

# User's Guide

Rev.A7

# AT4610/AT4710

## Data Logger



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## 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 circuit	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.
Operations not included in the manual are forbidden	The protection measurements will be failure while beyond the scope.

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

	Do not leave in the trash can
--	-------------------------------

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

This Applent instrument product is warranted against defects in material and workmanship for a period corresponding to the individual warranty periods of its component products. **The warranty period is 1 year and begins on the date of shipment.** During the warranty period, Applent will, at its option, either repair or replace products that prove to be defective. This warranty extends only to the original buyer or end-user customer of a Applent authorized reseller, and does not apply to fuses, disposable batteries or to any product which, in Applent's opinion, has been misused, altered, neglected or damaged by accident or abnormal conditions of operation or handling.

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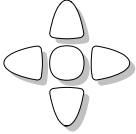
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# 1. Unpacking and Preparation



This chapter describes:

- Packing List
- Power Requirements
- Environmental Requirements
- Cleaning

## 1.1 Packing List

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



*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 options.



*If an abnormality is detected, contact the company and send the meter to your nearest Apilent 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 Requirement

Use AT46xx as per the following power supply conditions:

~Line: 100VAC~240VAC  
Frequency: 50Hz/60Hz



**To prevent electrical shock, please connect to GND.**  
**If users change power cord, please make sure reliable connection of GND.**

## 1.3 Operation Environment

Ensure that the operation environment meets the following requirements.

Temperature: 0 °C ~ 55 °C  
Humidity @23°C < 70%RH

## 1.4 Cleaning

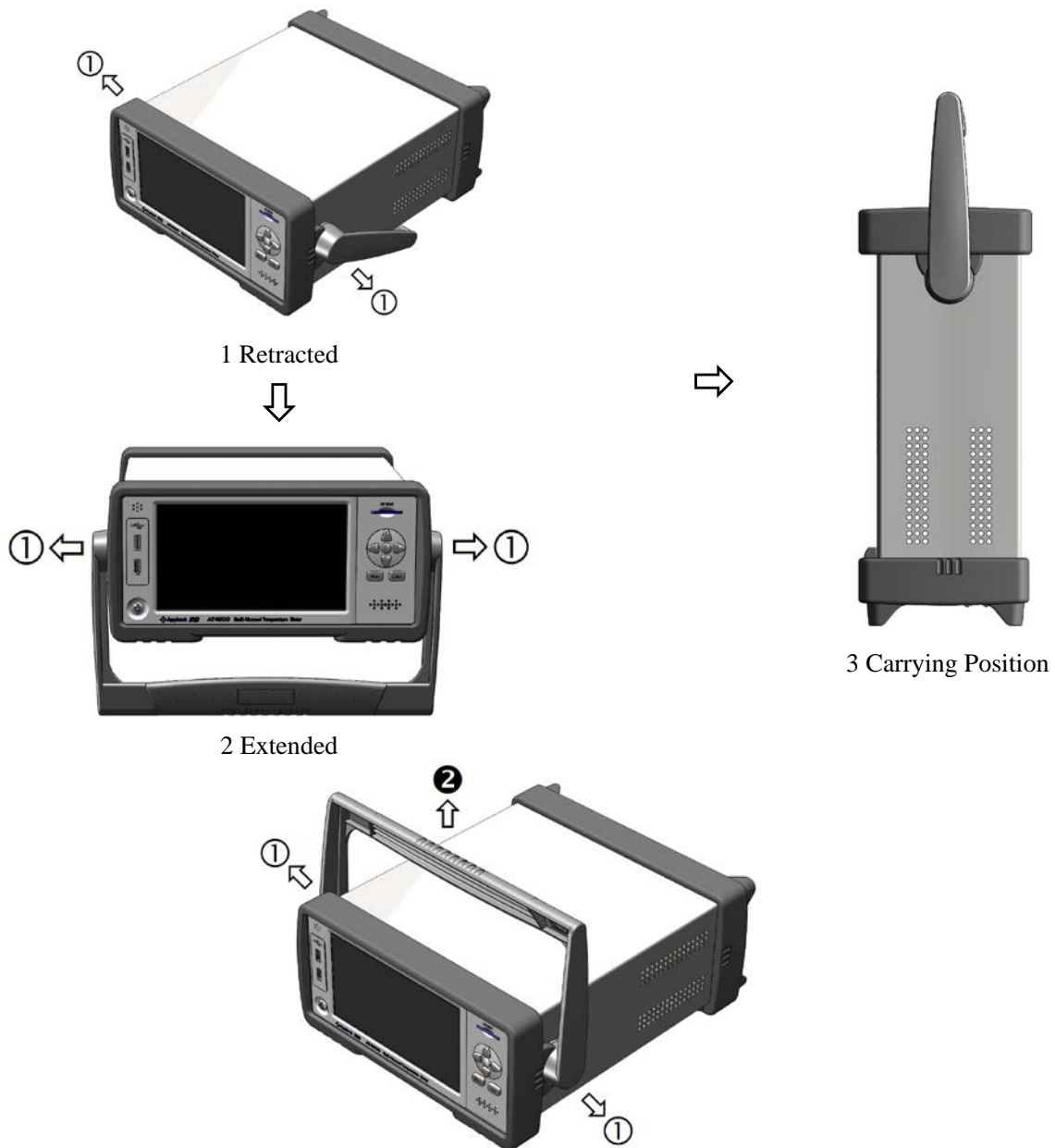
To prevent electrical shock, disconnect the AT46xx/AT47xx power cable from the receptacle before cleaning.  
 Use dry clothes slightly dipped in water to clean the case.  
 Do not attempt to clean the internal of the instrument.



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

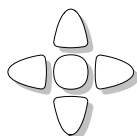
## 1.5 Instrument Handle

Figure 1-1 A handle kit is attached to the AT4610/AT4710



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

## 2. Overview



*This chapter is organized as follows*

- *Introduction*
- *Main Specifications*

### 2.1 Introduction

Thank you for purchasing AT4610/AT4710 Data Logger.

AT4610/AT4710 adopts high-performance ARM microprocessor and FPGA, it can record data with real-time and high speed. It is 7 inches highlight true color LCD display screen, all touch panel assist secondary function key to operate, it uses Applent ATOS Rev.7 operating system, and it is more easy to use and more intelligent. Real-time display measured data and graph brings you newer experience.

New design AT46/AT47 series data logger adopts real-time FPGA circuit, breaks the limitation of sampling rate, coordinates high-efficient、high precise analog circuit, realize high precise and super high sampling rate, the resolution of measured temperature reaches  $0.01^{\circ}\text{C}$ , sampling rate of single channel  $<1\text{ms}$ , it only takes 10ms to complete measurement of 10 channels.

The AT4610/AT4710 can measure multiple channels' signal, they include temperature ( $-270^{\circ}\text{C}\sim+2000^{\circ}\text{C}$ ), DCV (0.0005mV~100V) (AT4610 only), resistance ( $1\text{m}\Omega\sim 200\Omega$ ) (AT4610 only) and so on. AT4610/AT4710 support various types of temperature sensors, they include thermocouple K、J、E、T、N、S、B、R type, RTD: 3 wire and 4 wire PT100.

In order to apply to alive test, instrument adopts high voltage buffer circuit, MCU and IU can withstand voltage 300VAC, allow MAX withstand voltage 300VDC for each channel.

There is 80MB high capacity data cache inside the instrument, used to real-time record, it can save 5.5 hours' data under 10ms sampling rate (AT4610 Only). Instrument supports four USB2.0 host interface and one SD card interface.

The instrument configures comparator, and optional Handler (PLC) interface, output 10 channels NG signal.

Built-in LAN interface, RS-232C interface and USB232 interface, also have optional RS485 and Wireless LAN module.

The instrument adopts Applent enhanced PC remote control command, compatible with SCPI (Standard Command for Programmable Instrument), and realize high-efficient remote control and data acquisition function.

AT4610/AT4710 can be applied in many areas, they include fuel cell, electro bile battery, lithium battery, acid battery pack's develop and maintenance, LED and related circuit's develop, cars and their parts' evaluation and measurement, daily maintenance of automatic equipment, factory monitor, power device and other electronic components' measurement.

Reference

See complete technical specifications in chapter 12.

## 2.2 Main Specification

### 2.2.1 Parameters

Thermocouple graduation: K、J、E、T、N、S、B、R;  
 RTD graduation: 3 wire or 4 wire PT100;  
 DC voltage (AT4610 only);  
 DC resistance (AT4610 only)

### 2.2.2 Measurement Range

Table 2-1 Measurement range

Input	Graduation	Measurement Range
TC	K	-270°C ~ 1300°C
	J	-210°C ~ 1200°C
	E	-270°C ~ 1000°C
	T	-270°C ~ 400°C
	N	-200°C ~ 1300°C
	S	-50°C ~ 1700°C
	B	250°C ~ 1800°C
	R	-50°C ~ 1700°C
RTD	PT100	-100°C ~ 850°C
DCV(AT4610)	DCV	0.0005mV ~ 100.000V
DCR(AT4610)	DCR	0.001Ω ~ 200.00Ω

### 2.2.3 Sampling Rate

AT4610 presets 19 kinds of sampling rate:  
 10ms, 20ms, 50ms, 100ms, 200ms,  
 500ms, 1s, 2s, 5s, 10s, 20s, 30s,  
 1min, 2min, 5min, 10min, 20min, 30min and 1h

And AT4710 preset 14 kinds of sampling rate:  
 500ms,  
 1s, 2s, 5s, 10s, 20s, 30s,  
 1min, 2min, 5min, 10min, 20min, 30min and 1h

### 2.2.4 Basic Accuracy

DC voltage: 0.1% (AT4610)  
 DC resistance: 0.1% (AT4610)  
 Thermocouple:  $\pm 0.6^{\circ}\text{C}$  (K/J/E/T: 0~100°C)  
 PT100 RTD:  $\pm 0.6^{\circ}\text{C}$  (-100~100°C)

### 2.2.5 Resolution

Temperature: 0.01°C  
 Resistance and voltage: Varying according to different range, please refer to “Specifications” chapter.

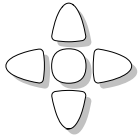
## 2.2.6 Comparator

Individually setting Upper/Lower value for each channel and can be output via Handler.

## 2.2.7 Interface

- **RS-232 remote control (can communicate with host USB by USB-232 interface)**  
*Supports MAX baud rate 115200bps, compatible with SCPI protocol, ASCII transmit.*
- **Built-in 10M network card**  
*Compatible with SCPI protocol, ASCII transmit.*
- **USB host interface**  
*Instrument built-in 4 groups USB interface, can externally connect USB-disk (U-disk or USB HDD), support plug and play external USB mouse.*
- **SD card interface**
- **Support SD card storage**
- **Handler interface**  
*Support internal 5V and external MAX 35V power supply.  
Input: trigger signal  
Output: All sorting compare results' signal; high current drive output, direct drive relay.*
- **Optional Wireless LAN interface**  
*Applent's USB Wireless LAN card is optional for the instrument.*

# 3. Startup



This chapter describes:

- Front panel
- Rear panel
- Power up
- Connect to device

## 3.1 Front Panel

### 3.1.1 Front panel description

Figure 3-1 Front panel

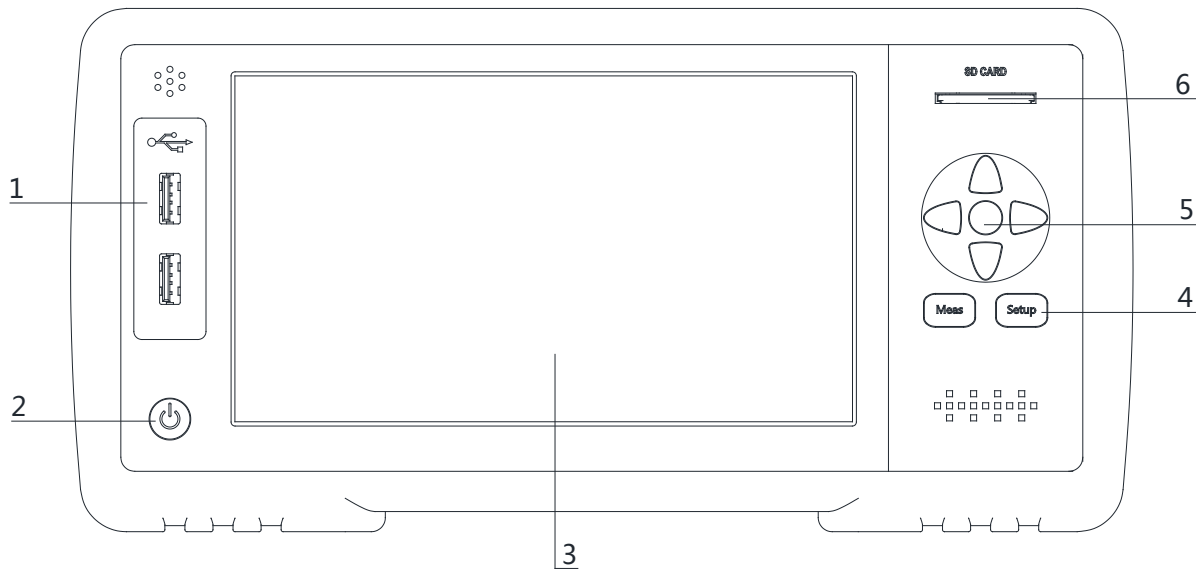


Table 3-1 Front panel description

No.	Description
1	USB disk interface
2	Power switch
3	LCD display screen with touch panel
4	Main function key: Measurement and setup
5	Cursor keys
6	SD card slot

## 3.2 Rear Panel

Figure 3-2 Rear panel

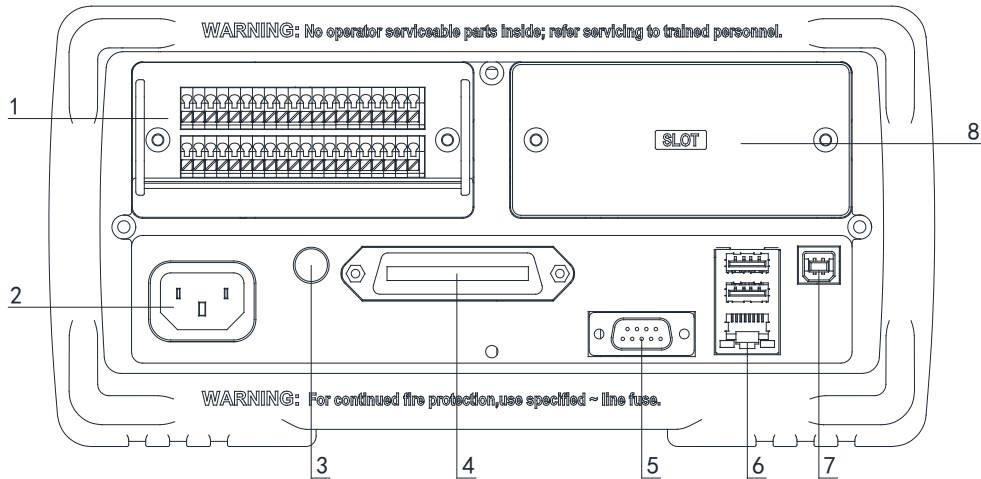
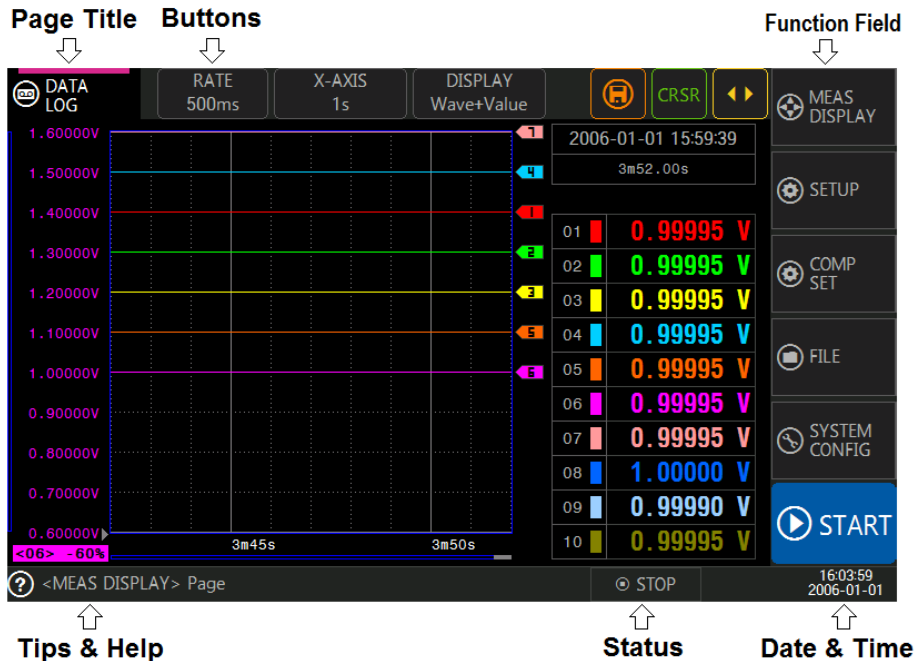


Table 3-2 Rear panel description

No.	Description
1	Test input terminal
2	Power socket (100V-240VAC, 50Hz/60Hz)
3	Fuse holder (3A, 250V SB)
4	HANDLER interface
5	RS-232C interface and RS-485 interface (Optional)
6	LAN interface and USB host interface
7	USB slave interface
8	Reserve expanding input port

### 3.3 Display Layout

Figure 3-3 Display layout



## 3.4 Power up

### 3.4.1 Power on/off

The power switch is tact switch with indicator light.

Press the power key for at least 2 seconds, release the power key after the buzzer beeps, instrument will power up and power switch indicator will be turned on.

