

# OPERATION MANUAL

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**TH2523/A      Battery Tester**

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**Declaration:**

The descriptions contained in this manual may not cover all information about this instrument. Introductions to the improvements of the instrument in performance, function, internal structure, outer appearance, accessories, packing material, etc. are subject to change without notice. If you find any inconformity of this manual with our instruments, please contact us for further consultation by the address listed on the cover.

# Chapter 1 Introduction to Instrument, Unpacking and Installing

Thank you for your purchase and use of our products! This chapter will introduce the basic instrument performance, which is followed by notes of unpacking and installing.

**Caution: the low test terminal of TH2523/A is connected to the ground. When testing other device or component except the battery, or sending it to Bureau of Standard Measurement for calibration, please make corresponding treatment.**

## 1.1 Introduction to the Instrument

With the rise of consumer electronics, smart phones, home appliances, electric vehicles and emerge in endlessly. All these products require batteries to work properly, quickly and accurately detecting the battery performance will directly affect the product performance.

With profound electronic technology and extensive market research, we introduce the color LCD battery tester --- TH2523 battery tester. Its superior performance, ease of operation, beautiful appearance is comparable to leading-edge products on the market.

## 1.2 OOBA (Out of Box Audit)

Inspect the shipping container for damage after unpacking it. It is not recommended to power on the instrument in the case of a damaged container.

If the contents in the container do not conform to the packing list, notify us or your dealer.

## 1.3 Power Connections

- ( 1 ) Power Supply Voltage: 220V  $\pm$ 10%
- ( 2 ) Power Supply Frequency: 50 Hz, 60Hz
- ( 3 ) Power Supply Power Range:  $\leq$  30 VA.
- ( 4 ) L (line wire), N (neutral wire) and E (earth ground wire) of the power supply input

socket should correspond to the power plug of the instrument.

- ( 5 ) The instrument has been carefully designed for decreasing noise jamming caused by the input in AC power terminal, but it is also recommended to use it in the environment of low noise. If noises cannot be avoided, install a power filter please.

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***WARNING: To avoid injury to personnel and damage to the instrument resulting from electric shock, do ensure that the earth ground wire is grounded.***

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## 1.4 Fuse

The fuse is a standard configuration, so use the included custom fuse please.

## 1.5 Environment

- ( 1 ) Do not store or use the instrument where it could be exposed to many dusts, great vibration, direct sunshine and corrosive gas.
- ( 2 ) The instrument should operate under the temperature ranging from 0°C to 40°C , relative humidity of no greater than 75%. For high accuracy, use the instrument in the environment above mentioned.
- ( 3 ) For high accuracy, do not block the left air vent so as to ensure good ventilation.
- ( 4 ) The instrument has been carefully designed for decreasing noise jamming caused by the AC power input, but it is also recommended to use it in the environment of low noise. If noises cannot be avoided, install a power filter please.
- ( 5 ) If the instrument will not be used for a long time, please place it in the original or a similar packing box. The environment temperature should be kept in range of 5°C to 40°C, and the relative humidity should not be greater than 85%. The box should be located in an airy room where it could not be exposed corrosive impurities and direct sunlight.
- ( 6 ) Test leads on the instrument that are connected to DUTs should be kept away from strong electromagnetic fields to avoid interference.

## 1.6 Use of Test Fixture

Only use the test fixture or cable made by our company, because the use of other test fixtures or cables may result in incorrect measurement results. In addition, for good contact of DUT and fixture, keep the test fixture or cable and pins of DUT clean.

Connect the test fixture or cable to  $L_{CUR}$ ,  $L_{POT}$ ,  $H_{POT}$  and  $H_{CUR}$  terminals on the instrument front panel. Pay attention to the direction when inserting the test fixture to avoid abnormal measurement.

## 1.7 Warm-up

- ( 1 ) For accurate measurement, the warm-up time should not be less than 30 minutes.
- ( 2 ) Do not turn on or off the instrument frequently. This may cause internal data confusion.

## 1.8 Other Features

- ( 1 ) Consumption:  $\leq 10VA$ .
- ( 2 ) Dimensions ( W\*H\*D ): 235mm\*105mm\*360mm; This dimension is the final packaging size.
- ( 3 ) Weight: Approx. 3.6kg.



## Chapter 2 Introduction to Front Panel and Operation

This chapter will deal with basic operation procedures of TH2523. Before using the instrument, please read this chapter carefully.

### 2.1 Introduction to Front Panel

Figure 2-1 shows the front panel of TH2523.

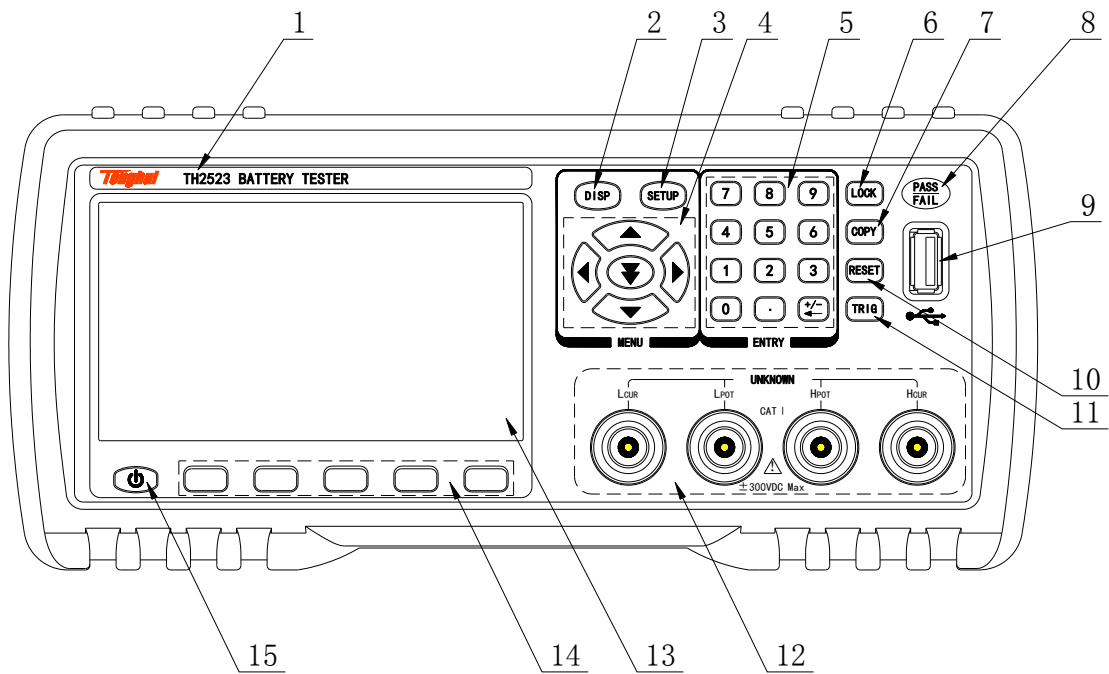


Figure 2-1 Front Panel

- (1) **Trademark and Model**  
Show instrument trademark and model.
- (2) **[DISP] Key**  
Press [DISP] to enter into the MEAS DISP page.
- (3) **[SETUP] Key**

Press [SETUP] to enter into the MEAS SETUP page.

(4) **Universal Arrow Keys**

There are four arrow keys: up, down, left and right arrow keys.

(5) **Numeric Key**

This key is used to input the figure.

(6) **LOCK Key**

Press this key to lock the screen and press it again to unlock the screen.

(7) **COPY Key**

Press this key to save the current screen shot to U-disk.

(8) **PASS/FAIL Display**

The compare results will be displayed through PASS/FAIL .

(9) **USB Interface**

USB HOST Interface

(10) **RESET Key**

System reset key.

(11) **TRIG Key**

In MAN (manual) mode, pressing this key can trigger the instrument manually.

(12) **Test Terminal (INPUT)**

4-terminal test terminal is used to measure DUT by a 4-terminal test cable.

(13) **LCD screen**

480×272 dot-matrix LCD display

(14) **Soft key area**

When the cursor stays in different area, the soft key area will display different function.

(15) **POWER**

Power switch.

## 2.2 Introduction to Rear Panel

Figure 2-2 shows the rear panel of TH2523.

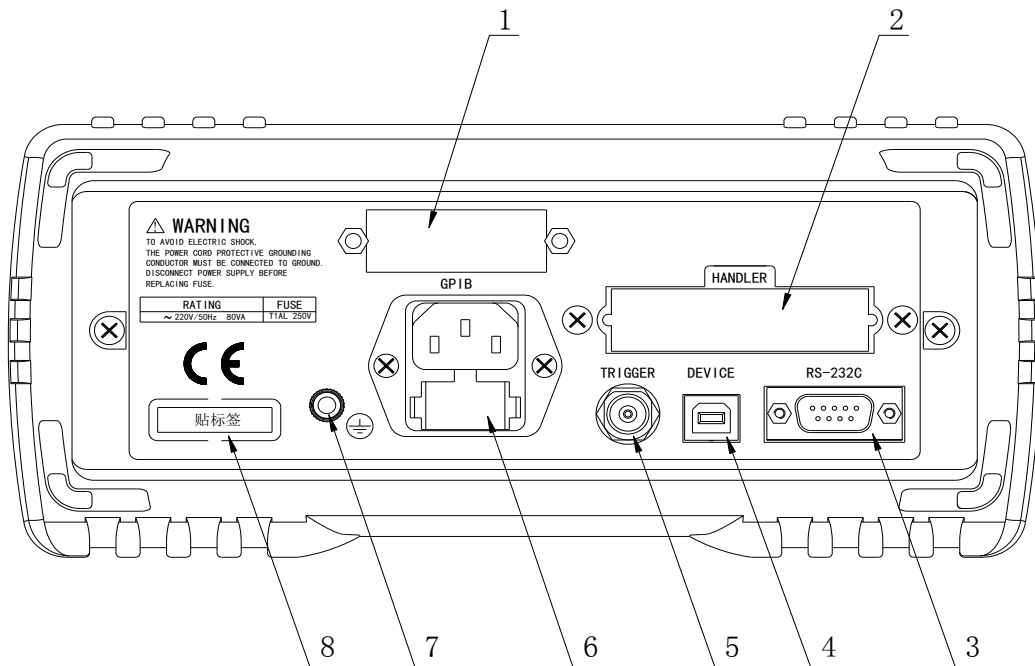


Figure 2-2 Rear Panel

**(1) GPIB Interface (Option)**

The GPIB interface is used to communicate with PC and further construct a GPIB test system.

**(2) HANDLER Interface**

Through HANDLER interface, an automatic test system can be conveniently constructed to realize auto test. TH2523 will output bin comparator result signals and handshake signals by this interface, meanwhile, “start up” signal will also be sent to the instrument by it.

**(3) RS232C Serial Interface**

It realizes the serial communication of the instrument with PC.

**(4) USB Interface**

PC can remotely control TH2523 through USB DEVICE.

**(5) TRIGGER**

It is used to externally trigger signals. In this mode, user can apply footswitch (option) to make triggering measurement.

**(6) Power Socket**

It is used to input AC power.

**(7) Ground Terminal**

This terminal connects the instrument chassis thus to protect or shield ground connection.

**(8) Nameplate**

It shows the instrument model.

## 2.3 Display Zones

TH2523 adopts 24 bits 4.3-inch LCD screen with a resolution of 480×272.

The display screen is divided into the following zones, as shown in figure 2-3.


<b>&lt;MEAS DISP&gt;</b>		FILE	TOOLS		
FUNC : R-X		RNG_V : AUTO			
SPEED : MED		RNG_R : AUTO			
<b>R: 3.1660k Ω</b> <b>X: 0.0076k Ω</b> Vm:OFF                      Im:OFF					
U disk is available!					
	MEAS DISP	BIN DISP	TRACE DISP	STAT DISP	

Figure 2-3 Display Zones

- 1) Main Menu  
Indicate the name of the currently displayed page.
- 2) Function  
Test parameters can be modified in this zone.
- 3) Measurement Result  
Indicate primary and secondary parameter results.
- 4) Prompt Information  
Indicate all prompt information.
- 5) Soft keys  
Indicate function menu corresponding to the cursor zone.

## 2.4 Keys and Their Corresponding Display Pages

### 2.4.1 Main Menu Key: [DISP]

Press (DISP) to enter into display homepage. Selectable functions in this page are shown as follows:

<MEAS DISP>  
<BIN DISP >  
<TRACE DISP>  
<STATI DISP>

### 2.4.2 System Setup Key: [SETUP]

Press this key to enter into the system setup page. System setup and file list are in this page.

<MEAS SETUP>  
<BIN SETUP >  
<TRACE SETUP>  
<SYSTEM SETUP>

## 2.5 Basic Operations

Basic operations of TH2523 keys are as follows :

- Choose the desired page by menu keys [DISP], [SETUP] and soft keys.
- Move the cursor to the destination zone by arrow keys ([←] [↑] [→] [↓]).
- The soft keys, corresponding to the current cursor, will be displayed in the soft key zone. Press the soft key to choose the desired interface.

## 2.6 Starting Up

Ensure the power earth (ground) wire is grounded, plug into a 3-wire power socket. Press down the power switch on the bottom left corner of the front panel, the instrument will be started up and a boot screen will be displayed.

Figure 2-4 shows the boot screen of TH2523, indicating product information such as instrument trademark, model, and version.

