

# Simpson

INSTRUMENTS THAT STAY ACCURATE

## OPERATOR'S MANUAL

**MODEL 880 VOLTMETER**  
**MODEL 880 WATTMETER**

**SIMPSON ELECTRIC COMPANY**

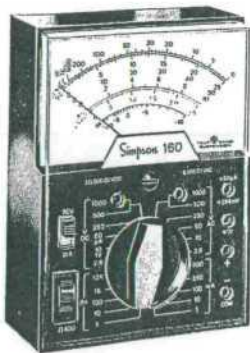
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Area Code 312, Telephone 379-1121  
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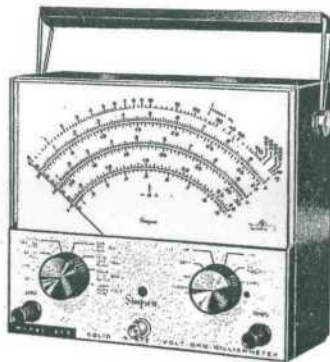
- 20,000  $\Omega$  VDC . . . 5,000  $\Omega$  VAC
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## OPERATOR'S MANUAL

## MODEL 880 VOLTMETER MODEL 880 WATTMETER

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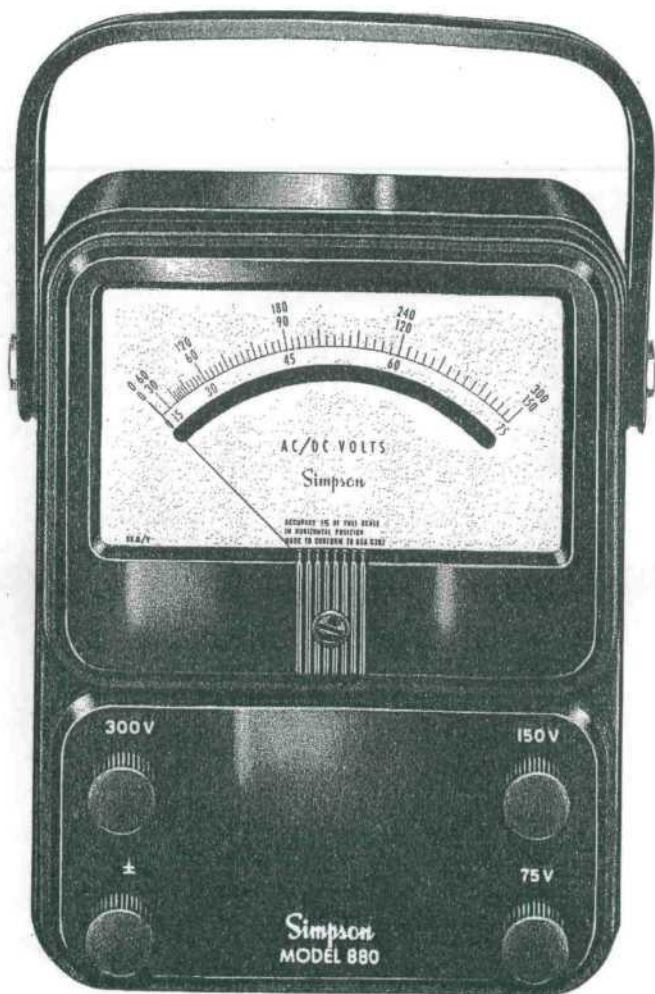


FIGURE 1. MODEL-880 VOLTMETER

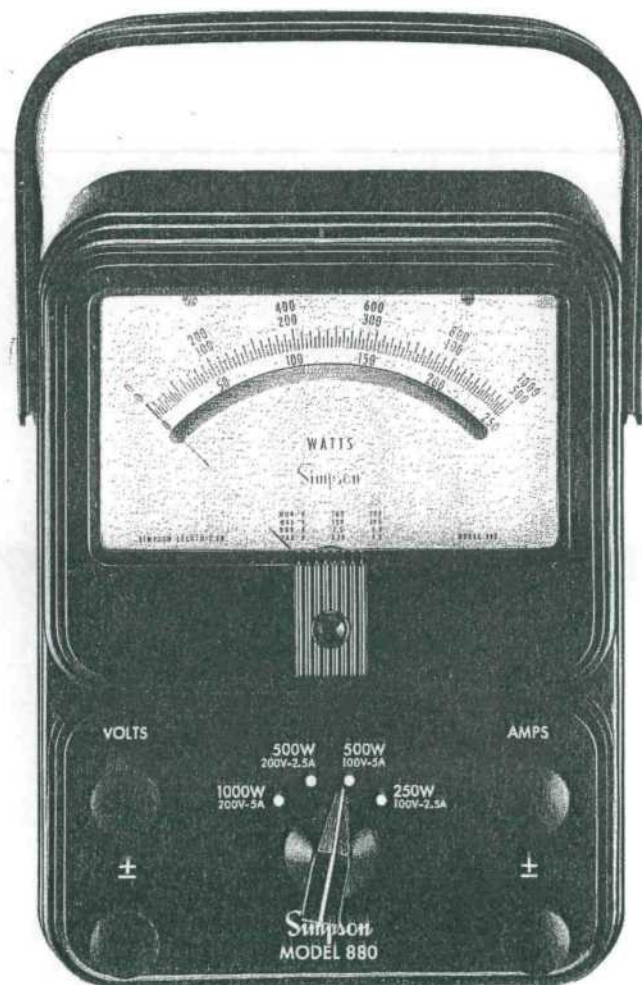


FIGURE 2. MODEL-880 WATTMETER

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## SECTION I

### GENERAL INFORMATION

#### 1.1 INTRODUCTION

The Simpson Instrumentation Products Group Model 880 Series are rugged and reliable portable instruments. These instruments are divided into two basic types.

