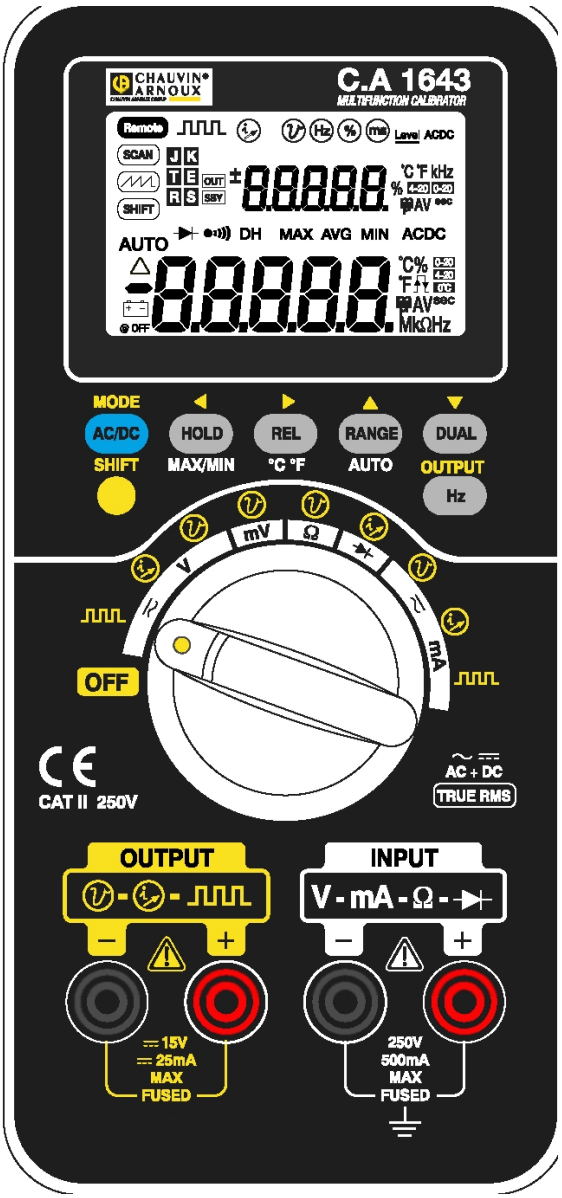
■ MULTIFONCTION CALIBRATOR

C.A 1643



ENGLISH User's manual

CHAUVIN® ARNOUX
CHAUVIN ARNOUX GROUP

/!\ Please read the instruction manual before using the product!

You have just acquired a multifunction **CALIBRATOR C.A 1643** and we thank you for your confidence.
.
To get the best service from your instrument:

- **read** carefully this user's manual,
- **respect** the operating precautions detailed within

SAFETY INFORMATION

This process calibrator/meter is a hand-held and battery-operated instrument for testing and troubleshooting power electronic systems. If this device is damaged or something is missing, contact the purchasing place immediately.
A **WARNING** identifies conditions and actions that may cause hazard(s) to the user; a **CAUTION** identifies conditions and actions that may damage this Device. Following **Table-1** explain international electrical symbols used on this meter.

Table-1. International Electrical Symbols

	AC - Alternating Current
	DC - Direct Current
	AC and DC - Alternating and Direct Current
	Ground
	Double Insulation
	See Explanation In The Manual
	WEEE 2002/96/EC

To avoid electric shock, injury, or damage to this instrument and ensure that you use the meter safely, follow the safety guidelines listed below:

- Read this operation manual completely before using this device and follow all safety instructions
- This device is for indoor use, altitude up to 2,000 m
- Avoid working alone
- Use the device only as specified in this manual; otherwise, the protection provided by the meter may be impaired
- Never measure Voltage when the current measurement is selected
- Do not use this device if it looks damaged
- Inspect the leads for damaged insulation or exposed metal. Replace damaged leads.
- Disconnect the power and discharge all high-voltage capacitors before testing in the resistance, continuity, and diode function.
- Be cautions when working above 70V DC or 33VRMS and 46.7V peak, such voltages may cause a shock hazard.
- Always keep your hands behind the protective guard of the probe as measuring
- Select the proper function and disconnect the test leads from test points before changing functions
- Do not mix with different types of battery. Always use specified battery
- The meter is safety-certified in compliance with EN61010 (IEC 1010-1, IEC 1010-2-031) Installation Category II 250V Pollution Degree 2. In order to maintain its insulation properties, please be sure to use with the standard or compatible test probes
- CE requirement: Under the influence of R.F field according to standard, the supplied test leads will pick up induced noise. To have better shielding effect, a short-twisted lead should be used.

WARRANTY

Unless notified to the contrary, our instruments are guaranteed from any manufacturing defect or material defect. They do not bear the specification known as the safety specification. Our guarantee, which may not under any circumstances exceed the amount of the invoiced price, goes no further than the repair of our faulty equipment, carriage paid to our workshops. It is applicable for normal use of our instruments, and does not apply to damage or destruction caused, notably by error in mounting, mechanical accident, faulty maintenance, defective use, overload or excess voltage.
Our responsability being strictly limited to the pure and simple replacement of the faulty parts of our equipment, the buyer expressly renounces any attempt to find us responsible for damages or losses caused directly or indirectly. **Our guarantee is applicable for twelve (12) months after the date on which the equipment is made available.** The repair, modification or replacement of a part during the guarantee period will not result in this guarantee being extended

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CONTENTS

1. INTRODUCTION

This device can be used not only for instrument system maintenance, but also for maintaining, servicing industrial meters, testing electronic circuits and electronic equipments. Even the sensor or transmitter in automotive or automatic control system can be measured and calibrated by this meter.

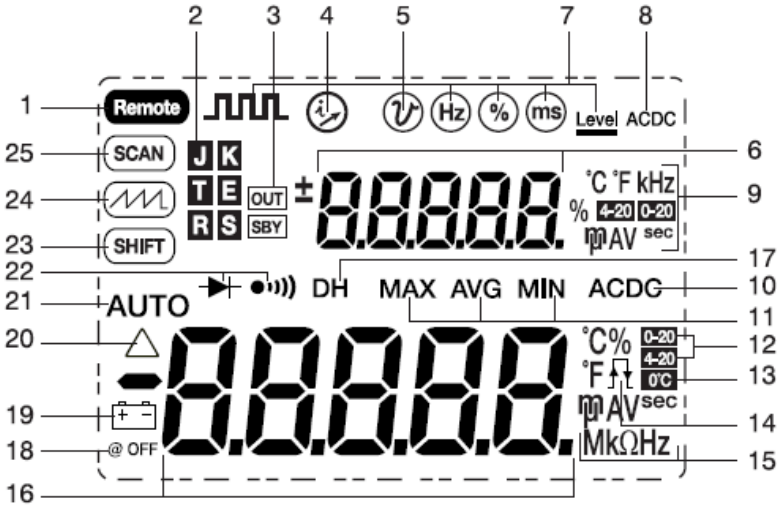
To generate high accuracy constant voltage, constant current and square wave output, and includes a strong multi-meter function. A full functional device to generate and measure signals, simultaneously.

Main Features:

- **Generates and Measures Signal simultaneously**
- **1,200Ω drive capability for 20mA simulation**
- **Constant voltage, Constant Current and Square wave outputs**
- **Intelligent Output and Standby control**
- **Built-in rechargeable battery**
- **Smart Charger design without battery removed**
- **Brightness EL backlight**
- **You are the master to Coarse or Fine turn for outputs**
- **The % scale readout for 4-20mA or 0-20mA measurement**
- **Adjustable steps and time interval for Auto Scan**
- **Adjustable resolutions and start for linear Ramp output**
- **1ms Peak hold to catch inrush voltage and current easily**
- **Temperature test with the optional of 0°C compensation**
- **Frequency, Duty cycle and Pulse width measurements**
- **Dynamic Recording for Min/Max/Average**
- **Data Hold with Manual or Auto Trigger and Relative modes**
- **Diode and Audible Continuity Test**
- **Bi-directional optic computer interface with SCPI commands**
- **Safe, precision and speed closed case calibration**
- **50,000 count precision True-RMS digital multi-meter and designed to meet IEC-1010 CAT. II 250V standard**

2. DESCRIPTION

2.1 DISPLAY ILLUSTRATION

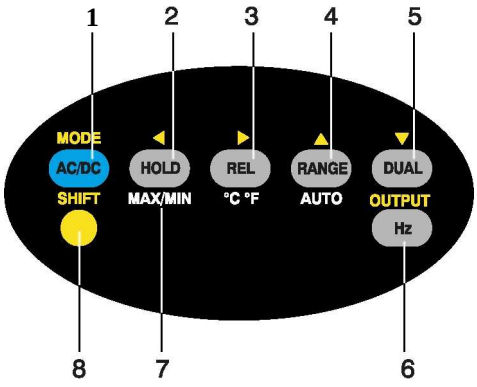


1 ⇒ Remote control
2 ⇒ Thermal type for temperature test
3 ⇒ *OUT* : Output Enable
SBY : Output Disable
4⇒Constant Current Output
5⇒Constant Voltage Output
6⇒Secondary Display for OUTPUT and INPUT
7⇒Square Wave Output for Hz, % mS and Level
8⇒Alternating/ Direct Current
9⇒Input units
10⇒Alternating/ Direct Current or Voltage
11⇒Dynamic Recording Mode
12⇒« % 0-20 » : 0-20 mA
« % 4-20 » : 4-20 mA
13⇒« 0℃ » : Without ambient temperature compens ation
14⇒Positive ⌐‾ or Negative ‾⌐ trigger slope for % and ms tests
15⇒Input units
16⇒Primary Display for INPUT
17⇒Data Hold (Manual Trigger)
18⇒Auto power off sign
19⇒Low Battery
20⇒Relative Mode
21⇒Auto Range
22⇒Diode/Audible continuity
23⇒SHIFT button operations for output
24⇒RAMP Output
25⇒*SCAN* output

2.2 PUSH-BUTTON OPERATIONS

The operation of push-button is shown as below. When push the button, a related symbol will be lit, and the beeper will sound. Turning the rotary switch to another position will reset current operation of push buttons.

2.2.1 Input operation



1 => **BLUE:** To select DC, AC or AC+DC measuring
PEAK: Press and hold for more than 1 sec. to toggle PEAK Hold ON/OFF for V/mA

AC/ DC (BLUE): *Select DC, AC, DC+AC Test*

- *Push this button momentarily to step through DC, AC and DC+AC for Voltage measurement.*
- *Push this button momentarily to step through DC, % of mA, AC and DC+AC for Current measurement.*
- *For Voltage and current measurements, press this button for more than 1 second to toggle 1 ms peak hold ON/OFF. The display will show "**DH MAX**" to indicate the PEAK + and show "**DH MIN**" to indicate the PEAK -.*
- *For Ohm test, push this button momentarily to toggle continuity "•))" ON/OFF. The beeper will sound continuity when test value below 10 ohms or 1000 counts.*
- *For Duty cycle and Pulse width tests, press this button for more than 1 second to change the trigger slope ⌐ or ¬.*
- *For temperature measurement, press this button to toggle environment compensation ON/OFF. The "0°C" sign means environment compensation has been disabled.*

2 => **HOLD** : Freeze existing measuring value. Press again to trigger next measuring value
Press and hold for more than 1sec. to exit trigger hold.

DATA HOLD (Trigger) or Refresh Data Hold (Auto trigger)

- *Press this button momentarily to hold the existing displayed digital value and enter trigger mode.*
- *Press this button momentarily again to trigger another data hold*
- *Press this button for more than one second to exit trigger mode.*
- *To select " Refresh Hold " by setup mode. The reading can be updated automatically when the reading is changed, and the beeper sounds a tone to remind user, simultaneously*

3 => ***REL*** : Set the value on the display to be subtracted.
C℉ : Press and hold for more than 1 sec. to toggle mV and temperature tests.

Relative function

- *The relative function shows the difference between the measured value and the stored value.*
- *Press to toggle* ***Relative (Δ)*** *ON or OFF.*
- *For mV measurement, press this button for more than 1 second to enter Temperature measurement. Press this button again for more than 1 second will come back the mV measurement.*

4 => *RANGE* : Change measuring range.
AUTO : Press and hold for more than 1 sec. to set Auto-range.

RANGE:

- *In auto-range, press this button to select manual range and turn off the " AUTO " sign.*
- *In manual range, press this button momentarily to step up 1 range at one time, press this button for more than 1 second to select auto-range.*
- *In auto-range, the " AUTO " is lit and the meter will select an appropriate range for resolution if a reading is greater than maximum available range, " OL "(overload) will be displayed on the display. The meter will select a lower range when reading is less than about 9% of full scale.*
- *Push this button momentarily to change measuring range and re-start the PEAK+ and PEAK- measurements after setting the peak mode.*

5 => ***DUAL*** : Select different combination displays.

Dual Display Combination

- *Press this button momentarily to select different combination displays. Detail combination displays, please refer to the chapter of* ***MULTI-DISPLAY MULTIMETER****.*
- *Push this button momentarily to re-start a new peak value measurement after setting peak mode.*

6 => *Hz* : Select Hz, % and Pulse width tests on Primary display. Press and hold for more than 1 sec. to quit.

Select Frequency, Duty Cycle and Pulse Width Tests

- *For Voltage or Current test, press this button momentarily to enter Frequency test and Voltage or Current will be indicated in secondary display. Press this button again to step through Frequency, Duty cycle, Pulse width test. Press this button for more than one second to come back voltage or current measurement.*
- *The combination displays by pushing "Hz" button, please refer to the chapter of* ***MULTI-DISPLAY MULTIMETER****..*

7 => ***HOLD MAX MIN*** : Press and hold for more than 1 sec to toggle Dynamic recording mode. Press this button momentarily to cycle through **MAX, MIN, AVG** and present (**MAX AVG MIN**) readings at recording mode.

Dynamic Recording

- *Record maximum, minimum, and calculates true average.*
- *Press this button for more than 1 second to toggle recording mode on or off at continuous mode (non data hold).*
- *Press this button momentarily to cycle through* ***MAX, MIN, AVG*** *and present (****MAX AVG MIN****) readings.*
- *The beeper sounds when a new maximum or minimum value is recorded.*
- *Press this button momentarily to cycle through* ***Peak +****,* ***Peak -*** *reading after setting peak mode. The screen shows "****DH MAX****" to indicate the PEAK + and show "****DH MIN****" to indicate the PEAK .*

8 **=> *SHIFT* :** Press to shift button operation for INPUT (SHIFT OFF) or OUTPUT (SHIFT ON)

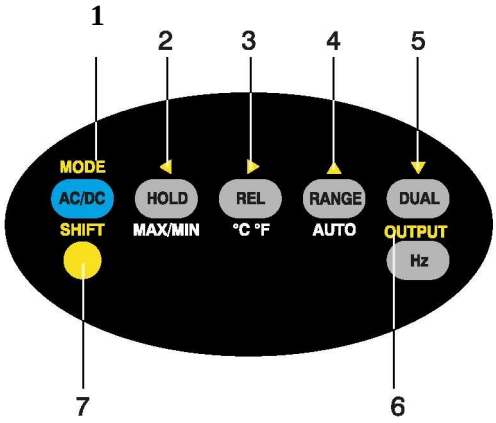
=> **O :** Press and hold for more than 1 sec. to toggle backlit ON/OFF

Back-lit/SHIFT

- *Press this button momentarily to shift the pushbutton operation. The pushbuttons are operating for output function as the SHIFT (SHIFT) is lit on the display.*
- *Press this button for more than 1 second to toggle backlit ON or OFF. Backlit turns off automatically after setting period.*

2.2.2 Output operation

You have to take into account yellow sign.



1 => ***MODE*** : Select output modes for CV (CC), SCAN and RAMP.
Select Hz, %, pulse width and Level adjustments for Square wave output.

Select adjustment mode

- *For square wave output, press this button momentarily to select which parameter to be adjusted. Press this button to cycle through **Hz, %, ms and amplitude** adjustment modes.*
- *For constant voltage output, press this button momentarily to cycle through **±1.5V, ±15V, SCAN ±1.5V, SCAN±15V, RAMP±1.5V** and **RAMP±15V** output modes.*
- *For constant current output, press this button momentarily to cycle through **±25mA, SCAN±25mA** and **RAMP±25mA** output modes.*
- *After setting SCAN and RAMP for constant voltage and current output, press and hold this button for more than 1 second to enter Memory generation adjustment mode. Please refer to the chapter about Memory Generation for detail description*

2 => ***LEFT*** : Select which Digits or polarity to be adjusted
For voltage and current output, press this button momentarily to select which Digits or polarity to be adjusted. The selected position will be flashed on the secondary display.

± <- D5 ± <- D4 <- D3 <- D2 <- D1 <- ±

Select which Digits or polarity to be adjusted:

- *After set SCAN mode for voltage and current output, press this button momentarily to select **Continuous**, **Cycle** or **Step** output. Normally, it is defined to continuous output. Please refer to the chapter about Memory Generation for detail description.*
- *After set RAMP mode for voltage and current output, press this button momentarily to select **Continuous** or **Cycle** output. Normally, it is defined to continuous output. Please refer to the chapter about Memory Generation for detail description.*

3 => ▯ ***RIGHT*** : Select which Digits or polarity to be adjusted
For voltage and current output, press this button momentarily to select which Digits or polarity to be adjusted. The selected position will be flashed on the secondary display.

± → D5 ± → D4 → D3 → D2 → D1→ ±

4 => ▯ ***UP*** : Adjust digit or polarity. Press momentarily to increase/ decrease 1 count for present digit or toggle the polarity of output state.

Adjust digit or polarity

- *Press this button momentarily to increase 1 count for present digit or toggle the polarity of output state.*
- *Press and hold this button will repeat above action.*

5 => ▯ ***DOWN*** : Adjust digit or polarity. Press momentarily to increase/ decrease 1 count for present digit or toggle the polarity of output state.

Adjust digit or polarity

- *Press this button momentarily to increase 1 count for present digit or toggle the polarity of output state.*
- *Press and hold this button will repeat above action*

6 => ***OUTPUT*** : Press momentarily to toggle the output state **ON** and **OFF**. The OUT means this signal has been sent out, and SBY means the signal has been disabled output.

Control the output state

- *Press this button momentarily to toggle the output state **ON** and **OFF**. The OUT means this signal has been sent out. The SBY means the signal has been disabled.*
- *For SCAN and RAMP adjustment modes, press this button momentarily to save your setting*

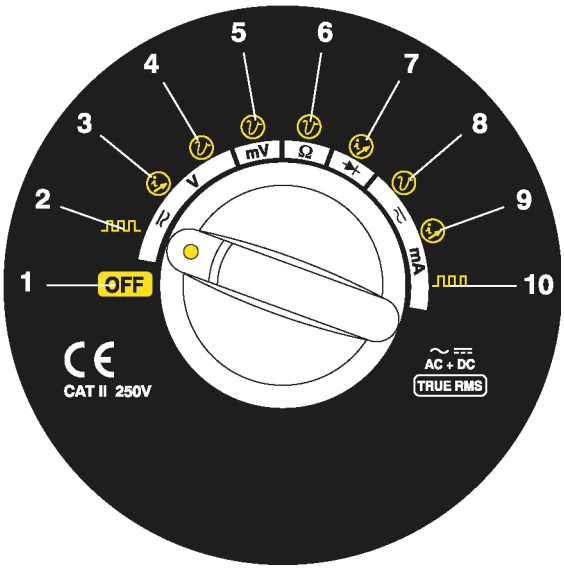
7 => ***SHIFT*** : Press to shift button operation for INPUT (SHIFT OFF) or OUTPUT (SHIFT ON).
=> **O :** Press and hold for more than 1 sec. to toggle backlit ON/OFF.

Backlit/SHIFT

- *Press this button momentarily to shift operation of push buttons. All push buttons will be used to adjust OUTPUT states as SHIFT lit on the display.*

2.3 ROTARY SWITCH

Set the slide switch to M or M/S position first. To turn this device ON and select a combined function you want by turning the rotary switch (**Figure-5**). The output and input function will be selected together. The outside circle indicates **OUTPUT** (SOURCE) function and inside circle indicates **INPUT** (METER) function, respectively.



INPUT

1. Power Off
2. DC, AC or DC+AC Voltage measurements
3. DC, AC or DC+AC mV measurements
4. DC, AC or DC+AC mV measurements
5. DC, AC or DC+AC mV measurements (Temperature)
6. Resistance/ Continuity measurements
7. Diode/ Audible Continuity
8. DC, AC or DC+AC mA measurements: 50mA and 500 mA
9. DC, AC or DC+AC mA measurements: 50mA and 500 mA:
10. DC, AC or DC+AC mA measurements: 50mA and 500 mA

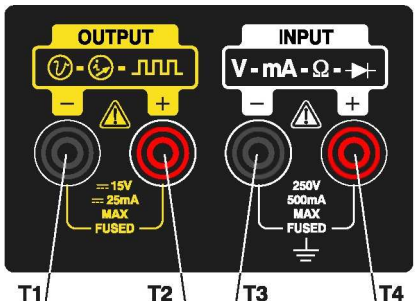
OUTPUT

1. Power Off
2. Square wave output
3. Constant current: ± 25 mA
4. Constant voltage: ± 1.5V, ± 15V
5. Constant voltage: ± 1.5V, ± 15V
6. Constant voltage: ± 1.5V, ± 15V
7. Constant current: ± 25 mA
8. Constant voltage: ± 1.5V, ± 15V
9. Constant current: ± 25 mA
10. Square wave output

2.4 INPUT AND OUTPUT TERMINALS

WARNING
To avoid damaging this device, do not exceed the input limit.

This device has four terminals, two terminals for input function that are protected against overloads to the limits shown in the specifications. The other two terminals use for output function. The overload protection is DC 30 volts. See the below table.

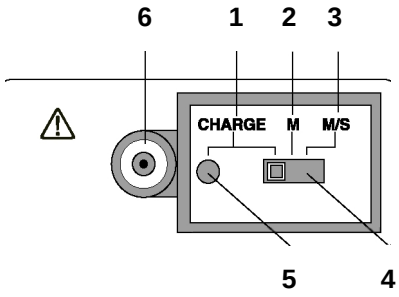


ROTARY SWITCH FUNCTION	INPUT TERMINAL	OVERLOAD PROTECTION
AC/DC Voltage range: 5V~ 250V AC/DC Voltage range: 50mV~ 500mV Ohm (Ω) Diode Temperature	T3 / T4	250 V RMS
AC/DC Current range: 50 ~500mA		250V/630mA, Quick acting fuse

2.5 SLIDE SWITCH

To turn the slide switch to following position:

- **Charge:** this position is selected to charge batteries. Please use the accessory of DC adapter to charge this meter.
- **M:** only measuring function can be achieved.
- **M/S:** the measuring and source function can be used, simultaneously



1. **Charge:** Charge batteries by using the standard DC adapter
2. **M:** Provide power for Meter (INPUT) only
3. **M/S:** Provide power for Measuring and Source function
4. **Slider Switch**
5. Charging indication: GREEN: Fully charge RED: Under charge
6. External DC adaptor jack:Plugged–in external DC adapter to charge the batteries or to be the power source of this device.

