User's Guide

Rev.A 2.0

Firmware description:

Applicable to the FW Version Rev.A2.0 and above

AT9220

Hipot Tester

ACW rated ouput : 5kV / 20mA

DCW rated outpur : 6kV / 10mA

IR rated output : 1kV / 10GΩ

DC fast discharge、Electric shock protection and Arc detection

Voltage rise time,Test time,and Fall time can be arbitrarily set within 999.9 seconds

Can store and edit 10test groups,each with 16 steps

HANDLER (PLC) interface

RS-232C interface

Applent Instruments Ltd.

No.14 , LianDong U Valler,No.9,Caoxi Road, Wujin, Changzhou, Jiangsu, China

TEL：0519-88805550

FAX：0519-86922220

http://www.anbai.cn

Sales Email: sales@applent.com

Tech Email: tech@applent.com

Safety Summary

⚠Warning⚠Danger： When you find the following abnormal situations occur, please immediately terminate the operation and disconnect the power cord.Immediately contact the sales department of Applent Instrument for repair.Otherwise, it will cause a fire or a potential electric shock dangerous to the operator.

- The instrument is operating abnormally
- The instrument produces abnormal noise, peculiar smell, smoke or flashes during operation.
- During operation, the instrument generates high temperature or electric shock.
- The power cord, power switch or power socket is damaged.
- Impurities or liquid flow into the instrument.

Security Infomation

⚠Warning⚠Dangerour： To avoid possible electric shock and protect personal safety, please follow the instruction below.

Disclaimer	The Applent Instruments assumes no liability for the customer's failure to comply with these requirements.
Ground The Instrument	To avoid electric shock hazard, the instrument chassis and cabinet must be connected to a safety earth ground by the supplied power cable with earth blade.
DO NOT Operate In An Explosive Atmosphere	Do not operate the instrument in the presence of inflammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.
DO NOT Open The Instrument	Non-professional maintenance personnel should not open the case of the instrument to try to repair the instrument. After the instrument is turned off, there are still undischarged charges present for a period of time, witch may cause an electric shock hazard to the human body.
DO NOT Use The Instrument in a Strong Magnetic Field Environment	If the instrument is used in a place with a strong magnetic field or electric field, electromagnetic pulses may cause the instrument to manlfunction and cause a fire
DO NOT Use The Instrument Near Sensitive Test Equipment And Receiving Equipment	If these devices are used near the instrument, the noise generated by the breakdown and breakdown of the DUT may affect these devices. If the test voltage exceeds 3KV, the electric field between the test lines will ionize the air and produce corona, which will cause a lot of radio frequency bandwidth interference between the test lines. In order to reduce this effect, make sure that the distance between the test leads is sufficiently far away. In addition, keep the test leads away from conductive surfaces (especially sharp metal ends)

DO NOT Using An Instrument That Is Not Working Properly	If the instrument does not work normally and its danger is unpredictable, please disconnect the power cord, do not use it again, and do not try to repair it by yourself.
DO NOT Use the instrument beyond the way specified in this manual	Beyond the range, the protective measures provided by the instrument will become invalid.

CERTIFIACTION, LIMITED & LIMITATION OF LIABILITY

Applent Instruments, Inc. （shortened form **Applent**） certifies that each set of AT9210 is perfectly qualified in terms of quality and specification. This warranty exclude fuse and damages caused by negligences, misuse, pollution, accidents, and use under abnornal condition. This warranty is only applicable to original buyer, and not transferrable.

Applent provide 90 days replacement guarantee and 2 years of free warranty, which covers VFD and LCD. During the replacement guarantee period, the guarantee terminates if the damages is caused by misuse.During the 2 years of free warranty period,, the repair expenditure will be borned by the user if the damage is caused by misuse. After two years until the end of the life of this instruments bought, Applent will charge for repair. For replacement of VFD or LCD, expenditure will be charged at cost.

If breakdown is found out, please contact APPLENT for approval of return and replacement information. Since then, return or replace it to seller. When return or replace the broken product, please illustrate the cause of the damage, and prepay the courier charge and premium covering from sender to recipient. For product within warranty period, APPLENT bears the cost of return shipment. For unwarranted product, APPLENT will evaluate the repair expenditure ,and do repair under the user's approval. The expenditure of repair will be borned by the user including the shipment cost of returning.

This clause is the sole guarantee of APPLENT, and the only compensation for you, without any implicit and explicit guarantee, for example, guaranteeing the applicability of a special purpose., and deny any other guarantee. APPLENT or other agents have no oral or written statements to setup a guarantee or expand the guarantee scope.For any special, indirect, adjunct or followed damages or loss such as material loss incurred by any reasons beyond the specified scope, APPLENT is not liable. If there is any clause at odds with local regulation or law, or judicial authority doesn't allow any exclusion or limitation of implicit guarantee, because it is subject to the local regulation or law, this clause is not applicable to you. But the arbitration of this clause doesn't affect the effectiveness and applicability of any other clauses.

People's Republic of China
Jiangsu Province
Changzhou Applent Instruments Inc.
Oct. 2009
Rev.A1

Contents

List of Illustrations

Table of Contents

1. Installation and setup

Thanks for reading our product! Please read carefully this chapter before use our product.
This chapter provides the following information:

- Packing List
- Power Supply
- Operation Environment
- Cleaning
- Fuse Replacement
- Instrument Handle

1.1 Packing List

Before using the instrument formally, please first:
1. Check whether the appearance of the product is damaged or scratched;
2. Check whether the instrument accessories are missing according to the instrument packing list.

List 1- 1 Instrument accessories

NAME	QUANTITY
Withstand voltage test line	1
Withstand voltage grounding wire	1
3A (220~240) slow blow fuse	2
power cable	1
AT9220 Series User Manual	1
RS232 interface cable	1

If it is damaged or the accessories are insufficient, please contact the sales department or distributor of Applent Instruments immediately.

1.2 Power Supply

AT9220 can only be used in the following power supply conditions:

Voltage：85V-250VAC

Freq：50Hz~400Hz

Warning: To prevent risk of electric shock, connect the power supply ground
If the user replace the power cord, make sure the power cord to be connected with a reliable connection.

1.3 Operation Environment

Ensure the operation environment meets the following requirements

Temperature Range: 0℃ ~ 55℃

Humidity: 23℃, < 70%RH

Altitude: 0~2000m

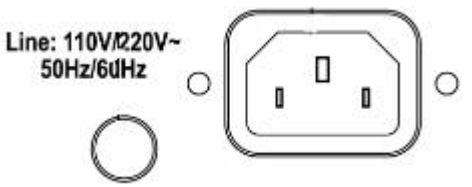
1.4 Cleaning

To prevent the risk of electric shock, unplug the power cord before cleaning.
Please use a clean cloth dipped in clean water to clean the housing and panel.
Do not clean the inside of the instrument.

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

1.5 Fuce Replacement

Figure 1- 1 Fuse box on the rear panel



To prevent electric shock, before checking or replacing the fuse, be sure to turn off the power switch and unplug the AC power cord. make sure The fuse used is consistent with the device specification, including shape, grade, characteristics, etc. If a different type of fuse is used Or short circuit, it may damage the equipment.

List 1- 2 Choose fuse type

Voltage Range	Freq Range	Fuse (Slow melt)	Power
110V	47-63Hz	5A	300VA
220V		3A	

1.6 Instrument Handle

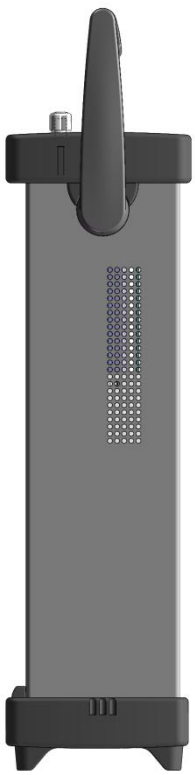
Instrument handle can be adjusted, both hands gripping the handles on both sides, gently pull to both sides, and then rotate the handle. The handle can be adjusted to four positions,

as shown below:

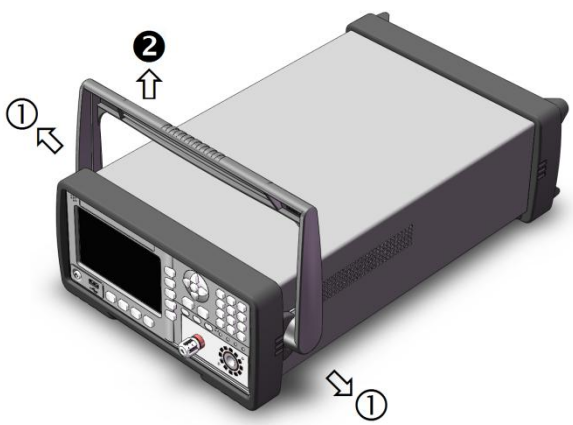
Figure 1- 2 The instrument handle (schematics, panel graphics and is not)

View 1: Position of a both hands holding the handles on both sides , gently pull to the sides until you can rotate freely ,and the switch to the View 2

View 2: Hands holding the handles on both sides at the same time , gently pull to both sides until it can reach freely rotated position ,and the switch to the mobile location.



Carrying Position



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

2. Overview

This chapter provides the following information:

- Safety Rules
- Product Performance

2.1 Safety Rules

Warning: This instrument generates **5kV** test high voltage that can cause personal **injury or even death**. When operating the instrument, you must be very careful and follow warnings, and other instructions given in this chapter.

2.1.1 Workstation Arrangement

➢ Work Position

The location of the workstation must be arranged in an open place where ordinary personnel do not necessarily pass, so that non-workers are far away from the workstation. The workstation must be separated from other facilities, and the "**high-voltage test workstation**" must be specially marked. During the test, it must be marked "**Danger! In execution of the test, Irrelevant staffs please don't approach!**".

➢ Input Power

Make sure that the instrument is connected to the electrical ground (earth) to ensure safety. The power supply of the workstation must have a separate switch, which should be installed in a conspicuous place at the entrance of the workstation and given a special mark, so that everyone can recognize that it is the power switch of the workstation. Once an emergency occurs, you can immediately turn off the power supply and then enter to deal with the accident.

➢ Workplace

Work tables or workbenches made of insulating materials must be used, and no metal should be used between the operator and the object to be tested. When designing the workplace, **it is not allowed to require the operator to step over the object under test to operate the test instrument**. The workplace must be kept tidy and clean. Please put the unused instruments and test lines in a fixed position, so that all personnel can immediately distinguish the in test, the under test and the tested part. The test station and its surroundings must not contain flammable gas and corrosive gas, and the measuring instrument cannot be used next to flammable substances.

2.1.2 Operator Regulations

➢ Personnel Qualifications

The operation of this series of testers is dangerous. Misoperation can cause personal injury, and this kind of injury can even be life-threatening..

It is dangerous, so the user must be trained first and strictly abide by the user manual.

➢ Safety Rules

Operators must be given safety education and training at any time, so that they

understand the imInterfaceance of various safe operations, and
Rule operation tester.

➢ Dress Code

Operators are not allowed to wear clothes with metal decorations, metal jewelry and watches, etc. These metal accessories are easy to make Accidental electric shock. **The operator must wear insulated gloves when operating the tester.**

➢ Medical Regulations

This series of testers must not be operated by persons who have heart disease or who wear heart rate regulators or pacemakers.

