ONMEAS®

Rev.A

AT5220/5210

Multi-channel Battery Meter



User's Guide

Scan QR code for operation video

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Changzhou,
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1.Unpacking and Preparation

This chapter describes how to set up and start the AT5220.

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

1.1 Incoming Inspection

After you receive the instrument, carry it out and check during unpacking according to the following procedures.



WARNING

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

Make sure that the packing box or shock-absorbing material used to package the instrument has not been damaged.

Referring to <Packing List> in the packing box, check that all packaged items supplied with the meter have been provided as per the specified optioned.

NOTE

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

1.2 Power requirements and setting up Fuse

~Line: 220VAC, 50Hz/60Hz

Fuse: 250V 1A Slow Blow

Please use the following fuse type.

UL/CSA type, Slow-Blow, 5×20-mm miniature fuse, 1A, 250 V



When you need a fuse, contact your nearest Applent Instruments sales or service office. To verify and replace the fuse, remove the power cable and pull out the fuse holder.

1.3 Environmental Requirements

Set up the AT5220 where the following environmental requirements are satisfied.

Operating Environments
Ensure that the operating environment meets the following requirements.
Temperature: 0°C to 55°C
Temperature range at calibration: 23°C±5°C (<1°C deviation from the temperature when performing calibration)
Humidity: 15% to 85% at wet bulb temperature ≤ 40°C (non-condensation) Altitude: 0 to 2,000m
Vibration: Max. 0.5 G, 5 Hz to 500 Hz

1.4 Cleaning

To prevent electrical shock, disconnect the AT5220 power cable from the receptacle before cleaning.
Use a dry cloth or a cloth slightly dipped in water to clean the casing.
Do not attempt to clean the AT5220 internally.

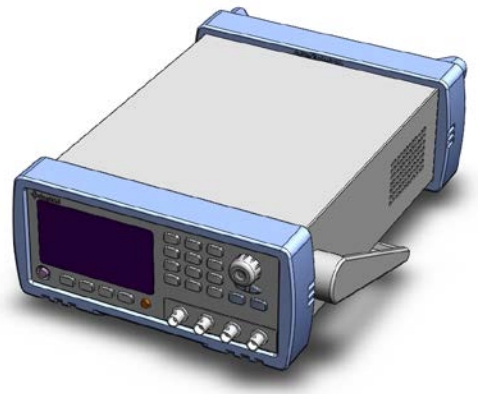


WARNING: Don't Use Organic Solvents (such as alcohol or gasoline) to clean the Instrument.

1.5 How to Remove the Handle

A handle kit is attached to the AT5220:

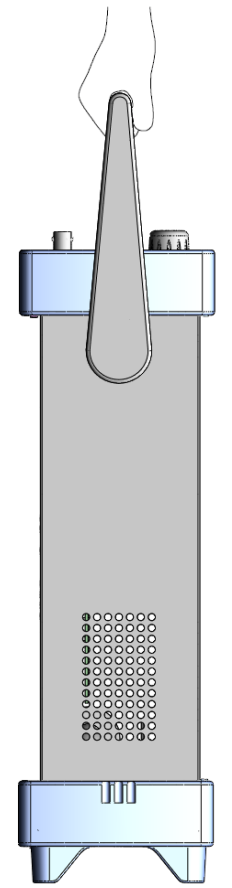
Figure 1-1 How to remove the handle



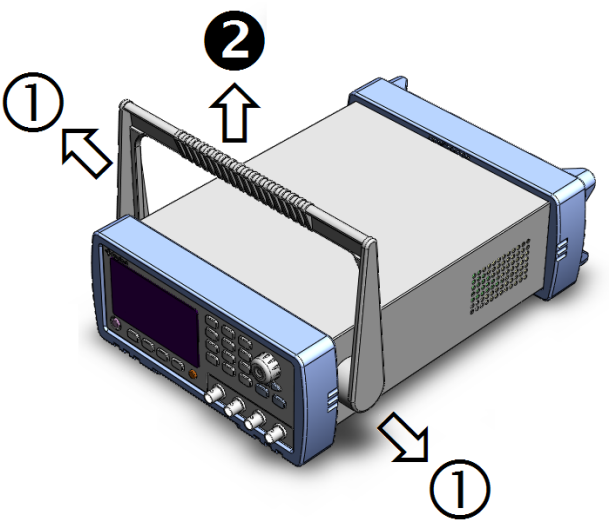
1 Retracted



2 Extended



3 Carrying Position



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

2.Overview

This chapter contains general information about AT5220 .The information is organized as follows

- Introduction
- Main Functions

2.1 Introduction

Thank you for purchasing AT5220 Multi-channel Battery Meter.

AT5220 adopts high-performance 32dgt ARM micro processor to control, 3.5 inches true-color LCD Chinese and English display and it is easy to operate. It can quickly complete 10 channels battery voltage and internal resistance sorting. Resistance range: 0.01mΩ~3kΩ, DC voltage range: 0.0001V~60.000V, resistance MAX display: 33000, voltage MAX display: 60000

AT5220 can mixed measure 10 channels of different batteries, each channel can independently set up comparator, and comparing results of 10 channels resistance and voltage can be output by Handler interface.

AT5220 is equipped with RS232 interface and Handler interface to apply to remote control, data acquisition and analysis.

SCPI （Standard Command for Programmable Instrument） to efficiently realize remote control and data acquisition function.

Reference:  For complete technical details, please refer to charpter “Specifications”

2.2 Main Functions

2.2.1 Range

Resistance：5 ranges，AC resistance range: 0.01mΩ~3kΩ
Voltage：DC voltage range: 0.0001V~60.000V
Manual Range

2.2.2 Measuring Speed

3 types of measuring speed：Slow、Medium、Fast
All channels are turned on, Manual Range:
Slow：9s/20 channels

Medium： 6s/20 channels

Fast： 4s/20 channels

2.2.3 Trigger Mode

Internal、External、Manual and Remote

2.2.4 Basic Accuracy

Slow、Medium：0.5%

Fast：1%

2.2.5 Correction

Short-circuit Clear Zero correction for all ranges.

2.2.6 Comparator Function (Sorting Function)

Each channel can independently set up comparator.

Resistance GD signal or voltage GD signal output independently.

Configurable outpur signal: ROK/VOK/R+VOK。

2.2.7 System Setup

1. Keypad lock function
2. Administrator Accountant Settings

2.2.8 Interface

RS-232 remote control：

Support MAX baud rate 115200bps，compatible with SCPI prootcal，ASCII transmission.

Handler interface

Full opto-isolator, built-in input and output of pull-up resistor.

Support 5V internal and 24V external power source.

Input：Trigger signal

Output：Signals for all sorting results; measurement synchronizing signal（EOC）.

3.Startup

This chapter describes names and functions of the front panel, rear panel, and screen display and provides the basic procedures for operating AT5220.

