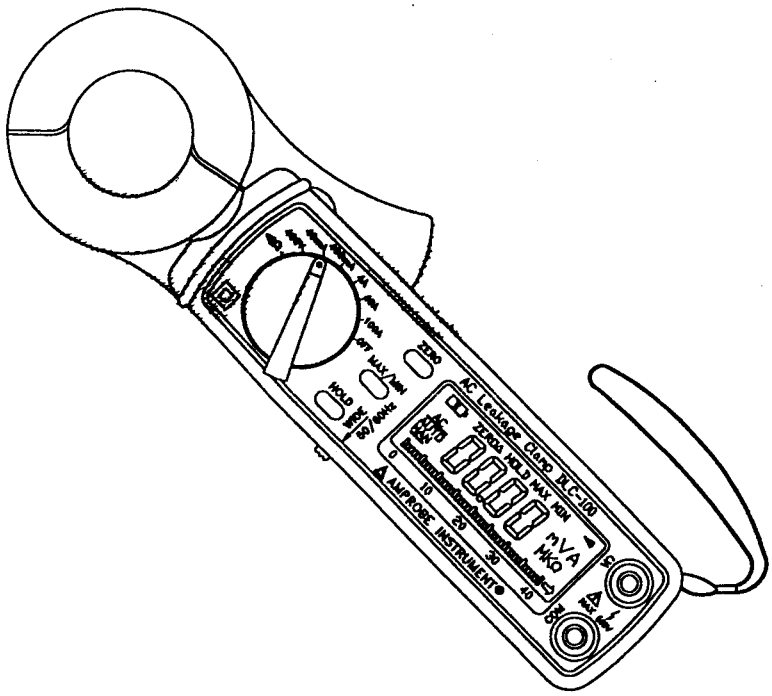
Part No. 932762
2/97

OPERATING INSTRUCTIONS

Digital AC Leakage Current Clamp
with Voltage and Continuity



Model DLC-100

AMPROBE®

Precautions for Personal and Instrument Protection

1. Read these instructions thoroughly and follow them carefully. Failure to follow these instructions and the precautions may result in personal injury and/or damage to the instrument and/or accessories. Amprobe and its representatives shall not be responsible or liable with regard to safety, or misapplication of this instrument, where personal injury, death, or property loss is concerned or any other consequential damages.

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.

3. Before using any electrical instrument 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 high energy sources.**

4. Before applying test leads to the circuit under test, make certain that the rotary switch is set to the proper range and function.

5. To avoid electrical shock to the user and/or damage to the instrument, do not use this instrument to measure voltage on circuits operating higher than 400 VAC. Do not attempt to measure a voltage unless you are already certain that the voltage is below 400 VAC.

6. Do not use this instrument to measure current on circuits operating higher than 600V RMS.

7. If the instrument should indicate that the voltage is not present in circuit, do not touch the circuit until you have checked to see that all instrument switches are in the proper positions and the instrument has been checked on a known live line.

8. Make certain that no voltage is present, in reference to an effective ground, before connecting ohmmeter to circuit.

9. Disconnect test leads from the circuit before changing functions.

10. Before taking any readings, make sure that the "ZERO", Data "HOLD", and/or "MAX/MIN" functions are not activated and their annunciators are not illuminated in the LCD.

Introduction

A small amount of current that flows through a ground conductor is generall referred to as leakage current. Leakage current in 50/60Hz distributio systems can be an early warning sign or an immediate indication of dangerous electrical problem, such as conductor insulation breakdown i conduit, motors, or compressors. Leakage current is also a source of EM whose effects still remain controversial.

The DLC-100 can measure milliamps of current that flow through ith grounding conductor back to the source. Leakage current measurements ar made quickly while the circuit is energized so it is an ideal instrument fc testing existing building circuits where power cannot be removed.

