Chapter 1 The General Description

LQ-9101 is a compact LCR measurement instrument that uses the principle of free axis impedance measurement, VI parallel processing, and modern components. It has the characteristics of small size, light weight, high precision, low power consumption, and fast measurement speed. It is suitable for electronic test, design, electrical maintenance and other occasions to facilitate rapid measurement and analysis of component performance.

1.1 Basic Performance

Measurement Source Frequency 0Hz(DC) 100Hz 120Hz 1000Hz 10KHz Error ±100PPM
Voltage DC: 0.56V±5%
    AC AC RMS: 100mV 300mV 600mV ±5%
Internal Resistance AC DC Constant 100Ω ±5%
Basic Accuracy ± Reading × 0.2%
Measurement Display Range
    Resistance 000.0 mΩ—1000 MΩ
    Q: 0.000—9999 D: 0.0000—9999.9 θ: -180.00°-- +180.00°
Minimum Resolution
    Rs/Rp/Z 0.1 mΩ
    100Hz120Hz 0.1P 0.1uH
    1000Hz 0.01P 0.01 uH
    10KHz 0.001P 0.001uH
Display Valid Digit
    Measurement Status Four Valid Digit
    Test Status Five Valid Digit
Display
    Window 43×29 mm Effective Display Area 37×23 mm
    LCD128×64 Automatic Backlight
    Update Frequency 3.75Hz
Measurement Terminal
    Body Built-in Spring Clip jack: Direct measurement
    of the external test socket: Suitable for Φ3.5mm stereo headphone plug test line
Measurement connection method
    Body reed clip jack: Four-wire mode
    External test line: Four-wire mode
measurement result display and model
    resistance, inductance, capacitance , Q value, D value, phase angle
    Ls(Cs)-Rs-Q model, Lp(Cp)-Rp-D model, Z-θ model
measurement time
    from the of the measured component, the main parameter is about 1 second parameter ≥1 second
power supply and a charging
    Set 3.7V / 450mAH rechargeable polymer lithium ion battery

normal operating voltage of > 3.5 ± 0.1V when the normal operating voltage of the bridge is lower than the boot can not be

Charging power supply DC5V, Φ 3.5mm inner and outer core plugs, inner + outer - charging time of about 2 hours

The power consumption of

the power consumption of maximum27mA (dark ambient backlight automatic adjustment of the brightest, non-test state)

Basic operating current 23mA (light environment backlight automatically adjust the most Dark, non-test state)

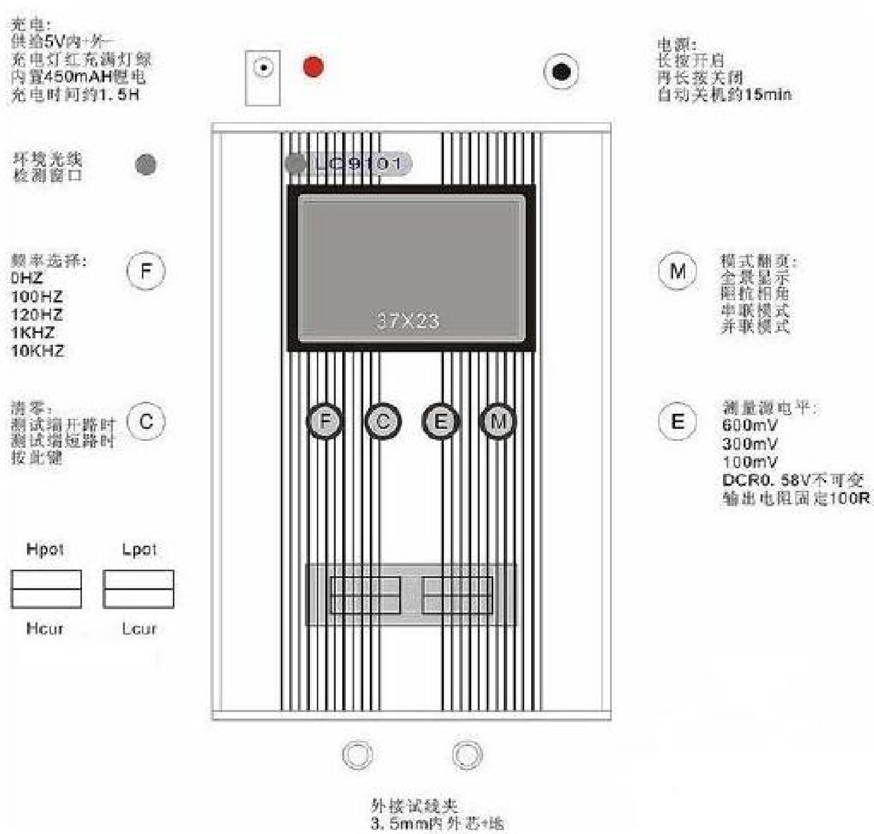
Power OFF state consumption < 1uA Automatic shutdown time

15 ± 2 minutes, automatic shutdown pre-reminded time 1 minute The maximum size and weight of the whole machine 103 × 69 × 24 mm 180g

1.2 Panel function configuration

shown in Figure 1 Each functional part of the instrument (charging jack, charging indicator, power switch on the top side, and external test cord outlet on the lower side)

Fig. 1



1.3 Display interface description

Figure 2 shows the integrated display interface. The content description is shown in the figure.

