用户手册
User's Guide

AT827/AT828

Rev.A0

Firmware Description:

Applicable to the main program RevA1.0 and above

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1. Installation and Setup Guidance

Thank you for purchasing our product! Read the following before any operation to ensure your safety and to keep the instrument in the best possible condition.
You will learn about the following：

- Package Contents
- Power Supply
- Operation Environment
- Cleaning the Instrument

1.1 Package Contents

Before using the instrument, please first:

- Inspect the product's exterior for any damage, scratches, or other defects;
- Verify all accessories are present by comparing them to the packing list.
- If any damage or missing accessories are found, please immediately contact our Sales Department or authorized distributor.

1.2 Power Supply

- You can use the USB power adapter to connect the instrument to the USB port (Type-C) to charge the internal LI-ION battery.
- The minimum output of the USB power adapter is 5VDC, 3A.
- The USB power adapter must comply with CE regulations to ensure the safety of charging the instrument.

1.3 Operation Environment

AT827/828 must be used under the following environmental conditions:

- Temperature：0℃ to 55℃，
- Humidity：23℃ to 70% RH(non-Condensing)
- Altitude：<2000m

1.4 Cleaning the Environment

Do not clean the inside of the instrument.

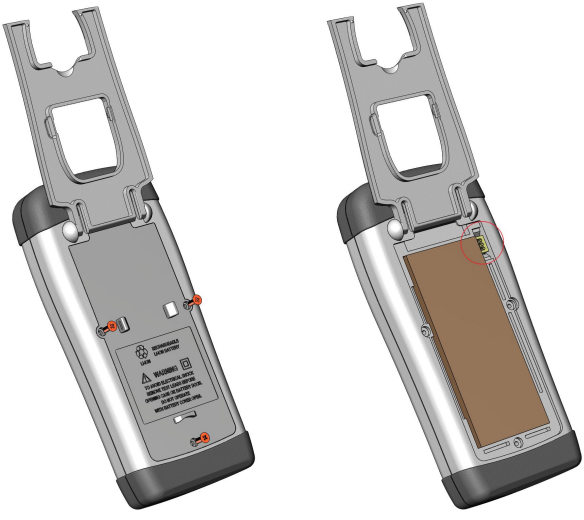
Note: Do not use solvents (such as alcohol or gasoline) to clean the instrument.

Wipe the outer casing and panel with a clean cloth dampened with a small amount of water.

1.5 Battery Replacement

The instrument is built-in with a rechargeable lithium battery, which has been pre-installed in the battery compartment of the instrument at the factory.
Please follow the steps below if battery replacement is needed.

Figure 1- 1 Battery replacement



1. Use a screwdriver to loosen the 3 screws on the battery cover and remove the battery cover.
2. Remove the plug on the old battery, plug in the plug of the new battery, pay attention to the direction of plug.
3. Put the new battery into the battery compartment, cover the battery cover , and tighten the screws.

2. Overview

In this chapter, you will learn about the following :

- Introduction
- Text Functions
- Signal Source
- Main Functions

2.1 Introduction

Thank you for using AT827/828 Series handheld LCR Meter as your testing instrument. This Manual contains the detailed installation steps. To ensure personnel safety and to protect your equipment and data, please check if the following accessories are fully supplied before starting the installation.

AT827/828 Digital Bridge is a handheld precision testing instrument with automatic real-time detection controlled by a high-performance microprocessor. The instrument uses true-color TFT-LCD, operates with keyboard and touch screen, high-precision measurement and easy-to-use.

The instrument can provide the highest test frequency of 100kHz, and provide 0.3/0.7/1.0Vrms signal level, automatic measurement of inductance L, capacitance C, resistance value R, complex impedance Z, quality factor Q, loss angle Tangent D, phase and Rdc.

50,000 count display primary and secondary parameters are displayed, and the basic accuracy is 0.2% so that this instrument can meet the requirements of various component manufacturers, schools, research institutes and metrology quality inspection departments for accurate testing.

The instrument provides the sorting function of the tolerance mode, and provides a set of main parameter percentage sorting.

The whole series of instruments are equipped with USB-HID and USB-VCOM interfaces as standard. The computer remote control commands open to users are compatible with SCPI (Standard Command for Programmable Instrument standard command set), and users can write computer software independently to complete remote control efficiently and data collection functions.

Reference For complete technical specifications, please refer to Chapter 10.

2.2 Test Functions

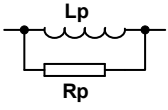
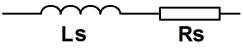
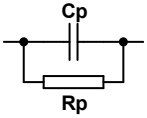
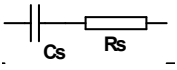
2.2.1 Text Parameters

C-D, C-Q, C-R, L-D, L-Q, L-R, L-Rdc, R-Q, R-X, R-Rdc, Rdc, Z-D, Z-Q, Z-θr, Z-θd

2.2.2 Equivalent Circuit

Series (subscript s), parallel (subscript p).
Actual capacitors, inductors, and resistors are not ideal components of pure reactance and pure resistance. They usually have both resistive and reactive components. An actual impedance element can be simulated by an ideal resistor and an ideal reactor (inductance or capacitance) in series or in parallel.
It can be converted mathematically with a formula, but the two forms are different, and the inconsistency depends on the quality factor Q (or loss D).

Table 2- 1 Equivalent circuit

Circuit		Dissipation Faction	Conversion
L		$D=2\pi FLp/Rp=1/Q$	$Ls=Lp/(1+D^2)$ $Rs=RpD^2/(1+D^2)$
		$D=Rs/2\pi FLs=1/Q$	$Lp=(1+D^2)Ls$ $Rp=(1+D^2)Rs/D^2$
C		$D=1/2\pi FCpRp=1/Q$	$Cs=(1+D^2)Cp$ $Rs=RpD^2/(1+D^2)$
		$D=2\pi FCsRs=1/Q$	$Cp=Cs/(1+D^2)$ $Rp=Rs(1+D^2)/D^2$

The definitions of Q, D, and Xs are: $Q=Xs/Rs$, $D=Rs/Xs$, $Xs=1/2\pi FCs=2\pi FLs$

Suggestion	For components with low impedance value Z (high value capacitors and low value inductors) use the series equivalent circuit, For components with large impedance Z (low value capacitors and high value inductors) use parallel equivalent circuits. The equivalent circuit is determined according to the actual use of the component. For example, for a capacitor, a series equivalent circuit is used for power filtering, and a parallel equivalent circuit is used for an LC oscillator circuit.

2.2.3 Range

Auto, Hold range. Total 8 Rangers.

2.2.4 Speed

2 speeds: slow and fast.
Text conditions:
Text frequency: 1kHz, range: AUTO
Fast: 8 times/s
Slow: 2.3 times/s

Text frequency: 1kHz, range: HOLD
Fast: 10 times/s
Slow: 2.5 times/s

2.2.5 Basic Accuracy

0.2%

2.2.6 Display Range

Table 2- 2 AT827 Measurement display range

Function	Display Range
L	0.01μH ～ 999.9H
C	0.01pF ～ 999.9mF
R、X、Z、Rdc	0.0001Ω ～ 99.99MΩ
D	0.0001 ～ 9.999
Q	0.0001 ～ 999.9
Θd	-179.99°～179.99°
Θr	-3.1416 ～ 3.1416
%	-999.9% ～ 999.9%

Table 2- 3 AT828 Measurement display range

Function	Display Range
L	0.001μH ～ 999.9H
C	0.001pF ～ 999.9mF
R、X、Z、Rdc	0.0001 Ω ～ 99.99MΩ
D	0.0001 ～ 9.999
Q	0.0001 ～ 999.9
θ d	-179.99° ～179.99°
θ r	-3.1416 ～ 3.1416
%	-999.9% ～ 999.9%

Reference For detailed measurement display range, please refer to the chapter 1.

2.3 Signal Source

2.3.1 Test Frequency

AT827: 50Hz, 100Hz，120Hz，1kHz，2kHz，10kHz
AT828: 50Hz, 100Hz，120Hz，1kHz，2kHz，10kHz，50kHz and 100kHz
Frequency Accuracy：0.02%

2.3.2 Test Level

0.3V，0.7V and 1.0Vrms Level Accuracy: 10%

2.3.3 Output Impedance

100Ω，Accuracy: 5%

2.4 Main Functions

2.4.1 Calibration Function

Open-circuit zeroing: Eliminates the influence of stray impedance within the test lead and instrument.
The instrument can perform full-frequency open-circuit zeroing.
Short-circuit zeroing: Eliminates the influence of series resistance and inductance in the leads.
The instrument can perform full-frequency short-circuit zeroing.

2.4.2 Comparator Function

The instrument can perform percentage sorting of a group of main parameters, and the secondary parameters do not participate in the sorting.

2.4.3 System Settings

- Data hold function
- Touch screen settings
- Power saving mode settings

2.4.4 Interface

The instrument supports USB communication interface, which can be set as HID and virtual serial port (VCOM) two interfaces.
USB-HID remote control
Support USB high-speed mode 48MHz, ASCII transmission.
USB-VCOM remote control
Virtual serial port communication, baud rate adaptive, maximum baud rate 115200, ASCII transmission.