2.1.3 Prohibited Operations

✓ Don’t Switch The Power Continuously

After turning off the power switch, make sure to wait a few seconds or longer before turning on the power switch again. Don't repeatedly turn on/off the power switch frequently. If you do so, the protection facilities of the instrument may not be able to fully perform the protection function. When the instrument is generating the test voltage, don't turn off the power switch, except in special or emergency situations.

✓ Don’t Short-Circuit The Output Terminal and Ground

Be careful of the high-voltage test line of the instrument, and do not short-circuit the nearby AC power cord that has been connected to the ground or other nearby equipment (such as transmission equipment). If it is short-circuited, the case of the instrument will be charged with dangerous high voltage.

✓ Don’t Connect External Voltage To The Test Terminal

Don't connect any external voltage to the output terminal of the instrument. In the non-discharged state, the instrument does not have the function of external discharge. Connecting the output terminal to an external voltage may damage the instrument.

2.1.4 Precautions During The Test

● Suspension (suspend) Test Precautions

To change the test conditions, please press [Stop] once to make the instrument exit the test preparation state. If you need to rest for a period of time, or will leave the test place, please turn off the power switch to prevent accidentally touching the start switch and causing safety hazards.

● Charged Items During High Voltage Test

In the high voltage test, the test wire, test probe, and DUT are all charged with high voltage. The instrument has a discharge circuit, and sometimes it needs to be discharged after the output is cut off. There is still a risk of electric shock during the discharge process. In order to avoid electric shock, make sure that the DUT, test leads, probes, and output terminals with high voltage are not in contact with anything other than the test component. If it is possible to touch these, make sure that the high-voltage hazard indicator is off and remove the hidden danger. Once the test is over, the discharge circuit of the instrument starts to discharge forcibly. Do not disassemble the DUT during the test and before the end of the discharge. Under normal circumstances, it can be guaranteed that the test circuit voltage will be within a safe voltage range when the discharge is over. When the capacitance of the DUT is too large or the structure of the DUT will cause incomplete discharge, the technician must change the test method to ensure complete discharge.

Discharge Time:

Discharge time calculation formula: t = -ln（30 / U）×R×C

t: Discharge time

30: Residual safety voltage of discharge 30V

U: Test set voltage

R: The insulation resistance of the test piece is about 2k when it is connected to the instrument and discharged

C: The capacitance of the tested part

Generally, only DC-type high voltage tests need to be discharged, and the length of the discharge time depends on the nature of the device under test.

During the test, the discharge of the component under test is realized through the secondary side of the transformer (about 2k resistance), 1uF with 6000V high voltage

It takes about 0.1s to discharge the capacitor to 30V. The fixed discharge time of the instrument is 0.2s to ensure that the device is completely discharged.

- Conditions To Ensure Long-Term Trouble-Free Use

Due to the size, weight, and actual use of the instrument, the heat dissipation design of the voltage generating module of the instrument is relatively small. Therefore, the instrument is recommended to be used within the following range. If the fan works continuously for 30 minutes, the use of the instrument must be suspended, otherwise the power amplifier output module may be burned out due to overheating.

List 2- 1 Necessary conditions for withstand voltage test

Ambient Temperature	Power Max		Pause Time	Output Time Limit
T≤40℃	ACW	>6mA	At least as long as the output time	1 minute
		<4mA	No Requirement	Continuous
	DCW	>3mA	At least as long as the output time	1 minute
		<2mA	At least the same as the charging waiting time	Continuous

NOTE: Test time <= output time <= Voltage rise time + Test time + Voltage fall time

2.2 Product Performance

2.2.1 Product introduction

AT9220 AC/DC Withstanding Tester uses a 5-inch color LCD display (with touch control), and is equipped with a mainstream high-performance 32-bit ARM processor. Small size, light weight (8kg), super cost-effective, easy to operate.

AT9220 AC/DC Withstanding Tester can be widely used in the safety performance inspection of household appliances, transformers, electrical equipment, and components. The instrument is equipped with Handler interface (PLC interface) and RS232C, which can easily communicate with PC and remotely control data to meet the requirements of automated testing and improve production efficiency.

2.2.2 Product Feature

AT9220 can provide 5kVAC/20mA withstand voltage, 6kVDC/10mA withstand voltage, insulation resistance test.

AT9220A can provide 5kVAC/20mA withstand voltage, 6kVDC/10mA withstand voltage test.

AT9220B can provide 5kVAC/20mA withstand voltage test.

The principle structure of the instrument: The high-voltage module is a DA reference, a controllable sine generator, a class AB power amplifier, a 40-600Hz high-voltage transformer boost, and the output voltage is closed-loop controlled.

DA benchmark: to ensure that the output voltage amplitude is controllable.
Controllable sine generator: It can be set to work at 50 or 60 Hz during AC output, and is no longer limited by line voltage;

Linear power amplifier: the distortion of the voltage waveform is small, the control is simple and the reliability is high.

40 ~ 600Hz high-voltage transformer step-up: in response to the problem of large power supply ripple in DC and insulation resistance testing, the test instrument generates 600Hz The AC power supply, after rectification, forms a DC voltage as the power supply, ensuring that the ripple of the DC power supply is much smaller than the previous type of voltage regulator withstand voltage meter.
Output voltage closed-loop control: to ensure that the load adjustment rate is small and the test data is reliable.

The AT9210 series can not only independently perform AC withstand voltage test, DC withstand voltage test, and insulation resistance test, but also do multiple project sequential test by project setting of test solution.

3. Startup

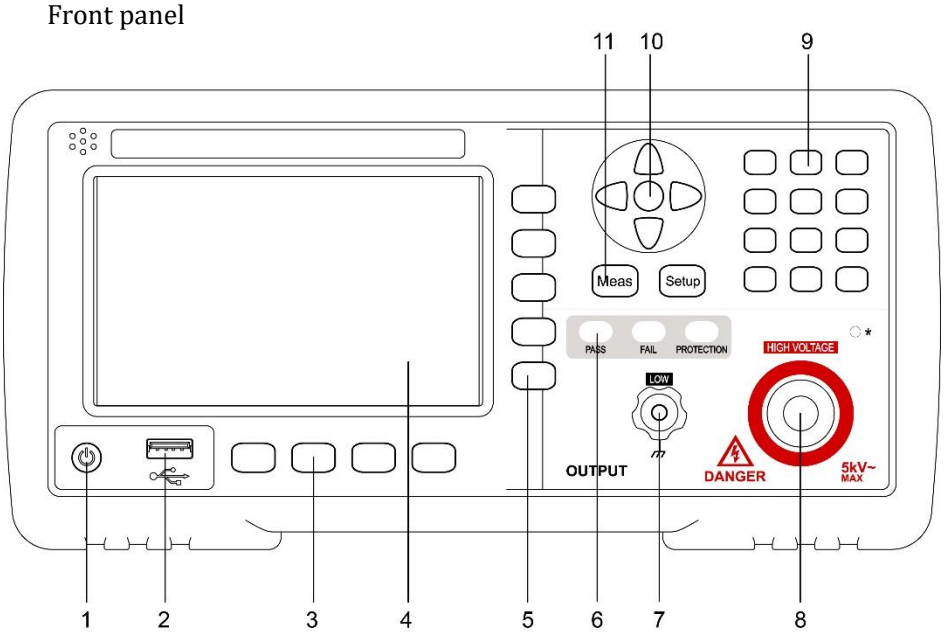
This chapter provides the following information:

- Front panel: Including key and introduction of test terminal.
- Back panel: Power supply and Interface information
- Startup: Including self-check process, dfault value of device and pre-heating time of device.
- Test terminal connect:Including how to connect test terminal.

3.1 Front Panel

3.1.1 Front Pannel Description

Figure 3- 1 Front panel

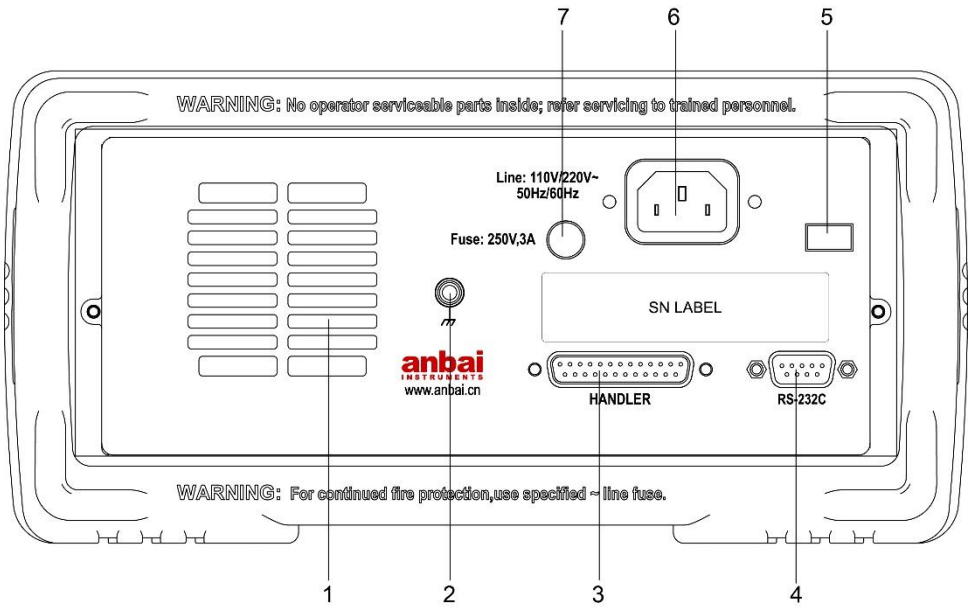


List 3- 1 Front panel function description

NO	Function
1	Power Switch
2	USB Disk interface
3	System Key
4	LCD Display
5	Soft Key
6	Test Status Indicator
7	Low-Voltage Side
8	High-Voltage Side, High-voltage hazard indicator
9	Entry Key
10	Cursor Key
11	Menu Key

3.1.2 Back Pannel

Figure 3- 2 Back panel



List 3- 2 Back panel function description

NO	Function
1	Fan Vent
2	Ground Terminal
3	HANDLER（PLC） Interface
4	RS-232C Interface
5	Line Voltage Mode (110V 、 220V) Switch
6	Power Outlet
7	Fuse Box

3.2 Startup

3.2.1 Start

The button marked"⏻"at the bottom left of the front panel is the power switch.
AT9220 adopts soft start mode:

- Power ON： Press the power button, When the POWERLED light turns on (green), release the power button.
- Power OFF： Press the power button.When the POWERLED light turns off,release the power button

3.3 Test Terminal Connect

- The withstand voltage test line is connected to the L and N lines of the tested object
- The withstand voltage grounding wire is connected to the ground wire or the shell of the measured object

4. [Setup] Page

This chapter provides the following information:

- Test step settings
- AC withstand voltage test parameter setting
- DC withstand voltage test parameter setting
- Insulation resistance test parameter setting

In the stop state, press [Setup] key to enter < setup> page.

4.1 Test Step Setup

All settings related to measurement are operated on the <Measure Set> page.