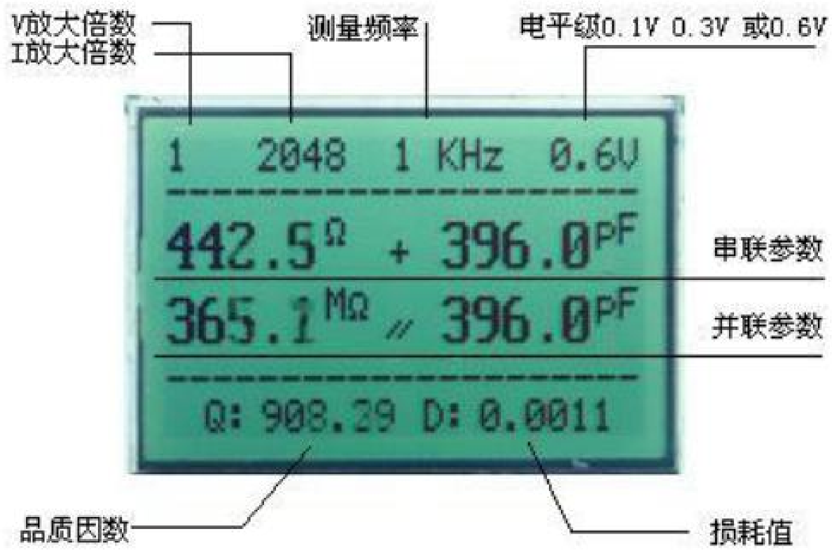
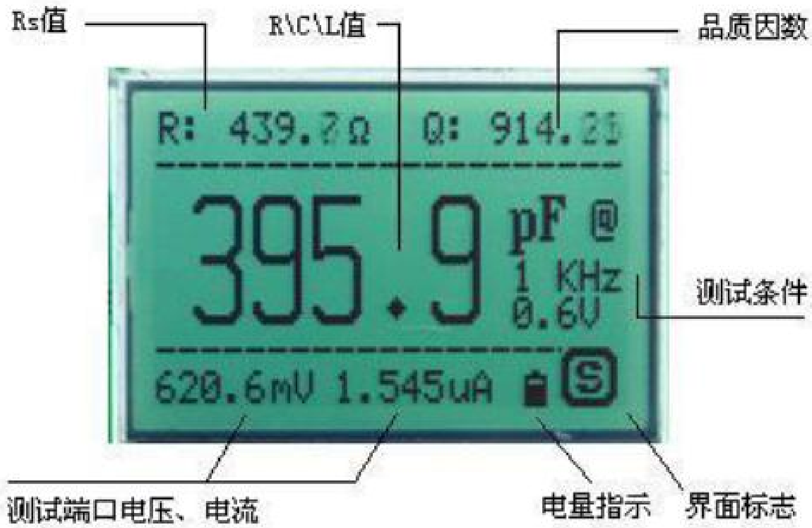


Figure 2

Figure 3 is the Z-θ display interface, and the interface mark is the lower right corner □Z. For the description of the content, see the

figure 3

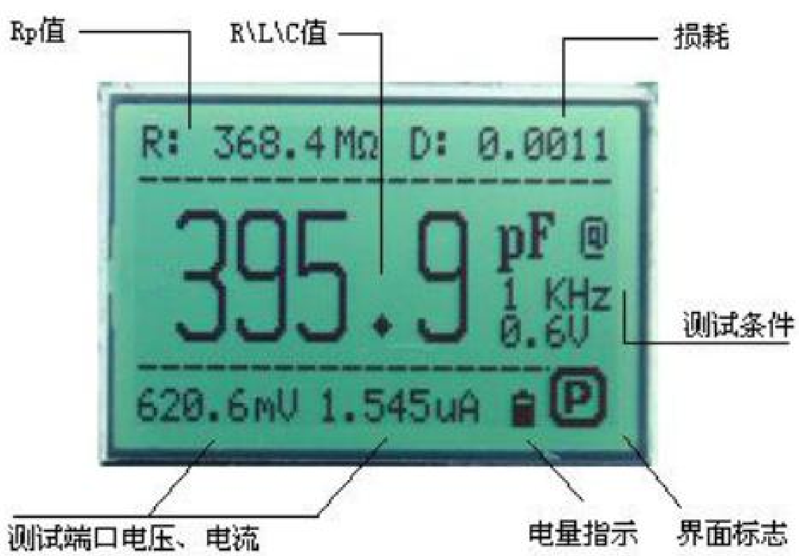
FIG 4 is a tandem parameter interface, the interface is marked as the lower right corner □S, see figure Description



4

5 is parallel parameter interface, the interface is the lower right corner flag □P, illustrated5,see Description

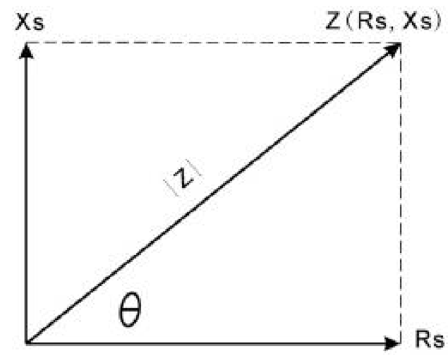
in FIG.



Complex Impedance and Equivalent Circuit

2.1 Complex Impedance Parameter Description

The measured component impedance can be regarded as the complex value of a series model, ie the real part resistance Rs and imaginary The series of reactance Xs is represented by the vector diagram 6 .



$$Z = Rs + jXs \qquad Rs = |Z|COS(\theta) \qquad Xs = |Z|SIN(\theta)$$

$$|Z| = \sqrt{Rs^2 + Xs^2} \qquad \theta = TAN^{-1}(Xs / Rs)$$

Figure 6

Xs can be either capacitive reactance or inductive reactance, related to frequency f

$$XC = 1 / 2\pi f\ C \qquad XL = 2\pi f\ L$$

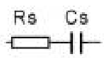
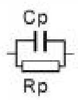
2.2 Equivalent parameter description

For impedance Z, the series equivalent of the series model can be used. Z = Rs + jXs

The expression of can also be expressed by the parallel equivalent parameter Z = Rp || jXp of the parallel model. The form is different but |Z| and θ are the same, ie the two models are equivalent.

In the equivalent two models, the relationship between the parameters Rs and Rp, Xs and Xp, and the quality factor Q or loss factor D is shown in Fig. 7. In the figure, F is the frequency.

The conversion relation described in the chart is for reference when the user understands it, and the bridge directly outputs the corresponding parameter in different display modes without user conversion.

	等效形式	品质因数损耗因数	换算关系
L	 Rs Ls	D = 1/Q =Rs / 2* π *F*Ls	Lp = $(1+D^2)*Ls$ Rp = $Rs*(1+D^2)/D^2$
	 Lp Rp	D = 1/Q =2* π *F*Lp / Rp	Ls = $Lp/(1+D^2)$ Rs = $Rp*D^2/(1+D^2)$
C	 Rs Cs	D = 1/Q = 2* π *F*Cs*Rs	Cp = $Cs/(1+D^2)$ Rp = $Rs*(1+D^2)/D^2$
	 Cp Rp	D = 1/Q = 1 / 2* π *F*Cp*Rp	Cs = $(1+D^2)*Cp$ Rs = $Rp*D^2/(1+D^2)$

7

Part III describes testing accuracy

3.1Ae accuracy of impedance regularity as shown in FIG.

