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INSTRUCTION MANUAL

**MODEL SK-6150
SK-6155**

V— Ω —A—Hz

DIGITAL MULTIMETER

KAISE CORPORATION

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1. INTRODUCTION

1-1. FEATURES

SK-6150/6155 series has new looks featuring 4000 Count Large LCD with Bar Graph and Terminals located in the upper part of the front case.

The instrument provides various measuring functions such as frequency, capacitance (SK-6155) and 400A AC/DC by an optional clamp adapter.

This is a very sensitive, general purpose instrument that provides the facilities and quality required by today's electric/electronic technicians and engineers.

1. 4000 Count LCD with Bar Graph is beautiful and one of the largest ones for handy type DMMs.
2. This instrument provides versatility such as Frequency, Capacitance (SK-6155 only), EXT Range (400A AC/DC), MIN/MAX, Difference, Display Hold and Range Hold.
3. To make Test Leads operation easier, Terminals are located in the upper part of the front case.
4. The cases became very tough because they adopted Dust and Water Resistant construction and Heat Resistant ABS Resin.
5. Provided with two fuses rated 600V and new structure, this series has been designed and tested according to IEC Publication 348.
Moreover, equipped with Auto Power-off Device to save battery power.

1-2. UNPACKING AND INSPECTION

Before unpacking, examine the shipping carton for any sign of damage.

Unpack and inspect the instrument and accessories for any damage from mechanical shock, water leakage, or other causes. If any damage or missing item is found, consult the local dealer for replacement.

Make certain that following items are included in the box.

1. Digital Multimeter
2. One pair of Test Leads (100-32)
3. Two 1.5V R6P (SUM-3, AA) Batteries
4. Instruction Manual

2. SPECIFICATIONS

2-1. GENERAL

1. DISPLAY :

- a. **Numerical Display** ; 4000 count LCD, maximum reading 9999, numerals 18mm high
- b. **Bar Graph** ; 40 segments (1 segment/100 digits)
- c. **Unit and Sign** ; mV, V, mA, A, Ω , K Ω , M Ω , nF, μ F, Hz, BAT, DIFF, DH, MAX, MIN, \rightarrow , \leftarrow , \dashv , \sim , $-$, AUTO, MAN and decimal point.
- * nF and μ F are for SK-6155 only.

2. OPERATING PRINCIPLE : Dual Slope Integration.

3. RANGE SELECTION : Auto or Manual Ranging

- * Auto only for Hz, Manual only for Amperes.

4. POLARITY : Autopolarity, + sign is implied.

5. OVERRANGE INDICATION : MSD 4 blinks.

- * MSD 9 blinks on Hz range.
- * No blinking on highest ranges of voltage AC/DC and on 20A AC/DC ranges.

6. BATTERY WARNING : LCD display becomes faint and BAT sign blinks.

LCD Viewing Angle comes this side as battery voltage goes down below 2.5V.

7. SAMPLING RATE : 2 times/sec. (Numerals).

20 times/sec. (Bar Graph).
1 time/sec. (Capacitance).

8. MIN/MAX VALUE : measured by MIN/MAX Key.

9. DIFFERENCE : measured by DIFF Key.

10. DISPLAY HOLD : Display is held by DH Key.

11. CONTINUITY TESTS : Buzzer sounds less than 40 ohms.

12. DIODE TESTS : GOOD or BAD judgement.

13. EXT RANGE : 400A AC/DC measurements by optional 660 Clamp Adapter.

14. OVERLOAD PROTECTION : written below measuring specifications.

15. DIELECTRIC STRENGTH : 6kV AC one minute between Cases and Terminals.

16. OPERATING TEMPERATURE & HUMIDITY : 0 $^{\circ}$ C to 40 $^{\circ}$ C, less than 80% RH in non-condensing.

17. STORAGE TEMPERATURE & HUMIDITY : -10 $^{\circ}$ C to 50 $^{\circ}$ C, less than 70% RH in non-condensing.

18. TEMPERATURE COEFFICIENT : 0 $^{\circ}$ C to 18 $^{\circ}$ C, 28 $^{\circ}$ C to 40 $^{\circ}$ C, (Accuracy on 23 $^{\circ}$ C \pm 5 $^{\circ}$ C) \times 0.1/ $^{\circ}$ C.

19. POWER SUPPLY : Two 1.5V R6P (SUM-3, AA) Batteries.

20. POWER CONSUMPTION : 3mW, 500 hour continuous operation.

21. AUTO POWER-OFF : Power turns off automatically (goes down in sleep condition) after 30 minutes of Power on.

- * When DH key is operating, Auto Power-off does not work.

22. FUSES : One 1A/600V, one 15A/600V 10 \times 38mm.

23. DIMENSIONS & WEIGHT : 180 \times 86 \times 35mm, 320g.

24. OPTIONAL ACCESSORIES : • 660 AC/DC Clamp Adapter • 840 hFE Test Adapter • 860 High Voltage Probe (50KV DC) • 870 Clamp Adapter (1200A AC) • 940 Alligator Clips • 995 Carrying Case

2-2. SPECIFICATIONS OF MODEL SK-6150

1. AC VOLTAGE (\sim V)

Average Value Rectification

Range	Accuracy	Resolution	Input Impedance	Max. Input Voltage
400.0mV	2.0%rdg \pm 7dgt	100 μ V	\geq 100M Ω	DC 1000V or 750V Rms
4.000 V	1.5%rdg \pm 5dgt	1mV	\geq 11M Ω	
40.00 V		10mV	\geq 10M Ω	
400.0 V		100mV		
750 V		1 V		

* Above accuracy is specified under the following Frequency.

