

REPAIR SERVICE INSTRUCTIONS — CALIBRATION

2236-20 Clamp Meter for HVAC/R

2237-20 Clamp Meter

Environmental Condition

Perform all calibration at an ambient temperature of $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ / $73.4^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$ and relative humidity of 80% - allow the fork meter to sit at this temperature for a minimum of 30 minutes before proceeding.



REPAIR SERVICE INSTRUCTIONS

Calibration



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58-92-2236d2 06/2012

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Introduction

WARNING

To avoid shock or injury, do not perform the verification tests or calibration procedures described in the manual unless you are qualified to do so.

The information provided in this document is for the use of qualified personnel only.

CAUTION

The 2236-20 and 2237-20 contain parts that can be damaged by static discharge.

Follow the standard practices for handling static sensitive devices.

Precautions and Safety Information

Use the Meter only as described in the Operator's Manual. If you do not do so, the protection provided by the Meter may be impaired. Read the "Safety Information" page before servicing this product.

In this manual, a  **WARNING** identifies conditions and actions that pose hazard (s) to the user; a

CAUTION identifies conditions and actions that may damage the Meter or the test instruments.

The Symbols

The symbols used on the Meter and in this manual are explained in Table 1.

Table A. The Symbols

	Risk of electric shock
	See instruction card
	DC measurement
	Equipment protected by double or reinforced insulation
	Battery
	Earth
	AC measurement
	Conforms to EU directives
	Application around and removal from hazardous live conductors is permitted.
	Do not discard this product or throw away.

SAFETY

Review the following safety precautions to avoid injury and prevent damage to this product or products connected to it. To avoid potential hazards, use the product only as specified.

⚠ WARNING: These statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION: These statements identify conditions or practices that could result in damage to the equipment or other property.

Specific precautions

To reduce the risk of injury, user must read and understand operator's manual.

Do not operate without covers. To avoid personal injury, do not apply any voltage or current to the product without covers in place.

Electric overload. Never apply a voltage to a connector on the product that is outside the range specified for that connector.

Avoid electric shock. To avoid injury or loss of life, do not connect or disconnect probes or test leads from the meter while they are connected to a voltage source.

Do not operate in wet/damp conditions. To avoid electric shock, do not operate this product in wet or damp conditions.

SPECIFICATIONS

All specifications are warranted unless noted typical and apply to the 2236-20 and 2237-20. Stated accuracies are at 23°C±5°C at than 80% relative humidity and without the battery indicator displayed.

General specifications

Characteristics	Description
Display count	6000 counts
Numeric update rate	3 times / sec
Polarity display	Automatic
Overrange display	Display "OL" when the reading exceeds range by 10%
Low voltage indicator	 is indicated
Automatic power-off time	20 minutes
Power source	1.5V * 2 IEC LR6 or AA size
Maximum input voltage	600V CAT III between V and COM
Maximum floating voltage	600V CAT III between any terminal and earth ground
V connector	$V_{\sim}$, $V_{\text{---}}$, Ω , mA , A
Temperature Coefficient	0.1×(Spec. Accuracy) / °C, <18°C or >28°C
Battery Life	30 hours typical (Alkaline)

Measurement Specifications

Accuracy is $\pm(\% \text{ reading} + \text{number of digits})$ at $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, less than 80% R.H.

Temperature coefficient: $0.1 * (\text{Specified accuracy})/^{\circ}\text{C}$, $<18^{\circ}\text{C}$, $>28^{\circ}\text{C}$

(1) DC Voltage

Range	Resolution	Accuracy
60.0V	0.01V	$\pm(1\% \text{ reading} + 3 \text{ digits})$
600V	0.1V	

(2) AC Voltage

Range	Resolution	Accuracy (Sine Wave)
0.05V	0.01V	$\pm(1.5\% \text{ reading} + 4 \text{ digits})$ (50/60 Hz)
600V	0.1V	$\pm(3.5\% \text{ reading} + 5 \text{ digits})$ (40~400 Hz)

