AT682/683 Megohmmeter

User's Manual

Applent® Instruments, Inc.

Address: Lanlin Dangnan Industrial Park,
Changzhou, Jiangsu, China (PRC)
Post Code: 213014
Telephone (Sales):
0086-0519-88805550 / 89966117/89966227
Fax：0086-0519-89966550
Sales Email: sales@applent.com
Tech Email: tech@applent.com
http://www.applent.com

Safety Summary

⚠Warning ⚠Dangerous:

When you notice any of the unusual conditions listed below, immediately terminate operation and disconnect the power cable.
Please Contact Applent Instruments Incorporation sales representative for repair of the instrument. If you continue to operate without repairing the instrument, there is a potential fire or shock hazard for the operator.

- Instrument operates abnormally
- Instrument emits abnormal noise, smell, smoke or a spark-like light during the operation.
- Instrument generates high temperature or electrical shock during operation.
- Power cable, plug, or receptacle on instrument is damaged.
- Foreign substance or liquid has fallen into the instrument.

Safety Summary

⚠Warning ⚠Dangerous:

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific WARNINGS elsewhere in this manual may impair the protection provided by the equipment. In addition it violates safety standards of design, manufacture, and intended use of the instrument.

Disclaimer	*The Applent Instruments assumes no liability for the customer's failure to comply with these requirements.*
Ground The Instrument	To avoid electric shock hazard, the instrument chassis and cabinet must be connected to a safety earth ground by the supplied power cable with earth blade.
DO NOT Operate In An Explosive Atmosphere	Do not operate the instrument in the presence of inflammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.
Keep Away From Live Circuits	Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.
DO NOT Service Or Adjust Alone	Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.
DO NOT Substitute Parts Or Modify Instrument	Because of the danger of introducing additional hazards, do not install substitute parts or perform unauthorized modifications to the instrument. Return the instrument to an Applent Inc Sales and Service Office for service and repair to ensure that safety features are maintained.
⚠ **WARNING & DANGEROUS**	**Dangerous voltage levels, capable of causing death, are present in this instrument.** **Use extreme caution when handling, testing, and adjusting this instrument.**

AT682/683 Megohmmeter
User's Manual

FIRMWARE REVISIONS
This manual applies directly to instruments that have the firmware **Rev.I**

English

Applent Technologies

Manual Print History

The print history shown below lists the printing dates of all Revisions and Addenda created for this manual. The Revision Level letter increases alphabetically as the manual undergoes subsequent updates. Addenda, which are released between Revisions, contain important change information that the user should incorporate immediately into the manual. Addenda are numbered sequentially. When a new Revision is created, all Addenda associated with the previous Revision of the manual are incorporated into the new Revision of the manual. Each new Revision includes a revised copy of this print history page.

Revision A January, 2005
Revision B January, 2008
Revision C November, 2009

CERTIFICATION, LIMITED WARRANTY & LIMITATION OF LIABILITY

Applent Instruments, Inc.（shortened form **Applent**）certifies that this product met its published specifications at the time of shipment from the factory. Applent further certifies that its calibration measurements are traceable to the People's Republic of China National Institute of Standards and Technology, to the extent allowed by the Institution's calibration facility or by the calibration facilities of other International Standards Organization members.

This Applent instrument product is warranted against defects in material and workmanship for a period corresponding to the individual warranty periods of its component products. **The warranty period is 2 years and begins on the date of shipment.** During the warranty period, Applent will, at its option, either repair or replace products that prove to be defective. This warranty extends only to the original buyer or end-user customer of a Applent authorized reseller, and does not apply to fuses, disposable batteries or to any product which, in Applent's opinion, has been misused, altered, neglected or damaged by accident or abnormal conditions of operation or handling.

For warranty service or repair, this product must be returned to a service facility designated by Applent. The buyer shall prepay shipping charges to Applent and Applent shall pay shipping charges to return the product to the Buyer. However, the Buyer shall pay all shipping charges, duties, and taxes for products returned to Applent from another country.

Applent warrants that its software and firmware designated by Applent for use with an instrument will execute its programming instruction when properly installed on that instrument. Applent does not warrant that the operation of the instrument, or software, or firmware, will be uninterrupted or error free.

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by the Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside the environmental specifications for the product, or improper site preparation or maintenance.

THIS WARRANTY IS BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. APPLENT SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, WHETHER ARISING FROM BREACH OF WARRANTY OR BASED ON CONTRACT, TORT, RELIANCE OR ANY OTHER THEORY.

Applent Instruments, Inc.
Changzhou,
Jiangsu,
The People's Republic of China.
Rev.A2 January, 2005
Rev.B0 January, 2008

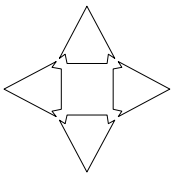
Contents

Megohmmeter Safety

WARNING :
The AT682/683 Megohmmeter can provide an output voltage as high as 1000VDC to the external device under test (DUT).
Although the AT682/683 unit is designed with full attention to operator safety, serious hazards could occur if the instrument is used improperly and these safety instructions are not followed.

- The AT682/683 is designed to be operated with its chassis connected to earth ground. The instrument is shipped with a three-prong power cord to provide this connection to ground. The power cord should only be plugged in to a receptacle that provides earth ground. Serious injury can result if the Sentry unit is not connected to earth ground.
- Tightly connect cable(s) to the (red) GND terminal. If this is not done, the DUT's casing can be charged to the high voltage test level and serious injury or electrical shock hazards could result if the DUT is touched.
- **NEVER** touch the metal of the High Voltage probe directly. Touch only the insulated parts of the lead(s).
- **NEVER** touch the test leads, test fixture or DUT in any manner (this includes insulation on all wires and clips) when the high voltage is applied and the red **HV LED** is lit.
- Before turning on the AT682/683, make sure the AC power cord is plugged into the proper voltage source and that there is no device (DUT) or fixture connected to the test leads.
- After each test, press the [DISCH] button for safety. This terminates the high voltage being applied to the output terminals.
- When the **HV LED** is lit NEVER touch the device under test, the lead wires or the output terminals.

1 Unpacking and Preparation



This chapter describes how to set up and start the AT682/683 Megohmmeter.

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

1.1 Incoming Inspection

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

WARNING

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

1. Check that the packing box or shock-absorbing material used to package the instrument has not been damaged.
2. Referring to Table 1-1, 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.

Table 1-1 **Items Packaged with the meter**

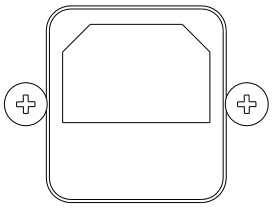
Name	Qty	remark
AT682/683 Megohmmeter	1	
User's Manual	1	
Power Cable	1	220V/50Hz
Fuse	2	250V, 1A Slow-blow
ATL507 Test Clip Leads	1	
ATL801 RS232 Cable	1	
Warranty certificate	1	Includes Product certification

1.2 Power Supply

Confirm that the power supplied to the AT682/683 meets the following requirements:

Voltage：198-252VAC
Frequency：47.5-52.5Hz
Power-consumption: 30VA max

1.3 Setting up Fuse



~Line: 47.5Hz-52.5Hz
198VAC– 242VAC
30VA MAX
Fuse: 250V 1A
Slow Blow
Figure 1-1 **Fuse Holder**

Please use the following fuse type.

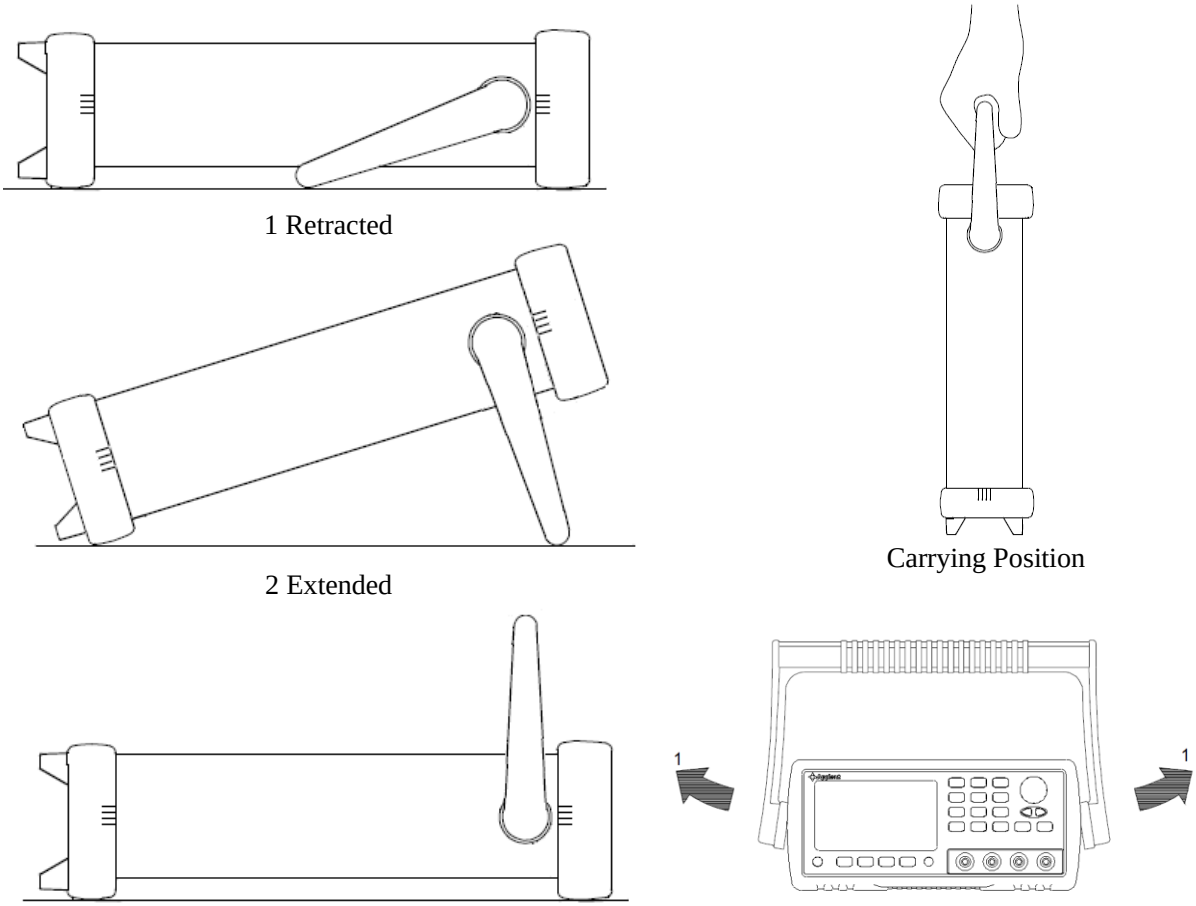
UL/CSA type, Slow-Blow, 5×20-mm miniature fuse, 1A, 250 V

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.

