

**3805**

**DIGITAL HiTESTER**

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**INSTRUCTION MANUAL**



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## Introduction

Thank you for purchasing the HIOKI "3805 DIGITAL HiTESTER". To obtain maximum performance from the product, please read this manual first, and keep it handy for future reference.

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## 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.

### ■ Accessories

3851-10 TEST LEAD (a pair)	1
Protective holster	1
Instruction Manual	1
6F22 manganese battery (built into this unit, for monitor)	1











## Safety Notes







**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

	<ul style="list-style-type: none"><li>• 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.</li><li>• In the manual, the  symbol indicates particularly important information that the user should read before using the product.</li></ul>
	Indicates a double-insulated device.
	Indicates DC (Direct Current).
	Indicates AC (Alternating Current).
	Indicates both DC and AC.
	Indicates grounding terminal.
	Indicates that dangerous voltage may be present at this terminal.

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

	Indicates that incorrect operation presents an extreme hazard that could result in serious injury or death to the user.
	Indicates that incorrect operation presents a significant hazard that could result in serious injury or death to the user.
	Indicates that incorrect operation presents a possibility of injury to the user or damage to the product.
	Advisory items related to performance or correct operation of the product.



We define measurement tolerances in terms of f.s. (full scale), rdg. (reading) and dgt. (digit) 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.
  
- **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".

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## **Measurement categories (Overvoltage categories)**

This product conforms to the safety requirements for CAT II (1000V), CATIII (600V) measurement products.

To ensure safe operation of measurement product, 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.

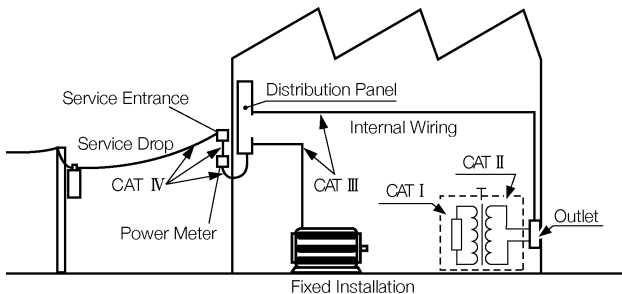
**CAT IV** : The circuit from the service drop to the service entrance, and to the power meter and primary overcurrent protection device (distribution panel).

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.



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## Notes on Use



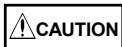
Follow these precautions to ensure safe operation and to obtain the full benefits of the various functions.

### ■ Preliminary Check

Before using the product the first time, verify that it operates normally to ensure that no damage occurred during storage or shipping. If you find any damage, contact your dealer or Hioki representative.



- **Do not use the product where it may be exposed to corrosive or combustible gases. The product may be damaged or cause an explosion.**
- **Before using the product, make sure that the insulation on the test leads is undamaged and that no bare conductors are improperly exposed. Using the product under such conditions could result in electrocution. Replace the test leads with the specified Hioki Model 3851-10.**



- To avoid damage to the product, do not allow the product to get wet, and do not use it when your hands are wet.
- Adjustments and repairs should be made only by technically qualified personnel.
- This product should be installed and operated indoors only, between 0 and 40°C and 80% RH or less. However, it can be safely operated down to -10°C.
- 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.
- 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.
- Do not use the product near a device that generates a strong electromagnetic field or electrostatic charge, as these may cause erroneous measurements.
- To avoid damage to the product, protect it from vibration or shock during transport and handling, and be especially careful to avoid dropping.
- If the protective functions of the product are damaged, either remove it from service or mark it clearly so that others do not use it inadvertently.

**NOTE**

To avoid corrosion from battery leakage, remove the batteries from the product if it is to be stored for a long time.

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# Chapter 1

## Overview

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### 1.1 Product Overview

This multimeter has DCV, ACV, DCA, ACA, OHM, Diode check, Audible continuity, Capacitor, Temperature and % of 4-20 mA tests. It also built-in TRUE-RMS for non-linear and traditional loads, and frequency measurement helps detect the presence of harmonics in neutral conductors and determine whether they are the result of unbalanced phases or non-linear loads. The display of Harmonic Ratio will be helpful for quickly to know the presence of harmonic. Smart scanning display lets you can see the T1, T2 and  $\Delta T$  values for temperature measurements periodical. The built-in optical RS-232C will assist you to capture the data without hazardous as the high voltage has been measured.

## 1.2 Features

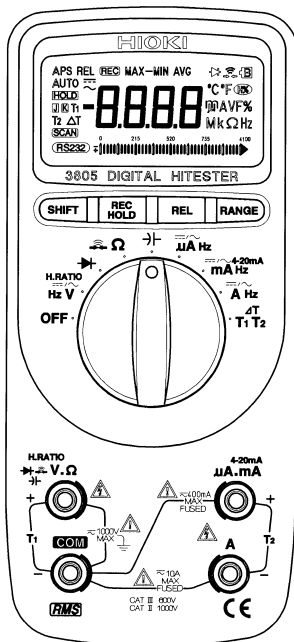
The multimeter is shown in the following Figure. This meter has a lot of functions can be used in HVAC, Power, Process fields, Electronic/Electrical system diagnostics and troubleshooting. It will be the best one of your need. See below detail:

- Resolution of display: 9,999 counts for Voltage and frequency and 3,999 counts for other measurements.
- TRUE RMS measurement for non-linear and traditional loads.
- Both paths of Current and Voltage can do frequency measurement.
- The thermocouple types of temperature measurement can be selected K and J.
- Scan T1, T2 and T1-T2 displays.
- % of mA display can be selected for 4-20 mA or 0-20 mA.
- The timer of auto power save can be adjusted from 1 to 99 minutes even disable this function.
- Dynamic Recording helps to record the variation of tests.
- Data Hold to freeze displayed digital value.
- Refresh Hold to freeze the digital value for difficult measuring place.
- Relative function
- Auto and Manual Ranging
- Communication with RS-232C



# Chapter 2

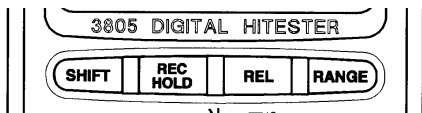
## Names and Functions of Parts



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## 2.1 Push Buttons

The operation of push-button is shown as below. When push the button, a display symbol will light, and the beeper will sound. Turning the rotary switch to another switch setting resets all push buttons to their default state.



**SHIFT** button

- For voltage and current measurements, press this button momentarily to cycle through DC, frequency and AC tests.
- For voltage measurement, press this button for more than 1 second to set Harmonic ratio measurement.
- For mA measurement, press this button for more than 1 second to set % of 4-20mA display.
- For temperature test, press this button momentarily to cycle through T2,  $\Delta T$  and T1 tests. Press this button for more than 1 second to set scanning the T1, T2 and  $\Delta T$  displays.

- 
- For Ohm test, press button momentarily to toggle "Audible continuity mode" ON/OFF. Pushing this button for more than 1 second will exit the continuity function and returns to the auto-ranging ohm measurement.

#### **HOLD** button (Data Hold or Refresh Hold)

- Press this button momentarily to toggle data hold on or off. The display shows **HOLD** to indicate the hold function.
- The data hold function allows operator to hold the displayed digital value, if you select " Refresh Hold " by Power-ON Options, the reading is updated to the display automatically when the reading changes. The beeper sounds a tone to remind user, that an update has occurred.

