K-200

OPERATING INSTRUCTION FOR FET-VOM MODEL K-200

KYORITSU ELECTRICAL INSTRUMENTS WORKS, LTD.

TOKYO, JAPAN

(Printed in Japan)

NOTICE

After unpacking the K-200 you will find one Eveready E-93(UM-2) and two Eveready 216(006P) batteries inside the polyfoam box with the test leads. When installing the batteries, pull the two latches for the battery cover and remove the battery cover. Then the batteries can be installed into the battery compartment.

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1. GENERAL DESCRIPTION

This instrument is an epoch making device using field effect transistors and is so highly sensitive that it covers high input impedance and by far the widest frequency ranges for its small size. It answers to all needs in the measurement of DC voltage, DC current, resistance as well as AC voltage and AC current.

While its function is so versatile as a test meter, its scale face is extremely simplified. In the ordinary works of AC voltage measurement, it has so far been the case that two different scales had to be provided according to high or low tensions to be measured. Our new model however has obviated this sort of inconvenience and has only one scale that serves to indicate all ranges without any misreading both for AC voltage and AC current measurement. This instrument is composed of the following parts:

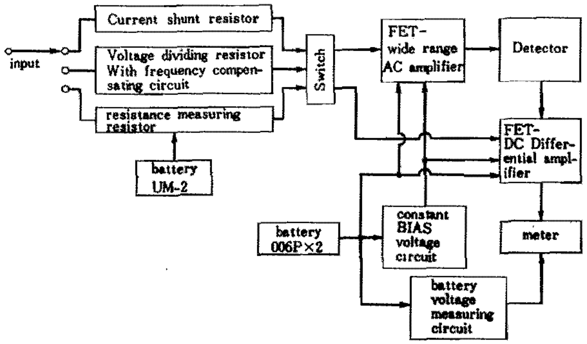

Fig. 1

2. CONTROLS ON THE K-200

The Field Effect Meter is as simple to operate as a standard VOM. Panel controls include the RANGE switch, ZERO ADJ, OHMS ADJ, the OFF-BATT-ON switch and METER ZERO ADJ. The following is a brief description of each control and how it is used.

OFF-BATT-ON switch: the OFF-BATT-ON switch controls the power to the circuit in the Field Effect Meter. In the OFF position, the battery is disconnected from the circuit and the meter is off. In the BATT position, battery voltage can be measured.

In the ON position, the battery voltage is applied to the circuit and the meter is ready to go. A red flag appears in the switch opening to indicate when the Field Effect Meter is on.

ZERO ADJ: the ZERO ADJ is used to position the pointer of the meter over the zero on the extreme left of the meter scale or to position the pointer on the center zero when using the zero center ranges of the Field Effect Meter.

OHMS ADJ: The OHMS ADJ is the same as that found on most meters. Prior to measuring resistance, the test leads are opened and the OHMS ADJ is rotated for a full scale deflection (∞) as read on the ohms scale of the meter.

FUNCTION SWITCH: The FUNCTION switch selects the type of measurement to be performed. Minus or Plus DC volts or MA, AC volts or MA and OHMS.

RANGE SWITCH: The RANGE switch selects the desired range of current, voltage, or resistance to be measured.

METER ZERO ADJUST (MECHANICAL)

The mechanical ZERO adjustment can be accomplished by inserting a screwdriver into the slot located in the center of the front panel immediately below the scale. Turn the mechanical ZERO-Adjust counterclockwise until the pointer rests at ZERO. Perform above with the OFF-BATT-ON switch set the OFF position.

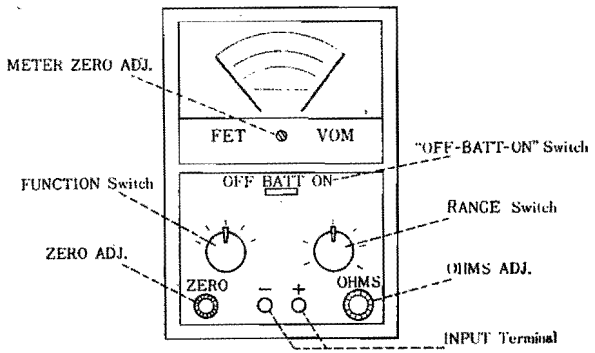

Fig. 2

3. FET-VOM SPECIFICATIONS

◎DC Voltage: 0.3~1000V (8 ranges)
(change-over possible between+DC and—DC
Ranges: 0-0.3/1.0/3.0/10/30/100/300/1000V
Input Resistance: 10 megohms
Accuracy: ±3% at full scale value.
Overvoltage, maximum: 1000V DC (at 0.3V range)

◎DC Current: 0.03~300mA (8 ranges)
Ranges: 0-30μA/300μA/1.0/3.0/10/30/100/300mA
Terminal voltage drop: 300mV
Accuracy: ±3% at full scale value.