After the instrument is powered on, it will load Applent ATOS operating system, and this process will take 10 seconds.

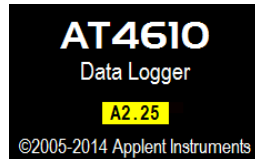
Then ATOS operating system will begin to perform AT4610/AT4710 procedure.



*When instrument is in process of start or instrument's procedure collapse or crash, press power switch or about 4 seconds, then power will be forced to turn off.*

### 3.4.2 Instrument Version

Figure 3-4 Instrument's version



After finish loading ATOS operating system, the screen will display product model for a while and its version.

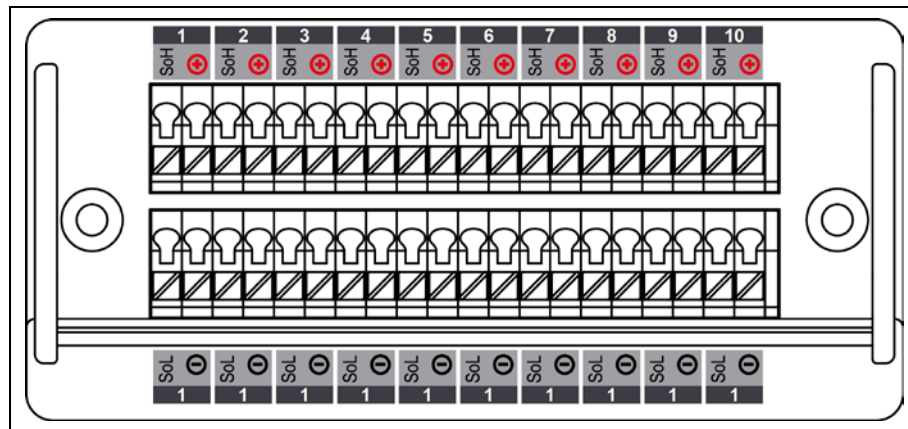
In addition, on <SYSTEM CONFIG> page and <SETUP> page, instrument's version is also available.

You can also check instrument version by remote control's command [idn?]

## 3.5 How to Connect

The input terminal on rear panel:

Figure 3-5 Test input terminal on rear panel



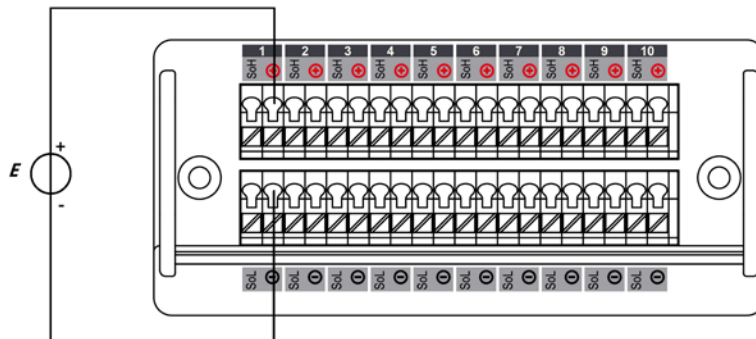
There are 10 groups of input, each input will AUTO configure 2 terminal, 3 terminal or 4 terminal according to input type.

Measuring voltage and thermocouple use 2 terminal, RTD uses 3 terminal or 4 terminal, and resistance use 4 terminal.



### 3.5.1 Connection of Voltage

Figure 3-6 Connection of voltage



Please connect voltage source's positive pole to input terminal's positive pole, connect negative pole to input terminal's negative pole, as per the above figure, otherwise, instrument will display negative value.

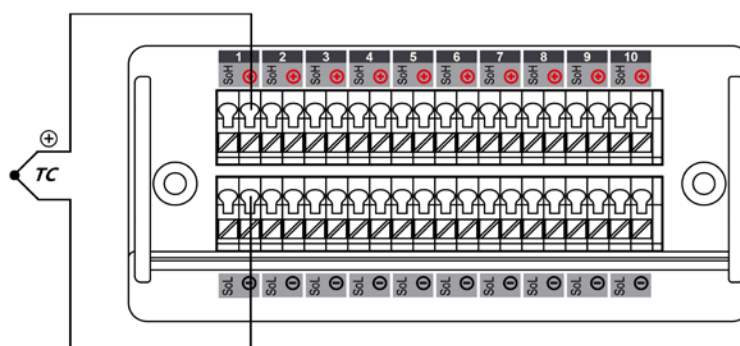


The test terminal is limited to connect to DC voltage, connect to AC voltage will damage instrument.  
Input voltage cannot exceed 120VDC.

### 3.5.2 Connection of Thermocouple

Instrument supports 8 types of thermocouple, connecting method for each type of thermocouple is the same.

Figure 3-7 Connection of thermocouple



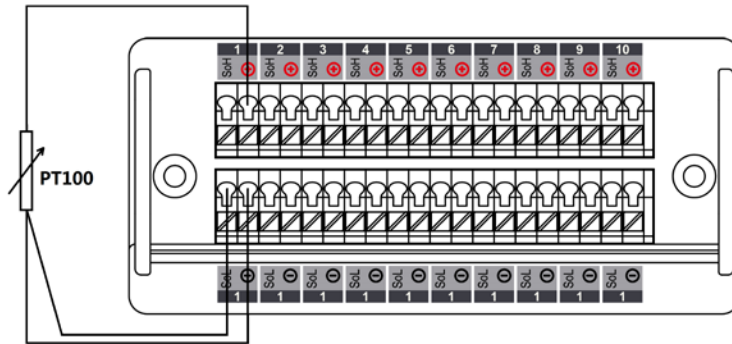
Please plug 2 terminals of thermocouple to positive and negative test terminal, generally speaking, red wires is positive pole, black wire is negative pole.



Instrument allows thermocouple to work with alive test, but ensure that the live voltage does not exceed 300VDC.  
The MAX allowed voltage between input terminals is 300VDC.  
If exceeding the above voltage, the input circuit of instrument will be damaged.

### 3.5.3 Connection of 3-wire RTD

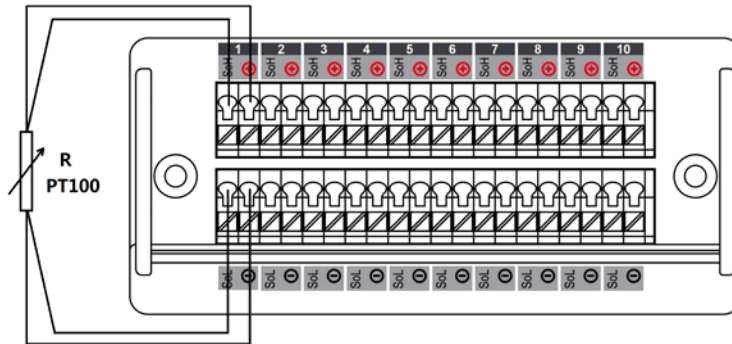
Figure 3-8 Connection of 3-wire RTD



In order to eliminate the effect of lead resistance, RTD usually use 3-wire to connect, please do it as per the above figure.

### 3.5.4 Connection of Resistance and 4-wire RTD

Figure 3-9 Connection of resistance and 4-wire RTD



4 terminal method can efficiently eliminate the error caused by lead resistance. AT4610/AT4710 can only use 4-wire to measure resistance, high precise RTD also use 4-wire method to connect.

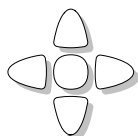



---

The instrument uses 4-wire connecting method to measure resistors.

---

# 4. <SETUP> Page



This chapter describes all channels' setting function

- Channel Color Setup
- Channel Turn on/off
- Input Type Setup
- Measuring Range Setup
- Graph Upper/Lower limit in <DATALOG> Page

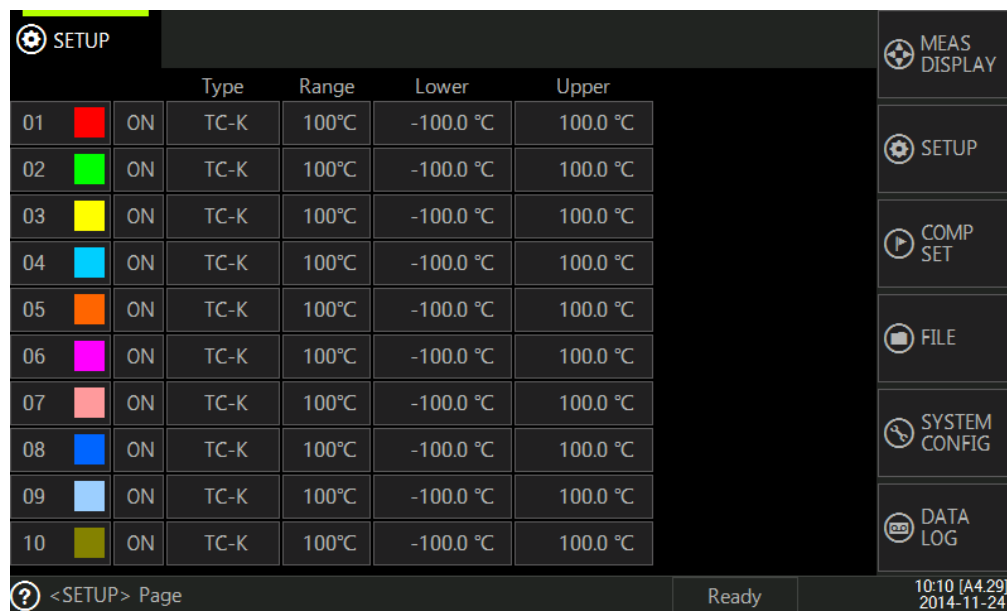
Press [Setup] key or light touch page title, then light touch [SETUP] button in functional field, instrument will enter <SETUP> Page.

All setup that is related to channel and <MEAS DISPLAY> Page and <DATALOG> Page is operated in <SETUP> page.

On <SETUP> Page, the setting includes the following parameters:

- Channel color setup
- Channel turn on/off
- Input type
- Range
- Curve graph lower limit value
- Curve graph upper limit value

Figure 4-1 <SETUP> Page



## 4.1 Channel [Color] Setup

The graph color and measured data color for each channel can be set, there are 21 types of color inside the instrument.

- Steps of setting color:

- Step 1 Enter <SETUP> Page  
 Step 2 Touch screen & click or use cursor to select [Channel Color] button;  
 Step 3 Touch screen function field at right side, click & select color.



*The color for measured data is controlled by [Value Color] in [SYSTEM CONFIG] Page, it is only available when it is set as Graph Color.*

## 4.2 Channel [ON/OFF]

Users can independently turn off each channel, after turning off, all parameters at current channel is set as unavailable.

## 4.3 Input [Type]

Each channel can individually set its input type, due to instrument supports various types of inputs and each input type varies, DC-V and thermocouple (TC-K, TC-J, TC-E, TC-T, TC-N, TC-S, TC-B, TC-W, TC-R) adopt 2 terminal method to test, 3-wire RTD adopts 3 terminal method to test, 4-wire RTD and DC-R adopt 4 terminal method to test, after set input type, please make sure input terminal is correct.

■ Steps of setting input type:

- Step 1 Enter <SETUP> Page  
 Step 2 Touch screen & click or use cursor to select [Type] field;  
 Step 3 Touch screen function key field at right side, click & select Input Type.

Function keys	Function
TC-K	Thermocouple
TC-J	Thermocouple
TC-E	Thermocouple
TC-T	Thermocouple
TC-N	Thermocouple
TC-S	Thermocouple
TC-B	Thermocouple
TC-W	Thermocouple
TC-R	Thermocouple
RTD-3W	3 wire PT100 RTD
RTD-4W	4 wire PT100 RTD
Cu50	Copper RTD
DC-V	DC Voltage (AT4610 only)
DC-R	DC Resistance (AT4610 only)
One key set	Set the rest channel's type the same as this type



*Due to the range and unit of temperature, voltage and resistance is different, the range of these input signal and upper/lower limit value is independently saved in the internal disk, and they don't affect each other.*

## 4.4 [Range] Setting

Table 4-1 Range limit of DC voltage (AT4610)

Range #	Range	Range Limit	Resolution
0	10mV	-10.0000mV~10.0000mV	0.5μV
1	20mV	-20.000mV~20.000mV	1μV
2	100mV	-100.000mV~100.000mV	5μV
3	200mV	-200.00mV~200.00mV	10μV
4	1V	-1.00000V~1.00000V	50μV
5	2V	-2.0000V~2.0000V	100μV
6	10V	-10.0000V~10.0000V	500μV
7	20V	-20.000V~20.000V	1mV
8	100V	-100.00V~100.00V	10mV

Table 4-2 Range limit of K type thermocouple

Range #.	Range	Range Limit	Resolution
0	100°C	-100.00°C~100.00°C	0.01°C
1	500°C	-270.00°C~500.00°C	0.05°C
2	2000°C	-270.0°C~1372.0°C	0.1°C

Table 4-3 Range limit of J type thermocouple

Range #	Range	Range Limit	Resolution
0	100°C	-100.00°C~100.00°C	0.01°C
1	500°C	-210.00°C~500.00°C	0.05°C
2	2000°C	-210.0°C~1200.0°C	0.1°C

Table 4-4 Range limit of E type thermocouple

Range #	Range	Range Limit	Resolution
0	100°C	-100.00°C~100.00°C	0.01°C
1	500°C	-200.00°C~500.00°C	0.05°C
2	2000°C	-200.0°C~1000.0°C	0.1°C

Table 4-5 Range limit of T type thermocouple

Range #	Range	Range Limit	Resolution
0	100°C	-100.00°C~100.00°C	0.01°C
1	500°C	-270.00°C~400.00°C	0.05°C

Table 4-6 Range limit of N type thermocouple

Range #.	Range	Range Limit	Resolution
0	100°C	-100.00°C~100.00 °C	0.01°C
1	500°C	-200.00°C~500.00 °C	0.05°C
2	2000°C	-200.0°C~1300.0 °C	0.1°C

Table 4-7 Range limit of S type thermocouple

Range #	Range	Range Limit	Resolution
0	100°C	0.00°C~100.00°C	0.01°C
1	500°C	0.00°C~500.00°C	0.05°C
2	2000°C	250.0°C~1820.0°C	0.1°C

Table 4-8 Range limit of W type thermocouple

Range #	Range	Range Limit	Resolution
0	100°C	-100.00°C~100.00°C	0.01°C
1	500°C	-270.00°C~500.00°C	0.05°C
2	2000°C	-270.0°C~1000.0°C	0.1°C

Table 4-9 Range limit of R type thermocouple

Range #.	Range	Range Limit	Resolution
0	100°C	-50.00°C~100.00°C	0.01°C
1	500°C	-50.00°C~500.00°C	0.05°C
2	2000°C	-50.0°C~1768.0°C	0.1°C

Table 4-10 Range limit of PT100 (RTD-3W/RTD-4W)

Range #	Range	Range Limit	Resolution
0	100°C	-100.00°C~100.00°C	0.01°C
1	500°C	-270.00°C~500.00°C	0.05°C
2	2000°C	-270.0°C~850.0°C	0.1°C

Table 4-11 Range limit of resistance (AT4610)

Range #	Range	Range Limit	Resolution
0	10Ω	0.0000~12.0000Ω	0.0001Ω
1	20Ω	0.0000~22.0000Ω	0.0001Ω
2	100Ω	0.000~120.000Ω	0.001Ω
3	200Ω	0.000~220.000Ω	0.001Ω

■ Steps of setting range:

- Step 1 Enter <SETUP> Page  
 Step 2 Touch screen & click or use cursor to select [Range] field;  
 Step 3 Touch screen function key field at right side, click & select Range.

Function keys	Function
Range	Refer to the above RANGE TABLE
One key set	Set the rest same type for channel range the same as this range.

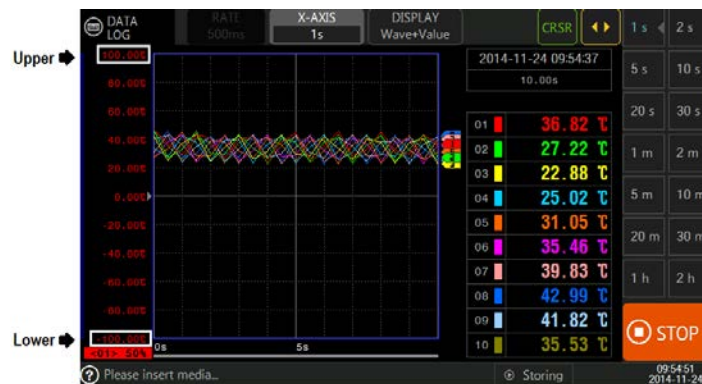
## 4.5 Graph [Lower Limit] [Upper Limit]

In <Data Acquisition> page, graph Y axis is measured value, its upper/lower limit value is bound by [Upper] Limit and [Lower] Limit.

Figure 4-2 Setting lower limit and upper limit in &lt;SETUP&gt; page



Figure 4-3 Upper limit and lower limit in &lt;DATA LOG&gt; page





Due to each channel's Upper/lower limit can be independently set value, so the graph of each channel's corresponding graph scope varies, even if there are 2 coincide graphs, it does not necessarily mean the same data, this only proves that the trend is same.

- Step 1
- Step 2
- Step 3

- Steps of setting Upper/Lower limit:  
 Enter <SETUP> Page  
 Touch screen & click or use cursor to select [Upper/Lower Limit] field;  
 Touch screen function key field at right side, click & select Upper/Lower Limit.

