

表 4

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Product specifications and appearance are subject to change without notice due to continual improvements.

70-1201-7720-2 1606

表 1

kaise

AC/DC DIGITAL CLAMP METER

Instruction Manual

SK-7720
SK-7722



KAISE CORPORATION

SK-7720

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1. INTRODUCTION

A. GENERAL

The models SK-7720/7722 are quite a new type of Digital Clamp Meters which can measure different 2 elements at a time and display them on a bigger Dual Display LCD. When measuring current, simply clamp on the conductor to be tested with the clamp head. Both the models are very useful and versatile clamp meters designed for testing and maintaining multifarious electric/electronic appliances, equipments and facilities and also designed with feasibility in mind for checking electric systems of motorcars.

B. FEATURES

- 1. WIDE RANGING :** 1000A AC/DC and 650V AC/DC (SK-7720) or 250V AC/DC (SK-7722). Frequency, Resistance, Temperature Measurements are available.
- 2. 4000 COUNT AND DUAL DISPLAY LCD:** Unit and various signs are shown.
- 3. TRUE RMS MEASUREMENTS:** Measurements can be made accurately by True Rms for AC voltage and current even if the signals are dissimilar to sinewaves.
- 4. FREQUENCY · DUTY CYCLE · PULSE WIDTH MEASUREMENTS:** Very useful for checking controlling systems of motorcars as well as apparatus and equipments.
- 5. DISPLAY HOLD, PEAK/MAX/MIN and DIFFERENCE MEASUREMENTS:** Each function works simultaneously on 2 channels. Max/Min values are shown in 4 combinations.
- 6. DUST-PROOF AND WATER-RESISTANT CASES:** The first clamp meters in the world that provided DUST-PROOF and WATER-RESISTANT cases made of high heat resistant ABS.
- 7. SAFETY DESIGN:** SK-7720 has been designed according to IEC Publications 348.

2. SPECIFICATIONS

2-1. SPECIFICATIONS OF MODEL SK-7720

$\overline{A} + \overline{V}$ (DC CURRENT+DC VOLTAGE)

	Range	Resolution	Accuracy	Input Resistance	Max. Input Current/Voltage
\overline{A}	400.0A	0.1A	$\pm 1.5\%rdg \pm 3dgt$		1100A 600V line
	1000A (400~600A)	1A	$\pm 1.5\%rdg \pm 1dgt$		
	(601~1000A)		$\pm 3\%rdg \pm 3dgt$		
\overline{V}	400.0V	100mV	$\pm 1.0\%rdg \pm 3dgt$	approx.	700V
	650V	1V	$\pm 1.0\%rdg \pm 1dgt$	2M Ω	

- Sampling rate is 3.75 times/sec. in ordinary mode, but 15 times/sec. in PEAK/MAX/MIN VALUE MEASUREMENTS and $\pm 1.0\%rdg \pm 3dgt$ is added to the above accuracy.
- Overload Protection : A range 1500A DC for one minute (600V line)
V range 1000V DC for one minute

$\tilde{A} + Hz$ (AC CURRENT+FREQUENCY/DUTY CYCLE/PULSE WIDTH)

True RMS (AC coupled)

	Range	Resolution	Accuracy		Max. Input
			50Hz~60Hz	40Hz~400Hz	Current
\tilde{A}	400.0A	0.1A	$\pm 1.5\%rdg \pm 3dgt$	$\pm 2.5\%rdg \pm 3dgt$	1100A rms 600V line
	1000A (400~600A)	1A	$\pm 1.5\%rdg \pm 1dgt$	$\pm 2.5\%rdg \pm 1dgt$	
	(601~1000A)		$\pm 3\%rdg \pm 3dgt$	$\pm 4\%rdg \pm 3dgt$	

- Crest Factor : less than 3
- Overload Protection : 1500A rms for one minute (600V line)

	Range	Resolution	Accuracy	Gate Time	Input Sensitivity
Hz	10.0Hz~100.0Hz	0.1Hz	$\pm 0.5\%rdg \pm 1dgt$	$\Delta 0.1sec.$	10A (sinewave)
	56Hz~4000Hz	1Hz	$\pm 0.5\%rdg \pm 1dgt$	1sec.	
Duty Cycle	0.0%~99.9%	0.1%	$\pm 3\%rdg \pm 3dgt$	—	10A
Pulse Width	1.0mS~999.9mS	0.1mS	$\pm 0.5\%rdg \pm 3dgt$	—	(sinewave)

\bar{V} + Hz (AC VOLTAGE + FREQUENCY/DUTY CYCLE/PULSE WIDTH)

True RMS (AC Coupled)

	Range	Resolution	Accuracy		Input Resistance	Max. Input Voltage
			50Hz~60Hz	40Hz~400Hz		
\bar{V}	400.0V 650V	100mV 1V	$\pm 1.0\% \text{rdg} \pm 3 \text{dgt}$	$\pm 1.5\% \text{rdg} \pm 3 \text{dgt}$	Approx. 2M Ω	700V rms

- Crest Factor : less than 3
- Overload Protection : 1000V rms for one minute

	Range	Resolution	Accuracy	Gate Time	Input Sensitivity
Hz	10.0Hz~100.0Hz	0.1Hz	$\pm 0.5\% \text{rdg} \pm 1 \text{dgt}$	$\leq 0.1 \text{sec.}$	30V
	95Hz~4000Hz	1Hz		1sec.	(sinewave)
Duty Cycle	0.0%~99.9%	0.1%	$\pm 3\% \text{rdg} \pm 3 \text{dgt}$	—	30V
Pulse Width	1.0mS~999.9mS	0.1mS	$\pm 0.5\% \text{rdg} \pm 3 \text{dgt}$	—	(sinewave)

 Ω (RESISTANCE)