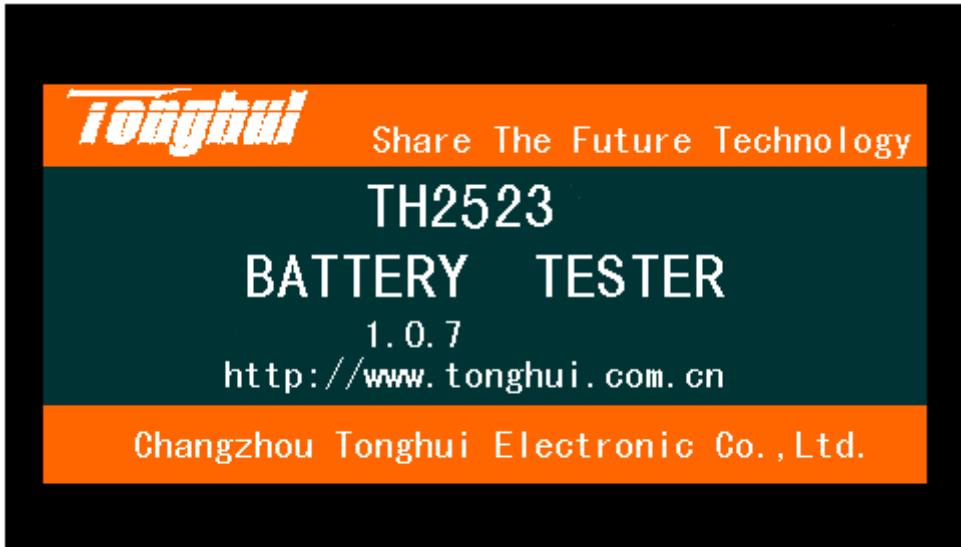


Figure 2-4 TH2523 Boot Screen

If the password protection is enabled, you will be asked to input your password. After inputting your password, press [ENTER] to enter into the main menu page.

NOTE: The series of products have enabled password protection and the default password is 2523. You can reset the password by yourself. See the password function on the <SYSTEM SETUP> page for more details.

## Chapter 3 Basic Operations

### 3.1 <MEAS DISP>

Press down [DISP], the <MEAS DISP> page will be displayed in the screen, as is shown in figure 3-1.

<MEAS DISP>		FILE	TOOLS		
FUNC : R-X				RNG_V : AUTO	
SPEED : MED				RNG_R : AUTO	
<p>R: 3.1660k <math>\Omega</math></p> <p>X: 0.0076k <math>\Omega</math></p> <p>V<sub>m</sub>:OFF                  I<sub>m</sub>:OFF</p>					
U disk is available!					
	MEAS DISP	BIN DISP	TRACE DISP	STAT DISP	

Figure 3-1 Measurement Display

The following measurement parameters can be set in this page.

- Measurement Function (**FUNC R-X**)
- Impedance Range (**Range<sub>(R)</sub> AUTO**)
- Voltage Range (**Range<sub>(V)</sub> AUTO**)
- Measurement Speed (**Speed MED**)
- File Management (**FILE**)
- Other Tools (**TOOLS**)
- Soft Keys (used to enter into operation pages)

The following information will be displayed in the display zone of measurement result/conditions. These conditions can be set on pages of <MEAS SETUP> and <MEAS DISP>.

- Voltage/ current monitoring of DUT (Vm,Im) .
- ON/OFF status indicator of the REL function. (ON indicates that the current displayed value has been dealt with by the relative function) .
- ON/OFF status indicator of SHORT function (ON indicates that the current displayed value has been dealt with by the short function.)

### 3.1.1 Measurement Functions

Measurable parameters on TH2523 are as follows:

#### Primary Parameters

- |Z| (modulus of impedance)
- R (resistance)
- L (inductance)
- V (voltage)
- C (capacitance)

#### Secondary Parameters

- Q (quality factor)
- R (ESR)
- X (reactance)
- r (radian)
- $\Theta$  (phase angle)
- D (loss factor)

Primary and secondary parameters are respectively displayed in two lines in the form of large characters. The upper line indicates the primary parameter, while the lower line shows the secondary parameter.

#### Operation procedures of measurement setup:

- 1) Use the keys to select the FUNC zone, the following information will be displayed on the right side of the screen.
  - R
  - R-V
  - V
  - R-Q
  - more 1/3
- 2) If the desired parameters are not displayed in this page, press more 1/3 to display them.
  - L-Q



- L-R
  - R-X
  - C-D
  - more 2/3
- 3) If the desired parameters are not displayed in this page, press more 2/3 to display them
- Z- $\theta$ d
  - Z- $\theta$ r
  - R-C
  - 
  - more 3/3

### 3.1.2 MEAS RANGE

There are two options in MEAS RANGE, which can be selected according to the impedance and the DC voltage of DUT.

TH2523 has 6 AC impedance measurement ranges: 30m $\Omega$ , 300m $\Omega$ , 3 $\Omega$ , 30 $\Omega$ , 300 $\Omega$ , 3k $\Omega$ .

TH2523 has 2 DC voltage measurement ranges: 6V, 60V.

TH2523A has 2 DC voltage measurement ranges: 30V, 300V.

#### Operation procedures are as follows:

Move to the RNG\_R zone, the following items will be displayed:

- **AUTO** Set the RNG\_R as AUTO.
- **HOLD** Switch the RNG\_R from AUTO to HOLD. Since the RNG\_R is set to HOLD, the current measurement range will be locked and displayed in the RANGE zone.
- $\uparrow(+)$  Increase the range.
- $\downarrow(-)$  Decrease the range.

Move to the RNG\_V zone, the following items will be displayed:

- **AUTO** Set the RNG\_V as AUTO.
- **HOLD** Switch the RNG\_V from AUTO to HOLD. Since the RNG\_V is set to HOLD, the current measurement range will be locked and displayed in the RANGE zone.
- 60V (TH2523)/300V (TH2523A) Select the displayed voltage range
- 6V(TH2523)/30V(TH2523A) Select the displayed voltage range

### 3.1.3 Measurement Speed

The measurement speed of TH2523 is decided by the following factors:

- Integral sampling period
- Average times (measurement times)

- Measurement delay time (a time starting from the measurement start-up to the measurement beginning)
- time showing measurement result

Three measurement speeds are available: FAST (fast, approx. 50meas/ sec), MED (medium, approx. 10meas/ sec) and SLOW (slow, approx. 6.25meas/ sec).

### Operation procedures are as follows:

The measurement result is displayed as a 5-digit number in the decimal point floating mode. The impedance parameter is displayed in the fixed decimal point mode, while the inductance parameter is displayed in the floating decimal point mode.

- 1) Move the cursor to the SPEED zone, the following items will be displayed in the soft key zone.
  - FAST (fast)
  - MED (medium)
  - SLOW (slow)

### 3.1.4 File Manage

- 1) INTER File
- 2) EXTER File

### 3.1.5 TOOLS

#### Operation procedures are as below:

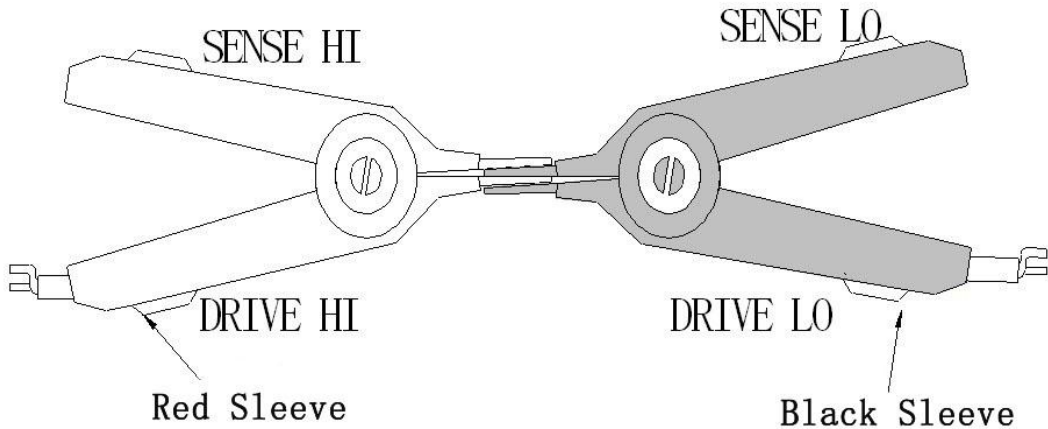
Move to the TOOL zone, the following menus will be displayed in the soft key zone.

- REL OFF (Relative function on /off. When OFF is selected, Relative function will be disabled; when ON is selected, Relative function will be enabled.)
- SHORT OFF (Choosing OFF to turn off the short function, while choosing ON to turn it on.)
- SHORT (Execute the short operation)
- DISP ON (Display the measure result on full screen mode. Press any key (except TRIGGER) to exit.)
- Start Save/ Stop Save: the current measurement result will be saved to a U disk. Before a U disk is inserted, the save function is disabled.

**NOTE: Measurement speed:** when the measurement speed is selected as SLOW or MED, the measurement result will be a 5-digit number, while in FAST speed it is a 4-digit number.

**Save operation:** Be sure to press “Stop Save” to stop saving data after “Start Save” is pressed, otherwise data will lose.

**SHORT operation:** When this key is used for short clear, the test fixture must be shorted correctly, or it will result in relative data error and finally it will deviate from the accurate measurement result. The correct short connection is shown as follows.



### 3.2 <BIN DISP>

Press the [DISP] button and press **BIN DISP** in soft key area to enter into the <BIN DISP> page, as is shown in figure 3-2 and 3-3.

<BIN DISP>		FILE TOOLS			
MODE : BIN		SOUND : NG			
COMP : ON					
BIN : 5					
R: 3.1660k Ω			X : 0.0076k Ω		
U disk is available					
	MEAS DISP	BIN DISP	TRACE DISP	STAT DISP	

Figure 3-2 Bin Display Page

<BIN DISP>		FILE TOOLS			
MODE : COMPARE		SOUND : NG			
COMP : ON		LOAD BIN : BIN1			
COMP : HI					
R: 3.1660k $\Omega$		X : 0.0076k $\Omega$			
U disk is available					
	MEAS DISP	BIN DISP	TRACE DISP	STAT DISP	

Figure 3-3 Compare Display Page

- MODE: Compare and BIN. Compare: compare function of DUT; BIN: judgment of good or bad products.
- SOUND: NG, GD and OFF. NG: not good product sound; GD: good product sound; OFF: sound is off.
- COMP: ON means the compare function is open; OFF means the compare function is not open.
- LOAD BIN: BIN1~9. The measurement result will be compared with high and low limits of the current loaded bin, and then comparing result will be displayed.

### 3.3 <TRACE DISP>

Press **TRACE DISP** in soft key area to enter into <TRACE DISP>. Touch **TOOLS**, the following page will be displayed.

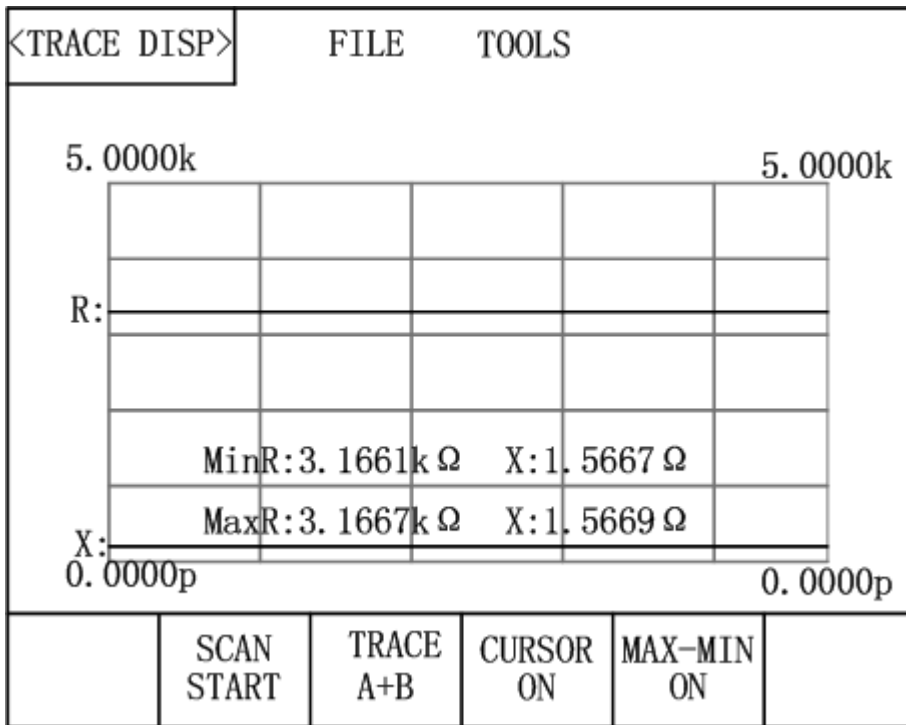


Figure 3-4: Trace Display Page

Move to **TOOLS**, the following items will be displayed in the soft key zone:

- **SCAN START**: Press [SCAN START], trace scanning will start; when [SCAN STOP] is displayed and press it, trace scanning will stop.
- **TRACE A+B**: Press this key, A+B, A, B will be alternately displayed. A indicates that the primary parameter trace will be displayed; B, secondary parameter trace will be displayed; A+B, traces of primary and secondary parameters will be displayed simultaneously.
- **CURSOR**: Press this key and the measurement result will be displayed. Use the left-right direction keys to move the cursor.
- **Max-Min ON**: Press [Max-Min ON], maximum and minimum values of primary and secondary parameters will be displayed after trace scanning. When [Max-Min OFF] is displayed, this function will be disabled.

### 3.4 <MEAS SETUP>

Press **SETUP** to enter into the <MEAS SETUP> page shown in figure 3-5.

<MEAS SETUP>		FILE			
FUNC : R-X		RNG_V : AUTO			
SPEED : MED		RNG_R : AUTO			
TRIG : INT		AVG : 1			
DELAY : 0ms		LINE : 50Hz			
Vm : ON		Im : ON			
DEV_A : OFF		REF_A : 0			
DEV_B : OFF		FER_B : 0			
	MEAS SETUP	BIN SETUP	TRACE SETUP	SYSTEM SETUP	

Figure 3-5 Measurement Setup Page

The following items can be set in the <MEAS SETUP> page.

- **FUNC R-X:** Move the cursor to it, and then you can choose the desired parameters in the soft key zone.
- **Range<sub>(R)</sub>:AUTO:** AUTO, HOLD, ▼, ▲ will be displayed in the soft key zone by touching this key. Press one of them, resistance range will be automatically selected or locked. Meanwhile, the resistance range can be regulated through up and down keys.
- **Range<sub>(V)</sub>:AUTO:** Move the cursor to it, AUTO, HOLD, 6V/60V (TH2523), 30V/300V (TH2523A) will be displayed in the soft key zone. Press one of them, voltage range will be automatically selected or locked. The voltage range can be switched between 6V/60V and 30V/300V.
- **SPEED:MED:** Move the cursor to it, FAST, MED, and SLOW will be displayed in the soft key zone. By touching them, the measurement speed can be toggled among them.
- **TRIG:INT:** Move the cursor to it, INT, MAN, EXT and BUS will be displayed in the soft key zone. The corresponding functions are respectively auto measurement mode, manual trigger measurement mode, external trigger measurement mode and bus trigger measurement mode.
- **AVG:1:** Enter the desired number through the numerical keyboard ranging from 1 to

255, and then press X1 to finish inputting.