400mV Range : 45Hz - 100Hz The other Ranges : 45Hz - 500Hz

* Overload Protection : 1500V DC or AC Peak 1 minute.

2. DC VOLTAGE (\dashv V)

Range	Accuracy	Resolution	Input Impedance	Max. Input Voltage
400.0mV	0.5%rdg \pm 2dgt	100 μ V	\geq 100M Ω	DC 1100V or 750V Rms
4.000 V		1mV	\geq 11M Ω	
40.00 V	0.8%rdg \pm 1dgt	10mV	\geq 10M Ω	
400.0 V		100mV		
1000 V		1 V		

* Overload Protection : 1500V DC or AC Peak 1 minute.

3. AC CURRENT (\sim A)

Average Value Rectification

Range	Accuracy	Resolution	Voltage Drop	Max. Input Current
400.0mA	1.5%rdg \pm 5dgt	100 μ A	400mV	400mA Rms
20.00 A	2.5%rdg \pm 5dgt(10A)	10mA	350mV(10A)	20A (within 30 sec.)
	3.0%rdg \pm 10dgt(20A)			

* Above accuracy is specified under the frequency : 40Hz - 500Hz

* Overload Protection : 400mA Range \cdots 1A/600V Fuse

20A Range \cdots 15A/600V Fuse

* 10A - 20A must be measured within 30 sec.

4. DC CURRENT (---A)

Range	Accuracy	Resolution	Voltage Drop	Max. Input Current
400.0mA	1.2%rdg ± 2dgt	100μA	400mV	400mA
20.00 A	2.0%rdg ± 2dgt(10A) 2.5%rdg ± 4dgt(20A)	10mA	350mV(10A)	20A (within 30 sec.)

* Overload Protection : 400mA Range.....1A 600V Fuse
20A Range.....15A 600V Fuse

* 10A ~ 20A must be measured within 30 sec.

5. RESISTANCE (Ω)

Range	Accuracy	Resolution	Measurement Current	Max. Input Voltage
400.0 Ω	1.0%rdg ± 2dgt	100mΩ	≤ 0.5mA	DC 500V or 500V Rms
4.000K Ω	0.7%rdg ± 2dgt	1 Ω	≤ 0.2mA	
40.00K Ω		10 Ω	≤ 40 μA	
400.0K Ω		100 Ω	≤ 4 μA	
4000K Ω	1.0%rdg ± 2dgt	1K Ω	≤ 0.4μA	
40.00M Ω	2.0%rdg ± 2dgt	10K Ω	≤ 40 nA	

* Maximum Open Circuit Voltage between Terminals : 0.4V DC

6. CONTINUITY TESTS (•••)

Range	Buzzer	Measurement Current	Open Circuit Voltage
400.0Ω (Auto)	less than 40Ω	≤ 0.5mA	≤ 0.4V

* Maximum Input Voltage : 500V DC or 500V Rms.

7. FREQUENCY (Hz)

Autorange only

Range (Auto)	Input Sensitivity (Circuit Voltage)			Resolution
	10.0mV(≥0.5V)	0.100V(≥5V)	1.00V(≥15V)	
99.99 Hz	1.0%rdg ± 10dgt	1.0%rdg ± 10dgt	1.0%rdg ± 10dgt	0.01Hz
999.9 Hz	0.3%rdg ± 3dgt	0.3%rdg ± 3dgt	0.3%rdg ± 3dgt	0.1Hz
9.999kHz				1Hz
99.99kHz		0.5%rdg ± 5dgt	0.5%rdg ± 5dgt	10Hz
999.9kHz		0.5%rdg ± 5dgt	0.5%rdg ± 5dgt(0 to 400kHz) 1.0%rdg ± 10dgt(≥400kHz)	100Hz

* Sampling Rate : 2 times sec.

* Input Sensitivity Selection : 10.0mV (400mV Range),
0.100V (4V Range) or 1.00V (40V Range) by RANGE Key.

* Maximum Input Voltage : 350V DC or 250V AC Rms 1 minute.

8. DIODE TESTS (→|←)

Test	Resolution	Measurement Current	Open Circuit Voltage
GOOD or BAD	1mV	≤ 4mA	≤ 3.3V

* Maximum Input Voltage : 500V DC or 500V AC Rms.

9. EXT RANGE (400A AC DC by 660 Clamp Adapter)

Range	Accuracy	Resolution	Max. Input Voltage
→ 400A Range	0.8%rdg ± 1 dgt	0.1A	1V
← 400A Range	1.5%rdg ± 5dgt		

* Frequency on AC Current Range : 50Hz ~ 400Hz

* The above accuracy is of the digital multimeter itself.

Add the accuracy of the Clamp Adapter to the accuracy.

2-3. SPECIFICATIONS OF MODEL SK-6155

1. AC VOLTAGE (~V)

Average Value Rectification

Range	Accuracy	Resolution	Input Impedance	Max. Input Voltage
400.0mV	1.0%rdg ± 5dgt	100μV	≥ 100MΩ	DC 1000V or 750V Rms
4.000 V		1mV	≈ 11MΩ	
40.00 V		10mV	≈ 10MΩ	
400.0 V		100mV		
750 V		1 V		

* Above accuracy is specified under the following frequency.

400mV Range : 45Hz ~ 100Hz The other Ranges : 45Hz ~ 500Hz

* Overload Protection : 1500V DC or AC Peak 1 minute.