(A) Model 880 Voltmeter

(B) Model 880 Wattmeter

These two basic types are available in a variety of ranges to meet the demand of a wide field of applications, such as in the shop, laboratory, or Quality Control Department. The Model 880 Wattmeter may also be utilized as an AC to DC transfer standard.

Wherever a precise measurement must be taken, you will find that Model 880 Instruments are dependable and easy to operate.

#### 1.2 DESCRIPTION

The heart of the Model 880 Instrument is the Simpson Dynamometer type movement. These instruments are capable of dependable AC and DC measurements. The voltmeter versions of the Model 880 have clearly marked binding posts showing the full scale voltage value of each range. Wattmeter versions of the Model 880 have separate binding posts for voltage and current. These units measure true wattage, (compensated for power factor, not simply volt-amperes).

All Model 880 instruments have a large, easy to read 4-1/2" scale located in the upper half of the front panel. The scale is hand stepped and drawn to match each individual movement's characteristics to insure the best possible scale tracking accuracy.

Parallax error has been virtually eliminated by use of a thin "knife edge" pointer and an image reflecting mirror mounted below the scale arc.

The phenolic case is designed with heavy reinforced walls and back for maximum durability and protection for the circuit components.

1-1

## General Information

### 1.3 TABLE OF SPECIFICATIONS

#### MODEL 880 VOLTMETER

Parameters:	AC/DC Volts
Movement:	Dynamometer Type
Sensitivity:	Approx. 55 Ohms per Volt
*Accuracy:	±1% of Full Scale @ 25°C
Response Time:	2.5 Seconds Maximum
Frequency Influence:	±0.5% from 54 Hz to 66 Hz Sine Wave
Dielectric:	2600 Volts 60 Hz Sine Wave
Damping Factor:	2 Minimum
Size, Weight	5¼" x 3½" x 7" — Approx. 2½ lb.
*Applies when instrument is in horizontal position only.	

#### MODEL 880 WATTMETER

Parameters:	AC/DC Watts (true power)
Movement:	Dynamometer Type
*Accuracy:	±1% of Full Scale @ 25°C
Response Time:	2.5 Seconds Maximum
Frequency Influence:	±0.5% from 54 Hz to 66 Hz Sine Wave +1.5% at 400 Hz Sine Wave
Dielectric:	1500 Volts 60 Hz Sine Wave
Damping Factor:	2 Minimum
Size, Weight	5¼" x 3½" x 7" — Approx. 2½ lb.
*Applies when instrument is in horizontal position only.	

#### 1.4 VERSIONS AND OPTIONS

Model 880 Voltmeters and Model 880 Wattmeters are available in the following ranges and combinations of ranges:

#### MODEL 880 AC/DC VOLTMETERS

Range	Catalog Number
150V	13130
150-300V	13140
75-150-300V	13150
150-300-600V	13160

1-2

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## MODEL 880 AC/DC WATTMETERS

The following instruments have a single current range and two voltage ranges.

## POWER RANGES

Maximum Voltage 150V	Maximum Voltage 300V	Maximum Current	Catalog Number
100 Watts	200 Watts	1.5 A	13170
200 Watts	400 Watts	3.0 A	13180
500 Watts	1000 Watts	7.5 A	13190
1000 Watts	2000 Watts	15.0 A	13200
2000 Watts	4000 Watts	30.0 A	13210
5000 Watts	10000 Watts	75.0 A	13220

## MODEL 880 AC/DC WATTMETERS

The following instruments have two current ranges in addition to two voltage ranges.

## POWER RANGES

Maximum Voltage 150V	Maximum Voltage 300V	Maximum Current		Catalog Number
		Low Scale	High Scale	
250-500 Watts	500-1000 Watts	3.75 A	7.5 A	13230
500-1000 Watts	1000-2000 Watts	7.5 A	15.0 A	13240

## NOTE:

Maximum current and maximum voltage cannot be applied simultaneously. Overloading and possible damage to the instrument will be the result. Any combination of voltage and current within the maximum limits is permissible as long as their product does not exceed the full scale wattage rating of the instrument.

## 1.5 CARRYING CASES

Carrying cases are available for all of the Model 880 Voltmeters and Model 880 Wattmeters.

	Catalog Number
Slide-in vinyl case	1818
Ever-ready vinyl case	0805
Ever-ready cowhide case	4236
Roll-top phenolic case	6192

## 1.6 SERIAL NUMBERS

Each Model 880 instrument is serially numbered for ease of identification.

The serial number is located in the lower right hand corner of the instrument scale. A space has been provided on the title page in the front of this manual. When a new instrument is purchased, the customer is advised to insert the serial number in this space, so he will have a permanent record of the instrument for future identification purposes.

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## UNPACKING AND INSTALLATION

**2.1 UNPACKING**

All Model 880 Instruments are packed one unit per carton. An instruction manual is enclosed with each instrument. When removing the instrument from the carton *DO NOT CUT THE BOX!!* Doing so may damage the instrument. Also, if the instrument is found to be damaged in transit or must be returned for any other reason, the original carton can be used.

**2.2 INCOMING INSPECTION**

Carefully check for any visible signs of damage that may have occurred in transit such as a cracked glass window, chipped or marred case or panel, etc. Check instrument movement for freedom of action. There should not be any indication of binding or sticking of the pointer. Refer to the page of specifications in this manual for balance and calibration accuracy, etc. See Section 3 for operating instructions.

**2.3 PHYSICAL MOUNTING INSTRUCTIONS**

The Model 880 Instruments may be used in the horizontal or vertical position. The handle may be used to position the instrument at a convenient angle by folding the handle back under the instrument case.

The guaranteed accuracy of Model 880 instruments applies only when the unit is used in horizontal position, (front panel of Instrument facing upward). Therefore when the most precise measurements are required always place the instrument in a horizontal position.

