User's Guide

Rev.A4
FIRMWARE REVISIONS

AT2811
LCR Meter

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Safety Summary

⚠Warning ⚠Dangerous:

When you notice any of the unusual conditions listed below, immediately terminate operation and disconnect the power cable.
Please Contact Applent Instruments Incorporation sales representative for repair of the instrument. If you continue to operate without repairing the instrument, there is a potential fire or shock hazard for the operator.

- Instrument operates abnormally
- Instrument emits abnormal noise, smell, smoke or a spark-like light during the operation.
- Instrument generates high temperature or electrical shock during operation.
- Power cable, plug, or receptacle on instrument is damaged.
- Foreign substance or liquid has fallen into the instrument.

⚠Warning ⚠Dangerous:

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific WARNINGS elsewhere in this manual may impair the protection provided by the equipment. In addition it violates safety standards of design, manufacture, and intended use of the instrument.

Disclaimer	*The Applent Instruments assumes no liability for the customer's failure to comply with these requirements.*
Ground The Instrument	To avoid electric shock hazard, the instrument chassis and cabinet must be connected to a safety earth ground by the supplied power cable with earth blade.
DO NOT Operate In An Explosive Atmosphere	Do not operate the instrument in the presence of inflammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.
Keep Away From Live Circuits	Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.
DO NOT Service Or Adjust Alone	Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.
DO NOT Substitute Parts Or Modify Instrument	Because of the danger of introducing additional hazards, do not install substitute parts or perform unauthorized modifications to the instrument. Return the instrument to an Applent Inc Sales and Service Office for service and repair to ensure that safety features are maintained.

CERTIFIACTION, LIMITED & LIMITATION OF UABILITY

Applent Instruments, Inc. (shortened form **Applent)** certifies that this product met its published specifications at the time of shipment from the factory. Applent further certifies that its calibration measurements are traceable to the People's Republic of China National Institute of Standards and Technology, to the extent allowed by the Institution's calibration facility or by the calibration facilities of other International Standards Organization members.

This Applent instrument product is warranted against defects in material and workmanship for a period corresponding to the individual warranty periods of its component products. **The warranty period is 1 years and begins on the date of shipment.** During the warranty period, Applent will, at its option, either repair or replace products that prove to be defective. This warranty extends only to the original buyer or end-user customer of a Applent authorized reseller, and does not apply to fuses, disposable batteries or to any product which, in Applent's opinion, has been misused, altered, neglected or damaged by accident or abnormal conditions of operation or handling.

For warranty service or repair, this product must be returned to a service facility designated by Applent. The buyer shall prepay shipping charges to Applent and Applent shall pay shipping charges to return the product to the Buyer. However, the Buyer shall pay all shipping charges, duties, and taxes for products returned to Applent from another country.

Applent warrants that its software and firmware designated by Applent for use with an instrument will execute its programming instruction when properly installed on that instrument. Applent does not warrant that the operation of the instrument, or software, or firmware, will be uninterrupted or error free.

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by the Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside the environmental specifications for the product, or improper site preparation or maintenance.

THIS WARRANTY IS BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. APPLENT SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, WHETHER ARISING FROM BREACH OF WARRANTY OR BASED ON CONTRACT, TORT, RELIANCE OR ANY OTHER THEORY.

Applent Instruments, Inc.
Changzhou,
Jiangsu,
The People's Republic of China.
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1.Unpacking and Inspection

Thank you for purchasing our product, please refer to this chapter before using the instrument.
This chapter describes how to set up and start the AT2811 LCR Meter.

- Packing List
- Power Supply Requirements
- Setting up the Fuse
- Environmental Requirements
- Cleaning

1.1 Packing List

After you receive the instrument, carry out checks during unpacking according to the following procedures.

1. Check that the packing box or shock-absorbing material used to package the instrument has not been damaged.
2. Referring to Table 1-1, check that all packaged items supplied with the meter have been provided as per the specified optioned.

Table 1-1 Included Accessories

NAME	QTY	REMARK
User's Manual	1	
AC Power Cord	1	220V/50Hz
Fuse	2	0.5A Slow-Blow
ATL501 Kelvin Test Leads	1	
Test Report	1	

If there is damaged or shortage in accessories, please contact Applent Sales Department or retailer.

