ONMEAS®

Rev.A0

AT826 / 825 / 824

Handheld LCR Meter



User's Guide

Scan QR code for operation video

Safety Summary

Warning Dangerous

Disclaimer	Applent Instruments assumes no liability for the customer's failure to comply with these requirements.
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.
DO NOT Operate In A Damp Atmosphere	The instrument is not waterproof; keep instrument probes away from water, the instrument should not be used in damp conditions.
DO NOT Open Instrument Case	Other than replacing the old battery, non-professional maintenance staff do not open the instrument case, in an attempt to repair the instruments.
DO NOT Substitute Parts Or Modify Instrument	Try to substitute parts or modify instrument will cause protection failure.

Warning:
1. Do not connect probes with DC voltage or live circuits
2. Before measuring capacitors, make sure the capacitors had been discharged.

Safety Sign;



Equipment protection by double insulation or reinforced insulation

Waste Electrical and Electronic Equipment (WEEE) Directive **2002/96/EC**



Do not discard in household garbage

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 1 year 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,
China,
Oct 2009 Rev.A3

Contents

Safety Summary 2
CERTIFICATION, LIMITED WARRANTY, & LIMITATION OF LIABILITY 3
Contents 4
Figure Contents 7
Table Contents 8
1. Unpacking and Preparation 9
1.1 Incoming Inspection 9
1.2 Power Requirements 9
1.3 Environmental Requirements 9
1.4 Cleaning 10
1.5 Replace the battery 10
1.6 Adjust the support 11
2. Overview 12
2.1 Introduction 12
2.2 Main Specifications and Features 12
2.2.1 Measurement parameters 12
2.2.2 Equivalent Circuit 13
2.2.3 Range 13
2.2.4 Measurement Speed 13
2.2.5 Basic Accuracy 14
2.2.6 Measurement Range 14
2.3 Test Signal 15
2.3.1 Test Signal Frequency 15
2.3.2 Test Signal Level 15
2.3.3 Output Impedance 15
2.4 Main Functions 15
2.4.1 Correction 15
2.4.2 Comparator (Sorting Function) 15
2.4.3 System Setup 15
2.4.4 Interface 15
3. Startup 16
3.1 Front Panel 16
3.2 LCD Screen 17
3.3 Interfaces 18
3.4 External Power and Battery 18
3.4.1 Charge Li Battery 19
3.5 Power up 19
3.6 Unknown Terminals Slot 20
3.6.1 Clips and Cables: 20
4. [MEAS DISPLAY] Page 21

4.1 <MEAS DISPLAY> 21
4.1.1 Measurement Function [FUNC A] [FUNC B] 21
4.1.2 Test Signal Frequency [FREQ] 22
4.1.3 Impedance Range [RANGE] 23
4.1.4 Measurement Speed [SPEED] 24
4.1.5 Equivalent Circuit [EQU] 24
5. [SETUP] Page 25
5.1 <SETUP> Page 25
5.1.1 Comparator [COMP] 26
5.1.2 [BEEP]Set 26
5.1.3 Input Nominal Value [NOM] 26
5.1.4 Input Tolerance Value [TOL] 27
5.2 User Correction 28
5.2.1 Open Correction [OPEN CORR] 28
5.2.2 Short Correction 29
6. [SYSTEM CONFIG] Page 30
6.1 <SYSTEM CONFIG> page 30
6.1.1 [LANGUAGE] 30
6.1.2 [FILE] 31
6.1.3 [TOUCH PANEL] 31
6.1.4 [BRIGHTNESS] 32
6.1.5 DIM DISPLAY [DIM] 33
6.1.6 AUTO POWER OFF [APO] 33
7. EXAMPLES 34
7.1 Example 34
8. Remote Control 36
8.1 USB-HID 36
8.2 Programming guide 36
8.3 Command set 37
8.3.1 Command packet 37
8.3.2 Notation Conventions and Definitions 38
8.3.3 Parameter types 39
8.4 Command Reference 39
8.4.1 DISP Subsystem 40
8.4.2 FUNC Sub System 40
8.4.3 FREQ Sub System 42
8.4.4 APER Speed Sub System 43
8.4.5 FETC? Sub System 43
8.4.6 COMP Comparator sub system 43
8.4.7 Correction subsystem 44
8.4.8 SYST System Sub System 45
8.4.9 IDN? Subsystem 45
8.4.10 RST Subsystem 45

8.4.11 Error Subsystem 45
8.5 Command List 46
9. Specification 47
9.1 General Specification 47
9.2 Accuracy 48
9.2.1 C and D 48
9.2.2 L and Q 50
9.2.3 Z and θ 51
9.2.4 ESR 51
9.3 Demensions 52

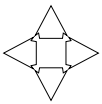
Figure Contents

Figure 1-1 Replace the battery 10
Figure 1-2 60 Degrees Supporting 11
Figure 1-3 45 Degrees Supporting 11
Figure 3-1 Front Panel 16
Figure 3-2 LCD Screen 17
Figure 3-3 Interface panel 18
Figure 3-4 Power Adapter 19
Figure 3-5 Charging LED (Orange) 19
Figure 3-6 Unknown Terminals 20
Figure 4-1 <MEAS DISPLAY> Page 21
Figure 5-1 <SETUP> page 25
Figure 5-2 To input nominal by touch screen 27
Figure 5-3 Stray Admittance 29
Figure 5-4 Remaining impedance 29
Figure 6-1 <SYSTEM CONFIG> Page 30
Figure 6-2 The Brightness key 32
Figure 7-1 Example 35
Figure 8-1 The APPLENT USB logo in windows device manager 36

Table Contents

Table 2-1	Equivalent Circuit	13
Table 2-2	AT824 Measurement Range	14
Table 2-3	AT825 Measurement Range	14
Table 2-4	AT826 Measurement Range	14
Table 3-1	Description of the Front Panel	17
Table 3-2	LCD Screen descriptions	17
Table 3-3	Interface panel description	18
Table 4-1	Primary Parameters	22
Table 4-2	Sub Parameters	22
Table 4-3	Parameters descriptions	22
Table 4-4	Auto Range and Range Hold	23
Table 4-5	Range No	23
Table 8-1	A complete command pack in Hex format.	38
Table 8-2	Notation Conventions and Definitions	39
Table 8-3	Available data type	39
Table 8-4	Magnification	39
Table 8-5	The Error Code and message	45
Table 8-6	All USB Commands	46

1. Unpacking and Preparation



This chapter describes how to set up and start the AT824/825/826 Handheld LCR Digital Meter.

- Incoming Inspection
- Power Requirement
- Operation Environment
- Cleaning

1.1 Incoming Inspection

1. Referring to <Packing List> in the packing box, check that all packaged items supplied with the meter have been provided as listed
2. Check the appearance of whether there is damage or scratches

If there was damage or lack of accessories, please contact Applent Instruments Sales Department or local agency.

1.2 Power Requirements

AC power adapter: ATL909 Rechargeable Li battery: ATL805。:
Input: 90V-260VAC, 49Hz~62Hz, <10VA



Warning: Do Not use any other power adapter or battery.

1.3 Environmental Requirements

Temperature: 0℃～55℃,

Humidity: at 23℃, <70% R.H.

Altitude: 0~2000m

1.4 Cleaning

Do not clean the inside of the equipment.

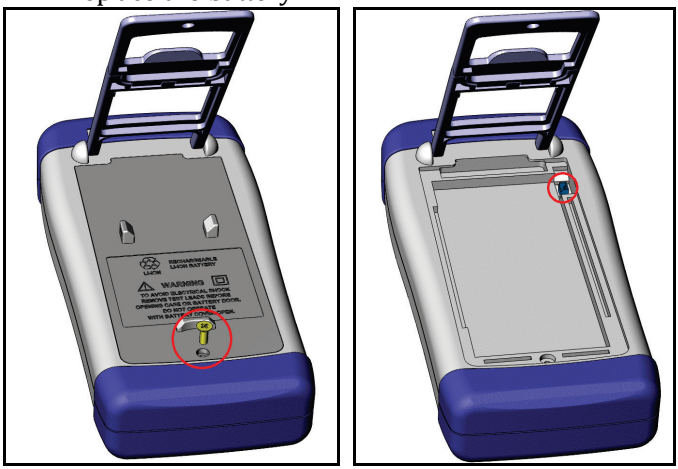
Warning: Do not use the cleaning solvent (alcohol or gasoline, etc.) on the instrument.