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## OPERATING INSTRUCTIONS

**3.1 SAFETY PRECAUTIONS**

When connecting an instrument into a circuit, it is always a sound safety policy to turn off all power and discharge all capacitors in the circuit under test. Then proceed to connect the instrument into the circuit. Pictorial diagrams are included in this manual to serve as an aid in helping the technician follow the correct test procedure in a variety of circuit applications.

Caution should be exercised to insure that the lead wire, clips, and terminals are of sufficient gauge to carry the maximum current to the instrument. Batteries or external power sources are not required for the Model 880 Instruments.

**3.2 LEADS AND BINDING POSTS**

Leads are not supplied with the Model 880 instruments. A spade type of terminal on the lead end that connects to the instrument binding post is very satisfactory. The binding post diameter is 0.2". The lead insulation should have a dielectric strength well in excess of the maximum voltage applied to the instrument.

**3.3 ZERO ADJUSTMENT**

Each time the Model 880 is put into service the zero setting should be checked. Place the instrument in the horizontal position. Check the movement pointer to see if it is exactly over the zero mark on the scale. If the pointer is off zero, it should be reset. This is accomplished by placing a screw-driver in the slot of the zero adjust screw located in the movement cover.

The zero adjust screw can then be rotated a full 360 degrees clockwise or counterclockwise to place the instrument pointer exactly over the zero graduation. When a precise zero setting has been made, slowly back off the zero adjust screw a very slight amount so as to relieve pressure off the zero adjust screw resting against the movement zero adjust fork.

**3.4 TEST PROCEDURES****MODEL 880 VOLTMETER**

To measure AC or DC voltage, connect leads to the binding post marked  $\pm$  and to the binding post with the desired voltage range. The leads can then be connected to the test circuit. See figure 9 for wiring diagram. It is not necessary to observe polarity when measurements are taken with the Model 880 Voltmeter.

When in doubt as to the correct voltage range to be used, always start with the highest range of the Model 880 Instrument, so as to afford a greater degree of protection to the unit.

**3.5 TEST PROCEDURES—WATTMETER****MODEL 880 WATTMETER****A. SINGLE PHASE**

To measure power in a single-phase circuit, only a single model 880 wattmeter is required.

Caution should be exercised to be sure the  $\pm$  potential and  $\pm$  current terminal are connected to the same side of the line. Diagrams are provided in this manual to aid the user in making swift effective tests with the model 880 wattmeter.

**B. THREE-PHASE, THREE WIRE**

Wattage (power) measurement in a three-phase, three wire circuit balanced or unbalanced is accomplished by use of two single-phase Model 880 wattmeters. See Figure 6 for wiring diagram.

**C. THREE-PHASE, FOUR WIRE**

Wattage (power) measurement in a three-phase four wire circuit, balanced or unbalanced, is accomplished by use of three single-phase Model 880 wattmeters. See Figure 8 for wiring diagram.

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Polarity must be observed as indicated in the following diagrams with regard to the marked binding post of each model 880 wattmeter used in a poly-phase test circuit. This is important since a base must be established to determine polarity of the readings.

When the power factor in the circuit under test is less than 0.5, the reading of one of the model 880 wattmeters will read reverse. After re-checking to see that the connection polarity of all the wattmeters are the same, the current coil leads of the reverse reading unit should then be reversed. The indication should now be up-scale. This up-scale value should be noted and recorded as a negative quantity. This negative quantity should then be added algebraically to the total positive sum to obtain the true power dissipation of the circuit under test.

Example:

In a typical three-phase four wire circuit three model 880 wattmeters are used. Meter #1 produces an up-scale reading of 500 watts.

Meter #2 produces a reverse reading. Re-check leads for correct polarity before reversing leads to current coils. The up-scale reading is now -400 watts. Meter #3 produces an up-scale reading of 475 watts.

Meter #1 = +500 watts

Meter #2 = -400 watts

Meter #3 = +475 watts

Algebraic Sum = +575 watts true power



SECTION IV  
MAINTENANCE

4.1 PREVENTATIVE MAINTENANCE

The Model 880 Dynamometer type movement is designed to withstand a reasonable amount of shock and vibration. However, like any other fine piece of precision equipment, care should be exercised to avoid undue electrical or mechanical abuse. Momentary electrical overloads of 500% should not usually cause permanent damage. However, after an accidental overload occurs the accuracy should be rechecked.

4.2 PERIODIC MAINTENANCE

Model 880 Instruments should be checked periodically for calibration accuracy. The time period between accuracy checks is flexible and is left to the discretion of the individual to set up a system that best meets his needs.

4.3 PARTS COMMON TO  
MODEL 880 VOLT AND WATTMETERS

Cover assembly . . . . .	0-005572
Case assembly including handle . . . . .	0-006190
Handle assembly . . . . .	10-860158
Lockwasher, case #6 . . . . .	1-110333
Stud Handle, mounting . . . . .	1-114883
Screw, case, to panel . . . . .	1-131514
Screw, cover, mounting lower . . . . .	1-131520
Screw, cover, mounting upper . . . . .	1-131494
Knob, 1-1/8" long, wattmeter only . . . . .	3-262871
Knob Set Screw, wattmeter only, #8-32 x 3/8, cone point . . . . .	1-111519
Binding post, all metal 1/4 - 28 . . . . .	3-311642
Binding post, phenolic black #10-32 . . . . .	1-117647
Hex nut brass #10-32, binding post mtg. . . . .	1-111541
Terminal #10 binding post mtg. . . . .	1-115568
Lockwasher split #10 binding post . . . . .	1-111854
Washer, brass flat #10 binding post mtg. . . . .	1-111557

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Maintenance

4.4 WARRANTY

All instruments in the Simpson Instrumentation Products Group are warranted to the original purchaser to perform according to published specifications upon delivery, and to be free from defects in material or workmanship for one year from date of shipment. Within this period, any instrument which is returned, transportation charges prepaid, to our repair department or one of our authorized service agencies, and which we confirm to be defective, will be repaired or adjusted (or, at our option, replaced) without charge.