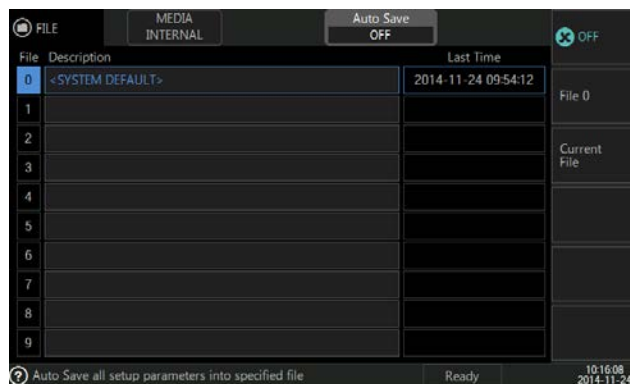
Function Buttons	Function
Input number	Popup input value page to input data. There is no rate unit for temperature and resistance, users can input m (V) for voltage.
By Range	Set Upper/Lower limit value by range limit value. (Refer to the above [RANGE] TABLE)
One key set	Set Upper/Lower limit value for channel of the rest same type and same range the same as this range.

## 4.6 [Auto Save] Setting Value

When power off, the instrument can save the revised data in <SETUP> page into disk automatic, and when users power on next time, the data will be available.

“[Auto Save] function” must be set by [Auto Save] option in [File] page, set [Auto Save] option as [file 0] or [Current File]

Figure 4-1 Auto-Save Setting on File Page

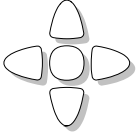


If [Auto Save] is under state of [OFF], then users need to enter <FILE> page and manually save set data into the file.



If the instrument is powered off due to accident power failure, the revised data will not automatically be saved. For more details, please refer to chapter of <FILE> page.

## 5. <SYSTEM CONFIG>Page



This chapter will describe the system configuration of the instrument:

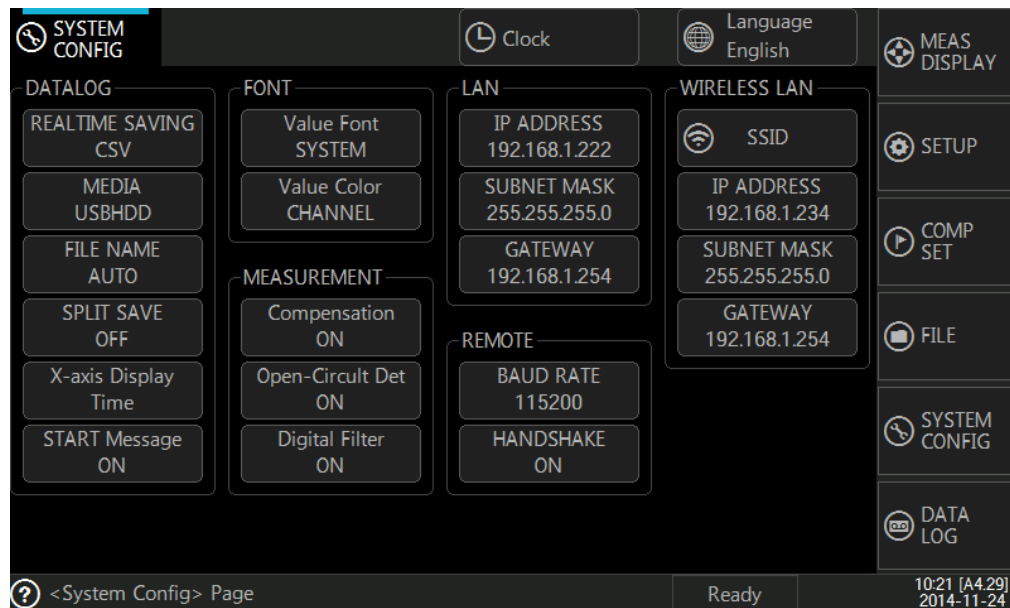
- Configure Data Logging
- Font Configuration
- Measurement Configuration
- Communication Configuration

Light touch page title, then light touch [SYSTEM CONFIG] button in functional field to enter <SYSTEM CONFIG> page.

<SYSTEM CONFIG> page includes the following settings:

- Date/Time Setting
- Language Setting
- Data Logging
- Value Display Font Setting
- Measurement Related Setting
- Local Network Connection
- WIRELESS LAN Connection
- Communication Setting

Figure 5-1 < SYSTEM CONFIG > Page



### 5.1 Date/Time

The Instrument adopts 24 hours format.

Light touch the screen's Clock button, select [Clock] at right side of function key field, then will popup input field:



Figure 5-2 Clock input box



Use touch screen to input date and time.

## 5.2 Change System [Language]

Simplified Chinese and English is available for Instrument.

### ■ Steps of changing language

Step 1

Enter <SYSTEM CONFIG> Page

Step 2

Touch screen or use cursor to select [Language] field;

Step 3

Touch screen function key field at right side, click & select the following items:

Function keys	Function
Chinese	
English	

## 5.3 [DATALOG] Group

All options related to data logging is set in [DATALOG] group, they include:

- File type for [Real-time Saving] – CSV and BIN
- Save to a specified [Media] - USBHDD and SDCARD
- [File Name] – Prefixing to the stored file
- [Split Save] – Store data split into different files according to time quantum.
- [X-axis Display] - Type of time axis display: relative time, absolute date and data buffer pointer.
- [START Message] – Start/Stop prompt dialog box of logging

### 5.3.1 File Type for [Real-time Saving]

Instrument provides 2 types of file saving: CSV format and BIN format.

#### ● CSV file format

CSV (Comma-Separated Values) is a standard full text format, it is widely applied among incompatible program to transfer table data, it is convenient to use Excel to open CSV files in Window operating system, and CSV files are directly converted by Excel format.

Due to it is text format and include many separators, so CSV file takes bigger disk space.

The following is an example of CSV file snippet

Line #	File content
1	"File name", "AUTO0008.CSV", "Rev A"
2	""
3	"Trigger Time", "2006-01-01 14:57:47"

4	"Channel"," 1"," 2"," 3"," 4"," 5"," 6"," 7"," 8"," 9"
5	"Type","TC-K","TC-K","TC-K","TC-K","TC-K","TC-K","TC-K","TC-K","TC-K","TC-K"
6	"Range","100°C","100°C","100°C","100°C","100°C","100°C","100°C","100°C","100°C","100°C"
7	""
8	""
9	""
10	""
11	"Time (s)","°C","°C","°C","°C","°C","°C","°C","°C","°C"
12	0.000000000e+000,+9.69648e+000,+9.65055e+000,+9.64948e+000,+9.70566e+000,+9.65621e+000,+9.68654e+000,+9.65610e+000,+9.64510e+000,+9.66155e+000,+9.68334e+000,
13	1.000000000e+000,+9.61571e+000,+9.61667e+000,+9.67916e+000,+9.62468e+000,+9.61453e+000,+9.66581e+000,+9.63163e+000,+9.60556e+000,+9.64509e+000,+9.63269e+000,

- BIN file format

BIN file adopts binary data and store data to files, data is stored directly without any processing, so users need to use specific program to read.



TIP

When [Real-time Saving] setting is turned off, the whole external storage function will be turned off, users can store data manually into external disk after stop logging.

### 5.3.2 Media

The instrument supports 2 kinds of disk medium: USBHDD (USB disk) and SDCARD (Secure Digital Memory Card).

Users need to select a media before storing data.

### 5.3.3 File Name Prefix

File name that is saved to disk use “file name” + “serial number” format:

**AUTO0008.CSV**

Users must assign a filename prefix.

Touch button on the screen, press [Input] key at right side of function field, it will popup input field:

Figure 5-3 Input filename



Use touch screen to input filename.



Filename can't be empty.

### 5.3.4 Split Files

Longer storage time will lead to single file too large, users can separate large files according to time and save into independent files.

Touch the screen and select preset time interval or select input time interval at right side of function field.

Figure 5-4 Input time interval of split files



Input time (unit: minute).



The larger the time interval, the larger the file, oversize files will take more time to write into external media. Undersize time interval will lead to too frequency for the instrument to accessed disk.

### 5.3.5 X-axis Display

The graph in <DATA LOG> page, X-axis is time axis, Y axis is value axis. X axis can be configured as relative [Time], absolute [Date] and buffer [Data Pointer].

- Relative [Time]

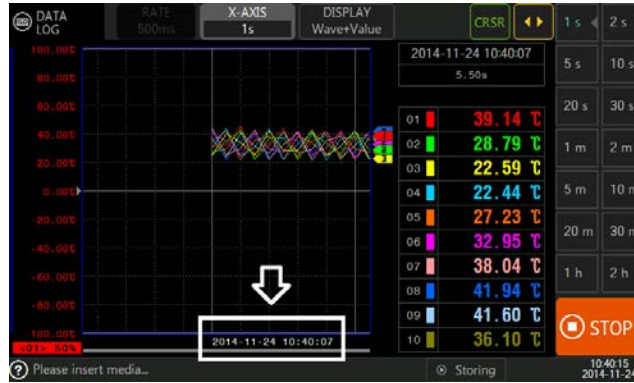
Figure 5-5 Graph of when X axis is time



When begin logging, X axis always begins with 0s.

- Absolute [Date]

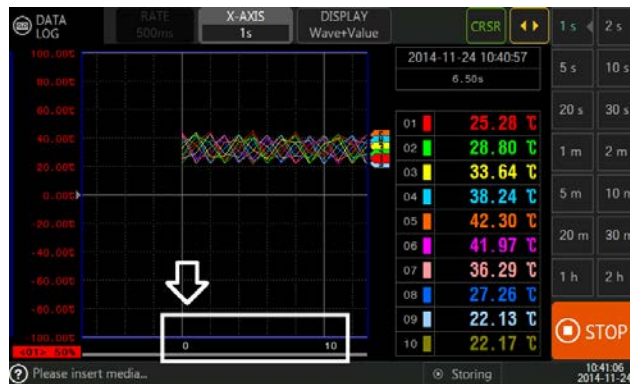
Figure 5-6 Graph of when X axis is date



When begin logging, X axis begins with current system date and time

- [Data Index]

Figure 5-7 Graph of when X axis is data pointer



When begin logging, X axis's display is internal data buffer pointer.

Instrument provides 20,000 thousand data buffer, and assigns 2,000 thousand data buffer for each channel.

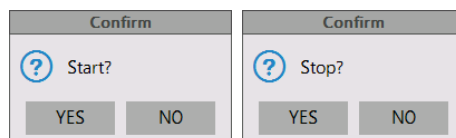
“10” in the above figure represents data buffer's 10<sup>th</sup> data, once X axis's data reaches 2,000,000, buffer will be rewind, and the older data in buffer will be covered.

### 5.3.6 Start Prompt Dialog Box

On <DATA LOG> page, press START and STOP button, screen will pop up the prompt dialog box and inquire whether begin logging or stop logging.

Whether need to popup prompt dialog box is decided by [START Message] option.

Figure 5-8 Start prompt dialog box



### 5.4 [FONT] Group

The font and color of measured data on <DATA LOG> page and <MEAS DISPLAY> page can be changed by [FONT] group.

### 5.4.1 Value Font

The instrument provides 4 types of font for numeric display, they include:

SYSTEM [System Font]	98.87 ℃
SWISS:	98.85 ℃
ENVY:	98.85 ℃
CPM:	98.82 ℃



*Value font only affects measured data's font, other fonts won't be changed.*

### 5.4.2 Value Color

The instrument provides 2 options for selection:

- CHANNEL – value font will be corresponding to each channel's color in <SETUP> page.
- WHITE – value color of each channel is white.

## 5.5 [MEASUREMENT] Group

Options that are related to measurement is set in [MEASUREMENT] group, they include: Cold Junction Compensation, Open-Circuit Detection and Digital Filter.

### 5.5.1 Cold Junction Compensation

Cold junction compensation only specific to thermocouple, other input type is invalid.

- Cold junction and hot junction  
Measuring terminal of thermocouple is hot junction, the terminal that is connected to measuring circuit by leading wire (input terminal) is cold junction.
- About thermocouple cold junction temperature compensation:  
In theory, thermocouple cold junction use 0°C as standard to begin measurement, but when make measurement, instrument is usually under condition of indoor temperature, because test input terminal (cold junction) is not 0°C, it leads to thermos potential difference decrease, which will make measurement incorrect and cause error. In order to minimize error, the indemnifying measure is cold junction temperature compensation.

Instrument built-in cold junction temperature compensation function, users can turn it on or off by [Compensation] field.

### 5.5.2 Open-Circuit Detection

Instrument can sense whether the input terminal is unconnected to thermocouple/RTD/Resistance, whether thermocouple is broken or not, which refers to thermocouple is open circuit.

Turn on [Open-Circuit Det.] function, when check whether the input terminal is unconnected to thermocouple/RTD/Resistance whether thermocouple is bad contact, whether thermocouple is broken or not, numeric display field appear OPEN.

### 5.5.3 Digital Filter

To ensure measurement accuracy rating, instrument adopts digital filter technique. When make

measurement, instrument's FPGA circuit will automatically and continuously measure a period of signal, and after accumulation, averaging to get stable and high precise data. In order to match different test speed, filtering time and integral time varies under each speed.

Digital filter can be turned off to improve test response, but this will cause decline of accuracy.

Once digital filter is turned off, instrument applies fastest integral time to sample once for input signal.

## 5.6 Local Network Connection

Instrument internally installed LAN interface, users can connect instrument to company's local area network, and realize control and data acquisition to other PC.

Before using LAN interface, ensure to allot IP to instrument, and specify gateway of local area network.




---

*Due to the limitation of instrument hardware, instrument is unable to automatically acquire IP and gateway, users must attain them from the administrator.*

*This instrument's TCP/IP port is 4600.*

---

## 5.7 WIRELESS LAN Connection

Instrument's USB interface supports USB WIRELESS LAN connection, if users want to use Wireless LAN, you must purchase Applent USB WLAN card.




---

*Due to the limitation of instrument hardware, it DOES support RT2870 network card, we advise users buying network card from our company to ensure its compatibility.*

*This instrument's TCP/IP port is 4600.*

---

## 5.8 Remote Control Setting

Instrument can use standard RS-232C to communicate with PC or PLC and touch screen equipment.

Before using RS-232C interface, please setup Baud Rate first.

Instrument supports MAX 115200bps Baud rate to fit high speed communication request.

### 5.8.1 RS-232 Baud Rate

Instrument provides 5 kinds of Baud Rate:

9600	low speed equipment, such as PLC.
19200	
38400	
57600	
115200	high speed equipment, such as PC

### 5.8.2 RS-232 Configuration

Other configurations related to RS232 communication, instrument has preset, and they are

unchangeable, these parameters include:

Start bits: 1-bit

Data bits: 8-bit

Stop bits: 1-bit

Verifying mode: none

### 5.8.3 Command Handshake

After command handshake is turned on, and each time receiving command, instrument will return an identification code to the host after finishing process.

For example:

Transmit: DISP: PAGE SETUP

Return: E0

*Table 5-1 Identification code definition return by command handshake*

Identification code	Meaning
E0	Normal communication, no error.
E2	Command error
E3	Parameter error
E4	Invalid parameter
E5	Separator error
E6	Numeric parameter error
E7	Numeric Over length
E8	Invalid command

## 6. <COMPARATOR SET> Page



This chapter will describe comparator setup:

- Turn on/turn off Comparator
- Comparator Upper/Lower limit Setup

Touch the page title, then touch [COMP SET] button in function field to enter <COMPARATOR SET> page.

There are 2 sets of comparator for each channel, each comparator can be set independently.

In <COMPARATOR SET> page, you can set:

- Turn on/off comparator
- Input lower limit and upper limit value of group 1 comparator
- Input lower limit and upper limit value of group 2 comparator



In <COMPARATOR SET> page, type and range cannot be set, please set it in <SETUP> page if users want to change.

Figure 6-1 <COMPARATOR SET> page,

COMPARATOR SET			COMP ON						MEAS DISPLAY
CH	TYPE	RANGE	①	LOWER	UPPER	②	LOWER	UPPER	SETUP
01	TC-K	100°C	ON	0.00 ℃	50.00 ℃	ON	50.00 ℃	100.00 ℃	COMP SET
02	TC-K	100°C	ON	0.00 ℃	50.00 ℃	ON	50.00 ℃	100.00 ℃	FILE
03	TC-K	100°C	ON	0.00 ℃	50.00 ℃	ON	50.00 ℃	100.00 ℃	SYSTEM CONFIG
04	TC-K	100°C	ON	0.00 ℃	50.00 ℃	ON	50.00 ℃	100.00 ℃	DATA LOG
05	TC-K	100°C	ON	0.00 ℃	50.00 ℃	ON	50.00 ℃	100.00 ℃	
06	TC-K	100°C	ON	0.00 ℃	50.00 ℃	ON	50.00 ℃	100.00 ℃	
07	TC-K	100°C	ON	0.00 ℃	50.00 ℃	ON	50.00 ℃	100.00 ℃	
08	TC-K	100°C	ON	0.00 ℃	50.00 ℃	ON	50.00 ℃	100.00 ℃	
09	TC-K	100°C	ON	0.00 ℃	50.00 ℃	ON	50.00 ℃	100.00 ℃	
10	TC-K	100°C	ON	0.00 ℃	50.00 ℃	ON	50.00 ℃	100.00 ℃	

Setup the comparator STOP 11:47:33 2014-11-24

### 6.1 Turn on/off Comparator [COMP]

[COMP] option is main switch, which allows turning on/off comparator function.



## 6.2 Comparator [Upper/Lower] Limit Setting

The comparator for each channel is independently set, and there are 2 groups of independent comparator for instrument's each channel,

■ Steps of changing upper/lower limit

- Step 1 Enter <COMPARATOR SET> page
- Step 2 Touch screen or use cursor to select the field of one channel's [Lower] Limit or [Upper] Limit.
- Step 3 Touch function field at right side, click & select [Input Lower] or [Input Upper], input data in the popup window:



Please don't input lower limit value lower than upper limit value.