Range	Resolution	Accuracy	Measuring Current	Open Circuit Voltage
4000 Ω	1 Ω	$\pm 1.0\% \text{rdg} \pm 3 \text{dgt}$	Approx. 0.1mA	$\leq 5V$
20.00k Ω	10 Ω	$\pm 1.0\% \text{rdg} \pm 1 \text{dgt}$		

- Overload Protection : 400V rms for one minute

 $^{\circ}\text{C}$ (TEMPERATURE)

Range	Resolution	Accuracy
-30 $^{\circ}\text{C}$ ~150 $^{\circ}\text{C}$	1 $^{\circ}\text{C}$	$\pm 1\% \text{rdg} \pm 3 \text{dgt}$

- The above accuracy is that of DCM only. When measuring, the accuracy of Temperature Probe must be added.
- Overload Protection : 400V rms for one minute

2-2. SPECIFICATIONS OF MODEL SK-7722

 \bar{A} + \bar{V} (DC CURRENT + DC VOLTAGE)

	Range	Resolution	Accuracy	Input Resistance	Max. Input Current/Voltage
\bar{A}	400.0A	0.1A	$\pm 1.5\% \text{rdg} \pm 3 \text{dgt}$		1100A 600V line
	1000A (400~600A) (601~1000A)	1A	$\pm 1.5\% \text{rdg} \pm 1 \text{dgt}$ $\pm 3\% \text{rdg} \pm 3 \text{dgt}$		
\bar{V}	40.00V	10mV	$\pm 1.0\% \text{rdg} \pm 3 \text{dgt}$	Approx. 2M Ω	300V
	250.0V	100mV	$\pm 1.0\% \text{rdg} \pm 1 \text{dgt}$		

- Sampling rate is 3.75 times/sec. in ordinary mode, but 15 times/sec. in PEAK/MAX/MIN VALUE MEASUREMENTS and $\pm 1.0\% \text{rdg} \pm 3 \text{dgt}$ is added to the above accuracy.
- Overload Protection : A range 1500A DC for one minute (600V line)
V range 400V DC for one minute

 \bar{A} + Hz (AC CURRENT + FREQUENCY/DUTY CYCLE/PULSE WIDTH)

True RMS (AC coupled)

	Range	Resolution	Accuracy		Max. Input Current
			50Hz~60Hz	40Hz~400Hz	
\bar{A}	400.0A	0.1A	$\pm 1.5\% \text{rdg} \pm 3 \text{dgt}$	$\pm 2.5\% \text{rdg} \pm 3 \text{dgt}$	100A rms 600V line
	1000A (400~600A) (601~1000A)	1A	$\pm 1.5\% \text{rdg} \pm 1 \text{dgt}$ $\pm 3\% \text{rdg} \pm 3 \text{dgt}$	$\pm 2.5\% \text{rdg} \pm 1 \text{dgt}$ $\pm 4\% \text{rdg} \pm 3 \text{dgt}$	

- Crest Factor : less than 3
- Overload Protection : 1500A rms for one minute (600V line)

	Range	Resolution	Accuracy	Gate Time	Input Sensitivity
Hz	10.0Hz~100.0Hz	0.1Hz	$\pm 0.5\% \text{rdg} \pm 1 \text{dgt}$	$\leq 0.1 \text{sec.}$	10A
	95Hz~4000Hz	1Hz		1sec.	(sinewave)
Duty Cycle	0.0%~99.9%	0.1%	$\pm 3\% \text{rdg} \pm 3 \text{dgt}$	—	10A
Pulse Width	1.0mS~999.9mS	0.1mS	$\pm 0.5\% \text{rdg} \pm 3 \text{dgt}$	—	(sinewave)

$\bar{V} + \text{Hz}$ (AC VOLTAGE + FREQUENCY/DUTY CYCLE/PULSE WIDTH)

True RMS (AC Coupled)

	Range	Resolution	Accuracy		Input Resistance	Max. Input Voltage
			50Hz~60Hz	40Hz~400Hz		
\bar{V}	40.00V	10mV	$\pm 1.0\% \text{rdg} \pm 3 \text{dgt}$	$\pm 1.5\% \text{rdg} \pm 3 \text{dgt}$	Approx. 2M Ω	300V rms
	250.0V	100mV				

- Crest Factor : less than 3
- Overload Protection : 400V rms for one minute

	Range	Resolution	Accuracy	Gate Time	Input Sensitivity
Hz	10.0Hz~100.0Hz	0.1Hz	$\pm 0.5\% \text{rdg} \pm 1 \text{dgt}$	$\leq 0.1 \text{sec.}$	5V
	65Hz~4000Hz	1Hz		1sec.	(sinewave)
Duty Cycle	0.0%~99.9%	0.1%	$\pm 3\% \text{rdg} \pm 3 \text{dgt}$	—	5V
Pulse Width	1.0mS~999.9mS	0.1mS	$\pm 0.5\% \text{rdg} \pm 3 \text{dgt}$	—	(sinewave)

 \square (RESISTANCE)

Range	Resolution	Accuracy	Measuring Current	Open Circuit Voltage
4000 Ω	1 Ω	$\pm 1.0\% \text{rdg} \pm 3 \text{dgt}$	Approx. 0.1mA	$\leq 5\text{V}$
20.00k Ω	10 Ω	$\pm 1.0\% \text{rdg} \pm 1 \text{dgt}$		

- Overload Protection : A range 400V rms for one minute

 $^{\circ}\text{C}$ (TEMPERATURE)

Range	Resolution	Accuracy
$-30^{\circ}\text{C} \sim 150^{\circ}\text{C}$	1 $^{\circ}\text{C}$	$\pm 1\% \text{rdg} \pm 3 \text{dgt}$

- The above accuracy is that of DCM only. When measuring, the accuracy of Temperature Probe must be added.
- Overload Protection : 400V rms for one minute

ANALOG OUTPUT

	Output Voltage	Accuracy	Output Resistance
DC 1000A	DC 1V f.s.	0~600A : $\pm 2.5\% \text{rdg} \pm 2 \text{mV}$	Approx. 200 Ω
		601~1000A : $\pm 4.0\% \text{rdg} \pm 2 \text{mV}$	
DC 250V	DC 2.5V f.s.	$\pm 2.0\% \text{rdg} \pm 2.5 \text{mV}$	
AC 1000A (50~60Hz)	AC 1V f.s.	0~600A : $\pm 3.0\% \text{rdg} \pm 2 \text{mV}$	
		601~1000A : $\pm 5.0\% \text{rdg} \pm 2 \text{mV}$	
AC 250V (50~60Hz)	AC 2.5V f.s.	$\pm 2.5\% \text{rdg} \pm 2 \text{mV}$	

- When Frequency is between 40Hz and 400Hz (except 50Hz to 60Hz) on 1000A AC or 250V AC range, $1.0\% \text{rdg} \pm 3 \text{dgt}$ must be added to the above accuracy.

