

# USER'S MANUAL

# AM90 AM91

The Ultimate Series™

AMPROBE®

# TABLE OF CONTENTS 1) SAFETY.....

f)	SAFETY	. 1
H)	INTRODUCTION	. 4
III)	PRODUCT DESCRIPTION	. 6
	(A) PANEL ILLUSTRATION	. 6
	(B) LCD ILLUSTRATION	
	(C) ANALOG BAR GRAPH	
	(D) CREST FACTOR	12
	(E) AVERAGE RESPONDING (AM-90)	
	(F) DC+AC TRUE RMS (AM-91)	13
	(G) ACV BANDWIDTH	15
	(H) NMRR (Normal Mode Rejection Ratio)	15
NΛ	(1) CMRR (Common Mode Rejection Ratio)	15
IV)	BASIC OPERATION(A) DCV VOLTAGE function	
	(B) AC, AC+Hz VOLTAGE functions	
	(C) DC, AC, AC+Hz mV functions	
	( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )	
	(E) dBm+Hz function (AM-91 only)	
	(F) DC, AC, AC+Hz ADAPTOR functions	
	(G) Hz, %+Hz (AM-91 only) functions	
	(H) $\Omega$ RESISTANCE, ns+G $\Omega$ CONDUCTANCE	
	(I) •1) AUDIBLE CONTINUITY function	
	(J) <b>IF</b> CAPACITANCE function	
	(K) → DIODE TEST function	
	(L) DC, AC, AC+Hz of uA, mA or A functions	38
V)	ADVANCED OPERATION	42
	(A) 40,000 COUNTS HIGH RESOLUTION SLOW	
	MODE	42
	(B) HOLD	44
	(C) MANUAL OR AUTO RANGING	
	(D) DATA STORE & RECALL	
	(E) RELATIVE MODES A.%.UNIT	46
	(F) RECORD R MODE	50

	(G) CREST (Instantaneous Peak Value) MODE	52
	(H) SORT S™ MODE	54
	(I) BACK LIGHT FEATURE (AM-91 ONLY)	56
	(J) LINE FILTER FREQUENCY 50 Hz OR 60 Hz	
	SELECT	
	(K) SET BEEPER OFF	56
	(L) AUTO POWER OFF (APO)	58
	(M) INPUT WARNING	59
VI)	SPECIFICATIONS	62
	General Specifications	
	Electrical Specifications	63
VII)	MAINTENANCE	72
	Battery Replacement Procedure	72
	Fuse Replacement Procedure	74
	Accessories and Replacement Parts	74
VIII)	SERVICE	

# 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, clothing and eye protection should be worn.
- To avoid electrical shock to the user and/or damage to the instrument, do not apply more than 1000V between any terminal and ground.
- 4) Before applying test leads to circuit under test, make certain that leads are plugged into proper jacks and switches are set to proper range and function.
- 5) Before using any electrical instruments or tester for actual testing, the unit should be checked on a low energy high impedance source. Do not use power distribution lines or any other high energy sources.
- 6) When measuring current using the uA, mA or 10A input: Before connecting or disconnecting the meter to or from the circuit to be tested, turn off all power to the circuit.
- 7) Do not attempt to measure a voltage unless you are already certain that the voltage is below 750 VAC or 1000 VDC. Do not use the 400 mV range unless you are already certain that the voltage is below 500V (AC or DC).
- 8) 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.
- Make certain no voltage is present in circuit before connecting ohmmeter to circuit.

IMPORTANT: Plug in only one accessory probe or set of test leads at any one time, except as directed.

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

# I) SAFETY

This instrument is designed and manufactured to meet Protection Class II per International Safety Standard IEC1010-1 Installation Category III and UL3111-1.

This manual contains information and warnings that must be followed for operating the instrument safely and maintaining the instrument in a safe operating condition.

#### TERMS IN THIS MANUAL

WARNING identifies conditions and actions that could

result in serious injury or even death to the

user.

**CAUTION** identifies conditions and actions that could

cause damage or malfunction in the instrument.

#### INTERNATIONAL ELECTRICAL SYMBOLS

Attention!Refer to the explanation in Manual

Dangerous Voltage

**∔** Ground

Double Insulation

**—** Fuse

DC—Direct Current

AC---Alternating Current

₹ Either DC or AC

DC+AC Voltage

#### WARNING

To avoid electrical shock hazard or damage to the meter, do not exceed the overload level shown in **TABLE 1** 

FUNC	CTION	TERMINALS	OVERLOAD LEVEL
DC	VOLTAGE		
AC	VOLTAGE	Ω <b>V</b> +F & COM	1000 VDC or Vpeak
DC+A	AC VOLTAGE		·
mV	MILLI-VOLT		
ADP	ADAPTOR		
Hz	FREQUENCY		
%	DUTY CYCLE		
Ω	RESISTANCE	ΩV+F & COM	600 VDC or VAC rms
nS	CONDUCTANCE	4 00111	
->))	AUDIBLE CONTINUITY		
╂	CAPACITANCE		
₩	DIODE TEST		
A CURRENT		A & COM	10A/600V*
mA or uA CURRENT		mA uA & COM	630mA/500V

<sup>\* 10</sup>A CONTINUOUS; 20A FOR 30 SECONDS MAXIMUM, 5 MINUTES COOL DOWN INTERVAL

TABLE 1

#### WARNING

To avoid electrical shock hazard, observe the proper safety precautions when working with voltages above 60 VDC or 25 VAC rms. These voltage levels pose a potential shock hazard to the user.

Inspect test leads, connectors, and probes for damaged insulation or exposed metal before using the instrument. If any defects are found, replace them immediately.

To avoid electrical shock hazard, do not touch test lead tips or the circuit being tested while power is applied to the circuit being measured.

Never attempt a voltage measurement with the test lead inserted into the mA/uA or A input jacks. You might be injured or damage the meter.

CAUTION: To avoid damage to the meter

Disconnect the test leads from the test points before changing functions. Always set the instrument to the highest range and work downward for an unknown value. Always use the correct replacement fuses. Check the manual for proper part numbers.

# II) INTRODUCTION

The Ultimate Series<sup>™</sup>, Models AM-90 and AM-91 are hand held, professional quality digital multimeters with benchtop features used for today's complex electrical and electronic system diagnostics and troubleshooting. The AM-91 offers DC+AC True RMS with a wide AC bandwidth for non-sinusoidal waveform measurements, as well as a Back Lighted LCD display for all light condition applications. The AM-90 is an Average sensing DMM RMS calibrated.

The measuring functions include DC Voltage, AC Voltage, DC+AC Voltage (AM-91), dBm (AM-91), Adaptor input, Frequency, Duty Cycle, Resistance, Conductance, Continuity Test, Capacitance, Diode Test, DC & AC Current . A dual display LCD so you can view 2 variables at the same time, ACV & Hz, ACA & Hz, ADP & Hz, nS & G $\Omega$ , Duty% & Hz

Pushbutton functions include a 4000 count fast measuring mode, 40,000 count high resolution slow measuring mode, Data Hold, 41 segment bargraph that updates 128 times per second, Auto Polarity, Auto or Manual Ranging, Data Store & Recall, Relative Zero mode, Relative Percent Change mode, Relative Per Unit mode, 50ms Record Max/Min/Max-Min/Avg, 0.8ms Crest Max/Min/Max-Min, Sort™ Max/Min/Max-Min/Avg, dBm Reference Impedances Selection (AM-91) as well as Secondary Function Selection.

Power on options include Line Filter Frequency 50/60Hz Selection for best noise rejection (normally only available on expensive bench top instruments), Auto Power off Disable as well as a Beeper Disable.

The Ultimate Series<sup>™</sup> is housed inside a gasket sealed heavy duty casing which keeps out grease, oil, dirt and moisture to maintain superb accuracy and reliability. The case is made of a high impact, thick wall fire retardant material to maximize durability of the meter, and safety to the user.

In addition, a sealed battery compartment design keeps battery leakage contaminants off the PC board, which largely reduces the potential risks of shortages and degrading of accuracy due to the contaminants.

The Ultimate Series<sup>™</sup> is designed and manufactured according to Protection Class II per the International Safety Standard IEC1010-1 installation category III, UL-3111-1 and CSA 22.2 No.1010-1-92. Contains NO CFC Ozone Depleting Substances, and are not manufactured with such substances.