- Lower limit ≤ measured value ≤ Upper limit      OK (green indicator 1 2)
- Measured value < Lower limit                      NG (red indicator 1 2)
- Measured value > Upper limit                      NG (red indicator 1 2)

## 6.3 Display Comparative Result

Give an example of how comparator display in <MEAS DISPLAY> page:

Suppose the comparator value of all channels is as below:

- Type: TC-K
- Range: 100° C
- Comparator 1: turn on, range [0.00°C, 50.00°C]
- Comparator 2: turn on, range [50.00°C, 100.00°C]

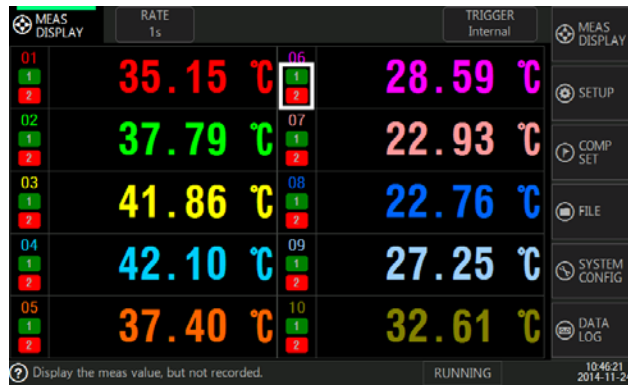
See as follow figure:

Figure 6-2 the data of group 1 in <COMPARATOR SET> page

COMPARATOR SET			COMP OFF				OFF	
CH	TYPE	RANGE	①	LOWER	UPPER	②	LOWER	UPPER
01	TC-K	100°C	ON	0.00 °C	50.00 °C	ON	50.00 °C	100.00 °C
02	TC-K	100°C	ON	0.00 °C	50.00 °C	ON	50.00 °C	100.00 °C
03	TC-K	100°C	ON	0.00 °C	50.00 °C	ON	50.00 °C	100.00 °C
04	TC-K	100°C	ON	0.00 °C	50.00 °C	ON	50.00 °C	100.00 °C
05	TC-K	100°C	ON	0.00 °C	50.00 °C	ON	50.00 °C	100.00 °C
06	TC-K	100°C	ON	0.00 °C	50.00 °C	ON	50.00 °C	100.00 °C
07	TC-K	100°C	ON	0.00 °C	50.00 °C	ON	50.00 °C	100.00 °C
08	TC-K	100°C	ON	0.00 °C	50.00 °C	ON	50.00 °C	100.00 °C
09	TC-K	100°C	ON	0.00 °C	50.00 °C	ON	50.00 °C	100.00 °C
10	TC-K	100°C	ON	0.00 °C	50.00 °C	ON	50.00 °C	100.00 °C

### 6.3.1 Display Comparative Result on <MEAS DISPLAY> page

Figure 6-3 Comparator display in <MEAS DISPLAY> page



Use comparator results

Green: 1 2 stand for OK  
 Red: 1 2 stand for NG

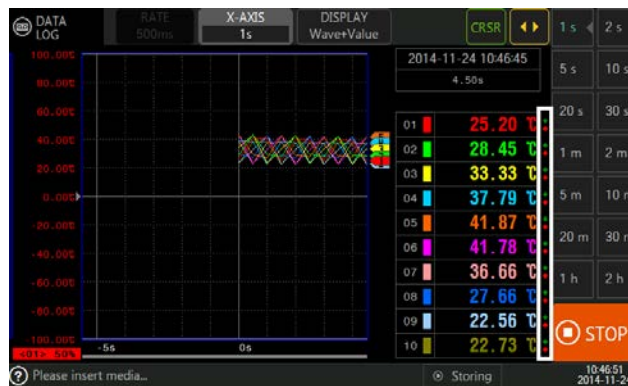
In above figure, the measured value of CH6 is 28.59 °C

The comparator set value of CH1 is: ① [0.00 °C, 50.00 °C] ② [50.00 °C, 100.00 °C]

So comparator displays that comparator 1 is OK 1 (GREEN), comparator 2 is NG 2 (RED).

### 6.3.2 Display Comparative Results on <DATA LOG> Page

Figure 6-4 Comparator display on <DATA LOG> page



Use comparator results

GREEN dots stand for OK

RED dots stand for NG

The measured value of CH1 is 25.20°C, the comparator set value of CH1 is: ① [0.00 °C, 50.00 °C] ② [50.00 °C, 100.00 °C]

So comparator displays that comparator 1 is OK (GREEN dots), comparator 2 is NG (RED dots).

## 7. <File> Page



This chapter will describe instrument's file setup:

- Save Setup into Files
- Read Setup into System from Disk

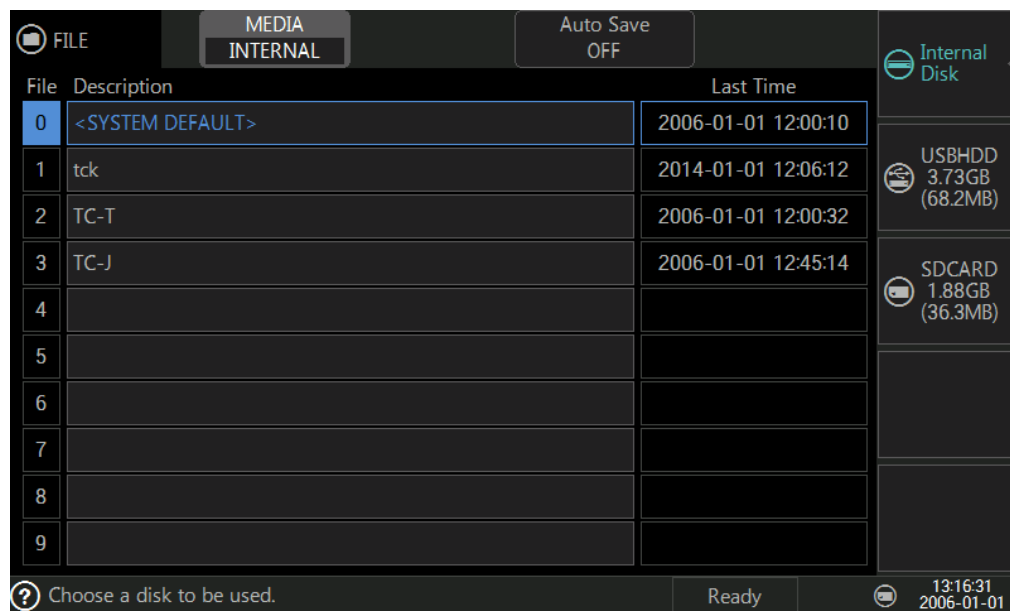
Light touch page title, then light touch [FILE] button at function field to enter <FILE> page.

All parameters in <SETUP> page, <COMPARATOR SET> page and part of <SYSTEM CONFIG> page can be chosen to save and read files in <FILE> page.

On <FILE> page, users can set:

- Select Target Media.
- Save Files into Disk Automatic.
- Manual Save/Load/Delete Files from media.

Figure 7-1 <File> page



### 7.1 Target [Media]

Instrument default adopts internal disk to save setting files.

Provides 3 types of storage media:

Table 7-1 Target disk list

Media	Name	File Number	Remark
INTERNAL	Internal disk	0~9	Default disk
USBHDD	USB disk 1	10~19	Valid when insert USB disk
USBHDD1	USB disk 2	20~29	Valid when insert 2 and more than 2 USB

			disk at the same time
USBHDD2	USB disk 3	30~39	Valid when insert 3 and more than 3 USB disk at the same time
USBHDD2	USB disk 4	40~49	Valid when insert 4 and more than 4 USB disk at the same time
SDCARD	SD card	50~59	Valid when insert SD card

Every time insert disk, [Media] option will list the newer inserted disk automatic.

---

*If external disk is removed, instrument will AUTO switch to internal disk.*

TIP

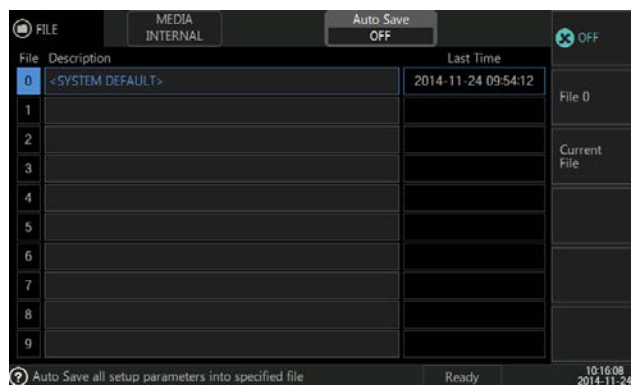
*After disk is inserted, system needs to wait for about 3~10s to enumerate disk, once enumerating finishes, there will be status indicator in status bar at lower right corner.*

---

## 7.2 [Auto Save] Setting

[Auto Save] setting allows save all revised data to an appointed file automatic when instrument is powered off.

Figure 7-1 [Auto Save] Setting on FILE page



2 types of file are available:

- File 0 – file will be AUTO saved into File 0 when power off, and instrument will AUTO load File 0's data when power on next time.
- Current file – file will be AUTO saved into current file when instrument is powered off, and will AUTO load when power on next time.




---

*When instrument is powered off due to accident power failure, [Auto Save] function will be invalid, revised data will be missing.*

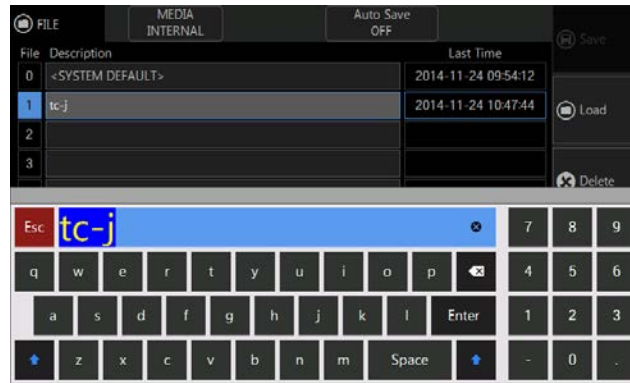
*Because file 0 is often used by system, please do not use this file to save important data.*

---

## 7.3 Saving Files into Internal Disk

### Steps of saving files into internal disk

- Step 1 Enter <FILE> page, and select [Media] as [Internal]
- Step 2 Touch screen & click or use cursor to select file required to save at [Description] field
- Step 3 Click & select [Save], input file description in the popup input window:

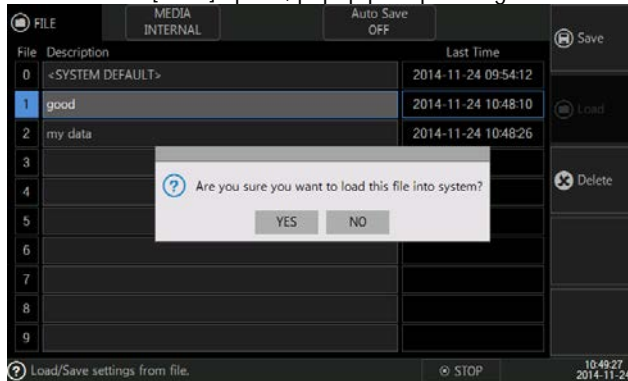


- Step 4 For example: input TC-J  
Press [Enter] keypad, file is saved in file 1, and file 1 is set as current file.

## 7.4 Load File from Internal Disk

### Steps of reading file data from internal disk

- Step 1 Enter <FILE> page, and select [Media] as [Internal]  
Step 2 Touch screen & click or use cursor to select file required to read at [Description] field  
Step 3 Click & select [Load] option, popup prompt dialog box of whether to read or not:

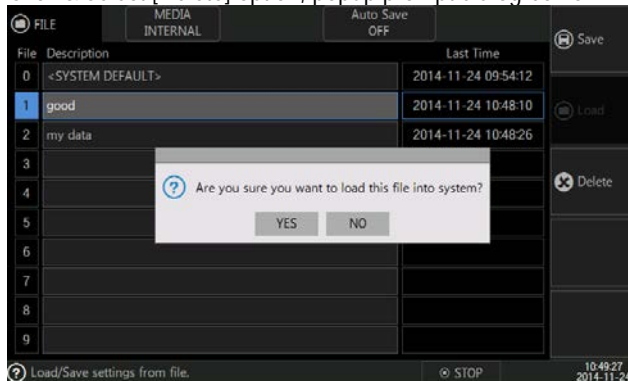


- Step 4 Select [YES], file 1 will be load into system, and will be set as current file.

## 7.5 Delete File

### Steps of deleting file

- Step 1 Enter <FILE> page  
Step 2 Touch screen & click or use cursor to select file required to delete at [Description] field  
Step 3 Click & select [Delete] option, popup prompt dialog box of whether to delete or not:



- Step 4 Select [Yes], file 1 will be deleted.



The file under using cannot be deleted.

## 7.6 Access External Media

In order to make it convenient to transfer data among instruments, users can store files into external disk.

### ■ Steps of saving file into internal disk

- Step 1 Enter <File> page, and select [MEDIA] as [USBHDD#]
- Step 2 Touch screen & click or use cursor to select file required to save at [Description] field.  
For example: file 11
- Step 3 Click & select [Save], input file description in the popup input window.  
For example: input *usb2*
- Step 4 Press [ENTER] key, data will be saved into file 11, and file 11 is set as current file:



- If users remove the under using USBHDD1, disk and file list will AUTO return to internal disk, file 11 is still current file, but, when [Auto Save] option is [current file], instrument will not detect current disk recovery when power off, data will be saved into internal disk file 0, the original data in file 0 will be covered, file 0 will also be set as current file.
- Instrument supports four USBHDD, due to limitation of instrument hardware, system will assign name according to the order of checking disk, for example: the first inserted disk name is [USBHDD] allocated file number is 10~19, then the inserted disk is [USBHDD1] allocated file number is 20~29. After disk is all removed, and insert them again, the order may be changed, and lead to file number allocation malposition, and save file into an incorrect disk, then original data will be covered. So please insert one USBHDD only to avoid writing in incorrectly.



Operating of reading and deleting external disk is the same as that of internal disk, please refer to the previous chapter.

## 8. <MEAS DISPLAY> Page



Meas page includes:

- Related setup of <MEAS DISPLAY> page

### 8.1 <MEAS DISPLAY> Page

Touch the page title, then touch [MEAS DISPLAY] button at function field to enter <MEAS DISPLAY>page.

<MEAS DISPLAY> page is used for real-time monitor measuring results and the data cannot be saved.

Users can set the following functions on this page:

- Sampling Rate
- Trigger - Set Trigger Mode

Figure 8-1 <MEAS DISPLAY> page



### 8.2 Sampling Rate

On <MEAS DISPLAY> page, users can set sampling rate. 5 types of sampling rate is available.

- Select sampling rate  
Enter <MEAS DISPLAY> page

Step 1



Step 2

Touch sampling [Rate] button or use cursor to move to sampling [Rate] button.

Step 3

The following sampling rate will be listed at right side of functional field

Function Button	Function
100ms	It takes 100ms to sample all channels, is equivalent to 10 t/s.
200ms	It takes 200ms to sample all channels, is equivalent to 5 t/s.
500ms	It takes 500ms to sample all channels, is equivalent to 2 t/s.
1s	It takes 1s to sample all channels, is equivalent to 1 t/s, the best accuracy.
2s	It takes 2s to sample all channels, is equivalent to 0.5 t/s, the best accuracy.




---

*Sampling rate on <MEAS DISPLAY> page is independently set and saved, it won't affect sampling rate on <DATA LOG> page.*

---

### 8.3

## Trigger

3 types of trigger are available for instrument: internal, manual and external trigger.

- Internal trigger: instrument will make loop test according to the set sampling rate, current test will cover previous data.
- Manual trigger: instrument is controlled by [Trigger 1 time] button in trigger option, each time instrument make test, current measured data will be saved on instrument display screen.
- External trigger: instrument is controlled by trigger input on Handler, each time handler receives a rising edge signal, and instrument will make one measurement. This function is usually used to connect with PLC and other equipment.

## 9. <DATA LOG> Page



<DATA LOG> page includes the following contents:

- Sampling Rate Setup
- Graph Gridding Setup
- Display Setup
- Start/Stop Data Logging
- Data Browse and Cursor Setup

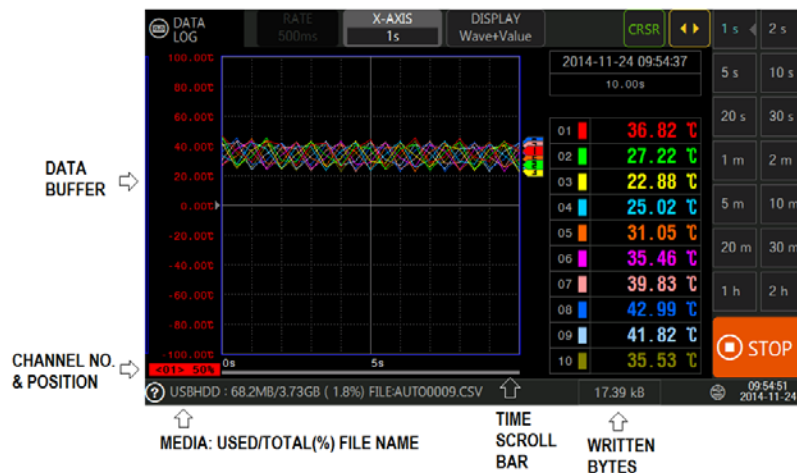
Press [Meas] key, or touch the page title, then touch [DATA LOG] button in function field to enter < DATA LOG > page.

On <DATA LOG> page, sample data can be displayed on screen according to time axis, and can save sample data automatic or manually into USB disk or SD card.

On <DATA LOG> page, the following contents can be set:

- Setting Sampling Rate
- Horizontal Axis Gridding Setting
- Display Setting
- Manual Save
- Cursor Measurement
- Browse Graph

Figure 9-1 <DATA LOG> page



### 9.1 Setting Sampling Rate

Sampling rate is used to control sampling time of instrument's AD converter, this sampling time represents the time that all channels finish testing one circle.