Leakage current levels in AC branch circuits are typically caused by tw factors. Insulation breakdown (IL1) and capacitive coupling(IL2). See Fig.1

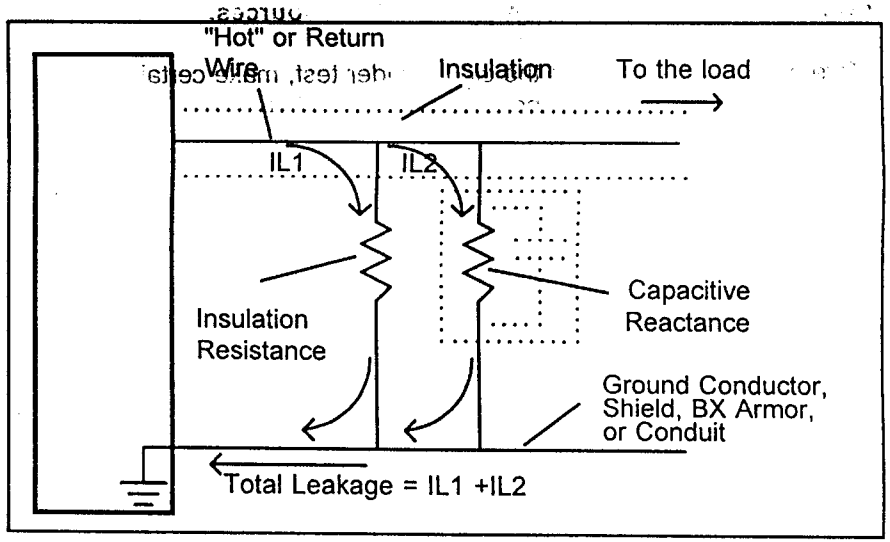


Fig.1. Insulation Resistance and Capacitive Coupling effect leakage current levels.

Age, heat, moisture, contaminants, and overstress due to pulling th conductor, are all factors that contribute to the degradation of a conductor' insulation.

Levels of Capacitive coupling vary with insulation type, voltage, frequency

length of conductor run, and the distance between adjacent conductors. The effects of these variables are calculated to form the dielectric constant for the insulation. Capacitive coupling contributes to leakage current more often in higher voltage and/or higher frequency applications.

To calculate an acceptable level of leakage current due to capacitive coupling for a circuit would require a series of long calculations and would be an estimate at best. It is much easier and more accurate to take routine leakage current measurements for each circuit and record the data over time or compare the initial results to measurements on similar circuits. If the data shows that leakage current measurements are rising or higher than a similar circuit, further investigation is required before levels become catastrophic. Leakage current measurements should be made part of a regimented preventative maintenance schedule to determine acceptable or unacceptable levels of leakage current and help predict and avoid dangerous electrical failure or costly downtime.

The DLC-100 also functions as a standard clamp on current meter up to 100 Amps, allowing imbalance and load currents to be measured. The unit functions as a voltmeter up to 400V AC and an ohmmeter up to 400Ω. Other features such as Max/Min function, Data Hold, 50/60Hz or Wide Frequency Band Response Selection, Continuity Alarm, Auto Power-Off, Null Button, Bargraph Display, Fully Annunciated 3-3/4 Digit, 4000 Count LCD, Overload Protection and Alarm, make the DLC-100 the most complete AC leakage current clamp in its class.

Automatic Features

Auto Power Off: The meter will automatically turn itself off thirty minutes after initial turn on. To turn the meter back on, press the Data HOLD button or turn the rotary switch to the OFF position then switch to the desired range. To disable the Auto Power Off function, with the rotary switch in the OFF position, depress the Data HOLD button and simultaneously rotate the rotary switch to the desired range.

Full Scale Overload Alarm: If the current or voltage measurement is more than the instrument can display, the unit will emit an audible tone while the LCD displays 4.000 and flashes the 4.

Component Description

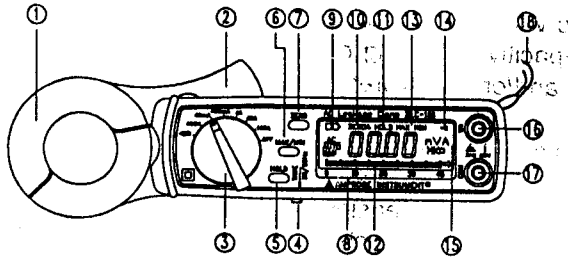


Figure 4: Reference Designations.