3. SELF-PROTECTION

/!\ WARNING
Select the proper function by rotary switch before connecting the test leads or alligator clips to a current loop or simulation points.

3.1 OUTPUT - STANDBY

This instrument offered an Output/ Standby function, which prevents the output function to be broken. It is a popular function on a high-end calibrator, to save customer maintenance cost. Only we know your needs!

This instrument can generate and measure the signal, simultaneously. You will have many chances to get favor with this function. The calibrator will stop the output automatically, the OUT sign will be disappeared and the SBY will be lit on the display. That means the calibrator has been set to standby state. Following instances:

1. You may input the signal to output terminals while the output function has set output state.
2. The noise invades from external power system or output terminals, caused an error signal to output. For instance, ESD test up to 8000 volts, this instrument will go to the standby mode.
3. An overload condition has been detected at constant voltage or square wave outputs.
4. Weaken battery or low battery condition. That will ensure output quality and a useful way to know energy of the power supply.
5. If you didn't use the output function, and turned the slide switch to "M" (input only) position to save the power of battery.

3.2 OVERLAOD ALERT FOR VOLTAGE MEASUREMENT

/!\ WARNING
For your safety, please be aware of the alert. Don't be nervous and just remove the test leads from measuring source.

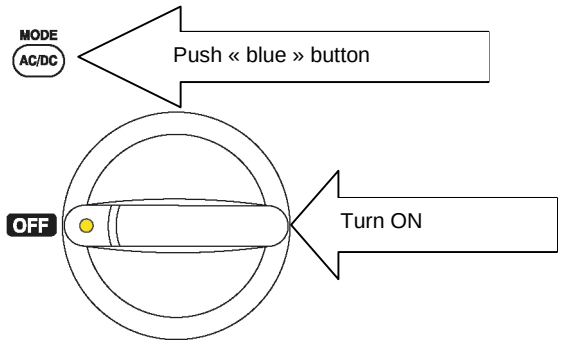
This meter provides an overload alert for voltage measurement during auto-ranging mode or manual range can recognize 251V. The beeper sounds tones periodically once the measuring voltage is exceeded alerting voltage of 251.00V. For your safety, please be aware of this alert.

4. HOW TO USE

4.1 POWER-ON OPTIONS

4.1.1 How to enter setup mode

To press and hold **MODE (BLUE)** button while turn the rotary switch to any “ON” position. The meter will enter setup mode, these parameters will be remained in non-versatile memory even the meter is turned off.



User can configure related parameters on setup mode by following procedures:

1. Press “◀ **(LEFT)**” or “▶ **(RIGHT)**” button to select which menu item to be set.
2. Press “▲ **(UP)** or ▼ **(DOWN)**” button to change the parameter.
3. Push “**OUTPUT**” button momentarily to save your change.
4. Push “**SHIFT**” button momentarily to exit setup mode.

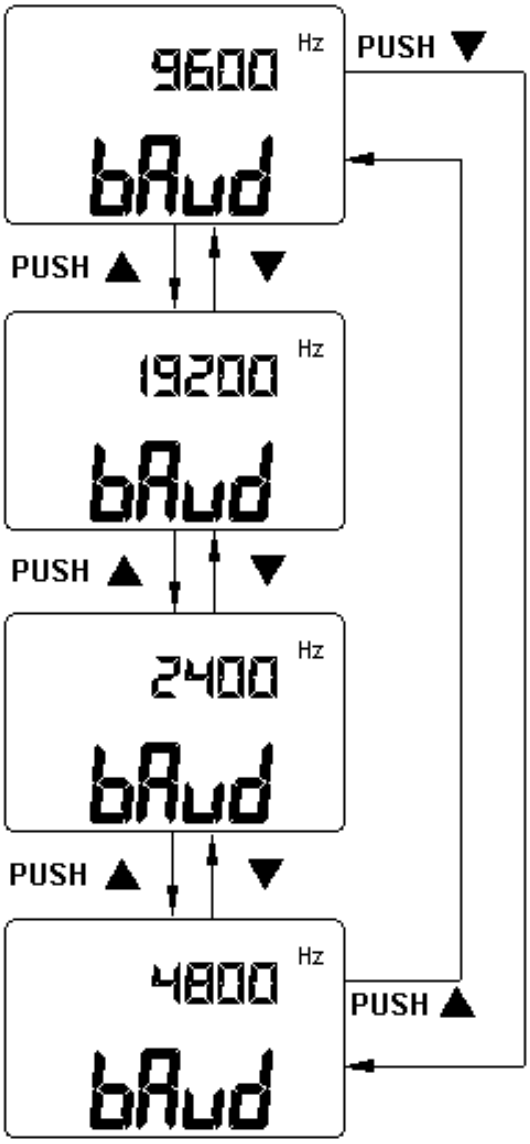
4.1.2 Factory Default

Following Table-3 describes the outline of the setup menu item and indicates the factory settings.

Menu item	Factory Setting	Selectable Parameters	§
Baud Rate	9600	2400, 4800, 9600, 19200	§ 4.1.2.1
Data bits	8	8 bits or 7 bits (Stop bit is always 1 bit)	§ 4.1.2.2
Parity	None	Odd, even or none	§ 4.1.2.3
ECHO	OFF	ON or OFF	§ 4.1.2.4
Print	OFF	ON or OFF	§ 4.1.2.5
Refresh Hold	OFF	OFF means Data Hold (Manual Trigger), set 100~1000 variation counts to enable refresh hold.	§ 4.1.2.6
Percentage scale	4-20mA	4-20mA and 0-20mA for % scale readout	§ 4.1.2.7
Frequency	0.5Hz	Set minimum measuring frequency, 0.5Hz, 1Hz or	§ 4.1.2.8
Beep	4800	The driving frequency can be set for 4800,2400,1200 or 600 Hz. “OFF” means to disable beep.	§ 4.1.2.9
Temperature	°C	Four combinations can be selected: °C only, °C/ °F, °F only, °F/ °C	§ 4.1.2.10
Auto power off	15	1~99 minutes, “OFF” means to disable auto power off.	§ 4.1.2.11
Backlit	30	1~99 seconds, “0FF” means to disable turning off backlit automatically.	§ 4.1.2.12

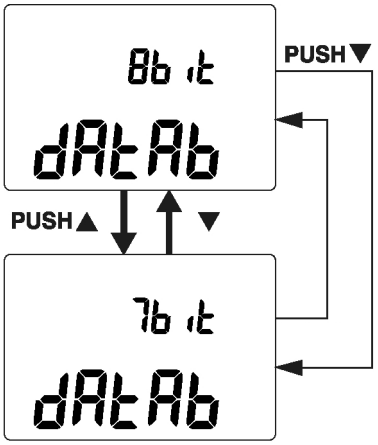
4.1.2.1 Baud rate

The baud rate is selected for remote control. It can be set to 2400, 4800, 9600 or 19200 Hz. To select your request as follows:



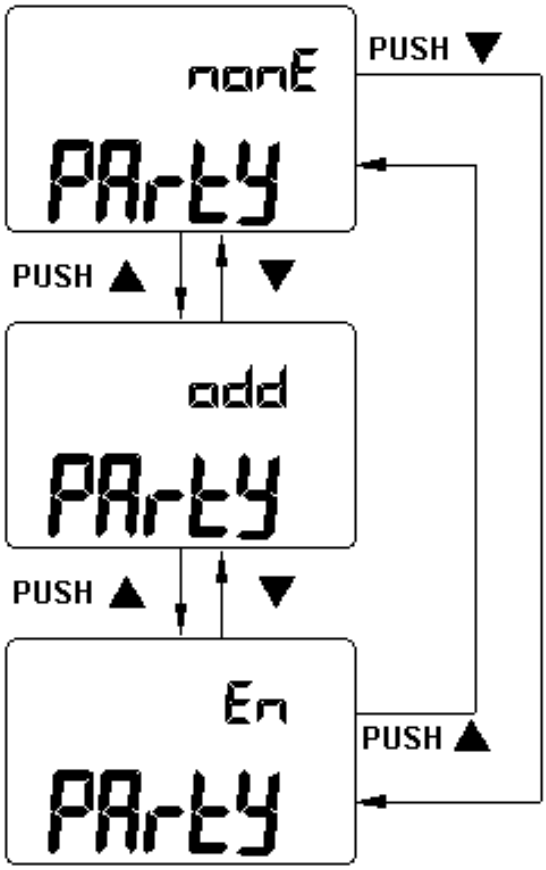
4.1.2.2 Data bit

The data bit is selected for remote control. It can be set to 8 or 7 bits. The stop bit is defined to 1 bit and can't be changed. To select the data bit as follows:



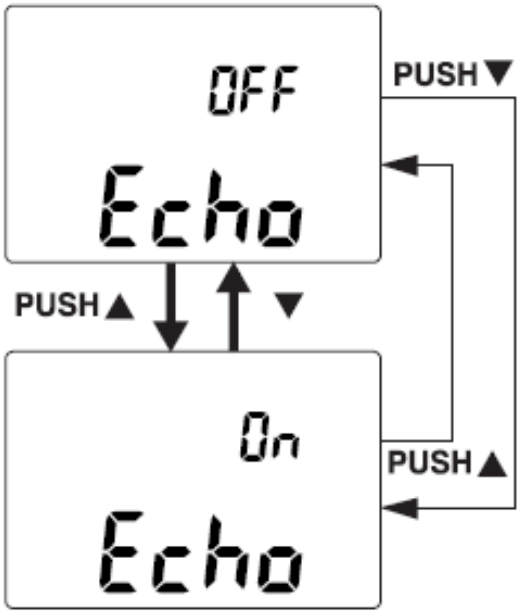
4.1.2.3 Parity check

The parity check is selected for remote control. It can be set to none, even or odd bit. To select the parity as follows:



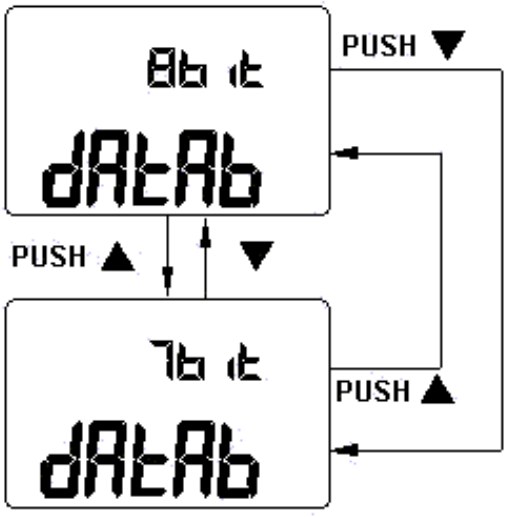
4.1.2.4 ECHO

With ECHO ON, the meter echoes (returns) all the characters whatever it receives. To enable the Echo as follows:



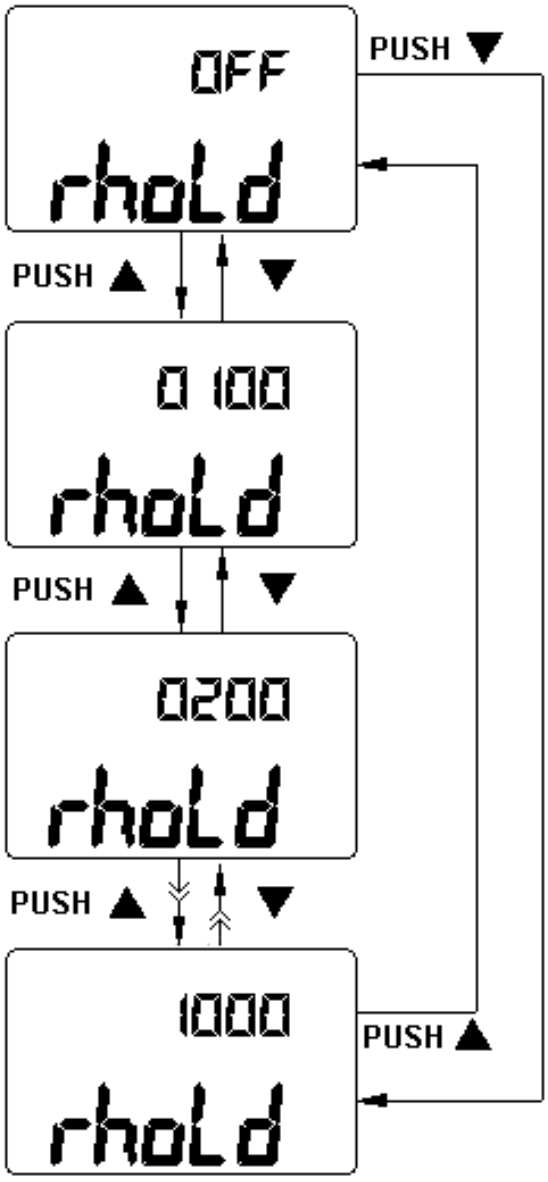
4.1.2.5 Print only

If the remote interface of the meter is under Print-only mode, the meter will print out the measured data when the measuring cycle is completed. The meter sends the newest data to a host automatically and continuously. The meter doesn't accept any commands from the host under Print-Only enabled. The remote indicator of the meter will be flashed during operation as Print-only ON. To enable the print-only as follows:



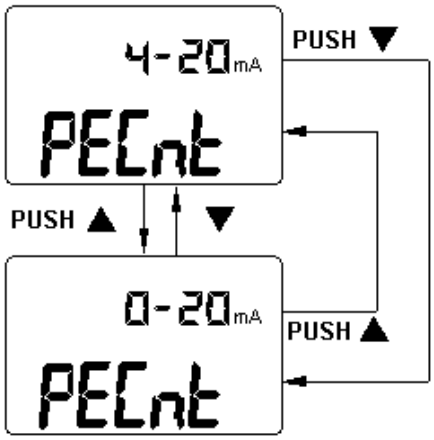
4.1.2.6 REFRESH HOLD

Normal, factory default the hold mode to Data Hold (Manual Trigger by key/ BUS trigger by remote control). Set “OFF” for Data Hold (Manual Trigger), and set 100~1000 variation counts to enable Refresh Hold. The variation of measuring value exceed the setting of variation count, the refresh hold will be ready to trigger. To enable refresh hold as follows:



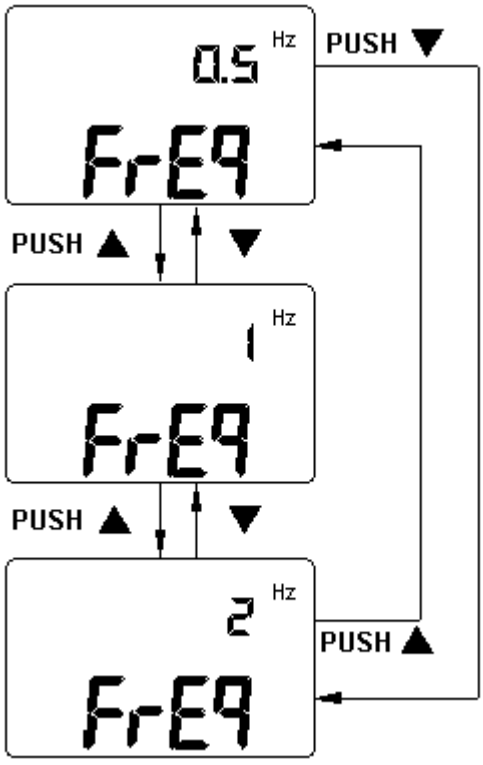
4.1.2.7 Percentage (%) scale for 4-20mA or 0-20mA measuring

To set the DC current measuring display with % scale readout. Set 4-20mA or 0-20mA for proportional to 0%~100%. The 25% scale readout represents DC 8mA at 4-20mA, and DC 5mA at 0-20mA. To set % scale proportional as follows:



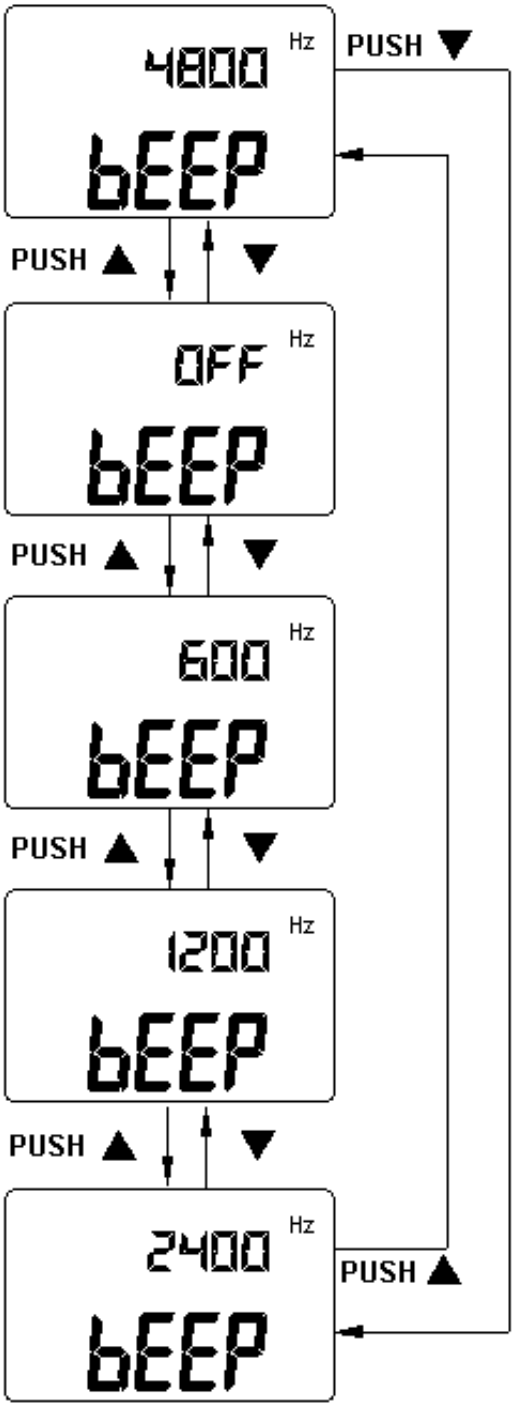
4.1.2.8 Minimum Frequency measuring

To set minimum measuring frequency will influence the measuring rate for frequency, duty cycle, and pulse width measurement. Normal, the measuring rate defined at general specification is based on the minimum frequency is 1 Hz.



4.1.2.9 Beep Frequency

The driving frequency can be set for 4800, 2400,1200 or 600 Hz. The beeper can be set to ”OFF” as you want kept silent during operation, to select a tone you like according to follows:

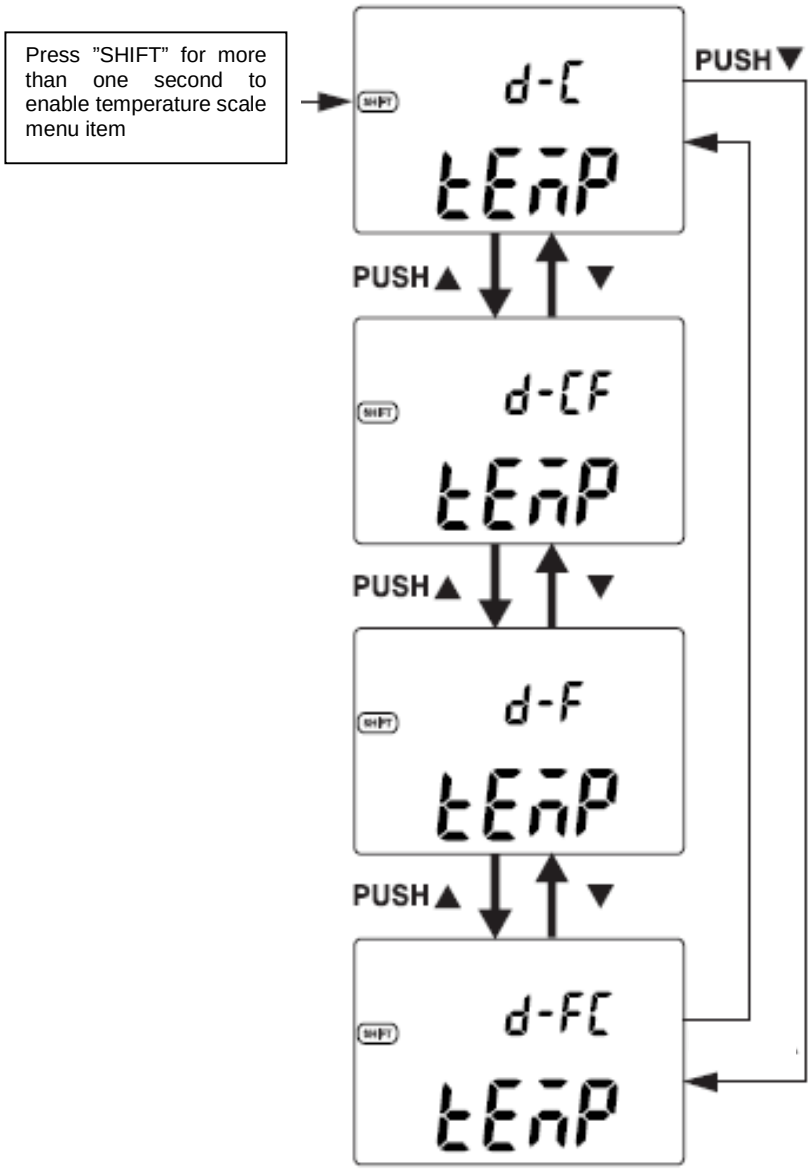


4.1.2.10 Temperature unit

/!\ CAUTION.
Always set the temperature unit display for official requirements and comply with National law.