This warranty does not apply to tubes, transistors or batteries, nor to instruments which have been altered outside of our service organization, operated in an abnormal manner, or abused. This warranty is expressed in lieu of all other liabilities expressed or implied. We are not liable for consequential damage.

4.5 REPAIR AND CALIBRATION

Complete facilities are maintained at our factory for the repair and calibration of all Simpson instruments. Service is also available for most instruments at the Regional Service Centers listed on back cover. No advance authorization is required to make use of repair and calibration service at the factory; however, Regional Service Centers should be notified in advance of shipment. Pack the equipment securely and ship prepaid. It is usually advisable to insure the shipment.

Enclose with the equipment a letter containing:

1. Detailed report of difficulty encountered or calibration requested.
2. Purchase date.
3. Indication whether estimate is required before work is done.
4. Name and phone number of individual to contact should we have a question regarding your request.
5. Address to which the equipment is to be returned, and address to which any charges should be billed.

## Maintenance

Recalibration is conducted with standards traceable to the National Bureau of Standards. A certificate of calibration can be issued if requested.

Should repair or calibration data beyond that in our instruction manuals be required, contact our Chicago repair facility at (312) 379-1121.

### 4.6 REPLACEMENT PARTS

Replacement parts for products should be ordered from our Parts Sales Department in Chicago.

Please specify:

1. Part number and description.
2. Model and serial numbers of the instrument.

The minimum billing for parts is \$10 per order unless payment is enclosed.

4-3

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## SECTION V

### MODEL 880 TYPICAL TEST CIRCUIT CONNECTIONS

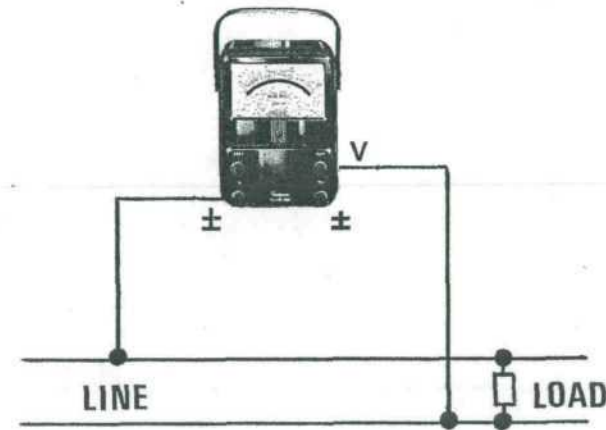


FIGURE 3: MODEL 880 VOLTMETER CONNECTED ACROSS LOAD.

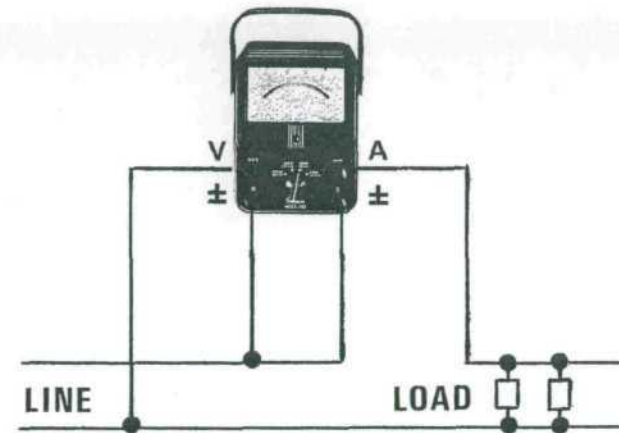


FIGURE 4: MODEL 880 WATTMETER CONNECTED TO READ THE POWER TO A SINGLE-PHASE LOAD. (RECOMMENDED FOR LOW-CURRENT, HIGH-VOLTAGE LOAD).

5-1



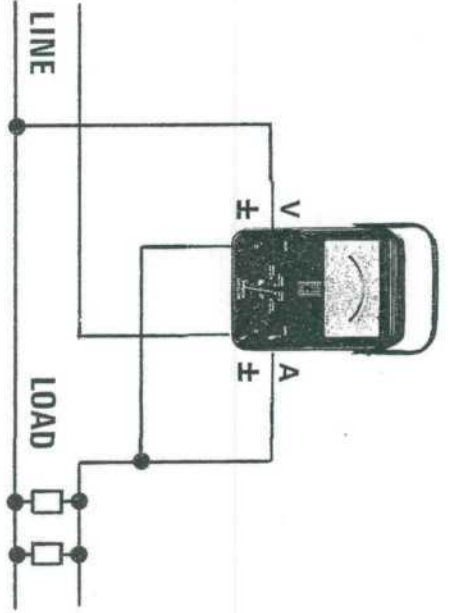
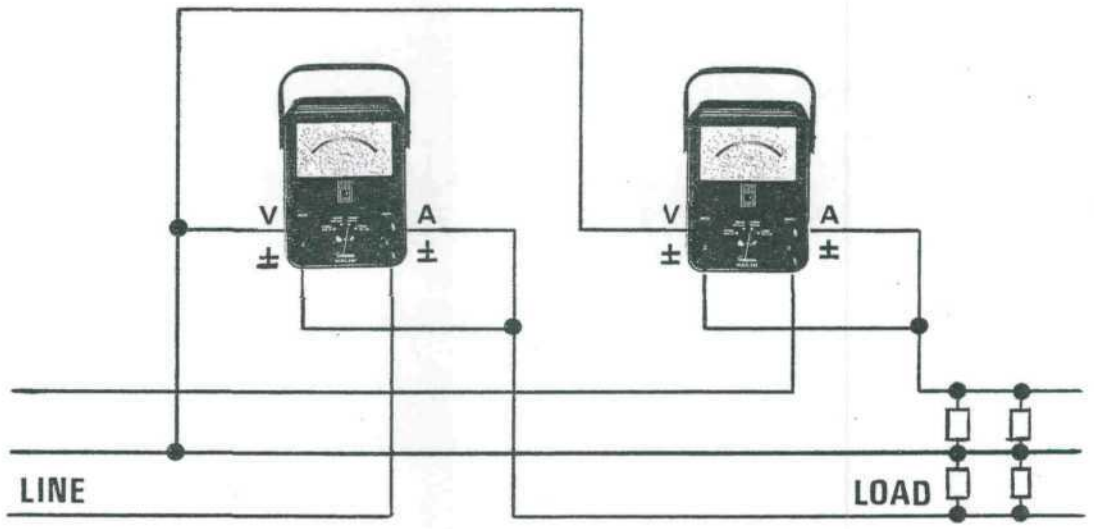


