

aise

AUTOMOTIVE  
DIGITAL MULTIMETER

INSTRUCTION MANUAL

KT-2022

KAISE CORPORATION

FOR SAFETY MEASUREMENTS!!

To prevent an electrical shock hazard to the operator and/or damage to the instruments, read this instruction manual carefully before using the instrument. **WARNINGS** with the symbol ⚠ on the instrument and this instruction manual are highly important.

**Important Symbols**

⚠ The symbol listed in IEC 61010-1 and ISO 3864 means "Caution (refer to instruction manual)".

⚠ **WARNING** The symbol in this manual advises the user of an electrical shock hazard that could result in serious injury or even death.

⚠ **CAUTION** The symbol in this manual advises the user of an electrical shock hazard that could cause injury or material damages.

⚠ **WARNING**

Do not measure High Power Line (High Energy Circuits) that might exceed 6kVA. High Power Line is very dangerous and sometimes includes High Surge Voltage that could cause explosive short in the instrument and could result in serious injury to the operator. For dangerous voltage measurement, always keep the instrument away from your body without holding it in your hands. Do not touch the instrument, test leads, and any part of the circuit.

INTRODUCTION

Thank you for purchasing "KT-2022 AUTOMOTIVE DIGITAL MULTIMETER". To obtain the maximum performance of this instrument, read this Instruction Manual carefully, and take safe measurement.

1. UNPACKING AND INSPECTIONS

Confirm if the following items are contained in the package in good condition. If there are any damage or missing items, ask your local dealer for replacement.

- |  |             |
|--|-------------|
| 1. Digital Multimeter (with holster)               | 1 pce.      |
| 2. Test Lead (100-66)                              | 1 set       |
| 3. RPM Sensor (653 / for Direct Ignition Engine)   | 1 pce.      |
| 4. RPM Sensor (654 / for High Tension Code)        | 1 pce.      |
| 5. Temperature Probe (818-02)                      | 1 pce.      |
| 6. Alligator Clip (943)                            | 1 pce.      |
| 7. Carrying Case (1024)                            | 1 pce.      |
| 8. Spare Fuse (F38, 11A/1000V and F39, 0.4A/1000V) | 1 pce. each |
| 9. Instruction Manual                              | 1 pce.      |

2. SPECIFICATIONS

2-1. GENERAL SPECIFICATIONS

- DISPLAY (LCD)**
  - Numerical Display** : 4 digit 6000 count, with Bar Graph
  - b. Units and Symbols** : AUTO,  $\square$ ,  $\Delta$ ,  $\sim$ ,  $\square$ , RPM,  $\text{Hz}$ ,  $\text{ms}$ ,  $\mu\text{F}$ ,  $\mu\text{A}$ ,  $\text{mA}$ ,  $\text{A}$ ,  $\%$ , Trig and decimal point
- OPERATING PRINCIPLE** : Sigma-delta Conversion
- MEASURING PRINCIPLE** : Average Rectification
- SAMPLING RATE** : 5 times per second (Bar Graph : 40 times per second max.)
- RANGE SELECTION** : Auto / Manual (Frequency, Injection Pulse width and Capacitance measurement are Auto only)
- BATTERY WARNING** :  $\text{BAT}$  indication at approx. 2.3V or less
- DISPLAY HOLD** : Hold indicating values by pressing HOLD Key
- AUTO POWER OFF** : Power turns off automatically after approx. 34 minutes
- OVERLOAD PROTECTION** : a)  $\mu\text{A}$  &  $\text{mA}$  : 0.4A/1000V fast-acting fuse  
b)  $\text{A}$  : 11A/1000V fast-acting fuse  
c)  $\text{V}$  : 1050Vrms or 1450Vpeak  
d)  $\text{mV}$ ,  $\Omega$  and others : 1000Vrms
- OPERATING TEMPERATURE & HUMIDITY** : Maximum relative humidity 80% for temperature up to 31°C decreasing linearly to 50% relative humidity at 40°C
- STORAGE TEMPERATURE & HUMIDITY** : -20 to 60°C, less than 80%RH in non-condensing.
- TEMPERATURE COEFFICIENT** : Accuracy at 23°C  $\pm 5^\circ\text{C} \times 0.15^\circ\text{C}$
- SAFETY LEVEL** : CE marking approved.  
LVD : CAT II 1000V, CAT III 600V, CAT IV 300V AC and DC  
EMC : EN61326-1 (2013)
- POWER SUPPLY** : 1.5V R03(AAA) Battery  $\times 2$
- FUSE** : Fast-acting 11A/1000V ( $\phi 10 \times 38\text{mm}$ )  $\times 1$   
Fast-acting 0.4A/1000V ( $\phi 6 \times 32\text{mm}$ )  $\times 1$
- POWER CONSUMPTION** : approx. 4.3mA  
(in Auto Power Off : approx. 10  $\mu\text{A}$ , in backlighting : approx. 27mA)
- CONTINUOUS OPERATING TIME** : approx. 180 hours (manganese cell), approx. 360 hours (alkaline cell)
- DIMENSIONS & WEIGHT** : 161(H)  $\times$  80(W)  $\times$  50(D)mm, approx. 340g
- ACCESSORIES** : 100-66 Test Lead, 653 RPM Sensor (for Direct Ignition), 654 RPM Sensor (for High Tension Code), 818-02 Temperature Probe, 943 Alligator Clip, 1024 Carrying Case, Holster, 1.5V R03(AAA) Battery (Installed), F38 Spare Fuse (11A/1000V), F39 Spare Fuse (0.4A/1000V), Instruction Manual
- OPTIONAL ACCESSORIES** : 660 AC/DC Clamp Adapter, 100-41 Test Lead Kit, 100-62 Test Lead Set, 944 Test Pin, 946 Battery Clip, 793 Coil Contact Pin

When using Clamp Adapter, read its instruction manual carefully.

