

Chapter 1

Overview

This series of meters are categorized into the standard and thermocouple type. This manual is illustrated based on the thermocouple type.

This series of meters has the following functions:

- 100 mV, 30 V DC voltage measurement, 20 mA DC current measurement, and switching value measurement;
- 100 mV, 30 V DC voltage output, 20 mA DC current output and SIMULATE output;
- V, mA manual step output, automatic waveform output;
- Simultaneous display of V, mA and percentage;
- Loop detection function: It simultaneously provides the 24 V loop power supply and measures the current.

The following functions are added to the thermocouple type:

- Eight scale division (i.e., R, S, B, K, E, J, T and N) thermocouple measurement and output function;
- Temperature display in Celsius degree and Fahrenheit degree;
- Automatic and manual cold junction compensation function.

Open-package Inspection

Check the goods to see if they are damaged during delivery. Check if the goods are complete, and keep the

packing materials for future delivery.

This meter comes with the following standard accessories:

- One pair of test leads (with alligator clips)
- One manual
- One 9 V alkaline battery (6LR61)

Safety Warnings

The design, manufacturing and test of this meter all meet the safety standard requirements of IEC61010-1. The manual contains the warnings and safety rules that users must comply with to ensure the safe use of the meter and its safe status. Please read the following instructions before use.

Warning


- Do not use a damaged meter. Before using the meter, please check its enclosure to see if there is any crack, missing plastic part or if its outer protective cover is in place. Please pay special attention to the insulation layer of the joints.
- Please make sure that the battery cover is locked tightly before using the meter.
- Please remove the test leads from the meter before opening the battery cover.
- Check the test lead to see if its insulation has any damage or it has any exposed part. Check the connectivity of the test leads. If the lead is damaged, please replace it before using the meter.
- If the meter malfunctions, it means that the protection

could have been damaged, so please do not use it. If there is any doubt, the meter should be sent for maintenance.

- Do not use the meter near explosive gases, steam or dust.
- The meter only uses 6LR61 batteries, so please make sure the battery is correctly installed.
- When using a test probe, the finger should hold the back of the probe's protective layer.
- When connecting wires, connect the common test leads first, and then connect the live test leads. When dismantling, remove the live test lead first.
- Please carefully read and understand the manual before using the meter.
- The requirements of the manual must be complied with at any time, and the manual should be well kept to ensure it available for reference at any time.
- During the meter test, incorrect operation may lead to accident and damage to the meter.








 **Cautions**

To prevent damage to the meter caused by the tested equipment :

- The knob switch must be turned to the correct position of measurement range when conducting a measurement. The test lead and the tested circuit must be disconnected before turning the knob switch. It is strictly prohibited to switch the range during a measurement, to prevent damage to the meter.
- When the screen shows " " signal, do not use the meter.

- Do not store or use the meter in a high temperature, high humidity, combustible, explosive, or strong electromagnetic environment, or a place with excessive dew or direct exposure to sunlight.
- Do not use abrasives or solvents to clean the meter; please use a damp cloth or neutral detergent.
- When the meter is dampened, please dry it up before storing it.

Symbol

Symbol	Meaning	Symbol	Meaning
	AC		Grounding
	DC		Double insulation
	AC and DC		Battery
	Critical information		

Chapter II

Understand the Meter Meter Panel

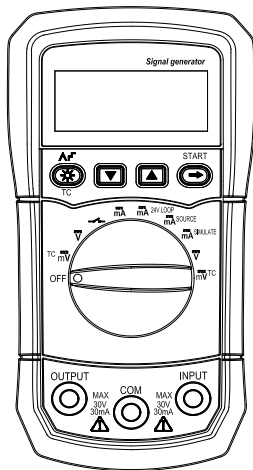


Figure 1

Startup

To switch on the meter, please turn the knob switch to any of the function positions.

When the power is turned on, the meter starts an internal self-diagnosis with a full screen display before corresponding operations can be conducted.

To ensure correct live operation of the meter, the meter

must be powered off for 5 seconds before restarting it.

Automatic Power Off



The factory setting of the meter: If the user does not perform any operation on the meter within 15 minutes, it will automatically turn off the power.

Once the meter automatically powers off, to restart it, please turn the knob switch to OFF position and then turn it on.

Users can set on their own whether to use the automatic power off function (Refer to Chapter IV "Setting Function").