◎AC Voltage (effective value): 0.3~1000V (8 ranges)
Ranges: 0-0.3/1.0/3.0/10/30/100/300/1000V
(peak to peak value): 0.84~2800V (8 ranges)
Ranges: 0-0.84/2.8/8.4/28/84/280/840/2800 Vp-p
(dBm): -25.5~62dBm (0dB=1mW, 600 ohms)
Input Resistance: 10 megohms
Input Copacitance: APX. 50 pF (at 0.3V range)
APX. 35pF (at other ranges)
APX. 80pF (test cord)

Accuracy: ±4% at full scale value. (based on 50 Hz)
Frequency Response.
25Hz~1MHz (at 0.3V range) ±0.5 dB
20Hz~3MHz (at other ranges) ± 1dB
Overvoltage, maximum: 600V AC at 0.3V range (RMS for sine wave)

◎AC Current (effective value): 0.03~300mA (8 ranges)
Ranges: 0-30μA/300μA/1.0/3.0/10/30/100/300mA
Accuracy: ±4% at full scale value. (based on 50 Hz)
Terminal Voltage Drop: 300mV
◎Resistance: 0~500MΩ (7 ranges)
Ranges: R×1/×10/×100/×1K/×10K/×100K/×1M
Center Value: 10 ohms (at R×1 scale)
Accuracy: ± 3% of scale length
◎Meter Sensitivity: 60 μA DC
◎Operation Temperature Range: 0 ~40°C
◎Inside Battery: UM-2 (EVEREADY E-93) 1 pce.
006P (EVEREADY 216) 2 pcs. (Battery check possible)
◎Dimension: 130(W)×195(H)×112(L) (excepting handle)
◎Weight: Apx. 1.6Kg.
◎Accessories: Test cord 1 set
Operation Manual 1 copy

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4. OPERATING THE K-200

[1] PREPARATION FOR MEASURING

a. With the power switch at the OFF position, check to see that the pointer of the instrument is at zero. If the pointer is off zero, adjust it.

b. Insert the black banana plug of the test cord to minus terminal, and red banana plug to plus terminal.
c. Turn the Power switch to the "BATT" position, and observe the deflection of the meter pointer. As long as the pointer remains within the range of "BATT. OK". indicated by red arrowhead on the upper part of the scale, the instrument is good for measuring work.
d. Set the Power switch at the "ON" position.
e. Turn the function switch to the function desired.
Then keep the tips of the test cord in short — circuited condition and turn the knob marked "ZERO ADJ" clockwise or counter — clockwise until the instrument pointer rests over the zero mark on the left side of the scale.

[2] MEASURING DC VOLTAGES

After the mechanical and electrical zero has been set properly, proceed as follows:
a. Turn the function switch to the — DC. V or + DC. V position, depending on the polarity of the voltage to be measured.
b. When measuring an unknown voltage, set the range switch fully clockwise.
c. Connect the ground lead of the tester to ground or reference point of the circuit under test. Bring the probe tip in contact with the point to be measured.
d. Observe the instrument reading. If the instrument pointer deflects to the left, turn the function switch to the correct polarity.
e. Read the instrument scale indication at the pointer position on one of the black arcs. For the 0.3, 3.0, 30, 300 volt use the arc in black marked 3V. For the 1.0, 10, 100 1000 volt use the black arc marked 1V.

[3] ZERO CENTER DC VOLTAGES

a. Set function switch at +DC. V. and short the test leads together.
b. Rotate the ZERO ADJ control knob clockwise until the meter pointer rests over the center zero mark. (The very

bottom scale)

c. Set the range selector switch to a range which is at least twice the probable voltage to be measured. Connect the test leads to the circiut the same as for DC voltage measurements.

d. Observe the instrument pointer indication on the black arc marked DC. Positive voltages will make the pointer deflect to the right of the center zero mark; negative voltages will make the pointer deflect to the left of the center zero mark. Each side of the scale represents one-half of the range being used. For example, when the 10 volt range is being used, each half of the scale represents 5 volts and each division 0.2 volt. The purpose for which the center zero scale is used usually does not require an accurate measurement of the voltage quantity, but merely is indication of a balanced condition. For example, if the K-200 is used in the alignment of an FM discriminator, the desired balanced condition will result in a reading of zero on the tester. A misaligned condition will cause some deflection in either the positive or negative direction.