(3) DC μA

Range	Resolution	Accuracy
600.0 μA	0.1 μA	$\pm(1\% \text{ reading} + 5 \text{ digits})$

(4) AC Current

Range	Resolution	Accuracy
0.5 to 600.0A Peak 1500A CF = 2.5 @ 600A CF = 3.0 @ 500A	0.1A	$\pm 2.0\% \text{ rdg} \pm 5 \text{ dgt}$ (50/60Hz) $\pm 3.5\% \text{ rdg} \pm 5 \text{ dgt}$ (40 ~ 400Hz) * Add 2% at CF>2 * < 5A, add 3dgt

(5) Resistance

Range	Resolution	Accuracy
600 Ω /6k Ω	0.1 Ω /0.001k Ω	$\pm 1.0\% \text{ rdg} \pm 5 \text{ dgt}$

(6) Continuity

Range	Resolution	Accuracy
Continuity Buzzer 0-600.0 Ω		Buzzer sounds at 45 Ω or less

(7) Capacitance

Range	Resolution	Accuracy
0.01nF - 4000 μF Auto-ranging	0.01nF/0.1nF/ 0.001 μF /0.01 μF / 0.1 μF /1 μF	0.01nF-39.99nF $\pm 2.5\% \pm 2 \text{ nF}$ 40.00nF-1000uF $\pm 2.5\% \pm 20 \text{ dgt}$ 1000uF > $\pm 5\% \pm 20 \text{ dgt}$

(8) Temperature

Range	Resolution	Accuracy
-40°C ~ 400°C -40°F ~ 20.0°F 20.1°F ~ 752°F	0.1°C 0.1°F	±1% ±2.0°C ±1.5% ±4.0°F ±1.5% ±2.0°F

(9) Volt Sense

Volt Sense Light should be on at 90V @ 1 inch (2.54 cm).

(10) Thermocouple

K Type Class II Thermocouple with standard dual banana jack.

Measurement Range: -40.0°C ~ 260.0°C (-40.0°F ~ 500.0°F)

Accuracy: ±2.5°C

(11) Over-range Indication

Display "OL" when the reading exceeds the measuring range.

(12) Rotary Switch

In order to prevent a "0" reading, the contacts about the input signal must be made properly before the contact of the function selection.

(13) Auto Power Off

The meter automatically turns the power off after powering up and no operation for 20 ± 5 minutes.

Press any key or rotate the rotary to power up.

(14) Battery: Alkaline 1.5V Battery * 2, LR6**(15) Battery life (ALKALINE):**

Approx. 30 hours, all lights on.

(16) Overvoltage Category

IEC 61010-1 600V CAT. III

(17) Operating Temperature

-10°C to 50°C (14°F to 122°F)

(18) Storage Temperature

-40°C to 60°C (-40° to 140°F) (No batteries)

Physical and Environmental Characteristics

Environmental characteristics	Description
Temperature operating	-10 to +50°C
Non-Operating	-40 to +60°C
Humidity (operating)	<80% R.H.
Altitude Operating	2,000M (6560 ft.)
Vibration & shock Operating	MIL-PRF-28800F for Class 2 Instrument
Indoor Use	

Certifications and compliances

Safety	Designed to IEC61010-1, UL61010-1 and CSA specifications
Input rating	Category III 600V.
Over voltage category	CAT IV : The source of the Low-Voltage installation.
	CAT III : Distribution level mains, fixed installation.
	CAT II : Local level mains, appliances, portable equipment
	CAT I : Signal level, special equipment or parts of equipment, telecommunication, electronics.
Pollution Degree 2	Do not operate in environments where conductive Pollutants may be present.

Basic Maintenance

⚠WARNING

To avoid shock, disconnect test leads from any voltage source than remove from meter before opening the case or replacing the battery.

Opening the Meter Case

CAUTION

To avoid unintentional shock circuit, always place the uncovered Meter assembly on a protective surface. When the case of the Meter is open, circuit connections are exposed.