- Front panel summary
- Rear panel summary
- Power On/Off
- Connect to Device under Test

3.1 Front Panel

3.1.1 Front Panel Description

Figure 3-1 Front panel

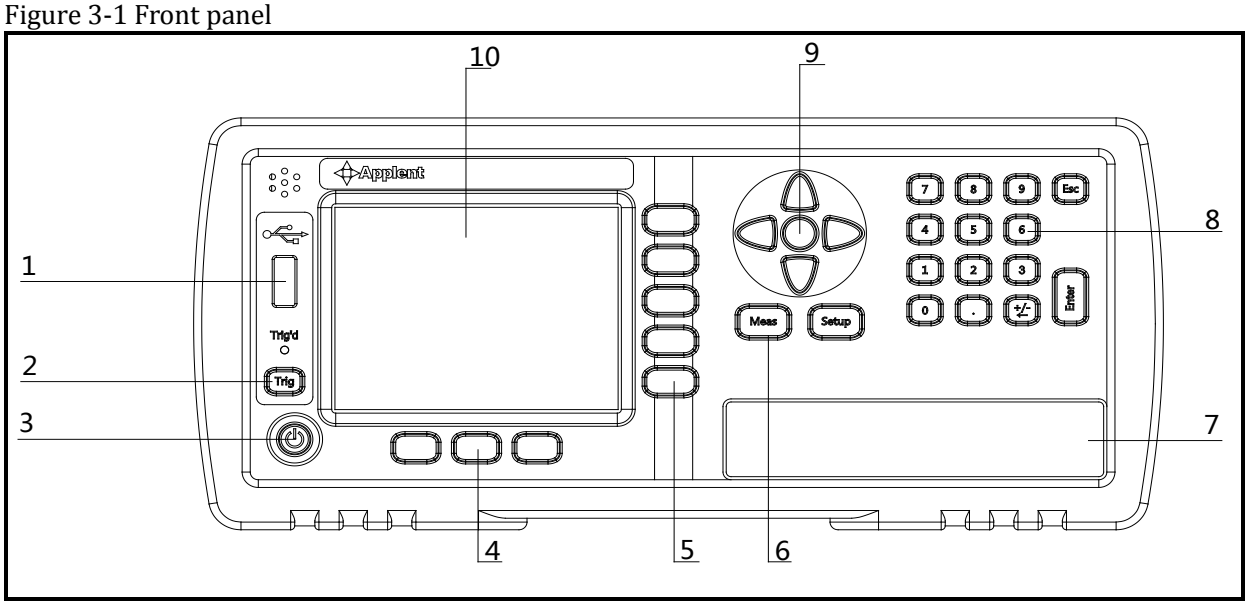
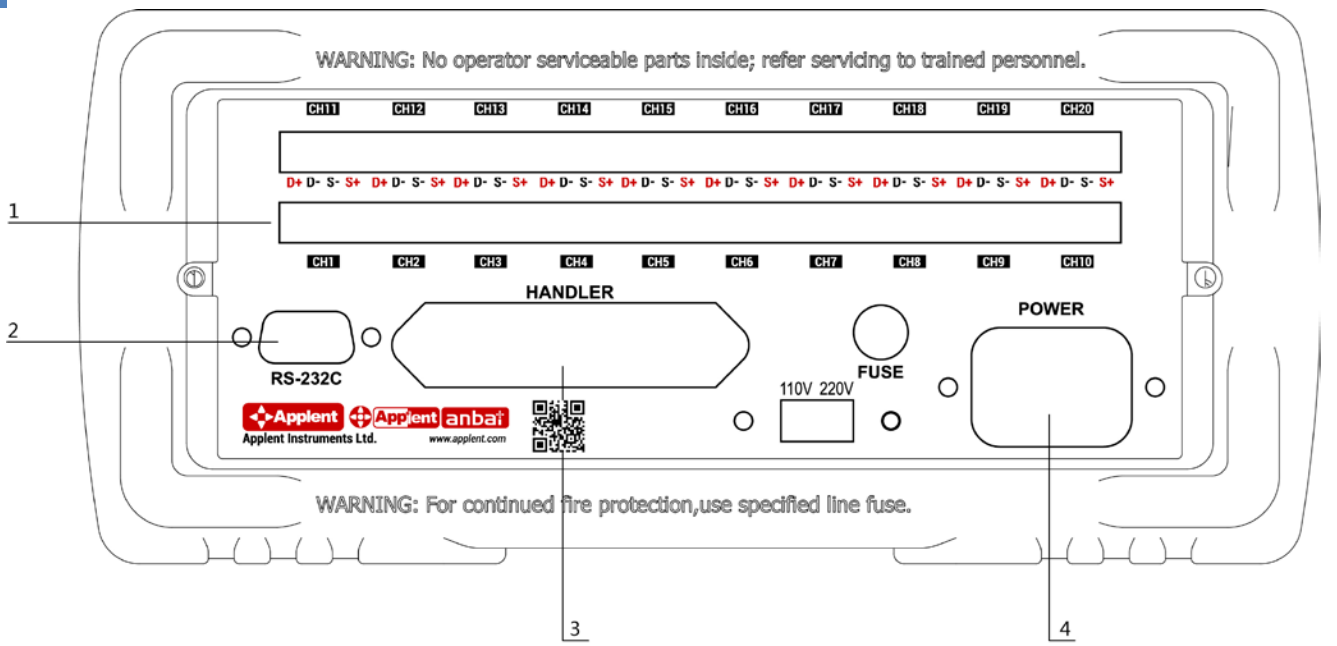


Table 3-1 Front panel description

No.	Description
1	USB Disk Port (USB-Host)
2	Trigger Key
3	Power Switch
4	System Key (Include File, System and Key Lock)
5	Soft Key
6	Menu key
7	Invalid Terminal (Test terminal for all channels is at rear panel)
8	Entry Key
9	Cursor Key
10	LCD Display

3.1.2 Rear Panel

Figure 3-2 Rear panel



1. Test terminal
2. RS-232C interface
3. HANDLER interface
4. AC Power Cord Receptacle

3.2 Power ON/OFF

3.2.1 Power ON

 Power ON.  Power OFF.

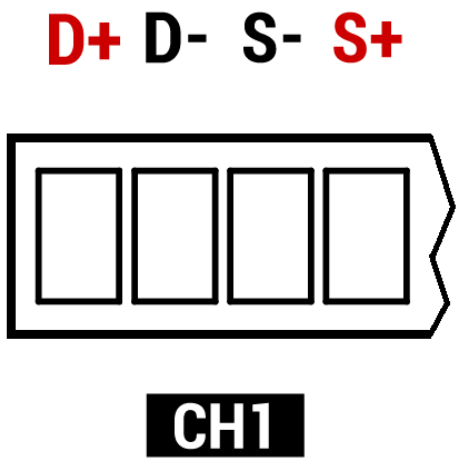
AT5220 is ready to be used as soon as the power-up sequence has completed. However, to achieve the accuracy rating, warm up the instrument for 30 minutes.

3.3 Connect to Device under Test (DUT)

Instrument's test terminal is at rear panel, please go with rabbet direction and insert test socket to test port correctly.

Definition of test terminal pin for each channel is as below:

Figure 3-3 Test terminal for each channel



Warning：NO measuring batteries with more than 60VDC, otherwise, it will cause damage to the instrument.

4.[Meas] Page

4.1 <MEAS DISPLAY> Page

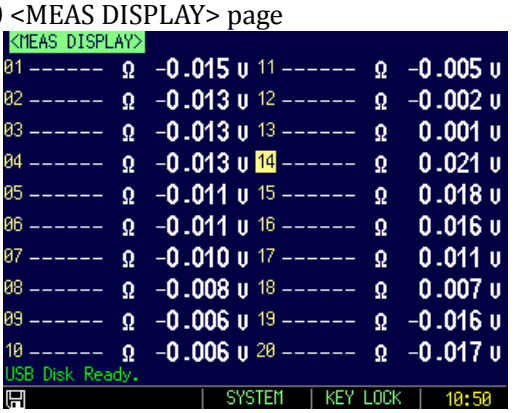
Press [Meas] key to enter <MEAS DISPLAY>Page.

<MEAS DISPLAY> page highlighs displaying measuring results, display current sorting results in small characters.

This page can set up 6 common used functions, including:

- Trigger – trigger setup
- 01-10 – channel setup

Figure 4-1 AT5220 <MEAS DISPLAY> page



4.1.1 【Trigger】 Mode

4 trigger modes are available for AT5220 :

INT (internal), EXT (external), MAN (manual) and BUS (RS-232)

Trigger Mode	Description
INT	Continuously repeats the measurement cycle.
MAN	Performs one cycle of measurement each time you press the [Trig] key.
EXT	Performs one cycle of measurement each time a rising pulse is input to the handler external trigger input pin on the rear panel.
BUS	Performs one cycle of measurement each time it receives a trigger command sent via RS-232.

