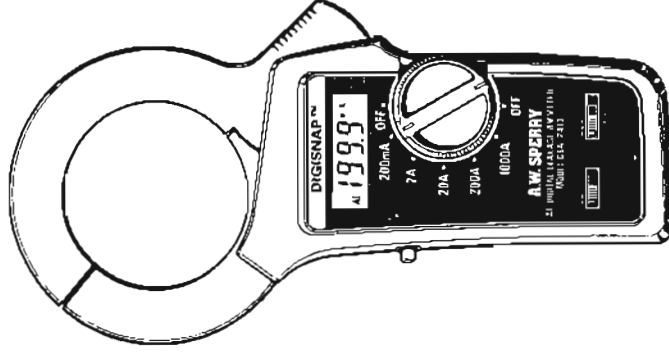


Operating Instructions
DIGISNAP™ AC DIGITAL LEAKAGE AMMETER
MODEL
DSA-2413



CAUTION

Please read this Manual thoroughly and completely before putting instrument into use. Failure to do so might result in injury and/or damage to equipment. Observe all standard industry safety rules.

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1. SAFETY WARNING

- This instruction manual contains warnings and safety rules which must be observed by the user to ensure safety operation of the instrument and retain it in safe condition. Therefore, read these operating instructions thoroughly and completely before using the instrument.
 - The symbol  means that the user must read the instructions in this manual for safe operation of the instrument.
- ⚠ WARNING**
This is a warning for the user to avoid electric shock hazard.
- ⚠ CAUTION**
This is a caution for the user to avoid damage to the instrument.
- To avoid electric shock hazard do not use the instrument if it is in the following conditions:
 - a. Shows visible damage.
 - b. Fails to perform intended operation.
 - c. Has been subjected to prolonged storage under unfavorable conditions.
 - d. Has been subjected to severe transport stress.

! WARNING

- Never open the battery compartment cover when making measurements
- Never make current measurements on a circuit above 600V AC/DC as the instrument is designed for measurements on low voltage circuits only (Also refrain from clamping onto a bare conductor even on a low voltage line.)

! CAUTION

- Never exceed the maximum allowable input of any function when making measurements
- Do not expose the instrument to the direct sun, extreme temperature or dew fall
- When not in use for a long period of time place the instrument in storage after if a battery is removed from it
- Never apply voltage to the output terminal

- Always set the Function/Range Selector Switch to the OFF position after use.
- Keep the instrument operation to the time limit for measurement as specified. Otherwise, it may become damaged due to overheating.
- When taking normal measurements, set the Peak Hold Selector Switch to the OFF position.
- When making peak hold measurements, set the Peak Hold Selector Switch to the 10ms or 100ms position only after the transformer jaws are clamped onto the conductor. The peak hold display may read higher than an actual value to be measured because of the noise that may develop when the Peak Hold Selector Switch is set before the transformer jaws are clamped.
- The instrument must be used by a competent, trained person and operated in strict accordance with the instructions. A. W. Sperry Instruments, Inc. will not accept liability for any damage or injury caused by misuse or non-compliance with the instructions or safety procedures. It is essential to read and understand the safety rules contained in the instructions. They must be observed when using the instrument.

2. FEATURES

- Limited lifetime warranty.
- Digital clamp meter for leakage and high current measurements.
- Shielded transformer jaws to minimize the effect of external stray magnetic field.
- 200mA AC range with 0.1mA minimum resolution.
- Can measure from 0.1mA to 1000A AC.
- Data hold function to allow for easy readings in hard-to-reach locations. Display can be observed away from the conductor.
- Peak hold facility with selectable response time of 10ms or 100ms.
- Single power/range selector switch for easy one hand operation.
- AC output terminal for waveform viewing on oscilloscope. For true rms measurements connect the instrument to a true rms digital multimeter.
- DC output terminal for recording the current input.
- 20Hz to 1kHz frequency response on all ranges (measurements also possible with $\pm 7\%$ accuracy at 20kHz on 200mA range).
- Can accurately measure leakage current from high frequency electric appliances such as inverters, which has not been possible with other clamp meters.