NOTE Two fuses in Fuse Holder.

1.4 How to Remove the Handle

A handle kit is attached to the AT682/683.



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

Figure 1-2 **Handle**

1.5 Environmental Requirements

Set up the AT682/683 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℃ (non-condensation)

Altitude: 0 to 2,000m

Vibration: Max. 0.5 G, 5 Hz to 500 Hz

1.6 Cleaning

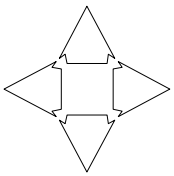
To prevent electrical shock, disconnect the AT682/683 power cable from the receptacle before cleaning.

Use a dry cloth or a cloth slightly dipped in water to clean the casing.

Do not attempt to clean the AT682/683 internally.

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

2 Overview



This chapter contains general information about the AT682/683 Megohmmeter .The information is organized as follows

- Introduction
- Main Specifications
- Feature overview

2.1 Introduction

Thank you for purchasing AT682/683 Megohmmeter.

The Applent AT682/683 is a Megohmmeter (Insulation Resistance Meter) for quality control and laboratory use. AT682/683 is used for measuring insulation resistance of electronic components, devices, dielectric materials, wires, cables and etc.

The AT682/683 Dual Display (insulation resistance and leakage current) Megohmmeter includes 4-digit (9,999 counts), 6-range (auto and manual), broad measurement range (10kΩ~1TΩ) and super fast test rate (55 readings per second). The voltage applied to the device under test (DUT) is programmable from 1 to 1000 volts.

The AT682/683 can output comparison/decision results for sorting components into 2 bins. Furthermore, by using the handler interface, the AT682/683 can be easily combined with a component handler and a system controller to fully automate component testing, sorting, and quality-control data processing. A GD/NG indicator on VFD provides a visual display of test results based on a preset limit. Thirty sets of test conditions are stored in the unit and can be reprogrammed by the user.

The RS232C (used SCPI) and Handler interfaces are standard interfaces on the AT682/683 and enabled automatic testing.

2.2 Main Specifications

Full AT682/683 specifications are included in Appendix A.

Some main specifications of the AT682/683 include:

- Measuring Insulation Resistance and Leakage Current。
- Output Negative Voltage: 1.0VDC~1000VDC, Basic Accuracy：1%
  <100V: 0.1V step，≥100V: 1V step。
- Basic Accuracy: <1G: ±1%，≥ 1G: ±3%，≥10G: ±5%
- Max Charge Current: 30mA ± 5mA
- Automatic Test with 6 Ranges
  AT682:Board Measurement Range from 10kΩ to 1TΩ
  AT683:Board Measurement Range from 100kΩ to 10TΩ

- Super Fast Test Rate
  55 readings/second with 1,999 counts
- Built-in 2 timers
  Charge Timer: 0s~999.9s
  Sample Timer: 0s~999.9s
- Trigger mode: Internal Trig, Manual (Remote) Trig and External (Handler) Trig.

2.3 Feature Overview

- High brightness VFD
  window size: 98mm×58mm
- Correction (Zeroing) Function
  Zero out test lead and fixture measurement errors.
- Built-in Comparator (Sorting)
  Thirty sets of Record can be used to store user's data. Display on VFD Screen and/or Output to Handler.
- Beep and VFD Brightness can be Adjusted
  Setup GD or NG Beep and adjust VFD Brightness.
- Interfaces
  1. Handler interface: GD/NG Output, Trig Signal Input and EOC (Busy) Output.
  2. RS232C interface: SCPI Compatibility, ASCII Transmission.

3 Getting Started

This chapter describes names and functions of the front panel, rear panel, and screen display and provides the basic procedures for operating the AT682/683.

- Front Panel Summary
- Real Panel Summary
- Power-up
- Begin Measuring

3.1 Front Panel

3.1.1 Front Panel Summary

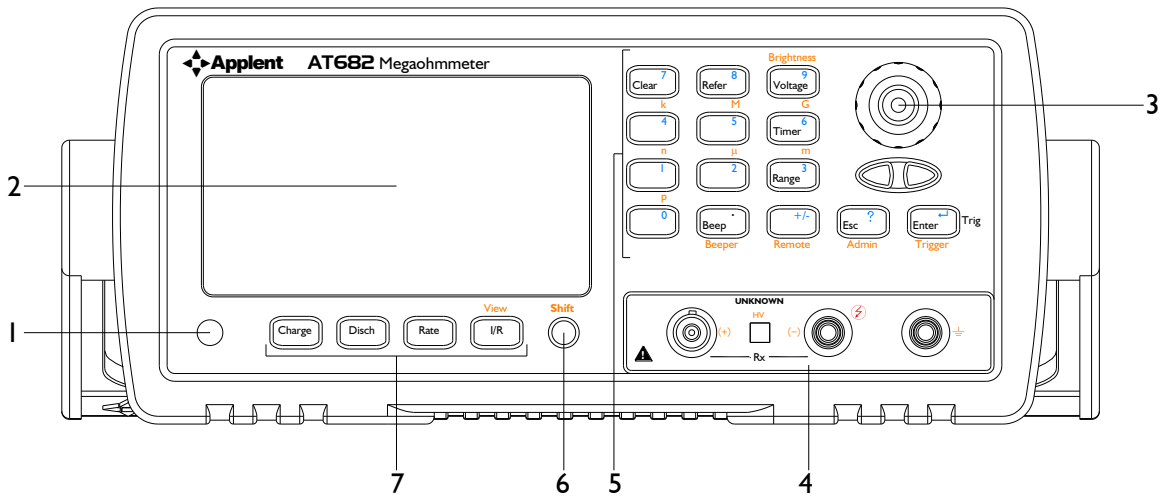


Figure 3-1 **Front Panel**

1. **Power Switch**
   To apply power to the instrument, Push Down: ON, Push Up: OFF
2. **Display**
   VFD Screen, Displays measurement results, instrument status and user's interface menus.

Full VFD Content Includes in section "3.1.3 VFD".

3. **Knob**
   To Choose Menu Item and Input Number
4. **Terminals**
   + *BNC (Red) (Sense)*
   - *High Negative Voltage Output (Black) (Drive)*
   GND Ground (Red) (Ground Terminal for jumper of (+) Input Terminal or Guard Input to Chassis GND)

Full Terminals Information refers to **"**Connection to DUT**"**

5. **Keypad II (shifted or un-shifted)**
   Multi-function keys: Numeric, 1st Function and 2nd Function.
6. **Shift Key**
7. **Keypad I (shifted or un-shifted)**
   Dual-Function keys: 1st Function and 2nd Function.

Full Keypad Descript in follow section "3.1.2 Keypad"

3.1.2 Keypad

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

Figure 3-2 **Keypad I**

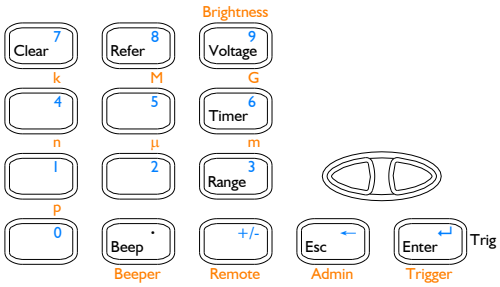


Figure 3-3 **Keypad II**

1st Function Keys (Un-shifted)

ASSUMER:
Black Words on Button represents 1st Function;
Following functions can be chosen while the **Shift** mark on VFD is off.

Charge	Charge/Measure Initiate the Measurement
Disch	Discharge the energy components (such as capacitances) *to stop the measurement (terminate high voltage at the negative output terminals).*
Rate	Measurement rate *3 items could be chosen: Slow, Medium, Fast*
Param	Select the Parameter *IR or Current*
Clear	Open Correction
Refer	Limit Reference Values
Voltage	Input the output Voltage values

Timer	Preset Charge Timer and Sample Timer.
Range	Auto or Manual measurement. Logo AUTO on VFD reps. Range Automatic
<,>	Choose Range 1~6。
Esc	To exit menu mode with no parameter changes made and backspace one number. Available only in the Menu windows.
Enter	To switch user to entry mode and accept menu entry as entered. Available in the Menu windows.
Trig	Triggers a measurement from the front panel. Available in the Manual Trigger mode.

2nd Functions (Shifted)

ASSUMER:

On the Instrument Panel:

Orange Words on Panel represents 2nd Function;

Following functions can be chosen while the **Shift** mark on VFD is on.

View	Disabled
Brightness	Adjust VFD Brightness
n,μ,m,k,M,G	Unit Available in Input box.
Beeper	To setup the beep feature.
Remote	Open/Close RS232 Interface.
Admin	Only administrators can operate.

NOTE:

Admin Functions: Password Protected.

For more technical support, please contact Applent Instruments.

Send An Email to Applent Technical Center: tech@applent.com

Trigger	Trigger Set。

Numeric Keys

ASSUMER:

On the Instrument Panel:

Blue Words on Button represents Numeric Key.

The numeric keys include Blue word keys, ESC key、 Enter key and units (p, n, μ,m, k, M, G).