The Ultimate Series<sup>™</sup> from Amprobe are equipped with a heavy duty Rubber holster, Test Leads with Alligator adaptor clips, 9 volt battery and an Instruction Manual.

# III) PRODUCT DESCRIPTION

# (A) PANEL ILLUSTRATION, See FIG 1

1. LCD display 4-3/4 digit 40000 counts + 4 digit 9999 counts dual display LCD

SORTS HOLDE Pushbutton. Press momentary to activate HOLD, or press and hold for 1 second to activate SORT<sup>™</sup> function

 $dBm\text{-}\Omega$ RANGE Pushbutton to select Auto/Manual ranging, or to select different reference impedances in dBm function (AM-91 only)

Pushbutton to select Relative Zero. Relative Percentage Change, Relative Per Unit mode

Pushbutton to Recall stored data

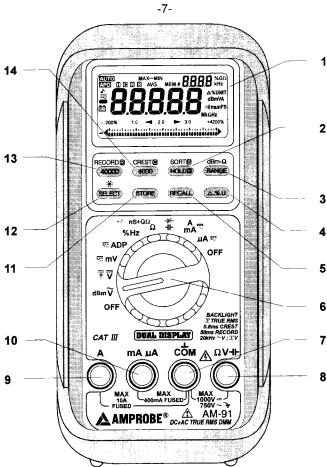
Turn the Power On or Off and Select a Selector function

Common (Ground reference) Input Jack COM for all functions

 $\Omega$ V+F Input Jack for all functions EXCEPT current functions, color coded

Input Jack for 4A or 10A current 9. Α functions, color coded

FIG 1. FRONT PANEL LAYOUT



-8-

10. mA uA

Input Jack for 400mA, 40mA, 4000uA, or 400uA current functions, color coded

11. STORE

Pushbutton to store data displayed for later recall

12 **SELECT** 

Pushbutton. Press momentary to select secondary functions. Press and Hold for 1 second to turn on the LCD back light (AM-91 only)

RECORD®

13. 40000

Pushbutton. Press momentary to select 40,000 counts, or Press and Hold for 1 second to activate RECORD function

CREST**C** '

Pushbutton. Press momentary to select 4,000 counts fast mode, or Press and Hold for 1 second to activate CREST function

### (B) LCD ILLUSTRATION, See FIG 2

15. **A.**%.UNIT

Δ annunciator indicates relative zero.
 Δ % annunciators together indicate relative percentage change
 Δ UNIT annunciators indicate relative per unit

16. •**1)** 

This annunciator indicates audible continuity function

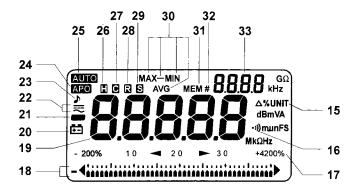


FIG 2. LCD DISPLAY (SHOWN ACTUAL SIZE)

	-10-		-11-
17. +4200%	Analog bar graph scale	28. 🖫	This annunciator indicates the RECORD function is activated
18 ◀•□□□	Analog bar graph with overload flag and polarity	29. 🛭	This annunciator indicates the SORT <sup>™</sup> function is activated
19. <b>DATA</b>	Main digital readings of data being measured	MAX-MIN 30. avg	This annunciator indicates MAX (Maximum), MIN (Minimum), MAX —MIN
20. 🛅	Low Battery alert, replace the battery as soon as possible to ensure accuracy		(Maximum minus Minimum), or AVG (Average) reading is being displayed
21.	This symbol indicates Negative Polarity	31. мем	This annunciator blinks 2 times to
22. ≅	annunciator indicates direct current (DC) is selected. annunciator indicates alternating current (AC) is selected. annunciator indicates DC		confirm data storage when the STORE pushbutton is pressed, and turns on with the recalled data when the RECALL pushbutton is pressed
	+AC is selected	32. #	This annunciator together with the
23. 🎝	This annunciator indicates beeper is on		secondary display data indicate the number of event in the SORT <sup>™</sup> function
24. APO	This annunciator indicates Auto Power Off is enabled	33. <b>DATA</b>	Secondary display for Dual Display data
		(C) ANALOG BAF	
25. <b>AUTO</b>	This annunciator indicates Autoranging	measurement	ar graph provides a visual indication of like a traditional analog meter needle.
26.	This annunciator indicates data HOLD function is activated	The AM-90/91 second in DC excellent sign	analog bar graph updates 128 times per V and RESISTANCE functions showing al pattern in detecting faulty contacts,
27. 🖸	This annunciator indicates the CREST function is activated	identifying pot spikes during a	rentiometer clicks, and indicating signal adjustments.

#### (D) CREST FACTOR

Crest Factor is the ratio of the Crest (instantaneous peak) value to the total DC+AC True RMS value. That is:

Crest Factor =  $\frac{\text{Vcrest}}{\text{Vrms}}$ 

A pure sinusoidal waveform has a Crest Factor of 1.414. A badly distorted sinusoidal waveform normally has a much higher Crest Factor. If you are measuring a signal above the DMM's specified Crest Factor, the DMM may not produce accurate measurements. AM-91 can accurately measure the True RMS value of voltage signal with a Crest Factor of at least 3.0 at full scale, and 6.0 at half scale.

#### (E) AVERAGE RESPONDING RMS CALIBRATED (AM-90)

RMS (Root-Mean-Square) is the term used to describe the effective or equivalent DC value of an AC signal. Most digital multimeters use Average responding RMS calibrated technique to measure RMS values of AC signals. This technique is to obtain the Average value by rectifying and filtering the AC signal. The Average value is then scaled upward (calibrated) to read the RMS value of a sine wave.

In measuring pure sinusoidal waveform, this technique is cost effective and accurate. In measuring nonsinusoidal waveforms, however, significant errors can be introduced because of different scaling factors relating Average to RMS values.

-13-

#### (F) DC+AC TRUE RMS (AM-91)

DC+AC True RMS is a term which identifies a DMM that responds accurately to the total effective RMS value regardless of the waveform, and is given by the expression:

$$\sqrt{DC^2 + (AC \text{ rms})^2}$$

DC+AC True RMS voltage is the total effective voltage having the same heating value corresponding a DC voltage. With DC+AC True RMS voltage measurement, you can accurately measure the voltage values regardless of the waveforms such as: square, sawtooth, triangle, pulse trains, spikes, as well as distorted waveforms with the presence of harmonics and DC components. Harmonics and DC components may cause:

- Overheated transformers, generators and motors to burn out faster than their rated life
- 2) Circuit breakers to trip prematurely
- 3) Fuses to blow
- Neutrals to overheat due to triplen harmonics present on the neutral (180Hz)
- 5) Bus bars and electrical panels to vibrate

AC only True RMS and Average responding meters can introduce significant errors in many applications. See **TABLE 2** for typical example.

INPUT WAVEFORM	DC+AC TRMS	AC TRMS	AVERAGE REPONSE
Sine 1.414V	1.000V ERROR= 0% CF=1.414	1.000V ERROR= 0% CF=1.414	1.000V ERROR= 0%
Full wave rectified Sine	1.000V ERROR= 0% CF=1.414	0.436V ERROR= 56.4% CF=3.247	0.421V ERROR= 57.9%
Half wave rectified Sine	0.707V ERROR= 0% CF=2.000	0.546V ERROR= 22.7% CF=2.591	0.550V ERROR= 22.2%
50% duty pulse train	1.000V ERROR= 0% CF=1.414	0.707V ERROR= 29.3% CF=2.000	0.785V ERROR= 21.5%

TABLE 2. WAVEFORMS AND CREST FACTORS

# (G) ACV BANDWIDTH

ACV bandwidth of a DMM is the range of frequencies over which ACV measurements can be made within the specified accuracy. In other words, a DMM cannot accurately measure the ACV value with frequency spectrums beyond the frequency response of the DMM. In reality, complex waveforms, noise and distorted waveforms contain much higher frequency spectrum than its fundamentals. AM-90/91 series has ACV bandwidth specifications up to 20kHz in most ranges, and extended bandwidth specification up to 50kHz on AM-91 AC 400mV range.

#### (H) NMRR (Normal Mode Rejection Ratio)

NMRR is the DMM's ability to reject unwanted AC noise effect which can cause inaccurate DC measurements. NMRR is typically specified in terms of dB (decibel). AM-90/91 series has a NMRR specification of >60dB at 50 and 60Hz, which means the effect of AC noise is reduced more than 1000 times in DC measurements.

