

MODEL 310-FET TYPE 2 HAND-SIZE VOM

TTT **TRIPLETT**
INSTRUCTION MANUAL

Instruction Manual



Triplett

Model 310-FET Type 2

Hand-Size VOM

Triplett Corporation

One Triplett Drive

Bluffton, Ohio 45817

SAFETY RULES

WARNING

This tester has been designed with your safety in mind. However, no design can completely protect against incorrect use. Electrical circuits can be dangerous and/or lethal when lack of caution or poor safety practices are used.

READ THE MANUAL

Read this Instruction Manual carefully and completely.

Voltages and currents within the capability of this test equipment can be hazardous. Follow the instructions in this manual for every measurement. Read and understand the general instructions before attempting to use this tester. Do not exceed the limits of the tester.

SAFETY CHECK

Double check the switch setting and lead connections before making measurements. Are you following all of the instructions?

Disconnect the tester or turn off the power before changing switch positions.

Do not connect to circuits with voltage present when switch is in any ohms or current position.

When replacing fuses use only specified type fuses and insert in correct fuse holder.

DON'T TOUCH

Don't touch exposed wiring, connections or other "live" parts of an electrical circuit. If in doubt, check the circuit first for voltage before touching it.

Turn off the power to a circuit before connecting test probes to it. Be sure there is no voltage present before you touch the circuit.

Do not use cracked or broken test leads.

HIGH VOLTAGE IS DANGEROUS

Always start with the power off. Be sure there is no voltage present before making connections to the circuit.

Don't touch the tester, its test leads, or any part of the circuit while it is on.

Before disconnecting the tester, turn the circuit off and wait for the meter to return to "zero."

DISTRIBUTION CIRCUITS PACK A PUNCH

In high energy circuits such as distribution transformers and bus bars, dangerous arcs of explosive nature can occur if the circuit is shorted. If the tester is connected across a high energy circuit when set to a low resistance range, a current range, or any other low impedance range, the circuit is virtually shorted.

Special equipment designed for use with these circuits is available. Contact a qualified person for assistance before attempting to make measurements on any high energy circuit.

W A R N I N G

**REMOVE CLAMP-ON AC AMMETER
ADAPTER FROM TESTER WHEN
MEASURING VOLTAGE**

SAFETY IS NO ACCIDENT

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DC Volts

Ranges:

0-.3, 1.2, 6, 30, 120, 600

Input Resistance:

10 Megohms

Accuracy:

± 3% of full scale value

AC Volts

Ranges:

0-3, 12, 60, 300, 600 (5,000 ohms per volt)

Accuracy:

± 4% of full scale value (on 60 Hz sine wave at 77°F)

Ohms

Ranges:

0-5k, 500k, 50M, 5000M

Accuracy:

± 3% of DC scale length with fully charged battery

Ohmmeter Specifications

	Range			
	X1	X100	X10K	X1M
Max. Voltage (Volts)	1.6	1.6	1.6	1.6
Max. Current (mA)	32 mA	.32 mA	3.2 μ A	.032 μ A
Max. Power (mW)	12.8 mW	.128 mW	1.28 μ W	.0128 μ W

6 SPECIFICATIONS (Cont'd.)

DC Milliamperes

Ranges:

0-.12, 1.2

Accuracy:

$\pm 3\%$ of full scale value

Current Range	Approximate Full Scale Voltage Drop
0-.12, 1.2 mA	300 mV

Meter:

50 μ A (Suspension)

Overload Protection

RX1 range protected by fuse.

Polarity Reversal

The polarity switch reverses the polarity of the tester on all DCV, mA and resistance ranges.

Test Lead Polarity

DC Voltage: Lead connected to VOM jack is positive with polarity reversal switch in + position.

DC Current: Lead connected to COM jack is positive with polarity reversal switch in + position.

Ohms: Positive terminal of ohmmeter battery is connected to the VOM jack with polarity switch in + position.

Batteries

One 1.5 volt "N" size (NEDA 910A)

One 15 volt Eveready 504 (NEDA 220)

Weight

Approximately 14 oz.