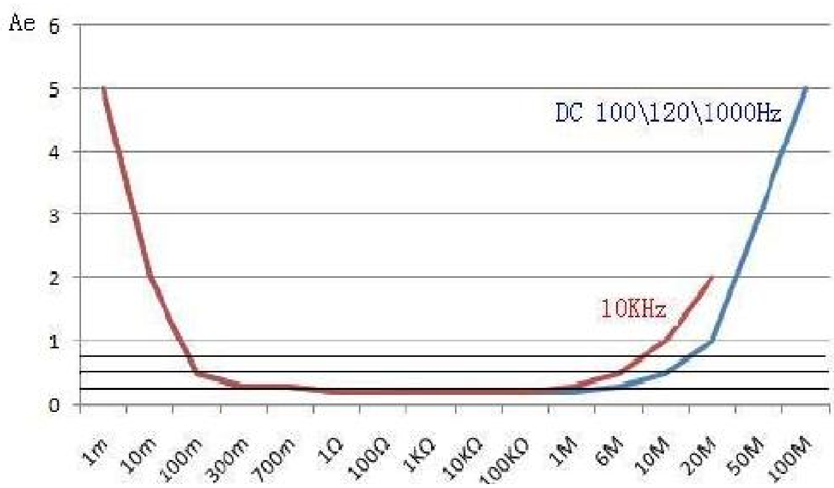


Figure 8

The accuracy of L, C, in addition to the impedance, also relates to D (or Q):

Ae(LC) = Ae *√(1+ D^2)

When D<0.1, Ae(LC) ≈ Ae

the accuracy of R, in addition to impedance, is also related to D(or Q):

Ae(R) = Ae* *√(1+ Q^2)

When Q<0.1 In the case of Ae(R) ≈ Ae

DC, Q can be considered to be infinitely small, ie equal to Ae

D. Accuracy

De = Ae/100 ---- Condition D<0.1

De = (1+D)*Ae/100 -- - Condition D> 0.1

Operation and use of the fourth part

Warning: When measuring, should avoid the external signal, DC voltage is added to the measuring mouth, prevent the bridge from damaging.

4.1 The charging

bridge has a built-in 450mAH polymer lithium-ion battery. The charging interface is a 3.5mm DC socket. Input 5V DC power, the positive pole of the core, through a random USB to DC charging cable, can be connected to the computer USB port to charge, you can also use a mobile phone charger with USB charging output, charging treasure and other charging power. The charging indicator red indicates charging and green indicates charging is complete.

After the built-in rechargeable battery is fully charged, the accumulated time for the use of the bridge for normal measurement is not less than 8 hours. Allows the bridge to be used while charging, without affecting the stability and accuracy of the measurement.

4.2 startup and shutdown

bridge supply controlled by a key. Long press the key, the built-in buzzer "drip", turn on, and then long press the shutdown. The bridge power supply has an automatic shutdown feature. The typical automatic shutdown time is 15 minutes. The built-in buzzer one minute before the automatic shutdown prompts two short “drip” sounds to remind the user that the user is about to shut down. If you do not want to shut down, press the power control button briefly. The buzzer will beep once, this time the automatic shutdown will be eliminated, the automatic shutdown time will be re-timed, and the state will continue to be turned on. After power on, the display is on, the word “WELCOME” appears, and the copyright information appears. Then it enters the measurement state.

4.3 Clearing the Short Circuit and Clearing the Open Circuit

4.3.1 Clearing the Basic Description

Bridge ○ The key is the short-circuit clear and open-circuit clear control keys, which share one key. When the test port is short-circuited or open-circuited, the short-circuit impedance is not zero due to the effects of the hardware's own parasitic parameters, and the open-circuit impedance is not infinite, but there is a certain parasitic impedance. Typical parasitic impedance values are several mΩ or less at short circuit, tens of MΩ or more at open circuit, and when the device under test is at mΩ and MΩ level, the parasitic impedance will affect the accuracy of the test results (non-low-end and high-end The measured impedance is less affected by spurious impedance. Therefore, it is necessary to make the short-circuit clear and open-circuit clear once for different frequencies.

The allowed thresholds for the bridge are as follows:

Short circuit clear <100mΩ;

Open circuit clear, frequency 1KHz and below> 10MΩ, clearance

10KHz > 5MΩ. Clearing the impedance value outside the threshold does not work.

When measuring with a local jack, an external Kelvin clip, or an external table pen, it is necessary to clear this connection mode. After the clear operation, the clear data with the conditions of the current measurement method and the test level level* are saved. When the measurement is still done in this way, it is not necessary to clear each time; when changing the measurement connection mode, the data must be cleared again. Zero operation.

4.3.2 Zeroing the local measurement connector to clear theshort circuit:

Insert the shorting piece (or a good conductor) into the body socket to confirm that the connection is good. When the display is stable, press ○C and the series parameter is zero or minimum. 0.XXXmΩ+ 0.000uH.

Open circuit clear: open the socket, without inserting any components. When the display is most stable, press ○C. The parallel parameter is the largest and the display is >1000MΩ// 0.000P.

4.3.3 Kelvin Test Clip Clear

When using the Kelvin clip measurement method to clear or measure, the two test wires should be stranded. This approach helps to reduce the uncertainty of the test line's parasitic parameters due to changes in the attitude of the test line. Sex, especially when measuring low impedance or high impedance, should be twisted. For intermediate impedance, stranding is not so important.

Specially pointed out that when the two clips of the Kelvin clips are snapped to one another and are short-circuit-cleared, attention should be paid to following the order of the terminal names shown in Fig. 9, that is, the current terminal is next to the current terminal, and the voltage terminal and the voltage terminal are next to each other. Do not alternate. For self-made external test leads, refer to 4.5.4.

