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Rev. A1.0

# [AT817D LCR Meter]

## USER'S GUIDE

# 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 operators.

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 Instruments Sales and Service Office for service and repair to ensure that safety features are maintained. |

# CERTIFICATION, LIMITED WARRANTY, & LIMITATION OF LIABILITY

**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 2 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.
Rev.A2 January, 2005
Rev.B0 January, 2008

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# 1. Unpacking and Preparation

This chapter describes how to set up and start the AT817D LCR Meter.

- Incoming Inspection
- Power Requirements
- Setting up the Fuse
- How to Remove the Handle
- Environmental Requirements
- Cleaning

## 1.1 Incoming Inspection

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

**WARNING**

**If the external face of the instrument (such as the cover, front/rear panel, VFD screen, power switch, and port connectors) appears to have been damaged during transport, do not turn on the power switch. Otherwise, you may get an electrical shock.**

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

**NOTE**

If an abnormality is detected, contact the company and transport the meter to your nearest Applent Instruments sales or service office. For inspection by the transport company, save the packing box, shock-absorbing material, and packaged items as you received them.

## 1.2 Power requirements

Voltage: 198-252VAC
Frequency: 47.5-52.5Hz
Power: MAX 25VA

## 1.3 Replacing Fuse

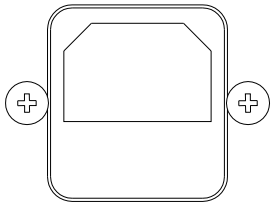


Figure 1-1 Fuse holder and inlet

Please use 250V, 0.5A Slow-Blow fuse

To verify and replace the fuse, remove the power cable and pull out the fuse holder.

NOTE Two fuses in Fuse Holder.

## 1.4 Environmental Requirements

Set up the AT817D where the following environmental requirements are satisfied.

Operating Environments
Ensure that the operating environment meets the following requirements.
Temperature: 0°C to 55°C
Humidity: < 95% at wet bulb temperature ≤ 40°C (non-condensation)
Temperature range at calibration: 23°C±5°C (<1°C deviation from the temperature when performing calibration)

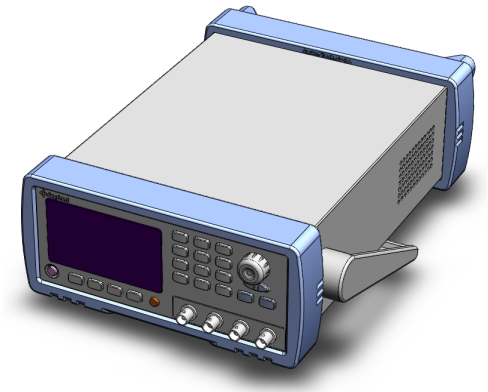
## 1.5 Cleaning

To prevent electrical shock, disconnect the AT817D 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 AT817D internally.

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

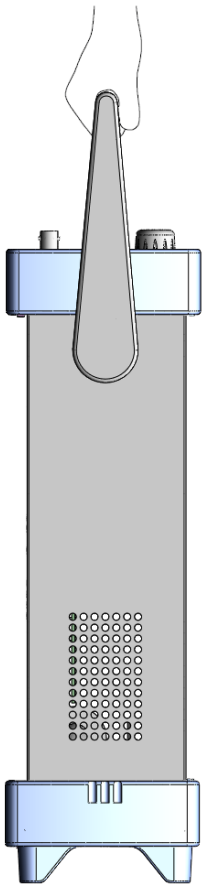
## 1.6 How to Remove the Handle

A handle kit is attached to the AT817D:

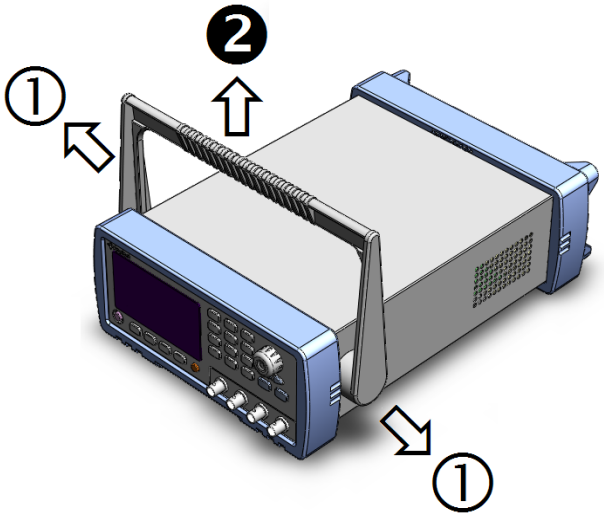


1 Retracted

2 Extended



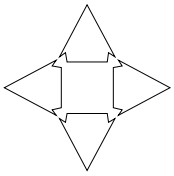
3 Carrying Position




Remove Handle（*Lift the handle perpendicular to the unit while pulling it in the direction of 1.*）

Figure 1-2 How to remove the handle

# 2. Overview



This chapter contains general information about the AT817D LCR Meter .The information is organized as follows

- Introduction
- Main Specifications
- Feature overview

## 2.1 Introduction

Thank you for purchasing AT817D LCR Meter.

