

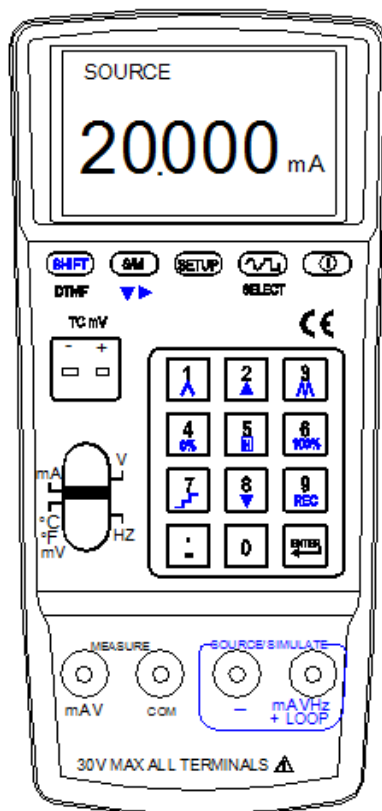


## Instruction Manual

# RS-133

## Documenting Multifunction Calibrator & Arbitrary Function Generator

EN



**This unit passes the following tests:**



**EN 61326-1 : 2013**

**EN 61000-3-2 : 2014**

**EN 61000-3-3 : 2013**

## Safety Symbols



Please read the statement thoroughly to prevent injury or loss of life, and prevent damage to this product.



Earth (ground)



DC (Direct Current)



Conforms to relevant European Union directives.



Do not dispose of this instrument as unsorted municipal waste. Contact a qualified recycler for disposal.



Please remove all the test leads before performing maintenance, cleaning and battery replacement, etc.



Do Not plug in the AC adapter when the ambient temperature exceeds 45°C / 113°F.



Do Not charge the lithium battery when the ambient temperature exceeds 45°C / 113°F.



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## Features:

1. **Unique mapping function** let you calibrate temperature (300 °C) or voltage (220V) directly (instead of 4 to 20mA indirectly).
2. A **multifunction calibrator** and an **arbitrary function generator**.
3. **Simulate** a current **transmitter**.
4. 4~20mA (open voltage 24V) **direct source** mode.
5. Make a measurement and **output loop power** 24V (LOOP+) simultaneously.
6. User selectable HART™ resistor to facilitate use with **HART™ communication** devices.
7. **Electronic load** (max. 30V, 24mA).
8. **Source:** mA (4 to 20mA), V (0 to 15V, 0 to 70mV), Hz, sine wave, square wave, triangular wave, truncated sine wave, user programmable waveform and temperature for 11 types of thermocouples.
9. **Measure:** Current (mA), Voltage (V, mV) and temperature in °C or °F.
10. **Programmable cold junction compensation** allows users to fine tune temperature output and measurement.
11. Programmable 0% and 100% value for easy **25% step function**.
12. **Output error warning** when output is shorted or open.
13. **Short circuit protection** for voltage output.
14. **Clear and easy user interface** (Numerical key pad, sliding switch and dot matrix LCM with backlight).
15. Voltage, frequency, PWM duty-cycle (square wave and triangular wave), and offset are programmable in the **Hz function**.
16. **Frequency range (0.3Hz to 20KHz)** covers application of audio band (speaker, MP3, MD etc.)
17. **DTMF** (Dual Tone Multi-Frequency) can perform professional testing for telephone line and audio product (MP3 or MD).
18. **Auto-step and auto-ramp functions** can quickly perform linear test.
19. **PC** can program calibrator through USB port.
20. Perform **data logging** with programmable sampling time (0-255 seconds) and memory of 4000 records.
21. **Rechargeable Lithium battery** (1600mAH) with built-in charging circuit.

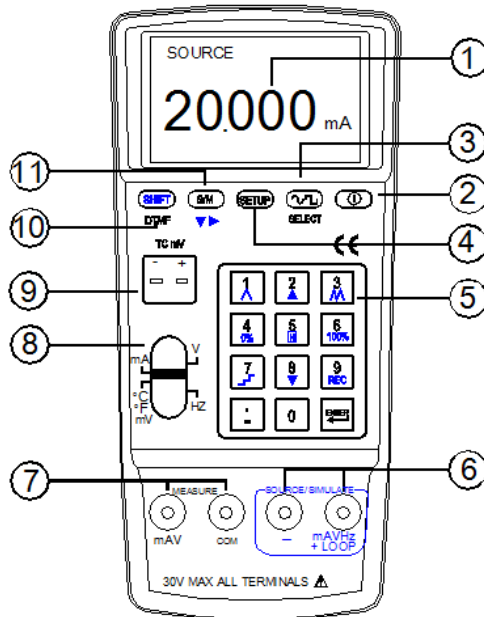
22. **Calibration results** (source and measure) can be **saved in memory** (2000 records). Then users download them to a PC for documentation. No needs to transcribe calibration data manually.
23. To **distinguish calibration data** at different locations, data can be saved under different file names.

## Applications:

1. **Calibration of 4~20mA** panel meters.
2. **Simulating a current transmitter.**
3. **LED brightness testing (0~24mA).**
4. **Electronic load (max. 30V, 24mA).**
5. **Temperature calibration** of panel meters or instruments for 11 types of thermocouples.
6. **Calibration of valve opening** by changing duty cycle of a PWM signal.
7. **Generation** of selected test **frequency and waveform** for electronic device.
8. **Pre-stored** 1/3 octave audition, white noise, and pink noise for MP3, MD, speaker and audio driver tests.
9. **Audio Frequency Synthesizer:** Programmable frequency and phase synthesis of single tone, DTMF(Double Tone, Multi-Frequency) for audio products such as MP3, MD and telephone line.
10. **Function generation** for transistor DC bias characteristics test, amplifier overload and transient characteristics.
11. **Function generation** for vibration testing.
12. **Calibration of a chart recorder** with different waveforms (sine, square, or triangular wave).
13. Simulation of **PLC.**



## I. PANEL DESCRIPTION



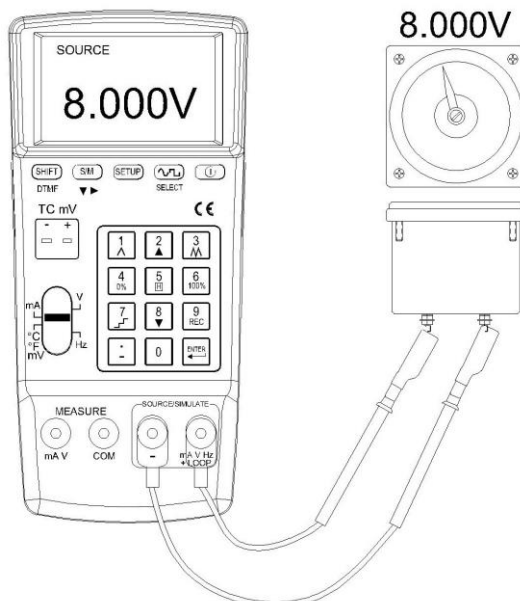
1. **LCM** display.
2. **ON/OFF** button.
3. **SELECT** button for selecting waveforms (in the Hz function).
4. **SETUP** button.
5. Numerical key pads; or buttons for special functions.
6. Output/Simulation terminals (for **SOURCE**).
7. Input terminals (for **MEASURE**).
8. **Sliding switch** (for various functions).
9. Temperature input/output terminals.
10. **SHIFT** button for using secondary functions on the numerical key pads:  
**DTMF** and Frequency switching.
11. **S/M** button (for selecting **SOURCE** or **MEASURE**).

## II. OPERATION

### 1. Voltage Source

#### 1a. 0V ~ 15V

- (1) Turn on the power. Turn the sliding switch to V.
- (2) Press S/M button to select SOURCE (output) mode.  
(Press **SETUP** once to store it as default mode when power is turned on.)
- (3) Type in a voltage value (including decimal point); then press ENTER.
- (4) Connect Test leads or Alligator clips to SOURCE terminals (red to +, and black to -).
- (5) Then connect Test leads or Alligator clips to the object for calibration.
- (6) To perform voltage scanning, refer to “Scanning for Source” chapter.
- (7) To perform data logging function, refer to “Data logging” chapter.




**Remark:**

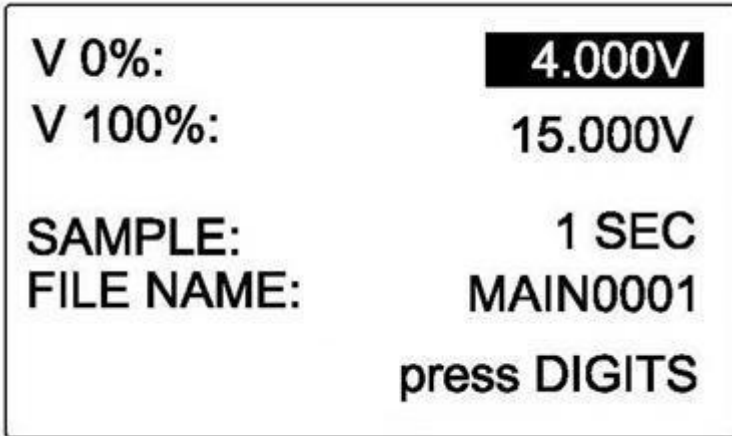
1. Users are allowed to type in max. 5 digits.
2. Type in a voltage value (including decimal point), press ENTER, then the calibrator will output this voltage value.
3. When the output value is  $<0$ , please type in a negative sign first.
4. When the output value is  $<1$  and  $>0$ , please type in "0." first.

**Warning:**

1. Do not make an input with voltage potential or connect any charged circuitry to SOURCE (terminals) to prevent from damaging the calibrator.
2. When there is a short circuit or overload at the output terminals, the calibrator can not output the correct voltage. Please remove connecting leads and check when there is a symbol of OUTPUT ERROR.
3. Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE , MEASURE , or TC alone.


**1b. How to set up**

- (1) Press  to enter SETUP function.
- (2) V 0%: set up the "starting" voltage for scanning.  
(refer to SCANNING chapter).
- (3) V 100%: set up the "ending" voltage for scanning.  
(refer to SCANNING chapter).
- (4) SAMPLE: set up the "sampling time" for data logging.  
(refer to DATA LOGGING chapter).
- (5) FILE NAME: data can be saved under different file names. Here users can set up a "file name". (refer to DATA LOGGING chapter)



### 1c. Details for set up





- (1) Press  button to select the item you'd like to setup.
- (2) When the selected item is in reverse video, type in a value.
- (3) FILE NAME: Type in a name by corresponding to ASCII codes (refer to Appendix 1). For example, for the letter "A" users should type in "65".
- (4) The data under the same file name will be put together.