#### **REC** button (Dynamic Recording)

- Records maximum, minimum, and calculates true average. Press this button for more than 1 second to toggle recording mode on or off.
- Press this button momentarily to cycle through MAX, MIN, MAX-MIN, AVG and present ( **REC** ) readings.
- The beeper sounds when a new maximum or minimum value is recorded.

**REL** button

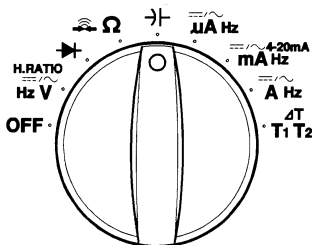
Press this button momentarily to toggle the relative mode ON or OFF.

**RANGE** button

- In auto-range press this button momentarily to select manual range and turn off the "**AUTO**" annunciator.
- In manual range, press this button momentarily to step up 1 range at one time, press this button for more than 1 second to select auto-range.
- In auto-range, the "**AUTO**" annunciator is lit and the meter will select an appropriate range for measurement being made. If a reading is greater than maximum available range, "**OL**"(overload) is displayed on the screen. The meter selects a lower range when reading is less than about 9% of full scale.
- For temperature measurement, press this button momentarily to cycle through **K**<sup>°C</sup>, **K**<sup>°F</sup>, **J**<sup>°C</sup> and **J**<sup>°F</sup>, then come back **K**<sup>°C</sup>. These sets will disappear after power save. It will be set to original setup condition when power ON.

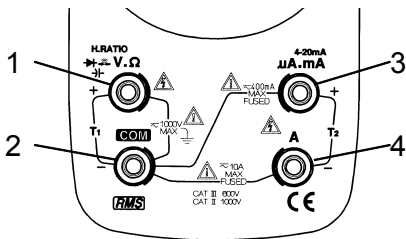
## 2.2 Rotary Switch

To select function, turn the rotary switch to a switch setting. Then the meter is ready for use. (If you press and hold any push button while pushing the meter from OFF to ON, the display will remain lit until the push button is released.)



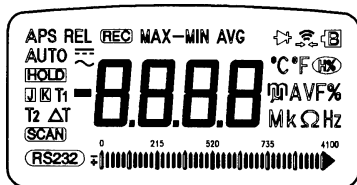
<b>OFF</b>	Power off position.
<b>V</b>	AC or DC voltage measurements. Initial test is defined to AC.
<b>→ </b>	Diode Check
<b>Ω</b>	Ohm and Continuity measurements
<b>→ </b>	Capacitance measurement.
<b>μA</b>	AC or DC Current measurements
<b>mA</b>	AC or DC Current measurements.
<b>A</b>	AC or DC Current measurements.
<b>T<sub>1</sub>T<sub>2</sub></b>	Temperature measurement

## 2.3 Input Terminal




1. Volts, Ohms, Diode, T1, Capacitance and Frequency of Voltage measurements.
2. Common terminal for all measurements except temperature of T1 test.
3. Current (maximum 400 mA) and temperature of T2 measurements.
4. Current (maximum 10 A continuous) and temperature of T2 measurements.

## 2.4 LCD Display Illustration



<b>APS</b>	Enable Auto power save
<b>AUTO</b>	Indicates AUTO range Mode
<b>HOLD</b>	Data hold annunciator
<b>J K</b>	Thermocouple type display
<b>T1 T2</b>	T1 or T2 temperature measurement
<b>ΔT</b>	T1-T2 temperature measurement
<b>SCAN</b>	Scan the T1, T2 and ΔT measurements
<b>RS232C</b>	Enable RS-232C
<b>REL</b>	Relative mode annunciator
<b>---</b>	Direct Current or Voltage
<b>~</b>	Alternating Current or Voltage
<b>REC</b>	Dynamic recording mode, Present reading
<b>MAX-MIN</b>	Different reading for MAX-MIN
<b>MAX</b>	Maximum reading
<b>MIN</b>	Minimum reading
<b>AVG</b>	Average reading
<b>▶</b>	Diode measurement
<b>⚡</b>	Continuity function annunciator
<b>B</b>	Low battery indicator

$^{\circ}\text{C}, ^{\circ}\text{F}$	Units of Temperature
<b>H%</b>	Harmonics ratio
<b>%</b>	% display for 4-20mA measurement
<b>m V</b>	Units of Voltage measurement
<b><math>\mu\text{m A}</math></b>	Units of Current measurement
<b><math>\mu\text{m F}</math></b>	Units of Capacitance measurement
<b>Mk <math>\Omega</math></b>	Units of Resistance (ohm) measurement
<b>kHz</b>	Units of frequency measurement
	Bar-graph indicator



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## Chapter 3

# Measurement Procedures

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**⚠ DANGER**

Observe the following precautions to avoid electric shock.

- Always verify the appropriate setting of the function selector before connecting the test leads.
- Disconnect the test leads from the measurement object before switching the function selector.

**NOTE**

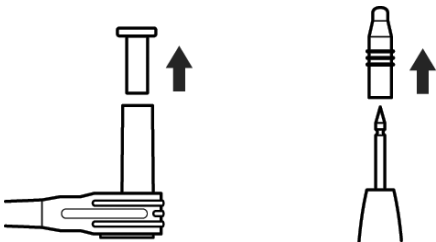
When measuring voltage which includes harmonic waves

(ex. horizontal output of TV), there is the possibility that a setting error may occur.

**■ Preparation for Measurement**

The safety caps are attached to the test leads.

Remove these caps before connecting to the unit.



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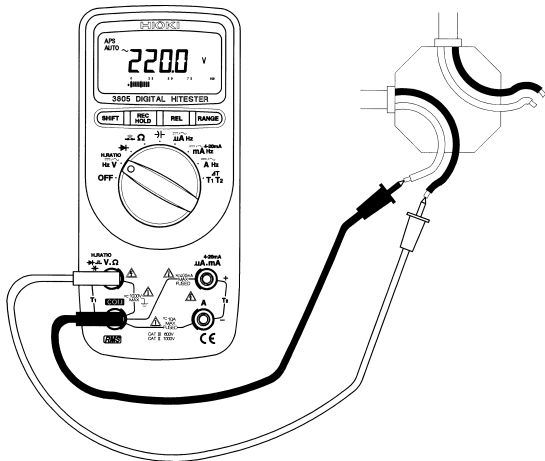
## 3.1 Voltage Measurement



- The maximum input voltage is 1000 VDC, 1000 Vrms or  $10^6$  V • Hz. Attempting to measure voltage in excess of the maximum input could destroy the product and result in personal injury or death.
- To avoid electrical shock, be careful to avoid shorting live lines with the test leads.
- For safety, test lead connections must always be made at the secondary side of a circuit breaker.

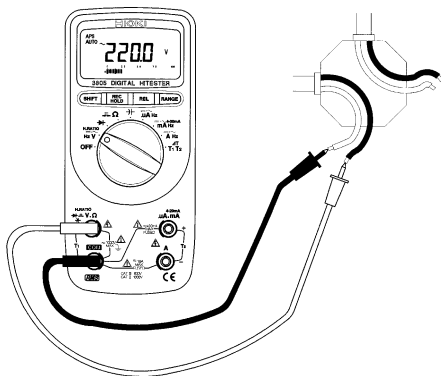
### 3.1.1 AC Voltage Measurement

- (1) Set the rotary switch to "Hz  $\sim$  V".
- (2) Connect the black test lead to "COM" terminal and red test lead to "V  $\Omega$   $\rightarrow$ " terminal.
- (3) Touch the test leads to the test points and read the display.