〔4〕 MEASURING AC VOLTAGES, RMS, PEAK TO PEAK

Note: Effect of waveform in measuring AC voltages. The K-200 employs a peak-to-peak type detector, and is calibrated using a sinusoidal signal. The scale is calibrated to give rms readings, using effective values based on a true sine wave. When it is known that other than sinusoidal signals are being used, it must be recognized that the accuracy as specified for sinusoidal input will not apply.

a. Set the function switch to the AC V position.

b. Set the range switch to the desired range position.

c. Connect the clip lead of the ground side of the test cord to the chassis or reference point of the circuit under test.

d. Bring the tip of the probe in contact with the point in the circuit where the voltage is to be measured.

e. Observe the instrument readings. The pointer will indicate voltages on two red arcs for AC measurements: RMS and peak to peak. Both values apply when the input waveshape being measured is a sine wave. Only the peak-to-peak value applies when the input waveshape is not a sine wave.

For Range Switch Positions 0.3, 3.0, 30, 300 volts RMS, use the arc in red marked 3 V. Peak-to-peak readings are obtained on the 8.4 volt full scale arc. For Range Switch Positions 1.0, 10, 100, 1000 volts RMS, use the red arc marked 1 V. For peak-to-peak readings, use the 2.8 volts full scale arc.

〔5〕 dB MEASUREMENT

The DBM scale (−15~+2dB) for measuring output level is calibrated according to the standard of 1 mW (600 Ohms), and the Range Switch is devised for direct reading at 1 V. For the rest of the ranges, the value read on basis of this dB scale must necessarily be corrected as described below:

0.3 V	Range	add −10.5 dB
1 V	〃	read directly as indicated
3 V	〃	add 9.5 dB
10 V	〃	add 20 dB
30 V	〃	add 29.5 dB
100 V	〃	add 40 dB
300 V	〃	add 49.5 dB
1000 V	〃	add 60 dB

〔6〕 MEASURING DC CURRENT

a. Set the function switch to DC. A.

b. Set the range selector switch to the range desired. If the approximate value of current flowing within the circuit is not known, turn the range selector switch to the 300 mA position (fully clockwise).

c. Open the circuit in which you wish to measure current flow. Connect the ground lead of the test cord toward the negative side of the circuit. Connect the tip of the probe

toward the positive side of the circuit under test.

d. Turn the power on in the circuit under test. Observe the instrument. If the pointer is deflected to the left, the current polarity is opposite to that which was anticipated. Turn off the power, reverse the test cord connections and turn the power on again.

e. Read the instrument scale indication at the pointer position on one of the black arcs. For the 30μA. 300μA, 3.0, 30, 300mA use the arc in black marked 3A. For the 1.0, 10,100mA use the black arc marked 1A.

〔7〕 MEASURING AC CURRENT

a. Set the function switch to AC. A.

b. Set the range selector switch to the range desired. If the approximate value of current flowing within the circuit is not known, turn the range selector switch to the 300 mA position (fully clockwise).

c. Open the circuit in which you wish to measure current flow. Connect the probe and clip to the circuit.

d. Turn the power on in the circuit under test.

e. Read the instrument scale indication at the pointer position on one of the red arcs. For the 30μA, 300μA, 3.0, 30, 300mA use the arc in red marked 3A. For the 1.0, 10, 100mA use the red arc marked 1A.

〔8〕 MEASURING RESISTANCES

a. Turn the function switch to the position marked OHMS.

b. Set the range selector switch to the range desired.

c. Short the probe tip to the ground lead clip and check the instrument pointer for a zero indication. If necessary, rotate the ZERO ADJ control to obtain a zero indication.

d. Disconnect the shorted leads. The instrument pointer should deflect to full scale. Turn the OHMS ADJ control for a reading of full scale. When the pointer cannot be brought up to full scale, the 1.5 volt battery inside the case must be replaced.

e. Before making any resistance measurement, make sure the

power is removed from the circuit under test. It is recommended that the operator shonld take precautions in making resistance measurements by assuring that no power is applied to the circuit under test.

f. Connect the probe tip and the ground lead clip to the two points between which DC resistance is to be measured.