2. DC VOLTAGE (---V)

Range	Accuracy	Resolution	Input Impedance	Max. Input Voltage
400.0mV	0.35%rdg ± 1dgt	100μV	≥ 100MΩ	DC 1000V or 750V Rms
4.000 V		1mV	≈ 11MΩ	
40.00 V		10mV	≈ 10MΩ	
400.0 V	100mV			
1000 V	1 V			

* Overload Protection : 1500V DC or AC Peak 1 minute.

3. AC CURRENT (~ A)

Average Value Rectification

Range	Accuracy	Resolution	Voltage Drop	Max. Input Current
4.000mA	1.5%rdg ± 5dgt	1 μ A	400mV	400mA Rms
40.00mA		10 μ A		
400.0mA		100 μ A		
20.00 A	2.5%rdg ± 5dgt(10A) 3.0%rdg ± 10dgt(20A)	10mA	350mV	20A (within 30sec.)

* Above accuracy is specified under the frequency : 40Hz ~ 500Hz.

* Overload Protection : 400mA Range.....1A 600V Fuse
20A Range.....15A 600V Fuse

* 10A ~ 20A must be measured within 30 sec.

4. DC CURRENT (--- A)

Range	Accuracy	Resolution	Voltage Drop	Max. Input Current
4.000mA	1.2%rdg ± 2dgt	1 μ A	400mV	400mA
40.00mA		10 μ A		
400.0mA		100 μ A		
20.00 A	2.0%rdg ± 2dgt(10A) 2.5%rdg ± 4dgt(20A)	10mA	350mV (10A)	20A (within 30sec.)

* Overload Protection : 400mA Range.....1A 600V Fuse
20A Range.....15A 600V Fuse

* 10A ~ 20A must be measured within 30sec.

5. RESISTANCE (Ω)

Range	Accuracy	Resolution	Measurement Current	Max. Input Voltage
400.0 Ω	0.7%rdg ± 2dgt	100m Ω	≤ 0.5mA	DC 500V or 500V Rms
4.000K Ω		1 Ω	≤ 0.2mA	
40.00K Ω		10 Ω	≤ 40 μ A	
400.0K Ω		100 Ω	≤ 4 μ A	
4000K Ω	1.0%rdg ± 2dgt	1K Ω	≤ 0.4 μ A	
40.00M Ω	2.0%rdg ± 2dgt	10K Ω	≤ 40 n A	

* Maximum Open Circuit Voltage between Terminals : 0.4V DC

6. CONTINUITY TESTS (•••)

Range	Buzzer	Measurement Current	Open Circuit Voltage
400.0 Ω (Auto)	less than 40 Ω	≤ 0.5mA	≤ 0.4V

* Maximum Input Voltage : 500V DC or 500V AC Rms.

7. FREQUENCY (Hz)

Autorangeing only

Range (Auto)	Input Sensitivity (Circuit Voltage)			Resolution
	10.0mV(≥ 0.5V)	0.100V(≥ 5V)	1.00V(≥ 15V)	
99.99 Hz	1.0%rdg ± 10dgt	1.0%rdg ± 10dgt	1.0%rdg ± 10dgt	0.01Hz
999.9 Hz	0.3%rdg ± 3dgt	0.3%rdg ± 3dgt	0.3%rdg ± 3dgt	0.1Hz
9.999kHz				1Hz
99.99kHz		0.5%rdg ± 5dgt	0.5%rdg ± 5dgt	10Hz
999.9kHz		0.5%rdg ± 5dgt	0.5%rdg ± 5dgt(O to 400kHz)	100Hz
		(O to 400kHz)	1.0%rdg ± 10dgt(≥ 400kHz)	

* Sampling Rate : 2 times. sec.

* Input Sensitivity Selection : 10.0mV (400mV Range).

0.100V (4V Range) or 1.00V (40V Range) by RANGE Key.

* Maximum Input Voltage : 350V DC or 250V AC Rms 1 minute.

8. DIODE TESTS (→•)

Test	Resolution	Measurement Current	Open Circuit Voltage
GOOD or BAD	1mV	≤ 4mA	≤ 3.3V

* Maximum Input Voltage : 500V DC or 500V AC Rms.

9. CAPACITANCE (C)

Range	Accuracy	Resolution	Test Voltage
4.000nF	2.0%rdg ± 5dgt	1PF	1V
40.00nF		10PF	
400.0nF		100PF	
4.000 μ F		1nF	
40.00 μ F		10nF	

* Maximum Input Voltage : 500V DC or 500V AC Rms.

10. EXT RANGE (400A AC DC by 660 Clamp Adapter)

Range	Accuracy	Resolution	Max. Input Voltage
~ 400A Range	0.8%rdg ± 1 dgt	0.1A	1V
~ 400A Range	1.5%rdg ± 5dgt		

* Frequency on AC Current Range : 50Hz ~ 400Hz

* The above accuracy is of the digital multimeter itself.

Add the accuracy of the Clamp Adapter to the accuracy.

3. NAME ILLUSTRATION



A. LCD

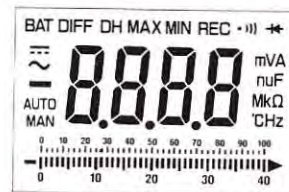


Fig. 1

- BAT : Battery Warning.
- : DC (Direct Current)
- ~ : AC (Alternating Current)
- : - polarity
- AUTO : Autoranging
- MAN : Manual Ranging
- DIFF : Difference Measurements (zero adjustment)
- DH : Display Hold
- DH MIN : Minimum Value Measurement
- DH MAX : Maximum Value Measurement
- REC : Recording, not used
- ||| : Continuity Test Buzzer
- ↔ : Diode Test
- mV, V : Voltage Unit
- mA, A : Current Unit
- nF, μ F : Capacitance Unit
- Ω , k Ω , M Ω : Resistance Unit
- $^{\circ}$ C : Celsius Degree of Temperature, not used.
- Hz, kHz : Frequency Unit
- 0 10 100 : 100% scale of Bar Graph
- 0 10 40 : 40 scale (for 4000 digit) of Bar Graph
- ▶ : Overrange Indication of Bar Graph

B. FUNCTION SWITCH

This switch selects Power-on, off, Measuring Elements and Current Ranges.