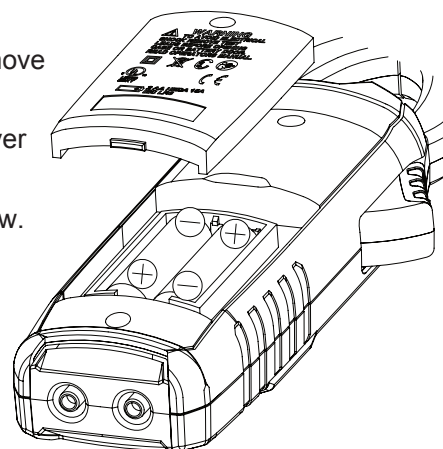
To open the Meter case, do the following:

1. Disconnect test leads from any voltage source than remove from meter before opening the case.
2. Remove the battery door by using a flat-blade screwdriver to turn the battery door screw counter-clockwise.
3. The battery door is secured to the case top by one screw. Using a Phillips-head screwdriver, remove the screw.

Replacing the Battery

The meter is powered by 2 AA 1.5V batteries.

To replace the battery refer to figure.



Performance Tests

The following performance tests verify the complete operability of the Meter and check the accuracy of each Meter function against the Meter's specifications.

Accuracy specifications are valid for a period of one year after calibration, when measured at an operating temperature of 18°C to 28°C and a maximum of 80% relative humidity.

To perform the following tests, it is not necessary to open the case, no adjustments are necessary, merely make the required connections, apply the designated inputs, determine if the reading on the Meter display falls within the acceptable range indicated.

If the Meter fails any of these tests, it needs calibration adjustment or repair.

Testing the Display

Press "HOLD" key while turning the Meter on from the "OFF" position to hold the display in the Display Test Mode. Compare the display with the example in Figure 2. Turn off the meter to escape the test mode.