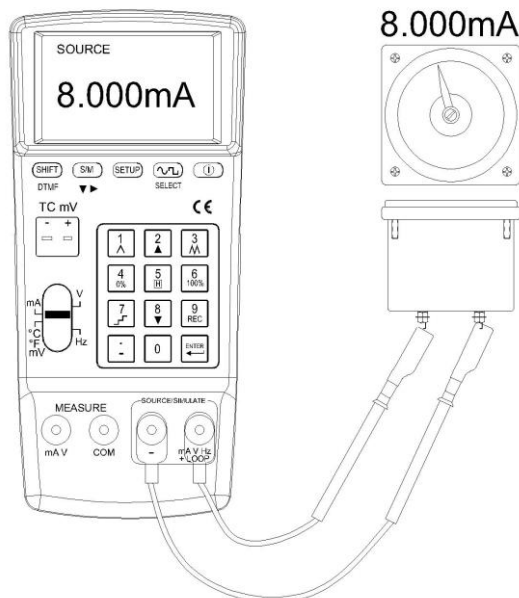
## 2. Current Source

### 2a-1. 4 ~ 20mA

- (1) Turn on the power. Turn sliding switch to mA.
- (2) Press S/M button to select SOURCE (output) mode.

(Press  once to store it as default mode when power is turned on: when you press  the OUTPUT mode can be set as SOURCE.)

- (3) Type in a current value (including decimal point); then press ENTER.
- (4) Connect Test leads or Alligator clips to SOURCE terminals (red to +, and black to -).
- (5) Then connect Test leads or Alligator clips to the object for calibration.
- (6) Current scanning function: refer to “Scanning for Source” chapter.
- (7) Data logging function: refer to “Data logging” chapter.

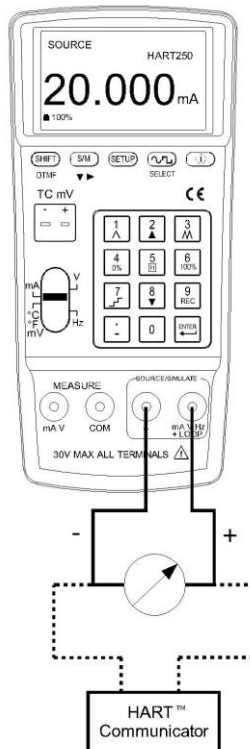


## 2a-2. Output (4~20mA) and Facilitating use with HART™ Communicator

- (1) Turn on the power. Turn sliding switch to mA.
- (2) Press S/M button to select SOURCE (output) mode.


(Press **SETUP** to set the OUTPUT mode as SOURCE, HART250 mode Enabled.)

- (3) Type in a current value (including decimal point); then press ENTER.
- (4) Connect Test leads or Alligator clips to SOURCE terminals (red to +, and black to -).
- (5) Then connect Test leads or Alligator clips to the object for calibration.
- (6) Current scanning function: refer to “Scanning for Source” chapter.
- (7) Data logging function: refer to “Data logging” chapter.

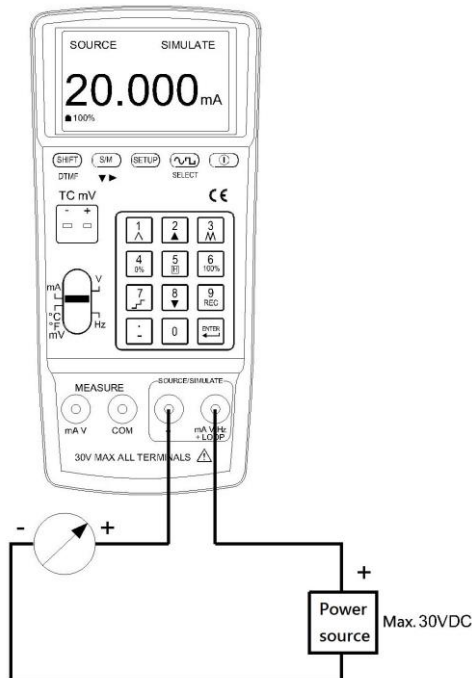


### 2a-3. Simulating a Transmitter

- (1) Turn on the power. Turn sliding switch to mA.
- (2) Press S/M button to select SOURCE (output) mode.

(Press  to set the OUTPUT mode as SIMULATE, HART250 mode Disabled.)

- (3) Type in a current value (including decimal point); then press ENTER.
- (4) Connect Test leads or Alligator clips to SOURCE terminals (red to +, and black to -).
- (5) Then connect Test leads or Alligator clips to the power source and the panel meter (or current measuring device).
- (6) Current scanning function: refer to “Scanning for Source” chapter.
- (7) Data logging function: refer to “Data logging” chapter.

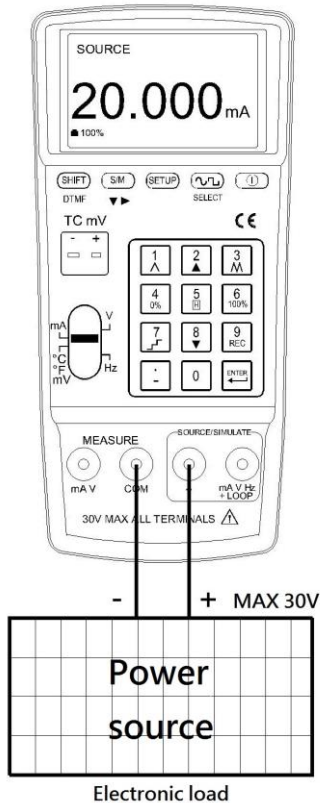


## 2a-4 Simulating Electronic Load (Max. 30V, 24mA)

- (1) Turn on the power. Turn sliding switch to mA.
- (2) Press S/M button to select SOURCE (output) mode.

(Press **SETUP** to set the OUTPUT mode as SOURCE.)


- (3) Type in a current value (including decimal point); then press ENTER.
- (4) Connect Test leads or Alligator clips to SOURCE terminals (red to +, and black to -).
- (5) Then connect Test leads or Alligator clips to the power source.
- (6) Current scanning function: refer to “Scanning for Source” chapter.
- (7) Data logging function: refer to “Data logging” chapter.



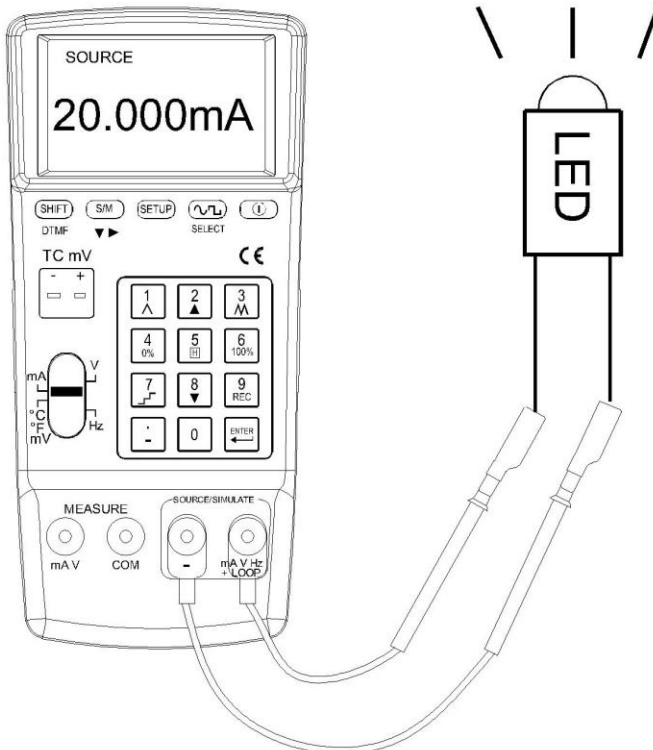


## 2a-5 LED Brightness Testing (0~24mA)

- (1) Turn on the power. Turn sliding switch to mA.
- (2) Press S/M button to select SOURCE (output) mode.

(Press  to set the OUTPUT mode as SOURCE.)

- (3) Type in a current value (including decimal point); then press ENTER.
- (4) Connect Test leads or Alligator clips to SOURCE terminals (red to +, and black to -).
- (5) Then connect Test leads or Alligator clips to LED.
- (6) Current scanning function: refer to “Scanning for Source” chapter.
- (7) Data logging function: refer to “Data logging” chapter.




**Remark:**

1. Users are allowed to type in max. 5 digits.
2. Type in a current value (including decimal point), press ENTER, then the calibrator will output this current value.
3. When the output value is <0, please type in a negative sign first.
4. When the output value is <1 and >0, please type in "0." first.

**Warning:**

1. Do not make an input or connect any charged installment to SOURCE (terminals) to prevent from damaging the calibrator.
2. When there is an output open circuit or overload, the calibrator can not output the correct current. Please remove connecting leads and check when there is a symbol of OUTPUT ERROR.
3. Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE , MEASURE , or TC alone.