2-2. MEASUREMENT SPECIFICATIONS (23°C  $\pm 5^\circ\text{C}$ , <80%RH in non-condensing)

1. DC Voltage ( $\text{mV} / \text{V}$ )

Range	Resolution	Accuracy	Input Impedance	Maximum Input	Overload Protection
60.00 mV	0.01 mV	$\pm 0.4\% \text{rdg} \pm 3 \text{dgt}$	$\approx 10 \text{M}\Omega$ , 50pF	600mV AC/DC	1000Vrms
600.0 mV	0.1 mV	$\pm 0.3\% \text{rdg} \pm 3 \text{dgt}$			

6.000 V	1 mV	$\pm 0.4\% \text{rdg} \pm 3 \text{dgt}$	$\approx 10 \text{M}\Omega$ , 50pF	1000V AC/DC	1050Vrms 1450Vpeak
60.00 V	10 mV				
600.0 V	100 mV				
1000 V	1 V				

2. AC Voltage ( $\text{mV} / \text{V}$ ) 50Hz to 500Hz Average Rectification

Range	Resolution	Accuracy	Input Impedance	Maximum Input	Overload Protection
60.00 mV	0.01 mV	$\pm 2.0\% \text{rdg} \pm 5 \text{dgt}$	$\approx 10 \text{M}\Omega$ , 50pF	600mV AC/DC	1000Vrms
600.0 mV	0.1 mV				

6.000 V	1 mV	$\pm 2.0\% \text{rdg} \pm 5 \text{dgt}$	$\approx 10 \text{M}\Omega$ , 50pF	1000V AC/DC	1050Vrms 1450Vpeak
60.00 V	10 mV				
600.0 V	100 mV				
1000 V	1 V				

3. DC Current ( $\mu\text{A} / \text{mA} / \text{A}$ )

Range	Resolution	Accuracy	Burden Voltage	Maximum Input	Overload Protection
600.0 $\mu\text{A}$	0.1 $\mu\text{A}$	$\pm 0.7\% \text{rdg} \pm 3 \text{dgt}$	0.25mV / $\mu\text{A}$	6000 $\mu\text{A}$ AC/DC	0.4A / 1000V Fuse
6000 $\mu\text{A}$	1 $\mu\text{A}$	$\pm 0.5\% \text{rdg} \pm 3 \text{dgt}$			

60.00 mA	0.01 mA	$\pm 0.7\% \text{rdg} \pm 3 \text{dgt}$	2.5mV / mA	600mA AC/DC	0.4A / 1000V Fuse
600.0 mA	0.1 mA	$\pm 0.5\% \text{rdg} \pm 3 \text{dgt}$			
6.000 mA	1 $\mu\text{A}$	$\pm 0.7\% \text{rdg} \pm 3 \text{dgt}$	0.03V / A	10A AC/DC	11A / 1000V Fuse
10.00 mA	10 $\mu\text{A}$	$\pm 0.5\% \text{rdg} \pm 3 \text{dgt}$			

※ 10A Continuous measurement is possible.  
10A to 20A is measurable within 30 seconds but 5 minutes cooling down interval is necessary.

4. AC Current ( $\mu\text{mA} / \text{mA} / \text{A}$ ) 50Hz to 500Hz Average Rectification

Range	Resolution	Accuracy	Burden Voltage	Maximum Input	Overload Protection
600.0 $\mu\text{A}$	0.1 $\mu\text{A}$	$\pm 2.2\% \text{rdg} \pm 5 \text{dgt}$	0.25mV / $\mu\text{A}$	6000 $\mu\text{A}$ AC/DC	0.4A / 1000V Fuse
6000 $\mu\text{A}$	1 $\mu\text{A}$	$\pm 2.0\% \text{rdg} \pm 5 \text{dgt}$			

60.00 mA	0.01 mA	$\pm 2.2\% \text{rdg} \pm 5 \text{dgt}$	2.5mV / mA	600mA AC/DC	0.4A / 1000V Fuse
600.0 mA	0.1 mA	$\pm 2.0\% \text{rdg} \pm 5 \text{dgt}$			
6.000 mA	1 mA	$\pm 2.2\% \text{rdg} \pm 5 \text{dgt}$	0.03V / A	10A AC/DC	11A / 1000V Fuse
10.00 mA	10 mA	$\pm 1.2\% \text{rdg} \pm 5 \text{dgt}$			

※ 10A Continuous measurement is possible.  
10A to 20A is measurable within 30 seconds but 5 minutes cooling down interval is necessary.

