

OPERATING INSTRUCTIONS

for
AMPROBE®
MODELS AW80 and AW81
Watt/Ampere Transducers
Single Phase*
and
LAW-82/82T Recording Module

*May be used on three-phase, three and four-wire systems (balanced or unbalanced) as explained in these instructions.

- See PRECAUTIONS FOR PERSONAL AND INSTRUMENT PROTECTION on page 3.
- See Limited Warranty on page 2.

IMPORTANT:

The AW-80/81 transducers may be used with any digital multimeter with 0-2/10/20 VAC/DC ranges, at least a 10 meg-ohm input and which accepts standard banana test leads.



LIMITED WARRANTY

Congratulations! You are now the owner of an AMPROBE® instrument. It has been quality crafted according to quality standards and contains quality components and workmanship. This instrument has been inspected for proper operation of all of its functions. It has been tested by qualified factory technicians according to the long-established standards of AMPROBE INSTRUMENT.

Your AMPROBE instrument has a limited warranty against defective materials and/or workmanship for one year from the date of purchase provided, in the opinion of the factory, the instrument has not been tampered with or taken apart.

Should your instrument fail due to defective materials, and/or workmanship during the one year warranty period return it along with a copy of your dated bill of sale which must identify instrument by model number and serial number.

IMPORTANT:

For your protection, please use the instrument as soon as possible. If damaged, or should the need arise to return your instrument, it must be securely wrapped (to prevent damage in transit) and sent prepaid via Air Parcel Post insured or UPS where available to:

Service Division
AMPROBE INSTRUMENT
630 Merrick Rd. (Use for U.P.S.)
P.O. Box 329 (Use for P.P.)
Lynbrook, N.Y. 11563-0329

Outside of the U.S.A. the local Amprobe representative will assist you.

Above limited warranty covers repair and replacement of instrument only and no other obligation is stated or implied.

Serial number is located on a label on the back of the unit.

SPECIFICATIONS

Ranges with AM-Series* See P. 11 for LAW-82.

Amps: AW-80/81 0-1000 Amps (50-60Hz)

Kilowatts: AW-80 0-20/200 KW with voltage input of up to 240 VAC and current input of 0-150A/1000A. (50-60Hz) Single phase. AW-81 0-40/400 KW with voltage input of 208-600VAC and current input of 0-150/1000A (50-60Hz) Single phase.

Accuracy: KW $\pm 2.8\%$ of reading.

AC Amps $\pm 2\%$ of reading based on sinusoidal waveform.

Circuit Protection:

Overload protected to 2000 Amps AC and 400 volts AC (AW-80).
600 volts (AW-81).

Operating Temperature/Humidity:

+32°F to 104°F (0°C to 40°C) RH 80%.

Battery Life: Based on test cycle of 10 seconds "on" and 20 seconds "off" 25 hours or 3000 cycles. Based on test cycle of 20 seconds "on" and one minute "off" 33 hours or 1500 cycles.

Response Time: Same as AM-Series*.

Case Voltage Breakdown: 3000VAC

CAUTION— Do not use on un-insulated conductors in circuits with voltage above 3000VAC.

* Series refers to Models AM-4, 4A, 4B, 14, 1200, 1260 & 1280.

PRECAUTIONS FOR PERSONAL AND INSTRUMENT PROTECTION

- 1) Read these instructions thoroughly and follow them carefully.
- 2) In many instances you will be working with dangerous levels of voltage and/or current; therefore, it is important that you avoid direct contact with any uninsulated, current-carrying surfaces. Appropriate insulating gloves and clothing should be worn.
- 3) Before connecting or disconnecting the meter to or from the circuit to be tested, turn off all power to the circuit.
- 4) Before applying test leads to circuit under test, make certain:
 - a) Test leads are plugged into proper instrument jacks and
 - b) Selector switches are set to proper range and function.

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- 5) Before using any electrical instrument or tester for actual testing, the unit should be checked on a known live line to make certain it is operating properly.
- 6) If the instrument should indicate that voltage is not present in circuit, do not touch circuit until you have checked to see that all instrument switches are in proper position and instrument has been checked on a known live line.

