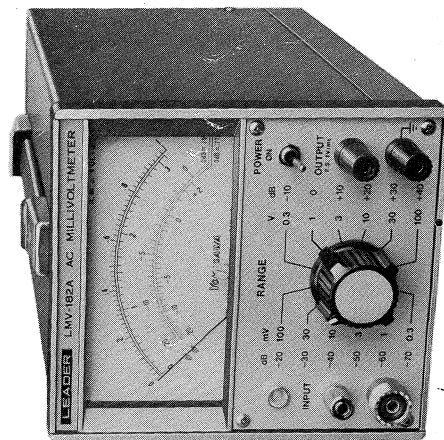


MODEL LMV-182A
MODEL LMV-182B
AC MILLIVOLTMETER

INSTRUCTION MANUAL



LEADER ELECTRONICS CORP.

2-6-33 TSUNASHIMA-HIGASHI, KOKOKU-KU,

YOKOHAMA, JAPAN.

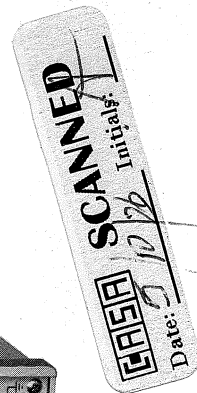
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LEADER ELECTRONICS CORP.

MEMO

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Note: This instruction manual applies to both 182A and 182B, and the information in brackets [] refers to the 182B.

MEMO

1. General

These instruments are millivoltmeters and voltmeters with mean value indicating devices that offer effective value calibration, and are used for measuring sine wave alternating current voltages of $30\mu\text{V} - 100\text{V}$ [$50\mu\text{V} - 150\text{V}$] in the $5\text{Hz} - 1\text{MHz}$ frequency range. These instruments are highly sensitive and precise. New circuitry insures wide range readings with excellent linearity characteristics. The use of output terminals enables application of these units as wide-band high gain amplifiers or pre-amplifiers on other electronic apparatus.

2. Features

1. Wide band-width of $5\text{Hz} - 1\text{MHz}$.
2. High accuracy; $\pm 2\%$.
3. Highly precise, reliable and stable voltmeters of new circuit design.
4. Wide-use voltmeters with two decibel scales ($0\text{dB} = 1\text{V}$, $0\text{dB} = 0.775\text{V}$) in addition to the effective voltage scales.
5. The output is calibrated at 1V_{rms} full scale, so that these instruments can be used as low-noise high-gain pre-amplifiers on wave form monitors.

3. Specifications

Voltmeter

Measuring voltage range		$30\mu\text{V} - 100\text{V}$ [$50\mu - 150\text{V}$]	
Measuring range		Measuring range	12 ranges 0.3, 1, 3, 10, 30, 100, mV 0.3, 1, 3, 10, 30, 100, V

Decibel rang 12 ranges -20 dB
 $-70, -60, -50, -40, -30, -20$ dB
 $-10, 0, +10, +20, +30, +40$ dB
 (0 dB = 1 V, 0 dB = 0.775 V)

Measuring accuracy $\pm 2\%$ of full scale

(at 1 kHz or 400 Hz)

Frequency characteristics 5 Hz – 1 MHz ±10%

10Hz – 500kHz ±5%

20Hz - 100kHz $\pm 2\%$

(1 kHz as base)

Input resistance		10 M Ω
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Input capacitance Under 50pF

