
FLUKE187&189 Series Maintenance Manual

FLUKE187

FLUKE189



FLUKE187&189 Series true effective value digital multimeter

The maximum table count is 50000 Word and support dual display mode, support

hold AC+DC Features, DB measuring, nS Conductivity measurement, diode,

capacitance, temperature measurement, etc.! AC voltage block and AC current block

The frequency response is 100KHz

For specific measurement parameters, please refer to

187&189 User manual, not much introduction here!

Fluke 187&189 True effective value digital multimeter

First introduce 187 with 189 The difference:

187 The motherboard is in 189 On the basis of the motherboard, a memory chip (located under the LCD screen) and a farad battery are omitted

Content (located on the back of the motherboard), other places 187 with 189 It's exactly the same!

The position of the omitted components is shown in the figure below ↓

Left: Memory chip location



Right picture: Farad capacitor position



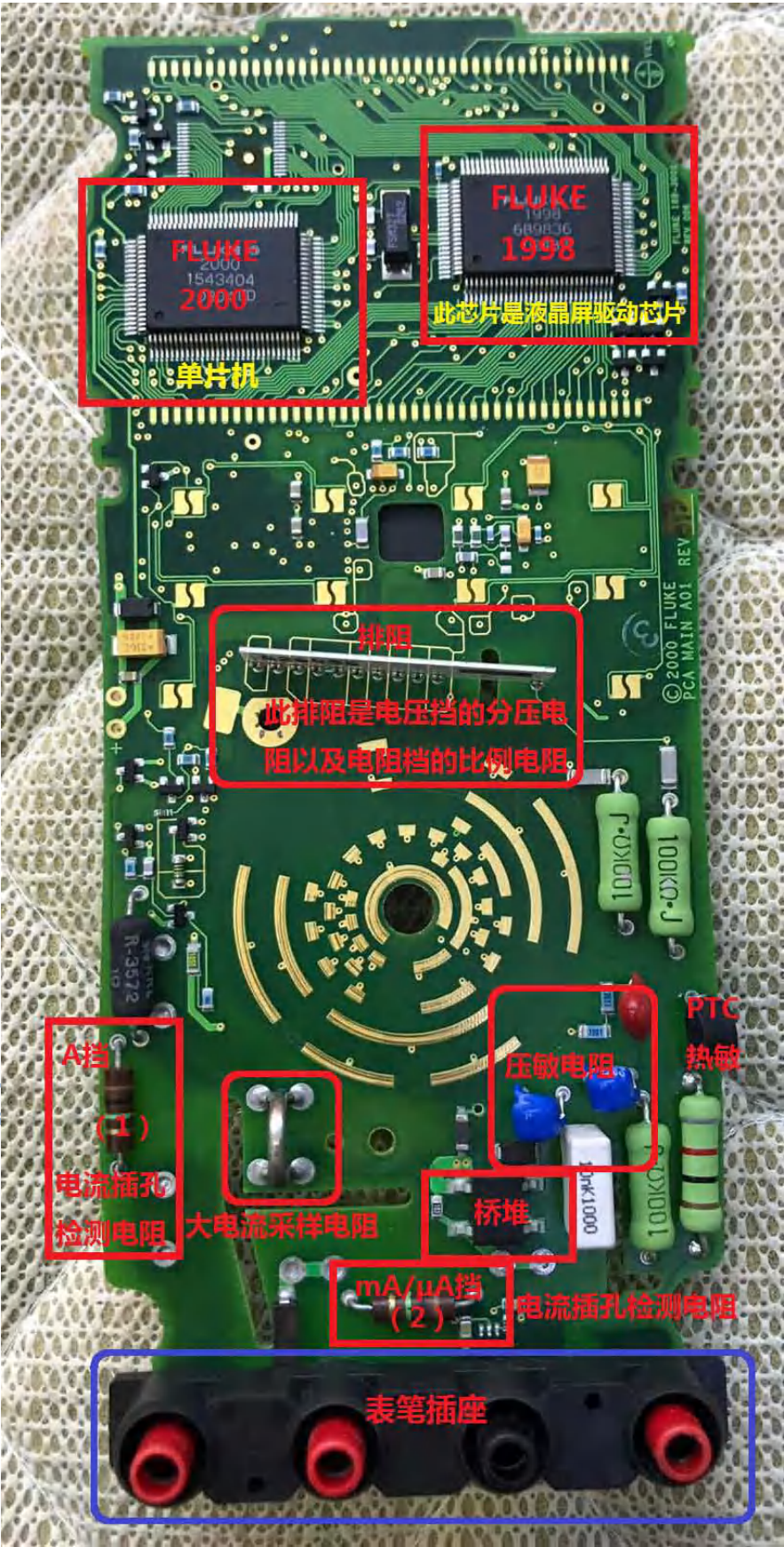
Fluke 187 with 189 Motherboard, LCD LCD screen, test lead socket, and other measurement parameters are the same, the only area

Don't lie in 189 ratio 187 One more data storage mode!