3. Appearance

In this chapter, you will learn the following:

- Get to know the front panel
- LCD display
- Interfaces--introducing power supply and interface information
- Connection of text terminal

3.1 Front Panel

Figure 3- 1 Front panel

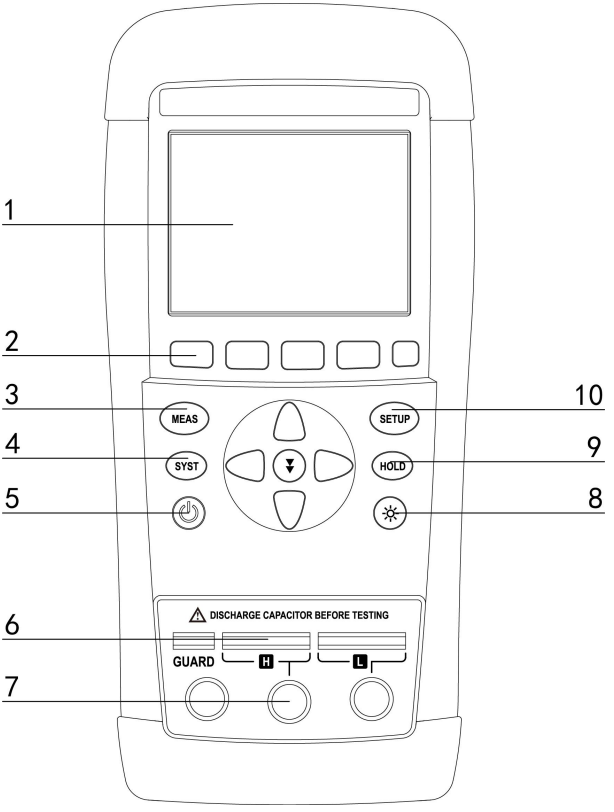


Table 3- 1 Description of front panel functions

Number	Function
1	TFT - LCD display screen
2	Soft keys
3	MEAS Measurement - enter the measurement display ares page. （Page *15: 4 [MEAS DISPLAY]* measurement display ares page）
4	SYST System - enter system setup page. （Page *26: 7 [SYST]* system setup page）
5	Power - power on/off of the instrument, built-in battery charging indicator.
6	Five - wire terminal test socket
7	Three - wire terminal test jack
8	☼ Backlight brightness adjustment - 2 level of backlight display, 50% and100% This key is also used as an unlock key when the keypad is locked in remote control.
9	HOLD Hold - when DH is displayed on the display, it means that the display value is frozen.
10	SETUP Setup - enter setup page.（Page *19: 5 [SETUP]* setup page）

3.2 Top Panel

Figure 3- 2 Top panel

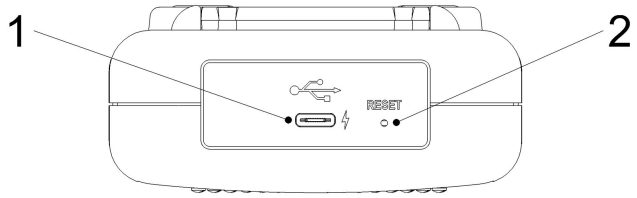


Table 3- 2 Description of top panel

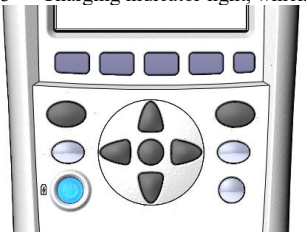
Number	Function
1	**USB:** USB port (Type C) This port is used for remote control and battery charging. Using an external power supply, the measurement accuracy will not be guaranteed.
2	**Reset.** When the instrument unexpectedly fails to shut down or freezes, reset and restart the instrument.

3.2.1 Battery Charging Function

If the battery is not fully charged, the instrument's charging circuit will automatically activate to charge the internal lithium battery once a USB cable is connected. The built-in indicator light on the power button will turn on to indicate that charging is in progress. This indicator light will remain on even when the instrument is turned off, and will only go out when the battery is fully

charged.

Figure 3- 3 Charging indicator light, which glows orange during charging.



Warning	The built-in charging indicator in the power button will stay lit when the battery is being charged, even if the instrument is turned off.

3.3 Power on

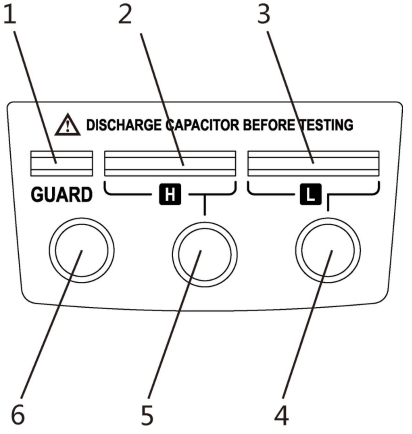
Press the power button for about 2 seconds, the instrument will turn on/off.

3.4 Connection of Test Terminal

The instrument has two kinds of test ports: five-terminal and three terminal test ports.

If you want to meet the accuracy specification of the instrument, you must use the five-terminal test terminal, and the lower accuracy of the three-terminal test will not guarantee the specification.

Figure 3- 4 Connection of test terminal



Warning: Do not apply direct current voltage or current to the test terminals, as this may damage the instrument.

Warning: When testing charged devices, ensure that their electric charge is completely discharged before measurement.

4. [MEAS DISPLAY] Measurement Display

In this chapter, you will learn about all the measurement display functions.

At any time, you can enter the [MEAS DISPLAY] page by pressing the **MEAS** key.

4.1 [MEAS DISPLAY] - Measurement Display Page

Press the [MEAS] Key to enter the [MEAS DISPLAY] page

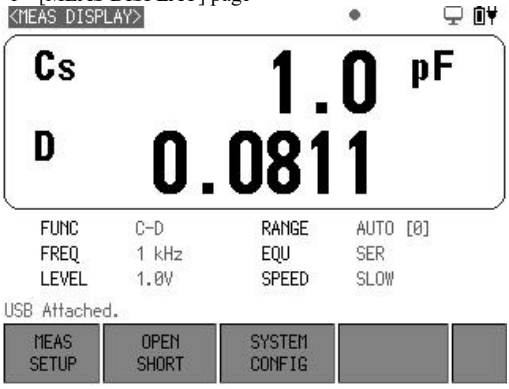
[MEAS DISPLAY] page shows the measurement results and allows configuration of 6 commonly used functions, which include:

- FUNC - Measurement function
- FREQ - Measurement frequency
- LEVEL - Measurement signal level
- RANGE - Measurement range
- SPEED - Measurement speed
- EQU - Equivalent Circuit methods

These settings can also be configured on the [SETUP] page.

The primary and secondary test results are displayed in this area in large font.

Figure 4- 1 [MEAS DISPLAY] page



4.1.1 FUNC - Measurement Function

C-D, C-Q, C-R, L-D, L-Q, L-R, L-Rdc, R-Q, R-X, R-Rdc, Rdc, Z-D, Z-Q, Z-θr, Z-θd Wherein:

L: Inductance C: Capacitance R: Resistance Z: Impedance X: Reactance

B: Susceptance G: Conductance D: Dissipation Factor, Loss coefficient

θ: Phase Angle Q: Quality Factor Rdc: DC Resistance

■ Steps for setting up the measurement function:

Step 1	Press the [MEAS] key to enter measurement page.
Step 2	Use the cursor key to select the [FUNC].
Step 3	Use the function softkeys to select the primary and secondary parameters.

4.1.2 FREQ - Measurement Frequency

AT827：50Hz, 100Hz，120Hz，1kHz，2kHz，10kHz
AT828：50Hz, 100Hz，120Hz，1kHz，2kHz，10kHz，50kHz and 100kHz
Frequency Accuracy: 0.02%

■ Steps for setting up the measurement frequency:

Step 1	Press the [MEAS] key to enter measurement page.
Step 2	Use the cursor key to select the [FREQ].
Step 3	Use the function key to select frequency.

4.1.3 LEVEL - Measurement Signal Level

3 levels: 0.3Vrms，0.7Vrms and 1.0Vrms
Level Accuracy: 10%

■ Steps for setting up the measurement signal level:

Step 1	Press the [MEAS] key to enter measurement page.	
Step 2	Use the cursor key to select the [LEVEL].	
Step 3	Use the function key to select level.	
	Function key	
	0.3V	
	0.7V	
	1.0V	

4.1.4 RANGE - Measurement Range

Table 4-1 Description of measurement range

Range	Description	Advantage	Disadvantage
AUTO	Automatically selects the appropriate range based on the impedance. The range number in the range field will be set automatically.	Users do not need to participate in any way.	Automatic ranging requires a pre-measurement step, resulting in a slower test speed than manual ranging. This difference is particularly noticeable at low frequencies (100 Hz and 120 Hz).
HOLD	The instrument will always perform measurements using the range specified by the user.	The fastest test speed.	The user is required to participate in range selection.

■ Parameter Description:

There are 8 ranges, including: 10Ω，100Ω，300Ω, 1kΩ，3kΩ, 10kΩ，30kΩ, 100kΩ.

The instrument will select the appropriate range according to the impedance|Z| of the device under test.

Table 4-2 Range and corresponding test range

Range number	Range definition	Impedance measurement range

7	10Ω	0Ω ～ 10.5Ω
6	100Ω	10.2Ω ~ 320Ω
5	300Ω	300Ω ~ 990Ω
4	1kΩ	950Ω ～ 3.2kΩ
3	3kΩ	3kΩ ～ 9.9kΩ
2	10kΩ	9.5kΩ ～ 32kΩ
1	30kΩ	3kΩ ~ 99kΩ
0	100kΩ	95kΩ ～ ∞

■ Steps for setting up measurement range

Step 1	Press the [MEAS] key to enter the measurement page.	
Step 2	Use the cursor key to select the [RANGE].	
Step 3	Use the function keys to select the range (AUTO, MANUAL) or HOLD	
	[FUNC]	function
	AUTO	Automatically selects the range. The instrument will select the appropriate range according to the impedance|Z| of the device under test.
	HOLD	Locks on the current range The fastest test speed.
	INCR +	Locks on the current range and increases the range number.
	DECL -	Lock on current range and decreases the range number.

4.1.5 SPEED - Measurement Speed

Measurement speed: SLOW and FAST. The lower the measurement speed, the more accurate and stable the measurement results will be.