LCD Graphics 2236-20



Figure 2 Display Test

1. Component Layout and Spare Parts List

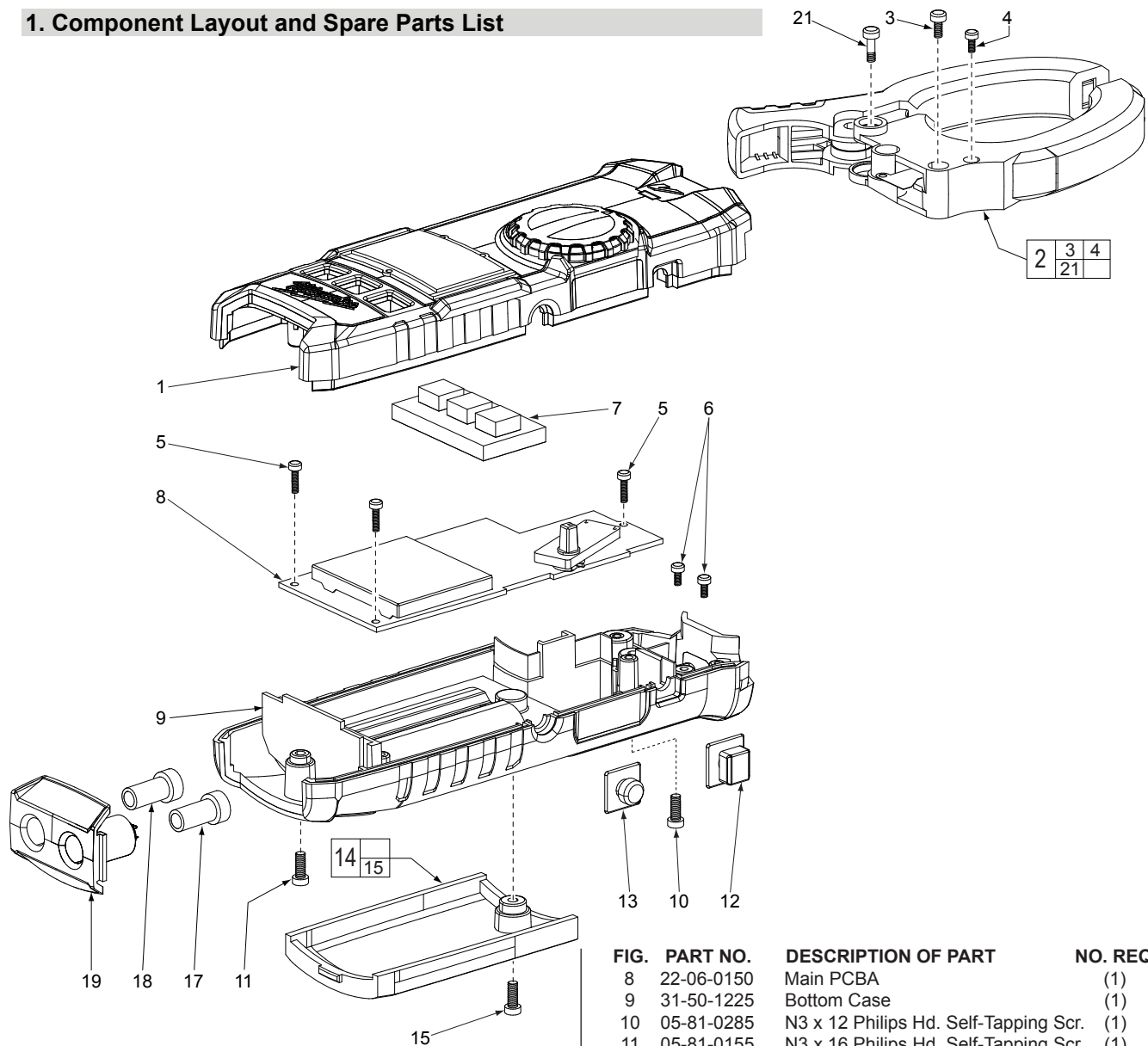


FIG.	PART NO.	DESCRIPTION OF PART	NO. REQ.
1	31-50-1220	Top Case	(1)
2	30-55-0015	Left and Right Jaw Set	(1)
3	05-78-0140	N3 x 12 Philips Hd. Self-Tapping Scr.	(1)
4	05-78-0145	N2.3 x 8 Philips Hd. Self-Tapping Scr.	(1)
5	05-81-0290	N2.3 x 8 BTP Philips Hd. Screw	(3)
6	05-78-0150	N2.3 x 5 BTP Philips Hd. Screw	(2)
7	42-42-0930	Keypad	(1)

FIG.	PART NO.	DESCRIPTION OF PART	NO. REQ.
8	22-06-0150	Main PCBA	(1)
9	31-50-1225	Bottom Case	(1)
10	05-81-0285	N3 x 12 Philips Hd. Self-Tapping Scr.	(1)
11	05-81-0155	N3 x 16 Philips Hd. Self-Tapping Scr.	(1)
12	42-42-0910	Hold Button	(1)
13	42-42-0920	Flashlight Button	(1)
14	31-21-0040	Battery Door	(1)
15	05-81-0280	Battery Door Screw	(1)
17	23-74-0135	Input Terminals (Red)	(1)
18	23-74-0145	Input Terminals (Black)	(1)
19	22-58-0025	Input Block	(1)
21	-----	Slotted Flat Head Jaw Axle	(1)

2. Disassembly

2.1 Removal of Battery cover

- (1) Unscrew one Battery-cover-fixing screw [15] and remove the Battery Cover [14]

2.2 Removal of Panel

- (1) Set the Range Knob on the Top Case [1] to the "OFF" position.
- (2) Loosen two Bottom Case Screws [10 & 11].
- (3) Remove the Bottom Case [9].

2.3 Removal of PCB

- (1) Loosen three PCB-fixing Screws [5].
- (2) Melt the solder connecting the PCB Assembly [8] and Flex PCB jutting out from the Jaw Assembly [2] – then remove them separately.
- (3) Remove the PCB Assembly from the Bottom Case [9].