The Applent AT817D is a general-purpose LCR meter for incoming inspection of components, quality control, and laboratory use.

The AT817D is used for evaluating LCR components, materials, and semiconductor devices over a wide range of frequencies (100 Hz to 100 kHz) and test signal levels (0.1Vrms, 0.3Vrms and 1Vrms).

The AT817D can display comparison/decision results for sorting components into 5 bins.

## 2.2 Main Specifications

Some main specifications of the AT817D include:

Full specifications are included in Chapter 5.

- Test Function: L-Q, C-D, R-Q, Z-D and Z-Q
- Test Signal Frequency: 50Hz, 60Hz, 100Hz, 120Hz, 1kHz, 10kHz, 20kHz, 40kHz, 50kHz, 100kHz
- Frequency Accuracy: ±0.02%
- Test Signal Level: 0.1V, 0.3V and 1V
  *Level Accuracy: ±10%*
- Measurement Speed: Fast, Medium, Low, Fast 20 times/s
- Source: 30Ω, 50Ω, 100Ω
- Range: Auto and Manual with 9 ranges
- Equivalent Circuit: Serial and Parallel
- Test Terminal: 5-terminal test
- Basic Accuracy: 0.1%

## 2.3 Feature Overview

- High brightness VFD
  *window size: 98mm×58mm*
- Correction (Zeroing) Function
  *Zero out test lead and fixture measurement errors.*
- Built-in Comparator (Sorting)
  *5Bins: BIN1-BIN3, AUX and OUT.*
- Beep and VFD Brightness can be Adjusted

*Setup Pass or Fail Beep and adjust VFD Brightness.*

- Keypad lock and data hold function

## 2.4 Front Panel

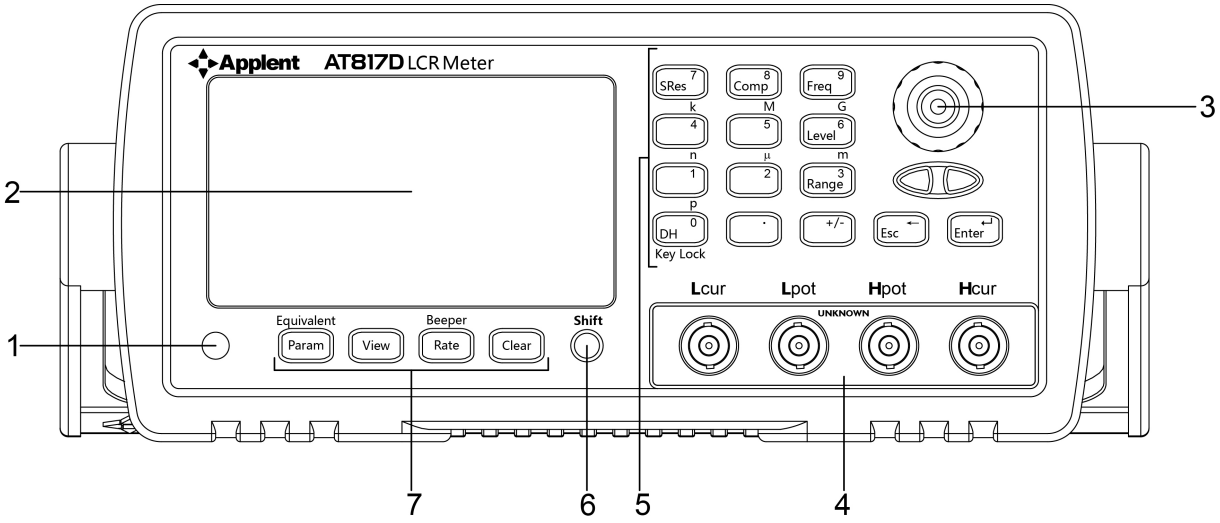



Figure 2-1 Front Panel

Table 2-1 Front panel description

| No. | Function |
|---|---|
| 1 | **Power Switch**<br>*To apply power to the instrument, Push Down: ON, Push Up:* OFF |
| 2 | **Display** *VFD Screen, Displays measurement results, instrument status and user's interface menus.* |
| 3 | **Knob**<br>*To Choose Menu Item and Input Number* |
| 4 | **Terminals** |
| 5 | **Keypad II** |
| 6 | **Shift Key** |
| 7 | **Keypad I** |

## 2.5 Keypad Area

ASSUMER:

On the front Panel:
**Black** Words on Button represents 1st Function;
Orange Words on Panel represents 2nd Function;
Blue Words on Button represents Numeric Key.