# (I)CMRR (Common Mode Rejection Ratio)

Common mode voltage is voltage present on both the COM and VOLTAGE input terminals of a DMM, with respect to ground. CMRR is the DMM's ability to reject common mode voltage effect which can cause digit rattle or offset in voltage measurements.

AM-90/91 series has a CMRR specifications of >60dB at DC to 60Hz in ACV function; and >120dB at DC, 50 and 60Hz in DCV function. If neither NMRR nor CMRR specification is specified, the DMM's performance will be uncertain.

Do not apply more than 1000VDC or 750 AC to the input. Do not apply more than 1000 Volts between any input terminal and earth ground. Exceeding these limits creates a shock hazard and may damage the meter.

# IV) BASIC OPERATION

# (A) DC VOLTAGE function

- 1) Set rotary switch to  $\overline{\mathbf{v}}$  position
- 2) Insert red (+) test lead into **ΩV-I** jack and black (-) test lead into **COM** input jack
- Connect test leads to voltage source and observe the digital display, see FIG 3

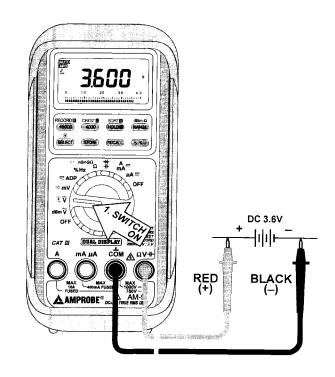


FIG 3. DC VOLTAGE FUNCTION

-18-

# (B) AC, AC+Hz VOLTAGE functions

- 1) Set rotary switch to  $\widetilde{\mathbf{v}}$  position
- 2) Insert red (+) test lead into  $\Omega V + \Gamma$  jack and black (-) test lead into COM input jack
- 3) Connect test leads to voltage source and observe the digital display, see FIG 4
- 4) Default at AC. Press SELECT button momentary to select ACV+Hz in dual display if required

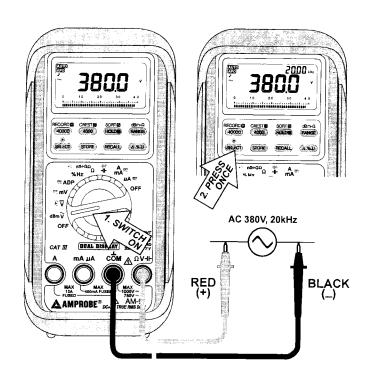


FIG 4. AC, AC+Hz VOLTAGE FUNCTIONS

-20-

- (C) DC, AC, AC+Hz mV functions
- Set rotary switch to ≅ mV position
   Default at DC. Press SELECT button momentary to select AC, and press again to select AC+Hz in dual display if required
- 3) Insert red (+) test lead into  $\Omega V + I$  jack and black (-) test lead into COM input jack
- 4) Connect test leads to voltage source and observe the digital display, see FIG 5

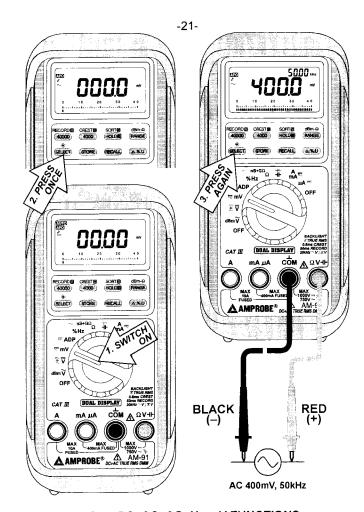


FIG 5. DC, AC, AC+Hz mV FUNCTIONS

-22-

# (D) DC+AC VOLTAGE function (AM-91 only)

- 1) Set rotary switch to  $\frac{1}{2}$   $\overline{V}$  position 2) Default at DC. Press SELECT button momentary to select to DC+AC
- 3) Insert red (+) test lead into  $\,\Omega {\, {\mbox{V-I-}}}\,$  jack and black (-) test lead into COM input jack
- 4) Connect test leads to voltage source and observe the digital display, see FIG 6

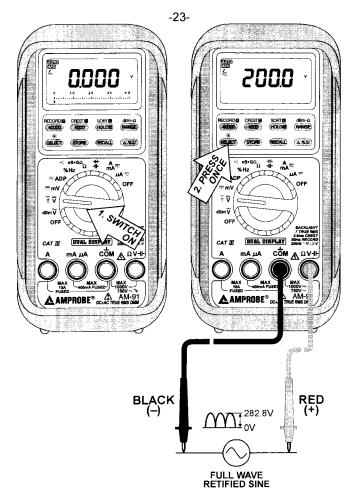


FIG 6. DC+AC VOLTAGE FUNCTION

-24-

# (E) dBm + Hz function (AM-91 only)

1) Set rotary switch to  $dBm \widetilde{V}$  position

2) Default at AC Press SELECT button momentary two times to select dBm. Default Reference impedance 600  $\Omega$  will be displayed for 2 seconds before displaying the dBm & Hz readings

3) Press  $dBm-\Omega$  (RANGE) button momentary to select different reference impedances from 4, 8, 16, 32, 50, 75,

93, 110, 125, 135, 150, 200, 250, 300, 500, 600, 800, 900, 1000, up to  $1200\,\Omega$  . Impedance values will again be displayed for 2 seconds before displaying the dBm &

Hz readings

4) Insert red (+) test lead into  $\Omega V + I$  jack and black (-)

test lead into COM input jack

5) Connect test leads to signal source and observe the digital display, see FIG 7

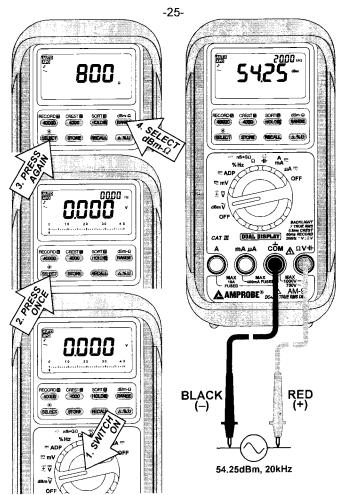


FIG 7. dBm+Hz FUNCTION

-26-

#### (F) DC, AC, AC + Hz ADAPTOR functions

- 1) Set rotary switch to ADP position
- Default at DC. Press SELECT button momentarily to select AC, and press again to select AC+Hz in dual display if required
- 3) Insert output plug of the adaptor with positive (+) into  $\Omega$  V-I- jack and the negative (-) into COM input jack, see FIG 8
- 4) The digital display defaults at 10 counts per mV, and can be extended to 100 counts per mV in 40,000 counts mode
- 5) The extra high input impedance of 1000 M $\Omega$  makes the ADP function possible to cope with most voltage output adaptors available. For current clamp adaptor with output 1mV per Ampere, 2000 counts on the digital display represents 200 Ampere. For temperature adaptor with output 1mV per degree, 2000 counts represents 200 degree

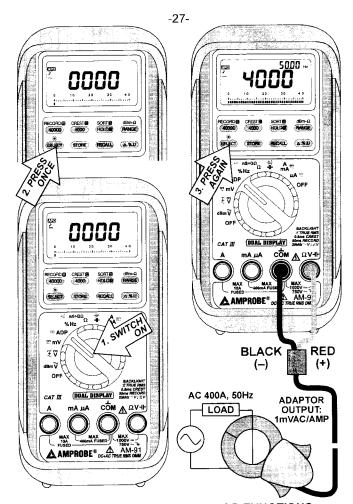


FIG 8. DC, AC, AC+Hz ADAPTOR FUNCTIONS

-28-

- (G) Hz, % + Hz (AM-91 only) functions
- 1) Set rotary switch to %Hz
- 2) Insert red (+) test lead into  $\Omega V + F$  jack and black (--) test lead into COM input jack
- 3) Connect test leads to signal source and observe the digital display, see FIG 9
- 4) Default at **Hz**. Press **SELECT** button momentary to select **%+Hz** in dual display (AM-91 only)