Figure 4- 1 Test step setting page

Current step 1-total steps: the step ID of the test plan, the current parameter is the number of steps in the test plan – there are several steps in total

List 4- 1 Test plan modification instructions

BUTTON	FUNCTION	REMARK
F1	INSERT	A new item will be added prior to the current item. The current item and the following items will be moved afterwards.
F2	DELETE	Delete the current item. Subsequent items are moved backward.
F3	NEW	Create a new test plan.The system will setup a new default test plan. After edit the new plan, please save it.
F4	PREV	Access the parameters of the preceding step
F5	NEXT	Access the parameters of the succeeding step.

As shown in Figure 4-1, the working mode of the current test item is AC withstand voltage. You can use the cursor keys to select [FUNC] to switch to DC withstand voltage and insulation resistance items. For the convenience of use, press the [START] key in this interface to directly enter the [MEAS DISP] interface, and at the same time start the test according to the currently set test plan.

4.1.1 ACW parameter setting

Figure 4- 2 ACW parameter setting page

List 4- 2 ACW parameter description

PARA	RANGE	REMARK
VOLT	0.050 ~ 5.000kV	AC test voltage value
UPPER	0.001 ~ 20.00mA	AC current upper limit value
LOWER	0.001 ~ 20.00mA	The lower limit value of AC current, which must be less than the upper limit value
	OFF	No lower limit required
ARC	1-9Level	1 – 9level （Corresponding current 20mA、18mA、16mA、14mA、12mA、10mA、7.7mA、5.5mA、2.8mA）
	OFF	Arc not required
TIME	0.2~999.9S	Testing time
	OFF	Unlimited test time
RISE	0.1~999.9S	Test voltage rise time
	OFF	Default=0.1s, integrated with test time
FALL	0.1~999.9S	Test voltage drop time
	OFF	After the test, cut off the voltage output directly (the DUT may be charged)
FREQ	50/60HZ	AC test frequency

4.1.2 DCW parameter setting

Figure 4- 3 DCW parameter setting page

List 4- 3 DCW parameter description

PARA	RANGE	REMARK
VOLT	0.050 ~ 6.000kV	DC test voltage value
UPPER	0.1uA ~ 10.00mA	DC current upper limit value
LOWER	0.1uA ~ 10.00mA	The lower limit value of DC current, which must be less than the upper limit value
	OFF	No lower limit required
ARC	1-9Level	1 – 9level （Corresponding current 20mA、18mA、16mA、14mA、12mA、10mA、7.7mA、5.5mA、2.8mA）
	OFF	Arc not required
TIME	0.1~999.9S	Testing time
	OFF	Unlimited test time
RISE	0.1~999.9S	Test voltage rise time
	OFF	Default=0.1s, integrated with test time
FALL	0.1~999.9S	Test voltage drop time
	OFF	After the test, cut off the voltage output directly (the DUT may be charged)
WAIT	0.1 ~ 999.9S	DC charging waiting time
	OFF	DUT does not need to be charged.
RAMP	ON	When the voltage rises, the current upper limit judgment is allowed.
	OFF	The current upper limit is not detected, but the current limit judgment is performed.

4.1.3 IR parameter setting

Figure 4- 4 IR parameter setting page

List 4- 4 IR parameter description

PARA	RANGE	REMARK
VOLT	0.050 ~ 1.000kV	Insulation resistance test voltage value
UPPER	0.1M ~ 10.00G	Insulation resistance upper limit value
	OFF	Does not judge the upper limit of insulation resistance
LOWER	0.1M ~ 10.00G	Insulation resistance lower limit value
TIME	0.1~999.9S	Testing time
	OFF	Unlimited test time
RISE	0.1~999.9S	Test voltage rise time
	OFF	Default=0.1s, integrated with test time
FALL	0.1~999.9S	Test voltage drop time
	OFF	After the test, cut off the voltage output directly (the DUT may be charged)
RANG	AUTO	Auto-ranging mode: Improve test accuracy. (When auto-ranging, due to range switching, the test time is at least 1s)
	2uA	Fixed range mode: You can use I=U/R to estimate the range to speed up the test.
	20uA	
	200uA	
	2mA	
	10mA	

5. [Meas] Page

This chapter provides the following information:

- <MEAS DISPLAY>
- Instructions for Use

5.1 <MEAS DISP>Page

Press【Meas】 key to enter【MEAS DISP】Page.

Figure 5- 1 <MEAS DISP>page（Take ACW as an example）

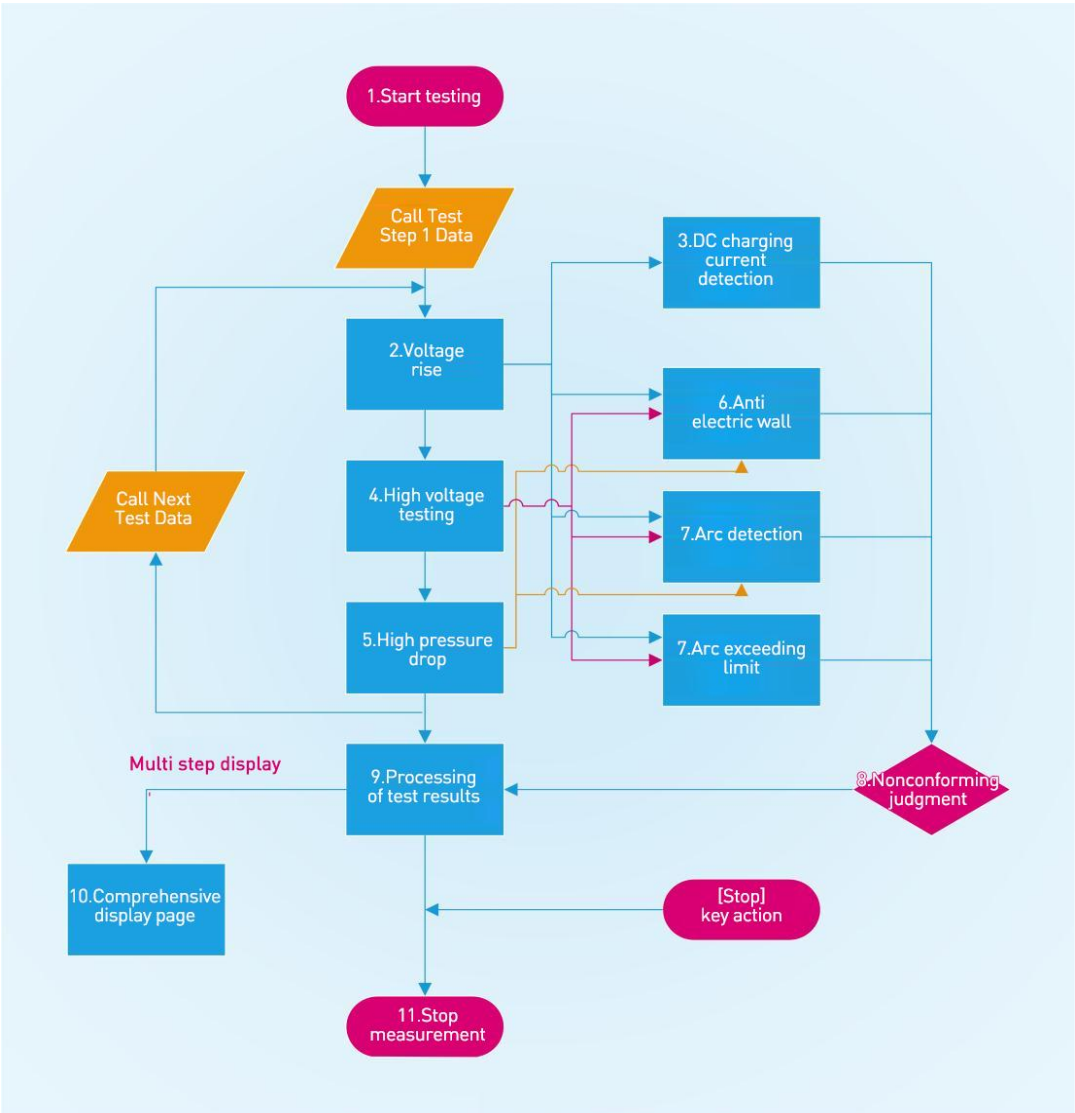
In this interface, you can [**START**] high voltage to measure the high voltage of the component under test. For the sake of safety and test accuracy, this page is only for display, and **the buttons cannot be used to set parameters (but the parameters of the current step can be modified by touch)**. Its test parameters must be set in detail and correctly in the setting interface. Display real-time test data during the test. The real-time test data is displayed during the test. When the test is over, if you don't press the [STOP] button, the displayed is the result of last test.

After starting the measurement, in the middle of the display screen of the instrument, two data are displayed in large fonts:
The first line shows the output voltage
The second line shows the measured current or insulation resistance at the lower end of the test.

The lower part of the LCD screen of the instrument displays two data in small fonts:
On the LEFT is the remaining time for the corresponding step of the test. If the user closes the test time, the test time shows the time after entering the test state, and the count will not be accumulated after the count is greater than 999.9. The test state must be exited with [stop].
On the RIGHT is the status of the high voltage test (OFF, RISE, TEST, FALL), and the results of the upper and lower limit comparisons (PASS, HI, FAIL , LOW FAIL) and the status of the alarms (ARC, SHORT, GFI).

5.2 Instructions for use

Figure 5-2 Test flow chart



5.2.1 Start test

When the instrument is in the test mode, check the test conditions. After the DUT is connected correctly, press the [START] key to start the test.

5.2.2 Voltage rise

Some DUTs are sensitive to sudden changes in voltage, so this function is required. When the instrument starts to output, the voltage is zero, and then the control voltage rises steadily at 0.1s each step. The voltage step range is determined according to the test voltage and rise time ($\Delta V = V / (10 * S)$).

5.2.3 DC charge current detection

It is mainly used to judge the reliable connection of the DUT. The DUT is generally capacitive. In DC mode, the distributed capacitance will have a charging process during the voltage rise time (ie, at the beginning of the test), and the current at this time is much larger than the set current under test. The charging current decreases rapidly when it is fully charged, and it can be judged whether the DUT is reliably connected by judging whether there is a charging current or not. When using this function, set the test waiting time longer than the charging time

to avoid misjudgment.

5.2.4 HIGH-PRESSURE test

Perform a high voltage test on the DUT. At this time, it should be ensured that the test circuit is correct, and the test result will not be affected by some special incidental parameters, which is the actual withstand voltage current required for the test.

5.2.5 Voltage drop

The rise of the same test voltage is determined by the characteristics of the DUT. When the high-voltage test is over, the current drop, At that time, the instrument will control the output voltage to drop at pace of 0.1s each step. The step-down value is determined according to the test voltage and voltage drop time （ΔV =- V / (10*S)）.

5.2.6 Electric wall

The ground wire current detection is to detect the current flowing through the casing of the instrument to prevent electric shock. When the high voltage is output, the current flows back from the voltage output terminal through the human body to the instrument shell, causing serious consequences.