Accessories supplied with the Model 310-FET

1. One red and one black test lead
2. Insulated screw-on alligator clips
3. Batteries: 1 - 1.5 V; 1 - 15 V
4. Instruction Manual

The Triplett Model 310-FET is a pocket size FET Volt-Ohm-Milliameter. It features ranges, sensitivity and accuracies comparable to larger bench size VTVM's.

It offers overload protection against damage to the meter movement caused by accidental overloads and a fuse to protect the RX1 range. The fuse and batteries can be easily replaced by removing the cover on the back.

The DC Voltage ranges have a constant input resistance of 10 Megohms.

The AC Voltage ranges have sensitivities of 5000 ohms per volt.

Directly under the ohms adjust control is a polarity reversing switch for the DC voltage, current and resistance measurements. With the switch in the UP position a positive voltage is applied to the VOM terminal during resistance measurements. In the DOWN position a negative potential is applied to the VOM jack.

The alligator clips provided with the tester screw on the end of the test probes. These alligator clips allow measurement without handling the test probes. **ALWAYS SHUT OFF THE POWER** source before attempting to connect alligator clips.

When the approximate value of the quantity being measured is not known, **ALWAYS START ON THE HIGHEST RANGE**. For greater accuracy, choose the range which will allow readings to be taken in the upper (right hand) portion of the scale.

Readings are taken on the scale having the appropriate significant figures (both 3 and 300 volts are read on the 0-300 scale) by multiplying or dividing by a factor of 10 or 100 as indicated by the range/scale ratio (i.e.; on the 3 volt range divide the scale readings by 100).

The test probes should be disconnected from the voltage source (or the source shut off) before the switch position is changed. This practice will result in an increased life and reliability for the tester as well as a good safety practice.

Mechanical Zero:

The Meter Zero Adjust Screw is located near the center of the tester. It should be periodically

10 GENERAL INSTRUCTIONS (Cont'd.)

adjusted so the meter pointer is on zero with the tester in the off position (ACV) and with no input into the tester.

Electrical Zero:

DCV and DCmA

The tester is turned on by setting the range selector switch to the DCV or DCmA position.

To zero the pointer, short test leads together and adjust the ZERO ADJUST CONTROL located in the center of the range switch lever for a zero indication on the meter.

The tester is now ready for use on DCV and DCmA measurements.

Ohms

The tester is turned on by setting the range selector switch to the Ohms position.

To zero the pointer, short test leads together and adjust the ZERO ADJUST CONTROL so the pointer indicates zero. Open the test leads and adjust the OHMS ADJUST CONTROL to full scale or ∞ .

Test Leads:

Check the test leads periodically. Leads that are worn, have damaged insulation, damaged plugs, damaged probes or loose parts should be replaced.

GENERAL INSTRUCTIONS (Cont'd.) 11

The polarity reversal switch should be checked before making DC voltage, DC current or resistance measurements.

Readings on the sensitive voltage, current and resistance ranges may sometimes be different than calculated values. Thermo-electric or electro-chemical reactions can sometimes generate voltage (and current) in a circuit due to elevated temperatures from soldering, contact of dissimilar metals, chemical fumes or moisture. Also, the fingers should never touch the metal parts of the test probes since body resistance can cause erroneous readings — particularly on the high ohmmeter ranges.

Care:

Although this instrument is portable and rugged it should be treated with care. Do not drop it or handle it roughly.

Avoid placing it on a bench where machine tools are used or severe vibration is encountered.

When possible keep it in a place of moderate temperature. Avoid subjecting it to extreme temperatures and severe temperature changes.

If the tester has not been used for a long period of time, rotate the switch in both directions several times to wipe the switch contacts for good contact.

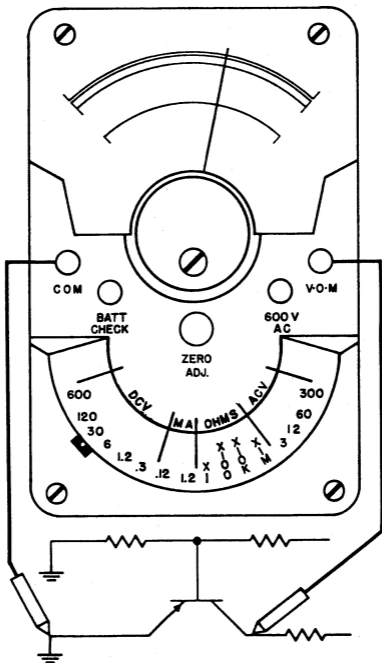
12 DC VOLTAGE MEASUREMENTS

0-.3 thru 0-600 Volts:

- 1. Insert test leads in VOM and COM jacks.**
- 2. Set switch to appropriate DCV range.**
- 3. Check setting of polarity reversal switch.**
- 4. Check electrical zero.**
- 5. Connect probes across to voltage to be measured.**
- 6. Read voltage on black AC-DC scale.**

DO NOT TOUCH THE VOM while it is connected to high voltage!