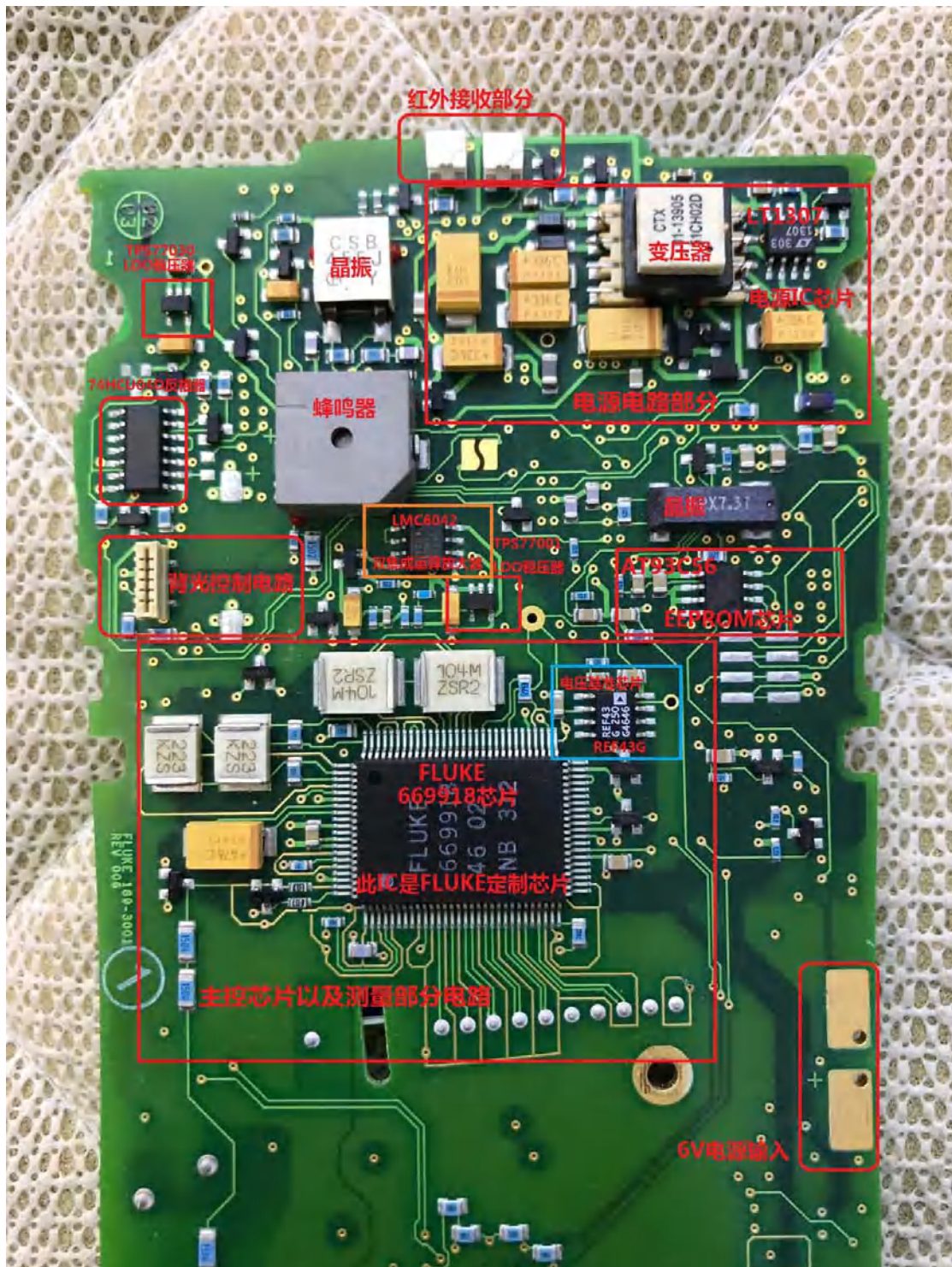
The above introduction 187 with 189 The difference between a multimeter!

Fluke 187&189 The layout of the mainboard components of the multimeter!

Front view:



back image:



The above two pictures are Fluke 187 Layout of motherboard components!

Most of the components and chips on the front and back of the motherboard have been marked

Note, fluke1998 , fluke2000 , fluke669918 These three

Chip is FLUKE Custom chips, these three chips are not specific

The models have been polished off, and these three chips cannot be found

The specific model and chip Datasheet Data sheet, so this

Once the three chips are damaged, you can only use other 187 Remove the motherboard Machine to be replaced!

Let me talk about it first 187&189 Common faults of two multimeters

The first common fault: well known 187 with 189 The common problem is that the test lead is sitting, because the test lead socket is a contact type detection structure

Yes, once the test pen sits on the inner metal piece due to foreign matter entering the test pen Sitting causes a short circuit, the multimeter will display leads And full gear alarm,

The test lead is easy to be damaged. If the test lead is damaged, it can be repaired or repaired.

For replacement, if the inside of the test lead is dirty or damp, it will leak electricity.

Causes the problem of chaotic alarm when starting up, and secondly if an error occurs

Leads The problem should also focus on checking the two next to the pen sitting

Brown resistor (this resistor is the current block detection and identification resistor)

If the fuse is damaged, an error may be reported leads You need to check

11A or 440mA The fuse has been opened for replacement!





The second common fault: 187 with 189 The motherboard is afraid of humidity, because the motherboard is 6 Floor PCB, low sensitivity and high impedance input,

Once the motherboard gets wet, it will cause PCB Board leakage, there will be a lot

Problems such as: resistance file open circuit is not displayed OL How many M The

resistance of Ω , the DC voltage range does not return to zero has a great base, the current range is

Show OL Or give the alarm randomly, the measurement error is very large, if

In the case of current leakage, the specific solution is: disassemble the entire motherboard

Come out with 95% Pour the alcohol into the container, soak the motherboard completely

Soak in alcohol container twenty four More than hours, then take it out to dry,

Why do you want to soak the motherboard with alcohol instead of brushing it with a brush

Motherboard because 187 The motherboard is 6 Floor PCB Board, once it gets

damp, a lot of through holes will also cause leakage. If you use a brush to

Middle layer PCB It can't be brushed, but if you use a container to

Soak completely, then the entire motherboard can be attached, so that

Make PCB Where there is leakage in the via or middle layer line, pass

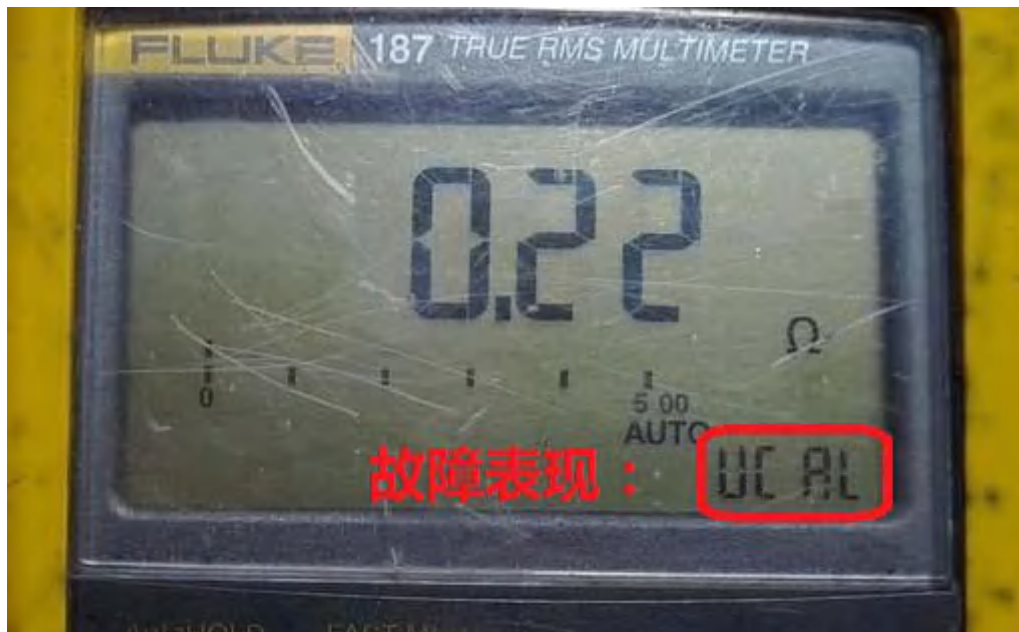
The method of soaking alcohol can also be solved.