The circuitry response of testing and judging ground wire current of intrument:

- The ground wire current detection is enabled, and when the ground wire current is greater than 0.5mA , it is judged as electric shock.
- When it is judged that there is an electric shock, the instrument will end the high voltage output within 0.3S, exit the test state, and display (GFI)

When the current reaches 30mA, if there is indeed a electric shock, the consequence will be very serious in that it may cause coma or death. Hence, if the product allow, it is suggested that start the ground current detection function.

5.2.7 Overcurrent and arc detection

Current over-limit classification: current lower limit, current upper limit, current over-limit, arc detection.

- Current lower limit judgment: generally used as a test low-end open circuit judgment. When the instrument tests the equipment, the equipment will have leakage current. When the leakage current tested by the instrument is less than the lower limit set current value, it can be considered that the test fails (no equipment is connected). If the leakage current of the tested element is small, this function must be turned off. Judgment display (LOW FAIL) when the limit is exceeded, this judgment is only valid in test mode. And it is timing sampling at rate of 100ms.

- Current upper limit judgment: When the instrument tests the equipment, when the leakage current of the test equipment is greater than the upper limit set current value, it is considered that the withstand voltage level of the equipment is not enough, and the test fails. Judgment display (HI FAIL) when the limit is exceeded. It is timing sampling at rate of 100ms.

- Current limit judgment: The current sampling judgment is slow, the current changes quickly when the insulation collapses, and the sampling circuit cannot respond immediately. When the current peak value exceeds the allowable output range of the instrument, the limit judgment will be triggered and displayed (SHORT). Because the data cannot be collected after such current exceeds the limit, the system output result is the test result 100ms before the limit is exceeded. The current limit is twice the allowable output constant current of the instrument (AC is 1.5 times the peak value), the fall time is invalid, and this judgment cannot be masked.

- Arc detection: The test is to test the local current oscillation caused by the instantaneous discharge of the local circuit in the high-voltage test circuit. Since it is superimposed on the normal test current and the mutation time is short, ordinary current detection circuits cannot make appropriate judgments in response to current changes. The arc detection circuit filters out normal current values and only handles high-speed current pulse changes. Due to the randomness of low-pass filtering and arc size, this function can only estimate the extent of localized sparking. Since the data cannot be collected after the current exceeds the limit, the output result at this time is the last test result when the current is qualified, and it is displayed (ARC) when the limit is exceeded. The ARC current is a qualitative analysis of the test, and the randomness of the effect of the amplitude,test environment,test line distributed capacitance are very big, which make the attention necessary.

■ Unqualified judgment

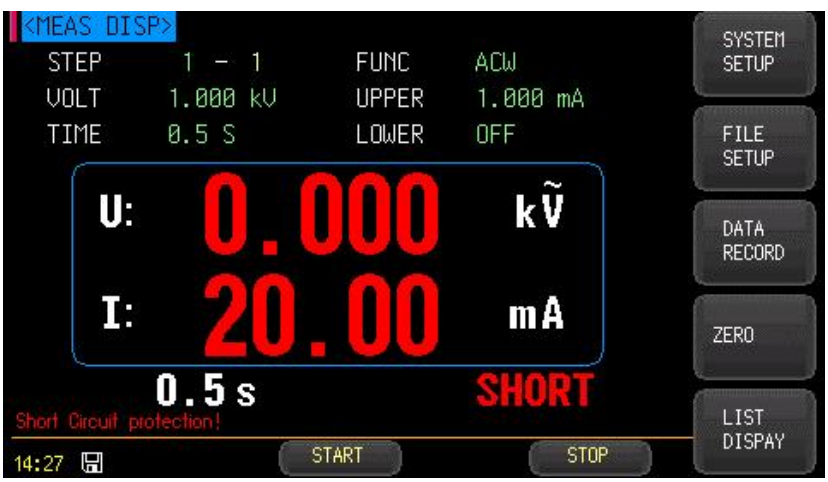
- During the test, if the current exceeds the maximum output current that the instrument can withstand, or the instrument finds that there is a potential safety hazard, the instrument will immediately cut off the voltage output and judge it to be unqualified.
- If the test result exceeds the limit set by the test item, the instrument will determine that the DUT is unqualified, and immediately stop the current test, cut off the voltage output, and deal with the unqualified test result.

5.2.8 Test result processing

If the test result is judged to be qualified after the test time, the display (PASS) will be displayed, and the pass indicator will be on.
Take the test results as PASS and SHORT as examples below.

Figure 5- 2 <PASS>

Figure 5- 3 <SHORT>



5.2.9 LIST DISPLAY

When measuring in multiple steps, the results are displayed in a list.

Figure 5- 4 List display

After a test plan is completed, you can view the data through the [DATA RECORD] on the sidebar of the [MEAS DISP] page or [MEAS SETUP] page.

5.2.10 Stop test

Press the [STOP] key during the whole test process, the instrument will end the test automatically, and there is no result judgment output.

6. [SYSTEM] Page

This chapter provides the following information:

- <SYSTEM CONFIG>
- <SYSTEM INFORMATION>

In the high voltage stop state, once you press the [MEAS] or [SETUP] key, and the [SYSTEM SETUP] key will show up in the sidebar.

6.1 SYSTEM CONFIG

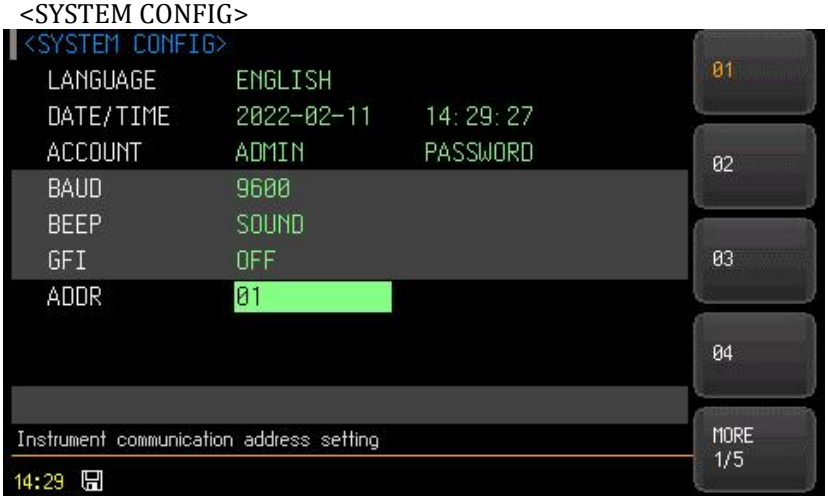
On the [MEAS] or [SETUP] page, press the [SYSTEM SETUP] key to enter the <SYSTEM CONFIG> page

The system configuration page includes the following settings:

- LANGUAGE
- DATA/TIME
- ACCOUNT
- BAUD
- BEEP
- GFI
- ADDR

All settings in the system configuration page will be automatically saved in the system and will be automatically loaded when the next boot.

Figure 6- 1 <SYSTEM CONFIG>



6.1.1 【LANGUAGE】

command: **SYSTem:LANGuage {ENGLISH,CHINESE,EN,CN}**

Instrument supports Chinese and English.

■ **Step to set the language**

STEP 1 Enter <SYSTEM CONFIG> page

STEP 2 Use cursor keys to select [LANGUAGE] field

STEP 3 Use soft key to select

Soft Key	Function

[CHN]	Chinese
ENGLISH	English

6.1.2 Modify [DATA] and [TIME]

built-in 24-hour clock.

■ **Step to set the data:**

STEP 1 Enter <SYSTEM CONFIG> page
STEP 2 Use cursor keys to select [DATA] field
STEP 3 Use soft key to select

Soft Key	Function
YEAR INCR+	+1 year
YEAR DECR-	-1 year
MONTH INCR+	+1 month
MONTH DECR-	-1 month
DAY INCR+	+1 day
DAY INCR-	-1 day

■ **Step to set the time:**

STEP 1 Enter <SYSTEM CONFIG> page
STEP 2 Use cursor keys to select [TIME] field
STEP 3 Use soft key to select

Soft Key	Function
HOUR INCR+	+1 Hour
HOUR DECR-	-1 Hour
MINUTE INCR+	+1 Minute
MINUTE DECR-	-1Minute
SECOND INCR+	+1Second
SECOND DECR-	-1 Second

6.1.3 [ACCOUNT] Setting

The instrument has two user modes to choose from:

- Administrator - Except the [System Services] page, other functions are open to the administrator, and the parameters set by the administrator are saved in the system memory after a delay of 5 seconds, which is convenient for loading at the next boot.
- User - Except the [System Service] and [File] pages, other functions can be operated by the user, the data modified by the user will not be saved, and the parameter values set by the administrator will be loaded next time the system is powered on.

■ **Step to set the Account:**

STEP 1 Enter <SYSTEM CONFIG> page
STEP 2 Use cursor keys to select [ACCOUNT] field
STEP 3 Use soft key to select

Soft Key	Function
Administrator	Except the [System Services] page, other functions are open to the administrator. If you forget your password, please call our sales department.
User	[System Services] page and [File] page cannot be operated, other functions can be operated, and the set data will not be saved.

■ **Step to set password for administrator:**

STEP 1 Enter <SYSTEM CONFIG> page
STEP 2 Use cursor keys to select [PASSWORD] field
STEP 3 Use soft key to select

Soft Key	Function
CHANGE PASSWORD	Input 9 digits numeric password. If you forget the password, please contact our sales department.
DELETE PASSWORD	

6.1.4 【BAUD】Setting

In order to correct communication, please make sure the baud rate set up correctly, PC with different baud rate will not be able to correct the communication instrument. 232 interface using SCPI language for programming.

RS-232 configuration is as follows:
Data bits: 8-bit
Stop bits: 1-bit
Parity: none

Step to set baudrate:

STEP 1 Enter <SYSTEM CONFIG> page
STEP 2 Use cursor keys to select [BAUD] field
STEP 3 Use soft key to select

Soft Key	Function
1200	Chose the baud rate if you use the opto-isolated communication converter
9600	
38400	
57600	
115200	Chose this high-speed baud rate while communicating with the PC

6.1.5 【BEEP】Setting

Step to set the Beep:

STEP 1 Enter <SYSTEM CONFIG> page
STEP 2 Use cursor keys to select [BEEP] field
STEP 3 Use soft key to select

Soft Key	Function
OFF	Turn off the buzzer
SOUND	Turn on the big buzzer
LOW	Turn on the small buzzer

6.1.6 【GFI】Setting

Ground current detection (anti-electric wall)

Step to set the GFI:

STEP 1 Enter <SYSTEM CONFIG> page
STEP 2 Use cursor keys to select [GFI] field
STEP 3 Use soft key to select

Soft Key	Function
OFF	The anti-electric wall function is closed
ON	The anti-electric wall function is turned on

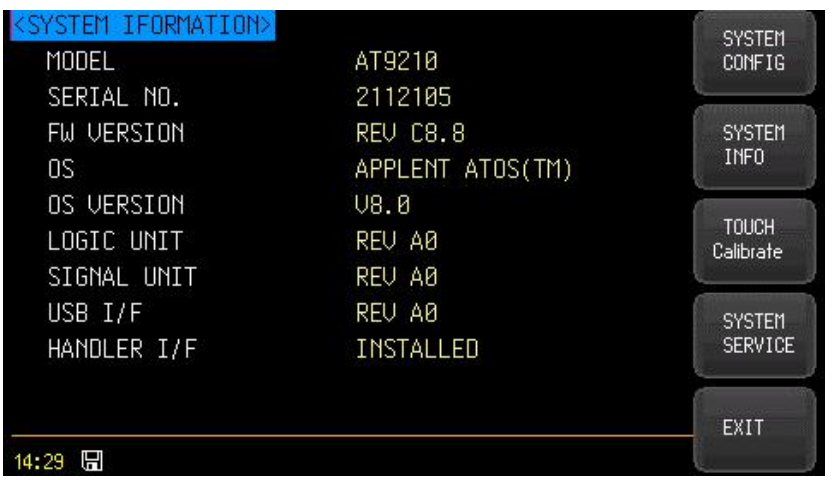
6.1.7 Touch screen calibration

Press [TOUCH CALIBRATION], and click the corresponding position according to the on-screen guidance to complete the calibration.