FIGURE 5: MODEL 880 WATTMETER CONNECTED TO READ THE POWER TO A SINGLE-PHASE LOAD. (RECOMMENDED FOR HIGH-CURRENT, LOW-VOLTAGE LOAD).

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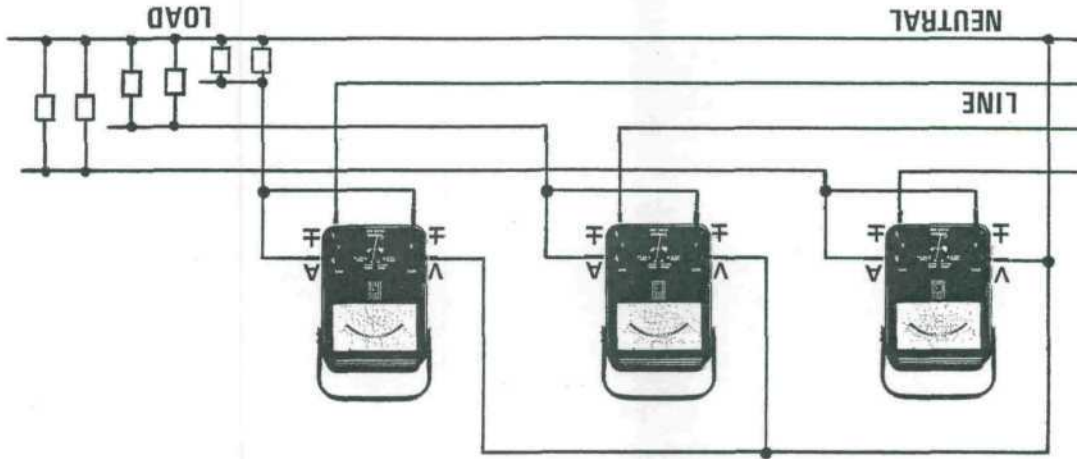
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FIGURE 6: TWO MODEL 880 WATTMETERS CONNECTED FOR MEASUREMENT OF POWER IN A THREE-PHASE, THREE-WIRE CIRCUIT (BALANCED OR UNBALANCED).

FIGURE 8: THREE MODEL 880 WATTMETERS CONNECTED FOR MEASUREMENT OF POWER IN A THREE-PHASE, FOUR-WIRE CIRCUIT (BALANCED OR UNBALANCED).



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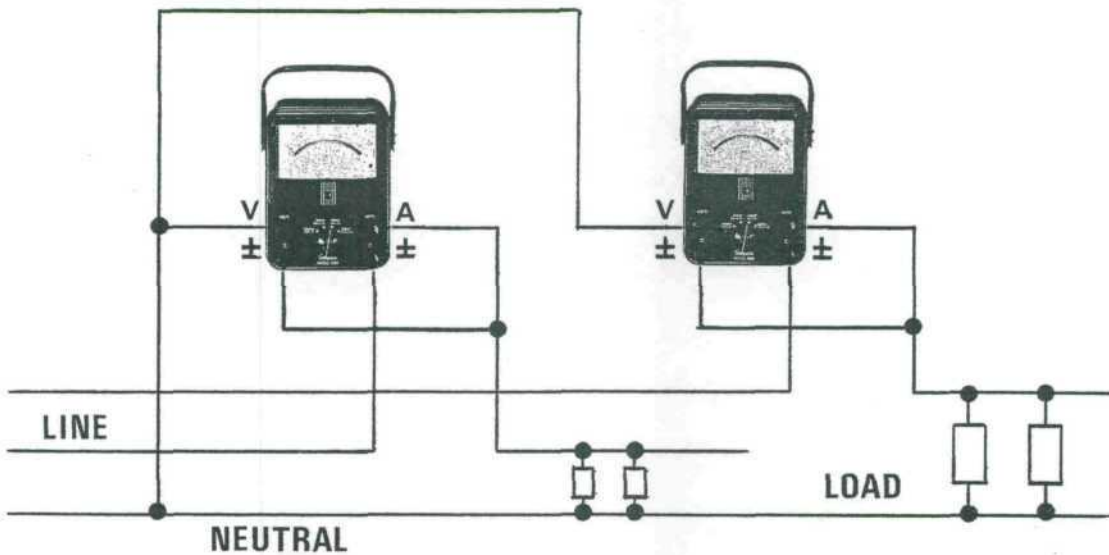
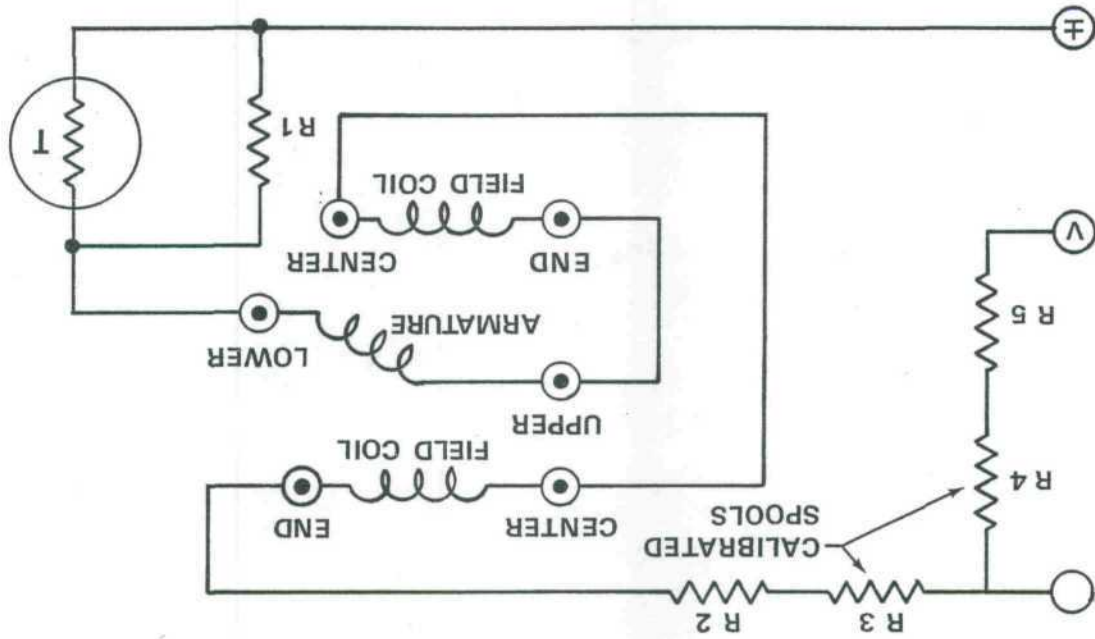