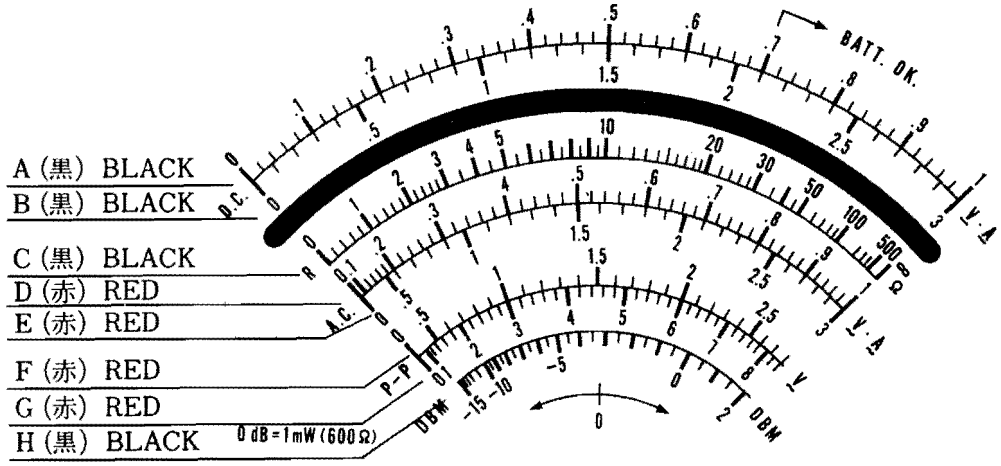
g. Read the pointer indication on the black arc marked R. Multiply the reading by the value indicated on the range switch position. K stands for 1.000, M stands for 1.000.000 The result will be resistance in ohms.

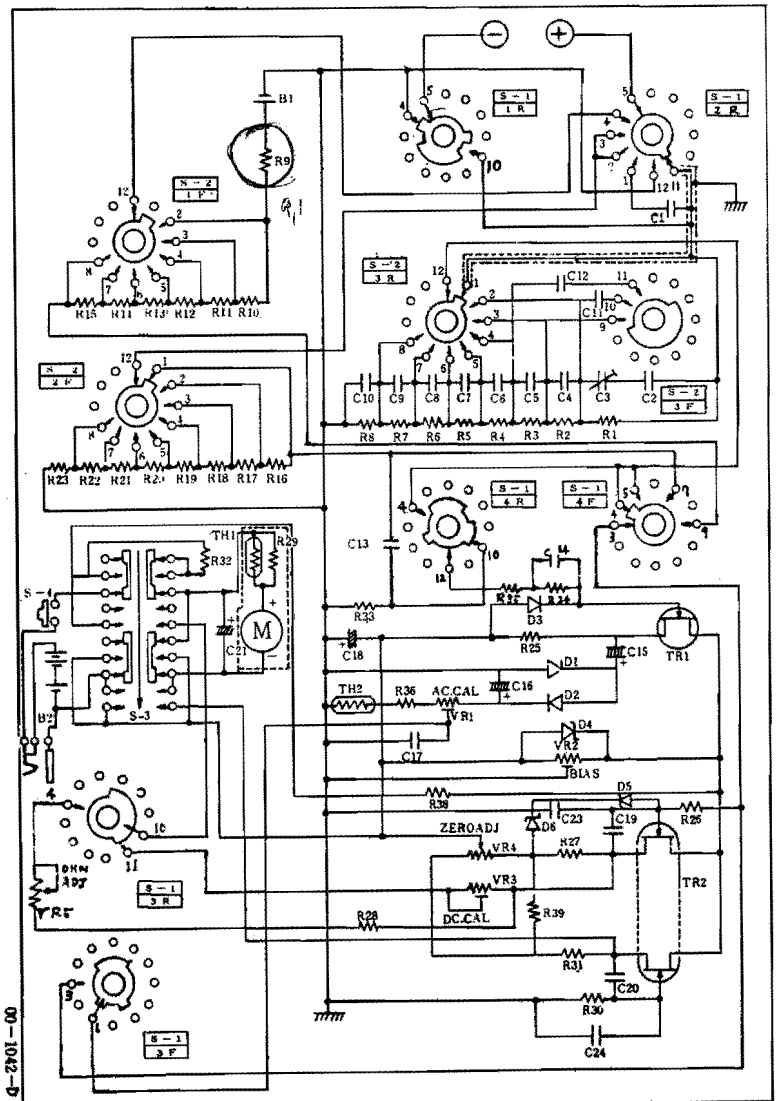
For Range Switch Position:		Read Indication in Ohms
R×1	(0 to 500 ohm range)	0—500 directly
R×10	(to 5,000 ohm range)	Multiply by 10
R×100	(to 50,000 ohm range)	Multiply by 100
R×1K	(to 500,000 ohm range)	Multiply by 1000
R×10K	(to 5,000,000 ohm range)	Multiply by 10,000
R×100K	(to 50,000,000 ohm range)	Multiply by 100,000
R×1M	(200,000 to 500,000,000 ohm range)	Multiply by 1,000,000