1. Transformer Jaw: Harnesses electromagnetic field that enables the meter to measure and display current.
2. Transformer Trigger: Enables user to open and close the jaw.
3. Function Selector Switch: Allows Current, Voltage, and Resistance scales to be selected.
4. Frequency Band Selector: Allows the user to select the current measurement to primarily consist of 50/60Hz or "Wide Band" from 40Hz to 1kHz.
5. Data Hold: Pressing this button allows data in the display to be temporarily stored. Data is cleared by pushing the Data Hold button once again.
6. MAX/MIN Hold: Allows maximum or minimum current readings to be temporarily stored. Push the MAX/MIN button once. The HOLD and MIN indicator will illuminate and the minimum measured value held in the display. Push the MAX/MIN button once again. The HOLD and MAX indicator will illuminate and the maximum value held in the display. Push the MAX/MIN button a third time to return to normal operation.
7. Zero Button: Allows the display to be set to 0 and relative measurements taken.
8. LCD: Fully annunciated, 4000 count, 3-3/4 Digit.
9. Low Battery Indicator
10. Zero Indicator: Indicates that the measurement is referenced to a preset value.
11. Data Hold Indicator
12. 40 Segment Bargraph Display
13. Max and Min Indicator
14. Continuity Indicator
15. Unit symbols (A, mA, V,Ω)
16. V, Ω Terminal
17. Common Terminal
18. Hand Strap

Installing Batteries

Your DLC-100 comes complete with batteries. If the Low Battery indicator illuminates:

1. Remove the DLC-100 from the circuit
2. Remove the test leads from the instrument.
3. Turn the rotary selector switch to the OFF position.
4. Remove the battery compartment cover retaining screw.

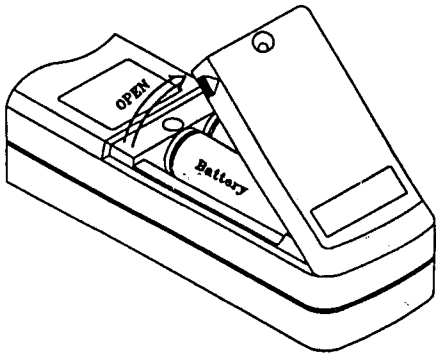


Fig. 3: Battery Replacement

5. Remove battery compartment as shown in Fig. 3.
6. Replace the batteries observing the polarity illustrated in the etched diagram on the bottom of the battery compartment. Use "AA" Alkaline only.
7. Replace the battery compartment cover and retaining screw.

Measuring Branch Circuit Leakage Current

Warning!!: Treat every conductor as if it were live. Ineffective grounding or bonding may limit current to flow and allow lethal voltages to be present. Check for Voltage in reference to an effective earth ground before proceeding.

Warning!!: Do not attempt to measure current on circuits operating higher than 600V RMS.

1. Before taking any readings, make sure that the "ZERO", Data "HOLD", and/or "MAX/MIN" functions are not activated and their annunciators are not illuminated in the LCD.
2. Set the rotary switch to the 100A scale.
3. Press the trigger to open the transformer jaw and clamp around the "Hot" and return conductor or the ground conductor only (see Fig.4). Make sure that the jaw is fully closed.

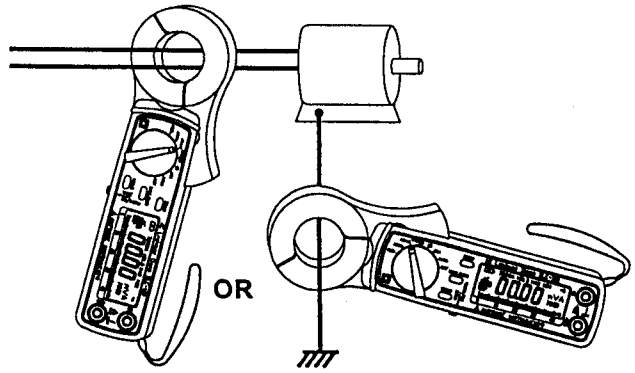


Fig. 4 Branch Circuit Leakage Current Measurement

4. Reset the rotary switch to a lower scale that yields the most resolution without full scale overload.
5. Read the displayed measurement on the LCD.

Measuring Leakage and Imbalance Current in 3 Phase 3 Wire Circuits

Two electrical problems can cause imbalance:

1. **Conductors Insulation Breakdown**
   A. in conductor runs to the load,
   B. from winding to winding in motors or compressors,reducing turn ratios, or
   C. from the windings to ground, allowing current to flow to ground.
2. Phasing Problem (3 Phase):
   A. The phase relationship of the applied voltage may not be exactly 120 degrees apart or
   B. the voltages may not be of equal magnitude.

To Measure Leakage Current

- Before taking any readings, make sure that the "ZERO", Data "HOLD", and/or "MAX/MIN" functions are not activated and their annunciators are not illuminated in the LCD.
- Set the rotary switch to the 100A scale.
- Press the trigger to open the transformer jaw and clamp around the ground conductor only (see Fig.5). Make sure that the jaw is fully closed.