(Pro test! The main board leakage failure caused by damp, soaking wine

High precision maintenance success rate 95%)! the above

The third common fault: calibration data error causes the multimeter to turn on

Display in the lower right corner UCAL As shown ↓



Generally, this happens, and many of them are because of the subsequent calibration

The lead seal causes the meter to enter the calibration mode, so it will prompt this

UCAL Solution, first: re-calibrate and then keep

Save to solve the display UCAL Question, second: if not

The calibration conditions can be flashed AT93C56 Internal data

To solve the display UCAL The problem(93C56 Chip is EEPROM

Chip), the data saved inside this chip is set by the instrument

Factory parameters and verification data files.



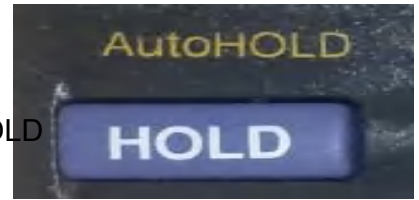
The fourth common fault: LCD The LCD screen displays missing strokes or too many

Strokes, if there are multiple or few strokes, troubleshoot first

LCD Whether the LCD screen is damaged, test LCD The specific

operation of whether it is damaged: hold down while turning on HOLD

button.



Under normal circumstances, the screen should light up all the pen segments, such as

If you find that some pen segments or symbols or analog segments are not displayed,

It is possible that the LCD screen is aging and disconnected, causing some symbols to fail

Display, it may also be conductive glue and LCD screen and motherboard gold hand

Poor contact between the fingers, oxidation of the gold fingers on the motherboard will cause pen lac

The phenomenon of painting or multiple strokes!



The normal display should look like this:



LCD screen, conductive glue, golden fingers, poor contact or oxygen

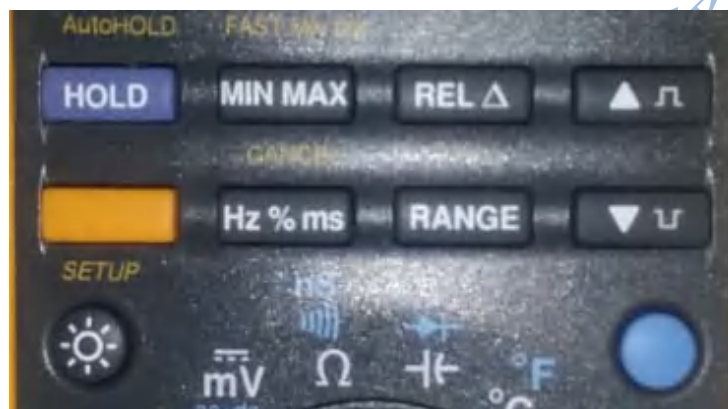
Change will lead to missing strokes or multiple strokes, the turntable touches

Poorness can also cause problems such as abnormal display and abnormal shifting.

Another common fault is 187 The common problem of the buttons, in the frequent use

used 187 Most of the problems in the table are the buttons

Will fail.



There is a key failure problem, which may be PCB Contact not touching

Good and oxidation cause the button to fail, or it may be conductive

The aging of the glue contact causes the button to fail, if it is PCB Contact contact

If it is not good, it can be solved by cleaning, if it is conductive adhesive for buttons

Aging, can be replaced directly!



The fifth common fault: also Fluke 189 The common fault is

Farad capacitors are prone to rust and leakage.

As shown in the figure below: ↓



Fluke 189 Rust and corrosion of farad capacitors can cause 189

The system time of the multimeter will be reset if it cannot be maintained after a power failure.

Secondly, if this farad capacitor leaks, it will lead

After the multimeter is turned off, the power consumption is large, and the whole machine is working

In the case of high flow, the maintenance method is also very simple and replace it directly

Or you can remove it and use it, FLUKE189 This farad

If it is removed, it will not affect the normal use of the measurement function

, Only after disconnecting the battery power supply, the system time and storage

The stored data cannot be saved, which is 189 A small pass

disease.

The above-mentioned faults are for Fluke 187&189 Two multimeters

The common faults are introduced and the solutions are

Obstacles are prone to problems on these two watches!

Let's introduce Fluke 187 Each gear of the multimeter displays normally

Reading when showing:

The first gear after turning on is the AC voltage gear, which is ACV block

1 : ACV The normal display should be 0.0028-0.0034 Left and right

Reading, this is the reading in an environment away from electromagnetic radiation. communicate with

The voltage block has a bottom number. This is a normal phenomenon, because Fluke 187

Is a true effective value multimeter ACmV Normally, there is a base.

ACV Normal display:



2 : DCV It should be displayed when the test pen is not inserted normally 0.0000

The number of jumps may occur at the end (0.000X) If out

If the base number or reading is too large, it can't be reset to zero after short-circuiting the test leads

The meter is faulty.

DCV Normal display:



3 : Ω block (electric barrier) normal display should be OL Readings,

If two test leads are open, and the display 1M Reading above Ω

Number, it means that the meter is faulty or the main board is

Hole leakage!

Ω resistance file is displayed normally:



4 : Capacitor block normal capacitor block should be displayed 0.068nF Left and right

Capacitance value, the bottom number of this capacitance block is the distribution of the instrument i

Capacitance, has no effect on normal capacitance test, if you want to test

The small capacitance prevents this base number from affecting the measurement results.

To use REL The relative value model will nF The base number of the stage is

cleared to enable small capacitance measurement.

Normal display of capacitor block:



5 : Temperature block ($^{\circ}\text{C}/^{\circ}\text{F}$) normal display should be OPEN Will two

The meter will display a temperature reading if only the test leads are shorted.

The temperature can be measured by inserting the electric couple (temperature probe) into the meter

The temperature block is good.