- **Vm:OFF:** Move the cursor to it, ON and OFF will be displayed in the soft key zone. The measurement voltage across DUT will be displayed in the <MEAS DISP> page when ON is selected; when OFF is selected, it will be turned off.
- **Im:OFF:** Move the cursor to it, ON and OFF will be displayed in the soft key zone. The measurement current through DUT will be displayed in the <MEAS DISP> page when ON is selected; when OFF is selected, it will be turned off.
- **DEV A:OFF:** Move the cursor to it, OFF, ABS and % will be displayed in the soft key zone. When OFF is selected, the primary display value is the primary measurement value; when ABS is selected, the primary display value is the primary measurement value minus the primary reference value; when % is selected, the primary display value=[(the primary measurement value-the primary reference value)/ the primary reference value]\*100%.
- **DEV B:OFF:** Move the cursor to it, OFF, ABS and % will be displayed in the soft key zone. When OFF is selected, the secondary display value is the secondary measurement value; when ABS is selected, the secondary display value is the secondary measurement value minus the secondary reference value; when % is selected, the secondary display value=[(the secondary measurement value-the secondary reference value)/ the secondary reference value]\*100%.
- **REF A /REF B:** Primary and secondary reference values. Move the cursor to it, INCR++, INCR+, DECR-, DECR-- and MEAS will be displayed in the soft key zone. When MEAS is selected, primary and secondary measurement values of the current DUT will be displayed in REF A and REF B. Press INCR++, INCR+, DECR-, DECR-- keys and the value will be increased and decreased. You can also input the desired value through the numerical keyboard and press the corresponding soft key to confirm.
- **LINE:50Hz:** Move the cursor to it, 50Hz and 60Hz will be displayed in the soft key zone. User should adopt a power source whose frequency is identical to that of the inlet power supply, thus to decrease the measurement error causing by the noise of power frequency.
- **Delay:0ms:** Move the cursor to it and input the desired value through the numerical keyboard ranging from 0 to 60s, and then press X1 to finish inputting.

### 3.4.1 TRIG

TH2523 has four trigger modes: INT (internal trigger), MAN (manual trigger), EXT (external trigger) and BUS (bus trigger).

When Trig is set to the INT mode, TH2523 will automatically make continuous measurement.

When Trig is set to the MAN mode, TH2523 will make a measurement by each press of [TRIG] button on the front panel.

When Trig is set to the EXT mode, TH2523 will make a measurement at each time the HANDLER interface receives a trigger signal. In addition, by controlling the footswitch at TRIGGER interface on the rear panel, trigger-controlling measurement will also be done.

When Trig is set to the BUS mode, the trigger measurement will be done through BUS.

### 3.4.2 Delay

Use the numerical keyboard to input the measurement delay time starting from 1s to 60s with ms as the unit.

## 3.5 <BIN SETUP>

Press **SETUP** key and then press **BIN SETUP** in soft key area to enter into the <BIN SETUP> page shown in figure 3-6.

<BIN SETUP>		FILE			
MODE : ABS		COMP_A : ON		COMP_B : ON	
NOM_A : 2 $\Omega$		NOM_B : 1m $\Omega$			
BIN	HIGHA[ $\Omega$ ]	LOWA[ $\Omega$ ]	HIGHB[ $\Omega$ ]	LOWB[ $\Omega$ ]	
1	2.01	1.99	1.01m	0.99m	
2	2.02	1.98	1.02m	0.98m	
3	2.03	1.97	1.03m	0.97m	
4	2.04	1.96	1.04m	0.96m	
5	2.05	1.95	1.05m	0.95m	
6	2.06	1.94	1.06m	0.94m	
7	2.07	1.93	1.07m	0.93m	
8	2.08	1.92	1.08m	0.92m	
9	2.09	1.91	1.09m	0.91m	
	MEAS SETUP	BIN SETUP	TRACE SETUP	SYSTEM SETUP	

Figure 3-6 Limit Setup

Comparator functions can be set in this page. TH2523 can set 9 groups of nominal and limit values for primary and secondary parameters.



### Introduction to <BIN SETUP>

- **MODE:** Move the cursor to it, % and ABS will be displayed in the soft key zone. When % is selected, upper and lower limits will be displayed in the percentage error mode; When ABS is selected, upper and lower limits will be displayed in the absolute value error mode.
- **COMP:** COMP\_A and COMP\_B for primary and secondary parameters. COMP\_A (ON: the bin comparison function of primary parameter will be enabled; OFF: the bin comparison function of primary parameter will be disabled) and COMP\_B (ON: the bin comparison function of secondary parameter will be enabled; OFF: the bin comparison function of secondary parameter will be disabled).
- **NOM\_A /NOM\_B:** Nominal value is only valid in % mode. Nominal value for primary and secondary parameters (NOM\_A and NOM\_B). You can input nominal values of primary and secondary parameters through the numerical keyboard.
- **HIGH\_A/LOW\_A:** High and low limit for primary and secondary parameters. According to different modes, the value of high and low limit can be respectively percentage value (-100~100) and absolute value (-10000~10000).
- **CLEAR:** Press it in soft key area and the setup data on where the cursor is located can be cleared.
- **CLEAR LINE:** Press it in soft key area and the line setup data in which the cursor is positioned can be cleared.

### 3.6 <TRACE SETUP>

Press **SETUP** key and then press **TRACE SETUP** to enter into the <TRACE SETUP> page shown as figure 3-7.

<TRACE SETUP>		FILE			
TOTAL : 20s		INTERVAL : 1.0s			
A MAX : 5k		B MAX : 5k			
A MIN : 0u		B MIN : 0u			
A STOP1 : 5k		B STOP1 : 5k			
A STOP2 : -5k		B STOP2 : -5k			
Max, Min : for coordinate		Current Func : R-V			
Stop1, Stop2 : for scan stop					
	MEAS SETUP	BIN SETUP	TRACE SETUP	SYSTEM SETUP	

Figure 3-7 Trace Setup Page

This page indicates the information about the discharge trace test of battery. It shows the discharging process of battery and displays measurement results of each time period in the trace form. This function can set the total time of monitoring, time interval between measurements and test point of auto stop. It can run with no personnel monitoring and further improve your working efficiency.

The following parameters can be set in the <TRACE SETUP> page.

- Total: Move the cursor to it and input the total time of measurement through the numerical keyboard and press the corresponding soft key to confirm.
- Interval: Move the cursor to it and input the time interval between measurements through the numerical keyboard and press the corresponding soft key to confirm.
- A Max/A Min: Move the cursor to it and input the maximum and minimum coordinates that are used to draw the primary trace through the numerical keyboard and press the corresponding soft key to confirm.
- B Max/B Min: Move the cursor to it and input the maximum and minimum coordinates that are used to draw the secondary trace through the numerical keyboard and press the corresponding soft key to confirm.
- A Stop1/A Stop2: Move the cursor to it and input the maximum and minimum ranges of the primary parameter through the numerical keyboard and press the

corresponding soft key to confirm. When the primary measurement result is larger than the datum set in A Stop1 or less than the datum set in A Stop 2, the instrument will automatically stop testing. For the accuracy of measurement result, two more measurements will be done when the instrument finds the measurement result exceeding its range, and then TH2523 will stop testing.

- **B Stop1/B Stop2:** Move the cursor to it and input the maximum and minimum ranges of the secondary parameter through the numerical keyboard and press the corresponding soft key to confirm. When the secondary measurement result is larger than the datum set in B Stop1 or less than the datum set in B Stop 2, the instrument will automatically stop testing. For the accuracy of measurement result, two more measurements will be done when the instrument finds the measurement result exceeding its range, and then TH2523 will stop testing.
- **CLEAR:** Press it in soft key area and the setup data on where the cursor is located can be cleared.
- **CLEAR LINE:** Press it in soft key area and the line setup data in which the cursor is positioned can be cleared.

### 3.7 <STATIS DISP>

Press [DISP] and then choose **STAT DISP** to enter into the <STAT DISP> page shown as below figure 3-8.

<STATIS DISP>		FILE	TOOLS		
MODE ABS	NOM_A 22m	NOM_B 0	STATUS ON	STATIS A	
NUMBER 5	HI [ Ω ] 30m	LO [ Ω ] 10m	MEAN 1.9922	STDEV 0.00n	
SASTDEV 0.00n	Cp 99.990	CpK 99.990	HI (NUM) 5	LO (NUM) 0	
IN (NUM) 0	MAX 1.9932	MAXINDEX 2	MIN 1.9917	MININDEX 5	
Measurement completed					
	MEAS DISP	BIN DISP	TRACE DISP	STAT DISP	

Figure 3-8 Statistic Display Page

The function of this page is to count measurement data, such as some engineering coefficients, the PASS/FAIL rate. In this page, it is also workable to analyze the average value of results for multiple measurements. Details are as below.

### 3.7.1 Mode

Move the cursor to it and select different modes through the soft key. There are two modes for comparison of high-low value: ABS (resistance value, inductance value and voltage value of Hi/Lo) and % (percentage of nominal value and Hi/Lo).

NOTE: the formula of percentage mode:

Upper limit value= nominal value\*(1+ upper limit%)

Lower limit value= nominal value\*(1+ lower limit%)

### 3.7.2 NOMA/NOMB

Move the cursor to it and input the data through the numerical keyboard.

A: nominal value of primary parameter

B: nominal value of secondary parameter

### 3.7.3 Number

Move the cursor to it and input the total measurement times of statistic analyses through the

numerical keyboard. The instrument can make statistic analysis on up to 30,000 measurement results.

### 3.7.4 Statis A/Statis B

Move the cursor to it and select through the soft key. When A is selected, TH2523 will compare the measurement result with the limit ranges of its primary parameter, count times of pass, times of higher and lower results; When B is selected, TH2523 will compare the measurement result with the limit ranges of its secondary parameter, count times of pass, times of higher and lower results;

### 3.7.5 Hi/Lo

Move the cursor to it and input the data through the numerical keyboard.

NOTE: Upper and lower limit values should match **Statis A** and **Statis B**. When the statistic mode is Statis A, upper and lower limit values should be that of the primary parameter; when the statistic mode is Statis B, upper and lower limit values should be that of the secondary parameter.

### 3.7.6 Parameter Specifications for Statistic Analysis

1)  $\bar{X}$  : Average value. Corresponding formula:  $\bar{x} = \frac{\sum x}{n}$

2)  $\sigma$  : Population Standard Deviation. Corresponding formula:  $\sigma = \sqrt{\frac{\sum x^2 - n\bar{x}^2}{n}}$   
 ( $=\sigma_n$ )

3)  $s$  : Sample Standard Deviation. Corresponding formula:  $s = \sqrt{\frac{\sum x^2 - n\bar{x}^2}{n-1}}$   
 ( $=\sigma_{n-1}$ )

4)  $C_p$  : Process Capability Index (Dispersion). Corresponding formula :

$$C_p = \frac{|Hi - Lo|}{6s}$$

5)  $C_p K$  : Process Capability Index (Deviation).

Corresponding formula: 
$$C_p K = \frac{|Hi - Lo| - |Hi + Lo - 2\bar{x}|}{6s}$$

NOTE: Explanations for variables in formulas from 1) to 5)

$n$  : The total measurement times that a sample is used to make statistic analysis, which corresponds to the value of **TIMES**.

$x$  : Measurement results of each sample measurement. The data are saved in the instrument buffer memory.

$Hi$  : Upper limit value, used to be compared, corresponds to the value of **UPPER** limit.

$Lo$  : Lower limit value, used to be compared, corresponds to the value of **LOWER** limit.

When  $C_p, C_p K > 1.33$ , the working capacity is ideal.

When  $1.33 \geq C_p, C_p K > 1.00$ , the working capacity is qualified.

When  $1.00 \geq C_p, C_p K$ , the working capacity is insufficient.

- 6) Hi(num): Be used to add up times that the measurement result exceeds the upper limit value.
- 7) Lo(num): Be used to add up times that the measurement result is less than the lower limit value.
- 8) In(num): Be used to add up times that the measurement result passes.
- 9) Max: Be used to display the maximum measurement result among all measurement results.
- 10) MaxIndex: Be used to display the test serial corresponding to the maximum measurement result.
- 11) Min: Be used to display the minimum measurement result among all measurement results.
- 12) MinIndex: Be used to display the test serial corresponding to the minimum measurement result.

### 3.7.7 TOOLS

Move the cursor to **TOOLS**, the following items will be displayed:

- **STATSTART/STOP**: Select **STAT START**, the instrument will start counting. When a measurement is done, results will be added up and analyzed. The statistic result

will be displayed in the corresponding zone (measurement times is the times set on the screen). Pressing **STAT STOP** will stop counting.

- **TRIG:** Trigger the instrument to make measurement operation.

## Chapter 4 System Setup and File Manage

### 4.1 System Setup

Press [SETUP] and then press SYSTEM SETUP in soft key area to enter into the <SYSTEM SETUP> page shown in the following figure 4-1.

<SYSTEM SETUP>		FILE	TOOLS
KEY SOUND : ON		BUS MODE : RS232C	
LANGUAGE : 中文		BAUD RATE : 9600	
PASSWORD : OFF		BUS ADDR : 8	
DATE : 15-02-13		TIME : 09:24:34	
U disk is available!			
	MEAS SETUP	BIN SETUP	TRACE SETUP
			SYSTEM SETUP

Figure 4-1 System Setup Page

The following functions can be set in this page: Key Sound, Language, Password, Bus Mode, Baud Rate, Bus Addr, Date and Time.

#### 4.1.1 Key Sound

Set the key sound.

