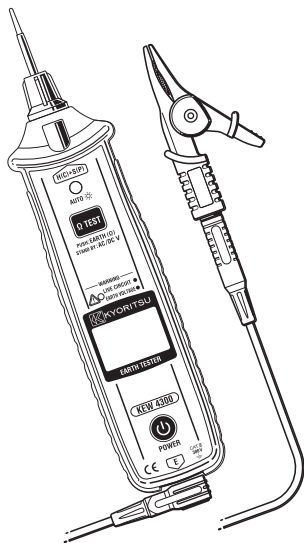


Instruction Manual



Simplified Earth Tester

KEW 4300



**KYORITSU ELECTRICAL
INSTRUMENTS WORKS, LTD.**

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1. Safety warnings


This instrument has been designed and tested according to IEC Publication 61010: Safety Requirements for Electronic Measuring Apparatus. This instruction manual contains warnings and safety rules which must be observed by the user to ensure safe operation of the instrument and retain it in safe condition. Therefore, read through these operating instructions before starting using the instrument.


DANGER


- Read through and understand the instructions contained in this manual before using the instrument.
- Save and keep the manual handy to enable quick reference whenever necessary.
- The instrument is to be used only in its intended applications.
- Understand and follow all the safety instructions contained in the manual.

Failure to follow the instructions may cause injury, instrument damage and/or damage to equipment under test. Kyoritsu is by no means liable for any damage resulting from the instrument in contradiction to this cautionary note.

The symbol  indicated on the instrument, means that the user must refer to the related parts in the manual for safe operation of the instrument. It is essential to read the instructions wherever the  symbol appears in the manual.

 **DANGER** : is reserved for conditions and actions that are likely to cause serious or fatal injury.

 **WARNING** : is reserved for conditions and actions that can cause serious or fatal injury.

 **CAUTION** : is reserved for conditions and actions that can cause injury or instrument damage.

⚠ DANGER

- Never make measurement on a circuit in which the electrical potential exceeds 300V.
- Do not attempt to make measurement in the presence of flammable gasses. Otherwise, the use of the instrument may cause sparking, which can lead to an explosion.
- Never attempt to use the instrument if its surface or your hand is wet.
- Be careful not to short-circuit the power line with the metal part of the test leads when measuring voltage. It may cause personal injury.
- Do not exceed the maximum allowable input of any measurement range.
- Never open the Battery compartment cover during a measurement.
- Keep your fingers and hands behind the protective fingerguard during measurement.





⚠ WARNING

- Never attempt to make any measurement if any abnormal conditions, such as a broken cover or exposed metal parts are present on the instrument and test leads.
- Do not press the Test button when connecting the test leads to the instrument.
- Do not install substitute parts or make any modification to the instrument. Return the instrument to your local Kyoritsu distributor for repair or re-calibration in case of suspected faulty operation.
- Do not replace batteries if the instrument is wet.
- Ensure that the L-shaped Banana plug of MODEL7248 is firmly inserted into the E terminal.
- Power off the instrument when opening the Battery compartment cover for battery replacement.
- Stop using the test lead if the outer jacket is damaged and the inner metal or color jacket is exposed.

⚠ CAUTION

- Ensure that the instrument is powered off after use and test leads are disconnected. Remove the batteries if the instrument is to be stored and will not be in use for a long period.
- Do not expose the instrument to direct sunlight, high temperature, humidity or dew.
- Use a damp cloth with neutral detergent or water for cleaning the instrument. Do not use abrasives or solvents.
- Do not store the instrument if it is wet.

Symbols

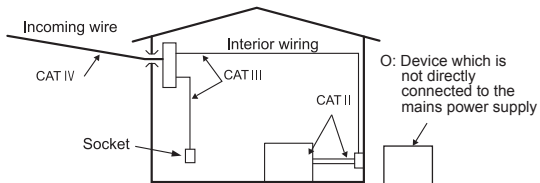
	Instrument with double or reinforced insulation
	User must refer to the explanations in the instruction manual.
	(Functional) Earth terminal
	Crossed-out wheel bin symbol (according to WEEE Directive: 2002/96/EC) indicating that this electrical product may not be treated as household waste, but that it must be collected and treated separately.