3.1.3 VFD

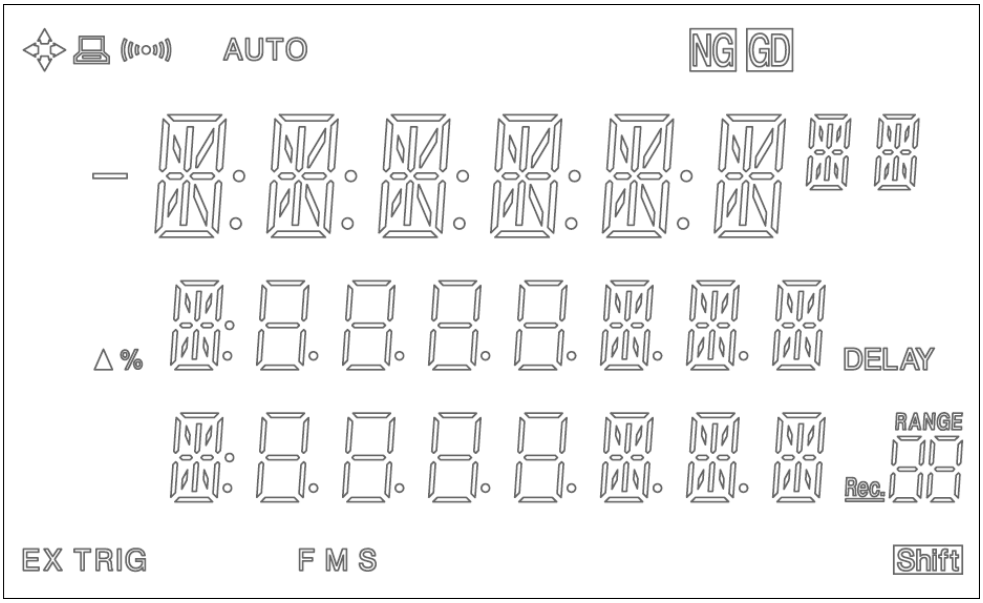


Figure 3-4 **VFD**

	Applent's Trade Mark.
	Remote Interface (RS232) ON
	Beep Enabled.
AUTO	Auto ranging enabled.
NG	Pass.
GD	Fail.
EX	External Trigger enabled.
TRIG	Manual (Remote) Trigger enabled.
F M S	Rate (Fast, Medium and Slow)
DELAY	Timer Started.
	Current Range Number or Record Number.
Shift	Shifted to the 2nd Function.

3.2 Real Panel Summary

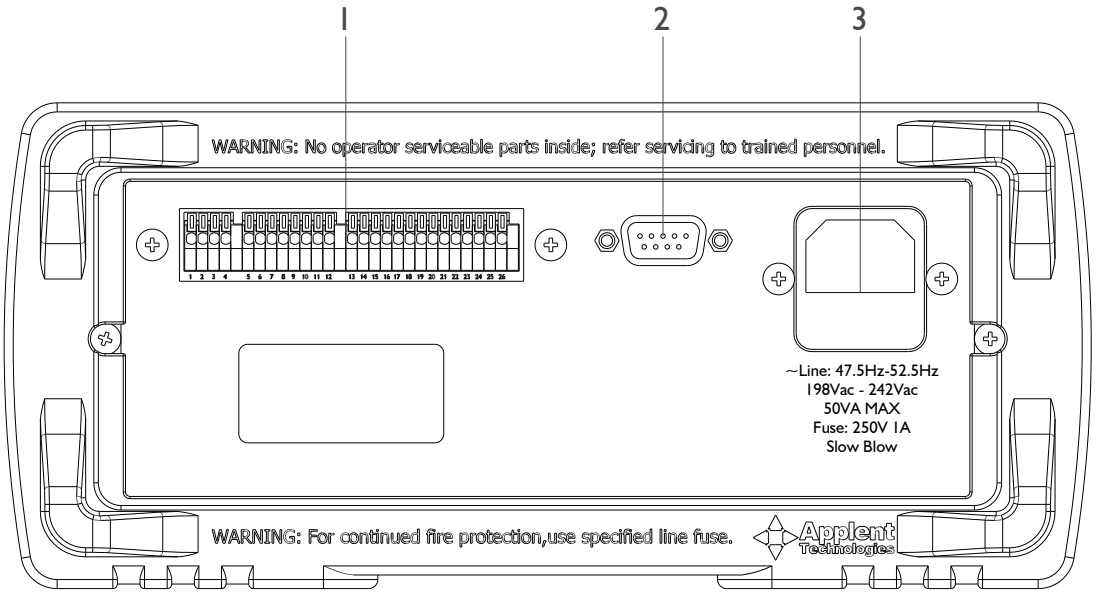


Figure 3-5 **Real Panel**

1. Handler Interface
2. RS232C Interface
3. AC Inlet Module

3.3 Power-up

3.3.1 Line Power Connection

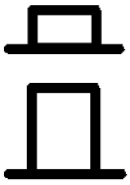
Follow the procedure below to connect the AT682/683 to line power and turn on the instrument.

1. Before plugging in the power cord, make sure that the front panel power switch is in the off (0) position.
2. Connect the female end of the supplied power cord to the AC receptacle on the rear panel. Connect the other end of the power cord to a grounded AC outlet.

WARNING :

The power cord supplied with the AT682/683 contains a separate ground wire for use with grounded outlets. When proper connections are made, instrument chassis is connected to power line ground through the ground wire in the power cord. Failure to use a grounded outlet may result in personal injury or death due to electric shock..

3. Turn on the instrument by pressing the front panel power switch to the on (1) position.



Power On

Power Off

3.3.2 Power-up Sequence

On power-up, AT682/683 performs self-tests on its FlashRom and RAM and momentarily lights all segments and annunciators. If a failure is detected, the instrument will not enter the measurement state.

3.3.3 Power-up Defaults

The power-on default will be the last configuration you saved.

3.3.3 Warm-up Time

AT682/683 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.

3.4 Measurement configuration

3.4.1 Connection to Device under Test (DUT)

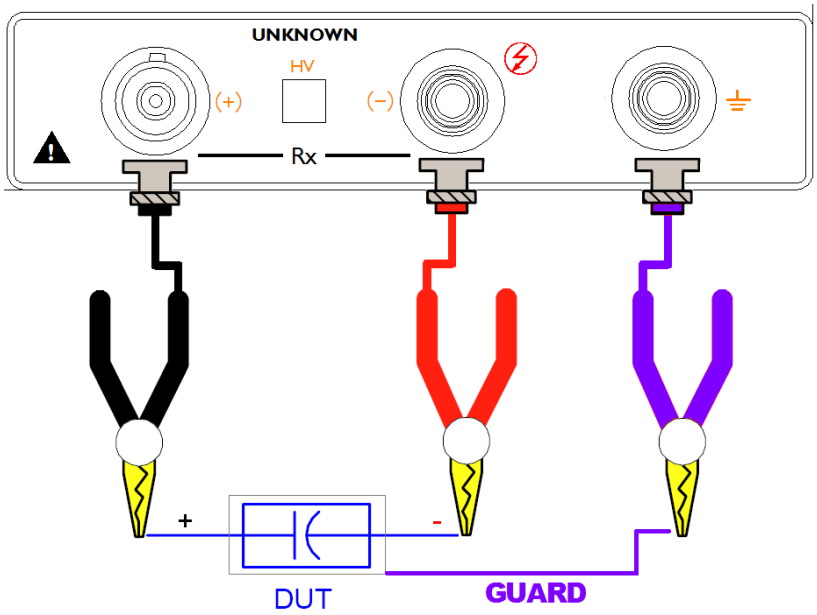
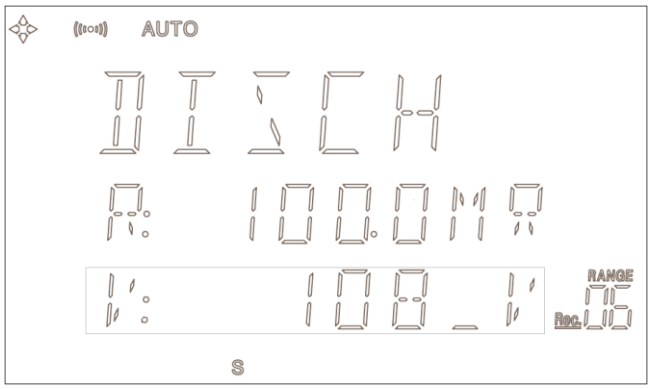


Figure 3-6 **Connection to DUT**

WARNING:
When the **HV LED** is lit, **No touching** the device under testing, the lead wires or the output terminals.

3.4.2 Voltage

Voltage Input box accepts entry of a test voltage between 1.0 and 1000 VDC. <100V in 0.1V intervals, ≥100V in 1V intervals.



1. Press Voltage key, a cursor flashed at 3rd line on the VFD.
2. Press Numeric Key Enter value.
3. Press Enter to finish input, the Value will save in Flashrom and back to Discharge State.
   Press Esc key to cancel input and back to Discharge State.

3.4.3 Range

Full Resistance Range in the Appendix A.

Manual ranging

To select a range, simply press the Range, < and > key. The instrument changes one range per key press.

Auto ranging

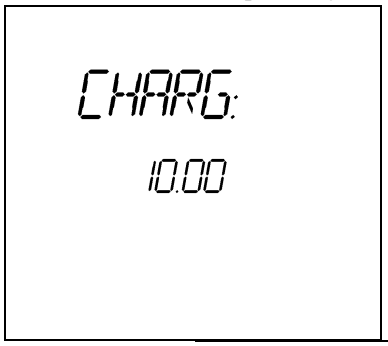
To enable auto ranging, press the Range key. The AUTO annunciator turns on when Auto ranging is selected. While auto ranging is selected, the instrument automatically chooses the suitable range to measure the applied signal.

NOTE:

- Auto ranging should not be used when optimum speed is required. The manual ranging can improve test speed effectively.
- Under auto ranging, some devices (such as CBB capacitance) will fail to choose right range. Such was the situation normal. Using manual ranging will avoid such situation.

3.4.4 Charge Timer

Accepts entry of a charge time between 0 and 999.9 seconds in 0.1 second.