 $(0.3\text{mV} - 100\text{mV} [0.5\text{mV} - 150\text{mV}])$

Under 35pF

 $(0.3\text{V} - 100\text{V} [0.5\text{V} - 150\text{V}])$

Maximum input voltage AC peak + DC = 600V

Noise Within 4% of full scale by shorting input

Amplifier

Output voltage 1V no load

when 1.0V [5.0V] is indicated

at full scale of each range

Frequency characteristics 10Hz – 500kHz –3 dB (1 kHz

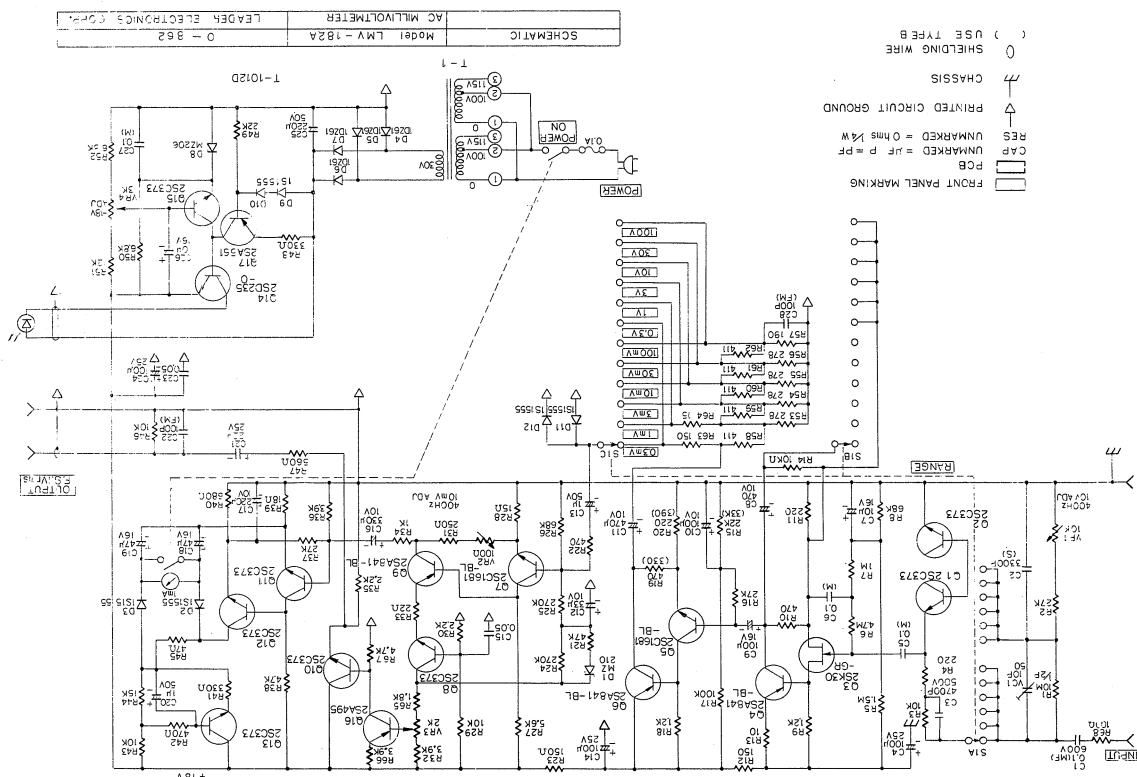
as base)

Output impedance $600\Omega \pm 20\%$

Distortion factor Within 1% at full scale (1 kHz)

(except range of $300\mu\text{V}$)

Operating temperature range



Operating humidity range	Less than 85%
Power Supply	100V $\pm$ 10% 50/60 Hz (can be changed to 115V, 200V, 230V by switching over the in- terior trans-tap)
Size and weight	2.5 VA 132(W) $\times$ 150(H) $\times$ 250(D)mm, 2 kg. (exclusive of buttons, rub- ber legs and handle)
Accessories	 Terminal adaptor for plug type 1 Connection cord (banana-alligator) 1 Instruction manual 1