- a. OFF Position : Battery Power turns off.
- b. ~ V Position : AC Voltage Measurements (0 to 750V).

- c. $\overline{\text{V}}$ Position : DC Voltage Measurements (0 to 1000V).
- d. Hz Position : Frequency Measurements (10 to 999.9kHz).
- e. Ω / \bullet Position : Resistance Measurements (0 to 40M Ω) or Continuity Tests (40 Ω less) by Buzzer.
- f. \rightarrow / C Position : Diode Tests or Capacitance Measurements (0 to 40 μ F).
(SK-6150 is \rightarrow only)
- g. EXT Position : 400A AC/DC measurements by using 660 AC/DC Clamp Adapter.
- h. 20A Position : 20A AC/DC Range.
- i. 400mA Position : 400mA AC/DC Range.
- j. 40mA Position : 40mA AC/DC Range.
(SK-6155 only)
- k. 4mA Position : 4mA AC/DC Range.
(SK-6155 only)

CAUTION : Set this FUNCTION Switch to OFF position whenever measurements are finished.

C. DH Key

Press DH key to hold display. DH sign turns on on LCD. To cancel DH key, press DH key again. DH sign disappears.

NOTE : Auto Power-off Function does not work when DH key is on.

D. MIN/MAX Key

When measurement is being made, the first press of MIN/MAX key displays DH MIN sign and minimum value on LCD. The minimum value will be renewed during measurement. The second press of this key displays DH MAX sign and maximum value on LCD. The third press of this key cancels this key and displays normal measurement value. Each press of this key works in this order.

NOTE : DH MIN or DH MAX can be set before connecting Test Leads to the circuit being measured.

E. DIFF key

DIFF Key is used to make Difference Measurements and Zero Adjustment.

1. DIFFERENCE MEASUREMENTS

When measuring a value or applying a desired value into the instrument, press DIFF key and the input value is stored and converted to read zero plus or minus one digit on LCD with DIFF sign displayed.

The difference between the stored value and a measuring value is displayed on LCD with proceeding measurements.

Input Value stored = X_0
Measuring Value proceeding = X_n
Difference = $X_n - X_0$

The stored Input Value is renewed with each press of DIFF Key. To cancel DIFF Key, press this key for two seconds.

EXAMPLE : When applying a desired value of 20.00V DC on DC Voltage Range, the display will change as follows.

[OPERATION]	[DISPLAY]
20.00V DC is applied	20.00V DC
Press DIFF key.	0.00V DC
If 35.00V is measured	15.00V DC
If 10.00V is measured	-10.00V DC

NOTE : DH Key works when DIFF Key is operating.

But, DIFF Key does not work when DH Key is operating.

NOTE : The Maximum Input Values are the same even when DIFF Key is operating. Do not make measurements that will exceed the maximum input values.

2. ZERO ADJUSTMENT

ZERO ADJUSTMENT is not necessary in usual measurements. But, it is sometimes useful to compensate the small resistance value of the Test Leads being used or to keep the instrument out of error under noisy circumstances. Short Test Prods of Test Leads inserted into INPUT Terminals together, and then press DIFF Key to read zero plus or minus one digit on LCD. "DIFF" sign appears on LCD.

To cancel "DIFF" sign, press DIFF Key again, "DIFF" sign disappears on LCD.

F. RANGE Key (Range Selection)

When measuring Voltage AC/DC, Resistance or Capacitance (SK-6155), press RANGE Key to select a desired range.

When FUNCTION Switch is set to desired range, the initial range setting is Autoranging with AUTO sign displayed on LCD. When selecting Manual Ranging, there are two ways.

1. Before taking measurements (Test Leads are not yet connected to the circuit being measured.), press RANGE Key several times watching the movement of the decimal point until desired range is selected. The decimal point and the range move from the lowest range to the highest range and circulate with each press of RANGE Key.

- When measuring in autoranging, press this key. The range to which the measuring value belongs is held. For example, when 100V AC is measured, 400V AC range is held.
To cancel Manual Ranging, press RANGE Key for two seconds.
AUTO sign turns on again.

G. DC/AC Ω / \cdot \rightarrow /C Key

- DC/AC Key : Press this key to select DC or AC when FUNCTION Switch is set to Current Range or EXT Range.
- Ω / \cdot Key : Press this key to select Ω or \cdot (Continuity Test Buzzer) when FUNCTION Switch is set to Ω / \cdot position.
- \rightarrow /C Key : Press this key to select \rightarrow (Diode Tests) or C (Capacitance) when FUNCTION Switch is set to \rightarrow /C position.

H. INPUT Terminals

- V·Hz· Ω · \cdot · \rightarrow ·C Terminal : Insert Red Test Plug of Test Leads into this Terminal when measuring Voltage, Frequency, Resistance, Continuity Tests, Diode and Capacitance (SK-6155 only)
- COM Terminal : This Terminal is used in common for all measurements.
Insert Black Test Plug of Test Leads into this Terminal.
- mA-EXT Terminal : Insert Red Test Plug of Test Leads or Clamp Adapter into this Terminal when measuring Current up to 400mA AC/DC or 400A AC/DC using AC/DC Clamp Adapter.
- 20A Terminal : Insert Red Test Plug of Test Leads into this Terminal when measuring Current up to 20A AC/DC.