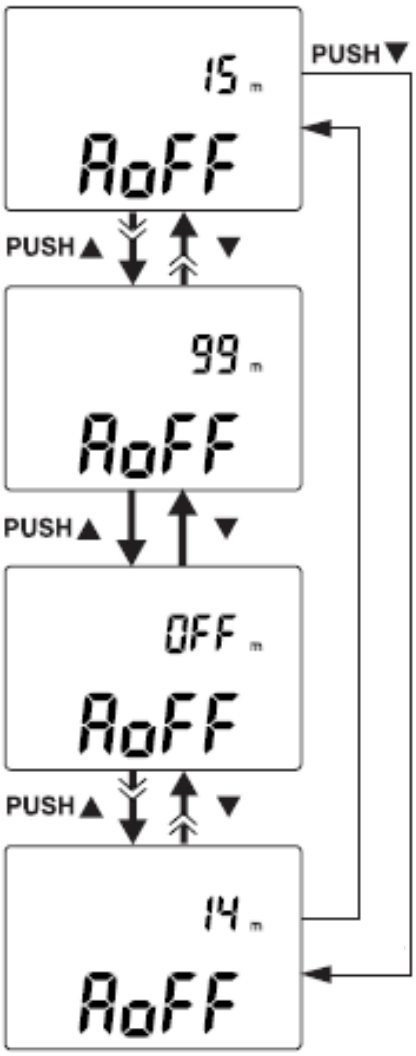
Normally, the temperature unit is different for various areas. To select an official required scale unit by setup mode. Four combination displays can be selected:

1 Celsius only (°C on primary display only).
2 Celsius/ Fahrenheit (°C/ °F), the primary and secondary display can be switched to indicate Fahrenheit/ Celsius (°F/ °C).
3 Fahrenheit only (°F on primary display only).
4 Fahrenheit/ Celsius (°F/ °C), the primary and secondary display can be switched to indicate Celsius/ Fahrenheit (°C/ °F)



4.1.2.11 Auto Power Off

The timer for auto power off can be set to 1~99 minutes, “OFF” means to disable auto power off. To set timer of auto power off as follows:



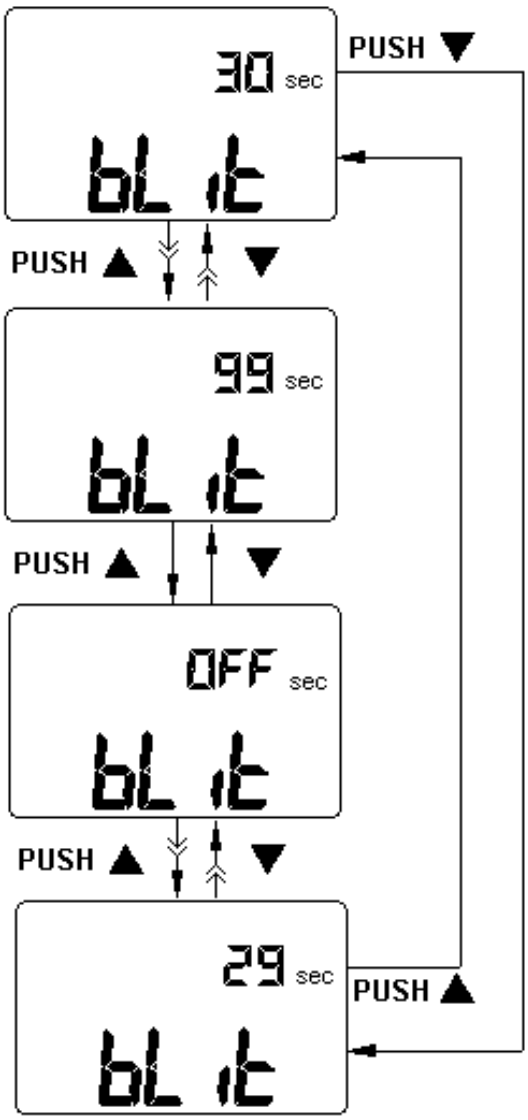
Auto power off is for power saving. The instrument may automatic turn off within a setting period, if none of the following happens.

a. Push buttons are used.
b. Measurement function is changed.
c. Dynamic recording is set.
d. 1 ms peak hold is set.
e. Auto power off has been disabled by Setup mode.
f. The output has been enabled, and the OUT lit

You must turn the rotary switch to the OFF position, then turn on again to activate the meter after auto power off. When the meter is to be used for long periods of time, the operator may disable the auto power off. The meter will stay on continuously as the auto power off function is disabled,. To shut off the meter by turning the rotary switch to the off position. The sign "APOFF" will be turned off when auto power off function disabled.

4.1.2.12 Backlit Display

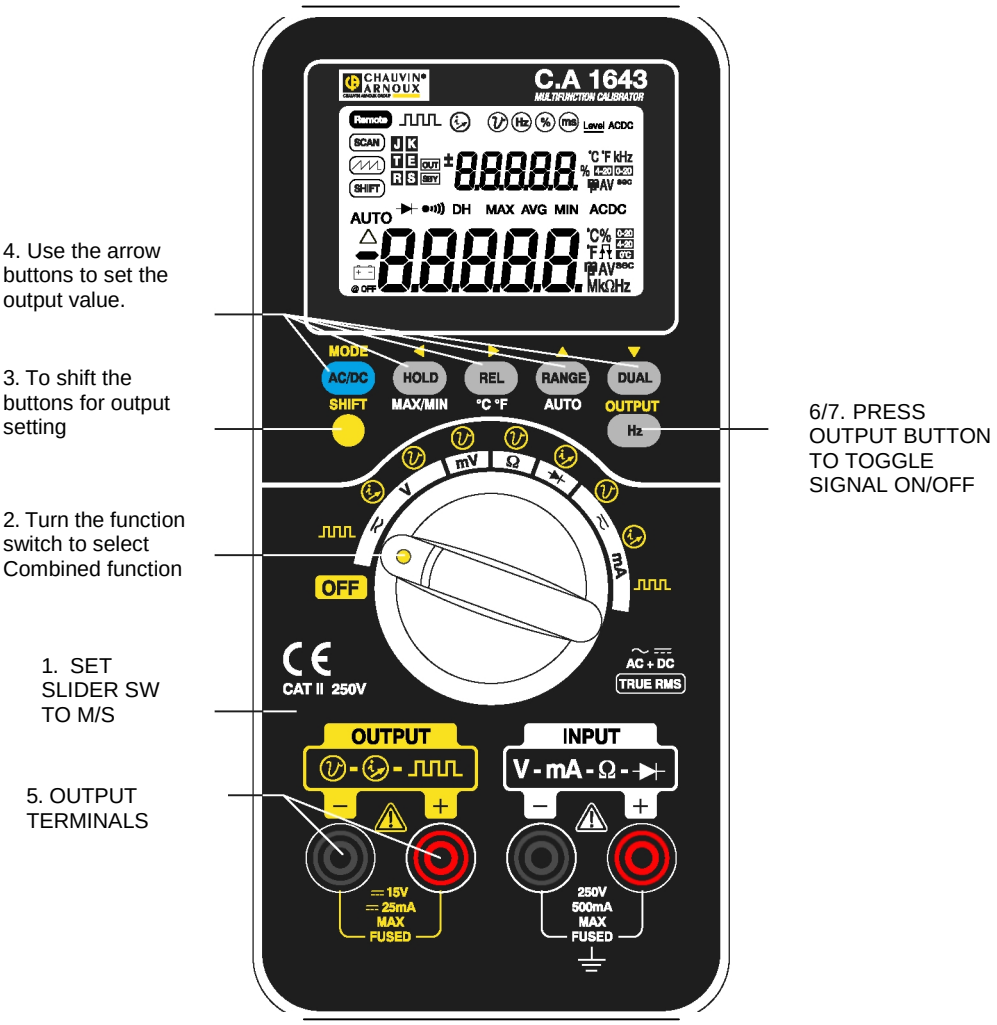
The timer can be set to 1~99 seconds, “0FF” means to disable turning off backlit automatically. The backlight will be turned off automatically after a setting period. To set the period as follows:



4.2 QUICK START

4.2.1 OUTPUT- Setup and output a process calibration signal

1 Slide the side switch at left side to "**M/S**" position
2 Turn the function switch to select combined function for the output function required (⎍⎍⎍, ⓣ or ⓣ) and related input function will be used simultaneously.
3 Press the **"SHIFT"** button to shift the buttons for output setting.
4 Use the **arrow** buttons (left / right for digit selection, up / down for value) to set the output value.
5 Connect the **OUTPUT** terminals to the device to be tested.
6 Press the **OUTPUT** button. The process signal will become active.
7 Press the **OUTPUT** button again to turn off the signal.



4.2.2 INPUT- ACV and Frequency measurements

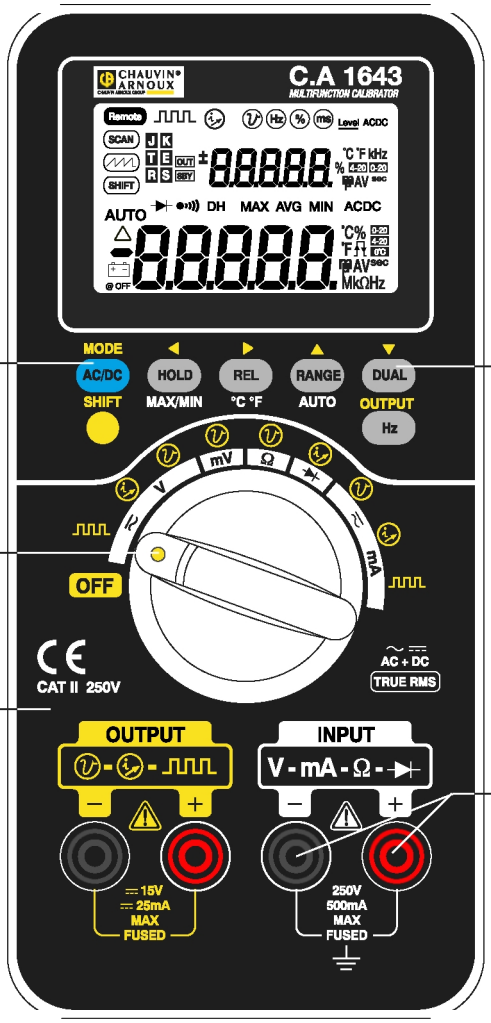
1 Slide the side switch at left side to "**M**" or "**M/S**" position

2 Turn the function switch to select combined function for "~ **V**" and the output function (⎍⎍⎍, ⏲ or ⏲) you wanted.

3 Press the **"AC/DC"** button momentarily to select AC voltage measurement.

4 Press the "**Dual**" button momentarily to set frequency measuring on secondary display.

5 Connect the **INPUT** terminals by test leads to the source to be tested.



3. Press momentarily to select AC voltage measurement

2. Turn the rotary switch to the "~ V" function

1. Set the Slide switch to M or M/S position

4. Press momentarily to set frequency measuring on secondary display

5 Connect the INPUT terminals by test leads to the source to be tested

4.3 MEMORY GENERATION

For constant voltage and current output, this device offers two usefully functions. One is SCAN output, it has 16 steps can be set amplitude and time interval. The Other one is RAMP output. It has dual slopes for linear simulation, and can be set different resolution. Detail description as follows.

4.3.1 *AUTO SCAN* output

1 How to select the scan function:

(1) Turn the rotary switch to the or output position

(2) Press SHIFT button momentarily to shift operation of push buttons. Ensure the SHIFT sign is lit on the display.

(3) For voltage output, press MODE button momentarily to cycle through **±1.5V, ±15V**, **SCAN±1.5V, SCAN±15V**, **RAMP±1.5 V** and **RAMP±15V** output modes. For current output, press MODE button momentarily to cycle through **±25mA**, **SCAN ±25mA** and **RAMP ±25mA** output modes

(4) After setting the scan function, the SCAN sign will be indicated on the screen..

2 BELOW TABLE IS INITIAL SET AT THE MEMORY:

Mode	SCAN **±1.5000 V**	SCAN **±15.000 V**	SCAN **±25.000 mA**		**Mode**	
Step	Amplitude	Time interval	Amplitude	Time interval	Amplitude	Time interval
1	+1,5V	02 sec	+15V	02 sec	+00 mA	02 sec
2	+1,2V	02 sec	+12V	02 sec	+04 mA	02 sec
3	+0,9 V	02 sec	+09 V	02 sec	+08 mA	02 sec
4	+0,6 V	02 sec	+06 V	02 sec	+12 mA	02 sec
5	+0,3 V	02 sec	+03 V	02 sec	+16 mA	02 sec
6	+0 V	02 sec	+00 V	02 sec	+20 mA	02 sec
7	-0,3 V	02 sec	-03 V	02 sec	+16 mA	02 sec
8	-0,6 V	02 sec	-06 V	02 sec	+12 mA	02 sec
9	-0,9 V	02 sec	-09 V	02 sec	+08 mA	02 sec
10	-1,2 V	02 sec	-12 V	02 sec	+04 mA	02 sec
11	-1,5 V	02 sec	-15 V	02 sec	+00 mA	02 sec
12	+00 V	00 sec	+00 V	02 sec	+04 mA	00 sec
13	+00 V	00 sec	+00 V	02 sec	+08 mA	00 sec
14	+00 V	00 sec	+00 V	02 sec	+12 mA	00 sec
15	-1,5 V	00 sec	-15 V	02 sec	+16 mA	00 sec
16	+00 V	00 sec	+00 V	02 sec	+20 mA	00 sec

3 Automatic SCAN output::

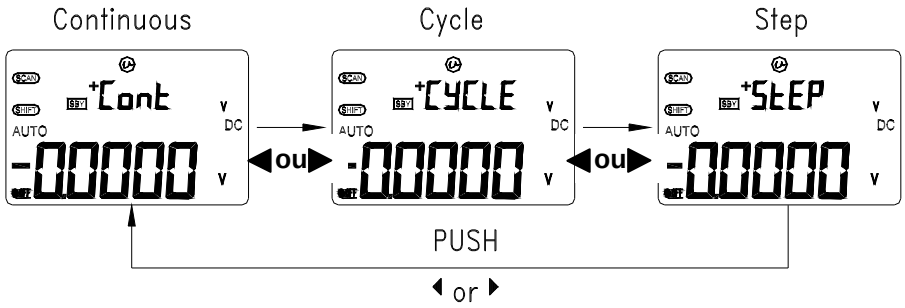
After setting SCAN function, press " ◀ " or " ▶ " button momentarily to select three modes for Continuous, Cycle or Step output. The secondary display will show **Cont, CYCLE**, or **StEP** respectively.

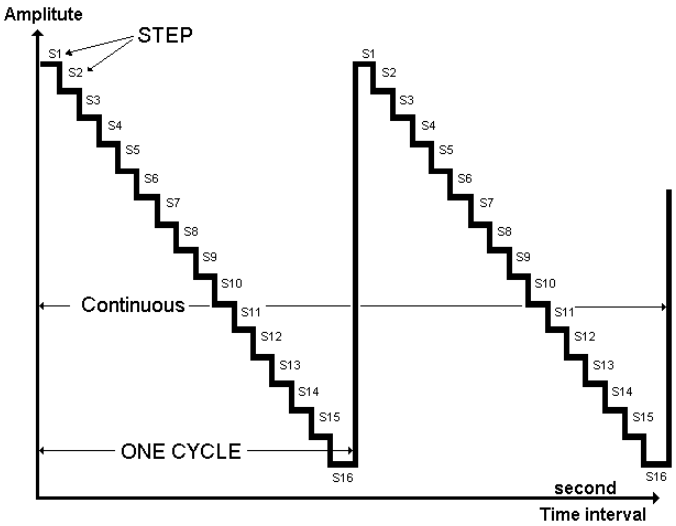
For Continuous and Cycle outputs always start from step 1. If the time interval of step 1 is "00" second, the output setting will be set to the amplitude of step 1 as you achieve the output function, but the output status will be set to SBY. If you stop to send out the signal when continuous or cycle output is sent out, the step of next output will be come back step 1.

(1) **Cont:** Means continuous output. Press the "**OUTPUT**" button to start the source output. The signal will be sent out according to memory states and started from step 1 until the time interval of memory is "00" second, then will go back to step 1 output. The amplitude of each step will be kept a period for setting time interval of each step. For instance, in the initial setting, the output is from step1 to step 11, and then come back step1 because the time interval of step 12 is "00"second.

(2) **CYCLE:** Means one cycle output. Press the "**OUTPUT**" button to start the source output. The signal will be sent out according to memory states, and started from step 1, and lock the output on previous step which the timer interval of memory is "00" second, The amplitude of each step will be kept a period for setting time interval of each step. For instance, in the initial setting, the output is from step1 to step 11, then locked on step 11

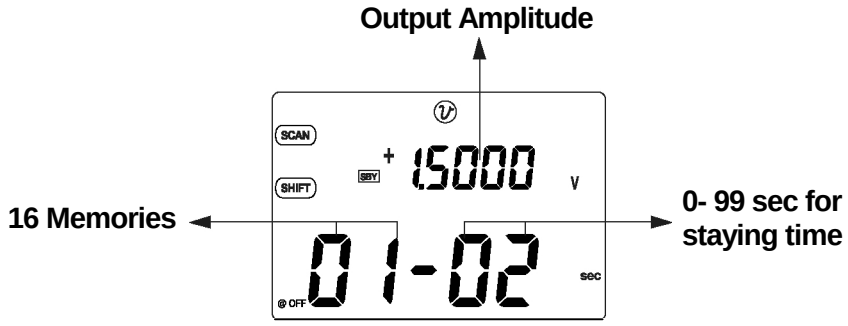
(3) **STEP:** Step by step output. It is manual to send out the step of memory. You can push the "▲" or "▼" button to select which step will be send out. The amplitude of each step will be kept until you change step or otherwise.





4 How to change parameters of SCAN in the memory:

Press and hold "**MODE**" button for more than 1 second to enter SCAN adjustment mode. It has 16 steps of memory for settling time interval and amplitude. The secondary display shows the amplitude. The left two digits of primary display are used to indicate which step. The last two digits of primary display are used to indicate time interval. Push the "**MODE**" button momentarily to cycle through **step, time interval** and **amplitude** adjustments. The screen will flash the digit to be adjusted. Normal, it is stayed in the step 1 adjustment when enter memory adjustment. Time interval can be set from 0 to 99 seconds by pressing the "▲" or "▼" button. Press the "**OUTPUT**" button momentarily to save the setting. Press the ▶ button for more than 1 second that will set the time and amplitude of present step to zero directly.



4.3.2 AUTO RAMP Output

1 How to select the RAMP function:

(1) Turn the rotary switch to the ⏻ or ⏻ output position

(2) Press "**SHIFT**" button momentarily to shift operation of push buttons. Ensure the SHIFT sign is lit on the display.

(3) For voltage output, press "**MODE**" button momentarily to cycle through **±1.5V, ±15V, SCAN±1.5 V, SCAN ±15V, RAMP ±1.5 V** and **RAMP±15V** output modes. For current output, press MODE button momentarily to cycle through **±25mA, SCAN ±25mA** and **RAMP±25mA** output modes.

(4) After setting the RAMP function, the ⏻ sign will be indicated on the screen.

2 Below table is initial set at the memory:

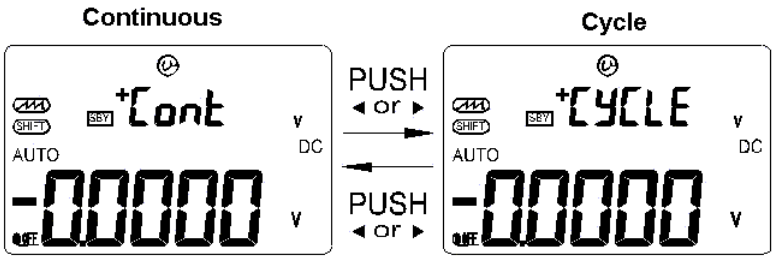
Mode	⏻ ± 1 , 5 V		⏻ ± 1 5 V		⏻ ±25 mA	
Position	Amplitude	Resolution	Amplitude	Resolution	Amplitude	Resolution
Start	-1,5 V	15 steps	-15 V	15 steps	-25 mA	25 steps
End	+ 1,5 V	15 steps	+15 V	15 steps	+25 mA	25 steps

3 Automatic RAMP output:

After setting **RAMP** function, press the "◀" or "▶" button momentarily to select Continuous or Cycle output. The secondary display will show **Cont** and **CYCLE,** respectively.

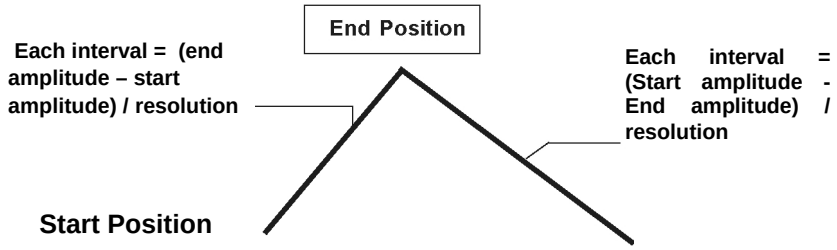
(1) Cont: Continuous output. Press the "**OUTPUT**" button to start the source output. The signal will be sent out according to memory states per 0.33 seconds. For instance, in the initial setting, the interval of first slope is (end amplitude - start amplitude) divide resolution. So, the interval is (1.5V+1.5V)/15steps= 0.2 V for ⏻ **± 1.5000 V.** The interval of secondary slope is (start amplitude - end amplitude) divide resolution. So, the interval is (-1.5V-1.5V)/15steps= -0.2 V for ⏻ **± 1.5000 V.**.

(2) CYCLE: One cycle output. Press the "**OUTPUT**" button to start the source output. The signal will be sent out according to memory states per 0.33 seconds approx., and lock on last output.

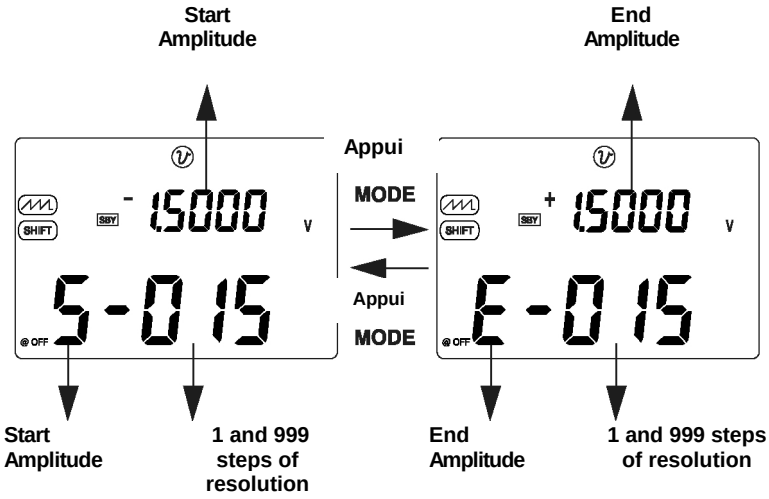


4 How to set the parameters of RAMP in the memory:

Press and hold "**MODE**" button for more than 1 second to enter RAMP adjustment mode. The **RAMP** function is dual slope output. So, you can adjust the resolution between start and end positions or end and start positions, and amplitude of start or end positions.