Normal display of temperature block:



6 : Current block (A , mA , M A) The normal current is blocked without the meter

Case of pen A with mA And μ A All three files should be displayed

LEADS , If it shows leads And Dididi called the police and said

It shows that the meter is faulty or the test pen is sitting wrong!

A , mA , M A Normal display:



FLUKE187&189 Repair of digital multimeter circuit failure:

1. No power on (no power on) fault repair:

(1) First check 6V Is the power input normal?

Whether the pool is installed correctly, four sections are used

1.5V Battery series configuration 6V Voltage input)

(2)an examination 6V Voltage source input anti-reverse protection

Whether the diode is broken down, and whether the tantalum capacitor is short

road!



(3) Check whether the tantalum capacitor of the power circuit part has a bias

Low or short circuit conditions, power on and test several tantalum capacitors

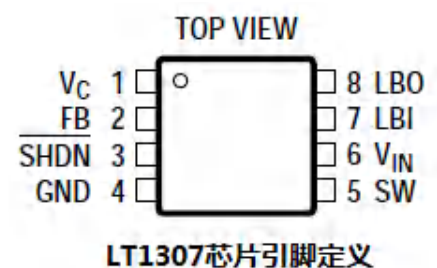
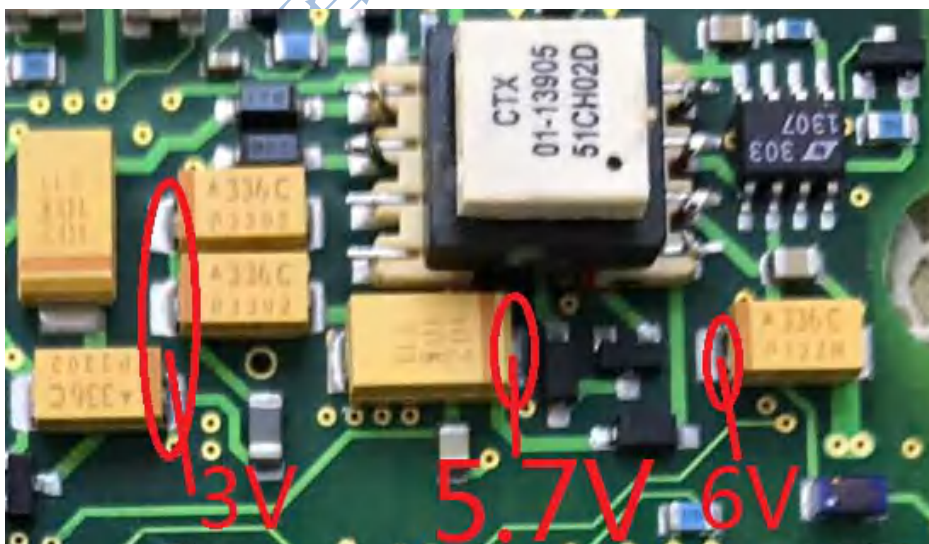
The voltage above must have 3V , 5.7V , 6V After several sets of voltages

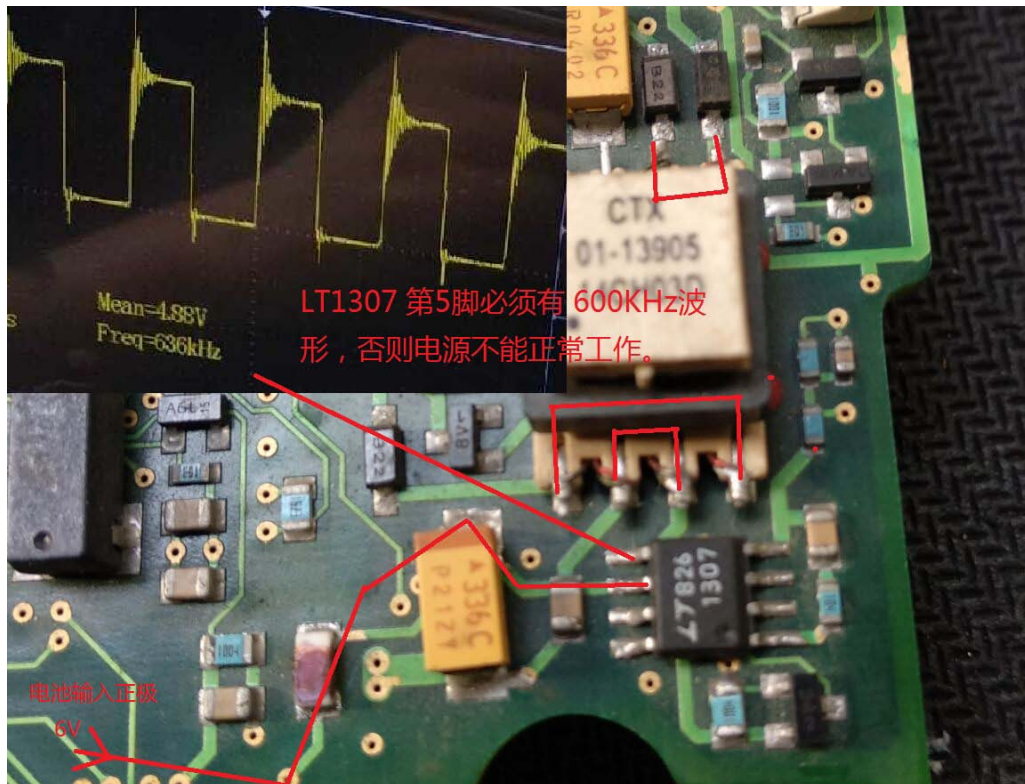
are generated, these sets of voltages should be measured normally, such as