6.2 SYSTEM INFORMATION

On the [MEAS] or [SETUP] page, press the [SYSTEM SETUP] key to enter the <SYSTEM CONFIG> page,press [SYSTEM INFO] key to enter <SYSTEN INFORMATION> page.
There are no configurable options in the <SYSTEM INFORMATION> page.

Figure 6- 2 <SYSTEM INFORMATION>



7. [FILE] Page

This chapter provides the following information:

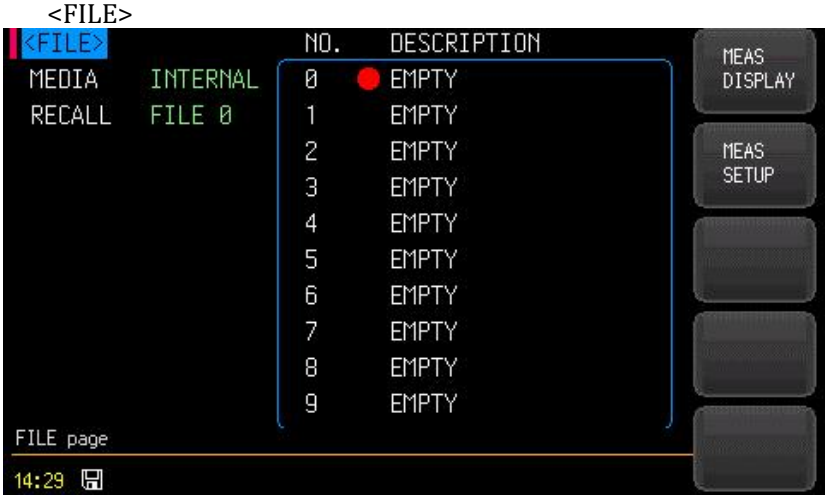
- MEDIA
- RECALL
- FILE SET

User can save up to 10 files to internal non-volatile memory.

7.1 [FILE] Page

On the [MEAS] or [SETUP] page, press the [FILE SETUP] key to enter the <FILE> page

Figure 7- 1 <FILE>



On this page, placing the cursor on the corresponding field can set the following controls:

- Select files from instrument internal memory or external USB stick
- Recalling files at instrument startup

7.1.1 [MEDIA] Setting

The memory function is to select files from the instrument memory or external U disk. Up to 10 files can be accessed.

■ **Step to set the Media**

STEP 1 Enter <FILE> page

STEP 2 Use cursor keys to select [MEDIA] field

STEP 3 Use soft key to select

Soft Key	Function
Internal	Access instrument memory files
External	Access external USB drive files

7.1.2 [RECALL] Setting

Recall FILE0 or the current file when the instrument is powered on.

■ **Step to set the Recall:**

STEP 1 Enter <FILE> page

STEP 2 Use cursor keys to select [RECALL] field

STEP 3 Use soft key to select

Soft Key	Function
LAST FILE	Recall the last used file at boot
FILE0	Recall FILE0 at boot

7.1.3 [FILE] Setting

■ **Step to set the File:**

STEP 1 Enter <FILE> page

STEP 2 Use cursor keys to select [FILE]

STEP 3 Use soft key to select

Soft Key	Function
SAVE	Save user settings data to the currently selected file
RECALL	Load setup data from the currently selected file
DELETE	Delete the selected file, and restore the default value of the setting data next time you start up
MODIFYDES	Modify file description

8. Handler（PLC)

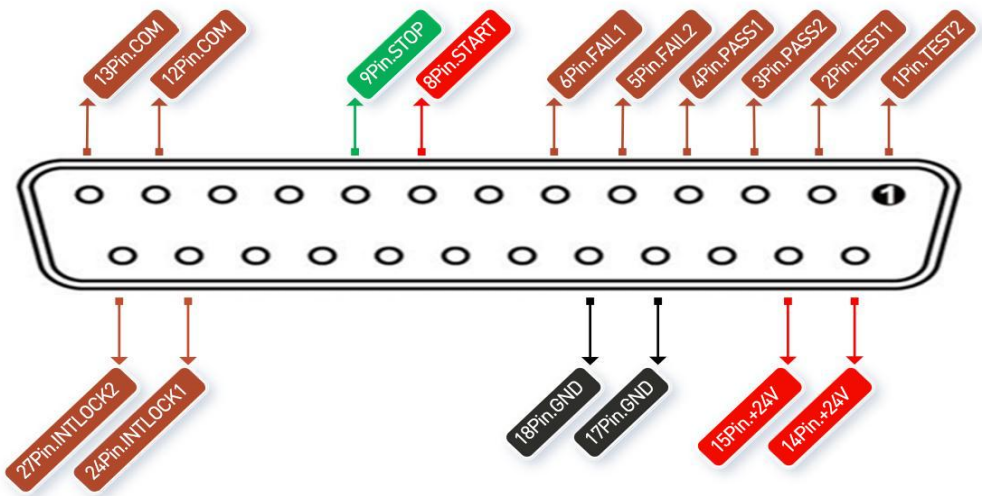
This chapter provides the following information:

- Terminals
- How to connect and Interface schematic

The instrument provides users with a wealth of processor interfaces. Through this interface, the instrument can easily complete the automatic control function with the user's system control components.

8.1 Terminals and Signals

Figure 8- 1 Terminals



- START、STOP、COM signal is composed of remote input control, and the switch input is closed and valid.
- TEST、PASS、FAIL signal constitutes the remote output control. The switch output is closed and valid. TEST can be used as a high voltage start signal or a pulse signal for the normal operation of the instrument.
- PIN 14-15 provide +24V power output,the output current is less chan 1A, with TEST, PASS, FAIL signals, it can be used to drive indicator lights, photoelectric switches, low-power solenoid valves, etc. (see Figure 8-4).
- INTLOCK is an instrument selection signal for multi-instrument leveling tests. This signal is reserved for instrument signals and does not work.

8.2 Connection method

- Interface principle

Figure 8- 2 Handler Interface internal circuit structure

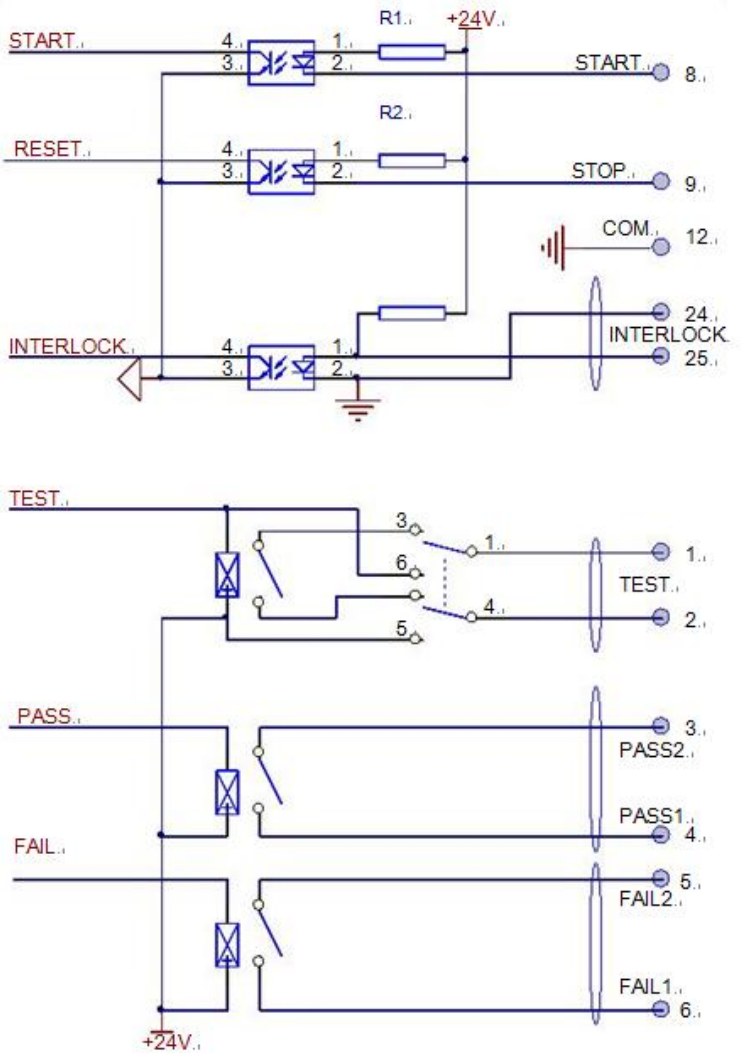
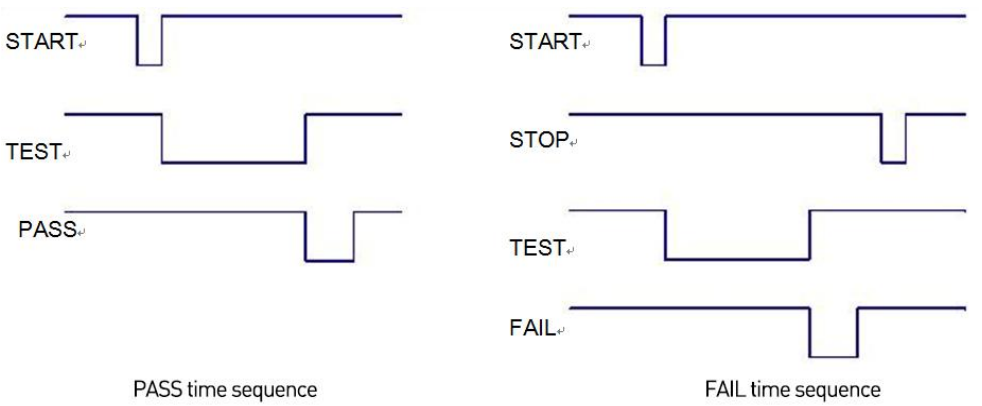