2-3. GENERAL SPECIFICATIONS

1. DISPLAY:

- Numerical Display: Dual Display 4000 Count LCD, Max 9999.

b. Unit and signs:

Channel 1: mV, V, mA, A, Ω , k Ω , $^{\circ}\text{C}$, BAT, AUTO, DH, DIFF, REC, P, MAX, MIN, —, —, —

Channel 2: mV, V, Hz, mS, %, DIFF, REC, MAX, MIN, —, —, —

2. OPERATING PRINCIPLE: Dual Slope Integration

3. RANGE SELECTION: Autorange "AUTO" sign shows.

4. SAMPLING RATE: 16 times/sec (each channel). But, 3.75 times/sec. for $\bar{A} + \bar{V}$ measurement in ordinary mode.

5. POLARITY: Autopolarity, "—" sign when minus.

6. OVERLOAD INDICATION: "OL" sign blinks.

7. BATTERY WARNING: "BAT" sign shows.

8. DISPLAY HOLD (DH): Data are held by DH Key and "DH" sign shows.

9. PEAK/MAX/MIN VALUE MEASUREMENTS (REC): Max/Min readings on two channels. Peak/Max/Min readings are available for $\bar{A} + \bar{V}$ and $\bar{A} + \text{Hz}$ measurements.

10. DIFFERENCE MEASUREMENTS (DIFF): Desired value being measured is converted to read zero on LCD and only difference is shown with preceding measurements. DIFF sign shows.

11. DUTY CYCLE (DUTY): When measuring \bar{A} or \bar{V} and Frequency(Hz) is shown, first press of DUTY Key shows Duty Cycle (%). Second press shows Pulse Width (mS) in High Level, third press shows Pulse Width (mS) in Low

Level and fourth press returns to Frequency (Hz) measurements.

12. OUTPUT TERMINAL(SK-7722 only):

When measuring $\bar{A} + \bar{V}$, $\bar{A} + \text{Hz}$ or $\bar{V} + \text{Hz}$, Output Terminal can be connected to Oscilloscope or Recorder to observe waveform or record the data.

Stereo Mini Jack (3.5mm ϕ) is used for OUTPUT Terminal.

Output Voltage: 1000A AC/DC --- AC/DC 1V f.s.

250V AC/DC --- AC/DC 2.5V f.s.

Output Resistance: approx. 200 Ω

Output Accuracy: DC 0~600A, $\pm 2.5\%/rdg \pm 2mV$

DC 0~250V, $\pm 2.0\%/rdg \pm 2.5mV$

13. OVERLOAD PROTECTION:

- a. \bar{A} : 1800A AC/DC for one minute, 800V line
- b. \bar{V} : SK-7720; 1000V rms AC/DC for one minute
SK-7722; 400V rms AC/DC for one minute
- c. $\Omega / ^\circ C$: 400V rms AC/DC for one minute

14. DIELECTRIC STRENGTH:

SK-7720 : 4kV AC for 1 minute (between the case and the Terminals) according to IEC Publications 348.

SK-7722 : 2.2kV AC for 1 minute (between the case and the Terminals) and does not accord to IEC Publications.

15. MAXIMUM VOLTAGE OF CURRENT LINE: 600V AC/DC

16. OPERATING TEMPERATURE & HUMIDITY: 0°C~40°C less than 80% RH in non-condensing.

17. STORAGE TEMPERATURE & HUMIDITY: -20°C~60°C less than 70% RH in non-condensing.

18. POWER SUPPLY: One 9V 6F22(S-006P or NEDA 1604) battery or AC Adapter (procure in each country)

19. BATTERY LIFE: 25 hour continuous operation

20. CONDUCTOR DIAMETER: Max. 38mm ϕ

21. DIMENSIONS & WEIGHT: 200 x 64 x 33 mm, 310g

22. ACCESSORIES: One pair Test Leads (100-57), One 9V Battery 6F22 (S-006P), 1007 Carrying Case, Instruction Manual

23. OPTIONAL ACCESSORIES: 818-02 Temperature Probe, 922 Input Cord for Battery Power (SK-7722 only), 930 Output Cord for Recorder (SK-7722 only), 940 Alligator Clips

3. SAFETY PRECAUTIONS

Correct knowledge about electric measurements is necessary since electric measurement 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.

1. Do NOT attempt to take any measurement of voltage or current higher than the maximum range of the function on this instrument.
2. The instrument performs POWER-ON INITIALIZE automatically with POWER/FUNCTION Switch set to desired position. INITIALIZE cannot be performed exactly if any value of input is being applied to the instrument. Do not fail to set POWER/FUNCTION Switch to desired position with no input value being applied. For details, refer to page 18.
3. Do NOT change POWER/FUNCTION Switch with Test Leads connected to the circuit to be measured.
4. Acquaint yourself with the location of high voltage in the equipment under test or in the circuit to be measured. If there is something wrong with the equipment or the circuit, high voltage leaks from unexpected locations, which may cause the electric shock accidents.
5. When making measurements, take safety distance from the power supply or the circuit to prevent any part of your body from touching high voltage.
6. Do NOT fail to confirm before every measurement that the body of this instrument and the handle insulators of the Test Leads attached to the instrument 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.
7. Keep the instrument away from strong noise which may sometimes cause random display or measurement error.
8. This instrument is NOT APPROVED for use in explosive atmosphere, vapor or dust.