3. SPECIFICATIONS

SPECIFICATIONS

(for 23°C ±10°C at 85% max. relative humidity)

• AC Current Ranges

Ranges	Accuracy		Time Limit for Measurements
	Frequency Selector Switch	50/60Hz position	
200mA	±1.0%rdg ±2dgt (50Hz/60Hz)	±1.5%rdg	Continuous
2A	±3.0%rdg ±2dgt (40Hz~1kHz)		
20A	±1.5%rdg ±2dgt (50Hz/60Hz) ±3.5%rdg ±2dgt (40Hz~1kHz)	±2.0%rdg ±2dgt	
200A	±1.5%rdg ±2dgt (50Hz/60Hz) ±3.5%rdg ±2dgt (40Hz~1kHz)	±2.0%rdg ±2dgt	10 minutes max.
1000A	±5.0%rdg (50Hz/60Hz) ±10 0% (40Hz~1kHz)	±5.5%rdg	

Refer to Fig 1 for frequency characteristics.

- Effect of External Stray Magnetic Field 10mA AC max. in proximity to 100A AC carrying, 10mm-dia conductor.

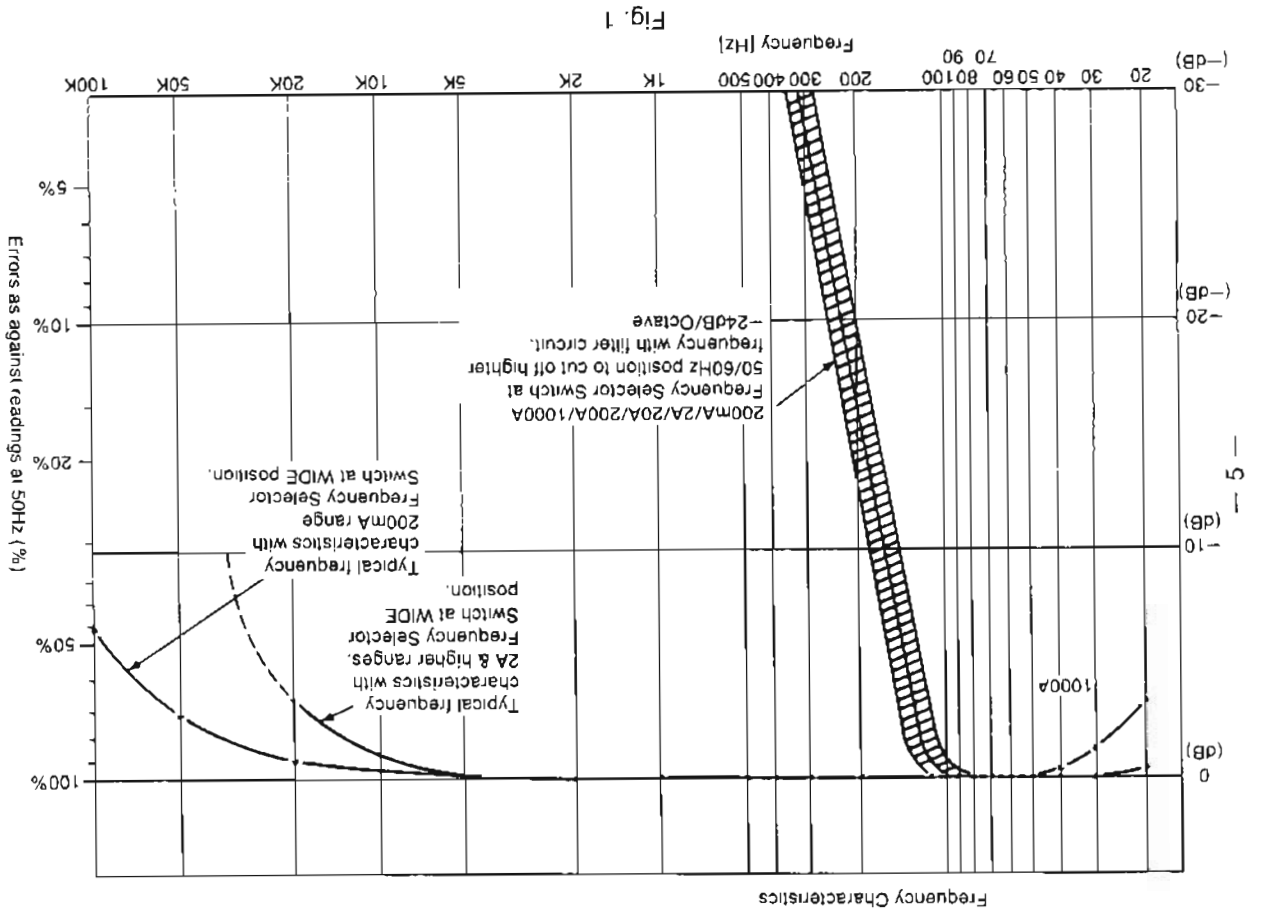


Fig. 1

Analogue Output (Output Impedance: Approx. 1k Ω)

• AC Output Terminal

Ranges	AC Input Current	AC Output Voltage	Accuracy
200mA AC	0~200mA AC	0~200mV AC	±2% rdg
2A AC	0~2A AC		
20A AC	0~20A AC		
200A AC	0~200A AC		
1000A AC	0~500A AC		
	500~1000A AC	0~50mV AC	±3% rdg
		50~100mV AC	±5% rdg

• Same output waveform as input current waveform at WIDE frequency range regardless of frequency or peak hold switch positions.

• DC Output Terminal

Ranges	AC Input Current	DC Output Voltage	Accuracy	