5. Resistance ( $\Omega$ )

Range	Resolution	Accuracy	Open Circuit Voltage	Overload Protection
600.0 Ω	0.1 Ω	±0.5%rdg±6dgt	0.45V DC	1000Vrms
6.000 kΩ	1 Ω	±0.5%rdg±3dgt		
60.00 kΩ	10 Ω			
600.0 kΩ	100 Ω	±0.8%rdg±4dgt		
6.000 MΩ	1 kΩ	±1.0%rdg±5dgt		
60.00 MΩ	10 kΩ	±1.5%rdg±5dgt		

6. Frequency (Hz)

Function	Sensitivity	Range (Auto)	Display	Accuracy
6 V	0.5 V rms	10 Hz to 10 kHz	6553 count max.	$\pm 0.1\% \text{rdg} \pm 3 \text{dgt}$
60 V	5 V rms	10 Hz to 50 kHz		
600 V	50 V rms			
1000 V	500 V rms	45 Hz to 1 kHz		

7. IP-RPM ( Inductive Pickup type )

	Range	Accuracy
RPM4	240 to 20000RPM	$\pm 0.2\% \text{rdg} \pm 20 \text{dgt}$
RPM2	120 to 10000RPM	
RPM2-M	60 to 5000RPM	

NOTE : Measurement cannot be made depending on the vehicles.

8. IG-RPM ( Contact Signal type )

	Range	Accuracy	Selectable Number of Cylinders
RPM4	60 to 20000RPM	$\pm 0.2\% \text{rdg} \pm 20 \text{dgt}$	1,2,3,4,5,6,8,10,12 (Select by CYLINDER Key)
RPM2	30 to 10000RPM		
RPM2-M	15 to 5000RPM		

NOTE : Measurement cannot be made depending on the vehicles.

9. Dwell Angle ( $^\circ$   $\Delta$ ), Duty Cycle (%)

Range	Accuracy	Selectable Number of Cylinders
0.0° to 360.0°	$\pm 1.2\% \text{krpm} \pm 1 \text{dgt}$	1,2,3,4,5,6,8,10,12 (Select by CYLINDER Key)
0.0% to 100.0%	$\pm 0.04\% \text{krpm/cyl} \pm 2 \text{dgt}$	

※ Specified ranges depend on engine rpm and number of cylinders (cyl).

10. Injection Pulse Width (ms), Duty Cycle (%)

	Range	Accuracy
Multi Point Injection	0.05ms to 250.0ms	$\pm 0.05\text{ms} \pm 1 \text{dgt}$
	0.0% to 100.0%	$\pm 0.04\% \text{krpm} \pm 2 \text{dgt}$
Single Point Injection	0.05ms to 250.0ms	$\pm 0.05\text{ms} \pm 1 \text{dgt}$
	0.0% to 100.0%	$\pm 0.04\% \text{krpm/cyl} \pm 2 \text{dgt}$

※ Specified ranges depend on trigger slopes, engine rpm and number of cylinders (cyl).

11. Diode Test ( $\rightarrow$ )

Range	Accuracy	Test Current	Open Circuit Voltage	Overload Protection
1.000 V	$\pm 1.0\% \text{rdg} \pm 3 \text{dgt}$	0.50mA typ.	<1.6V DC typ.	1000Vrms

12. Temperature ( $^\circ\text{C} / ^\circ\text{F}$ )

Range	Resolution	Accuracy	Overload Protection
-50°C to 1000°C	1°C	$\pm 0.5\% \text{rdg} \pm 3 \text{dgt}$	1000Vrms
-58°F to 1832°F	1°F	$\pm 0.5\% \text{rdg} \pm 6 \text{dgt}$	

K-type thermocouple / sensor accuracy is not included.

13. Continuity ( $\rightarrow$ )

Threshold Level	Response Time	Overload Protection
between 10 $\Omega$ and 200 $\Omega$	32ms	1000Vrms

14. Capacitance ( $\rightarrow$ )

Range	Resolution	Accuracy	Overload Protection
6.000 $\mu\text{F}$	0.001 $\mu\text{F}$	$\pm 2.0\% \text{rdg} \pm 5 \text{dgt}$	1000Vrms
60.00 $\mu\text{F}$	0.01 $\mu\text{F}$	$\pm 3.5\% \text{rdg} \pm 5 \text{dgt}$	
600.0 $\mu\text{F}$	0.1 $\mu\text{F}$		
2000 $\mu\text{F}$	1 $\mu\text{F}$	$\pm 4.0\% \text{rdg} \pm 5 \text{dgt}$	

3. SAFETY PRECAUTIONS

3-1. WARNINGS

Correct knowledge of electric measurements is essential to avoid unexpected danger such as operator's injury or damage to the instrument. Read carefully and observe the following precautions for safety measurements.

⚠ **WARNING 1. Checks of Body and Test Lead**

Before measurement, confirm the body of this instrument and handle insulators of the Test Lead have no cracks or any other damages. Dust, grease and moisture must be removed.

⚠ **WARNING 2. High Power Line Measurements is Prohibited**

Do not measure High Power Line (High Energy Circuits) such as Distribution Transformers, Bus Bars and Large Motors. High Power Line sometimes includes High Surge Voltage that could cause explosive short in the instrument and could result in shock hazard. Generally, shock hazard could occur when the current between the circuit, that involves more than 33V rms or 46.7V DC or peak, and ground goes up to 0.5mA or more.

⚠ **WARNING 3. Warning for High Voltage Measurements**

Even for Low Energy Circuits of electric/electronic appliances, such as heating elements, small motors, line cords and plugs, High Voltage Measurements are very dangerous. Do not touch any part of the circuit.

⚠ **WARNING 4. Dangerous Voltage Measurement Procedure**

For dangerous voltage measurement, strictly observe the warnings below.

- Do not hold multimeter in your hands. Keep safety distance from power source or circuit to be measured not to touch the dangerous voltage.
- Attach black and red alligator clips to test lead pins.
- Turn off the power of the circuit to be measured when connecting test leads.
- After measurement, before detaching alligator clips (test leads), turn the circuit power off and discharge the all capacitors.