On all resistance ranges, the probe tip has "plus"polarity in reference to the ground test lead. This may be an important fact to be considered when checking components which have a forward and reverse resistance such as semiconductors, electrolytic capacitors.

HOW TO READ THE SCALES ON MODEL K-200

	ELECTRICAL QUANTITY TO BE MEASURED	FUNCTION SWITCH	RANGE SWITCH	SCALE	HOW TO READ SCALE
DC Volts	0—0.3V	+DC.V or −DC.V	0.3V, 30μA	B	DIVIDE by 10
〃	0.3—1V	〃	R×1, 1V, 300μA	A	READ DIRECT
〃	1—3V	〃	R×10, 3V, 1mA	B	〃
〃	3—10V	〃	R×100, 10V, 3mA	A	MULTIPLY by 10
〃	10—30V	〃	R×1K, 30V, 10mA	B	〃
〃	30—100V	〃	R×10K, 100V, 30mA	A	MULTIPLY by 100
〃	100—300V	〃	R×100K, 300V, 100mA	B	〃
〃	300—1000V	〃	R×1M, 1000V, 300mA	A	MULTIPLY by 1000
AC Volts	0—0.3V	AC.V	0.3V, 30μA	E	DIVIDE by 10
〃	0.3—1V	〃	R×1, 1V, 300μA	D	READ DIRECT
〃	1—3V	〃	R×10, 3V, 1mA	E	〃
〃	3—10V	〃	R×100, 10V, 3mA	D	MULTIPLY by 10
〃	10—30V	〃	R×1K, 30V, 10mA	E	〃
〃	30—100V	〃	R×10K, 100V, 30mA	D	MULTIPLY by 100
〃	100—300V	〃	R×100K, 300V, 100mA	E	〃
〃	300—1000V	〃	R×1M, 1000V, 300mA	D	MULTIPLY by 1000
DC Current	0—30μA	+DC.A	0.3V, 30μA	B	MULTIPLY by 10μ
〃	30—300μA	〃	R×1, 1V, 300μA	B	MULTIPLY by 100μ
〃	300μA—1mA	〃	R×10, 3V, 1mA	A	MULTIPLY by 1m
〃	1—3mA	〃	R×100, 10V, 3mA	B	〃
〃	3—10mA	〃	R×1K, 30V, 10mA	A	MULTIPLY by 10m
〃	10—30mA	〃	R×10K, 100V, 30mA	B	〃
〃	30—100mA	〃	R×100K, 300V, 100mA	A	MULTIPLY by 100m
〃	100—300mA	〃	R×1M, 1000V, 300mA	B	〃
AC Current	0—30μA	AC.A	0.3V, 30μA	E	MULTIPLY by 10
〃	30—300μA	〃	R×1, 1V, 300μA	E	MULTIPLY by 100
〃	300μA—1mA	〃	R×10, 3V, 1mA	D	READ DIRECT
〃	1—3mA	〃	R×100, 10V, 3mA	E	〃
〃	3—10mA	〃	R×1K, 30V, 10mA	D	MULTIPLY by 10
〃	10—30mA	〃	R×10K, 100V, 30mA	E	〃
〃	30—100mA	〃	R×100K, 300V, 100mA	D	MULTIPLY by 100
〃	100—300mA	〃	R×1M, 1000V, 300mA	E	〃
Resistance	0—30Ω	OHMS	R×1, 1V, 300μA	C	READ DIRECT
〃	30—300Ω	〃	R×10, 3V, 1mA	C	MULTIPLY by 10
〃	300—3KΩ	〃	R×100, 10V, 3mA	C	MULTIPLY by 100
〃	3K—30KΩ	〃	R×1K, 30V, 10mA	C	MULTIPLY by 1K
〃	30K—300KΩ	〃	R×10K, 100V, 30mA	C	MULTIPLY by 10K
〃	300K—3MΩ	〃	R×100K, 300V, 100mA	C	MULTIPLY by 100K
〃	3M—500MΩ	〃	R×1M, 1000V, 300mA	C	MULTIPLY by 1M
Peak to Peak	0—0.84V	AC.V	0.3V, 30μA	G	DIVIDE by 10
〃	0.84—2.8V	〃	R×1, 1V, 300μA	F	READ DIRECT
〃	2.8—8.4V	〃	R×10, 3V, 1mA	G	〃
〃	8.4—28V	〃	R×100, 10V, 3mA	F	MULTIPLY by 10
〃	28—84V	〃	R×1K, 30V, 10mA	G	〃
〃	84—280V	〃	R×10K, 100V, 30mA	F	MULTIPLY by 100
〃	280—840V	〃	R×100K, 300V, 100mA	G	〃
〃	840—2800V	〃	R×1M, 1000V, 300mA	F	MULTIPLY by 1000
Output (dBm)	−15～2dB	AC.V	R×1, 1V, 300μA	H	READ DIRECT