**ON:** Turn on the key sound.

**OFF:** Turn off the key sound.

#### 4.1.2 Language

Set the language.



**ENGLISH:** Set the language as English.

**CHINESE:** Set the language as Chinese.

### 4.1.3 Password

Set the password protection function.

**OFF:** Disable the password protection function. Before turning off the password protection function, you must input the original password.

**ON:** Enable the password protection function. The passwords are used to start up the instrument and to protect files.

**MODIFY:** This key is used to modify password.

---

NOTE: *The default password is 2523.*

---

### 4.1.4 Bus Mode

Set the communication interface.

#### Operation Procedures:

- 1) Move the cursor to **Bus Mode**, the following items will be displayed.
  - **RS232C**
  - **GPIB (option)**
  - **USBTMC**
  - **USBCDC**
- 2) Press **RS232C**, the RS232C interface is selected.
- 3) Press **GPIB**, the GPIB interface is selected.

---

**NOTE:** GPIB is an option. Only when it is installed, this mode can be available.

---

- 4) Press **USBTMC**, the USBTMC interface is selected. The instrument communicates with PC through the USB interface (USB DEVICE) on the rear panel.
- 5) Press **USBCDC**, the USBCDC interface will be selected. The instrument communicates with PC through USB (USB DEVICE) virtual serial interface.

### 4.1.5 Baud Rate

Baud rate is used to select the baud rate for RS232 interface. There are 6 selectable baud rates: 9600, 19200, 28800, 38400, 57600, 115200.

Move the cursor to **Baud Rate**, the following items will be displayed in soft key area.

**INCR+:** Touch this key to increase the baud rate.

**DECR-:** Touch this key to decrease the baud rate.

### 4.1.6 Bus Addr

Bus address is used to control and display the current GPIB interface bus address.

Move the cursor to **BUS ADDR**, the following items will be displayed in the soft key zone.

- **INCR++**  
Press this key, the instrument increases the number of bus address by 5.
- **INCR+**  
Press this key, the instrument increases the number of bus address by 1.
- **DECR-**  
Press this key, the instrument decreases the number of bus address by 1.
- **DECR--**  
Press this key, this instrument decreases the number of bus address by 5.

The bus address number ranges from 0 to 31.

### 4.1.7 Time

Set the correct date and time at the local time zone.

For example: 9 o'clock 13 minute and 25 second a.m. on November 12, 2010 will be shown as 10-11-12 09:13:25.

Operations are as follows: Touch the time zone to be modified, the following items will be displayed.

- **INCR++**  
Press this key, the time will increase by 5.
- **INCR+**  
Press this key, the time will increase by 1.
- **DECR-**  
Press this key, the time will decrease by 1.
- **DECR--**  
Press this key, the time will decrease by 5.

## 4.2 <File Manage>

TH2523 series can save parameters that are set by user to the internal non-volatile memory in the file format. User can load the file to use these parameters instead of resetting.

This section will introduce the information about the function of Save/Recall.

Notation Explanation:

E: Abbreviation of External, representing external memory, like U disk.

I: Abbreviation of Internal, representing internal memory, like internal Flash.

### 4.2.1 Introduction to Save/Recall

By the function of save/recall, user can save measurement results and configuration information to TH2523 internal Flash or external U disk; meanwhile user can recall data from TH2523 internal Flash or external U disk.

Introduction to Methods and Applications of Save

The table below shows the applicable save methods and applications:

Table 4-1 Methods and Applications of Save

save method		recall	application
type	file format		
configuration save (internal Flash)	*.STA	Yes	Save the current configuration to internal Flash.
configuration save (external U disk)	*.STA	Yes	Save the current configuration to a U disk.
data save (external U disk)	*.CSV	No	Save measurement results to a U disk.
screen save (external U disk)	*.GIF	No	Save the screen information to a U disk.

### 4.2.2 Structure of File Folder/ File in a U Disk

Before saving data to a U disk, you are recommended to save it into a file and folder that have existed in the memory as shown in table 4-2. If you want to save the configuration file into a file folder in PC, you should enter into the folder on the instrument and then take relative file operations.

Table 4-2 Folder in U disk

Folder	Maximum Amount of File	Description
CSV	102	Including measurement result, like *.CSV file.
STA	102	Including configuration data, like *.STA file.
PIC	102	Including screen information, like *.GIF file.

**NOTE:** CSV and STA folders might be automatically generated when a U disk is connected. Structure of Folder/File in a U disk is shown in figure 4-2.

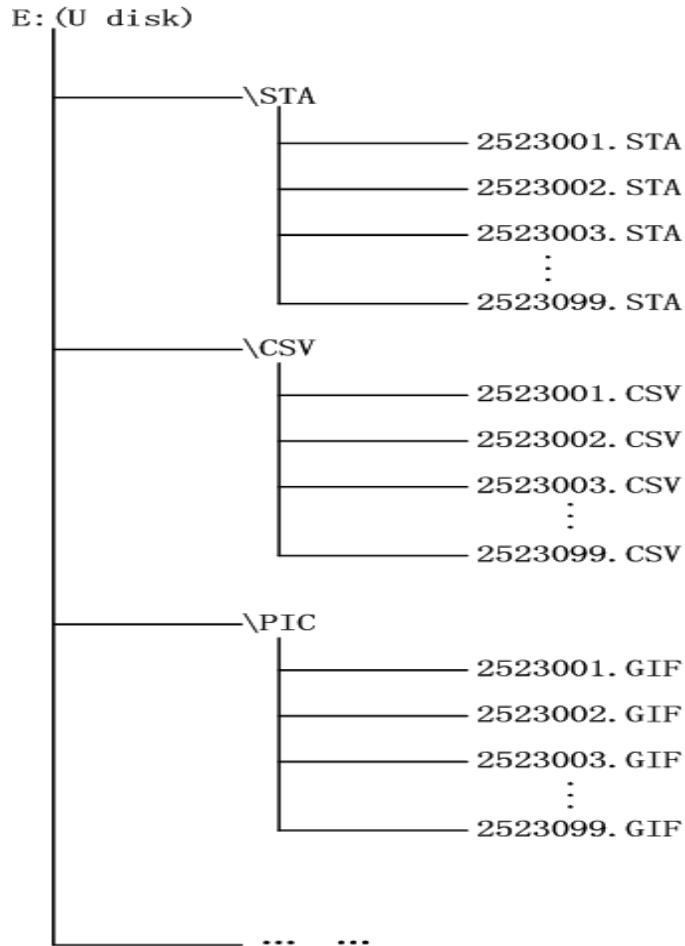


Figure 4-2 file structure in a U disk

When using a U disk on TH2523, you should pay special attention to the following points:

1. Use a U disk with the USB2.0 interface.
2. The U disk file system should be FAT16 or FAT32. FAT16 or FAT32 standard should be used to format the U disk. If the U disk memory exceeds 512M, it is recommended to use FAT32 standard to format the disk.
3. Before a U disk is connected to TH2523, you are recommended to save the data on it and Tonghui will not be liable for the data loss.
4. In order to rapidly save the instrument data to a U disk, it is not recommended to store too many files or folders.

### Operation Procedures

Press **FILE** and select **INTER File** to enter into the internal file page, as shown in below figure 4-3.

Press [INTER File] and [EXTER File] to respectively display files stored in the internal

FLASH and the external U disk. Press [Exit] to exit the file page.

<INTER FILE>				
NO	Folder/File	Date/Time		Load
01	2523001. STA	01/21	16:38	
02	2523002. STA	01/21	16:42	
03				
04				
05				
06				
	INTER File	EXTER File	Exit	

Figure 4-3 Internal file page

6 files' information will be displayed in each internal file page or external file page, including file names and time of being saved.

Operations of the internal file and the external file are similar. Take internal file operations as an example to describe the specific procedures of file operations.

Operations on file are as follows:

Move the cursor to the file name to be edited, the following items will be displayed in soft key area.

- **LOAD**

Press **LOAD**, if the file name that the cursor locates is not empty, [YES] and [NO] will be displayed in the soft key zone. When [YES] is selected, the instrument will load the setup data in the file; when [NO] is selected, the current operation will be cancelled.

- **SAVE**

Move the cursor to empty file area, SAVE is displayed in the software area. Press **SAVE**, [YES] and [NO] will be displayed in the soft key zone. When [NO] is selected, the operation of saving the file is cancelled; when [YES] is selected, the instrument will pop up the alphabetical keyboard, input the filename and press ENTER to confirm it. The parameter settings of the current interface are saved in

this file.

- **Copy to E:**

Press “Copy to E”. The instrument will copy the file the cursor locates or the selected file to a U disk.

- **Delete**

Press “Delete”, if “YES” is selected, the instrument will delete the file that the cursor locates.

## Chapter 5 Performance Index

### 5.1 Measurement Function

#### 5.1.1 Measurement Parameters and Notations

R: resistance	V: DC voltage
Z: impedance	X: reactance
C: capacitance	L: inductance
Q: quality factor	$\theta$ : phase angle (deg degree)
r: phase angle (rad radian)	

#### 5.1.2 Measurement Groups

TH2523 has 11 measurement groups: R, R-V , V , R-Q , L-Q , L-R , R-X , C-D, Z- $\theta$ d, Z- $\theta$ r ,R-C.

#### 5.1.3 Mathematical Operations

Mathematical operations on TH2523 are operations for absolute value deviation ( $\Delta$ ABS) and percentage deviation ( $\Delta$ %) between a measurement value and a programmable nominal value.

#### 5.1.4 Range

Double-range bin for resistance and DC voltage, Mode: AUTO, MANU (HOLD, UP, DOWN)

#### 5.1.5 Trigger

Internal, manual, external, bus

Internal: Continuously test a DUT and then output and display the result.

Manual: Press the “TRIGGER” button on the panel, the instrument will test a DUT once and display the result. This mode keeps in waiting mode when it is not used.

External: Test a DUT once and display the result when the instrument receives an external “start up” signal from the footswitch of HANDLER interface or TRIGGER interface on the rear panel.

BUS: Send the measurement result to an upper computer through the communication interface and the instrument will not display the result.

### 5.1.6 Average

Range from 1 to 255, programmable

### 5.1.7 Display Digits

	SLOW, MED	FAST
Resistance range	5 digits, maximum display number: 35,000	4 digits, maximum display number: 3500
Voltage range	5 digits, maximum display number: 31,000	4 digits, maximum display number: 3100

## 5.2 Test Signal

### 5.2.1 Frequency

The test signal is a sinusoidal wave with the frequency of  $1\text{kHz}\pm 0.2\text{Hz}$ .

### 5.2.2 Maximum Input Voltage

TH2523: The maximum input voltage that the test terminal can withstand is 65V.

TH2523A: The maximum input voltage that the test terminal can withstand is 350V.

### 5.2.3 Maximum Display Range

Parameter	Measurement Display Range
L	0.2000nH to 1H
R、X、Z	0.001m $\Omega$ to 3.5000k $\Omega$
Q	0.001 to 9999.9
$\theta$	Deg -179.99 °to 179.99 ° Rad -3.1416 to 3.1416
V (TH2523/A)	0.0001V to 350.000V (TH2523A)



### 5.2.4 Measurement Accuracy

Measurement accuracy depends on measurement stability, temperature coefficient, linearity, repeatability and correction interpolation error.

Checking the measurement accuracy should be taken under the following circumstances:

- a. Warm-up time should be more than 30 minutes.
- b. Correctly short the test cables and reset the instrument by pressing the REL button on the front panel.

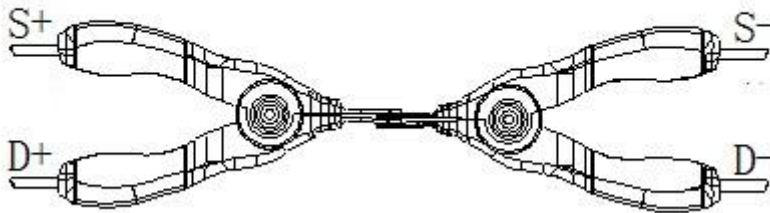
The correct short of the test cable is as follows:

Red

Black

White

Blue



### 5.2.5 Basic Accuracy for |Z|, L, R, X Measurement

The following two tables display the basic accuracy of |Z| at SLOW, MED and FAST.

SLOW, MED: (acquiring the basic accuracy at the temperature of 20 °C ± 5 °C; the temperature coefficient plus ±0.05%/ °C.)

Model: TH2523 /TH2523A			Display Digits: 5		
Range	Maximum display value	Resolution	Measurement constant current	Accuracy for 6 months	Accuracy for one year
30 mΩ	33.000 mΩ	1 μ Ω	100mA (±10%)	± (0.3%Rdg + 0.01%Fs)	± (0.6%Rdg + 0.01%Fs)
300 mΩ	330.00 mΩ	10 μ Ω	100mA (±10%)	± (0.1%Rdg + 0.01%Fs)	± (0.3%Rdg + 0.01%Fs)
3 Ω	3.3000 Ω	100 μ Ω	10mA (±10%)		
30 Ω	33.000 Ω	1 mΩ	1mA (±10%)		
300 Ω	330.00 Ω	10 mΩ	100μ A (±10%)		
3 kΩ	3.5000 kΩ	100 mΩ	10μ A (±10%)		

FAST: (acquiring the basic accuracy at the temperature of  $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ ; the temperature coefficient plus  $\pm 0.05\% / ^{\circ}\text{C}$ .)