The secondary display shows the amplitude for Start or End position. The left first digit of primary display is used to indicate Start or End positions. The last three digits of primary display are used to indicate interval. Push the "**MODE**" button momentarily to cycle through position, interval and amplitude adjustment. The screen will flash the digit to be adjusted. The resolution can be set from 1 to 999 by pressing the "▲" or "▼" button. Press the "**OUTPUT**" button momentarily to save your setting.



4.4 A FREE-FOR-ALL APPLICATION FUNCTION

4.4.1 Square Wave Output

Square wave output a unique function for unimaginable applications, for instances, PWM (Pulse Width Modulation) output, Adjustable Voltage Control, Synchronic clock (baud rate generator) etc. Also you can use to check and calibrate flow-meter displays, counters, tachometers, oscilloscopes, frequency converter, frequency transmitter and other frequency input devices. That is a free-for-all application function.

Square wave output can set four parameters for frequency, amplitude, duty cycle, and pulse width..

1 How to select the square wave output function:

(1) Turn the rotary switch to the ⎍ output position

(2) Press "**SHIFT**" button momentarily to shift operation of push buttons. Ensure the SHIFT sign is lit on the display.

(3) The square wave output has 4 parameters can be set. Initial setting is **150 Hz, 50.00 %, 3.3333ms** and **+ 5V**, there are frequency, duty cycle pulse width and amplitude, respectively. See the **Figure**.

(4) Press "**OUTPUT**" button momentarily to send out the signal**.**

2 The 28 frequencies can be selected, please refer below table:

Frequency
0,5, 1, 2, 5, 10, 15, 20, 25, 30, 40, 50, 60, 75, 80, 100, 120, 150, 200, 240, 300, 400, 480, 600, 800, 1 200, 1 600, 2 400, 4 800 Hz

To send out different frequency in accordance with following procedures:

(1) Press "**SHIFT**" button momentarily to shift operation of push buttons. You will find the SHIFT

sign will be lit.

(2) Press "**MODE**" button momentarily to select frequency adjustment. The Hz sign will be lit.
(3) You can select the frequency by pressing the "▲" or " ▼" button
(4) Press "**OUTPUT**" button momentarily to send out the signal**.**

3 The duty cycle can be adjusted for 256 steps. Each step is 0.390625 %, the screen can indicate the best resolution with 0.01 % only.

To adjust the duty cycle in accordance with following procedures :

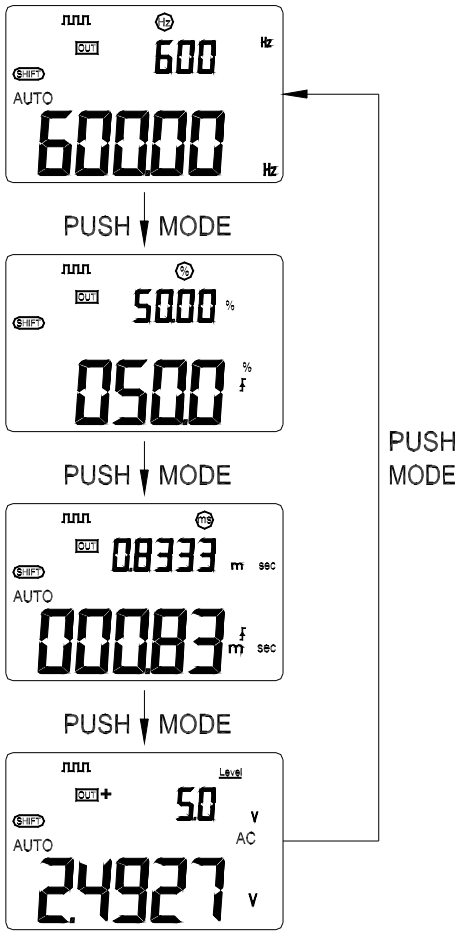
(1) Press "**MODE**" this button momentarily to select duty cycle adjustment. The % sign will be lit then.

(2) Press the "▲" or " ▼" button to adjust the duty cycle.

4 The Pulse width can be adjusted for 256 steps. Each step is 1/ (256*frequency) and depends on the frequency:

(1) Press "**MODE**" button momentarily to select pulse width adjustment. The MS sign will be lit then.
(2) Press the "▲" or " ▼" button to adjust the pulse width.

5 To select the amplitude for + 5V, ± 5V, + 12V and ± 12V levels:
Please refer to following procedures to select the amplitude:
(1) Press "**MODE**" this button momentarily to select amplitude adjustment. , The **Level** sign will be lit then.
(2) Press the "▲" or " ▼" button to select the amplitude



4.5 CALCULATION FUNCTION

This device provides operators with various functions.

4.5.1 Dynamic recording

The dynamic recording mode can be used to catch intermittent turn on or turn off surges, verify performance, measure while you are away, or take readings while you are operating the equipment under test and can't watch the meter.

The average reading is useful for smoothing out unstable or changing inputs, estimating the percentage of time a circuit is operated, or verifying circuit performance.

The operational procedures are described below:

1 Press "**MAX • MIN**" for more than 1 second to enter the dynamic recording at continuous mode (non data hold). The present value is stored to memories of maximum, minimum and average, also the **MAX AVG MIN** sign will be lit.

2 Press this button for more than 1 second to exit recording mode.

3 Press this button momentarily to cycle through maximum, minimum, average and present readings. The **MAX**, **MIN**, **AVG** or **MAX AVG MIN** sign will be lit respectively to indicate which value is being displayed.

4 The beeper sounds when a new maximum or minimum value is recorded

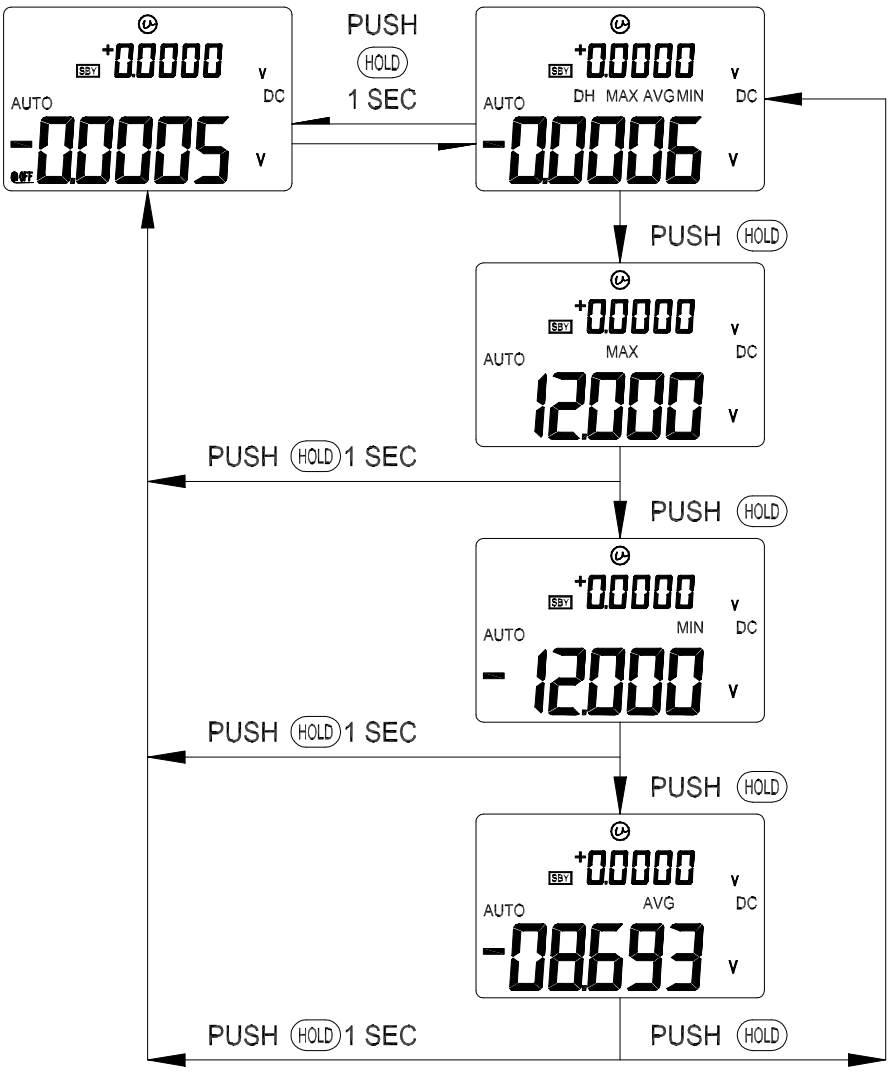
5 If an overload is recorded the averaging function will stop. The average value becomes " **OL** "(overload).

6 In dynamic recording, the auto power off feature will be disabled, and the "  " will be turned off.

7 Selecting dynamic recording in auto range, it will record the value of MAX, MIN or AVG for different ranges.

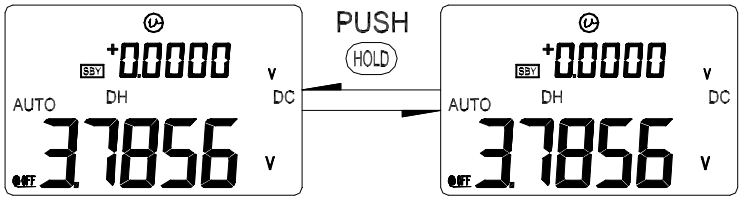
8 The recording speed of dynamic recording in manual range is about 0.067 seconds approx.

9 The average value is the true average of all measured values taken since the recording mode was entered.



4.5.2 DATA HOLD (Manual Trigger)

The data hold function allows operators to hold the displayed digital value. Press **HOLD** button to freeze the displayed value and enter the manual trigger mode, and the "**DH**" will be displayed. Press the button again to trigger another new measuring value updated to display. The “DH” will be flashed before the new updates. Press **HOLD** button for more than one second to exit this mode.



4.5.3 REFRESH HOLD (Auto Trigger)

You can use the setup mode to enable the **Refresh Hold** when you are working on a difficult measuring field. This function will auto trigger or update HOLD value with new measuring value, and sound a tone to remind user. The operation of push-button is same as the operations of Data hold.

Press “HOLD” button to enter Refresh Hold mode. The present value will be held and the ”DH” will be lit. It will be ready to hold new measuring value once the variation of measuring value exceed the setting of variation count, and the “DH” will be flashed. The hold value will be updated until the measuring value is stable, then stop flash and light “DH” and sound a tone to remind user.

For voltage and current measurements, the holding value will not be updated when the reading below 500 counts. For resistance and diode measurements, the holding value will not be updated if the reading at “**OL**” or open state. The holding value may not be updated once the reading can’t reach stable state for all measurements.

4.5.4 RELATIVE (ZERO)

The relative function subtracts a stored value from the present measurement and displays the result.

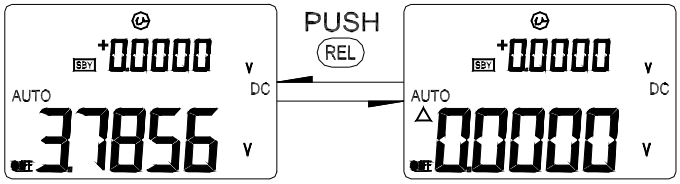
1. Press **REL** button momentarily to set the relative mode. This sets the display to zero and stores the displayed reading as a reference value, also " Δ " will be displayed.

2. The relative mode can be set at auto or manual range, but can't be set when an overload has occurred.

3. Press this button again to exit the relative mode.

4. When the Ohm measurement mode is entered, the display will reads a non-zero value due to the presence of test leads. You can use the relative function to Zero-Adjust the display.

5. For DC voltage measurement, the thermal effect will influence the accuracy. Use relative function to zero the thermal effect. Short the test leads, press REL button momentarily as the display value is stable.



4.5.5 1 ms Peak Hold

You can use this Meter to analyze components such as power distribution transformers and power factor correction capacitors. The additional features allow the measurement of the half-cycle peak voltage by using the 1 ms peak hold feature. This allows the determination of the crest factor:

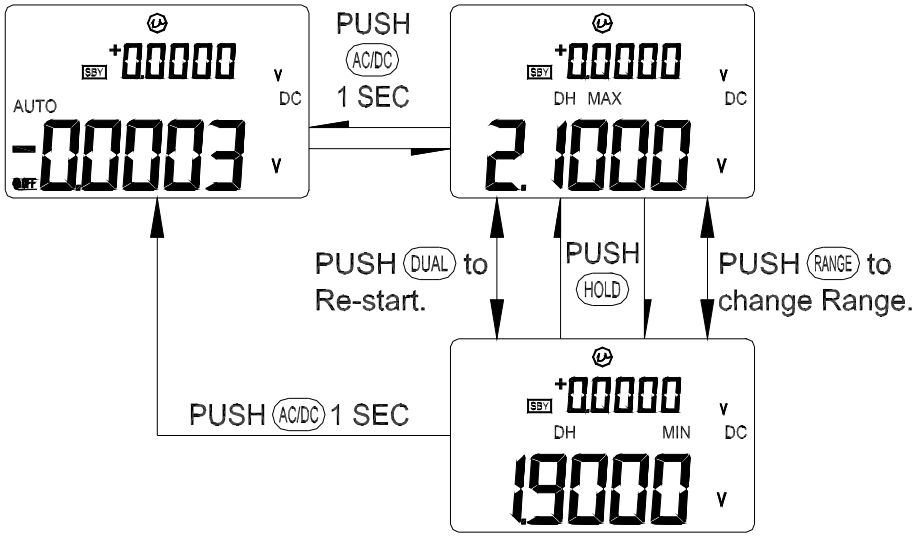
Crest factor = Peak value/True RMS value

1. Press **BLUE** button for more than 1 second to toggle 1 ms peak hold mode ON/OFF.

2. Press **DH (MAX• MIN)** button momentarily to show peak + or peak - value after setting the peak mode. The display shows "**DH MAX**" to indicate the PEAK + and shows "**DH MIN**" to indicate the PEAK -. See **Figure.**

3. If the reading is " **OL**", then you can push **RANGE** button momentarily to change measuring range and re-start the PEAK measurement after setting the peak mode.

4. Press **DUAL** button momentarily to re-start the 1 ms peak hold again after setting peak mode.



4.6 MULTI-DISPLAY MULTIMETER

The frequency measuring helps detect the presence of harmonic currents in neutral conductors and determines whether these neutral currents are the result of unbalanced phases or non-linear loads.

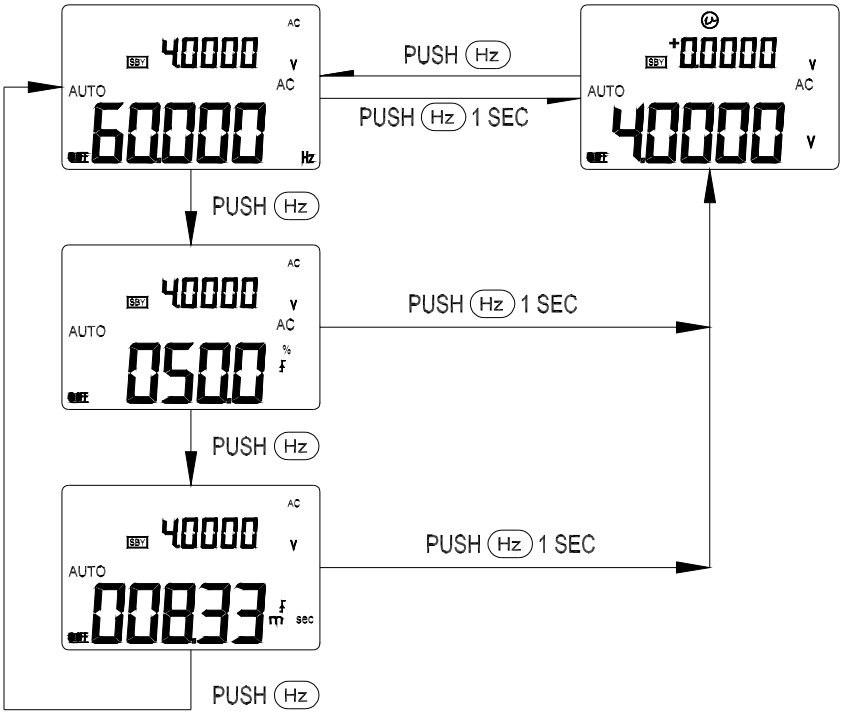
4.6.1 Selection by Hz Button

For Voltage or Current test, press **Hz** button momentarily to enter Frequency test. Voltage or Current will be displayed on the secondary display, the frequency will display on the primary display. Press this button again to step through Frequency, Duty cycle and pulse width tests. This allows simultaneously monitor the present levels and frequency (or Duty Cycle, or pulse width).

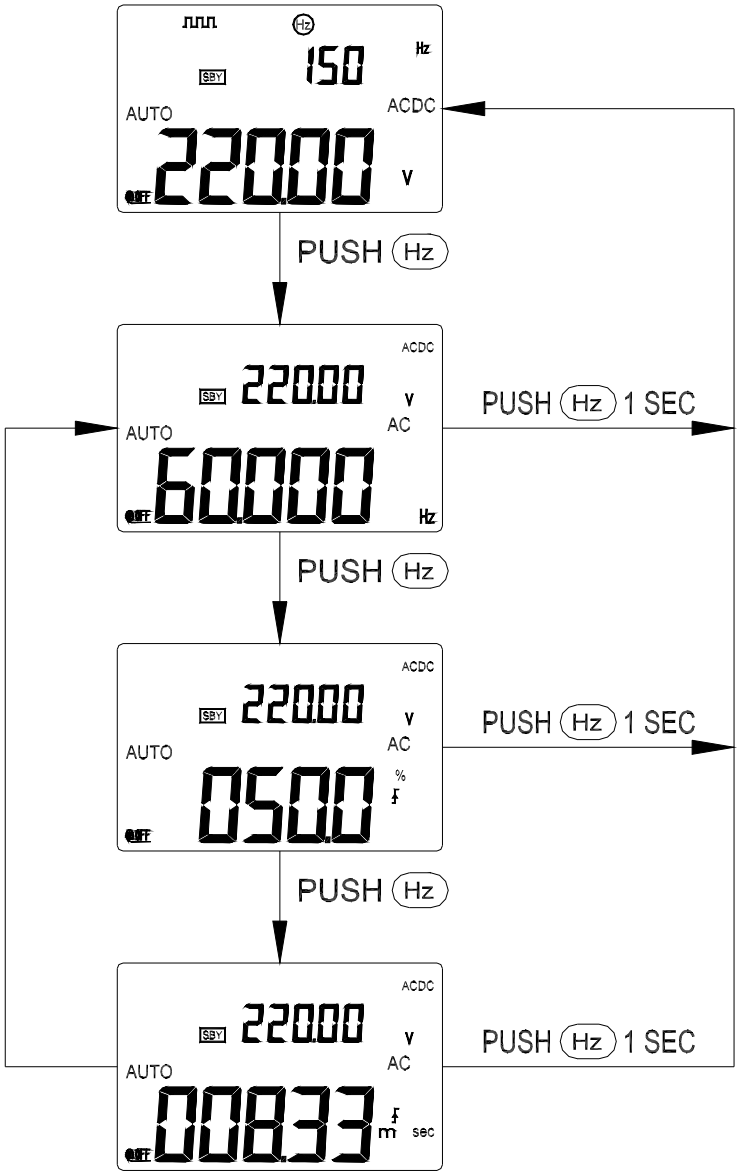
Press **Hz** button for more than 1 second to return to Voltage or Current measurement.