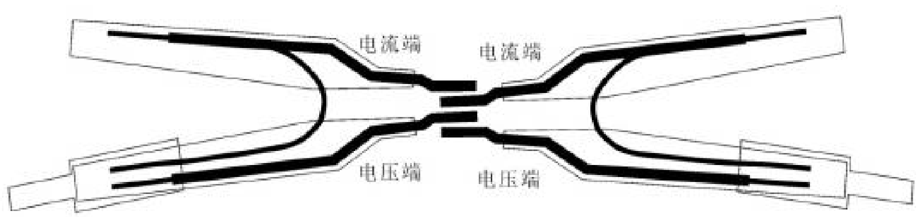


Figure 9

4.3.4 External two-wire table pen to clear

external two-wire table pen measurement method, the contact resistance is affected by the surface conductivity of the pen tip, operating pressure and other factors, not suitable for low impedance measurement, so the short-circuit clearing effect is not ideal. The operation of short-circuit and open-circuit clearing is the same as other measurement methods. The parasitic parameters of the external two-wire meter pens will also cause uncertainty due to the change of the attitude of the two pens. Therefore, it is also required to glue the two pens together as much as possible.

4.4 The measuring

bridge is a fully automated working method. Range determination, impedance property determination, equivalent parameter conversion, etc. are all completed by the program. According to the actual needs of users, the operation of the items are: selection frequency, select the level level *.

The machine body has the best characteristics of its own measuring socket and should be used with priority. The external test leads are suitable for situations where it is not convenient to use the body's own receptacle measurement, such as large-size components, on-line inspection, etc.

4.4.1to read the measured value

In order to facilitate the user reading, four display interface design, with the control key ○ M mode control loop, the interface details,

see 1.3 section.

Based on the component loss values, the possible error range of the measured parameters is estimated as described in 3.1.

Note: In the S interface and the P interface, the values of R and R\L\C are exchanged according to the main features of the components. For example, the measuring resistor, the resistance is the main parameter *, will automatically be displayed in large font in the middle, the distributed capacitance of the resistor is a secondary parameter *, Cs or Cp is displayed in small font in the upper left corner.

4.4.2 Stability of measurement results

Generally, low-impedance series parameters are more stable than parallel parameters, and high-impedance parallel parameters are more stable than series parameters. When Q value is high, L or C is more stable than R parameters. In contrast, R parameter ratio L or C is stable; when the Q value is near 1, the stability of the parameters is best. This is a general rule. Some parameters are unstable under certain conditions and are normal.

Some unstable conditions are caused by improper measurement methods.

Coil type components should avoid environmental interference magnetic fields and high-impedance components, and also need to consider avoiding the interference of the surrounding electric field. Temperature-sensitive components should avoid direct hand contact with components and measure under relatively stable conditions; when DCR* is measured, The micro-resistance should fully consider the influence of the thermo-electromotive force, pay attention to inserting and extracting the frictional heat, the imbalance of heat caused by the hand-contact local, when these factors are unavoidable, it should wait for the reading to be basically stable and the time may be longer.

4.4.3 Effects of clearing accuracy

Impact of short-circuit clearing on measurement:

Short-circuit clearing has a significant effect on low-impedance measurements. If the actual resistance of the short-circuited piece (short-circuited line) is 10mΩ instead of zero, measure 100mΩ after clearing. The result will be 90 mΩ, measuring 6mΩ and will show -4 mΩ. **Note: Since the negative number**

display is limited by the number of display screen dots, the integrated display interface is designed below the corresponding unit. It can be seen that when measuring low impedance, care should be taken to ensure that the short circuit (component) impedance is much lower than the instrument's low resistance measurement capability.

The effect of open circuit clear on the measurement: Open circuit clear has a relatively large influence on high impedance measurement. After the open circuit is cleared to zero, the equivalent internal resistance of the meter is not less than 1GΩ, usually not less than 30 GΩ, so the measurement of high impedance, such as At 100 MΩ, it is still necessary to estimate the degree of influence on the device under test.

4.5 Selecting the Right Measurement Mode

4.5.1 The built-in test socket of thebody comes with a test socket

, which is more accurate and stable than the external test wire. The best performance, adapt to 10mΩ-50MΩ, as long as conditions permit, use this measurement method as much as possible.

Note: When measuring the outlet, the test line must be removed to use.

4.5.2 The Kelvin clip testerKelvin clip test method is

plug that is provided with theconnected to the jack according to the provisions in Figure 10. The clip port feature of the Kelvin clip complies with the terminal name shown in Figure 9. The inner core of the left jack is a high-end voltage, and the outer core is a high-side current; the inner core of the right jack is a low-end current, and the outer heart is a low-end voltage. You should know these names when you make your own test line.

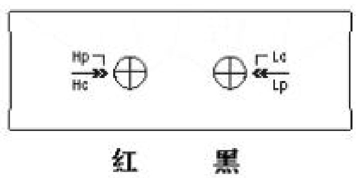


Figure 10

Kelvin clamp test method for low impedance measurement, adapt to 10mΩ-1MΩ, mainly for the measured impedance is relatively low and not too high.

When the measured impedance is low, attention should be paid to the influence of the additional parameters of the test line, mainly the additional inductance. The additional inductance changes as the area enclosed by the two test lines changes. Therefore, the additional inductance should be kept as stable as possible so that the short-circuit is cleared and no longer changes, which will not affect the measurement. In order to facilitate the stability of the additional inductance, the two test wires should be twisted. When the actual situation is not allowed, the relative postures of the two test wires should be fixed as much as possible.

When the measured impedance is relatively high, the influence of the additional resistance and the additional inductance can basically not be considered, and the influence of the additional capacitance is significant. Therefore, the additional capacitance formed by the two test clips should be ensured as much as possible so that the open circuit will not change after being cleared. Reduce the impact on the measurement results.

4.5.3-The line meter pen

Two pen measurement is a two-wire method. Generally, the jack is not specified. The difference between the two jacks is that the high-end jack (left) has strong ability to withstand interference, and the low-end jack (right) has weak ability to withstand interference. . According to the actual situation, if the user is on the road test, the user should give priority to the ground or large-area conductor connected to the target of the high-end test line.

Two-wire test leads

Suitable for 1Ω to 10MΩ, are used when the measured impedance is not too low.

The second-line table pens are used for road detection analysis and are more convenient than other methods. The following conditions should be taken into account in the detection or measurement of independent components.

Due to the large contact resistance of the second-hand table pen and the large influence of the size of the force, the contact area and the degree of cleanliness, the subjective perception is that the reading is unstable. Therefore, when the measured impedance is low, besides paying attention to the influence of the additional inductance, it is necessary to adopt Measures of contact resistance stability, specific methods, can use a trowel to trim the nib, trim into a sharp cone or prismatic shape, for reference only.