**2b. How to set up**

- (1) Press  to enter SETUP function.
- (2) mA 0%: set up the "starting" current for scanning.  
(refer to SCANNING chapter).
- (3) mA 100%: set up the "ending" current for scanning.  
(refer to SCANNING chapter).
- (4) 4mA→: set up the mapping unit for 4mA.
- (5) 20mA→: set up the mapping unit for 20mA.
- (6) MAPPING: here users can decide if they want MAPPING function.
- (7) OUTPUT MODE: Current output modes switched to SOURCE or SIMULATE.
- (8) HART250: HART™ mode Enabled or Disabled.

mA 0%:	<b>4.000mA</b>
mA 100%:	20.000mA
4mA →	0.0000KW
20mA →	100.00KW
MAPPING	YES


press DIGITS

OUTPUT MODE:	SOURCE
HART250:	Disabled

press SELECT

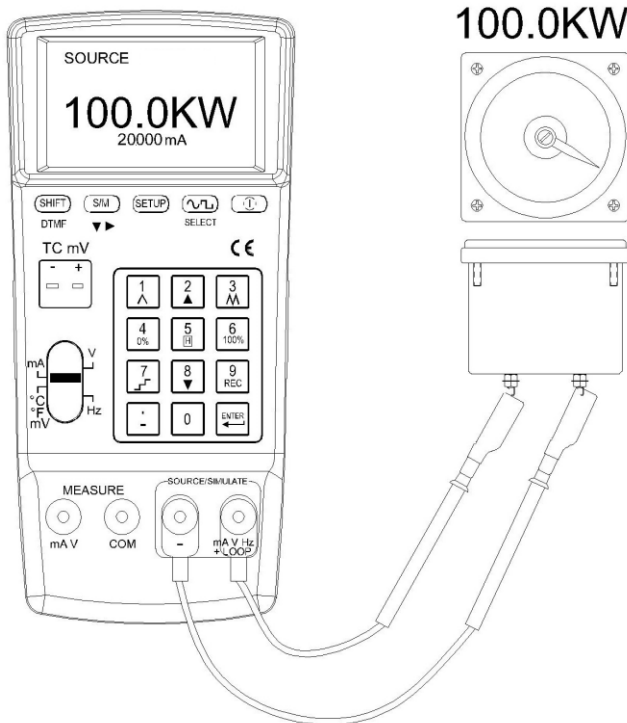
### 2c. Details for set up



- (1) Press  button to select the item you'd like to setup.
- (2) When the selected item is in reverse video, type in a value.
- (3) When setting up the mapping unit for 4mA or 20mA, type in the unit by corresponding to ASCII codes (refer to Appendix 1). For example, for "KW" users should type in "75" and "87".
- (4) MAPPING: "YES" means the mapping function is enabled;  
"NO" means the mapping function is disabled.

## 2d. MAPPING Function

- (1) In the SETUP display when users choose YES for MAPPING, the MAPPING function is enabled
- (2) The display unit will be the same as the one set up by users. For example, for the unit “KW” users should type in “75” and “87”.
- (3) (If in the SETUP display, users set up 0KW for 4mA and 100KW for 20mA)  
When users type in 100 and then press ENTER, the display will show:  
**100.0KW** (the main display) and **20.000mA** (which means the original output of the calibrator is 20.000mA).
- (4) When users perform scanning function, the display show 0~100KW instead of 4mA ~ 20mA.

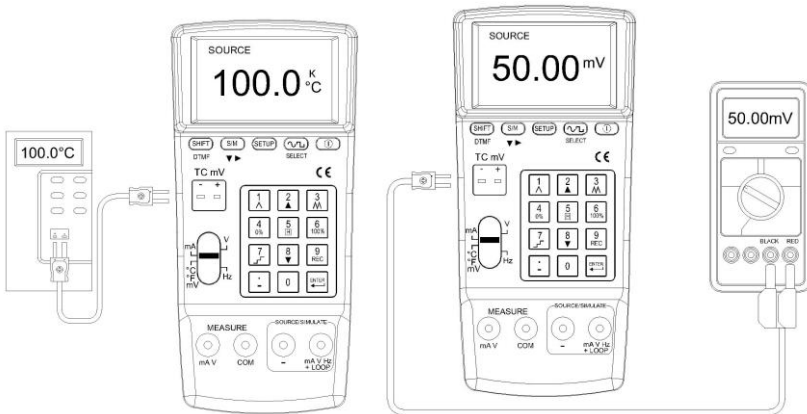


### 3. TEMPERATURE SOURCE (THERMOCOUPLES, °C&°F)

#### 3a. TC Simulating Thermocouple Signals

(for Types K, J, E, T, R, S, N, L, U, B, C, and mV Output)

- (1) Turn on the power. Turn sliding switch to °C °F mV.
- (2) Select a TC TYPE in the SETUP display.
- (3) Type in a temperature value (including decimal point); then press ENTER.
- (4) Connect Thermocouple to TC/mV terminals.
- (5) Then connect the other end of Thermocouple to the object for calibration.



**Remark: 1.** Users are allowed to type in max. 5 digits.

**2.** Type in a temperature value (including decimal point), press ENTER, then the calibrator will output this temperature value.

**3.** When the output value is <0, please type in a negative sign first.


**4.** When the output value is <1 and >0, please type in "0." first.

**Warning: 1.** Do not make an input or connect any charged installment to TC terminals to prevent from damaging the calibrator.

**2.** When there is an output short circuit or overload, the calibrator can not output the correct temperature. Please remove connecting leads and check when there is a symbol of OUTPUT ERROR.

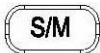
**3.** Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE, MEASURE, or TC alone.


### 3b. How to set up

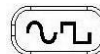
- (1) Press  to enter SETUP function.
- (2) TC 0%: set up the “starting” temperature for scanning.  
(refer to SCANNING chapter).
- (3) TC 100%: set up the “ending” temperature for scanning.  
(refer to SCANNING chapter).
- (4) C. J. COMP.: set up the Cold Junction Compensation.
- (5) TC TYPE: set up the thermocouple type.
- (6) UNIT: here users can choose °C or °F.

TC 0%:	<b>100.0°C</b>
TC 100%:	1000.0°C
C.J.COMP.:	0.0°C
TC TYPE:	K
UNIT:	°C
press DIGITS	

### 3c. Details for set up



- (1) Press  button to select the item you'd like to setup.
- (2) When the selected item is in reverse video, type in a value.
- (3) C. J. COMP.: Users can type in the temperature for Cold Junction Compensation. (The default is 0.0°C, users can make compensation from -5°C to +5°C in accordance with the ideal output values.)



- (4) When “TC TYPE” is in reverse video, users can press **SELECT** button to choose the thermocouple type they want.




- (5) When “UNIT” is in reverse video, users can press **SELECT** button to choose °C or °F.

## 4. Frequency (Hz) Output

### 4a. 0.1Vpp ~ 20Vpp , 0.3Hz ~ 20KHz , offset: -5V ~ +5V


(1) Turn on the power. Turn sliding switch to Hz.

(Press  once to store it as default mode when power is turned on.)



(2) Press **SELECT** button to select the type of waveform (Sine wave, Square wave, Triangular wave, Truncated sine wave, and User programmable waveform).

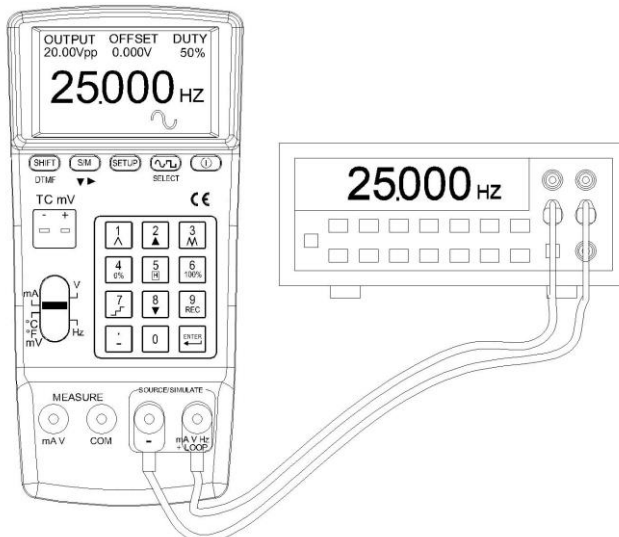


(3) Press  button to switch among “Voltage Peak to Peak (Vpp)”, “OFFSET”, “DUTY” and “Hz”.

(4) Then type in a value (including decimal point) and press ENTER.

(5) Connect Test leads or Alligator clips to SOURCE terminals (red to +, and black to -).

(6) Connect Test leads or Alligator clips to the object for calibration.




**Remark:**

1. Users are allowed to type in max. 5 digits.
2. Type in each parameter (including decimal point), press ENTER, then the calibrator will output the parameter values.
3. When the output value is <0, please type in a negative sign first.
4. When the output value is <1 and >0, please type in "0." first.


**Warning:**

1. Do not make an input or connect any charged installment to SOURCE (terminals) to prevent from damaging the calibrator.
2. When there is an output short circuit or overload, the calibrator can not output the correct frequency.
3. Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE , MEASURE , or TC alone.

**4b. How to set up**

(1) Press  to enter SETUP function.

(2) Waveform Index: give a number for a "user programmable waveform".

(3) Press  again to enter the main display of Hz range.



(4) Press **SELECT** button to select the "user programmable waveform".  
Then, the calibrator will output this selected "user programmable waveform"  
(e.g. number 7 waveform – named SINONE60 Sinusoidal Wave 60Hz).

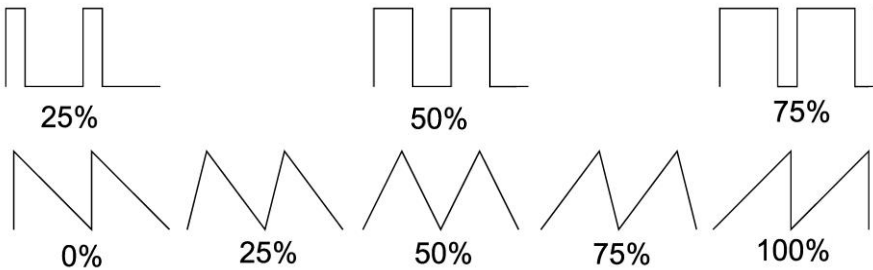
**Waveform Index:      7**  
**SINONE60 Sinusoidal Wave**  
**60Hz**

**press DIGITS**

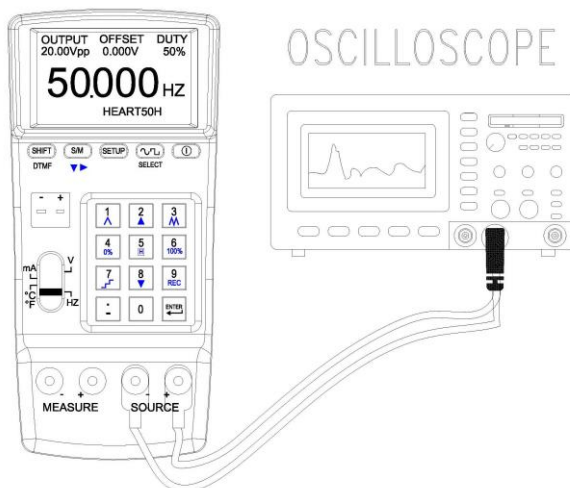


#### 4c. Details for fine-tuning items

- (1) Hz: set up the output frequency.
- (2) OUTPUT: set up the output voltage (Peak to Peak).
- (3) OFFSET: set up the output DC bias accurate position. Fine tune this item can output TTL or modulate PWM signal.
- (4) DUTY: for a square wave, users can decide the band width of the positive wave. For a triangular wave, users can set up the saw-toothed shape.