Function	Primary display	Secondary display
AC Voltage	Frequency (Hz)	ACV
	Duty Cycle (%)	ACV
	Pulse Width (ms)	ACV
DC Voltage	Frequency (Hz)	DCV
	Duty Cycle (%)	DCV
	Pulse Width (ms)	DCV
AC+DC Voltage	Frequency (Hz)	AC+DCV
	Duty Cycle (%)	AC+DCV
	Pulse Width (ms)	AC+DCV
AC Current	Frequency (Hz)	ACA
	Duty Cycle (%)	ACA
	Pulse Width (ms)	ACA
DC Current	Frequency (Hz)	DCA
	Duty Cycle (%)	DCA
	Pulse Width (ms)	DCA
AC+DC Current	Frequency (Hz)	AC+DCA
	Duty Cycle (%)	AC+DCA
	Pulse Width (ms)	AC+DCA
%(0-20 or 4-20)	Frequency (Hz)	% (0-20 ou 4-20)
	Duty Cycle (%)	% (0-20 ou 4-20)
	Pulse Width (ms)	% (0-20 ou 4-20)

AC VOLTAGE MEASUREMENT



AC+DC VOLTAGE MEASUREMENT

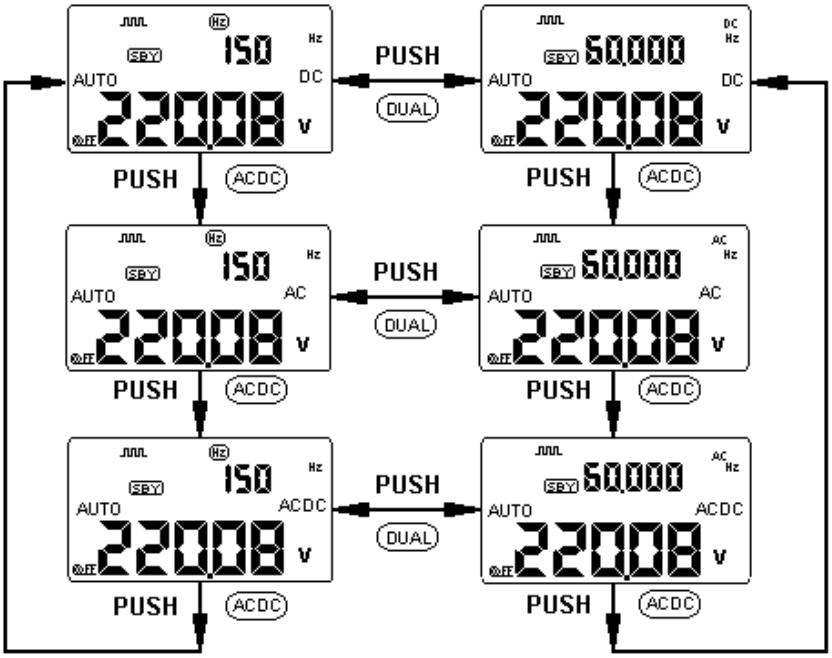


4.6.2 Selection by DUAL button

It is another way to have combination display. Press DUAL button momentarily to select different combinations of dual display. The DUAL button will be disabled when recording or trigger mode has been enabled. The combinations of dual display are shown as following table:

Function	Primary display	Secondary display
AC Voltage	ACV	Hz (AC coupling)
DC Voltage	DCV	Hz (DC coupling)
AC + DC Voltage	AC+DC V	Hz (AC coupling)
DC Current	DCA	Hz (DC coupling)
AC Current	ACA	Hz (AC coupling)
AC+DC Current	AC+DC A	Hz (AC coupling)
%(0-20 or 4-20)	%(0-20 or 4-20)	Hz (DC coupling)
Temperature	Celsius (°C)	Fahrenheit (°F)
	Fahrenheit (°F)	Celsius (°C)

Voltage Measurement



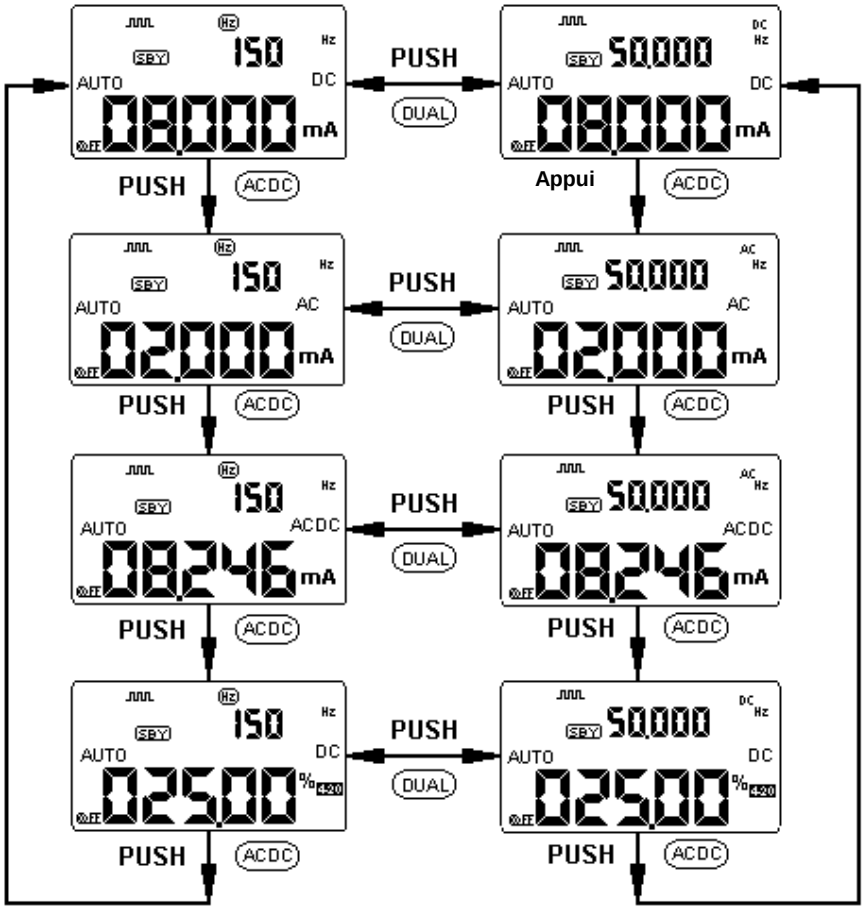
CURRENT MEASUREMENT

1 Press **AC/DC** button momentarily to step through AC, DC+AC and DC test.

Key operation	Primary display	Secondary display
Press AC/DC	AC mA	
Press AC/DC	AC+DC mA	
Press AC/DC	DC mA	
Press AC/DC	% for 4-20 or 0-20 mA	

2 Press **DUAL** button momentarily to enter multi-display mode.

Key operation	Primary display	Secondary display
Push Dual	DC mA (AC, AC+DC, % for 4-20 or 0-20mA)	Hz
Push Dual	DC mA (AC, AC+DC, % for 4-20 or 0-20mA)	



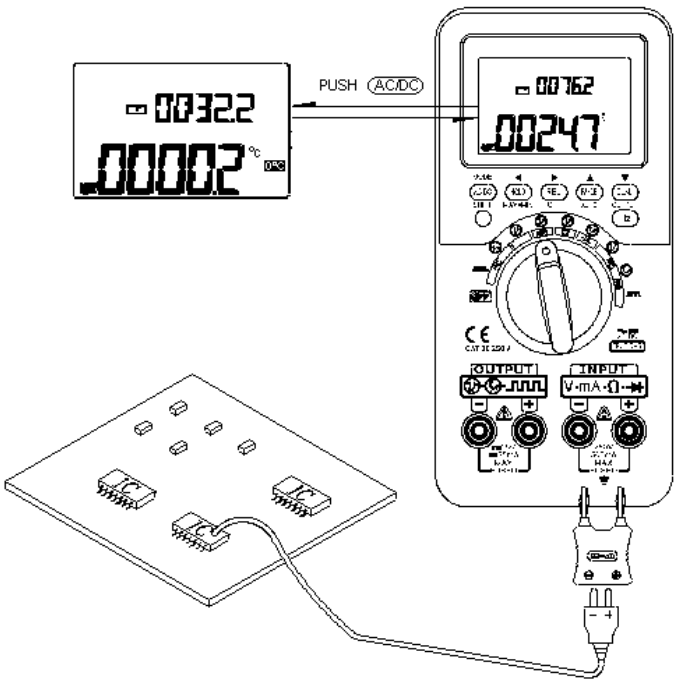
Temperature Measurement

/!\ CAUTION
Do not bend the thermocouple leads, sharply.
Repeatedly bending the leads can break them.

The bead type thermocouple probe is suitable for making temperature measurements from -40°C (°F) to 204°C (399°F) in Teflon compatible environments. Above this temperature, toxic gas might be emitted. Do not immerse this thermocouple in liquids. For best results, use a thermocouple probe designed for each application (i.e. an immersion probe for liquid or gel, an air probe for air measurements, etc.). Follow the measuring techniques as below:

- Clean the measurement surface and make sure the probe is attached securely to the surface.
- When measuring above ambient temperatures, move the thermocouple on the surface until you get the highest temperature reading.
- When measuring below ambient temperatures, move the thermocouple on the surface until you get the lowest temperature reading.
- Always set slider switch to “M” position for meter operation only The meter shall be putted on the operating environment for 1 hour at least as using non-compensation transfer adaptor with miniature thermal probe. If you use the thermocouple probe which the thermal wires have penetrated into banana or lantern terminals (TP-41), just put the meter on the operating environment for 15 minutes at least.
- If you want to have the output operation together, please use the 0°C compensation to see the temperature variation of the thermocouple sensor. The 0°C compensation will assist you to measure relative temperature immediately.

1. Turn the slider switch to “M” position to disable all output function.
2. Turn the rotary switch to the " mV " range.
3. Press and hold “**REL**” button for more than 1 second for temperature measurement.
4. Plug the adapter with thermocouple probe into the "**+**" and "**-**" input terminals.
5. Attach the thermocouple to the surface being measured.
6. Read the display.
7. If you are working on a varied environment, which the ambient temperature is non-constant. It is another way to quickly measure the relative temperature by 0°C compensation. Press "**BLUE** " button to toggle 0°C compensation.
8. Don’t touch the surface you want to measure by thermocouple probe. Wait for a constant reading, then press “REL” button to the reading to be relative reference temperature.
9. Attach the thermocouple to the surface being measured
10. Read display for the relative temperature

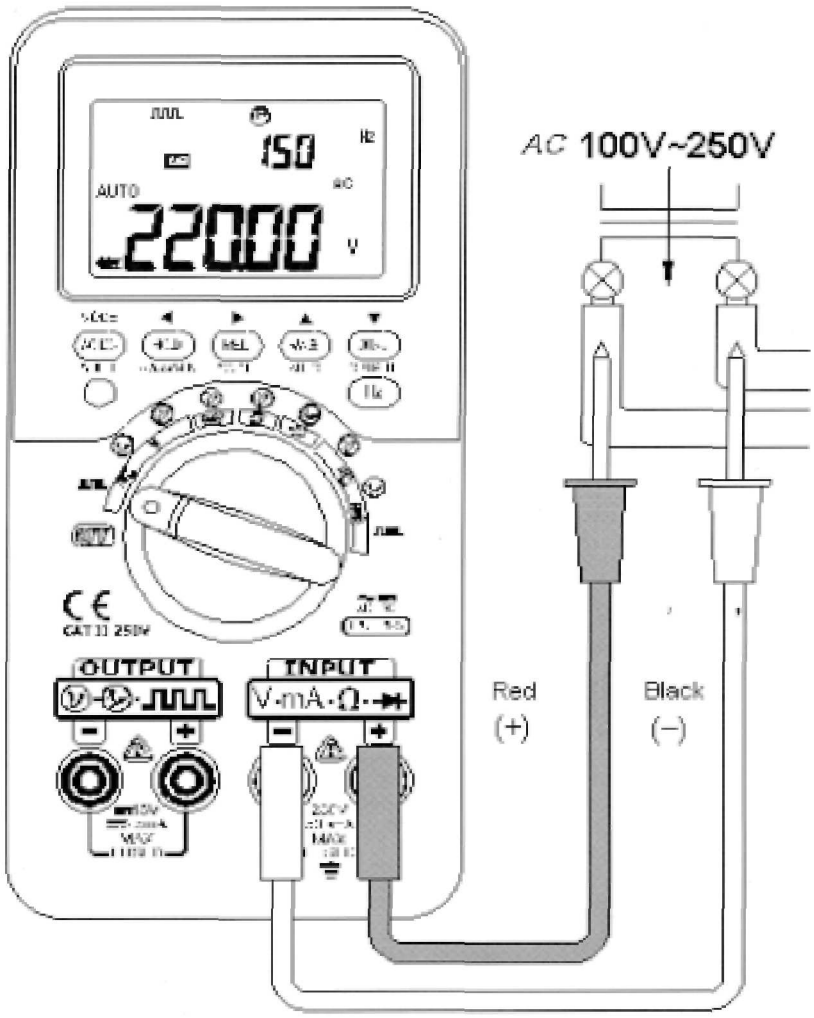


4.7 SAMPLES

4.7.1 Operate in process field

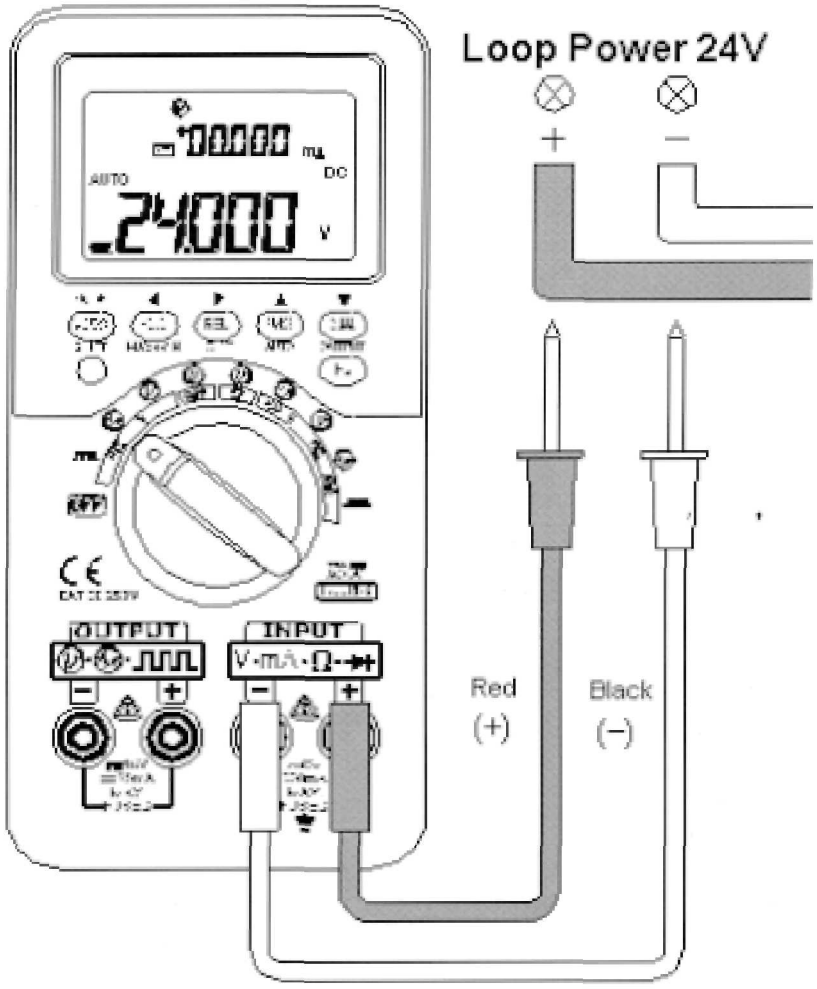
4.7.1.1 Line power voltage measurement

1. Set the rotary switch to " ~ **V** ".
2. Press **AC/DC** button momentarily to enter AC voltage measurement.
3. Connect the Red and black test leads to " **+** " and " **-** " input terminals.
4. Touch the probes to the test points and read the display.



4.7.1.2 Loop power measurement

1. Set the rotary switch to " ⏦ **V** ".
2. Press **AC/DC** button momentarily to select DC voltage test.
3. Connect the Red and black test leads to " **+** " and " **-** " input terminals.
4. Touch the probes to the test points and read the display.

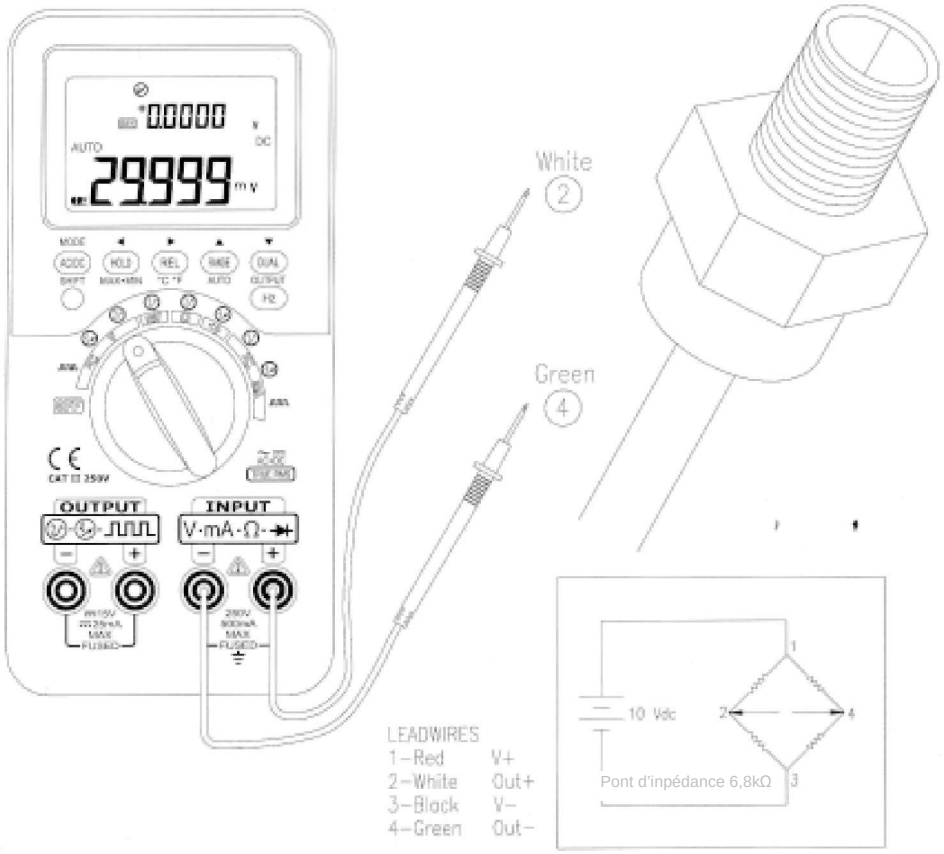


4.7.1.3 Pressure Transducer Measuring

1. Set the rotary switch to " ⏦ **mV** ".
2. Connect the Red and black test leads to " **+** " and " **-** " input terminals.
3. Touch the probes to the test points and read the display.

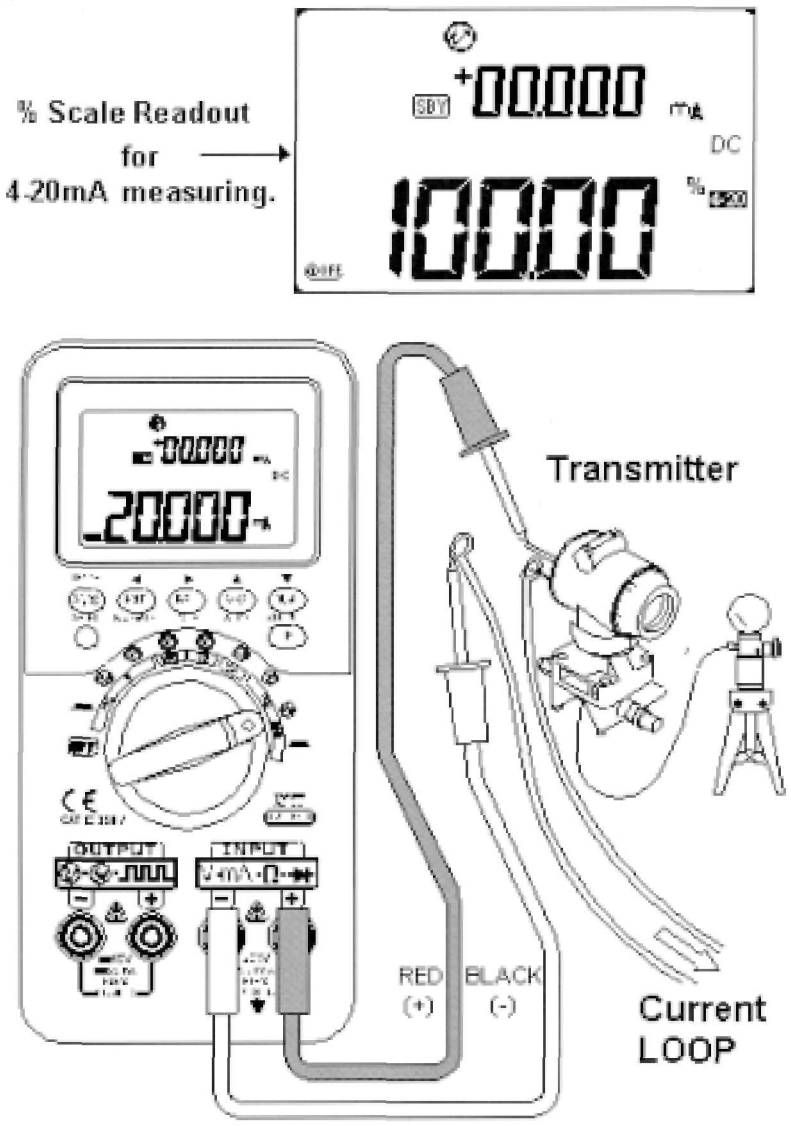
MILLI-VOLT OUTPUT TYPE PRESSURE TRANSDUCER

Range	0-5PSIG	0-15PSIG	0-30PSIG	0-60PSIG	0-30PSIG	0-30PSIG
Output	50 mV	100 mV	80 mV	60 mV	100 mV	60 mV



4.1.7.4 Loop Current Measurement

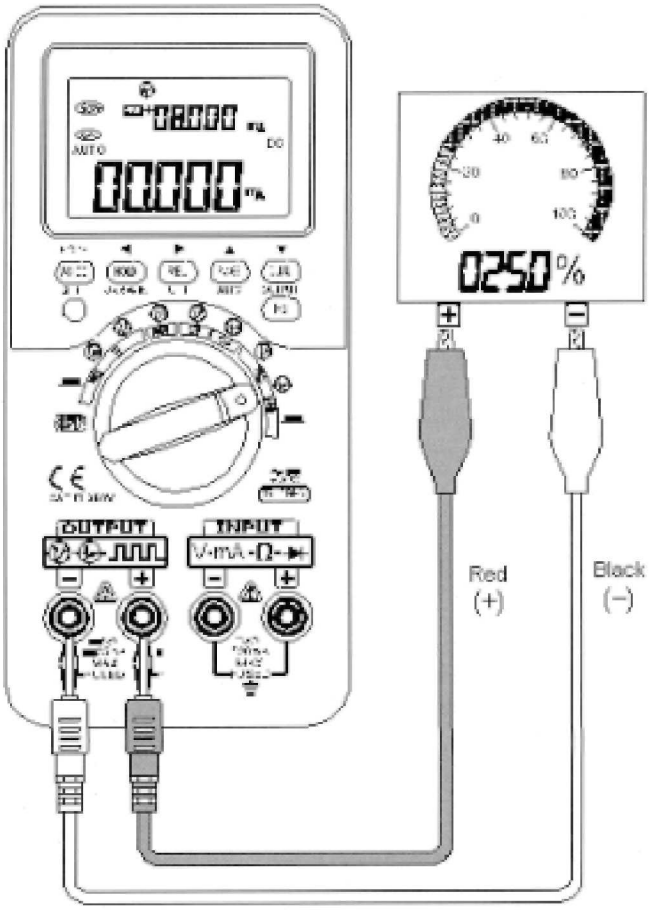
1. Set the rotary switch to " ⎓ **mA** ".
2. Connect the red and black test leads to " **+** " and " **-** " input terminals.
3. Touch the probes to the test points and read the display.



4.7.1.5 Source mode of mA Output

The meter provides steady, stepped, and ramped current output for testing 0-20 mA and 4-20 mA current loops. Use source mode whenever it is necessary to supply current into a passive circuit such as a current loop with no loop supply.

1. Turn the rotary switch to the "**mA /** " position.
2. Connect the red and black leads to " **+** " and "**-** " output terminals of this PCM
3. Connect the Red/black alligators the current loop. Make sure the polarity is correct.
4. Press "**SHIFT**" button to shift buttons for output function.
5. Set "**+08.000 mA**" output for 25% scale readout for 4-20mA.
6. You can use auto scan to test the loop by pressing "**MODE**" button to select SCAN±25mA, please refer to the chapter of Memory generation about what default value has been set on memory.
7. Press "**OUTPUT**" button momentarily to start auto scan output current.