Model:TH2523 /TH2523A			Display Digits: 4		
Range	Maximum display value	Resolution	Measurement constant current	Accuracy for 6 months	Accuracy for one year
30 m $\Omega$	33.000 m $\Omega$	10 $\mu\Omega$	100mA ( $\pm 10\%$ )	$\pm (0.5\% \text{Rdg} + 0.01\% \text{Fs})$	$\pm (0.7\% \text{Rdg} + 0.01\% \text{Fs})$
300 m $\Omega$	330.00 m $\Omega$	100 $\mu\Omega$	100mA ( $\pm 10\%$ )	$\pm (0.3\% \text{Rdg} + 0.01\% \text{Fs})$	$\pm (0.5\% \text{Rdg} + 0.01\% \text{Fs})$
3 $\Omega$	3.3000 $\Omega$	1m $\Omega$	10mA ( $\pm 10\%$ )		
30 $\Omega$	33.000 $\Omega$	10 m $\Omega$	1mA ( $\pm 10\%$ )		
300 $\Omega$	330.00 $\Omega$	100 m $\Omega$	100 $\mu$ A ( $\pm 10\%$ )		
3 k $\Omega$	3.5000 k $\Omega$	1 $\Omega$	10 $\mu$ A ( $\pm 10\%$ )		

L,C, X accuracy using condition:  $D_x (D \text{ test value}) \leq 0.1$

R accuracy using condition:  $Q_x (Q \text{ test value}) \leq 0.1$

When  $D_x \geq 0.1$ , L, C, X Accuracy =  $|Z| \text{ Accuracy} * \sqrt{1 + D_x^2}$

When  $Q_x \geq 0.1$ , R Accuracy =  $|Z| \text{ Accuracy} * \sqrt{1 + Q_x^2}$

## 5.2.6 Q Accuracy

The accuracy of Q is given by the formula below:

$$Q_e = \pm \frac{Q_x^2 \times D_e}{1 \mp Q_x \times D_e}$$

Where,  $Q_x$  is the value of the tested Q.

$D_e$  is the accuracy of D

Above formula should be used when  $Q_x \times D_e < 1$

Which,

The accuracy of D is given by the formula below:

$$D_e = \pm \frac{A_e}{100}$$

The formula is only available when  $D_x \leq 0.1$ .

When  $D_x > 0.1$ ,  $D_e$  should be multiplied by  $(1 + D_x)$

### 5.2.7 $\theta$ Accuracy

The accuracy of  $\theta$  is given by the formula below:

$$\theta_e = \frac{180}{\pi} \times \frac{Z \text{ Accuracy}}{100} \quad [\text{deg}]$$

### 5.2.8 Basic Accuracy for Voltage Measurement

SLOW, MED: (acquiring the basic accuracy at the temperature of  $20 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$ ; the temperature coefficient plus  $\pm 0.005\% / \text{ }^\circ\text{C}$ .)

Model: TH2523		Display digits: 5		
Range	Maximum display value	Resolution	Accuracy for 6 months	Accuracy for one year
6 V	6.5000 V	100 $\mu$ V	$\pm (0.05\% \text{Rdg} + 0.01\% \text{Fs})$	$\pm (0.06\% \text{Rdg} + 0.01\% \text{Fs})$
60 V	65.000 V	1 mV		

FAST: (acquiring the basic accuracy at the temperature of  $20 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$ ; the temperature coefficient plus  $\pm 0.005\% / \text{ }^\circ\text{C}$ .)

Model: TH2523		Display digits: 4		
Range	Maximum display value	Resolution	Accuracy for 6 months	Accuracy for one year
6 V	6.500 V	1 mV	$\pm (0.1\% \text{Rdg} + 0.01\% \text{Fs})$	$\pm (0.15\% \text{Rdg} + 0.01\% \text{Fs})$
60 V	65.00 V	10 mV		

SLOW, MED: (acquiring the basic accuracy at the temperature of  $20 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$ ; the temperature coefficient plus  $\pm 0.005\% / \text{ }^\circ\text{C}$ .)

Model: TH2523A		Display digits: 5		
Range	Maximum display value	Resolution	Accuracy for 6 months	Accuracy for one year
30 V	35.000 V	1 mV	$\pm (0.05\% \text{Rdg} + 0.01\% \text{Fs})$	$\pm (0.1\% \text{Rdg} + 0.01\% \text{Fs})$
300 V	350.00 V	10 mV		

FAST: (acquiring the basic accuracy at the temperature of  $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ ; the temperature coefficient plus  $\pm 0.005\%/^{\circ}\text{C}$ .)

Model: TH2523A		Display digits: 4		
Range	Maximum display value	Resolution	Accuracy for 6 months	Accuracy for one year
30 V	35.00 V	1 mV	$\pm (0.1\%R_{dg} + 0.01\%F_s)$	$\pm (0.15\%R_{dg} + 0.01\%F_s)$
300 V	350.0 V	10 mV		

## Chapter 6 Remote Control

### 6.1 RS232C Connection

RS-232 standard, also called as asynchronous serial communication standard, has already been widely used for data communication between computers, computer and external equipment. RS is the English abbreviation of Recommended Standard; 232, the standard number. This standard is issued by EIA in 1969, which rules to send one bit in a data line every time. As most serial interfaces, the serial interface of TH2523 is also not strictly based on RS-232 standard but only uses the smallest subset of this standard. The signals are listed in the following table.

Signal	Code	Connector Pin Number
Transmitted Data	TXD	2
Received Data	RXD	3
Signal Ground Common	GND	5

Table 6-1 RS-232 Signal and Pin Connector

The reason is that the use of three lines is much more inexpensive and much simpler than that of five lines or six lines, which is the biggest advantage of using serial interface for communication.

The connection of the instrument with PC is shown in figure 6-1.

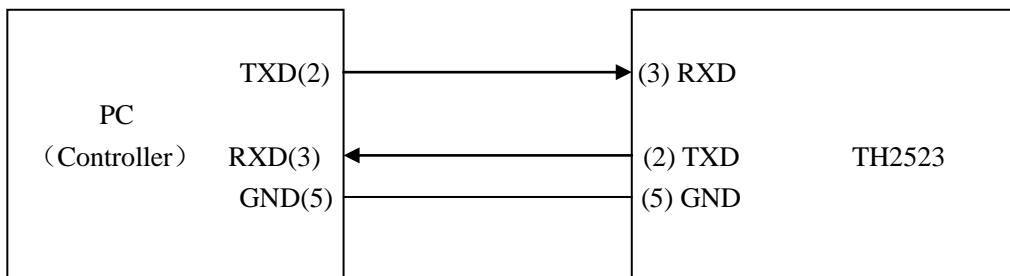


Figure 6-1 Connection of the instrument with PC

Figure 6-1 shows that the serial interface pin definition of this instrument is different from that of 9 pin connector used in computer. User can purchase the serial interface cable from our company.

RS232 interface characterizes with a baud rate ranging from 9600 to 115200, no parity, 8-bit data bit, 1-bit stop bit.

The instrument commands comply with the SCPI standard. When a command string is transmitted to the instrument, it is required to send LF (hexadecimal: 0AH) as the terminating character. Each time the maximum receivable number of SPCI command string is 2kB.

For result data formats transmitted to a PC from the instrument, see Commands Reference.

## 6.2 GPIB Bus (option)

IEEE488 (GPIB) is an international bus interface standard used on intelligent instruments. IEEE is the English abbreviation of Institute of Electrical and Electronics Engineers, and 488 is the standard number. Through this interface, TH2523 can communicate with PC or others intelligent equipments and meanwhile can make up automatic test system with the other test equipments. Up to 15 equipments can be connected on a same bus. TH2523 applies IEEE488.2 and the interface plate can be inserted in any one of the three expansion slots. Control command system is open so that user can use the PC operation interface provided by TH2523 or take measurements by the control command system. The control command system supports most functions of the instrument, that is to say, user can execute almost all operations on PC. Thus remote control to the instrument is realized.

When configuring a GPIB system, the following restrictions must be adhered to.

1. The total length of cable in one bus system must be less than or equal to two meters times the number of devices connected on the bus (the GPIB controller counts as one device) and the total length of cable must not exceed 20 meters.
2. A maximum of 15 devices can be connected on one bus system.
3. There are no restrictions on how the cables are connected together. However, it is recommended that no more than four piggyback connectors be stacked together on any one device.

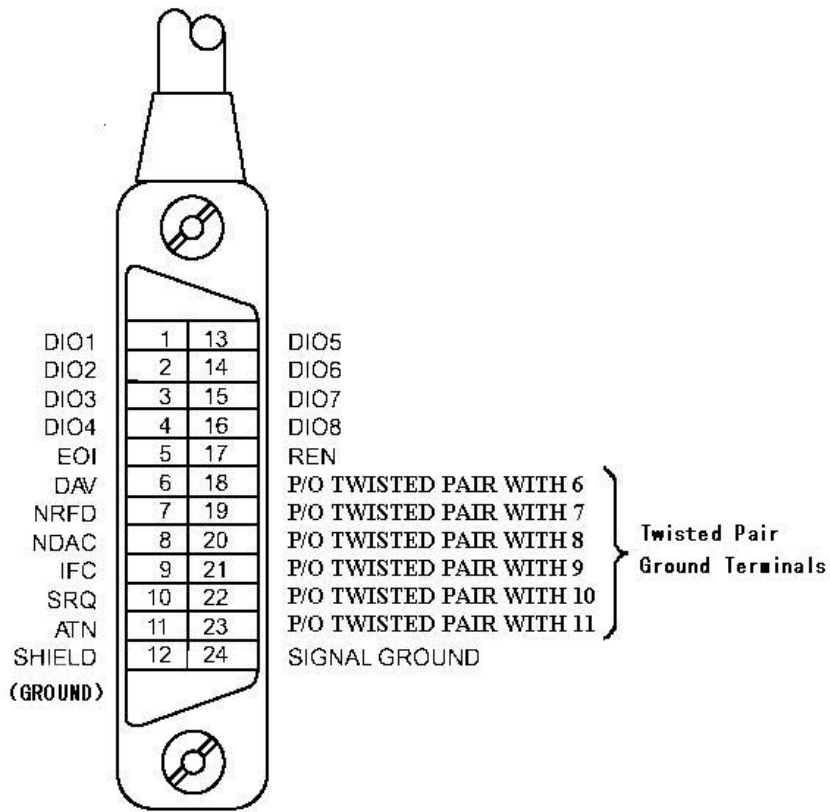


Figure 6-2 GPIB Connector/Pin Structure

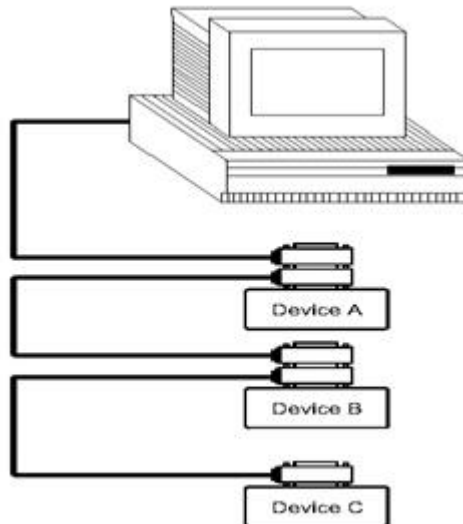


Figure 6-3 Typical GPIB System Interconnection for Double-piggyback Connector

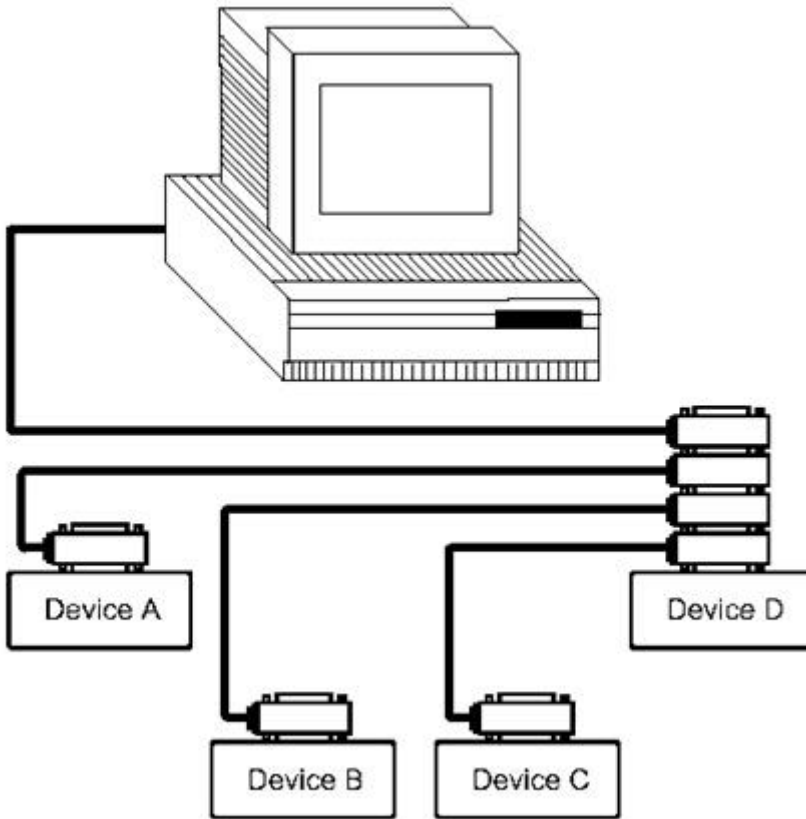


Figure 6-4 Typical GPIB System Interconnection for 4-piggyback Connector

### 6.2.1 GPIB Interface Functions

The following table shows the TH2523 GPIB interface functions:

Code	Capability	Function
SH1	Data Source Handshake	Three-wire Shake
AH1	Acceptor Handshake	Three-wire Shake
T5	Basic Talker	Transmit instrument data.
L4	Basic Listener	Receive instrument data.
SR1	Service Request	Request service.
RL1	Remote/Local Conversion	Remote/Local Conversion
DC1	Device Reset	Transmit clear signal.



Code	Capability	Function
DT1	Device Trigger	Transmit trigger signal.
C0	Control	Transmit control data.

Table 6-2 GPIB Interface Capabilities and Functions.

### 6.2.2 GPIB Addressing

User can set the bus mode address of the GPIB parallel communication interface to a value from 1 to 31. For more details about address setup, please refer to the page of <SYSTEM SETUP> under the [SYSTEM] menu.