BE CAREFUL around high voltage!



14 AC VOLTAGE MEASUREMENTS

0-3 thru 0-300 Volts:

- 1. Insert test leads in VOM and COM jacks.**
- 2. Set switch to appropriate ACV range.**
- 3. Connect probes across voltage to be measured.**
- 4. Read 0-3 volts on red AC scale, read all others on black AC-DC scale.**

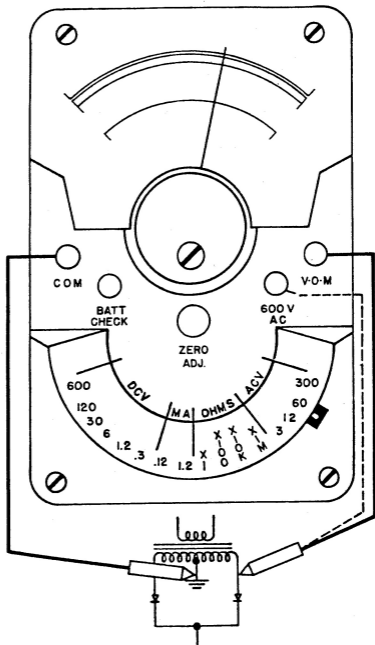
0-600 Volts:

- 1. Insert test leads in COM and 600 ACV jacks.**
- 2. Set switch to 300 ACV.**
- 3. Connect probes across voltage to be measured.**
- 4. Read voltage on black AC-DC scale.**

DO NOT TOUCH THE VOM while it is connected to high voltage!

BE CAREFUL around high voltage!

NOTE: For AC Amps measurements with the Model 10, disconnect the test leads. The range switch should be set to 3 ACV.



16 RESISTANCE MEASUREMENTS

X1 thru X1 Meg:

- 1. Insert test leads into VOM and COM jacks.**
- 2. Set switch to appropriate OHMS range.**
- 3. Check electrical zero.**
- 4. Short test probes together.**
- 5. Adjust OHMS ADJUST CONTROL until meter reads ∞ .**
- 6. Connect probes to component to be measured.**
- 7. Read ohms on OHMS scale (multiply value read by multiplier indicated by the switch).**

A fuse protects the X1 range against accidental overloads. If the fuse should blow, all OHMS ranges will not operate.

DO NOT TOUCH circuit, while making measurements.

DISCONNECT or ISOLATE the device being tested from other circuitry.

NOTE: 1K equals 1000.

To Measure	Set Range Switch	Leads Conn Black Lead Red Lead List
DC Volts		
0-.3	DCV .3	V-O-M
0-1.2	DCV 1.2	V-O-M
0-6	DCV 6	V-O-M
0-30	DCV 30	V-O-M
0-120	DCV 120	V-O-M
0-600	DCV 600	V-O-M
AC Volts		
0-3	ACV 3	V-O-M
0-12	ACV 12	V-O-M
0-60	ACV 60	V-O-M
0-300	ACV 300	V-O-M
0-600	ACV 300	600 V AC
OHMS		
0-5K	X1	V-O-M
0-500K	X100	V-O-M
0-50 Meg.	X10K	V-O-M
0-5000 Meg.	X1M	V-O-M
DCMA		
.12	MA .12	V-O-M
1.2	MA 1.2	V-O-M

Connections
and "COM"
Listed Below

Read on
Scale

Each Scale
Div. Equals

300 ÷ 1000	.005 Volts
12 ÷ 10	.02 Volts
60 ÷ 10	.1 Volts
300 ÷ 10	.5 Volts
12x10	2 Volts
60x10	10 Volts

AC

3 V AC	.05 Volts
12	.2 Volts
60	1 Volts
300	5 Volts
60x10	10 Volts

0-5K
0-5Kx100
0-5Kx10K
0-5Kx1 Meg.