Note: The meter will still consume about 1 mA current after it automatically turns off power, so it is recommended to turn the knob switch to the OFF position when not using it.

Turn on Back Light

Press the button  continuously to turn on the back light, and press the button  continuously again to turn it off.

Automatic Back Light off

The factory setting of the meter: If the user does not turn off the meter's back light within 30 seconds, the meter will automatically turn off the back light.

Users can set on their own whether to use the automatic back light off function (Refer to Chapter IV "Setting Function").

Knob Switch

Turn the knob switch to any function position to switch

on the meter. The standard display of the function will be shown on the screen of the meter.

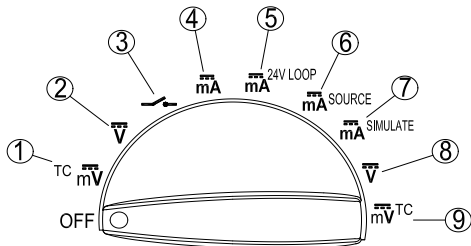





Figure 2

No.	Location	Knob Switch Function
①	TC mV	DC millivolt (DCmV) measurement Thermocouple type: TC measurement can be selected by pressing the button  .
②	V	DC voltage (DVC) measurement
③		Switching value measurement
④	mA	DC current (DCmA) measurement
⑤	mA 24V LOOP	Loop current measurement (loop power supply)
⑥	mA SOURCE	Current output
⑦	mA SIMULATE	Simulate transmitter
⑧	V	DC voltage (DCV) output
⑨	mV TC	DC millivolt (DCmV) output

	Thermocouple type: TC output can be selected by pressing the button  .
--	---

Display Screen

Figure 2-3 and Table 2-3 are the illustrations for the screen display.

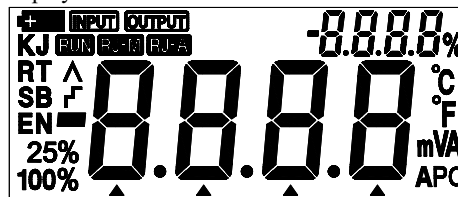









Figure 3

Display	Illustrations
	Low battery
	The meter works in the measurement mode
	The meter works in the output mode
	Start automatic waveform output
	Manual cold junction compensation of thermocouple
	Automatic cold junction compensation of thermocouple
	Data display area
%	Percentages of voltage and current
K J R T S B E N	Thermocouple (TC) scale division

°C, °F	Celsius degree, Fahrenheit degree.
mV, V, mA	Units of voltage and current
Λ Γ	Automatic ramp output, manual step output
25% 100%	25% 100% step output
▲▲▲▲	Output setting position

Chapter III

Use of Meter

Measurement of DC Voltage

1. Turn the knob switch to the white " \overline{V} " or " $^{TC} \overline{mV}$ " position;
2. Insert the black probe into "COM" plughole and the red probe into "INPUT" plughole;
3. Connect the probes to the circuit to be measured and read the measured value after stabilization.

Displayed voltage value	Percentage display	
	0~10V	1~5V
0.00V	0.0%	-25.0%
1.00V	10.0%	0.0%
5.00V	50.0%	100.0%
10.00V	100.0%	225.0%
30.00V	300.0%	750.0%

Measurement of Current

Turn the knob switch to the white " \overline{mA} " position;

1. Insert the black probe into "COM" plughole and the red probe into "INPUT" plughole;
2. Connect the probes to the circuit to be measured and read

the measured value after stabilization.

Displayed current value	Percentage display	
	4~20mA	0~20mA
0.00mA	-25.0%	0.0%
4.00mA	0.0%	20.0%
20.00mA	100.0%	100.0%
22.00mA	112.5%	110.0%

Measurement of Circuit Current

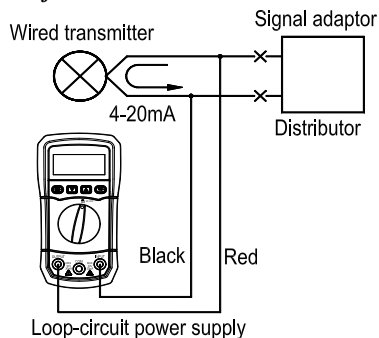


Figure 4

This function can be used to measure the flowing current when 24V constant DC is applied.

The 24V circuit measurement function can be used to measure the transmitter circuit.