IMPORTANT: Failure to follow these instructions and the above precautions may result in personal injury and/or damage to the transducer and/or instrument and/or recording module.

INSTALLING BATTERY

To install the battery (9 Volt Alkaline, Cat. No. MN1604), turn instrument over and remove battery cover by loosening screw (Fig. 1). Snap battery into connector, place battery in battery compartment and replace cover.

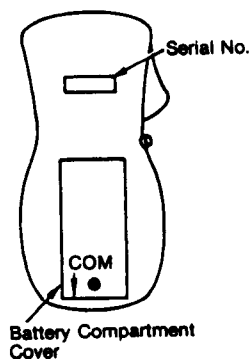


Figure 1

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SWITCHES

The AW-80 and AW-81 each have two switches on the front of the unit. The BATTERY TEST/KW/AMPS-POWER OFF switch is located at the bottom of the instrument.

When storing the instrument switch must be in the AMPS-POWER OFF position or the battery will be drained. This position is also used when measuring current. The other two positions are used when testing the battery (BATT TEST) and when measuring power (KW).

The position of the 150A/1000A switch determines the KW range. It can be in either position when measuring current only.

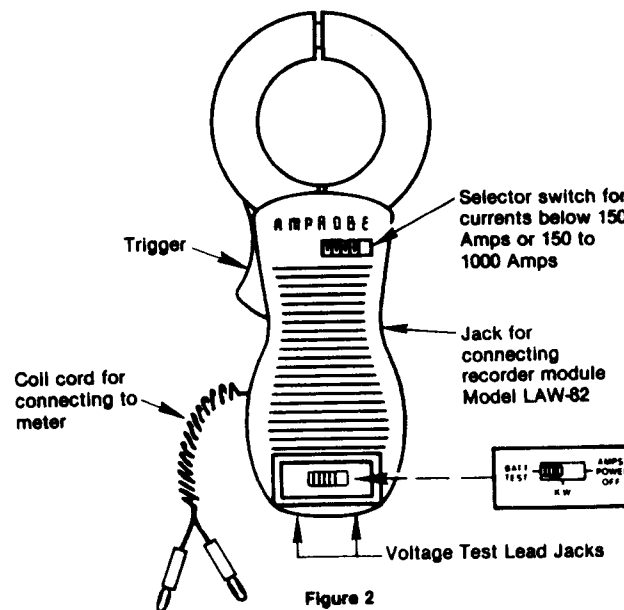


Figure 2

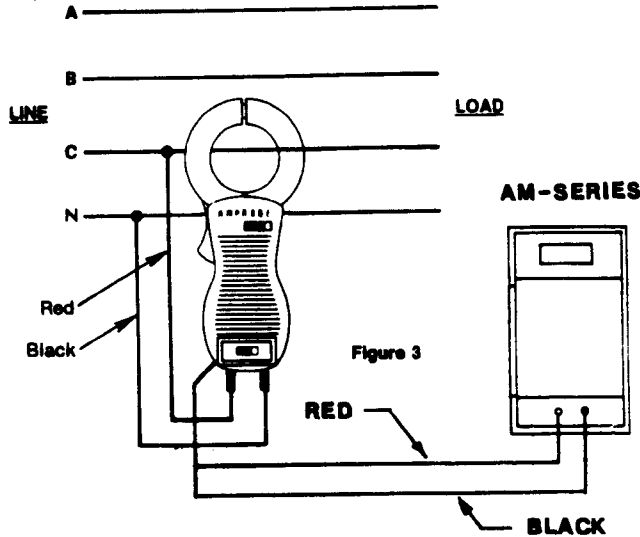
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BATTERY TESTS

A. An arrow (→) or a low battery indication in the display means the 9V alkaline battery in the instrument must be replaced.