Measurement categories (Over-voltage categories)

To ensure safe operation of measuring instruments, IEC 61010 establishes safety standards for various electrical environments, categorized as O to CAT IV, and called measurement categories.

Higher-numbered categories correspond to electrical environments with greater momentary energy, so a measuring instrument designed for CAT III environments can endure greater momentary energy than one designed for CAT II.

- O : Circuits which are not directly connected to the mains power supply.
- CAT II : Primary electrical circuits of equipment connected to an AC electrical outlet by a power cord.
- CAT III : Primary electrical circuits of the equipment 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).



2. Features

KEW4300 is a simplified earth resistance tester (based on 2-pole method) that can be used for various distribution lines and electrical appliances and it also can measure AC/DC voltages. (As for AC voltages, true rms values can be obtained.)

- Designed to meet the following safety standards
IEC 61010-1 CAT III 300V, Pollution degree 2
IEC 61010-031
IEC 61557-1, 5
- 200/ 2000 Ω (2 ranges) : auto-ranging
- Warning buzzer triggered at 100 Ω or less
- LED lights up when a large earth voltage is detected.
- Small test current (max 2mA) not triggering ELB
- Live circuit warning when 30V or higher voltage is detected.
(KEW4300 detects voltage even when measuring resistances.)
- LED light for illuminating measurement points
(It turns on/off automatically in relation to the ambient brightness.)
- Backlight working in conjunction with the LED light
- Glow in the dark button
- User-friendly and compact design
- Auto-power-off function is also available to power off the instrument when 10 min pass after the last operation. This function does not work while a continuous measurement is performed.
- Strap for prevent drop
- User replaceable metal tips are supplied as standard accessories

3. Specification

- Measurement range and accuracy ($23^{\circ}\text{C}\pm 5^{\circ}\text{C}$, relative humidity 75% or less)

Voltage/ Earth voltage measurement

Measurement range	Display range	Accuracy
AC5.0 to 300.0V (45 to 65Hz) (425V peak or less)	0.0 to 314.9V	$\pm 1\% \text{rdg} \pm 4 \text{dgt}$
DC \pm 5.0 to \pm 300.0V	0.0 to \pm 314.9V	$\pm 1\% \text{rdg} \pm 8 \text{dgt}$

*AC measurement method : rms detection

For the waveforms other than sinewave of $\text{CF} < 2.5$, the specified accuracy $\pm 1\% \text{f.s.}$ should be applied.

* AC/DC auto-detection at 5V or higher

* DC sign appears at 5V or higher.

(H+S(C+P) terminal: positive side, E terminal : negative side)

* The LCD reads 0.0V for 0.9V or lower voltages.

Earth resistance measurement

Range (auto-ranging)	Measurement range	Display range	Accuracy
200 Ω Range	5.0 to 2000 Ω	0.0 to 209.9 Ω	$\pm 3\% \text{rdg} \pm 5 \text{dgt}$
2000 Ω Range		160 to 2099 Ω	

Measurement method: Constant current inverter

approx. 1.4mA (200 Ω Range)/825Hz

approx. 0.7mA (2000 Ω Range)/825Hz

Open voltage: Approx. 13V

- Applicable standards
 - IEC 61010-1
 - IEC 60529(IP40)
 - IEC 61557-1, -5
 - IEC 61326-1, 2-2
 - IEC 61010-031
 - MODEL7248 / CAT III600V
(Alligator clip should be attached and used in the CAT III or higher environment.)
 - MODEL8253 / CAT III300V
(while it is connected to the instrument)
 - * When the test leads are connected to the instrument, the lower category either of them belongs to is applied.
- Location for use Altitude 2000m or less, indoor use
- LCD Segment display with backlight
- Operating temperature and humidity range -10°C to 50°C,
80% or less (no condensation)
- Storage temperature and humidity range -20°C to 60°C,
75% or less (no condensation)
- Withstand voltage AC3,540V(50/60Hz)/ for 5 sec between the electrical circuit and the enclosure
- Insulation resistance 50MΩ or more/ DC1000V between the electrical circuit and the enclosure
- Auto-power-off function Auto-power-off function operates with audible warning and powers off the instrument when approx 10min pass after the last operation.
(This function is disabled during a resistance measurement.)
- Backlight Turns off automatically when approx 2min pass after the last operation. (This function is disabled during a measurement.)
- Dimensions 232(L) x 51(W) x 42(D)mm
(including the metal tip)
- Weight Approx. 220g (including batteries)
- Power source Size AA, alkaline battery x 2pcs
(The use of alkaline LR6 is recommended.)