KYORITSU ELECTRICAL INSTRUMENTS WORKS,LTD.	K-200 FET VOM Circuit Diagram
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00-1042-D

SYM.	Description
TR1	Transistor ITE4339
TR2	〃 IMF3958
D1, D2	Diode 1N34A
D3	〃 1S358S
D4	〃 WZ061
VR1	Potentiometer 100K
VR2	〃 100K
VR3	〃 3K
VR4	Variable Res. 10K
VR5	〃 〃 1PF 10K
R1	Resistor 1PF 7M
R2	〃 ½PF 2M
R3	〃 〃 700K
R4	〃 〃 200K
R5	〃 〃 70K
R6	〃 〃 20K
R7	〃 〃 7K
R8	〃 〃 3K
R9	〃 〃 9.1Ω
R10	〃 〃 90Ω
R11	〃 〃 900Ω
R12	〃 〃 9K
R13	〃 〃 90K
R14	〃 〃 900K
R15	〃 〃 9M
R16	〃 ¼PF 9K
R17	〃 〃 700Ω
R18	〃 〃 200Ω
R19	〃 〃 70Ω
R20	〃 〃 20Ω
R21	〃 ½PF 7Ω
R22	〃 ¼PF 2Ω
R23	〃 ½PF 1Ω
R24	〃 ¼PJ 5M
R25	〃 〃 2.5K
R26	〃 〃 5M
R27	〃 〃 2.2K
R28	〃 〃 10K~13K
R29	〃 〃 900Ω
R30	〃 ½PJ 10M
R31	〃 ¼PJ 2.2K
R32	〃 ¼PF 160K
R33	〃 ¼PJ 5M
R38	〃 〃 300Ω
R35	〃 〃 2.3K
R36	〃 〃 22K

SYM.	Description
R39	Resistor ¼PJ 2K
C1	Capacitor 0.05μF 1.5KV
C2	〃 30pF 500V
C3	〃 100pF
C4	〃 27pF 250V
C5	〃 140pF 125V
C6	〃 600pF 50V
C7	〃 1700pF 50V
C8	〃 6000pF 50V
C9	〃 0.02μF 50V
C10	〃 0.04μF 50V
C11	〃 33pF 250V
C13	〃 0.05μF 50V
C14	〃 500pF 50V
C15	〃 5μF 16V
C16	〃 1μF 16V
C17	〃 0.1μF 50V
C18	〃 33μF 16V
C19	〃 0.001μF 50V
C20	〃 0.001μF 50V
C21	〃 10μF 6.3V
TH1	Thermistor 5E901
TH2	〃 5F172
B1	Battery 1.5Volt
B2	〃 9Volt×2
S-3	Slide Switch
S-4	Push Switch
M	Meter
C12	Capacitor 30pF 250V
C23, C24	〃 0.003μF 2KV
D5, D6	Diode 9V Zener

Note : Switch Position

S-1 : +DC.V
S-2 : 0.3V
S-3 : Off
S-4 : Off

S-1 Function Switch

1	+DC. VOLT
2	−DC. VOLT
3	AC. VOLT
4	+DC. CURRENT
5	AC. CURRENT
6	OHMS

S-2 Range Switch

1	0.3V	30μA	
2	1V	300μA	R× 1
3	3V	1mA	R× 10
4	10V	3mA	R× 100
5	30V	10mA	R× 1K
6	100V	30mA	R× 10K
7	300V	100mA	R×100K
8	1000V	300mA	R× 1M

00-1042-C

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