Procedure to set up trigger:

Step 1	Press [Meas] key to enter <MEAS DISPLAY>Page	
Step 2	Use cursor keys to select [TRIGGER] field	
Step 3	Use function keys to select trigger mode	
	Function keys	Function
	INT	Automatic Internal trigger
	MAN	Manual Trigger by pressing [Trig] key
	EXT	External Trigger Mode
	BUS	BUS Trigger by RS232 SCPI command

5.[Setup] Page

This chapter describes: :

- Measurement setup
- Short-circuit Clear Zero
- Comparator Setup

Press [Setup] key to enter <SETUP>page.

5.1 Measurement Setup

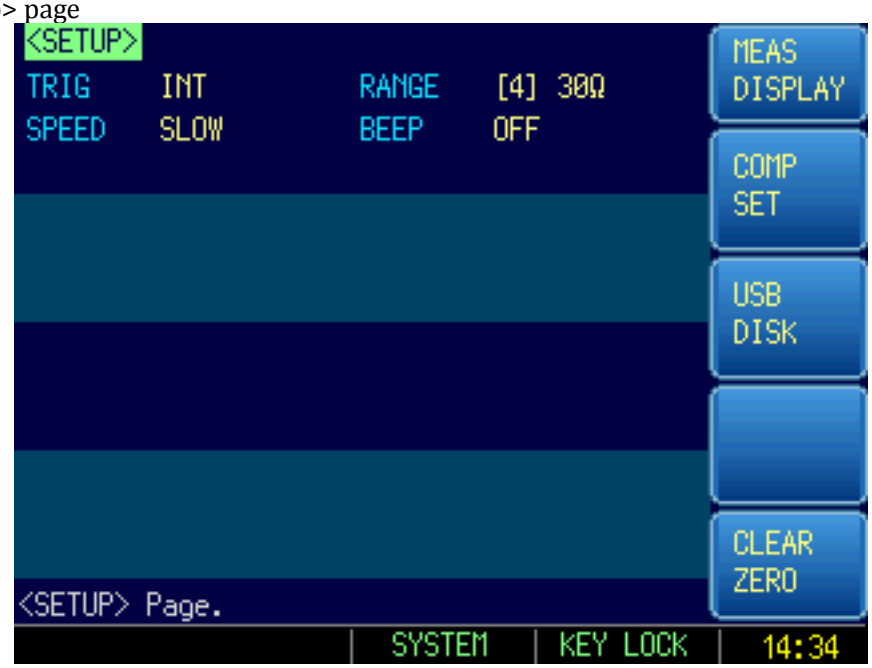
All setting related to measurement is operated in [Setup] page.

In <Setup> page , he Instrument does not display measurement result or comparator result, but testing is still in progress.

The <SETUP> page includes following setup :

- Trigger – trigger mode
- Range – measuring range
- speed – measuring speed
- Scan – scan method

Figure 5-1 <Setup> page



5.1.1 【Trigger】Mode

SCPI command : TRIGger:SOURce {INT,MAN,EXT,BUS}

4 trigger modes are available for AT5220 :

INT (internal), EXT (external), MAN (manual) and BUS (RS-232)

Trigger Mode	Description

INT	Continuously repeats the measurement cycle.
MAN	Performs one cycle of measurement each time you press the [Trig] key.
EXT	Performs one cycle of measurement each time a rising pulse is input to the handler external trigger input pin on the rear panel.
BUS	Performs one cycle of measurement each time it receives a trigger command sent via RS-232.

Procedure to set up trigger:

Step 1	Press [Meas] key to enter <MEAS DISPLAY>Page	
Step 2	Use cursor keys to select [TRIGGER] field	
Step 3	Use function keys to select trigger mode	
	Function keys	Function
	INT	Automatic Internal trigger
	MAN	Manual Trigger by pressing [Trig] key
	EXT	External Trigger Mode
	BUS	BUS Trigger by RS232 SCPI command

5.1.2 【Range】

SCPI command：

FUNCtion:RANGe {<Range NO.>,min,max}

5 ranges are available for AT5220, changes for each range is as below:

AT5220 only use manual range to make measurement:

Table 5-1 Range

Range NO.	Range	Range Ability	UP	DOWN
1	100mΩ	29.000mΩ~300.00mΩ	↓ 300mΩ ↓ 3Ω ↓ 30Ω ↓ 300Ω ↓	↑ 290mΩ ↑ 2.9Ω ↑ 29Ω ↑ 290Ω ↑
2	1Ω	290.00mΩ~3.0000Ω		
3	10Ω	2.9000Ω~30.000Ω		
4	100Ω	29.000Ω~300.00Ω		
5	1kΩ	290.00Ω~3.0000kΩ		

■ **Procedure to set up Range：**

Step 1 Press【Setup】key to enter Setup page；

Step 2 Use cursor keys to select [Range] field；

Step 3 Use function keys to select range

Function keys	Function
Increase +	Increase range，range is changed to LOCK
Decrease-	Decrease range，range is changed to LOCK

5.1.3 Measuring【Speed】

SCPI command：FUNCtion:RATE {SLOW,MED,FAST,ULTRA}

3 measuring speed is available for AT5220, (Slow、Medium、Fast)。The slower the measuring speed, the more the accuracy, the more stable.

When all channels are turned on, and the range method is manual, the speed is as below：

Slow： 4.5s/10 channels

Medium：3s/10 channels

Fast： 2s/10 channels

■ Procedure to set up Speed：

Step 1 Press【Setup】key to enter Setup page；

Step 2 Use cursor keys to select [Speed] field；

Step 3 Use function keys to select speed

Function keys	Function
Slow	4.5s/10 channels
Medium	3s/10 channels
Fast	2s/10 channels

5.1.4 【Scan】Mode

SCPI command：FUNCtion:SCAN {ON,OFF,<channel NO.>}

Users can set loop scan or fixed channel measurement, this can be completed in <MEAS DISPLAY> page.

■ Procedure to set up Scan Mode：

Step 1 Press【Setup】key to enter Setup page；

Step 2 Use cursor keys to select [Scan] field；

Step 3 Use function keys to select

Function keys	Function
Scan	Multichannel loop test
Single	Current channel test
Increase +	Change channel number of single channel test
Decrease-	Change channel number of single channel test

5.2 Short-circuit Clear Zero

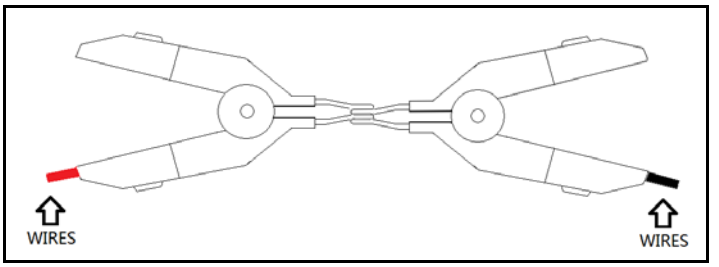
SCPI command：**CORRect:SHORt**

In order to get high measuring accuracy, it is necessary to do short-circuit clear zero correction to efficiently counteract the stay resistance in test cable.

When replace the test fixture or test cables, please do short –circle clear zero.

How to connect the test clips before executing short-circle clear.

Figure 5-2 Correct method of short-circuit clear zero



■ Procedure to perform short-circuit clear zero

Step 1 Press【Setup】to enter Setup page

Step 2 Short clamp test clip

Step 3 Use function key to select 【Clear】

Step 4 Press【OK】, instrument starts to perform clear zero

Step 5 Return to Setup page after the process is completed

5.3 Comparator Setup

Press【Setup】 key , then press【Comp Setup】 to enter < Comp Setup > page

All channels can be set upper limit and lower limit by comparator.

To take full advantage of comparator, instrument adopts built-in Handler interface.