### 6.2.3 GPIB Bus Commands

TH2523 will respond to the following bus commands:

- **ABORT I/O (IFC)**  
When this command is received, all bus activities will abort and the instrument will no longer receive data and reset the interface to the idle mode.
- **CLEAR LOCKOUT/SET LOCAL**  
This command provides conditions for the instrument to operate remotely.
- **DEVICE CLEAR (SDC or DCL)**  
As soon as this command is received, the selected device or all devices connecting with this interface will be cleared.
- **LOCAL (GTL)**  
LOCAL returns to local control and buttons on the front panel will be valid.
- **LOCAL LOCKOUT (LLO)**  
LOCAL LOCKOUT disables the LOCAL operation of all devices on the bus. After this command is sent, you will be unable to operate TH2523 from the front panel including the soft key LOCAL. Execute the LOCAL command to undo LOCAL LOCKOUT.
- **REMOTE**  
Set the control mode as remote control.
- **SPOLL**  
The SPOLL (serial poll) command is set the bus address status byte. 8 bytes are used to shield, read and judge the instrument operating status.
- **SERVICE REQUEST**  
When TH2523 requires the controller to execute a task, it will send out a SRQ service request control signal. SRQ, deemed as an interruption, will inform the controller to prepare the transmitted data or that errors exist on the instrument. As

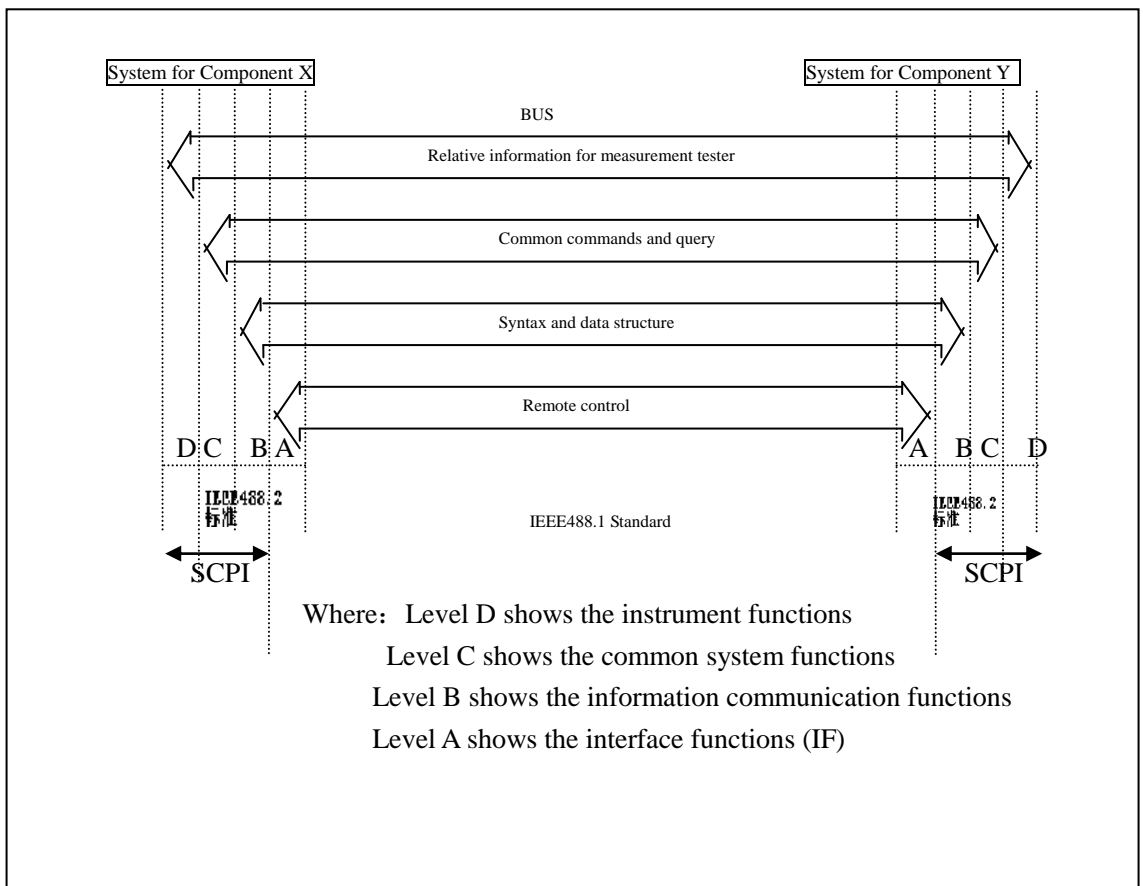
soon as TH2523 sends a SRQ service request signal, it will set the status byte to 6. 6 bytes are RQS request service bytes and sometimes connects with serial poll to act as the status byte. When TH2523 enables the SPOLL command, it will clear the RQS request service bit and the SRQ string. Each bit in a status byte will enables a SRQ service request. User can shield the status byte to judge which bit causes TH2523 to set SRQ. For details, see “Status Byte”.

- TRIGGER (GET)

Trigger bus command. This command can be sent to a selected device or all listener devices. It is necessary to assign TH2523 as a listener device firstly and then set the trigger mode as bus trigger mode. Finally send trigger data.

### 6.2.4 SCPI (Standard Commands for Programmable Instruments)

SCPI is a new general command based on the IEEE488.2-1987 standard. (SCPI is the same as TMSL, a system language for measurement testers adopted by HP.)



## 6.3 USBTMC Remote Control System

USB (Universal Serial Bus) remote control system controls the instrument through the USB interface. This connection conforms to USBTMC-USB488 and USB2.0 protocols.

### 6.3.1 System Configuration

Connect USB interfaces on PC and TH2523 through a USB cable.

### 6.3.2 Install the Driver

When TH2523 is first connected to a PC through a USB cable, the prompt information –Found New Hardware will show on the right bottom of the computer desktop, as is shown below:

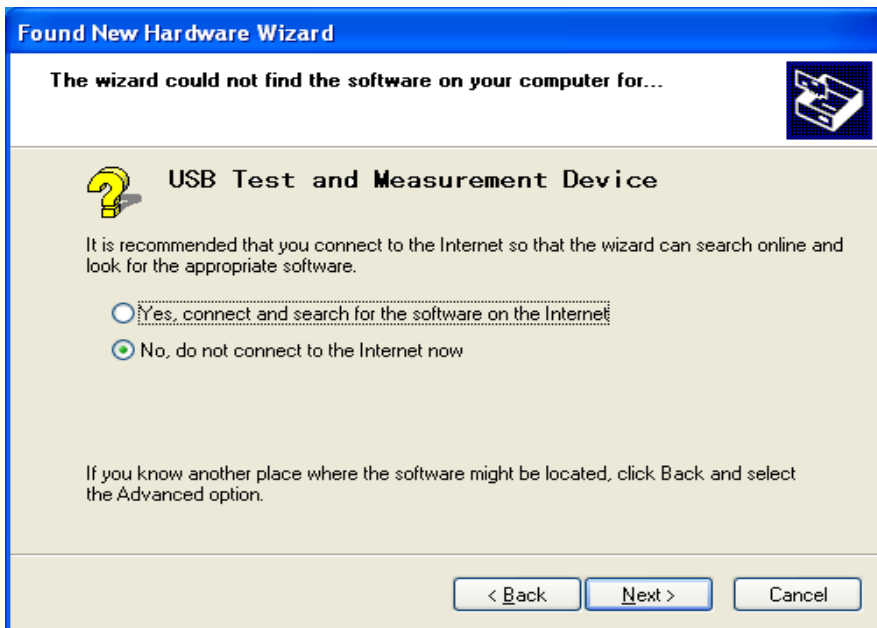


Figure 6-5 Procedure 1 of Installing USB Driver

Click “NEXT”, dialogue 6-6 will pop up. Choose “Install the software automatically (recommended)”.



Figure 6-6 Procedure 2 of Installing USB Driver

When the installation of driver is finished, user can see “usb test and measurement device” in the device manager of PC, as is shown in the following figure.

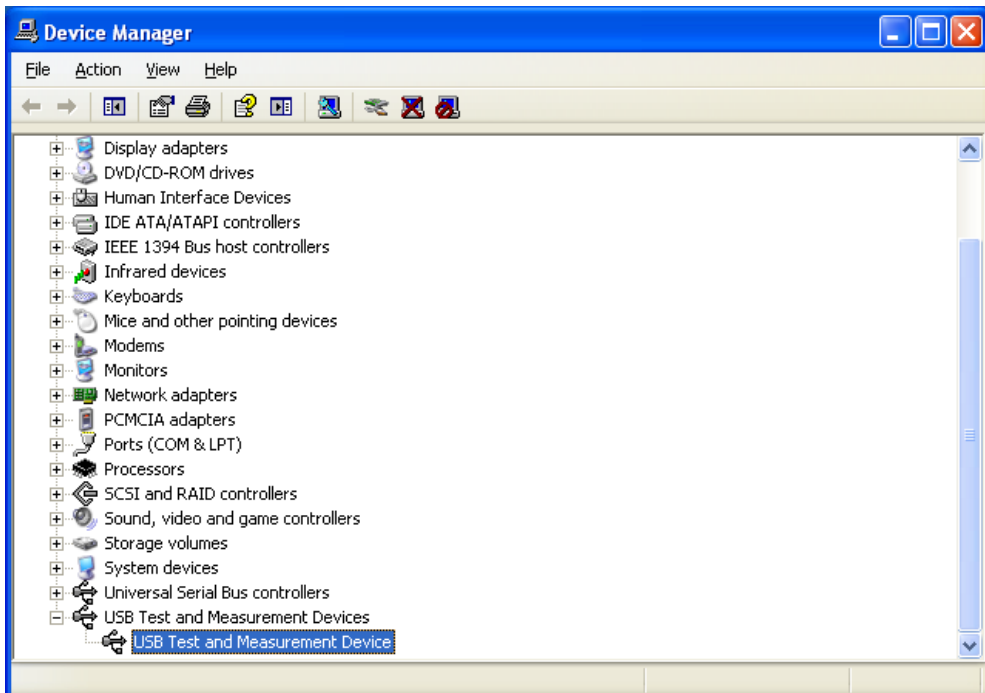


Figure 6-7 USBTMC Display of PC Device Manager

When user is using USBTMC interface, labview software can be used to access the instrument.

## 6.4 USBCDC Virtual Serial Port

When “USBCDC” is selected, the USB interface can be configured as a virtual serial port (VCom)

Connect PC and TH2523 to the USB interface through a USB cable.

Methods of installing USBCDC driver are the same with that of installing USBTMC driver. When the installation of driver is finished, user can see “usb VCom port” in the PC device manager, as is shown in figure 6-8.

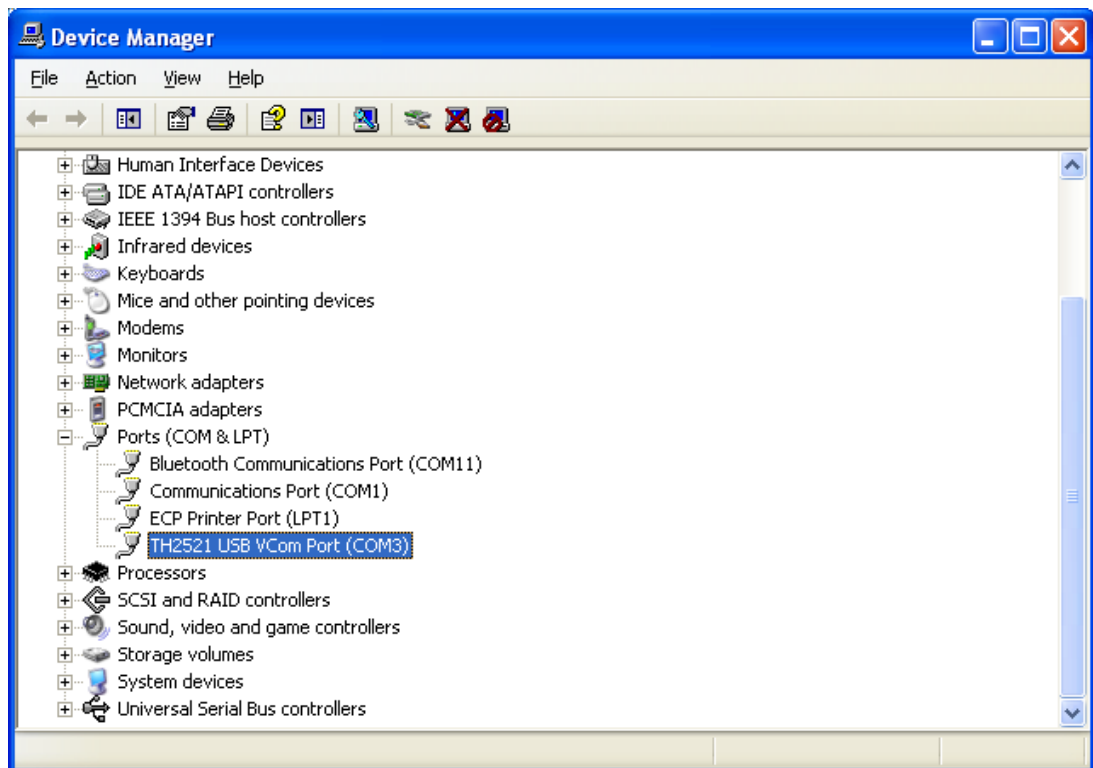


Figure 6-8 VCom Display of PC Device Manager

Now, usb VCom port acts as a serial port. When PC has no serial port, the communication software based on this serial port can be used as USB virtual serial port.

## Chapter 7 SCPI Command Reference

### 1. Data Conventions of This Manual

NR1: integer, for example:123

NR2: fixed number, for example: 12.3

NR3: floating number, for example: 12.3E+5

NL: CR character, integer: 10

^END: EOI (end) signal of IEEE-488 bus.

### 7.1 TH2523 Subsystem Commands

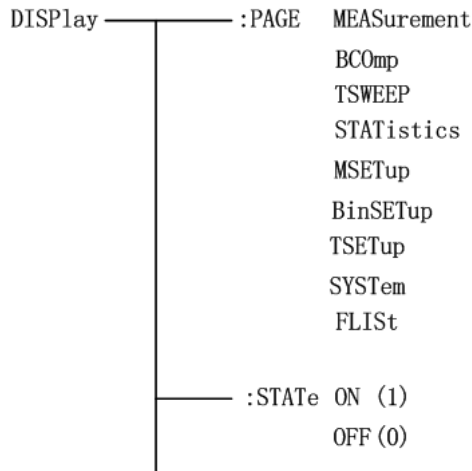
- DISPlay    ●TRIGger    ●COMParator    ●APERture    ●SYSTem
- FUNCTion   ●FETCh?    ●Mass MEMory   ●STATistical   ●TRACe
- BINSETup

#### 7.1.1 DISPlay Subsystem Commands

DISPlay subsystem commands are mainly used to set the instrument display page.