Please use a clean cloth dipped in some water to do the case and panel cleaning.

1.5 Replace the battery

The instrument built-in rechargeable lithium battery, the battery has been installed in the battery compartment of the instrument at the factory. You should replace the battery according to the following procedure.

Figure 1-1 Replace the battery



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

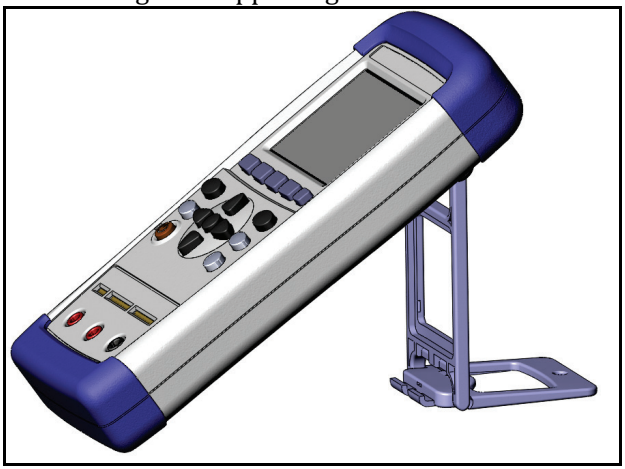
1.6 Adjust the support

The support has two positions: 60 degrees and 45 degrees.
45 degrees, makes the instrument more stable.

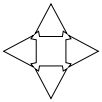
Figure 1-2 60 Degrees Supporting



Figure 1-3 45 Degrees Supporting



2. Overview



This chapter contains general information about AT824/825/826 Handheld LCR Digital Meter.

- Introduction
- Test Functions
- Signal Source
- Main Function

2.1 Introduction

Thank you for purchasing AT824/825/826 Handheld LCR Digital Meter

AT826, 825, 824 series handheld LCR Digital electric bridge adopts high performance 32-bit ARM microprocessor. True-color TFT liquid crystal display, keypad and touch screen double control. Use Li- battery supply power and USB communication. Switch in both English and Chinese. AT826, 825 handheld LCR digital meters have the highest configuration.

With the highest frequency of 100 kHz, constant 100Ω source internal resistance, 0.6Vrms measurement voltage level, and 0.2% accuracy, make AT826, 825 have the excellent performance of both desktop instrument and portability of handheld.。

□□ Referrance Full specifications in Section 9

2.2 Main Specifications and Features

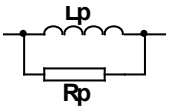
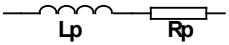
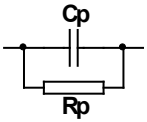
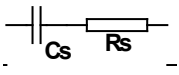
2.2.1 Measurement parameters

Main Parameters[FUNC A]: Capacitance C, Inductance L, Resistance R, Impedance Z and Auto.
Secondary Parameters[FUNC B]: Auto, Dissipation D, Quality Q and ESR (ESR: Equivalent series resistance)

2.2.2 Equivalent Circuit

Serial(Subscript s),Parallel(Subscript p)。。

Table 2-1 Equivalent Circuit

Circuit		Dissipation Factor **D**	Conversion
L		D=2πFLp/Rp=1/Q	Ls=Lp/(1+D^2) Rs=RpD^2/(1+D^2)
		D=Rs/2πFLs=1/Q	Lp=(1+D^2)Ls Rp=(1+D^2)Rs/D^2
C		D=1/2πFCpRp=1/Q	Cs=(1+D^2)Cp Rs=RpD^2/(1+D^2)
		D=2πFCsRs=1/Q	Cp=Cs/(1+D^2) Rp=Rs(1+D^2)/D^2

Q=Xs/Rs,D=Rs/Xs,Xs=1/2πFCs=2πFLs

Tips	Typically, for low impedance components (such as high-value capacitance and capacitance and low inductance), use the series equivalent circuit. Vice versa, use the parallel equivalent circuit for the high impedance components (low capacitance and high value of inductance). Also take the actual usage of the component into consideration, such as for power supply filtering capacitor series equivalent circuit for the LC oscillator circuit, use the parallel equivalent circuit.

2.2.3 Range

Auto and Hold range. Total 5 Ranges.

2.2.4 Measurement Speed

Fast: 4 readers per second.
Slow: 1.5 readers per second

2.2.5 Basic Accuracy

0.2%

2.2.6 Measurement Range

Table 2-2 AT824 Measurement Range

Parameter	Measurement Ranger
L	0.1μH ~ 999.9H
C	0.1pF ~ 999.9mF
R、X、Z	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 AT825 Measurement Range

Parameter	Measurement Ranger
L	0.01μH ~ 999.9H
C	0.01pF ~ 999.9mF
R、X、Z	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 2-4 AT826 Measurement Range

Parameter	MMeasurement Ranger
L	0.001μH ~ 999.9H
C	0.001pF ~ 999.9mF
R、X、Z	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%

2.3 Test Signal

2.3.1 Test Signal Frequency

AT824: 100Hz, 120Hz and 1 kHz
AT825: 100Hz, 120Hz, 1 kHz and 10 kHz
AT826: 100Hz, 120Hz, 1 kHz, 10 kHz and 100 kHz
Frequency: Accuracy: 0.02%

2.3.2 Test Signal Level

0.6Vrms Accuracy: ±10%±2 mV

2.3.3 Output Impedance

100Ω, Accuracy: 5%

2.4 Main Functions

2.4.1 Correction

OPEN/SHORT correction:
Eliminates measurement errors due to stray parasitic impedance in the test fixtures.

2.4.2 Comparator (Sorting Function)

One set of comparator sorting for primary parameters.

2.4.3 System Setup

- Keypad Lock Function
- Data Hold Function
- Switch in Both Chinese and English
- Data File will Be Saved Automatically
- Touch Screen Setup
- Power Saving Mode

2.4.4 Interface

USB Host Port:
USB high-speed mode: 48 MHz, USD-HID Protocol, ASCII Transit.

3. Startup

This chapter describes:

- Front Panel Summery
- LCD Screen
- Interface
- Slot and Cables

3.1 Front Panel

Figure 3-1 Front Panel

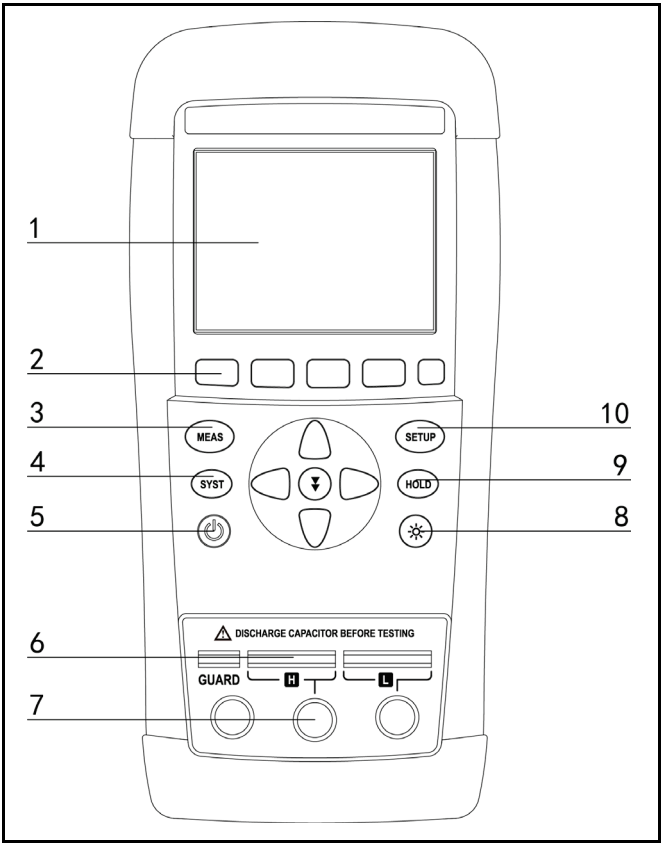


Table 3-1 Description of the Front Panel

1	TFT-LCD Screen
2	Select Keys
3	MEAS Measurement Key——Enter Measurement Page (Page 22: Measurement Page)
4	SYST System Key ——Enter System Setting Page (Page 30: System Setting Page)
5	Power On/Off Battery Charging Indicator
6	5-Terminal Test Slot
7	3-Terminal Test Slot
8	☼Background Brightness——30%,50%,70%, 100% Unlock the Keypad Lock
9	HOLD Data Hold Function——DH on, the data is hold in system。 USB: SYST:HOLD <ON | OFF | 1 | 0>
10	SETUP Enter Setup (*Page 25: 5 [SETUP]*)

