OPERATING INSTRUCTIONS

Digital AC Leakage Current Clamp
with Voltage and Continuity

Model DLC-100

AMPROBE®
Limited Warranty

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

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

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

For your protection, please use the instrument as soon as possible. If damaged, or should the need arise to return your instrument, place it in a shipping carton packed with sufficient cushioning material. It must be securely wrapped. Amprobe is not responsible for damage during transit. Be sure to include a packing slip (indicating model and manufacturer number) along with a brief description of the problem. Make certain your name and address appears on the box as well as packing slip.

Ship prepaid via Air Parcel Post insured or U.P.S. insured where available to:

Service Division
AMPROBE INSTRUMENT
630 Merrick Road (For U.P.S.)
PO Box 329 (For A.P.P.)
Lynbrook, NY 11563-0329

Outside the USA the local Amprobe representative will assist you. Above limited warranty covers repair and replacement of instrument only and no other obligation is stated or implied.
Precautions for Personal and Instrument Protection

A small amount of current that flows through the ground conductor is generally referred to as leakage current. Leakage current in 50/60 Hz distribution systems can be an early warning sign or an immediate indication of a dangerous electrical problem, such as conductor insulation breakdown or faults in the system, where personal injury, death, or property loss is concerned or any other consequential damages.

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.

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.

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

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.

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

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.

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

Disconnect test leads from the circuit before changing functions.

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

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

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

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

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

Levels of Capacitive coupling vary with insulation type, voltage, frequency, and other factors.
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 Annunciaged 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.

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**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 bandwidth are available.
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.
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 annunciaged, 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:

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.

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
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.

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.
**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](image)

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](image)

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 DCL-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 Megohmmeter, 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).

<table>
<thead>
<tr>
<th>Specifications</th>
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### AC Current

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>40mA</td>
<td>10μA</td>
<td>±1.0% rdg ±3dig.</td>
</tr>
<tr>
<td>400mA</td>
<td>100μA</td>
<td>±1.0% rdg ±3dig.</td>
</tr>
<tr>
<td>4A</td>
<td>1mA</td>
<td>±1.0% rdg ±3dig.</td>
</tr>
<tr>
<td>40A</td>
<td>10mA</td>
<td>±1.0% rdg ±3dig.</td>
</tr>
<tr>
<td>80A</td>
<td>100mA</td>
<td>±2.2% rdg ±5dig.</td>
</tr>
<tr>
<td>80-100A</td>
<td>100mA</td>
<td>±9.0% rdg ±10dig.</td>
</tr>
</tbody>
</table>

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

### AC Voltage (10MΩ input impedance)

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Continuity Threshold</th>
<th>O.L. Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>400V</td>
<td>0.1V</td>
<td>±1.5% rdg ±2dig.</td>
<td>Beep if &lt; 38.0 Ω</td>
<td>800VAC(1min.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resistance (.4V open voltage)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Range</th>
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<th>Accuracy</th>
<th>Continuity Threshold</th>
<th>O.L. Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-400ohms</td>
<td>0.1ohm</td>
<td>±1.0% ±2dig.</td>
<td>Beep if &lt; 38.0 Ω</td>
<td>800VAC(1min.)</td>
</tr>
</tbody>
</table>

### 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.(bar graph)
- 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)
- Jaw Size: 210mm x 62.0mm x 35.6mm
- Weight: 1.18" (30mm)
- Weight: 7.14oz (200g) including batteries