**In case of live-line measurement, strictly observe the warnings below**

- Do not hold multimeter in your hands. Keep safety distance from power source or circuit to be measured not to touch the dangerous voltage.
- Black test lead : Attach black alligator clip and connect to  $-$  (earth) side of the circuit.
- Red test lead : Connect to  $+$  (positive) side of the circuit.

3-2. PREVENTION OF FAILURE

⚠ **WARNING 1. Correct Selection of Function Switch**

Always confirm that **FUNCTION** Switch is set to the correct position. Do not measure voltage except at Voltage measurement function.

⚠ **WARNING 2. Maximum Input Observance**

Do not measure anything that might exceed the specified maximum input values.

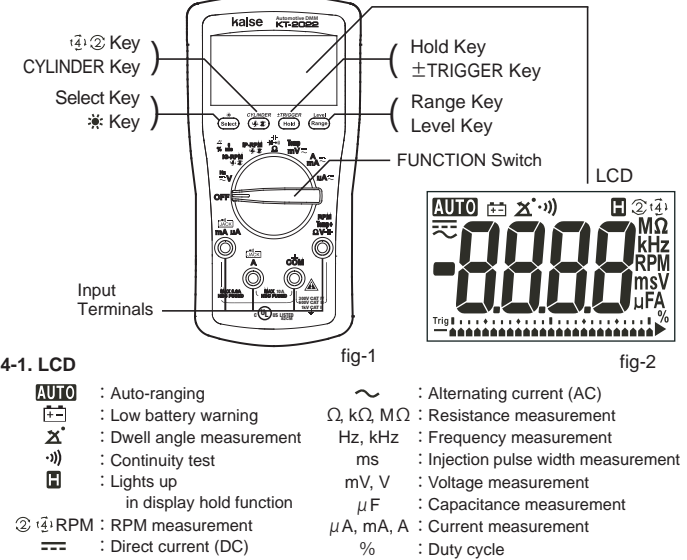
⚠ **WARNING 3. Test Lead Detachment**

Detach test leads from measuring circuit before changing measurement functions or removing rear cover for battery or fuse replacement.

3-3. GENERAL WARNINGS AND CAUTIONS

- ⚠ **WARNING 1.** Children and the persons who do not have enough knowledge about electric measurements must not use this instrument.
- ⚠ **WARNING 2.** Do not measure the electricity naked or barefooted to protect yourself from electrical shock hazard.
- ⚠ **WARNING 3.** Be careful not to get hurt with the sharp test lead pins.
- ⚠ **CAUTION 1.** Do not polish the case or attempt to clean it with any cleaning fluid like gasoline or benzine. If necessary, use silicon oil or antistatic fluid.
- ⚠ **CAUTION 2.** Away the instrument from hot and humid conditions like in the car. Do not apply hard mechanical shock or vibration.
- ⚠ **CAUTION 3.** Remove the battery when the instrument is out of use for a long time. The
- ⚠ **CAUTION 4.** exhausted battery might leak electrolyte and corrode the inside.

4. NAME ILLUSTRATION



4-1. LCD

- |               |                           |                                    |                                     |
|---------------|---------------------------|------------------------------------|-------------------------------------|
| $\text{AUTO}$ | : Auto-ranging            | $\sim$                             | : Alternating current (AC)          |
| $\text{BAT}$  | : Low battery warning     | $\Omega$ , k $\Omega$ , M $\Omega$ | : Resistance measurement            |
| $\Delta$      | : Dwell angle measurement | Hz, kHz                            | : Frequency measurement             |
| $\rightarrow$ | : Continuity test         | ms                                 | : Injection pulse width measurement |
| $\square$     | : Lights up               | mV, V                              | : Voltage measurement               |
|               | in display hold function  | $\mu\text{F}$                      | : Capacitance measurement           |
| $\text{RPM}$  | : RPM measurement         | $\mu\text{A}$ , mA, A              | : Current measurement               |
| $\text{DC}$   | : Direct current (DC)     | %                                  | : Duty cycle                        |

4-2. FUNCTION Switch

Turns the power on and selects measurement functions. After measurement, turn it to "OFF".

4-3. Select Key

Use this Key to select sub-measurement functions.

4-4. \* Key

Press this key for 1 second or more to turn on the LCD backlight. Press for 1 second or more again, backlight is turned off.

4-5.  $\rightarrow$  Key

Use this key to select the engine strokes in IP-RPM and IG-RPM measurements: Four-stroke/Two-stroke/Two-stroke, 2-cylinder simultaneous ignition.

4-6. CYLINDER Key

Use this Key to set number of cylinders in Dwell Angle and IG-RPM measurements.

4-7. Hold Key : Display Hold

Holds displayed value on LCD by pressing this Key. ("  $\square$  " lights up).

To release it : Press Hold Key again.

4-8.  $\pm$  TRIGGER Key

Change  $+$ / $-$  Trigger slopes in Duty Cycle and Injection Pulse Width measurements. (Refer to 6-2).

4-9. Range Key

Use this Key to change Auto or Manual-ranging (Refer to 6-1).

4-10. Level Key

Use this key to select the sensitivity level in IP-RPM, IG-RPM, Dwell Angle and Injection Pulse Width measurements.