In <Comp> page , users can set :

- 【Comp】 switch
- Compare【Mode】setup
- 【Output】signal setup
- Input data of【upper limit】、【lower limit】for each bin

Figure 5-3 <Comp Setup> Page

Independent Comp Set



Identical Comp Set:



5.3.1 【Comp】switch

SCPI command：COMParator[:STATe] {ON,OFF,1,0}

■ **Procedure to turn on/off comparator**

Step 1 Press 【Meas】 or【Setup】to enter correspond page

Step 2 Press 【Comp Setup】key

Step 3 Use cursor keys to select 【Comp】field

Step 4 Use function keys to select

Function keys	Function
OFF	Comparator is turned off
ON	Comparator is turned on

5.3.2 Compare【Mode】

SCPI command：COMParator:MODE {IDENtical,INDEpendent}

2 methods is available for instrument comparator：

- Identical setting
- Independent setting

Identical setting: comparator upper limit and lower limit for all channels utilize the setting of CH1

Independent setting: comparator of each channel has independent setting

■ **Procedure to set up compare mode**

Step 1 Enter <Comp Setup> page

Step 2 Use cursor keys to select 【Mode】field

Step 3 Use function keys to select

Function keys	Function
Identical	
Independent	

5.3.3 【Lower limit】and【Upper limit】setup

Command format : COMParator:rbin <channel NO.1~10>,<resistance lower limit>,< resistance upper limit>

Command format : COMParator:vbin < channel NO 1~10>,< voltage lower limit>,< voltage upper limit>

■ **Input direct reading limit value**

Step 1 Enter < Comp> page

Step 2 Use cursor keys to select【1】【Lower limit】field；

Step 3 Input data

Comparator utilize direct reading value to compare, users need to use function keys to select unit.

Step 4 Use cursor keys to select【1】【Upper limit】field；

Step 5 Input data

Step 6 Repeat step 2~5 to complete data input of other bin.

6. <SYSTEM CONFIG> Page

This chapter describes:

- SYSTEM CONFIG
- SYSTEM INFORMATION
- SYSTEM SERVICE

6.1 <SYSTEM CONFIG> Page

Press [SYSTEM] soft-key to enter <**SYSTEM CONFIG**> page.

- LANGUAGE – Choose English or Chinese Language
- DATE/TIME
- ACCOUNT
- BEEP Feature
- BAUD – RS232/RS485 Communication Baud Rate
- SHAKE HAND

All settings in <**SYSTEM CONFIG**> will be saved into internal flash disk automatically

Figure 6-1 <SYSTEM CONFIG> page



6.1.1 【LANGUAGE】

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

English and Chinese language are available

- **Procedure to change language:**

Step 1 Press bottom soft-key [SYSTEM] to enter <SYSTEM CONFIG>

Step 2 Use cursor keys to select [Language] field

Step 3 Use function keys to select

Function keys	Function
中文[CHN]	CHINESE
ENGLISH	ENGLISH

6.1.2 [DATE], [TIME]

The instrument uses a 24-hour time.

Procedure to set up date:

Step 1	Press bottom soft key [SYSTEM] to enter <SYSTEM CONFIG> page	
Step 2	Use cursor keys to select [DATE] field	
Step 3	Use function keys to set up date	
	Function keys	Function
	YEAR INCR+	+1 YEAR
	YEAR DECR-	-1 YEAR
	MONTH INCR+	+1 MONTH
	DAY+	+1 DAY
	DAY-	-1 DAY

Procedure to set up time:

Step 1	Press bottom soft key [SYSTEM] to enter <SYSTEM CONFIG> page	
Step 2	Use cursor keys to select [TIME] field	
Step 3	Use function keys to set up time	
	Function keys	Function
	HOUR INCR+	+1 HOUR
	HOUR DECR-	-1 HOUR
	MINUTE DECR+	+1 MINUTE
	MINUTE DECR-	-1 MINUTE
	SECOND INCR+	+1 SECOND
	SECOND DECR-	-1 SECOND

6.1.3 【KEY BEEP】Setting

KEY BEEP can be set as GD bee, NG beep and OFF.

■ **Procedure to set up the beep:**

Step 1 Press bottom soft-key [SYSTEM] to enter <SYSTEM CONFIG> page

Step 2 Use cursor keys to select [BEEP] field

Step 3 Use function keys to select :

Function keys	Function
OFF	Key beeper is set to OFF
ON	Key beep is set to ON.

6.1.4 【BAUD】Rate Setup

Before you can control the AT5220 by issuing RS-232 commands from built-in RS-232 controller connected via its DB-9 connector, you have to configure the RS-232 baud rate. The AT5220 built-in RS-232 interface uses the SCPI language.

The configuration of RS-232

The keypad will be locked when the commutation established.
Use SCPI language in Mini-USB programming.

RS-232 configuration is as follows:

- Data bits: 8
- Stop bits: 1
- Parity: none
- Baud rate: configurable

Procedure to set baud rate:

Step 1 Press bottom soft-key [SYSTEM] to enter <SYSTEM CONFIG> page

Step 2 Use cursor keys to select [BAUD] field

Step 3 Use function keys to select :

Function keys	Function
1200	For communication converter with opt coupler isolation
9600	Communicate with PLC or touch panel, recommend to use this baud rate
38400	Communicate with PLC or touch panel, can use this baud rate
57600	Can use this baud rate when communication with PC
115200	Best for communication with PC

6.1.5 RS-232 Shake Hand [SHAKE HAND]

AT5220 supports software “shake hand”. AT5220 will return the whole command to host and then response the command when the [SHAKE HAND] is turned

Procedure to turn ON the “Shake Hand”:

Step 1 Press bottom soft-key [SYSTEM] to enter <SYSTEM CONFIG> page

Step 2 Use cursor keys to select [SHAKE HAND] field

Step 3 Use function keys to select :

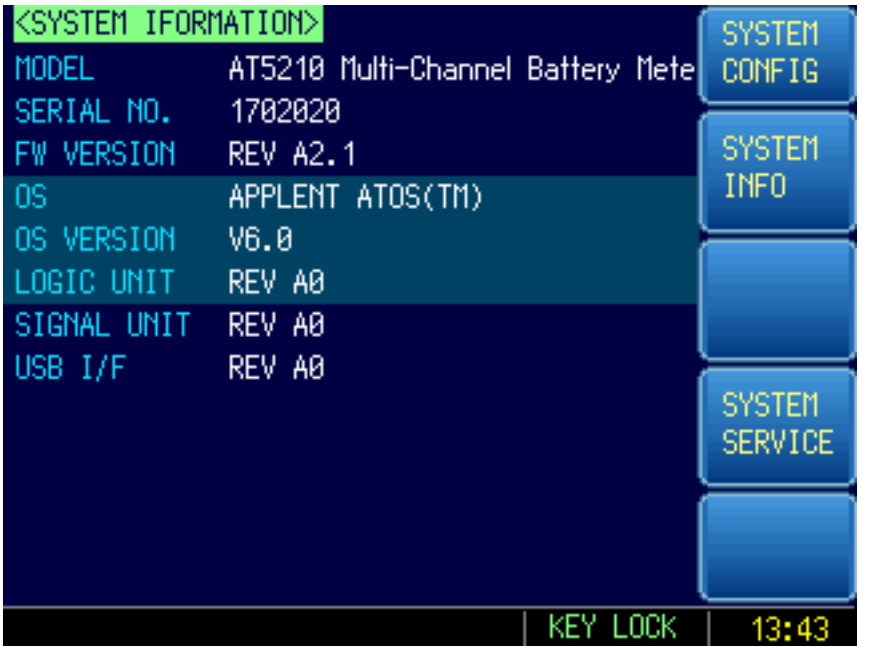
Function keys	Function
OFF	SHAKE HAND in invalid, no special requirement, please turn off SHAKE HAND.
ON	

6.2 <SYSTEM INFORMATION>

Press【Meas】or【Setup】 to enter main page, press buttom【SYSTEM】soft-key to enter <SYSTEM CONFIGURATION>page , then press【SYSTEM INFORMATION】.

There is no configurable option in the <SYSTEM INFO> page.