- (5) Set up the waveform: users can select among sine wave, square wave, triangular wave, truncated sine wave, and user programmable waveform.
- (6) User programmable waveform: first users have to compile a waveform in PC and then send it to the calibrator (the details please refer to Software Manual).




## 5. Pulse Function


### 5a. $3.0\mu\text{S} \sim 999.99\text{mS}$ , $0.5\text{Vpp} \sim 10\text{Vpp}$ , offset: $-5\text{V} \sim +5\text{V}$

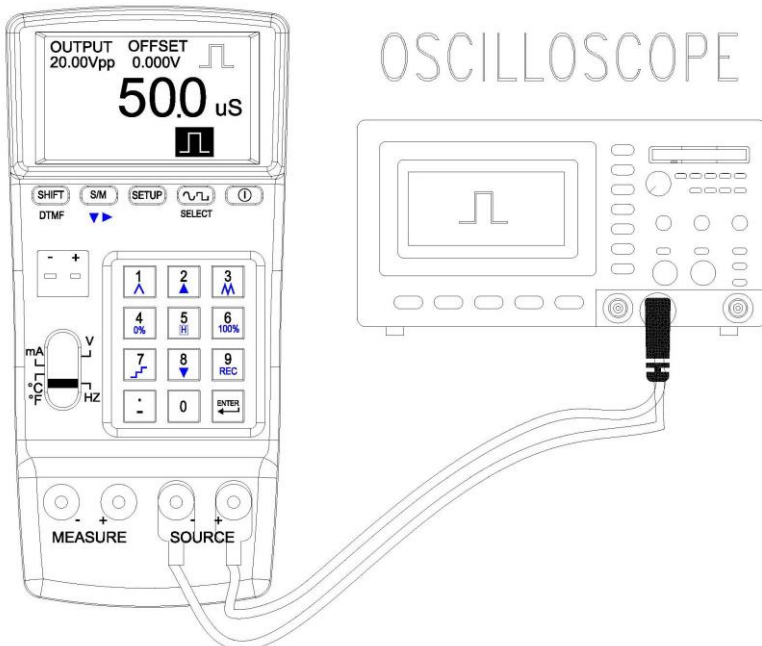
- (1) Turn off the power. Sliding switch turned to Hz.



- (2) Press **SELECT** button and  button at the same time; the display will show a reverse “PULSE” mark which means it already enters into the PULSE function.



- (3) Press  button to switch among “Voltage Peak to Peak (Vpp)”, “OFFSET” and “PULSE”.
- (4) Then type in a value (including decimal point) and press ENTER.
- (5) Connect Test leads or Alligator clips to SOURCE terminals (red to +, and black to -).
- (6) Connect Test leads or Alligator clips to the object for calibration.





**Remark:**

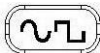
1. Users are allowed to type in max. 6 digits.
2. Type in each parameter (including decimal point), press ENTER, then the calibrator will output the parameter values.
3. When the output value is <0, please type in a negative sign first.
4. When the output value is <1 and >0, please type in "0." first.

**Warning:**

1. Do not make an input or connect any charged installment to SOURCE (terminals) to prevent from damaging the calibrator.
2. When there is an output short circuit or overload, the calibrator can not output the correct PULSE waveform.
3. Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE , MEASURE , or TC alone.

**5b. Details for fine-tuning items**

Press   button to select the parameter "OUTPUT -> OFFSET ->  $\mu\text{S}$ " for typing in "Output Voltage", "DC Offset" and "Pulse time".

**5c. Pulse Output**

Press **SELECT** button, the display will briefly show a "PULSE" mark which




means a pulse is already outputted; press **SELECT** button again to output next pulse.

## 6. DTMF (Dual Tone Multi-Frequency)

### 6a. 5Vpp~20Vpp, 0.3Hz~20KHz, offset: -5V~+5V, %: 0~100%, phase: 0~360°

(1) Turn on the power. Turn sliding switch to Hz.

(Press  once to store it as default mode when power is turned on.)



(2) Press **DTMF** button to enter DTMF mode.



(3) Press   button to set up all the parameters of F1 and F2.

(4) Then type in a value (including decimal point) and press ENTER.

(5) Connect Test leads or Alligator clips to SOURCE terminals (red to +, and black to -).

(6) Connect Test leads or Alligator clips to the object for calibration.



**Remark:**

1. Users are allowed to type in max. 5 digits.
2. Type in each parameter (including decimal point), press ENTER, then the calibrator will output the parameter values.
3. When the output value is <0, please type in a negative sign first.
4. When the output value is <1 and >0, please type in "0." first.

**Warning:**

1. Do not make an input or connect any charged installment to SOURCE (terminals) to prevent from damaging the calibrator.
2. When there is an output short circuit or overload, the calibrator can not output the correct frequency/waveform.
3. Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE , MEASURE , or TC alone.

**6b. How to set up**

- (1) Hz: set up the output frequency of F1 and F2.
- (2) %: set up the output % of F1 and F2.
- (3) Phase: set up the outset phase angle of F1 and F2.
- (4) Vpp: set up the output Peak to Peak voltage.
- (5) Offset: set up the output DC bias accurate position.



DTMF	F1	F2
HZ:	<b>50.0Hz</b>	2000.0Hz
%:	67%	33%
Phase:	60°	120°
Vpp:	20.000V	
Offset:	0.000V	

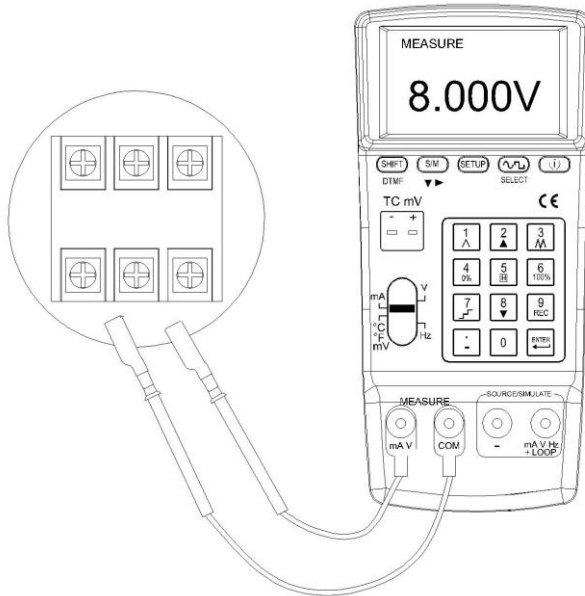
## 7. Voltage Input (Measure)

### 7a. -3V ~ 24V

- (1) Turn on the power. Turn sliding switch to V.



- (2) Press   button to select MEASURE (input) mode.
- (3) Connect Test leads or Alligator clips to MEASURE terminals (red to +, and black to -).
- (4) Then connect the other ends of Test leads or Alligator clips to the object for measurement.
- (5) The calibrator display will show the measurement result.
- (6) Data logging function: refer to “Data logging” chapter.



**Remark: 1.** The measurement result is 5-digit (including decimal point and negative sign).

**Warning: 1.** Do not measure over 30V for MEASURE (terminals) to prevent from damaging the calibrator.



**2.** Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE , MEASURE , or TC alone.

## 8. Current Input (Measure)

### 8a-1. -4mA ~ 24mA

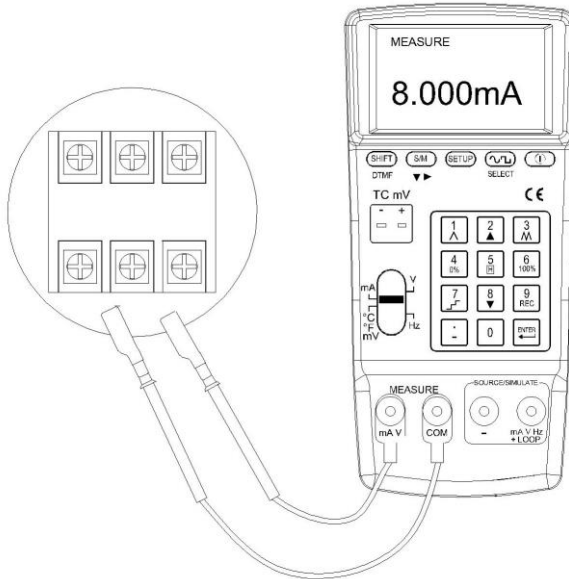
- (1) Turn on the power. Turn sliding switch to mA.



- (2) Press   button to select MEASURE (input) mode.

(Press  to set the OUTPUT mode as SIMULATE.)

- (3) Connect Test leads or Alligator clips to MEASURE terminals (red to +, and black to -).  
 (4) Then connect the other ends of Test leads or Alligator clips to the object for measurement.  
 (5) The calibrator display will show the measurement result.  
 (6) Data logging function: refer to “Data logging” chapter.




**Remark: 1.** The measurement result is 5-digit (including decimal point and negative sign).


**Warning: 1.** Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE , MEASURE , or TC alone.

## 8a-2. Measure and Output Loop Power 24V

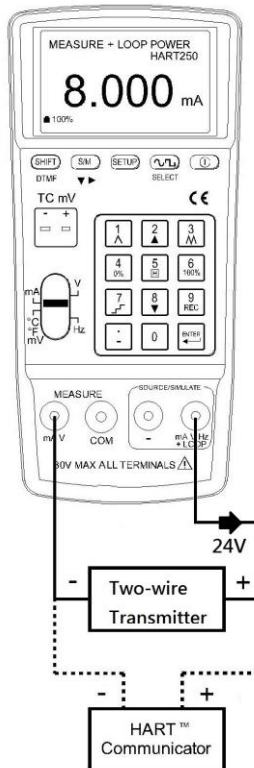
- (1) Turn on the power. Turn sliding switch to mA.



- (2) Press  button to select MEASURE (input) mode.

(Press  to set the OUTPUT mode as SOURCE, as for HART™ mode users can set it as Enabled or Disabled.)

- (3) Connect Test leads or Alligator clips to below terminals:  
Red to “mA V Hz +LOOP” terminal; Black to “mA V” terminal.
- (4) Then connect the other ends of Test leads or Alligator clips to the object for measurement.
- (5) The calibrator display will show the measurement result.
- (6) Data logging function: refer to “Data logging” chapter.