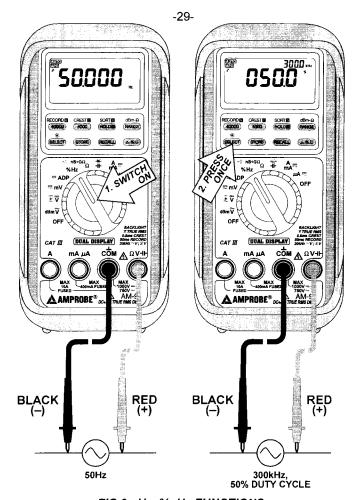


FIG 9. Hz, %+Hz FUNCTIONS

# (H) $\Omega$ RESISTANCE, nS + $G\Omega$ CONDUCTANCE

- 1) Set rotary switch to  $^{\circ\circ\circ\circ}$  nS+G $\Omega$   $\Omega$  2) Insert red (+) test lead into  $\Omega$  **V-I-** jack and black (—) test lead into COM input jack
- 3) Connect the test leads as shown in FIG 10 and observe the digital display
- 4) Default at  $\Omega$ . Press **SELECT** button momentary to select  $nS+G\Omega$  in dual display for resistance measurements beyond  $40M\Omega$

#### CAUTION

Using resistance measurement function in a live circuit will produce false results and may damage the instrument. In many cases the suspect component must be disconnected from the circuit to obtain an accurate reading

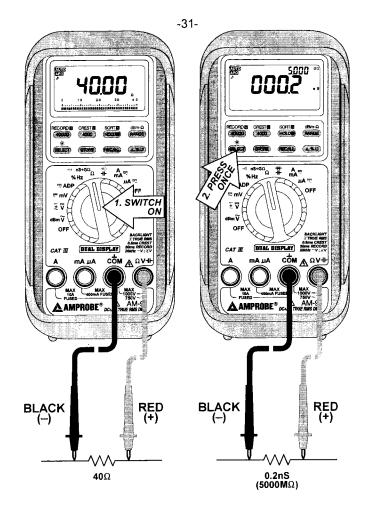


FIG 10.  $\Omega$ , nS+G $\Omega$  FUNCTIONS

# (I) \*\*\* AUDIBLE CONTINUITY function

- 1) Set rotary switch to \*\*\*) nS+G $\Omega$   $\Omega$ 2) Default at  $\Omega$ . Press **SELECT** button momentary two
- times to select  ${}^{\circ ij_{r}^{h}}$  audible continuity function 3) Insert red (+) test lead into  $\Omega V$ -IF jack and black (-)test lead into COM input jack
- 4) Connect the test leads to the end points of wire as shown in FIG 11
- 5) A continuous beep tone indicates a complete wire. This is useful for checking wiring connections and operation of switches

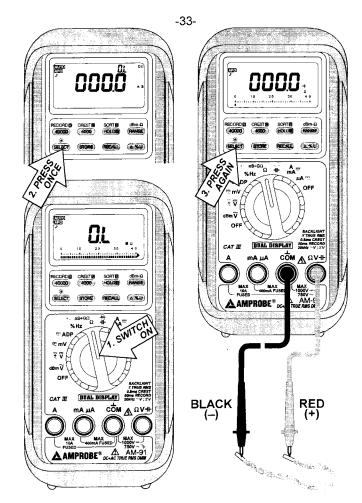


FIG 11. • )) AUDIBLE CONTINUITY FUNCTION

# (J) IF CAPACITANCE function

- 1) Set rotary switch to
- 2) Insert red (+) test lead into  $\Omega V + IF$  jack and black (—) test lead into COM input jack
- 3) Connect the test leads as shown in FIG 12 and observe the digital display

#### CAUTION

Discharge capacitors before making any measurement. Large value capacitors should be discharged through an appropriate resistance load

Note: Some Milli Farad Capacitance measurements may take up to 25 seconds

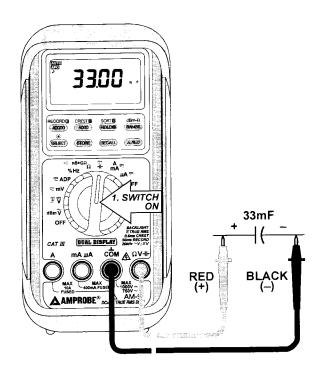


FIG 12. H- CAPACITANCE FUNCTION

### (K) \* DIODE TEST function

- 1) Set rotary switch to
- 2) Default at **-II-** Capacitance. Press **SELECT** button momentary to select idiode test
- 3) Insert red (+) test lead into  $\Omega V + IF$  jack and black (—) test lead into COM input jack
- 4) Connect the test leads as shown in **FIG 13** and observe the digital display
- 5) Normal forward voltage drop (forward biased) for a good silicon diode is between 0.400V to 0.900V. A reading higher than that indicates a leaky diode (defective). A zero reading indicates a shorted diode (defective). An OL indicates an open diode (defective)
- 6) Reverse the test leads connections (reverse biased) across the diode
- The digital display shows OL if the diode is good. Any other readings indicate the diode is resistive or shorted (defective)

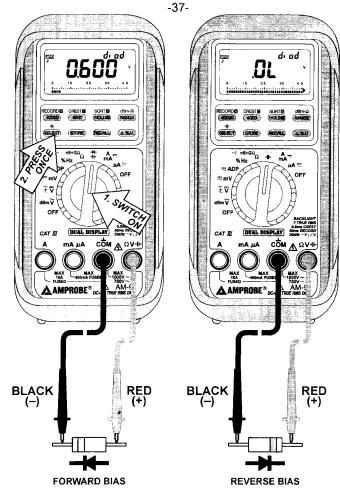


FIG 13. → DIODE TEST FUNCTION

Do not measure any circuit that draws more than the current ratings of the protection fuses. If the fuse blows, replace it with the proper fuse. Failure to do this may result in injury or damage to the meter. Do not attempt a current measurement where the open circuit voltage is above 500V for Ma uA jack; and 600v for A jack. Suspected open circuit voltage must be checked with voltage functions

Voltage output current clamp adaptors are recommended to use with the meter adaptor or voltage functions for making high current measurements

## (L) DC, AC, AC + Hz of uA, mA or A functions

- 1) Set rotary switch to A mA or uA
- 2) Insert red (+) test lead into mA uA jack and black (—) test lead into COM input jack for current measurements below 400mA, see FIG 14; and Insert red (+) test lead into A jack and black (—) test lead into COM input jack for currents measurements up to 10A, see FIG 15. mA or A ranges will be selected automatically after plug in
- Default at DC. Press SELECT button momentary to select AC, and press again to select AC+Hz in dual display if required
- 4) Connect the test leads as shown in FIG 14 or FIG 15 and observe the digital display

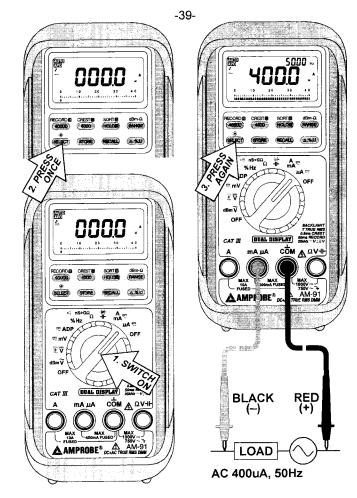
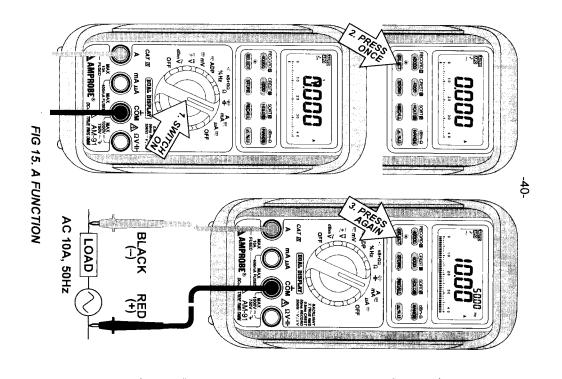


FIG 14. uA, mA FUNCTION



	DATA Hold	RANGE Lock	40,000 Counts	RELATIVE △.%.U	RECORD *	CREST *	SORT**	DUAL DISPLAY	STORE RECALL	
DC VOLTAGE	•	•	•	•	•	•	•		•	1
AC VOLTAGE	•	•	•	•	•	•	•	•	•	
DC+AC VOLTAGE	•	•	•	•	•	•	•		•	
DC CURRENT	•	•	•	•	•	•	•		•	
AC CURRENT	•	•	•	• •	•	•		•		l
RESISTANCE	•	•	•	•	•		•		•	
CONDUCTANCE	•		•					•	•	
FREQUENCY	•							-	•	-
DUTY CYCLE	•							•	•	
CAPACITANCE	•	•		•	•		•	₹,	•	
ADAPTOR	•		•	•	•	•	•	•	-	
dBm	•		•	•				•		l
CONTINUITY	•		•					•	•	
DIODE	•								•	