Note: Take note of the OFF position of white Selector Switch, which is installed on the PCB.

2.4 Removal of Jaws

- (1) Unscrew two Jaw-fixing screws [3 & 4] and one Jaw Axle [21].
- (2) Remove the Jaw Assembly from the Bottom Case.

3. Adjustment procedures

3.1 Required Equipments and Tools

Prepare following items for adjustment.

- a. AC current generator (capable of generating up to 10A with variable frequency range)
- b. AC voltage generator (capable of generating up to 600V)
- c. DC current generator (capable of generating up to 10A)
- d. DC voltage generator (capable of generating up to 600V)
- e. DC voltage power supply (capable of generating 100mA or more with variable voltage range between 2.2V and 3V)
- f. Standard resistor (with variable range of 6kΩ or less)
- g. Coil for current test (50 or 100 turns)
- h. Temperature generator (capable of generating output voltage equivalent to K-type thermocouple (-40°C to 400°C))
- i. Adjustor to generate simulated electric capacitance.
- j. Compensating lead with Plug for K-type thermocouple (for temperature Function adjustment)
- dia. 4 Banana plug at one end, the spec of the other end should be matched to the output terminal of temperature generator.
- k. Screwdriver for adjustment.

3.2 Adjustment procedure

- (1) Remove the Panel for current adjustment purpose only.
In case that voltage, electric capacitance and temperature adjustments are also required, remove the Panel and unscrew three PCB-fixing Screws [5].
- (2) Remove the batteries.
- (3) Connect the DC power supply and the Battery contact.
(Connect them with correct polarity. See Fig. 2)

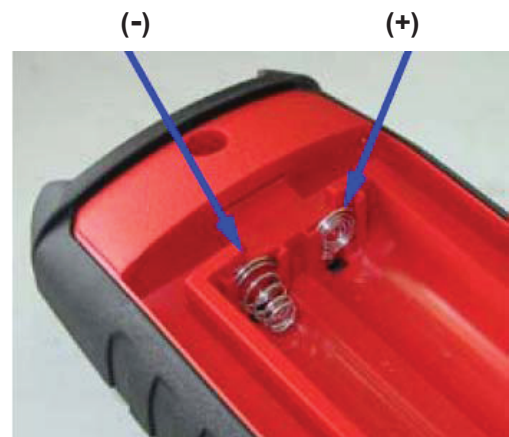


Fig. 2 Connection diagram

3.3 Current value for adjustment

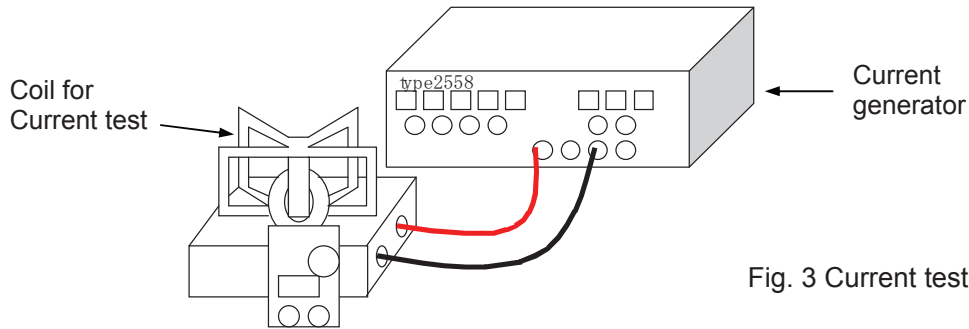
Current value for adjustment should be set according to the product of output current of Current generator and Turns of Coil. That is:

Current electric field for adjustment (A0T) =

Output current of Current generator (A) x Number of turns of Coil (Turn)

Example:

A0T	Output current of Current generator (A)	Number of turns of Coil
500	10	50
500	5	100



3.4 Check of Low Battery Warning (BATT mark)

- (1) Set the output voltage of DC power supply to 2.2V and apply the voltage to the instrument.
- (2) Rotate and set the Switch axis on the PCB to “600A” position. Then the indication on the LCD should be “AC_A” with “BATT” mark.
- (3) “BATT” mark should disappear when output voltage of DC power supply is increased to 2.4V.