			Freq. Selector Switch at WIDE position	Freq. Selector Switch at 50/50Hz position
200mA AC	0~200mA AC	0~200mV DC	±3% rdg	±3.5% rdg
2A AC	0~2A AC			
20A AC	0~20A AC			
200A AC	0~200A AC			
1000A AC	0~500A AC			
	500~1000A AC	0~50mV DC	±5% rdg	±4.0% rdg
		50~100mV DC	±7% rdg	±5.5% rdg
				±7.5% rdg

• 200mV DC output voltage against 2000 count displayed (same regardless of frequency selector switch position). Same peak hold output as peak hold value displayed.

Peak Hold	Peak display reads $1/\sqrt{2}$ of peak input current (RMS calibrated reading when a sinusoidal AC current is measured)
Peak Response Time	Approximately 10ms or 100ms response time is selectable.
Peak Hold Time Accuracy	±1% of initial peak reading 1 minute after peak hold (at 23°C ±10°C, 75% max. relative humidity)
Frequency Response	20Hz~1kHz min.
Size of Conductor under Test	68 mm (2.67") max.
Dimensions	250 (9.84")×130 (5.11")×50 (1.96") LWD
Weight	570g (20 oz.) approx. (battery included)
Power Source	1×9V manganese battery type AWS B-4, 9V transistor type battery (NEDA # 1604)
Accessories	Included
	Optional
	Battery, carrying case Model C-69, instruction manual
	Model 7073 2-way output cord