The shorter the sampling time, the faster the speed, the lower the accuracy, the more the data logged.

The longer the sampling time, the fewer the improvement of accuracy and the fewer the data logged.

Usually, when sampling rate is set to 500ms or 1s, can ensure the best accuracy and faster response.

The shorter the sampling time, the faster the buffer inside the instrument will use up, the following list is the logging time of internal RAM buffer (2,000 thousand groups data for each channel) of 10 channels after all is turned on. If exceeding MAX recording time, the previous data will be covered.

Table 9-1 Sampling rate and internal buffer logging time

Sampling Rate	Buffer's MAX Logging Time
10ms	5.56 hours
20ms	11.12 hours
50ms	27.78 hours (1.1 days)
100ms	55.56 hours (2.3 days)
200ms	111.11 hours (4.6 days)
500ms	11.5 days
1s	23 days
2s	46 days
5s	115 days
10s	231 days
20s	1 year 97 days
1m	3 years 293 days



- 20,000 thousand groups data is available for internal buffer, and they are allocated to 10 channels, each channel gets 2,000 thousand group data,
- Internal buffer is high speed RAM, power failure will make data lose.
- When sampling with high speed, accuracy will be low, to reach instrument's technical specifications, users can get this at higher than 1s sampling rate.

Step 1  
Step 2  
Step 3

- Steps of setting sampling rate:  
Enter <DATA LOG> page  
Under state of stopping data logging, touch screen or use cursor to select sampling [Rate] field;  
Touch functional field at right side of screen, click & select sampling rate value.  
19 types of sampling rate is available for instrument:

10 ms	20 ms	50 ms	100 ms	200 ms	500 ms
1 s	2 s	5 s	10 s	20 s	30 s
1 m	2 m	5 m	10 m	20 m	30 m
1h					



- Sampling rate can only be set after data logging stops, it cannot be set during logging.
- Under sampling rate of less than 50ms, due to limitation of storage speed of external disk, instrument will only use binary format to save files to external memory, and will not be decided by the file format of [Real-time Saving] in <SYSTEM CONFIG> page.
- Due to the bottleneck of external disk's speed, users cannot ignore the time of writing external disk in the course of high-speed record, so the graph will nap for a while every time writing into external disk.
- Under sampling rate of less than 100ms, saving data into external disk manually is recommended, don't insert disk during logging.

## 9.2 Horizontal Axis Gridding Setting

The larger the time of gridding setting, the more the sampling site one screen displays, the more obvious the trend.

21 types of horizontal axis gridding setting are available for the instrument:

100ms, 200ms, 500ms,  
1s, 2s, 5s, 10s, 20s, 30s,  
1min, 2min, 5min, 10min, 20min, 30min,  
1h, 2h, 5h, 10h, 12h, 24h

Figure 9-2 Graph of 1s's horizontal axis



Figure 9-3 Graph of 5s's horizontal axis



Horizontal axis gridding can be revised when stops recording or in the course of recording.



*When switching to larger gridding, system will take longer time to recover virgin curve. With increasing of buffer, time of restoring graph will be further increasing, please do not perform any operation when status bar on the bottom reminder [Wait...]:*

① Select the display contents of the waveform area.

Wait...

10:56:01  
2014-11-24

## 9.3 Curve Display

Instrument provides 3 types of display methods:

- Waveform + Value  
Under this display method, waveform adopts 10 gridding display, and value area is compressed to 1 line.
- Value  
Under this display method, value adopts larger area to display, graph is compressed to 5 gridding.

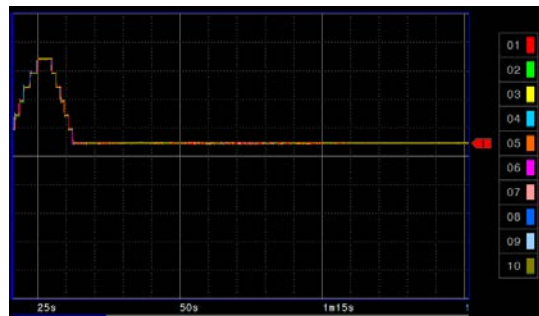
Figure 9-4 Numeric display method



● Waveform

Under this display method, numeric will not display, graph is compressed to 16 gridding.

Figure 9-5 Waveform display method

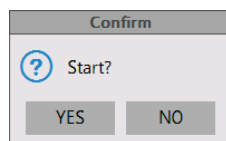


## 9.4 Start Logging Data

Before start logging, please select one sampling rate, sampling rate cannot be changed during logging.

Press [START] button, select [YES] in the popup prompt dialog box, and instrument will start logging.

Figure 9-6 Start prompt dialog box



---

Start prompt dialog box can be turned off, users can set it in [START Message] on <SYSTEM CONFIG> page.

---

## 9.5 Auto-Save Data to External Disk

Instrument adopts internal buffer to record real-time data, and doesn't rely on external disk. Due to limit of internal buffer's capacity, the data that exceed buffer's capacity will be covered by new data, so in order to avoid loss of data, users need to use external disk to save data. Users only need to insert external USBHDD or SDCARD to AUTO save data to external disk. After system detect a valid disk, instrument will AUTO create new file and save data.

### 9.5.1 Rules of File Creating

Creating filename is created on the basis of format of {File name} {Serial number}. {File type} in disk, for example:

AUTO0001.CSV

And,

AUTO is filename, please preset it in <SYSTEM CONFIG> page.

0001 is serial number of filename, system will AUTO detect the last serial number and begin progressive increasing every time creating new file.

CSV is file type, please preset it in <SYSTEM CONFIG> page.

### 9.5.2 File Path

Instrument will keep the acquisition data file in the following disk's path:

<Drive>\Apprent Instruments\AT4610\Data\<date>\<filename><serial number>.{CSV,BIN}

### 9.5.3 Comma-Separated Values File (CSV)

CSV (Comma-Separated Values) is a standard full text format, it is widely applied among incompatible program to transfer table data, it is convenient to use Excel to open CSV files in Window operating system, and CSV files are directly converted by Excel format.

Due to it is text format and includes many separators, so CSV file takes bigger memory space, instrument is unable to be applied to high speed data logging, under sampling rate of <100m, instrument only adopts binary file BIN to store.

Because it is ANSI text format, users can directly check its original file format through any text editor on PC.

#### ■ An example of CSV file snippet

Table 9-2 An example of a CSV file

Line#.	File Content
1	"File name","AUTO0008.CSV","Rev A"
2	""
3	"Trigger Time","2006-01-01 14:57:47"
4	"Channel","1","2","3","4","5","6","7","8","9"
5	"Type","TC-K","TC-K","TC-K","TC-K","TC-K","TC-K","TC-K","TC-K","TC-K","TC-K"
6	"Range","100°C","100°C","100°C","100°C","100°C","100°C","100°C","100°C","100°C","100°C"
7	""
8	""
9	""
10	""
11	"Time (s)","°C","°C","°C","°C","°C","°C","°C","°C","°C"
12	0.000000000e+000,+9.69648e+000,+9.65055e+000,+9.64948e+000,+9.70566e+000,+9.65621e+000,+9.68654e+000,+9.65610e+000,+9.64510e+000,+9.66155e+000,+9.68334e+000,
13	1.000000000e+000,+9.61571e+000,+9.61667e+000,+9.67916e+000,+9.62468e+000,+9.61453e+000,+9.66581e+000,+9.63163e+000,+9.60556e+000,+9.64509e+000,+9.63269e+000,
14	...

#### ■ File specification:

Line 1: is filename and version number

Line 3: starting time (instrument's system time)

Line 4: channel mark

Line 5: type

Line 6: range

Line 11: time and entity unit mark  
 Line 12: sampling data

■ Data format specification:

```
5.000000000e-001, +9.69648e+000, +9.65055e+000, +9.64948e+000, +9.70566e+000, +9.65621e+000 .....
```

Time	CH1	CH2	CH3	CH4	CH5.....
------	-----	-----	-----	-----	----------

All date and data adopt scientific notation.

Reference: *About details about scientific notation, please check:*  
[http://en.wikipedia.org/wiki/Scientific\\_notation](http://en.wikipedia.org/wiki/Scientific_notation)

There, second is entity unit of time.

For example: `5.000000000e-001` stands for  $5 \times 10^{-1}$ s, means 0.5s

Specifications of data entity unit in Line 11 of file, for example: `+9.69648e+000` stands for  $9.69648 \times 10^0$ , means  $9.69648^\circ \text{C}$



*Even though there is much total bit for data, it does not necessarily mean all the bits are valid. Please refer to <Specifications> chapter regarding each range's valid bit.*

*For example: the actual valid bit of `: +9.69648e+000` is 1 bit, means  $9.7^\circ \text{C}$  (about), other bit is for reference only.*

## 9.5.4 Binary File Format (BIN)

Due to there is speed bottleneck for external disk visit, when instrument makes high speed sampling (<50ms), it adopts binary file (BIN) format to store data.

Due to BIN file is housed data format, user-defined compressed format for all data, this file can only be read by Applent's special purpose converse routine, and convert to standard CSV format.

The following is BIN file definition format, (for C/C + programmer's reference only)

■ Structural body of BIN file header (initial address 0):

```
#pragma pack(push)
#pragma pack(1)
typedef struct
{
    BYTE    Ext[4];                // "BIN"      (4 bytes)
    BYTE    Model[12];            // "AT4610"  (12 bytes)
    BYTE    Rev[8];              // A1.0      (8 bytes)
    BYTE    Inc[20];              // Applent Instruments (20 bytes)
    BYTE    sRes[16];            // Reserve   (16 bytes)
    UINT    DataOffset;          // Data head initial address
} TBinFileHeader;
```

■ Structural body for data head:

```
#pragma pack(push)
#pragma pack(1)
typedef struct
{
    CHAR    TriggerTime[20];      // Starting time ASCII (20 bytes)
    UINT    nChannels;           // Channel number
    UINT    nTypeOffset;         // Type partial address
    UINT    nTypeSize;           // Number of bytes that Type occupies
    UINT    nRangeOffset;       // Range initial address
    UINT    nRangeSize;         // Number of bytes that Range occupies
    UINT    nUnitOffset;        // Unit initial address
    UINT    nUnitSize;          // Number of bytes that Unit occupies
}
```

```

    UINT    nDataOffset;          //Data initial address

} TMEMHEADER;

#pragma pack(pop)
    
```

■ Data area  
 Data format for data area is as followings:

<Time><Channel 1>< Channel 2>< Channel 3>< Channel 4>< Channel 5>.....  
 INT64 float  
 8 bytes 4 bytes



Data area can only be processed when using programming language (C/C++/VB etc.)

■ An example of BIN file:

Figure 9-7 An example of a BIN file

Offset	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	
00000000	42	49	4E	20	41	54	34	36	31	30	00	00	00	00	00	41	32	2E	32	35	00	00	00	41	70	70	6C	65	6E	74	20	BIN AT4610 A2.25 Applent	
00000001	49	6E	73	74	72	75	6D	65	6E	74	73	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	40	00	00	00	Instruments 0	
00000040	32	30	30	36	2D	30	31	2D	30	31	20	31	38	3A	32	36	3A	31	37	00	0A	00	00	00	74	00	00	00	32	00	00	00	2006-01-01 18:26:17 t 2
00000060	A6	00	00	00	3C	00	00	00	E2	00	00	00	1E	00	00	00	00	01	00	00	54	43	2D	4B	2C	54	43	2D	4B	2C	54	43	B < B TC-K,TC-K,TC
00000080	2D	4B	2C	54	43	2D	4B	2C	54	43	2D	4B	2C	54	43	2D	4B	2C	54	43	2D	4B	2C	54	43	2D	4B	2C	54	43	2D	4B	-K,TC-K,TC-K,TC-K,TC-K,TC-K,TC-K,TC-K,TC-K,TC-K
000000A0	2C	54	43	2D	4B	00	00	31	30	A1	E6	2C	31	30	30	A1	E6	2C	31	30	30	A1	E6	2C	31	30	30	A1	E6	2C	31	30	,TC-K 10000,10000,10000,10000,1C
000000C0	30	A1	E6	2C	31	30	30	A1	E6	2C	31	30	30	A1	E6	2C	31	30	30	A1	E6	2C	31	30	30	A1	E6	2C	31	30	30	A1	000,10000,10000,10000,10000,1000
000000E0	E6	00	A1	E6	2C	A1	E6	2C	A1	E6	2C	A1	E6	2C	A1	E6	2C	A1	E6	2C	A1	E6	2C	A1	E6	2C	A1	E6	2C	A1	E6	00	0 00,00,00,00,00,00,00,00,00
00000100	00	00	00	00	00	00	00	00	CE	86	BA	C2	F2	00	B8	C2	2A	C1	B3	C2	26	B4	B5	C2	08	8D	B7	C2	38	99	B4	C2	Bt000 00*00000µB ·000 E
00000120	74	78	B5	C2	A8	5A	B9	C2	A8	6A	B7	C2	40	DF	BB	C2	0A	00	00	00	00	00	00	94	15	B6	C2	38	C6	B7	C2	txµB"20B"j·00000 B 0000-E	
00000140	5E	49	B7	C2	9E	7E	B9	C2	02	58	DA	C2	66	62	B4	C2	DA	8A	DA	C2	02	38	BA	C2	1C	12	B7	C2	C6	7A	DA	C2	"1·00"00 X00fb`00000 000 ·00z0E
00000160	14	00	00	00	00	00	00	00	CA	C5	B2	C2	BE	0A	B7	C2	9C	C4	B1	C2	90	C8	BA	C2	92	E1	B9	C2	1A	C1	B4	C2	00000 ·000±0 0000000 B'E
00000180	9C	7E	B7	C2	34	33	BB	C2	26	21	B8	C2	C8	D1	B9	C2	1E	00	00	00	00	00	00	96	44	B5	C2	EA	EA	B6	C2	B"-043000!000000 B0µ0000E	
000001A0	08	F4	AE	C2	3C	19	B8	C2	48	19	BA	C2	36	4E	AE	C2	AE	F7	BA	C2	58	F0	B8	C2	C8	2C	B2	C2	2A	65	B8	C2	000< 00H 00G000±00X0000,00*e0E
000001C0	28	00	00	00	00	00	00	00	0C	05	B0	C2	86	4C	B7	C2	44	97	B4	C2	B4	CF	B7	C2	00	59	BA	C2	52	3B	A8	C2	( "0tL·000'0'0·00Y00R;"E
000001E0	76	F4	B6	C2	0A	40	BA	C2	28	C4	B5	C2	7C	AA	B6	C2	32	00	00	00	00	00	00	1C	63	B0	C2	F6	29	B7	C2	v000 000(0µ0!0002 c"00)·E	
00000200	3E	B3	B8	C2	76	B1	B4	C2	DE	BA	BA	C2	D0	4F	A5	C2	30	EC	B4	C2	02	3F	B8	C2	82	0A	B6	C2	9A	21	B7	C2	>000v "0000000000'0' ?000 000!·E
00000220	3C	00	00	00	00	00	00	00	5E	23	AC	C2	6E	AF	B7	C2	A2	F5	B3	C2	D0	C6	B5	C2	88	A4	B9	C2	88	CD	A9	C2	< ^#00n0·0000000µ0'000'00E
00000240	32	Bf	B6	C2	DA	41	B8	C2	72	0B	B7	C2	04	76	B8	C2	46	00	00	00	00	00	00	36	B6	AD	C2	12	8D	B7	C2	20000000r ·0 v00f G000 ·E	

In the above figure:  
 Area 1: file header  
 Area 2: data head  
 Area 3: data

### 9.6 Manual-Save Data to External Disk

When sampling with high speed (<100ms), AUTO save will make graph display unsmooth, this is because when disk writes in, it occupies some system resources. To avoid this phenomenon, instrument allows manually save data to external disk when stops recording.

Figure 9-8 Manual save to external disk





There is limitation for manual save, because the limit of internal buffer's size, data will lose if it exceeds buffer's data, please refer to Table 9-1 regarding this.

Users need to ensure external disk is ready when saving.  
 To save into USB disk (USBHDD) or SD card (SDCARD), users need to revise [MEDIA] option in <SYSTEM CONFIG> page.

## 9.7 Browse Historical Data

No matter during recording or after recording stops, users can browse historical data.

Figure 9-9 Browse historical data



Use button in functional field to move to a position needed.

As the above figure indicates, horizontal axis gridding is 1s, so every time users move a gridding, it is 1s, 10 gridding is 10s.

In process of recording, there is [Trace] button to real-time trace to current time.

■ Steps of browse historical data:

- Step 1
- Step 2
- Step 3

Enter <DATA LOG> page;  
 Touch screen or use cursor to select [◀▶] field;  
 Touch function key field at right side of screen, click and select the following options:

Function key	function
◀1	Left shift 1 case (time of 1 case = time of 1x horizontal axis gridding)
▶1	Right shift 1 case
◀10	Left shift 10 cases

▶10	Right shift 10 cases
◀100	Left shift 100 cases
▶100	Right shift 100 cases
◀1000	Left shift 1000 cases
▶1000	Right shift 1000 cases
◀◀	Jump to the beginning
▶▶	Jump to the end
Trace	Real-time trace display



*With increasing of time, data size will increase too, browse data will make time of restore graph longer, please do not perform any operation when status bar on the bottom reminder [Wait...].*

*After starting a new test, data buffer will be empty, previous historical data will lose too.*

## 9.8 Cursor Setting

One cursor is available for the instrument, which allows checking the measuring result of current data.

