HIOKI

INSTRUCTION MANUAL

3660

LAN CABLE HiTESTER

HIOKI E. E. CORPORATION

Contents

Introduction

Thank you for purchasing the HIOKI 3660 LAN CABLE HiTESTER. 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. In particular, check the accessories, panel switches. If damage is evident, or if it fails to operate according to the specifications, contact your dealer or Hioki representative.

Accessories

9336 WIREMAP TERMINATOR	1
3853 CARRYING CASE	1
LR6 alkaline battery	6
Instruction manual (Japanese&English)	1 each

Safety Notes

⚠ WARNING

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.

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.

Safety symbols

⚠	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. In the manual, the ⚠ symbol indicates particularly important information that the user should read before using the product.
I	Indicates the ON side of the power switch.
○	Indicates the OFF side of the power switch.

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.

Accuracy

We define measurement tolerances in terms of rdg. (reading) values, with the following meanings:

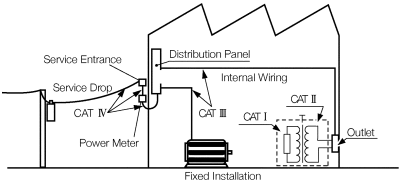
rdg.	(reading or displayed value) The value currently being measured and indicated on the measuring product. dgt. (resolution) The smallest displayable unit on a digital measuring product, i.e., the input value that causes the digital display to show a "1".

Measurement categories (Overvoltage categories)

This product complies with CAT I 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 overcurrent 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.



Notes on Use

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

DANGER

To prevent electric shock, do not connect the test terminals to a UTP cable, etc., that is connected to an operational network. The test terminals (RJ-45) for this device are specifically designed for checking standalone UTP cables.

WARNING

- **To avoid electric shock, do not allow the product to get wet, and do not use it when your hands are wet.**
- **Do not connect this device to a UTP cable while the device is wet. Doing so could result in electric shock.**
- **Do not use the product where it may be exposed to corrosive or combustible gases. The product may be damaged or cause an explosion.**
- **To avoid a shock hazard, disconnect the UTP cable before replacing the batteries. Before using the product after replacing the batteries, replace the cover and screw.**
- **Do not mix old and new batteries, or different types of batteries. Also, be careful to observe battery polarity during installation. Otherwise, poor performance or damage from battery leakage could result.**

⚠ WARNING

- **To avoid the possibility of explosion, do not short circuit, disassemble or incinerate batteries.**
- **Handle and dispose of batteries in accordance with local regulations.**

⚠ 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.
- Adjustments and repairs should be made only by technically qualified personnel.

NOTE

- The B indicator appears when battery voltage becomes low. Replace the batteries.
- Always turn the power switch off after you are done using the unit.
- Do not use any power source other than the specified batteries (LR6/AA). Using manganese or other batteries will result in shorter battery life.
- To avoid corrosion from battery leakage, remove the batteries from the product if it is to be stored for a long time.

Chapter 1 Overview

1.1 Product Overview

The 3660 can check the connection status between RJ-45 connectors attached to the near and far ends of a UTP cable (wiremap), and can check the length of a cable. Furthermore, when used with the optional 9337 DIRECTION TERMINATOR, the 3660 can be used to identify specific cables among many when cables are laid inside a wall or under the floor. Once the RJ-45 connectors have been attached, these functions can be easily used to check connections and identify cables during installation work. The 3660 is also demonstrates its power when it is needed to check cables in the event of a network failure caused by an open circuit or a short circuit in a cable.

1.2 Features

(1) Simple operation

Once the 3660 and the 9336 WIREMAP TERMINATOR have been connected to both end of the UTP cable to be tested, the wiremap check and cable length measurements can be performed simply by pressing the **TEST** key.