4. INSTRUMENT LAYOUT

- GENERAL Operating Principle Sensing**
 : Dual integration
 : Average sensing, calibrated in rms of a sine wave
- Display**
 : Field effect 3-1/2 digit liquid crystal display with maximum reading of 1999
- Range Selection**
 : Manual rotary switch
- Overrange Indication**
 : "1" is indicated on the highest digit except for 1000A AC range
- Low Battery Indication**
 : "B" symbol appears on the display
- Battery Life**
 : 80 hrs typical with manganese battery (approx 5mA max. current consumption)
- Response Time**
 : Approx. 1 second
- Sample Rate**
 : Approx. 3 times per second
- Data Hold**
 : For all ranges
- Temperature & Humidity for Specified Accuracy**
 : 23°C ±10°C at 85% max. relative humidity
- Storage Temperature & Humidity**
 : -10°C ~ +50°C at 80% max. relative humidity
- Operating Temperature & Humidity**
 : 0 ~ +40°C at 85% max. relative humidity
- Overload Protection**
 : 1500A AC max. for one minute
- Withstand Voltage**
 : 3000V AC max. for one minute between electrical circuit and housing case or metal section of transformer jaws
- Insulation Resistance**
 : 10MΩ min. at 1000V between electrical circuit and housing case or metal section of transformer jaws
- Packaging**
 : Model DSA-2413 comes complete with B-4 Battery, C-69 Carrying Case, Form # 214 Operating Instructions and Warranty Registration Card
- Optional Accessories**
 : Model MT-3000, 10:1 Current reduction transformer for measurements up to 3000 Aac @ ±3% accuracy
 Model E-1 Energizer. Used to split the power line on 125 Vac, 15 amp maximum appliances for easy snap-around current measurement
 Model 7073, 2-way output cord

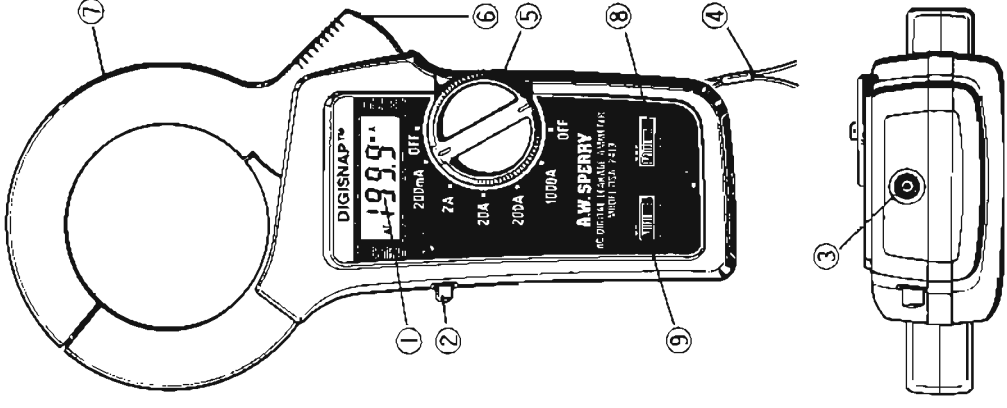


Fig. 2

- (1) LCD
3-1/2 digit, liquid crystal display with maximum indication of 1999. Function symbols (mA, A) and decimal point (.) automatically appears as the function/range selector switch (5) is turned. "B" also appears automatically for low battery warning. "1" is also displayed at the highest digit for overrange indication.
- (2) Data Hold Push Button
Allows for easy reading in dimly lit or hard-to-reach locations. The display can be observed away from the conductor after pushing the switch. Data hold will be released by pushing the switch again after the reading is taken.
- (3) Two-way Analogue Output Terminal
Provides AC and DC output voltages. Insert 2-way output cord Model 7073 into this terminal to observe the waveform of input current on oscilloscope, make true rms measurements using a true rms reading instrument or obtain output for recorder connector.
- (4) Safety Hand Strap
Prevents the instrument from slipping off the hand during use.
- (5) Power Function/Range Switch
Selects function and range. It is also used to turn power on. Always set the switch to the OFF position after use.
- (6) Jaw Trigger
Operates the transformer jaws. Press to open the jaws.
- (7) Transformer Jaws
Pick up the current flowing through the conductor.
- (8) Peak Hold Selector Switch
Selects 10ms or 100ms peak response time. Set the switch back to the OFF position to release peak hold or make normal measurements.
- (9) Frequency selector switch (Refer to Section 5-4)

5. OPERATION

5-1 Preparation

- (1) To check battery voltage set the function/range selector switch to the desired position. If the display is clear without symbol "B" showing, battery voltage is OK. If the display blanks or "B" is clearly indicated, replace the battery in accordance with the battery replacement procedures as outlined in section 6.