3.2 LCD Screen

Figure 3-2 LCD Screen

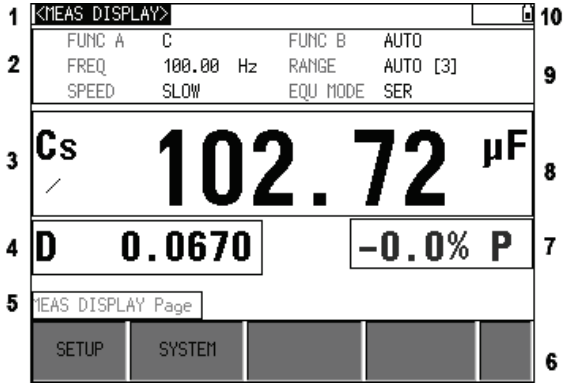


Table 3-2 LCD Screen descriptions

1	The Page Title
2	The Blue fields are label; the yellow fields are list box.
3	Primary Parameter Results
4	Sub Parameter Results
5	Help and message information
6	Function Area, Use the select keys to select
7	Comparator Results,

	Green and P: Pass, Red and F: Fail If the comparator was turned off, there's nothing displayed.
8	Battery Percentage and Keypad Lock Indicators

3.3 Interfaces

Figure 3-3 Interface panel

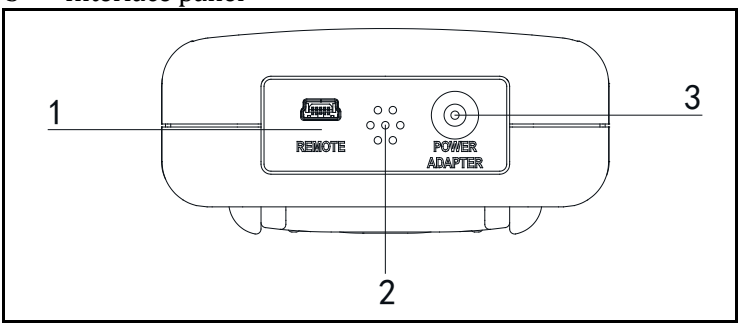


Table 3-3 Interface panel description

1	Remote Control Interface(USB-HID)
2	Beep
3	Power Adapter Jack(+9VDC)

3.4 External Power and Battery

The Battery can only be charged by Power Adapter ATL909。

While using the external power supply, the power adapter is also charging the battery.

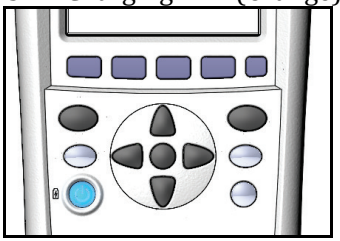
Figure 3-4 Power Adapter



3.4.1 Charge Li Battery

When the battery power is low, you could use the power adapter to charge the battery. The Power key is orange indicating while charging the battery.

Figure 3-5 Charging LED (Orange)



Attention! The key is also orange which charging even when the LCR meter is off previously.)

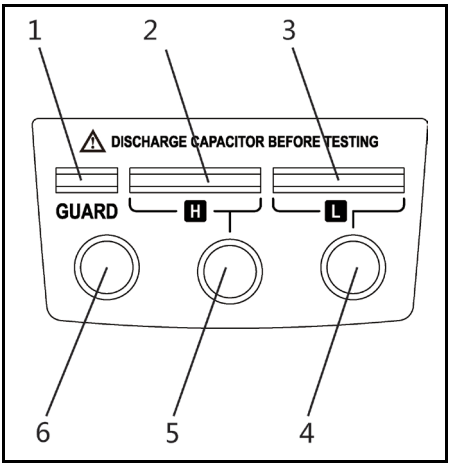
3.5 Power up

Press the Power key softly to start it.

3.6 Unknown Terminals Slot

Two Kinds of Test Slot: 3-Terminal and 5-Terminal
AT824/825/826 All Equipped with L501C Kelvin Clip
AT826 also equipped with L508B SMD Clip.

Figure 3-6 Unknown Terminals



1 The test terminal can NOT be connected into a live circuit
2 The capacitor must be discharged.

3.6.1 Clips and Cables:

Using clip or cable from other brands may cause mistakes
After a long time (1~2 Years), the surface of the accessories may be damaged, which will lead some inaccuracy.

Attention! Without clip or cable, the test result may not be stable.

4. [MEAS DISPLAY] Page

This section includes all measure result display information.

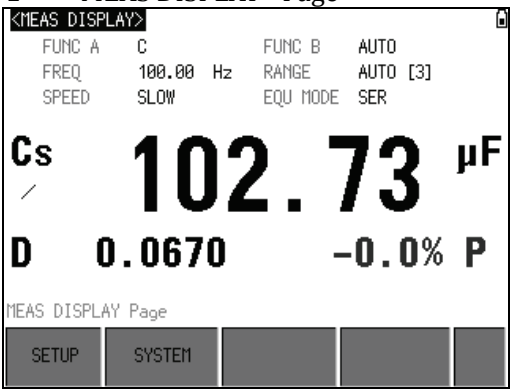
At any time, you can enter Meas Display page by press [MEAS]key.
USB-HID Communication Command: DISP:PAGE MEAS

4.1 <MEAS DISPLAY>

Press[MEAS], enter[MEAS DISPLAY]PAGE。
Measurement settings

- Primary Parameter
- Sub Parameter
- Frequency-Test Frequency
- Range – Auto, Hold
- Speed
- Equivalent Mode – Auto, Serial and Parallel

Figure 4-1 <MEAS DISPLAY> Page



4.1.1 Measurement Function [FUNC A] [FUNC B]

The AT826/825/824 simultaneously measure 2 components of the complex impedance (parameters) in one measurement cycle. These include primary parameter and secondary parameter

USB Command: FUNC:MAIN <C|L|R|Z|AUTO>

- Primary Parameters [FUNC A]:

Table 4-1 Primary Parameters

C	L	R	Z	Auto

- Sub Parameters [FUNC B]:

Table 4-2 Sub Parameters

Off	Auto	D	Q	ESR	θd	θr	X

You can set sub parameters off.

When sub parameter is Auto, it will be selected according to primary parameter.

- Measurement and Monitor parameter descriptions

Table 4-3 Parameters descriptions

Parameter	Description
Cs	Capacitance value measured using the series equivalent circuit model
Cp	Capacitance value measured using the parallel equivalent circuit model
Ls	Inductance value measured using the series equivalent circuit model
Lp	Inductance value measured using the parallel equivalent circuit model
Rs	Equivalent series resistance measured using the series equivalent circuit model (ESR)
Rp	Equivalent parallel resistance measured using the parallel equivalent circuit model
Z	Absolute value of impedance
X	Reactance
D	Dissipation factor
Q	Quality factor(=1/D)
θr	Phase radian
θd	Phase angle
ERS	Equivalent Serial Resistance(=Rs)

Procedure of setting the measurement function [FUNC]

Step 1. Press [Meas] key

Step 2. Use the cursor key to select [FUNC] field

Step 3. Use the select keys to select measurement function.