1.2 Power Supply Requirements

Confirm that the power supplied to the AT2811 meets the following requirements:

Voltage：198-252V AC

Frequency：47.5-52.5Hz

Consumption：<10VA

To prevent electrical shock, please connect to GND.
If users change power cord, please make sure reliable connection of GND.

1.3 Setting up the Fuse

A spare fuse is included with the accessories, the fuse is located on the instrument's rear panel, please refer to Rear Panel section in Chapter 3

Please use the following fuse type：
250V, 0.5A Slow-Blow

1.4 Environmental Requirements

Ensure that AT2811 is operatd under the following environment:

Temperature Range: 0℃～55℃ ,
Humidity Range: <95%RH at 40℃
Technical index Temperature：23℃ ±5℃
Technical index Humidity：<70%RH

1.5 Cleaning

To prevent electrical shock, disconnect the AT2811 power cable from the receptacle before cleaning.
Use a dry cloth or a cloth slightly dipped in water to clean the casing.
Do not attempt to clean the AT2811 internally.

WARNING:
Don't Use Organic Solvents (such as alcohol or gasoline) to clean the Instrument.

2.Overview

This chapter provides the following information:

- Introduction
- Main Specifications
- Features Overview

2.1 Introduction

AT2811 is small bench-type adopting high performance microprocessor. Four grades of test frequency: 100Hz, 120Hz, 1kHz, 10kHz，0.1V、0.3V and 1V Signal Level for selecting，Source Resistance 30Ω、100Ω. The instrument can AUTO test L、C、R、Z、Q and D.

Brand new AT2811 is with high cost-performance，easy operation UI，can meet accurate test and volume production requirements of components factories, schools, research institution and quality control institution.
The AT2811 can output comparison/decision results for sorting components into 5 bins.

2.2 Main Specifications

The AT2811 technical specifications, including the basic technical specifications of the instrument and equipment testing allows. These specifications are in the instrument factory can achieve。

Please refer to Chapter 4 for complete technical specifications.

- **Test Parameters**：L-Q, C-D, R-Q, Z-Q 。
- **Test Frequency**：100Hz，120Hz，1kHz，10kHz

  Accuracy：±0.02%
- **Test Signal Level**： 0.1Vrms, 0.3V and 1.0V

  Accuracy：±10%
- **Test Speed**：Slow: 3 times/second, Fast: 10 times/second
- **Source Resistance**：30Ω and 100Ω
- **Range**：Automatic and manual with 6 ranges
- **Equivalent Circuit**：In series and parallel
- **Test Mode**：five-terminal measurement
- **Basic Accuracy**：0.25%

2.3 Features Overview

- Display：
  Principal parameter 0.8 inches LED display，AUX parameter 0.5 inches LED display
  Can display main and AUX parameter simultaneously with 5 digits.
  A：L, C, R, Z
  B：Q, D

- correcting feature：
  Short and open full frequencies correction.

- Comparator（sorting） function：
  5 bins sorting results：3 bins percent GD bin、1 bin auxiliary bin and 1 bin NG bin.
  · Comparator function display：LED display
  · Beep：Can setup all comparator results beep.