### 3.1.2 Frequency Measurement

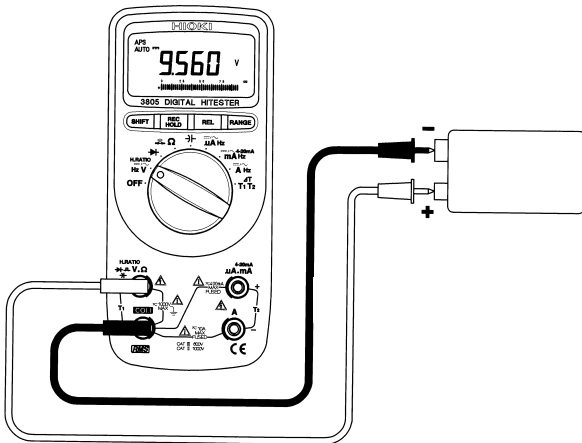
- (1) Set the rotary switch to "**Hz**  $\overline{\sim}$   $\sim$  **V**".
- (2) Press **SHIFT** button momentarily two times to set frequency measurement.
- (3) Connect the black test lead to "**COM**" terminal and red test lead to "**V  $\Omega$   $\rightarrow$** " terminal.
- (4) Touch the test leads to the test points and read the display.

**NOTE**

The bar graph is used to indicate the value of AC voltage.

### 3.1.3 DC Voltage Measurement

- (1) Set the rotary switch to "Hz  $\overline{\text{---}}$  /  $\sim$  V".
- (2) Push **SHIFT** button momentarily to set DC test.
- (3) Connect the black test lead to "COM" terminal and red test lead to "V  $\Omega$   $\rightarrow$ " terminal.
- (4) Touch the test leads to the test points and read the display.



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## 3.2 Diode Check



- **Never apply voltage to the test leads when the Diode Check functions is selected. Doing so may damage the product and result in personal injury.**
- **To avoid electrical accidents, remove power from the circuit before measuring.**

A good diode allows current to flow in one direction only. To test a diode, turn the power off, remove the diode from the circuit, and proceed as follows:

- (1) Set the rotary switch to "**▶**" position.
- (2) Connect the black test lead to "**COM**" terminal and red test lead to "**V Ω ▶**" terminal.
- (3) Touch the test leads to diode and read the display.
- (4) Touch the red lead to the positive side of the diode and the black lead to the negative side. The meter can display diode voltage drops to approximately 2.5 V. A typical voltage drop is 0.3 to 0.8 V, and the meter will sound a beep to remind user.

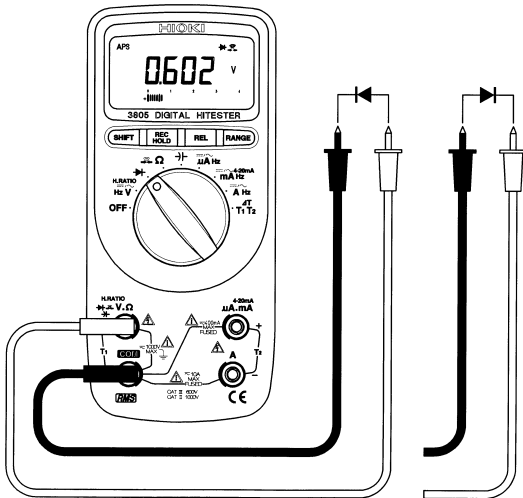
Reverse the test leads and measure the voltage across the diode again. If the diode is:

Good : "**OL**" is displayed.

Shorted : Near 0 V drop is displayed in both directions, and the beeper sounds continuously.

Open : "**OL**" is displayed in both directions.

Repeat step (3) and (4) for other diodes.








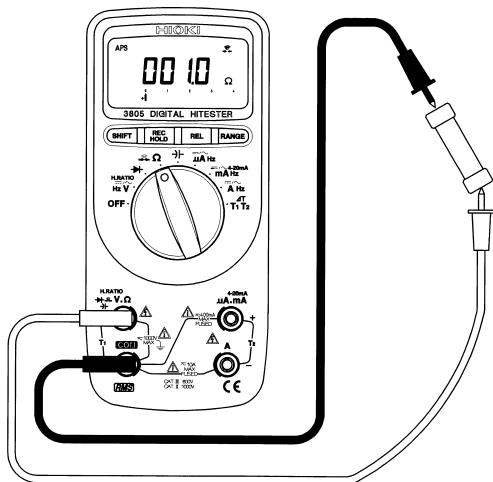
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## 3.3 Resistance Measurement



- **Never apply voltage to the test leads when the Resistance, Continuity Check functions are selected. Doing so may damage the product and result in personal injury.**
- **To avoid electrical accidents, remove power from the circuit before measuring.**

- (1) Set the rotary switch to " Ω".
- (2) Connect the black test lead to "COM" terminal and red test lead to " Ω " terminal.
- (3) Touch the test leads to resistor and read the display.
- (4) Press **SHIFT** button momentarily to toggle CONTINUITY function ON/OFF. The continuity range is 0 to 400.0 Ω.
- (5) Momentarily pushing this button will only turn the beeper off. While testing continuity, the beeper will sound if the resistance falls below 100 counts.



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## 3.4 Current Measurement



- **Never apply voltage to the test leads when a current measurement function is selected. Doing so may damage the product and result in personal injury.**
- **To avoid electrical accidents, remove power from the circuit before connecting the test leads.**



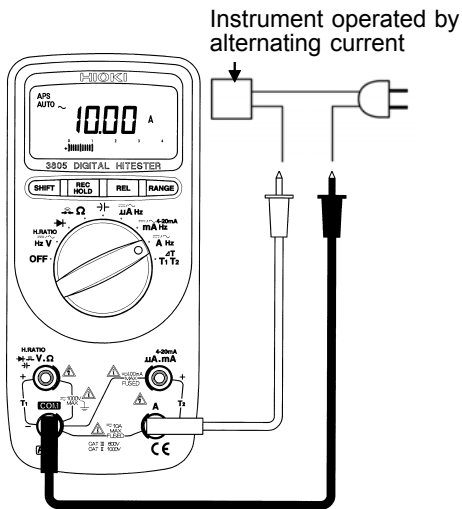
- **To prevent electrical accidents, do not use the tester to measure current when the electric potential is 600 V or greater. The current function overload protection trips at either 600 V DC, 600 V rms.**

### 3.4.1 AC Current Measurement

- (1) Set the rotary switch to "**Hz**  $\sim$  **A**".
- (2) Connect the black test lead to "**COM**" terminal and red test lead to "**A**" terminal.
- (3) Touch the test leads to the test points and read the display.

**NOTE**

If the reading is lower than 400 mA, to get better resolution of display, please turn the rotary switch to mA or  $\mu$ A position and remove the red test lead to " **$\mu$ A mA**" terminal.