4. System diagram

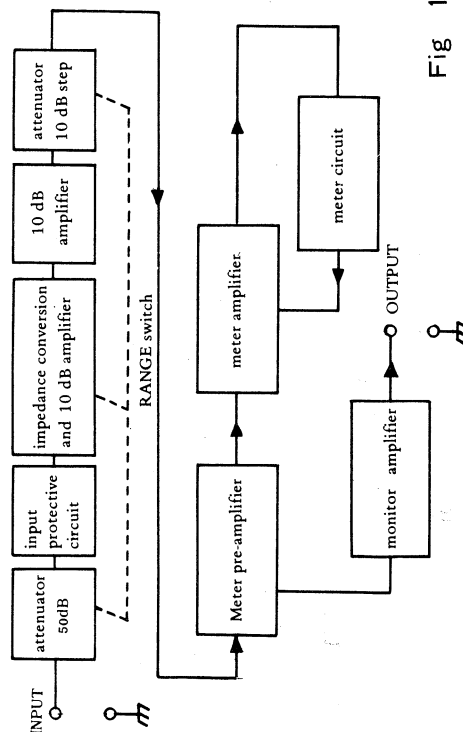


Fig 1

2. Procedure for correcting indicated values
 - 1) Connect a voltmeter calibrator to the INPUT.
 - 2) Set the voltmeter range at 10 mV.
 - 3) Set the output voltage of the calibrator to 10 mV, and adjust VR2 (10 mV 400 Hz ADJ) of Figure 7 to full scale.
 - 4) Next, set the voltmeter range at 10 V.
 - 5) Set the output voltage of the calibrator to 10V, and adjust so that it will be full scale at VR1 (10V 400Hz ADJ) of Figure 7.
 - 6) Next, set the voltmeter range at 1V.
 - 7) Change the signal source from the calibrator to an oscillator of good frequency characteristics. Set the frequency of the oscillator to 500Hz, and set the output voltage so that the instructed value is 1V full scale.
 - 8) Next, change the signal frequency from 500 Hz to 50 kHz, and adjust VC1 (50kHz ADJ) of Figure 7 so that the frequency characteristics is flat. If this adjustment does not work, repeat the correction procedure from the beginning.
3. Adjustment of output voltage terminals

After the above adjustment is finished, set the voltmeter range at 1V. Next, apply a 1 kHz signals to attain full scale, and adjust VR3 (OUT 1V ADJ) of Figure 7 so that the output terminal voltage is 1 Vrms.

Note: In the case of the 182B, adjust each set voltage by a multiplier of 1.5. For instance, 10 mV should be changed to 15 mV.

9-4 Adjustment and correction

If specifications are not met after repairs are made, make adjustments or corrections as follows:

1. Adjustment of stabilization power

Connect a DC voltmeter to the +18V line of the printed circuit, and adjust VR4 (V_{cc}18V ADJ) of Figure 7 to get +18V.

VR4 ○ (V _{cc} 18V ADJ)	
VR2 ○ (OUT 1V ADJ) (10mV 400Hz ADJ)	VR3 ○ (OUT 1V ADJ)
VR1 ○ (10V 400Hz. ADJ)	VC1 ○ (1 V 50kHz ADJ)

Side panel (when viewed from above)

Fig 7

5. Panel functions

Explanations of the front and rear panel controls are shown below.

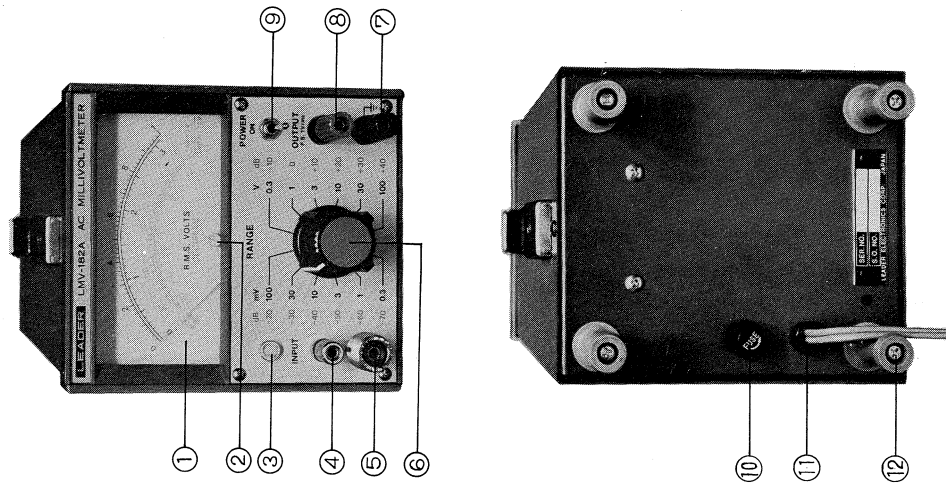
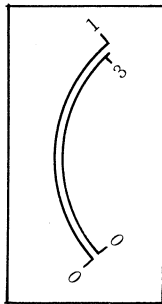


Fig 2

① Meter Faces

Voltage and dB scales are calibrated as shown in Figure 3.

1) Model 182A



2) Model 182B

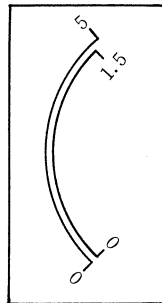


Fig 3

② Mechanical zero adjustment screw

Turn power switch ⑨ to off. Set the voltage calibration to 0 by adjusting the mechanical zero adjustment screw with an insulated screwdriver.