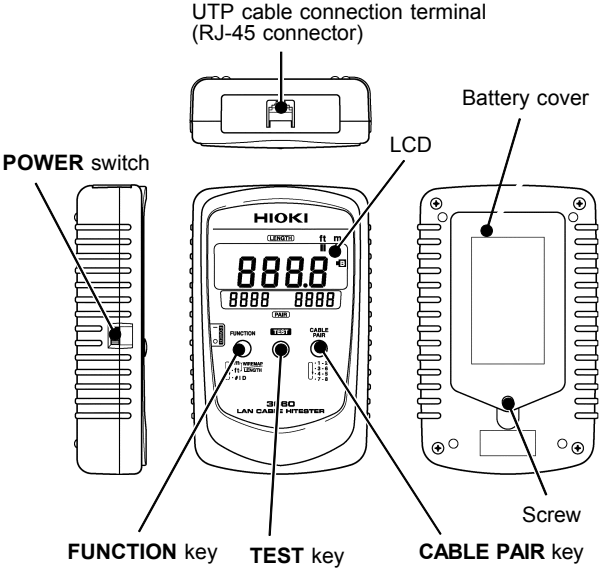
(2) Easy to see display on large LCD

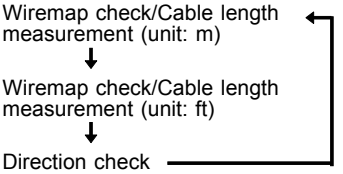
When using the wiremap check and cable length measurement functions, the results of the wiremap check and the cable length measurement are displayed on the large LCD. When using the direction check function, the cable identification results are displayed on the large LCD.

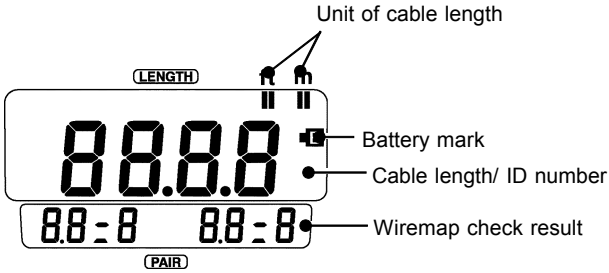
(3) Lengths displayed in meters (m) or feet (ft)

The 3660 can display cable lengths in meters (m) or feet (ft).

1.3 Identification of Controls and Indicators



POWER switch	Power switch for the 3660.
FUNCTION key	Pressing this key cycles through the functions as illustrated below. 
TEST key	This key is used to execute a test of a UTP cable.
CABLE PAIR key	When using the wiremap check and cable length measurement functions, this key is used to change the cable pair that is displayed on the LCD. Pressing this key cycles through the displayed cable pairs as illustrated below. **1-2** ⇒ **3-6** ⇒ **4-5** ⇒ **7-8** ⇒ **1-2**



Cable length/ ID number	When using the wiremap check and cable length measurement functions, the cable length is displayed here. When using the direction check function, the ID number of the DIRECTION TERMINATOR that is connected at the far end of the UTP cable is displayed here.
Wiremap check result	When using the wiremap check and cable length measurement functions, the wiremap check result for an individual pair is shown here.
Unit of cable length	The ▮▮ indicates the unit of length that is being used for the cable length display.
Battery mark	This symbol indicates that the battery needs to be replaced.

Chapter 2
Checking Method

DANGER

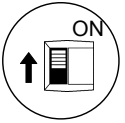
To prevent electric shock, do not connect the test terminals to a UTP cable, etc., that is connected to an operational network. The test terminals (RJ-45) for this device are specifically designed for checking standalone UTP cables.

WARNING

- **To avoid electric shock, do not allow the product to get wet, and do not use it when your hands are wet.**
- **Do not use the product where it may be exposed to corrosive or combustible gases. The product may be damaged or cause an explosion.**

NOTE In this manual the end of the UTP cable being tested that is to be connected to the 3660 is referred to as the "near end," while the end of the cable to which the 9336 WIREMAP TERMINATOR or the optional 9337 DIRECTION TERMINATOR is to be connected is referred to as the "far end."

2.1 Preparation for Checks



1. Turn the power switch on, and confirm that the display (the LCD) is on.

2. Confirm that the battery mark) is not displayed. If it is displayed, the battery is running low and needs to be replaced. (Refer to section 7.1, "Changing the battery.")

2.2 Checking Method

Checking after connecting the UTP cable connectors

The 3660's wiremap check function can be used to check the connection status of the connector pins.
(Refer to section 2.2.1.)

Use in analysis of problems in a working network

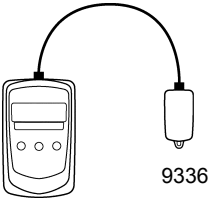
If there is an open circuit or a short circuit in a UTP cable, the 3660's cable length measurement function displays the distance from the near end of a cable to an open circuit or a short circuit in the cable. When a problem occurs in a working network, the cable length measurement function and the wiremap check function can be used together to determine whether the problem is caused by an open circuit/short circuit in a cable, or some other factor.
(Refer to section 2.2.1.)