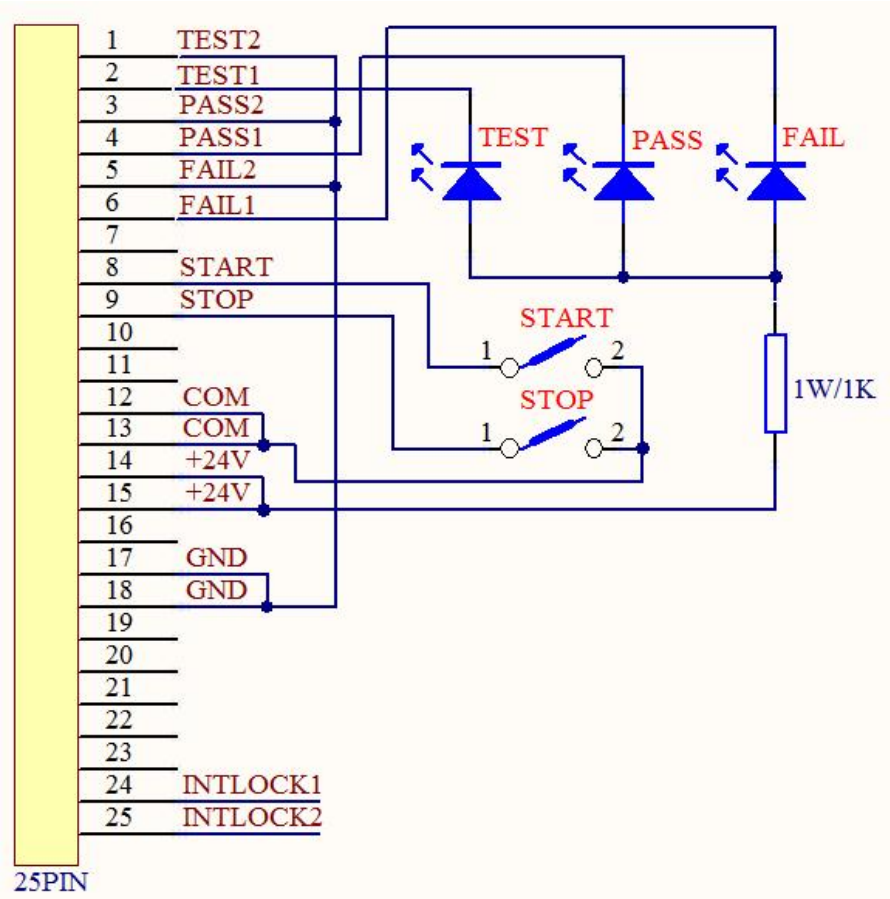
Figure 8- 3 Handler Interface default test timing



■ Instrument interface usage

The control interface is generally used for remote control and test synchronization or indication.

Figure 8- 4 Instrument interface external connection



Instruction:

1.Switches can be replaced by isolated switching elements such as optocoupler secondary side, and the current direction refers to the principle above (COM terminal is low-end).

2.The indicator light here can be replaced by other drive control components, and the current direction depends on the power supply.

3.Instrument internal power performance:

a) DC voltage output +24V

b) The maximum instantaneous current should not be greater than 1A, and the stable working current should be less than 0.5A. Please bring your own power supply if you need a large current.

c) If the external control voltage is greater than 220V voltage or 2A current, the internal relay of the instrument cannot bear it, please transfer it by yourself.

9. Remote Control

This chapter provides the following information to remotely control the AT45xx via the RS-232C or USB interface.This chapter provides the following information

- About RS-232C
- About USB Interface
- Select Baud Rate.
- About SCPI

9.1 About RS-232C

RS-232 is a widely used serial communication standard, also known as asynchronous serial communication standard, which is used to realize the communication between computers. Data communication between computer and peripherals. RS stands for Recommended Standard, and 232 stands for standard. The standard was officially published by the American Electronics Industry Association (EIA) EIA)1969, which stipulated that one bit at a time should be transmitted through a data line. The configuration of most serial ports is usually not strictly based on the RS-232 standard: 25-core connectors are used in each port (the current computer is basically Using a 9-core connector). The most commonly used RS-232 signals are shown in the table:

Table 9- 1 Common RS-232 signal

Signal	Symbol	Pin number of 25-core connector	Pin number of 9-core connector
Request to send	RTS	4	7
Clear To Send	CTS	5	8
Data setting preparation	DSR	6	6
Data carrier detection	DCD	8	1
Data terminal preparation	DTR	20	4
Send data	TXD	2	3
Receive data	RXD	3	2
Grounding	GND	7	5
Request to send	RTS	4	7

In addition, RS232 has a minimum subset, which is also the connection method adopted by the instrument.

Table 9- 2 RS-232Minimum subset of standards

Signal	Symbol	Pin number of 25-core connector
Send data	TXD	2
Receive data	RXD	3
Grounding	GND	5

You can connect a controller (i.e. PC and PLC) to the RS-232 interface using Applent RS-232 DB-9 cable.

NOTE:
The instrument cannot use cable null modem.
You can directly make or purchase a 9-core straight-through cable from Applent Instruments format.

User-made 3-wire cable should pay attention to:
Using the DB9 port of PC, it may be necessary to short the 4-6 and 7-8 of the DB-9 connector (pin) on the computer side.
Cable length should not exceed 2m.

Figure 9- 1 The RS-232 connector in the real panel

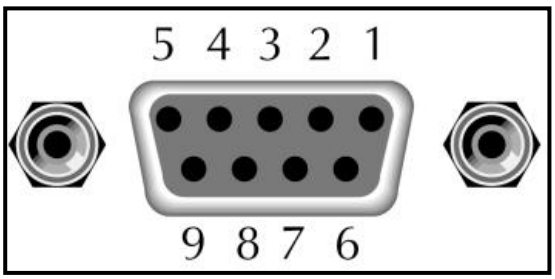


Table 9- 1RS-232 connector pinout

NAME	DB-25	DB-9	NOTE
DCD	8	1	Not Connection
RXD	3	2	Transmit data
TXD	2	3	Receive date
DTR	20	4	Not Connection
GND	7	5	Ground
DSR	6	6	Not Connection
RTS	4	7	Not Connection
CTS	5	8	Not Connection

- Make sure the controller you connect to AT45xx also uses these settings.
  The RS-232 interface transfers data using:
  8 data bits,
  1 stop bit,
  And no parity.

9.2 Handshake protocol

Because the instrument uses the minimum subset of RS-232 standard and does not use hardware handshake signal, in order to reduce the possible data loss in communication. Or data error, the instrument can enable software handshaking, and the senior language software engineer should strictly follow the following handshaking protocol to perform computer.

Compilation of communication software:

- The instrument command parser only accepts ASCII format, and the command response also returns ASCII code.
- The command string sent by the host must end with NL ('\ n'), and the instrument command parser will not start executing the command string until it receives the end.
- The instrument can set instruction handshake: the instrument immediately sends the character back to the host after receiving each character, and the host can only continue to send the next character after receiving the returned character.

Tip: If the host cannot receive the data returned by the instrument, you can use the following methods to try to solve it:

1. The software handshake is turned off. Please refer to the instrument < System Settings > page to turn it on.
2. Serial port connection failure, please check the cable connection.。
3. The communication format of the computer-side high-level language program is wrong. Please try to check whether the serial port number, communication format and baud rate are correct or not.
4. If the instrument is parsing the last command and the host cannot receive the response from the instrument, please try again later.

<The problem still can't be solved, please consult Amber Instrument Technical Engineer immediately.>

9.3 SCPI

Standard Commands for Programmable Instruments (SCPI) is a kind used by Amber Instruments. General command set for testing instruments. SCPI is also called TMSL-test and measurement system language. Developed by Agilent Technologies according to IEEE488.2, it has been widely used by test equipment manufacturers.

Reference :

The built-in command parser of the instrument is responsible for parsing various command formats of users.

Because the command parser is based on SCPI protocol, but it is not completely consistent with SCPI, please read the chapter "SCPI command reference" carefully before starting work.

10. SCPI Command Reference

This chapter contains reference information on programming Instruments with the SCPI commands.

- Command parser;
- Command grammar
- Search grammar
- Inquiry response
- Command reference

This chapter illustrates all SCPI commands adopted by the instrument, through which all functions of the instruments can be fully controlled.

10.1 Command string parsing

The host can send a series of commands to the instrument, and the instrument command parser starts parsing after catching the terminator (\n) or the input buffer overflow.

For example: Legal command string:

AAA:BBB CCC;DDD EEE;:FFF

The instrument command parser is responsible for parsing and executing all commands. Before writing a program, you must first understand its parsing rules.

10.1.1 Command parsing rule

1. The command parser only parses and responds to ASCII code data.
2. The SCPI command string must end with NL ('\ NL(' \n' ASCII 0x0A), and the command parser will not start executing the command string until it receives the end or the buffer overflows.
3. If the instruction handshake is turned on, the command parser will immediately send the character back to the host after receiving each character, and the host can only continue to send the next character after receiving this echo character.
4. The command parser immediately terminates the parsing after parsing the error, and the current instruction is invalid.
5. After the command parser parses the query command, it terminates the parsing of this command string, and then the string is ignored.
6. The command parser is case-insensitive.
7. The command parser supports command abbreviations. Please refer to the following chapter for abbreviation specifications.

10.1.2 Symbol Convention and Definition

This chapter uses some symbols, which are not part of the command tree, just to better understand the command string.

<> The text in angle brackets indicates the parameters of the command.

[ ] The text in square brackets indicates optional commands.

{} When braces contain several parameter items, it means that only one item can be selected.

( ) The abbreviated form of the parameter is enclosed in parentheses.

Capital letter The abbreviated form of the command.

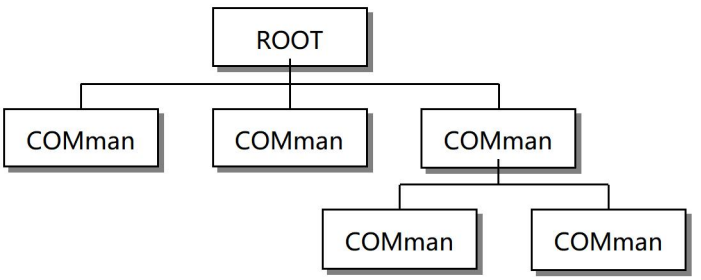
10.1.3 Command Structure

If the SCPI command adopts a tree structure, it can go down to three levels (note: the command parser of this instrument can parse any layer down), and the highest level here is called subsystem command. Only when a subsystem command is selected, its subordinate command is valid. SCPI uses a colon (:) to separate high-level commands from low-level commands.

A colon (:) is used to separate the higher level commands and the lower level commands.

Semicolon (;) A semicolon does not change the current path but separates two commands in the same message.

Figure 10- 10-1 Command Tree Example



Example:

ROOT:CCC:DDD ppp

ROOT Subsystem Command

CCC Level 2

DDD Level 3

ppp Parameter

10.2 Header and Parameters

A command tree consists of commands and [parameters] separated by a space (ASCII: 20H).

For example: AAA:BBB 1.234

Command [Parameter]

10.2.1 Command

Command words can be in long command format or abbreviated form. Using long format is convenient for engineers to better understand the meaning of command string. Abbreviated forms are suitable for writing.