The :DISPlay? query returns the current page.

Command Tree:



The :PAGE command sets the display page.

The DISPlay:PAGE? query returns the current page.

Command Syntax: DISPlay:PAGE <page name>

Functions of <page name> are as follows:

MEASurement	Set the display page to the basic measurement.
BCOMP	Set the display page to bin comparator.
TSWEEP	Set the display page to trace sweep.
STATistics	Set the display page to statistics.
MSETup	Set the display page to measurement setup.
BinSETup	Set the display page to bin setup (this command is invalid).
TSETup	Set the display page to trace setup.
SYSTem	Set the display page to system setup.
FLISt	Set the display page to (internal) file list.

The :STATe command is used to select whether to refresh the measurement display result in measurement display page.

Command Syntax:

DISPlay:STATe	$\left\{ \begin{array}{l} \text{ON (0)} \\ \text{OFF (1)} \end{array} \right.$

Query syntax: DISPlay:STATe?

Return format: <NR1><NL^END>

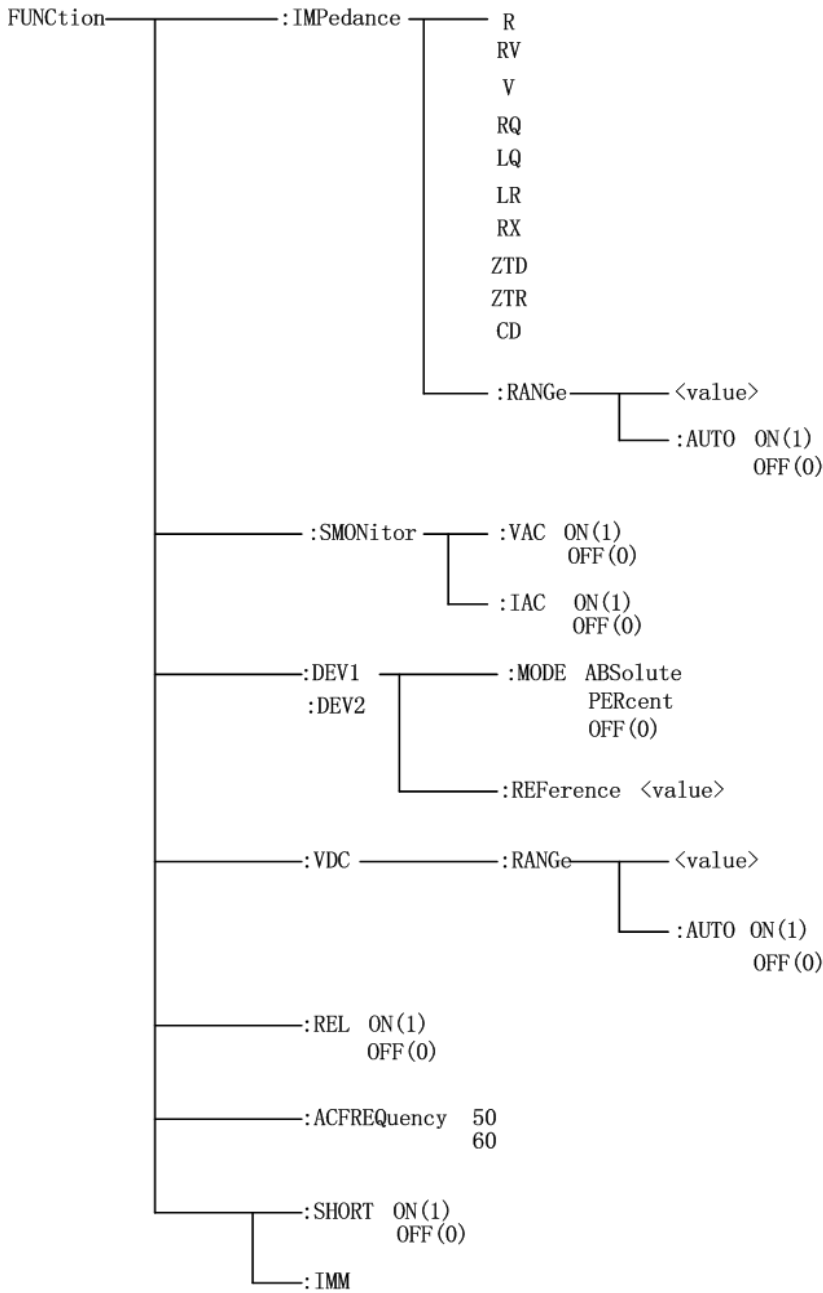
<NR1> is as follows:

- 1
- 2

### 7.1.2 FUNCTION Subsystem Commands

FUNCTION subsystem commands are mainly used to set “function”, “range”, “speed”, current and voltage monitoring switch, mode selection of deviation display, nominal setup, etc..

Command Tree:



The :IMPedance command sets the “function” parameters.

The FUNCTION:IMPedance? query returns the current “function” parameters.

Command Syntax: FUNCTION:IMPedance <function>



Details are as follows:

R	Set “function” as R.
V	Set “function” as V.
RV	Set “function” as R-V.
RQ	Set “function” as R-Q.
LQ	Set “function” as L-Q.
LR	Set “function” as L-R.
RX	Set “function” as R-X.
ZTD	Set “function” as Z- $\theta^\circ$ .
ZTR	Set “function” as Z- $\theta$ r.
CD	Set “function” as C-D.

For example: WrtCmd(“FUNC:IMP RX”); Set “function” as R-X .

Query syntax: FUNCtion:IMPedance?

Return Format: <function><NL^END>

The :IMPedance:RANGe command sets the instrument range.

The FUNCtion:IMPedance:RANGe? query returns the current range parameters.

Command Syntax: FUNCtion:IMPedance:RANGe <value>

Where, <value> is the positive integer from 0~5.

0	30m $\Omega$
1	300m $\Omega$
2	3 $\Omega$
3	30 $\Omega$
4	300 $\Omega$
5	3k $\Omega$

For example: WrtCmd(“FUNC:IMP:RANG 0”); Set the instrument range as 30m $\Omega$  .

Query syntax: FUNCtion:IMPedance:RANGe?

Return format: <value><NL^END>

Where, <value> can be:

3m	300m	30
30	300	3k

The :IMPedance:RANGe:AUTO command sets the range auto selection mode.

The FUNCtion:IMPedance:RANGe:AUTO? query returns the current range mode.

Command syntax:

FUNCtion:IMPedance:RANGe:AUTO  $\left\{ \begin{array}{l} \text{ON (1)} \\ \text{OFF (0)} \end{array} \right.$

Where,

Character 1 (integer:49) means ON.

Character 0 (integer: 48) means OFF.

For example: WrtCmd(“FUNC:IMP:RANG:AUTO ON”); Set the range mode as auto.

Query syntax: FUNCtion:IMPedance:RANGe:AUTO?

Return format: <NR1><NL^END>

The :VDC:RANGe command sets the range of DC voltage.

The FUNCtion:VDC:RANGe? query returns the current DC voltage range parameter.

Command syntax: FUNCtion:VDC:RANGe <value>

Where, <value> can be the positive integer from 0~1.

0 300V(TH2523A) 60V(TH2523)

1 30V(TH2523A) 6V(TH2523)

For example: WrtCmd(“FUNC:VDC:RANG 0”); Set the DC voltage range as 300V (TH2523A) or 60V (TH2523).

Query syntax: FUNCtion:VDC:RANGe?

Return format: <value><NL^END>

Where, <value> can be:

300V(TH2523A) 60V(TH2523)

30V(TH2523A) 6V(TH2523)

The : VDC:RANGe:AUTO command sets the auto selection mode of DC voltage range.

The FUNCtion: DC voltage:RANGe:AUTO? query returns the current range mode of DC voltage.

Command syntax:

FUNCtion:VDC:RANGe:AUTO  $\left\{ \begin{array}{l} \text{ON (1)} \\ \text{OFF (0)} \end{array} \right.$

Where:

Character 1 (integer:49) means ON.

Character 0 (integer: 48) means OFF.

For example: WrtCmd("FUNC: VDC:RANG:AUTO ON"); Set the DC voltage range as auto.

Query syntax: FUNCtion: DC voltage:RANGe:AUTO?

Return format: <NR1><NL^END>

The :Source MONitor:VAC command sets the voltage monitoring switch.

The FUNCtion:SMONitor:VAC? query returns the current mode of the voltage monitoring switch.

Command syntax:

FUNCtion:SMONitor:VAC	{	ON (1)
		OFF (0)

Where:

Character 1 (integer:49) means ON.

Character 0 (integer: 48) means OFF.

For example: WrtCmd("FUNC:SMON:VAC ON"); Set the voltage monitoring switch as "ON".

Query syntax: FUNCtion:SMONitor:VAC?

Return format: <NR1><NL^END>

The :Source MONitor:IAC command sets the current monitoring switch.

The FUNCtion:SMONitor:IAC? query returns the current mode of the current monitoring switch.

Command syntax:

FUNCtion:SMONitor:IAC	{	ON (1)
		OFF (0)

Where:

Character 1 (integer:49) means ON.

Character 0 (integer: 48) means OFF.

For example: WrtCmd("FUNC:SMON:IAC ON"); Set the current monitoring switch as "ON".

Query syntax: FUNCtion:SMONitor:IAC?

Return format:<NR1><NL^END>

The :DEV<n>:MODE command sets the deviation measurement mode.

The FUNCtion:DEV<n>:MODE? query returns the current mode of the deviation measurement.

Command Syntax:

FUNCtion:DEV<n>:MODE { ABSolute  
PERCent  
OFF

Where:

ABSolute            Deviation display of absolute value

PERCent            Deviation display of percentage

OFF                 Directly display the real measurement value.

<n> may be:

Character 1 (integer: 49)    Sets the deviation mode of primary parameter.

Character 1 (integer: 50)    Sets the deviation mode of secondary parameter.

For example: WrtCmd("FUNC:DEV1:MODE ABS");

Query syntax: FUNCtion:DEV<n>:MODE?

Return format:

ABS }  
PERC } <NL^END>  
OFF }

The :DEV<n>:REFerence command sets the nominal value of deviation.

The FUNCtion:DEV<n>:REFerence? query returns the current deviation nominal value.

Command syntax: FUNCtion:DEV<n>:REFerence<value>

Where:

<value> may be a number in NR1, NR2 or NR3 format.

<n> may be:

Character 1 (integer: 49) sets the deviation nominal value of primary parameter.

Character 1 (integer: 50) sets the deviation nominal value of secondary parameter.

For example: WrtCmd("FUNC:DEV1:REF 10");

Query syntax: FUNCtion:DEV<n>:REfERENCE?

Return format: <NR3><NL^END>

The :DEV<n>:REfERENCE:FILL sets the nominal value of deviation. It controls the instrument to make a measurement and copies primary and secondary results as nominal value.

Command syntax: FUNCtion:DEV<n>:REfERENCE:FILL

Where,

<n> may be character 1 (integer: 49) or character 2 (integer: 50). Both above characters can set primary and secondary deviation nominal values.

For example: WrtCmd("FUNC:DEV1:REF:FILL");

The :REL  $\left\{ \begin{array}{l} \text{ON} \\ \text{OFF} \end{array} \right\}$  command controls the rel function.

Command syntax: FUNC:REL ON

Return format: FUNC:REL?

Return: 1 (integer: 49) means ON.

0 (integer: 48) means OFF.

:SHORT:IMM

The :SHORT:IMM command executes the short function.

Command syntax :FUNC:SHORT:IMM

:SHORT  $\left\{ \begin{array}{l} \text{ON}(1) \\ \text{OFF}(0) \end{array} \right\}$

This command switches the short function to ON or OFF.

Command syntax: :FUNC:SHORT ON

Query syntax: :FUNC:SHORT?

Return: 1(49) means ON.

0(48) meansOFF.

:ACFREQuency  $\left\{ \begin{array}{l} 50 \\ 60 \end{array} \right\}$

This command is used to control the supply frequency.

Command syntax: :FUNC:ACFREQuency 50

Query syntax: :FUNC:ACFREQuency ?

Return:       50   the supply frequency is 50Hz  
               60   the supply frequency is 60Hz

### 7.1.3 APERTure Subsystem Commands

The APERTure subsystem commands are mainly used to set the measurement speed and the average times used in measurement.

The APERTure? query returns the current measurement speed and average times used in measurement.

Command Syntax:

$$\text{APERTure} \left\{ \begin{array}{l} \text{FAST} \\ \text{MEDium} \\ \text{SLOW} \end{array} \right\} [ , <\text{value}> ]$$

Where:

FAST:       Fast: 100meas/sec

MEDium:    Medium: 50meas/sec

SLOW :      Slow: 6.25meas/sec

<value>    Average number ranging from 1 to 128(NR1).

For example: WrtCmd("APER MED,55");

Query syntax: APERTure?

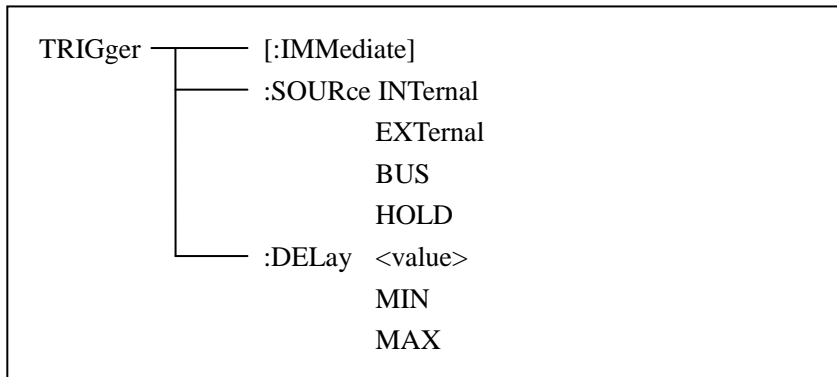
Return format:

$$\left\{ \begin{array}{l} \text{FAST} \\ \text{MED} \\ \text{SLOW} \end{array} \right\} , <\text{NR1}> <\text{NL}^{\wedge}\text{END}>$$

### 7.1.4 TRIGger Subsystem Commands:

The TRIGger subsystem commands set the instrument trigger source and the delay time after triggering, and triggers instrument measurement.