4-11. Input Terminals

Connect black test lead to COM terminal and red test lead to RPM/Temp/ $\Omega$ /V/ $\text{Hz}$  Terminal for all measurements except  $\mu\text{A}$ , mA, A measurements.

**NOTE** : Connect red test lead to mA/ $\mu\text{A}$  terminal for mA/ $\mu\text{A}$  measurement and connect it to A terminal for 6A (10A for 30sec) measurement.

5. MEASUREMENT PROCEDURES

5-1. PREPARATION FOR USE



1. INSTRUCTION MANUAL ⚠




Read INSTRUCTION MANUAL carefully to understand the specification and functions correctly. "3. SAFETY PRECAUTIONS" is very important for safety measurement.

2. BATTERY

Two 1.5



4. Press   key and choose the engine strokes from the following list.

- Four-stroke cycle engine 
- Two-stroke cycle engine 
- Two-stroke cycle, 2-cylinder simultaneous ignition engine  M

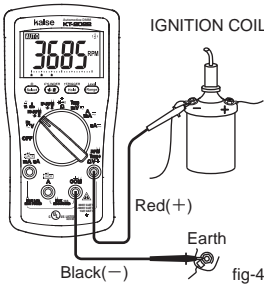
5. Set number of cylinders. Press **Cylinder** Key for 1 second or more to enter cylinder setting mode, and press **Cylinder** Key again within 1 second to select the number of cylinders from 1, 2, 3, 4, 5, 6, 8, 10, 12. Default setting is "4".

6. Stop pressing **Cylinder** Key when necessary number is displayed.

7. Connect Test Lead to IGNITION COIL as shown in fig-4.

8. Start the engine and read the measurement value on LCD.

9. After finishing the measurement, set **FUNCTION** Switch to "OFF".











Input sensitivity can be changed in the following procedures.

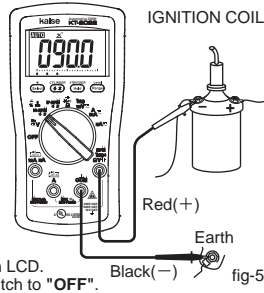
- Press **Level** Key during IG-RPM measurement. Input sensitivity level is changed as Level 3→2→1→4. (default setting is Level 3).
- Sensitivity level is shown with the number of "▲" under the bar graph.
- Change of input sensitivity is effective in the following cases.  
When measured value is unstable, reduce the current input sensitivity level.  
When measured value is "0", increase the current input sensitivity level.

#### 5-4. DWELL ANGLE MEASUREMENT ( ° )

##### ⚠ WARNING

- Do not measure voltage in     position. This will cause electrical shock hazard to the operator and/or damage to the instrument.
- Be careful not to drop off the instrument and test leads into the engine room.
- Ignition system generates high voltage that could cause an electrical shock hazard. Stop the engine when connecting or removing the test leads.
- Read "3. SAFETY PRECAUTIONS" carefully before measurement.

- Stop the engine.
- Insert black test lead to **COM** terminal, and insert red test lead to **RPM/Temp+/Ω/V/Hz** terminal.
- Set **FUNCTION** Switch to     position, and press **Select** Key until "Δ" appears on LCD.
- Set number of cylinders. Press **Cylinder** Key for 1 second or more to enter cylinder setting mode, and press **Cylinder** Key again within 1 second to select the number of cylinders from 1, 2, 3, 4, 5, 6, 8, 10, 12. Default setting is "4".
- Stop pressing **Cylinder** Key when necessary number is displayed.
- Connect Test Lead to IGNITION COIL as shown in fig-5.
- Start the engine and read the measurement value on LCD.
- After finishing the measurement, set **FUNCTION** Switch to "OFF".



#### DUTY CYCLE MEASUREMENT ( % )





Duty Cycle (%) Converted value is displayed by pressing **Select** Key once during Dwell Angle measurement.





Input sensitivity can be changed in the following procedures.

- Press **Level** Key during Duty Cycle measurement. Input sensitivity level is changed as Level 3→2→1→4. (default setting is Level 3).
- Sensitivity level is shown with the number of "▲" under the bar graph.
- Change of input sensitivity is effective in the following cases.  
When measured value is unstable, reduce the current input sensitivity level.  
When measured value is "0", increase the current input sensitivity level.

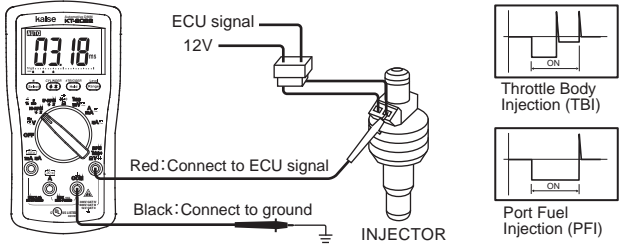
#### 5-5. INJECTION PULSE WIDTH MEASUREMENT ( ms )

##### ⚠ WARNING

- Do not measure voltage in     position. This will cause electrical shock hazard to the operator and/or damage to the instrument.
- Read "3. SAFETY PRECAUTIONS" carefully before measurement.

- Insert black test lead to **COM** terminal, and insert red test lead to **RPM/Temp+/Ω/V/Hz** terminal.
- Set **FUNCTION** Switch to     position, and press **Select** Key until "ms" appears on LCD.
- Connect test leads to an INJECTOR as shown in fig-6.  
**NOTE** : Try some connections to find ECU signal when it is difficult to be found depending on the injection wiring.  
**NOTE** : Use of 100-41 Test Lead Kit or 100-62 Test Lead Set, which contains a narrow test pin model 792, are recommended for safety measurement.
- Read the measurement value on LCD.
- After finishing the measurement, set **FUNCTION** Switch to "OFF".