■ Steps for setting for measurement speed:

Step 1	Press the [MEAS] key to enter the measurement page.	
Step 2	Use the cursor key to select the [Speed].	
Step 3	Use the function key to select.	
	[FUNC]	Function
	Slow	2.5 times/s
	Fast	10 times/s

4.1.6 EQU - Equivalent Circuit

Equivalent Circuit methods: Series (SER) and Parallel (PAL).

■ Steps for setting up equivalent circuit

Step 1	Press the [MEAS] key to enter the measurement page.	
Step 2	Use the cursor key to select the [EQU].	
Step 3	Use the function key to select.	
	FUNC	function
	Parallel	Parallel Equivalent
	Series	Series Equivalent

4.1.7 HOLD – Data Hold

AT827/828 front panel has a [HOLD] key to freeze and record current measurements.

Figure 4- 2 [HOLD] Data hold function

When data hold is enabled, an [H] indicator will appear in the top-right corner of the screen. Press the [HOLD] key again to deactivate the data hold function.

5. [SETUP] Setup Page

In this chapter, you will learn about all the configuration functions.
At any time, you can enter the [SETUP] page by pressing the **SETUP** key.

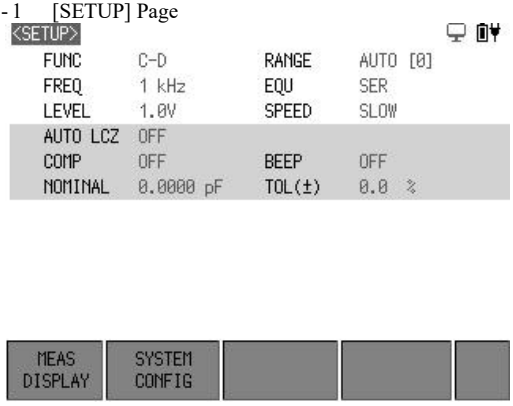
5.1 [SETUP] Setup Page

All measurement-related settings are configured in the [SETUP] page.
These settings include the following parameters:

- FUNC - Measurement Function
- FREQ - Measurement Frequency
- LEVEL - Measurement Signal Level
- RANGE - Measurement Range
- SPEED - Measurement Speed
- EQU - Equivalent Circuit
- AUTO LCZ - Automatic LCZ Selection
- COMP - Comparator Switch
- BEEP - Beep Setup
- NOMINAL - Nominal Setup
- TOL(±) - Tolerance Plus-Minus

The six most commonly used settings can also be configured in the <Measurement Display> page.
For configuration methods, refer to 4.1[MEAS DISPLAY] - Measurement Display Page.

Figure 5- 1 [SETUP] Page



5.1.1 AUTO LCZ – Automatic LCZ Selection

The auto parameter selection function automatically selects the optimal parameters and the best equivalent circuit approach.
If the range is set to auto, the LCR will be in a fully automatic test state.
After AUTO-LCZ is turned on, the FUNC item will display [AUTO-LCZ] and

the EQU item will display [AUTO].

■ Steps for setting up Auto LCZ

Step 1 Press the [SETUP] key to enter the setup page.
Step 2 Use the cursor key to select the [AUTO LCZ].
Step 3 Use the function keys to Select.

FUNC	Function
Turn off	The automatic parameter function is turn off. Setting FUNC or EQU will also turn off the AUTO-LCZ function.
Turn on	The automatic parameter function is turn on. At this point, the [FUNC] will display 'AUTO-LCZ', and the [EQU] will display 'AUTO'.

Note

After the automatic parameter is turned on, the user resets [FUNC] or [EQU], and the automatic parameter function will be turned off.

5.1.2 COMP - Comparator Switch

The built-in simple comparator function of the instrument can compare the main parameters and display the relative deviation percentage on the measurement display page.
The formula for the comparator is as follows:

$$Tol = \frac{Rx - Nom}{Nom} \cdot 100\%$$

Rx: Current measured value
Nom: Nominal value entered

To use the comparator function， set the [COMP] field to ON.

■ Steps to turn on comparator:

Step 1	Press the [SETUP] key to enter the measurement page.	
Step 2	Use the cursor key to select the [COMP].	
Step 3	Use the function key to select.	
	FUNC	Function
	OFF	Turn off the comparator function
	ON	Turn on the comparator function

5.1.3 BEEP - Beep Function

The instrument provides two types of beep functions: Pass and Fail, which are used to indicate the status of test results.

■ Steps for setting up beep:

Step 1	Press the [SETUP] key to enter the measurement Page.	
Step 2	Use the cursor key to select the [BEEP].	
Step 3	Use the function key to select.	
	FUNC	Function
	OFF	Beep off.
	PASS	Beep on Pass.
	FAIL	Beep on Fail.

Note	When powered by an external power source, the beep will beep continuously until the status changes. When on battery power, the beep will beep short until the status changes. Normally, if you want to enable the beep function, you should set the beep to [Pass].

5.1.4 NOMINAL - Input [Nominal Value]

Input Nominal Value：

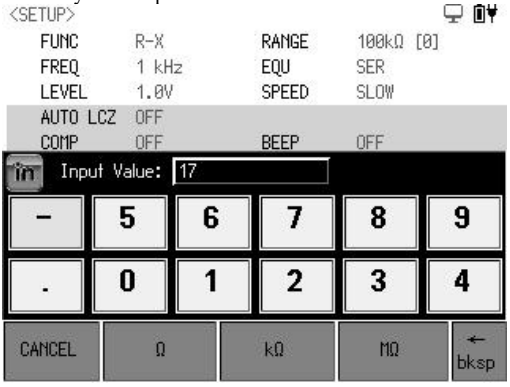
1. [KEYPAD INPUT]: Input using the touch screen keyboard
2. [MEAS INPUT]: Use measurement standard component value input

■ Steps for Setting Automatic Parameters:

Step 1	Press the [SETUP] key to enter the measurement Page.	
Step 2	Use the cursor key to select the [NOMINAL].	
Step 3	Use the function key to select.	
	FUNC	Function
	KEYPAD INPUT	Input using the touch screen keyboard.
	MEAS INPUT	Use measurement standard component value input.

■ Use the touchscreen [KEYPAD INPUT] nominal value

Figure 5- 2 Keyboard input box



Step 1	After pressing the [KEYPAD INPUT] key, the keyboard input box will be displayed.
Step 2	Use your finger to lightly touch the number keys on the touch screen to enter the nominal value or use the direction keys to select a number and then press the key to enter the nominal value.
Step 3	Finally, press the unit function key to complete the input.

Note	If the touch screen is turned off in the system, when the input box is activated, the touch screen is automatically enabled for touch screen input.

■ Steps to enter [MEAS INPUT] Nominal Value

Step 1	After pressing the [MEAS INPUT] key, the LCD display prompt:: **Plug a Standard Component...**
Step 2	Inserting the standard component
Step 3	Press the [OK] key to start measuring the standard component, and the measured value is displayed in the nominal value item.

5.1.5 TOL - Input Percentage Deviation

Use the touch screen keyboard to enter the relative deviation (percentage deviation), and also provide 4 common values: 1%, 5%, 10% and 20%.

■ Steps to Enter [Relative Deviation]

Step 1	Press the [SETUP] key to enter the measurement page.	
Step 2	Use the cursor key to select the [Relative Deviation].	
Step 3	Use the function key to select.	
	FUNC	Function
	KEYPAD INPUT	Use touch screen virtual keyboard input box to input.
	±1%	Set to ±1%.
	±5%	Set to ±5%.
	±10%	Set to ±10%.
	±20%	Set to ±20%.

6. [OPEN SHORT] Open Short Page

In this chapter, you will learn how to perform the user Open Short correction on the instrument.

In order to achieve the accuracy of the technical indicators, please perform open circuit test and short circuit test before measuring after warming up the instrument.
When replacing the test fixture or test cable, please reset the open and short test again.
When the temperature changes greatly, please perform open and short test in time.

6.1 [OPEN SHORT] Page

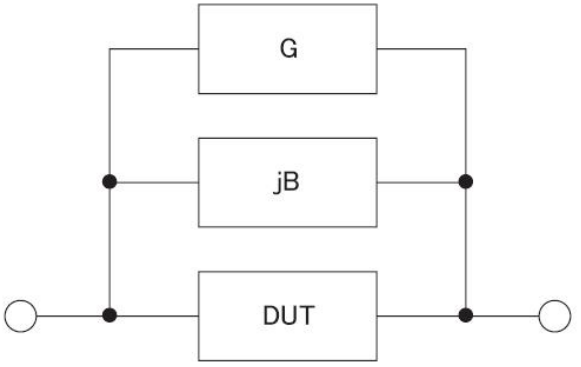
Figure 6- 1 [OPEN SHORT] page

On the [MEAS DISPLAY] page, press the [OPEN SHORT] key to enter the [OPEN SHORT] page. This page offers two options:
OPEN TEST - Open circuit correction
SHORT TEST - Short circuit correction

6.2 [OPEN TEST]-Open Circuit Correction

Open correction capability cancels errors due to the stray admittance(G,B) in the test fixture.

Figure 6- 2 Stray admittance



[Open Test] Correction performs an open short on all instrument frequencies. Frequency points vary by instrument version.

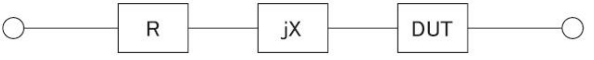
■ Method for Open Test:

Step 1	Press the [OPEN SHORT] key to enter the [OPEN SHORT] page.	
Step 2	Use the arrow keys to select the [OPEN TEST] item.	
	FUNC	Function
	ON/OFF	Enable or Disable the open circuit correction function.
	LCR OPEN	Open correction for LCR only.
	DCR OPEN	Open correction for DCR only.
Step 3	Select [MEAS OPEN] or [DCR OPEN] to start open correction. LCD display prompt: Open-circuit the test terminals At this time, please keep the test terminal or test fixture open and do not contact with any objects.	
Step 4	Press [OK] to start correction. During correction, progress bar will be displayed at the bottom of the page as a prompt. Please wait for the correction to complete. While correction is in progress, LCD will display a progress bar, and you can press the [CANCEL] key to cancel the correction.	