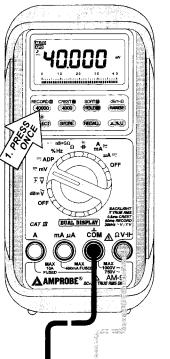
\*Note: RECORD, CREST & SORT™ features are NOT available in Dual Display mode

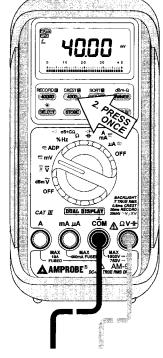
TABLE 3. FEATURE AVAILABILITY SUMMARY

# (A) 40,000 COUNTS HIGH RESOLUTION SLOW MODE

Press the 40000 button momentary to enter the 4-3/4 digit high resolution slow mode with a maximum display at 40,000 counts. Press the 10000 button momentary to return to 3-3/4 digit fast mode. See FIG 16. The 4-3/4 digit mode is available in all functions except Frequency, Duty Cycle, Capacitance and Diode Test

In 3-3/4 digit fast mode, the digital display updates 5 times per second nominal to give you the maximum measuring speed. In 4-3/4 digit slow mode, the digit display updates 1.25 times per second nominal to give you smooth readings as well as the full accuracy of the meter \( \)





PRESS MOMENTARY TO SELECT 4-3/4 DIGITS 40,000 COUNTS SLOW MODE PRESS MOMENTARY TO SELECT 3-3/4 DIGITS 4,000 COUNTS FAST MODE

FIG 16. 40,000 COUNTS HIGH RESOLUTION SLOW MODE

-43-

#### (B) HOLD

Press the button momentary to activate the hold function with LCD annunciator turns on. Press momentary again to release. See FIG 17. When in normal measuring modes, the hold feature freezes the display for later view. When in RECORD or CREST mode, however, the hold function stops updating the measurements, and you can read throughout the locked MAX, MIN, MAX-MIN, and AVG readings. Release the hold function to continue RECORD or CREST

#### (C) MANUAL OR AUTO RANGING

Press the RANGE button momentary to select manual-ranging, and the meter will remain in the range it was in with LCD annunciator AUTO turns off. Press the button momentary again to step through the ranges. Press and hold the button for 1 second or more to resume autoranging. See FIG 18

Note: When the meter is in Record, Crest, Sort, Hold, Recall or Relative mode, changing the measuring range manually will cause the meter to exit those features

#### (D) DATA STORE & RECALL

Press the STORE button momentary to store the displaying information. The LCD annunciator MEM blinks two times to confirm storage. Press the RECALL button momentary to recall the stored data with LCD annunciator MEM turns on. See FIG 19. Press any other buttons EXCEPT RECALL to resume measurements. This feature stores the whole display data in memory for later recall. The memory will remain even in auto-power-off mode, and can also be recalled while you are in another meter function. The memory will be erased if the rotary switch is switched to the OFF position



PRESS MOMENTARY TO ACTIVATE HOLD



PRESS MOMENTARY

FIG 17. HOLD FUNCTION

-45-



PRESS MOMENTARY
TO SELECT MANUAL RANGING



PRESS 1 SECOND TO RESUME AUTO RANGING

FIG 18. MANUAL OR AUTO RANGING



PRESS MOMENTARY TO STORE DATA



PRESS MOMENTARY
TO RECALL DATA

FIG 19. DATA STORE & RECALL

# (E) RELATIVE MODES A.%.UNIT

Press the button momentary to enter the Relative Zero (△) mode, the LCD annunciator △ turns on. Relative zero allows the user to offset the meter measurements with a relative reference value. Practically all displaying readings can be set as relative reference value including MAX, MIN, MAX-MIN, and AVG readings of RECORD or SORT™ functions. See FIG 20a

Press the button momentary again to enter the Relative Percentage Change (%) mode, the LCD annunciators  $\Delta$ % turn on. In this mode, the readings show relative percentage changes, and the bar graph automatically indicates +/-200%, or +/-20% full scale changes with respect to the relative reference value as center zero point. \*It simplifies zero, peaking, nulling measurements, and is excellent for fine adjustments. See FIG 20b

Press the About button momentary again to enter the Relative Per Unit (U) mode, the LCD annunciators A UNIT turn on. This is a unique feature to show the ratio of measuring values to the relative base value. The relative base value is considered to be one unit, and the consecutive measurements will be displayed in terms of units. Measuring the parallel capacitance of co-axial cable or parallel wire in conjunction with the relative per unit mode, for example, helps estimating the total cable length or locating cable breakage locations. See FIG 20c

Press and hold the button for 1 second or more to exit relative modes and resume normal measurements

\*Note : Bar Graph is not available in the DC + AC voltage mode.

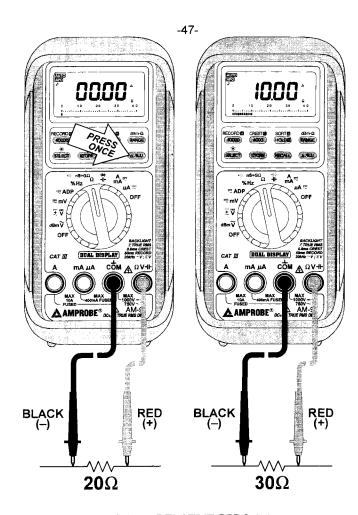


FIG 20a. RELATIVE ZERO (Δ)

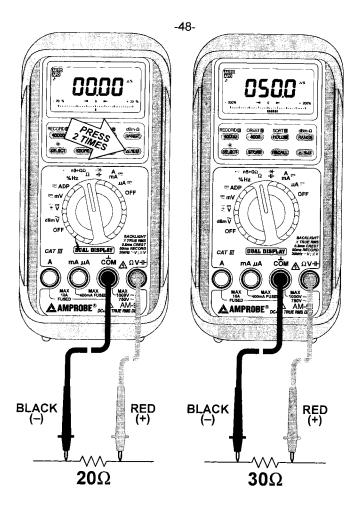
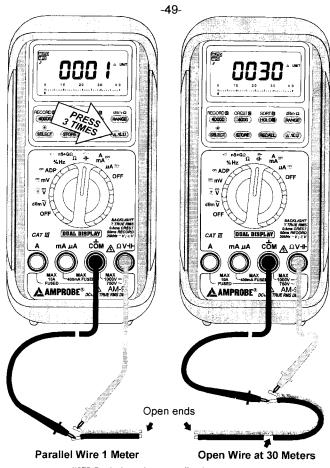


FIG 20b. RELATIVE PERCENTAGE CHANGE (%)



NOTE: Test lead capacitance may affect the accuracy of this application. Lead length should be as short as possible.

Accuracy is ±15% of reading.

FIG 20c. RELATIVE PER UNIT (U)

### (F) RECORD ☑ MODE

Perform measurements as described in BASIC OPERATION. Press and hold the button for 1 second or more to activate RECORD mode with LCD annunciators Avg turn on. The meter beeps when new maximum or minimum reading is updated. Press the button momentary to read throughout the Maximum (MAX), Minimum (MIN), Maximum minus Minimum (MAX—MIN), and Average (AVG) readings. Press the button for 1 second or more to exit RECORD mode. See FIG 21

With the Auto-Ranging RECORD mode, you can easily track intermittent signals, and monitor line voltage changes over a much wider dynamic range with the best resolution. It largely surpasses single range recording which is easily over-flowed, or with insufficient resolution. The AM90/91 features a fast single range sampling speed of 50ms for MAX, MIN, MAX-MIN and AVG readings. The faster the sampling speed, the more accurate the measurement of surges, spikes and sags will be. The true average AVG feature calculates all readings taken over time continually

Note:1. Auto Power Off feature will be disable automatically in this mode

 To retain the readings after measurements, use HOLD function to stop updating the measurements before disconnecting the test leads. Use similar pushbutton procedures described above to read throughout the locked readings