※ This function can measure both Port Fuel Injectors (PFI) which operate with a single on time pulse and Throttle Body Injectors (TBI) which operate with twin pulses.



#### DUTY CYCLE MEASUREMENT ( % )



Duty Cycle (%) Converted value is displayed by pressing **Select** Key three times during Injection Pulse Width measurement.

Input sensitivity can be changed in the following procedures.

- Press **Level** Key during Duty Cycle measurement. Input sensitivity level is changed as Level 3→2→1→4. (default setting is Level 3).
- Sensitivity level is shown with the number of "▲" under the bar graph.
- Change of input sensitivity is effective in the following cases.  
When measured value is unstable, reduce the current input sensitivity level.  
When measured value is "0", increase the current input sensitivity level.

#### 5-6. RPM MEASUREMENT ( IP-RPM ) ※measuring RPM with RPM Sensor








##### ⚠ WARNING

- Do not measure voltage in   position. This will cause electrical shock hazard to the operator and/or damage to the instrument.
- Be careful not to drop off the instrument and RPM sensor into the engine room.
- Ignition system generates high voltage that could cause an electrical shock hazard. Stop the engine when connecting or removing the RPM sensor.
- Read "3. SAFETY PRECAUTIONS" carefully before measurement.

##### ⚠ CAUTION

###### Cautions for 654 RPM Sensor

- Clamp a sensor gently without letting go of a lever suddenly when clamping 654 RPM Sensor on high tension cord. 654 RPM Sensor Pick Up may be damaged by strong shock.
- Do not apply hard mechanical shock to RPM Sensor by the fall.

- Stop the engine.
- Insert black plug of 653 or 654 to **COM** terminal and inset red plug to **RPM/Temp+/Ω/V/Hz** terminal.
- Set **FUNCTION** Switch to   position.
- Press   Key and choose the engine strokes from the following list.
  - Four-stroke cycle engine : 
  - Two-stroke cycle engine : 
  - Two-stroke cycle, 2-cylinder simultaneous ignition engine :  M
- Direct Ignition Engine** : 653 RPM Sensor

Put contact surface of the sensor on the top or side of Direct Ignition Coil as shown in fig-7.

**NOTE** : Measurement may not be done depending on the sensor position. In that case, move the sensor to the measurable position.

**NOTE** : Contact surface is marked in Red.

**NOTE** : Use tapes to fix the sensor.

6. **High Tension Code type Engine** : 654 RPM Sensor

Clamp the sensor on No.1 High Tension Cord facing the arrow sign to the spark plug. (refer to fig-8)

**NOTE** : Confirm if the clamp of the sensor is completely closed.

7. Start the engine and read the measurement value.

8. After finishing the measurement, set **FUNCTION** switch to "OFF".

**NOTE** : After finishing the measurement, remove the fixing tapes used for 653 RPM sensor.

Input sensitivity can be changed in the following procedures.


- Press **Level** Key during IG-RPM measurement. Input sensitivity level is changed as Level 3→2→1→4. (default setting is Level 3).
- Sensitivity level is shown with the number of "▲" under the bar graph.
- Change of input sensitivity is effective in the following cases.  
When measured value is unstable, reduce the current input sensitivity level.  
When measured value is "0", increase the current input sensitivity level.



#### NOTES FOR RPM MEASUREMENT

- KT-2022 is able to change the sensor sensitivity, however, RPM measurement may not be done depending on the types of engines. In that case, we recommend to use "SK-8401 Digital Tachometer".
- Do not apply hard mechanical shock to RPM Sensors.
- Measurement does not work for rotary engine / diesel engine / vehicles with MSD or MDI systems / some vehicles with wasted spark ignition.

#### 5-7. RESISTANCE MEASUREMENT ( Ω )


##### ⚠ WARNING



- Do not measure voltage in  position. This will cause electrical shock hazard to the operator and/or serious damage to the instrument.
- In case in-circuit resistance is measured, turn off power to the circuit being measured and discharge the all capacitors.
- Discharge high-capacity capacitor through appropriate resistance load.
- Read "3. SAFETY PRECAUTIONS" carefully before measurement.

- Insert black test lead to **COM** terminal and insert red test lead to **RPM/Temp+/Ω/V/Hz** terminal.
- Set **FUNCTION** Switch to   position, and press **Select** Key until "MΩ" appears on LCD.
- If the resistor to be measured is connected in a circuit, turn off power to the circuit and discharge the all capacitors. Then, disconnect one side of the resistor.
- Connect test leads to the resistor (or circuit) to be measured.
- Read the measurement value on LCD.
- After finishing the measurement, set **FUNCTION** Switch to "OFF".

#### 5-8. DIODE TEST ( → )

##### ⚠ WARNING

- Do not measure voltage in  position. This will cause electrical shock hazard to the operator and/or damage to the instrument.
- If the diode is connected in a circuit, turn off the power to the circuit and discharge the all capacitors.
- Discharge high-capacity capacitor through appropriate resistance load.
- Read "3. SAFETY PRECAUTIONS" carefully before measurement.