③ Pilot lamp

When power switch ⑨ is pushed up to turn power on, the lamp should light.

④ "INPUT" (metallic terminal)

This is the ground terminal when measuring voltage.

⑤ INPUT (plug, U.H.F. type)

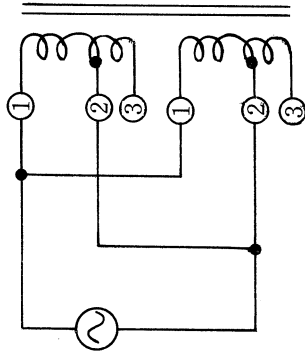
This is the terminal for applying voltage to be measured. Type M and type UHF connectors and twin-type banana plugs can be used because ④ and ⑤ are 19mm apart. Individual banana plugs may also be used with ④ and ⑤ separately.

⑥ RANGE button

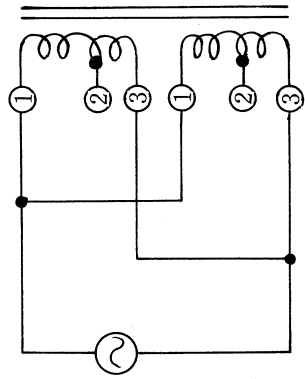
This button is used for selecting full scale value. At each stop position, the voltage values of the full scale are indicated in

*1, 2, 3 for each primary winding; there are two primary windings.

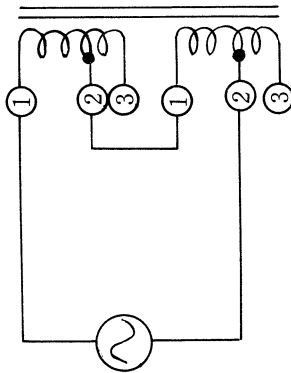
A. 100V



B. 115V



C. 200V



D. 230V

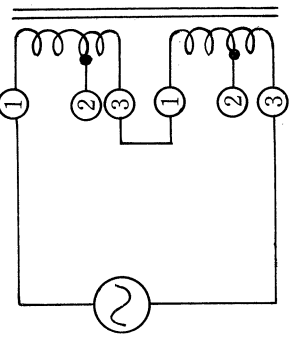


Fig 6

9-2 How to remove the cover

Remove the cover as shown below.

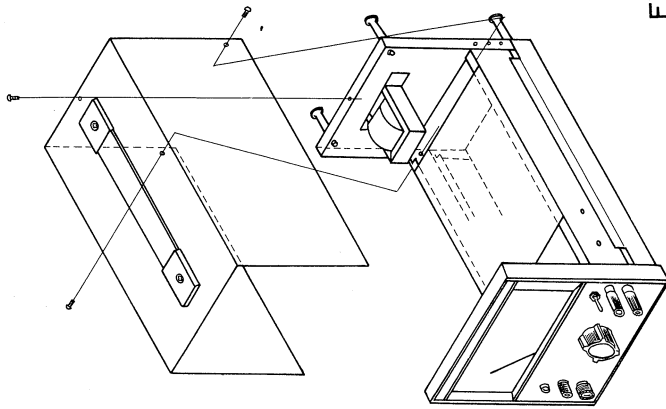


Fig 5

Remove the three screws on the top and side of the cover, slide it backward by 1 — 2cm, and then remove it.

9-3 Changing the voltage to the correct power source voltage

The power transformer is on the rear side when the case is opened. The terminals numbered 1, 2, 3* and 1, 2, 3* are primary ones. When changing the voltage of the applied power source, change wiring as shown in Figure 6.

black, and the absolute levels of 0 dB calibration are shown in dB.

⑦ “OUTPUT” (black terminal)

When this instrument is used as an amplifier, this output terminal is ground.

⑧ “OUTPUT” (red terminal)

This is the “Hot” output terminal when this instrument is used as an amplifier. When the meter indicates full scale at each stop position of the range switch ⑥, 1 Vrms of voltage can be obtained.

“1” calibration in the case of 182A

“5” calibration in the case of 182B

⑨ “POWER” switch

Power goes on if the switch is pushed up to “ON”.