3.Start up

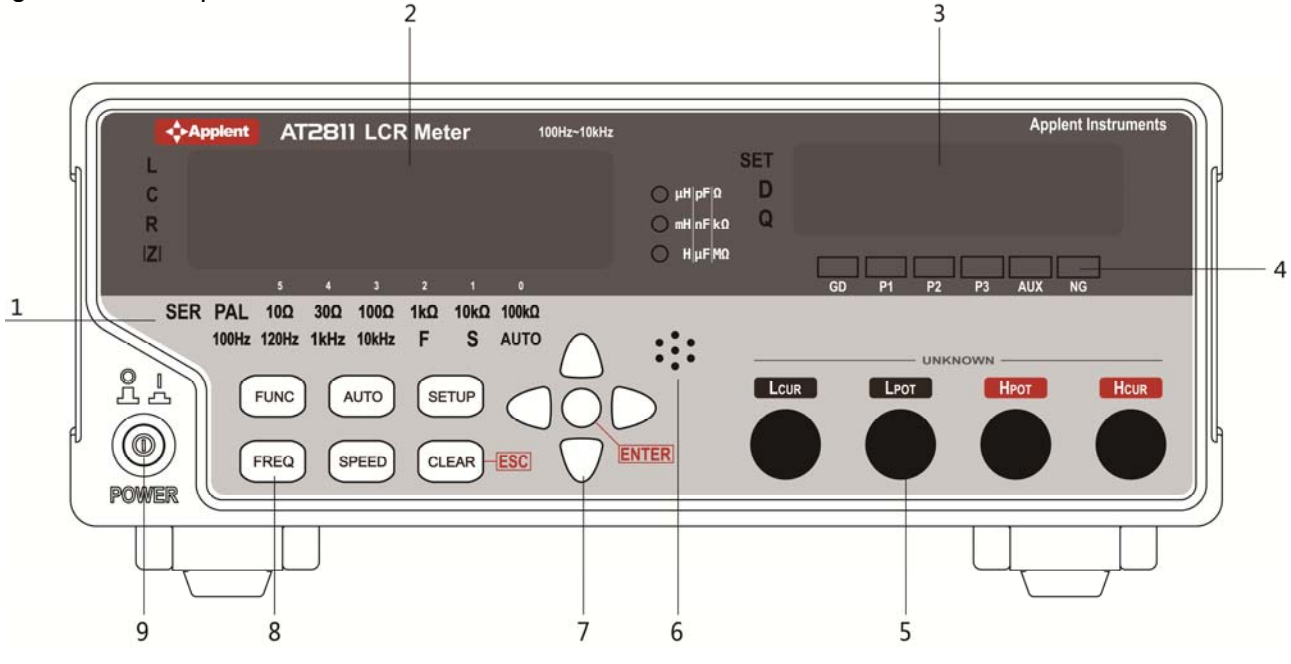
This chapter provides the following information:

- Front Panel Summary
- Rear Panel Summary
- Power ON/OFF
- Connect to Device under Test

3.1 Front Panel

3.1.1 Front panel description

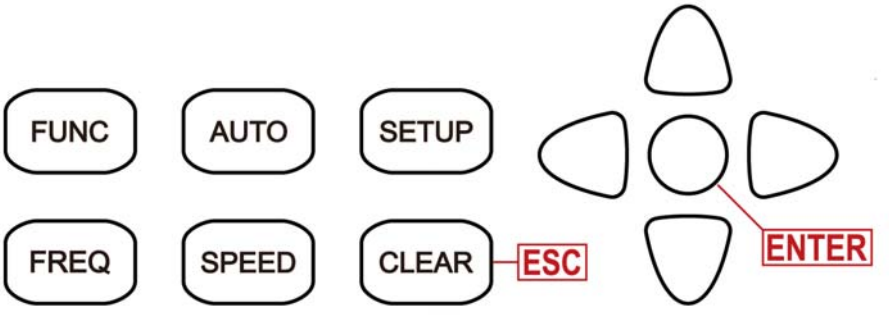
Figure 3-1 Front panel



1	State indicator, range NO.、speed、range、equivalent mode and frequency indicator
2	Principal parameter display window: 0.8 inches LED display
3	AUX parameter display window: 0.5 inches LED display
4	Sorting indicator
5	Test terminal
6	Beep indicator
7	Direction key
8	Principal function key
9	Power switch