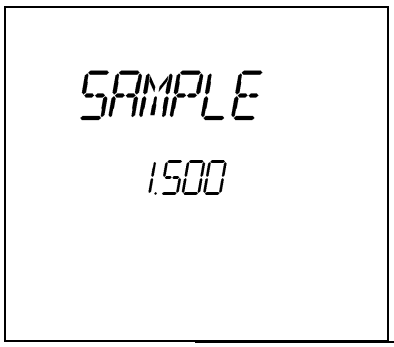
1. Under discharge state, press Timer key into timer window. Rotate knob to choose"CHARG"item and enter setup window.
2. Press Numeric Keys to Enter time value.
3. Enter key can be pressed to finish the input.
4. Press Esc to save time value or Press Enter key to exit setup window.

NOTE:

If charge time value set to 0s, the charge timer will be disabled.

3.4.5 Sample Timer

Accept entry of a sample time between 0 and 999.9 seconds in 0.1 second. In the measurement state, AT682/683 will sample a data every sample time.



1. Under discharge state, press Timer key into timer window. Rotate knob to choose"SAMPLE"item and enter setup window.
2. Press Numeric Keys to enter time value.
3. Enter key can be pressed to finish the input.
4. Press Esc to save time value or Press Enter key to exit setup window.

NOTE:

If sample time value set to 0 s, the sample timer will be disabled.

3.4.6 Clear Zero Correction (Zeroing)

Before making measurements, AT682/683 should be zeroed to correct for test lead or fixture errors. During the zeroing process corrections are calculated and stored in AT682/683 flashrom and applied to ongoing measurements. The zeroing process automatically measures stray parameters and retains the data, which is used to correct measurements so that results represent parameters of the DUT alone without test lead or fixture capacitance. Zeroing is recommended at the start of each work day or more often if leads, fixture or test configuration to the DUT is changed. Zeroing should also be performed anytime the test voltage is changed, which also includes recalling a set of test conditions from memory with a different test voltage.

1. Press Clear key to enter clear window. Before zeroing, remove all components from test fixture.

NOTE:
The (+) test lead must be opened and suspended. NO touching any objects (such as table).

2. Press Enter to clear zero.
3. Press Esc to terminate clearing process and exit zeroing window.

3.4.7 Adjust VFD Brightness

Press Shift Brightness key to adjust VFD Brightness. The first line of VFD displays "VFD-LT" and the 2nd line shows current brightness level.
Press <, > or turn the Knob to change a new level. Press Enter to save and exit to discharge state. Press Esc to exit to discharge state but not save.
Brightness includes 8 levels:
0(dark) ~ 7(bright)

3.5 Measurement Procedure

3.5.1 Charge – Test - Discharge

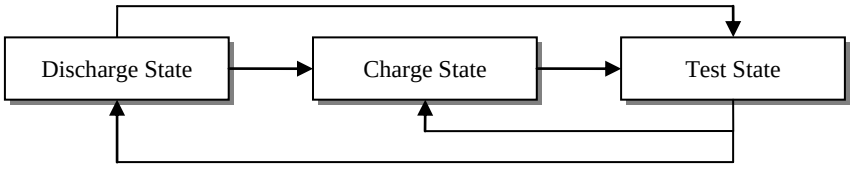
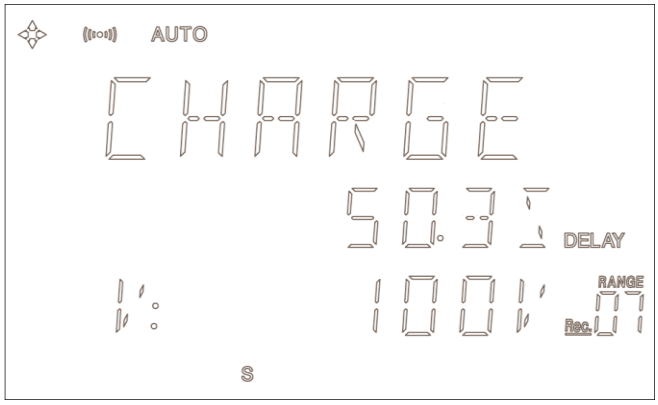


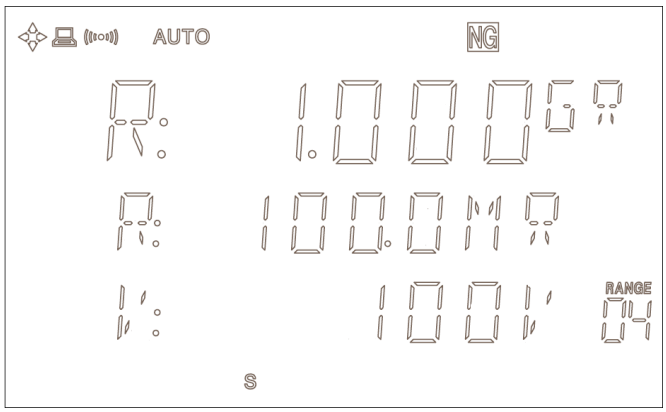
Figure 3-8 Three States



Charge State:

1. Press Charge key to enter charge state.
2. The (-) terminal outputs negative voltage and charge timer starts.
3. After timer decreasing to zero, the state will be switched to "Test State".
4. Press Charge key again to enter "Test State" directly. The available time will be ignored.

TIP:
If the charge time set to 0, the charge timer would be closed.



Test State:

If the charge timer closed, press Charge key will enter TEST STATE.

At TEST STATE, press Charge key to enter CHARGE STATE again.

3.5.2 Changing the Parameter

You can change test parameter whether at DISCHAGE STATE or TEST STATE.

Press Param key to switch IR to current testing.

3.5.3 Rate

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

The RATE items are explained as follows, you can press Rate key to choose.

Fast: 55 readings/s. Use FAST if speed is of primary importance (at the expense of increased reading noise and fewer usable digits.

Medium: 25 readings/s. Use Medium when a compromise between noise performance and speed is acceptable.

Slow: 3 readings/s. SLOW provides better noise performance at the expense of speed.

3.5.4 Display IR and Leakage at one time.

AT682/683 can display IR at 1st line of the VFD and Leakage current at 2nd line.
Under TEST STATE，Press View key to choose follow items at 2nd line:

Ix or Rx	Leakage Current or IR (According to the different parameter)
Peak	
GD/NG	Sorting Result

3.5.4 Display Peak

Press View key to display peak at VFD 2nd line.

TIP:
IR's peak is Minimum, the MIN annunciator displayed.
Leakage Current's peak is Maximum, the MAX annunciator displayed.

3.5.5 Display Sorting Result

Press View key to display sorting result (GD/NG) at VFD 2nd line.

3.5.6 Turning ON/OFF the Beep Feature.

The AT682/683 has a beep feature which generates beeps when the following two conditions have been occurred:

- The DUT is out of range limit and the situation has been sorted as NG by the comparator.
- The DUT is in the range limit and the situation has been sorted as GD by the comparator.

Regardless of whether the beep feature is on or off, beeps are generated whenever:
AT682/683 starts up
Key pressed.
An error message or warning message has appeared.
To set up the beep feature:
Press Beep to turn on or turn off the beep feature. A beep annunciator shows you the beep on/off state.

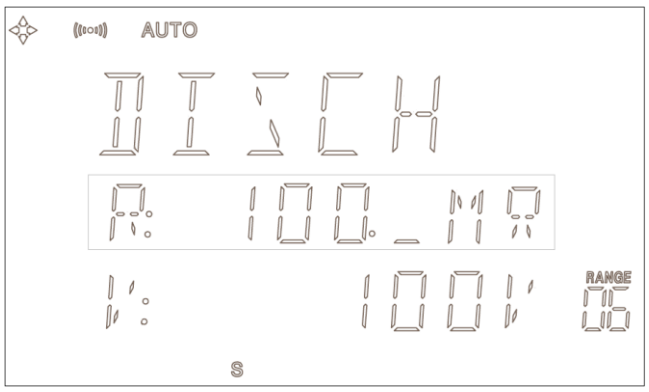
Refer chapter 4, Comparator, to set beep feature.

4 Comparator

This chapter provides information about comparator:

- Input limit reference value.
- Setup beep feature.

4.1 Input Limit reference value



1. Under DISCHARGE STATE, Press Refer key, a cursor flashed。
2. Press Digits to input value.
3. Press Shift + n/μ/m/k/M/G to key in unit. The value saved.
   Press Esc to cancel and exit to DISCHARGE STATE.

NOTE:
The Resistance's limit reference value is UPPER limit. Rx ≥ Refer, PASS (GD).
The Leakage Current's limit reference value is LOWER limit. Ix ≤ Refer, PASS.

4.2 Set Beep Feature:

4.2.1 Turning on/off the beep:

Press Beep to turn on/off the beep.

The beep annunciator shows you the beep on/off state.

4.2.2 Set Beep:

1. Press Shift Beeper key to enter beep set window.
2. Press < > key or Turn Knob to choose following items:
   GD Beep while pass.
   NG Beep while fail.

3. Press Enter key to exit to DISCHARGE STATE and the setting saved.
4. Press Esc key to exit to DISCHARGE STATE and the setting without being saved.

4.2.3 How the comparator work

Under TEST STATE, the comparator determines whether the measurement result (displayed value) is within the upper or lower limits set by the Refer Comparator Limit key. The comparator function is always ON. The comparison results can be displayed on the VFD display, can be output to the handler interface, or can be revealed by the beeper.

Comparator work flow:

Insulation Resistance:

Rx ≥ Rrefer (Upper value)	PASS	Display GD
Rx < Rrefer (Upper value)	FAIL	Display NG

Leakage Current:

Ix ≤ Irefer (Lower value)	PASS	Display GD
Ix > Irefer (Lower value)	FAIL	Display NG

5 Handler Interface

This chapter describes how to use the handler interface.

- Pin Assignment
- Circuit Diagram
- Timing Chart

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 AT682/683. You can also input the external trigger signal and the comparator select signal to the AT682/683. With this interface and the comparator function, you can build an automatic screening system composed of the AT682/683 and the handler.