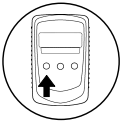
Identification if individual cables installed in a group

When multiple cables are installed together, it can be difficult to know which cable is connected to what. When the 3660's direction check function is used in conjunction with the optional 9337 DIRECTION TERMINATOR, it becomes easy to identify individual cables. When used with the 9337, up to five cables can be identified.
(Refer to section 2.2.2.)

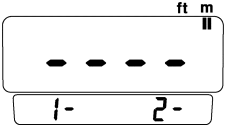
2.2.1 Checking the WireMap/ Cable Length (WireMap Check/Cable Length Measurement)

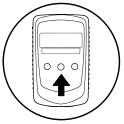
1. Connect one end of the UTP cable to be checked to the 3660, and connect the other end to the 9336 WIREMAP TERMINATOR.



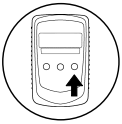


2. Display the WireMap Check/Cable Length Measurement function and select either "m" display or "ft" display. (Press the **FUNCTION** key to change the screen.)





3. Press the **TEST** key to execute the test.



4. Check the connection status and cable length of each pair. Press the **CABLE PAIR** key to switch the cable pair that is displayed.

NOTE In order for the 3660 to conduct the wiremap check, at least two out of eight wires need to be connected to correctly at both ends, and one other wire needs to be connected either correctly or incorrectly. If these conditions are not met, all pin numbers return an error.

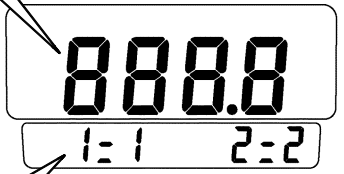
Reading the Display

Cable length display

Displays the cable length. If there is an open circuit or a short circuit in a cable, the distance from the near end of the cable to the location of the break or short circuit is displayed.

Error display

Measurement is not possible if the UTP cable being measured exceeds the measurable length, or if the characteristic impedance of the cable is significantly different from 100 ohms.



Wiremap check results

Displays the wiring status of each pair.

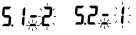
Displays the connected pin number.
Flashes if the connected pin number is different than the near end pin number.

Indicates whether the connected pin number is on the near end or the far end.
: Indicates that the connected pin number is a far end pin.
: Indicates that the connected pin number is a near end pin.

Indicates the near end pin number.

Error display

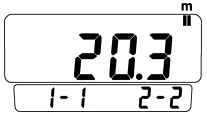
Indicates whether there is a short circuit, an open circuit, or if measurement is not possible.

 : Indicates a short circuit (1,2 pair).

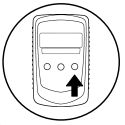
 : Indicates an open circuit (1,2 pair).

 : Indicates that measurement is not possible (1,2 pair).

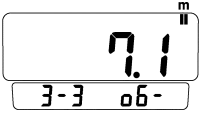
Measurement



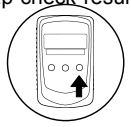
1,2 pair
Cable length: 20.3 m



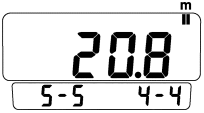
CABLE PAIR



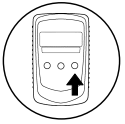
3,6 pair
Cable length: 7.1 m
WireMap check results: Pin 6 open



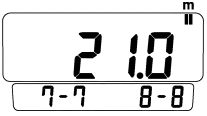
CABLE PAIR



4,5 pair
Cable length: 20.8 m

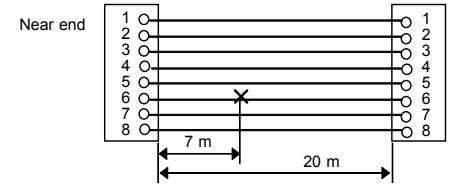


CABLE PAIR



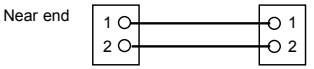
7,8 pair
Cable length: 21.0 m

Compared to the lengths of other cable pairs, the length of cables 3 and 6 are shorter. Furthermore, the wiremap check results at the bottom of the display indicate that pin 6 is open. It can therefore be determined that there is an open circuit about 7m from the near end in the 20m cable that is connected to pin 6.