3.5 DC voltage adjustment

- (1) Set the output of DC power supply to 3V and apply the voltage to the instrument.
- (2) Rotate and set the Switch axis on the PCB to “DCV” position. (Then the indication on the LCD should be “DC_V.”)
- (3) Apply DC50V to the instrument via a DC voltage generator and adjust **VR2** to indicate “49.95 - 50.05V” on the LCD.
- (4) Apply 500V via a DC voltage generator to the instrument respectively and check the accuracy of each reading.

3.6 AC voltage adjustment

- (1) Rotate and set the Switch axis on the PCB to “ACV” position. (Then the indication on the LCD should be “AC_V.”)
- (2) Short-circuit the input terminals of the instrument while stopping the output voltage from the AC voltage generator.
- (3) Apply AC10V(60 or 60Hz) to the instrument via an AC voltage generator and then adjust **VR1** to indicate “9.7-9.8V”.
- (4) Apply AC500V (50 or 60 Hz) to the instrument via an AC voltage generator and adjust **VR5** to indicate to “499.5 - 500.5” on the LCD.

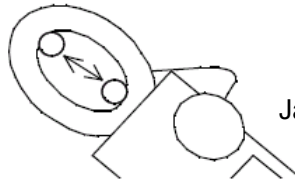
* 0 Adjustment mentioned at above (3) can be done at AC600A Function.

3.7 AC current adjustment

3.7.1 Jaw balance adjustment

- (1) Set the output of DC power supply to 3V and apply the voltage to the instrument.
- (2) Rotate and set the Switch axis on the PCB to "600A" position. (Then the indication on the LCD should be "AC_A".)
- (3) Measure a current of AC500A (A·T)/50 or 60Hz generated by the AC current generator mentioned at clause 3.3.
- (4) Adjust **VR7** and make the variation in readings, when moving the coil back and forth, should be within ± 5 counts.

Move the coil back and forth.



Jaw balance adjustment

3.7.2 AC current adjustment

- (1) Position the coil at the center of the Jaws (center of Δ mark on the Jaw Case) while Applying a current of AC500A, and adjust VR8 to indicate within "501.0 ~ 501.5A".

3.7.3 Off-set adjustment for DC current (2237)

- (1) Press the SELECT Button on the PCB once, and select "DC600A" function. (Then the indication on the LCD should be "DC_A".)
- (2) Adjust **VR8** to indicate +000.2 ~ -000.2A" with no load.
- (3) It may affect the adjustments already done according to clause 3.7.1 & 3.7.2. Re-adjustment is required.

3.7.4 Check of accuracy at 600A Function

- (1) Press the SELECT Button, and select "AC600A" function.
- (2) Apply AC10/ 300/ 500 (A·T) to the instrument via an AC current generator and check the accuracy of each reading.
- (3) (2237) Rotate and set the Switch axis on the PCB to "DCA" and select "DC600A" function.
- (4) Apply DC10/ 300/ 500 (A·T) to the instrument via a DC current generator and check the accuracy of each reading.