5.1 Pin Assignment

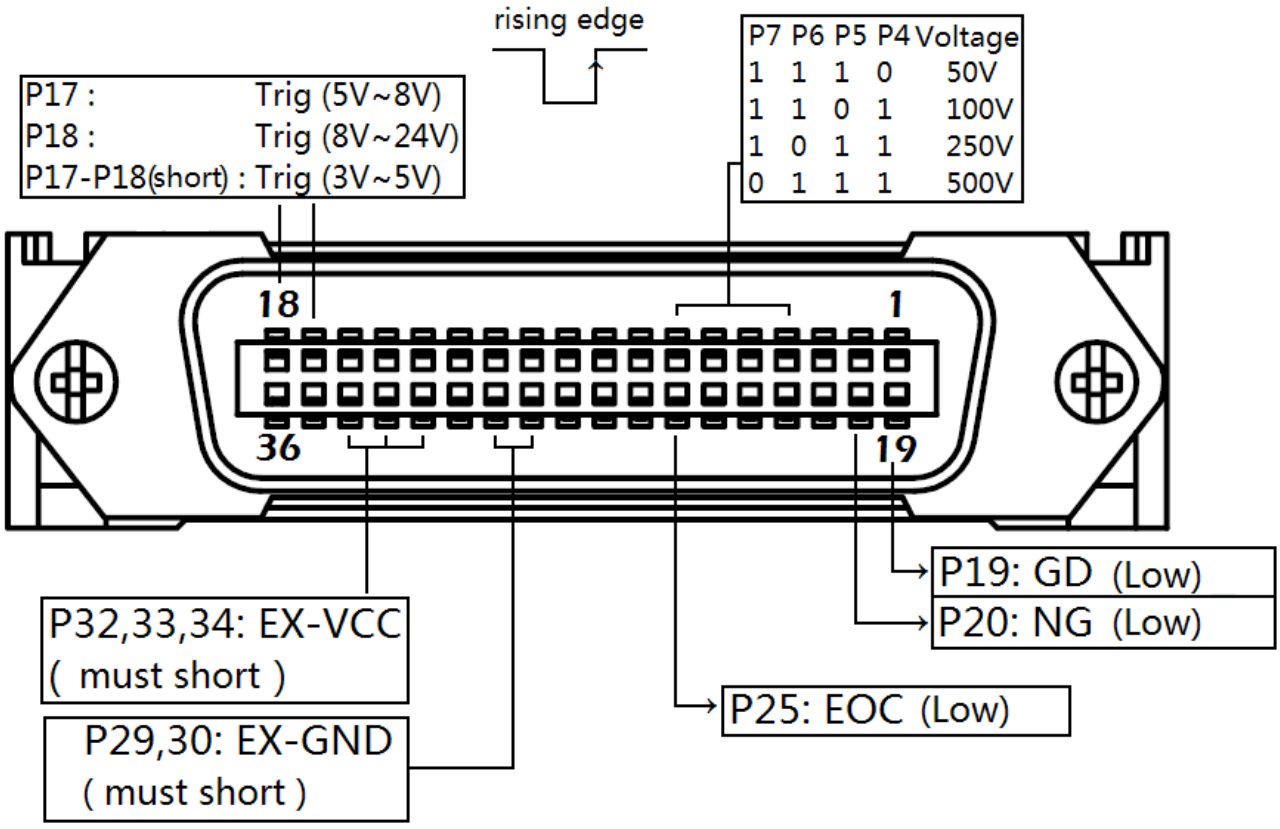


Figure 5-1 **Pin Assignment of Handler Interface Connector**

Table 5-1 **Description of Handler Interface Input Signals**

9	COMP.0	Comparator Record Selector. (1 thru 30) See Table 5-1.
10	COMP.1	
11	COMP.2	
12	COMP.3	

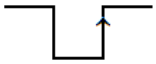
13	COMP.4	
14	DISCH	Discharge. (Low)
15	CHARG	Charge and Test. (Low)
17	TRIG8V	External Trigger Signal  (Rising edge) 17-18 SHORT = TRIG5V
18	TRIG24V	

Table 5-3 **Output Signals**

4	EX0	See Tale 5-4.
5	EX1	
6	EX2	
7	EX3	
7	EOC	Measurement completion signal. (Low)
19	GD	Pass signal. (Low)
20	NG	Fail signal. (Low)

Table 5-4 **Typical Voltage Control Signal**

EX3	EX2	EX1	EX0	Voltage
1	1	1	0	50V
1	1	0	1	100V
1	0	1	1	250V
0	1	1	1	500V

Table 5-5 **Power Signal**

27	IN-GND	*Internal GND: Not Recommend to use*
28	IN-GND	
29	EX-GND	External GND
30	EX-GND	
32	EX-VCC2	External VCC2: Pull-up Resistance(5kΩ) Power Supply
33	EX-VCC1	External VCC1: Main Power Supply
34	EX-VCC1	
35	IN-VCC	*Internal* 3.3V: *Not Recommend to use*
36	IN-VCC	

5.2 Electrical Characteristics

Input Signal:

Each input signal is connected to the LED (cathode side) of the photo-coupler. The LED (anode side) is connected to the pull-up power supply voltage.

Output Signal:

Each output signal is outputted via an open collector by using a photo-coupler. The voltage of each output is obtained by connecting pull-up resistors, inside or outside of the AT682/683.

NOTE:
If the external power supply greater than 8VDC, use external pull-up resistance please. The Pin 32 leaves float.
The output signal current can not drive relay.

Power supply

The power supply for the judgment output signal pull-up and that for the operation output signal pull-up and input signal drive can be set separately. You can select +3.3V of the internal power supply or from +3.3V to +24V external power supply.

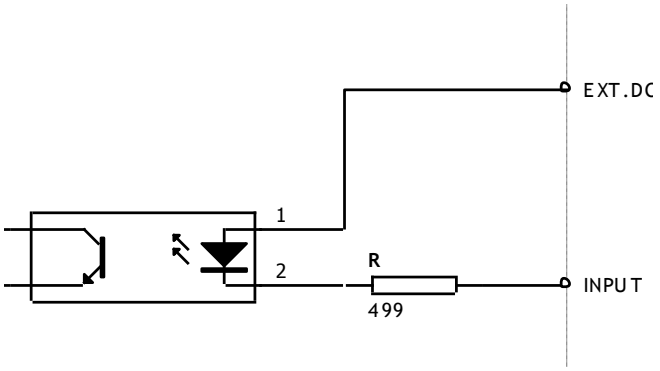


Figure 5-2 **Typical Circuit Diagram of Handler Interface Input signals.**

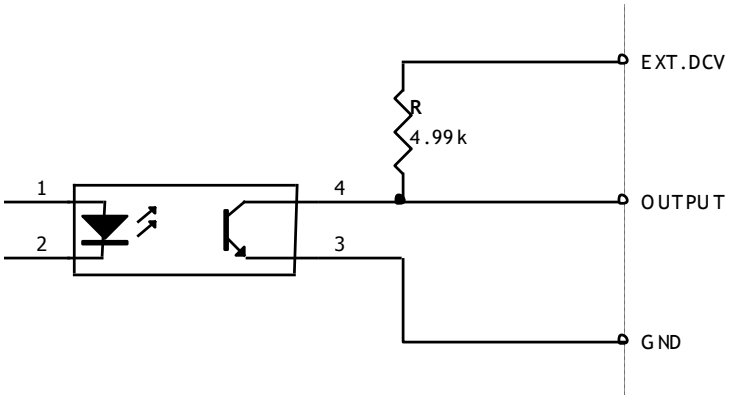


Figure 5-3 **Typical Circuit Diagram of Handler Interface Output signals.**

6 Remote Control

This chapter provides the following information to remotely control the AT682/AT683 via the RS-232C interface.

- About RS-232C
- RS-232C operation.
- SCPI

AT682/683 can use the RS-232 interface to communicate with the computer to complete all the instrument functions.

6.1 About RS-232C

You can connect a controller (i.e. PC and PLC) to the RS-232 interface using Applent RS-232 DB-9 cable. The serial port uses the transmit (TXD), receive (RXD) and signal ground (GND) lines of the RS-232 standard. It does not use the hardware handshaking lines CTS and RTS.

NOTE:
JUST ONLY Use an Applent (not null modem) DB-9 cable.
Cable length should not exceed 2m.

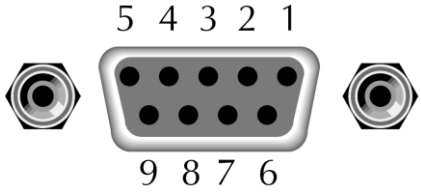


Figure 6-1 **The RS-232 connector in the real panel**

Table 6-1 **RS-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 AT682/AT683 also uses these settings.

The RS-232 interface transfers data using:

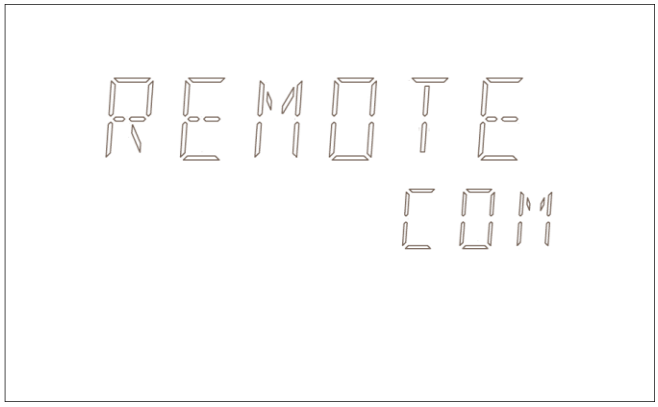
8 data bits,

1 stop bit,

And no parity.

6.2 Enable RS-232C Interface and select baud rate

To enable RS-232 interface, do the following:



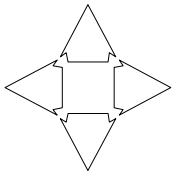
1. Under DISCH state, press SHIFT Remote key into REMOTE window.
2. Rotate knob to choose"COM"item.
3. Enter key enable RS-232.
4. Rotate knob to choose 4800 / 9600/ 19200/ 38400/ 57600 items.
5. Confirm your selection by pressing ENTER.