Figure 6-2 <SYSTEM INFORMATION>page


<SYSTEM IFORMATION>
MODEL AT5210 Multi-Channel Battery Mete
SERIAL NO. 1702020
FW VERSION REV A2.1
OS APPLENT ATOS(TM)
OS VERSION V6.0
LOGIC UNIT REV A0
SIGNAL UNIT REV A0
USB I/F REV A0
SYSTEM CONFIG
SYSTEM INFO
SYSTEM SERVICE
KEY LOCK
13:43

7. PLC (Handler) Interface

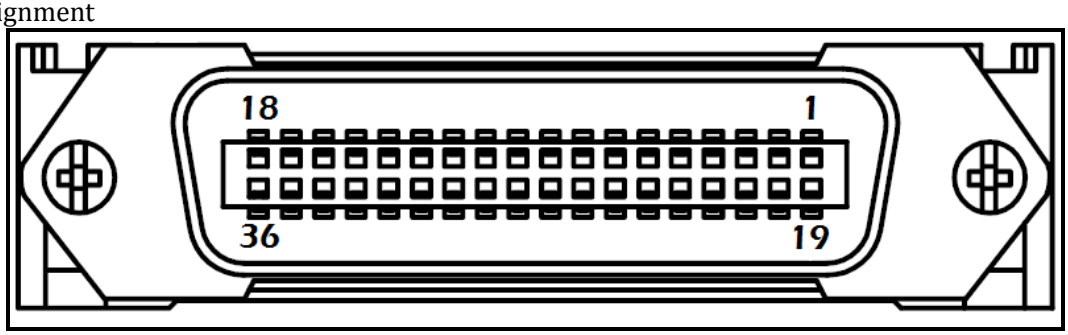
This chapter describes how to use the handler interface.

- Pin Assignment
- Connection and Circuit Diagram

By using the handler interface, you can output the measurement completion signal (EOC), the screening result of the comparator function (GD/NG), and so on to external devices from the AT5220. You can also input the external trigger signal and the comparator select signal to the AT5220. With this interface and the comparator function, you can build an automatic screening system composed of the AT5220 and the handler.

7.1 Pin Assignment

Figure 7-1 Pin assignment



- Output signals （all signals are low level valid）

Table 7-1 Input terminal pin definition

Pin	Name	Description
1	CH8-R	0：R-OK
2	CH9-R	0：R-OK
3	CH10-R	0：R-OK
5	NG	All channels are NG output 1：OK, 0：NG
7	EOC	0：in measuring，1：measuring completed
19	CH7-R	0：R-OK
20	CH6-R	0：R-OK
21	CH5-R	0：R-OK
22	CH4-R	0：R-OK
23	CH3-R	0：R-OK
24	CH2-R	0：R-OK
25	CH1-R	0：R-OK
8	CH1-V/RV	0：V-OK or RV-OK

	<Remark>	
9	CH2-V/RV	0 : V-OK or RV-OK
10	CH3-V/RV	0 : V-OK or RV-OK
11	CH4-V/RV	0 : V-OK or RV-OK
12	CH5-V/RV	0 : V-OK or RV-OK
13	CH6-V/RV	0 : V-OK or RV-OK
14	CH7-V/RV	0 : V-OK or RV-OK
15	CH8-V/RV	0 : V-OK or RV-OK
16	CH9-V/RV	0 : V-OK or RV-OK
17	CH10-V/RV	0 : V-OK or RV-OK

<Remark> : P8~P17 V/RV is configurable pin , configure as V-OK or RV-OK (R+V all GD) format , please refer to Comparator chapter.

■ Input terminal

Table 7-2 Input terminal pin definition

Pin	Name	Description
18	trigger input	Trigger input terminal, built-in 0.25W, 499Ω current-limiting resistance.

■ VCC

Table 7-3 VCC pin definition

Pin	Name	Description
27-30	GND	External power source input GND
33-34	External VCC	External power source input plus terminal
35-36	*Internal VCC*	*Internal VCC power plus terminal* (5V,1A)

7.2 Connection

■ Use external power source (recommended)

Please use external power source to connect to the pins as below:

VCC : pin 33-34

GND : pin 27-30

Internal power source 35-36 : float

■ Use internal power source



Under condition of unknown or uncertain power, don't use internal power source, otherwise, the instrument will not be able to work.

Under condition of small power, uses can use internal power source, but it will make instrument's antijamming capability become weak.

Internal power source : 5V MAX 1A。

Use internal power source , and connect to the pins as below:

VCC (5V) : 34-35
GND: 27-30

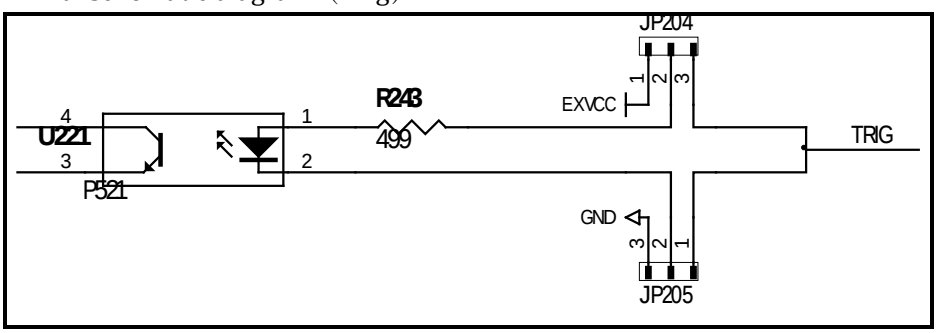
■ Electrical Characteristics

Power requirements : +3.3V~35VDC
Output signals : collector output of built-in pull-up resistor. Darlington drive, low level is valid.
MAX voltage : supply voltage
Input signals : opto-isolator. low level is valid.
MAX current : 50mA

Tip : To avoid the damage to interface, supply voltage can not exceed power requirement.
To avoid damage to interface, please connect cable after instrument is powered off.
Output signal can control signal and small pwer relay (instrument internal has integrated reverse energy release diode) . Don't use internal power source for large power relay.

■ Input terminal schematic diagram

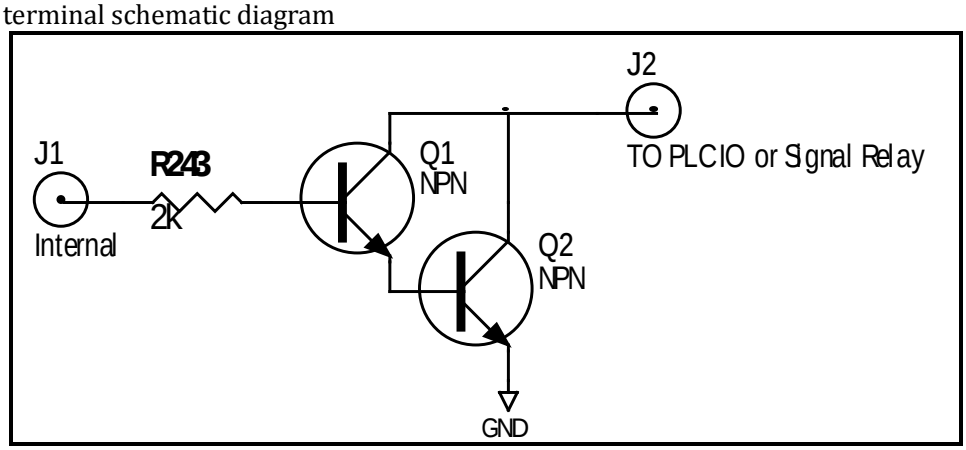
Figure 7-2 Input terminal schematic diagram（Trig）



In above figure : JP204 and JP205 is factory configuration 1-2 short circuit, trigger signal is rising edge trigger.
If trigger signal is falling edge trigger, please short circuit 2-3 for JP204 and JP205, external VCC floats.

■ Output terminal schematic diagram

Figure 7-3 Output terminal schematic diagram



8. Remote Control

This chapter provides the following information to remotely control the AT5220 via the RS-232C or USB interface.

- About RS-232C
- About RS-232C connection
- Select Baud Rate.
- About SCPI

AT5220 can use the RS-232 interface to communicate with the computer to complete all the instrument functions.