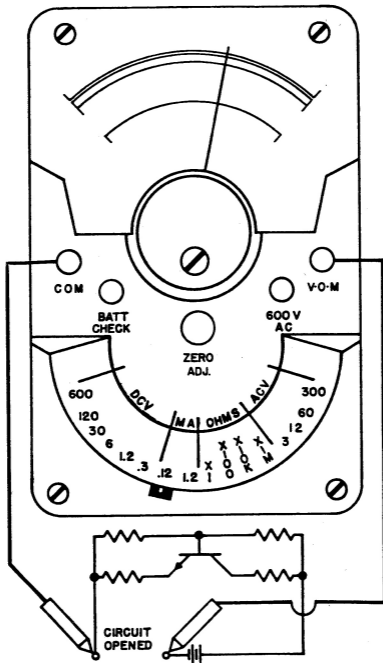
12 ÷ 100K	2 Mic.
12 ÷ 10K	20 Mic.

20 DC CURRENT MEASUREMENTS

0-.12 thru 0-1.2 Milliampere

- 1. Insert test leads into VOM and COM jacks.**
- 2. Set switch to appropriate MA range.**
- 3. Check setting of polarity reversal switch.**
- 4. Check electrical zero.**
- 5. Connect the probes in series with the circuit on.**
- 6. Turn circuit on.**
- 7. Read current on black AC-DC scale.**

DISCONNECT POWER before connecting the Model 310-FET into the circuit.

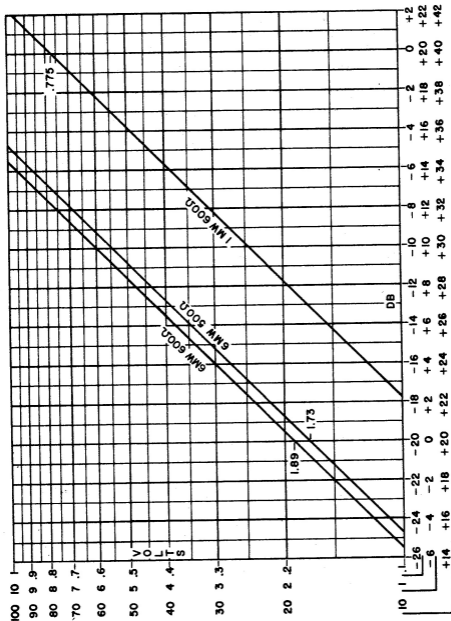


22 DECIBEL MEASUREMENTS (dB)

The decibel is a unit that expresses the ratio of power levels. It is mathematically derived to reduce multiplication and division to addition and subtraction, respectively. The decibel measure, roughly approximates human hearing ratios. For this reason, it is commonly used in audio and telephone measurements.

Because the decibel represents a ratio, it may be used as a measure of absolute magnitude only when referred to a reference level.

To measure decibels set the tester for AC volts. Convert the readings to decibels with the aid of the chart on page 23.



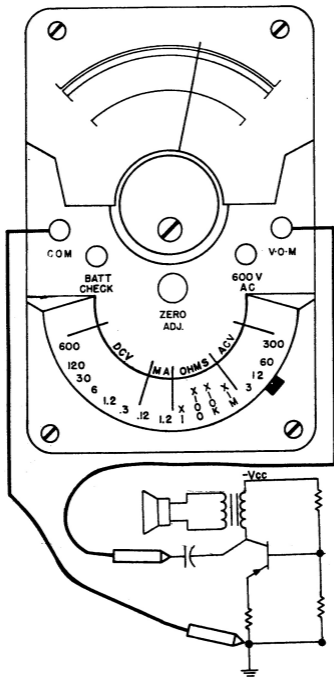
24 MEASURING OUTPUT VOLTAGE

Output voltage is the AC part of a combined AC and DC voltage. Such a voltage is usually found in amplifier circuits, but it may also be found in other circuits. To measure output voltage, the DC part of the combined voltage must be removed or "blocked." This is done by inserting a .1 μ F 500 DCV capacitor in series with the AC voltage section of the VOM.