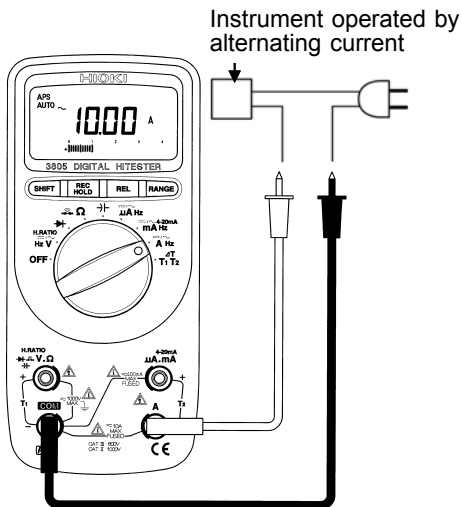


## 3.4.2 Frequency Measurement

- (1) Set the rotary switch to "**Hz**  $\overline{\sim}$   $\sim$  **A**".
- (2) Press **SHIFT** button momentarily two times to set frequency measurement.
- (3) Connect the black test lead to "**COM**" terminal and red test lead to "**A**" terminal.
- (4) Touch the test leads to the test points and read the display.

**NOTE**

The bar graph is used to indicate the value of AC current.

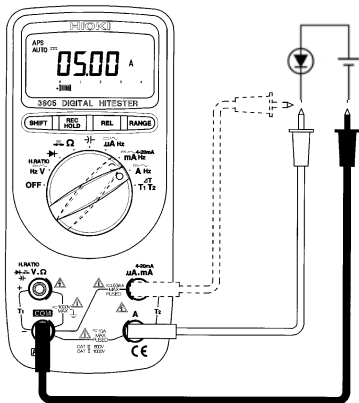


### 3.4.3 DC Current Measurement

- (1) Set the rotary switch to "**Hz**  $\overline{\text{---}}$ / $\sim$  **A**".
- (2) Push **SHIFT** button momentarily to set DC test.
- (3) Connect the black test lead to "**COM**" terminal and red test lead to "**A**" terminal.
- (4) Touch the test leads to the test points and read the display.

#### NOTE

If the reading is lower than 400 mA, to get better resolution of display, please turn the rotary switch to **mA** or  **$\mu$ A** position and remove the red test lead to " **$\mu$ A mA**" terminal.



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## 3.5 Capacitance Measurement

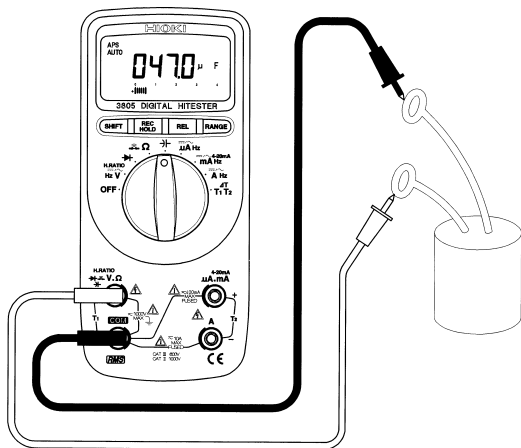


- **Never apply voltage to the test leads when the Capacitance functions are selected. Doing so may damage the product and result in personal injury.**
- **To avoid electrical accidents, remove power from the circuit before measuring.**

- (1) Set the rotary switch to " $\rightarrow$ |" position
- (2) Connect the red lead to " $\rightarrow$ |" terminal, and black lead in "**COM**" terminal.
- (3) Open test leads, then push **REL** button momentarily to zero the residual.
- (4) Remove the capacitor from circuit board or device.
- (5) Connect the test lead across the capacitor and read the display.

**NOTE**

- Observe polarity when measuring the polarized capacitors.
- Discharge capacitor before measurement.
- When testing low-capacitance devices, noise introduced into the test leads from the human body may prevent the measured value from stabilizing. If this occurs, use the optional 9617 CLIP ON BASE or the optional 9618 CLIP-TYPE LEAD and keep hands away from the leads during measurement.





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## 3.6 Temperature Measurement



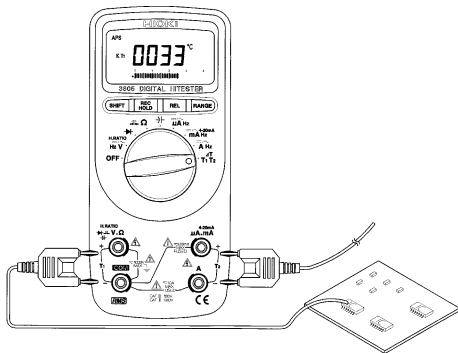
- Do not apply a voltage while a temperature range is selected. Applying a voltage may result in damage to the unit, or a serious accident.
- Do not input a voltage exceeding 30 Vrms or 60 VDC to the temperature probe.

- (1) Turn the rotary switch to the "T1 T2" position.
- (2) Press **SHIFT** button momentarily to cycle through T2, T1 and  $\Delta T$  tests. Press this button for more than 1 second to set scanning the T1, T2 and  $\Delta T$  displays.
- (3) Press **RANGE** button momentarily to cycle through  $K/^{\circ}C$ ,  $K/^{\circ}F$ ,  $J/^{\circ}C$  and  $J/^{\circ}F$ , then come back  $K/^{\circ}C$ . These sets will disappear after power off. It will be set to original setup condition when power ON.
- (4) Plug the thermocouple probe into T1 or T2 for the plus side and the minus side terminal.
- (5) Attach the thermocouple to the heated source.
- (6) Read the display.

**NOTE**

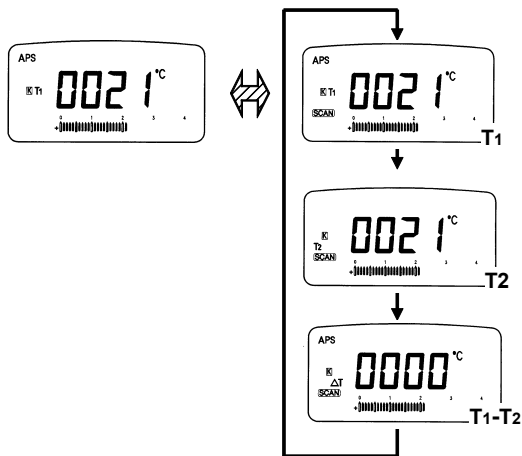
Do not sharply bend the thermocouple leads. Repeatedly bending the leads can break them.

- The optional temperature probes are all the K type probe. Please use it in accordance with the instruction manual of the temperature probe. For J type temperature probes, please read its manual prior to use.
- The temperature range of the 3805 is different from the range of temperature probes. Please measure within the common temperature range.



## □ SCAN MODE

This function will assist you to see the T1, T2 and  $\Delta T$  (T1-T2) display, quickly. Press and hold **SHIFT** button for more than 1 second to toggle SCAN mode ON or OFF. When SCAN mode is selected, the display continuously cycles between T1, T2 and  $\Delta T$  temperature readings, and the annunciator of will be lit. The cycling time is around 3 to 4 seconds, and the T1, T2 and  $\Delta T$  will be lit to indicate which reading has been display, respectively. For bar graph, it is using to indicate the environment temperature. For scale  $^{\circ}\text{C}$ , each bar is equal  $1^{\circ}\text{C}$ . For scale  $^{\circ}\text{F}$ , each bar is equal  $2.5^{\circ}\text{F}$ .





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## **Chapter 4**

# **Special Functions**

## **Instructions**

---

This multi-meter provides the operator with various functions including:

- (1) Data Hold
- (2) Refresh Hold
- (3) Dynamic Recording
- (4) Harmonic Ratio Measurement
- (5) Relative (Zero)
- (6) % of mA Measurement (4-20 mA)
- (7) Beeper On/Off
- (8) Set Up
- (9) Communication (RS-232C)

## 4.1 Data Hold

The data hold function allows operators to hold the displayed digital value, while the analog bar graph continues showing the present readings. Press **HOLD** button to enter the data hold mode, and the "**HOLD**" will be displayed. Press the button again to exit. The present reading is now shown.