Wiremap Display Example

(1) Display examples for correct wiring



Wiremap check results display

When a straight cable that is wired correctly is checked with the 3660, the wiremap display is as follows:

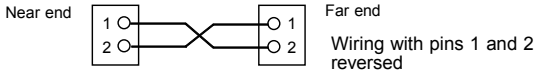
Displayed pair	Connection display 1	Connection display 2
1, 2	1-1	2-2
3, 6	3-3	6-6
4, 5	4-4	5-5
7, 8	7-7	8-8

When a crossed cable that is wired correctly is checked with the 3660, the wiremap display is as follows:

Displayed pair	Connection display 1	Connection display 2
1, 2	1-3	2-6
3, 6	3-1	6-2
4, 5	4-4	5-5
7, 8	7-7	8-8

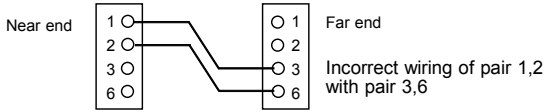
(2) Display examples for incorrect wiring

① Reversed wiring



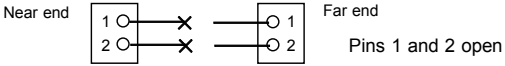
Wiremap check results display

② Transposed wiring



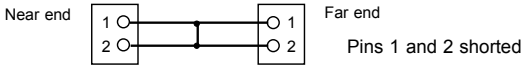
Wiremap check results display

③ Open circuit



Wiremap check results display

④ Short circuit



Wiremap check results display

⑤ Measurement not possible

Wiremap check results display

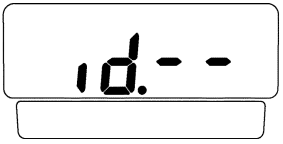
When the error display appears, that pin cannot be measured. If the error display appears for all pin numbers, make sure that the UTP cable that is being checked is securely connected to the 3660 and the 9336. If the error display appears for all pin numbers even though all connections are secure, it is possible that the connector wiring does not satisfy the test requirements.

NOTE
- In order for the 3660 to conduct the wiremap check, at least two out of eight wires need to be connected to correctly at both ends, and one other wire needs to be connected either correctly or incorrectly. If these conditions are not met, all pin numbers return an error.
- If only cable length is being measured, it is not necessary to connect the 9336.

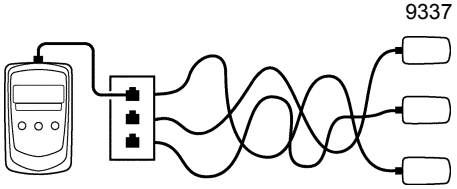
2.2.2 Checking Cable Connections (Direction Check)

NOTE Use the optional 9337 DIRECTION TERMINATOR. The direction check cannot be performed using the 9336 WIREMAP TERMINATOR.

1. Press the **FUNCTION** key to display the direction check screen.



2. Connect the direction terminator to the far end of the UTP cable for which you want to check the connection.

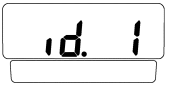


NOTE
- Up to five cables can be identified using the 9337 DIRECTION TERMINATOR.
- At a location where there are multiple cables gathered together, connect the 3660 to the individual cable that you want to identify.

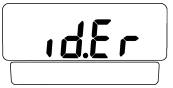
3. Press the **TEST** key to execute the check.

4. The ID number of the direction terminator that is connected to the far end of the cable appears on the LCD.

5. Check the display.
*: Repeat steps 2 through 5 to check other cables.



Indicates ID number 1



Error display
Either a direction terminator is not connected, or there is a problem with the wiring in the cable.

Chapter 3 Supplement

3.1 Wiremap Pair Display

TIA/EIA-568B is the U.S. standard for LAN wiring. The 3660 displays pairs in accordance with the connector wiring specifications stipulated in these standards.

3.2 Cable Length Measurement

The cable length measurement function in the 3660 uses the TDR method to input a pulse signal to the cable from the 3660 (on the near end), measures the time until the reflected wave returns to the 3660 from the far end of the cable, and then calculates the cable length based on the following equation.

$$L = \frac{C \times T \times NVP}{2}$$

L: Cable length (m)
C: Speed of light = 3×10^8 (m/s)
T: Time from when wave is initiated until wave returns to near end (s)
NVP: Nominal Velocity of Propagation

The NVP value varies, depending on the type of cable and how it is twisted, but the 3660 assumes an NVP of 0.7 to calculate the cable length.

Therefore, there may be a certain margin of error between the measured results and the actual physical length of the cable, and different values may be displayed for each pair.