4.1.2 Test Signal Frequency [FREQ]

AT824: 100Hz, 120Hz and 1 kHz

AT825: 100 Hz, 120 Hz, 1 kHz and 10 kHz

AT826: 100 Hz, 120 Hz, 1 kHz, 10 kHz and 100 kHz

	Frequency Accuracy: 0.02%
Tips	120 Hz accurate frequency is 120.048 Hz, frequency accuracy is 0.05%

USB Command: FREQ <100|120|1k|10k|100k>

■ Procedure of setting test frequency:

Step 1	Press[MEAS]key to enter <MEAS DISPLAY> page
Step 2	Use the cursor key to select[FREQ]field
Step 3	Select the frequency by soft key

4.1.3 Impedance Range [RANGE]

Table 4-4 Auto Range and Range Hold

Range		Pros	Cons
Auto	Automatically select the best range according to impedance Range is automatically set.	Very convenient	Test speed is slower than manual ranging, especially in lower frequencies (100Hz and 120Hz)
Hold	The instrument will always use the user-specified range	Highest speed	Set the range previously

Five Range: 30Ω,100Ω, 1kΩ, 10kΩ and 100kΩ。

Table 4-5 Range No

Range No.	Range	Measurement Range
4	10Ω	0Ω ~ 100Ω
3	100Ω	100Ω ~ 1kΩ
2	1kΩ	1kΩ ~ 10kΩ
1	10kΩ	10kΩ ~ 100kΩ
0	100kΩ	100kΩ ~ ∞

■ Procedure of setting the range:

Step 1	Press [MEAS] key to enter <MEAS DISPLAY > page	
Step 2	Use the cursor key to select [RANGE] ;	
Step 3	Auto	Auto ranging
	Hold	Current range is hold

	INCR+	Increase
	DECL-	Decline

4.1.4 Measurement Speed [SPEED]

SLOW and FAST can be selected for AT826/825/824
SLOW mode will result in more stable and accurate measurement result.
USB Command: APER <SLOW|FAST>

■ Procedure for setting measurement speed

Step 1	Press[MEAS]key to enter <MEAS DISPLAY > page	
Step 2	Use the cursor key to select[SPEED]	
Step 3	SLOW	1.5 times/second
	FAST	4 times/second

4.1.5 Equivalent Circuit [EQU]

Two kinds of equivalent circuits: serial and parallel. If you are not sure which one to choose, select Auto. The equipment will select the tight one.
USB Command: FUNC:EQU <SERIAL|PARALLEL|AUTO>

■ Procedure of setting equivalent circuit:

Step 1	Press [MEAS] key to enter <Meas Display > page	
Step 2	Use the cursor key to select [EQU MODE] field	
Step 3	Auto	Selected by system automatically
	Parallel	Parallel equivalent circuit
	Serial	Serial equivalent circuit

5. [SETUP] Page

This section includes all setup functions
At any time, press [SETUP]to enter <SETUP> page.
USB-HID Command :DISP:PAGE SETUP

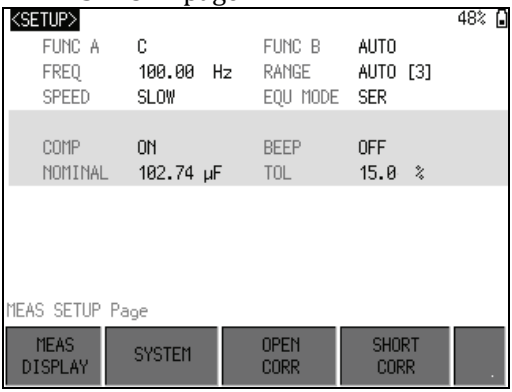
5.1 <SETUP> Page

In < SETUP> page, the Instrument does not display any results, testing is not in progress.
The setup includes

- Primary Parameters [FUNC A]
- Sub Parameters [FUNC B]
- Frequency [FREQ]
- Range Auto, Range Hold [RANGE]
- Speed [SPEED]
- Equivalent Circuit [EQU MODE]
- Comparator [COMP]
- Nominal Value [NOMINAL]
- Tolerance [TOL]
- User Correction [OPEN CORR] [SHORT CORR]

The first six settings can also be set in <MEAS DISPLAY> page.

Figure 5-1 <SETUP> page



5.1.1 Comparator [COMP]

Comparator formula:

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

Rx: Test Value
Nom: Nominal Value

USB Command: COMP <ON | OFF | 0 | 1>

■ Procedure to turn[COMP]on:

Step 1	Press[SETUP]to enter setup page ;	
Step 2	Select[Auto Parameters] ;	
Step 3	Off	Comparator off
	On	Comparator on

5.1.2 [BEEP]Set

Use the beep to indicate test result pass or fail.
USB Command: COMP:BEEP <OFF | PASS | FAIL>

■ Procedure to set beep

Step 1	Press[SETUP]to enter <SETUP> page	
Step 2	Select[BEEP]	
Step 3	OFF	Turn Beep feature Off
	Pass	Beep while Pass
	Fail	Beep while Fail

5.1.3 Input Nominal Value [NOM]

Three ways to input nominal value:

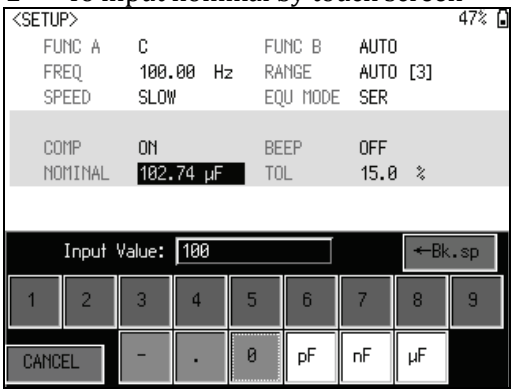
1. Use touch screen[Keypad Input]
2. Nominal components measure[Measure Input]
3. USB Command: COMP:NOM <Floating Points >

■ Procedure to input nominal value:

Step 1	Press [SETUP] key to enter <SETUP> page ;	
Step 2	Select[NOMINAL]	
Step 3	Keypad Input	Use touch screen to type in
	Meas Input	Measure a standard component as nominal

■ How to use touch screen to input nominal value

Figure 5-2 To input nominal by touch screen



Step 1	Press [Keypad Input] key
Step 2	Input the nominal value by touch the screen button
Step 3	Select the unit for the nominal value

Tips Touch Screen is still available even it is turned off in system setting.

■ Input nominal value by measurement

Step 1	Press [MEAS INPUT] soft key
Step 2	Plug a standard component
Step 3	Press [OK] to start the test, the result will be set as nominal value

5.1.4 Input Tolerance Value [TOL]

Press 1%, 5%,10% and 20% as tolerance.
Press KEYPAD INPUT key to input tolerance value (%).
USB Command: COMP:TOL <Percentage>

■ Procedure to input tolerance

Step 1	Press [SETUP] key to enter <SETUP> page	
Step 2	Select [TOL] field	
Step 3	KEYPAD INPUT	Use touch screen virtual keypad to input
	1%	Set 1%
	5%	Set 5%
	10%	Set 10%
	20%	Set 20%

5.2 User Correction

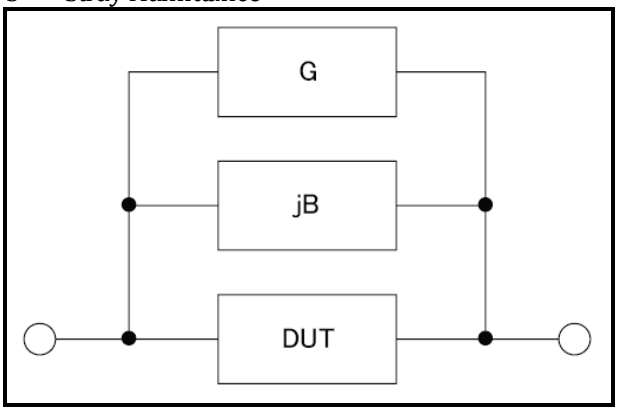
There are two corrections: Open correction and Short Correction.
Press [SETUP] key and choose OPEN CORR or SHORT CORR by soft key.

Tips	It is necessary to execute open correction and short correction. After replacing the test fixture or test cables, you should execute open correction and short correction again. Usually low ranges need open correction more, high ranges need short correction more.

5.2.1 Open Correction [OPEN CORR]

Open correction compensates any stray admittance (G, B)
USB Command: CORR:OPEN

Figure 5-3 Stray Admittance



[OPEN CORR] function will correct all frequencies. The frequency points may be different in different versions.