⑩ FUSE

Protects instrument against overload and short circuits. Fuse is removable by counter-clockwise rotation.

⑪ Power supply cord

Connects unit to power source.

⑫ Cord winder

Provides convenient power cord storage.

6. Preliminary notes

6-1 The line voltage used for this instrument should be $\pm 10\%$ of the rated value.

6-2 Mechanical zero adjustment of the indicator

If the pointer of the scale is not at 0 when power is off, set to 0 by adjusting the mechanical zero adjusterscrew with an insulated screwdriver.

6-3 Excessive input voltage

The maximum input voltage of this instrument is AC peak + DC = 600V. Do not apply a voltage greater than this value. If a larger input is applied to the input terminals, circuit parts may be damaged or destroyed.

6-4 Input waveform

This instrument gives indications according to the mean value of the input waveform, and the calibration is done in effective values of sine waves. Therefore, distortion of the input voltage waveform may result in incorrect readings.

6-5 Induction noise

When the measured voltage is very small, or when the impedance of the source of the measured voltage is relatively high, an incorrect indication may result due to the induction of external noises. If this occurs, use shielded cables to reduce or eliminate noise pick-up.

7. Operation

7-1 Preparation

1. Before connecting this instrument to the power source, check to see that the pointer of the scale is at 0. If it is off 0, set it to 0 by adjusting the zero adjustment screw.
2. Connect the power plug to the power source of the correct voltage.
3. Set the range switch to 100V [150V] in advance.
4. When the power switch is pushed to ON, the pilot lamp should light.

The pointer will vibrate irregularly for about five seconds after power goes on, but it does not indicate a malfunction.

5. The instrument will stabilize in about five seconds after power is applied.

into low impedance, and has an amplification factor of +10 dB.

4. +10 dB Amplifier

It consists of Q_5 and Q_6 and has an amplification factor of 10 dB.

5. 10 dB step attenuator

In conjunction with the 60 dB attenuator, it selects proper values to be measured.

6. Meter pre-amplifier

It consists of Q_7 and Q_9 , and amplifies small signals into large signals.

7. Meter amplifier and meter circuit

Consists of $Q_{1,1}$, $Q_{1,2}$, $Q_{1,3}$, D_2 , D_3 and meter. The rectifier circuits of D_2 and D_3 and the meter are in the feedback circuit of the amplifier, so, the indications of the meter are in proportion to the input voltage.

8. Monitor amplifier

1 Vrms output is obtained at the "OUTPUT" terminal when the meter indicates full scale after a signal is taken out of a part of the meter preamplifier and amplified.

9. Stabilization power circuit

This circuit consists of D_4 , D_5 , D_6 and D_7 rectifier circuits and D_8 , $Q_{1,4}$ and $Q_{1,5}$ stabilization circuits. With D_8 Zener diode as the reference voltage, it supplies +18V stabilized voltage to the impedance conversion circuit, meter pre-amplifier, meter amplifier and monitor amplifier.

9. Maintenance

9-1 Changing fuses

A fuse can be removed by turning the fuse holder on the rear side in the direction of the arrow. Use 0.1A fuses. After fuses

7-2 Measurement of AC Voltage

1. The meter will indicate presence of voltages when a connection is made to the "INPUT" terminal and the voltage to be measured is applied.
2. If the reading is less than 30% of full scale, turn the "RANGE" button counterclockwise, and reduce the voltage range gradually. Read the indicated value when the pointer is more than 30% of the full scale and less than full scale.
3. There are two maximum voltage calibrations, "1" and "3" ["1.5" and "5"], on the scale. Tables 1 and 2 show the positions of "RANGE" buttons vs. the calibration of the voltages used.

LMV-182A

RANGE	Scale	Multiplier	V per DIV
100V	0 — 1	100	2V
30V	0 — 3	10	1V
10V	0 — 1	10	0.2V
3V	0 — 3	1	0.1V
1V	0 — 1	1	0.02V
0.3V	0 — 3	0.1	0.01V
100mV	0 — 1	100	2mV
30mV	0 — 3	10	1mV
10mV	0 — 1	10	0.2mV
3mV	0 — 3	1	0.1mV
1mV	0 — 1	1	0.02mV
0.3mV	0 — 3	0.1	0.01mV

Table 1

Current can be determined out by measuring the voltages at both ends of the resistance based on the above relationship.