4. SAFETY PRECAUTIONS

Correct Knowledge about electric measurements is necessary since electric measurements is sometimes a very dangerous work .

To eliminate possibility of injury to operator and damage to the instrument and equipment, the following precautions and measurement procedures are recommended. Mis-use, abuse and carelessness cannot be prevented by any written word and is fully the operator's responsibility. Observing the following precautions, take safe measurements.

- Maximum Input Observance** : Do NOT attempt to take any measurements that might exceed the specified maximum input value of this instrument.
- Test Leads Disconnection** : Prior to changing FUNCTION Switch to another function during measurement, or opening Rear Case for replacement of batteries or fuses, always disconnect Test Leads from the circuit being measured.
- Warning for High Voltage Measurements** : When measuring high voltage, do not hold this instrument with your hands, and take safety distance from the power sources or the circuit to prevent any part of your body from touching high voltage.
- Maintenance Inspection** : Before every measurement, do not fail to inspect that the body of this instrument and the handle insulators of the test leads have no cracks nor any other damage on it. Make sure that the body and the handle insulators are free of dust, grease and moisture.

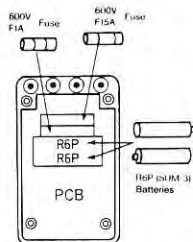
5. MEASUREMENT PROCEDURE

5-1. PREPARATION FOR USE

- INSTRUCTION MANUAL** : Read this instruction manual carefully and familiarize yourself with specifications and functions of this instrument.
Especially read and observe strictly the "4. SAFETY PRECAUTIONS".
- BATTERIES** : Remove Rear Case unscrewing the four screws and place two new batteries 1.5V R6P (SUM-3 or AA) in the Battery Case.
NOTE : When opening Rear Case, do not touch inner components, and use care not to stamp inner lead wires when replacing Rear Case.
- FUSES** : To protect the instrument against overload, two fuses are installed in the Fuse Case, one is for mA ranges and another is for 20A range.
When placing the batteries, confirm that the fuses are set tightly in the Fuse Holders.
For replacement, use specified ones, fast acting 1A/600V or 15A/600V 10 × 38mm. Also, BBS type 10 × 35mm fuses are usable.
NOTE : If the instrument is used with blown fuses or without fuses, current measurement becomes impossible.



Rear Case



Inside of Front Case

Fig. 2

4. FUNCTION Switch ON : Set this Switch to $\sim V$ position from OFF position.

All segments are displayed on LCD and buzzer sounds.

NOTE : In this case, if LCD is not turned on, batteries might be set in the wrong polarity or battery contacts might be bad.

NOTE : If the instrument is taken out of service for an extended time, remove the batteries from the battery case and store separately.

5. TEST LEADS :

- (1) One pair of Test Leads which consists of a Red Test Lead and a Black Test Lead is furnished with each instrument. Each Test Lead consists of one Test Plug of a short insulator and one Test Prod of a long handle insulator.
- (2) Insert Black Test Plug into COM Terminal and Red Test Plug into V·Hz· Ω · μ ·mV· \rightarrow ·C Terminal, mA·EXT Terminal or 20A Terminal.
- (3) Connect Black and Red Test Prods to the power sources or circuit to be measured. It is good practice to use Black Test Lead for - polarity and Red Test Lead for + polarity.

6. OVERRANGE INDICATION

When making measurements, if input value exceed the maximum value of the range being used, 4000 digits or 9999 digits on Hz range, MSD "4" ("9" on Hz range) blinks.

NOTE : When measuring voltage in Autoranging or on the highest range in Manual-ranging, Overrange Indication is not shown on LCD even if input voltage exceed the maximum input voltage of 750V AC or 1000V DC. To avoid injury to operator and damage to the instrument, do not make measurement that might exceed the maximum input voltage.

5-2. AC VOLTAGE ($\sim V$) MEASUREMENTS

WARNING

Maximum Input Voltage of $\sim V$ Range is 750V Rms.

Overrange Indication is not shown, even if an input greater than 750V Rms is measured.

Do NOT attempt to make any ac voltage measurements that might exceed 750V Rms to avoid electrical shock hazard and/or damage to the instrument.

1. Insert Black Test Plug of Test Leads into COM Terminal and Red Test Plug into V·Hz Terminal.
2. Set FUNCTION Switch to $\sim V$ position.
3. Connect Black Test Prod to the negative side of the circuit being measured and Red Test Prod to the positive side of the circuit.

NOTE : When taking voltage measurements, always connect the instrument **IN PARALLEL** with the circuit being measured.

NOTE : If desired for safety, use Alligator Clips connected with Test Leads.

4. Read the ac voltage on LCD.

5. RANGE Key.

- a. Before measurements, press RANGE Key several times to select a desired range watching the movement of Decimal Point. MAN sign appears and the range is held.
- b. When measuring, press RANGE Key. A range to which the measurement value belongs is held.

To cancel RANGE HOLD, press RANGE Key for two seconds. MAN sign disappears and AUTO sign appears. Refer to "4. F. RANGE Key."

NOTE : When DH Key is operating, RANGE Key does not work. Use RANGE Key prior to DH Key.

NOTE : When in Autoranging, AC 400mV range does not work. In case AC 400mV range is required, use RANGE Key.