If undetectable, need to check LT1307 First 5 foot SW

With or without 600KHz If there is no waveform, then

1307 Damaged, the subsequent voltage cannot be generated.

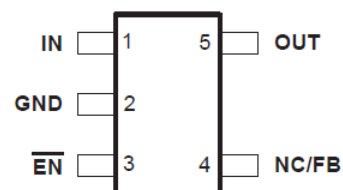


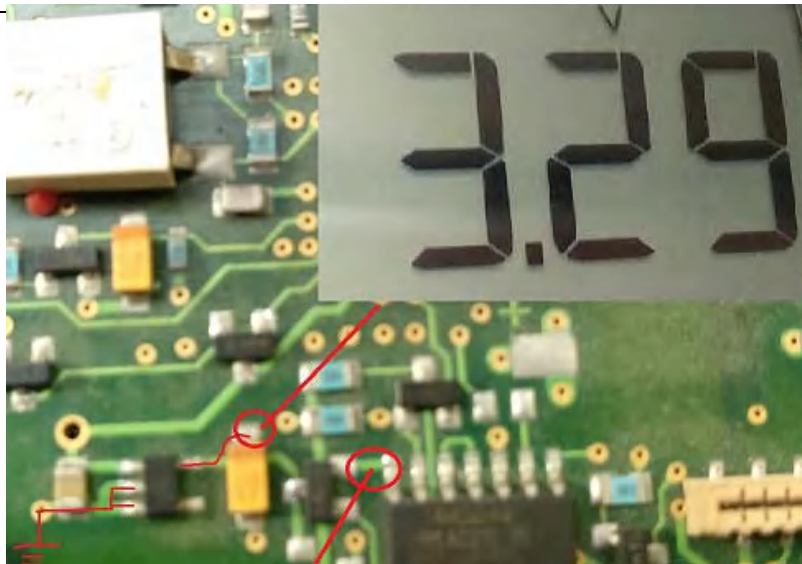


The picture above is LT1307 First 5 foot SW The waveform on the pin.

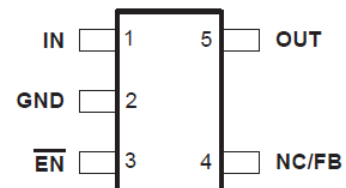
in LT1307 When the power circuit is normal, tantalum capacitors also have
Several voltage outputs are generated, then you need to measure two
LDO The output voltages are 3.3V , 5V Two sets of power supply.

First LDO Model is TPS77030 The output voltage is 3.3V give
Power supply for the rear chip!





the second LDO Model is TPS77001 The output voltage is 5V After giving
Chip power supply!



2. Failure repair of DC voltage block not working normally:

The measurement error of the DC voltage block is large and cannot be measured (no reading)

(1) The measurement error of DC voltage file is large: DCV Stop appearance measurement

If the error is large, first make sure that your measured object is standard.

Secondly, if the measurement is not accurate, check whether the meter

Insufficient battery voltage leads to large measurement errors due to undervoltage.

Excluding the above two conditions, it is necessary to focus on the main control

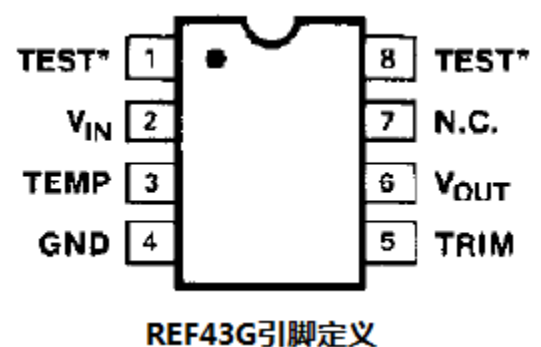
(FLUKE669918 Chip) reference voltage generating circuit.

The reference voltage of the main control chip is generated by a

REF43G Reference voltage chip generated 2.5V Reference voltage, if this chip is

damaged, it will cause measurement errors in AC and DC voltage files

Great difference!



REF43G This voltage reference chip is very important, its performance

Good or bad directly determines the accuracy of the instrument.

(2) The voltage divider (exclusion) resistance problem causes the voltage measurement error

Great difference!

The multimeter needs to use the divided voltage when measuring higher voltage

The resistance divides the voltage proportionally to obtain a higher voltage measurement range.

Range, so once the voltage divider circuit fails, it will also cause the voltage

The problem that the gear cannot be used or the measurement error of the voltage gear becomes large

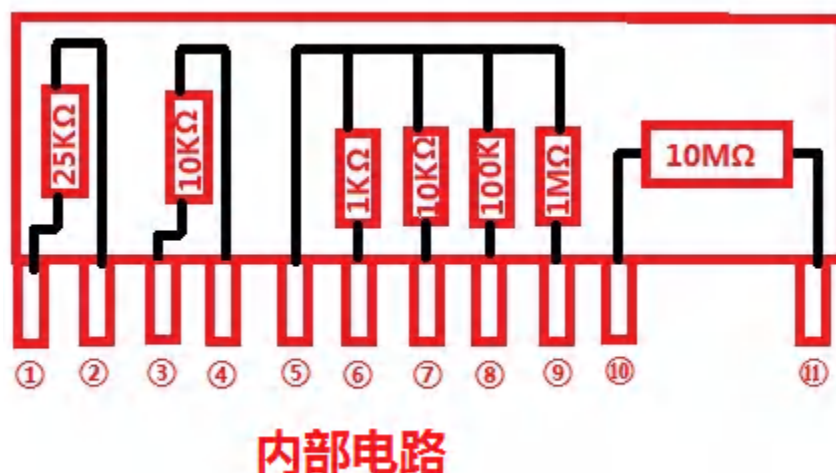
Fluke 187/189 The voltage divider resistor uses exclusion

The order of the pins is as follows:

Physical map:



Internal circuit:



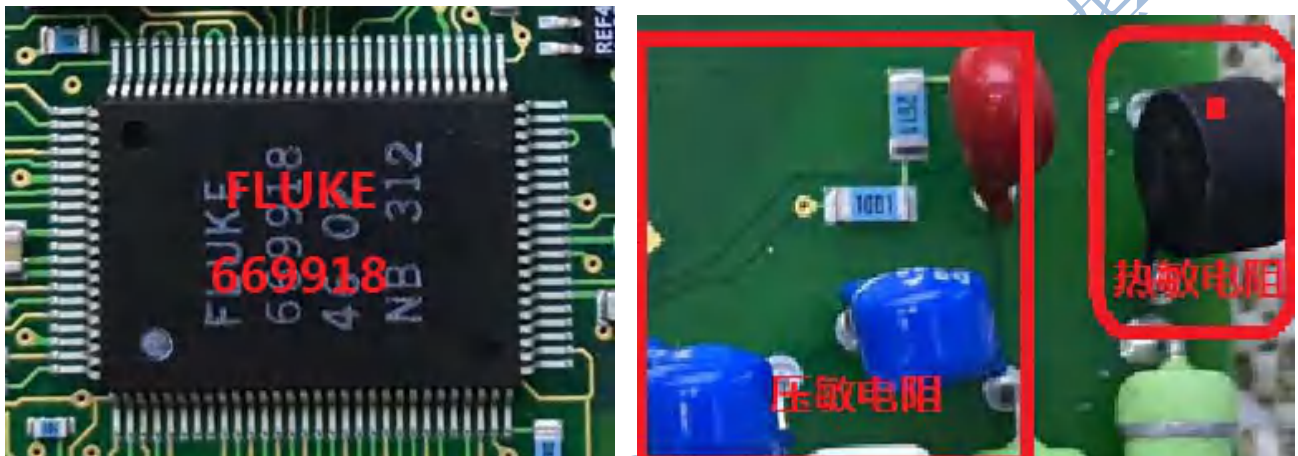
(3) Other problems cause the DC voltage file to not work normally:

Eliminate the problems of the above reference voltage circuit and the voltage divider circuit

The problem, if the DC voltage block still cannot be used normally, the key

Check the resistance of the input circuit (thermal, pressure sensitive, etc.)