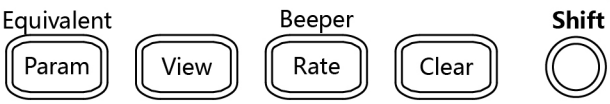



Figure 2-2 Keypad I

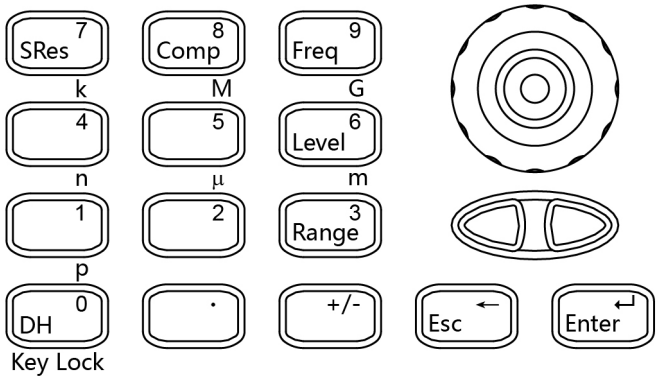



Figure 2-3 Keypad II

### 2.5.1 Primary (1st) Function

Table 2-2 Keypad 1st Function Description

| Keypad | Description |
|---|---|
| Param | Select Parameter: L-Q, C-D, R-Q, Z-D, Z-Q |
| View | Display the comparator result. |
| Rate | Setup Measurement Speed: F, M and S. |
| Clear | Perform Open/Short Correction. |
| SRes | Signal Source: 30Ω, 50Ω, 100Ω is available |
| Comp | Setup Comparator. |
| Freq | Setup Test Frequency: 100Hz, 120Hz, 1kHz, 10kHz |
| Level | Setup Signal Level: 0.1V, 0.3V, 1V |
| Range | Auto Range and Manual Range |
| DH | Data Hold |
| ESC | Return to the upper status. It is enabled in the setup status. |
| ENTER | Confirm the operations. It is enabled in the setup status. |

### 2.5.2 2nd Function Keypad

Orange is 2nd functions, press Shift, when Shift indicator is on, select the following functions

Table 2-3 Keypad 2nd Function Description

| Keypad | Description |
|---|---|
| Equivalent | Equivalent Circuit: SER and PAL |
| Beeper | Beeper setup |
| Key Lock | Lock the keypad |
| p,n,μ,m,k,M | Unit. Select the unit in the input status. |

### 2.5.3 Numeric keypad

Blue is numeric keypad
Numeric keypad is available only under input state
A complete numeric key includes Blue Words keypad, Enter keypad, ESC keypad in the Keypad Ⅱ and p, n, μ, m, k, M, G in the 2nd Function Keypad.

## 2.6 VFD

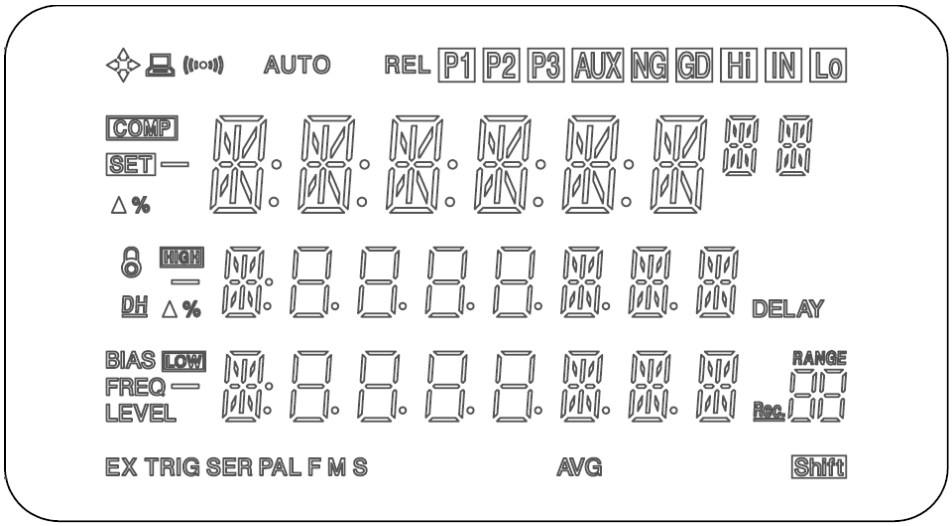



Figure 2-4 VFD

Table 2-4 VFD description

| ICON | Function |
|---|---|
| | Trademark |
| | Remote |
| | Beep |
| AUTO | Range Auto |
| REL | Clearance value on |
| P1 | Comparator Pass Bin-1 |
| P2 | Comparator Pass Bin-2 |
| P3 | Comparator Pass Bin-3 |
| AUX | Comparator Sub-bin Fail |
| NG | Fail |
| Hi | Main Parameter high |
| IN | Main Parameter pass |
| Lo | Main Parameter low |
| COMP | Comparator on |
| SET | Setup Comparator |
| HIGH | Comparator high limit |
| LOW | Comparator low limit |
| | Keypad is locked |
| DH | Data hold |
| FREQ | Frequency |
| LEVEL | Signal level |
| EX | External trigger |
| TRIG | Manual, remote trigger |
| SER | Serial |
| PAL | Parallel |
| F M S | Rate: Fast, Medium, slow |
| Rec. | Files record NO. |
| Range | Range NO. |
| Shift | Changing function |