Note: "B" also appears on the display when the battery becomes exhausted during use. Replace with a new battery.

- (2) Make certain that the data hold switch is in the off position. If a measurement is made with the data hold switch pressed in, the display remains locked irrespective of input.

5-2 AC Current Measurements

WARNING

- Never use the instrument on a high voltage circuit above 600V AC. Measurements on circuits above this voltage may cause shock hazard and damage to the instrument or equipment under test.
- The transformer jaws are made of steel and their tips are not insulated. Be especially careful about the hazard of possible shorting where the equipment under test has exposed metal parts.
- Never use the instrument with the battery compartment cover removed from it.

CAUTION

- The transformer jaws, especially their tips, have been precisely adjusted to obtain maximum accuracy. Take sufficient care to avoid shock, vibration or excessive force when handling the instrument.
- The size of a conductor to be tested is approx. 68mm in diameter. An accurate measurement cannot be made when the transformer jaws are not fully closed on a conductor larger than 68mm.
- Frequency selector switch is designed to select the 50/60Hz and WIDE frequency ranges. For further details refer to section 5-4 for operation of the frequency selector switch.
- The transformer jaws do not fully close when a foreign substance is stuck in the jaw tips or they are not properly engaged due to the excessive force applied. In such a case do not release the jaw trigger suddenly or attempt to close the transformer jaws by applying external force. If this is done, the metal tips of the jaws will be deformed, making it impossible to engage them properly. Make sure that the jaws close by themselves after removing the foreign substance or making them free to move. Never attempt to close the jaws by force. If the metal section of the jaws should be deformed, correct it by ensuring that all metal laminations (0.50mm thick) are aligned 0.50mm apart. However, this requires very delicate adjustments. Where possible, it is recommended that the unit be returned for repair. When returning it, place a small plate or insert between the jaw covers to prevent the jaws from closing. When the jaws are found not repairable due to the damage caused by forcing them to open, it is necessary to replace the whole jaw assembly. This is very costly and will not be covered by warranty repairs. Therefore, please use every care and caution when the jaws do not close properly.
- Keep the instrument operation to the maximum allowable measurement time for large current measurements, as indicated in section 3 for specifications. Exceeding this limit may cause instrument damage due to over heat.

- (1) Set the function/range selector switch to the desired position (do not exceed the maximum allowable input currents)
- (2) For normal measurements press the trigger to open the transformer jaws and clamp onto one conductor only (Fig. 3). The current measured will be indicated on the display. Earth leakage current and small current that flow through a grounded wire can also be measured by this method (Fig. 4). It is recommended that the conductor is placed at the center of the closed jaws.
- (3) To measure out of balance leakage current clamp onto all conductors except a grounded wire. The leakage current measured will be indicated on the display (Fig. 4 & Fig. 5).