3.2 Keypad

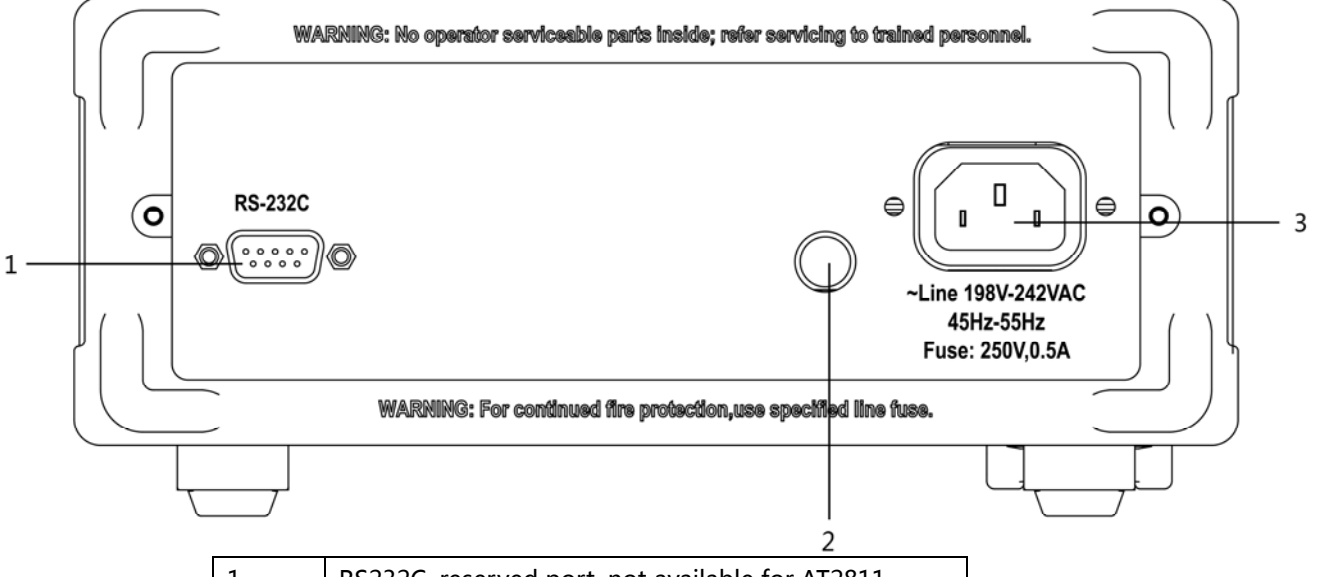
Figure 3-2
Keypad area



Parameter	Select parameter: L-Q, C-D, R-Q, |Z|-Q
Frequency	Select test frequency: 100Hz、120Hz、1kHz and 10kHz is available
AUTO	Select AUTO and Manual range
Speed	Select test speed. Slow and fast speed is available.
Setup	Enter sorting and other function setup
Clear Zero	Enter Zero page
◀▶	Select range
ESC	Return to test state from setup page
Enter	Confirm option or input

3.3 Rear Panel

Figure 3-3 Rear Panel



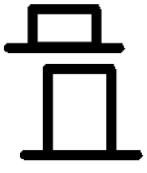
1	RS232C, reserved port, not available for AT2811.
2	Fuse Holder 250V，0.5A fuse
3	AC Power Cord Receptacle

	198V~242VAC，45Hz~55Hz

3.4 Power ON/OFF

3.4.1 Power up

At bottom left side of panel, there is“+”key



Power ON

Power OFF

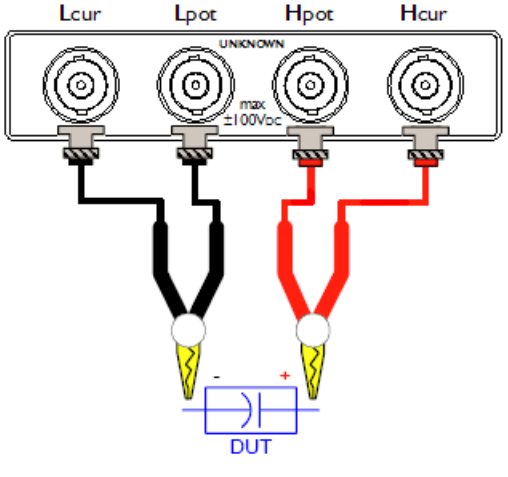
3.4.2 Warm-up time

AT2811 is ready to be used as soon as the power-up sequence has completed. However, to achieve the accuracy rating, warm up the instrument for 15 minutes.

3.5 Connect to Device under Test

If you use Kelvin clip that comes with the instrument, please connect to device same as the following:

Figure 3-4
Test terminal



Warning: Do not apply DC voltage or current to the UNKNOWN terminal. Applying DC voltage or current may lead to device failure.
Warning: The capacitors should be discharged before connected to the terminals.

3.6 To select principal and AUX parameter

Under measurement state, press FUNC key to select first display line and second display line parameter.

Four parameters are available for selection:

L-Q, C-D, R-Q, Z-Q

Unit that is used by Corresponding parameter：

L	μH（microhenry）	mH（millihenry）	H（henry）
C	pF（miicromicro farad）	nF（nanofarad）	μF（microfarad）
R/Z	Ω（ohm）	kΩ（kiloohm）	MΩ（megohm）

Note：

Z take ADS, L/C/R has plus and minus. When C-D make measurement , principal parameter displays negative value, the actual tested component shows inductive ; When L-Q measurement displays negative values, the actual tested component shows capacitive. In theory, R value constant is positive, under some condition, it possibly apprears R is negative, this is caused by excessive clear zero, so please perform clear zero in correct way.