## 2.7 Real Panel Summary

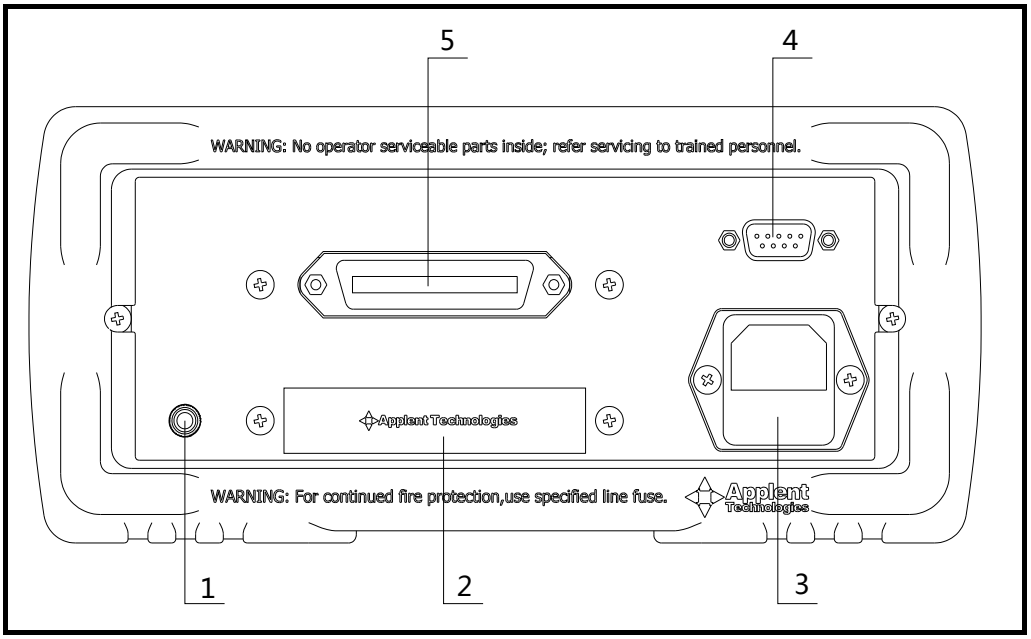


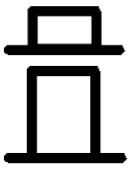

Figure 2-5 Rear panel

1. Ground terminal of instrument housing
2. Reserve
3. AC power cord and fuse holder
4. Reserve
5. Reserve

## 2.8 Power-up

### 2.8.1 Starting up

There is "⏻" on the bottom left of the instrument.



Power On

Power Off

### 2.8.2 Warm-up Time

AT817D 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. Configuration

This chapter describes how to configure AT817D. Include:

- Connect to Device under Test (DUT)
- Setup

## 3.1 Connect to Device under Test (DUT)

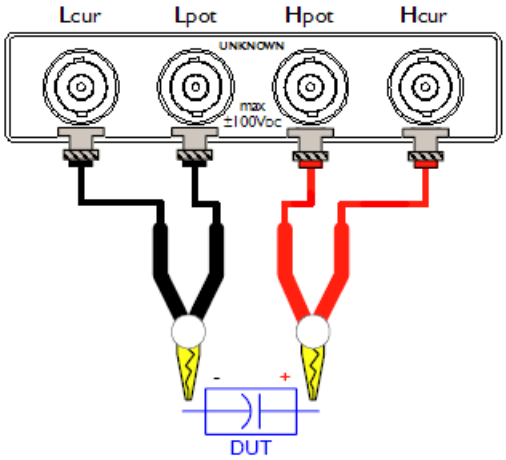



Figure 3-1 Connect to DUT

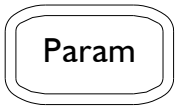
## 3.2 Measurement Parameter [Param key]

The AT817D simultaneously measures three components of the complex impedance (parameters) in a measurement cycle. These include primary parameter, secondary parameter.