1. PRESS 1 SECOND



4. PRESS MOMENTARY AGAIN TO SEE MAX-MIN



2. PRESS MOMENTARY AGAIN TO SEE MAXIMUM



5. PRESS MOMENTARY AGAIN TO SEE AVERAGE



3. PRESS MOMENTARY AGAIN TO SEE MINIMUM



6. PRESS 1 SECOND TO EXIT RECORD

FIG 21. RECORD MODE

-51-

Perform measurements as described in BASIC OPERATION. Press and hold the calculation button for 1 second or more to activate CREST mode with LCD annunciators **MAX** turn on. Press the button momentary to read throughout the Maximum (MAX), Minimum (MIN), and Maximum minus Minimum (MAX—MIN) readings. Press the button for 1 second or more to exit CREST mode. See **FIG 22** 

With the CREST mode, you can capture transient signal crest voltage (instantaneous peak value) as short as 0.8ms. This function can be used to determine crest factor which can indicate the presence of harmonics. Crest factor is the ratio of crest value to the true rms value. A pure sinusoidal waveform has a crest factor of 1.414

- Note:1. Auto Power Off feature will be disabled automatically in this mode
  - 2. To retain the readings after measurements, use HOLD function to stop updating the measurements before disconnecting the test leads. Use similar pushbutton procedures described above to read throughout the locked readings
  - Do not use Current Transducer to make Crest Measurements while in the 400mVAC or ADP AC mode. In general crest measurements are limited to ≥ 15% of the range



1. PRESS 1 SECOND TO ACTIVATE CREST (MAXIMUM)



3. PRESS MOMENTARY AGAIN TO SEE CREST MAX-MIN ( Vp-p)



2. PRESS MOMENTARY TO SEE CREST MINIMUM



4. PRESS 1 SECOND TO EXIT CREST

FIG 22. CREST MODE

-53-

#### (H) SORT S™ MODE

Perform measurements as described in BASIC OPERATION. Press and hold the total button for 1 second or more to activate SORT mode with LCD

annunciators S avg turn on. The meter beeps when a stable reading is captured, and the last captured reading together with the number of capture will be automatically hold & displayed. Press the button momentary to read throughout the Maximum (MAX), Minimum (MIN), Maximum minus Minimum (MAX MIN), and Average (AVG) readings. Press the button for 1 second or more to exit SORT mode. See FIG 23

SORT™ is one of the most useful innovations. The function senses a stable measurement, beeps, captures it for comparison & display, then stores the maximum and minimum readings together with the event numbers in memory for later display. The average feature calculates all the readings taken and displays the true average value together with number of events counted. This simplifies MAX & MIN values sorting, MAX-MIN & AVG values calculation, and quantity counting in component inspection. When used with relative % change function, readings will be displayed in terms of percentage deviation

Note: 1. Auto Power Off feature will be disabled automatically in this mode



1. PRESS 1 SECOND TO ACTIVATE SORT™



4. PRESS MOMENTARY AGAIN TO SEE MAX-MIN



2. PRESS MOMENTARY TO SEE MAXIMUM



5. PRESS MOMENTARY AGAIN TO SEE AVERAGE



3. PRESS MOMENTARY



PRESS 1 SECONE

FIG 23. SORT™ MODE

-55-

# (I) BACK LIGHT FEATURE (AM-91 ONLY)

Press and hold the button for 1 second or more to activate backlight. The backlight will be off 42 seconds after each activation automatically to extend battery life. When the backlight is already on, press and hold the button again to reset the automatic off timing

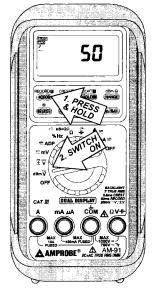
# (J) LINE FILTER FREQUENCY 50 Hz OR 60 Hz SELECTION

The line filter frequency can be selected as a power-on option. Press the \*\*GENTED\*\* button while turning the meter on to display the set frequency. Press the \*\*SELECT\*\* button for 50 Hz or press the \*\*STORE\*\* button for 60 Hz selection. Then press the \*\*RANGE\*\* button to store the selected frequency. See FIG 24

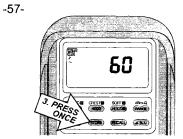
Selecting the appropriate line filter frequency to cope with your line frequency can maximize the meter's noise rejection ability. This is normally only available in expensive bench top multimeter

#### (K) SET BEEPER OFF

The beeper feature can be disabled manually as a power-on option by pressing the button while turning the meter on. The LCD annunciator will be off during operation. All beeper functions are turned off except input warning beeper



1. PRESS THE BUTTON WHILE 2. TURNING ON THE METER



3. PRESS MOMENTARY TO SELECT 60Hz



4. PRESS MOMENTARY TO SELECT 50Hz



5. PRESS MOMENTAR'
TO ENTER (SET)

FIG 24. LINE FILTER FREQUENCY 50Hz OR 60Hz SELECTION

#### (L) AUTO POWER OFF (APO)

The Auto Power Off (APO) mode turns the meter off automatically to extend battery life after 4.5 minutes of inactivities. The meter turns back on if the rotary switch is turned. Activities are specified as:

- 1) Rotary switch or push button operations
- 2) Significant measuring data readings

When the meter enters the RECORD, CREST or SORT mode, the Auto Power Off will be disabled automatically, and the LCD annunciator APO will be off

The Auto Power Off feature can be disabled manually as a power-on option by pressing the 4000 button while turning the meter on. The LCD annunciator APO will be off during operation

For maintenance purpose, the Auto Power Off timing can be shortened to 5 seconds by pressing the RANGE button while turning the meter on

Note: 1. Stored data (MEM) remains after Auto Power Off, but will be erased if the rotary switch is switched to the OFF position

 Always turn the rotary switch to the OFF position when the meter is not in use. The meter will produce a beep sound to alert the user while turn off

#### -59-

#### (M) INPUT WARNING

This meter produces a beep tone as well as a 'InErr' display to warn the user against possible damage to the meter due to improper connections to the mA uA or A input jacks. See

#### **FIG 25**

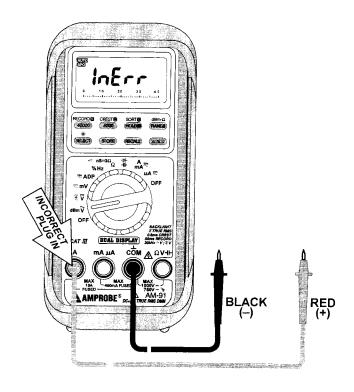


FIG 25. INPUT WARNING

(N) USING TILT STAND & BELT CLIP

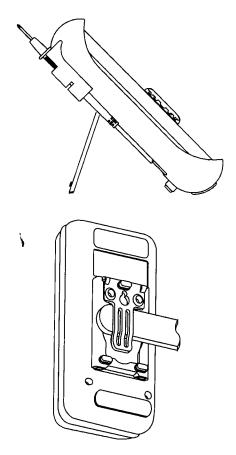


FIG 26. USING TILT STAND & BELT CLIP

# -61(O) USING PROBE HOLDERS & WIRE RETAINERS

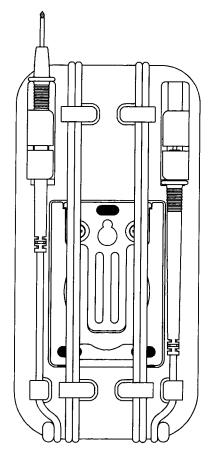


FIG 27. USING PROBE HOLDERS & WIRE RETAINERS

# (VI) SPECIFICATIONS

#### **GENERAL SPECIFICATIONS**

**Display:** 3-3/4 digits 4000 counts or 4-3/4 digits 40000 counts selectable (5 digits 99999 counts for Hz), and 4

digits 9999 counts dual display LCD

Polarity: Automatic **Update Rate:** 

3-3/4D Data: 5 times per second nominal; 4-3/4D Data: 1.25 times per second nominal;

41 Segments Bar graph: 128 times per second max

Low Battery: The indicator appears when the battery

voltage drops below approx. 5.8V

Operating Temperature:  $0^{\circ}C(32^{\circ}F)$  to  $35^{\circ}C(95^{\circ}F)$ , 0-80%

R.H.;  $35^{\circ}$ C( $95^{\circ}$ F) to  $50^{\circ}$ C( $122^{\circ}$ F), 0-70% R.H.