10.2.2 Parameter

- Single command word command, no parameters.
  Example: AAA:BBB
- Parameters can be in the form of strings, and their abbreviation rules still follow the "command abbreviation rules" in the previous section.
  Example: AAA:BBB 1.23
- Parameters can be in numerical form.
  - *<integer>* Integer 123, +123, -123
  - *<float>* Floating-point number
    1. <fixfloat>: Fixed point floating point number: 1.23, -1.23
    2. <Sciloat>: Floating-point number by scientific counting method: 1.23E+4, +1.23e-4
    3. <mpfloat>: Floating-point number expressed by magnification: 1.23k, 1.23M,

1.23G，1.23u

List 10- 1 Multiplication condensation

Definition	Condensation
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

Tip: the magnification is case-insensitive, and its writing is different from the standard name.

10.2.3 Separator

The instrument command parser only accepts allowed delimiters, and the other delimiters will generate an "Invalid separator" error. These delimiters include:

; Semicolon, used to separate two commands.

Example: AAA:BBB 100.0 ; CCC:DDD

: Colon, used to separate the command tree, or command tree restart.

Example: AAA : BBB : CCC 123.4; : DDD : EEE 567.8

? Question mark, used for query.

Example: AAA ?

□ Spaces, used to separate parameters.

Example: AAA:BBB□1.234

10.3 Command Reference

All commands are explained in subsystem command order, all subsystems are listed below.

- DISPlay Display subsystem
- FUNCtion Function subsystem
- FETCh Get results subsystem
- FILE File management subsystem
- SYSTem System subsystem

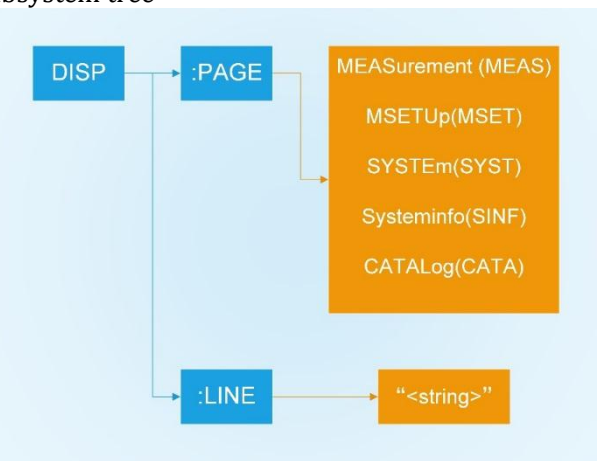
Public order:

- IDN? Instument information query subsystem

10.4 Display Subsystem

Display subsystem Can be used to switch between different display pages or to display text on the page tooltip.

Figure 10- 10- 2 Display subsystem tree



10.4.1 DISPlay:PAGE

DISP:PAGE used to switch to the specified page

Command Syntax: **DISPlay:PAGE <page name>**

Parameter: <page name> include:

MEASurement	Measure Display
MSETUp	Setup Display
SYSTem	System Display
SYSTEMINFO(SINF)	System Information Display
CATALog(CATA)	File Display

Example: **send> disp:page mset<NL>** //switch to setting page

Query Syntax: **DISP:PAGE?**

Query Response:
<page name> abbreviation
ACW MEAS
DCW MEAS
IR MEAS
SETUP
SYST
SINF
CATA

Example:
send> disp:page? <NL>
ret> SETUP <NL>

10.4.2 DISP:LINE

DISP:LINE Used to display text in the prompt bar at the bottom of the page, up to 30 characters.

Command Syntax: **DISPlay:LINE <*string*>**

Parameter: **<string>** up to 30 characters

Example: **send> DISP:LINE "This is a Comment." <NL>**

10.4.3 FUNCtion subsystem

Figure 10- 10- 3 FUNCtion subsystem tree

10.5 FUNCtion subsystem

Figure 10- 10- 3 FUNCtion subsystem tree

10.5.1 High Voltage Start/Stop Command

FUNC:START used to starting high voltage output

Command Syntax: **FUNCtion:START**

Example: **send> FUNC:STARt<*NL*>**
//Start the test , the function is equivalent yo the [START] button

FUNC:STOP used to stop high voltage output

Command Syntax: **FUNCtion:STOP**

Example: **send> FUNC:STOP<*NL*>**
////Stop the test , the function is equivalent yo the [STOP] button

10.5.2 Test Step Instruction Set

FUNC:SOUR:STEP? Used to query the current test steps and the total test steps.

Command Syntax: **FUNC:SOUR:STEP?**

Query Response: **Current step – total steps**
STEP <1-16> - TOTAL <1-16>

Example: **send> FUNC:SOUR:STEP?<NL>**
ret> **STEP 5 - TOTAL 11 <NL>**

FUNC:SOUR:STEP1:INS add a new test item to an existing test plan.

Command Syntax: **FUNC:SOUR:STEP:INS**

Example: **send> FUNC:SOUR:STEP:INS <NL>** //add a new test item

FUNC:SOUR:STEP1:DEL delete the current test project within an existing test plan

Command Syntax: **FUNC:SOUR:STEP:DEL**

Example: send> **FUNC:SOUR:STEP:DEL <NL>** //delete the current test project

FUNC:SOUR:STEP1:NEW creat a new empty test plan to write a new test plan

Command Syntax: **FUNC:SOUR:STEP:NEW**

Example: send> **FUNC:SOUR:STEP:NEW <NL>** //creat a new empty test plan

10.5.3 Function parameter instruction set

FUNC:SOUR:STEP<1-16>: TYPE In an existing test plan,set the function of the current test step.

Command Syntax: **FUNC:SOUR:STEP<1-16>:TYPE {ACW,DCW,IR}**

Example: **send> FUNC:SOUR:STEP5:TYPE IR<NL>**
//Under the premise of total steps ≥5,set the function of step 5 to IR

Query Syntax: **FUNC:SOUR:STEP<1-16>:TYPE?**

Query Response: **{ACW,DCW,IR}**

FUNC:SOUR:STEP<1-16>: VOLT In an existing test plan,set the voltage of the current test step

Command Syntax: **FUNC:SOUR:STEP<1-16>:VOLT <float>**

Parameter: **<float>**（date unit is kV）:
ACW : 0.050 - 5.000 Without unit
DCW : 0.050 - 6.000 Without unit
IR : 0.050 - 1.000 Without unit

Example: **send> FUNC:SOUR:STEP5:VOLT 1<NL>**
// Under the premise of total steps ≥5,set the Voltage of step 5 to 1kV

Query Syntax: **FUNC:SOUR:STEP<1-16>:VOLT?**

Query Response: **<float>**: (data unit is kV)
ACW : 0.050 - 5.000 With unit
DCW : 0.050 - 6.000 With unit
IR : 0.050 - 1.000 With unit

Example: send> **FUNC:SOUR:STEP5:VOLT?<NL>**
ret> **1.000 KV <NL>**

FUNC:SOUR:STEP<1-16>: UPPER In an existing test plan,set the upper of the current test step

Command Syntax: **FUNC:SOUR:STEP<1-16>:UPPER <float>**

Parameter: **<float>**（data unit is mA / MΩ）:
ACW : 0.001 - 20.00 Without unit
DCW : 0.001 - 10.00 Without unit
IR : 0 , 0.1 - 1E4 （where 0 means the upper limit is OFF）

Example: send> **FUNC:SOUR:STEP5:UPPER 1<NL>**

// Under the premise of total steps ≥5,set the upper of step 5 to 1mA

Query Syntax: **FUNC:SOUR:STEP<1-16>:UPPER?**

Query Response: **<float>**: (data unit is mA/MΩ)
ACW : 0.001 - 20.00 With unit
DCW : 0.001 - 10.00 With unit
IR : OFF，0.1 - 1E4 With unit

Example: send> **FUNC:SOUR:STEP5:UPPER?**<NL>
ret> **1.000 mA** <NL>

FUNC:SOUR:STEP<1-16>：LOWER In an existing test plan,set the lower of the current test step

Command Syntax: **FUNC:SOUR:STEP<1-16>:LOWER <float>**

Parameter: **<float>**（data unit is mA / MΩ）：
ACW : 0 ，0.001 - 20.00,（0 means lower limit OFF）
DCW : 0 ，0.001 - 10.00,（0 means lower limit OFF）
IR: 0.1 - 1E4 Without unit

Example: send> **FUNC:SOUR:STEP5:LOWER 0.1**<NL>
// Under the premise of total steps ≥5,set the upper of step 5 to 0.1mA

Query Syntax: **FUNC:SOUR:STEP<1-16>:LOWER?**

Query Response: **<float>**:
ACW : OFF， 0.001 - 20.00 With unit
DCW : OFF， 0.001 - 10.00 With unit
IR : 0.1 - 1E4 With unit

Example: send> **FUNC:SOUR:STEP5:LOWER?**<NL>
ret> **0.100mA** <NL>

FUNC:SOUR:STEP<1-16>：RTIM In an existing test plan,set the rise time of the current test step

Command Syntax: **FUNC:SOUR:STEP<1-16>:RTIM <float>**

Parameter: **<1-16>:** step
<float>（data in seconds）：0，0.1 - 999.9 Without unit

Example: send> **FUNC:SOUR:STEP5:RTIM 10**<NL>
// Under the premise of total steps ≥5,set the rise time of step 5 to 10s

Query Syntax: **FUNC:SOUR:STEP<1-16>:RTIM?**

Query Response: **<float>**:
OFF，0.1 - 999.9 With unit

estExample: send> **FUNC:SOUR:STEP5:RTIM?**<NL>
ret> **10.0s** <NL>

FUNC:SOUR:STEP<1-16>：TTIM In an existing test plan,set the test time of the current test step

Command Syntax: **FUNC:SOUR:STEP<1-16>:TTIM <float>**

Parameter: **<1-16>:** step
<float>（data in seconds）：0，0.1 - 999.9（0 means continuous testing）

Example: send> **FUNC:SOUR:STEP5:TTIM 10**<NL>
// Under the premise of total steps ≥5,set the test time of step 5 to 10s

Query Syntax: **FUNC:SOUR:STEP<1-16>:TTIM?**

Query Response: **<float>**:
OFF，0.1 - 999.9 With unit

Example: send> **FUNC:SOUR:STEP5:TTIM?**<NL>
ret> **10.0s** <NL>

FUNC:SOUR:STEP<1-16>：FTIM In an existing test plan,set the fall time of the current test step

Command Syntax:	**FUNC:SOUR:STEP<1-16>:FTIM <float>**
Parameter:	**<1-16>:** step **<float>**（data in seconds）：0，0.1 - 999.9 Without unit
Example:	send> **FUNC:SOUR:STEP5:FTIM 10**<NL> // Under the premise of total steps ≥5,set the fall time of step 5 to 10s
Query Syntax:	**FUNC:SOUR:STEP<1-16>:FTIM?**
Query Response:	**<float>**: OFF，0.1 - 999.9 With unit
Example:	send> **FUNC:SOUR:STEP5:FTIM?**<NL> ret> **10.0s** <NL>

FUNC:SOUR:STEP<1-16>：ARC In an existing test plan,set the ARC level of the current test step

Command Syntax:	**FUNC:SOUR:STEP<1-16>:ARC < *int* >**
Parameter:	**< int>**: 0 - 9，（ This function is not available under **IR** ; 0 = OFF）
Example:	send> **FUNC:SOUR:STEP5:ARC 1**<NL> // Under the premise of total steps ≥5,set the ARC level of step 5 to 1
Query Syntax:	**FUNC:SOUR:STEP<1-16>ARC?**
Query Response:	**<int>**: OFF，1 - 9
Example:	send> **FUNC:SOUR:STEP5:ARC?**<NL> ret> **LEVEL 1** <NL>