And the master chip (FLUKE669918)



Input the resistance of part of the circuit, thermistor, varistor, etc.

If the parts are damaged and open circuit will affect the voltage measurement, the input part of PCB The broken wire of the copper foil will also affect the normal voltage block

Use, followed by FLUKE669918 Damage to the main control chip will also

The voltage block cannot be used normally because A/D The conversion chip is

R G(669918 Chip) internal.

The problems of unusable DC voltage block and large measurement error are as above

In general, there are only a few points: reference circuit, voltage divider circuit,

Input circuit, inside the main control chip (A/D Circuit).

3. Maintenance of failures in which the AC voltage block cannot be used:

AC voltage block measurement error is large, can not be measured (no reading)

(1) : If the measurement error of AC voltage block is large, please refer to the above

The method of DC voltage block error is large, first check the base

The quasi-voltage generating circuit is REF43G The quality of the chip, its

Second, check whether the resistance of the voltage divider in the voltage divider circuit is positive

Normally, if the measurement error of the AC voltage block is large, then

The DC gear also has a large measurement error, most of which are reference voltages.

Caused by the road.

(2) : AC voltage can not be measured (no reading) :

AC voltage can not be measured and displayed 0.0000 Or show OL

Exclude some components of the input circuit (coupling capacitors in the input circuit

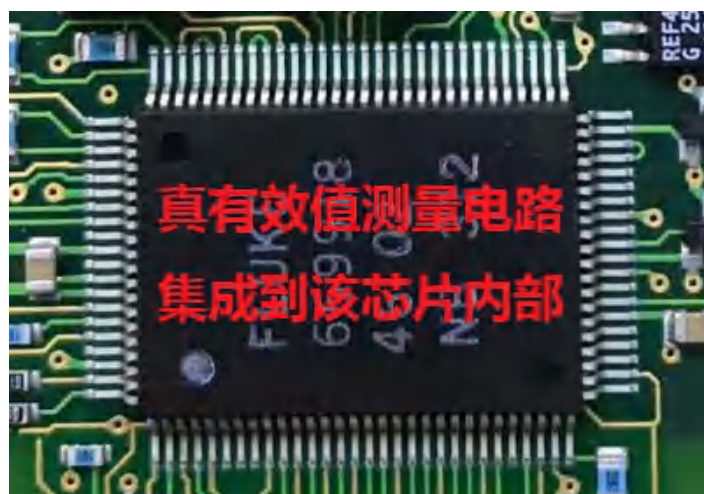
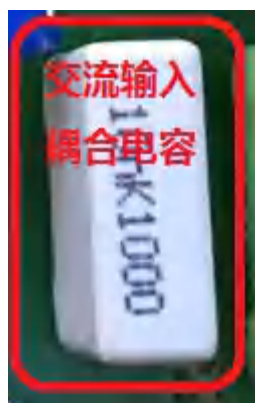
Damage can also lead to inability to measure) Direct inspection (FLUKE669918

Chip) because the true effective value conversion circuit is integrated into 669918 core

Inside the film, so if the AC block fails, most of it

The internal circuit of the chip is damaged and can only be replaced 669918

Chip to solve!



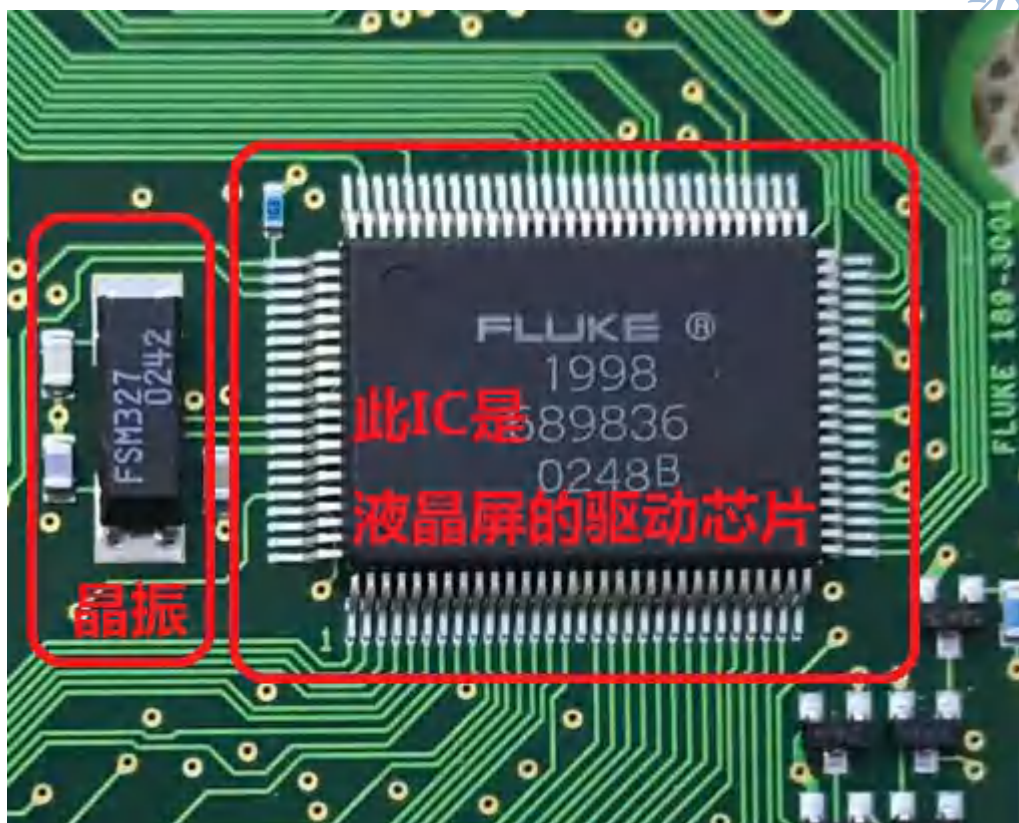
Four, the failure maintenance of the multimeter's abnormal display:

The multimeter can be turned on normally but does not display, or the display is incorrect.