When the measured impedance is not too low, the above-mentioned low-resistance influencing factors do not stand out.

When the impedance to be measured is relatively high, follow the notes in 4.5.2.

4.5.4 Self-made external test leads

The self test of the external test leads is not complicated. Refer to Figure 11, Figure 12

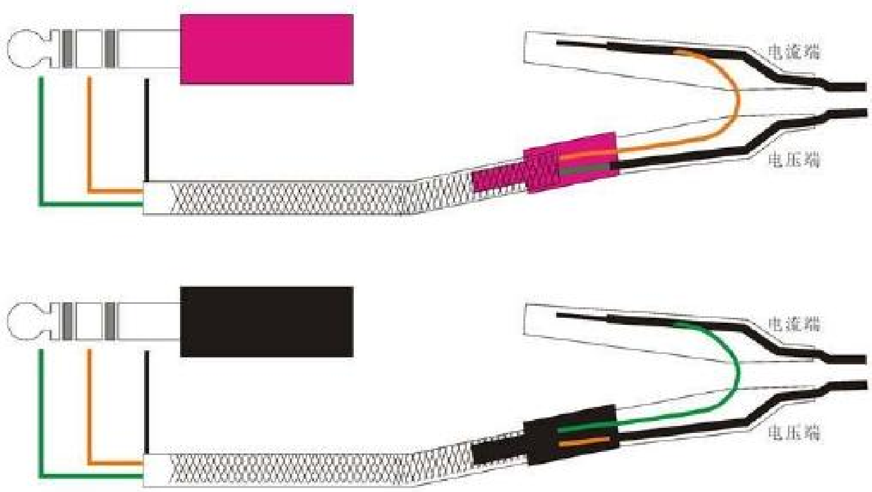


Figure 11

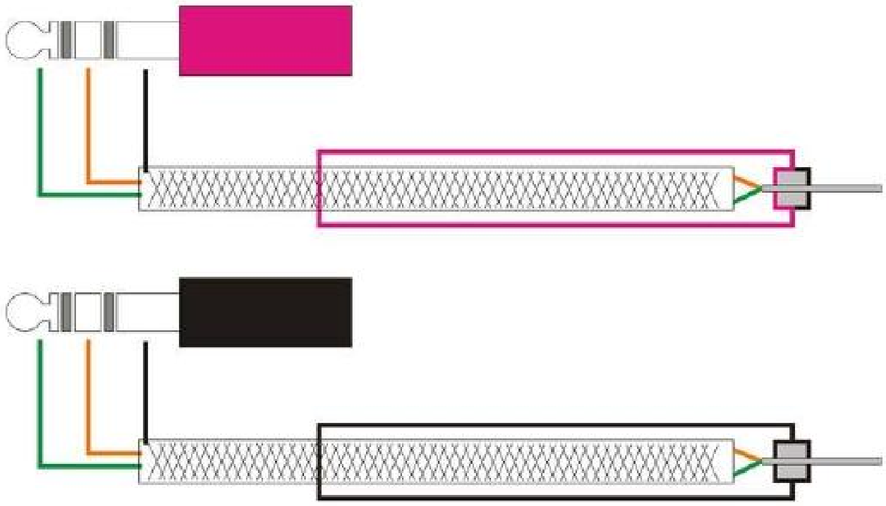


Figure 12

4.6 Special Applications

4.61 Measurement of inductance under bias current conditions

Is usually measured directly. For inductive components that contain iron cores or cores, the result may be different due to the nonlinear distortion of the core. To reduce the nonlinear distortion error, the test level should be selected lower.

The bridge does not have the function of providing the inductor bias current. When the inductor bias current is needed, it should be provided by an external circuit.

When designing an external circuit, it should be ensured that no DC voltage is applied to the bridge to access the measurement terminal.

Reference bridge special application documents

4.6.2 Capacitance Measurement under Applied Bias Voltage

The bridge does not have the function of providing voltage bias. When a capacitor bias is required, it should be provided by an external circuit.

When designing an external circuit, it should be ensured that no DC voltage is applied to the bridge to access the measurement terminal.

Bridge Reference Special Application Documents

4.6.3 Batteries Internal Resistance Measurement

Reference Bridge Special Application Documents

4.6.4 Transformer Leakage Sensitivity Measurement

Reference Bridge Special Application

4.6.5 Derating Ratio

Reference Bridge Special Application Document

Note Part 5 Inspection and Maintenance Precautions

5.1 Power-On Display Information

Normal boot-up information is shown in Figure 13.

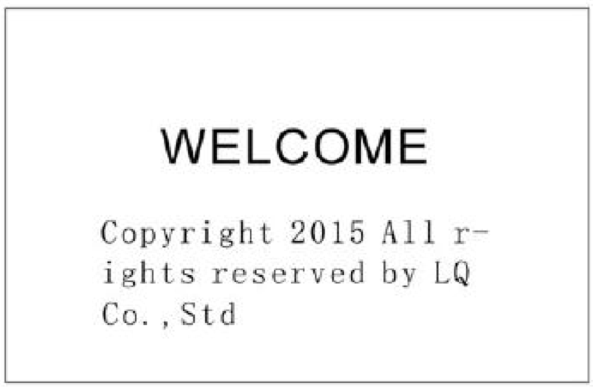


Figure 13

Figure 14 shows the start-up information, indicating that the calibration of the internal calibration data is incorrect.

Figure 14

Bridge internal calibration data is a full calibration of the bridge before shipment. Because the bridge has a wide range of measurement, multiple ranges, and many frequency points, and the calibration data is a complex value, the amount of data is also large, and the safety and correctness of the calibration data is extremely important.

Although the stability and safety of the bridge data are highly reliable during design, the data verification function is still designed and prompts are given at startup.

After repeated testing, data corruption has not yet occurred. Perhaps, when the entire service life of the bridge is over, the user will not see the error message of Figure 12. In the event that data corruption occurs, the processing is detailed in section 5.4 Firmware Update.

5.2 General check

Each function key has normal control and can be cleared by short circuit and clear by open circuit. After the short-circuit is cleared, the series equivalent parameter should show 0.XXXmΩ + 0000uH; after the open circuit is cleared, the parallel parameter should show >1000M // 0000P.