8.1 RS-232C

RS-232 is currently widely used serial communications standard, is also called asynchronous serial communications standard, it is applied to realize communication of PC and PC、 PC and peripheral. RS is the English abbreviation for "Recommended Standard" (recommended standard), 232 is standard number, this standard is officially announced by EIA in 1969.

Most configuration of serial port is not based on RS-232 standard: each port use 25-core or 9-core connector (now all PC use 9-core connector). The most common RS-232 signal is as below:

Table 8-1 RS-232 Standard minimum subset

Signal	Mark	9-core connector Pin No
Transmit Data	TXD	2
Receive Data	RXD	3
Ground	GND	5

8.1.1 RS232C Connection

RS-232 serial interface can be connected to serial interface of controller (such as PC or PLC) by DB-9 cable.

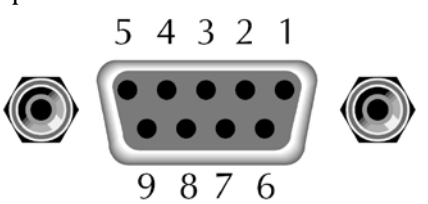
Tip: instrument cannot use null modem cable.

Users can make it or buy 9-core cable from Applent Instruments.

If users make 3-core cable, should pay attention to:

If using PC' s built-in DB9 port, probably users need to short circuit 4-6、7-8 on PC port' s DB-9 connector (pin).

Figure 8-1 Connector at rear panel



Tip: In order to avoid electrical shock, please disconnect power when insert and pull the connector.

■ Instrument’ s default communications setting:

Transmission mode: includes full duplex asynchronous communication of start bits and stop bits

Data bits: 8-bit

Stop bits: 1-bit

Parity bits: None

8.2 Handshake Protocol

Instrument adopts RS-232C standard minimum subset, and software handshake to reduce phenomenon of possible data loss or data error during communication.

Instrument can start using software handshake, high-level language software engineer should strictly do it according to the following handshake protocol to program communication software:

- Instrument terminator only accepts ASCII format, command response also returns ASCII code.
- **Command string that sent by host must be ended with NL (‘\n’) mark, instrument terminator will begin performing command string only after it receives end mark.**
- Instrument can set command handshake: instrument will return an identification code after it receives command and finishes processing.

8.3 SCPI Language

SCPI-Standard Commands for Programmable Instruments is a common command that Applent adopts and it is used to test instrument. SCPI is also called TMSL-Test and Measurement System Language, which is developed by Agilent Technologies according to IEEE488.2, so far it is widely used by equipment manufacturers.

Reference :

Instrument built-in terminator is responsible for parsing user’s various command formats. Because terminator is on the basis of SCPI protocol, but it is not fully consistent with SCPI, please read “SCPI command” chapter before using instrument.

9.SCPI Command Reference

This chapter includes the following content:

- Terminator
- Command Syntax
- Query Syntax
- Query Response
- Command Reference

This chapter provides descriptions of instrument's available SCPI commands sets, which can complete all the instrument functions.

9.1 Terminator

Host can send a string of command to instrument, instrument terminator will begin parsing after it captures end mark (\n) or after input buffer overflows.

For example: Legal command string:

AAA:BBB CCC,DDD,EEE

Instrument terminator is responsible for parsing and performing all commands, before programming, users must know about parsing rules.

9.1.1 Terminator Rules

1. Terminator only parses and responds ASCII code's data.
2. **Command string must be ended with NL (' \n' ASCII 0x0A) mark, terminator will begin performing command string only after it receives end mark or after** buffer overflows.
3. If command handshake is turned on, every time terminator receives one string, it will promptly return this string to the host, only when host receives this returned string, can it continues sending the next string.
4. After terminator parses error, it will promptly stop parsing, and the current command is canceled.
5. When terminator parses the query command, it will terminate parsing this command string, the latter command string will be ignored.
6. When parsing command string, terminator is case insensitive.
7. Terminator supports command abbreviated form, please refer to the latter chapter regarding abbreviation norms.

9.1.2 Notation Conventions and Definitions

This chapter employs some marks, these marks are not a part of command tree; they are only for better understanding of command string.

< >	the character in <> means this command's parameter
[ ]	the character in [] means optional command
{}	When there includes several parameter items in {}, means that users can only choose one item from it.
( )	the abbreviated form of parameter is put in ()
Capital letter	Abbreviated form of command.

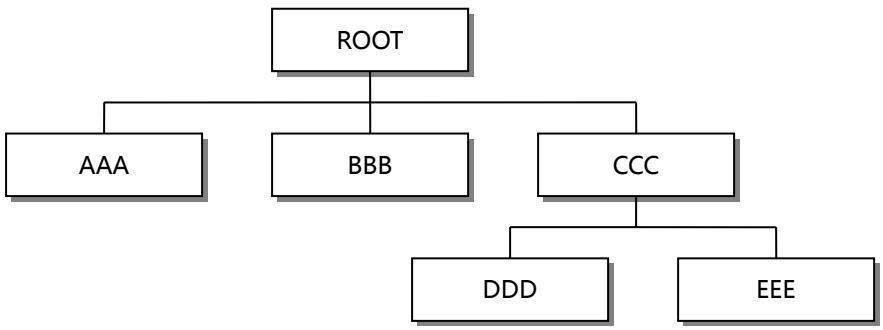
9.1.3 Command Structure

The SCPI commands are tree structured three levels deep. The highest level commands are called the subsystem commands in this manual. So the lower level commands are legal only when the subsystem commands have been selected.

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 9-1 Command Tree Example



Example

ROOT:CCC:DDD ppp
ROOT Subsystem Command
CCC Level 2
DDD Level 3
ppp Parameter

9.2 Header and Parameters

A command tree consists of header and parameters, it uses a space (ASCII: 20H) to separate in the middle.

Example

AAA:BBB 1.234
Header [Parameter]

9.2.1 Header

Headers can be of the long form or the short form. The long form allows easier understanding of the program code and the short form allows more efficient use of the computer.

9.2.2 Parameter

- Single command word, no parameter.
  Example: AAA:BBB
- Parameter can be character string form, the abbreviation rules are the same as the rules for command.

Example: AAA:BBB 1.23

- Parameter can be numeric form

- <*integer*> integer 123, +123, -123
- <*float*> floating number

1. <Fixfloat>：fixed point floating number：1.23, -1.23
2. <Scifloat>：scientific notation floating number：1.23E+4, +1.23e-4
3. <Mpfloat>: multiplier expressed by floating number: 1.23k, 1.23M,1.23G,1.23u

Table 9-1 Multiplier Mnemonics

Definition	Mnemonic
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: Multiplier is Case Insensitive, its writing style is different from standard name.

9.2.3 Separator

Instrument terminator only accepts allowed separators, terminator will occur E5 error if beyond this separator, and these separators include:

: colon, used for separate command tree, or restart command tree.
Example: AAA:BBB:CCC 123.4

? question mark, used for query
Example: AAA?

□ space, used for separate parameter
Example: AAA:BBB□1.234

9.3 Command Reference

All commands in this reference are fully explained and listed in the following functional command order, the following is all subsystem

- DISPlay Display SUBSYSTEM
- FUNCtion Function SUBSYSTEM
- CORRection Correction SUBSYSTEM
- COMParator Comparator SUBSYSTEM
- SYSTem System SUBSYSTEM
- TRIGger Trigger SUBSYSTEM
- FETCh? Fetch SUBSYSTEM
- ERRor Error SUBSYSTEM

Common command：

- IDN? Instrument information query SUBSYSTEM
- TRG Trigger and acquire data

9.4 DISPlay SUBSYSTEM

DISPlay subsystem is used for switching different display page or display a string of text on page reminder bar.

Figure 9-2 DISPlay SUBSYSTEM tree

DISPlay	:PAGE	{MEASurement, SETUp,COMParator,SYSTem,SYSTEMINFO(SINF)}
	:LINE	<string>

9.4.1 DISPlay:PAGE

DISP:PAGE is used for switching to an appointed page.