3.7.5 DCuA Adjustment (2236)

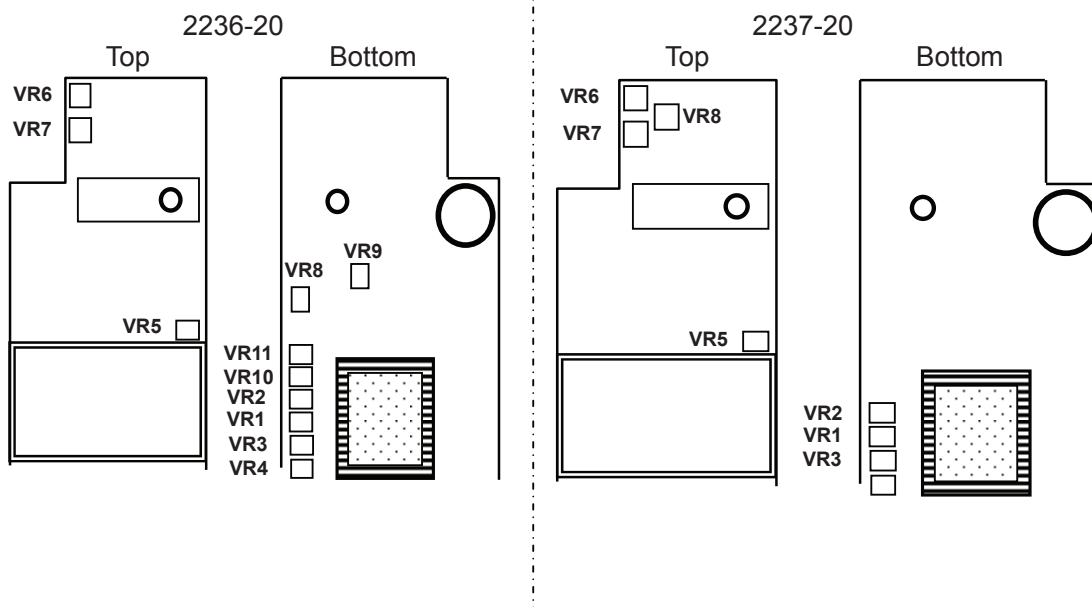
- (1) Set the Function to "DCuA".
- (2) Apply DC500uA to the instrument via a DCuA generator and adjust VR6 to indicate "500.0uA" on the LCD.

3.7.6 Electric Capacity Function

- (1) Set the Function to Capacitance. ("nF" will be displayed on the LCD)
- (2) Connect the input terminal of the instrument and the Electric capacitance generator with a test lead.
- (3) Press the ZERO Key to adjust the reading on the LCD to "00.00nF".
- (4) Output 3.0uF via the generator.
- (5) Adjust VR3 to indicate "2.998 to 3.002uF".
- (6) Output 100.0uF via the generator.
- (7) Adjust VR3 to indicate "99.8 to 100.2uF".

3.7.7 Temperature Measurement Function (2236)

- (1) Set the Function to "Temp °F/°C".
- (2) Room temperature (ambient temperature) should be displayed on the LCD.
- (3) Set the simulated temperature generator according to the output of K-type thermocouple.
- (4) Connect the input terminal of the instrument and the generator with a compensating lead. *
V/Ω terminal is positive, COM is minus.
- (5) Apply a voltage equivalent to 0.0°F to the instrument via a generator.
- (6) Adjust **VR9** to indicate "-1.0 to +1.0°F".
- (7) Apply a voltage equivalent to 200.0°F to the instrument via a generator.
- (8) Adjust **VR10** to indicate "199.8 to 200.2°F".
- (9) Apply a voltage equivalent to -40.0°F to the instrument via a generator.
- (10) Adjust **VR11** to indicate "-39.8 to 40.2°F".
- (11) Repeat the step from (6) to (10).



4. Operation check

4.1 Resistance Function

- (1) Disconnect the DC power supply from the instrument and install batteries.
- (2) Set the Function switch to "Ω" position. (Then "O.L kΩ" will be displayed on the LCD.)
- (3) Connect a standard resistor to COM and V/Ω terminals.
- (4) Vary the resistance to 600/6k Ω and check the accuracy of each reading.

4.2 Continuity function

- (1) Set the Function switch to **•|||** position. (Then "O.L Ω" will be displayed on the LCD.)
- (2) Buzzer should sound continuously when the resistance of a standard resistor is <45 Ω.
- (3) Buzzer should stop at resistance of 200 Ω.