Fig. 3

6. **DIFF Key** : Press DIFF Key when measuring a value or applying a desired value into the instrument. The reading value is stored and converted to read zero plus or minus one digit on LCD.

DIFF sign appears and a difference value from the stored value is shown with proceeding measurements.

The stored value is renewed every time DIFF Key is pressed.

To cancel DIFF Key, press DIFF Key for two seconds.

Refer to "3. E. DIFF Key".

NOTE : When DH Key is operating, DIFF Key cannot be cancelled.

Cancel DH Key first and then press DIFF Key for two seconds.

DIFF sign disappears and DIFF Key is cancelled. In this case, MAN sign is still displayed and in Manual-ranging.

To select Autoranging, press RANGE Key for two seconds.

7. **MIN/MAX Key** : When measuring, the first press of this Key displays MAN DH MIN sign, hold a range and start minimum value measurements.

The second press of this Key displays MAN DH MAX sign and starts maximum value measurements. The third press of this Key turns off DH MAX sign, but MAN sign still remains. MIN/MAX Key is cancelled and returns to an ordinary ac voltage measurements with the range still held. Refer to "3. D. MIN/MAX Key".

NOTE : To turn off MAN DH MIN or MAN DH MAX sign and to return to Autoranging, press RANGE Key for two seconds.

8. **DH Key** : To hold display on LCD when measuring, press DH Key.

DH Key works when RANGE Key, DIFF Key or MIN/MAX Key is operating.

To cancel DH Key, press it again.

5-3. DC VOLTAGE (~ V) MEASUREMENTS

WARNING

Maximum Input Voltage of $\overline{\text{---}}$ V Range is $\pm 1000\text{V}$ DC.

Overrange Indication is not shown, even if an input greater than 1000V is measured.

Do NOT attempt to make any dc voltage measurements that might exceed 1000V DC to avoid electrical shock hazard and/or damage to the instrument.

1. Insert Black Test Plug into COM Terminal and Red Test Plug into V·Hz Terminal.
2. Set FUNCTION Switch to $\overline{\text{---}}$ V position.

NOTE : In this case of without input, random numerals and bargraph movements are displayed on LCD. But, this is a normal phenomenon and not a trouble with this instrument.

This is caused by the high impedance greater than 100M ohms of the 400mV DC range.

3. Connect Black Test Prod to the negative side of the circuit being measured and Red Test Prod to the positive side of the circuit.

NOTE : When taking voltage measurements, always connect the instrument **IN PARALLEL** with the circuit being measured.

4. Read the dc voltage on LCD.

5. **RANGE Key, DIFF Key, MIN/MAX Key** and **DH Key** are available in the same way as in "5-2. AC VOLTAGE (~ V) MEASUREMENTS".



Fig. 4

5-4. CURRENT (~ A or $\overline{\text{---}}$ A) MEASUREMENTS

WARNING

Maximum Input Current of mA Range is 400mA AC or DC, and that of 20A Range is 20A AC or DC (measure 10A to 20A within 30 seconds).

Overrange Indication is not shown, even if an input greater than 20A is measured.

Use extreme caution not to measure voltage on the current ranges.

1. Insert Test Plugs of Test Leads into INPUT Terminals as follows.

a. 400mA and less : Insert Black Test Plug into COM Terminal and Red Test Plug into mA Terminal.

b. 20A Range : Insert Black Test Plug into COM Terminal and Red Test Plug into 20A Terminal.

2. Set FUNCTION Switch to a desired range, mA or 20A ranges.
3. Press DC/AC Key to select DC or AC.

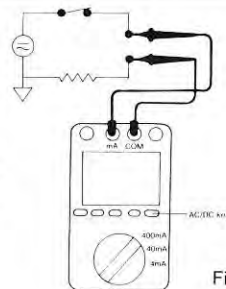


Fig. 5

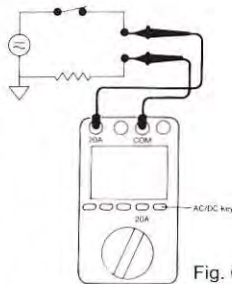
4. Remove power to the circuit being measured and open the circuit in which current is to be measured.

5. Connect Black Test Prod to the negative side of the circuit being measured and Red Test Prod to the positive side.

NOTE : When taking current measurements, always connect the instrument **IN SERIES** with the circuit being measured.

NOTE : Use Alligator Clips connected with Test Prods when desired.

6. Apply power to the circuit being measured and read the current on LCD.
7. Remove all power to the circuit being measured and discharge all capacitors.
8. Disconnect Test Prods of Test Leads from the circuit and reconnect the circuit that was being measured.
9. **DIFF Key, MIN/MAX Key and DH Key** are available in the same way as in "5-2. AC VOLTAGE (~ V) MEASUREMENTS".
RANGE Key does not work on current ranges as they consist of only one range.



5-5. RESISTANCE (Ω) MEASUREMENTS

WARNING

Maximum Overload Voltage of Ω Range is 500V DC or 500V Rms.
Do NOT apply voltage on Ω ranges by mistake when measuring resistance.
Before taking any in-circuit resistance measurements, remove power to the circuit being measured and discharge all capacitors in the circuit.

1. Insert Black Test Plug into COM Terminal and Red Test Plug into $\Omega \cdot \cdot \cdot \cdot$ Terminal.
2. Set FUNCTION Switch to $\Omega / \cdot \cdot \cdot \cdot$ position.
3. Press $\Omega / \cdot \cdot \cdot \cdot$ (DC/AC) Key to select Ω . AUTO M Ω appears on LCD with 4 of the first digit blinking.
4. If the resistance being measured is connected in a circuit, remove power to the circuit being measured and discharge all capacitors.

