

# HIOKI

## 9657-10

### CLAMP ON LEAK SENSOR

#### INSTRUCTION MANUAL

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#### HIOKI E. E. CORPORATION

##### HEAD OFFICE

81 Koizumi, Ueda, Nagano 386-1192, Japan  
TEL +81-268-28-0562 / FAX +81-268-28-0568  
E-mail: os-com@hioki.co.jp URL http://www.hioki.co.jp/

##### HIOKI USA CORPORATION

6 Corporate Drive, Cranbury, NJ 08512, USA  
TEL +1-609-409-9109 / FAX +1-609-409-9108

#### Introduction

Thank you for purchasing the HIOKI "9657-10 CLAMP ON LEAK SENSOR". To obtain maximum performance from the product, please read this manual first, and keep it handy for future reference.

#### Inspection

When you receive the product, inspect it carefully to ensure that no damage occurred during shipping. If damage is evident, or if it fails to operate according to the specifications, contact your dealer or HIOKI representative.

#### Preliminary Check

- Before using the product the first time, verify that it operates normally to ensure that the no damage occurred during storage or shipping. If you find any damage, contact your dealer or Hioki representative.
- Before using the product, make sure that the insulation on the cables is undamaged and that no bare conductors are improperly exposed. Using the product in such conditions could cause an electric shock, so contact your dealer or Hioki representative for repair.

#### Maintenance and Service

- To clean the product, wipe it gently with a soft cloth moistened with water or mild detergent. Never use solvents such as benzene, alcohol, acetone, ether, ketones, thinners or gasoline, as they can deform and discolor the case.
- If the product seems to be malfunctioning, confirm that the cables are not open circuited before contacting your dealer or Hioki representative. When sending the product for repair, pack the product carefully so that it will not be damaged during shipment, and include a detailed written description of the problem. Hioki cannot be responsible for damage that occurs during shipment.

## Overview

The 9657-10 is a voltage output type clamp on sensor compatible to 10A AC measurements. The instrument can be relied upon to measure subtle current with great accuracy due to the high magnetic permeability material used for the core and magnetic shield.

## Specifications

Accuracy is guaranteed for one year at 23±5°C (73±9°F) and Max. 80% RH. (Opening and Closing of the Sensor: Maximum 10000 times)

Rated current	10 A AC
Output voltage	100 mV AC/A
Amplitude accuracy	±1.0% rdg.±0.05% f.s. (f.s.: 10A) (at the clamp core center, 45 to 66 Hz)
Phase accuracy	within ±3°(at 50Hz, 60Hz, Measurement current: Min. 1A)
Maximum input current	30A continuous at 45 to 60Hz (Ambient temperature: 50°C)
Effect of conductor position	within ±0.1% (in any direction from sensor center)
Effect of external magnetic fields	400 A AC/m corresponds to 5 mA, Max. 7.5 mA
Remaining electric current character	Max. 5 mA (in 100 A go and return electric wire)
Dielectric strength	3536 Vrms for 15 seconds (between clamp window and case)
Maximum rated voltage to earth	Max. 300 Vrms (Insulated conductor)
Operating temperature and humidity range	0 to 50°C (32 to 122°F) Max. 80%RH (no condensation)
Storage temperature and humidity range	-10 to 60°C (14 to 140°F) Max. 80%RH (no condensation)
Location for use	Altitude up to 2000 m (6562 feet), Indoors
Standards applying	<b>EMC</b> EN 61326:1997+A1:1998+A2:2001+A3:2003 <b>Safety</b> EN 61010-2-032:2002 Type B current sensor Measurement Category III, Pollution Degree 2 (anticipated transient overvoltage 4000 V)
Diameter of measurable conductor	Within φ 40 mm (1.57")
Cable length	Approx. 3 m (118.11")
External dimensions	Approx. 74W x 145H x 42D mm 2.91"W x 5.71"H x 1.65"D (excluding protrusions)
Mass	Approx. 380 g (12.2 oz.)
Accessories	Instruction manual: 1

We define measurement tolerances in terms of f.s. (full scale) and rdg.(reading) values, with the following meanings:

- **f.s. (maximum display value or scale length)**  
The maximum displayable value or the full length of the scale. This is usually the maximum value of the currently selected range.
- **rdg. (reading or displayed value)**  
The value currently being measured and indicated on the measuring product.