Figure 9-10 Cursor



### ■ Steps of setting cursor:

- Step 1 Enter <DATA LOG> page
- Step 2 Touch screen or use cursor to select [CRSR] field;
- Step 3 Touch function key field at right side of screen, click and select the following options:

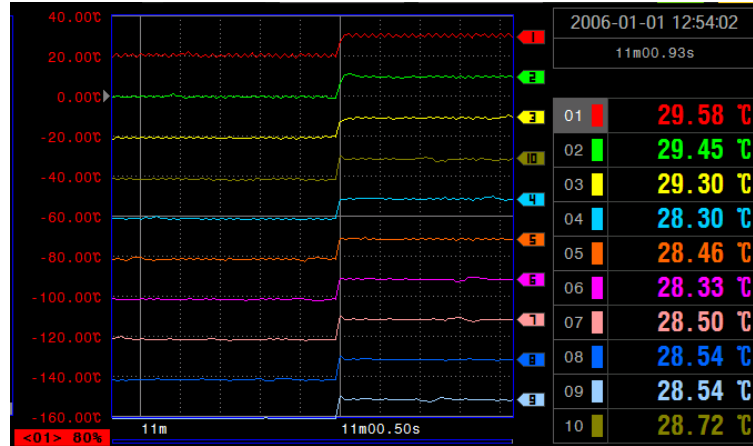
Function key	Function
Jump to cursor position	Under state of trace, skip to preset cursor position
Jump to beginning	
Skip to end	
←1	Left shift 1 buffer's data (time = 1 x sampling rate)
→1	Right shift 1 buffer's data
←10	Left shift 10 buffer's data
→10	Right shift 10 buffer's data
←100	Left shift 100 buffer's data
→100	Right shift 100 buffer's data
Trace	Real-time trace display

## 9.9 Channel Display

Each channel can independently display or hide, users can also change a certain channel's

position.

Figure 9-11 Channel display



In above figure, each channel's position has been changed, for example, CH1's position is at 80%, CH2's position is at 60% and CH3's position is at 40%.



Due to each channel can be independently set, so Y axis's gauge at left side only aims at the current selected channel, once the channel position is changed, users need to strictly distinguish to avoid misleading.

# 10. Remote Control



This chapter includes the following content:

- About RS-232 Interface
- RS-232 Connection
- Select Baud Rate
- Ethernet Interface
- Wireless Ethernet Interface
- Software Protocol

Instrument adopts RS-232 interface (standard configuration)、USB-232 interface (standard external module)、interface、and WLAN interface (optional interface) to communicate with PC. By standard SCPI command, users can program various kinds of fitting acquisition system.

## 10.1 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 10-1 Common RS-232 signal

Signal	Mark	25-core connector Pin No	9-core connector Pin No
Request To Send	RTS	4	7
Clear To Send	CTS	5	8
Data Set Ready	DSR	6	6
Data Carrier Detect	DCD	8	1
Data Terminal Ready	DTR	20	4
Transmit Data	TXD	2	3
Receive Data	RXD	3	2
Ground	GND	7	5
Request To Send	RTS	4	7

In addition, there is MAX subset for RS232, it is convenient to connect 3-wire, and widely used by industrial control, and instrument also adopts this connection method.

Table 10-2 RS-232 Standard minimum subset

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

### 10.1.1 RS232C Connection

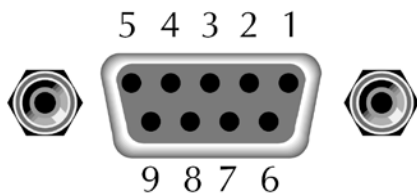
RS-232 serial interface can be connected to serial interface of controller (such as PC or PLC ) by DB-9 cable.



*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 10-1 RS-232 connector on rear panel



*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
  - Baud Rate: MAX 115200bps

## 10.2 USB-232 Interface

Because PC and laptop have eliminated RS232 interface, which makes it difficult for instrument to communicate, so our company provides USB-232 interface.

Because PC is very mature to support RS232, this is very helpful for programmer to program, operating system of Windows7 or above Windows7 can identify our company's USB-232 interface, and AUTO install driver, then programmer can control instrument by virtual RS232 interface.

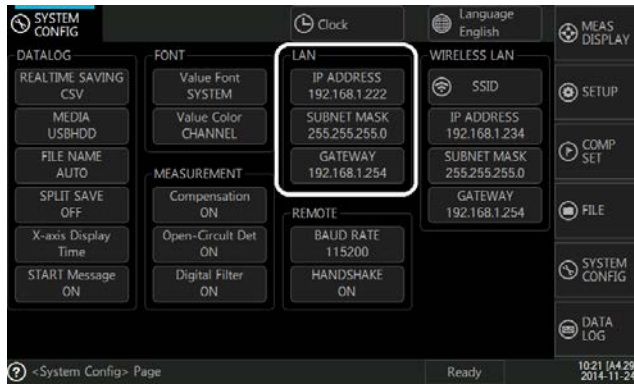
## 10.3 Ethernet Interface

Instrument built-in 10Mbps Ethernet interface, which is used for company's LAN, with LAN, any instrument can be visited by IP address, and exchange data.

Before using LAN, please ensure to allocate IP to instrument, and appoint gateway of LAN.

- Steps of setting local network connection

- Step 1** Use standard 10M reticle to connect instrument to LAN Router, after connection, please ensure indicator light on instrument's RJ-45 instrument interface is lightened and begins glittering.
- Step 2** Enter <SYSTEM CONFIG> page
- Step 3** In [LAN] group, select and input IP address, mask and gateway (Router's IP address)



In above figure,  
 IP address: 192.168.1.222  
 Subnet mask: 255.255.255.0  
 Gateway: 192.168.1.254 (Router's IP address)



TIP

- Due to the limitation of instrument hardware, instrument is unable to automatically acquire IP and gateway, users must attain them from the administrator.
- IP address cannot be the same as the LAN's other equipment, otherwise instrument cannot communicate.
- Usually gateway is Router's IP address.
- This instrument's TCP/IP port is 4600.

## 10.4 WIRELESS LAN Ethernet Interface

Instrument's USB interface supports USB WIRELESS LAN card connection, if users want to use WIRELESS LAN, you need to buy specialized USB WIRELESS LAN card.



TIP

- Due to limitation of instrument hardware, currently it only supports Applent's specialized network card. We advise users buying network card from our company to ensure its compatibility.
- Because WIRELESS LAN card spend plenty of system resources, instrument forbids WIRELESS LAN card's plug and play function. Please ensure to insert WLAN card before power on, and do not pull the card after instrument is started up.
- This instrument's TCP/IP port is 4600.

If users need to use Wireless LAN, you need to insert Wireless LAN card to instrument's any one of USB host interface, and preset IP to instrument, and appoint LAN gateway.

### ■ Steps of setting Wireless LAN connection

**Step 1** Under state of power off, insert RT2870 network card to any one of USB host interface, and then start up instrument.

**Step 2** Enter <SYSTEM CONFIG> page

**Step 3** In [local network connections] group, input IP address, mask and gateway (Router IP address)



In above figure,

## Step 4

IP address: 192.168.1.234  
 Subnet mask: 255.255.255.0  
 Gateway: 192.168.1.254(wireless router's IP address)  
 Touch SSID button in [LAN] group, select an available Wireless LAN at functional field, and input PASSWORD.



- Due to the limitation of instrument hardware, instrument is unable to automatically acquire IP and gateway, users must attain them from the administrator.
- IP address cannot be the same as the LAN's other equipment, otherwise instrument cannot communicate.
- For cryptographic Wireless LAN, users need to attain it from the administrator.

## 10.5 SCPI Language

SCPI-Standard Commands for Programmable Instruments is a common command that Applet 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.



*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.*

## 10.6 Handshake Protocol

Instrument adopts 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.

## 10.7 Handshake Identification Code

Instrument adopts the following error identification code:

Table 10-3 Identification code definition returned by command handshake

Identification code	Meaning	
E0	Normal Communication	No error.
E1	<Reserve>	
E2	Error command	Invalid command, possibly spelling mistake
E3	Error parameter	Parameter spelling mistake
E4	Invalid parameter	Need command of parameter, but parameter is unavailable
E5	Error separator	Invalid separator
E6	Error numeric parameter	
E7	Numeric Over length	

E8	Invalid command	Use command under restriction page or state
E9	Invalid parameter	

Instrument's command handshake is default to be turned off, users need to turn on [Handshake] in <SYSTEM CONFIG> page.



*Command handshake can efficiently inform host of performing state of this command.  
To make sure the reliability of communication, we advise users turning on command handshake.*

**Remark:**

*if host is unable to receive the data returned by instrument, users can try to resolve the problem by the following methods:*

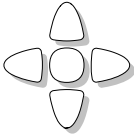
1. *Software handshake is turned off, please refer to <SYSTEM CONFIG> page and turn it on.*
2. *Serial port connection fault, please check cable connection.*
3. *The format of high-level language program communication at computer end is error, please try to check whether serial port number and communication format is correct, and check whether Baud Rate is the same as that of instrument's setting.*
4. *If instrument is parsing the previous command, host will be unable to receive response from instrument, please try later.*

*<If problem still cannot be solved, please contact our technical engineer.>*





# 11. 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, listed in functional subsystem order.

No matter using what kind of connecting method (RS232/USB232/LAN/WLAN), SCPI command is used.

## 11.1 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.

### 11.1.1 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.

### 11.1.2 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 ()
<i>Capital letter</i>	Abbreviated form of command.

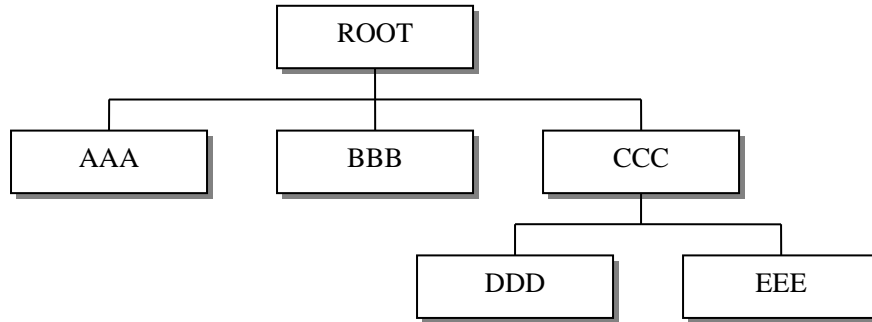
### 11.1.3 Command Structure

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 11-1 Command Tree Example



#### Example

```

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

## 11.2 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]
  
```

### 11.2.1 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.

### 11.2.2 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 11-1 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



*Multiplier is Case Insensitive, its writing style is different from standard name.*

### 11.2.3 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

## 11.3 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 Page
- SETUP Setup SUBSYSTEM
- SYST System SUBSYSTEM
- COMP Comparator SUBSYSTEM
- FILE File SUBSYSTEM
- MEAS Meas Display SUBSYSTEM
- LOG Data Logging SUBSYSTEM

Other command:

- IDN? Query instrument's version
- KEYLOCK keypad lock
- TIME time set
- ERR:SHAK handshake command switch

## 11.4 DISPLAY SUBSYSTEM

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

page reminder bar .

Table 11-2 DISPLAY subsystem tree

DISPlay	:PAGE	{DATA LOG,MEAS,COMP,FILE,SETUP,SYSTEM}
	:LINE	<string>

### 11.4.1 DISPlay:PAGE

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

Command Syntax	<b>DISPlay:PAGE &lt;page name&gt;</b>
Parameter	<page name> includes: <b>DATA LOG</b> <DATA LOG> page <b>MEAS</b> <MEAS DISPLAY> page <b>COMP</b> <COMP SET> page <b>FILE</b> <FILE> page <b>SETUP</b> <SETUP> page <b>SYSTEM</b> <SYSTEM CONFIG> page
Example	SEND> <b>disp:page setup</b> <NL>        //switch to Setup page
Query Syntax	<b>DISP:PAGE?</b>
Query Response	<page name>
Example	SEND> <b>disp:page?</b> <NL> RET> <b>meas</b> <NL>

### 11.4.2 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	<b>DISPlay:LINE &lt;text color&gt;,&lt;background color&gt;,&lt;string&gt;</b>
Parameter	<text color> standard RGB color value <background color> standard RGB color value MAX <string> is 200 characters, and MAX Chinese character is 100, excess portion will be cut off.
Example	SEND> <b>DISP:LINE -1,-1,This is a Comment.</b> <NL>   //Default color display text SEND> <b>DISP:LINE 0xFFFFFF,0x0000FF,This is a Comment.</b> <NL>...//Red box with white character display text
	☐☐ Conversion formula of RGB color, please use the following macro definition to change into color used by instrument in C/C++ file: <pre>#define RGB(r,g,b) ((COLORREF)(((BYTE)(r) ((WORD)((BYTE)(g))&lt;&lt;8) (((DWORD)(BYTE)(b))&lt;&lt;16)))</pre> For example: Red:    0x0000FF Blue:   0x00FF00 Green:  0xFF0000 White:  0xFFFFFFFF Black:  0 System color: -1 <String> character will be typed with original shape in information bar.

## 11.5 SETUP SUBSYSTEM

Table 11-3 SETUP system tree

SETUP:CH? <ch>	Query setup parameter of an appointed channel
SETUP:CH:EN <ch>,{0,1}	Turn on/off current channel
SETUP:CH:TYPE <ch>,<type>	Setting Type of an appointed channel
SETUP:CH:RANGE <ch>,<rangen>	Setting Range of an appointed channel

**SETUP:CH:LIMIT <ch>,<lower>,<upper>***Setting Lower/Upper Limit of an appointed channel***11.5.1 SETUP:CH?**

SETUP:CH? Is used for query set parameter for an appointed channel.

*Query Syntax* **SETUP:CH? <ch>***Parameter* there,

&lt;ch&gt; 1~10 (AT4610/AT4710)

*Return* <Channel NO.>,{0(OFF),1(ON)},<Type>,<Range>,<Lower limit Value>,<Upper Limit Value>*Example* SEND> **SETUP:CH? 1<NL>** //Query setup parameter of CH1  
RET> **01,1,TC-K,100° C,-1.0000e+002,+1.0000e+002****11.5.2 SETUP:CH:EN**

SETUP:CH:EN Is used for turning on/off an appointed channel.

*Command syntax* **SETUP:CH:EN <ch>,{0,1}***Parameter* there,

&lt;ch&gt; 1~10 (AT4610/AT4710)

{0,1} 0 : OFF, 1 : ON

*Example* SEND> **SETUP:CH:EN 1,0<NL>** //turn off display of CH1*Query syntax* Reference 11.5.1 SETUP:CH?**11.5.3 SETUP:CH:TYPE**

SETUP:CH:TYPE Is used for setting current channel type.

*Command syntax* **SETUP:CH:TYPE <ch>,<type>***Parameter* there, <ch> 1~10 (AT4610/AT4710)

&lt;type&gt; types are as followings :

TC-K,TC-J,TC-E,TC-T,TC-N,TC-S,TC-B,TC-R,RTD-3W,RTC-4W,DC-V,DC-R

*Example* SEND> **SETUP:CH:TYPE 1,DC-V<NL>** //setup as DC-V*Query syntax* Reference 11.5.1 SETUP:CH?*On <DATA LOG> page, if logging has been started up, this command is invalid.***11.5.4 SETUP:CH:RANGE**

SETUP:CH:RANGE Is used for setting Range of current channel type.

*Command syntax :* **SETUP:CH:RANGE <ch>,<rangen>***Parameter :* there,

&lt;ch&gt; 1~10 (AT4610/AT4710)

&lt;rangen&gt; please refer to Setup section in &lt;SETUP&gt; page

*Example :* SEND> **SETUP:CH:RANGE 1,1<NL>** //Setup CH1's Range as 1*Query syntax:* Reference 11.5.1 SETUP:CH?*On <DATA LOG> page, if logging has been started up, this command is invalid.***11.5.5 SETUP:CH:LIMIT**

SETUP:CH:LIMIT Is used for setting graph's lower/upper limit on &lt;DATA LOG&gt; page.

*Command syntax* **SETUP:CH:LIMIT <ch>,<lower>,<upper>****SETUP:CH:LIMIT <ch>,range***Parameter* there,

&lt;ch&gt; 1~10 (AT4610/AT4710)

<lower> lower limit value, floating point type  
 <upper> upper limit value, floating point type  
 range The set lower/upper limit range is range limit

*Example* SEND> **SETUP:CH:LIMIT 1, -100,100<NL>** //setup CH1's display range as -100,100  
 SEND> **SETUP:CH:LIMIT 1,range<NL>** // setup CH1's display range as range limit

*Query syntax* Reference 11.5.1 SETUP:CH?

## 11.6 SYSTEM CONFIG SUBSYSTEM

Table 11-1 SYST subsystem tree

SYST:LOG:FEXT	File type setup
SYST:LOG:MEDIA	Disk setup
SYST:LOG:SPLIT	split file's time set
SYST:LOG:FILE	Filename setup
SYST:LOG:XDISP	X axis display type
SYST:LOG:MSG	Start/stop switch of prompt dialog box display
SYST:CJC	Cold junction compensation switch
SYST:OCD	Thermocouple open circuit checking switch
SYST:FILTER	Digital filter switch
SYST:RESULT:FONT	Measuring data display font
SYST:RESULT:COLOR	Measuring data display color configuration

### 11.6.1 SYST:LOG:FEXT

SYST:LOG:FEXT Setup saving file type for data logging

*Command syntax* **SYST:LOG:FEXT {OFF, CSV, BIN}**

*Parameter*

there,  
 OFF: turn off data save function  
 CSV: CSV file format  
 BIN: BIN file format

*Example* SEND> **SYST:LOG:FEXT CSV<NL>** //Setup as CSV format

*Query syntax* **SYST:LOG:FEXT?**

*Query response* {OFF, CSV, BIN}



On <DATALOG> page, if logging has been started up, this command is invalid.