FIGURE 7: TWO MODEL 880 WATTMETERS CONNECTED FOR MEASUREMENT OF POWER IN A TWO-PHASE, THREE-WIRE CIRCUIT.

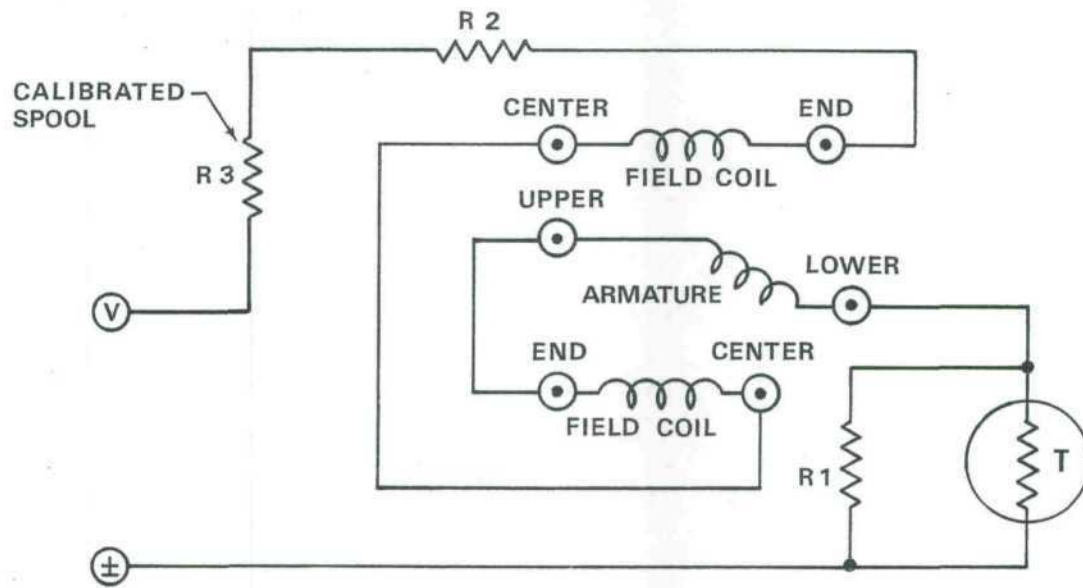


FIGURE 10: TYPICAL SCHEMATIC DIAGRAM FOR MODEL 880 DOUBLE RANGE VOLTMETER.



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FIGURE 9: TYPICAL SCHEMATIC DIAGRAM FOR MODEL 880 SINGLE RANGE VOLTMETER.

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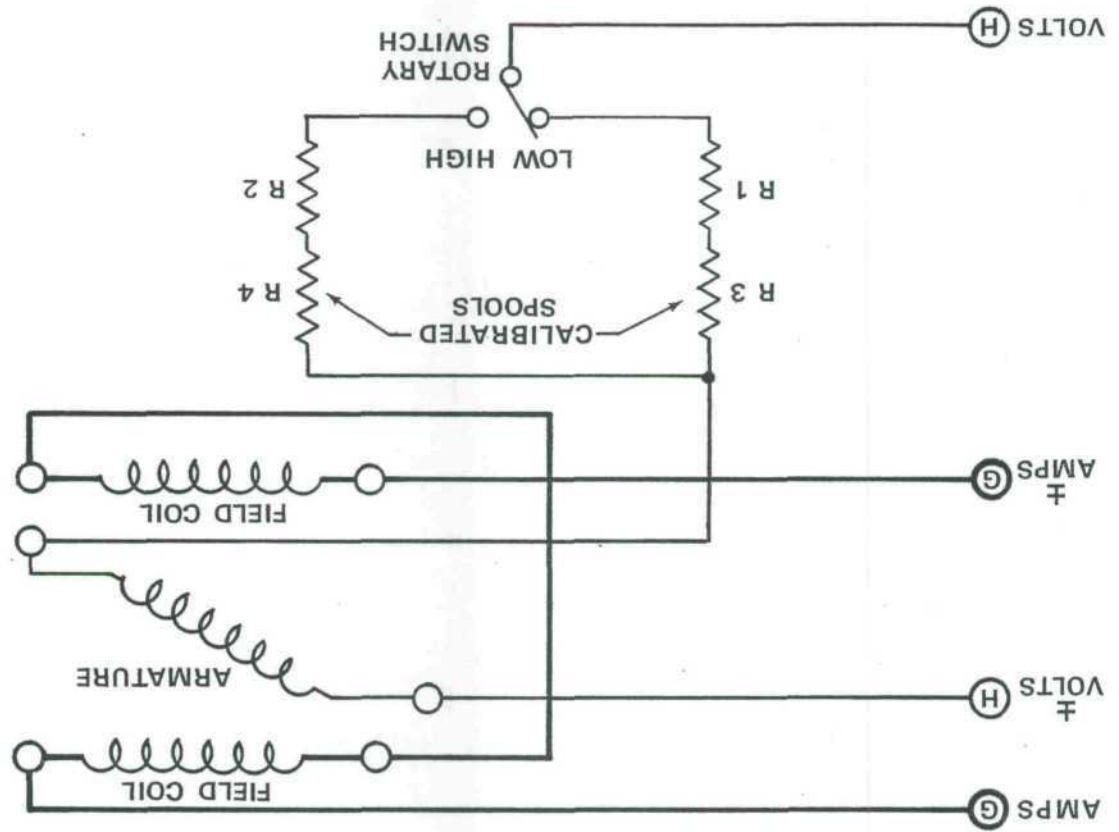