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

Parameter <page name> includes :

MEASurement <MEAS DISPLAY> page
SETUp <SETUP> page
COMParator <COMP> page
SYSTem <SYSTEM CONFIG> page
SYSTEMINFO(SINF) <SYSTEM INFO> page

Example SEND> **disp:page setup** //switch to Setup page

Query Syntax **DISP:PAGE?**

Query Response **<page name> abbreviation**
meas
setu
syst
sinf
comp

Example SEND> **disp:page?**
RET> **meas**

9.4.2 DISP:LINE

DISP:LINE Is used for display a string of text at the bottom of reminder bar page, text can display maximum 30 characters.

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

Parameter **<string>** maximum 30 characters.

Example SEND> **DISP:LINE "This is a Comment."**

9.5 FUNCtion SUBSYSTEM

Figure 9-3 FUNCtion SUBSYSTEM tree

FUNCtion	:RANGe	{Range NO. , max , min}	
		:MODE	{AUTO,HOLD,NOMinal}
	:RATE	{SLOW,MED,FAST,ULTRA}	
	:SCAN	{<Channel NO.>,on,off}	

Parameter set by FUNCtion SUBSYSTEM will not be saved in the instrument system, users need to reset when restart.

9.5.1 FUNCtion:RANGe

FUNC:RANG is used for set up range mode and range NO.

Command Syntax **FUNCtion:RANGe {<Range No.>,min,max}**

Parameter Of which , <Range NO.> include **1~5**

	min range=**1** **max** range=**5**
Example	SEND> **FUNC:RANG 5** //switch to Range NO. 5 (1kΩ)
Query Syntax	**FUNC:RANG?**
Query Response	**Range NO.1~5**
Example	SEND> **FUNC:RANGE?** RET> **5**

9.5.2 FUNCtion:RATE

FUNC:RATE is used for setting measuring speed.

Command Syntax	**FUNCtion:RATE {SLOW,MED,FAST }**
Example	SEND> **FUNC:RATE FAST** //set as fast measuring speed
Query Syntax	**FUNC:RATE?**
Query Response	**{SLOW,MED,FAST}**

9.5.3 FUNCtion:SCAN

FUNC:SCAN is used for setting channel scan mode and single channel test channel NO.

Command Syntax	**FUNCtion:SCAN {ON,OFF,<channel NO.>}**
Example	SEND> **FUNC:SCAN ON** //turn on scan mode SEND> **FUNC:SCAN 5** //single channel test, CH5
Query Syntax	**FUNC:SCAN?**
Query Response	**<channel NO.>,{SCAN,SINGLE}**
Example	SEND> **FUNC:SCAN?** RES> **5,SINGLE** //single channel test, CH5

9.6 COMParator SUBSYSTEM

Comparator parameter set by COMParator SUBSYSTEM will be saved in system.

COMP SUBSYSTEM is used for setting comparator parameter.

Figure 9-4 COMParator SUBSYSTEM tree

COMParator	[:STATe]	{OFF,ON,0,1}
	:BEEP	{OFF,GD,NG}
	:MODE	{IDENtical, INDEpendent}
	:OUTPut	{R+V,R+RV}
	:RBIN :VBIN	<channel NO.1~10> , <float lower>,<float upper>

9.6.1 COMParator[:STATe]

COMP[:STATe] is used for turning on/off comparator.

Command Syntax	**COMParator[:STATe] {ON,OFF,1,0}**
Example	SEND> **COMP:STAT ON** //turn on comparator SEND> **COMP:STAT 0** //turn off comparator
Query Syntax	**COMP[:STAT]?**
Query Response	**{ON,OFF}**

9.6.2 COMParator:MODE

COMP:MODE is used for setting comparator mode.

Command Syntax	**COMParator:MODE {IDENtical,INDEpendent}**
Example	SEND> **COMP:MODE identical** //uniform setting mode of comparator upper limit and lower limit
Query Syntax	**COMP:MODE?**
Query Response	**{identical , independent }**

9.6.3 COMParator:OUTPut

COMP:OUTPut is used for setting Handler signal output mode.

Command Syntax	**COMParator:OUTPut {R+V,R+RV}**
Example	SEND> **COMP:OUTP R+RV** //Handler output is ROK and RVOK
Query Syntax	**COMP:OUTP?**
Query Response	**r+rv**

9.6.4 COMParator:RBIN

COMP:RBIN is used for setting resistance upper limit and lower limit for a specified channel.

Command Syntax	**COMParator:RBIN <channel NO.1~10>,<float lower limit>,<float upper limit>**
Example	SEND> **COMP:RBIN 1,10m,100m** //set up resistance upper limit and lower limit for CH1
Query Syntax	**COMP:vbin? <channel NO.1~10>**
Query Response	**<scifloat>,<scifloat>**
Example	SEND> **COMP:RBIN? 1** RET> **+1.000000e-04,+1.000000e-05**

9.6.5 COMParator:VBIN

COMP:VBIN is used for setting voltage upper limit and lower limit for a specified channel.。

Command Syntax	**COMParator:VBIN <channel NO.1~10>,<float lower limit>,<float upper limit>**
Example	SEND> **COMP:VBIN 1,10m,100m** // set up voltage upper limit and lower limit for CH1
Query Syntax	**COMP:vbin? <channel NO.1~10>**
Query Response	**<scifloat>,<scifloat>**
Example	SEND> **COMP:VBIN? 1** RET> **+3.500000e+00,+3.700000e+00**

9.7 TRIGger SUBSYSTEM

Figure 9-5 TRIGger SUBSYSTEM tree

TRIGger	[:IMMediate]	
	:SOURce	{INT,MAN,EXT,BUS}
TRG		

TRIGger is used for setting trigger source and generate a trigger.

9.7.1 TRIGger[:IMMediate]

TRIG[:IMM] when trigger source set as BUS, it generates a trigger, but it will not return trigger measuring data, if usres want return data, use TRG command.

Command Syntax	**TRIGger[IMMediate]**
Example	SEND> **TRIG** //Stops after instrument test one time

9.7.2 TRIGger:SOURce

TRIG:SOUR is used for setting trigger source

Command Syntax	**TRIGger:SOURce {INT,MAN,EXT,BUS}**
Example	SEND> **TRIG:SOUR BUS** //Set as BUS trigger mode.
Query Syntax	**TRIG:SOUR?**
Query Response	**<INT,MAN,EXT,BUS>**

9.7.3 TRG

TRG when trigger source set as BUS, it generates a trigger and return trigger measuring data.

Command Syntax	**TRG**
Example	SEND> **TRG** //Instrument tests one time, and return measuring data RET> **+9.9651e+01,NG,+9.9481e-01,GD,+9.9575e+00,NG,+9.9481e-01,GD,+6.0212e-04,NG,+9.9575e+00,NG,+9.9331e-01,GD,+1.0025e+04,NG,+1.0008e+03,NG,+1.1139e+04,NG**

9.8 FETCh? SUBSYSTEM

FETCh? Is used for acquiring measuring data. Before using this command, please set 【Result Send】 as【FETCH】 in <SYSTEM CONFIGURATION> page.

FETCh ? command will return measuring data of all channels.

Figure 9-6 FETCh? SUBSYSTEM tree

FETCh?	

Query Syntax	**FETCh?**
Query Response	**<R>,{GD,NG},<V>,{GD,NG}**
Example	SEND> **FETC?** RET> **+9.9651e+01,NG,+9.9481e-01,GD,+9.9575e+00,NG,+9.9481e-01,GD,+6.0212e-04,NG,+9.9575e+00,NG,+9.9331e-01,GD,+1.0025e+04,NG,+1.0008e+03,NG,+1.1139e+04,NG,+9.9651e+01,NG,+9.9481e-01,GD,+9.9575e+00,NG,+9.9481e-01,GD,+6.0212e-04,NG,+9.9575e+00,NG,+9.9331e-01,GD,+1.0025e+04,NG,+1.0008e+03,NG,+1.1139e+04,NG**

9.9 SYSTem SUBSYSTEM

SYSTem SUBSYSTEM is used for setting parameter related to system.