- Operating Error

Operating error (B) is an error obtained within the rated operating conditions, and calculated with the intrinsic error (A), which is an error of the instrument used, and the error (E_i) due to variations. According to IEC61557, the maximum operating error should be within ±30%.

- Operating error at earth resistance measurements (IEC61557-5)

Formula: $B = \pm(|A| + 1.15 \times \sqrt{E_2^2 + E_3^2 + E_4^2})$

A	Reference condition
E ₁	Normal operating position ±90°
E ₂	Variation due to changing the supply voltage (until the Battery symbol BATT appears)
E ₃	Variation due to changing the temperature (-10°C to 50°C)
E ₄	Variation due to series interference voltage 16•2/3Hz, 50Hz, 60Hz, DC: 10V 400Hz: 3V
E ₅	Variation due to resistance of the probes and auxiliary earth electrode resistance

E₁ : It is not applicable to digital testers.

E₅ : It is not applicable to simplified earth testers.

Measurement range within which the maximum operating error ±30% applies: 5.00Ω to 2000Ω.

- Number of measurement

(measuring for 5 sec and take a pause for 25 sec)

Function	Resistor for test	Number of measurement (within effective battery voltage range)
Earth measurement	10Ω	Approx. 3000 times

4. Instrument layout

(1) Instrument Body

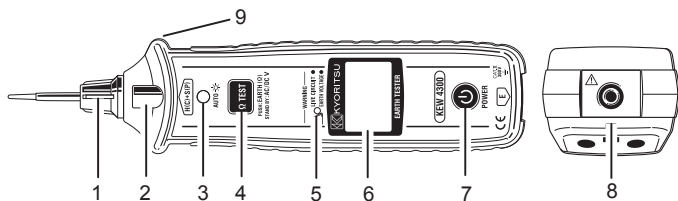


Fig. 4-1

	Name	Details
1	H+S(C+P) terminal	To connect the replaceable metal tip MODEL8072 has been installed and delivered.
2	LED light	To illuminate the measurement spots The light turns on/off automatically in relation to ambient brightness.
3	Ambient light sensor	To sense ambient brightness for turning on/ off the light
4	Test button	To conduct resistance measurement Measurement is conducted when the button is held down.
5	Warning LED	To give warnings for live circuit (blinking red) and for large earth voltage (blinking yellow)
6	LCD	LCD with backlight The backlight turns on/off automatically in relation to ambient brightness.
7	Power button	To power on/ off the instrument. The button should be held down for 1 sec or longer.
8	E terminal	To connect the test lead MODEL7248
9	Protective fingerguard	It is a part providing protection against electrical shock and ensuring the minimum required air and creepage distances.

(2) LCD

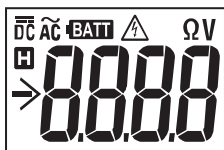


Fig. 4-2

• Symbols displayed on the LCD

BATT	Indicate the batteries need to replace.
0000	Show the measured results.
>	Appear when the measured result exceeds the display range. Resistance : >2099Ω Voltage : > 314.9V (“-OL” for negative DC voltages)
H	Indicate the end of a measurement with frozen measured result.
⚠	Blink to give a warning for live circuit

• Symbol displayed at earth measurements

Ω	A unit of earth resistance
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• Symbols at voltage/ earth voltage measurements

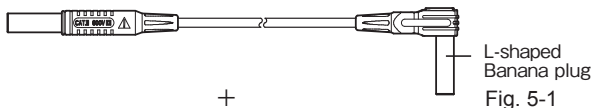
AC · DC	“AC” for alternate voltages and “DC” for direct voltages
V	A unit of voltage
-	Polarity sign for negative voltages

5. Accessories

- Test leads

(1) MODEL7248 – with Alligator clip and Flat test bar

(2) Banana plug, both ends, black



(3) Alligator clip



(4) Flat test bar



- Tip metal tips for H+S(C+P) terminal

(1) MODEL8072



Fig. 5-4

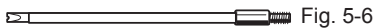
Standard metal tip
installed at a shipment.