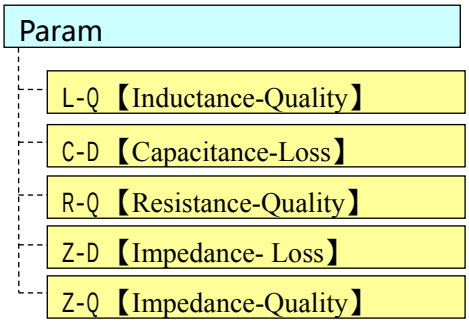
**Types of measurement parameters**
L-Q, C-D, R-Q, Z-D and Z-Q

**Measurement and Monitor parameter descriptions**
L: Inductance value
C: Capacitance value
R: Resistance value
Z: Absolute value of impedance
D: Dissipation factor
Q: Quality factor (=1/D)
ΔABS: Absolute deviation value
Δ%: Relative deviation value

**To choose measurement parameter:**




Under measurement mode, Press Param Key to enter Param page,
5 parameters are available:




Units:

| | | | |
|---|---|---|---|
| L | μH | mH | H |
| C | pF | nF | μF |
| R/Z | Ω | kΩ | MΩ |

## 3.3 Setup Test Frequency (Freq key)


Frequency accuracy: ±0.02%

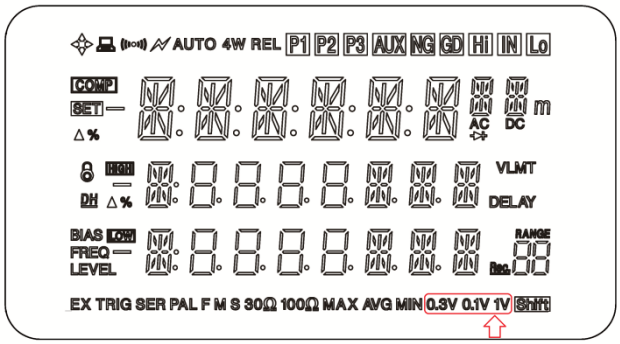
Press Freq, enter Freq page, there are 10 frequency points available:
50Hz, 60Hz, 100Hz, 120Hz, 1kHz, 10kHz, 20kHz, 40kHz, 50kHz, 100kHz

The frequency will appear in the third line of test page

## 3.4 Signal Level [Level key]

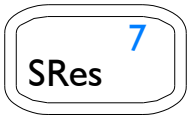

Level accuracy: ±10%

Press Level, enter Level page, there are 3 levels available:
0.1V, 0.3V, 1V
The level will appear in bottom right corner of the VFD screen.




## 3.5 Signal source Impedance [SRes key]

The Source output impedance can be set to 30Ω or 100Ω
If you use AT817D to test a lower inductor, please use 30Ω.
If you need to compare test results with Agilent 4284A, select 100Ω.




Press SRes key to enter SRes Page, there are 3 items available:
30Ω, 50Ω, 100Ω

## 3.6 Selection of monitor parameter

View

Press View, enter View page, “OFF” and “PER” is available:
OFF (monitor parameter will be turned off),
PER (percent result will be displayed on 3rd line)

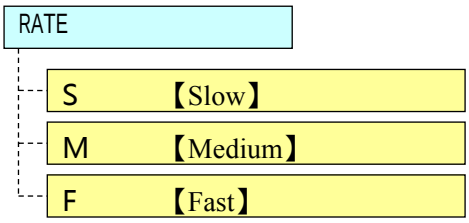
## 3.7 Setting the Sampling Rate [Rate Key]

The Rate operation sets the integration time of the A/D converter, the period of time the input signal is measured (also known as aperture). The integration time affects the usable digits and the amount of reading noise.

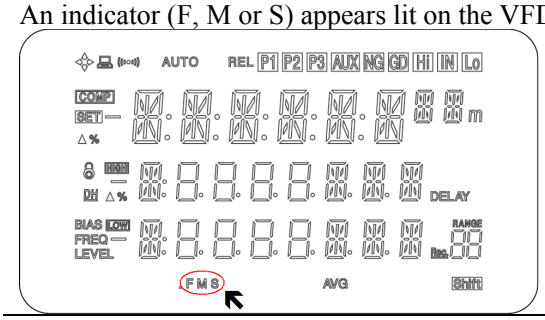
The Rate items are explained as follows, you can press Rate key to choose.
**Fast**: 20 times/s. Use FAST if speed is of primary importance, at the expense of increased reading noise and fewer usable digits.
**Medium**: 8 times/s. Use Medium when a compromise between noise performance and speed is acceptable.
**Slow:** 3 times/s. SLOW provides better noise performance at the expense of speed

Rate

Press Rate, enter test rate setup page




An indicator (F, M or S) appears lit on the VFD.



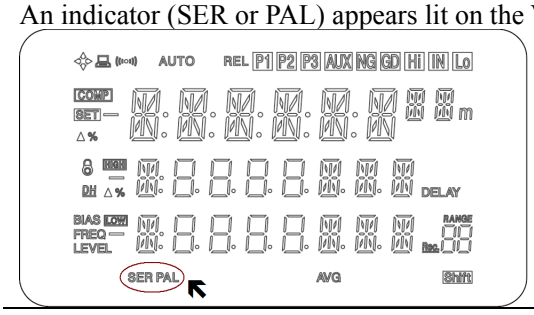

## 3.8 Equivalent [Shift+Param key]

Two equivalent circuits can be select in EQU page:
Series (SER) and Parallel (PAL)

Equivalent
Shift + Param

Press Shift + Param and switch to Equivalent function page, “SER” and “PAL” is available

An indicator (SER or PAL) appears lit on the VFD.