4. NAME ILLUSTRATION



A. POWER/FUNCTION Switch

Power and Functions are selected easily by a single-deck ROTARY Switch. Set POWER/FUNCTION Switch to desired position. Do NOT fail to set this Switch to OFF position after measurements.

B. DH Key

Press DH Key to hold displays of both CH1 and CH2 on LCD. DH sign is shown. When measuring OHM or °C, the display of CH1 is held only. To cancel this Key, press it again and DH sign disappears.

NOTE: When DH Key is operating, REC Key, DIFF Key and DUTY Key do not work. (But, REC Key works to make Max/Min value display if REC Key is pressed before DH Key is pressed)

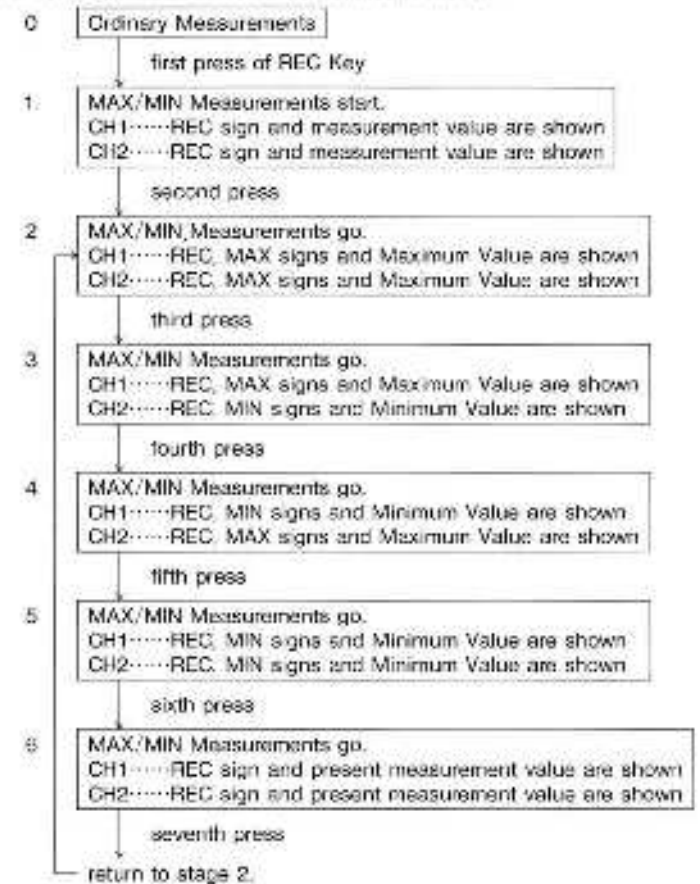
C. REC Key

REC Key operates in two modes. In the first mode, Maximum and Minimum Values are shown on LCD as C-1 Flow Chart. But, in Resistance or Temperature Measurements, Maximum and Minimum Values are shown on CH1 only.

In the second mode, Peak Value of AC / DC current for CH1 can be measured in $\bar{A} + \bar{V}$ and $\tilde{A} + \text{Hz}$ measurements. Peak, Maximum and Minimum Values are shown on LCD as C-2 Flow Chart.

C-1. CH1 MAX/MIN + CH2 MAX/MIN MEASUREMENT MODE

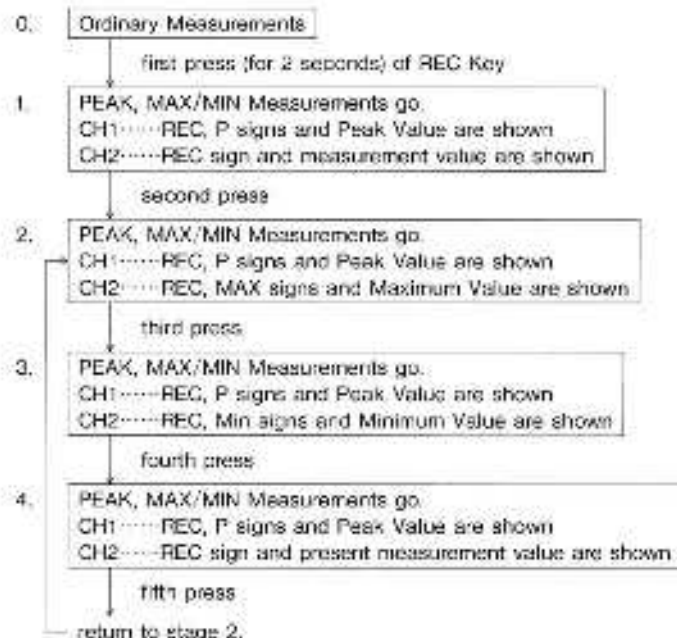
Press REC Key (within one second) to enter this mode.



C-2. CH1 PEAK + CH2 MAX/MIN MEASUREMENT MODE

(In \bar{A} + \bar{V} and \bar{A} + Hz measurements. AC peak for CH1 in \bar{A} + Hz.)

Press REC Key (for two seconds) to enter this mode.



Note: To make Battery Test when starting engine of automobile, enter this mode C-2, and select "3. CH1 REC P + CH2 REC MIN". Peak Current and Minimum Voltage of battery can be measured.

C-3. DH Key Operation

If DH Key is pressed when REC Key is operating, measuring and recording new measurement values are stopped. In this case, the measurement value at that time, maximum and minimum values till that time are recorded, and they are displayed each time REC Key is pressed.

To cancel DH Key, press DH Key again. Measurements return to ordinary REC Key mode.

C-4. REC Key Cancellation

To cancel this Key, press it for more than 2 seconds. REC Key cannot be cancelled if DH Key is operating.