4.3 Frequency function(2237)

- (1) Set the Function switch to "ACV" position and press the "Hz" Button once in order to shift to the Frequency function. (Then "0 Hz" will be displayed on the LCD.)
- (2) Connect the Measuring terminal of the instrument and an AC voltage generator.
- (3) Apply 40V with frequency of 50/ 60/ 400Hz to the instrument respectively via the generator and check the reading of frequency.

4.4 Current function

- (1) Set the Function switch to “ACA” position and clamp the coil to 500AT AC.
- (2) Then check that the indication of the instrument is within the range of 492.5 – 507.5 A

4.5 DC Current function (2237)

- (1) Set the Function switch to “ACA” position and press the “ZERO” Button once.
- (2) Clamp on the coil set to 500AT DC.
- (3) Then check that the indication of the instrument is within the range of 494.3 – 505.7A

4.6 DC uA function(2236)

- (1)Set the Function switch to “uA” position. (Then “000.0uA DC” will be displayed on the LCD.)
- (2)Connect the measuring terminal of the instrument and DC current generator.
- (3)Apply 500uA DC from DC current generator to the instrument,
- (4)Then check that the indication of the instrument is within the range of 494.3 – 505.7uA.

5. Trouble shooting

Symptoms	Possible Causes	Remedies
No indication when Function SW is set to a range other than “OFF” position.	Insufficient capacity of batteries	Replace the batteries.
	Poor contact at Battery Contact	Replace the Battery Contact.
	Poor contact at Function SW	Clean the tracks for the switch on the PCB. When the symptom isn't solved, replace the Sliding Contact.
	Defect of circuit component	Defect of PCB; when current consumption is about 70mA or more. Replace the PCB.
Chip of segment or indication error	Poor contact at circuit components	Poor contact between the Rubber Contact and the LCD. Disassemble and clean them.
	Defect of circuit component	Replace the PCB.
Incapable measurement at a Current range	Break in the Flex PCB for Jaws	Measure the resistance (several hundred Ω) between the input and output of Hall Element, which is installed in the Flex PCB. Replace the PCB when there is a break.
	Defect of circuit component	Replace the PCB
Inaccurate current measurement	Insufficient capacity of batteries	Replace the batteries when “BATT” mark is displayed on the LCD.
	Re-adjustment of PCB	Check above things, and if there is no problem, follow the adjustment procedure, clause 5 in this document and re-adjust the PCB.
Incapable measurement at a Voltage, Ω or Electric capacitance range	Break in Test Lead	Conduct a Continuity test for the Test Lead; if there is a break, replace it with a new one.
	Defect of circuit component	Replace the PCB
Inaccurate voltage, resistance or electric capacitance measurement	Insufficient capacity of batteries	Replace the batteries when “BATT” mark is displayed on the LCD.
	Re-adjustment of PCB	Check above things, and if there is no problem, follow the adjustment procedure, clause 5 in this document and re-adjust the PCB.

5. Trouble shooting - continued

Symptoms	Possible Causes	Remedies
Buzzer doesn't sound at Continuity function	Defect of circuit component	Replace the PCB
Incapable measurement at temperature range	Defect in Temperature Probe	Replace the Temperature Probe.
	Defect of circuit component	Replace the PCB.
Inaccurate temperature measurement	Insufficient capacity of batteries	Replace the batteries when "BATT" mark is displayed on the LCD.
	Re-adjustment of PCB	Check above things, and if there is no problem, follow the adjustment procedure, clause 5 in this document and re-adjust the PCB.
Invalid Function buttons	Poor contact at circuit components	Poor contact between the Function Buttons and the PCB. Disassemble and clean them.
	Defect of circuit component	Replace the PCB or Rubber Contact.
LED for NCVD doesn't light up	Break in the Flex PCB for Jaws	Replace the Jaws when there is a break in tracks on the Flex PCB.
	Defect of circuit component	Replace the PCB
	Orientation of NCVD LED	Adjust the NCVD LED upward.