## 8b. How to set up


- (1) Press **SETUP** to enter SETUP function.
- (2) 4mA→: set up the mapping unit for 4mA.
- (3) 20mA→: set up the mapping unit for 20mA.
- (4) MAPPING: here users can decide if they want MAPPING function.

mA 0%:	4.000mA
mA 100%:	20.000mA
4mA →	0.0000KW
20mA →	<b>100.00KW</b>
MAPPING	YES
	press DIGITS

OUTPUT MODE:	SOURCE
HART250	Disabled
	press SELECT

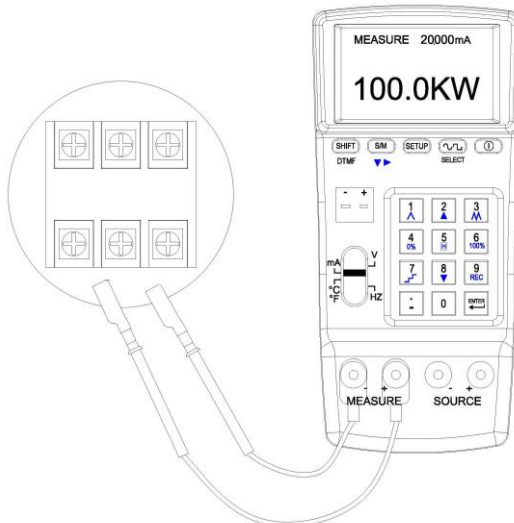
### 8c. Details for set up



- (1) Press  button to select the item you'd like to setup.
- (2) When the selected item is in reverse video, type in a value.
- (3) When setting up the mapping unit for 4mA or 20mA, type in the unit by corresponding to ASCII codes (refer to Appendix 1). For example, for "KW" users should type in "75" and "87".
- (4) MAPPING: "YES" means the mapping function is enabled; "NO" means the mapping function is disabled.

### 8d. MAPPING Function

- (1) In the SETUP display when users choose YES for MAPPING, the MAPPING function is enabled
- (2) The display unit will be the same as the one set up by users. For example, for the unit "KW" users should type in "75" and "87".
- (3) (If in the SETUP display, users set up 0KW for 4mA and 100KW for 20mA) When users type in 100 and then press ENTER, the display will show: **100.0KW** (the main display) and **20.000mA** (which means the original output of the calibrator is 20.000mA).




## 9. Temperature Input (Measure)

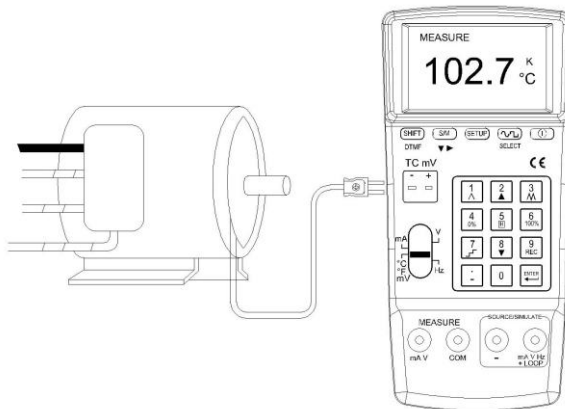
### 9a. TC Simulating Thermocouple Signals

(for Types K, J, E, T, R, S, N, L, U, B, C, and mV Input)

(1) Turn on the power. Turn sliding switch to °C °F mV.



- (2) Press  button to select MEASURE (input) mode.
- (3) Select a TC TYPE in the SETUP display.
- (4) Connect Thermocouple to TC/mV terminals.
- (5) Then connect the other end of Thermocouple to the object for measurement.
- (6) The calibrator display will show the temperature of the tested object.




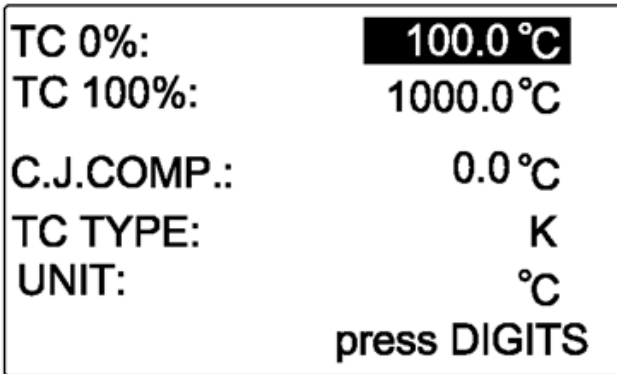
**Remark: 1.** The measurement result is 5-digit (including decimal point and negative sign).

**Warning:**

1. The Input TC terminals is for measuring mV, do not measure over 30V for MEASURE (terminals) to prevent from damaging the calibrator.
2. Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE , MEASURE , or TC alone.


### 9b. How to set up

- (1) Press  to enter SETUP function.
- (2) C. J. COMP.: set up the Cold Junction Compensation.
- (3) TC TYPE: set up the thermocouple type.
- (4) UNIT: here users can choose °C or °F.



### 9c. Details for set up



- (1) Press  button to select the item you'd like to setup.
- (2) When the selected item is in reverse video, type in a value.
- (3) C. J. COMP.: Users can type in the temperature for Cold Junction Compensation. (The default is 0.0°C, users can make compensation from -5°C to +5°C in accordance with the ideal output values.)



- (4) When "TC TYPE" is in reverse video, users can press **SELECT** button to choose the thermocouple type they want.




- (5) When "UNIT" is in reverse video, users can press **SELECT** button to choose °C or °F.

### III. SCANNING FOR SOURCE

#### 1. Voltage Scanning for SOURCE

##### 1a. How to setup:

- (1) Press  button to enter SETUP function.
- (2) V 0%: set up the “starting” voltage for scanning.
- (3) V 100%: set up the “ending” voltage for scanning.

V 0%:	<b>4.000V</b>
V 100%:	15.000V
SAMPLE:	1 SEC
FILE NAME:	MAIN0001
press DIGITS	









**Remark:**

1. Users are allowed to type in max. 5 digits.
2. Type in a voltage value (including decimal point), press ENTER, then the calibrator will output this voltage value.
3. When the output value is <0, please type in a negative sign first.
4. When the output value is <1 and >0, please type in “0.” first.

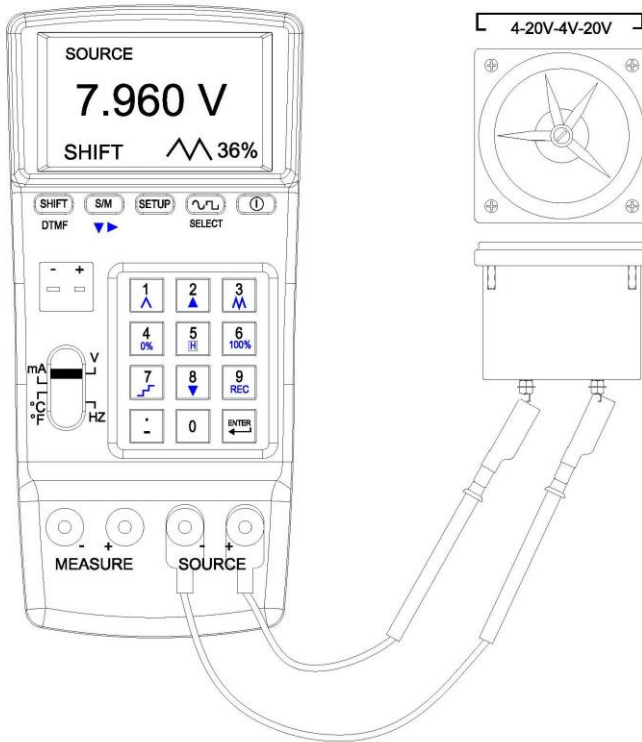
## 1b. Functions of Voltage Scanning for SOURCE



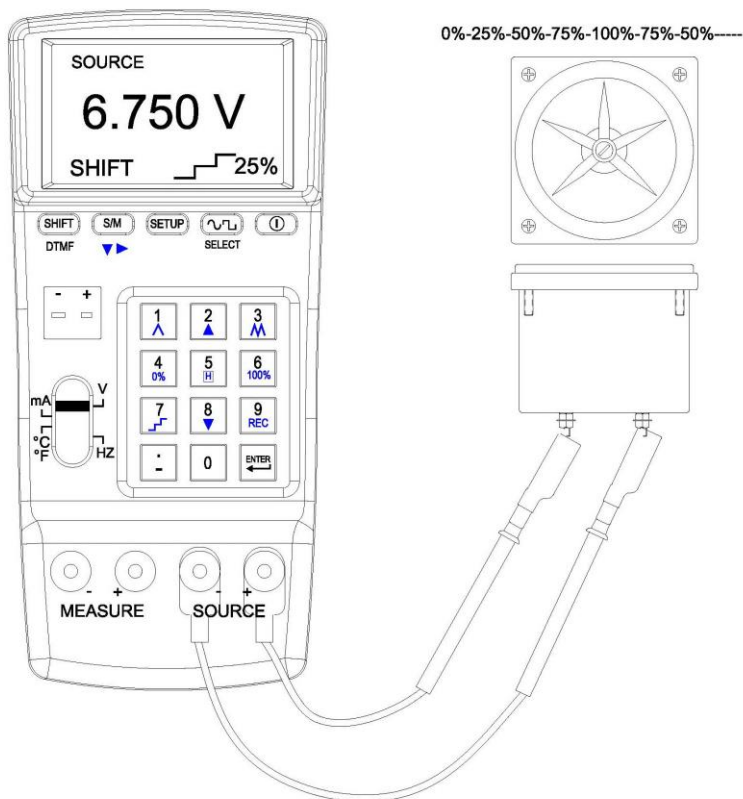
Press **DTMF** , then the lower left of LCM will display various functions (see the descriptions on below).

SHIFT +	Functions
	<b>Ramp scanning</b> 1% 2%.... 100% 99%....2% 1%
	<b>Manual Multi-step scanning (increase progressively)</b> Press this button once +25% till it reaches 100%
	<b>Fast ramp scanning</b> 4% 8%....100% 96%....8% 4%
	Return to the “ <b>starting</b> ” point of scanning 0%
	Press it during scanning period to <b>HOLD</b> the scanning
	Return to the “ <b>ending</b> ” point of scanning 100%
	<b>Auto Multi-step scanning (increase and decrease progressively)</b> 0% 25% 50% 75% 100%....
	<b>Manual Multi-step scanning (decrease progressively)</b> Press this button once -25% till it reaches 0%.