6.3 SCPI Language

Standard Commands for Programmable Instruments (SCPI) is fully supported by the RS-232 interfaces.

NOTE:
AT682/683 ONLY supports the SCPI Language.

7 Command Reference



This chapter contains reference information on programming AT682/683 with the SCPI commands.

This chapter provides descriptions of all the AT682/683's available RS-232 commands which correspond to Standard Commands for Programmable Instruments (SCPI) command sets, listed in functional subsystem order.

7.1 Terminator

NL：The EOI line is asserted by New Line or ASCII Line Feed character (decimal 10 ，Hex 0x0A，or ASCII ‘\n’)

7.2 Notation Conventions and Definitions

The following conventions and definitions are used in this chapter to describe RS-232 operation.

< > Angular brackets enclose words or characters that are used to symbolize a program code parameter or an RS-232 command.

[ ] A square bracket indicates that the enclosed items are optional.

\n Command Terminator

7.3 Command Structure

The AT682/AT683 commands are divided into two types: Common commands and SCPI commands.

The common commands are defined in IEEE std. 488.2-1987, and these commands are common for all devices. The SCPI commands are used to control all of the AT682/AT683's functions.

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.

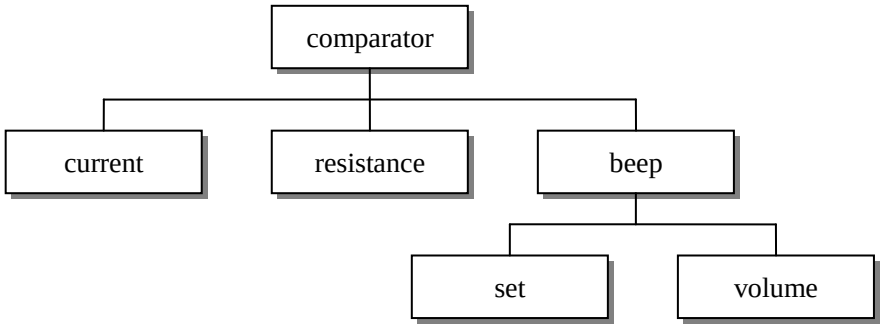


Figure 7-1. **Command Tree Example**

Example:

comp:beep:set ng\n

comp Subsystem Command
beep Level 2
set Level 3
ng Parameter

■ The basic rules of the command tree are as follows.

- Letter case (upper and lower) is ignored.
  For example,
  COMPARATOR:RESISTANCE = comparator: resistance
- Spaces (_ used to indicate a space) must not be placed before and/or after the colon (:).
  For example,
  ☒ comparator_:_resistance → ☑ comparator: resistance
- The command can be completely spelled out or in abbreviated.(The rules for command abbreviation are described later in this section)
  For example,
  comparator: resistance = comp:res
- The command header should be followed by a question mark (?) to generate a query for that command.
  For example,
  comp:res?
- The semicolon (;) can be used as a separator to execute multiple commands on a single line. The multiple command rules are as follows.
  Commands at the same level and in the same subsystem command group can be separated by a semicolon (;) on a multiple command line.
  For example,
  comp: beep: set ng; vol low
  To restart commands from the highest level, a semicolon (;) must be used as the separator, and then a leading colon (:), which shows that the restarted command is a command at the top of the command tree, must follow.
  For example,
  comp:beep:set ng; : comp:r 100e6
- The common commands can restart only after a semicolon on a multiple command line.
  For example,

func:rang 8;*IDN?;auto on

- Command abbreviations:

  Every command and character parameter has at least two forms, a short form and a long form. In some cases they will be the same. The short form is obtained using the following rules.

  A) If the long form has four characters or less, the long form and short form are the same.

  B) If the long form has more than 4 characters:

  (a) If the 4th character is a vowel, the short form is the first 3 characters of the long form.

  For example:

comparator	abbr. to	comp
current	abbr. to	curr
range	abbr. to	rang

  (b) If the 4th character is not a vowel, the short form is the first 4 characters.

  For example:

resistance	abbr. to	res
volume	abbr. to	vol

- If the long form mnemonic is defined as a phrase rather than a single word, then the long form mnemonic is the first character of the first word(s) followed by the entire last word. The above rules, when the long form mnemonic is a single word, are then applied to the resulting long form mnemonic to obtain the short form.

  For example:

PercentTolerance	abbr. to	ptol

The AT682/AT683 accepts the three forms of the same SCPI commands: all upper case, all lower case, and mixed upper and lower case.

7.4 Header and Parameters

The commands consist of a command header and parameters. (See the following.)

For example

```
comp:res 100.0e6
```

Header Parameter

- 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.
- Parameters may be of two types as follows.

  (A) Character Data and String Data Character data consists of ASCII characters. The abbreviation rules are the same as the rules for command headers.

  (B) Numeric Data

  (a) interger: For example, 1,+123,-123

  (b) fix float: For example, 1.23,+1.23,-1.23

(c) floating point: For example, 1.23e3, 5.67e-3, 123k, 1.23M, 2.34G,

The available range for numeric data is 9.9E37. When numeric data is used as a parameter, the suffix multiplier mnemonics and suffix units (The suffix multiplier must be used with the suffix unit.) can be used for some commands as follows.

Table 7-1 **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

7.5 Command Reference

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

- FUNCtion
- VOLTage
- CORRection
- COMParator
- STATe
- TIMEr
- APERture
- SYSTem
- TRIGger
- FETCh?
- ERRor

Common Command:

- *IDN?
- *RST

The explanation of each subsystem command is patterned as follows.

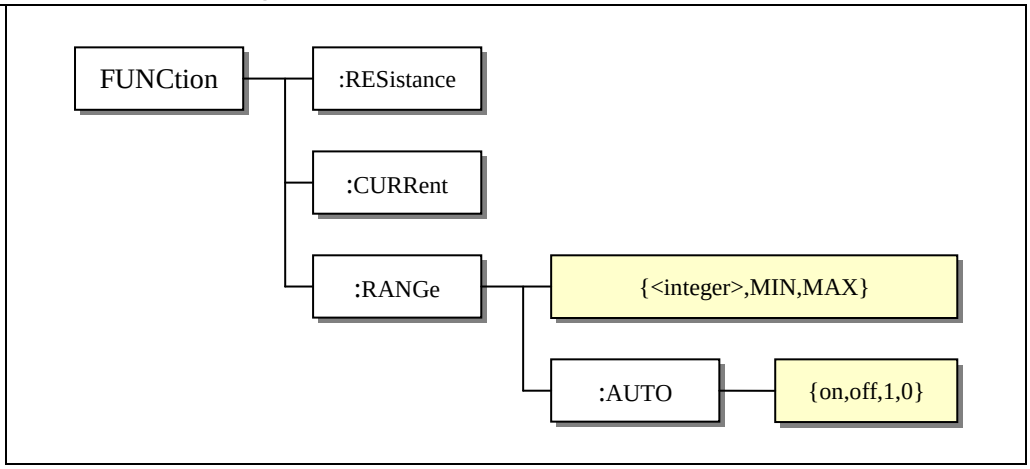
1. Subsystem command name
2. Command Tree (Subsystem command only)
3. Compound Command Name
4. Command Description
5. Command Syntax
6. Example Using the Above Command Syntax

7. Query Syntax
8. Query Response
9. Example Using the Above Query Syntax
10. Constraints

7.6 Function Subsystem

The **FUNCtion** subsystem command group sets the measurement parameter and measurement range.

Figure 7-2 FUNCtion Command Tree



:RESistance

The **:RESistance** command sets the measurement parameter to resistance (R).

Command Syntax	`FUNCtion:RESistance\n`
Parameters	none
Query	none
Constraints	none

:CURRent

The **:CURRent** command sets the measurement parameter to current (I).

Command Syntax	`FUNCtion:CURRent\n`
Parameters	none
Query	none
Constraints	none

:RANGe

The **:RANGe** command sets the measurement range. If the current range was AUTO, then converted to manual.

Command Syntax	`FUNCtion:RANGe {<integer>,MIN,MAX}`

Parameters	{<integer>,MIN,MAX} where, <interger> Range no from 1 to 6. MIN =1 MAX =6
For example:	**Tx>** func:rang 5 //set range to 5 **Tx>** func:rang min //set range to 1 **Tx>** func:rang max //set range to 7
Query Syntax	**FUNCtion:RANGe?**
Query Response	<*integer*> Range no from 1 to 6.
For example:	**Tx>** func:rang? **Rx>** 6
Constraints	none

:RANGe:AUTO

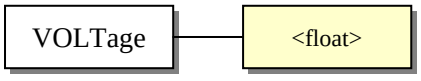
The **:RANGe:AUTO** command sets the auto range to ON or OFF.

Command Syntax	**FUNCtion:RANGe:AUTO {ON,OFF,1,0}**
Parameters	{ON,OFF,1,0} where, 1: =ON, ASCII(decimal 49), 0: =OFF, ASCII(decimal 48)
For example:	**Tx>** func:rang:auto off //The auto range will set to manual.
Query Syntax	**FUNCtion:RANGe:AUTO?**
Query Response	{on,off}
For example:	**Tx>** func:rang:auto? **Rx>** off
Constraints	none

7.7 VOLTage Subsystem

The **VOLTage** subsystem sets test voltage.

Figure7-3 VOLTage Command Tree



Command Syntax	**VOLTage <float>**
Parameters	<float> 1.0~650
For example:	**Tx>** VOLT 10.2 **Tx>** VOLT 500
Query Syntax	**VOLTage?**
Query Response	<float> 1.0~650.0

For example:	**Tx> VOLT?** **Rx> 10.0**
Constraints	Available under DISCH state

7.8 CORRection Subsystem

The **CORRection** subsystem command group sets the OPEN correction function.