(The meter can be connected to the transmitter instead of


the signal regulator.)

Warning

The typical value of circuit power supply is 24VDC. The voltage between terminals may exceed 24V, as the case may be, such as circuit current value, and the existence of internal series resistance, and others.

1. Turn the knob switch to the " $\overline{\text{mA}}^{24\text{V LOOP}}$ " position;
2. Insert the black probe into "INPUT" plughole and red probe into "OUTPUT" plughole;
3. Connect the probes to the circuit to be measured and read the measured value after stabilization.

Test of Switching Value



1. Turn the knob switch to "" position;
2. Insert the black probe into "COM" plughole and red probe into "INPUT" plughole;
3. Connect the probes to the contacts on the switch to be tested. And display "OFF" (open) or "ON" (close) according to the status of the switch. When the test result is "ON", the buzzer will tweet. When the switch resistance exceeds 20k Ω , it is considered to be in an "OFF" status.

Measurement of Thermocouple




1. Turn the knob switch to white " $\overline{\text{TC}} \overline{\text{mV}}$ " position and select the corresponding scale division of thermocouple (TC).
2. Insert the thermocouple into "COM" and "INPUT" plugholes. Ensure that the thermocouple plug with +

symbol is inserted into "INPUT" plughole of the meter.


3. Read the measurement result from the display.




The main display area shows the temperature value and the auxiliary display area shows the cold junction temperature value. Users can select automatic compensation (screen display ) , automatic compensation once every 10 seconds) or manual compensation (screen display ) for cold junction temperature; or select to close cold junction compensation. Whether to open the cold junction compensation is up to the user himself (Refer to Chapter IV "Setting Function").



Use of Voltage Output Function

1. Turn the knob switch to yellow " $\overline{\text{V}}$ " position or " $\overline{\text{mV}}^{\text{TC}}$ " position;
2. Insert the black probe into "COM" plughole and red probe into "OUTPUT" plughole;
3. Connect the probes to the input end of user's meter;
4. Press the button  to select the output setting position; press the button   to change the value of setting position, which can increase or decrease automatically. Keep pressing the button, and the value can be changed consecutively after 1 second.

Use of Thermocouple Output Function

1. Turn the knob switch to yellow " $\overline{\text{mV}}^{\text{TC}}$ " position; press the button  to select the corresponding scale division of

- thermocouple (TC);
2. Insert the black probe into "COM" plughole and red probe into "OUTPUT" plughole;
 3. Connect the probes to the input end of user's meter
 4. Press the button  to select the output setting position; press the button   to change the value of setting position, which can increase or decrease automatically. Keep pressing the button, and the value can be changed consecutively after 1 second.

The main display area displays the temperature setting value, and the auxiliary display area displays the cold junction temperature value. Users can select automatic compensation (screen display , automatic compensation once every 10 seconds) or manual compensation (screen display ) for cold junction temperature; or select to close cold junction compensation. Whether to open the cold junction compensation is up to the user himself (Refer to Chapter IV "Setting Function").

Use of Current Output Function

This meter provides two output modes:




SOURCE mode: Current is provided from the meter;

SIMULATE mode (analog): The meter absorbs the current from the external voltage source.

Constant Current Output (SOURCE Mode)

1. Turn the knob switch to the " $\overline{\text{mA}}^{\text{SOURCE}}$ " position and the

output is set as 0mA;

2. Insert the black probe into "COM" plughole and red probe into "OUTPUT" plughole;
3. Connect the lead wire to the circuit to be measured;
4. Press the button  to select the output setting position; press the button   to change the value of setting position, which increase or decrease automatically. Keep pressing the button, and the value can be changed consecutively after 1 second.

Constant Current Output (SIMULATE Mode)

SIMULATE (analog) mode refers to simulation of a set of current circuit transmitters by using the meter. When the external DC voltage (5 to 28V) and the measured current circuit are in series, SIMULATE mode should be selected.

Warning

Before connecting test leads to current circuit, set the knob switch in some position of mA output first. Otherwise, the low impedance from other positions of the knob switch may occur in the circuit, resulting in the current up to 35mA flowing in the circuit.