**NOTE**

The range is held in the case of auto range.

---

## 4.2 Refresh Hold

The reading is updated the value automatically and the beeper sounds when the measurement value changes 30 counts at least.

The refresh hold mode is effective until the power supply is turned off.

- (1) To active the refresh hold mode, turn on the power supply while pressing the **HOLD** button.
- (2) Release the button after all the LCD segments are lit. Press any button for the measurement modes
- (3) Press **HOLD** button to select ON/OFF of the refresh hold. While the refresh hold mode is effective , **HOLD** is displayed.

### NOTE

- When the reading value is unstable, the 3805 may not update the display.
- In the voltage, current, and capacitance function, the reading is not updated when the measurement value is less than 50 counts.
- In the resistance and diode function, the reading is not updated when the reading is "OL" or the test leads are open.
- The hold mode and the refresh hold mode use the same display, so please pay attention when measuring to make sure you are in the correct mode.

## 4.3 Dynamic Recording

The dynamic recording mode can be used to catch intermittent and turn on or turn off surges, verify performance, measure while you are away, or take readings while you are operating the equipment under test and can not watch the meter.

The average reading is useful for smoothing out unstable or changing inputs, estimating the percent of time a circuit is operational, or verifying circuit performance.

The operational procedures are described below:

- (1) Press **REC** button for more than 1 second to enter the dynamic recording. The present value is stored to memories of maximum, minimum and average, and the annunciator turns on.
- (2) Press **REC** button for more than 1 second to toggle recording mode on or off.
- (3) Press **REC** button momentarily to cycle through maximum, minimum, maximum - minimum, average and present readings. The MAX, MIN, MAX-MIN, AVG or annunciator will turn on respectively to indicate what value is being displayed.



- 
- (4) The beeper sounds when a new maximum or minimum value is recorded.
  - (5) If an overload is recorded the averaging function is stopped. An average value becomes "**OL**"(overload).

**NOTE**

- In dynamic recording, the auto power save feature is disabled, after disabled and the "**APS**" turns off.
- Select dynamic recording in auto range, it will record the values of MAX, MIN or AVG for different ranges.
- The record speed of dynamic recording is about 100 ms (0.1 s).
- The average value is the true average of all measured values taken since the recording mode was entered.
- If the range is changed in the manual range mode or the function is changed, the dynamic recording function is canceled.



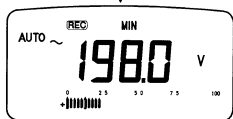
Press **REC** button for more than 1 second



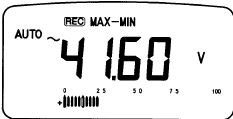
**Current value**



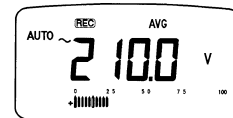
**Maximum value**



**Minimum value**



**Max. - Min. value**



**Average value**

---

## 4.4 Harmonic Ratio Measurement

The harmonic ratio measurement function shows how much the wave is distorted.

The distortion rate of the wave is shown in accordance with the following formula.

The harmonic ratio = (the conversion value from the mean value - the true RMS value) X 100/the true RMS value.

In order to convert from the mean value to the RMS value, the mean value is multiplied by 1.11.

Although the harmonic ratio becomes 0% when a sine wave is measured, the harmonic ratio becomes 11.1% in the case of a square wave.

- (1) Set the rotary switch to "Hz  $\overline{\sim}$ /~ V".
- (2) Push and hold **SHIFT** button for more than 1 second to enter Harmonic Ratio mode.
- (3) Connect the black test lead to "COM" terminal and red test lead to "V  $\Omega$ " terminal.
- (4) Touch the test leads to the test points and read the display.

**NOTE**

The bar graph is used to indicate the value of AC voltage, however if you push **RANGE** button momentarily, the digits will indicate the value of AC voltage. The meter will return to indicate the value of Harmonic Ratio after 3 seconds automatically.

## 4.5 Relative (Zero)

The relative function subtracts a stored value from the present measurement and displays the result.

- (1) Press **REL** button momentarily to set the relative mode. It will set the display to zero and stores the displayed reading as a reference value, also "**REL**" is displayed.
- (2) Press this button again to exit the relative mode.

**NOTE**

- Both auto-range or manual range can set relative mode.
- The relative mode can't be set when an overload has occurred.

---

## 4.6 % of mA Measurement (4-20mA)

The 4-20 mA (0-20 mA) function converts 4 mA (0 mA) as 0% and 20 mA as 100%.

It is used in instrumentation.

- (1) Set the rotary switch to "**Hz**  $\overline{\text{---}}$ / $\sim$  **mA**".
- (2) Push and hold **SHIFT** button for more than 1 sec to set % of mA test.
- (3) Connect the black test lead to "**COM**" terminal and red test lead to " **$\mu$ A mA**" terminal.
- (4) Touch the test leads to the test points and read the display.

**NOTE**

The 0-20mA mode and the 4-20mA mode use the same display, so please confirm the correct display at the set up mode.(Refer to Section **4.8.2** )

## 4.7 Beeper On/Off

Press and hold **REL** button while turning the rotary switch to any on position. Turns off all beeper functions. Beeper off function remains selected until the meter is turned off.

---

## 4.8 Set Up

This multi-meter provides the operator with set up procedures below:

- (1) Timer setting for auto-power save
- (2) Selecting % display for 4-20 mA, or 0-20 mA
- (3) Selecting J/k types and °C/ °F display

### ■ How to entry setup mode

Press and hold **SHIFT** button then turns the rotary switch to any ON positions. Release pressing button after the LCD lit all signs. It will enter setup mode, first mode is time setting for auto power save. In the setup mode, the button will be operated, see following explanation:

---

**SHIFT**

Press button momentarily to select other setup modes. The existing value will be indicated on the display.

---

**HOLD**

Push this button momentarily to adjust value.

---

**REL**

Press this button momentarily to save the settling value into the memory.

---

**RANGE**

Press this button momentarily to exit setup mode, it will come to the normal measurement.

---

**NOTE**

Between the auto power save setting screen and the screen for selecting 4-20mA or 0-20mA measurement, the setting screen for the back light appears. Although this screen appears, the 3805 can not perform this function. Because the 3805 does not include a back light, please ignore this display.

---

### 4.8.1 Timer Setting for Auto-power Save

When the meter is to be used for long periods of time, the operator might want to disable the auto power save. Once the auto power save function is disabled, the meter will stay on continuously. The meter will shut off by turning the rotary switch to the off position.

In general, the auto power save function will turn the meter off if neither rotary switch nor push button is activated for existing setting. The LCD will indicate existing time setting, and the **APS** will light. You can set the timer from 0 to 99 minutes. Each step is 1 minute by pushing **HOLD** button. When you set the timer to zero, the auto power save will be disabled, the meter will stay on continuously. Press **REL** button momentarily to save your setting after you finished. Press **RANGE** button momentarily to exit set up procedures.



**NOTE**

The instrument will auto-power save, if none of the following happens. You can push any buttons to wake-up the meter after auto power save.

- Push buttons used.
- Measurement function changed.
- Set dynamic recording.
- Disable auto power save with power-on option.