Instrument can display maximum 5 digits, sometimes it displays 4 digits, see the following transformational relation:

Previous display digits	Current measurement pre-two value	Current display digits
4	<33	5
5	>30	4

3.7 To set up test frequency

Frequency accuracy：±0.02%

Press freq and then display in circulation at frequency indicator

100Hz，120Hz，1kHz，10kHz

3.8 AUTO and Manual range

Press AUTO to switch AUTO and hold range

Auto indicates current state, when AUTO indicator is lighted, it means AUTO range is used, when AUTO indicator is extinguished, it means manual range is used.

3.9 To select test speed

Press Speed to switch 2 bin test speed：

Slow: 3 times/second

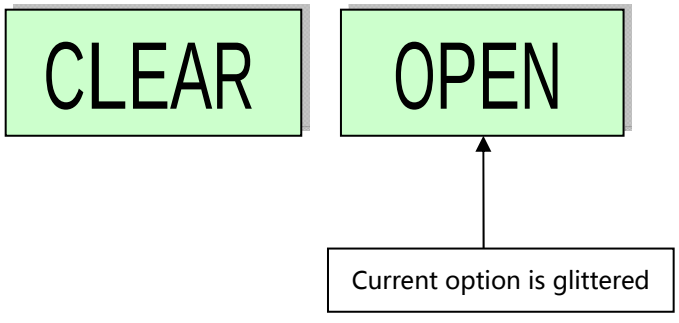
Fast: 10 times/second

3.10 Clear zero

To achieve high accuracy measurement, clear zero is necessary.

Clear zero can efficiently eliminate test clips, test lead, stray capacitance, inductance and leads reistance, inductance inside the instrument that affect measurement. When instrument is used with tremendous temperature change, performing clear zero is also recommended.

Press Clear key to enter clear zero page, instrument will provide OPEN or SHORT option according to current state of test terminal:



Press ESC key to return to test state

Perform:

At this moment, please OPEN circuit or SHORT circuit your test clip, instrument will AUTO check test terminal state , and provide OPEN and SHORT option.

Press Enter key to begin clearing, this process lasts for about 20 seconds, please OPEN circuit or SHORT circuit your test clip (if previous state is SHORT clear, please OPEN circuit your test clip; if previous state is OPEN clear, please SHORT circuit your test clip, press Enter again and wait for about 20 seconds, then clearing finishes and return to test state.)

Press ESC key to terminate clearing process.

After clearing is completed, clearing value is saved in the internal memory of the instrument.

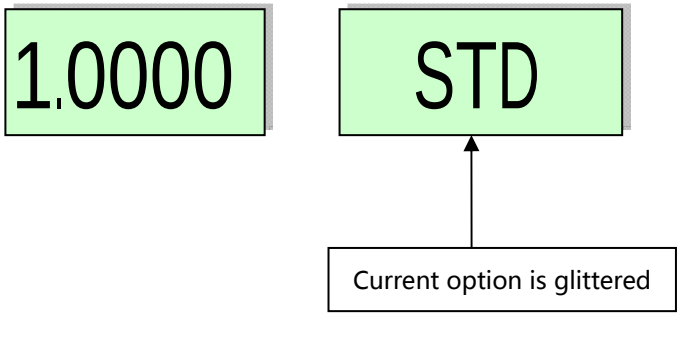
Details:

When performing clear zero , it possibly appear FAIL (FAIL) , this maybe caused by non using of low resistance short circuit or non reliable contact, please re short circuit and then perform clear zero.

Instrument will clear all ranges under all frequencies, it will save data in NVM (nonvolatile memory). Change frequency to test under same test condition, do not reperfrom clear zero.

3.11 Setup

Under test state, press Setup key , it will appear the following page:



Press ▲▼ to select turn page and display setup option.

Press ESC key to return to setup page.

Press Enter key to enter sub menu setup page.