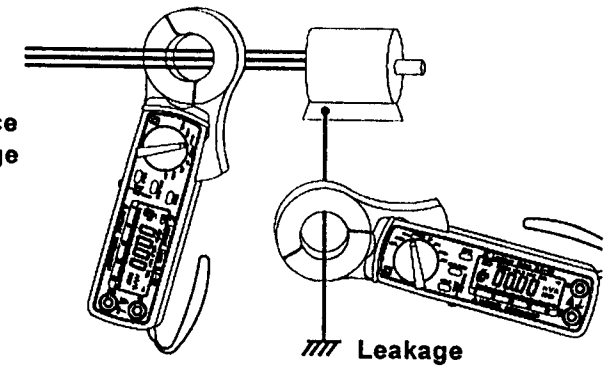


Fig.5: 3ϕ 3 Wire Imbalance and Leakage Measurement

- Reset the rotary switch to a lower scale that yields the most resolution without full scale overload.
  Read the displayed measurement on the LCD.

To Measure Imbalance Current

1. Before taking any readings, make sure that the "ZERO", Data "HOLD", and/or "MAX/MIN" functions are not activated and their annunciators are not illuminated in the LCD.
2. Set the rotary switch to the 100A scale.
3. Press the trigger to open the transformer jaw and clamp around the three "Hot" conductors only (see Fig.5). Make sure that the jaw is fully closed.
4. Reset the rotary switch to a lower scale that yields the most resolution without full scale overload.
5. Read and record the displayed measurement on the LCD. This measurement equals the Imbalance + Leakage.
6. Set the rotary switch back to the 100A scale.
7. Press the trigger to open the transformer jaw and clamp around the ground conductor only (see Fig.5). Make sure that the jaw is fully closed.
8. Reset the rotary switch to a lower scale that yields the most resolution without full scale overload.
9. Read and record the displayed measurement on the LCD. This is Leakage Current.
10. Subtract the second measurement from the first:
    (Imbalance + Leakage) - (Leakage) = Imbalance
11. The result will be the total current attributed to imbalance.

Measuring Load Current

To measure load current, you must clamp on one conductor only, usually the "Hot". Access to the "Hot" conductor can be made at the circuit panel or nearest junction box. By clamping around the "Hot" conductor only, the meter will display the load current which may also include any leakage current. When testing two wire line cord appliances, you may use Amprobe's "Energizer" accessory, model A-47L (not included).

1. Before taking any readings, make sure that the "ZERO", Data "HOLD", and/or "MAX/MIN" functions are not activated and their annunciators are not illuminated in the LCD.
2. Set the rotary switch to the 100A scale.
3. Press the trigger to open the transformer jaw and clamp around the "Hot" conductor. Make sure that the jaw is fully closed.(see Fig.6)

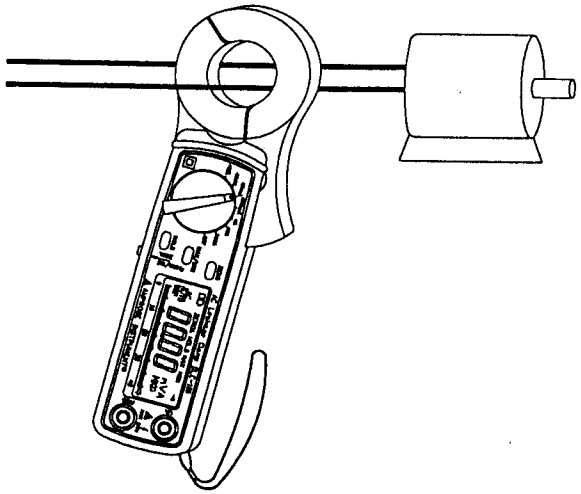


Fig. 6 Load Current Measurement

4. If necessary set the rotary switch a lower scale that yields the most resolution without full scale overload.
5. Read the displayed measurement on the LCD.

Measuring Voltage

WARNING!! Do not attempt to measure voltage on circuits operating at more than 400V RMS

1. Before taking any readings, make sure that the "ZERO", Data "HOLD", and/or "MAX/MIN" functions are not activated and their annunciators are not illuminated in the LCD.
2. Insert the test leads into the meter.
3. Rotate the rotary selector switch to the 400V position (see Fig.7)

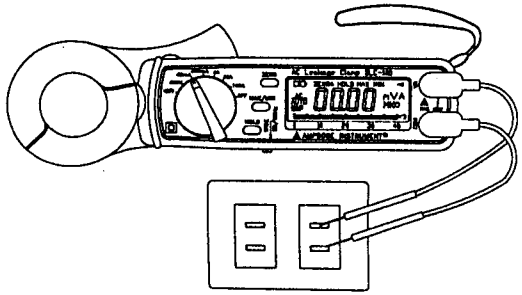


Fig. 7

4. Touch one probe tip to ground and the other probe tip to the "Hot" conductor so the meter is connected in parallel to the load.
5. Read the displayed measurement on the LCD.