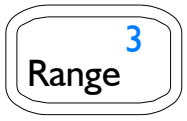


## 3.9 Setting the Measurement Range [Range key]

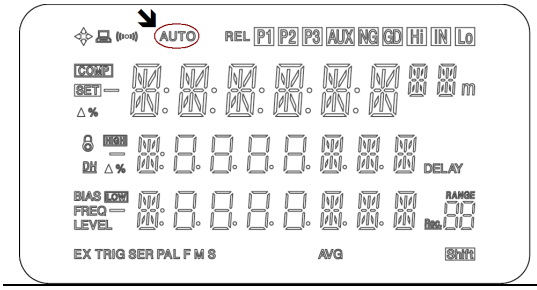
For any measurement range, the maximum accuracy is obtained when the measured impedance is close to the full-scale value of the measurement range being used. Conversely, if the measured impedance is much lower than the full-scale value of measurement range being used, the measurement accuracy will be reduced. This sometimes cause a discontinuity occurs in the measurement values at the measurement range boundaries. If measurement range is set to Auto range, the impedance curve will skip when impedance range change occurs. To prevent this from occurring, the impedance range should be set to the hold range mode.

Figure 3-2 Effective measurement range for the impedance range

| Range No. | Impedance range | Effective measurement range |
|---|---|---|
| 8 | 10Ω | 0 - 10Ω |
| 7 | 30Ω | 10Ω -100Ω |
| 6 | 100Ω | 100Ω -316Ω |
| 5 | 300Ω | 316Ω-1kΩ |
| 4 | 1kΩ | 1kΩ-3.16kΩ |
| 3 | 3kΩ | 3.16kΩ-10kΩ |
| 2 | 10kΩ | 10kΩ-31.6kΩ |
| 1 | 30kΩ | 31.6kΩ-100kΩ (∞) |
| 0 | 100kΩ | 100kΩ-∞ |




Use the ⇦⇨ keys to select the desired range.
Press the Auto key to select auto-range.

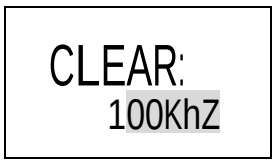



## 3.10 Clear Zero [Clear key]

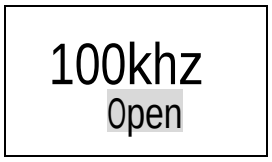
The OPEN/SHORT correction for correcting the stray admittance and residual impedances can be performed.
The correction function has two kinds of correction methods. In one method the open and short correction can be performed at all of the frequency points using the interpolation method, and in the other method the open and short correction can be performed at the frequency points current used.

Before making measurements, the AT817D should be zeroed to correct for test lead and/or fixture errors. During the zeroing process corrections are calculated and stored in instrument memory and applied to ongoing measurements.
Open and short circuit zeroing should be done at the end of this cable.
Generally the unit should be zeroed at least once per day and each time test leads or fixture is changed.


1. Open or Short the test cable before clearing zero.
2. Press Clear key to enter clear-zero page.




3. Use [⇦⇨] key to choose current frequency or All frequencies[SWEEP] .




or


4. Press ESC to exit this page and back to TEST state. Or press [⇦⇨] key to choose "OPEN"(Open-circuit) or "SHORT"(Short-circuit).
5. Press ENTER to perform correction.

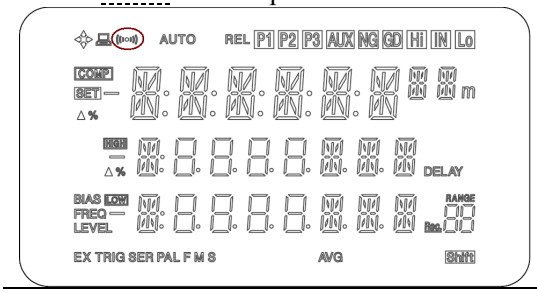
## 3.11 Beeper [Shift+Rate key]


Press Shift + Rate, switch to Beeper page
You may use knob or [⇦⇨] to select the following items:

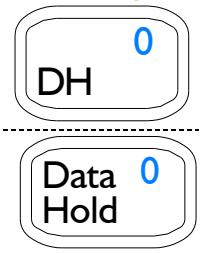
| | |
|---|---|
| NG | Not Good |
| P1. P2. P3 | Good Bins |
| AUX | Auxiliary Bin |
| HI, IN, LO | Main parameter high, good and low |
| OFF | Beep Off |

**Exit**: Press ESC to exit the current page and return to test page
**Perform**: Press Enter, save the setup, return to test page

Mark:  on the top left corner means that the beeper is turned on.