If it can be powered on normally but the display is incorrect or not displayed, you should

The focus should be on the LCD driver chip 187 Using alone

Stand up LCD Driver chip (FLUKE1998) As shown below ↓



This chip is the LCD driver chip, if the power supply of the chip and nearby 32.7KHz Abnormal crystal oscillator will cause the chip to fail

Normal work, if the chip does not work normally, the display will

Will not be displayed or displayed incorrectly.

If the power supply and clock signal of this chip are normal, it still shows

There is a high probability that the chip is damaged.

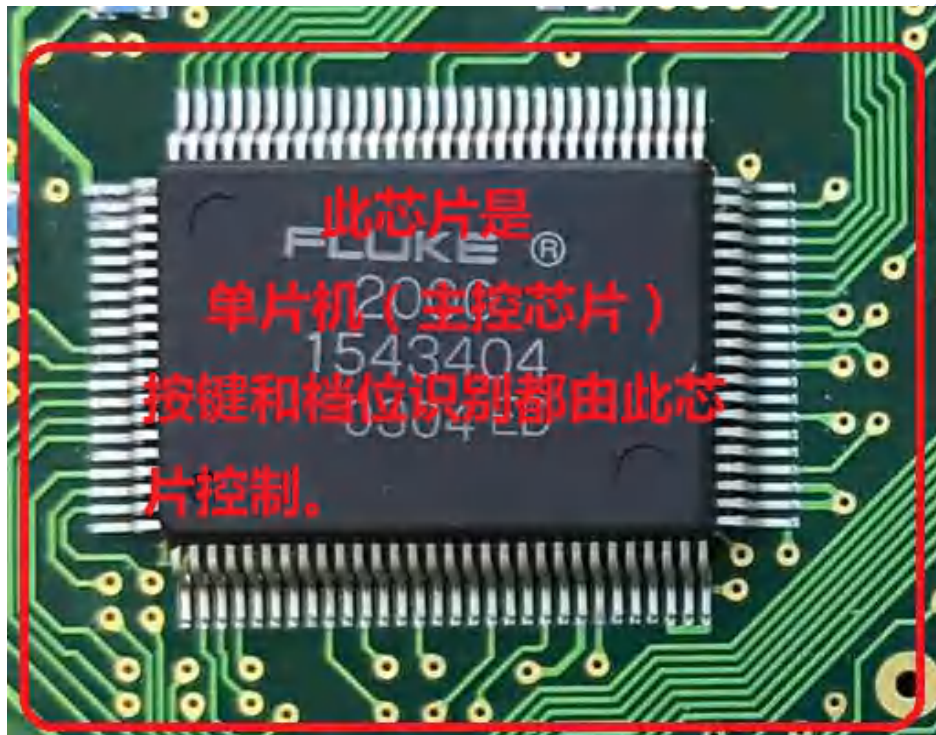
question. Replace this chip to solve the malfunction that cannot be displayed normally!

5. Failure maintenance of function buttons and gear wheel control failure:

The multimeter can't identify the gear, and the function buttons can't be pressed.

Key conductive switch and turntable V The problem with the film, the fault should appear

On the main control microcontroller, which is at the bottom of the screen (FLUKE2000)
chip!

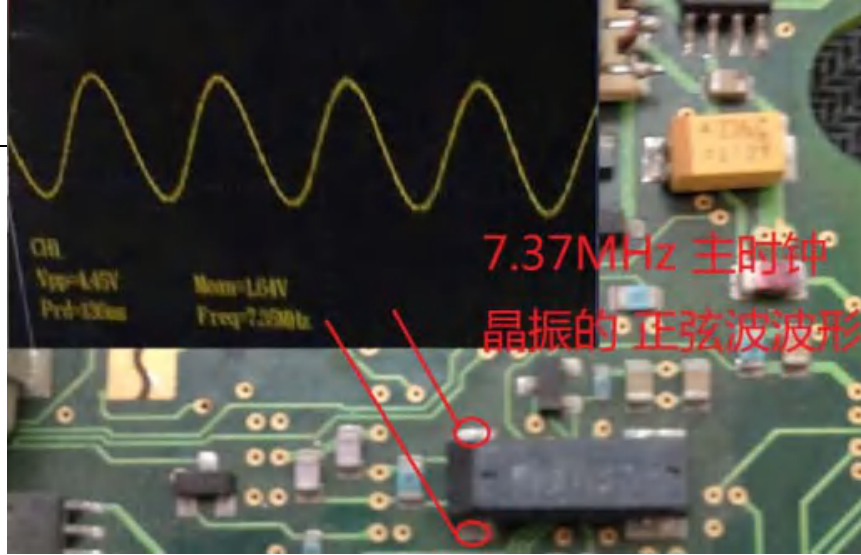


This chip (FLUKE2000) Is the master of the microcontroller (master control chip)

The main role is to control the function buttons, turntable gear recognition, and

According to communication, signal processing, etc.!





this 7.37MHz The crystal is (FLUKE2000) The main time of the microcontroller Zhong Jingzhen, if this crystal is damaged, the microcontroller will not work properly jobs.

6. Solutions to the buzzer not ringing:

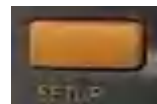
Under normal circumstances, the buzzer itself will not be damaged, mostly because

The buzzer is turned off in the system settings, so the buzzer is caused

No sound, you can basically solve the problem by turning on the buzzer in the settings question!

Steps to turn on the buzzer:

First press the yellow button (SETUP)



Then press the backlight button



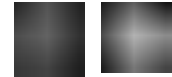
The screen will show BEEP (This option is the buzzer option)

as the picture shows:



Below SET will NO change to YES Save it! Change by backlit

button and blue button YES/NO



Under normal circumstances, the buzzer can sound after changing the settings.

Seven, Ω electrical barrier cannot be tested, and the open circuit is not infinite (OL)

Electric barrier cannot be measured and displayed OL , First of all, we must determine the test

Whether the test leads are in poor contact, or the internal

To. Secondly, check whether the test lead jack is in poor contact and the jack is disconnected.