6.3 [SHORT TEST] - Short Circuit Correction

Short correction compensates for any residual impedances (R,X), such as the impedance of the cables and the DUT connection points.

Figure 6- 3 Residual Impedances



■ Method for short test:

Step 1	Press the [OPEN SHORT] key to enter the [OPEN SHORT] page.	
Step 2	Use the arrow keys to select the [SHORT TEST] item.	
	FUNC	Function
	ON/OFF	Enable or Disable the short circuit correction function.
	LCR SHORT	Short correction for LCR only.

	DCR SHORT	Short correction for DCR only.
Step 3	Select [MEAS SHORT] or [DCR SHORT] to start short correction. LCD display prompt: Short-circuit the test terminals Please insert the short bar into the test terminal or short the test fixtures together.	
Step 4	Press [OK] to start correction. During correction, progress bar will be displayed at the bottom of the page as a prompt. Please wait for the correction to complete. While correction is in progress, LCD will display a progress bar, and you can press the [CANCEL] key to cancel the correction.	

7. [SYST] System Configuration Page

In this chapter, you will learn about the instrument's system information and how to configure the system.

At any time, you can enter the [SYSTEM CONFIG] page by pressing the **SYST** key.

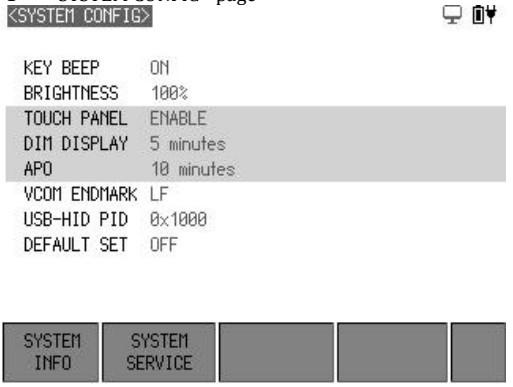
7.1 [SYSTEM CONFIG] System Configuration Page

The system configuration page includes the following information and settings:

- KEY BEEP - Turn ON or OFF key sound
- BRIGHTNESS - LCD screen brightness for adjustment
- TOUCH PANEL - Touchscreen Enable/Disable
- DIM DISPLAY - Decrease backlight brightness time setting
- APO - Auto Power Off Time Setting
- VCOM ENDMARK - USB Virtual serial port terminator
- USB-HID PID - Instrument ID setting
- DEFAULT SET - Reset setting to factory defaults

All settings of the system configuration are automatically saved when the system is turned off.

Figure 7- 1 <SYSTEM CONFIG> page



7.1.1 KEY BEEP - Turn ON/OFF Key Sound

[KEY BEEP] Allow to turn on or off key and touch screen sounds

■ **Turn on or off key sound**

Step 1 Press the [SYST] to enter [SYSTEM CONFIG] page.

Step 2 Use the cursor key to select the [KEY BEEP].

Step 3 Use the function key to select.

FUNC	Function
OFF	Turn off key and touch screen sounds.
ON	Turn on key and touch screen sounds.

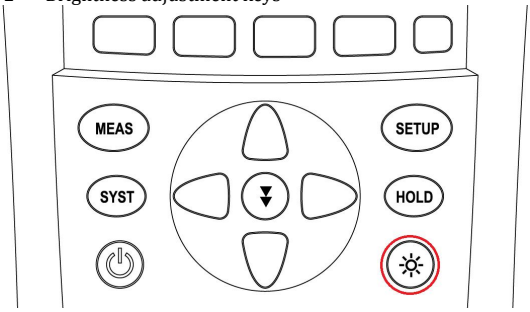
7.1.2 BRIGHTNESS – LCD Screen Brightness for Adjustment

The instrument has two sections of LCD screen brightness for adjustment: 50%, 100%

Note	When powered by external power supply, the screen brightness will be automatically adjusted to 100% When the battery is powered, if you want to extend the working time, you can use 50% brightness to reduce the power consumption of the instrument.

It can be directly adjusted by keyboard key [ ]

Figure 7- 2 Brightness adjustment keys



■ **Steps to Brightness adjustment**

Step 1	Press the [SYST] key to enter the [SYSTEM CONFIG] page.	
Step 2	Use the cursor key to select the [BRIGHTNESS].	
Step 3	Use the function key to select.	
	FUNC	Functin
	50%	50% brightness: Effectively reduces overall instrument power consumption.
	100%	Max Brightness.

The instrument is equipped with a built-in touch screen, which allows for more convenient operation of the instrument.

7.1.3 TOUCH PANEL – Touchscreen Setting

The instrument can complete the measurement operation by using the direction building and function keys. However, when a value needs to be input, a touch screen is required to assist input. When the input box is opened, if the touch screen is closed, it will be automatically opened for use.

■ **Steps to touch screen setting**

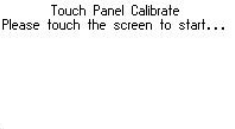
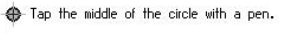
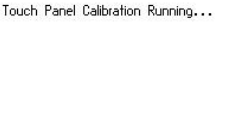
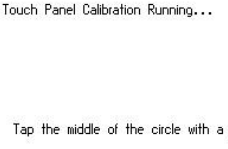
Step 1	Press the [SYST] to enter [SYSTEM CONFIG] page.	
Step 2	Use the cursor key to select the [TOUCH PANEL].	
Step 3	Use the function key to select.	
	FUNC	Function
	ENABLE	Turn on the touch screen function.

	DISABLE	Turn off the touch screen function.
	CALIBRATE	Calibrate touch screen coordinates.
	RESET	Resets the coordinates of the touch screen to the factory value of the instrument.

■ **Steps to touch screen calibration**

Touch screen calibration requires a touch pen.

Note	A touch pen is not included as standard with the instrument. You may use a smartphone touch pen to complete the touchscreen calibration. It is not recommended to use fingers to calibrate the touch screen

Step 1	Press the [SYST] to enter the[SYSTEM CONFIG] page.
Step 2	Use the cursor key to select the [TOUCH PANEL].
Step 3	Press the CALIBRATE function key to enter the calibration page. Touchscreen Calibration Page Display: 
Step 4	Use the touch pen to touch the screen, and the calibration starts.   Calibrate the first point: touch the cross in the upper left orner.  Calibrate the second point: touch the cross in the lower right corner.

Step 5	Calibration complete. 
Step 6	Tap the screen to exit the calibration process.

7.1.4 DIM DISPLAY - Decrease Backlight Brightness Time Setting

When the instrument is powered by batteries, it can be set that no button and touch screen operations are performed within a specified period of time, and the screen backlight can be actively reduced to save battery power.

■ Steps to decrease brightness

Step 1	Press the [SYST] to enter the [SYSTEM CONFIG] page.	
Step 2	Use the cursor key to select the [DIM DISPLAY].	
Step 3	Use the function key to select.	
	FUNC	Function
	5 minutes	The screen brightness will decrease to 30% after 5 minutes.
	10 minutes	The screen brightness will decrease to 30% after 10 minutes.
	20 minutes	The screen brightness will decrease to 30% after 20 minutes.
	30 minutes	The screen brightness will decrease to 30% after 30 minutes.
	OFF	The Brightness Decrease Function will be disabled.

Note	This feature is only available on battery power. The DIM DISPLAY timer will be reset when the instrument detects any operation on the keys or touchscreen.

7.1.5 APO – Auto Power Off Time Setting

When the instrument is powered by battery, it can set the time for automatic shutdown without any operation.

■ Steps to auto power off time setting

Step 1	Press the [SYST] to enter the [SYSTEM CONFIG] page.	
Step 2	Use the cursor key to select the [APO].	
Step 3	Use the function key to select.	
	FUNC	Function
	5 minutes	Instrument powers off after 5 minutes.
	10 minutes	Instrument powers off after 10 minutes.
	20 minutes	Instrument powers off after 20 minutes.
	30 minutes	Instrument powers off after 30 minutes.

	OFF	The auto power-off function will be disabled.

Note	This feature is only available on battery power. The APO timer will be reset when the instrument detects any operation on the keys or touchscreen.

7.1.6 VCOM ENDMARK - USB Virtual Serial Port Terminator

AT827/828 series has a built-in USB-VCOM virtual serial port for communication with the host computer. USB-VCOM supports the following configurations:

Data bits: 8 bits
Stop bit: Adaptive,1 or 2 bits
Parity: None
Baud rate: adaptive，up to 115200bps.

AT827/828 communication protocol uses a simple SCPI protocol, which only supports single-line instructions and does not support instruction cascading.

Note:

1. The end character must be added at the end of the command sent by the host computer, and the instrument will respond.
2. The end character sent by the host computer must be one of them: NUL (0x00), LF (0x0A), CR (0x0D), CR+LF (0x0D0A), which may not be the same as the VCOM ENDMARK setting.
3. The setting of VCOM ENDMARK will be added at the end of the data returned by the instrument.

VCOM terminator setting steps:

Step 1	Press the [SYST] key to enter the [SYSTEM CONFIG] page.	
Step 2	Use the cursor key to select the [VCOM ENDMARK].	
Step 3	Use the function key to select.	
	FUNC	Function
	NUL	HEX 0x00
	LF	HEX 0x0A
	CR	HEX 0x0D
	CR+LF	HEX 0x0D0A

7.1.7 USB-HID PID - Instrument ID Setting

AT827/828 series has a built-in standard USB-HID communication interface for high-speed communication with the host computer. By setting the PID of USB-HID, the host computer can establish communication with up to 8 AT 827/828.