■ Procedure of open correction

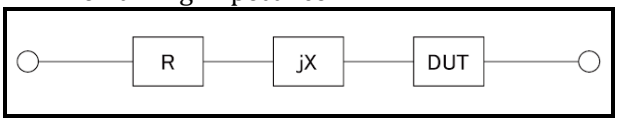
Step 1	Press [SETUP] to enter <SETUP> page
Step 2	Keep test clip or cable open circuit.
Step 3	Press [OPEN CORR] soft key
Step 4	Press [OK] to execute. When correction is done, the data will be saved. During correction, press [Cancel]to cancel correction.

5.2.2 Short Correction

Short correction compensates any remaining impedance.

USB Command: CORR:SHORT

Figure 5-4 Remaining impedance



■ Procedure of short correction

Step 1	Press [SETUP] key to enter <SETUP> page
Step 2	Use the short jumper to shorten test clips or connect cables together.
Step 3	Press [SHORT CORR]
Step 4	Press [OK] key to start. During correction press[Cancel]to cancel correction.

6. [SYSTEM CONFIG] Page

This section includes all system information.
USB-HID Command: DISP:PAGE SYSTEM

At any time, press [SYST] key to enter [SYSTEM CONFIG] page.

6.1 <SYSTEM CONFIG> page

Following information can be configured in the <SYSTEM CONFIG> page.

- System date and time configuration [DATE/TIME]
- LANGUAGE
- FILE
- TOUCH PANEL
- BRIGHTNESS
- DIM DISPLAY
- APO – Auto Power Off

Figure 6-1 <SYSTEM CONFIG> Page



6.1.1 [LANGUAGE]

You can switch system language in both Chinese and English.

■ Procedure to change language

Step 1	Press [SYST] key to enter <SYSTEM CONFIG> page.	
Step 2	Select[LANGUAGE]	
Step 3	中文 (CHS)	Switch into Chinese
	ENGLISH	Switch into English

6.1.2 [FILE]

■ Procedure of file setting

Step 1	Press [SYST] key to enter <SYSTEM CONFIG> page.	
Step 2	Select [FILE] field	
Step 3	AUTO	All parameters set by user will be saved in system.
	IGNORED	The parameters will be lost after power off
	SAVE NOW	All parameters set by user will be saved in system.

6.1.3 [TOUCH PANEL]

Tips	The LCR meter can work well without touch panel. But you cannot type number without touch panel. When you need to input numbers, the touch panel will be activated even it is shut down in system setting.

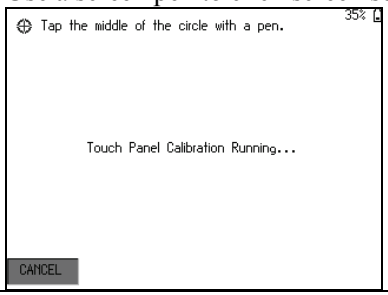
■ Procedure of setting touch panel

Step 1	Press [SYST] key to enter <SYSTEM CONFIG> page.	
Step 2	Select [TOUCH PANEL] field	
Step 3	ENABLE	Enable touch panel
	DISABLE	Disable touch panel
	CALIBRATE	Calibrate touch panel
	RESET	Reset touch panel data

■ Procedure to calibrate touch panel

Tips	You will need a screen pen to calibrate touch pane. Do not use your finger!

Step 1	Press[SYST]key to enter <SYSTEM CONFIG> page.
Step 2	Select[TOUCH PANEL]soft key
Step 3	Select[CALIBRATE]soft key

Step 4	Use a screen pen to click screen softly to start calibration 
Step 5	Tap the middle of the circle with a pen on Left-Up corner. Then tap the middle of the circle with a pen on the Right-Bottom corner to finish the calibration.
Step 6	Click on the screen softly to exit.

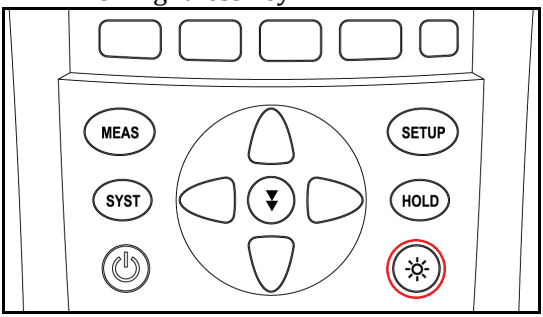
6.1.4 [BRIGHTNESS]

Four degrees of brightness 30%, 50%, 70%, 100%

Tips	If powered by external power, the brightness is 100%. If powered by battery, the low brightness can make the meter work longer.

Also, press [☼]to change the brightness.

Figure 6-2 The Brightness key



■ Procedure to change brightness

Step 1	Press [SYST] key to enter <SYSTEM CONFIG> page.	
Step 2	Select [BRIGHTNESS] field.	
Step 3	30%	30% of full brightness
	50%	50% of full brightness

	70%	70% of full brightness
	100%	Full brightness

6.1.5 DIM DISPLAY [DIM]

■ Procedure to dim display:

Step 1	Press [SYST] key to enter <SYSTEM CONFIG> page.	
Step 2	Select [DIM DISPLAY]	
Step 3	5 minutes	5 minutes later, brightness becomes 30%
	10 minutes	10 minutes later, brightness becomes 30%
	20 minutes	20 minutes later, brightness becomes 30%
	30 minutes	30 minutes later, brightness becomes 30%
	OFF	Dim display off

Tips: Timer will be reset when press any keys or touch screen.

6.1.6 AUTO POWER OFF [APO]

■ Procedure of set auto power off:

Step 1	Press [SYST] to enter <SYSTEM CONFIG> page.	
Step 2	Select[APO]	
Step 3	5 minutes	5 minutes later, power off
	10 minutes	10 minutes later, power off
	20 minutes	20 minutes later, power off
	30 minutes	30 minutes later, power off
	OFF	[APO]off

Tips: Timer will be reset when press any keys or touch screen.

7. EXAMPLES

This chapter covers basic measurement procedures as well as basic L, C, and R measurement theory. It also offers various measurement hints. After the descriptions of basic measurement procedures, practical measurement examples are shown using AT826

Warning: Do not connect the unknown terminal into a live circuit!
Warning: Before test a capacitor, make sure the capacitor is discharged

7.1 Example

This paragraph describes a practical example of measuring a ceramic capacitor.
In this example, a ceramic capacitor is measured under the following conditions.

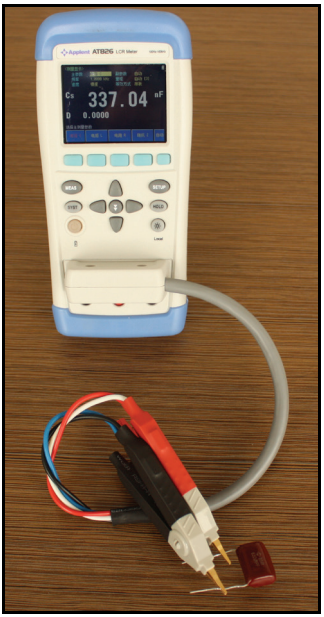
- Sample (DUT) : Ceramic capacitor
- Primary parameter[FUNC A]: C
- Sub parameter [FUNC B]: D
- Test frequency: 1kHz

Step 1	Press Power key to start the instrument to enter <MEAS DISPLAY> page.
Step 2	[FUNC A]:[C] [FUNC B]:[D] [FREQ]:[1kHz] [RANGE]:[AUTO] [SPEED]:[SLOW] [EQU MODE]:[AUTO]
Step 3	Insert the capacitor into the test slot. If you use test cables, connect the cables to the meter.
Step 4	Run [open correction] again after replaced the cables. 1. Press[SETUP]key to enter<SETUP> page 2. Press[OPEN CORR]soft key 3. Keep test cable open circuit. 4. Press[OK] Run short correction

	If you are using test cables, then connect them together. If you are using test slot, insert the jumper to shorten the circuit. Press [SHORT CORR], press [OK] to start.
Step 5	Press[MEAS]key to enter <MEAS DISPLAY> page
Step 6	Connect capacitor to test cables or insert it into test slot.
Step 7	Read the test result.

Figure 7-1 Example





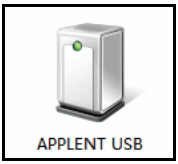
8. Remote Control

This chapter provides the following information to remotely control the AT826/825/824 via the USB interface.