- Insert black test lead to **COM** terminal and insert red test lead to **RPM/Temp+/Ω/V/Hz** terminal.
- Set **FUNCTION** Switch to   position, and press **Select** Key until "V" appears on LCD.
- If the diode is connected in a circuit, turn off the power to the circuit and discharge the all capacitors. Disconnect one side of the diode.
- Connect black test lead to Anode side and red test lead to Cathode side of the diode (Reverse connection). Confirm "OL" is displayed on LCD.
- Connect test leads to the opposite side of 4 (Forward Connection). Test results are good if the following voltage values are displayed on LCD.
  - Silicon diodes...0.4V to 0.9V
  - Germanium diodes...0.1V to 0.4V
- After finishing the measurement, set **FUNCTION** Switch to "OFF".

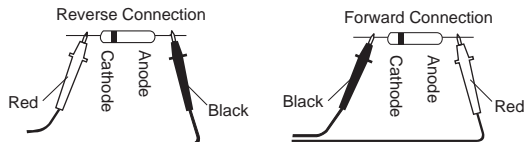





fig-9

#### 5-9. CONTINUITY TEST ( • )


##### ⚠ WARNING



- Do not measure voltage in  position. This will cause electrical shock hazard to the operator and/or damage to the instrument.
- When measuring in-circuit continuity, turn off power to the circuit to be measured and discharge the all capacitors.
- Discharge high-capacity capacitor through appropriate resistance load.
- Read "3. SAFETY PRECAUTIONS" carefully before measurement.

- Insert black test lead to **COM** terminal and insert red test lead to **RPM/Temp+/Ω/V/Hz** terminal.
- Set **FUNCTION** Switch to   position, and press **Select** Key until "•" appears on LCD.
- If the diode is connected in a circuit, turn off the power to the circuit and discharge the all capacitors. Disconnect one side of the diode.
- Connect test lead to both side of the circuit to be measured. Buzzer sounds when the circuit resistance is between 10Ω and 200Ω.
- After finishing the measurement, set **FUNCTION** Switch to "OFF".

#### 5-10. CAPACITANCE MEASUREMENT ( Hz )


##### ⚠ WARNING



- Do not measure voltage in  position. This will cause electrical shock hazard to the operator and/or damage to the instrument.
- If the capacitor is connected in a circuit, turn off the power to the circuit and discharge the all capacitors.
- Discharge high-capacity capacitor through appropriate resistance load.
- Read "3. SAFETY PRECAUTIONS" carefully before measurement.

- Insert black test lead to **COM** terminal and insert red test lead to **RPM/Temp+/Ω/V/Hz** terminal.
- Set **FUNCTION** Switch to   position, and press **Select** Key until "μF" appears on LCD.
- If the capacitor is connected in a circuit, turn off the power to the circuit and discharge the all capacitors. Disconnect one side of the capacitor.
- Connect test lead to both side of the capacitor to be measured.
- Read the measurement value on LCD.
- NOTE** : High capacitance capacitor should be taken longer to get a measurement value.
- After finishing the measurement, set **FUNCTION** Switch to "OFF".

#### 5-11. TEMPERATURE MEASUREMENT ( °C / °F )



##### ⚠ WARNING





- Do not measure voltage in  position. This will cause electrical shock hazard to the operator and/or damage to the instrument.
- Read "3. SAFETY PRECAUTIONS" carefully to avoid electric shock hazard and serious damage to the instrument.

- Insert "—" side of temperature probe to **COM** terminal and insert "+" side to **RPM/Temp+/Ω/V/Hz** terminal.
- Set **FUNCTION** Switch to   position, and press **Select** Key until "°C (---)" or "°F (---)" appears on LCD.
- Put the tip of temperature probe on the object to be measured, and read the LCD.
- After finishing the measurement, set **FUNCTION** Switch to "OFF".

#### 5-12. CURRENT MEASUREMENT ( μA, mA / A )

##### ⚠ WARNING

- Do not measure the current that exceeds the maximum value (A : 10A AC/DC, mA : 600mA AC/DC, μA : 6000μA AC/DC) to avoid electrical shock hazard and/or damage to the instrument.
- Connect **RED** test lead to "mA/μA" or "A" terminal.
- Do not measure the current that exceeds 250V open circuit voltage.
- 20A AC/DC measurement is possible, but within 30 seconds. For continuous measurement, every 5 minutes interval is necessary for cooling down.
- Do not measure voltage in   position. This will cause electrical shock hazard to the operator and/or damage to the instrument.
- Read "3. SAFETY PRECAUTIONS" carefully before measurement.

- Insert black test lead to **COM** terminal.
- Insert red test lead to **mA/μA** terminal for mA or μA measurement, or insert it to **A** terminal for A measurement.
- Set **FUNCTION** Switch to   position for A or mA measurement, or set it to   position for μA measurement.
- Press **Select** Key to select DC (—) or AC (～).
- Turn off the power of the circuit to be measured. Open the circuit after discharging the capacitors.
- Connect black test lead to — (earth) side and connect red test lead to + (positive) side of the circuit to be measured.  
**NOTE** : Connect the instrument **IN SERIES** to the circuit.  
**NOTE** : Use Alligator Clips for dangerous current measurement.

##### ⚠ WARNING

10A AC/DC measurement is possible, but within 30 seconds. For continuous measurement, every 5 minutes interval is necessary for cooling down.

- Turn on the power of the circuit being measured and read the measurement value on LCD.
- Disconnect test leads from the circuit being measured after turn it off and discharge the all capacitors.
- After finishing the measurements, set **FUNCTION** Switch to "OFF".