Before multi-machine communication, be sure to set the PID of each instrument to a different PID.

■ USB-HID PID setting steps：

Step 1	Press the [SYST] key to enter the [SYSTEM CONFIG] page.	
Step 2	Use the cursor key to select the [USB-HID PID].	
Step 3	Use the function key to select.	
	FUNC	Function
	1000	HEX 0x1000
	1001	HEX 0x1001
	1002	HEX 0x1002
	1003	HEX 0x1003
	1004	HEX 0x1004
	1005	HEX 0x1005
	1006	HEX 0x1006
	1007	HEX 0x1007

7.1.8 DEFAULT SET - Reset Setting to Factory Defaults

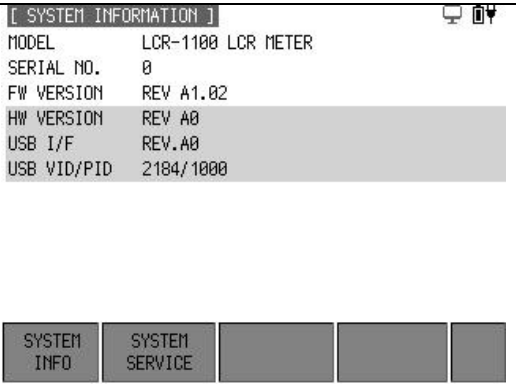
[DEFAULT SET] option allows the user settings to be restored to the factory default settings.

7.2 [SYSTEM INFORMATION] System Information Page

Displays the model, serial number , firmware/hardware/USB version and USB VID/PID of the instrument.

There are no user-configurable options available on the System Information page.

Figure 7- 3 <System Configuration> page


[SYSTEM INFORMATION]
MODEL LCR-1100 LCR METER
SERIAL NO. 0
FW VERSION REV A1.02
HW VERSION REV A0
USB I/F REV.A0
USB VID/PID 2184/1000
SYSTEM INFO
SYSTEM SERVICE

8. Measurement Operations and Examples

This chapter describes a measurement example.

Warning: Do not apply DC voltage or current to the test terminal, otherwise the instrument will be damaged.
Warning: Before testing the capacitor, make sure the capacitor has been discharged, otherwise the voltage will damage the instrument.
Warning: Do not use in humid environment.
Warning: Do not use in dusty environment.

8.1 Measurement Examples

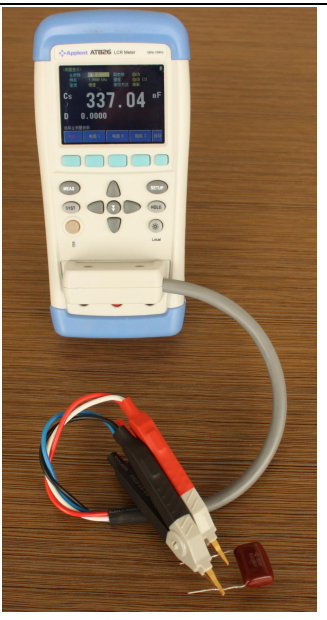
To measure a thin film ceramic capacitor, explain how to measure the capacitance value.
Before testing, please determine the following measurement conditions according to the specifications of the capacitor.

- DUT: Film capacitor
- Main parameter: Capacitance C
- Secondary parameter: Loss D
- Test frequency: 1kHz

Step 1	Press the power button to start the instrument, the instrument will enter the page.
Step 2	Use the cursor key to select: [FUNC]: Press the function key to select the [C-D] [FREQ]: Select [1.0000 kHz] [RANGE]: Select [AUTO] [SPEED]: Select [SLOW] [EQU]: Select [SERIAL]
Step 3	Please install the test fixture or use the test slot of the instrument.
Step 4	Please follow the OPEN/SHORT chapter to perform open circuit and short circuit zero reset calibration.
Step 5	Insert the capacitor into the test slot of the instrument or connect the capacitor with a test fixture.
Step 6	Read the test result.

Figure 8- 1 Test results for capacitors


Applient AT826 LCR Meter
Cs
337.00
nF
D
0.0001
MEAS
SETUP
SYST
HOLD
Local
DISCHARGE CAPACITOR BEFORE TESTING
GUARD


337.04
nF
0.0000

9. Remote Control/Command Overview

In this chapter, you will learn how to establish communication between the instrument and a computer, as well as the relevant command set.

9.1 USB-HID Device Class

The instrument provides USB-HID class, which can be automatically identified by Windows when connected to a PC. Therefore, the user does not need to install the driver, and the instrument can be installed automatically under the Windows system (as shown below), and the user can use the Windows internal API function to complete the control of the instrument.

Note AT827/828 only supports operating systems above Windows 7.

Figure 9- 1 On the computer, the instrument is recognized as GW Intek HID

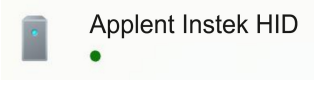
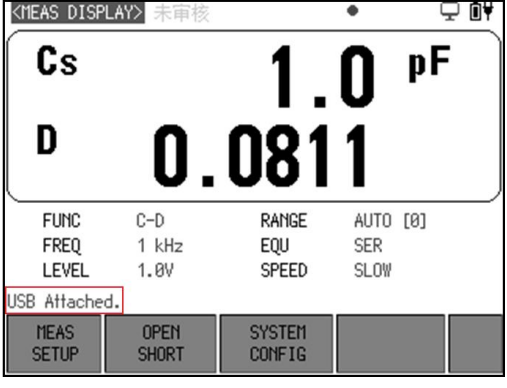


Figure 9- 2 On the instrument, the bottom prompt line displays USB attached

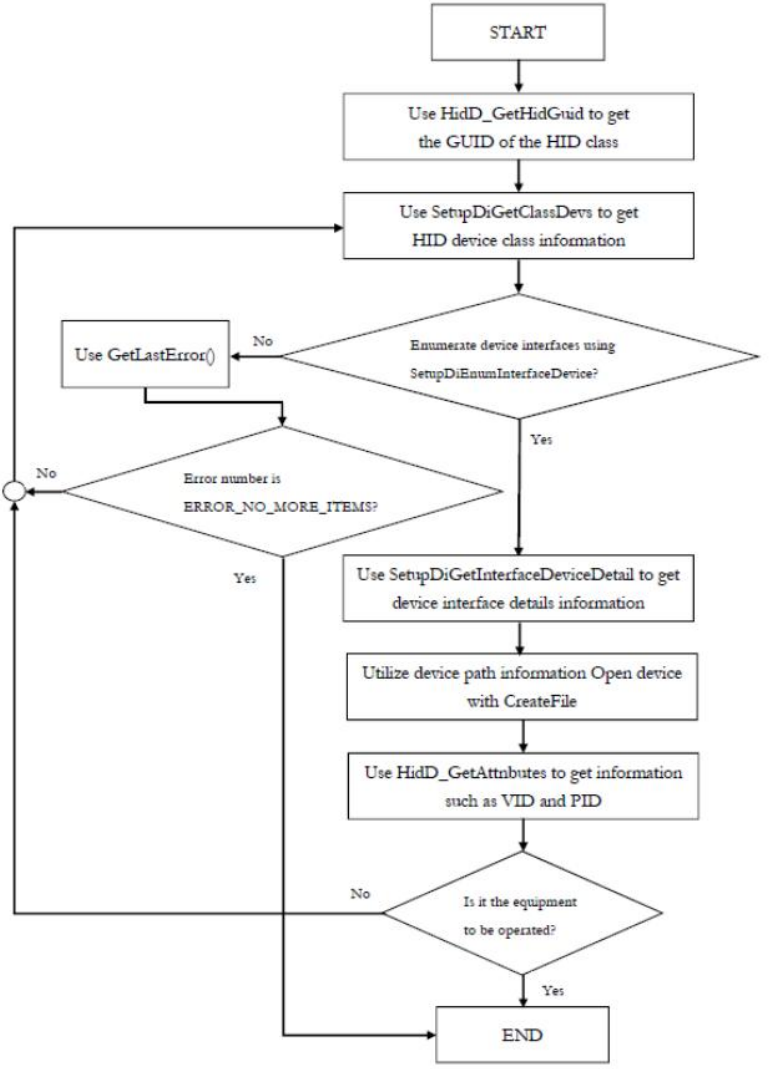


9.2 USB-HID WriteFile

The instrument provides free data communication examples for user reference, and the sample code is distributed together with the instruction manual.

Note If user needs to write software by himself, please understand the related knowledge of USB and USB HID first, which can be obtained from www.usb.org website.

Figure 9- 3 Flowchart for Windows host access to USB-HID devices



The basic API functions used are as follows:

- **CreateFile(**

```
devDetail->DevicePath,                    // Device path
GENERIC_READ | GENERIC_WRITE,             // Access method
FILE_SHARE_READ | FILE_SHARE_WRITE,       // Share mode
NULL,
OPEN_EXISTING,              // When the file does not exist, return failure
FILE_FLAG_OVERLAPPED,       // Open in overlapped (asynchronous) mode
NULL);
```

Here, CreateFile is used to open the HID device, where the device path is obtained through the function SetupDiGetInterfaceDeviceDetail.

- **ReadFile(**

```
hDev,                    // Device handle, which is the return value of CreateFile
```

```
recvBuffer,                    // Buffer for receiving data
IN_REPORT_LEN,                 // The length of the data to be read
&recvBytes,                // The number of bytes of data actually received
&ol);                          // Asynchronous mode
```

Here, ReadFile is used to read the input report sent by the HID device through the interrupt IN transfer.