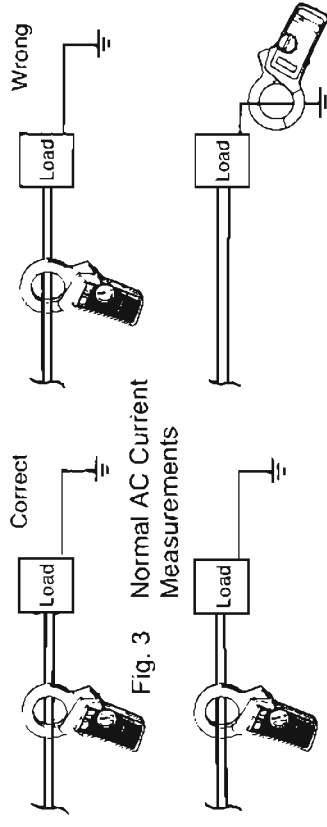


Fig. 3 Normal AC Current Measurements

Fig. 4 Leakage Current Measurements on the Single-Phase Systems

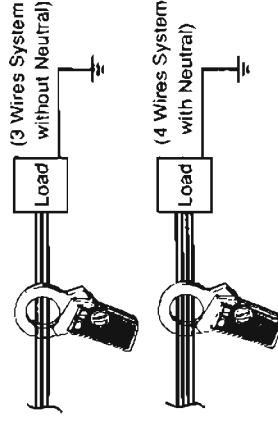


Fig. 5 Leakage Current Measurements on the Three-Phase Systems

5-3 Peak Hold Measurements

The peak hold circuit is designed to select 10ms or 100ms response time. Choose it according to your application needs.

- (1) With the transformer jaws clamped onto the conductor under test slide the peak hold switch from OFF position to the desired peak response time position.
- (2) The peak hold display reads $1/\sqrt{2}$ of the peak current. Therefore, an rms reading will be obtained when a sinusoidal waveform is measured.

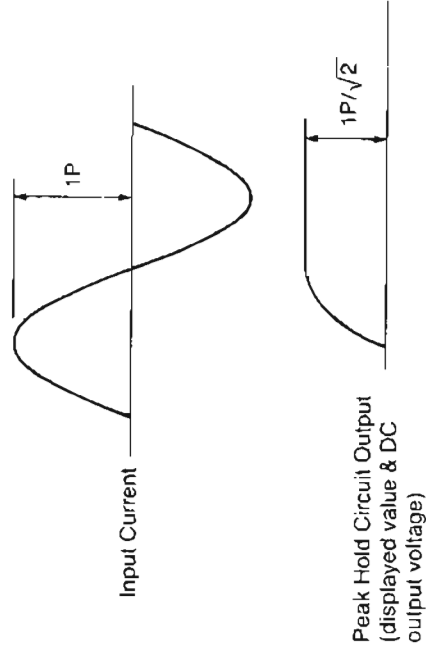


Fig. 6

- (3) Difference between 10ms and 100ms Peak Response Time
The peak hold circuit in this instrument is designed to charge the capacitor after rectifying the input waveform. The time constant for the voltage of the capacitor to reach its peak value varies according to the capacity of the capacitor and the output impedance of the charging circuit. Two output impedance circuits are provided for the DSA-2413 to select approximately 10ms or 100ms peak response time by switch when the voltage of the capacitor reaches 90% of its peak value. Refer to Fig. 7 for further details.

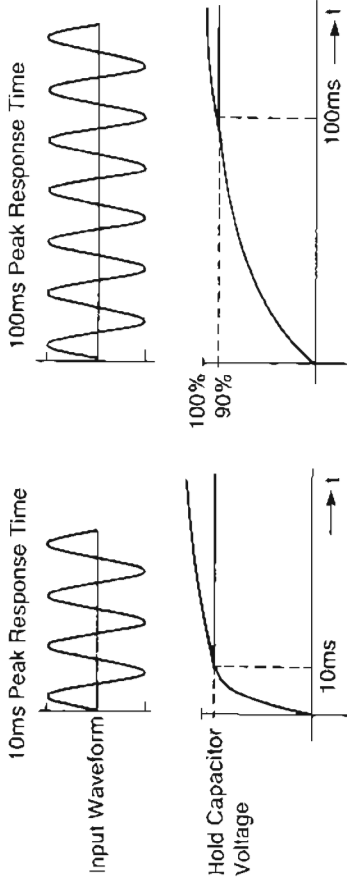


Fig. 7 Hold Capacitor Voltage Variations against 50Hz Input

- (4) Slide the peak hold switch back to the OFF position for a reset. The peak hold circuit is designed to select 10ms or 100ms response time. Choose it according to your application needs. For instance, select the 10ms response time when measuring a surge current that will occur when the power supply is switched on. The 100ms response time is recommended for measuring the starting current of a motor, etc. (a stable measurement can be made on the 100ms second response time setting as the peak hold circuit does not readily respond to the surge current).