8.1 USB-HID

The USB-Serial Interface allows you to connect AT824/825/826 to a USB port on you PC.
You needn't to install a driver in Windows system.

Figure 8-1 The APPLENT USB logo in windows device manager



8.2 Programming guide

The instrument goes along with data communication and acquisition software. You can also go to our website: www.applent.com to download.

Tips:	If you want to program the software by yourself, you need to know some basic knowledge about USB and USB-HID. Go to www.usb.org to find out more.

Basic API functions:

- ```
  CreateFile(
  devDetail->DevicePath,
  ENERIC_READ | GENERIC_WRITE,
  FILE_SHARE_READ | FILE_SHARE_WRITE,
  NULL,
  OPEN_EXISTING,
  FILE_FLAG_OVERLAPPED,
  NULL);
  ```

Use CreateFile to open HID equipment, equipment communication channels can be found through function
  ```

SetupDiGetInterfaceDeviceDetail.

- ```
  ReadFile(
    hDev,
    recvBuffer,
    IN_REPORT_LEN,
    &recvBytes,
    &ol);
  ```

  Use ReadFile to read HID equipment. Report based on the data fransferred from IN.

- ```
  WriteFile(
    hDev,
    reportBuf,
    OUT_REPORT_LEN,
    &sendBytes,
    &ol);
  ```

  WriteFile is used to transfer an output report to HID equipment.

- Communication Parameters

  VIP: 0825

  PID: 0826

  Packet size: 64bits

Tips:	Any problems in programming, please contact our tech department, you can send an email to tech@applent.com. USB is always available, you needn't set any parameters.

8.3 Command set

8.3.1 Command packet

Use 64 bits/pack to transfer data, every USB-HID command is 1 pack.

Tips:	Command packets have a fixed format, the user must follow the format agreed by the instrument of writing, and otherwise it is impossible to establish communication. The command word is case-insensitive. Each command packet contains the first 60 bytes of checksum, fill in the last four bytes.

PC command pack format(a C language-defined pack structure):

```
#define program pack(1)
typedef __packed struct
{
uint       cSize;     //packet size 4bytes    =60
char   sHeader[24];  //command 24bytes
char       sPara[28];//parameter   28bytes
uint   nSignature;   //signature   4bytes
```