### 11.6.2 SYST:LOG:MEDIA

SYST:LOG:MEDIA Setup saving target disk for data logging

*Command syntax* **SYST:LOG:MEDIA {USBHDD, SDCARD}**

*Parameter*

there,  
 USBHDD: USB disk  
 SDCARD: SD card

*Example* SEND> **SYST:LOG:MEDIA USBHDD<NL>** //Setup as USB disk

*Query syntax* **SYST:LOG:MEDIA?**

*Query response* {USBHDD, SDCARD}



On <DATALOG> page, if logging has been started up, this command is invalid.

### 11.6.3 SYST:LOG:FILE

SYST:LOG:FILE Setup saving filename for data logging

*Command syntax* **SYST:LOG:MEDIA <string>**

*Parameter*

there,

	<string> filename character string (support 8 characters of English or 4 characters Chinese)
Example	SEND> SYST:LOG:FILE My_File_Name<NL>
Query syntax	SYST:LOG:file?
Query response	<string> character string (Chinese/English)
	<ul style="list-style-type: none"> <li>On &lt;DATALOG&gt; page, if logging has been started up, this command is invalid.</li> <li>MAX 8 English characters and 4 Chinese characters are available for filename, the redundant will be deleted.</li> <li>If there is space between front and back of filename, it will be removed, space in the middle of filename is allowed.</li> <li>Filename will change English characters into capital letters.</li> <li>Filename cannot include special character : \ / : * ? " &lt; &gt;   , otherwise, this command will terminate and return error code.</li> </ul>



#### 11.6.4 SYST:LOG:SPLIT

	SYST:LOG:SPLIT Setup split saving time during data logging
Command syntax	SYST:LOG:SPLIT {<minutes>,OFF}
Parameter	there, <minutes>: time interval of split file, entity unit is minute ; 0/OFF: turn off split file function.
Example	SEND> SYST:LOG:SPLIT 60<NL> //setup split file every 60 minutes.
Query syntax	SYST:LOG:SPLIT?
Query response	{<minutes>,0} there, 0 means OFF.
	On <DATALOG> page, if logging has been started up, this command is invalid.



#### 11.6.5 SYST:LOG:XDISP

	SYST:LOG:XDISP Setup graph axis display type on LOG page.
Command syntax	SYST:LOG:XDISP {TIME,DATE,INDEX}
Parameter	there, TIME: axis type is relative time DATE: axis type is absolute time INDEX: axis type is buffer pointer
Example	SEND> SYST:LOG:XDISP TIME<NL> // setup axis type as relative time
Query syntax	SYST:LOG:XDISP?
Query response	{TIME,DATE,INDEX}
	On <DATALOG> page, if logging has been started up, this command is invalid.



#### 11.6.6 SYST:LOG:MSG

	SYST:LOG:MSG Start up and shut prompt dialog box switch during data logging.
Query syntax	SYST:LOG:MSG {OFF,ON,0,1}
Parameter	there, OFF/0: unavailable prompt dialog box ON/1 : use prompt dialog box
Example	SEND> SYST:LOG:MSG ON<NL> // use prompt dialog box
Query syntax	SYST:LOG:MSG?
Query response	{ON,OFF}

**11.6.7 SYST:CJC**

SYST:CJC Cold junction compensation switch.

Command syntax **SYST:CJC {ON,OFF,0,1}**

Query syntax **SYST:CJC?**

Query response {ON,OFF}



On <DATALOG> page, if logging has been started up, this command is invalid.

**11.6.8 SYST:OCD**

SYST:OCD Thermocouple open circuit checking switch.

Command syntax **SYST:OCD {ON,OFF,0,1}**

Query syntax **SYST:OCD?**

Query response {ON,OFF}



On <DATALOG> page, if logging has been started up, this command is invalid.

**11.6.9 SYST:FILTER**

SYST:FILTER Digital filter switch.

Command syntax **SYST:FILTER {ON,OFF,0,1}**

Query syntax **SYST:FILTER?**

Query response {ON,OFF}



On <DATALOG> page, if logging has been started up, this command is invalid.

**11.6.10 SYST:RESULT:FONT**

SYST:RESULT:FONT Select font for measuring value display on <DATALOG> page and <MEAS DISPLAY> page.

Command syntax **SYST:RESULT:FONT {SYSTEM,SWISS,ENVY,CPM}**

Query syntax **SYST:RESULT:FONT?**

Query response {SYSTEM,SWISS,ENVY,CPM}

**11.6.11 SYST:RESULT:COLOR**

SYST:RESULT:COLOR Configure color for measuring value display on <DATALOG> page and <MEAS DISPLAY> page.

Command syntax **SYST:RESULT:COLOR {CHANNEL,WHITE}**

Parameter

there,

CHANNEL: and channel set color in <SETUP> page

WHITE: white color

Query syntax **SYST:RESULT:COLOR?**

Query response {CHANNEL,WHITE}

**11.7 COMPARATOR SET SUBSYSTEM**

Table 11-4 COMPARATOR subsystem tree

COMP:EN	Comparator main switch
COMP:CH:EN	Comparator switch of an appointed channel
COMP:CH	COMPARATOR SET of an appointed channel



**11.7.1 COMP:EN**

COMP:EN Main switch for comparator

*Command syntax* **COMP:EN {ON,OFF,1,0}**

*Query syntax* **COMP:EN?**

*Query response* {ON,OFF}

**11.7.2 COMP:CH:EN**

COMP:CH:EN Switch for channel comparator.

*Command syntax* **COMP:CH:EN {<ch>,ALL},{1,2},{ON,OFF,0,1}**

*Parameter*

there,

{<ch>,ALL}: channel NO.1~10 (AT4610/AT4710) or all channels

{1,2}: comparator NO., only be 1 or 2 ;

{ON,OFF,0,1}: switch

*Example* SEND> **COMP:CH:EN 1,1,ON<NL>** //turn on switch for CH1's Comparator 1

SEND> **COMP:CH:EN ALL,2,ON<NL>** // turn on switch for all channels' Comparator 2

*Query syntax* **COMP:CH:EN? <ch>**

*Query response* <COMP 1 {0,1}>,<COMP 2 {0,1}>

*Example*

SEND> **COMP:CH:EN? 1<NL>**

RET> 0,1<NL> //Comparator 1 is turned off, Comparator 2 is turned on

**11.7.3 COMP:CH**

COMP:CH Setup comparator's upper/lower limit for an appointed channel

*Command syntax* **COMP:CH <ch>,{1,2},<float(lower limit)>,<float(upper limit)>**

*Parameter*

there,

<ch>: channel NO.1~10 (AT4610/AT4710)

{1,2}: comparator NO., only be 1 or 2 ;

<float(lower limit)>: lower limit floating number (fixed point, scientific notation or multiplying data)

<float(upper limit)>: upper limit floating number (fixed point, scientific notation or multiplying data)

*Example* SEND> **COMP:CH 1,1,0,100<NL>** //CH1's Comparator 1 lower limit=0, upper limit=100

SEND> **COMP:CH 1,2,100.00,200.00<NL>**// CH1's Comparator 2 lower limit=100, upper limit=200

*Query syntax* **COMP:CH? 1**

*Query response* <ch>,<Lower Limit of Comparator 1>, <Upper Limit of Comparator 1>, < Lower Limit of Comparator 2>,<Upper Limit of Comparator 2>

there,

<ch>: channel NO. 1~10 (AT4610/AT4710)

Data use scientific notation

*Example* SEND> **COMP:CH? 1<NL>**

RET> 01,+0.0000E+000,+1.0000E+002,1.0000E+002,2.0000E+002

**11.8 FILE SUBSYSTEM**

Table 11-5 FILE Subsystem tree

FILE:SAVE	Save set parameter to current using file
FILE?	Query current using file number

## 11.8.1 FILE:SAVE

FILE:SAVE Command all set parameter to save into current using file, if current file is invalid, it will be saved into file0.

**Command syntax** FILE:SAVE( <string>)

**Parameter** there, <string> File description is selectable, file description character allows MAX 30 English characters, 15 Chinese characters.

**Example** SEND> FILE:SAVE Tom Save<NL> //save to current file, update file description as Tom Save  
SEND> FILE:SAVE // save to current file

The file description will add [REMOTE] character at the end of description.



For example:

Tom Save [REMOTE]

## 11.8.2 FILE?

FILE? Is used for query current filename used by system.

**Query syntax** FILE?

**Query response** <file number>

**Example** SEND> FILE?<NL>

RET> 0<NL> //current file is saved in file 0



On <DATALOG> page, if logging has been started up, this command is invalid.

## 11.9 MEAS SUBSYSTEM

Table 11-6 MEAS subsystem tree

MEAS:RATE	measuring speed setup
MEAS:FETCH?	Acquire measuring data
MEAS:FETC?	

### 11.9.1 MEAS:RATE

MEAS:RATE Can set speed in <MEAS DISPLAY> page.

**Command syntax** MEAS:RATE {100ms, 200ms, 500ms, 1s, 2s}

**Example** SEND> MEAS:RATE 500ms<NL> //change measuring speed as 500ms

**Query syntax** MEAS:RATE?

**Query response** { 100ms,200ms,500ms,1s,2s }

**Example** SEND> MEAS:RATE?<NL>

RET> 1s



MEAS:RATE is only available in <MEAS DISPLAY> page.

### 11.9.2 MEAS:FETCH?

MEAS:FETCH? Is used for acquiring measuring data, and return all channels' data at a time.

**Query syntax** MEAS:FETCH? or MEAS:FETC?

**Query response** <float(ch1)>,<float(ch2)>,<float(ch3)>,<float(ch4)>,<float(ch5)>,  
<float(ch6)>,<float(ch7)>,<float(ch8)>,<float(ch9)>,<float(ch10)>

there,

1.00000E+020 means current channel is turned off.

**Example** SEND> MEAS:FETC?<NL>

RET>

1.00000E+020, 9.39032E+000, 9.37317E+000, 9.36991E+000, 9.36044E+000, 9.32721E+000, 9.32594E+000, 9.37496E+000, 9.34793E+000, 9.34361E+000<NL>



//CH1 is turned off

- This command is only valid in <MEAS DISPLAY> page.
- Every time the command acquires all channels' data, returning data 1E20 means current channel is turned off.

## 11.10 LOG SUBSYSTEM

Table 11-7 LOG subsystem tree

LOG:STATE	Start/stop LOG function
LOG:RATE	LOG speed setup
LOG:DIV	LOG horizontal axis gridding setup
LOG:DISP	LOG display setup
LOG:FETCH? LOG:FETC?	LOG data acquisition

### 11.10.1 LOG:STATE

LOG:STATE Can remote start/stop LOG function

Command syntax **LOG:STATE {ON,OFF,1,0}**

Parameter there,  
{ON,1} start LOG  
{OFF,0} stop LOG

Example SEND> **LOG:STATE 1<NL>** //start logging  
SEND> **LOG:STATE 0<NL>** //stop logging

Query syntax **LOG:STATE?**

Query response {0,1}  
0: stopped 1: logging



This command is only valid in <DATALOG> page.

### 11.10.2 LOG:RATE

LOG:RATE Can set LOG speed.

Command syntax **LOG:RATE {10ms, 20ms, 50ms, 100ms, 200ms, 500ms, 1s, 2s, 5s, 10s, 20s, 30s, 1min, 2min, 5min, 10min, 20min, 30min, 1h}**

Example SEND> **LOG:RATE 500ms<NL>**

Query syntax **LOG:RATE?**

Query response {10ms, 20ms, 50ms, 100ms, 200ms, 500ms, 1s, 2s, 5s, 10s, 20s, 30s, 1min, 2min, 5min, 10min, 20min, 30min, 1h}



- This command is only valid in <DATALOG> page.
- This command is valid only after LOG function is turned off.

### 11.10.3 LOG:DIV

LOG:DIV Setup horizontal axis gridding for LOG

Command syntax **LOG:DIV {100ms, 200ms, 500ms, 1s, 2s, 5s, 10s, 20s, 30s, 1min, 2min, 5min, 10min, 20min, 30min, 1h, 2h, 5h, 10h, 12h, 24h}**

Example SEND> **LOG:DIV 5s<NL>**

Query syntax **LOG:DIV?**

Query response {100ms, 200ms, 500ms, 1s, 2s, 5s, 10s, 20s, 30s, 1min, 2min, 5min, 10min, 20min, 30min, 1h, 2h, 5h, 10h, 12h, 24h}




- This command is only valid in <DATALOG> page.
- The sent parameter can not be less than or equal to sampling rate, otherwise, it will return error code E3.
- This command needs to restore graph, and it takes longer time, please process next command after receiving identification code.

### 11.10.4 LOG:DISP

LOG:DISP Is used for switching to LOG display.

Command syntax	<b>LOG:DISP {WAVE+VALUE, WAVE, VALUE}</b>
Parameter	there, WAVE+VALUE      combine display of graph and value WAVE              only display graph VALUE             display that highlight value
Example	SEND> LOG:DISP WAVE<NL>
Query syntax	<b>LOG:DISP?</b>
Query response	{WAVE+VALUE, WAVE, VALUE}




- This command is only valid in <DATALOG> page.
- This command needs to restore graph, and it takes longer time, please process next command after receiving identification code.

### 11.10.5 LOG:FETCH?

LOG:FETCH? Is used for acquiring logging data, return data according to an appointed buffer.

Query syntax	<b>LOG:FETCH? &lt;start data pointer&gt;, &lt;data total line number&gt; or LOG:FETC? &lt;start data pointer&gt;, &lt;data total line number&gt;</b>
Parameter	there, <Start data pointer>: data pointer is corresponding to data buffer's serial number, after begin logging, it will be writing in data from buffer 0, data pointer=0. Under 1s sampling rate, one buffer corresponds to 1s; under 500ms sampling rate, one buffer corresponds to 500ms, means 1s consist of two buffers. The calculation formula of buffer pointer corresponding to relative time is as following: $\text{Data pointer (integer)} = \text{time (s)} / \text{sampling rate(s)}$ Example : when sampling rate is 500ms, request data pointer at 10s : $10s\text{'s data pointer} = 10s / 0.5s = 20$ Example : when sampling rate is 5s, request data pointer at 2s : $2s\text{'s data pointer} = 2s / 5s = 0$
Query response	#<total line number>,\$<time>,<CH data>.....< CH10 data>,\$<next time>,< CH1 data>..... There, # start character Valid line number returned by <total line number>, if appointed line number exceeds actual buffer number, it will return actual line number. \$ data start character <Time> is current relative time, marked by scientific notation. <Channel Data> marked by scientific notation. 1E9 means overflow, 1E10 means open circuit.
Example	SEND> LOG:FETC? 0,2<NL>      //begin acquire 2 groups' data from buffer 0. RET> ##2,\$0.00000000e+000,+1.00000e+010,+1.00000e+010,+1.00000e+010,+1.00000e+010,+1.00000e+010,+1.00000e+010,+1.00000e+010,+1.00000e+010,+1.00000e+010, \$5.00000000e-001,+1.00000e+010,+1.00000e+010,+1.00000e+010,+1.00000e+010,+1.00000e+010,+1.00000e+010,+1.00000e+010,+1.00000e+010,+1.00000e+010,+1.00000e+010, \$1.00000000e+010,+1.00000e+010,+1.00000e+010,+1.00000e+010,<NL> SEND> LOG:FETC? 2,2<NL>      // begin acquire 2 groups' data from buffer 2. RET> ##2,\$1.00000000e+000,+9.38435e-002,+1.46542e-002,-5.36098e-002,-1.56517e-002,+7.65038e-003,-4.01554e-002,+1.81522e-002,+4.81033e-003,+9.83810e-003,+6.16875e-002,\$1.50000000e+000,+2.13394e-002,+4.80328e-002,+2.39658e-002,+5.41573e-002,+3.24955e-002,+5.61237e-002,+1.04027e-002,+4.57363e-002,+2.02484e-002,+1.57623e-002,<NL>



- This command is only valid in <DATALOG> page.
- Due to there are 2,000,000 group data for instrument's buffer, the data that exceeds buffer will rewind to buffer start, the earliest data will be covered. If buffer has rewind, start data pointer will point to previous position, and it will return E9 (invalid parameter).
- If the appointed data pointer > current pointer, it will return E9 (invalid parameter).
- Every time command acquires all channels' data, if returns data 1E9, this means overflow, 1E10 means

*thermocouple open circuit.*

- *Due to transmission time takes system resources, this will be more obvious when transmitting mass of data, so total line number for data transmission is restricted within 100 lines. Furthermore, during logging and under <100ms sampling rate, real-time data transmission will seriously affect the efficiency of data logging, and lead to display stop. So during high speed sampling, please do not perform any operation, or do data transmission after stop logging.*

### 11.11 IDN?

IDN? is used for query instrument information, in the meantime, this command is used to check whether communication of instrument is normal or not.

Query syntax	<b>IDN?</b>
Query response	<Model>,<Version>,<Serial Number>,<Company Name>
Example	SEND> IDN?<NL> RET> AT4610,A1.00,0000000,Applent Instruments

### 11.12 KEYLOCK Command

KEYLOCK Lock/unlock instrument's keyboard and touch screen.

Command syntax	<b>KEYLOCK {ON,OFF,0,1}</b>
Parameter	there, ON,1: lock the keyboard and touch screen. OFF,0: Unlock.



*After instrument is reboot, key lock will be unlocked.*

### 11.13 Setting System TIME

TIME is used for setup or query system time.

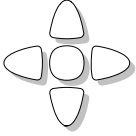
Command syntax	<b>TIME &lt;YYYY&gt;,&lt;MM&gt;,&lt;DD&gt;,&lt;HH&gt;,&lt;mm&gt;</b>
Parameter	there, <YYYY>: year, 2010~2099 <MM>: month, 1~12 <DD>: date, 1~31 <HH>: hour, 0~24 <mm>: minute, 0~59
Example	SEND> TIME 2014,2,1,12,10<NL> //1 <sup>st</sup> , Feb, 2014 12:10
Query syntax	<b>TIME?</b>
Query response	<YYYY>-<MM>-<DD> <HH>:<mm>:<ss> there <ss> is second
Example	SEND> TIME?<NL> RET> 2014-02-01 12:10:30

### 11.14 ERR: SHAKE Command

ERR:SHAK Turn on/off HANDSHAKE command.