Note 1: DSA-2413 uses an analogue peak hold circuit to ensure a quick response to input current. Because of the nature of this circuit the peak hold reading may gradually fall with time (or rise in a rare case). However, this does not indicate a faulty condition. It is likely to be apparent when the instrument is used in a high temperature, high humidity environment. The instrument will restore its original condition when returned to a normal temperature and humidity. The instrument will not be suitable for making measurements for hours. In case of such a need connect a recorder to the output terminal of the instrument for monitoring.

Note 2: If it is necessary to read the display away from the conductor in a peak hold measurement, press the data hold switch first and then remove the instrument from the conductor. Otherwise, the peak hold reading may be higher than the actual value due to the noise caused by the opening and closing of the transformer jaws. Press the data hold switch again for a reset.

5-4 How to Use Frequency Selector Switch

DSA-2413 has a very good frequency response due to the electrical property of the transformer jaws used for the instrument. Therefore, it measures AC current of not only 50Hz or 60Hz of fundamental wave form but also of high frequencies and harmonics superimposed on the fundamental frequency when present in the circuit under test. To eliminate the effect of noise from the high frequency and measure AC current of 50Hz or 60Hz fundamental frequency, a filter circuit is incorporated into the 2413 which works when the frequency selector switch is set to the 50/60Hz position (this switch is for AC current measurements only). It is designed to attenuate frequencies starting from around 100Hz with an attenuation characteristic of approx. -24dB/octave (signal strength declines to one sixteenth of that at the initial frequency when it doubled). Please see Fig. 1. With the frequency selector switch at the "WIDE" position, the instrument also permit AC current measurements from 40Hz to 1kHz minimum, including high frequencies and harmonics, if present in the circuit under test, that originate from inverters and other high frequency generating devices.

Recently there has been increased usage of power through inverters, switching regulators, etc. When the high frequency noise from such appliances leaks or flows into the ground through capacitors not filtering completely, the earth leakage breaker may not trip. In such a case the instrument may not give current readings with the frequency selector switch at the 50/60Hz position. Therefore, it is necessary to make current measurements with the switch at the "WIDE" position. When in doubt as to the presence of high frequencies and harmonics that affect AC current measurements, take current readings with the switch at the 50/60Hz and "WIDE" positions respectively and then compare the results obtained.

5-5 Data Hold Function

Push the data hold switch to freeze the reading. This is especially useful for taking a reading in a dimly lit or hard-to-reach locations. The display can be observed away from the conductor. Push again to release the reading.

5-6 2-Way Analog Output Terminal

AC output and DC output can be obtained by inserting optional Model 7073 output cord into analog output terminal.

AC Output —

Can be monitored by connecting a digital multimeter to analog output terminal or observed as a waveform by connecting an oscilloscope. For true rms measurements connect a true rms reading digital multimeter.

DC Output —

Can be monitored by connecting a digital multimeter or recorder (especially for many hours of monitoring). Refer to Fig. 8. With the DSA-2413 in the peak hold mode, DC voltage corresponding to $1/\sqrt{2}$ of a peak current value can be held and put out.