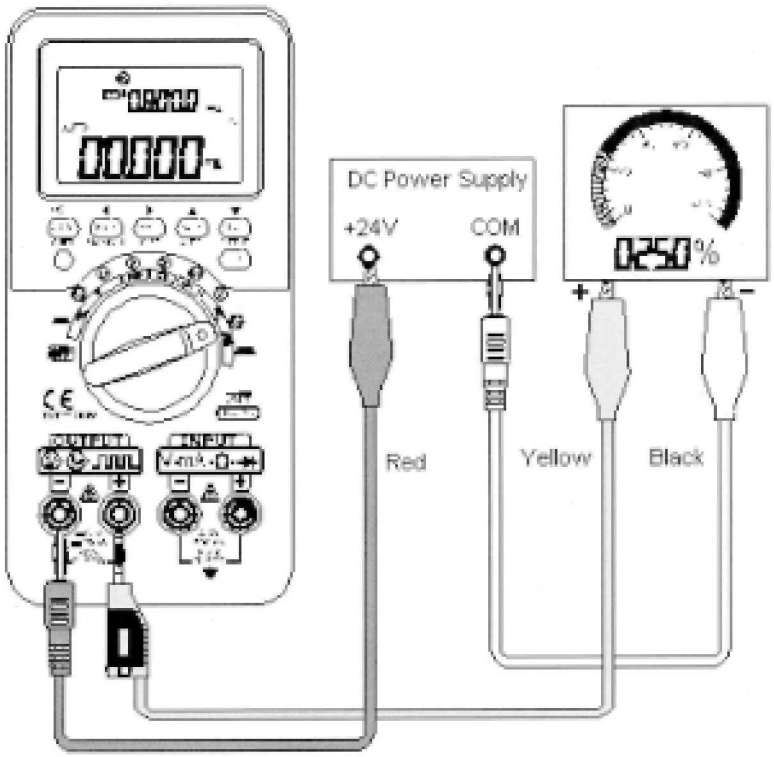


4.7.1.6 Simulating Mode of mA Output

/!\ Caution
Always use Special yellow test lead to do mA simulation.
Be sure to remove the test lead away the loop before changing function by rotary switch or turn off this meter. Otherwise, it will cause 16mA current minimum on the loop as 250Ω load connected.

Simulating mode is so named because the meter simulates a current loop transmitter. Use simulate mode when an external DC 24V or 12V is in series with the current loop under test. Be sure to use special yellow test lead.

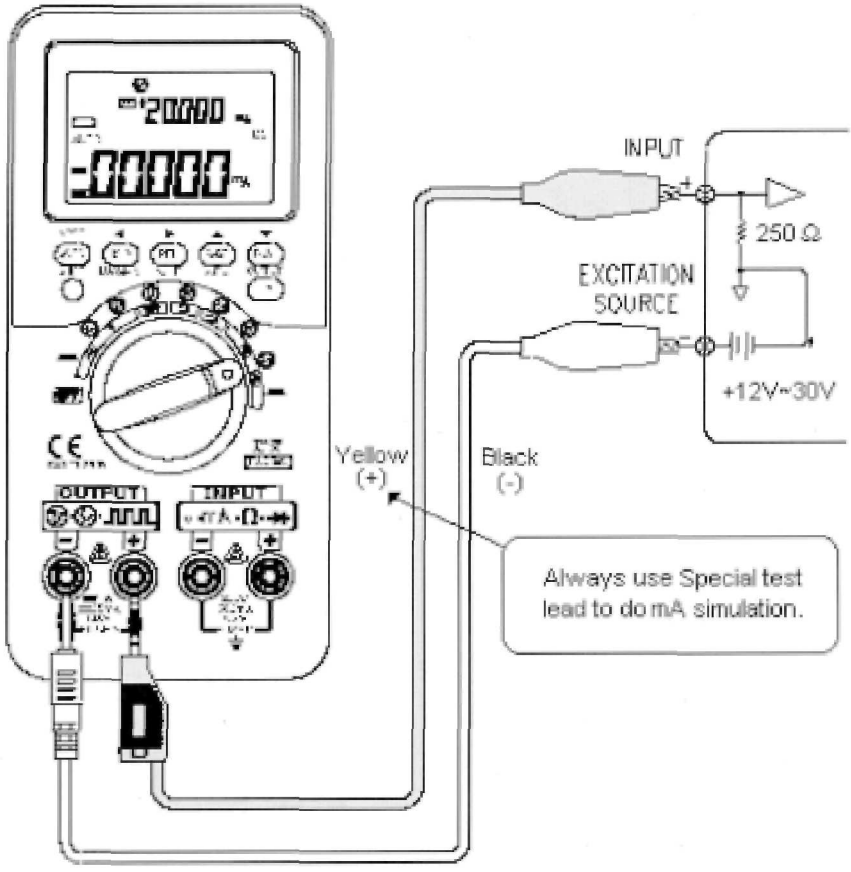
1. Turn the rotary switch to "**mA /** " or " **V /** " position.
2. Connect the special yellow test lead from "**+**" output terminal on the PCM* and the black test lead from "COM" end of loop source to the "+" and "-" ends of the measurement device on the current loop, respectively. Refer to **Figure-44.**
3. Connect the Red test lead from the "**-**" output terminal on the PCM to the current loop source "+24V". Make sure the polarity is correct.
4. Press "**OUTPUT**" button momentarily to send out the test current.
5. **To set current from 0 to 20mA, and never set minus current output.**
6. This connection can be used for any loop voltage from 12 to 30 Volts.
7. Do not exceed 30 volts across the PCM output terminals.



4.7.1.7 Simulation of a Two-Wire Transmitter on a current loop

A special yellow test lead is supplied with this PCM (Process Calibrator/ Meter) for simulation a two-wire transmitter. This lead is used in place of the red lead in other applications and has the advantages of using the same two output terminals for all applications and also protects the meter from high loop voltages.

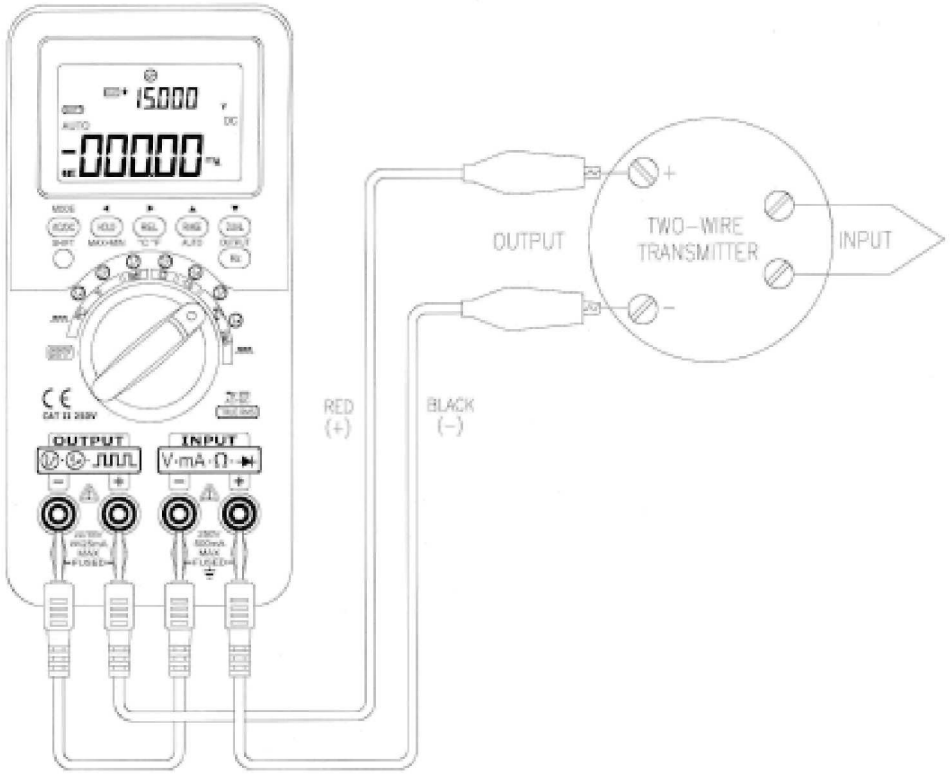
1. Turn the rotary switch to the "**mA /** " or the" **V /** " range.
2. Connect the special yellow test lead from " **+** " output terminal on the PCM* to the input of the measurement device on the current loop. Refer to **Figure-45.**
3. Connect the black test lead from the " **-** " output terminal on the PCM to the current loop excitation source. Make sure the polarity is correct.
4. Press the **OUTPUT** momentarily to send out the test current.
5. To set current from 0 to +20mA, and never set minus current output.
6. This connection can be used for any loop voltage from 12 to 30 Volts.
7. Do not exceed 30 volts across the PCM output terminals



4.7.1.8 Two-Wire Transmitter Operational check-Out

This is a convenient method to verify the operation of two-wire transmitter. The method takes advantage of the PCM's ability to source voltage and simultaneously measure current.

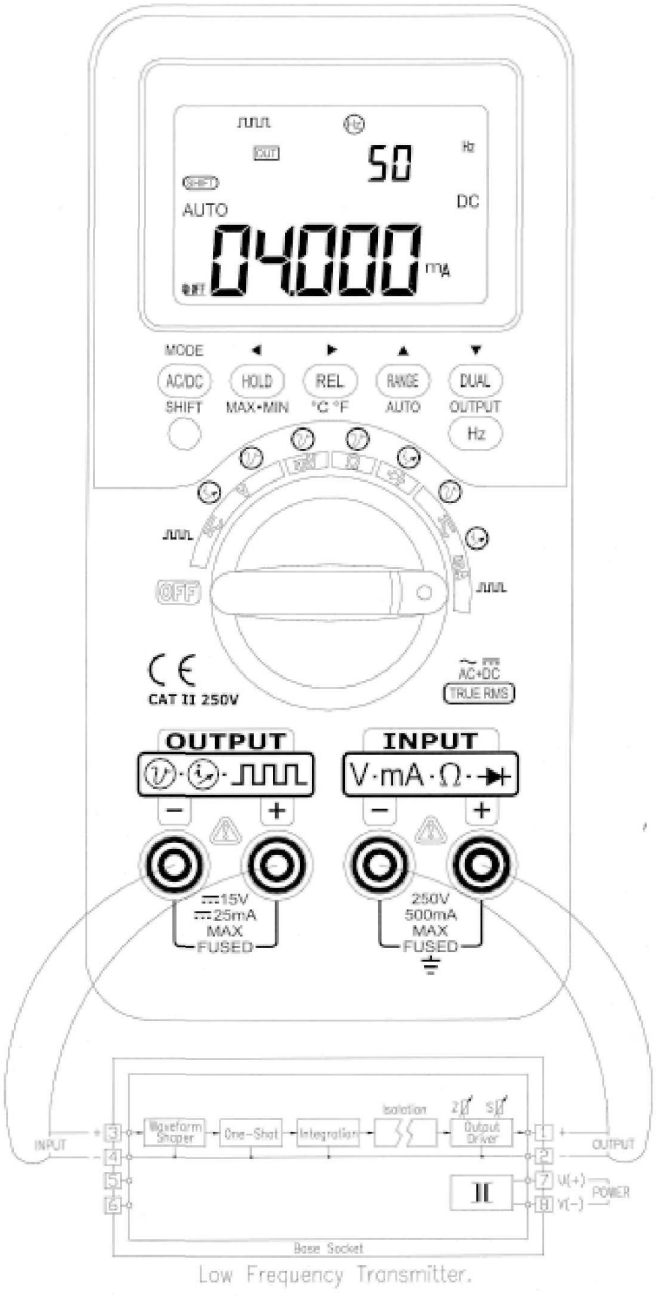
1. Turn the rotary switch to the "**mA /** " range.
2. Connect the red test lead from " **+** " OUTPUT terminal on the PCM to the " **+** " output of the two-wire transmitter. Refer to **Figure-46.**
3. Connect from the " **-** " OUTPUT terminal on the PCM to the " **-** " INPUT terminal on the PCM.
4. Connect the black test lead from the " **+** " INPUT terminal on the PCM to the " **-** " output of the two-wire transmitter.
5. The supply can be set for any voltage up to +15 volts.
6. Press the "**OUTPUT**" button momentarily to send out the excitation voltage.
7. The output current from the transmitter is now measured on the PCM depending on the input signal.



4.7.1.9 Frequency Transmitter

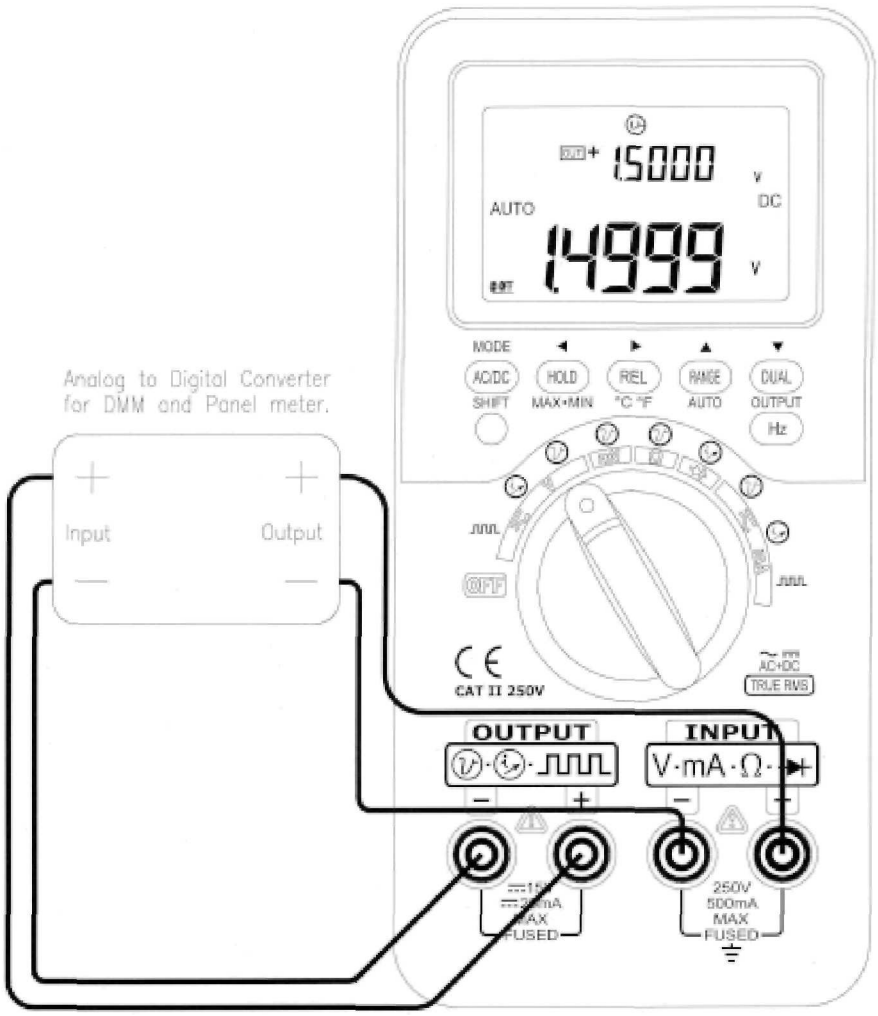
For some frequency transmitters, you can use square wave output as a source simulator and measure the current from transmitter output.

1. Turn the rotary switch to the "~ **mA /** ⎍⎍ " range.
2. The default output: FREQUENCY= 150 Hz, Duty cycle = 50 %.
3. Press "**MODE**" button momentarily to cycle through duty cycle. Pulse width, output level and frequency adjustments.
4. Connect the test leads and alligator clips to input and output terminals, respectively.
5. Connect the test leads to the output terminals of the transducer.
6. Connect the output leads to " **-** " and " **+** " terminals of output, fix the alligator clips to the input of transducer. Make sure the polarity correct.
7. Press "**OUTPUT**" button momentarily to send out the signal.
8. Read the display. Check the current reading whether the frequency is proportional to the specification of transducer.
9. Change the frequency output and monitor the current reading on the display.



4.7.2 Simple repair tools for equipment

You can use constant voltage, constant current or square wave outputs as a source, then use meter function to measure the value according to device to be maintained and verified, for examples, Oscilloscope, Digital multi-meter, Panel Meter, Power Supply and Monitor products etc. See the Figure for basic connection for source and measurement.



4.7.2.1 Oscilloscope Verification

1. Turn the rotary switch to or the" ⎓V / ⏦" position.
2. Connect the "+" end of output to the probe of an oscilloscope
3. Connect the "-" ends of output to the ground of an oscilloscope.
4. Set output value to +0.5000 V, then check the Vertical voltage scale of an oscilloscope
5. Turn the rotary switch to the" ⎓V / ⎍" position.
6. Set square wave output value to ±5V/ 100Hz/ 50.00%, then check the Horizontal timing scale of an oscilloscope.

4.7.2.2 Self-verification by your PCM

1. Turn the rotary switch to or the" ⎓V / ⏦" position.
2. Short the input test leads for voltage measurement, then press "**REL**" button momentarily to zero the residual of thermal effect until the measuring value is stable.
3. Connect the "**+**" ends for INPUT and OUTPUT together.
4. Connect the "**+**" ends for INPUT and OUTPUT together.
5. Set output value to "**+4.5000V**".
6. Then you can see measuring value in the primary display.
7. Following Table for related function can be self-verified.

Rotary Switch Position	Output value (OUTPUT)	Measuring value (INPUT)
⎓V / ⏦	+4,5 V	DC 4,5 V
⎓mA / ⏦	+25mA	DC 25 mA
⎓V / ⎍	100 Hz	100 Hz
	0,39-99,6 %	0,3 %~99,6 %
	± 5 V	AC 4,9586 V
	± 12 V	AC 11,959 V

For related output/ input value is reference only, please refer to respective specification.

4.7.3 Component tester

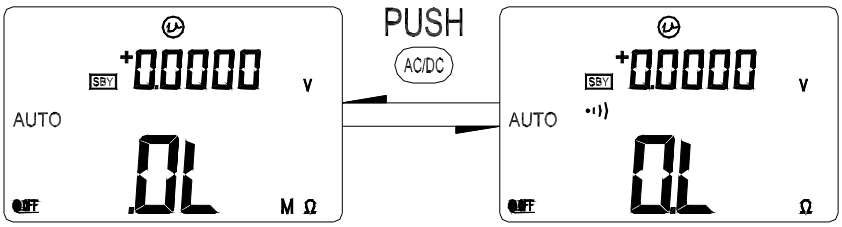
4.7.3.1 Resistance / continuity measurements

In Ohm test, press "**BLUE**" button momentarily to toggle **CONTINUITY** function ON/OFF. The continuity range is set to 0-500.00Ω. Momentarily pushing this button again will only turn the beeper on/off.

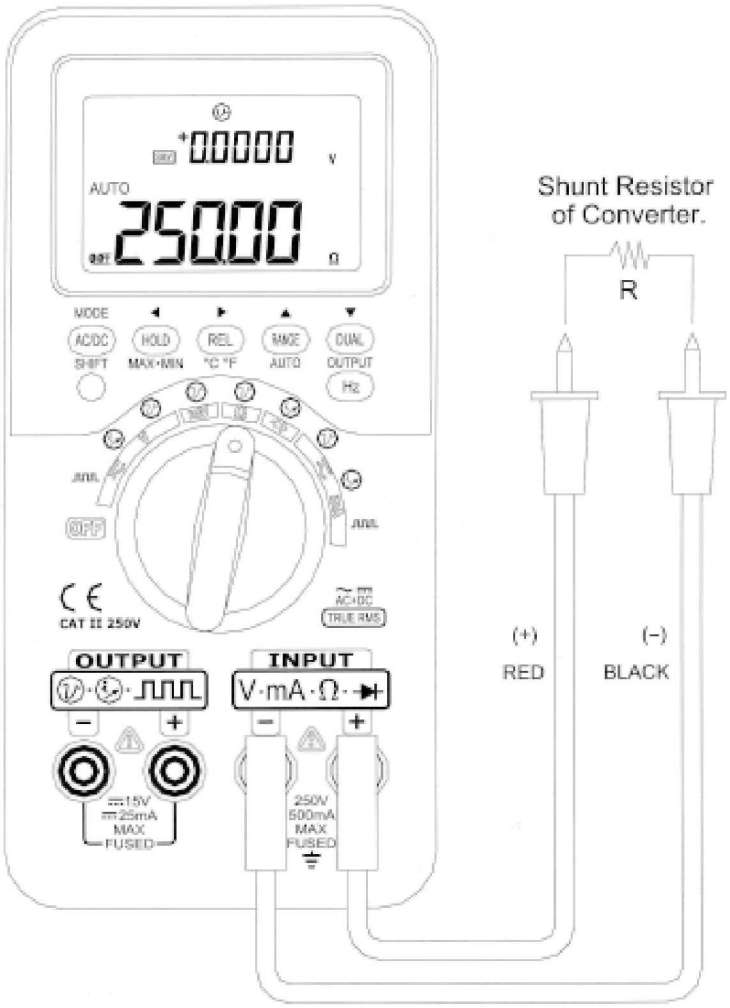
While testing continuity, the beeper will sound if the resistance falls below
10Ω. For other ranges, the beeper will sound if the resistance falls below the typical values indicated in Table 4.

Table 4. Beeper Responses in Continuity Test

Measuring range	Beeper On if
500 Ω	< 10 Ω
5 Ω	< 100 Ω
50 Ω	< 1 kΩ
500 Ω	< 10 kΩ
5 Ω	< 100 kΩ
50 Ω	< 1 MΩ

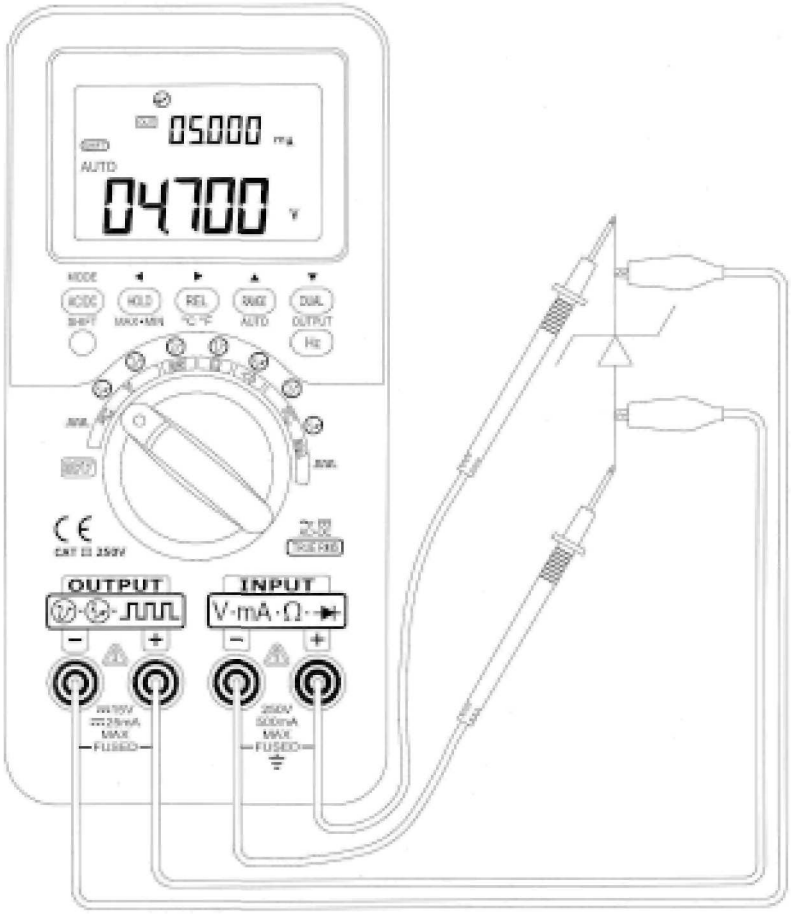


1. Set the rotary switch to " Ω".
2. Connect the red/ black test leads to " **+** " and " **-** " input terminals, respectively.
3. Touch the probes to resistor (or shunt) and read the display.
4. In Ohm test, press "**BLUE**" button momentarily to toggle **CONTINUITY** function ON/OFF. The continuity range is 0-500.00Ω. Momentarily pushing this button will only turn the beeper off. While testing continuity, the beeper will sound if the resistance falls below 10Ω in the range of 500.00Ω..