Command syntax	<b>ERR:SHAK {ON,OFF,0,1}</b>
Parameter	there, ON, 1: Turn on HANDSHAKE command. OFF,0: Turn off HANDSHAKE command.

# 12. Specifications and Calibration



This chapter describes:

- Technical Specifications
- General Specifications
- Dimensions

This chapter provides instrument's technical specifications, and provides calibration basis for third-party detection institution.

## 12.1 Calibration Environment

Calibrate under the following conditions:

### 12.1.1 Test Environment

Temperature:  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$   
 Humidity:  $\leq 65\%$  R.H.  
 Warm-up Time:  $> 30$  minutes

### 12.1.2 Instrument Conditions

Calibrate on <MEAS DISPLAY> page  
 Sampling rate: 1s  
 Trigger mode: Internal trigger  
 Set the following parameters on <SYSTEM CONFIG> page:  
 Open circuit det.: OFF  
 Compensation: ON  
 Digital filter: ON

## 12.2 Technical Specifications

### 12.2.1 DC Voltage

Figure 12-1 Connection of voltage

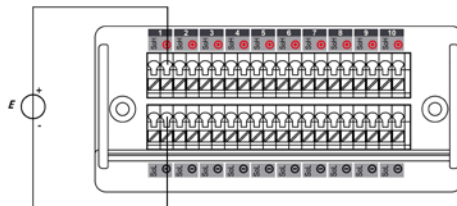


Table 12-1 DC voltage specifications

Range NO.	Range(f.s.)	MAX Resolution	Measurement Range	Measurement Accuracy
0	10 mV	500 nV	-10 mV ~ 10 mV	$\pm 10 \mu\text{V}$
	20 mV	1 $\mu\text{V}$	-20 mV ~ 20 mV	
1	100 mV	5 $\mu\text{V}$	-100 mV ~ 100 mV	$\pm 100 \mu\text{V}$
	200 mV	10 $\mu\text{V}$	-200 mV ~ 200 mV	
2	1 V	50 $\mu\text{V}$	-1 V ~ 1 V	$\pm 1 \text{ mV}$
	2 v	100 $\mu\text{V}$	-2 v ~ 2 V	
3	10 V	500 $\mu\text{V}$	-10 V ~ 10 V	$\pm 10 \text{ mV}$
	20 V	1 mV	-20 V ~ 20 V	
4	100 V	5 mV	-100 V ~ 100 V	$\pm 100 \text{ mV}$

## 12.2.2 DC Resistance

4-wire connecting method is used for DC resistance measurement:

Figure 12-2 Connection of resistance

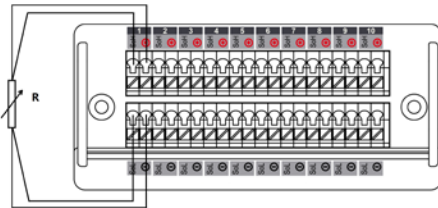


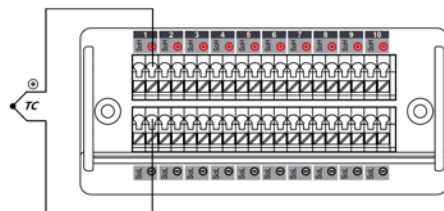
Table 12-2 DC resistance specifications

Range NO.	Range(f.s.)	MAX Resolution	Measurement Range	Measurement Accuracy
0	10 $\Omega$	0.5 m $\Omega$	0 ~ 10 $\Omega$	$\pm 10 \text{ m}\Omega$
	20 $\Omega$	1 m $\Omega$	0 ~ 20 $\Omega$	
1	100 $\Omega$	5 m $\Omega$	0 ~ 100 $\Omega$	$\pm 100 \text{ m}\Omega$
	200 $\Omega$	10 m $\Omega$	-200 mV ~ 200 mV	

## 12.3 Temperature

### 12.3.1 Thermocouple

Figure 12-3 Connection of thermocouple



- The following accuracy excludes accuracy for cold junction compensation, the accuracy for actual demand additional cold junction temperature sensor is  $\pm 0.5^\circ\text{C}$ .
- Open circuit checking function will affect accuracy rating a little, please turn off this function before calibration.

■ TC-K

Table 12-3 Specifications for thermocouple TC-K

Range(f.s.)	MAX Resolution	Measurement Range	Accuracy
100 °C	0.01 °C	-100.00 ~ 0 °C	±0.8 °C
		0 ~ 100 °C	±0.6 °C
500 °C	0.05 °C	-270.00 ~ -100.00 °C	±1.5 °C
		-100 ~ 0 °C	±0.8 °C
		0 ~ 500 °C	±0.6 °C
2000 °C	0.1 °C	-270.0 ~ -100 °C	±1.5 °C
		-100 ~ 1300 °C	±0.8 °C

■ TC-J

Table 12-4 Specifications for thermocouple TC-J

Range(f.s.)	MAX Resolution	Measurement Range	Accuracy
100 °C	0.01 °C	-100.00 ~ 0 °C	±0.8 °C
		0 ~ 100 °C	±0.6 °C
500 °C	0.05 °C	-210.00 ~ -100.00 °C	±1.0 °C
		-100 ~ 0 °C	±0.8 °C
		0 ~ 500 °C	±0.6 °C
2000 °C	0.1 °C	-210.0 ~ -100 °C	±1.0 °C
		-100 ~ 1200 °C	±0.8 °C

■ TC-E

Table 12-5 Specifications for thermocouple TC-E

Range(f.s.)	MAX Resolution	Measurement Range	Accuracy
100 °C	0.01 °C	-100.00 ~ 0 °C	±0.8 °C
		0 ~ 100 °C	±0.6 °C
500 °C	0.05 °C	-200.00 ~ -100.00 °C	±1.0 °C
		-100 ~ 0 °C	±0.8 °C
		0 ~ 500 °C	±0.6 °C
2000 °C	0.1 °C	-200.0 ~ -100 °C	±1.0 °C
		-100 ~ 1000 °C	±0.8 °C

■ TC-T

Table 12-6 Specifications for thermocouple TC-T

Range(f.s.)	MAX Resolution	Measurement Range	Accuracy
100 °C	0.01 °C	-100.00 ~ 0 °C	±0.8 °C
		0 ~ 100 °C	±0.6 °C
500 °C	0.05 °C	-270.00 ~ -100.00 °C	±1.5 °C
		-100 ~ 0 °C	±0.8 °C
		0 ~ 400 °C	±0.6 °C
2000 °C	0.1 °C	-270.00 ~ -100.00 °C	±1.5 °C
		-100 ~ 0 °C	±0.8 °C
		0 ~ 400 °C	±0.6 °C

■ TC-N

Table 12-7 Specifications for thermocouple TC-N

Range(f.s.)	MAX Resolution	Measurement Range	Accuracy
100 °C	0.01 °C	-100.00 ~ 0 °C	±1.2 °C
		0 ~ 100 °C	±1.0 °C
500 °C	0.05 °C	-200.00 ~ -100.00 °C	±2.2 °C
		-100 ~ 0 °C	±1.2 °C
		0 ~ 500 °C	±1.0 °C
2000 °C	0.1 °C	-200.00 ~ -100.00 °C	±2.2 °C
		-100 ~ 0 °C	±1.2 °C
		0 ~ 1300 °C	±1.0 °C



■ TC-S

Table 12-8 Specifications for thermocouple TC-S

Range(f.s.)	MAX Resolution	Measurement Range	Accuracy
100 °C	0.01 °C	0 ~ 100 °C	±4.5 °C
500 °C	0.05 °C	0 ~ 100 °C	±4.5 °C
		100.00 ~ 300.00 °C	±3.0 °C
2000 °C	0.1 °C	300 ~ 500 °C	±2.2 °C
		0 ~ 100 °C	±4.5 °C
		100.00 ~ 300.00 °C	±3.0 °C
		300 ~ 1700 °C	±2.2 °C

■ TC-B

Table 12-9 Specifications for thermocouple TC-B

Range(f.s.)	MAX Resolution	Measurement Range	Accuracy
100 °C	-	-	-
500 °C	0.05 °C	250 ~ 500 °C	±1.8 °C
2000 °C	0.1 °C	0 ~ 1800 °C	±1.8 °C

■ TC-R

Table 12-10 Specifications for thermocouple TC-R

Range(f.s.)	MAX Resolution	Measurement Range	Accuracy
100 °C	0.01 °C	0 ~ 100 °C	±4.5 °C
500 °C	0.05 °C	0 ~ 100 °C	±4.5 °C
		100.00 ~ 300.00 °C	±3.0 °C
2000 °C	0.1 °C	300 ~ 500 °C	±2.2 °C
		0 ~ 100 °C	±4.5 °C
		100.00 ~ 300.00 °C	±3.0 °C
		300 ~ 1700 °C	±2.2 °C

12.3.2 PT100 RTD

Figure 12-4 Connection of 3-wire RTD

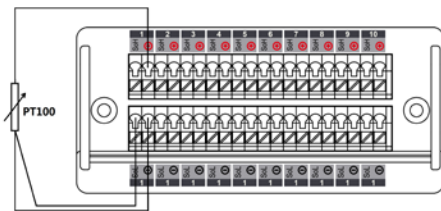
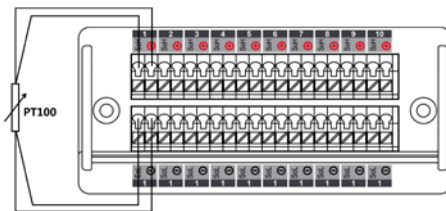


Figure 12-5 Connection of 4-wire RTD



Executive standard JIS C1604-1997, IEC751, JB/T8622-1997, JB/T8623-1997

Table 12-11 PT100 RTD (RTD-3W/RTD-4W) Specifications

Range(f.s.)	MAX Resolution	Measurement Range	Accuracy
100 °C	0.01 °C	-100 ~ 100 °C	±0.6 °C
500 °C	0.05 °C	-200 ~ 500 °C	±0.8 °C
2000 °C	0.1 °C	-200 ~ 850 °C	±1.0 °C

12.3.3 Cu50 Copper RTD

Table 12-12 Cu50 (3W) Copper RTD Specifications

Range(f.s.)	MAX Resolution	Measurement Range	Accuracy
100 °C	0.01 °C	-50 ~ 100 °C	±0.6 °C
500 °C	0.05 °C	-50 ~ 150 °C	±0.8 °C
2000 °C	0.1 °C	-50 ~ 150 °C	±1.0 °C

## 12.4 General Specifications

Measurement Functions			
Parameters	DC-V DC Voltage(2 terminal measurement) DC-R DC Resistance(4 terminal measurement) Temperature : Thermocouple TC-K、TC-J、TC-E、TC-T、TC-N、TC-S、TC-B and TC-R type (2 terminal measurement) PT100 RTD(3 or 4 terminal measurement)		
Measurement Range	<b>Input Type</b>	<b>Graduation</b>	<b>Measurement Range</b>
	Thermocouple	K	-270°C ~ 1300°C
		J	-210°C ~ 1200°C
		E	-200°C ~ 1000°C
		T	-270°C ~ 400°C
		N	-200°C ~ 1300°C
		S	-50°C ~ 1700°C
		B	250°C ~ 1800°C
		W	-270°C ~ 1000°C
	R	-50°C ~ 1700°C	
	RTD	PT100	-100°C ~ 850°C
	RTD	Cu50	-50°C ~ 150°C
DC Voltage	DCV	0.0005mV ~ 100.000V	
DC Resistance	DCR	0.001Ω ~ 200.00Ω	
Test Speed (sampling period)	<MEAS DISPLAY> page	100ms, 200ms, 500ms, 1s, 2s	
	<DATALOG> page	10ms, 20ms, 50ms, 100ms, 200ms, 500ms, 1s, 2s, 5s, 10s, 20s, 30s, 1min, 2min, 5min, 10min, 20min, 30min, 1h	
Horizontal Axis Display	(Only use on <DATALOG> page) 100ms, 200ms, 500ms, 1s, 2s, 5s, 10s, 20s, 30s, 1min, 2min, 5min, 10min, 20min, 30min, 1h, 2h, 5h, 10h, 12h, 24h		
Data Storage Function			
Internal Cache	SDRAM : 80M byte(20M byte for each channel)		
Internal Cache Recording Time (part)	<b>Sampling Rate</b>	<b>MAX recording time for buffer</b>	
	10ms	5.56 hours	
	20ms	11.12 hours	
	50ms	27.78 hours(1.1 days)	
	100ms	55.56 hours(2.3 days)	
	200ms	111.11 hours(4.6 days)	
	500ms	11.5 days	
	1s	23 days	
	2s	46 days	
	5s	115 days	
	10s	231 days	
20s	1 year 97 days		
1m	3 year 293 days		
External Memory	Support 4 groups of USB disk and 1 group of SD card (MAX capacity 64GB)		
Saving Disk	Can set as USB disk and SD card		
External File Saving Type	CSV file (use under 100ms and more than 100ms sampling rate) BIN file(binary file, support all sampling rate)		
Saving Mode	AUTO save : AUTO save to external disk during data logging Manual save : Manual save to external disk after finish data logging		
Split File	AUTO splitting file saving according to set time (minute)		
Interface			

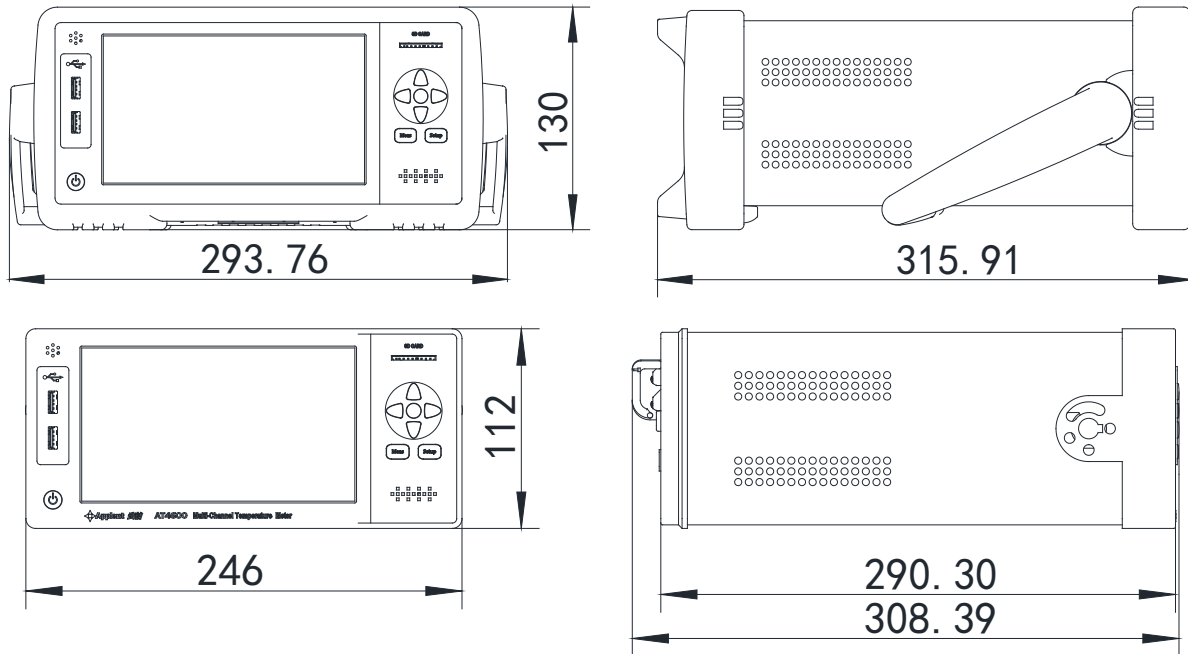
HANDLER	Handler interface : trigger input, 10 group comparator 1 output
RS-232C	MAX Baud Rate : 115200bps, stop bit 1 bit, even parity check
USB-232C	Support Applent USB-232C interface, Baud Rate : 115200bps, stop bit 1 bit, even parity check
LAN Interface	Apply to IEEE 802.3 Ethernet 10BASE-TX, nonsupport DHCP.
WIRELESS LAN Interface	Optional wireless USB network card, only support Applent's special purpose network card.
<b>General Specifications</b>	
Display Screen	TFT-LCD true color with touch screen, 7 inches screen, resolution: 800×480
Trigger	Internal、 Manual、 External (only valid on <MEAS DISPLAY> page)
Man-machine Interaction Input	Touch screen Assist cursor key and 2 shortcut keys. Support plug and play wired and wireless USB mouse.
Accuracy for Logger's X Axis	0.2s/day
Battery Life for System Clock	More than 5 years
MAX Input Voltage of Input Port	±120VDC
MAX Withstand Voltage for each channel	DC300V
MAX Withstand Voltage between Earth	AC300V/DC300V
Input Impedance	(2 terminal measurement)1MΩ (3 terminal and 4 terminal measurement)2MΩ

## 12.5 Environmental Requirement

Environmental Requirement	
Index Temperature and Humidity	Temperature 18°C-28°C Humidity ≤ 65% RH
Operating Temperature and Humidity	Temperature 10°C-40°C Humidity 10-80% RH
Store Temperature and Humidity	Temperature 0°C-50°C Humidity 10-90% RH
Power Supply	100VAC-240VAC 50Hz-400Hz
Fuse	250V,3A slow blow
Weight	About 5kg

## 12.6 Dimension

Figure 12-6 Dimension



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 English Edition  
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