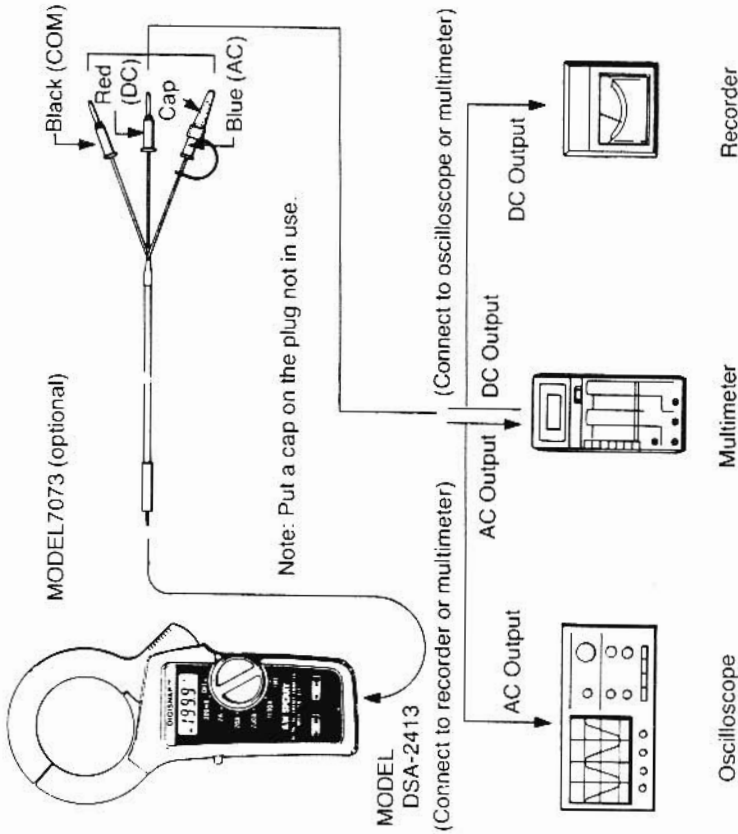


Fig. 8

6. BATTERY REPLACEMENT

Replace the battery when "B" symbol appears on the LCD display.

- (1) Set the function range selector switch to the OFF position.
- (2) Unscrew and remove the battery compartment cover from the rear of the case.
- (3) Install a new 9V battery type AWS B-4 or equivalent observing correct polarity.

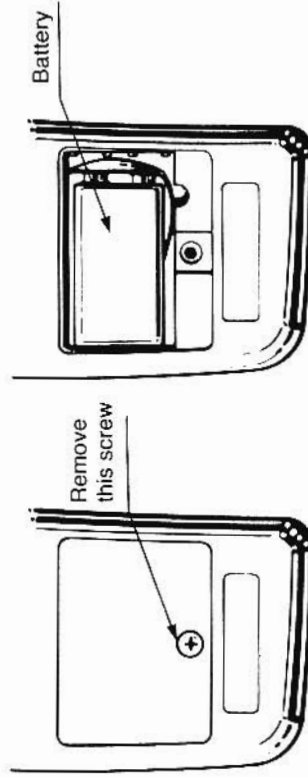


Fig. 9

WARNING

Never replace the battery during measurement

LIFETIME LIMITED WARRANTY.*

The attention to detail of this fine snap-around instrument is further enhanced by the application of A.W. Sperry's unmatched service and concern for detail and reliability. These A.W. Sperry snap-arounds are internationally accepted by craftsmen and servicemen for their unmatched performance. All A.W. Sperry's snap-around instruments are unconditionally warranted against defects in material and workmanship under normal conditions of use and service; our obligations under this warranty being limited to repairing or replacing, free of charge, at A.W. Sperry's sole option, any such A.W. Sperry snap-around instrument that malfunctions under normal operating conditions at rated use.1

REPLACEMENT PROCEDURE

Securely wrap the instrument and its accessories in a box or mailing bag and ship prepaid to the address below. Be sure to include your name and address, as well as the name of the distributor, with a copy of your invoice from whom the unit was purchased, clearly identifying the model number and date of purchase.

A.W. SPERRY INSTRUMENTS, INC.
Attn: Customer Service Dept.
245 Marcus Boulevard
Hauppauge, N.Y. 11788

1. The warranty is not applicable if the instrument has been: misused, abused, subjected to loads in excess of specifications, has had unauthorized repair or has been improperly assembled or used.

A. W. Sperry reserves the right to change specifications and designs described in this manual without notice and without obligations.