FIGURE 11: TYPICAL SCHEMATIC DIAGRAM FOR MODEL 880 DOUBLE RANGE WATTMETER.

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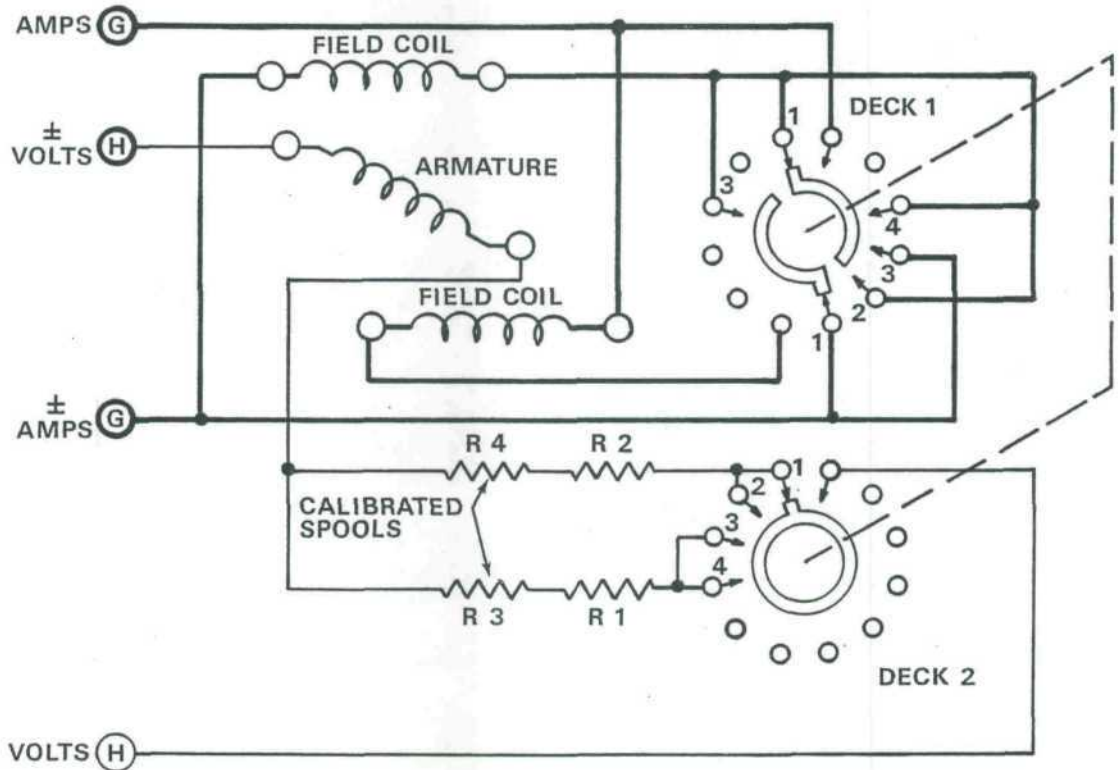


FIGURE 12: TYPICAL SCHEMATIC DIAGRAM OF MODEL 880—3-RANGE WATTMETER.