FUNC:SOUR:STEP<1-16>：FREQ In an existing test plan,set the frequence of the current test step

Command Syntax:	**FUNC:SOUR:STEP<1-16>:FREQ < *int* >**
Parameter:	**< int>**: 50 / 60，（**Only available under ACW**）
Example:	send> **FUNC:SOUR:STEP5:FREQ 60**<NL> // Under the premise of total steps ≥5,set the frequency of step 5 to 60Hz
Query Syntax:	**FUNC:SOUR:STEP<1-16>FREQ?**
Query Response:	**<int>**: 50 / 60
Example:	send> **FUNC:SOUR:STEP5:FREQ?**<NL> ret> **60HZ** <NL>

FUNC:SOUR:STEP<1-16>：WTIM In an existing test plan,set the waiting time of the current test step

Command Syntax:	**FUNC:SOUR:STEP<1-16>:WTIM <float>**
Parameter:	**<float>**（data in seconds）： 0，0.1 - 999.9 Without unit（**Only available under DCW**）
Example:	send> **FUNC:SOUR:STEP5:WTIM 10**<NL> // Under the premise of total steps ≥5,set the waiting time of step 5 to 10s
Query Syntax:	**FUNC:SOUR:STEP<1-16>:WTIM?**
Query Response:	**<float>**（data in seconds）： OFF，0.1 - 999.9 With unit
Example:	send> **FUNC:SOUR:STEP5:WTIM?**<NL> ret> **10.0s** <NL>

FUNC:SOUR:STEP<1-16>：RAMP In an existing test plan,set the boost judgment of the current test step

Command Syntax:	**FUNC:SOUR:STEP<1-16>:RAMP {ON,OFF}　(Only available under DCW)**
Example:	send> **FUNC:SOUR:STEP5:RAMP ON**<NL> // Under the premise of total steps ≥5,set the RAMP of step 5 to on
Query Syntax:	**FUNC:SOUR:STEP<1-16>:RAMP?**
Query Response:	**{ON,OFF}**

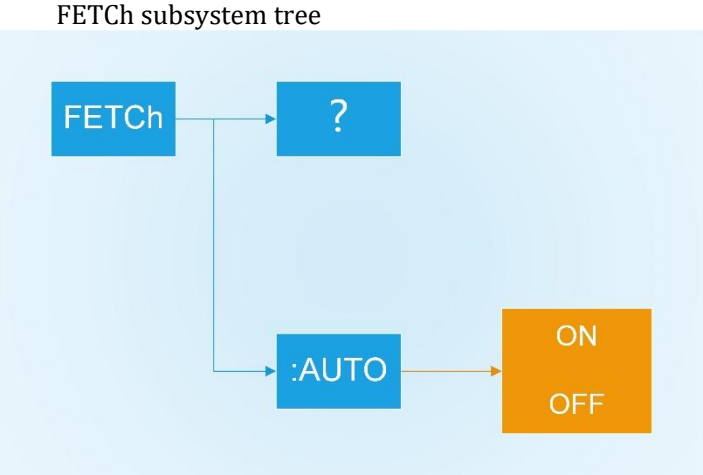
FUNC:SOUR:STEP<1-16>：RANG In an existing test plan,set the rang of the current test step

Command Syntax:	**FUNC:SOUR:STEP<1-16>:RANG　<int>　(Only available under IR)**
Parameter:	**<int>**: 0 - 5 Without unit（Where 0 is Auto, 5 is 5mA, 4 is 1mA, 3 is 100uA，2 is 10uA, 1 is 1uA）
Example:	send> **FUNC:SOUR:STEP5:RANG 1**<NL> // Under the premise of total steps ≥5,set the range of step 5 to 1uA
Query Syntax:	**FUNC:SOUR:STEP<1-16>:RANG?**
Query Response:	**<int>**: AUTO，1 - 5 With unit
Example:	send> **FUNC:SOUR:STEP5:RANG?**<NL> ret> **Range 1** <NL>

10.6 FETCh Subsystem

The fetch subsystem command set is used to obtain the measurement results of the instrument and set the acquisition mode.

Figure 10- 4 FETCh subsystem tree



FETCh:AUTO Set whether the instrument returns the result of each measurement.

Command Syntax:	**FETCh:AUTO {ON,OFF}**
Example:	send> **FETCh:AUTO ON**<NL>　//Automatic sending of each measurement result
Query Syntax:	**FETCh?**
Example:	send> **FETC?** <NL>

ret> **IR,0.050kV,34.59MΩ,PASS;ACW,0.050kV,0.000mA,PASS;** *<NL>* The instrument returns each measurement result.

10.7 FILE Subsystem

FILE subsystem commands are used to perform file operations.

Figure 10- 5 FILE subsystem tree

FILE	*:SAVE*	*<File NO.>*
	:LOAD	*<File NO.>*
	:DELete	*<File NO.>*

10.7.1 FILE?

FILE? Command is used to query the file number used by the system.

Command Syntax: **FILE?**

Query Syntax: **<int>**:
0 – 9

Example: send> **FILE?***<NL>*
ret> **1***<NL>*

10.7.2 FILE:SAVE <n>

FILE:SAVE command is used to save the user setting to the current file.

Command Syntax: **FILE:SAVE**

Example: send> **FILE:SAVE***<NL>*

FILE:SAVE <n> command is used to save the user setting to the specified file.

Command Syntax: **FILE:SAVE <n>**

Parameter: **<int>**:
0 - 9,

Example: send> **FILE:SAVE 1***<NL>*

10.7.3 FILE:LOAD <n>

FILE:LOAD command is used to load all user setting from the currently used file.

Command Syntax: **FILE:LOAD**

Example: send> **FILE:LOAD***<NL>*

FILE:LOAD <n> command is used to load all user setting from the specified file

Command Syntax: **FILE:LOAD <n>**

Parameter: **<int>**:
0 - 9,

Example: send> **FILE:LOAD 1***<NL>*

10.7.4 FILE:DELete <n>

FILE: DELete command is used to delete all user setting from the currently use file.

Command Syntax:	**FILE: DELete**
Example:	send> **FILE: DELete** *<NL>*

FILE: DELete <n> command is used to delete all user setting from the specified file.

Command Syntax:	**FILE: DELete <n>**
Parameter:	**<int>**: 0 - 9,
Example:	send> **FILE: DELete 1***<NL>*

10.7.5 SYSTem Subsystem

SYSTem subsystem used to set system-related parameters.

SYSTem subsystem set data is not kept together internally.

Figure 10- 5 SYSTem subsystem tree

SYSTem	*:LANGuage*	*{ENGLISH,CHINESE,EN,CH}*
	:GFI	*{ON,OFF}*
	:BEEP	*{ON,OFF}*

10.8 FILE Subsystem

SYSTem subsystem used to set system-related parameters.

SYSTem subsystem set data is not kept together internally.

Figure 10- 6 SYSTem subsystem tree

SYSTem	*:LANGuage*	*{ENGLISH,CHINESE,EN,CH}*
	:GFI	*{ON,OFF}*
	:BEEP	*{ON,OFF}*

10.8.1 SYSTem LANGuage

SYST:LANG Set language。

Command Syntax:	**SYSTem:LANGuage {ENGLISH,CHINESE,EN,CH}**
Example:	send> **SYST:LANG EN***<NL>* //Set to display inEnglish
Query Syntax:	**SYST:LANG?**
Query Response:	**{ENGLISH,CHINESE}**

10.8.2 SYSTem:GFI

SYST:GFI Set electric shock protection status.

Command Syntax:	**SYSTem:GFI {ON,OFF}**
Example:	send> **SYST:GFI ON***<NL>* //Set electric shock protection on
Query Syntax:	**SYST:GFI?**
Query Response:	**{ON,OFF}**

10.8.3 SYSTem:BEEP

SYST:GFI Set beep

Command Syntax:	**SYSTem:BEEP {ON,OFF}**
Example:	send> **SYST:BEEP ON**<*NL*> //Set beep on
Query Syntax:	**SYST:BEEP?**
Query Response:	**{ON,OFF}**

10.9 IDN? Subsystem

Figure 10- 7 IDN? Subsystem tree

IND?	

IDN? Subsystem is used to return the version number of the instrument.

Query Syntax:	**IDN?**
Query Response:	**<MODEL>,<Revision>,<SN>,< Manufacturer>**
Example:	send> **IDN?** <*NL*> ret> **AT9220,REV C1.0,0000000,Applent Instruments**<*NL*>

11. SPECIFICATION

This chapter provides the following information:

- Technical indicators
- Function model
- Environmental requirements
- Dimensions

11.1 Technical indicators

AT9220 AC/DC Withstanding Tester			
AC withstand voltage			
Rate Output	5kV / 20mA		
	Range	Resolution	Accuracy
Output Voltage	0.050kV-5.000kV	0.001 (1V)	± (2%×Reading + 5digital)
Test Current	0.001mA-10.00mA	0.001 / 0.01	± (2%×Reading + 5digital)
Frequency	50Hz or 60Hz， ±0.1%		
Output Waveform	Sine wave，distortion less than 3%（pure resistive load）		
Voltage regulation	± （2%×Reading+5V） （From empty to full）		
DC withstand voltage			
Rate Output	6kV / 10mA		
	Range	Resolution	Accuracy
Output Voltage	0.050kV-6.000kV	0.001 (1V)	± (2%×Reading + 5digital)
Test Current	0.1uA-5.00mA	0.1 / 0.01	± (2%×Reading + 5digital)
Insulation			
Rate Output	1kV / 10GΩ		
	Range	Resolution	Accuracy
Output Voltage	0.050kV-1.000kV	0.001 (1V)	± (1%×Reading + 2digital)
Measure Range	0.02MΩ-10GΩ		
Measure Accuracy	≥500V	< 500V	
	1MΩ-1GΩ ± (5%Reading+5digital)	0.1MΩ-1GΩ ± (10%Reading+5digital)	
	1GΩ-10GΩ ± (10%Reading+5digital)	1GΩ-10GΩ For reference only, no precision requirements	
General parameters			
Discharge Function	Automatic discharge after the test is over.		
Arc Detection	1-9level （AC / DC）		
Vosltage rise time	0.1s-999.9s		
Vosltage test time	0.1s-999.9s		
Vosltage fall time	0.1s-999.9s		

interface	Handler interface（PLC interface） 、RS232C 、USB

11.2 Model Function

	ACW	DCW	IR
AT9220	✓	✓	✓
AT9220A	✓	✓	
AT9220B	✓		

11.3 Environmental requirements

Environment index： temperature 18℃~28℃ huniditu ≤ 65% RH
operate： temperature 10℃~40℃ huniditu 10~80% RH
store： temperature 0℃~50℃ huniditu 10~90% RH

Power supply： 110VAC/220VAC（1±10%）

fuse： 110V 5A slow melting、220V 3A slow melting

power： MAX300VA

weight： about 8 kg

11.4 Dimensions

(Schematic)