### 1c. Example of Connecting Leads (for Rapid and Multi-step Scanning)



**Connecting Leads for Fast ramp**




### Connecting Leads for Multi-step Scanning



## 2. Current Scanning for SOURCE

### 2a. How to setup:

- (1) Press  button to enter SETUP function.
- (2) mA 0%: set up the “starting” current for scanning.
- (3) mA 100%: set up the “ending” current for scanning.

mA 0%:	<b>4.000mA</b>
mA 100%:	20.000mA
4mA →	0.0000KW
20mA →	100.00KW
MAPPING	YES
	<b>press DIGITS</b>









#### Remark:

1. Users are allowed to type in max. 5 digits.
2. Type in a current value (including decimal point), press ENTER, then the calibrator will output this current value.
3. When the output value is <0, please type in a negative sign first.
4. When the output value is <1 and >0, please type in “0.” first.

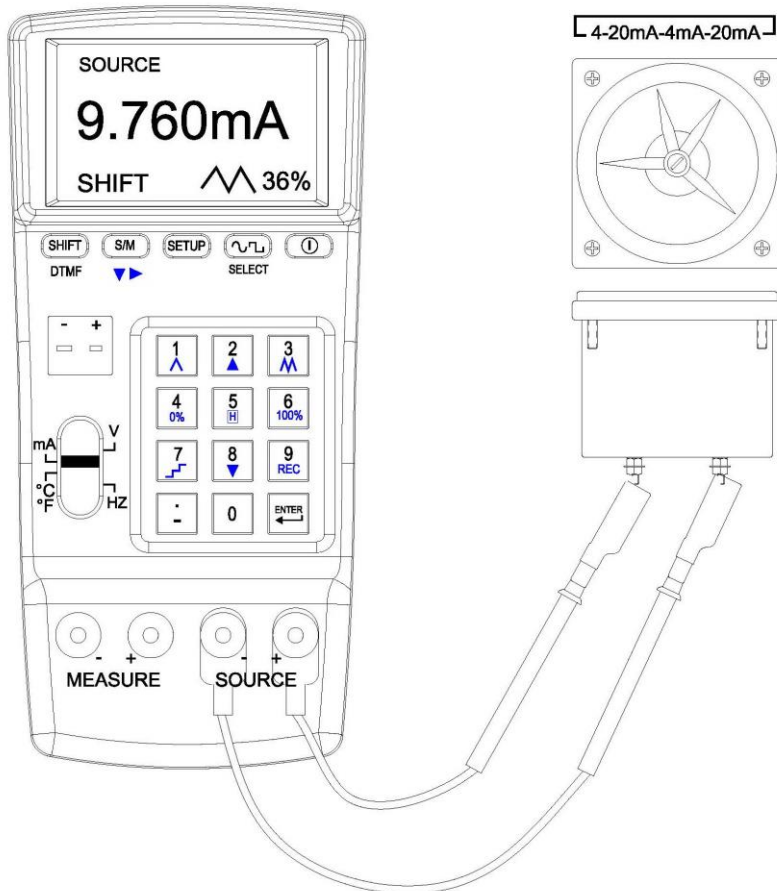
## 2b. Functions of Current Scanning for SOURCE



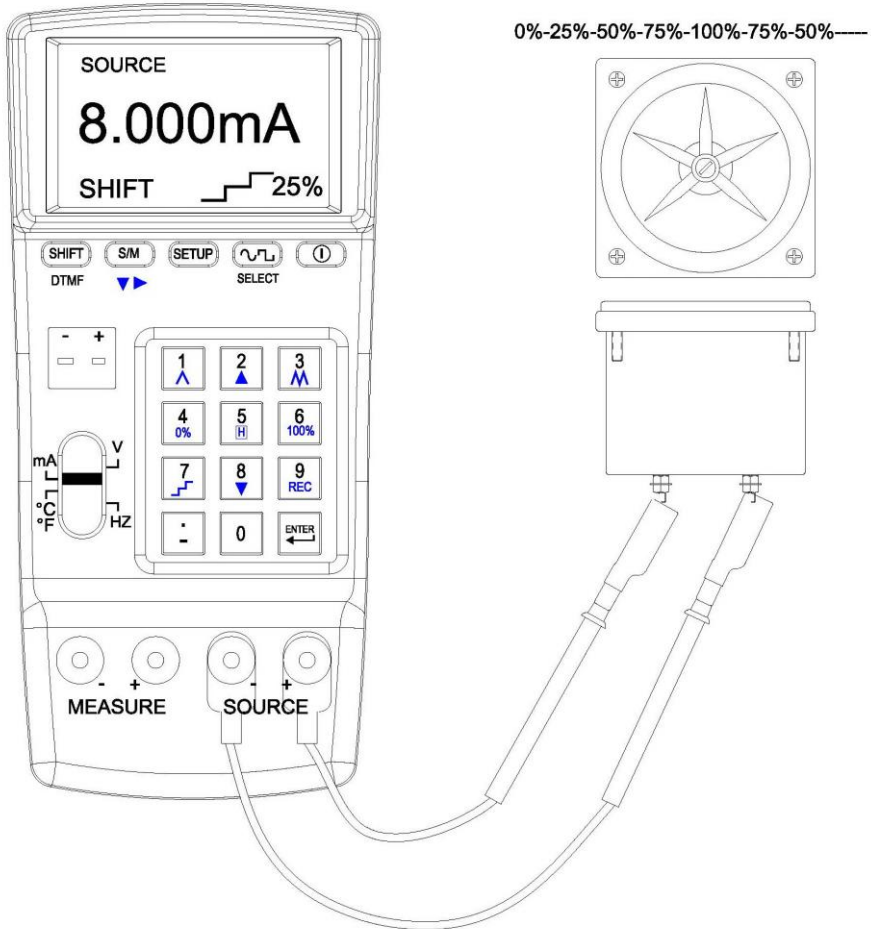
Press **DTMF** , then the lower left of LCM will display various functions (see the descriptions on below).

SHIFT +	Functions
	<b>Ramp</b> 1% 2%.... 100% 99%....2% 1%
	<b>Manual Multi-step scanning (increase progressively)</b> Press this button once +25% till it reaches 100%
	<b>Fast ramp</b> 4% 8%....100% 96%....8% 4%
	Return to the “ <b>starting</b> ” point of scanning 0%
	Press it during scanning period to <b>HOLD</b> the scanning
	Return to the “ <b>ending</b> ” point of scanning 100%
	<b>Auto Multi-step scanning (increase and decrease progressively)</b> 0% 25% 50% 75% 100%....
	<b>Manual Multi-step scanning (decrease progressively)</b> Press this button once -25% till it reaches 0%.

## 2c. Example of Connecting Leads (for Rapid and Multi-step Scanning)




**Connecting Leads for Fast ramp**

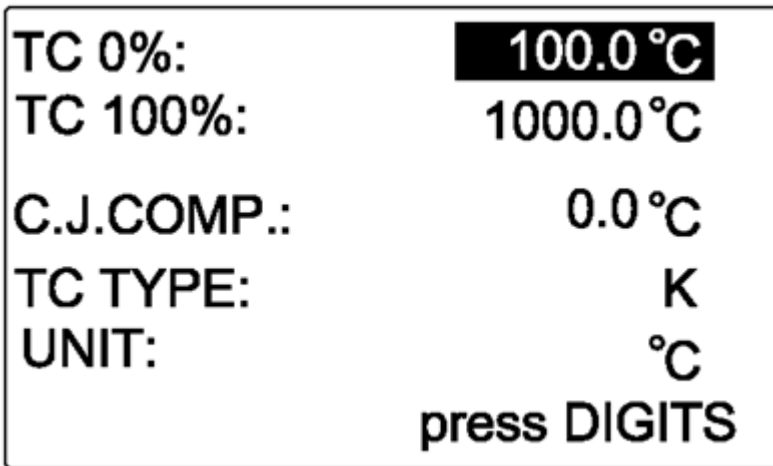


### Connecting Leads for Multi-step Scanning

### 3. Temperature Scanning for SOURCE

#### 3a. How to setup:

- (1) Press  button to enter SETUP function.
- (2) TC 0%: set up the “starting” temperature for scanning.
- (3) TC 100%: set up the “ending” temperature for scanning.











#### Remark:

1. Users are allowed to type in max. 5 digits.
2. Type in a temperature value (including decimal point), press ENTER, then the calibrator will output this temperature value.
3. When the output value is <0, please type in a negative sign first.
4. When the output value is <1 and >0, please type in “0.” first.

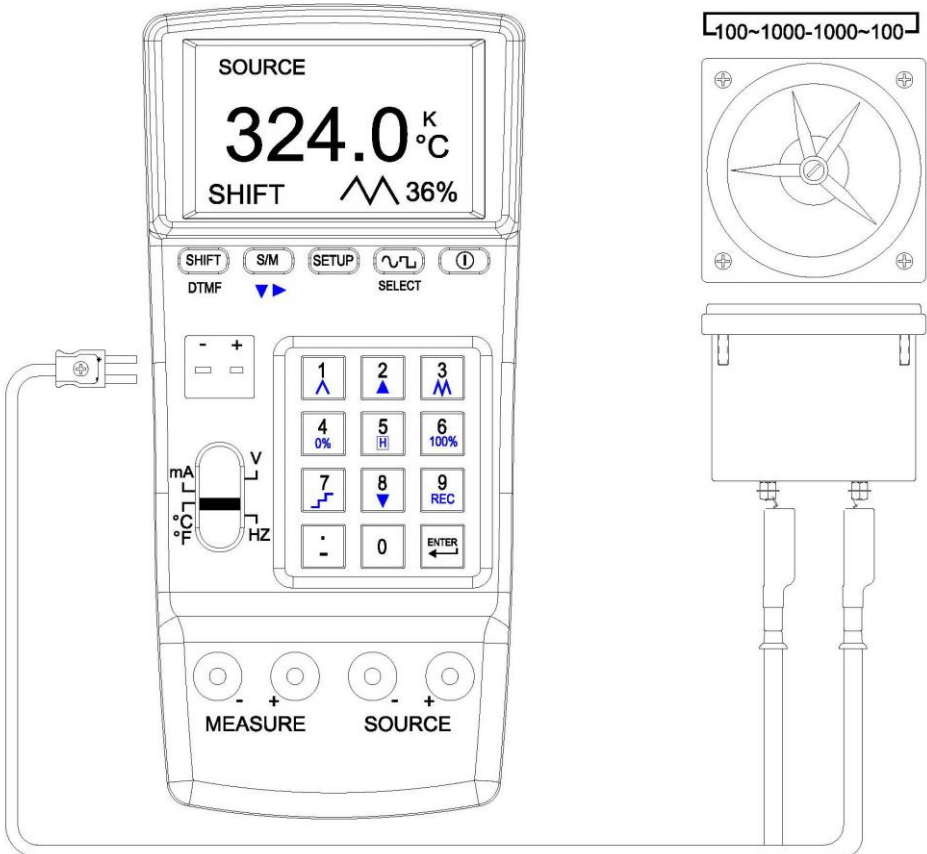
### 3b. Functions of Temperature Scanning for SOURCE