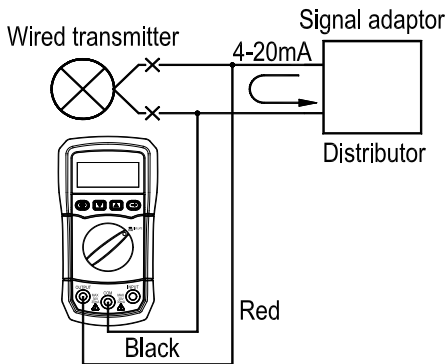


Figure 5

Apply polarity of voltage according to the diagram and do not reverse the voltage.

1. Turn the knob switch to the " $\overline{\text{mA}}^{\text{SIMULATE}}$ " position and the output is set as 0mA;
2. Insert the black probe into "COM" plughole and red probe into "OUTPUT" plughole;
3. Connect the lead wire to the circuit to be measured;
4. Press the button \rightarrow to select the output setting position; press the button \uparrow \downarrow to change the value of setting position, which can increase or decrease automatically. Keep pressing the button, and the value can be changed consecutively after 1 second.

Manual Step Output

Under 10V voltage and current output, press the button ⊗ to select 25% or 100% manual step output function in turn, the screen shows: ⏏ .


Press the button \uparrow \downarrow to increase or decrease the voltage or current by 25% step or 100% step.


Different voltage and current span can be selected through this function. (Refer to Chapter IV "Setting Function")

Voltage stepping	Output value	
	0~10V	1~5V
0.0%	0.00V	1.00V
25.0%	2.50V	2.00V
50.0%	5.00V	3.00V
75.0%	7.50V	4.00V
100.0%	10.00V	5.00V

Current stepping	Output value	
	4~20mA	0~20mA
0.0%	4.00mA	0.00mA
25.0%	8.00mA	5.00mA
50.0%	12.00mA	10.00mA
75.0%	16.00mA	15.00mA
100.0%	20.00mA	20.00mA

Automatic Waveform Output




Under 10V voltage and current output, press the button  to select the automatic waveform output function with the screen display: **A**, and at the same time display the default output set value and output the corresponding signal.















Press the button  to start or stop automatic waveform output. If automatic waveform output is started, the screen displays the " **RUN** " character; if the automatic waveform output is stopped, the output will remain at the current value.





Different voltage and current span can be selected through this function. (Refer to Chapter IV "Setting Function")

Chapter IV

Setting Function

To enter the meter setup, press the button  under the meter shutdown status, and then turn the knob switch to any non-OFF position. In the setup mode, the screen's auxiliary display area displays the settings, and the main display area shows the factory default values. Press the button  to change the settings; press the button  continuously to save the settings (the main display area shows **SAVE** , indicating that this setting has been saved). When the setup is completed, turn off the machine.

Settings		Function	Default Values
RPoF	Automatic shutdown	ON or OFF. Press the button   to select.	ON
bLoF	Automatic switch off back light	ON or OFF. Press the button   to select.	ON
IPCL	Current span	4-20 or 0-20. Press the button   to select.	4-20
UPCL	Voltage span	0-10 or 1-05. Press the button   to select.	0-10
TEMP	Temperature unit	°C or °F . Press the button   to select.	°C
rJan	Cold junction compensation of thermocouple	ON or OFF. Press the button   to select.	ON
rJSt	Cold-junction compensation method	Automatic (<i>Auto</i>) or manual operation (<i>MANU</i>). Press the button to   select.	<i>Auto</i>

r 11.8	Temperature on the manual cold junction	-10.0°C~50.0°C (0.0°F~122.0°F). Press the button  for the setting position; press the button   to change the setting position value.	23.0
FACT	Return to the factory default value	Press the button  continuously, and the main display area displays SAUE , indicating that it has returned to the factory default value.	

Chapter V

General Maintenance

- Clean the meter enclosure on a regular basis with a damp cloth and mild detergent. Do not use abrasives or solvents.
- If the battery isn't used for a long time, it shall be taken out.
- Dirt or wet air on the plughole can affect the reading.

Please follow the following steps to clean the connection port:

1. Turn off the meter power and dismantle all test leads;
2. Clean the dirt on the connection port;
3. Clean each connection port with a new cotton swab

dipped in alcohol.

Replace Battery

This meter uses one 9V (6LR61) alkaline battery.

Please follow the following steps to replace the battery:

1. Turn off the meter power and disconnect all test leads;
2. Remove the screw on the battery box with a cross screwdriver, and remove the battery cover.
3. Take off the old battery and fasten a new battery to the battery buckle. Then put it into the battery compartment;
4. Put the battery in the lower case and tighten the screw.