- **WriteFile(**

```
hDev,                  // Device handle, which is the return value of CreateFile
reportBuf,                     // Buffer with data to be sent
OUT_REPORT_LEN,                // Length of data to be sent
&sendBytes,                // The number of bytes of data actually received
&ol);                          // Asynchronous mode
```

Here, WriteFile is used to transmit an output report to the HID device.

- **Communication parameters:**

VIP：2184 （HEX）

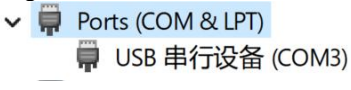
PID：1000~1007 (HEX)

Packet：64 bytes

Note	The instrument's USB port remains permanently active, no additional parameters require configuration beyond setting the PID.

9.3 USB-VCOM Virtual Serial Port

AT827/828 connected to PC, it will automatically install the driver and create a virtual serial port. The serial port number needs to be viewed in the Device Manager



Note	Older versions of the Windows operating system may require driver installation.

USB-VCOM follows the standard serial protocol for communication.

USB-VCOM communicates using the following parameters:

1. Data bits: 8 bits
2. Stop bit: adaptive，1 or 2 bits
3. Parity: None
4. Baud rate: adaptive，up to 115200bps.

Note	The instrument's USB-VCOM function is always enabled, and no additional parameter configuration is required.

When using USB-VCOM to communicate with AT827/828, please use the simplified SCPI protocol, which can only send one command at a time, and cannot use multiple commands.

For Example:

SEND> FUNC C-D<terminator> Correct

SEND> FUNC C-D;FREQ 1K<terminator> Error

9.4 Command Overview

AT827/828 instruction set is common to both USB-HID and USB-VCOM. The difference is that USB-HID needs to be packaged and used, while USB-VCOM can be used directly.

9.4.1 USB-HID Command Package

If the USB-HID interface is used for communication, the instrument transmits data at a rate of 64 bytes per packet. Therefore, each USB-HID command occupies exactly one packet.

Note	Command packets follow a fixed format. Users must adhere to the format specified by the instrument when developing them; otherwise, communication cannot be established. The command bytes included in a command packet are not case-sensitive. Each command packet must contain a checksum calculated from the first 60 bytes, which shall be filled in the last 4 bytes.

The command packet format sent by the PC (a packet structure defined in C language, other language formats must be similar):

```
#define program pack(1)
typedef __packed struct
{
    uint      cSize;              //Packet size 4=60
    char      sHeader[24];        //Command 24
    char      sPara[28];          //parameter 28
    uint      nSignature;         //Signature 4=0x88805550
    uint      nChecksum;          //Checksum 4
} TUSB_CMD;
#define program pack()
```

in,

cSize:	always 60
nSignature:	always 0x88805550
sCmd and sPara:	see SCPI command set
nChecksum:	32-bit checksum

A complete sending instruction package (PC side) is as follows:

cSize:	0x0000003C,
sHeader:	IDN?
sPara:	(empty)
nSignature:	0x88805550
nChecksum:	0x00002BC1

Since the format and number of digits of the sending command packet are fixed, the command word and parameters must be filled with hexadecimal HEX: 0x00 if the number of bytes is less than the specified number. For example, the Hex format

of a complete sending packet is as follows:

Table 9-1 Command to send packet data

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
00	00	00	40	49	44	4E	3F	00	00	00	00	00	00	00	00
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
00	00	00	00	00	00	00	00	88	80	55	50	00	00	2B	C1

The packet size of the instrument response is also 64 bytes, which is not enough to fill with 0x00 (Note: not the ASCII number 0).
A received packet (instrument side) is as follows: ASCII format:
APPLENT,AT828,0,REV A1.0

9.4.2 Specifiers

When describing the directive, we use some specifiers, these specifiers are not part of the directive, just for the convenience of explanation, please don't include it when passing the directive.

Table 9-2 Specifiers

Specifier	Description
<>	Angle brackets denote parameter names
[ ]	Square brackets indicate that the content is optional
|	Indicates multiple choice

9.4.3 Data Types

AT827/828 supports multiple data types.

Table 9-3 Table list of data formats

Format	Description	Example
<NR1>	Integer	100，+100，-100
<NR2>	Real number	1.23，+1.23，-1.23
<NR3>	Floating point number	1.23E4，+1.23E4，-1.23E4，-1.23e-4
<NR4>	Floating point number with multiplier	1.23K，1.23N，1.23U （see the table below for multiplier）

Table 9-4 Magnification

Definition	Suffix
1E18 (EXA)	EX
1E15 (PETA)	PE
1E12 (TERA)	T
1E9 (GIGA)	G
1E6 (MEGA)	MA
1E3 (KILO)	K
1E-3 (MILLI)	M
1E-6 (MICRO)	U

1E-9 (NANO)	N
1E-12 (PICO)	P
1E-15 (PEMTO)	F
1E-18 (ATTO)	A

9.5 Command List

Summary of all USB commands:

- DISP Display Subsystem
- FUNC Function Subsystem
- FREQ Frequency subsystem
- APER Speed Subsystem
- FETC? Query Result Subsystem
- COMP Comparator Subsystem
- CORR Calibration Subsystem
- SYST System Configuration Subsystem
- IDN? Version Query Subsystem
- RST Warm Start Subsystem
- ERR Error Subsystem

9.5.1 DISP Display Subsystem

■ DISP:PAGE <meas|setup|system>

Description	It sets the display page.
Set syntax sHeader	DISP:PAGE
Set parameter sPara	<MEAS|SETUP|SYSTem|CSET|SINF> In: MEAS：Measurement display page SETUP: Setup page SYSTem: System page CSET: OPEN/SHORT calibration page SINF: System information page

■ DISP:PAGE?

Description	It queries the display page.
Query syntax sHeader	DISP:PAGE?
Set parameter sPara	Empty
Return data	<meas|setup|cset|sinf|system>

■ DISP:LINE <string>

Description	It displays the specified character string in the help prompt column of the instrument.
Set syntax sHeader	DISP:LINE
Set parameter	<string> The content of the string to be displayed, the

sPara	maximum length of the string is 28 bytes, if the length exceeds, it will be ignored.

9.5.2 FUNC Function Subsystem

FUNC <C-D, C-Q, C-R, L-D, L-Q, L-R, L-Rdc, R-Q, R-X, R-Rdc, Rdc, Z-D, Z-Q, Z-θr, Z-θd>

Description	It sets the measurement parameters.
Set syntax sHeader	FUNC
Set parameter sPara	<C-D|C-Q|C-R|L-D|L-Q|L-R|L-Rdc|R-Q|R-X|R-Rdc|Rdc|Z-D| Z-Q|Z-thr|Z-thd>
Note	When AUTO-LCZ is ON, after sending FUNC command, AUTO-LCZ will be turned off.

■ FUNC?

Description	It queries the measurement parameters.
Query syntax sHeader	FUNC?
Set parameter sPara	Empty
Return data	<C-D|C-Q|C-R|L-D|L-Q|L-R|L-Rdc|R-Q|R-X|R-Rdc|Rdc|Z-D| Z-Q|Z-thr|Z-thd>

■ FUNC:EQU <SERIAL|PARALLEL >

Description	It sets the equivalent mode.
Set syntax sHeader	FUNC:EQU
Set parameter sPara	<SERIAL|PARALLEL> SERIAL: Serial PARALLEL: Parallel
Note	When AUTO-LCZ is ON, after sending FUNC:EQU command, AUTO-LCZ will be turned off.

■ FUNC:EQU?

Description	It queries the equivalent mode.
Query syntax sHeader	FUNC:EQU?
Set parameter sPara	Empty
Return data	<SERIAL|PARALLEL>

■ FUNC:LCR:RANG <0|1|2|3|4|5|6|7>

Description	It sets the LCR measurement range.
Set syntax sHeader	FUNC:LCR:RANG
Set parameter sPara	<0|1|2|3|4|5|6|7> 0~7 represents the range number

■ FUNC:LCR:RANG?

Description	It queries the LCR measurement range.
Query syntax sHeader	FUNC:LCR:RANG?
Set parameter sPara	Empty
Beep	<0~7>

■ FUNC:DCR:RANG <0|1|2|3|4|5|6|7>

Description	It sets the DCR measurement range.
Set syntax sHeader	FUNC:LCR:RANG
Set parameter sPara	<0|1|2|3|4|5|6|7> 0~7 represents the range number

■ FUNC:DCR:RANG?

Description	It queries the DCR measurement range.
Query syntax sHeader	FUNC:DCR:RANG?
Set parameter sPara	Empty
Return data	<0~7>

■ FUNC:RANG:AUTO <ON|OFF|1|0>

Description	It sets the range mode.
Set syntax sHeader	FUNC:RANG:AUTO
Set parameter sPara	<ON|OFF|1|0>

■ FUNC:RANG:AUTO?

Description	It queries the range mode.
Query syntax sHeader	FUNC:RANG:AUTO?
Set parameter sPara	Empty
Return data	<on|off>

9.5.3 FREQ Frequency Subsystem

■ FREQ <50|100|120|1k|2k|10k|50k|100k>

Description	It sets the test frequency.
Set syntax sHeader	FREQ
Set parameter sPara	<50|100|120|1k|2k|10k|50k|100k> In: The frequency value can accept any numerical format, but the data must be the frequency value of the instrument, and the incorrect frequency value will use the closest correct frequency value. The frequency values for each model are as follows:

	<50|100|120|1k|2k|10k>(AT827) <50|100|120|1k|2k|10k|50k|100k>(AT828)

■ FREQ?

Descripyion	It queries the test frequency.
Query syntax sHeader	FREQ?
Set parameter sPara	Empty
Return data	<50|100|120|1000|2000|10000|50000|100000>

9.5.4 APER Speed Subsystem

■ APER <SLOW|FAST>

Description	It sets the test speed.
Set syntax sHeader	APER
Set parameter sPara	<SLOW|FAST>

■ APER?