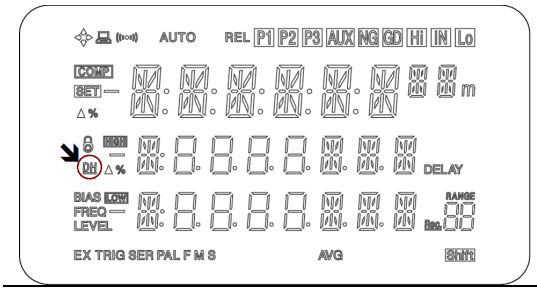



## 3.12 Data Hold




Under the measurement state, press Data Hold, the current test data will be held on the screen.

When "DH" is on, it means that the current data is held, the sampling will be discontinued.



## 3.13 Key Lock [Shift+DH key]


Press Shift + DH (Data Hold),switch to Key Lock function

Mark: When appearing on left of screen, the keypad is locked.
This function is used under remote or external trigger state.

## 3.14 Setup Comparator


Press Comp, enter Comparator page

Comparator Setup
NOM Nominal Value
SEC Second Parameter
P1-P3 Pass Bin Limit

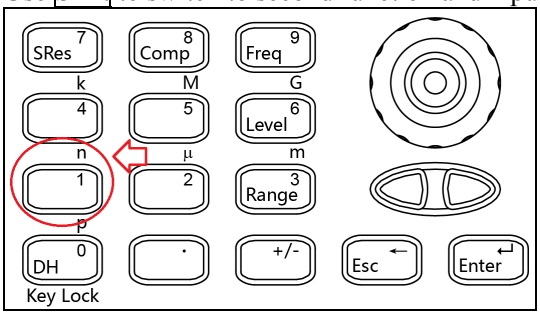
Use “knob” to change pages

**Exit:** Press ESC, return to test state

### 3.14.1 Nominal Value

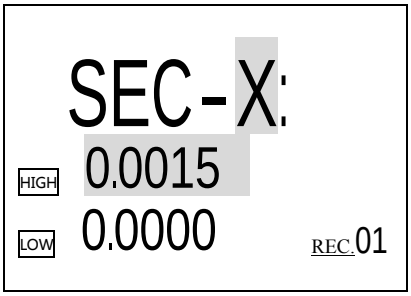

**How to modify value:**
Press Enter key or press numeric key directly to input the value.
**Example:**
To input 12.345nF:

1. Press 1 directly and begin to input value
2. After you input 12.345, ready to input unit
3. Use Shift to switch to second function and input “n”




4. Press Enter and return to select state

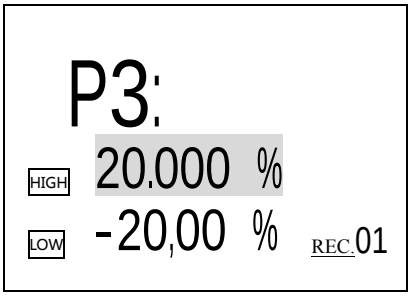
### 3.14.2 Setting high limit and low limit of monitor parameter



SEC-D: Loss input page
SEC-Q: Quality
SEC-R: Resistance Value
HIGH: High limit
LOW: Low limit

**How to modify value:**
Press Enter key or numeric key, input the value in the current flicker volume.
Press Enter to save data, press ESC to cancel the current input.

### 3.14.3 P1-P3: Setting high limit and low limit of main parameter




P1-P3: bin number.
HIGH: High limit, if comparator mode is PER, the unit is %
LOW: Low limit

**How to modify value:**
Press Enter key or numeric key, input the value in the current flicker volume.
Press Enter to save data, press ESC to cancel the current input.

### 3.14.4 How the comparator work

AT817D has 5+3 bins
P1-P3 is used to indicate whether main parameters pass or not, if fail, NG, HI, LO indicator will be on and the sorting work is over, if pass, it will continue to compare monitor parameter.

AUX is used to indicate whether monitor parameters pass or not, if fail, AUX indicator will be on, if pass, the indicator will be off. If you need Auxiliary Bin to identify, please turn on AUX in the comparator setup.

If NG main parameter fails, NG will be on, or when Auxiliary Bin is off, if monitor parameter fails, NG will be on.

If NG main parameter fails, then NG will be on, or under the state of turning off Auxiliary Bin, monitor parameter fails, then NG will be on

When GD indicator P1-P3 is on, if Auxiliary display is setup as “sorting result”, then it will indicate BIN1-BIN3.