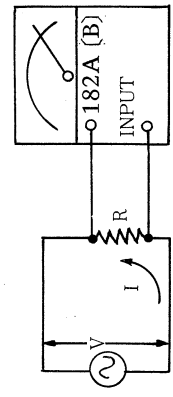


Fig 4

Note: The "INPUT" terminal of this instrument is grounded at one end.

8. Functional description

LMV-182A and LMV-182B are similar as far as functions are concerned. They consist of a 50 dB attenuator, input protective circuit, impedance conversion circuit, 10 dB step attenuator, meter pre-amplifier, meter amplifier, meter circuit, monitor amplifier and stabilization power circuit.

1. 50 dB attenuator
Controls input voltage so that the impedance conversion circuit will work normally. The attenuation quantity is 0 dB in the 0.3 mV — 100 mV [0.5 mV — 150 mV] range, and 50 dB in higher ranges.
2. Input protective circuit
It consists of Q₁ and Q₂, and protects FET Q₃ from excessively large input voltages.
3. Impedance conversion circuit + 10 dB amplifier
It consists of Q₃ (FET) and Q₄ converts high input impedance

LMV-182B

RANGE	Scale	Multiplier	V per DIV
150V	0-1.5	100	5V
50V	0-5	10	1V
15V	0-1.5	10	0.5V
5V	0-5	1	0.1V
1.5V	0-1.5	1	0.05V
0.5V	0-5	0.1	0.01V
150mV	0-1.5	100	5mV
50mV	0-5	10	1mV
15mV	0-1.5	10	0.5mV
5mV	0-5	1	0.1mV
1.5mV	0-1.5	1	0.05mV
0.5mV	0-5	0.1	0.01mV

Table 2

7-3 How to use Decibel Range

The indicator has the following two red dB calibrations:

0 dB = 0.775 V (1 mW 600Ω dBm)

0 dB = 1 V dBV

Table 3 shows each dB range vs dBm and dBV.

Range setting	LMV-182A		LMV-182B	
	dBm	dBV	dBm	dBV
+40	+20~-+42	+20~-+40	+20~-+46	+20~-+44
+30	+10~-+32	+10~-+30	+10~-+36	+10~-+34
+20	0~-+22	0~-+20	0~-+26	0~-+24
+10	-10~-+12	-10~-+10	-10~-+16	-10~-+14
0	-20~-+2	-20~-+0	-20~-+6	-20~-+4
-10	-30~-+8	-30~-+10	-30~-+4	-30~-+6
-20	-40~-+18	-40~-+20	-40~-+14	-40~-+16
-30	-50~-+28	-50~-+30	-50~-+24	-50~-+26
-40	-60~-+38	-60~-+40	-60~-+34	-60~-+36
-50	-70~-+48	-70~-+50	-70~-+44	-70~-+46
-60	-80~-+58	-80~-+60	-80~-+54	-80~-+56
-70	-90~-+68	-90~-+70	-90~-+64	-90~-+66

Table 3

Decibel values can be read by adding range dB values to indicated values of the pointer.

Example 1 Example 2

Scale	+ 1 dBm	Scale	- 4 dBV
Range	+ 20 dB	Range	- 30 dB
Level	+ 21 dBm	Level	- 34 dBV

7-4 Use of "OUTPUT" terminal

When the indicator show "1" ["5"] at full scale, the "OUTPUT" terminal can obtain an output of 1Vrms no matter where the RANGE switch is positioned. An oscilloscope can be used as a monitor of measured signal waveforms, or as a pre-amplifier by connection to the "OUTPUT" terminal. Table 4 shows the degrees of amplification when the instrument is used as a pre-amplifier.

Notes: The following troubles will occur if a low load impedance is connected to the terminal.

Resistance Output voltage is lowered. Low frequency characteristics deteriorate.

Capacitance As load capacitance increases, high frequency characteristics deteriorate.

Range setting (dB)	-70	-60	-50	-40	-30	-20	-10	0	10	20	30	40
Degree of amplification (dB)	70	60	50	40	30	20	10	0	-10	-20	-30	-40

Table 4

7-5 Measurement of alternating current

When AC voltage is V, alternating current is I and resistance is R, there is a relationship as follows:

$$I = V/R$$