C-5. DIFF Key Operation

DIFF Key can not operate when REC Key is operating.

While REC Key can operate and PEAK/MAX/MIN Measurements are available when DIFF Key is operating.

DIFF key can operate in "Peak mode" of C-2. (current only)

D. DIFF Key

DIFF Key provides Zero Adjustment as well as Difference Measurements.

DIFF Key works on 2 channels at a time. But, when measuring Resistance or Temperature, it works on CH1 only.

D-1. ZERO-Adjustment

The instrument performs POWER-ON INITIALIZE automatically with POWER/FUNCTION Switch set to desired position.

If INITIALIZE is performed exactly, LCD will display 0+1 digit.

But, sometimes LCD displays 3-4 digits due to residual magnetism on the clamp head. In this case, click CLAMP HEAD slightly several times.

If not yet effective, press DIFF Key, and LCD will display 0+1 digit with DIFF sign shown.

NOTE: Generally, start measurements to see 0+1 digit on LCD. But, the specified accuracy is ensured even if measurement are made with 3 to 4 digits remained.

D-2. Difference Measurements

When measuring a desired value or applying a desired value on the instrument, press DIFF Key, and the desired value is stored and converted to display zero plus or minus one digit on LCD. DIFF sign appears on LCD. The difference between measuring value and stored value is displayed on LCD with succeeding measurements.

Note: When DIFF sign is shown on LCD, If DIFF Key is pressed again, the measurement value then is stored and displayed 0+1 digit.

Note: + difference is displayed if a measurement value is larger than the stored value, and - difference when that is smaller. In case of + difference, + sign is implied.

Note: In case of Difference Measurements, Maximum Input Value must be as follows.

\bar{A} (DC A) or \bar{A} (AC A) : 1000A

\bar{V} (DC V) or \bar{V} (AC V) : SK-7720; 660V
SK-7722; 250V

Ω (Resistance) : 20k Ω (CH1 only)

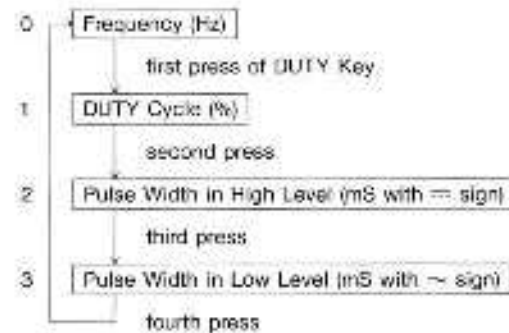
$^{\circ}\text{C}$ (Temperature) : 150 $^{\circ}\text{C}$ (CH1 only)

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

E. DUTY Key

Use DUTY Key when $\tilde{A} + \text{Hz}$ or $\tilde{V} + \text{Hz}$ measurements are being made.

E-1. DUTY Key Mode



(Hold down DUTY key for over a second to return to Frequency (Hz) at once.)

E-2. DUTY CYCLE (%)

Duty Cycle is shown in percent and means the time of input signal that is above the trigger level.

Duty Cycle is used when measuring ON or OFF time of logic or switching controls.

Example: Fuel injection control of automobiles, Dwell angle (use the following formula), air conditioning control or inverter control of motor.

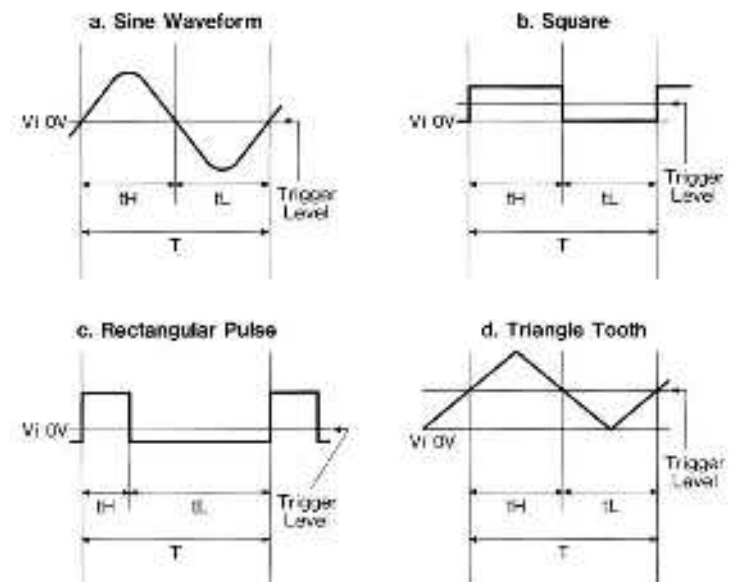
$$\text{Dwell (angle)} = \frac{\text{Duty Cycle(\%)} \times 360 \text{ degrees}}{\text{No. of Cylinders} \times 100}$$

Note: Above measurement is available when the Minimum Pulse Width is greater than 1mS and Frequency is between 10Hz and 200Hz.

E-3. Pulse Width (mS) (High Level and Low Level)

Pulse Width of pulse waveform of logic or switching controls is shown in mS (1mS = 1/1000 second). Pulse Width is measured from 1.0mS to 999.9 mS. ~ sign is shown on CH2 LCD when measuring High Level and ~ sign is shown in measuring Low Level.

E-4. Waveform and Trigger Level.



T: Cycle

tH: Pulse Width in High Level

tL: Pulse Width in Low Level

$$\text{Duty Cycle (\%)} = \frac{tH}{T} \times 100$$

F. INPUT Terminals

Insert Plugs of Test Leads to V and COM Terminals when measuring voltage. Insert Plugs of Test Leads to Ω and COM Terminals when measuring Resistance or Temperature.

G. OUTPUT Terminal (SK-7722 only)

When measuring Current or Voltage, OUTPUT Terminal can be connected to Oscilloscope or Recorder to observe waveform or record data using optional 900 Output Cord for Recorder.