B. To test the AW-80/81 Battery:

- 1) Push the "BATTERY TEST/KW/AMPS-POWER OFF" switch into the BATTERY TEST position.
- 2) Plug the AW-80/81 coil cord test leads into the instrument with the black lead into the "COM" jack and the red lead into the "+" or "Ω·V" jack.
- 3) Set the Multimeter to read 20 VDC.
- 4) Turn Multimeter "ON" by moving switch to "ON" position or appropriate range.
- 5) Replace battery in AW-80/81 if reading on Multimeter is less than 1.7 volts. If the reading is above 1.7 volts proceed with tests.



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AC CURRENT MEASUREMENT WITH AM MULTIMETER

The position of the 150A/1000A switch determines the KW range. It can be in either position when measuring current only.

- 1) Push the "BATTERY TEST/KW/AMPS-POWER OFF" switch into "AMPS-POWER OFF" position.
- 2) Plug the AW80/81 coil cord test leads into the instrument with the black lead into the "COM" jack and the red lead into the "+" or "Ω·V" jack.
- 3) Set the Multimeter to read 2VAC.
- 4) Turn Multimeter "ON" by moving switch to "ON" position or appropriate range.
- 5) Clamp jaws of the AW-80/81 around the conductor under test.
- 6) Take reading on Instrument and multiply reading by 1000. Eg. Instrument reading is $0.185 \times 1000 = 185$ amps.

NOTE: The AW-80/81 may be used with AMPROBE Models CT-50-1 and CT-50-2 (50-to-1 current transformers) (Digital setting) when measuring current only. The CT-50-1 and CT-50-2 may not be used with the AW-80/81 when measuring KW.

KW MEASUREMENT (Single Phase) WITH AM MULTIMETER SERIES See Note above.

CAUTION:

The AW-80/81 must be connected to the instrument before making any connections to the circuit. Failure to follow this procedure will expose the user to a voltage appearing at the banana plugs at the end of the coil cord.

- 1) a) If current is unknown, measure current following the instructions above.
- b) Remove the AW-80/81 from conductor.
- c) Set "150A/1000A" switch on the AW-80/81 to proper position based on current measurement ("150A" for currents up to 150 amps; "1000A" for currents 150 to 1000 amps.)
- 2) Push the "BATTERY TEST/KW/AMPS-POWER OFF" switch into "KW" position.

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- 3) Plug the AW-80/81 coil cord into the instrument with the black plug inserted into the "-" or "COM" jack and the red plug inserted into the "+" or "Q=V" jack.
- 4) Set Instrument up to measure 2VDC.
- 5) Turn Multimeter "ON" by moving switch to "ON" position or appropriate range.
- 6) a) Connect the Transducer's black voltage test lead to the "COM" jack of the AW-80/81
b) Connect the Transducer's red voltage test lead to the other jack of the AW80/AW81.
c) Connect voltage test leads to the circuits to be measured.
- 7) Clamp the jaws of the AW-80/81 around the same conductor to which the red voltage test lead is connected. Name "AMPROBE" must face towards "LOAD".

IMPORTANT:

Use AW-80 for voltages of 0-240 VAC (+ 10% maximum)
Use AW-81 for voltages of 208-550 VAC (+ 10% maximum)

- 8) To obtain KW measurements, multiply Multimeter reading by factor in table:

	For Currents	
	0-150A	150A-1000A
AW-80	X 10	X 100
AW-81	X 100	X 1000

Example: Using an AW-80 with the 150A/1000A switch in the 150A position. Multimeter reading is 1.841. Multiply by 10 to obtain 18.41 KW.

Note: If Multimeter indicates Over Range on the 2V range, switch to the 20V range.

- 9) When measurements are completed, push "BATTERY TEST/ KW/AMPS-POWER OFF" switch into "AMPS-POWER OFF" position.

KW MEASUREMENT (Three Phase)

Case 1 Three-Phase, Four-Wire

a) Balanced Load

Measure kilowatts in one phase as shown in Figure 3 and as explained under KW MEASUREMENT (Single Phase) and multiply Kilowatts by 3.

b) Unbalanced Load

Follow same procedure as explained in (a) above and make a measurement on each of the three phases (transducer jaws and red voltage lead must connect to the same phase, black voltage lead remains connected to "N") and add up all three measurements to obtain total power.