Storage Temperature:  $-20^{\circ}\text{C}(-4^{\circ}\text{F})$  to  $60^{\circ}\text{C}(140^{\circ}\text{F})$ , 80%

R.H. (with battery removed)

Temperature Coefficient: Nominal 0.15 x (specified accuracy)/°C @(0°C-18°C or 28°C-50°C), °F @(32°F-64

 $^{\circ}$ F or 82 $^{\circ}$ F-122 $^{\circ}$ F), or otherwise specified

Power Supply: Single Alkaline 9V battery NEDA1604,

JIS006P or IEC6F22

APO Timing: Idle for 4.5 minutes APO Consumption:  $20 \mu A$ 

Sensing: True RMS conversion for AM-91; Average

responding for AM-90

Power Consumption: 12 mA

-63-

Weight: 390 gm(.66 lb); 500 gm (1.1 lb) with holster

**Dimension:** L186mm(7.32") X W87mm(3.42") H35.5mm(1.39"); L198mm(7.79") X W97mm(3.81") X

H55mm(2.16") with holster

Safety: Designed to UL3111-1, CSA C22.2 NO.1010-1-92,

and IEC1010-1 installation category III

Accessories: Test leads (pair), holster, battery installed

and user's manual

#### **ELECTRICAL SPECIFICATIONS**

ACCURACY IS  $\pm$  (% READING DIGITS + NUMBER OF DIGITS) OR OTHERWISE SPECIFIED, AT 23°C(73°F) ±5°C(9°F) & LESS THAN 75% R.H.

DC Voltane

DC VOILage					
RANGE	AM-90 AM-91				
	Accuracy				
40.00 mV	0.5% + 6d				
400.0mV, 4.000V, 40.00V,	0.08% + 1d				
400.0V, 1000V					

**NMRR** : >60dB @ 50/60Hz

CMRR >120dB @ DC, 50/60Hz, Rs=1k $\Omega$ Input Impedance :  $10M\Omega$ , 30pF nominal (100pF nominal)

for 40mV & 400mV ranges)

Temperature coefficient : 0.1 X (Specified accuracy)/°C @(0°C —

18°C or 28°C —50°C), °F @(32°F — 64°F or 82°F — 122°F)

Overload protection : 780 Vrms / 1000Vpeak AC Voltage

RANGE	AM-90	AM-91*	
	Accuracy		
50Hz — 60Hz			
400.0mV, 4.000V, 40.00V,	0.5% + 3d	0.5% + 3d	
400.0V, 750V			
40Hz — 1kHz			
400.0mV	0.8% + 3d	0.8% + 3d	
4.000V, 40.00V, 400.0V	0.8% + 4d	0.8% + 4d	
750V	1.0% + 4d	1.0% + 4d	
1kHz —5kHz			
400.0mV	1.0% + 3d	1.0% + 3d	
4.000V, 40.00V, 400.0V	1.0% + 6d	1.0% + 4d	
750V	3.0%+8d**	3.0%+6d**	
5kHz — 20kHz			
400.0mV	2.0%+6d**	1.5%+6d**	
4.000V, 40.00V, 400.0V,	1.8%+8d**	1.8%+6d**	
750V	Unspec'd	Unspec'd	
20kHz — 50kHz			
400.0mV	Unspec'd	2.5%+6d***	

CMRR

:>60dB @ DC to 60Hz, Rs=1k $\Omega$ 

Input Impedance :  $10M\Omega$ , 30pF nominal (100pF nominal for 400mV range)

Overload protection: 780 Vrms / 1000Vpeak

1	AC.	+	DC	V	oli	la	u	e
- 1	AV	- 1	20	, .	v:	·u	ч	v

RANGE	AM-91*
	Accuracy
50Hz-60Hz	
4.000V, 40.00V, 400.0V, 750V	0.8% + 8d
40Hz — 1kHz	
4.000V, 40.00V, 400.0V	1.0% + 8d
750V	1.2% + 8d
1kHz — 5kHz	
4.000V, 40.00V, 400.0V	1.2% + 8d
750V	3.2% + 8d**
5kHz — 20kHz	
4.000V, 40.00V, 400.0V	2.0%+8d**
750V	Unspec'd

CMRR

: >60dB @ DC to 60Hz, Rs=1k $\Omega$ 

Input Impedance :  $10M\Omega$ , 30pF nominal

Overload protection: 780 Vrms / 1000Vpeak

<sup>\*</sup>AC Coupled True RMS Specified from 5% to 100% of range or otherwise specified; Crest Factor: <3:1 at full scale, and <6:1 at half scale

<sup>\*\*</sup>Specified from 10% to 100% of range

<sup>\*\*\*</sup>Add (30000/reading) counts below 38% of range

<sup>\*</sup>DC Coupled True RMS Specified from 5% to 100% of range or otherwise specified; Crest Factor: <3:1 at full scale, and <6:1 at half scale

<sup>\*\*</sup>Specified from 10% to 100% of range Update Rate: 1.6 per second nominal

### AC Current

RANGE	AM-90	AM-91*	burden Voltage
	Acc	uracy	
50Hz 60Hz			
400.0 μ A	1.0%+4d	1.0%+4d**	0.15mV/ $\mu$ A
4000 μ A	0.8%+3d	0.8%+3d	0.15mV/ $\mu$ A
40.00mA	1.0%+4d	1.0%+4d**	3.3mV/mA
400.0mA	0.8%+3d	0.8%+3d	3.3mV/mA
4.000A	1.0%+4d	1.0%+4d**	0.03V/A
10.00A***	0.8%+3d	0.8%+3d	0.03V/A
40Hz 300Hz			-
400.0 μ A	1.5%+4d	1.5%+4d**	0.15mV/ $\mu$ A
4000 μ A	1.0%+3d	1.0%+3d	0.15mV/ μ A
40.00mA	1.5%+4d	1.5%+4d**	3.3mV/mA
400.0mA	1.0%+3d	1.0%+3d	3.3mV/mA
4.000A	1.5%+4d	1.5%+4d**	0.03V/A
10.00A***	1.0%+3d	1.0%+3d	0.03V/A
300Hz 3kHz			
400.0 μ A	Unspec'd	Unspec'd	0.15mV/ $\mu$ A
4000 μ A	1.2%+3d	1.2%+3d	0.15mV/ $\mu$ A
40.00mA	Unspec'd	Unspec'd	3.3mV/mA
400.0mA	1.2%+3d	1.2%+3d	3.3mV/mA
4.000A	Unspec'd	Unspec'd	0.03V/A
10.00A***	1.2%+3d	1.2%+3d	0.03V/A

<sup>\*</sup>AC Coupled True RMS Specified from 5% to 100% of range or otherwise specified

mA  $\,\mu$  A Overload Protection  $\,$  : 0.63A/500V Fuse, Interrupt Rating 200kA : 15A/600V Fuse, Interrupt Rating 100kA A Overload Protection

#### DC Current

DC Current			
RANGE	AM-90	AM-91	Burden Voltage
	Accı	ıracy	
400.0 μ A	0.4%	+ 4d	0.15mV/ μ A
4000 μ A	0.2%	0.2% + 2d	
40.00mA	0.4%	0.4% + 4d	
400.0mA	0.2%	0.2% + 3d	
4.000A	0.8% + 6d		0.03V/A
10.00A*	0.4%	+ 4d	0.03V/A

.mA  $\,\mu$  A Overload Protection : 0.63A/500V Fuse, Interrupt Rating 200kA : 15A/600V Fuse, Interrupt Rating 100kA A Overload Protection

# Frequency

RANGE	AM-90	AM-91
	Accuracy	
99.999Hz, 999.99Hz, 9.9999kHz,	0.002% + 3d	
99.999kHz, 999.99kHz, 4.0000MHz		

Sensitivity: 5Hz — 100kHz\*, > 200 mVrms, <20 Vrms; 100kHz - 500kHz, >400 mVrms, <20 Vrms; 500kHz - 2MHz, >850 mVrms, < 20 Vrms; 2MHz —4 MHz, > 1 Vrms, < 20 Vrms

\*Pulse Width > 3  $\mu$  s in this frequency range

Update Rate

: 1.2 per second nominal

Temperature coefficient : 0.05 X (Specified accuracy)/°C @(0°C-18°C or

28°C - 50°C), °F @(32°F - 64°F or 82°F --

122°F)