5. Connect Test Prods of Test Leads to the circuit being measured and read the resistance on LCD.

NOTE : If measurements are unstable when measuring high resistance greater than 1M ohms, use Measuring Cable with shield.

6. **RANGE Key, DIFF Key, MIN/MAX Key and DH Key** are available in the same way as in "5-2. AC VOLTAGE (~ V) MEASUREMENTS".

5-6. CONTINUITY ($\cdot \cdot \cdot \cdot$) TESTS

WARNING

Maximum Overload Voltage of $\cdot \cdot \cdot \cdot$ Range is 500V DC or 500V Rms.
Before making continuity tests, remove power to the circuit being tested and discharge all capacitors in the circuit.

1. Insert Black Test Plug into COM Terminal and Red Test Plug into $\Omega \cdot \cdot \cdot \cdot$ Terminal.
2. Set FUNCTION Switch to $\Omega / \cdot \cdot \cdot \cdot$ position.
3. Press $\Omega / \cdot \cdot \cdot \cdot$ (DC/AC) Key to select $\cdot \cdot \cdot \cdot$. $\cdot \cdot \cdot \cdot$ MAN Ω sign appears on LCD with 4 of the first digit blinking.
4. Connect Test Prods of Test Leads to the circuit being tested.
Range is held on 400 Ω range and buzzer sounds less than 40 ohms.

5-7. FREQUENCY (Hz) MEASUREMENTS

WARNING

Maximum Overload Voltage of Hz Range is 350V DC or 250V Rms for one minute.
Do NOT attempt to measure frequency that might exceed the above Maximum Overload Voltage to avoid electrical shock hazard and/or damage to the instrument.

1. Insert Black Test Plug into COM Terminal and Red Test Plug into V \cdot Hz Terminal.
2. Set FUNCTION Switch to Hz position.
3. Press RANGE Key to select Input Sensitivity of 10.0mV (400mV range), 0.100V (4V range) or 1.00V (40V range).
4. Connect Test Prods of Test Leads to the circuit being measured.
NOTE : In case of frequency measurements, connect the instrument **IN PARALLEL** with the circuit being measured.

5. Read the frequency on LCD.
6. **DIFF Key, MIN/MAX Key and DH Key** are available in the same way as in "5-2. AC VOLTAGE (~ V) MEASUREMENTS".

5-8. DIODE (→|←) TESTS

WARNING

Maximum Overload Voltage of Diode Tests is 500V DC or 500V Rms.

Test Voltage of 3V DC is applied on diodes and transistors (between Emitter and Base Junction) and approx. 4mA DC is flowed keeping Forward Voltage to be 0.6V. Under this condition, Forward Voltage (V_F) is measured. At the same time, Reverse Voltage (V_R) is measured and diodes and transistors are judged to be good or bad.

1. Insert Black Test Plug into COM Terminal and Red Test Plug into →|← Terminal.
2. Set FUNCTION Switch to →|← (→|← /C SK-6155) position.
3. (SK-6155 only) : Press →|← /C Key to select →|← .
←|→ MAN V is displayed on LCD.
4. In case of diode, connect Black Test Prod to Cathode and Red Test Prod to Anode of the diode being measured. Read V_F , the forward voltage on LCD. In case of transistor, connect Test Prods to Emitter Pin and Base Pin depending on PNP or NPN type transistor being measured. Refer to the following figures.

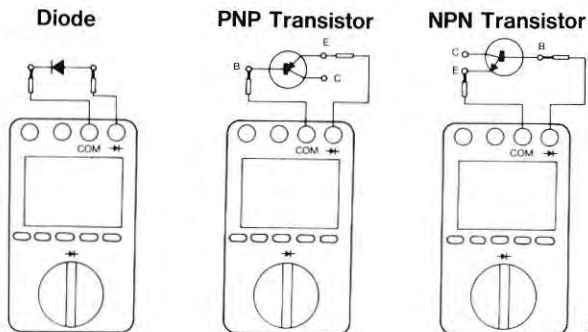


Fig. 7

In case of Silicon Diode, V_F reads about 0.5V to 0.8V. If the diode is defective and in short condition, V_F reads nearly 0V, and if the diode is in open condition, V_F reads nearly 3V.

NOTE : In case Germanium Diode except Point Contact Type, V_F reads about 0.2V to 0.4V. Point Contact Diode shows different value from its characteristic.

5. Reverse Test Prods connections to the device being measured. If the diode is good, V_F reads nearly 3V, the same value in open condition, and if the diode is defective and in short condition, V_F reads nearly 0V.

5-9. CAPACITANCE (C) MEASUREMENTS (SK-6155 only)

WARNING

Maximum Input Voltage of Capacitance Measurements is 500V DC or 500V Rms.

When measuring a condenser in a circuit, always turn off power to the circuit and discharge the condenser to be measured.

1. Set FUNCTION Switch to →|← /C position.
2. Press →|← /C (DC/AC) Key to select C. nF and AUTO sign appear on LCD.
3. Discharge the condenser being measured by briefly shorting the both ends.
4. Connect the both end leads to COM and C Terminals and press RANGE Key. A suitable range to the capacitance is held.

NOTE : In case capacitance value is approximately known, just press RANGE Key to select a desired range seeing the movement of decimal point.

5. Disconnect the condenser from the Terminals. In this case, when a range less than 40nF is selected, a random floating capacitance is shown on LCD. Therefore, press DIFF Key to delete it and display 0 ± 1 digit on LCD.
6. Connect the condenser again to COM and C Terminals and read the capacitance on LCD.