Chapter VI

Technical Specification

General Characteristics

Display refresh	2~3 times/second
Overload protection	50mA/30V
Working temperature and humidity range	0~40 °C and a relative humidity below 85% (no condensation)
Storage temperature and humidity range	-20 °C~60 °C and a relative humidity below 90% (no condensation)
Precision ensures the temperature and humidity range	23±5°C and a relative humidity below 75% (no condensation)
Temperature coefficient	0.1 × basic precision/°C (temperature range <18 °C or >28 °C)
Ambient conditions for use	Indoor and outdoor use (not waterproof), with an elevation of 0~2000 m
Outrange display	OL
Power supply	9V (6LR61) alkaline battery x 1
Power consumption	When alkaline battery is used Loop current measurement and DC current output (SOURCE) 20mA (a load of 1000Ω): approx. 1000mVA Other work function: approx. 300mVA
Low battery	Display battery sign
Automatic shutdown	No operation for about 15 min by default
Preheating time	10 min
Close the meter enclosure for calibration	No need for internal adjustment
Size	147 (L) ×75 (W) ×42 (D) mm
Weight	Approx. 230 g
Calibration cycle	One year

Detailed Precision Index

The accuracy is determined within one year after calibration when the operating temperature is $23 + 5$ °C, and the relative humidity is 75%.

The precision range can be marked as: \pm ([% of the reading]+ count) (Note: "count" represents the increased or decreased number of the minimum effective digit).

Detailed Precision Index of Measurement

Measurement Function	Range	Measure Range	Resolution	Accuracy	Notes
DC voltage	100mV	-10.0mV~110.0mV	100uV	0.2%+4	<ul style="list-style-type: none">• Input impedance: 30V: 300kΩ (nominal value) mV:>1MΩ (nominal value)• Common mode rejection: 50Hz or 60Hz >80dB• Series mode rejection: 50Hz or 60Hz > 40dB• Overvoltage protection:30V (peak to peak value)
	30V	-5.00V~30.00V	10mV	0.2%+4	
DC current	20mA	0.00mA~22.00mA	0.01mA	0.2%+4	<ul style="list-style-type: none">• Overload protection: 50mA/30V• Load voltage: approx. 18mV/mA
Thermocouple	R	0°C~1760°C	1°C	0.2%+4	<ul style="list-style-type: none">• Thermocouple measurement adopts ITS-90 thermometric scale,whose precision does not include error of the cold junction compensation, and the impact of thermoelectrical potential
	S	0°C~1760°C			
	B	400°C~1820 °C			
	K	-200°C~1370°C			
	E	-200°C~1000°C			
	J	-200°C~1200°C			
	T	-200°C~400°C			
N	-200°C~1300 °C				

Detailed Precision Index of Output

Output Function	Range	Output Setting Range	Resolution	Accuracy	Notes
DC voltage	100mV	0.0mV~110.0mV	100uV	0.2%+4	• Maximum output current 1mA
	10V	0.00V~11.00V	10mV	0.2%+4	• Maximum output current 5 mA (<10V)
DC current	20mA	0.00~22.00mA	0.01mA	0.2%+4	• 20mA maximum load: 1K Ω
Analog transmitter SIMULATE	-20mA	0.00~-22.00mA	0.001mA		• External power supply: 5~28V • 20mA maximum load: 1K Ω
Loop power supply LOOP	24V			$\pm 10\%$	• Maximum output current 25mA
Thermocouple	R	0°C~1760°C	1°C	0.2%+4	• Thermocouple measurement adopts ITS-90 thermometric scale, whose precision does not include error of the cold junction compensation, and the impact of thermoelectrical potential
	S	0°C~1760 °C			
	B	400°C~1800°C			
	K	0°C~1350°C			
	E	0°C~700°C			
	J	0°C~950°C			
	T	0°C~400°C			
	N	0°C~1300°C			
Capacitive load $\geq 0.01\mu\text{F}$					

Notes for Use of This Manual

This manual is subject to variation without prior notice.

The content of this manual is supposed to be correct. If the customer detect any mistake, omission, etc., please contact the manufacturer.

Our company does not undertake any responsibility for accidents or hazards caused by incorrect operations of the user.

The functions described in this manual do not be used as grounds for using the product for special purposes.