## Safety

This manual contains information and warnings essential for safe operation of the product and for maintaining it in safe operating condition. Before using the product, be sure to carefully read the following safety notes

### ⚠ DANGER

This product is designed to conform to IEC 61010 Safety Standards, and has been thoroughly tested for safety prior to shipment. However, mishandling during use could result in injury or death, as well as damage to the product. Be certain that you understand the instructions and precautions in the manual before use. We disclaim any responsibility for accidents or injuries not resulting directly from product defects.

### Measurement categories (Overvoltage categories)

This product complies with CATIII safety requirements. To ensure safe operation of measurement products, IEC 61010 establishes safety standards for various electrical environments, categorized as CAT I to CAT IV, and called measurement categories. These are defined as follows.

CAT I: Secondary electrical circuits connected to an AC electrical outlet through a transformer or similar device.

CAT II: Primary electrical circuits in equipment connected to an AC electrical outlet by a power cord (portable tools, household appliances, etc.)

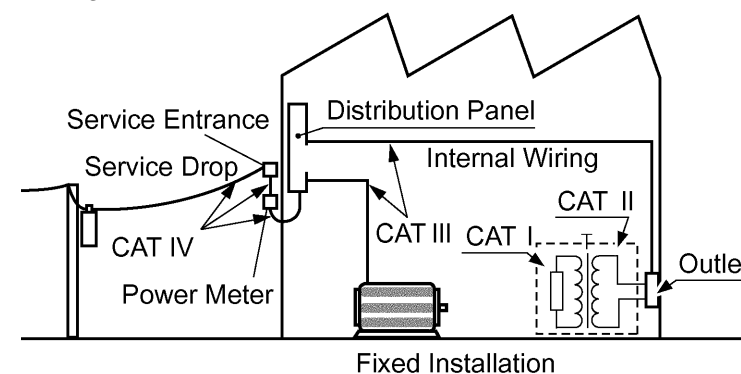
CAT III: Primary electrical circuits of heavy equipment (fixed installations) connected directly to the distribution panel, and feeders from the distribution panel to outlets.

CAT IV: The circuit from the service drop to the service entrance, and to the power meter and primary over-current protection device (distribution panel).




Higher-numbered categories correspond to electrical environments with greater momentary energy. So a measurement device designed for CAT III environments can endure greater momentary energy than a device designed for CAT II. Using a measurement product in an environment designated with a higher-numbered category than that for which the product is rated could result in a severe accident, and must be carefully avoided.

Never use a CAT I measuring product in CAT II, III, or IV environments.

The measurement categories comply with the Overvoltage Categories of the IEC60664 Standards.



## Safety Symbol

	In the manual, the ⚠ symbol indicates particularly important information that the user should read before using the product. The ⚠ symbol printed on the product indicates that the user should refer to a corresponding topic in the manual (marked with the ⚠ symbol) before using the relevant function.
	Indicates AC (Alternating Current).
	Wear appropriate protective insulation (insulating rubber gloves and boots, helmet and etc.) when connecting and disconnecting from live electric circuits.

The following symbols in this manual indicate the relative importance of cautions and warnings.

**⚠ DANGER** Indicates that incorrect operation presents an extreme hazard that could result in serious injury or death to the user.

**⚠ WARNING** Indicates that incorrect operation presents a significant hazard that could result in serious injury or death to the user.

**⚠ CAUTION** Indicates that incorrect operation presents a possibility of injury to the user or damage to the product.

**NOTE** Advisory items related to performance or correct operation of the product.

## Usage Notes

Follow these precautions to ensure safe operation and to obtain the full benefits of the various functions.

### ⚠ DANGER

Connect the CLAMP ON LEAK SENSOR to the product first, and then to the active lines to be measured.

Observe the following to avoid electric shock and short circuits.

- When conductors being measured carry in excess of the safe voltage level (SELV-E) and not more than 300 V, to prevent short circuits and electric shock while the clamp core jaw is open, make sure that conductors to be measured are insulated with material conforming to (1) Overvoltage Category III, (2) Pollution Degree 2, and (3) Basic Insulation Requirements for Working Voltages of 300 V.