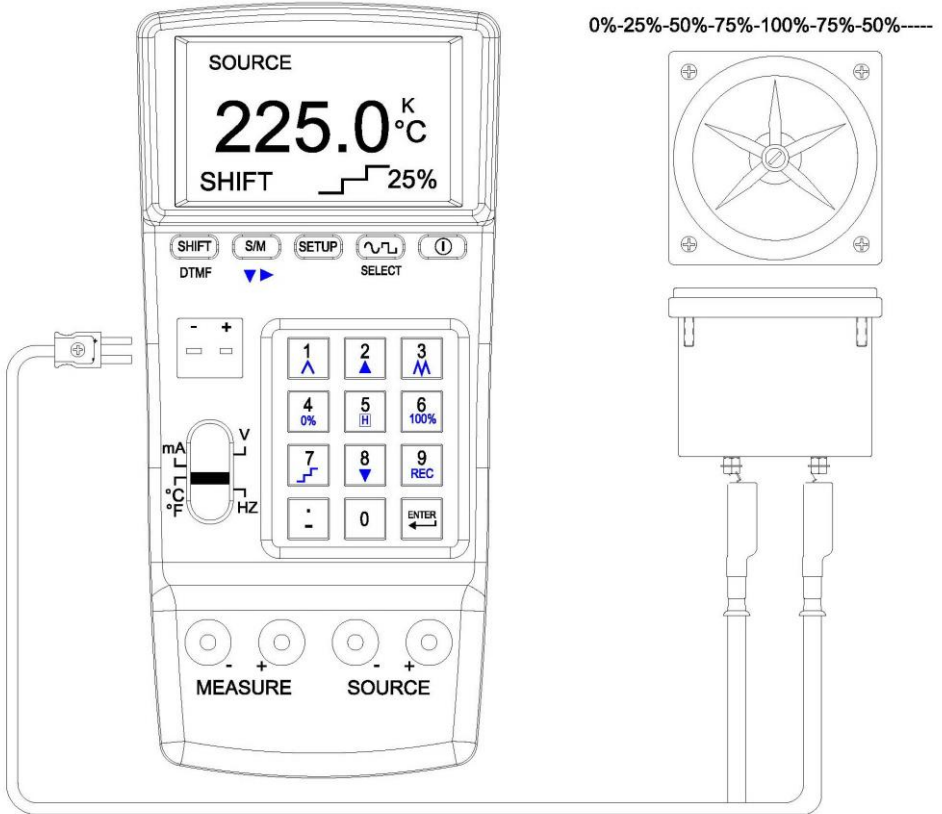
Press **DTMF** , then the lower left of LCM will display various functions (see the descriptions on below).

SHIFT +	Functions
	<b>Ramp</b> 1% 2%.... 100% 99%....2% 1%
	<b>Manual Multi-step scanning (increase progressively)</b> Press this button once +25% till it reaches 100%
	<b>Fast ramp</b> 4% 8%....100% 96%....8% 4%
	Return to the “ <b>starting</b> ” point of scanning 0%
	Press it during scanning period to <b>HOLD</b> the scanning
	Return to the “ <b>ending</b> ” point of scanning 100%
	<b>Auto Multi-step scanning (increase and decrease progressively)</b> 0% 25% 50% 75% 100%....
	<b>Manual Multi-step scanning (decrease progressively)</b> Press this button once -25% till it reaches 0%.

### 3c. Example of Connecting Leads (for Ramp and Multi-step Scanning)



Connecting Leads for Fast ramp



### Connecting Leads for Multi-step Scanning



## IV. DATA LOGGING


### 1. The way of logging

The data logging function is available for all the ranges except Hz.

#### 1a. How to set up

(1) Only under V range, users can set up SAMPLE and FILE NAME.

And the setups under V range will be applied to other ranges (mA, ...).

(2) Press  to enter SETUP function.

(3) SAMPLE: set up the “sampling time” for data logging.

(4) FILE NAME: data can be saved under different file names. Here users can set up a “file name”. (However, this function is available only when the SAMPLE is set up as “0”.)

V 0%:	4.000V
V 100%:	15.000V
SAMPLE:	1 SEC
FILE NAME:	<input checked="" type="checkbox"/> MAIN0001
	press DIGITS

#### 1b. Data logging for V, mA, Temperature (°C & °F)

(1) The data logging can be preformed under both modes (SOURCE and MEASURE). But the data can not be logged under different ranges or under different modes. (When the SAMPLE is set up as “0”, many single logged data under the same file name can be put together).



(2) To perform data logging, press **DTMF** and then “SHIFT” will show on

the left bottom of the display. Press  button to start data logging.

- (3) To stop data logging, please repeat the above procedures.  
To continue data logging, users just have to repeat it again.
- (4) When users want to logged data for a different mode (SOURCE or MEASURE), they have to clear memory first (and save the data before clearing the memory if necessary, please refer to Software Manual).

### 1c. Save data in FILE NAME

This data logging can be performed under any ranges (V, mA, °C & °F) and any modes (SOURCE and MEASURE). And the logged data can be saved in the FILES NAME(s) decided by users.

- (1) SAMPLE (rate) has to be 0 if users would like to use the function of saving data in FILE NAMEs..



- (2) To perform data logging, press **DTMF** and then “SHIFT” will show on




the left bottom of the display. Press **9 REC** button to start data logging.

- (3) Data logging for various data can be performed under any ranges or any modes. Users just have to follow the above procedures to continue data logging and saving.

## 2. Single-point Data Logging

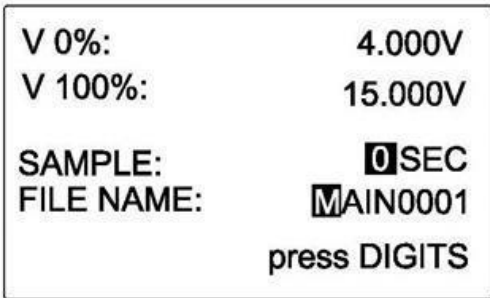
### 2a. Data Logging Set Up

- (1) Only under V range, users can set up SAMPLE and FILE NAME.  
And the setups under V range will be applied to other ranges (mA, ...).

- (2) Press  to enter SETUP function.

- (3) SAMPLE: set up the “sampling time” as “0”.

- (4) FILE NAME: data can be saved under different file names. Here users can set up a “file name” (by referring to ASCII codes).



## 2b. Start Data Logging



(1) Under any ranges/modes except Hz range, press **DTMF** and then “SHIFT”



will show on the left bottom of the display. Press **9 REC** button to start logging single-point data under specified FILE NAME.

(2) Under all the ranges/modes, single-point data under the same FILE NAME can be logged together.

(3) To continue data logging under each range, users just have to repeat the above step 1.

## 3. Multi-point Data Logging

### 3a. Data Logging Set Up

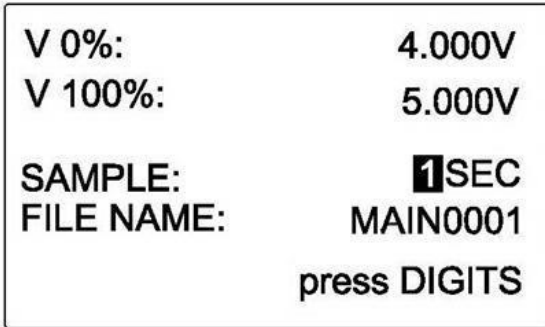
(1) Only under V range, users can set up SAMPLE and FILE NAME.

And the setups under V range will be applied to other ranges (mA, ...).

(2) Press **SETUP** to enter SETUP function.

(3) SAMPLE: set up the “sampling time” (from 1~255 sec.).


(4) FILE NAME: for multi-point data logging, data can not be saved under different file names. Here users do not have to set up a “file name”.



### 3b. Start Data Logging




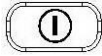
(1) Under any ranges/modes except Hz range, press **DTMF** and then “SHIFT”

will show on the left bottom of the display. Press  button to start logging multi-point data per the sampling time set us by users.

(2) To stop data logging, please repeat the above procedure.

(3) All the data can not logged under different ranges or different modes. If users have to log data for a different mode or range, they have to download data or clear memory first.

















## 4. Delete Data & Download Data

(1) Delete Data: Turn off the power first. Press  and  buttons at the same time, there will be 2 beep sounds. Then the memory is cleared.

(2) Download Data: First install the software (provided along with the calibrator) to PC, then users can download data (refer to software manual).

## V. REMOTE PC (CONTROLLING the calibrator)

1. The baud rate between PC and the calibrator is 460800 Bps.
2. Please refer to below list for corresponding the calibrator buttons to the (remote) PC buttons.

Calibrator buttons	PC buttons	ASCII
	0	0x30
	1	0x31
	2	0x32
	3	0x33
	4	0x34
	5	0x35
	6	0x36
	7	0x37
	8	0x38
	9	0x39
	°	0x2E
	ENTER	0x0D
	F	0x46
	U	0x55
	S	0x53
	I	0x49

## VI. BATTERY RECHARGING

1. Inside the calibrator there is a rechargeable lithium battery.
2. After turning on the power of the calibrator, the display will show the remaining power percentage of the rechargeable battery.
3. When the remaining power percentage of the rechargeable battery is less than 10%, we suggest users to recharge the battery by using the AC power adaptor provided along with the calibrator.
4. To recharge the battery, users just need to:
  - (1) put the AC power adaptor into the socket;
  - (2) connect the AC power adaptor to DC terminal of the calibrator;
  - (3) turn on the calibrator then the recharging will start.

**Warning:**

The AC power adaptor is used for lithium battery recharging only.

The power source of the calibrator is always the (rechargeable) lithium battery, NOT the AC power adaptor.