G-1. How to use OUTPUT Terminal

Function	Output
a. $\overline{A} - \overline{V}$ position : DC Current + DC Voltage Output	
Note: AC Current (\tilde{A}) + AC Voltage (\tilde{V}) input are possible on this position, and observing waveform or recording data of AC Output can be made. But, measurement values are not displayed on LCD.	
b. $\tilde{A} + \text{Hz}$ position : AC Current Output only	
Note: AC Voltage can be applied on COM and V Terminals on this position, and observing waveform or recording data of AC Current + AC Voltage Output can be made. But, AC Voltage values are not displayed on LCD.	
c. $\tilde{V} + \text{Hz}$ position : AC Voltage Output only	
Note: If Clamp Head is used on this position, observing waveform or recording data of AC Voltage + AC Current can be made. But, AC Current values are not displayed on LCD.	

G-2. OUTPUT Standard

Output Voltage: 1000A AC/DC — AC/DC 1V f.s.

250V AC/DC — AC/DC 2.5V f.s.

Output Signals : DC Coupled

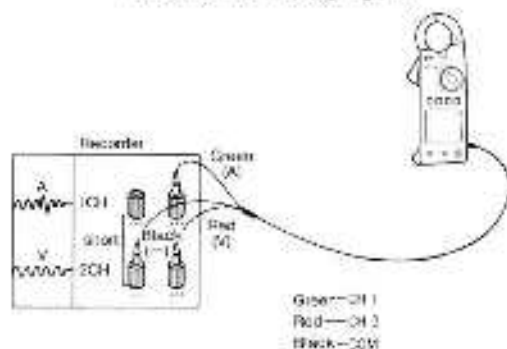
Output Resistance: about 200 Ω

Zero-adjustment: OUTPUT Terminal is DC Coupled, so, Zero- adjustment must be done in Oscilloscope or Recorder side.

Precaution for Voltage Measurements: Connect COM of OUTPUT Terminal with COM of Oscilloscope or Recorder.

Wrong connection will give damage to the instrument concerned.

Refer to the following Figure.



H. AC ADAPTER Terminal (SK-7722 only)

AC ADAPTER (please procure a suitable one in each country.) is required when continuous measurements are made for a long time. Connect Plug of AC ADAPTER to AC ADAPTER Terminal.

Voltage : 8V to 14V

Current : more than 20mA

I. LCD

Each Sign that appears on LCD stands for the right side explanation.



= : Direct Current on Voltage and Current Measurements or Pulse Width Measurements in High Level is operative.

~ : Alternating Current on Voltage and Current Measurements or Pulse Width Measurements in Low Level is operative.

- : Negative Input sign which is automatically shown.

BAT : Battery is consumed.

AUTO : Autoranging

DH : Display Hold is operative

DIFF : 0-Adjustment or Difference Measurements are operative.

REC : Maximum and Minimum Values are recorded.

P : Peak Value ($\overline{A} + \overline{V}$ and $\tilde{A} + \text{Hz}$ measurements)

MAX : Maximum Value

MIN : Minimum Value

°C : Unit of Temperature

 $\Omega, k\Omega$: Units of Resistance

mA, A : Units of Current

mV, V : Units of Voltage

% : Unit of Duty Cycle

mS : Unit of Pulse Width

Hz : Unit of Frequency

J. CLAMP HEAD

When measuring Current DC or AC, just clamp on a single conductor to be tested in the center of CLAMP HEAD.

Make sure that the polarity of the conductor to be measured accords with ↓ mark (plus to minus) on Clamp Head. The accuracy is ensured regardless of the conductor position in Clamp Head.

5. MEASUREMENT PROCEDURE

5-1. PREPARATION FOR USE

1. Remove Rear Case by unscrewing the 4 screws. Install the 9V battery in Battery Case. For details, refer to "6-2. BATTERY REPLACEMENT".
2. Set POWER/FUNCTION Switch to desired position and all segments appear on LCD for two seconds.

NOTE: If the display does not appear or BAT sign appears after all segments appear on LCD, the battery may be consumed. In this case, replace the battery.

NOTE: If DH Key is operating, measurement can not be made.

3. When POWER/FUNCTION Switch is turned on, the initial measurement settings are as follows.

FUNCTION : A selected function appears.

RANGE : Autoranging with AUTO sign shown.

DH Key, REC Key, DIFF Key, DUTY Key : All Keys are OFF.

NOTE: Make sure that all Keys are off. If DH Key is operating, measurements become impossible.

4. POWER-ON INITIALIZE

The instrument performs POWER-ON INITIALIZE automatically when POWER/FUNCTION Switch is set to desired position. All segments appear on LCD for two seconds and 0 ± 1 digit is displayed on LCD (except Ω and $^{\circ}\text{C}$). INITIALIZE cannot be performed exactly if some small input value is applied to the instrument. Always set POWER/FUNCTION Switch ON with no input applied and with Clamp Head closed.

NOTE: Under no input condition, INITIALIZE sometimes cannot be performed exactly due to timing error of GPU and LCD displays more than 2 digits. In this case, use DIFF Key to make accurate measurements.

NOTE: When measuring current, sometimes LCD does not display 0 ± 1 digit due to residual magnetism of Clamp Head. In this case, click CLAMP HEAD slightly several times to display 0 ± 1 digit.

NOTE: When measuring current, if Clamp Head is close to a live conductor, it receives magnetic influence and POWER-ON INITIALIZE cannot be performed exactly. Set POWER/FUNCTION Switch ON keeping Clamp Head away from the conductor.

NOTE: When measuring AC Current or Voltage, it takes 20 seconds till LCD displays 0 ± 3 digits since the instrument adopts True Rms measurements. The accuracy is ensured if measurements are made before LCD displays 0 ± 3 digits.

5-2. $\overline{\text{A}} + \overline{\text{V}}$ (DC CURRENT AND DC VOLTAGE) MEASUREMENTS

WARNING

To avoid electric shock hazard and/or damage to the instrument, do NOT attempt to measure Current and Voltage that might exceed 1000A DC and 650V DC(SK-7720) or 250V DC(SK-7722).

