ - V/A	Button in
AC - DC	Button pushed in or out
mA - VOLTS	Button in

#### NOTE

*For best accuracy use a TEKTRONIX P6602 Temperature Probe that has been calibrated with the individual instrument.*

Connect the TEKTRONIX P6602 Temperature Probe to the LOW and V/ $\Omega$ /TEMP input connectors. The temperature is displayed by the 4-digit readout. The polarity of the readout indicates if the temperature is over 0  $^{\circ}$ C (+) or below 0  $^{\circ}$ C (-).

Apply the probe sensor tip to the device being measured. For the best temperature transfer, coat the surface of the device being measured with silicone grease and apply the probe tip squarely to the surface. Allow sufficient time for the probe tip to stabilize before taking a reading. The time required depends on several factors. Generally, when the tip is first applied to the device under test, readings change less rapidly and finally stabilize. Refer to Section 1 for more information on the specifications of the TEKTRONIX P6602 Temperature Probe.

### Repackaging Information

If the DM 504A is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing the owner (with address) and the name of an individual at your firm who 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 its finish. Obtain a carton of corrugated cardboard with a carton test strength of 200 pounds per square inch. the carton should have inside dimensions of no less than six inches more than the instrument's dimensions. Cushion the instrument by tightly packing three inches of dunnage or urethane foam between carton and instrument on all sides. Seal the carton with shipping tape or an industrial stapler.

## Warning

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



# MAINTENANCE

## Introduction

This section provides general maintenance information.

## Recalibration

To assure accurate measurements, check the calibration of this instrument after each 1000 hours of operation or every six months if used infrequently.

## Cleaning Instructions

This instrument should be cleaned as often as operating conditions require. Accumulation of dirt on components may act as an insulating blanket and prevents efficient heat dissipation that can cause overheating and component breakdown.

Use a non-residue type of cleaner; preferable isopropyl alcohol or denatured ethyl alcohol. Before using any other type of cleaner consult your Tektronix Service Center or representative.

**Exterior:** Loose dust accumulated on the front can be removed by a soft cloth or a small brush. Dirt that remains can be removed with a soft cloth dampened with a mild detergent and water solution. Do not use abrasive cleaners.

**Interior:** It is recommended that in cleaning the interior that the accumulated dust be first blown off with dry low pressure air, then use a soft brush to remove any remaining dust.

If further cleaning is required, use a mild detergent and water solution.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

100

100





1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100