Data set up by SYSTem SUBSYSTEM will not be saved in instrument.

Figure 9-7 SYSTem SUBSYSTEM tree

SYSTem	:LANGuage	{ENGLISH,CHINESE,EN,CN}
	:SENDmode	{FETCH,AUTO}

9.9.1 SYSTem:LANGuage

Language setting

Command Syntax	**SYSTem:LANGuage {ENGLISH,CHINESE,EN,CN}**
Example	SEND> **SYST:LANG EN** //set as English display
Query Syntax	**SYST:LANG?**
Query	**{ENGLISH,CHINESE}**

Response	

9.9.2 SYSTem:SENDmode

SYST:SEND is used for setting data sending mode: AUTO or FETCH command.

Command Syntax	**SYSTem:SENDmode {FETCH,AUTO}**
Example	SEND> **SYST:SEND AUTO** //set as AUTO sending
Query Syntax	**SYST:SEND?**
Query Response	**{FETCH,AUTO}**

9.9.3 SYSTem:DATAmode

SYST:DATA is used for setting data sending format: all channel or single channel data.

Command Syntax	**SYSTem:DATAmode {ALL,ONE}**
Example	SEND> **SYST:DATA ONE** //set as single channel sending
Query Syntax	**SYST:DATA?**
Query Response	**{ALL,ONE}**

9.10 CORRect SUBSYSTEM

CORR SUBSYSTEM is used for completing one short-circuit correction.

Figure 9-8 CORRect SUBSYSTEM tree

CORRect	:SHORt	

9.10.1 CORRect:SHORt

CORR:SHOR complete one short-circuit correction, test terminal must be short-circuit before sending the command.。

Command Syntax	**CORRect:SHORt**
Example	SEND> **CORRect:SHORt** RET> **Short Clear Zero Start.** //clear zero starts RET> **PASS** //clear zero success (FAIL)

9.11 IDN? SUBSYSTEM

Figure 9-9 IDN? SUBSYSTEM tree

IDN?	

IDN? SUBSYSTEM is used for returning instrument version number.

Query Syntax	**IDN?**
Query Response	**<model>,<version number>,<serial number>,<manufacturer>**
Example	SEND> **IDN?** RET> **AT5220,REV A1.0,0000000,Applent Instruments**

10. Specifications

This chapter describes:

- Technical Specifications
- General Specifications
- Dimensions

10.1 Technical Specifications

The data as below is acquired by the following conditions:

Temperature： 23°C±5°C

Humidity： ≤65% R.H.

Adjustment：short-circuit clear zero before measurement

Warm-up Time： >60 minutes

Calibration validity：12 months

Channel：CH1

Measuring speed：slow

RANGE		Max Reading	Resolution	FAST	MED	SLOW
1	**300mΩ**	300.00mΩ	10μΩ	1%±5 dgt	0.5%±3dgt	0.5%±2dgt
2	**3Ω**	3.0000Ω	100μΩ	1%±5 dgt	0.5%±3dgt	0.5%±2dgt
3	**30Ω**	30.000Ω	1mΩ	1%±5 dgt	0.5%±3dgt	0.5%±2dgt
4	**300Ω**	300.00Ω	10mΩ	1%±5 dgt	0.5%±3dgt	0.5%±2dgt
5	**3kΩ**	3.0000kΩ	100mΩ	1%±5 dgt	0.5%±3dgt	0.5%±2dgt

10.2 General Specifications

Display： TFT-LCD true-color display，3.5 inches

Measuring speed：All channels are turned on, range mode is manual:

SLOW： 9s/20 channels

MED： 6s/20 channels

FAST： 4s/20 channels

Max reading： 30000

Range： Manual

Calibration： short-circuit clear zero for all ranges

File： parameters are AUTO saved

Trigger： Internal、External、Manual and BUS

Interface： PLC （Handler） interface

RS232 interface

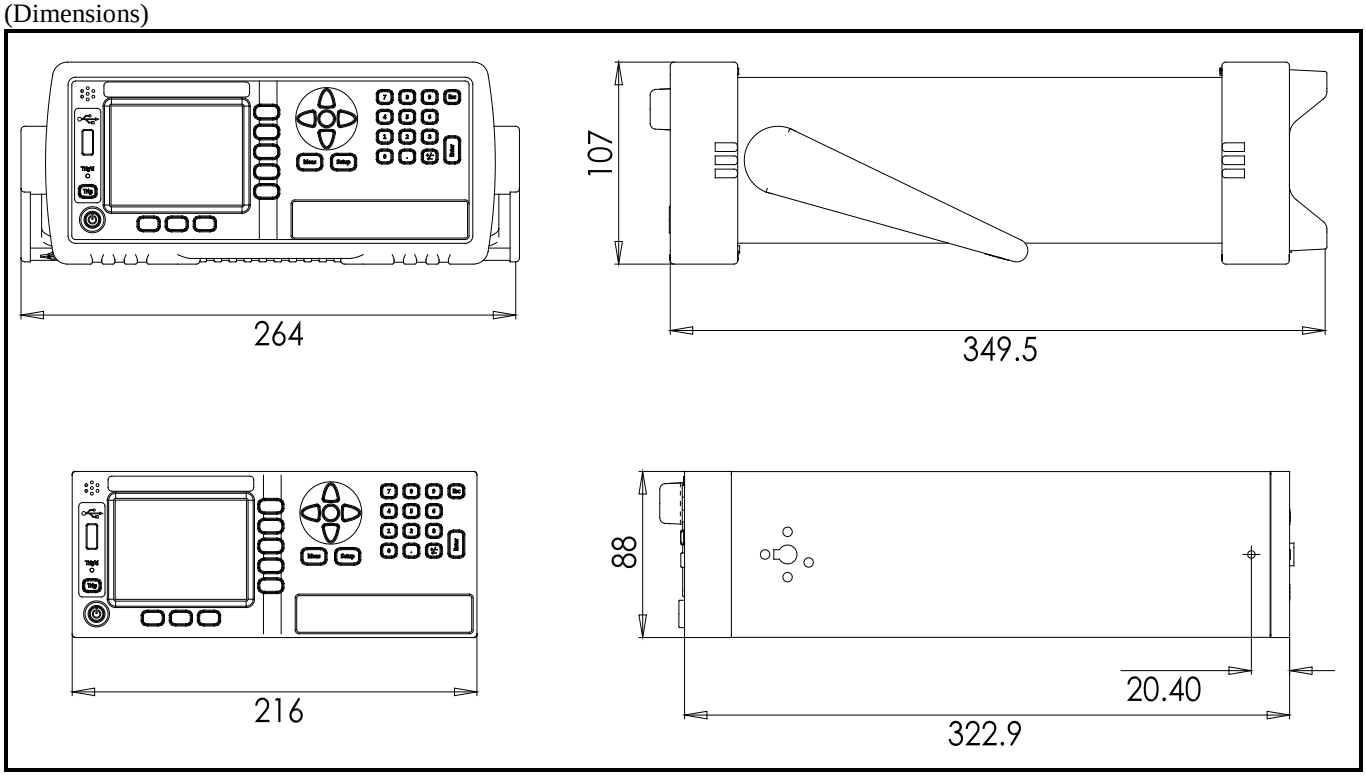
Programming language： SCPI

Auxiliary function： keypad lock

Environment：	Index：	temperature 18℃~28℃	humidity ≤ 65% RH
	Operation：	temperature 10℃~40℃	humidity 10~80% RH
	Storage：	temperature 0℃~50℃	humidity 10~90% RH
Power supply：	220VAC (1±10%)		
Fuse：	250V 1A Slow-Blow		
Power：	MAX 20VA		
Wright：	About 5kg		

10.3 Dimensions

(Dimensions)



Onmeas **Instruments**

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English
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