---

## 4.8.2 Selecting % Display for 4 to 20 mA

In this mode, you can set % display for other ranges. The LCD will indicate existing setting, and the % and mA will light. The digit will indicate existing setting. For example of 4 to 20 mA, the digits will show "0420". You can press the **HOLD** button to toggle 04 to 20mA and 00 to 20mA. Press **REL** button momentarily to save your setting after you finished. Press **RANGE** button momentarily to exit set up procedures.

### 4.8.3 Selecting J/ k Types and °C/°F Display

The display will indicate existing setting. Press **HOLD** button momentarily to change the setting. It will cycle through K/°C, K/°F, J/°C and J/°F, then come back K/°C. Press **REL** button momentarily to save your setting after you finished. Press **RANGE** button momentarily to exit set up procedures.

**NOTE**

The following expression converts degrees Fahrenheit into degree Celsius

$$^{\circ}\text{F} = 1.8^{\circ}\text{C} + 32$$

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## 4.9 Communication (RS-232C)

This meter has a communication capability. This function will assist user to recording and keeping data easy.

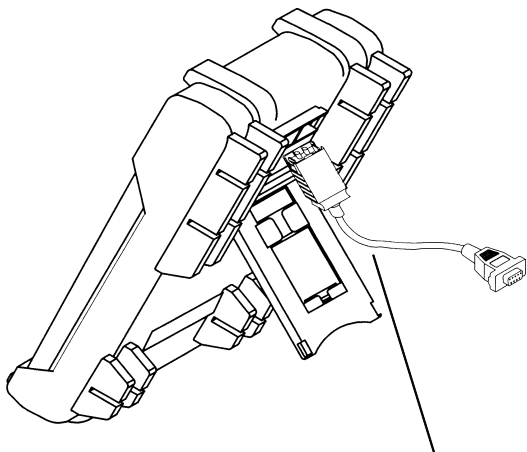
We offer the 3854 RS-232C PACKAGE to optional accessories. This package includes a cable with optical receiver, positional connector and a software disc.

Please refer following procedures if you want to communicate with personal computer.

- (1) Fixed the connector to the holster.
- (2) Fixes one side of cable to the positional connector, and connect the 9 pin's terminal of cable to communication port 1 or 2 of personal computer.
- (3) Push and hold the **RANGE** button then turn the rotary switch from off position to any function, wait 1 second, then release the push button. You will find that the annunciator of **RS232** is light on the display.
- (4) Execute the software to take the data for your necessary

**NOTE**

Please refer to manual that the use method of software belonged to 3854 RS-232C PACKAGE . The RS-232C function remains selected until the meter is turned off.



Please fix the connector so that the label becomes downward.

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# Chapter 5

## Specifications

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### 5.1 General Specifications

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<b>Measurement Mode</b>	Dual integration
<b>AC measurement Mode</b>	True RMS measurement
<b>Function</b>	DCV, ACV, DCA, ACA, OHM, Diode check, Audible continuity, Capacitor, Temperature, % of 4-20 mA and Frequency tests. Harmonics ratio measurement. The thermocouple types can be selected for K and J.
<b>Additional Function</b>	Auto Range function Dynamic Recording function Data Hold Refresh Hold Harmonic Ratio Measurement % of mA Measurement (4-20mA) Relative function Auto Power Save function Low Battery Indicate function RS-232C Interface
<b>Type of Display</b>	LCD

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- 
- Display**
- The liquid crystal display (LCD) is 4 digits with maximum reading 3,999/9,999 counts.
  - 41 segments analog bar graph and full annunciator
  - Automatic polarity indication.
- 

**Range Selection**                      Automatic or Manual

---

**Measuring Rate**                  3 times per second.  
1 time per second for frequency measurement.

---

**Constituent Inputs**                V, Hz,  $\Omega$ , C, Audible continuity, Diode, H.RATIO, T1 Terminal  
 $\mu$ A, mA, 4-20mA, T2 Terminal  
A Terminal  
COM Terminal  
4 Terminal components

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**Power Supply**                      6F22 manganese battery X1 (9V)

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**Low Battery Indicator**            The "**B**" appears when the battery voltage drops below 6.3 to 7.5V (approx.).

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**Dimension**                          Approx. 76W X 167H X 33D mm  
Approx. 2.99"W X 6.54"H X 1.30"D

---

**Mass**                                  Approx. 300 g (with a battery included)  
Approx. 10.6 oz.  
Approx. 400 g (with protective holster and a battery)  
Approx. 14.1 oz.

---

**Dielectric Strength**                6 kVrms sin (1 minute at 50/60 Hz)

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**Electrical Specifications**        Accuracy: See "5.2 Accuracy Chart"  
Accuracy Guarantee: 23°C  $\pm$  5°C (73°F  $\pm$  5°F), less than 80% RH (no condensation)  
Supply Voltage: 9 V to Low Battery Indicator appears

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<b>Temperature Coefficient</b>	specified accuracy X 0.15/°C (from 0 to 18°C or 28 to 40°C) (from 32 to 64°F or 82 to 104°F)
<b>Noise Rejection</b>	NMRR DCV: more than -60 dB (50/60 Hz) CMRR DCV: more than -120 dB (50/60 Hz) ACV: more than -60 dB (50/60 Hz) (1 kΩ Unbalance)
<b>Rated Supply Voltage</b>	9.0VDC X 1 (6F22 manganese battery)
<b>Rated Power</b>	35 mVA (Typ.) (DCV Supply Voltage=9.0 V ) 50 mVA (Max.) (Diode (RS232-C) Supply Voltage=9.0 V)
<b>Continuous Operating Time</b>	Approx. 100 hours (DCV Function at 6F22 manganese battery)
<b>Operating Temperature</b>	0 to 40°C (32 to 104°F) less than 80% RH (no condensation)
<b>Storage Temperature</b>	-20 to 60°C (-4 to 140°F) less than 80% RH (no condensation)
<b>Location for Use</b>	Indoors, altitude up to 2000 m
<b>Accessories</b>	3851-10 TEST LEAD (a pair) Protective holster Manual 6F22 manganese battery (built in)

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<b>Option</b>	3851-10 TEST LEAD (a pair) Protective holster 3853 CARRYING CASE 3854 RS-232C PACKAGE 9180, 9182, 9183, 9472 to 9475 SHEATH TYPE TEMPERATURE PROBE 9181 SURFACE TEMPERATURE PROBE 9476 SURFACE TYPE TEMPERATURE PROBE 9617 CLIP ON BASE 9618 CLIP-TYPE LEAD
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<b>Protective Fuse</b>	<b><math>\mu\text{A} \cdot \mu\text{A}</math></b> D086483P (Made by FERRAZ Inc.) 0.5 A/660 V, $\phi$ 6.35-32 mm, Breaking Capacity 30 kA or 70125(Made by SIBA Inc.) 0.5 A/700 V, $\phi$ 6.35-32 mm, Breaking Capacity 50 kA <b>A</b> TDC600 ( Made by Cooper Bussmann Inc. ) 10 A/600 V, $\phi$ 6.35-25.35 mm, Breaking Capacity 10 kA
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<b>Applicable Standards</b>	Safety	EN 61010-1:2001 EN 61010-2-031:1994 Pollution 2, Measurement Category II (1000 V), Measurement Category III (600 V) (anticipated transient overvoltage 6000 V) UL 3111-1:1994 CAN/CSA-C22.2 No.1010-1-92+B-97 CAN/CSA-C22.2 No.1010.2.031-94
	EMC	EN61326:1997+A1:1998+A2:2001 +A3:2003