(2) MODEL8253



Metal tip with plastic molded

(3) MODEL8017



Long type and helpful to access
the distant measurement spot

- Others

(1) Carrying case

(2) Strap

(3) Size AA alkaline battery x 2 pcs

(4) Instruction manual

6. Getting started

6-1 Battery voltage check

- (1) Please refer to “10. Replacing batteries” in this manual and insert batteries in KEW4300.
- (2) Hold down the Power button at least 1 sec and power on KEW4300.
* A long press of 1 sec or longer is required to power on/ off the instrument. It is to prevent a malfunction.
- (3) The battery voltage is extremely low when the “**BATT**” symbol appears at the upper left corner on the LCD. Replace the batteries with reference to “10. Replacing batteries” to carry out further measurements.

The use of size AA alkaline battery is recommended. The Battery symbol may not appear correctly when the other types of batteries are used.

6-2 Attaching metal tip/ adapter

The metal tip for the H+S(C+P) terminal and the adapters for MODEL7248 to be connected to the E terminal are replaceable depending on applications.

DANGER

Always attach and use the M-8253 and the Alligator clip to use this instrument in the CAT III or higher environments. The other metal tips: M-8072, M-8017 and the Flat test bar have a large exposed metal and may short the equipment under test. It may cause a malfunction of the equipment under test, a fire or fatal/serious injuries to the user or the people around.

(1) Replaceable metal tip

The metal tips are replaceable depending on applications.

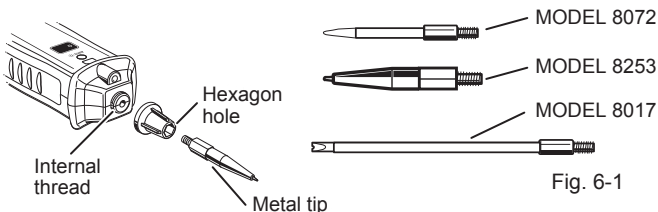
[Available tip metal tips]

1. MODEL8072 : Standard metal tip installed at a shipment
2. MODEL8253 : Metal tip with plastic molded
3. MODEL8017 : Long type and helpful to access the distant measurement spot

[How to replace the parts]

Detach the metal tip by turning the red plastic parts counter clockwise.

Install the metal tip you want to use into the hexagon hole, and turn the red plastic parts clockwise to tighten firmly.



(2) Test leads

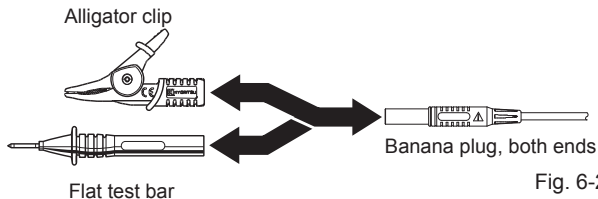
Either of the following adapters should be connected to the cord with Banana plug, both ends.

[Adapters for MODEL7248]

1. Alligator clip
2. Flat test bar

[How to connect]

Firmly insert and connect the adapter to the end of the cord with Banana plug, both ends.



⚠ DANGER

To avoid getting electrical shocks, ensure that test leads are disconnected from the instrument when replacing the metal tip or adapter for test leads.

7. Voltage measurement

⚠ DANGER

- Never apply voltages exceeding 300V, max over-voltage protection, to this instrument.
- Keep your fingers and hands behind the protective fingerguard during measurement.

7-1 Measurement procedure

(1) Connect the test leads to the instrument.

Plug the L-shaped Banana plug of MODEL7248 into the E terminal as illustrated below.

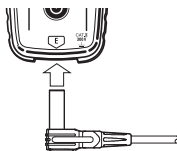


Fig. 7-1

(2) Connect the adapter for test leads to the earth side of the circuit under test and the metal tip (H+S(C+P) terminal) to the line side respectively. Connecting that in reverse is also fine if the circuit under test is not earthed.