Refer to the following standards regarding the meanings of underlined terms.

IEC 61010-1  
IEC 61010-2-031  
IEC 61010-2-032



- To avoid short circuits and potentially life-threatening hazards, never attach the product to a circuit that operates at more than 300 V rms, or over bare conductors.
- When the clamp sensor is opened, do not allow the metal part of the clamp to touch any exposed metal, or to short between two lines, and do not use over bare conductors.

### ⚠ DANGER

- This product should only be connected to the secondary side of a breaker, so the breaker can prevent an accident if a short circuit occurs. Connections should never be made to the primary side of a breaker, because unrestricted current flow could cause a serious accident if a short circuit occurs.
- To avoid electric shock, do not touch the portion beyond the protective barrier during use.

### ⚠ WARNING

- To avoid electric shock, do not allow the product to get wet, and do not use it when your hands are wet.
- To avoid electric shock when measuring live lines, wear appropriate protective gear, such as insulated rubber gloves, boots and a safety helmet.
- To avoid electric shock when measuring the ground conductor on a transformer Class 2 connection site, be careful not to approach high voltage devices or conductors. Also, if close to high voltage charging devices or if measurement is otherwise difficult, first change the route of the grounding wire.

### ⚠ CAUTION

- Do not store or use the product where it could be exposed to direct sunlight, high temperature or humidity, or condensation. Under such conditions, the product may be damaged and insulation may deteriorate so that it no longer meets specifications.
- To avoid damage to the product, protect it from vibration or shock during transport and handling, and be especially careful to avoid dropping.
- Be careful to avoid dropping the product or otherwise subjecting them to mechanical shock, which could damage the mating surfaces of the core and adversely affect measurement.
- Keep the clamp jaws and core slits free from foreign objects, which could interfere with clamping action.
- Keep the clamp closed when not in use, to avoid accumulating dust or dirt on the mating core surfaces, which could interfere with clamp performance.
- Measurements are degraded by dirt on the mating surfaces of the clamp-on sensor, so keep the surfaces clean by gently wiping with a soft cloth.
- This product is not designed to be entirely water- or dust-proof. To avoid damage, do not use it in a wet or dusty environment.
- This product is designed for indoor use, and operates reliably from 0°C to 50°C.
- This product should be installed and operated indoors only, between 0 and 50°C and 80% RH or less
- Avoid stepping on or pinching the cable, which could damage the cable insulation.
- Keep the cables well away from heat sources, as bare conductors could be exposed if the insulation melts.
- To avoid damaging the sensor cable, do not bend or pull the cable.
- Note that the product may be damaged if current exceeding the selected measurement range is applied for a long time

## Measurement Procedure

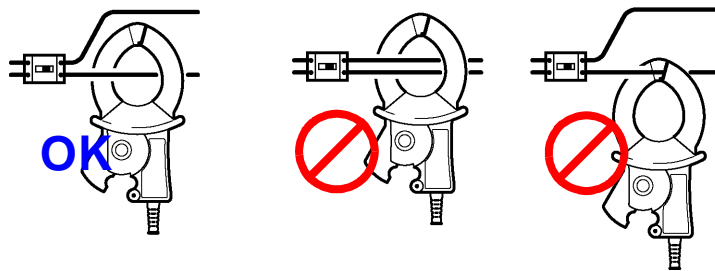
### ⚠ CAUTION

- When disconnecting the BNC connector, be sure to release the lock before pulling off the connector. Forcibly pulling the connector without releasing the lock, or pulling on the cable, can damage the connector.
- To prevent damage to the product and sensor, never connect or disconnect a sensor while the power is on, or while the sensor is clamped around a conductor.