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## 5.2 Accuracy Chart

### Temperature and humidity for guaranteed accuracy

- $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$  ( $73^{\circ}\text{F} \pm 9^{\circ}\text{F}$ ), 80% RH or less, no condensation

### Guaranteed accuracy period

- 1 year

#### (1) DC VOLTAGE

Range	Resolution	Accuracy	Overload Protection
999.9 mV	0.1 mV	$\pm 0.2\% \text{rdg.} \pm 5 \text{dgt.}$	1000 V DC/ 1000 V rms or $10^6 \text{ V} \cdot \text{Hz}$
9.999 V	1 mV	$\pm 0.1\% \text{rdg.} \pm 2 \text{dgt.}$	
99.99 V	10 mV		
999.9 V	0.1 V	$\pm 0.4\% \text{rdg.} \pm 5 \text{dgt.}$	

- Input Impedance: 10 M $\Omega$  (15 M $\Omega$  nominal for 999.9 mV range)

#### (2) AC VOLTAGE

##### 1. 40 Hz to 200 Hz

Range	Resolution	Accuracy	Overload Protection
999.9 mV	0.1 mV	$\pm 2.5\% \text{rdg.} \pm 5 \text{dgt.}$	1000 V DC/ 1000 V rms or $10^6 \text{ V} \cdot \text{Hz}$
9.999 V	1 mV	$\pm 1.1\% \text{rdg.} \pm 6 \text{dgt.}$	
99.99 V	10 mV	$\pm 1.1\% \text{rdg.} \pm 5 \text{dgt.}$	
999.9 V	0.1 V		

##### 2. 200 Hz to 500 Hz

Range	Resolution	Accuracy	Overload Protection
999.9 mV	0.1 mV	-	1000 VDC/ 1000 Vrms or $10^6 \text{ V} \cdot \text{Hz}$
9.999 V	1 mV	$\pm 1.1\% \text{rdg.} \pm 6 \text{dgt.}$	
99.99 V	10 mV	$\pm 1.1\% \text{rdg.} \pm 5 \text{dgt.}$	
999.9 V	0.1 V		

## 3. 500 Hz to 2 kHz

Range	Resolution	Accuracy	Overload Protection
999.9 mV	0.1 mV	-	1000 V DC/ 1000 V rms or $10^6$ V · Hz
9.999 V	1 mV	$\pm 2.0\% \text{rdg.} \pm 6 \text{dgt.}$	
99.99 V	10 mV	$\pm 2.0\% \text{rdg.} \pm 6 \text{dgt.}$	
999.9 V	0.1 V	-	

- Measurement accuracy is prescribed from 5% to 100% of the range
- For lower than 5.0mV, the specification will add 45dgt to specified accuracy.
- Input Impedance: 10 M $\Omega$  (999.9 mV range 15 M $\Omega$ )
- Crest factor: 3

## (3) DC CURRENT

Range	Resolution	Accuracy	Internal Resistance (approx)	Overload Protection
400.0 $\mu$ A	0.1 $\mu$ A	$\pm 0.2\% \text{rdg.} \pm 3 \text{dgt.}$	100 $\Omega$	0.5 A/600 V Quick Acting Fuse
4000 $\mu$ A	1 $\mu$ A	$\pm 0.1\% \text{rdg.} \pm 3 \text{dgt.}$	100 $\Omega$	
40.00 mA	10 $\mu$ A	$\pm 0.2\% \text{rdg.} \pm 3 \text{dgt.}$	1 $\Omega$	
400.0 mA	0.1 mA	$\pm 0.1\% \text{rdg.} \pm 3 \text{dgt.}$	1 $\Omega$	
4.000 A	1 mA	$\pm 0.3\% \text{rdg.} \pm 3 \text{dgt.}$	0.01 $\Omega$	10 A/600 V Quick Acting Fuse
10.00 A	10 mA	$\pm 0.3\% \text{rdg.} \pm 3 \text{dgt.}$	0.01 $\Omega$	

- 10 A continuous, 10 to 20 A for 30 seconds maximum with 5 minutes cool down interval.

**(4) AC CURRENT**

Range	Resolution	Accuracy	Internal Resistance (approx)	Overload Protection
400.0 $\mu$ A	0.1 $\mu$ A	$\pm 1.0\%$ rdg. $\pm 5$ dgt. (40 Hz to 500 Hz)	100 $\Omega$	0.5 A/600 V Quick Acting Fuse
4000 $\mu$ A	1 $\mu$ A		100 $\Omega$	
40.00 mA	10 $\mu$ A		1 $\Omega$	
400.0 mA	0.1 mA		1 $\Omega$	
4.000 A	1 mA	$\pm 1.5\%$ rdg. $\pm 5$ dgt. (500 Hz to 2 kHz)	0.01 $\Omega$	10 A/600 V Quick Acting Fuse
10.00 A	10 mA		0.01 $\Omega$	

- Measurement accuracy is prescribed from 5% to 100% of the range
- 10 A continuous, 10 to 20 A for 15 seconds maximum with 5 minutes cool down interval.
- Crest factor: 3

**(5) HARMONIC RATIO**

Range	Voltage
0.0% to 99.9%	100 mV AC to 1000 V AC

Harmonics Ratio function generates a value between 0% to 100% to indicate the deviation of non-sinusoidal to a sinusoidal waveform, which is a good indication of the presence of harmonics. Pure sinusoidal waveforms without harmonics have a Harmonics Ratio of 0%. The higher Harmonics Ratio, the more harmonics are present.

**(6) RESISTANCE**

Range	Resolution	Accuracy	Maximum Test Voltage	Overload Protection
400.0 $\Omega$	0.1 $\Omega$	$\pm 0.5\%rdg. \pm 3dgt.$	3.3 V max.	600 V DC/ 600 V rms
4.000 k $\Omega$	1 $\Omega$		1.28 V max.	
40.00 k $\Omega$	10 $\Omega$			
400.0 k $\Omega$	100 $\Omega$			
4.000 M $\Omega$	1 k $\Omega$	$\pm 0.8\%rdg. \pm 3dgt.$		
40.00 M $\Omega$	10 k $\Omega$	$\pm 1.2\%rdg. \pm 3dgt.$		

**(7) AUDIBLE CONTINUITY TEST**

Range	Threshold level	Overload Protection
CONTINUITY	The beeper will sound if the resistance falls below 100 counts.	600 V DC/ 600 V rms

- Relative mode is used in Audible continuity test function. Using Relative mode to zero residual.
- The measurement accuracy and open terminal voltage (test voltage) are the same as these of  $\Omega$  function.

**(8) CAPACITANCE**

Range	Resolution	Accuracy	Overload Protection
4.000 $\mu F$	1 nF	$\pm 2.0\%rdg. \pm 4dgt.$	600 V DC/ 600 V rms
40.00 $\mu F$	0.01 $\mu F$		
400.0 $\mu F$	0.1 $\mu F$	$\pm 3.5\%rdg. \pm 4dgt.$	
9999 $\mu F$	1 $\mu F$	$\pm 3.5\%rdg. \pm 5dgt.$ >2mF, NO Spec	

- The accuracy is based on the film capacitor or better. Using Relative mode to zero residual.