Welding causes the electric barrier to be unable to be tested, and eliminate the above problems.

It may be that the exclusion is damaged or open.



because 187/189 The electrical barrier of the multimeter is measured by the proportional method

Resistance, the quality of this exclusion will directly affect the function of electrical barrier

And accuracy, so once there is an open circuit in this exclusion

It will cause electrical blocking of a certain range or several ranges cannot be used

Case!

The input circuit part, input resistance, and thermistor

Or damage to the varistor will cause the electrical barrier to fail

use.



8. Maintenance of current block failure:

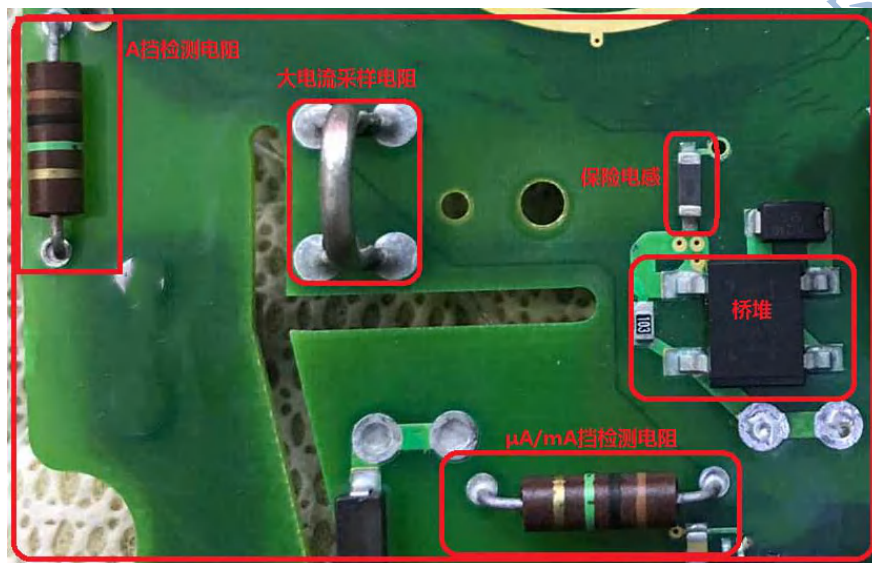
The current block is detected by inserting the test pen into the socket to identify the gear.

Once the detection circuit fails, the current block will also be abnormal.

Two brown ones in this picture 1M Resistance is the detection of current block

Do not resist. If the two resistors are damaged or leaking, it will cause current

The block cannot be tested or cannot be identified.



The clamp protection circuit composed of bridge stack and diode is to prevent use

The current jack to measure the voltage will cause the meter to burn, if the bridge stack and the diode

After the tube is broken down, the current gear cannot be used.

Damage to the sampling resistor and shunt of the current block will also cause current

The gear cannot be measured and the measurement error is large.



Fluke 187&189 The role of each chip is introduced:

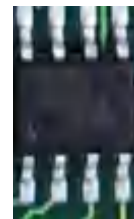
1 : LT1307 (600KHz PWM DC/DC Converter)

This chip is the control chip of the power circuit.



2 : AT93C56 (EEPROM Memory)

The internal storage of this chip is the factory
Calibration data and configuration files.



3 : LMC6042 (Low power consumption CMOS Dual operational amplifier)

This op amp is used as mV Preamplifier

Provide signal amplification of voltage block.



4 : REF43G (Voltage reference chip)

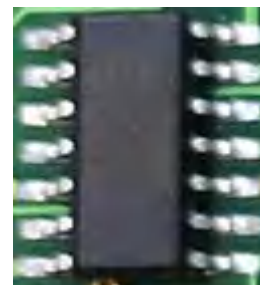
This chip is provided to the main control chip



(FLUKE669918)Internal A/D Chip reference voltage.

5:74HCU04D (Inverter logic circuit)

This chip is used in the display driver circuit.



6 : TPS77030/TPS77001 (LDO Low dropout regulator)

Two LDO The chip is used as a power control chip.



7 : (FLUKE669918) Custom front-end chip.

This front-end chip integrates: A/D Conversion circuit, really effective

Value measurement circuit, analog electronic switch, function measurement, etc.



8 : (FLUKE1998) LCD LCD driver chip.

This chip is also a custom chip whose main function is to drive the display

Screen display.



9 : (FLUKE2000) Single chip microcomputer (master control chip)

This chip is a custom chip mainly responsible for button control and gear

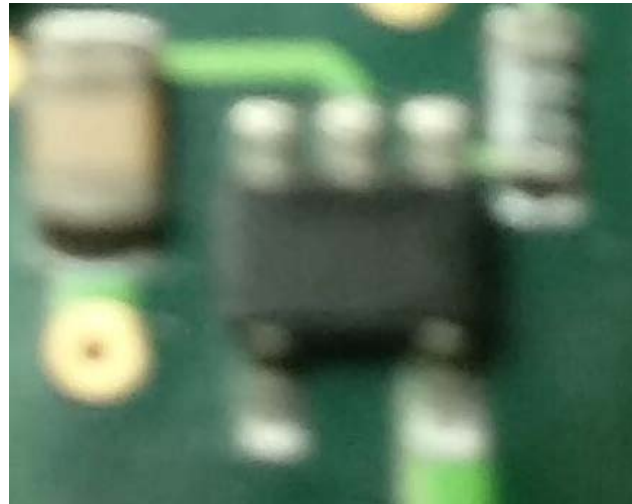
The function recognition of the turntable, as well as signal processing, data communication, etc.



10 : TMP36 Temperature Sensor.

Sit near the pen 5 Pin chip, responsible for temperature measurement

Sensor chip. Damage to this chip will cause the temperature profile to fail.



Free to buy this repair manual:

The following content↓

The following contents are: user manual, calibration manual, check number

according to(EEPROM), several chips on the motherboard PDF Document.



74HCU04D (反相器)



AT93C56(福祿克 187校验数据)



AT93C56A(EEPROM芯片)



FLUKE187、189 真有效值多用表使用手册



FLUKE187、189 真有效值多用表校准手册(中文版)



LMC6042(双运放)



LT1307(电源芯片)



REF43G(电压基准芯片)



TPS77001(LDO芯片)



TPS77033(LDO芯片)