All menu option is as below :

Setup	
STD	Principal parameter nominal value
SEC	AUX parameter (if principal parameter is L,R, or if Z display q-L ; if principal parameter is C display d-H)
P1-H	Bin 1 upper limit (input positive percentage, such as: 5% , principal parameter window displays 5.000)
P1-L	Bin 1 lower limit (input negative percentage, such as: -5% , principal parameter window displays -5.000)
P2-H	Bin 2 upper limit (input positive percentage, such as: 10% , principal parameter window displays 10.000)
P2-L	Bin 2 lower limit (input negative percentage , such as : -10% , principal parameter window displays -10.00)
P3-H	Bin 3 upper limit (input positive percentage, such as : 15% , principal parameter window displays 15.000)
P3-L	Bin 3 lower limit (input positive percentage, such as : -15% , principal parameter window displays -15.00)
BEEP	Beep setup : OFF: turn off P1 : PASS bin P1 beep P2 : PASS bin P2 beep P3 : PASS bin P3 beep AU: AUX parameter FAIL beep NG: Principal and AUX parameter is all FAIL beep
SrES	Source Resistance setup : 100 : 100Ω Source Resistance 30 : 30Ω Source Resistance
LEVEL	Signal Level setup : 0.1 : 0.1V 0.3 : 0.3V 1.0 : 1.0V
EQU	Equivalent Circuit setup : SER: series equivalent PAL: parallel equivalent
CAL	System correction page (password protection , is not open to users)

3.11.1 To setup sorting

Before set up sorting, please understand sorting system of AT2811 :

AT2811 has enhanced sorting distinguish system.

P1,P2,P3 is used for indicating principal parameter PASS or not, if FAIL, NG indicator is lighted, sorting finishes. If PASS, GD indicator P1-P3 is lighted, and continue performing AUX parameter compare.

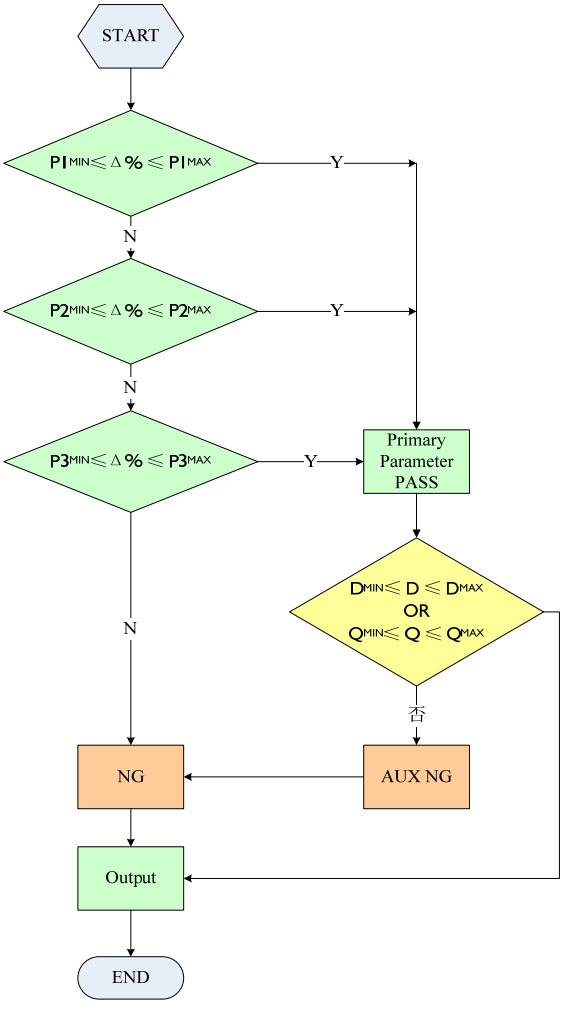
AUX is used for indicating AUX parameter PASS or not, if FAIL, AUX indicator is lighted, NG indicator is extinguished.

If there is one NG in principal and AUX parameter, NG indicator is lighted.

Several sorting signal that may appear:

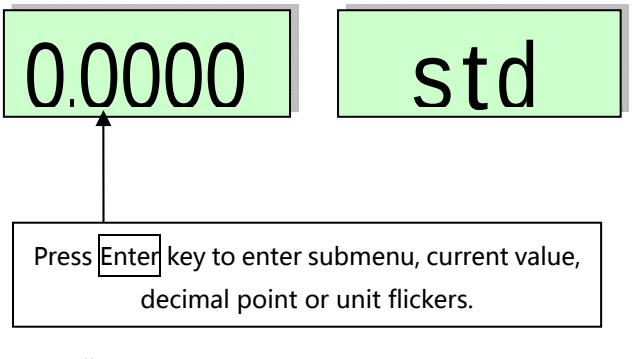
P1	P2	P3	AU	NG	
●	○	○	○	○	Principal parameter P1 and AUX parameter is all **PASS**
○	○	○	○	●	Principal parameter FAIL
○	○	○	●	●	Principal parameter PASS、AUX parameter **FAIL**

Figure 3-5
Sorting flow



3.11.2 Input sorting value

Figure 3-6
Input filed



Press ◀▶ to choose digit bit.
Press ▲▼ to increase or decrease number, or change unit.
Press ESC to return to main menu.
Press Enter key to save data and return to main menu.