Figure 7-4 CORRection Command Tree

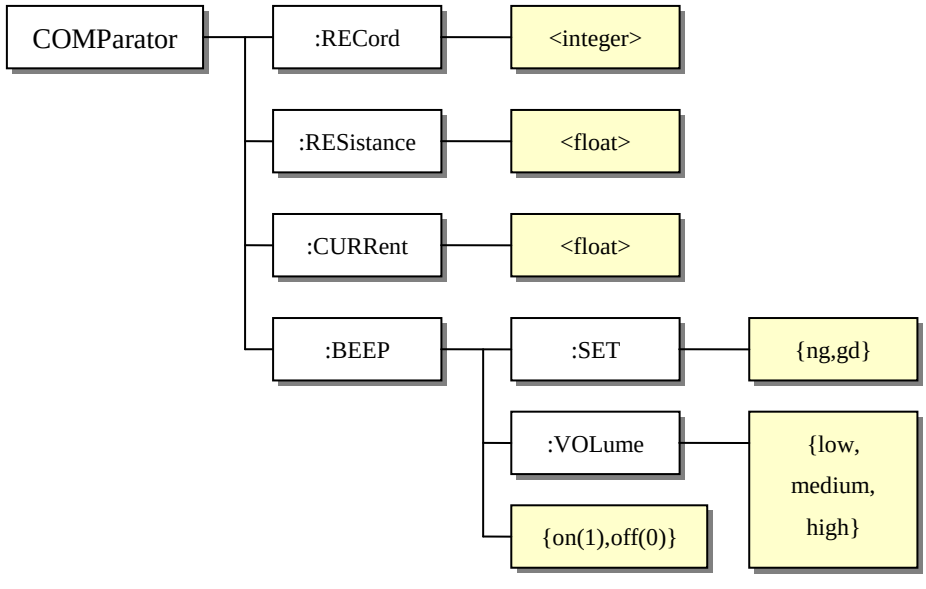
Command Syntax	**CORRection**
Parameters	none
For example:	**Tx>** CORR **Rx>** Clear 0 process, please wait. **Rx>** ok.
Query Syntax	none
Constraints	none

NOTE:
When clearing, the instrument will ignore any commands.

7.9 COMParator Subsystem

The **COMParator** subsystem command group sets the comparator function, including its RECORD NO, LIMIT REFERENCE VALUES and BEEP.

Figure 7-5 COMParator Command Tree



:RECord

The **:RECord** command sets Record number.

Command Syntax	**COMParator:RECord <integer>**
Parameters	<integer> 1-30
For example:	**Tx>** COMP:REC 2 //sets current record to 2
Query Syntax	**COMParator:RECord?**
Query Response	<integer> 1-30
For example:	**Tx>** COMP:REC? **Rx>** 2
Constraints	Available under DISCH state

:RESistance

The **:RESistance** command sets resistance limit value.

Command Syntax	**COMParator:RESistance <float>**
Parameters	<float> fix float or floating point，0-99999G
For example:	**Tx>** COMP:RES 100G //100GΩ
Query Syntax	**COMParator:RESistance?**
Query Response	<float> floating point
For example:	**Tx>** COMP:RES? **Rx>** 1.234560e+08
Constraints	Available under DISCH state

:CURRent

The **:CURRent** command sets current limit value.

Command Syntax	**COMParator:CURRent <float>**
Parameters	<float> fix float or floating point, 0-99999m
For example:	**Tx>** COMP:CURR 1m //1mA
Query Syntax	**COMParator:CURRent?**
Query Response	<float> floating point
For example:	**Tx>** COMP:CURR? **Rx>** 1.000000e-06
Constraints	Available under DISCH state

:BEEP

The **:BEEP** command set beep to ON or OFF.

Command Syntax	**COMParator:BEEP {on(1),off(0)}**
Parameters	{on(1),off(0)}

For example:	**Tx>** COMP:BEEP on
Query Syntax	**COMParator:BEEP?**
Query Response	{on,off}
For example:	**Tx>** COMP:BEEP? **Rx>** on
Constraints	none

:BEEP:SET

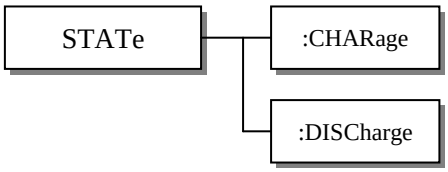
The **:BEEP:SET** command sets ng beep or gd beep.

Command Syntax	**COMParator:BEEP:SET {ng,gd}**
Parameters	{ng,gd}
For example:	**Tx>** COMP:BEEP:SET ng
Query Syntax	**COMParator:BEEP:SET?**
Query Response	{ng,gd}
For example:	**Tx>** COMP:BEEP:SET? **Rx>** ng
Constraints	none

7.10 STATe Subsystem

The STATe subsystem sets instrument state to CHARG or DISCH.

Figure 7-6 STATe Command Tree



Query Syntax	**STATe?**
Query Response	{charge,discharge,test} where, charge: CHARGE state discharge: DISCH state test: TEST state
For example:	**Tx>** STATe? **Rx>** discharge
Constraints	none

NOTE:
All commands after state subsystem will be ignored.

:CHARage

Command Syntax	**STATe:CHARage**
Parameters	none
For example:	**Tx>** STAT?
	Rx> discharge
	Tx> STAT:CHAR
	Tx> STAT?
	Rx> charge
	Tx> STAT:CHAR
Query Syntax	none
Query Response	none
Constraints	none

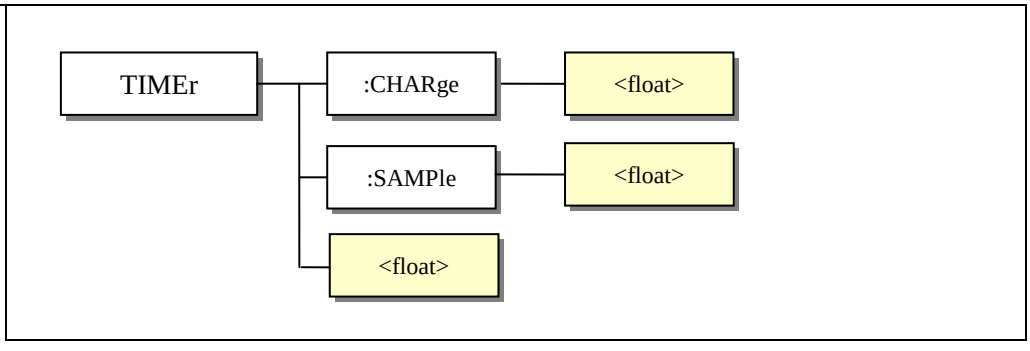
:DISCharge

Command Syntax	**STATe:DISCharge**
Parameters	none
Query Syntax	none
Constraints	none

7.11 TIMEr Subsystem

The TIMEr subsystem sets charge timer and sample timer.

Figure 7-7 TIMEr Command Tree



:CHARge

The **:CHARge** command sets charge timer value.

Command Syntax	**TIMEr:CHARge <float>**
Parameters	<float> fix float or floating point,0-999.9
For example:	**Tx>** TIME:CHAR 100.1 //100.1s
	Rx> TIME 0 //The charge timer sets to OFF
Query Syntax	**TIMEr?**

	TIMEr:CHAR?
Query Response	<float> 0.0–999.9
For example:	**Tx>** TIME? //Or TIME:CHAR?
	Rx> 12.0
Constraints	Available under DISCH state

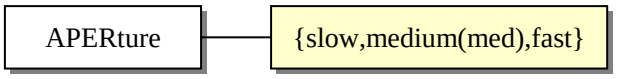
:SAMPle

The :SAMPle command sets sample timer value.

Command Syntax	**TIMEr:SAMPle <float>**
Parameters	<float> fix float or floating point,0-999.9
For example:	**Tx>** TIME:SAMP 100.1
	Tx> TIME:SAMP 0 //The sample timer sets to OFF
Query Syntax	**TIMEr:SAMP?**
Query Response	<float> 0.0–999.9
For example:	**Tx>** TIME:SAMP?
	Rx> 12.0
Constraints	Available under DISCH state

7.12 APERture Subsystem

Figure 7-8 APERture Command True



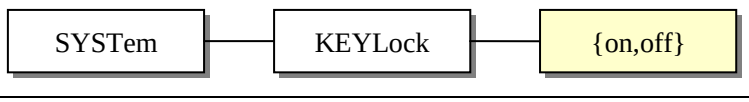
The **APERture** subsystem sets the convert time of the ADC.

Command Syntax	**APERture {slow,medium(med),fast}**
Parameters	{slow,medium(med),fast}
For example:	**Tx>** APER fast
Query Syntax	**APERture?**
Query Response	{slow,medium,fast}
For example:	**Tx>** APER?
	Rx> fast
Constraints	none

7.13 SYSTem Subsystem

The SYSTem subsystem sets KEYLOCK to ON/OFF.

Figure7-9 SYSTem



Command Tree

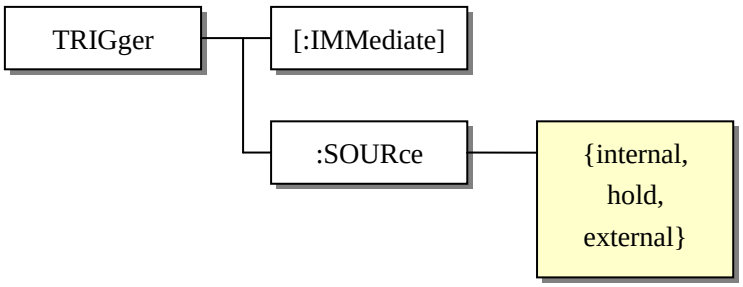
:KEYLock

Command Syntax	**SYSTem:KEYLock {on(1),off(0)}**
Parameters	{on(1),off(0)} on: keypad locked. off: keypad unlocked.
For example:	**Tx>** SYST:KEYL on
Query Syntax	**SYSTem:KEYLock?**
Query Response	{on,off}
For example:	**Tx>** SYST:KEYL? **Rx>** off
Constraints	none

7.14 TRIGger Subsystem

The **TRIGger** subsystem command group is used to enable a measurement and to set the trigger mode.

Figure 2-10 TRIGger Command Tree



[:IMMediate]

The [:IMMediate] command causes the trigger to execute a measurement.

Command Syntax	**TRIGger[:IMMediate]**
Parameters	none
For example:	**Tx>** TRIG:IMM **Tx>** TRIG
Query Syntax	none
Constraints	Available under DISCH state and Trigger source was HOLD.