There are voltage and current monitoring displays in the □Z or □S, □P models. When the circuit is opened, the displayed voltage value corresponds to the selected level. When the short circuit occurs, the current display value is approximately: open circuit voltage/100Ω.

Tests of components with known accuracy and parameters should be able to correctly measure the values of the parameters.

The above checks can randomly choose different frequencies, different levels.

5.3 Daily maintenance of the bridge

The bridge is a precision instrument to prevent strong vibration and prevent water ingress and strong light exposure. Do not force the excessively-sized components (>1.5mm in diameter) into the test socket. The components should not be stuck in the socket for a long time. External test leads should avoid plugging in the socket for a long period of time. The plugs used for the self-made test leads should be sized to ensure that the quality of the jacks is not improved due to poor plug quality. The surface of the body is kept clean and corrosive is prohibited. Cleaner, optional soft rubber wipe in general;

If you find that the bridge automatically shuts down after booting, or if it cannot be turned on, it should be charged in time. When it is not used for a long time, it should be fully charged and then sealed. The bridge should not allow DC voltage to be applied to the test port. Especially when measuring capacitance, it should be guarded against the capacitor not fully discharging and causing failure.

5.4 Firmware update

The bridge program has been upgraded and upgraded. Users can download the firmware of the corresponding machine number provided by the manufacturer (see the 6.4 secondary function part for the machine number query) to the bridge to complete the update.

When the bridge calibration data is accidentally damaged (see 5.1), the user can download the corresponding machine number data provided by the manufacturer to the bridge and restore the calibration data.

Bridge built-in proprietary BOOT program, users can use a common serial debugging program to complete the firmware update or data recovery.

5.4.1 Communication interface

USART communication, interface characteristics as shown in Figure 15 1 no, 2 ground, 3 data out, 4 data entry communication speed 19200, 3.3V compatible 5V level

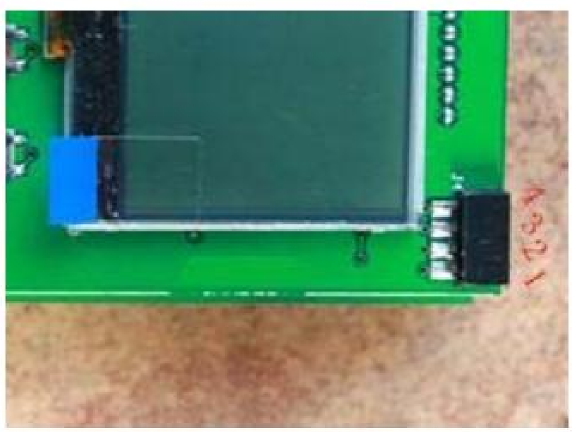


Figure 15

5.4.2 Update procedure

The following is the author's SSCOM32 universal Serial debugging procedures as an example to illustrate the method.

Step 1 Run SSCOM32
Step 2 "Open File" and load the firmware or calibration data file provided by the manufacturer *.BIN
Step 3 Clear the window
Step 4 Select communication parameters according to Figure 16

Figure 16

Step 5 “Turn on the serial port” opens the used serial port number

Step 6 When the bridge is off, press and hold the ○F and ○E buttons simultaneously to turn on the power. A drop of sound, the bridge no longer enters the working state, without any display, then enters the ready communication state.

Step 7 Type the command in the "character input box" of the serial debugging program. If the update is a program, enter "F?" , Click “Send” button, the receiving window returns “Ready to write FLASH..”; If the updated data is calibration data, enter the command “E?”, click “Send” button, and the receiving window returns “Ready to write EEPROM.”

Step 8 Click the "Send File" button and the bridge is automatically restarted after the bridge is downloaded.

The above process can be restarted from the first step regardless of the failure of that link.

Note: Do not experiment with update operations unless necessary.

Chapter 6 The quadratic function control

The four function keysbridge are pressed and turned on at the same time. Each key gives different functions.

6.1 ○ F key + boot

can be used normally measured, the difference is not clear operation. When short-circuiting or open-circuiting, the displayed result is the inherent residual capacity of the bridge, the inherent residual capacitance of the bridge itself is generally below 0.5P, and the series impedance residual is generally less than 1mΩ. Users use bridges, this function is not meaningful, mainly to facilitate the understanding of the basic hardware situation in the production test.

6.2 ○ C key + power on

The bridge to enter the test status screen * is characterized by five significant digits to display small fonts, multi-parameter display This function is not designed for the user. It is mainly for the purpose of calibrating the meter to view all the results.

Users may sometimes want to see more than the four valid digits of the normal situation, you can enter here to see five significant figures.

6.3 ○ E key + power on

normal operation, the level select key function is assigned a phase slide function. Each time the, the phase of the measurement source signal moves back one step to achieve the free axis movement. By changing the free axis, observe the phase angle. The maximum phase error is about 0.05° at 10KHz, and the maximum phase error is about 0.005° at 1KHz and below. This function is meaningless to the user and is mainly used to check the phase error caused by the distortion of the bridge when debugging.

6.4 ○ M key + boot

on the ruler interface, which is mainly used for positioning reference when installing the display screen. At the same time, the contrast of the display bridge's own machine number display screen is also controlled here. Bridge electrical factory before the appropriate contrast adjustment, the contrast when the user is not considered appropriate, or replaced with a new display, the user can adjust. The current state, ○ C button is to increase the contrast, ○ E button is contrast weakened ratio. After adjusting properly, turn off. When you turn the device back on, the adjusted contrast is effective.

6.5 ○ F + ○ E key + boot

into BOOT function, see description in 5.4 Firmware Update.

Chapter 7 FAQ

7.1 Under what circumstances open circuit, short circuit clear is very important?

Open, short circuit clear the impact on the measurement result, for the main parameters of the component *, only when measuring very high impedance or very low impedance Importantly, the 10Ω-500KΩ segment is not important.

Opening and short-circuit clearing also have an effect on the secondary parameters. When the series equivalent parameter Rs or Xs has a relatively small term, if the high Q component Rs is small, it is necessary to reconfirm whether the short-circuit clearing is qualified, when the parallel equivalent parameter Rp or When both items of Xp are relatively large, it is necessary to reconfirm whether the open circuit is cleared or not.