Overload protection

: 600VDC/VAC rms

<sup>\*\*</sup>Specified from 10% to 100% of range

<sup>\*\*\*10</sup>A continuous; 20A for 30 seconds maximum, 5 minutes cool down

<sup>\*10</sup>A continuous; 20A for 30 seconds maximum, 5 minutes cool down interval

-68**-**

Frequency & ACV or AC ADP in Dual Display

RANGE	AM-90	AM-91
	Accuracy	
99.99Hz, 999.9Hz, 9.999kHz,	0.002% + 1d	
20.00kHz		

Sensitivity\*

:  $5Hz-100 Hz^{**}$ , >15% F.S. of AC range;

100Hz-1kHz, >20% F.S. of AC range; 1kHz-10kHz, >35% F.S. of AC range; 10kHz-20kHz, >50% F.S. of AC range

\*ACV 750V range : 5Hz-100Hz, >420VAC;

100Hz—1kHz, >550VAC

\*\*Pulse Width>3  $\mu$  s in this frequency range Update Rate : 1.3 per second nominal

**Duty Cycle** 

RANGE	AM-91	
	Accuracy	
0.1% - 99.9%	0.5d/kHz+2d	

Input Frequency

: 50Hz -- 300 kHz; 5V Logic Family

Pulse Width > 2us

Update Rate

: 1.2 per second nominal

Overload protection: 600VDC/VAC rms

Capacitance

Capacitance		
AM-90	AM-91	
Accuracy*		
4.0% + 10d		
3.0% + 5d		
0.8% + 5d		
0.8% + 3d		
2.0% + 3d		
3.0% + 5d		
3.5% + 5d		
	Accu 4.0% 3.0% 0.8% 0.8% 2.0% 3.0%	

<sup>\*</sup>Accuracies with film capacitor or better \*\*Specified from 10% to 100% of range Overload protection : 600VDC/VAC rms

#### Ohme

UIIIIS		
RANGE	AM-90	AM-91
	Accuracy	
40.00Ω	0.2% + 6d	
$400.0\Omega$ , $4.000$ k $\Omega$ , $40.00$ k $\Omega$ ,	0.15% + 2d	
400.0kΩ		
$4.000$ M $\Omega$	0.3%	+ 2d
$40.00$ Μ $\Omega$	1.5% + 5d	
400.0nS	0.7% + 5d	

Open Circuit Voltage

: <1.3VDC

Temperature coefficient

: 0.1 X (Specified accuracy)/°C @(0°C-18°C or

 $28^{\circ}C - 50^{\circ}C$ ),  $^{\circ}F$  @  $(32^{\circ}F - 64^{\circ}F$  or  $82^{\circ}F$ 

-122°F)

Overload protection

: 600VDC/VAC rms

Range	Accuracy	Test Current (Typical)	Open Circuit Voltage
4.000V	2%+1d	0.8mA	< 3.5 VDC

Overload Protection: 600VDC/VAC rms

# •)) Audible Continuity Tester

Audible threshold: the beeper sounds if the measured resistance is lower than 10  $\,\Omega_{\, \cdot}$  and turns off when greater than 60  $\,\Omega_{\, \cdot}$  Response

time < 150  $\mu$  s

Overload protection: 600VDC/VAC rms

#### DC Adaptor

10 counts per 1 mVDC

Accuracy

: 0.08%+1d

Input Impedance

: 1000M  $\Omega$ , 70pF nominal

Temperature coefficient : 0.05 X (Specified accuracy)/°C @(0°C-

18°C or 28°C — 50°C), °F @ (32°F — 64

°F or 82°F — 122°F)

Overload protection

: 600VDC/VAC rms

#### **AC** Adaptor

10 counts per 1 mVAC

Accuracy

: Same as AC 400.0mV range

Input Impedance

:  $1000M\Omega$ , 70pF nominal

Temperature coefficient : 0.1 X (Specified accuracy)/°C @(0°C-18

 $^{\circ}$ C or 28 $^{\circ}$ C – 50 $^{\circ}$ C),  $^{\circ}$ F @ (32 $^{\circ}$ F – 64 $^{\circ}$ F

or 82°F-122°F)

Overload protection

: 600VDC/VAC rms

-71-

# dBm (AM-91)

At  $600 \Omega$ , -11.76dBm to 54.25dBm,

Accuracy

:  $\pm 0.25$ dB + 2d (@40Hz-20kHz)

Selectable reference impedance of 4, 8, 16, 32, 50, 75, 93, 110, 125, 135, 150, 200, 250, 300, 500, 600, 800, 900, 1000, 1200  $\Omega$ 

Input Impedance :  $10M\Omega$ , 30pF nominal

Update Rate

: 1.1 per second nominal

Overload protection: 780Vrms / 1000Vpeak

#### **RECORD** mode

Nominal Response for DC : 50ms to 80%, 100ms to 99% Nominal Response for AC  $\,:\,$  50ms to 80%, 100ms to 95%

Accuracy : Specified accuracy  $\pm 10$  digits for changes > 200 ms

in duration ( $\pm 40$  digits in AC); 1.5s autoranging

buffer (except Cx, AC + DCV)

#### **CREST** mode

Accuracy : Specified accuracy  $\pm 220$  digits for changes  $>\!0.8 \text{ms}$ 

in duration

#### SORT mode

Nominal sort rate  $\,:\,$  0.2s (except Cx, AC + DCV)

Accuracy

: Specified accuracy  $\pm 5$  digits

# VII)MAINTENANCE

#### WARNING

To avoid electrical shock, remove test leads and any input signals before opening the case. Do not operate with open case. Install only the same type of fuse or equivalent

#### Battery replacement procedure

When the battery symbol 🔁 on the display is on, replace the battery as soon as possible to ensure accuracy. The meter uses a single standard 9V alkaline battery (NEDA1604, JIS006P or IEC6F22)

- Disconnect the meter from any circuit and remove the test leads from the input jacks
- 2) Turn the meter OFF
- 3) Loosen the four captive screws from the case bottom and turn the case over, see FIG 28
- 4) Lift the end of the case top nearest the input jacks until it unsnaps from the case bottom
- 5) Lift gently the battery from the battery compartment, and disconnect the battery from the battery connector
- 6) Snap the battery connector to the terminals of the replacement battery, and reinsert the battery into the battery compartment. Dress the battery leads so that they are properly seated in the compartment groove and will not be pinched between the case top and case bottom
- Replace the case top, ensuring that all the gaskets are properly seated and the two snaps on the case top (near the LCD side) are engaged
- 8) Re-fasten the 4 captive screws

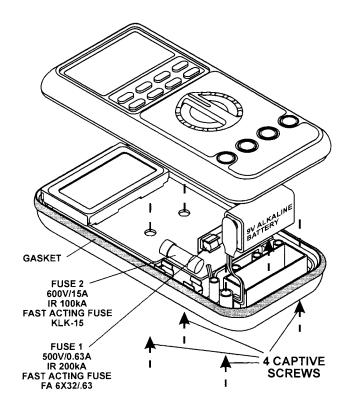


FIG 28. CHANGING BATTERY & FUSES

# Fuse replacement procedure

The meter uses a 500V/0.63A IR 200kA fast acting fuse (FUSE 1) for mA uA input, and a 600V/15A IR 100kA fast acting fuse (FUSE 2) for A input, See TABLE below for P/N#

- 1) Perform steps 1) through 4) of the battery replacement procedure
- 2) Replace the blown fuses
- 3) Perform step 7) through 8) of the battery replacement procedure

Accessories and replacement parts

Amprobe P/N	Description	Quantity
H-90Y	AM-90/91 Holster	1
TSBC-90	AM-90/91 Case Gasket	1
	AM-90/91 Tilt Stand	
	AM-90/91 Belt Clip	
	2 AM-90/91 case upper screws	
	2 AM-90/91 case lower screws	
MTL-90	AM-90/91 Test leads	1
FA-6x32/.63	AM-90/91 500V/.63A Fuse	1
KLK15	AM-90/91 600V/15A Fuse	1
MN1604	9V Battery	1
IR-100	INFRA-RED DMM Probe	1
TMA-1	Temp. Accessory	1
A663-4B	0-300A AC Transducer	1
A664-4B	0-1000A AC Transducer	1
CT-600 AC/DC	AC/DC 600A Transducer	1
AW-80	kW/AMP, 1000A, 200kW Transducer	1
AW-81	kW/AMP, 1000A, 400kW Transducer	1
MTC-3	1 Red+1 Black Alligator Adaptors	1