Description	It queries the test speed.
Query syntax sHeader	APER？
Set parameter sPara	Empty
Return data	<SLOW|FAST>

9.5.5 FETC? Query Result Subsystem

■ FETC?

Description	It queries the test results.
Query syntax sHeader	FETC?
Set parameter sPara	Empty
Return data	<primary parameter result, secondary parameter result> The instrument returns the test results of the primary and secondary parameters NR3 type. If the secondary parameter is closed, it will return data +0.000000e+00
Example	+7.929158e-15,+0.000000e+00

9.5.6 COMP Comparator Subsystem

■ COMP <ON | OFF | 0 | 1>

Description	It sets the status of the comparator.
Set syntax sHeader	COMP
Set parameter sPara	<ON | OFF | 0 | 1>

■ COMP?

Description	It queries the status of the comparator.
Query syntax sHeader	COMP?
Set parameter sPara	Empty
Return data	<on|off>

■ COMP:BEEP <OFF | PASS | FAIL>

Description	It sets the status of the beep.
Set syntax sHeader	COMP:BEEP
Set parameter sPara	<OFF | PASS | FAIL> In: PASS Pass beep FAIL Fail beep

■ COMP:BEEP?

description	It queries the status of the beep.
Query syntax sHeader	COMP:BEEP?
Set parameter sPara	Empty
Return data	<OFF | PASS | FAIL>

■ COMP:NOM <NR1|NR2|NR3|NR4>

Description	It inputs the data of nominal value.
Set syntax sHeader	COMP:NOM
Set parameter sPara	<NR1|NR2|NR3|NR4> Any form of data

■ COMP:NOM?

Description	It queries the data of nominal value.
Query syntax sHeader	COMP:NOM?
Set parameter sPara	Empty
Return data	<NR3>
Example	1.000000e-09

■ COMP:TOL <NR1|NR2|NR3>

Description	It inputs the percentage deviation.
Set syntax sHeader	COMP:TOL
Set parameter sPara	<NR1|NR2|NR3> any form of data, the input data is percentage data (no need to divide by 100), Do not enter the percent sign %.

Example	COMP:NOM 2 //Indicate2%

■ COMP:TOL?

Description	It queries the percentage deviation.
Set synatx sHeader	COMP:TOL?
Set parameter sPara	Empty
Return data	<NR2>
Example	10.0

9.5.7 CORR Calibration Subsystem

■ CORR:OPEN:STAT

Description	It sets the status of the open circuit correction function.
Set syntax sHeader	CORR:OPEN:STAT
Set parameter sPara	<ON|OFF|1|0>

■ CORR:OPEN:STAT?

Description	It queries the status of the open circuit correction function.
Query syntax sHeader	CORR:OPEN:STAT?
Set parameter sPara	Empty

■ CORR:SHOR:STAT

Description	It sets the status of the short circuit correction function.
Set syntax sHeader	CORR: SHOR:STAT
Set parameter sPara	<ON|OFF|1|0>

■ CORR:SHOR:STAT?

Description	It queries the status of the short circuit correction function.
Query syntax sHeader	CORR:SHOR:STAT?
Set syntax sPara	Empty

■ CORR:OPEN:LCR

Description	It executes LCR open circuit correction.
Set syntax sHeader	CORR:OPEN:LCR
Set parameter sPara	Empty
Note	“LCR open” is prompted when the correction starts Prompt “pass or fail” after correction

■ CORR:SHOR:LCR

Description	It executes LCR short circuit correction.

Set syntax sHeader	CORR:SHOR:LCR
Set parameter sPara	Empty
Note	“LCR short” is prompted when the correction starts Prompt “pass or fail” after correction

■ CORR:OPEN:DCR

Description	It executes DCR open circuit correction.
Set syntax sHeader	CORR:OPEN:DCR
Set parameter sPara	Empty
Note	“DCR open” is prompted when the correction starts Prompt “pass or fail” after correction

■ CORR:SHOR:DCR

Description	It executes DCR short circuit correction.
Set syntax sHeader	CORR:SHOR:DCR
Set parameter sPara	Empty
Note	“DCR short” is prompted when the correction starts Prompt “pass or fail” after correction

9.5.8 SYST System Configuration Subsystem

■ SYST:KEYL <ON | OFF | 1 | 0>

Description	It locks the keypad and touch screen.
Set syntax sHeader	SYST:KEYL
Set parameter sPara	<ON | OFF | 1 | 0>

Note	When the keys and touch screen are locked, the user can press the LOCAL[☼] key to unlock! The power button and key tone still work. Key sounds remain active even when the keys and touch screen are locked.

■ SYST:HOLD <ON | OFF | 1 | 0>

Description	It holds the current screen data.
Set syntax sHeader	SYST:HOLD
Set parameter sPara	<ON | OFF | 1 | 0>

Note	When the measured value is held, a red symbol DH will be displayed on the upper right corner of the screen. This command is valid only on the "MEAS DISPLAY" page.

■ SYST:HOLD <ON | OFF | 1 | 0>

Description	It holds the current screen data.
Set syntax sHeader	SYST:HOLD
Set parameter sPara	<ON | OFF | 1 | 0>

9.5.9 IDN？Version Query Subsystem

■ IDN？

Description	It is used to query the manufacturer, model, serial number and version information of the instrument.
Query syntax sHeader	IDN?
Set parameter sPara	Empty
Return data	APPLENT,AT828,<SN>,REV A1.03

9.5.10 ERR Error Subsystem

The user can use the ERR subsystem to query whether the command sent previously is wrong.

■ ERR？

Description	It queries whether the command sent before is wrong?
Query syntax sHeader	ERR?
Set parameter sPara	Empty
Return data	Error message

Table 9-5 Error codes and messages

0, No error	No error
1, Bad command	Command error
2, Parameter error	Parameter error
3, Missing parameter	Missing parameter
4, Invalid multiplier	Multiplier error
5, Numeric data error	Numerical data error
6, Value too long	The value is too long
7, Invalid command	Invalid command, indicating that the command is invalid in the current state

9.6 Command Summary

Table 9-6 Summary of all USB commands

Command （sHeader）	Parameter （sPara）	Description
DISP:PAGE	MEAS|SETUP|SYSTem| CSET|SINF	Switch display page.
DISP:PAGE?		Query the name of the

		currently displayed page
DISP:LINE	String(maximum 28 characters)	Display the string in the bottom prompt bar
FUNC	C-D|C-Q|C-R|L-D|L-Q|L-R|L-Rdc|R-Q|R-X|R-Rdc|Rdc|Z-D|Z-Q|Z-thr|Z-thd	Set the measurement function
FUNC?		Query main parameter option
FUNC:EQU	SERIAL|PARALLEL|AUTO	Set the equivalent mode option
FUNC:EQU?		Query the equivalent mode options
FUNC:LCR:RANG	0~7	Set LCR range.
FUNC:LCR:RANG?		query the LCR range number.
FUNC:DLCR:RANG	0~7	Set DCR range.
FUNC:DCR:RANG?		query the DCR range number.
FUNC:RANG:AUTO	ON|OFF|1|0	Set the range automatically.
FUNC:RANG:AUTO?		Query the automatic state of the range
FREQ	50|100|120|1k|2k|10k|50k|100k	set the frequency value
FREQ?		query frequency value
APER	SLOW | FAST	Set test speed
APER?		Query test speed
FETC?		Query test results
COMP	ON | OFF | 1 | 0	Turn on/off the comparator
COMP:BEEP	OFF | PASS | FAIL	Turns the beep on/off
COMP:NOM	<floating number>	Enter nominal value
COMP:NOM?		Query the nominal value
COMP:TOL	<float number>	Enter a percentage value
COMP:TOL?		Query percentage value
CORR:OPEN:STAT	ON|OFF|1|0	Open circuit reset switch
CORR:OPEN:STAT?		Query the open circuit reset switch
CORR:SHOR:STAT	ON|OFF|1|0	Short circuit reset switch
CORR:SHOR:STAT?		Query the short circuit reset switch
CORR:OPEN:LCR		Execute LCR open

		circuit clear
CORR:SHOR:LCR		Execute LCR short circuit clear
CORR:OPEN:DCR		Execute DCR open circuit clear
CORR:SHOR:DCR		Execute DCR short circuit clear
SYST:KEYL	ON|OFF|1|0	Key lock switch
IDN?		Query version number
RST		Performs a warm boot.
ERR?		Query error code and message

10. Specifications

You will learn the following:

- Specifications
- General Characteristics
- Dimensions

10.1 General Characteristics

Specifications	
Function	C-D, C-Q, C-R, L-D, L-Q, L-R, L-Rdc, R-Q, R-X, R-Rdc, Rdc, Z-D, Z-Q, Z-θr, Z-θd
Counts	50000 Counts
Basic Accuracy	0.2%
Equivalent	Series，Parallel
Range	Auto range,Hold range
Speed	Slow 2.5 times/sec，Fast 10 times/sec
Frequency	AT827：50Hz, 100Hz，120Hz，1kHz，2kHz，10kHz AT828：50Hz, 100Hz，120Hz，1kHz，2kHz，10kHz，50kHz and 100kHz
Level	0.3V，0.7V and 1.0Vrms Accuracy: 10%
Output Impedance	100Ω
Correction	Open,Short
Comparator	Main parameter(%),support sound(Pass/Fail)
Test terminal	5-terminal and 3-terminal
Interface	USB(Type C) Device class(HID),Virtual serial port(VCOM)
Function	
Display	2.8" LCD color display with touch screen
Backlight	50%,100%
Power-Saving configuration: dim brightness and auto power off	Battery power supports configurable dimming display and auto power off times
Power	
Power	Rechargeable lithium battery：ATL805
Battery charging current	USB charging output: 5VDC，3A
Maximum Power	1W
Battery continuous working time	100% backlight: 7 hours
	50% backlight: 9 hours
Battery charging time	Within about 3 hours
Battery charging power	5V, 2A Maximum 10VA