**(9) DIODE CHECK**

Range	Resolution Accuracy	Test Current Voltage	Overload Protection
Diode	1 mV $\pm 1.0\% \text{rdg.} \pm 2 \text{dgt.}$	approx. 0.7 mA Less than 3.3 V	600 V DC/ 600 V rms

- In Audible continuity function if measurement voltage is about less than 100 mV, the beeper sounds.

**(10) FREQUENCY MEASUREMENT FOR VOLTAGE**

Range	Resolution	Accuracy	Min. Input Freq.	Overload protection
9.999 Hz	0.001 Hz	$\pm 0.05\% \text{rdg.}$ $\pm 4 \text{dgt.}$	1 Hz	1000 V DC/ 1000 V rms or $10^6 \text{ V} \cdot \text{Hz}$
99.99 Hz	0.01 Hz			
999.9 Hz	0.1 Hz			
9.999 kHz	1 Hz			
50.00 kHz	10 Hz			

 **FREQUENCY SENSITIVITY**

INPUT RANGE	MINIMUM SENSITIVITY (rms sinwave)		
	40 Hz - 5 kHz	20 Hz <sup>*</sup> - 15 kHz	15 kHz - 50 kHz
999.9 mV	0.4 V	0.7 V	-
9.999 V	0.8 V	0.8 V	3 V
99.99 V	8 V	8 V	30 V
999.9 V	80 V	100 V	-
	20 Hz <sup>*</sup> - 10 kHz		
400.0 $\mu\text{A}$	50 $\mu\text{A}$		
4000 $\mu\text{A}$	300 $\mu\text{A}$		
40.00 mA	5 mA		
400.0 mA	30 mA		
4.000 A	0.5 A		
10.00 A	3 A		

- Maximum input for specified accuracy = 10 x Range or 1000 V
- <sup>\*</sup> In the case of a square wave : from 10 Hz to 20 kHz.

---

**(11) K -TYPE TEMPERATURE TEST**

Range	Resolution	Accuracy	Overload protection
-40°C to 850°C(K)	1°C	±0.3%rdg.±3°C	600 V DC /600 V rms
-40°C to 650°C(J)			
-40°F to 1562°F (K)	1°F	±0.3%rdg.±6°F	
-40°F to 1202°F(J)			

- Do not allow the temperature sensor to contact a surface that is energized above 30 V RMS or 60 V DC, such voltages pose a shock hazard.
- The accuracy does not include the tolerance of thermocouple probe.

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## Chapter 6

# Maintenance and Service

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### 6.1 Changing the Battery and Fuses

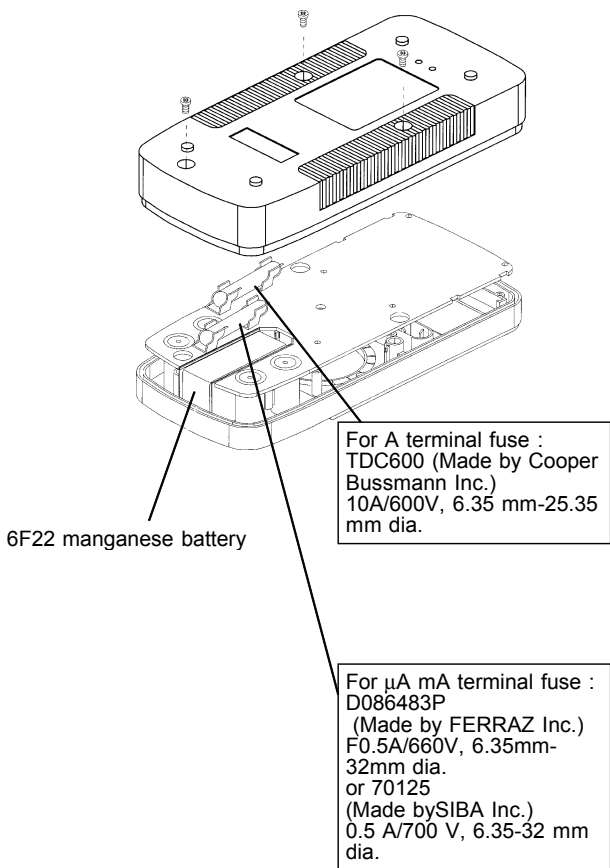


- To avoid electric shock when replacing the battery and fuse, first disconnect the test leads from the object to be measured, then open the cover.  
After replacing the battery or fuse, replace the cover and screws before using the product.
- When replacing the battery, Be sure to insert them with the correct polarity. Otherwise, poor performance or damage from battery leakage could result. Replace battery only with the specified type.
- To avoid the possibility of explosion, do not short circuit, disassemble or incinerate battery. Handle and dispose of battery in accordance with local regulations.
- Replace the fuse only with one of the specified characteristics and voltage and current ratings. Using a non-specified fuse or shorting the fuse holder may cause a life-threatening hazard.

Use the following procedures to replace the battery, or fuse.

- (1) Using the rotary switch to turn the meter off, and remove the test leads from terminals.
- (2) Loosen 3 screws on bottom cover, pull up and move the cover.
- (3) Replace the defective battery.  
The meter is powered by a 6F22 battery. Replace battery if the low battery sign (  ) is displayed and flashes.
- (4) Remove the defective fuse by gently prying one end of the fuse loose and sliding the fuse out of the fuse bracket.  
Install a new fuse of the same size and rating. Make sure the new fuse is centered in the fuse holder. There are 2 types of fuses, one for the  $\mu\text{A}$  , mA terminal and one for the A terminal. Be sure to set the correct fuse.
- (5) Reverse the procedure of opening cover to close the bottom cover.





## 6.2 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.

---

## 6.3 Service

If the product seems to be malfunctioning, confirm that the battery are not discharged, and that the test leads, and fuse 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.

**HIOKI**

**DECLARATION OF CONFORMITY**

Manufacturer's Name: HIOKI E.E. CORPORATION  
Manufacturer's Address: 81 Koizumi, Ueda, Nagano 386-1192, Japan  
Product Name: DIGITAL HiTESTER  
Model Number: 3803, 3804, 3805  
Accessory: 3851-10 TEST LEAD  
Option: 3854 RS-232C PACKAGE

The above mentioned products conform to the following product specifications:


Safety: EN61010-1:2001  
EN61010-031:2002  
EMC: EN61326:1997+A1:1998+A2:2001+A3:2003  
Class B equipment  
Portable test, measuring and monitoring  
equipment used in low-voltage distribution  
systems

Supplementary Information:

The products herewith comply with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC.

29 September 2006

HIOKI E.E. CORPORATION

  
Tatsuyoshi Yoshiike  
President

3803A999-05



## **HIOKI 3805 DIGITAL HiTESTER**

### **Instruction Manual**

Publication date: September 2006 Revised edition 8

Edited and published by HIOKI E.E. CORPORATION

Technical Sales Support Section

All inquiries to International Sales and Marketing  
Department

81 Koizumi, Ueda, Nagano, 386-1192, Japan

TEL: +81-268-28-0562 / FAX: +81-268-28-0568

E-mail: [os-com@hioki.co.jp](mailto:os-com@hioki.co.jp)

URL <http://www.hioki.co.jp/>

Printed in Japan 3805A980-08

- All reasonable care has been taken in the production of this manual, but if you find any points which are unclear or in error, please contact your supplier or the International Sales and Marketing Department at HIOKI headquarters.
  - In the interests of product development, the contents of this manual are subject to revision without prior notice.
  - Unauthorized reproduction or copying of this manual is prohibited.
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# HIOKI

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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](mailto: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

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3805A980-08 06-09H



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