7.2 Under what conditions do you need to re-open or short-circuit clear?

Under the condition of the determined measurement method* and level level*, do a thorough open and short-circuit clearing for each frequency. Afterwards, as long as you do not change the level and measurement method, do not Need to be cleared every time. Change the measurement method or level, estimate the effect on the result of the measured component, and decide whether or not to reset it as described in 7.1.

7.3 Large-capacity capacitors are measured at high frequencies. It is unreasonable to see why Cs is larger than low frequencies.

CAUTION The pins must be shortest. Large-capacity capacitors have low capacitive reactance at high frequencies. Pin parasitic inductances of several tens of nH have a significant effect on capacitive reactance, capacitive reactance is partially offset by parasitic inductance, and capacitive reactance decreases. As a result, the resulting capacity value is large, and bulk capacitors are When the frequency is low, this situation is not obvious and low frequency measurements should be selected.

7.4 Insert a short-circuit copper wire on the socket, showing tens of nH inductors, change the wire with a relatively short and thick thickness, and show a much larger inductance.

This is not related to the watch. The wire is a ferromagnetic material and it is imagined as a coil. More iron core to understand.

7.5 What is the selection of the series model in parallel?

In general, the nominal value of the low-impedance element is the equivalent value in series, and the nominal value of the high-impedance element is the parallel equivalent value. When verifying the failure of a single component, it is consistent with the manufacturer's model under the nominal conditions. If the series model parameters are referred to in the 47uF electrolysis product specification, then the series model parameter measurements must be read.

The equivalent value of the series equivalent parameter and the parallel equivalent parameter at the same frequency are the same, which is to say, is equivalent. It is correct to select any model. The main one is to look at the model more conveniently to analyze the problem. For example, when a repairer analyzes a circuit board component, the device under test is connected with other components on the board. The component model may be changed. The capacitance and resistance in the actual circuit are connected in parallel. When the measurement is performed, the parallel model can directly know how large the resistance of the capacitor is. The road analysis is very convenient. So you need to choose the right model according to the actual situation.

7.6 Why is the value of Q, D, R of the measuring capacitor sometimes negative? And θ is greater than 90°?

Theoretically, there should be no negative value. When the negative value occurs, the absolute value of Q is still very high, which means that there is a slight phase error. This is electricity. The error caused by the limited accuracy of the bridge cannot be completely avoided. Negative values sometimes occur because of over-zeroing, which requires careful confirmation of open and short-circuit clearing.

For a negative D value or a negative Q value, how to evaluate the true value of a component can be done by using a relative value method, which is specifically as follows: First, measure a good quality capacitor, record D as a reference value, and measure D of other components. Subtracting the reference value gives a more realistic D value.

7.7 Why does the reading of the meter jump after inserting the external test lead? The

external test lead is inserted. The test lead introduces external interference. In addition, after the open circuit is cleared, the display is >1000M // 0000P, but it is easy to change. The reason for the change is that the relative attitude of the test line is changing. Although the test line is not moving, the bridge is very sensitive and the small changes that are not noticeable can be Causes impedance changes. this is normal.

However, this situation does not affect the general measurement. Generally, the measured impedance of the component is limited, and the open impedance has little effect on the device under test. If an external test line is used to measure the high impedance component, such as using a test pen to measure a few P capacitors, it needs to be very serious and patient. The attitude remains unchanged after the test leads are cleared. In principle, body socket measurements should be used whenever possible when the measured impedance is high.

7.8 Why does the measurement of high-value resistance "error" become large when the frequency is high? When

measuring the resistance under AC signal excitation, especially when the resistance value is high, the element distribution parameters (such as the distributed capacitance of the high-resistance element) cannot be ignored, and the actual equivalent model It is far from a simple series and parallel model. The measurement result is the equivalent value of the component under the measurement frequency. The result is correct.

7.9 The higher the Q value measured, the larger the Q value?

is.normal Q = Xs/Rs, especially if Rs is very small (Q is very high). Due to the limited accuracy of the bridge, Rs is not stable. Therefore, the higher the Q, the larger the jitter is, and the stronger the stable display is impossible.

This is generally the case: the higher the Q, the more unstable and the greater the absolute error. For a 0.2% bridge, Q is greater than 500. The higher the accuracy of Q, the worse the accuracy. Even for a product with a basic accuracy, there is no need to be complacent for tens of thousands of measurements. When Q is high, the accuracy is already The decline is very strong.

In view of the high instability of Q, usually the quality of the component is measured by the inverse D parameter of Q. For example, D=0.0005, and the corresponding Q is between 1852 and 2222. If there are two identical bridges, one measured Q=1900, Another measure of Q=2100, there is no need to separate the two bridges for good or bad, because at this time the accuracy of Q itself is not high, and it is meaningless to pursue which one is more accurate.

7.10 The low resistance below 0.1mΩ is not stable, what is the reason?

The resolution of the bridge has been exceeded, and it is not necessary to pursue stability of several tens of uΩ.

7.11 How to use the probe to measure?

The capacitance of the chip capacitor is usually not silk screened. It is indeed a problem to recognize the capacitance of the packaging plate, which can be judged by the measurement.

There is nothing special about the patch component in terms of the measurement method. For example, in the absence of a special fixture, the test pen operation is quite convenient, and the measurement of the patch component can be performed like using a chopstick.

It should be noted that before the measurement, the state of the pen tip spacing equal to the length of the measured component shall be cleared and cleared. If you want to measure the 0805 component, hold the test lead so that the tip distance is equal to the length of 0805, clear the open circuit, and then you can measure the capacitance of the 0805 package.

7.12 The DCR measures very small resistance and is accurate and stable using its own socket. The use of an external test line Kelvin clip is sometimes accurate and sometimes inaccurate.reason?

What is theThis is a thermal EMF disturbance measurement. When the hand holds a Kelvin clip, the contact surface of the solder joint in the holder is heated to generate a thermoelectromotive force and is attached to the device under test. The thermo-electromotive force is very small, but it is still not small for a small voltage drop across the measured resistance, resulting in inaccurate measurements.

DC resistance measurement DCR (AC measurement should not affect), the effect of thermo-electromotive force on the measurement accuracy of the small resistance is difficult to avoid, and only to avoid the appropriate measurement methods:

1 Try to measure the small resistance using its own socket. The socket springs are not balanced with

respect to the pins of the device under test and can be quickly equilibrated.lead

2 When an external testmust be used, do not always hold the clips. After a sufficient time, reach thermal equilibrium. Short-circuit clearing and formal measurement before measurement must follow this principle.