Measuring Resistance/Continuity

WARNING!! Do not attempt to measure resistance on an energized line. Verify that the circuit is deenergized before measuring resistance.

1. Before taking any readings, make sure that the "ZERO", Data "HOLD", and/or "MAX/MIN" functions are not activated and their annunciators are not illuminated in the LCD.
2. Insert the test leads into the meter as in Fig.7.
3. Rotate the rotary selector switch to the Ω position.
4. Connect the probes across the circuit to be measured.
5. Read the displayed measurement on the LCD.

Note: If the measured resistance is less than 38Ω, the unit will emit a beep, indicating continuity.

Continuing the Investigation

Proper Grounding: A low impedance path must be available for leakage current or fault current to flow. Proper values of earth ground electrode resistance, and ground conductor impedance must fall within the guidelines of equipment manufacturers, IEEE, and NEC and values can not be calculated using leakage current measurements from the DLC-100. Evaluation of effective grounding and bonding can be verified with a tester such as **Amprobe's model GP-1, the Ground Probe**.

Insulation Testing: Excess leakage current on branch circuits may require further investigation. Further investigation may include a megohm test on the conductors with a Megohmeter, such as **Amprobe's model AMB-4D**. A Megohm test requires the loads to be removed from the circuit prior to the test and the circuit deenergized.

Identifying Loads: Before the circuit is deenergized and a megohm test performed, the loads that must be disconnected may be identified from the panel using a wire tracing system, such as the **Amprobe model AT-2005** Advanced Wire Tracer.

Finding The Faults: If the conductor insulation fails the megohm test, the location of the short or fault may be located with a current tracer, such as the **Amprobe model CT326B**.

Higher Current Measurements: The current measurement capabilities of the DLC-100 can be extended when used in conjunction with Amprobe's accessory model A50-1 (up to 600A).

Specifications

AC Current

		Accuracy	
Range	Resolution	50/60 Hz	Wide(40 - 1KHz)
40mA	10µA	±1.0% rdg ±3dig.	±1.5% rdg ±5dig.
400mA	100µA	±1.0% rdg ±3dig.	±1.5% rdg ±5dig.
4A	1mA	±1.0% rdg ±3dig.	±1.5% rdg ±5dig.
40A	10mA	±1.0% rdg ±3dig.	±1.5% rdg ±5dig.
80A	100mA	±2.2% rdg ±5dig.	±2.5% rdg ±5dig.
80 - 100A	100mA	±9.0% rdg ±10dig.	±9.5% rdg ±10dig.

Though meter can display up to 400A, calibration is not guaranteed over 100A

AC Voltage (10MΩ input impedance)

		Accuracy		Overload Protection
Range	Resolution	50/60 Hz	Wide(40 - 1KHz)	
400V	0.1V	±1.5% rdg ±2dig.	±2.0% rdg ±4dig.	800VAC

Resistance (.4V open voltage)

Range	Resolution	Accuracy	Continuity Threshold	O.L. Protection
0-400ohms	0.1ohm	±1.0% ±3dgts	Beep if < 38.0 Ω	600VAC(1min.)

Accessories

Batteries:	Two "AA" 1.5V alkaline (Amprobe model S912)
Test Lead Set:	Model DTL-10
Carrying case:	Model SV-100 (Soft Vinyl)\
Instruction Manual:	part number 932762
Power Consumption:	10mA (approx.)
Measurement:	Average Sensing
Sampling Rate:	2 times/sec.(display) 20 times/sec.(bargraph)
Operating Temperature:	13°F to 122°F (-10°C to 50°C)
Operating Humidity:	less than 85% relative
Storage Temperature:	-4°F to 140°F (-20°C to 60°C)
Storage Humidity:	Less than 75% relative
Dimensions:	8.3" (L) x 2.4" (W) x 1.4" (H) 210mm x 62.0mm x 35.6mm
Jaw Size:	1.18" (30mm)
Weight:	7.14oz (200g) including batteries