1. Set POWER/FUNCTION Switch to $\overline{\text{A}} + \overline{\text{V}}$ position.
2. Open CLAMP HEAD and clamp on a single conductor. Make sure of the polarity of conductor and clamp on the conductor according to the ↓ mark on Clamp Head. The measurement value is shown on CH1 LCD.

NOTE: If two or three conductors are clamped on, the measurement becomes impossible.

NOTE: Peak Value cannot be measured if a conductor is clamped on contrary to ↓ mark on Clamp Head.

3. Insert Black Test Plug into COM Terminal and Red Test Plug into V Terminal.
4. Make certain of the polarity of the circuit being measured. Connect Black Test Prod to the negative side of the circuit being measured and Red Test Prod to the positive side of the circuit.

The measurement value is shown on CH2 LCD.

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

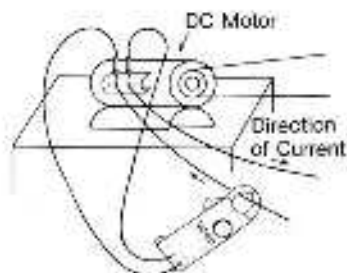
NOTE: For safety measurements, it is recommended to use alligator clips connected on Test Prods.

Use extreme caution to prevent any part of your body from touching high voltage.

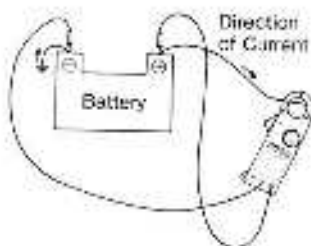
5. Read DC current and voltage on LCD.
6. **DH Key:** Press DH Key when desired to hold the display on LCD.
7. **REC Key:** Press REC Key to make Maximum/Minimum Measurements or Peak, Max/Min Measurements. For details, refer to page 11 "C. REC Key".

Measurement Example 1. DC Motor Test.

When starting a DC Motor, Maximum Current and Minimum Voltage can be measured.



1. Set POWER/FUNCTION Switch to $\overline{A} + \overline{V}$ position.
2. Insert Plugs of Test Leads into COM and V Terminals.
3. Connect Black Test Prod to the negative side of the DC Motor and Red Test Prod to the positive side.
4. Open Clamp Head and clamp on a negative cord of the DC Motor.
5. Press REC Key three times to set Maximum Current and Minimum Voltage measurements.
6. Start the DC Motor.
7. Read Maximum Current on CH1 LCD and Minimum Voltage on CH2 LCD.

Measurement Example 2. Battery Test when starting the engine of Automobile
Peak Current and Minimum Voltage of a battery can be measured.

1. Set POWER/FUNCTION Switch to $\overline{A} + \overline{V}$ position.
2. Insert Plugs of Test Leads into COM and V Terminals.
3. Connect Black Test Prod to the negative side of the battery and Red Test Prod to the positive side.
4. Open Clamp Head and clamp on the cable being measured.

NOTE: Make sure of the polarity and clamp on the conductor according to the \downarrow mark on Clamp Head.

5. Press REC Key for 2 seconds to select CH1 Peak + CH2 MAX/MIN Measurement mode. (refer to page 12 "C-2. REC Key")
6. Press REC Key 2 times to select Peak Current and MIN Voltage.
7. Start the engine of automobile.
8. Read Peak Current on CH1 LCD and MIN Voltage on CH2 LCD.

8. **DIFF Key:** Press DIFF Key to make Difference Measurements and sometimes to make Zero Adjustment.

9. **DUTY Key:** In this measurement, DUTY Key is not operative.

5-3. $\overline{A} + \text{Hz}$ (AC CURRENT AND FREQUENCY) MEASUREMENTS**WARNING**

To avoid electrical shock hazard and/or damage to the instrument, do NOT attempt to measure Current and Frequency that might exceed 1000A AC or 4kHz.

1. Set POWER/FUNCTION Switch to $\overline{A} + \text{Hz}$ position.
2. Open CLAMP HEAD and clamp on a single conductor.
NOTE: If two or three conductors are clamped on at a time, the measurement becomes impossible.
3. Read AC Current and Frequency on LCD.
4. **DH Key, REC Key and DIFF Key** are available in the same way as in $\overline{A} + \overline{V}$ measurements.
5. **DUTY Key:** DUTY Key can be used when \overline{A} and Hz are being measured.
The first press of this Key shows % for Duty Cycle on LCD.
The second press shows mS with \equiv sign for High Level Pulse Width. The third press shows mS with \sim sign for Low Level Pulse Width. The fourth press returns to Hz for Frequency.
(Hold down DUTY key for over a second to return to Frequency (Hz) at once.)

5-4. $\overline{V} + \text{Hz}$ (AC VOLTAGE AND FREQUENCY) MEASUREMENTS**WARNING**

To avoid electric shock hazard and/or damage to the instrument, do NOT attempt to measure high voltage and Frequency that might exceed 650V AC (5K-7720) or 250V AC (5K-7722) and 4kHz.

1. Set POWER/FUNCTION Switch to $\overline{V} + \text{Hz}$ position.
2. Insert Black Test Plug into COM Terminal and Red Test Plug into V Terminal.
3. Connect Test Prods to the circuit to be measured.
The connection should be **IN PARALLEL** with the circuit being measured.
NOTE: When connecting Test Prods to the circuit, it is recommended to use alligator clips connected on Test Prods.
4. Read AC Voltage and Frequency on LCD.

5. **DH Key, REC Key and DIFF Key** are available in the same way as in $\bar{A} + \bar{V}$ measurements.

6. **DUTY Key:** Each time DUTY Key is pressed, the display on LCD changes as follows; Hz (Frequency) \rightarrow % (Duty Cycle) \rightarrow mS with \equiv sign (Pulse Width in High Level) \rightarrow mS with \sim sign (Pulse Width in Low Level) \rightarrow Hz \rightarrow

(Hold down DUTY key for over a second to return to Frequency (Hz) at once.)