Dim display brightness	5 minutes/10 minutes/20 minutes/30 minutes/off *Only works on battery power
Auto power off	5 minutes/10 minutes/20 minutes/30 minutes/off *Only works on battery power
General	
Temperature Range	0°C~40°C
Relative Humidity	≤ 90%RH
Altitude	2000 meter
Storage temperature	-10°C~70°C
Weight	Approximately 350g
Safety and electromagnetic compatibility	IEC 61010-1:2001 IEC 61326-2-1:2005

10.2 Accuracy

The following data were measured under the following conditions:
Temperature: 23°C±5°C
Humidity: ≤65% R.H.
Zero adjustment: Perform open/short circuit zeroing before testing
Test Terminals: The built-in test ports of the instrument itself
Equivalent: Auto
Warm-up time: >30 minutes
Calibration time: 12 months

Measurement level accuracy: 10%
Measurement frequency accruacy[*1] : 0.02%
Parameter test basic accuracy[*2] : 0.2%（Within the instrument's range)

10.3 Accuracy

10.3.1 Capacitance C and Loss D

■ **50Hz/60Hz/100Hz/120Hz**

Range	Display range	Accuracy Ce	Accuracy De
20mF	5.0000mF - 50.000mF	2.0%+5 counts	0.0200
5mF	500.0μF - 4.9999mF	1.0%+3 counts	0.0100
500μF	50.00μF - 499.99μF	0.3%+2 counts	0.0030
50μF	5.000μF – 49.999μF	0.2%+2 counts	0.0020
5μF	500.0nF – 4.9999μF	0.2%+2 counts	0.0020
500nF	50.00nF – 499.99nF	0.2%+2 counts	0.0020
50nF	5.000nF – 49.999nF	0.3%+3 counts	0.0030
5nF	500pF – 4.9999nF	2.0%+5 counts	

■ **1kHz/2kHz**

Range	Display range	Accuracy Ce	Accuracy De
1mF	500.0μF – 4.9999mF	1.0%+5 counts	0.0200
500μF	50.00μF – 499.99μF	0.3%+3 counts	0.0300

50μF	5.000μF – 49.999μF	0.2%+2 counts	0.0030
5μF	500.0nF – 4.9999μF	0.2%+2 counts	0.0020
500nF	50.00nF – 499.99nF	0.2%+2 counts	0.0020
50nF	5.000nF – 49.999nF	0.2%+2 counts	0.0020
5nF	500.0pF – 4.9999nF	0.3%+3 counts	0.0030
500pF	50.0pF – 499.9pF	0.65%+5 counts	

■ **10kHz**

Range	Display range	Accuracy Ce	Accuracy De
50μF	5.000μF – 49.999μF	1.0%+3 counts	0.0100
5μF	500.0nF – 4.9999μF	0.3%+2 counts	0.0030
500nF	50.00nF – 499.99nF	0.2%+2 counts	0.0020
50nF	5.000nF – 49.999nF	0.2%+2 counts	0.0020
5nF	500.0pF – 4.9999nF	0.2%+2 counts	0.0020
500pF	50.00pF – 499.9pF	0.3%+3 counts	0.0030
50pF	0.00pF – 49.99pF	1.2%+5 counts	

■ **50kHz/100kHz**

Range	Display range	Accuracy Ce	Accuracy De
5μF	500.0nF – 4.9999μF	3.0%+10 counts	0.0300
500nF	50.00nF – 499.99nF	0.3%+5 counts	0.0030
50nF	5.000nF – 49.999nF	0.2%+2 counts	0.0020
5nF	500.0pF – 4.9999nF	0.2%+2 counts	0.0020
500pF	50.00pF – 499.99pF	0.3%+2 counts	0.0020
50pF	5.000pF – 49.999pF	1.0%+5 counts	0.0100
5pF	0.000pF – 4.999pF	3%+10 counts	

10.3.2 Inductance L and Quality Factor

■ **50Hz/60Hz/100Hz/120Hz**

Range	Display range	Accuracy Ce	Accuracy Qe *1
1000H	500.0H – 1000.0H	1.0%+3 counts	0.0100
500H	50.00H - 499.99H	0.3%+2 counts	0.0030
50H	5.000H – 49.999H	0.2%+2 counts	0.0020
5H	500.0mH – 4.9999H	0.2%+2 counts	0.0020
500mH	50.00mH – 499.99mH	0.2%+2 counts	0.0020
50mH	5.000mH – 49.999mH	0.3%+3 counts	0.0030
5mH	0μF – 4.999mH	1.4%+5 counts	

■ **1kHz/2kHz**

Range	Display range	Accuracy Ce	Accuracy Qe
100H	50.00H –99.99H	1.0%+3 counts	0.0100
50H	5.000H – 49.999H	0.3%+2 counts	0.0030
5H	500.0mH – 4.9999H	0.2%+2 counts	0.0020
500mH	50.00mH – 499.99mH	0.2%+2 counts	0.0020
50mH	5.000mH – 49.999mH	0.2%+2 counts	0.0020
5mH	500.0μH – 4.9999mH	0.3%+3 counts	0.0030
500μH	50.0μH – 499.9μH	1.4%+5 counts	

■ **10kHz**

Range	Display range	Accuracy Ce	Accuracy Qe
1000mH	500.0mH – 999.9mH	1.0%+3 counts	0.0100
500mH	50.00mH – 499.99mH	0.2%+2 counts	0.0020
50mH	5.000mH – 49.999mH	0.2%+2 counts	0.0020
5mH	500.00μH – 4.9999mH	0.2%+2 counts	0.0020
500μH	50.00μH – 499.9μH	0.65%+3 counts	0.0040
50μH	5.00μH – 49.99μH	1.4%+5 counts	

■ **50kHz/100kHz**

Range	Display range	Accuracy Ce	Accuracy Qe
100mH	50.00mH – 99.99mH	1.2%+5 counts	0.0120
50mH	5.000mH – 49.999mH	1%+2 counts	0.0100
5mH	500.0μH – 4.9999mH	0.65%+2 counts	0.0065
500μH	50.00μH – 499.99μH	0.65%+2 counts	0.0065
50μH	5.000μH – 49.999μH	1%+5 counts	0.0100
5μH	0.000μH – 4.999μH	2.5%+10 counts	

Note*1: Quality Factor Qe is defined below:

$$Q_e = \pm \frac{Q_x^2 \times D_e}{1 \mp Q_x \times D_e} \text{ (when } Q_x \times D_e < 1)$$

Where:
Q_x is the measurement Q value.
De is D's accuracy.

10.3.3 Impedance Z and Phase angleθ

■ **<=10kHz**

Range	Display range	Accuracy Ze	Accuracy θe
10MΩ	5.000MΩ - 10.000MΩ	3.0%+5 counts	1.7°

5MΩ	500.0kΩ - 4.9999MΩ	1.2%+3 counts	0.7°
500kΩ	50.00kΩ - 499.99kΩ	0.3%+3 counts	0.2°
50kΩ	5.000kΩ - 49.999kΩ	0.2%+2 counts	0.2°
5kΩ	500.0Ω - 4.999kΩ	0.2%+2 counts	0.2°
500Ω	50.00 - 499.99Ω	0.2%+2 counts	0.2°
50Ω	5.000Ω - 49.999Ω	0.3%+3 counts	0.2°
5Ω	0.5000Ω - 4.9999Ω	0.65%+3 counts	0.6°
0.5Ω	0.0500Ω - 0.4999Ω	3.0%+3 counts	

■ **>10kHz**

Range	Display range	Accuracy Ze	Accuracy θe
5MΩ	500.0kΩ - 4.9999MΩ	3.0%+10 counts	1.7°
500kΩ	50.00kΩ - 499.99kΩ	1.2%+5 counts	0.7°
50kΩ	5.000kΩ - 49.999kΩ	0.3%+2 counts	0.3°
5kΩ	500.0Ω - 4.999kΩ	0.2%+2 counts	0.2°
500Ω	50.00 - 499.99Ω	0.2%+2 counts	0.2°
50Ω	5.000Ω - 49.999Ω	0.3%+5 counts	0.3°
5Ω	0.5000Ω - 4.9999Ω	1%+10 counts	1.0°
0.5Ω	0.0500Ω - 0.4999Ω	3.0%+20 counts	

10.3.4 ESR

ESR is equal to the series equivalent resistance(Rs)

ESR accuracy formula:

$$Rs_e = \pm X_x \cdot \phi_e$$

Among them，X_x is the measurement reactance value

$$X_x = 2\pi f L_x \text{ or } X_x = \frac{1}{2\pi f C_x}$$

Phase Angle Accuracy: $\phi_e = \theta_e \cdot \frac{\pi}{180}$

Parallel equivalent resistance accuracy formula:

$$R_{pe} = \pm \frac{R_{px} \cdot \phi_e}{D_x \mp \phi_e}$$

10.3.5 DCR

■ **DCR**

Range	Display range	Accuracy
10MΩ	5.000MΩ - 10.000MΩ	3.0%+5 counts
5MΩ	500.0kΩ - 4.9999MΩ	1.2%+3 counts
500kΩ	50.00kΩ - 499.99kΩ	0.3%+3 counts
50kΩ	5.000kΩ - 49.999kΩ	0.2%+2 counts
5kΩ	500.0Ω - 4.999kΩ	0.2%+2 counts
500Ω	50.00 - 499.99Ω	0.2%+2 counts
50Ω	5.000Ω - 49.999Ω	0.3%+3 counts
5Ω	0.5000Ω - 4.9999Ω	0.65%+3 counts
0.5Ω	0.0500Ω - 0.4999Ω	3.0%+3 counts

10.4 Dimensions