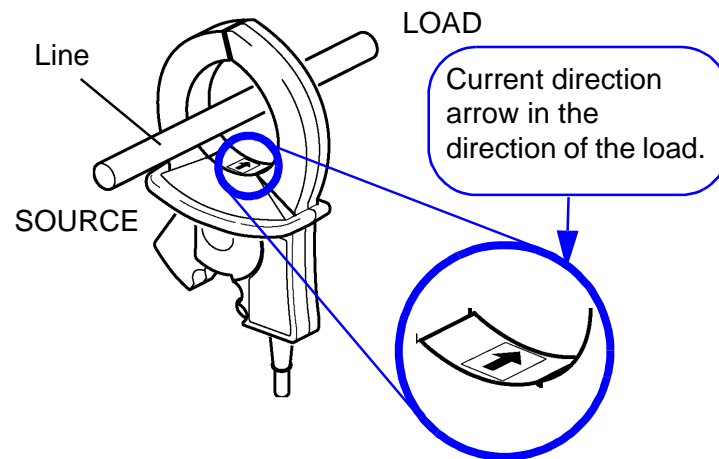
### 1. Load Current Measurement

#### NOTE

Attach the clamp around only one conductor. Single-phase (2-wire) or three-phase (3-wire) cables clamped together will not produce any reading.



When making the phases of the measurement current and output voltage the same, clamp the jaws of the sensor onto the conductor so that the current direction on the clamp points in the direction of the load, and so that the conductor is approximately centered between the jaws. Make sure that the tips of jaws are fully closed.



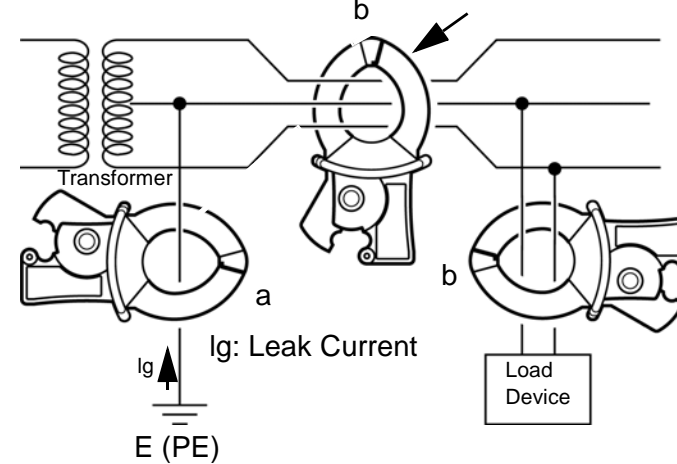
- Align the BNC connector with the connector guide notch on the current input connector. While pushing the connector in, turn it to the right to lock it.
- Open the jaws, and clamp the sensor onto the conductor.
- Make sure that the tips of jaws are fully closed.

### 2. Leak Current Measurement

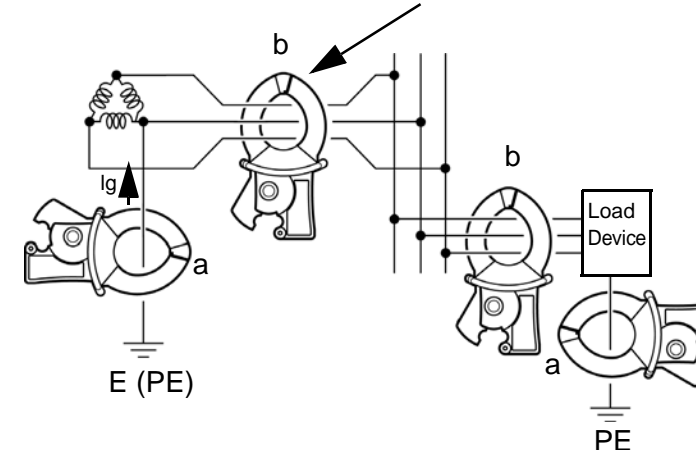
#### Connections method

Clamp the tester on the conductor, so that the conductor passes through the center of the clamp core. For measurement of grounded leads, clamp the tester on one lead only (see a). For overall measurements, clamp the tester on the entire circuit path (see b).