1. Insert test leads into VOM and COM jacks.
2. Set switch to appropriate ACV position.
3. Place capacitor in series with the VOM lead.
4. Connect capacitor lead and COM probe across voltage to be measured.
5. Read voltage on black AC-DC scale.

The impedance of the capacitor is generally insignificant at audio frequencies. However, it may cause the meter to read low at low frequencies. Its effect should be considered in critical low frequency measurements.

OBSERVE ALL SAFETY PRECAUTIONS

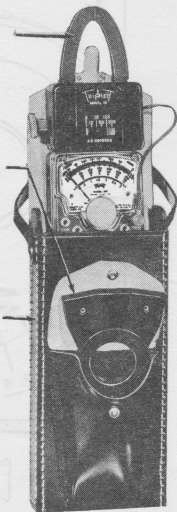


Model 10 Clamp-on AC Ammeter — Cat. No. 60-211*
Ranges, 0-6-12-30-60-120-300

Model 101 Line Separator —
 Cat. No. 60-218 — Divides two
 conductor cords direct or in-
 creases Model 10 sensitivity 10x
 and 20x.

Model 379 Carrying Case —
 Cat. No. 10-1456 For Model 310
 and Model 10 combination, plus
 Model 101.

Model 311 Lead — Cat. No.
 79-416 42" long lead to separate
 Model 10 from 310 unit for easy
 reading in awkward spots. (not
 shown)



Model 369 Carrying Case —
 Cat. No. 10-1258.

*Use Model 10 Type 2 only.

Battery Check and Replacement

The tester utilizes two batteries, a 15 volt battery to power the FET bridge circuit and 1 ½ volt battery for the Ohms circuit.

The 15 volt battery is checked by: placing the range selector in the battery check position (3ACV), polarity reversing switch in UP (+) position and touching the red test lead probe from the VOM jack to the BATT. TEST button located on the left center of the tester. The pointer on the scale should fall in the BATT. OK block. If it doesn't replace the 15 volt battery.

If the pointer cannot be adjusted to full scale on the OHMS ranges, replace the 1.5V battery.

Battery Cover Latch Repair

If the slide on the battery cover breaks, order a new battery cover assembly. To repair the tab on the tester body, order the battery cover latch repair kit.

Fuse Replacement

If none of the OHMS ranges work, replace the fuse. Use a ¼ AMP 8AG, MKB, or equivalent fuse.

Cleaning Plastic Window

The plastic window has been treated at the factory to dissipate static charges. If cleaning is necessary, use cotton dipped in a solution of common household detergent and water. After cleaning, allow the solution to dry without rubbing; the resultant detergent film will effectively dissipate static charges.

CAUTION: Solvents and liquids used in radio and TV shop work may craze or scar the plastic window if applied to it.

Parts Replacement

Parts available for replacement are listed in the parts list. When replacing any parts, be careful to not disturb or damage any others. Do not overheat resistors or diodes, but be sure to make a good solder connection.

In some cases, it is wise to leave part of the lead from the old component and solder the new component to the old lead to prevent damage to surrounding components.

If there is evidence of smoke or an electrical arc inside the VOM, return the VOM to the factory or an authorized service center. There is a chance of hidden damage that could cause another failure in the VOM.

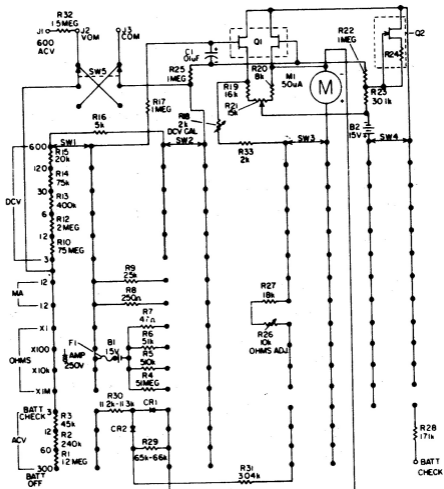
Calibration

With normal use, readjustment of this VOM should not be necessary. Replacement parts are designed to be installed without any need for recalibration of the VOM. An occasional check of the VOM against a known reference voltage or another VOM is good practice. If there is a question about the accuracy of the VOM, it should be returned to the factory or an authorized service center for a calibration check.