4.7.3.2 Zener test diode

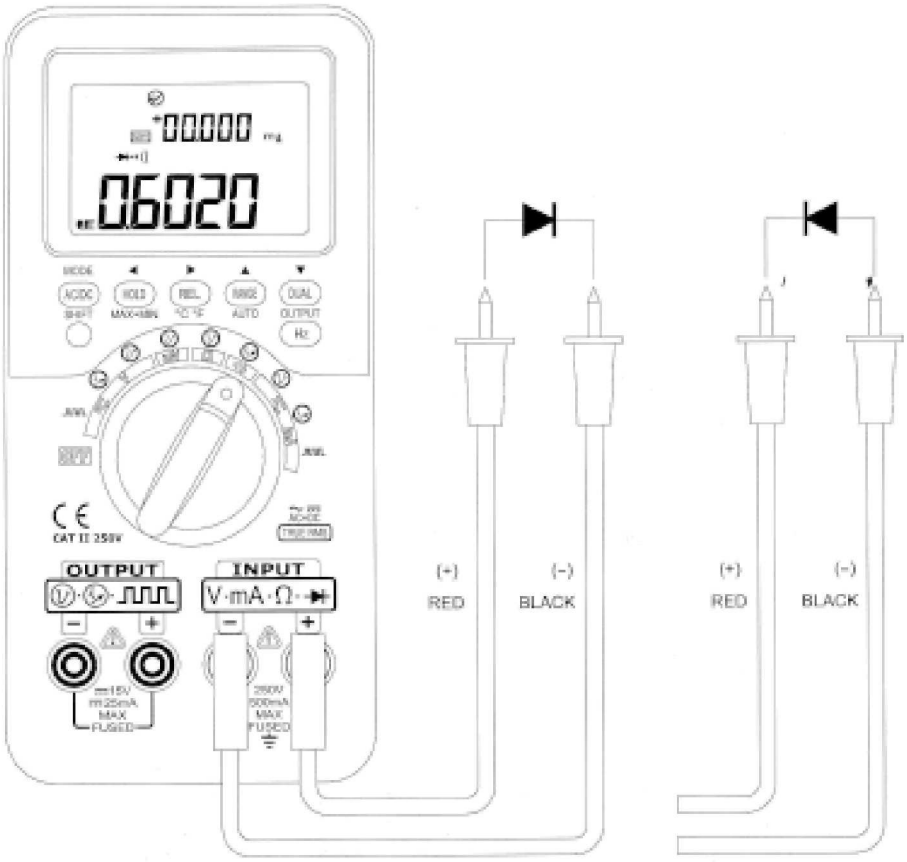
2. Set the rotary switch to " " **V /** position.
3. Connect the red/ black test leads to " **+** " and " **-** " input terminals, respectively.
4. Output the constant current for “+ 1 mA”, then measure the breaking voltage for the ZENOR diode.
5. Output the constant current for “- 1 mA”, then measure the forward voltage for the ZENOR diode.



4.7.3.3 Diode check

A good diode allows current to flow in one direction only. To test a diode, turn the power off, remove the diode from the circuit, and proceed as follows:

1. Set the rotary switch to " ⊣◁ "position.
2. Connect the red/ black test leads to " **+** " and " **-** " input terminals, respectively.
3. Touch the red lead to the positive (anode) side of the diode and the black lead to the negative side (cathode, side with band or bands). The meter can display diode voltage drops to approximately 2.1 V. A typical voltage drop is 0.3 ~ 0.8 V, and the meter will sound a beep to remind user.
4. Reverse the probes and measure the voltage across the diode again. If the diode is:
   - **Good:** " **OL** " is displayed.
   - **Short:** Near 0 V drop is displayed in both directions, and the beeper sounds continuously.
   - **Open:** " **OL** " is displayed in both directions.
5. Repeat step 3 and 4 for other diodes.

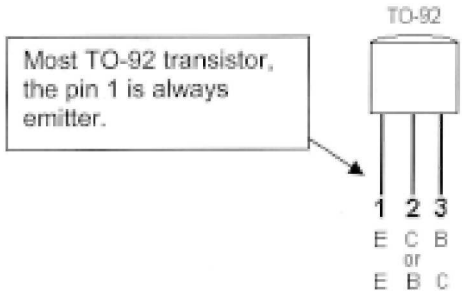


4.7.3.4 Bipolar junction transition

The BJT (bipolar junction transistor) is composed of input and output circuits by using one of electrodes namely, emitter, base, or collector as the common terminal. The transistor has polarities for PNP or NPN type. To get the related data sheet from manufacturers will be highly recommended. Sometime it will waste time. You can recognize the transistor by this meter. Following procedure may guide you how to recognize the polarities and poles of a transistor:

How to recognize NPN/PNP

1. Set the rotary switch to " ⊣◀ "position.
2. Connect the red/ black test leads to " **+** " and " **-** " input terminals, respectively. The "**+**" end of input provides positive test voltage.
3. Assume number 1, 2, and 3 for a TO-92 transistor as following Figure.



4 Touch pin 1 by red probe, and pin 2 by Black probe. If the measuring is OL, reverse the probes. If the measuring value is still OL. You can assume both pins would be Emitter and Collect poles. The residual pin 3 is Base pole. Always to find out which pin is Base pole first. Refer to following Table :

PIN	Probe Red/Black	Probe Black/Red	Base
1-2	OL	OL	3
1-3	OL	OL	2
2-3	OL	OL	1

5 Touch Base pole by RED probe, and connect black probe to other pins. Record the reading. Reverse the Red/ black probes. Record the reading. Then recognize the polarities (NPN or PNP) and Poles according to following table. The Vbe is always greater than Vbc. Most TO-92 transistor, the pin 1 is always emitter. Anyway, please check related data sheet from Manufacturers according. See following Table:

Base =Pin 3

PIN Probe	3-1	3-2	Pole (123) (Vbe>Vbc)	NPN/PNP
Red/Black	0,6749 V	0,6723 V	ECB	NPN
	0,6723 V	0,6749 V	CEB	NPN
Black/Red	0,6749 V	0,6723 V	ECB	PNP
	0,6723 V	0,6749 V	CEB	PNP

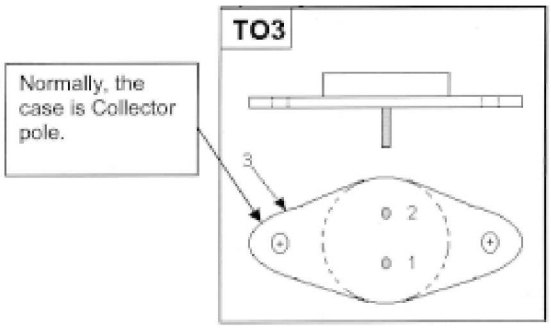
Base = Pin 2

PIN Probe	2-1	2-3	Pole (123) (Vbe>Vbc)	NPN/PNP
Red/Black	0,6749 V	0,6723 V	EBC	NPN
	0,6723 V	0,6749 V	CBE	NPN
Black/Red	0,6749 V	0,6723 V	EBC	PNP
	0,6723 V	0,6749 V	CEB	PNP

Base = Pin 1

PIN Probe	1-2	1-3	Pole (123) (Vbe>Vbc)	NPN/PNP
Red/Black	0,6749 V	0,6723 V	BEC	NPN
	0,6723 V	0,6749 V	BCE	NPN
Black/Red	0,6749 V	0,6723 V	BEC	PNP
	0,6723 V	0,6749 V	BCE	PNP

6 The other type TO3 package as following drawing



For example of 2N3055, a silicon NPN high power transistor.
According to previous procedures, the base pole will be pin 2.

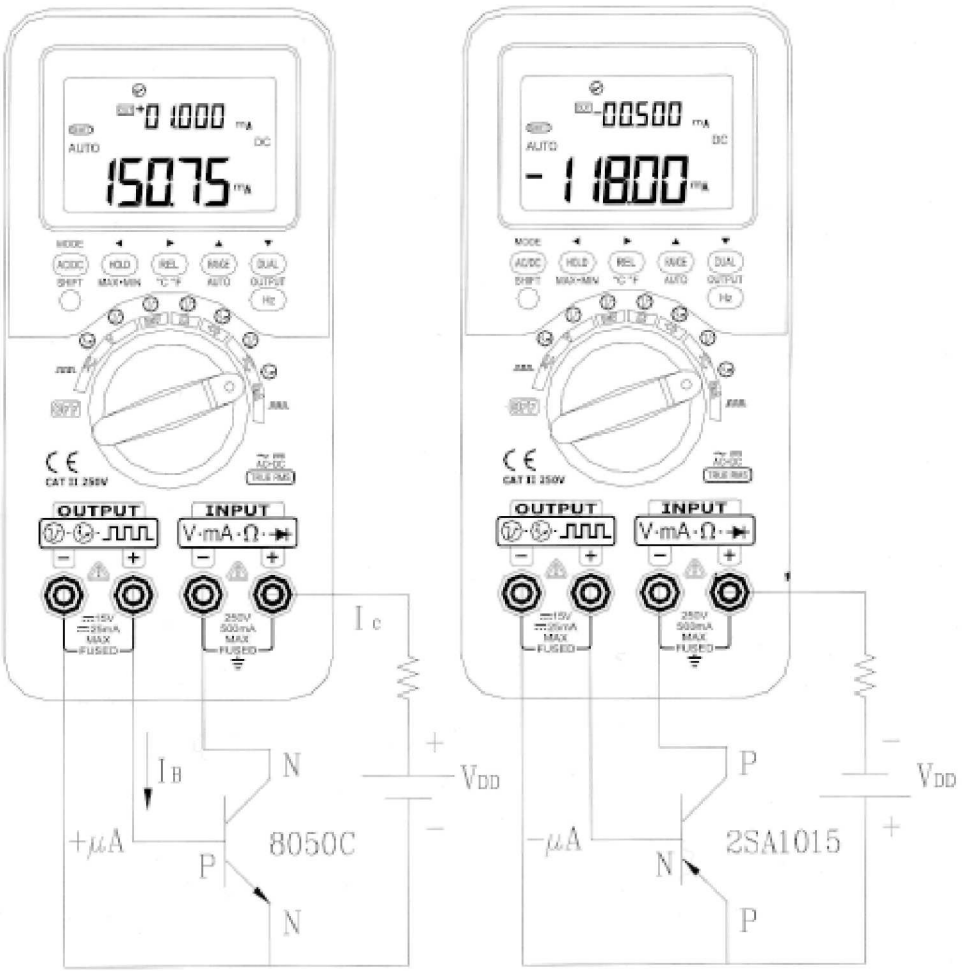
Base= Pin2

PIN Probe	2-1	2-3	Pole (123) (Vbe>Vbc)	NPN/PNP
Red/Black	**0,5702 V**	**0,5663 V**	**EBC**	**NPN**

hfe of TRANSISTOR TEST

Note: If you wish get correct results, please according to specified condition for different manufactory, like VDD and IB

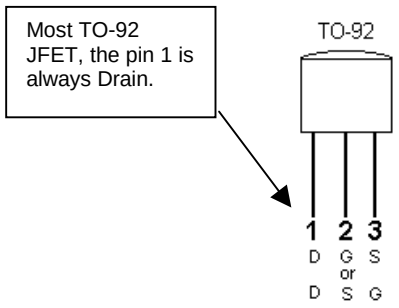
hfe = IC / IB = 152	hfe = IC / IB = 300
IB = CURRENT SOURCE	IC = Meter Reading



4.7.3.5 JFET switch test

The JFET (Junction Field-Effect Transistor) is composed of input and output circuits by using one of electrodes namely, Drain, Gate, or Source as the common terminal. The JFET has different type for P or N channel switch. To get the related data sheet from manufacturers will be highly recommended. You can recognize the JFET by this meter. Following procedure may guide you how to recognize JFET.

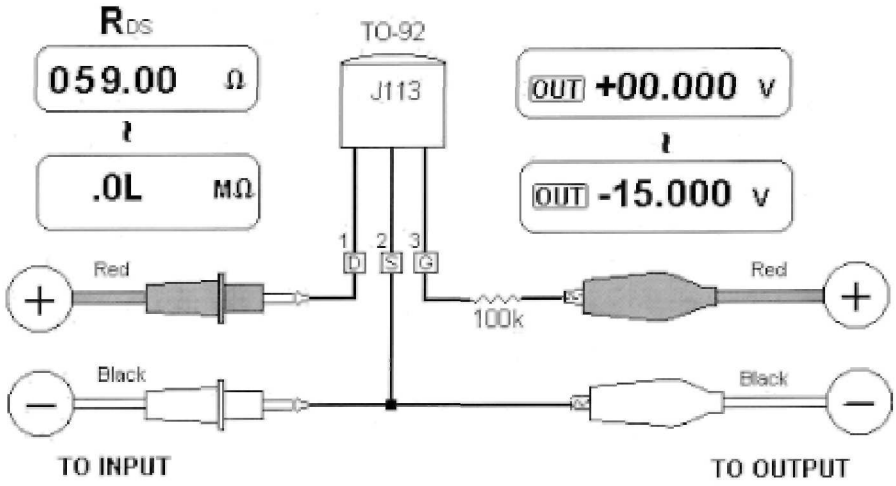
1. Set the rotary switch to " **Ω** "position.
2. Connect the red/ black test leads to " **+** " and " **-** " input terminals, respectively. The "**+**" end of input provides positive test voltage.
3. Assume number 1, 2, and 3 for a TO-92 JFET as following Figure



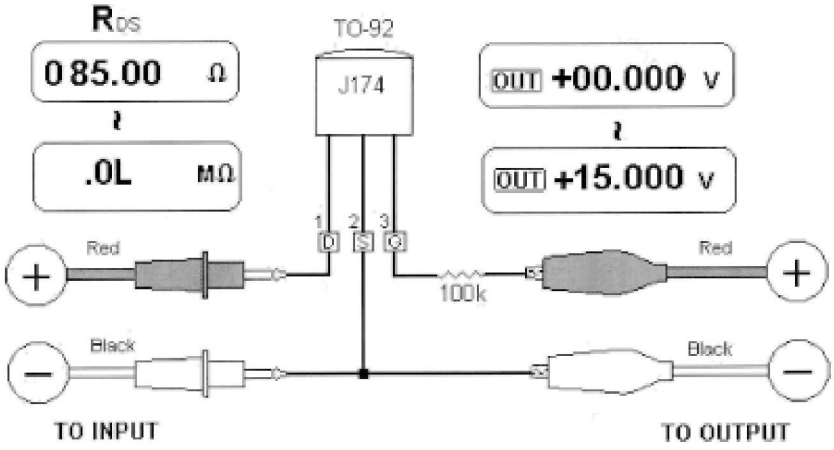
4 Touch pin 1 and pin 2 by red and black probes, to get the value. Then reverse the probes. If the two measuring value is < 1kΩ. You can assume both pins would be Drain and Source poles. The residual pin 3 is Gate pole. Always to find out which pin is Gate pole first. Refer to following Table:

PIN	Probe Red/Black	Probe Black/Red	Gate
1-2	<1kΩ	<1kΩ	3
1-3	<1kΩ	<1kΩ	3
2-3	<1kΩ	<1kΩ	3

5. To judge P-channel switch or N-channel, by constant voltage source and verify the RDS (Drain-Source on Resistance). Normal, both channel types will be switched when VGS) is equal to 0 V.
6. Connect the input probes to Drain and Source poles.
7. Then connect the red output alligator through a resistor of 100KΩ to Gate pole, the black output alligator to black input probe.
8. If the **RDS** increased as the V (GS) is negative voltage, this JFET will be N-channel. You can set the constant voltage output from **+00.000V** to **-15.000V**, and the **RDS** will be increased until "**OL**" of resistance measurement. You will know the cutoff voltage for this N-channel switch.



9 If the RDS increased as the V (GS) is positive voltage, this JFET will be P-channel. You can set the constant voltage output from 0.000V to +15.000V, and the RDS will be increased until "OL" of resistance measurement. You will know the cutoff voltage for this P-channelswitch



4.7.3.6 Ideal operational amplifier

The ideal amplifier is further assumed to have following characteristics:

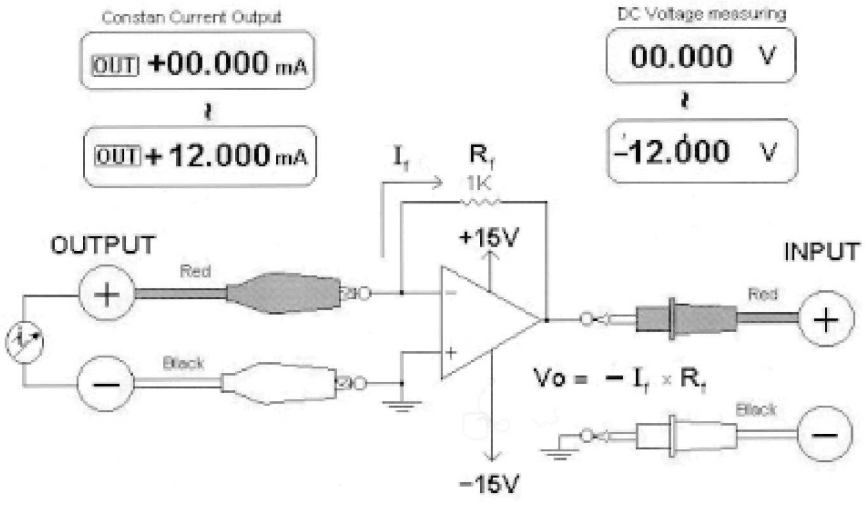
1. **Infinite Gain** as we shall show makes the performance entirely dependent on input and feedback networks.
2. **Infinite Input Impedance** ensures that no current flows into the input terminals of amplifier.
3. **Infinite Bandwidth** is a bandwidth extending from zero to infinity, ensuring a response to DC signals, zero response time and no phase change with frequency.
4. **Zero Output Impedance** ensures that the amplifier is unaffected by the load.
5. **Zero Voltage and Current Offset** ensures that when the input signal voltage is zero, the output signal will be zero also regardless of the input source resistance.

There are two basic ways of applying feedback to a differential operational amplifier. One is Current to Voltage Converter by Inverting operational amplifier, and the other one is Current to Voltage Converter by non-Inverting operational amplifier. Accompanying two examples give you application guide by this instrument..

Current to Voltage Converter

An ideal operational amplifier can act as current to voltage converter, In the following Figure-65, the ideal amplifier maintains its inverting input terminal at earth potential and forces any input current to flow through the feedback resistor. Thus I (in)= I(f), and Vo= -I(f) x R(f). Notice that the circuit provides the basis for an ideal current measurement; it introduces zero voltage drops into the measurement circuit, and the effective input impedance of the circuit measured directly at the inverting input terminal is zero.

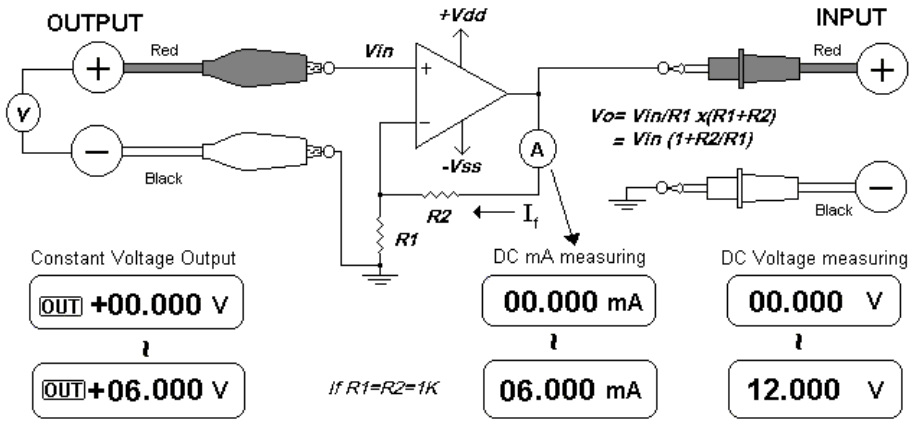
1. Set the rotary switch to " " **V /** " position.
2. Set Input to DC 50V range measurement.
3. Connect the Red and black test leads to " **+** " and " **-** " input terminals.
4. Connect the operation Amplifier as following circuit diagram.
5. The DC power supply shall have +15V and –15V output.
6. Output the constant current for "+ 00.000mA", then measure the offset voltage
7. Output the constant current from "+ 00.000mA" to "+ 12.000mA", then measure the output voltage of OP-amplifier. The Vo will be "00.000V" ~ "-12.000V" around. The Vo is influenced by the tolerance of feedback resistor, and the offset of Operational Amplifier.



Voltage to Current Converter

In maintaining its differential input voltage at zero the amplifier shown in the circuit of Figure-60 forces a current I= Vin/R1 to flow through the load of R2 in the feedback path. This value of this current is independent of the nature or size of load.

1. Set the rotary switch to " " **V /** position.
2. Set Input to DC 50V range measurement.
3. Connect the Red and black test leads to " **+** " and " **-** " input terminals.
4. Connect the Red and black alligator clips to " **+** " and " **-** " output terminals.
5. Connect the operation Amplifier as following circuit diagram.
6. The DC power supply shall have +15V and –15V output.
7. Output the constant voltage from "+00.000V" to "+ 06.000V", then measure the output voltage of OP-amplifier. You will verify the characteristic of voltage to current converter.
8. You can set the rotary switch to " " **mA /** position and connect the input test leads to meter "A" position shown as Figure-65. You will find the current variation is proportional to voltage input into operational amplifier.