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AND PARTS DEPOTS

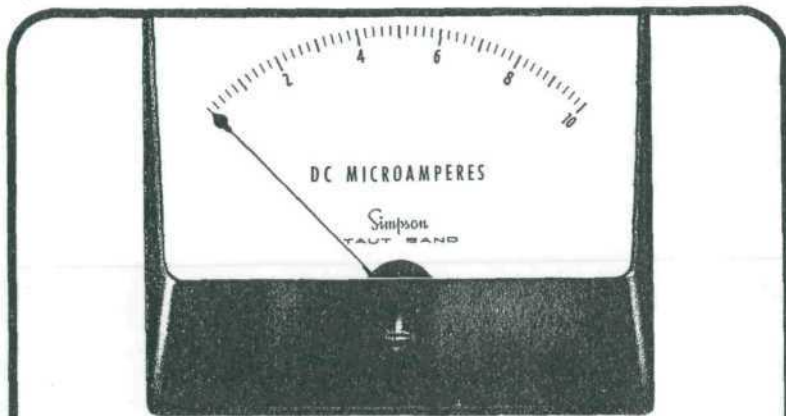
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Arizona, Phoenix 85034 Kierulff (Metermaster) 2633 E. Buckeye	Area Code 602 273-7331	Hawaii, Honolulu 96819 Electronic Measurement Corp. 2979 Ualena Street	
California, Glendale 91201 JSD Engineering Company 6915 San Fernando Road	Area Code 213 840-6187	Illinois, Chicago 60648 A & M Instrument, Inc. 6251 W. Touhy	Area Code 312 774-3500
California, Los Angeles 90022 Metermaster/Los Angeles 5646 Jellson St.	Area Code 213 685-4340	Illinois, Chicago 60644 Pacific Indicator Company 5924 West Madison Street	Area Code 312 261-1330
California, Palo Alto 94303 Kierulff/Metermaster 3969 E. Bayshore Road	Area Code 415 968-6292	Kansas, Wichita 67211 Main Electronics, Inc. 363 Pattie	Area Code 316 267-3581
California, San Diego 92111 Metermaster/Kierulff 8796 Balboa Ave.	Area Code 714 278-2112	Louisiana, New Orleans 70115 Industrial Instrument Works 3305 Tchoupitoulas Street	Area Code 504 895-5621
California, San Francisco 94105 Pacific Electrical Instrument Lab. 111 Main Street	Area Code 415 421-7185	Maryland, Beltsville 20705 Meter Devices 11325 Maryland Ave.	Area Code 301 345-7775
Colorado, Denver 80209 Meter Master Instrument Service 748 South Broadway	Area Code 303 722-5766	Maryland, Timonium 21093 E. I. L. Instrument Div. 110 W. Timonium Road	Area Code 301 252-1260
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Connecticut, New Haven 06511 Kaufman Instrument Lab. 810 Dixwell Avenue	Area Code 203 776-7201	Massachusetts, Needham Heights 02194 Instruments, Inc. 570 Hillside Avenue	Area Code 617 444-9410
Florida, Miami 33136 Florida Precision Instrument Corp. 800 N.W. 7th Avenue	Area Code 305 374-1731	Michigan, Ferndale 48220 Ram Meter, Inc. 1100 Hilton Road	Area Code 313 547-1000
Florida, Orlando 32806 Electro Tech, Inc. 307 - 27th Street	Area Code 305 423-5589	Minnesota, Minneapolis 55427 Instrumentation Services 957 Winnetka Ave.	Area Code 612 544-8916

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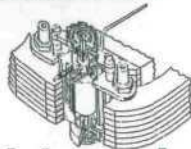
Missouri, St. Louis 63112 Scherrer Instruments 5449 Delmar Blvd.	Area Code 314 862-5449	Ohio, Cleveland 44103 Pioneer-Standard Electronics, Inc. 5403 Prospect Avenue	Area Code 216 432-0010
New Jersey, Belleville 07109 Marshall Instruments, Inc. 236 Washington Avenue	Area Code 201 751-1190	Ohio, Cleveland 44135 Weschler Electric Corp. 4250 West 130th Street	Area Code 216 251-4609
New Jersey, Roselle 07203 E. T. Instrument & Controls 205 Columbus Ave.	Area Code 201 241-8282	Ohio, Dayton 45404 Srepcu Electronics Div. 314 Leo Street	Area Code 513 224-0871
New Mexico, Albuquerque 87108 Eberline Instrument Corp. P.O. Box 8885, 1404 San Mateo, S.E.	Area Code 505 265-6655	Oklahoma, Tulsa 74120 Agra Engineering Company 551 S. Quaker	Area Code 918 582-5754
New York, Buffalo 14216 Electrical Instrument Labs. 932 Hertel Avenue	Area Code 716 876-0880	Oregon, Portland 97217 Westcon, Inc. 1910 Killingsworth Street	Area Code 503 285-6629
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New York, Vestal 13850 Compton Industries, Inc. 413 Commerce Road	Area Code 607 729-9221	Wisconsin, Milwaukee 53202 The Electro-Mechano Company 241 East Erie Street	Area Code 414 272-4050
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## here's the taut band reliability you should demand



Simpson's search for reliability began at a major source of trouble—the overly complicated design of conventional Taut Band suspensions. The result was an improved suspension with 25% fewer parts.

Because of this, you would expect life expectancy to zoom, and trouble to nose dive. And that's just what happened.

**The Ultimate in Test Programs**—As just one step in a comprehensive test program to insure reliability measuring up to today's needs, Simpson engineers put 150 of the improved Taut Band meters on a continuing 24-hour test (cycled zero to full scale 2200 times per hour). As of August 30, 1964, the 150 meters have logged 25,243,000 cycles without failure. This is equivalent to over 70 years of normal operation. Weekly calibration checks show that the meters are holding  $\pm 1/2\%$  accuracy. Simpson Taut Band meters also passed ASA tests for extreme temperature, humidity, shock, and vibration.

**Stocked for Immediate Delivery**—Present units stocked are microammeters in  $2\frac{1}{2}$ ",  $3\frac{1}{2}$ ", and  $4\frac{1}{2}$ " sizes. Ranges are 10, 15, 25, 50, 100 ua; accuracy,  $\pm 2\%$  F.S. For fast service, call your distributor.

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INSTRUMENTS THAT STAY ACCURATE

**Special Requirements**—Contact your Simpson representative or the factory. Sensitivities as low as 2 microamperes at accuracies of 1% or better can be supplied.



Continuing reliability tests being run on 150 improved Taut Band meters with 20 pivot-jewel meters used as control units.

WRITE FOR Bulletin PM-505.  
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a handful is all  
it takes...  
for many tests



### Simpson MICRO-TESTERS...18 Types...Get Several

If you run tests on communication systems, motors, wiring, appliances, tubes, components, batteries, or coolers, these nifty little testers are just what you're looking for. Micro-Testers measure only  $3" \times 5\frac{3}{4}" \times 2\frac{1}{2}"$ . They give you Simpson quality in a tester that is compact in both size and price. All 18 are in stock for immediate delivery. Call your Electronics Distributor or the factory for Bulletin 2066.

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INSTRUMENTS THAT STAY ACCURATE

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Quality is the indispensable component  
of every Simpson instrument . . . . .

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