#### Single-phase 3-lead circuits



#### Three-phase 3-lead circuits



#### NOTE

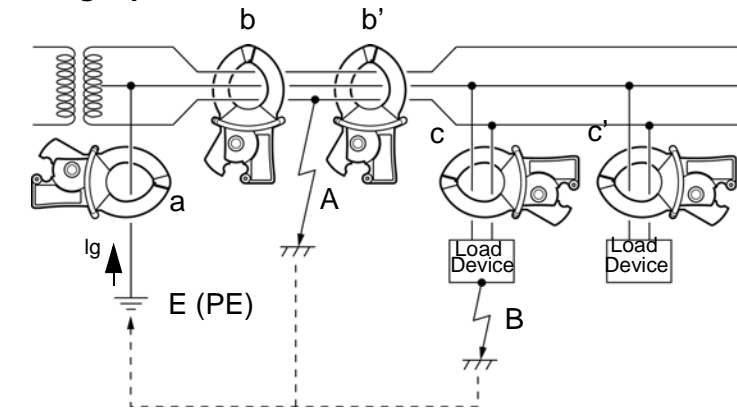
- For measurement of single-phase 2-lead circuits, clamp both leads of the circuit.
- For measurement of three-phase 4-lead circuits, clamp all four leads of the circuit. If this is not possible, the measurement can also be carried out on the ground lead of the equipment.
- If a strong current (on the order of 100 A) is flowing in an adjacent circuit, accurate measurement may not be possible. Perform the measurement at a sufficient distance from other current-carrying conductors.
- The frequency of special waveforms such as at the secondary side of an inverter may not be indicated correctly.
- Do not input a current which exceeds the rated current.

#### Checking for insulation faults

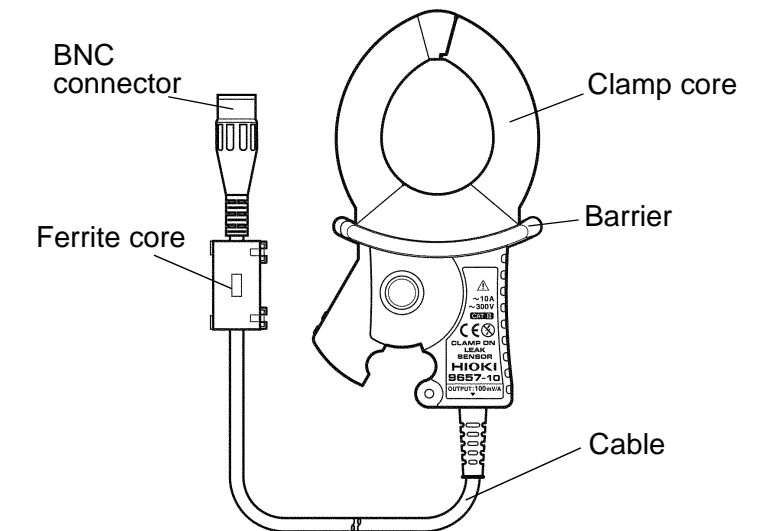
Normally, for a E(PE) grounding installation of a transformer, the measurement will first be made to check for overall circuit leak current in the ground lead (a). Current changes can be used to diagnose the leak current condition. When leak current has been detected, the measurement should proceed from the power source towards the load, using overall measurement.

- 1.If an insulation fault in the wiring has occurred at position A in the illustration, leak current will be detected at position b using overall measurement, but not at position b'.
- 2.If an insulation fault in the load equipment has occurred at position B in the illustration, leak current will be detected at position c using overall measurement, but not at position c'.
- 3.For detection of intermittent leak current conditions (such as only when a certain piece of equipment is operating), the use of a level recorder will be helpful.

#### Single-phase 3-lead circuits



## Parts Names



<b>HIOKI</b>	
<b>DECLARATION OF CONFORMITY</b>	
Manufacturer's Name:	HIOKI E.E. CORPORATION
Manufacturer's Address:	81 Koizumi, Ueda, Nagano 386-1192, Japan
Product Name:	CLAMP ON LEAK SENSOR
Model Number:	9657, 9657-10
The above mentioned products conform to the following product specifications:	
Safety:	EN61010-2-032:2002
EMC:	EN61326:1997+A1:1998+A2:2001+A3:2003 ClassB equipment Portable test and measurement equipment
Supplementary Information: The products herewith comply with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC.	
HIOKI E.E. CORPORATION	
15 September 2006	Tatsuyoshi Yoshitake President 9657A999-02