Note：if lower limit (P1-L,P2-L,P3-L) is minus deviation，users need to input (-) .

4.Specification

This chapter provides the following information:

- Technical Specifications
- General Specifications
- Dimension

4.1 Technical Specifications

The following data are measured under the following conditions :

Temperature：23℃±5℃

Humidity: ≤65% R.H.

Zero Correction: OPEN and SHORT Zeroing before testing

Warm up：60 minutes and more

Calibration Time：12 months

Test frequency accuracy: : 0.02%

Basic accuracy：0.25%

C: 0.25% (1+ Cx/Cmax+ Cmin/Cx)(1+Dx)(2+kf);

L: 0.25% (1+ Lx/Lmax+ Lmin/Lx)(1+1/Qx)(2+kf);

Z: 0.25% (1+ Zx/Zmax+ Zmin/Zx)(2+kf);

R: 0.25%(1+ Rx/Rmax+ Rmin/Rx)(1+Qx)(2+kf);

D: ±0.0025(1+ Zx/Zmax+ Zmin/Zx)(1+Dx+Dx^2)(2+ kf);

Q: ±0.0030(1+ Zx/Zmax+ Zmin/Zx)(Qx+1/Qx)(2+ kf);

Where:

1．L，C，R，Z is relative error; D，Q is absolute error.

2．Subscript that is X is this parameter's measured value, Subscript that is max is maximum value, min is minimum value.

3．kf frequency factor

Measured parameter maximum value and minimum value that affect accuracy

	100Hz	**120Hz**	**1kHz**	**10kHz**
Cmax	800μF	667μF	80μF	8μF
Cmin	1500pF	1250pF	150pF	15pF
Lmax	1590H	1325H	159H	15.9H
Lmin	3.2mH	2.6mH	0.32mH	0.032mH
Zmax/ Rmax	1MΩ			
Zmin/ Rmin	1.59Ω			

Test frequency error factor kf

When f = 100Hz、120Hz 、1kHz kf=0 ;

when f = 10kHz kf=0.5

4.2 General Specifications

Screen： LED display

Test parameter： L, C, R, Z, D, Q and AUTO parameter

Test frequency： 100Hz，120Hz，1kHz，10kHz

Signal level： 0.1Vrms，0.3Vrms and 1.0Vrms (1±10%)

Basic accuracy： 0.25%

Measurement range：

L	100/120Hz	1μH – 9.999kH
	1kHz	0.1μH - 999.9H
	10kHz	0.01μH – 99.99H
C	100/120Hz	1p – 9.999mF
	1kHz	0.1p – 999.9μF
	10kHz	0.01p – 99.99μF
R、|Z|	0.0001Ω - 99.99MΩ	
D/Q	0.0001 – 9999	

Display digits： principal and AUX parameter：5 digits

Test speed： Slow：3 times/second，Fast：10 times/second

Source Resistance： 30Ω and100Ω

MAX reading： 33000

Range： AUTO and Manual

Equivalent Circuit： In series and parallel

Correction： Short and open sweep frequency correction

Comparator： 5 bins：P1, P2, P3, AUX, NG

Beep： P1, P2, P3, AUX, NG、OFF

Environment index： temperature 18℃~28℃ humidity ≤ 65% RH

Operating： temperature 10℃~40℃ humidity 10~80% RH

Storage： temperature 0℃~50℃ humidity 10~90% RH

Power： 198V ~ 252VAC 48.5Hz ~ 52.5Hz

Fuse： 250V 0.5A slow-blow

Consumption： MAX 10VA

Weight： 2kg

Accessories： User's manual, ATL501 Kalvin test leads, AC power cord, test report, warranty card,

4.3 Dimension

Figure 4-1 Dimension