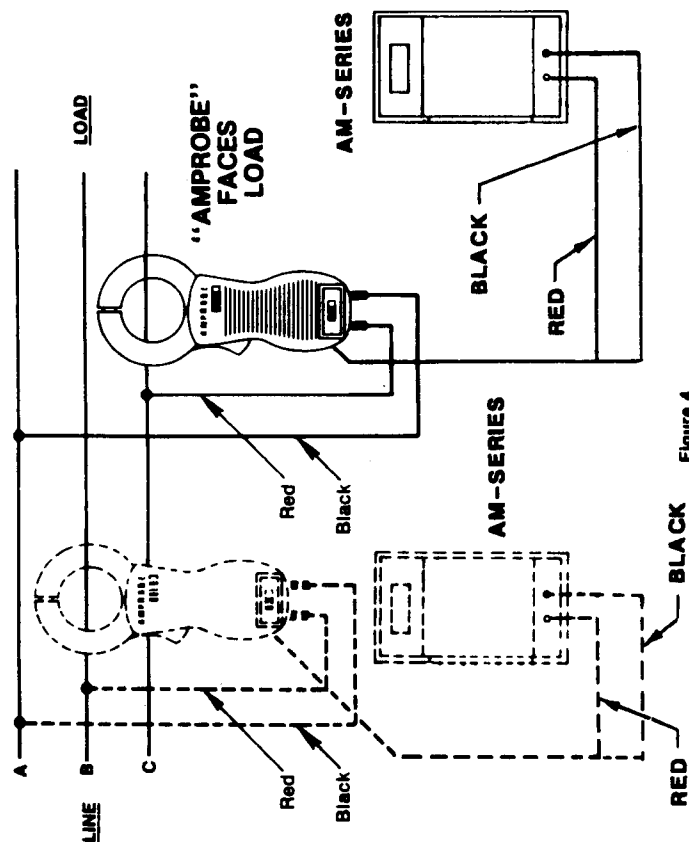
- 1) Take two readings with the AW-80/81 connected in the two positions as shown in Figure 4. (If two sets of instruments are available they may be connected and read at the same time.) Add the two Multimeter readings algebraically.
- 2) If the Power Factor is 50%, one of the readings will be zero and the other reading (multiplied by the appropriate multiplying factor shown on Page 8) will be the total power on the three-phase line.
- 3) If the Power Factor is less than 50%, one of the readings will be "negative" as indicated by a "-" sign in front of the reading on the Digital Multimeter. The "negative reading" is subtracted from the other reading. The result multiplied by the appropriate multiplying factor shown on Page 8 will be the total power on the three-phase line.
- 4) If the Power Factor is more than 50%, both Multimeter readings will be positive and should be added together and multiplied by the appropriate multiplying factor as shown on Page 8 to obtain the total power on the three-phase line.

POWER FACTOR

To determine power factor, measure the voltage using the Multimeter. Measure the current using the AW80/81 and the Multimeter. Measure the KW using the AW80/81 and the Multimeter.

$$\text{Power Factor} = \frac{\text{KW}}{\text{Volts} \times \text{Amps} \times .001}$$

**Case II Three-Phase, Three-Wire (Delta or Wye)
Balanced or Unbalanced**



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AC CURRENT RECORDING WITH LAW-82.

The position of the 150A/1000A switch on the AW-80/81 is only used to determine the KW range. It can be in either position when measuring current only.

The LAW-82 current ranges are 0-400/800 Amps AC. The KW ranges are:
with AW-80 0-10/20/100/200 KW.
with AW-81 0-20/40/200/400 KW.

- Use Chart No. 840W82.

See the LAW-82 lid label instructions for basic instructions to zero-adjust the recording module and install the chart paper.

- 1) Push the AW-80/81 "BATTERY TEST/KW/AMPS-POWER OFF" switch into the "AMPS-POWER OFF" position.