Chapter 4 Cautions Concerning Checks

- The 3660 is a tester for UTP cables connected to RJ-45 connectors. The 3660 cannot be used to check STP or FTP cables.
- The characteristics of UTP cables may differ, depending on how they are installed. Do not sharply bend a cable that is being tested. When a cable has to bend, bend it with a curve that has a radius that is at least four times greater than the outer diameter of the cable.

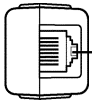
Chapter 5 Terminator

To do wiremap tests with the 3660, you must use the supplied 9336 WIREMAP TERMINATOR. For direction tests, you need the optional 9337 DIRECTION TERMINATOR.

(1) 9336 WIREMAP TERMINATOR

The 9336 WIREMAP TERMINATOR is made especially for wiremap and cable length testing. Connect it to the UTP cable when doing wiremap and cable length tests.

NOTE The 9336 terminator is for use with wiremap testing. For direction testing, use the optional 9337 DIRECTION TERMINATOR.



UTP cable connection terminal
(RJ-45 connector)

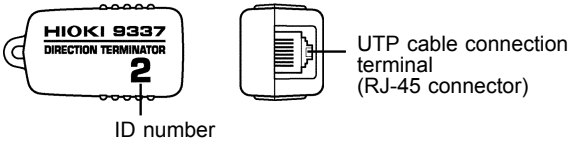
Specifications

Configuration	Resistance network
Cables and connectors that can be measured	UTP cable Specific impedance: 100 Ω CAT 3, 4, 5, 5e (between RJ-45 pins)
Size	Approx. 26W X 47H X 24.3D mm (1.02"W X 1.85"H X 0.96"D) (without protrusions)
Mass	Approx. 15.5 g (0.5 oz.)

(2) 9337 DIRECTION TERMINATOR (option)

The 9337 DIRECTION TERMINATOR is for use with direction testing.
Connect it to the UTP cable when doing direction tests.

NOTE The 9337 is a terminator for use with direction testing.
Use the 9336 WIREMAP TERMINATOR for wiremap testing.

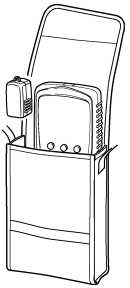


Specifications

Configuration	Resistance network
Cables and connectors that can be measured	UTP cable Specific impedance: 100 Ω CAT 3, 4, 5, 5e (between RJ-45 pins)
ID number	1, 2, 3, 4, 5 (5sets)
Size	Approx. 26W X 47H X 24.3D mm (1.02"W X 1.85"H X 0.96"D) (without protrusions)
Mass	Approx. 15.5 g (0.5 oz.)

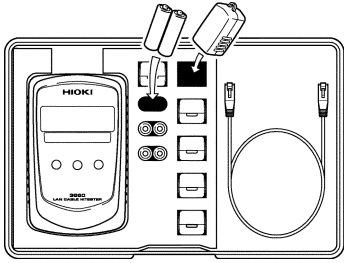
(3) 3853 CARRYING CASE

The 3853 CARRYING CASE is a standard accessory for the 3660.
It holds the 3660 and the 9336.



(4) 9350 CARRYING CASE (option)

The 9350 hard-shell carrying case holds the 3660, 9336 and 9337 together.
Extra space inside the case can be used for carrying other tools.



Chapter 6
Specifications

Measurement functions	● Wire map check Detected errors: Open circuit, short circuit, other wiring mistakes (Cannot detect split pairs.) Checking requirements *: In order for the 3660 to conduct the wiremap check, at least two out of eight wires need to be connected to correctly at both ends, and one other wire needs to be connected either correctly or incorrectly. ● Cable length measurement Measured lengths: 2 to 300 m, 6.6 to 984 ft Error: ± (1 m+15%), ± (3.3 ft+15%) Display resolution: 0.1m, 0.3 ft ● Direction check Up to five cables can be identified using the 9337 DIRECTION TERMINATOR
Cables and connectors that can be measured	UTP cable Specific impedance: 100 Ω CAT 3, 4, 5, 5e (between RJ-45 pins)
Checking method	● Wiremap check Voltage divider method ● Cable length measurement TDR method ● Direction check Voltage divider method