```
uint   nChecksum;    //Checksum    4bytes
} TUSB_CMD;
#define program pack()
```

Here,
cSize: 60
nSignature: 0x88805550
sCmd,sPara: reference at SCPI set
nChecksum: 32 checksum

A complete send command pack(from PC) as follows:
cSize: 0x0000003C,
sHeader: IDN?
sPara: (blank)
nSignature: 0x88805550
nChecksum: 0x00002BC1

As command pack format and number of bits are fixed, so command words and parameters which are not qualified with the specified number of bytes must be filled hexadecimal. HEX: 0x00.

Table 8-1 A complete command pack in Hex format.

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

Instrument response pack is 64 bytes, not sufficient for 0x00 fill out. (Not ASCII “0”)
A response pack (from instrument):
ASCII format: AT826, REV A1.0, 00000000, Applent Instruments Inc.

To test instrument USB-HID, we have free “Applent HID communication tester” software, you can download from:www.applent.com

8.3.2 Notation Conventions and Definitions

A definition is not a part of a command, just used in interpretation and is not included in transfer.
The following conventions and definitions are used in this chapter to describe USB-HID operation

Table 8-2 Notation Conventions and Definitions

<>	Name of a parameter
[ ]	The content is optional
|	Select from several options

8.3.3 Parameter types

Parameters may be of four types as follows.

Table 8-3 Available data type

Format		Samples
<NR1>	Integer	100,+100,-100
<NR2>	Rational	1.23,+1.23,-1.23
<NR3>	Floating-point	1.23E4, +1.23E4,-1.23E4,-1.23e-4
<NR4>	Floating-point with magnification	1.23K,1.23N,1.23U (magnification in following Table)

Table 8-4 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

8.4 Command Reference

All commands in this reference are fully explained and listed in the following functional command order.

- DISP Display subsystems
- FUNC Function subsystem
- FREQ Frequency subsystem
- APER Speed subsystem
- FETC? Result check subsystem

- COMP Comparator subsystem
- CORR Correction subsystem
- SYST System setting subsystem
- IDN? Version check subsystem
- RST Hot start subsystem
- ERR Error subsystem

8.4.1 DISP Subsystem

■ DISP:PAGE <meas|setup|system>

	To change screen page
sHeader	DISP:PAGE
sPara	<meas|setup|system> meas:MEAS DISPLAY setup:SETUP system:SYSTEM CONFIG

■ DISP:PAGE?

	To check the current page
sHeader	DISP:PAGE?
sPara	
Response	<meas|setup|system> meas:MEAS DISPLAY setup:SETUP system:SYSTEM CONFIG

■ DISP:LINE <string>

	To display byte serial
sHeader	DISP:LINE
sPara	<string> display byte serial,due to the restrict length of sPara,some content is can not displayed.

8.4.2 FUNC Sub System

■ FUNC:MAIN <C|L|R|Z|AUTO>

	To set primary parameter
sHeader	FUNC:MAIN
sPara	<C|L|R|Z|AUTO>

■ FUNC:MAIN?

	To check current primary parameter
sHeader	FUNC:MAIN
sPara	
Response	<C|L|R|Z|AUTO>

■ FUNC:MAIN:FACT?

	To check main factor when primary parameter is set Auto
sHeader	FUNC:MAIN:FACT?
sPara	
Response	<C|L|R|Z>

■ FUNC:SUB <OFF|AUTO|D|Q|ESR|THR|THD|X>

	To set primary parameter
sHeader	FUNC:SUB
sPara	<OFF|AUTO|D|Q|ESR|THR|THD|X>

■ FUNC:SUB?

	To check current primary parameter
sHeader	FUNC:SUB?
sPara	
Response	<OFF|AUTO|D|Q|ESR|THR|THD|X>

■ FUNC:SUB:FACT?

	To check sub factor when primary parameter is set Auto
sHeader	FUNC:SUB:FACT?
sPara	
Response	<D|Q|Rs|θr|θ°|X>

■ FUNC:EQU <SERIAL|PARALLEL|AUTO>

	To set equivalent mode
sHeader	FUNC:EQU
sPara	<SERIAL|PARALLEL|AUTO> SERIAL PARALLEL

■ FUNC:EQU?

	To set equivalent mode
sHeader	FUNC:EQU?
sPara	
Response	<serial | parallel | auto>

■ FUNC:EQU:FACT?

	To set equivalent mode under Auto
sHeader	FUNC:EQU:FACT?
sPara	
Response	<serial | parallel>

■ FUNC:RANG <0|1|2|3|4>

	To set the range
sHeader	FUNC:RANG
sPara	<0|1|2|3|4> 0~4 means the number of the range

■ FUNC:RANG?

	To Query the number of current range
sHeader	FUNC:RANG?
sPara	
Response	<0~4>

■ FUNC:RANG:AUTO <ON|OFF|1|0>

	To set range mode
sHeader	FUNC:RANG:AUTO
sPara	<ON|OFF|1|0>

■ FUNC:RANG:AUTO?

	To query current range mode
sHeader	FUNC:RANG:AUTO?
sPara	
Response	<on|off>

8.4.3 FREQ Sub System

■ FREQ <100|120|1k[|10k|100k]>

	To set test frequency
sHeader	FREQ
sPara	<100|120|1k|10k|100k> Frequency can accept any numeric format, but the data must be the frequency value of the meter. Illege value will be replaced by a close legal value as follows: 100,120,1k (AT824) 100,120,1k,10k (AT825) 100,120,1k,10k,100k (AT826)

■ FREQ?

	To check current frequency
sHeader	FREQ?
sPara	
Response	<100|120|1000|10000|100000>

8.4.4 APER Speed Sub System

■ APER <SLOW|FAST>

	To set test speed
sHeader	APER
sPara	<SLOW|FAST>

■ APER?

	To query current test speed
sHeader	APER?
sPara	
Response	<slow|fast>

8.4.5 FETC? Sub System

■ FETC?

	To query test result
sHeader	FETC?
sPara	
Response	<Primary parameter result A , sub parameter result B> The system will retrieve NR3 type parameter test resuls. If sub parameter is off, it will retrieve +0.000000e+00
Examples	+7.929158e-15,+0.000000e+00

8.4.6 COMP Comparator sub system

■ COMP <ON | OFF | 0 | 1>

	To turn on/off comparator
sHeader	COMP
sPara	<ON | OFF | 0 | 1>

■ COMP?

	To query the status of comparator
sHeader	COMP?
sPara	
Response	<on|off>

■ COMP:BEEP <OFF | PASS | FAIL>

	To turn on/off beep
sHeader	COMP:BEEP
sPara	<OFF | PASS | FAIL> PASS FAIL

■ COMP:BEEP?

	To query status of beep
sHeader	COMP:BEEP?
sPara	
Response	<off | pass | fail>

■ COMP:NOM <NR1|NR2|NR3|NR4>

	To input nominal value under current parameters
sHeader	COMP:NOM
sPara	<NR1|NR2|NR3|NR4>

■ COMP:NOM?

	To query nominal value under current parameters
sHeader	COMP:NOM?
sPara	
Response	<NR3>
Example	2.000000e-09

■ COMP:TOL <NR1|NR2|NR3>

	To input percentage deviation
sHeader	COMP:TOL
sPara	<NR1|NR2|NR3> Needn't to input %.
Example	COMP:NOM 2 // 2%

■ COMP:TOL?

	To query percertage deviation
sHeader	COMP:TOL?
sPara	
Response	<NR2>
Example	10.0

8.4.7 Correction subsystem

■ CORR:OPEN

	To execute open correction
sHeader	CORR:OPEN
sPara	

■ CORR:SHORT

	To execute short correction
sHeader	CORR:SHORT
sPara	

8.4.8 SYST System Sub System

■ SYST:KEYL <ON | OFF | 1 | 0>

	To lock/unlock keypad and touch screen
sHeader	SYST:KEYL
sPara	<ON | OFF | 1 | 0>

Tips: When the keypad and screen is locked, press[☼]to unlock ! Power key cannot be locked

■ SYST:HOLD <ON | OFF | 1 | 0>

	To hold data on the screen
sHeader	SYST:HOLD
sPara	<ON | OFF | 1 | 0>

Tips: When the screen is data hold, a red sign DH will be displayed on screen.
This command is only available on <MEAS DISPLAY> page.

8.4.9 IDN? Subsystem

■ IDN?

	To check version information
sHeader	IDN?
sPara	
Response	AT826,REV A1.0,<Serial Number>,Applent Instruments Inc.

8.4.10 RST Subsystem

■ RST

	To start in heat
sHeader	RST
sPara	

8.4.11 Error Subsystem

■ ERR?

	To check the message sent previously
sHeader	ERR?
sPara	
Response	In the following Table

Table 8-5 The Error Code and message

0, No error
1, Bad command

2, Parameter error
3, Missing parameter
4, Invalid multiplier
5, Numeric data error
6, Value too long
7, Invalid command

8.5 Command List

Table 8-6 All USB Commands

sHeader	sPara	Response
DISP:PAGE	MEAS | SETUP | SYSTEM	Change display page
DISP:PAGE?		Query current display page
DISP:LINE	STRING	Display String on screen