## VII. ELECTRICAL SPECIFICATIONS

**(23± 5°C, 10 minutes after turning on the power)**

**mA (source)** (  $V_{open} > 15V$  )

Range	Resolution	Accuracy of Reading
0.005mA to 4mA	1µA	+/-0.03% +/- 5dgts
4mA to 20mA	1µA	+/-0.03% +/-3dgts
20mA to 24mA	1µA	+/-0.03% +/-5dgts

**V (source)** (maximum load 1mA, short circuit protection < 100mA)

Range	Resolution	Accuracy of Reading
0.005V to 10V	0.001V	+/-0.03% +/-5dgts
10V to 15V	0.001V	+/-0.03% +/-5dgts

**mA (measure)**

Range	Resolution	Accuracy of Reading
-4mA to -0.005mA	1µA	+/-0.03% +/- 10dgts
0.005mA to 4mA	1µA	+/-0.03% +/- 5dgts
4mA to 20mA	1µA	+/-0.03% +/-3dgts
20mA to 24mA	1µA	+/-0.03% +/-5dgts

If reading of mA (measure) is less than 5 digits, it is displayed as 0.

**V (measure)**

Range	Resolution	Accuracy of Reading
-3V to -0.005V	0.001V	+/-0.03% +/-10dgts
0.005V to 10V	0.001V	+/-0.03% +/-5dgts
10V to 24V	0.001V	+/-0.03% +/-5dgts

If reading of V (measure) is less than 5 digits, it is displayed as 0.

**Frequency** (source, 10 Vpp, 0V offset, square wave, duty cycle = 50%)

Range (Hz)	Input Resolution	Accuracy
0.3 to 99.999	0.1Hz	0.002Hz
10.00 to 999.99	0.1Hz	0.02Hz
1000.0 to 9999.9	0.1Hz	0.2Hz
10000 to 20000	1Hz	2Hz

### Voltage Peak to Peak for Sine Wave

(V<sub>pp</sub>, 0.3~20KHz, 50% duty cycle, sine wave, 0V offset)

Range(V)	Resolution	Accuracy of Reading
0.1 to 20V	0.001V	5% +/- 0.3V

### Voltage Peak to Peak for Non-Sine Wave

(V<sub>pp</sub>, 0.3~20KHz, 0V offset)

Range(V)	Resolution	Accuracy of Reading
0.1 to 20V	0.001V	6% +/- 0.4V

### Voltage Peak to Peak

(V<sub>pp</sub>, 0.3~20KHz, 50% duty cycle, square wave, 0V offset)

Range(V)	Resolution	Accuracy of Reading
1 to 20V	0.001V	6% +/- 0.4V

### Voltage of Offset

(Maximum V<sub>pp</sub> < 20V)

Range	Resolution	Accuracy of Reading
-5V to 5V	0.001V	5% +/-0.5V +/-5% $\times$ V <sub>pp</sub>

### Duty Cycle

(%, square wave, 10 V<sub>pp</sub>, 0.3~20KHz)

Range	Resolution	Rise Time of V <sub>pp</sub>	Fall Time of V <sub>pp</sub>
0 to 100%	1%	10 $\mu$ S max, 5 $\mu$ S typical	15 $\mu$ S max, 7.5 $\mu$ S typical

### Pulse

(square wave, 10 V<sub>pp</sub>, Offset -5V~+5V)

Range	Resolution	Rise Time	Fall Time
3.0 $\mu$ S to 9999.9 $\mu$ S	0.1 $\mu$ S	10 $\mu$ S max, 5 $\mu$ S typical	15 $\mu$ S max, 7.5 $\mu$ S typical
10.000mS to 99.999mS	0.001mS		
100.00mS to 999.99mS	0.01mS		



**DTMF (Hz)**

Range (Hz)	Resolution	Accuracy of Reading
0.3 to 99.999	0.1Hz	0.002Hz
10.00 to 999.99	0.1Hz	0.02Hz
1000.0 to 9999.9	0.1Hz	0.2Hz
10000 to 20000	1Hz	2Hz

**DTMF (%)**

Range (%)	Resolution	Accuracy of Reading
0% ~ 100%	1%	5%

**DTMF  
(Phase Angle)**

Range (°)	Resolution	Accuracy of Reading
0 ~ 360	1°	100 $\mu$ S+1°

**DTMF**

(V<sub>pp</sub>, F1=F2, <1 KHz, %1=%2, Phase1=Phase2)

Range	Resolution	Accuracy of Reading
5V ~ 20V	0.001V	10% +/-0.6V

**DTMF**

(Offset, F1=F2, <1 KHz, %1=%2, Phase1=Phase2)

Range	Resolution	Accuracy of Reading
-5V ~ 5V	0.001V	10% +/-0.6V +/-5%xV <sub>pp</sub>

## Temperature, Thermocouples

(source and measure, 0.1 °C & 0.1 °F Resolution, Internal Cold Junction Compensation, thermocouple accuracy not included, 3 minutes after plugging in thermocouples.)

	°C		°F	
	Range	Accuracy	Range	Accuracy
K	-200 to -150	2.0	-382 to -238	3.6
	-150 to 0	1.2	-238 to 32	2.1
	0 to 1000	0.8	32 to 1832	1.4
	1000 to 1370	1.2	1832 to 2498	2.1
J	-200 to -150	2.0	-382 to -238	3.6
	-150 to 0	1.0	-238 to 32	1.8
	0 to 1050	0.7	32 to 1922	1.2
E	-200 to -150	1.5	-382 to -238	2.7
	-150 to 0	0.9	-238 to 32	1.6
	0 to 850	0.7	32 to 1562	1.2
T	-200 to -150	1.5	-382 to -238	2.7
	-150 to 0	1.2	-238 to 32	2.1
	0 to 400	0.8	32 to 752	1.4
R	0 to 500	1.8	32 to 932	3.2
	500 to 1760	1.5	932 to 3200	2.7
S	0 to 500	1.8	32 to 932	3.2
	500 to 1760	1.5	932 to 3200	2.7
N	-200 to 0	1.5	-328 to 32	2.7
	0 to 1300	0.9	32 to 2372	1.6
L	-200 to 0	0.9	-328 to 32	1.6
	0 to 900	0.7	32 to 1652	1.2
U	-200 to 0	1.1	-328 to 32	1.9
	0 to 600	0.7	32 to 1112	1.2
B	600 to 800	2.2	1112 to 1472	3.9
	800 to 1000	1.8	1472 to 1832	3.2
	1000 to 1820	1.4	1832 to 3308	2.5
C	0 to 1800	1.0	32 to 3272	1.8
	1800 to 2310	1.5	3272 to 4190	2.7
mV	-10mV to 70mV	0.05mV	-10mV to 70mV	0.05mV

## VIII. GENERAL SPECIFICATIONS

AC Power Adaptor:	AC 110V or AC 220V, 50/60Hz input. DC 15V / 0.5A output.
Dimension:	214.0(L) x 98.7(W) x 56.0(H) mm 8.4" (L) x 3.9" (W) x 2.2" (H)
Weight:	650g / 22.9oz (Batteries included)
Operation Environment:	0°C ~ 50°C, < 85% RH
Storage Environment:	-20°C ~ 60°C, < 75% RH
Accessories:	Carrying case x 1 User manual x 1 AC power adaptor x 1 USB cable x 1 Software CD x 1 Software manual x 1 K-type thermocouple (dual plugs) x 1 Alligator clips x 2 (black and red) Test leads x 2 (black and red) Rechargeable lithium battery (11.1V / 1600mAh) x 1

## ( Appendix 1 ) ASCII code list

Decimal System	ASCII	Decimal System	ASCII
32		62	>
33	!	63	?
34	"	64	@
35	#	65	A
36	\$	66	B
37	%	67	C
38	&	68	D
39	'	69	E
40	(	70	F
41	)	71	G
42	*	72	H
43	+	73	I
44	,	74	J
45	-	75	K
46	.	76	L
47	/	77	M
48	0	78	N
49	1	79	O
50	2	80	P
51	3	81	Q
52	4	82	R
53	5	83	S
54	6	84	T
55	7	85	U
56	8	86	V
57	9	87	W
58	:	88	X
59	;	89	Y

Decimal System	ASCII	Decimal System	ASCII
60	<	90	Z
61	=	91	[
92	\	127	°
93	]	128	∩
94	^	129	μ
95	_	130	🔔
96	`	131	⬆
97	a	132	⬇
98	b	133	⬅
99	c	134	➡
100	d	135	⬆
101	e	136	⬇
102	f	137	⬅
103	g	138	⬇
104	h	139	∧
105	i	140	△
106	j	141	千
107	k	142	万
108	l	143	元
109	m	144	丹
110	n	145	X
111	o	146	$\bar{X}$
112	p	147	$\bar{Y}$
113	q	148	$\bar{Z}$
114	r	149	<sup>2</sup>
115	s	150	∞
116	t	151	€
117	u	152	∩
118	v	153	±
119	w	154	≥
120	x	155	≤

Decimal System	ASCII	Decimal System	ASCII
121	y	156	$\alpha$
122	z	157	$\beta$
123	{	158	$\gamma$
124		159	$\delta$
125	}	160	$\epsilon$
126	~	161	$\zeta$
162	$\eta$		
163	$\theta$		
164	$\bar{\cup}$		
165	$\kappa$		
166	$\lambda$		
167	$\mu$		
168	$\nu$		
169	$\xi$		
170	$\circ$		
171	$\pi$		
172	$\rho$		
173	$\sigma$		
174	$\tau$		
175	$\upsilon$		
176	$\Phi$		
177	$\chi$		
178	$\phi$		
179	$\omega$		
180	$\Gamma$		
181	$\Sigma$		
182	$\Phi$		
183	$\Omega$		



## Limited Warranty

This meter is warranted to the original purchaser against defects in material and workmanship for 3 years from the date of purchase. During this warranty period, RS Components will, at its option, replace or repair the defective unit, subject to verification of the defect or malfunction. This warranty does not cover fuses, disposable batteries, or damage from abuse, neglect, accident, unauthorized repair, alteration, contamination, or abnormal conditions of operation or handling.

Any implied warranties arising out of the sale of this product, including but not limited to implied warranties of merchantability and fitness for a particular purpose, are limited to the above. RS Components shall not be liable for loss of use of the instrument or other incidental or consequential damages, expenses, or economic loss, or for any claim or claims for such damage, expense or economic loss. Some states or countries laws vary, so the above limitations or exclusions may not apply to you. For full terms and conditions, refer to the RS website.



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