:SOURce

The **:SOURce** command sets the trigger mode.

Command Syntax	**TRIGger:SOURce {internal(int),hold,external(ext)}**

Parameters	{internal(int),hold,external(ext)}
For example:	**Tx>** TRIG:SOUR hold
Query Syntax	**TRIGger:SOURce?**
Query Response	{internal,hold,external}
For example:	**Tx>** TRIG:SOUR? **Rx>** external
Constraints	Available under DISCH state

7.15 FETCh Subsystem

The **FETCh?** subsystem command group is a sensor-only command which retrieves the measurement data taken by measurement(s) initiated by a trigger

Figure 2-11 FETCh? Command Tree

FETCh?

Query Syntax	**FETCh?**
Query Response	<float>,<float>,{GD,NG} <float> floating point Rx <float> floating point Ix {GD,NG} comparator result
For example:	**Tx>** FETCh? **Rx>** 1.008860e+09,9.912178e-08,GD
Constraints	Available under TEST state

7.16 ERRor Subsystem

The ERRor subsystem sets or retrieves last error information.

Figure 7-12 ERRor? Command Tree

ERRor?

Query Syntax	**ERRor?**
Query Response	no error. Error information refer to appendix B
For example:	**Tx>** ERR? **Rx>** no error

Constraints	none

7.17 *IDN? Common Command

The *IDN? query returns AT682/AT683 Version.

Figure 7-13
**IDN?*
Common Command

Query Syntax	***IDN?**
Query Response	<model>,<version>,<ID>
For example:	**Tx>** *IDN? **Rx>** AT682,V1.00,68200710008

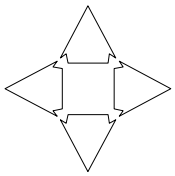
7.18 *RST Common Command

*RST restarts instrument.

Fignure 2-15
**RST*
Common Command

Command Syntax	***RST**
Parameters	none
For example:	**Tx>** *RST **Rx>** Wait for 3s…
Query Syntax	none
Constraints	none

A Specifications



This chapter describes the specifications and supplemental performance characteristics of the AT682/683：

- Specifications
- Dimension。

AT682/683 Megohmmeter Specifications

Accuracy is defined as meeting all of the following conditions.

Temperature: 23℃ ±5℃

Humidity: ≤65% R.H.

Zeroing: Open Correction

Warm up time is 30 min or more.

Rate: Slow

A 1-year calibration cycle

Insulation Resistance: Accuracy **<1G: ±1% ≥1G: ±3% ≥10G: ±5%** **M=10^6,G=10^9,T=10^{12}**

range / voltage	1	2	3	4	5	6
1V			100k~1M	1M~10M	10M~100M	100M~1G
10V		100k~1M	1M~10M	10M~100M	100M~1G	1G~10G
25V	25k~250k	250k~2.5M	2.5M~25M	25M~250M	250M~2.5G	2.5G~25G
50V	50k~500k	500k~5M	5M~50M	50M~500M	500M~5G	5G~50G
75V	75k~750k	750k~7.5M	7.5M~75M	75M~750M	750M~7.5G	7.5G~75G
100V	100k~1M	1M~10M	10M~100M	100M~1G	1G~10G	10G~100G
125V	125k~1.25M	1.25M~12.5M	12.5M~125M	125M~1.25G	1.25G~12.5G	12.5G~125G
250V	250k~2.5M	2.5M~25M	25M~250M	250M~2.5G	2.5G~25G	25G~250G
500V	500k~5M	5M~50M	50M~500M	500M~5G	5G~50G	50G~500G
750V	750k~7.5M	7.5M~75M	75M~750M	750M~7.5G	7.5G~75G	75G~750G
1000V	1M~10M	10M~100M	100M~1G	1G~10G	10G~100G	100G~1T

AT683: Insulation Resistance: Accuracy **<1G: ±1% ≥1G: ±3% ≥10G: ±5%**

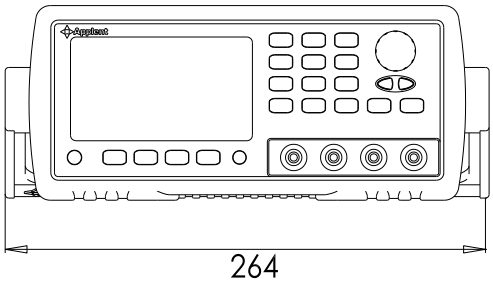
量程 / 电压	1	2	3	4	5	6
1V		100k~1M	1M~10M	10M~100M	100M~1G	1G~10G
10V	100k~1M	1M~10M	10M~100M	100M~1G	1G~10G	10G~100G
25V	250k~2.5M	2.5M~25M	25M~250M	250M~2.5G	2.5G~25G	25G~250G
50V	500k~5M	5M~50M	50M~500M	500M~5G	5G~50G	50G~500G
75V	750k~7.5M	7.5M~75M	75M~750M	750M~7.5G	7.5G~75G	75G~750G
100V	1M~10M	10M~100M	100M~1G	1G~10G	10G~100G	100G~1T
125V	1.25M~12.5M	12.5M~125M	125M~1.25G	1.25G~12.5G	12.5G~125G	125G~1.25T
250V	2.5M~25M	25M~250M	250M~2.5G	2.5G~25G	25G~250G	250G~2.5T
500V	5M~50M	50M~500M	500M~5G	5G~50G	50G~500G	500G~5T
750V	7.5M~75M	75M~750M	750M~7.5G	7.5G~75G	75G~750G	750G~7.5T
1000V	10M~100M	100M~1G	1G~10G	10G~100G	100G~1T	1T~10T

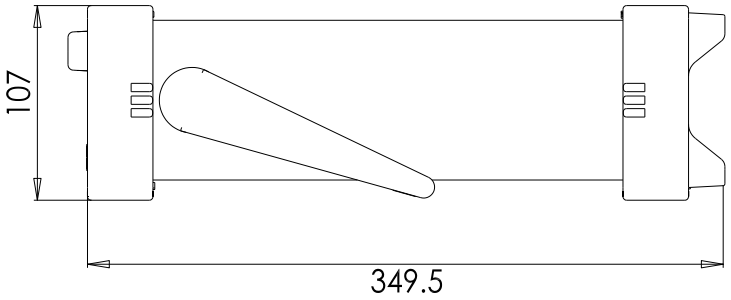
Display: Vacuum-Fluorescent-Display (4-Colors VFD) Size: 98x55mm
Output Voltage: -1.0VDC ~ -1000VDC programmable in 3 ranges
Voltage Accuracy: <10V ±10% ≥10V ±1%
<100V 0.1V resolution
≥100V 1V resolution
Parameter: Insulation Resistance, Leakage Current, Peak and Comparator Result.
Resistance Range: 100kΩ ~ 1TΩ
Basic Accuracy: (@Slow Rate) <1G: ±1% ≥1G: ±3% ≥10G: ±5%
Maximum Reading: Slow Rate: 9999 Medium and Fast: 1999
Maximum Charge Current: 30mA ± 5mA
Rate (App.): Fast: 55 readings/s Med.:25 readings/s Slow: 3 reading/s
Charge Time: 999.9s 0.1s resolution Accuracy: ±0.5%
Sample Time: 999.9s 0.1s resolution Accuracy: ±0.5%
Trigger: Internal, Manual (Remote) and External Trigger
Range: Auto and Manual 6 ranges.
Correction: Open Clear Zero
Comparator: 30 sets of record. Display and Output GD/NG.
Beep: GD, NG and OFF
Interfaces: Built-in Handler Interface.
Built-in RS232C Interface.
Program Language: SCPI

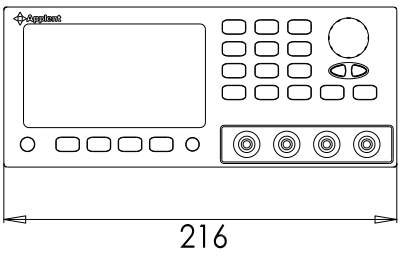
Environmental: MIL-T-28800D, Type 3, Class 5, Style E & F
Operating: 0°C to 50°C, stated accuracy <45% RH

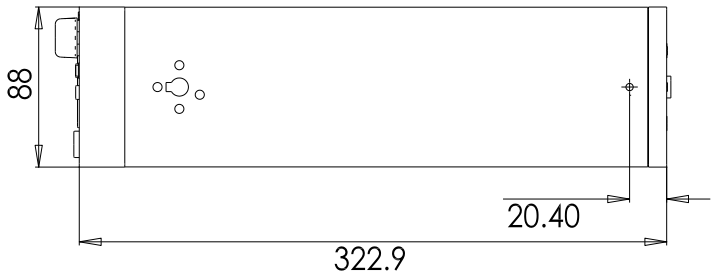
	Storage: -40°C to 71°C	
	Altitude: <2000m, Installation Category 1, Pollution Degree 1	
Power:	198V ~ 252VAC 48.5Hz ~ 52.5Hz 30W max	
Fuse:	250V 1A Slo-Blo	
Weight:	Approximately 5kg	(NET)
	Approximately 6kg	(SHIPPING)
Accessories:	User's Manual	
	ATL507 Lead Set	
	AC Power Cable	
	Warranty Certificate	

Dimensions









B Error message

Error message	Description
Bad command	Tx> comp:re Rx> 're' Bad command.
Parameter error	Tx> comp:beep:set nng Rx> 'nng' Parameter error. Tx> comp:res abc Rx> 'abc' Parameter error. (should be number)
Missing parameter	Tx> comp:res Rx> 'res' Missing parameter.
Invalid separator	Tx> comp Rx> '' Invalid separator.
Numeric data error	Tx> comp:res 100gg Rx> '100gg' Numeric data error. Tx> comp:res 100x Rx> '100x' Numeric data error.
Invalid command	Tx> stat:char Tx> volt 100V Rx> 'volt' Invalid command. (Available under TEST state)
Value string too long	Tx> comp:res 1.2345678901234567890e2 Rx> '1.2345678901234567890e2' Numeric data error