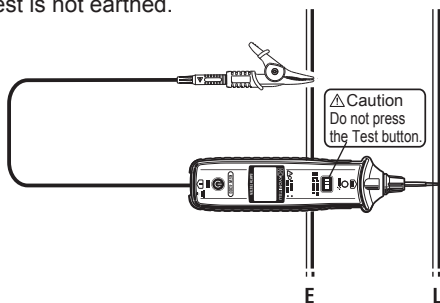


Fig. 7-2

(3) The measured voltage is displayed on the LCD.

Take the reading without pressing the Test button. The instrument judges DC or AC and shows “DC” or “AC” sign on the LCD.

* When negative DC voltages are detected at the H+S(C+P) terminal, the negative polarity sign “-” appears to the left of the measured value.

* The LCD does not show “DC”, “AC” nor sign when the measured values are less than 5V.

The LCD shows “>314.9V” when the measured value exceeds the display range (over range) and it shows “-OL” for negative DC voltages.

7-2 Live circuit warning

The warning LED starts blinking red with audible warning when the measured value is 30V or higher.

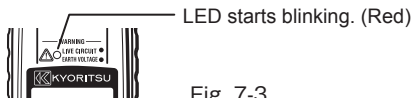


Fig. 7-3

* The instrument does not carry out resistance measurements even the Test button is held down while the live circuit warning is activating.

8. Earth resistance measurement

This instrument can measure the earth resistances of distribution line, internal wiring and electrical appliance.

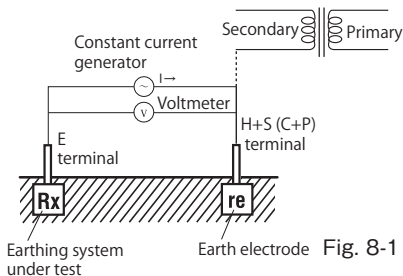
⚠ DANGER

- Never apply inputs exceeding 300V between the measuring terminals at earth voltage measurements.
- No voltage should be applied between the measuring terminals during earth resistance measurements.

8-1 Principle of measurement

This instrument carries out earth resistance measurements based on the fall-of-potential method. This is a simplified earth resistance tester and uses the existing earth systems (with a sufficiently low earth resistance) such as buried metal pipes like main water pipe, common earth for commercial power supply and a lightning electrode on buildings and performs measurements based on the 2-pole measurement method.

The AC constant current “**I**” is applied between the measurement object “**R_x**” (earth electrode) and the existing electrode “**re**” to obtain the earth resistance value “**R_x + re**” and find out the voltage “**V**” between the E and H+S(C+P) terminals. See Fig. 8-1.



$$R_x + re = V / I$$

The resistance “**re**” of the existing earth electrode with which H+S(C+P) terminal is connected is added to the true resistance “**R_x**” of the measured object, and displayed as the measured result. Re (measured value) = $R_x + re$

If the value of “**re**” is already known, deduct it from the measured value “**Re**” to determine “**R_x**” value.

$$R_x \text{ (true resistance value)} = Re - re$$

8-2 Measurement procedure

(1) Connect the test leads to the instrument.

Plug the L-shaped Banana plug of MODEL7248 into the E terminal as illustrated below.

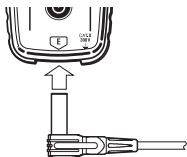


Fig. 8-2

(2) Connection

Connect the instrument as illustrated below.

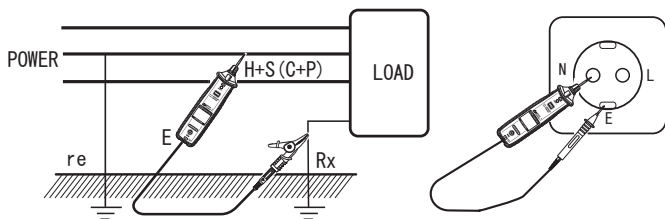


Fig. 8-3 Measuring the earth resistance of load

Fig. 8-4 Measuring the earth resistance of wall socket

⚠ DANGER

- Always use a voltage detector for testing the earth side of the commercial power supply.
- Do not use this instrument for testing the earth side of the commercial power supply. It is dangerous because the LCD may not show the measured voltage even the circuit under test is in live if the earth of the electrode under test is loose/ disconnected or the connection of the test leads is not proper.

(3) Checking the earth voltage

Check the earth voltage displayed on the LCD without pressing the Test button.