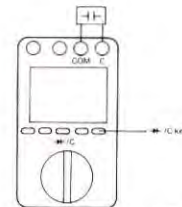


Fig. 8

NOTE : In case of measurements greater than 400nF, insert Test Prods of Test Leads into COM and C Terminal.
Then, capacitance can be measured using the Test Prods.
In this case, follow the above 1. 2. 3. procedures.

7. **RANGE Key, DIFF Key, MIN/MAX Key and DH Key** are available in the same way as in "5-2. AC VOLTAGE (\sim V) MEASUREMENTS".

5-10. EXT RANGE (400A AC/DC by AC/DC Clamp Adapter)

WARNING

EXT Range is an exclusive range for 660 AC/DC Clamp Adapter.
Maximum Input is 1V/400A.
Do not make measurements that might exceed the maximum input.

1. Insert Black Test Plug of 660 AC/DC Clamp Adapter into COM Terminal and Red Test Plug into EXT Terminal.
2. Set POWER/RANGE Switch of 660 to a desired range, 40A or 400A.
3. Set FUNCTION Switch to EXT position.
4. Press DC/AC Key to select DC or AC.
5. Open the clamp head of Clamp Adapter and clamp on a single conductor.
NOTE : When measuring dc current, check the polarity of the conductor being measured and clamp on it according to the \downarrow mark (plus polarity to minus) on the clamp head.
6. Read the current on LCD. In case of 40A range, read it divided by 10.
7. **DIFF Key, MIN/MAX Key and DH Key** are available in the same way as in "5-2. AC VOLTAGE (\sim V) MEASUREMENTS".
NOTE : **RANGE Key** does not work on EXT Range as it consists of one range.

6. MAINTENANCE

6-1. WARRANTY STATEMENT

The warranty statement for the Digital Multimeter SK-6150 and SK-6155 is printed on the last page of the manual. Read it carefully before requesting a warranty repair.

6-2. BATTERY AND FUSE REPLACEMENT

WARNING

To prevent electrical shock/hazard, turn off power and disconnect Test Leads before removing Rear Case.

A. Battery Replacement

1. If the batteries are worn-out, LCD display becomes faint and BAT sign blinks.
In this case, replace the battery with fresh ones.
2. Remove Rear Case unscrewing the 4 screws.
3. Take out the worn-out batteries from Battery Case and place fresh 1.5V R6P (SUM-3, AA or any equivalent) batteries in Battery Case.
Be careful of the battery polarity when replacing.
4. Replace Rear Case and screw the 4 screws.

NOTE : If the instrument is taken out of service for an extended time, remove the battery from the instrument and store separately.

B. Fuse Replacement

1. Two fuses are installed. 1A/600V fuse is for protecting mA range and 15A/600V is for 20 A range. If one of them is blown, the range concerned becomes null.
2. Remove Rear Case same as battery replacement.
3. Take out the blown fuse from Fuse Holder and place a specified one in it.
Fuse for mA Range : Fast acting 1A/600V, 10 \times 38mm
Fuse for 20A Range : Fast acting 15A/600V, 10 \times 38mm
CAUTION : Always use fuses that have the same specifications as above.
4. Replace Rear Case and screw the 4 screws.

6-3. CALIBRATION

In order to maintain the specifications described in page 3 to 8, it is recommended that the instrument may be calibrated once each year and/or after it is repaired. Calibration service is available at KAISE AUTHORIZED SERVICE AGENCY through your local dealer at a cost basis charge.

6-4. REPAIR

Repair service, warranty or non-warranty, is available at KAISE AUTHORIZED SERVICE AGENCY through your local dealer. Warranty repair is executed free of charge, but non-warranty repair is charged on the cost basis.

Pack the instruments securely in its original carton together with descriptions of your name, address, telephone number, problem encountered and the service required, and ship prepaid to your local dealer.

When the instrument does not operate properly, the following steps should be taken before returning the instrument for repair, warranty or non-warranty.

1. Check the battery and fuse connection.
2. Check the battery if it is alive and usable.
3. Check the fuse if it is not blown.
4. Make sure that every switch is set at correct position for the measurement being taken.
5. Make sure that input voltage or current is within maximum input value on each range.
6. Make sure that the body of this instrument and the handle insulators of the test leads have on cracks nor any other damage on them.
7. Be careful of noise from the equipment under test or the ambient environment in which the instrument is being used. The instrument is fully shielded against noise, but may read error due to very strong noise.

WARRANTY

The Digital Multimeter of SK-6150/6155 series is warranted in its entirety against any defects of material or workmanship under normal use and service within a period of six months after the date of purchase of the instrument by the original purchaser. This warranty is extended by **KAISE AUTHORIZED DEALER** only to original purchaser or original user of the instrument on condition that the Warranty Registration Card is completed and returned to the authorized dealer within two weeks after the purchase of the instruments new from the dealer.

The obligation under this warranty to be executed by **KAISE AUTHORIZED DEALER** is limited to repairing or replacing the Digital Multimeter of SK-6150 or SK-6155 returned intact to it, with transportation charge prepaid, and which to its satisfaction is judged by it to have been thus defective. **KAISE AUTHORIZED DEALER** and **KAISE CORPORATION**, the manufacturer shall not otherwise be liable for any damages or loss, consequential or otherwise. The foregoing warranty is exclusive and in lieu of all warranties including any warranty of merchantability, whether expressed or implied.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside **KAISE AUTHORIZED SERVICE AGENCY**, nor which have been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

KAISE AUTHORIZED DEALER