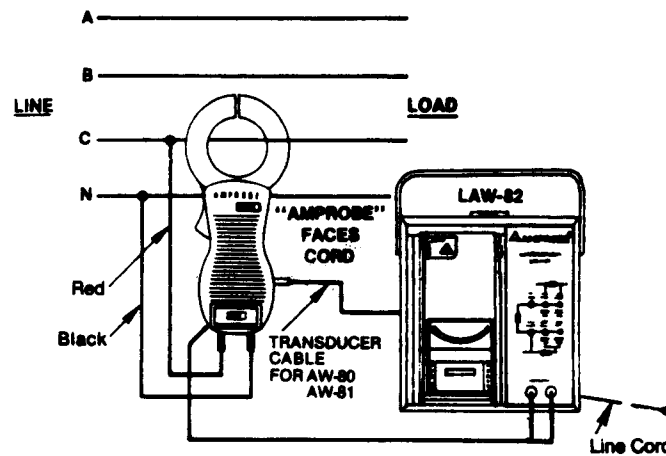


Figure 5

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- 2) a) Plug the AW-80/81 coil cord banana plugs into the LAW-82 observing proper polarity.
- b) Insert phono plug lead on LAW-82 (Transducer Cable. See Fig. 5) into jack on the right side of the AW-80/81.
- 3) a) Set the "AMPERES/KW" switch on the LAW-82 Control Panel to "AMPERES"
- b) To record up to 400 amperes, set the "X1/X½" switch to the "X½" position.
- c) To record up to 800 amperes, set the "X1/X½" switch to the "X1" position.
- 4) Clamp the jaws of the AW-80/81 around the conductor under test.
- 5) Push the LAW-82 chart drive switch into the "ON" position (exposing the word "ON"). See LAW-82 lid label instructions.

NOTE: The AMPROBE CT-50-1 and CT-50-2 (50-to-1 transformers) (Digital setting) may be used with the AW-80/81 and LAW-82 when recording current *but not when recording KW*.

KW RECORDING WITH LAW-82

See Note above.

See the LAW-82 lid label instructions for basic instructions to zero-adjust the recording module and install the chart paper.

CAUTION: The AW-80/81 must be connected to the LAW-82 before making any connections to the circuit. Failure to follow this procedure will expose the user to a voltage appearing at the banana plugs at the end of the coil cord.

- 1) a) If current is unknown, measure current following the instructions above.
- b) Remove the AW-80/81 from conductor.
- c) Set "150A/1000A" switch on the AW-80/81 to proper position based on current measurement ("150A" for currents up to 150 amps; "1000A" for currents 150 to 1000 amps).
- 2) Push the AW-80/81 "BATTERY TEST/KW/AMPS-POWER OFF" switch into the "KW" position.

- 3) Set the AW-80/81 switch on the LAW-82 control panel to "AW-80" if an AW-80 is being used or to "AW-81" if an AW-81 is being used.
- 4) Set the "AMPERES/KW" switch on the LAW-82 control panel to "KW"
- 5) a) Plug the AW-80/81 coil cord banana plugs into the LAW-82 observing proper polarity.
- b) Insert phono plug lead on LAW-82 (Transducer Cable. See Fig. 5) into jack on the right side of the AW-80/81.
- 6) To obtain a particular KW range, set switches as per the following:

X1/X½ Switch Position	AW-80 (For voltages up to 240VAC)			
	X ½		X1	
150A/1000A Switch Position	150A	1000A	150A	1000A
KW range on chart	10KW	100KW	20KW	200KW

X1/X½ Switch Position	AW-81 (For voltages of 208 to 550VAC)			
	X ½		X1	
150A/1000A Switch Position	150A	1000A	150A	1000A
KW range on chart	20KW	200KW	40KW	400KW

Eg. — If you are using an AW-80 with the LAW-82 and the switches are set for 150A and X½ and the recording on the chart is higher than 10KW, switch to the X1 position and read on the 20KW range.

- 7) a) Connect the AW-80/81 black voltage test lead to the "COM" jack of the AW-80/81
- b) Connect the AW-80/81 red voltage test lead to the other jack of the AW-80/81
- c) Connect voltage test leads to the circuit to be measured.
- 8) Clamp the jaws of the AW-80/81 around the same conductor to which the red voltage test lead is connected so that the name "AMPROBE" faces toward the load.