Repair or Service

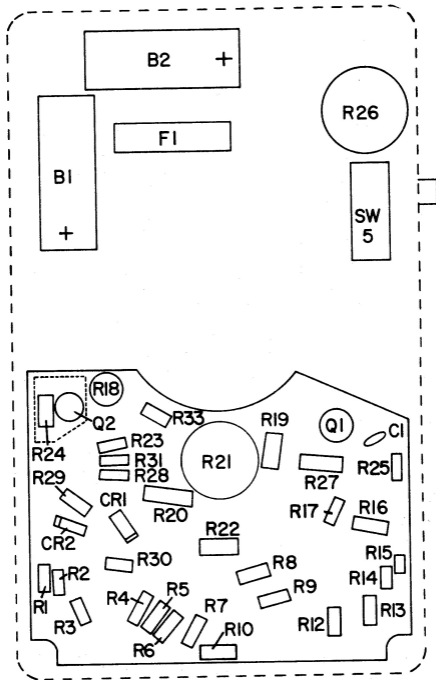
For repair of the VOM, return it to the factory or an authorized service center. To help in repairing the VOM, give a detailed description of the problem and any other data that might be helpful such as what kind of circuit was being measured when the problem was discovered.

CIRCUIT DIAGRAM



COMPONENT LOCATION

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REPLACEABLE PARTS LIST MODEL 310 FET TYPE 2

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Circuit Symbol	Part No.	Description
B1	37-29	Battery, 1.5 Volt (NEDA 910A)
B2	37-22	Battery, 15 Volt (NEDA 220)
C1	43-325	Capacitor, .01 MF 25V
CR1, CR2	11056	Diode
F1	3207-45	Fuse, 1/2 Amp 8AG
M	52-7537	Instrument Assembly, Suspension 50 μ A
Q1	127-138	Dual FET
Q2	127-139	Constant Current Source (Consists of Q2 and R24)
R1	15K-1204TB4	Resistor, 1.2 Meg. 1/4 Watt
R2	15K-2403TB4	Resistor, 240k 1/4 Watt
R3	15K-4502TA3	Resistor, 45k 1/4 Watt
R4	15R-516JC	Resistor, 51 Meg. 5/8 Watt
R5	15R-514JB	Resistor, 510k, 5/8 Watt
R6	15R-512JB	Resistor 5.1k 5/8 Watt

R7	15R-470JB	Resistor, 47 Ω 5% $\frac{1}{4}$ Watt
R8	15K-2500TA3	Resistor, 250 Ω 1% $\frac{1}{8}$ Watt
R9	15K-2501TA3	Resistor, 2.5k 1% $\frac{1}{8}$ Watt
R10	15-5783	Resistor, 7.5 Meg. 1% 2 Watt
R12	15K-2004TB4	Resistor, 2 Meg. 1% $\frac{1}{4}$ Watt
R13	15K-4003TB4	Resistor, 400k 1% $\frac{1}{4}$ Watt
R14	15K-7502TA3	Resistor, 75k 1% $\frac{1}{8}$ Watt
R15	15K-2002TA3	Resistor, 20k 1% $\frac{1}{8}$ Watt
R16	15K-5001TA3	Resistor, 5k 1% $\frac{1}{8}$ Watt
R17, R22, R25	15K-1004TA3	Resistor, 1 Meg. 1% $\frac{1}{8}$ Watt
R18	16-314	Resistor, Variable, 2k
R19	15K-1602TA3	Resistor, 16k 1% $\frac{1}{8}$ Watt
R20	15K-8001TA3	Resistor, 8k 1% $\frac{1}{8}$ Watt
R21	16-200	Resistor, Variable, 15k
R23	15K-3002TA3	Resistor, 30k 1% $\frac{1}{8}$ Watt
R24		Resistor, See Q2
R26	16-201	Resistor, Variable 10k
R27	15R-183JB	Resistor, 18k 5% $\frac{1}{4}$ Watt
R28	15K-1713TA3	Resistor, 171k 1% $\frac{1}{8}$ Watt
R29	15-C-316	Resistor, Selected