#### 6. FUNCTIONS

##### 6-1. RANGE HOLD : Range Key

Manual-range measurement is possible by pressing **Range** Key during auto-range measurement ("AUTO" disappears from LCD).

To change the measurement range in manual-range, press **Range** Key.

To return to Auto-range : Press **Range** Key for more than 1 second. ("AUTO" lights up).

##### 6-2. TRIGGER +/- CHANGING : ±TRIGGER Key

This function is available in Duty Cycle and Injection Pulse Width measurements.

"+" and "—" sides of measuring trigger slope can be displayed by pressing ±**TRIGGER** Key. Default display is "—".

For example: In the case of fig-10

- 3.18ms is measuring in Injection Pulse Width measurement. "—" sign shows that this value is "—" side of the measuring trigger slope.
- Press ±**TRIGGER** Key for 1 second or more.
- LCD display is changed into "+" side of the trigger slope and "+7.42ms" is displayed.
- LCD returns into "—" value by pressing ± **TRIGGER** Key again for 1 second or more.

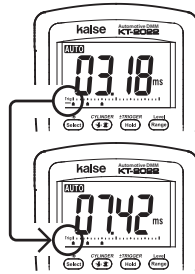


fig-10

5. For reference, the waveform of this measurement becomes like fig-11.

- In Duty Cycle terms, "—" should be 30% and "+" value should be 70% as shown in fig-11.

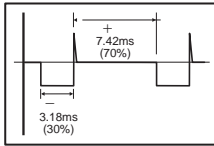



fig-11

#### 6-3. LCD BACKLIGHT





Backlight turns on LCD. It helps the measurement in a dark place.

- Press  Key for more than 1 second to turn on the backlight.

**NOTE** : Backlight turns off automatically after 32 seconds.

- During backlight turns on, press  Key for more than 1 second again to turn off the backlight.

#### 6-4. IMPROPER CONNECTION WARNING

- When the function except   and  is selected, warning buzzer sounds with "InEr" indication on LCD by connecting test lead to "mA/μA" or "A" terminal.
- When the function  is selected, warning buzzer sounds with "InEr" indication on LCD by connecting test lead to "A" terminal.

#### 7. MAINTENANCE

##### 7-1. BATTERY AND FUSE REPLACEMENT

##### ⚠ WARNING

- To avoid electrical shock, detach test leads from circuit when to replace battery and fuse.
- Set **FUNCTION** Switch to "OFF".
- Always use the specified fuse. Do not use this instrument shorting fuse holder or without using the fuse.

**FUSE SPECIFICATION** : Fast-acting 11A/1000V (φ10×38mm)  
Fast-acting 0.4A/1000V (φ6×32mm)

Replace the battery when  " lights up on LCD.

- Finish the measurement and set **FUNCTION** Switch to "OFF".
- Remove the holster and loosen a screw on rear cover.
- Remove rear cover from the bottom side.
- Remove the exhausted battery and replace it into 2 pcs of new 1.5V R03 (AAA) batteries in the correct polarity.
- When replacing a fuse, replace a blown fuse into a new one.
- Fix rear cover onto the rear case from upper side fitting their hooks together.
- Tighten the screws on rear case and fix the holster.

**NOTE** : Installed battery is for inspection purpose and might be exhausted earlier than the new battery.

**NOTE** : Remove the battery when the instrument is out of use for a long time. The exhausted battery might leak electrolyte and corrode the inside.

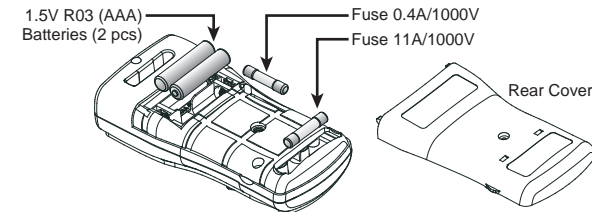


fig-12

##### 7-2. PERIODICAL CHECK AND CALIBRATION

Periodical check and calibration is necessary to make safety measurements and to maintain the specified accuracy. The recommended check and calibration term is once a year and after the repair service. This service is available at KAISE AUTHORIZED SERVICE AGENCY through your local dealer.

##### 7-3. REPAIR

Repair service is available at KAISE AUTHORIZED SERVICE AGENCY through your local dealer. Pack the instrument securely with your name, address, telephone number and problem details, and ship prepaid to your local dealer.

Check the following items before asking repair service.

- Check the battery connection, polarity, and capacity (" lights up or not).
- Confirm that FUNCTION Switch is set to the correct position.
- Confirm that the body of this instrument and handle insulators of test leads have no cracks or any other damages.
- Check if any noise affects the instrument. This instrument is fully shielded against noise, but possibly to be affected by very strong noise.

##### WARRANTY

KT-2021 is warranted in its entirety against any defects of material or workmanship under normal use and service within a period of one year from the date of purchase of the original purchaser. Warranty service is available at **KAISE AUTHORIZED SERVICE AGENCY** through your local dealer. Their obligation under this warranty is limited to repairing or replacing KT-2021 returned intact or in warrantable defect with proof of purchase and transport charges prepaid. **KAISE AUTHORIZED DEALER** and the manufacturer, **KAISE CORPORATION**, shall not be liable for any consequential damages, loss 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 of **KAISE AUTHORIZED SERVICE AGENCY**, nor which have been subject to misuse, negligence, accident, incorrect repair by users, or any installation or use not in accordance with instructions provided by the manufacturer.

KAISE AUTHORIZED DEALER



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

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