7.13 Other LCR tables have LCR function force options. How about this LQ-9101 bridge?

In fact, whether a component is R or L is not absolute. Such as wirewound resistors, although the component as a resistor, but its own inductance is also present, if the user is only concerned about the value of the resistance, just look at the resistance item on the line, if you are concerned about its own inductance, it can be read at the same time This is more convenient.

7.14 What is the use of level selection?

The bridge provides multiple measurement signal levels (internal resistance 100 ohms) for two purposes: first, Since the measurement signal is an alternating signal, the voltage applied to the device under test has a negative half cycle. For some devices that require a reverse voltage, such as a tantalum capacitor and a solid capacitor, using a low level means that the device is applied to the device under test. The upper reverse voltage is very small and will not damage the components. The second is when it is used to check the circuit board, that is, it is measured on the road. The small signal can avoid the non-linear effects of the semiconductor components and is convenient for on-the-road analysis.

7.15 What is the use of V magnification and I magnification in the upper left corner of the default interface of the bridge?

Refers to the amplifier magnification of the bridge voltage channel and the current channel. You can understand the working status of the bridge through the magnification factor. concern. For those friends who wish to have a deeper understanding, it has a role that if the 0.6V level is used, the two (amplification) values must have a value of 1, and if not, it may measure poor contact and re-contact. (Or re-insert it).

7.16 What is the lowest voltage and current in the bridge Z, S, P display interface?

The actual voltage of the output signal of the bridge and the current flowing through the measurement node. If a resistor is measured, it shows the signal voltage drop across the resistor and the signal current through the resistor.

7.17 What is the relationship between the parameters displayed on different interfaces of the bridge?

Just know that all the parameters Z, Q, D, and θ are irrelevant to the parametric model, for example, there is no display of the design D parameter in the S interface. If you need to know the D parameter, you can look at the other display interface and it is the same.

7.18 I have a Fluke multimeter, which is a world famous brand. Measured an electrolytic capacitor. Why is the measured value of the bridge inconsistent with the multimeter?

This is because the two devices have different measuring frequencies, and the parameters of the electrolytic capacitor at different frequencies are different. Multimeter test principle is various, impedance method, charge and discharge method, free oscillation method ... ... different principles, not specifically check the multimeter instructions its frequency is not known. Therefore, don't suspect that the multimeter is a world famous brand and you are actually skeptical about the results of the bridge. In fact, they are all correct, but the measurement conditions are different (such as different measurement frequencies). By the way, under the same measuring frequency conditions, the gap between the bridge and the multimeter will be smaller, not necessarily very close or equal. In this case, the bridge measurement result is more accurate.

7.19 Does the LQ-9101 need to be concerned about the deterioration of accuracy caused by aging?

Generally, it is not necessary to care. The bridge is said to be highly accurate and is relative. After all, it is still at the level of a few thousandth. The aging factor of the bridge is mainly the range resistance. Its aging guide is too small for the specified accuracy of the bridge, at least for the same reason. Do not care about such issues during the period. Aging indicators are important for high-precision, high-end digital meters. A few hundredths of a hundredth of a bridge involves less than demanding requirements.

7.20 is the same four significant digits, which shows the difference between 1000mΩ and 1.000Ω. The

number 1000 is the lowest resolution number of the four significant figures. Under the premise of the effective number of digits, this arrangement can determine the actual deviation range is -0.005‰ --- +0.05‰.

Taking 1 ohm in the example as an example, 1000mΩ means the actual value is greater than 999.95mΩ but less than 1Ω; 1.000Ω means the actual value is less than 1.0004Ω but the size is 1Ω. It can also be said that 1000mΩ means that it is slightly negative with respect to standard 1 Europe, and 1.000Ω means with a slight positive bias.

Although the absolute accuracy of the instrument is not so high, it may be helpful to select the matching resistor element for actual operation. Similarly, 1.000K and 1000Ω 1.000MΩ and 1000KΩ mean the same inductance and similar values: 1000nH and 1uH 1000uH and 1mH 1000mH and 1H... Capacitance also has similar values: 1000P and 1.000nF 1000nF and 1uF 1000uF and 1mF... The characteristics of the above values all occur at the juncture where the unit spans.

7.21 What is the difference between the LQ-9101 and the cheaper inductors and capacitors on the market?

One or two hundred dollars or even a few dozens of inductors and capacitors have products, most of which are self-resonant resonant schemes. Measured and inexpensive, general use is cost-effective.

The differences are mainly as follows: the operating frequency of the self-resonant resonance scheme is indeterminate, and varies with the parameters of the measured component. Capacitance and inductance parameters can be measured. The quality factor and loss factor of these two components cannot be determined. The accuracy and stability depend on the internal reference capacitance and reference inductance; LQ-9101 has a definite measurement frequency that can be selected to accurately reflect the parameters at the determined frequency of the device under test. The vector measurement principle used can measure the quality factor and loss factor of an element or the equivalent parameters of different models. Accuracy and stability depend on internal reference resistors. Highly stable reference resistors are easy to obtain and use. The former uses capacitive and inductive reference components far less than the latter's high stability resistors. Therefore, the LQ-9101 must have high stability. Many, functional and measurement levels are equivalent to current mainstream bridge products.

Documentation The expression of the main parameters in the middle refers to the significant components of the impedance properties in the impedance real and imaginary components, and the secondary parameter refers to another component. For example, a 100K ohm resistor is connected in series with a 1 nanohenry inductor. The impedance property at the test frequency is significant, and it is called the main parameter.

This article also uses the table terms for the primary and secondary parameters. The primary parameters are L, C, R, and Z. The secondary parameters are Q, D, and θ.

The DCR, DC resistance measurement mentioned in this document is essentially the same as the 0Hz measurement used in this device. Measurement status: refers to normal measurement usage. Test state: For debugging purposes, the output effective number of digits is more than the measurement state, but the font is small. Otherwise, it is the same as the working state of the bridge.

Level: Refers to the three levels of 0.1V, 0.3V, and 0.6V in this device.

Measurement method: refers to the three different ways of body socket, external Kelvin clip, and external meter pen provided with this device.