REPLACEABLE PARTS LIST MODEL 310 FET TYPE 2

Circuit Symbol	Part No.	Description
R30	15-C-317	Resistor, Selected
R31	15K-3041TA3	Resistor, 3.04k 1% 1/4 Watt
R32	15K-1504TB4	Resistor, 1.5 Meg. 1% 1/4 Watt
R33	15R-102JB	Resistor, 1k 5% 1/4 Watt
SW5	22-485	Slide Switch Assembly
	10-3009	Battery Cover Assembly
	46-32	Contact, Battery 15V Positive
	46-33	Contact, Battery 1.5V Positive
	46-110	Contact, Battery 1.5V Negative
	46-200	Contact, Battery 15V Negative
	10-2747	Front Assembly
	87-524	P. C. Board with Components
	79-153	Test Leads, Needle Point
	79-296	Test Leads, Blunt Point

The Triplett Corporation warrants instruments and test equipment manufactured by it to be free from defective material or factory workmanship and agrees to repair or replace such products which, under normal use and service, disclose the defect to be the fault of our manufacturing, with no charge for parts and service. If we are unable to repair or replace the product, we will make a refund of the purchase price. Consult the Instruction Manual for instructions regarding the proper use and servicing of instruments and test equipment. Our obligation under this warranty is limited to repairing, replacing or making refund on any instrument or test equipment which proves to be defective within one year from the date of original purchase.

This warranty does not apply to any of our products which have been repaired or altered by unauthorized persons in any way so as, in our sole judgment, to injure their stability or reliability, or which have been subject to misuse, abuse, misapplication, negligence or accident or which have had the serial numbers altered, defaced, or removed. Accessories, including batteries, not of our manufacture used with this product are not covered by this warranty.

To register a claim under the provisions of this warranty, return the instrument or test equipment to Triplett Corporation, Bluffton, Ohio 45817, transportation prepaid. Upon our inspection of the product, we will advise you as to the disposition of your claim.

ALL WARRANTIES IMPLIED BY LAW ARE HEREBY LIMITED TO A PERIOD OF ONE YEAR AND THE PROVISIONS OF THE WARRANTY ARE EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES EXPRESSED OR IMPLIED.

The purchaser agrees to assume all liability for any damages and bodily injury which may result from the use or misuse of

the product by the purchaser, his employees, or others, and the remedies provided for in this warranty are expressly in lieu of any other liability Triplett Corporation may have, including incidental or consequential damages.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. No representative of Triplett Corporation or any other person is authorized to extend the liability of Triplett Corporation in connection with the sale of its products beyond the terms hereof.

Triplett Corporation reserves the right to discontinue models at any time, or change specifications, price or design, without notice and without incurring any obligation.

This warranty gives you specific legal rights, and you may have other rights which vary from state to state.

TRIPLETT CORPORATION

Bluffton, Ohio

Printed in U.S.A.

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TWX. (810) 490-2400**

To Measure	Set Range Switch	Leads Connections Black Lead "COM" Red Lead Listed Below	Read on Scale	Each Scale Div. Equals
DC Volts				
0-.3	DCV .3	V-O-M	300 ÷ 1000	.005 Volts
0-1.2	DCV 1.2	V-O-M	12 ÷ 10	.02 Volts
0-6	DCV 6	V-O-M	60 ÷ 10	.1 Volts
0-30	DCV 30	V-O-M	300 ÷ 10	.5 Volts
0-120	DCV 120	V-O-M	12x10	2 Volts
0-600	DCV 600	V-O-M	60x10	10 Volts
AC Volts				
0-3	ACV 3	V-O-M	3 V AC	.05 Volts
0-12	ACV 12	V-O-M	12	.2 Volts
0-60	ACV 60	V-O-M	60	1 Volts
0-300	ACV 300	V-O-M	300	5 Volts
0-600	ACV 300	600 V AC	60x10	10 Volts
OHMS				
0-5K	X1	V-O-M	0-5K	
0-500K	X100	V-O-M	0-5Kx100	
0-50 Meg.	X10K	V-O-M	0-5Kx10K	
0-5000 Meg.	X1M	V-O-M	0-5Kx1 Meg.	
DCMA				
.12	MA .12	V-O-M	12 ÷ 100K	2 Mic.
1.2	MA 1.2	V-O-M	12 ÷ 10K	20 Mic.