- The displayed value should be less than 10V.
The warning LED starts blinking yellow when the earth voltage is 10V or higher. (The LED starts blinking at 3V or higher if the frequency of the earth voltage is 400Hz.)

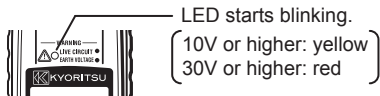


Fig. 8-5

Ensure that the systems connected to the earth electrode under test are turned off to get the earth voltages lower when the warning LED for earth voltage starts blinking. Otherwise, accurate measured results can not be obtained. The warning LED for earth voltage may not light up if the frequency is over 400Hz.

- The warning LED starts blinking red with audible warning when the voltage of 30V or higher is detected. Earth resistance measurements can not be carried out by pressing the Test button while the live circuit warning is activating.

(4) Measurement

Press the Test button. The LCD shows the measured result. The instrument carries out an earth resistance measurement while the Test button is held down. The buzzer sounds when the measured value is less than 100Ω.

The measurement is halted when the Test button is released, and the measured data freezes on the LCD. (The “**H**” symbol appears on the LCD.) A short press of the Test button while the result is being displayed on the LCD gets the instrument entered into the Voltage measurement mode.

- The LCD shows “>2099Ω” when the measured result exceeds the display range. (Over range)
- The instrument automatically enters into the voltage measurement mode when sensing the live circuit during a resistance measurement and activates the warning function.
- If an earth resistance measurement is continued at low battery level with Battery symbol on the LCD, the instrument may be powered off suddenly.

9. LCD backlight and LED light

The LCD backlight and the LED light on this instrument turn on/off automatically in relation to ambient brightness. These lights keep on for about 15 sec once they turn on. The Ambient light sensor as shown in the below figure senses the ambient brightness.

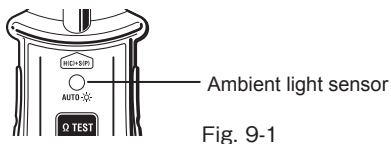


Fig. 9-1

- Dirt on the surface of the sensor may interfere the proper operation of the lights. Keep the sensor clean.
- The sensitivity of the sensor is not adjustable. Cover the sensor with your hand or finger if you need to turn on the lights. The lights keep on for about 15 sec once they turn on.

[Turning off the Auto-light mode]

The following procedure is for setting the lights always off.

1. Ensure that the instrument is powered off.
2. Hold down the Power button for 1 sec while the Test button is held down and power on the instrument.
3. Now the Auto-light mode is disabled. Repeating above steps 1.& 2. restores the mode.

The number of beep when powering on the instrument is different depending on the selected light mode. The selected mode will not be reset even after powering off the instrument.

Number of beep	Light mode
Once	Auto
Twice	Always off

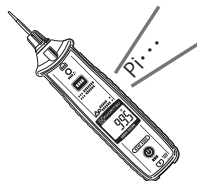


Fig. 9-2

Buzzer sounds when powering on the instrument.

10. Replacing batteries

When the Battery symbol appears on the LCD, replace the batteries with new ones.

⚠ DANGER

- Never open the Battery compartment cover if the instrument is wet.
- Do not attempt to replace batteries during a measurement. In order to avoid getting an electrical shock, ensure that the instrument is powered off and the test leads are disconnected from the instrument before replacing the batteries.
- Always install the Battery compartment cover when starting a measurement. Otherwise, it may cause an electrical shock hazard.

⚠ CAUTION

- Do not mix new and old batteries or mix different types of batteries.
- Install batteries in correct polarity as marked inside.

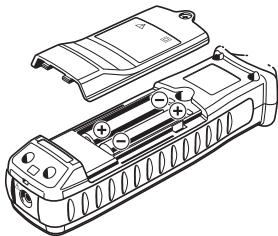


Fig. 10-1

- (1) Power off the instrument and disconnect the test leads from the instrument.
- (2) Loosen the screw at the backside of the instrument and remove the Battery compartment cover.
- (3) Remove all the old batteries. Install two new batteries in correct polarity.

The use of two, size AA alkaline batteries or alkaline batteries (LR6) is recommended.

- (4) Install the Battery compartment cover and tighten the screw.

MEMO

MEMO

DISTRIBUTOR

Kyoritsu reserves the rights to change specifications or designs described in this manual without notice and without obligations.



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