5-5. Ω (RESISTANCE) MEASUREMENTS

WARNING

Maximum Input Voltage on OHM Range is 400V DC/AC. Do NOT attempt to measure Resistance Circuit where voltage is alive.

1. Set POWER/FUNCTION Switch to Ω position.
OL sign blinks on LCD.

2. Insert Black Test Plug into COM Terminal and Red Test Plug into Ω Terminal.

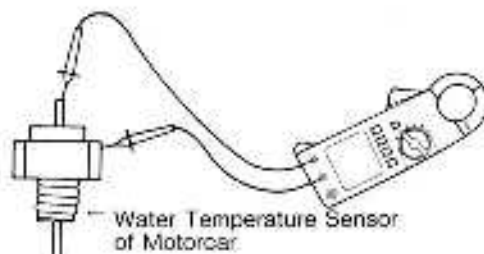
NOTE: Short Test Prods. of Test Leads together to see 0 ± 1 digit on LCD. But, sometimes 2 or 3 digits are displayed on LCD. In this case, press DIFF Key to display 0 ± 1 digit.

3. Connect Test Prods. to the resistor(circuit) to be measured.

NOTE: If the resistor being measured is connected in a circuit, remove power to the circuit and discharge all capacitors in the circuit before every measurement.

4. Read the resistance on LCD.

5. **DH Key, REC Key and DIFF Key** are available in the same way as in $\bar{A} + \bar{V}$ measurements.



5-6. $^{\circ}\text{C}$ (TEMPERATURE) MEASUREMENTS

WARNING

Maximum Input Voltage on Temperature Range is 400V DC or AC. Do NOT attempt to apply voltage on Temperature Range.

1. Set POWER/FUNCTION Switch to $^{\circ}\text{C}$ position.
2. Insert Plugs of Temperature Probe (Model 818-02 optional) into COM and $^{\circ}\text{C}$ Terminals.
3. Apply Temperature Probe to the substance to be measured.
4. Read the temperature on LCD.

NOTE: It takes 7 seconds in the water before the measurement value is stabilized.

5. **DH Key, REC Key and DIFF Key** are available in the same way as in $\bar{A} + \bar{V}$ measurements.

5-7. COMMENTS on True RMS MEASUREMENTS

When measuring AC signals, the True RMS (root-mean-square) Measurement Method is important to read effective values.

Many meters in use today adopt Average-Responding AC Converters rather than True RMS Converters. Average-Responding meters can display correct RMS values so long as the waveforms are sinusoidal, but can not display correct RMS values if the waveforms are not sinusoidal.

Refer to following Table. The Models SK-7720/7722 are provided with a True RMS Converter and can measure True RMS value with any kind of waveforms, mixed frequencies, modulated signals, square waves, sawtooths, random noise, rectangular pulses, etc.


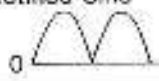
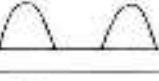
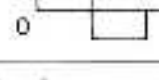

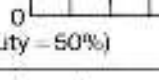
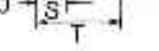
NOTE: CREST FACTOR

The crest factor of a waveform is the ratio of its peak value to its RMS value, and is useful for expressing the instrument capability of measuring variety of waveforms accurately.

$$\text{CREST FACTOR} = \frac{\text{PEAK value}}{\text{RMS value}}$$

The crest factor of this instrument is less than 3. Therefore, it is possible to measure waveforms up to three times of full scale value on each range in specified accuracy. But, regarding AC voltage, it is up to 600V on 650V range (SK-7720) and 100V on 250V range (SK-7722) and for AC current, up to 500A on 1000A range.

Comparison of Waveforms and Readings

Waveform	RMS Value	True RMS Rectifying	Crest Factor
Sine 	1	1	1.414
Full-Wave Rectified Sine 	1	0.435	1.414
Half-Wave Rectified Sine 	1	0.771	2.000
Square 	1	1	1.000
Triangle tooth 	1	1	1.732
Rectified Square Wave  (Duty = 50%)	1	0.707	1.414
Rectangular Pulse 	1	$\sqrt{1 - \frac{S}{T}}$	$\sqrt{\frac{T}{S}}$

6. MAINTENANCE

6-1. WARRANTY STATEMENT

The warranty statement for the AC/DC DIGITAL CLAMP METERS SK-7720 and SK-7722 are printed on the last page of the manual. Read it carefully before requesting warranty repair.

6-2. BATTERY REPLACEMENT

WARNING

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

1. Unscrew the four screws of Rear Case and remove it.
2. Take out the worn-out batteries from Battery Case and place a fresh 6F22 (3-008P), NEDA 1604 or any equivalent battery.
3. Replace Rear Case and screw the screws.

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

6-3. CALIBRATION

In order to maintain the specifications described in page 3 to 7, 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.

SYMPTOM	POSSIBLE CAUSE	NECESSARY STEPS
No display.	Low Battery.	Replace the battery. (Refer to P.25)
	Battery is installed in wrong polarity.	Install battery in correct polarity.
Readings are not stable on all ranges.	The contact of Plugs of Test Leads is bad.	Confirm the contact of Plugs.
	Influence of noise.	Use a suitable shield or keep away from noise.
POWER/FUNCTION Switch is set to desired position and LCD displays some value under no input being applied.		If LCD display 1 to 2 digits, continue the measurement. If LCD displays more than several digits and INITIALIZE is not performed exactly, press DIFF Key to display zero on LCD and perform measurements. In this case, accurate measurements are ensured.

WARRANTY

The AC/DC Digital Clamp Meter (SK-7720/7722) 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 instrument new from the dealer. The obligation under this warranty to be executed by **KAISE AUTHORIZED DEALER** is limited to repairing or replacing the AC/DC Digital Clamp Meter (SK-7720/7722) 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 other 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 has 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