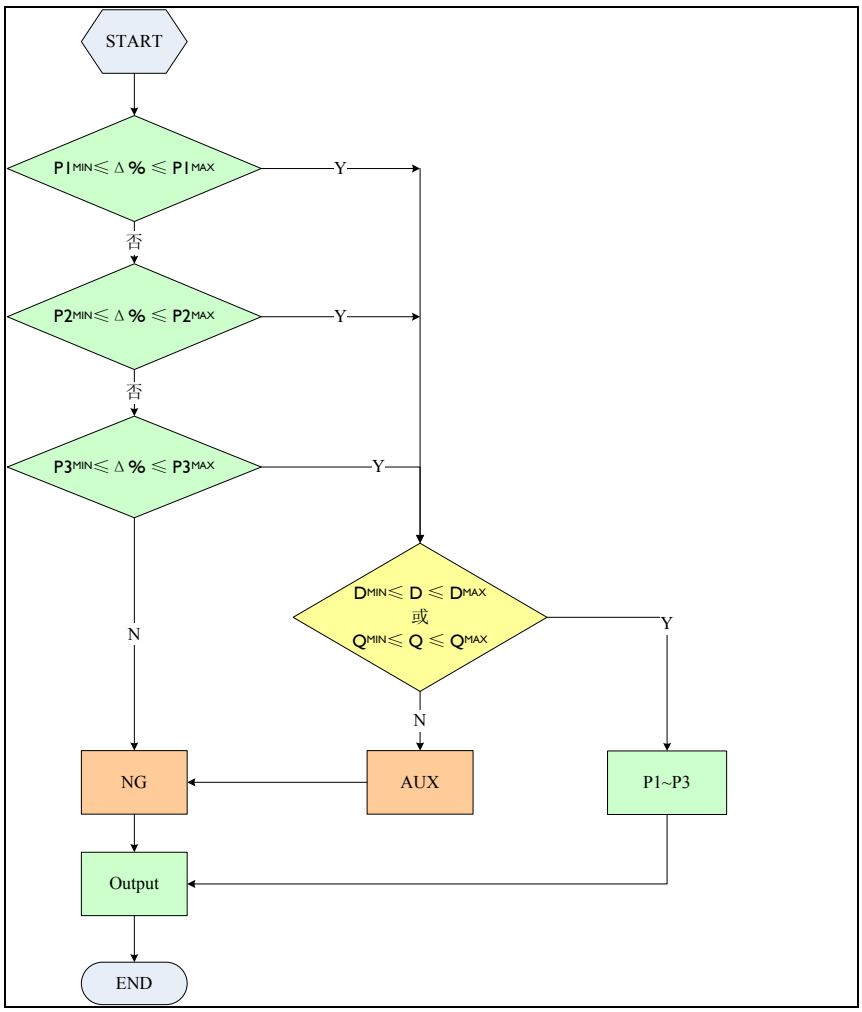
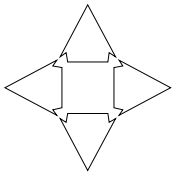



Figure 3-3 Comparator Workflow

# 4. Specification



This chapter describes the specifications and supplemental performance characteristics of the AT817D:

- Specifications
- Dimension

Accuracy is defined as meeting all of the following conditions.
Temperature: 23℃±5℃
Humidity: ≤65% R.H.
Zeroing: Open and Short Correction
Warm up time is 30 min or more.
Rate: Slow
A 1-year calibration cycle

Test signal level: 10%
Test frequency accuracy: 0.02%
Basic Accuracy: 0.1%

## 4.1 General Specification

Display: Vacuum-Fluorescent-Display (4-Colors VFD) Size: 98x55mm
Test Parameter: L-Q, C-D, R-Q, Z-D and Z-Q
Test Frequency: 50Hz, 60Hz, 100Hz, 120Hz, 1kHz, 10kHz, 20kHz, 40kHz, 50kHz, 100kHz
Test Signal Level: 0.1V, 0.3V, 1V
Basic Accuracy: 0.1%
Display digits: Main parameter 5 digits; Secondary parameter 5 digits
Measurement Speed: Fast: 20 times/s, Medium: 8 times/s, Low: 3 times/s
Source Resistance: 30Ω, 50Ω, 100Ω
Range: 9 ranges with Auto and Manual
Equivalent Circuit: Serial and Parallel
Correction: Open/short sweep frequency clear zero;
open/short point frequency clear zero
Beep: 8 bins setup or turn off

Measurement Range:

| | | |
|---|---|---|
| L | 100/120Hz<br>1kHz<br>10kHz<br>100kHz | 1μH – 9.9999kH<br>0.1μH - 999.99H<br>0.01μH – 99.999H<br>0.001μH – 9.9999H |
| C | 100/120Hz<br>1kHz<br>10kHz<br>100kHz | 1p – 9.9999mF<br>0.1p – 999.99μF<br>0.01p – 99.999μF<br>0.001p-9.9999μF |
| R、\|Z\| | 0.0001Ω - 999.99MΩ | |
| D/Q | 0.00001 – 999999 | |
| Δ% | 0.0001%～99999% | |

Auxiliary function: keypad lock and data hold

## 4.2 Environment

Temperature and humidity range: 18℃~28℃, 65% RH or less
Operating temperature and humidity range: 10℃~40℃,10~80% RH
Storage temperature and humidity range: 0℃~50℃,10~90% RH
Power Supply: AC 198 ~ 252V, 48.5Hz ~ 52.5Hz
Fuse: 250V 1A Slow-Blow
Maximum rated power: 25VA
Weight: 5kg, net
Standard accessories: ATL501 test cable, AC power cord, certificate of Approval

## 4.3 Dimensions