Output	● Wiremap check 2.9 Vp ● Cable length measurement Pulse signal (Pulse width: 10 ns, 20 ns, 80 ns, 320 ns (automatic setting), Amplitude: 3.3 Vp-p, Output resistance: 100 Ω) ● Direction check 2.9 Vp
Maximum allowable input	3.5 Vp (between RJ-45 pins)
Display Wiremap check/ cable length measurement Direction check	The cable length* of each wire in the pair and each of the near end pin connections (wire map) will be displayed. *: If a patch cord or similar extension cable is used, the cable length will include the length of the extension. Press the **CABLE PAIR** key to change the displayed pair. Displays the ID number of the direction terminator.
Power supply	1.5 VDC X 6 (LR6 alkaline battery x 6)
Maximum Rated Power	1.6 VA
Usage time	Approximately 250 hours (1 measurement/m)
Operating temperature and humidity	0 to 40℃ (32 to 104℉), 80%RH or less (non-condensating)
Storage temperature and humidity	-10 to 50℃ (14 to 122℉), 80%RH or less (non-condensating)

Operating temperature and humidity for guaranteed accuracy Guaranteed accuracy period	23℃±5℃ (73°F±9°F), 80%RH or less (non-condensating) 1 year
Operating Environment	Indoors, <2000 m (6562 feet) ASL
Size	Approx. 98W X 160H X 38D mm (3.86"W X 6.30"H X 1.50"D) (without protrusions)
Mass	Approx. 290 g (10.2 oz.) (excluding batteries)
Standards EMC Safety	 EN61326:1997+A1:1998+A2:2001+ A3:2003 EN61010-1:2001 Measurement Category I, Pollution Degree 2 (anticipated transient overvoltage 330 V)
Additional functions	● Power-saving mode Operates after measurement; unit leaves power-saving mode when **TEST** key is pressed and the unit begins measurement operation. ● Battery check The battery mark (⊟) lights when the battery is exhausted (at approximately 6.3 V). (When the battery mark is lit, accuracy is not assured.)

Accessories	9336 WIREMAP TERMINATOR ····· 1 3853 CARRYING CASE ····· 1 LR6 alkaline battery ····· 6 Instruction manual (English&Japanese) ····· 1each
Options	9337 DIRECTION TERMINATOR 9350 CARRYING CASE 9336 WIREMAP TERMINATOR 9628 LAN CABLE (1 m, for checking cable with an RJ-45 jack)

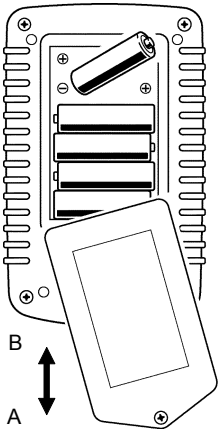
Chapter 7 Maintenance and Service

7.1 Changing the battery

⚠ WARNING

- **To avoid a shock hazard, disconnect the UTP cable before replacing the batteries. Before using the product after replacing the batteries, replace the cover and screw.**
- **Do not mix old and new batteries, or different types of batteries. Also, be careful to observe battery polarity during installation. Otherwise, poor performance or damage from battery leakage could result.**
- **To avoid the possibility of explosion, do not short circuit, disassemble or incinerate batteries.**
- **Handle and dispose of batteries in accordance with local regulations.**

NOTE
- Do not use any power source other than the specified batteries (LR6/AA). Using manganese or other batteries will result in shorter battery life.
- To avoid corrosion from battery leakage, remove the batteries from the product if it is to be stored for a long time.



1. For safety, turn the power off and disconnect from the unit the UTP cable that is being tested.

2. Remove the screw.

3. Open the battery compartment cover in the direction indicated by "A."

4. Replace all six batteries.

5. Insert the battery compartment cover in the direction indicated by "B."

6. Secure the battery compartment cover with the screw.

7.2 Cleaning

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.

7.3 Service

If the product seems to be malfunctioning, confirm that the batteries are not discharged before contacting your dealer or Hioki representative.
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.

HIOKI

DECLARATION OF CONFORMITY

Manufacturer's Name:	HIOKI E.E. CORPORATION
Manufacturer's Address:	81 Koizumi, Ueda, Nagano 386-1192, Japan
Product Name:	LAN CABLE HiTESTER
Model Number:	3660
Accessory:	9336 WIREMAP TERMINATOR
Option:	9337 DIRECTION TERMINATOR

The above mentioned products conform to the following product specifications:

Safety:	EN61010-1:2001
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 EMC Directive 89/336/EEC, but is not applicable to the Low Voltage Directive 73/23/EEC.

HIOKI E.E. CORPORATION

15 September 2006

T. Yoshiike

Tatsuyoshi Yoshiike

President

3660A999-02

HIOKI 3660 LAN CABLE HiTESTER
Instruction Manual

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