FUNC:MAIN	C|L|R|Z|AUTO	Set primary parameter [FUNC A]
FUNC:MAIN?		Query primary parameter
FUNC:MAIN:FACT?		Query main parameter factor
FUNC:SUB	OFF|AUTO|D|Q|ESR|THR|THD|X	Set sub parameter [FUNC B]
FUNC:SUB?		Query sub parameter
FUNC:MAIN:FACT?		Query sub parameter factor
FUNC:EQU	SERIAL|PARALLEL|AUTO	Set equivalent mode
FUNC:EQU?		Query equivalent mode
FUNC:EQU:FACT?		Query equivalent mode
FUNC:RANG	0~4	Set range
FUNC:RANG?		Query range number
FUNC:RANG:AUTO	ON|OFF|1|0	Set range AUTO
FUNC:RANG:AUTO?		Query range status
FREQ	100|120|1000[|10000|100000]	Set test frequency
FREQ?		Query test frequency
APER	SLOW | FAST	Set test speed
APER?		Query test speed
FETC?		Query test result
COMP	ON | OFF | 1 | 0	Turn on/off comparator
COMP:BEEP	OFF | PASS | FAIL	Turn on/off beep
COMP:NOM	<floating-point>	Input nominal value
COMP:NOM?		Check nominal value
COMP:TOL	<floating-point>	Input percentage value
COMP:TOL?		Check percentage value
CORR:OPEN		Execute open correction
CORR:SHORT		Execute short correction
IDN?		Query Version information
RST		Execute Hot Start
ERR?		Query Error code

9. Specification

This chapter describes the specifications and supplemental performance characteristics of the AT826/825/824:

- Specifications
- Dimension

9.1 General Specification

Specification		
Primary Parameters		C, L, R, Z, AUTO
Sub Parameters		OFF, AUTO, D, Q, ESR, θr,θ°,X
Display		50000 readers
Basic Accuracy		0.2%
Equivalent Mode		Serial, Parallel and AUTO
Ranging		Auto and Manual
Speed		Slow 1.5 times/second, Fast 4 times/second
Test Frequency	AT824	100Hz, 120.048Hz, 1kHz
	AT825	100Hz, 120.048Hz, 1kHz, 10kHz
	AT826	100Hz, 120.048Hz, 1kHz, 10kHz, 100kHz
Test Signal Level		0.6 Vrms, Accuracy: 10%
Signal Source Resistance		100Ω
Correction		Open and short correction
Comparator		Primary parameter percentage, Beep
Test terminal		5 terminals and 3 terminals
Interface		USB-HID
Features		
Display		TFT-LCD Display, 2.8 inch with touch screen
Brightness		30%,50%,70%,100%
Power-save		Adjustable brightness and auto power off time
Power		
Battery		Rechargeable Li Battery: ATL805
AC Adapter		ATL909 90V~250VAC 9VDC,1A
Max power		0.9W
Standby Current		50μA max

Battery working time	8h @100% brightness
	11h @ 50% brightness:
	14h @ 30% brightness
Charge time	About 2h
Lower brightness	5min/10min/20min/30min/OFF *Power by battery
Auto power off	5min/10min/20min/30min/OFF *Powered by battery
General	
Temperature	0°C~40°C
Humidity	≤ 90%RH
Altitude	2000m
Storage Temperature	-10°C~70°C
Weight	350g
Safety and electromagnetic compatibility	IEC 61010-1:2001 IEC 61326-2-1:2005

9.2 Accuracy

Accuracy is defined as meeting all of the following conditions.

Temperature: 23℃±5℃

Humidity: ≤65% R.H.
Correction: open and short correction
Test terminal: Internal Terminals Slot
Equivalent mode: Auto
Rate: Slow
Warming time: >30 min
A 1-year calibration cycle

Test level accuracy: 10%
Test frequency accuracy[*1] : 0.02%
Basic Accuracy: 0.2%

Tips:	120Hz is nominal frequency, actual frequency is 120.048 Hz, accuracy is 0.05%

9.2.1 C and D

- 100Hz/120Hz

Range	Display range	Accuracy Ce	Accuracy De
20mF	5.0000mF - 20.000mF	5.0%+5bit	0.0500
5mF	500.0μF - 4.9999mF	1.0%+3bit	0.0100
500μF	50.00μF - 499.99μF	0.3%+2bit	0.0030
50μF	5.000μF – 49.999μF	0.2%+2bit	0.0020
5μF	500.0nF – 4.9999μF	0.2%+2bit	0.0020
500nF	50.00nF – 499.99nF	0.2%+2bit	0.0020
50nF	5.000nF – 49.999nF	0.3%+3bit	0.0030
5nF	0pF – 4.9999nF	1.2%+5bit	

■ 1kHz

Range	Display range	Accuracy Ce	Accuracy De
1mF	500.0μF – 999.9mF	2%+5bit	0.0200
500μF	50.00μF – 499.99μF	1%+3bit	0.0100
50μF	5.000μF – 49.999μF	0.3%+2bit	0.0030
5μF	500.0nF – 4.9999μF	0.2%+2bit	0.0020
500nF	50.00nF – 499.99nF	0.2%+2bit	0.0020
50nF	5.000nF – 49.999nF	0.2%+2bit	0.0020
5nF	500.0pF – 4.9999nF	0.3%+3bit	0.0030
500pF	0.0pF – 499.9pF	1.2%+5bit	

■ 10kHz

Rnge	Display range	Accuracy	Acuracy De
100μF	50.00μF – 99.99μF	3.0%+5bit	0.0300
50μF	5.000μF – 49.999μF	1.0%+3bit	0.0010
5μF	500.0nF – 4.9999μF	0.3%+2bit	0.0030
500nF	50.00nF – 499.99nF	0.2%+2bit	0.0020
50nF	5.000nF – 49.999nF	0.2%+2bit	0.0020
5nF	500.0pF – 4.9999nF	0.2%+2bit	0.0020
500pF	50.00pF – 499.9pF	0.3%+3bit	0.0030
50pF	0.00pF – 49.99pF	1.2%+5bit	

■ 100kHz

Range	Display Range	Acuracy Ce	Accuracy De
10μF	5.000μF – 9.999μF	6.0%+20bit	0.0600
5μF	500.0nF – 4.9999μF	3.0%+10bit	0.0300
500nF	50.00nF – 499.99nF	0.8%+5bit	0.0080
50nF	5.000nF – 49.999nF	0.5%+2bit	0.0050
5nF	500.0pF – 4.9999nF	0.5%+2bit	0.0050
500pF	50.00pF – 499.99pF	0.8%+2bit	0.0080
50pF	5.000pF – 49.999pF	1.2%+5bit	0.0120
5pF	0.000pF – 4.999pF	3%+10bit	

9.2.2 L and Q

■ 100Hz/120Hz

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

■ 1kHz

Range	Display Range	Accuracy Ce	Accuracy De
100H	50.00H –99.99H	1.0%+3bit	0.0100
50H	5.000H – 49.999H	0.3%+2bit	0.0030
5H	500.0H – 4.9999H	0.2%+2bit	0.0020
500mH	50.00H – 499.99mH	0.2%+2bit	0.0020
50mH	5.000H – 49.999mH	0.2%+2bit	0.0020
5mH	500.0μH – 4.9999mH	0.4%+3bit	0.0040
500μH	0.0μH – 499.9μH	1.4%+5bit	

■ 10kHz

Range	Display Range	Accuracy Ce	Accuracy De
1000mH	500.0mH – 999.9mH	0.8%+3bit	0.0080
500mH	50.00mH – 499.99mH	0.2%+2bit	0.0020
50mH	5.000mH – 49.999mH	0.2%+2bit	0.0020
5mH	500.0μH – 4.9999mH	0.2%+2bit	0.0020
500μH	50.00μH – 499.9μH	0.4%+3bit	0.0040
50μH	0.00μH – 49.99μH	1.4%+5bit	

■ 100kHz

Range	Display Range	Accuracy Ce	Accuracy De
100mH	50.00mH – 99.99mH	1.2%+5bit	0.0120
50mH	5.000mH – 49.999mH	0.8%+2bit	0.0080
5mH	500.0μH – 4.9999mH	0.5%+2bit	0.0050
500μH	50.00μH – 499.99μH	0.5%+2bit	0.0080
50μH	5.000μH – 49.999μH	0.8%+5bit	0.0120
5μH	0.000μH – 4.999μH	2.5%+10bit	

Noted*1: Quality Qe

When $Q_x \cdot D_e \le 1, Q_e = \pm \frac{Q_x^2 \cdot D_e}{1 \mp Q_x \cdot D_e}$

Q_x is unknown value

9.2.3 Z and θ

■ 100Hz, 120Hz, 1kHz, 10kHz

Range	Display Range	Accuracy Ze	Accuracy θe
10MΩ	5.000MΩ - 10.000MΩ	3.0%+5bit	1.7°
5MΩ	500.0kΩ - 4.9999MΩ	1.2%+3bit	0.7°
500kΩ	50.00kΩ - 499.99kΩ	0.3%+3bit	0.2°
50kΩ	5.000kΩ - 49.999kΩ	0.2%+2bit	0.1°
5kΩ	500.0Ω - 4.999kΩ	0.2%+2bit	0.1°
500Ω	50.00 - 499.99Ω	0.2%+2bit	0.1°
50Ω	5.000Ω - 49.999Ω	0.3%+3bit	0.2°
5Ω	0.5000Ω - 4.9999Ω	1.0%+3bit	0.6°
0.5Ω	0.0000Ω - 0.4999Ω	3.0%+3bit	

■ 100kHz

Range	Display Range	Accuracy Ze	Accuracy θe
10MΩ	5.000MΩ - 10.000MΩ	8.0%+20bit	4.5°
5MΩ	500.0kΩ - 4.9999MΩ	3.0%+10bit	1.7°
500kΩ	50.00kΩ - 499.99kΩ	1.2%+5bit	0.7°
50kΩ	5.000kΩ - 49.999kΩ	0.8%+2bit	0.5°
5kΩ	500.0Ω - 4.999kΩ	0.5%+2bit	0.3°
500Ω	50.00 - 499.99Ω	0.5%+2bit	0.3°
50Ω	5.000Ω - 49.999Ω	0.8%+5bit	0.5°
5Ω	0.5000Ω - 4.9999Ω	2.5%+10bit	1.5°
0.5Ω	0.0000Ω - 0.4999Ω	6.0%+20bit	

9.2.4 ESR

ESR is equivalent serial resistance (=Rs)
ESR:

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

X_x is tested resistance

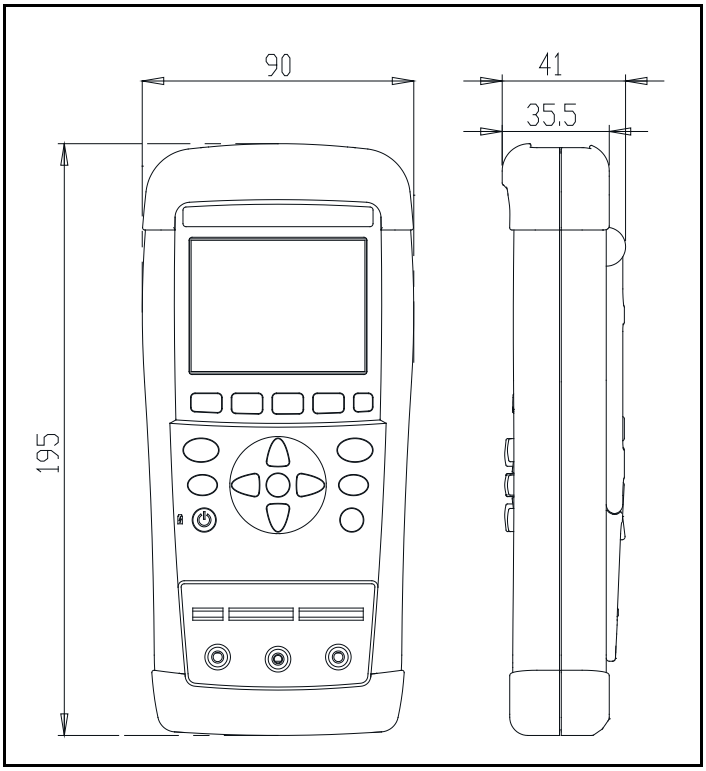
$$X_x = 2\pi f L_x \quad \text{or} \quad X_x = \frac{1}{2\pi f C_x}$$

$$\phi_e = \theta_e \cdot \frac{\pi}{180}$$

Equivalent parallel resistance:

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

9.3 Demensions



©2011 Applent Instruments Inc.

Changzhou ONMEAS Instruments Ltd.
#14,No. 9 Caoxi Road, Wujin district, Changzhou, Jiangsu province, China.

TEL：0519-88805550
https://www.onmeas.com
Sales Service Email: sales@applent.
comTech Support Email: tech@applent.
com
©2005-2026 Onmeas Ltd.

Specifications are subject to change without prior notice.
All are trademarks or registered trademarks of Changzhou Onmeas Instruments Ltd.