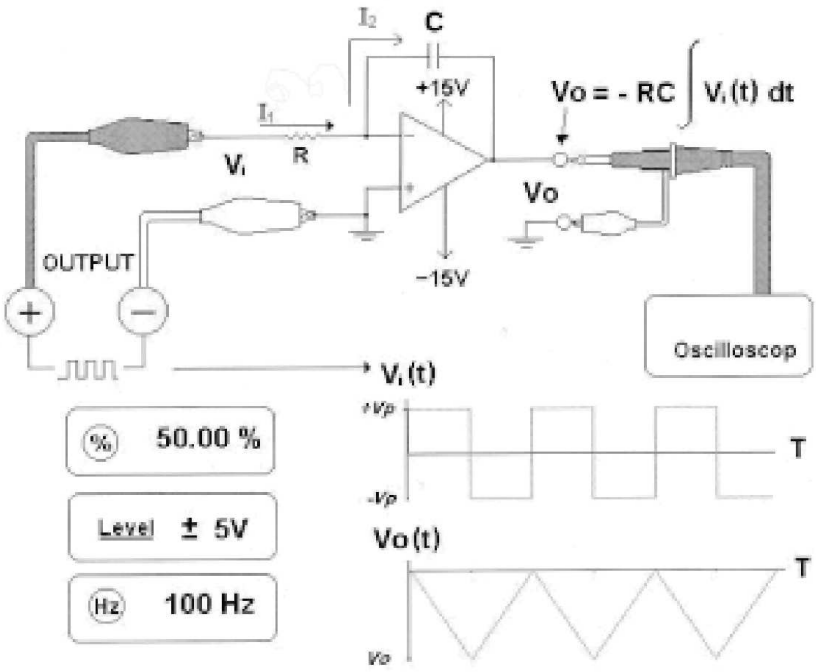


Integrator- Square to Triangular Wave Conversion

The integrating circuit of Figure-61 produces an output voltage that is proportional to the integral of the input voltage.

One of many use of the integrator is to convert a square wave into a triangular wave

1. Set the rotary switch to " " **V /** position.
2. Connect the Red and black alligator clips to " **+** " and " **-** "output terminals.
3. Connect the operation Amplifier as following circuit diagram.
4. The DC power supply shall have +15V and –15V output.
5. Use an oscilloscope to monitor the wave change.
6. Set duty cycle to 50.00%, amplitude to ±5V.
7. Output the Square wave.
8. To select different frequency, and vary the duty cycle to understand the characteristics of integrator.


I2
C
+15V
Vo = - RC ∫ Vi(t) dt
I1
R
Vi
Vo
OUTPUT
-15V
Oscilloscop
Vi(t)
50.00 %
Level ± 5V
100 Hz
+Vp
-Vp
T
Vo(t)
T
Vo

5. SPECIFICATIONS

5.1 SAFETY

Designed in compliance with EN61010-1 (IEC1010-1) for CAT-II 250V,
Pollution Degree II Environment.
EMC designed in compliance with EN61326

5.2 GENERAL SPECIFICATION

Display:
- Both primary and secondary displays are 5-digit liquid crystal display (LCD) with maximum reading of 51000 counts.
- Automatic polarity indication.

Function:
- DCV, ACV, DCA, ACA, OHM, Diode check, Audible continuity, Temperature, Frequency, Duty cycle and Pulse Width tests.
- Including **AC+DC** true RMS measurement for both voltage and current.
- 1-ms peak hold for capturing glitch easily.
- The % scale readout for 4-20mA and 0-20mA measurement
- High precision constant current and constant voltage outputs (Bipolar sink-source system).
- Memory generation: User programmable 16 memories for each range,
- Scanning Output for one cycle or continuous cycle process output
- Ramp Output for linear process output
- A unique square wave output with adjustable duty cycle, pulse width and amplitude.
- EL Backlit display for easy reading in the dark.
- Min/Max/Average, Data Hold with Manual or Auto Trigger and Relative modes
- Bi-directional optic computer interface with SCPI commands
- One-year calibration cycle suggested

Measuring rate (Approx.):
- 3 times per second (AC+DC: 1 time per second)
- 1 time per second for frequency or duty cycle measurement. (>1Hz)
- 0.25 ~1 times per second for Pulse Width measurements. (>1Hz)

Low battery indicator:

The "  " appears when the battery voltage drops below 9V (approx.)

Operating temperature: 0°C to 40 °C (32°F to 104 °F).

Storage temperature: -20°C to 60°C (-4°F to 140°F) with BATTERY REMOVED.

Relative Humidity (R.H.): maximum 80% R.H. for temperature up to 31°C decreasing linearly to 50% R.H. at 40°C

Temperature coefficient
INPUT: 0.15 * (specified accuracy) / °C (from 0°C to 18°C or 28°C to 40°C)
OUTPUT: ± (50ppm output + 0.5dgt)/ °C

Common Mode Rejection Ratio (CMRR):

>90 dB at DC, 50/60 Hz±0.1% (1kΩ unbalanced)
Normal Mode Rejection Ratio (NMRR): > 60 dB at 50/60 Hz±0.1%

Power supply:
1. Rechargeable batteries 1.2V x 8 pieces (Ni-MH), no cadmium, lead or mercury are added.
2. The external switching adapter, AC100~250V/47~63Hz input and DC14 Volts/1A output.

Power Consumption: 5.0VA maximum
3.5VA typical (DC CC: 25mA, maximum load)
0.6VA typical (Meter only)

Battery life (approx): 20 hours for meter only, 4 hours for meter/source. (The new Ni-MH 1300mA batteries have been fully charged.)

Charging time: 8 hours approx. at the environment of 10°C to 30 °C. (If the battery has been deep-discharged, a prolonged charging time is required to bring the battery back to full capacity.)

Dimension (H x W x L): 2.1x 3.54x 7.56 inches (54x 90x 192 mm.)

Weight: 3.76 lbs (1.710 Kg) with standard accessories.

5.3 Input specifications

Accuracy is given as ±(% of reading + counts of least significant digit) at 23°C ± 5°C, with relative humidity Less than 80% R.H., and warm-up for 5 minutes at least. The additional 5 counts of LSD will be added to the accuracy if without warm-up.

5.3.1 DC mV/ VOLTAGE

Range	Resolution	Accuracy	Overload Protection
50 mV	1 µV	0,05 % + 50 -N1	250 V RMS
500 mV	10 µV	0,03 % + 5	
5 V	0,1 mV		
50 V	1 mV		
250 V	10 mV		

- Input Impedance: 10MΩ (nominal) from 5V range, 1 GΩ (nominal) for 50/500 mV.
- N1: the accuracy could be 0.05%+5, always use relative function to zero thermal effect (short test leads) before measuring the signal

5.3.2 AC mV/ VOLTAGE (TRUE RMS: From 5% to 100% of range)

Range	**Resolution**	**Accuracy**		**Overload protection**
		45 Hz ~5 kHz	**5 kHz ~ 20 kHz**	**surcharges**
50 mV	1 µV	**0,7 % + 40**	**1.5 % + 40**	250 V RMS
500 mV	10 µV	**0,7 % +** 20	**1,5 % +** 20	
5 V	0,1 mV			
50 V	1 mV			
250 V	10 mV			

- Input Impedance: 1.1MΩ in parallel with <100pF(nominal) from 5V range, and 1 GΩ (nominal) for 50/500 mV.
- Crest factor<=3

5.3.3 AC+DC mV/ VOLTAGE (TRUE RMS: From 5% to 100% of range)

Range	Resolution	Accuracy		Overload protection
		45 Hz ~5 kHz	**5 kHz ~ 20 kHz**	
50 mV	1 µV	**0,8 % + 70**	**1,6 % + 70**	
500 mV	10 µV			
5 V	0,1 mV			250 V
50 V	1 mV	**0,8 % +** 25	**1,6 % +** 25	RMS
250 V	10 mV			

- Input Impedance: 1.1MΩ in parallel with <100pF (nominal) from 5V range, and 1 GΩ (nominal) for 50/500 mV.
- Crest factor <=3

5.3.4 1 ms PEAK HOLD (Capturing changes >1 ms in duration)

Function	DC mV/ Voltage
Accuracy	2%+400 for all ranges

5.3.5 DC CURRENT

Range	Resolution	Accuracy	Burden Voltage / Shunt	Overload Protection
50mA *N1	1µA	0.03% +5	0.06 V (1Ω)	250V, 630mA
500mA*N1	10µA	0.03% +5	0.6 V (1Ω)	Quick acting fuse

Note:
• N1: Always use relative function to zero thermal effect with open test lead before measuring the signal. If not use Relation function, the accuracy will be 0.03%+25. The thermal effect could be occurred as follows:
1. Constant Current / Constant Voltage/ Square wave output
2. Wrong operation to measure the high voltage of 250V for resistance, diode, and mV measurements.
3. After battery charging completed.
4. After measuring the current greater than 50mA.

5.3.6 AC CURRENT (TRUE RMS: From 5% to 100% of range)

Range	Resolution	Accuracy 45Hz ~ 2kHz	Burden Voltage / Shunt	Overload Protection
50 mA	1µA	0.6% +20	0.06 V (1Ω)	250V, 630mA
500 mA	10µA		0.6 V (1Ω)	Quick acting fuse

- Crest factor<=3

5.3.7 AC+DC CURRENT (TRUE RMS: From 5% to 100% of range.)

Range	Resolution	Accuracy 45Hz ~ 2kHz	Burden Voltage / Shunt	Overload Protection
50 mA	1µA	0.7% +25	0.06 V (1Ω)	250V, 630mA
500 mA	10µA		0.6 V (1Ω)	Quick acting fuse

- Crest factor<=3

5.3.8 RESISTANCE

Range	Resolution	Accuracy	Test current	Overload Protection
500Ω *N1	0.01 Ω	0.15% +8	0.45mA	250V RMS
5kΩ *N1	0.1 Ω	0.15% +5	0.45mA	
50kΩ	1 Ω		45μA	
500kΩ	10 Ω		4.5μA	
5MΩ	0.1 kΩ		450nA	
50MΩ*N2	1 kΩ	1% +8	45nA	

- Maximum open voltage: <+4.8V
- Instant Continuity: Built-in buzzer sounds when resistance is less than 10.00Ω
- N1: The accuracy of 500Ω and 5kΩ is specified after Relative function, which is used to substrate the test lead resistance and the thermal effect.
- N2: For the range of 50MΩ, the RH is specified for < 60%

5.3.9 DIODE CHECK/ AUDIBLE CONTINUITY TEST

Range	Resolution	Accuracy	Test Current	Open Voltage
Diode	0.1 mV	0.05% +5	Approx. 0.45mA	<+4.8V DC

- Overload protection: 250V RMS
- Built-in buzzer sounds when reading is below 50mV approx.

5.3.10 K -TYPE TEMPERATURE TEST

RANGE	Reso	A	Overload	RANGE	Resolution	Accuracy
-40°C ~	0.1°	0.	250V RMS	-40°C ~	0.1°C	0.3% +3°C
-40°F ~ 2502°F	0.1° F	0. 3 %		-40°F ~ 2502°F	0.1°F	0.3% +6°F

- The accuracy is defined on meter operation only, and excluded the tolerance of thermocouple probe. The meter should be putting on the place will be operating for 1 hour at least and the slider switch shall turn to “M” position for meter operation only

5.3.11 FREQUENCY

Range	Resolution	Accuracy	Min. Input Freq.
100Hz	0.001 Hz	0.02%+3	1Hz
1kHz	0.01Hz		
10kHz	0.1Hz		
100kHz	1 Hz		
200kHz	10Hz		

- Overload protection: 250V RMS

Sensitivity for Voltage Measurement

FREQUENCY SENSITIVITY AND TRIGGER LEVEL				
INPUT RANGE	MINIMUM SENSITIVITY (RMS SINEWAVE)		Trigger Level for DC coupling	
(Maximum input for specified accuracy = 10 x Range or 250V)	1 Hz – 100 kHz	> 100 kHz	< 20 kHz	20 kHz ~ 200 kHz
50 mV	15 mV	25 mV	20 mV	30 mV
500 mV	35 mV	50 mV	60 mV	80 mV
5 V	0,3 V	0,5 V	0,6 V	0,8 V
50 V	3 V	5 V	6 V	8 V
250 V	30 V	NÉANT	60 V	NÉANT

The accuracy for duty cycle and pulse width is based a 5V square wave input to the DC 5V range.

DUTY CYCLE:
Range: 0.1% to 99.9 % for DC coupling, 5% to 95% for AC coupling
Accuracy: Within (0.3% per kHz + 0.3%) of full scale

PULSE WIDTH:
Range: 0.01 ms to 1999.9 ms
Accuracy: 0.2%+3
Pulse width must be greater than 10µs and its range is determined by the frequency of the signal.

- Maximum input V-Hz and Input Impedance, please refer to AC Voltage measurement

Sensitivity for Current Measurement

Input Range	Minimum Sensitivity (RMS Sine-wave)
	30Hz~20kHz
50 mA	2,5 mA
500 mA	25 mA

- Maximum input, please refer to AC Current measurement.

5.4 OUTPUT SPECIFICATIONS

Accuracy is given as ±(% of output + counts of least significant digit) at 23°C ± 5°C, with relative humidity Less than 80% R.H., and warm-up for 5 minutes at least.

5.4.1 CONSTANT VOLTAGE (CV)

Range	Resolution	Accuracy	Minimum *N1 Output Current
± 1,5 V	0,1 mV	0,03 % + 3	25mA or above
± 15 V	1 mV		

NOTES:

1. Loading coefficient: **0.012mV/ mA** for 1.5V output.
2. Maximum protection input voltage: 30 V DC.

5.4.2 CONSTANT CURRENT (CC)

Range	Resolution	Accuracy	Minimum *N1 Output Voltage
± 25 mA	1 µA	0,03 % + 5	12 V ou supérieur

NOTES:

1. Loading coefficient: **1µA/ V**, the minimum output voltage is based on 20mA into 600Ω.
2. Maximum protection input voltage: 30 V DC
3. If the loop has 24V power, it could be reached minimum 24V at 20 mA into 1200Ω load with special yellow lead.

5.4.3 Square wave output

OUTPUT	Range	Resolution	Accuracy
Frequency Duty cycle ***N1** Pulse width ***N1** Amplitude Frequency	0,5, 1, 2, 5, 10, 15, 20, 25, 30, 40, 50, 60, 75, 80, 100, 120, 150, 200, 240, 300, 400, 480, 600, 800, 1 200, 1 600, 2 400, 4 800 Hz	0,01 Hz	0,005 % + 1
Duty cycle ***N1**	0,39 % ~ 99,60 %	0,390625 %	0,01 % +0,2 % -N3
Pulse width ***N1**	1 / Frequency	Range/256	0,01 % +0,3 ms
Amplitude	5 V, 12 V	0,1 V	2 % +0,2 V
	±5 V, ±12 V	0,1 V	2 % +0,4 V

NOTES:

1. The plus or minus pulse width must be greater than 50 µs for adjusting the duty cycle or pulse width under different frequency. Else, the accuracy and range will be different to definition.
2. Maximum protection input voltage: 30 V DC
3. For signal frequency greater than 1kHz, additional 0.1% per kHz to be added.

6. MAINTENANCE

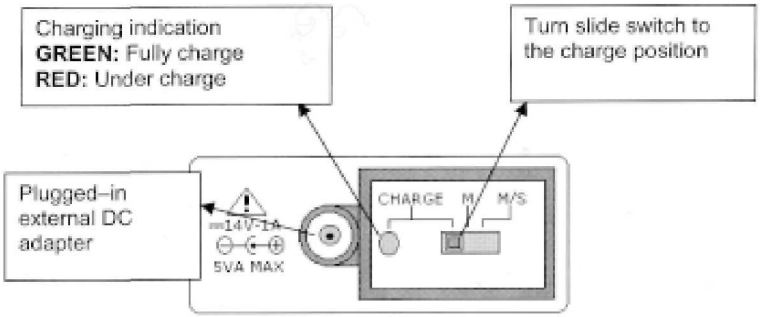
6.1 CHARGE BATTERY

WARNING

Never discharge the battery by short battery, and mixed different types of batteries or reverse polarity in any subjects. Always check the battery type before charging battery.

The meter is powered by 4 sets of rechargeable batteries. To charge battery as the sign "  " is displayed and flashing. Use the following procedures to charge the battery:

1. Turn the meter off and disconnect the test leads from external equipment.
2. Plug the DC adapter into the jack at left side.
3. Turn slide switch to the charge position.
4. The **RED** lamp indicates the battery is under charging.
5. Remove the DC adapter or turn the slide switch to "**M**" position when the **GREEN** lamp is indicated, the battery has been charged fully.



6.2 CLEANING

WARNING

/!\ To avoid electrical shock or damage to the meter, do not get water inside the case.

To clean the instrument, use a soft cloth dampened in a solution of mild detergent and water. Do not spray cleaner directly onto the instrument, since it may leak into the cabinet and cause damage. Do not use chemicals containing benzine, benzene, toluene, xylene, acetone or similar solvents to clean the instrument. After cleaning, make sure the instrument is dried completely before using.

6.3 METROLOGICAL CHECKS

For checking and calibration of your instrument, please contact our accredited laboratories (list on request) or the Chauvin-Arnoux subsidiary or Agent in your country.

6.4 SERVICE

If the instrument fails to operate, to check battery and test leads, and replaces them if necessary. If the instrument still can't work, double check operating procedure as described in this instruction manual. When servicing, use specified replacement parts only. Following table will guide you to identify basic problems:

Malfunction	Identification
No LCD indication as power ON by rotary switch	• Check the slider switch should be set to M or M/S position. • Check battery and charge it.
No beeper tone	• Check setup mode whether the beeper has been set to OFF. Then select the driving frequency you want
Failed on current measuring	• Check Fuse1
No output signal ● Press OUTPUT button, if the sign OUT lit shortly, then disappeared, and replaced with the sign SBY. ● The sign OUT is lit but without output	• Low battery. • Check the slider switch should be set to M/S. • Check the external Load whether it is exceeded the limitation. • Whether the loop has 24V power, if yes, please use special yellow test lead for mA simulation. • Check Fuse 2.
No charging indication	• Set the slider switch to Charge position. • Check external adaptor whether the output is DC 14V and plug into the DC jack completely. • Line power voltage (100V~250V AC 47Hz~ 63Hz) and power cord
Failed on Remote control	• The optical side of cable connected to meter, the text side of cover should be up. • Check the baud rate, parity, Data bit, Stop bit (default is 9600, n, 8, 1) • Driver install for USB- RS232.

6.5 BATTERY REPLACEMENT

WARNING
CONTAINS NICKEL-METAL HYDRIDE BATTERY, MUST BE RECYCLED OR DISPOSED OF PROPERLY.

1. Loosen screw on the cover of battery compartment.
2. Slide the cover to left side, then pull up and remove the cover. See **Figure-63**.
3. It is suggested to replace all defective battery sets.
4. Reverse the procedure of opening cover to close the bottom cover.

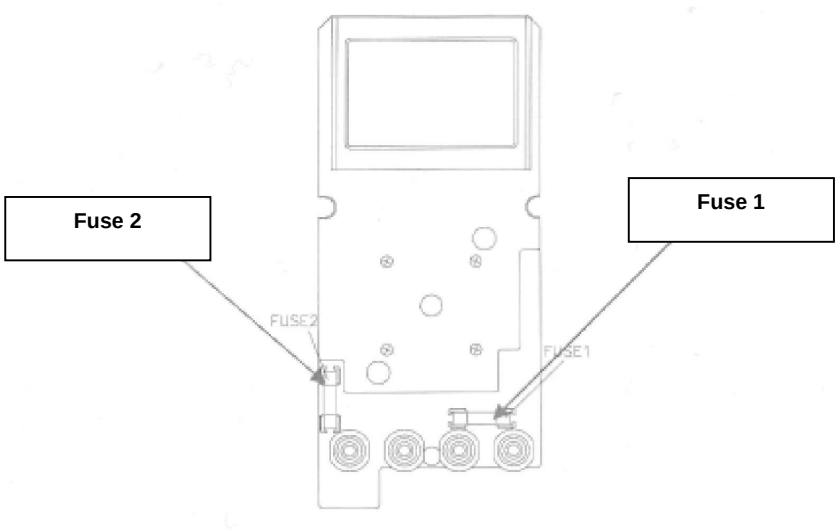
6.6 FUSE REPLACEMENT

Use the following procedures to replace the fuses of the meter:

1. Use the rotary switch to turn the meter off, and disconnect the test leads from external equipment. Be sure the adaptor has been removed.
2. Remove the cover of battery compartment as Fuse replacement, and remove the all battery sets.
3. Loosen 3 screws on bottom case, pull up and remove the cover.
4. Lift the circuit board as shown in **Figure 64**.
5. Remove the defective fuse by gently prying one end of the fuse loose and sliding the fuse out of the fuse bracket.
6. Install a new fuse of the same size and rating. Make sure the new fuse is centered in the fuse holder.
7. Ensure that the rotary switch on the top case and circuit board switch stay on the **OFF** position.
8. Then re-fasten the circuit board and the bottom cover respectively.
9. The rate, position and size for fuses see the below table

The rate, position and size for fuses see the below table.

POSITION	P/N	RATING	SIZE	Type
Fuse1	62- 25623-1B	630mA/ 250V	5x20 mm	Quick acting
Fuse2	62- 25593-1U	63mA/ 250V	5x20 mm	Time-lag acting



7. TO ORDER

C.A 1643 – MULTIFUNCTION CALIBRATOR……P01.6545.01

03 - 2007

Code691933A00 – Ed. 1

Deutschland - Straßburger Str4 - 77694 KEHL/RHEIN - Tél : (0785 1) 99 26-0 - Fax : (07851) 99 26-60
España - C/ Roger de Flor N°293 - Planta 1 - 08025 BARCELONA - Tél : (93) 459 08 11 - Fax : (93) 459 14 43
Italia - Via Sant' Ambrogio, 23/25 - 20050 BAREGGIA DI MACHERIO (MI) - Tél : (039) 245 75 45 - Fax : (039) 481 561
Liban - P.O BOX 60-154 - 1241 2020 Jal el dib - BEYROUT - Tél : +961 1 890 425 - Fax : +961 1 890 424
Österreich - Slamastrasse 29 / 3 - 1230 WIEN - Tél : (1) 61 61 9 61 - Fax : (1) 61 61 9 61 61
Schweiz - Einsiedlerstrasse 535 - 8810 HORGEN - Tél : (01) 727 75 55 - Fax : (01) 727 75 56
UK - Waldeck House - Waldeck Road - MAIDENHEAD SL6 8BR - Tél : 01628 788 888 - Fax : 01628 628 099
China - Shanghai Pujiang Enerdis Inst. CO. LTD - 5 F, 3 Rd buildind, n°381 Xiang De Road 200081 SHANGHAI. Tél : (021) 65 08 15 43 - Fax : (021) 65 21 61 07
USA - d.b.a AEMC Instruments - 200 Foxborough Blvd, Foxborough, MA 02035 - Tél : (508) 698-2115 - Fax : (508) 698-2118