Command Tree:



The :IMMEDIATE command triggers a measurement.

Command syntax: TRIGger[:IMMEDIATE]

For example: WrtCmd("TRIG");

The :SOURce command sets the mode of trigger source.

The :SOURce? query returns the current mode of trigger source.

Command syntax:

TRIGger:SOURce	}	INTernal
		EXTernal
		BUS
		HOLD

Where:

INTernal Be automatically triggered by the instrument and be the default setting of the instrument.

EXTernal Be triggered by the HANDLER interface.

BUS Be triggered by the RS232 interface or the GPIB interface.

HOLD Press the TRIGGER button on the panel.

For example: WrtCmd("TRIG:SOUR BUS");

Query syntax: TRIGger:SOURce?

Return format:

}	INT	<NL^END>
	EXT	
	BUS	
	HOLD	

The :DELAY command sets the delay time after triggering.

The TRIGger:DELAy? query returns the current delay time.

Command syntax:

TRIGger:DELAy	{	<value>
		MIN
		MAX

Details are as follows:

<value>      In NR1, NR2 or NR3 data format ranging from 0S to 60S by a resolution of 1mS.

MIN            Set the delay time as 0S.

MAX            Set the delay time as 60S.

For example: WrtCmd(“TRIG:DEL 5S”); Set the delay time as 5S, the default unit is S.

Query syntax: TRIGger:DELAy?

Return format: <NR3><NL^END>

### 7.1.5 FETCh? Subsystem Commands

FETCh? subsystem commands are used to make TH2523 output a measurement result.

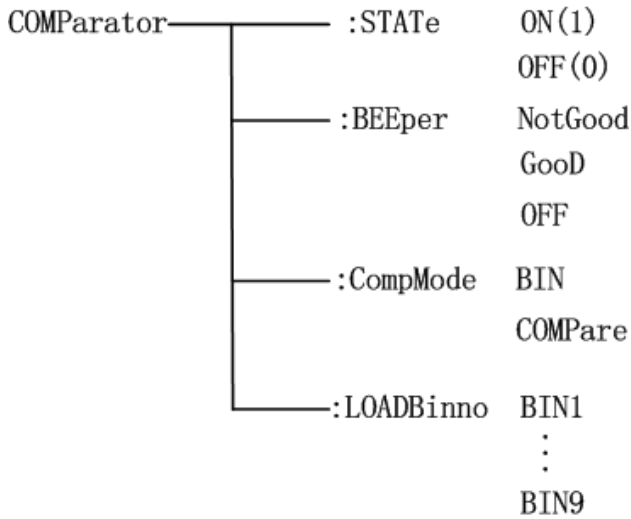
Command syntax: FETCh?

### 7.1.6 COMParator Subsystem Commands:

COMParator subsystem commands are used to set bin comparator functions, such as comparator ON/OFF, limit list.

Command Tree:

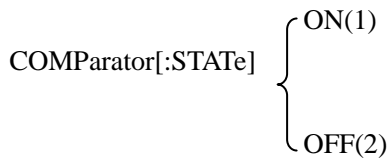




The [:STATe] command sets the comparator function ON or OFF.

The COMPArator[:STATe]? query returns the current status of the comparator function.

Command syntax:



Where,

1 (integer: 49) means ON.

0 (integer: 48) means OFF

For example: WrtCmd(“COMP:STAT ON”)

Query syntax: COMPArator[:STATe]?

Return format: <NR1><NL^END>

The [:BEEper] command sets the beeper of comparator function.

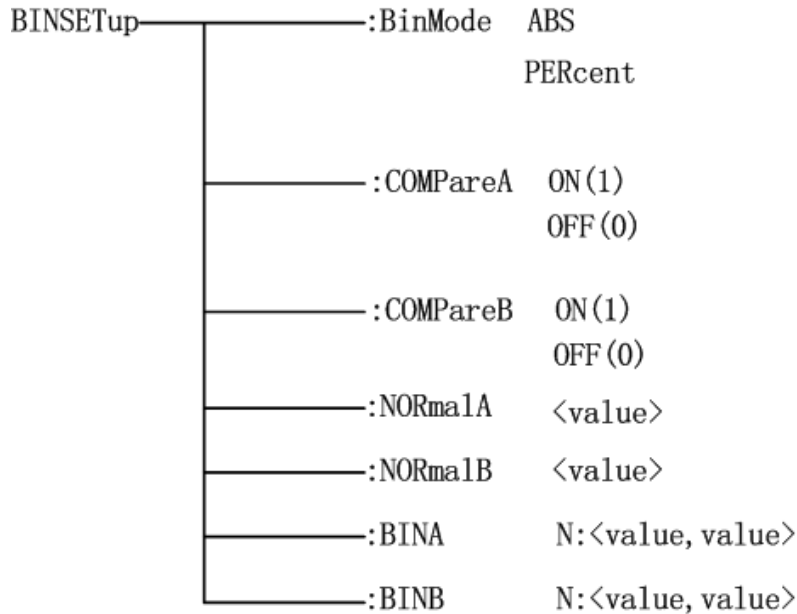
The COMPArator[:BEEper]? query returns the current beeper status.

Command syntax: COMPArator: BEEper   NotGood  
   Good  
   OFF

- NotGood       when the DUT fails, the buzzer beepers.
- Good           when the DUT passes, the buzzer beepers
- OFF            the beeper function is off.



Command Tree:



The:BINSETup:BinMode command set the bin compare mode. The:BINSETup:BinMode? query returns the current compare mode.

Command syntax: BINSETup:BinMode ABS  
PERcent

ABS absolute value mode  
PERcent percentage mode

For example: WrtCmd("BINSETup:BinMode ABS")

Query syntax: BINSETup:BinMode?

Return value: <NR1><NL^END>

<NR1> is 0 absolute value mode  
1 percentage mode

The:BINSETup:COMPareA command set the primary parameter as ON/OFF. The:BINSETup:COMPareA? query returns current status of primary parameter.

Command syntax: BINSETup:COMPareA ON(1)  
OFF(0)

ON set the primary parameter function as ON  
OFF set the primary parameter as OFF

For example: WrtCmd("BINSET: COMPA ON")

Query syntax: BINSETup:COMPA?

Return value: <NR1><NL^END>

<NR1> is 0 (integer:48) means OFF

1 (integer: 49) means ON

The:BINSETup:COMPareB command set the secondary parameter as ON/OFF.

The:BINSETup:COMPareB? query returns the current status of secondary parameter.

Command syntax: BINSETup:COMPareB ON(1)

OFF(0)

ON set the secondary parameter function as ON

OFF set the secondary parameter as OFF

For example: WrtCmd("BINSET: COMPB ON")

Query syntax: BINSETup:COMPB?

Return value: <NR1><NL^END>

<NR1> is 0 (integer:48) means OFF

1 (integer: 49) means ON

The:BINSETup:NORmalA command set the nominal value of the primary parameter.

The:BINSETup:NORmalA? query returns the current value of the primary parameter.

Command syntax: BINSETup:NORmalA <value>

Where, <value> is floating point type, ranged from -10k~10k.

For example: WrtCmd("BINSETup: NORmalA 15"); set the nominal value of the primary parameter as 15. It can be resistance of 15Ω or voltage of 15V according to the test parameter.

Query syntax: BINSETup:NORmalA?

Return value: <NR3><NL^END>

<NR3> the primary parameter

The:BINSETup:NORmalB command set the nominal value of the secondary parameter.

The:BINSETup:NORmalB? query returns the current value of the secondary parameter.

Command syntax: BINSETup:NORmalB <value>

Where, <value> is floating point type, ranged from -10k~10k.

For example: WrtCmd("BINSETup: NORmalB 15"); set the nominal value of the secondary parameter as 15. It can be resistance of 15Ω or voltage of 15V according to the test parameter.

Query syntax: BINSETup:NORmalB?

Return value: <NR3><NL^END>

<NR3> the secondary parameter

The:BINSETup:BINa command set the upper and lower limit of the primary parameter.

According to different modes, the upper and lower limit of absolute value or percentage can be set. The:BINSETup:BINa? query returns the current limit of current mode.

Command syntax: BINSETup:BINa N:<value,value>

N Bin number, ranges from 1~9.

<value,value> the upper and lower limit of the primary parameter

For example: WrtCmd("BINSETup: BINa 2:15,10");set the upper limit value of primary parameter in BIN2 as 15 and the lower limit as 10.

Query syntax: BINSETup: BINa N?

Return value: <NR3><NL^END>

<NR3> the upper and lower limit of the primary parameter

The:BINSETup:BINb command set the upper and lower limit of the secondary parameter.

According to different modes, the upper and lower limit of absolute value or percentage can be set. The:BINSETup:BINb? query returns the current limit of current mode.

Command syntax: BINSETup:BINb N:<value,value>

N Bin number, ranges from 1~9.

<value,value> the upper and lower limit of the secondary parameter

For example: WrtCmd("BINSETup: BINb 2:15,10");set the upper limit value of secondary parameter in BIN2 as 15 and the lower limit as 10.

Query syntax: BINSETup: BINb N?

Return value: <NR3><NL^END>

<NR3> the upper and lower limit of the secondary parameter

### 7.1.8 Statistical Subsystem Commands

Statistical subsystem commands are used to count the measurement result or to set statistical function.

Command Tree:

STATIstics	:STATe	A (1) B (2)
	:STATUS	ON (1) OFF (0)
	:MODE	ABS PERcent
	:CLEAR	
	:START	ON (1) OFF (0) TRIG
	:COUNT?	
	:MEAN?	
	:MAXimum?	
	:MINimum?	
	:SET	<num, high, low>
	:NORminalA	<value>
	:NORminalB	<value>
	:DEViation?	
	:SampleDEViation?	
	:CP?	

The :STATIstics:STATe command sets the statistical function of primary parameter or secondary parameter to ON or OFF.

Command syntax: : STATIstics:STATe <1,2,A or B>

Where,

1 (integer: 49) means A.

2 (integer: 50) means B.

- A set the statistical function of primary parameter to ON
- B set the statistical function of secondary parameter to ON

Query syntax: :STATIstics:STATe?

Response: <A or B> <NL^END>

For example: Query: :STATI:STAT?

Response: A

The :STATIstics:STATUS command sets the statistical function to ON or OFF.

Command syntax: : STATIstics:STATUS ON(1)  
OFF(0)

Where,

- ON set the statistical function to ON
- OFF set the statistical function to OFF

Query syntax: :STATIstics:STATUS?

Response: <NR1> <NL^END>

NR1 is 0 (integer: 48) means OFF.

1 (integer: 49) means ON.

The : STATIstics:MODE command sets the mode of high and low limit in statistical function.

Command syntax::

STATIstics:MODE ABS  
PERcent

ABS the absolute value mode of high and low limit

PERcent the percentage mode of high and low limit

For example: WrtCmd(“STATIstics:MODE ABS”)

Query syntax: STATIstics:MODE?

Return value: <NR1><NL^END>

NR1 is 0 means the percentage mode

1 means the absolute value mode

The : STATIstics:CLEAr command clears statistical results.

The : STATIstics:START ON(1) command is used to enable statistic function.

OFF(0) command is used to disable statistic function.  
TRIG command is used to trigger the measurement.

The : STATIstics:COUNT? query returns the statistical comparator result.

Query syntax: : STATIstics: COUNT?

Response: <HI counting (NR1)>, <IN counting (NR1)>, < LO counting (NR1)>

For example: Query: STATI: COUNT?

Response: 1516, 9310, 737

The : STATIstics:MEAN? query returns the average value of statistical results.

The : STATIstics:MAXimum? query returns the maximum value of statistical results.

Query syntax: : STATIstics:MAXimum?

Response: <maximum (NR3), serial number corresponding to the maximum (NR1)>

For example: Query: :STATI: MAX?

Response: 1.2450E+01, 5

The : STATIstics:MINimum? query returns the minimum value of statistical results.

Query syntax: : STATIstics:MINimum?

Response: <minimum (NR3)>,< serial number corresponding to the minimum (NR1)>

For example: Query: :STATI: MIN?

Response: 1.2350E+01,8

The : STATIstics:SET <num>, <hi>, <lo> command sets the statistical times, statistical high and low limits.

**Command syntax:** :STATI:SET 20,200,100

Or STATI:SET 20,0.03,0.01 (percentage mode)

Query syntax: : STATIstics:SET?

Response:

<(NR2)>,<(NR3)>,< (NR3)>

For example: Syntax: :STATI:SET?

Response: 20, 2.0000E+02,1.0000E+02

Or 20,3.0000E-02,1.0000E-02



The : STATIstics:NORmaLA command sets the nominal value of primary parameter in statistical function.

Command syntax:

STATIstics: NORmaLA <value>

For example: STATIstics: NORmaLA 50

Set the nominal value of primary parameter to 50, the unit can be  $\Omega$  or V according to the selected measurement parameter.

Query syntax: STATIstics: NORmaLA?

Response: < NR3><NL^END>

The : STATIstics:NORmaLB command sets the nominal value of secondary parameter in statistical function.

Command syntax:

STATIstics: NORmaLB <value>

For example: STATIstics: NORmaLB 50

Set the nominal value of secondary parameter to 50, the unit can be  $\Omega$  or V according to the selected measurement parameter.

Query syntax: STATIstics: NORmaLA?

Response: < NR3><NL^END>

The : STATIstics:DEVIation? query returns the statistical deviation.

Query syntax: : STATIstics:DEVIation?

Response: < $\sigma_n$ (NR3)>

For example: Syntax: :STATI:DEV?

Response: 0.0159E-3

The : STATIstics:SampleVARiance? query returns the statistical variance.

Query syntax: : STATIstics: SampleVARiance?

Response: < $s_n$ (NR3)>

For example: Syntax: :STATI:DEV?

Response: 0.0159E-3

The : STATIstics:CP? query returns the Process Capability Index (CP).

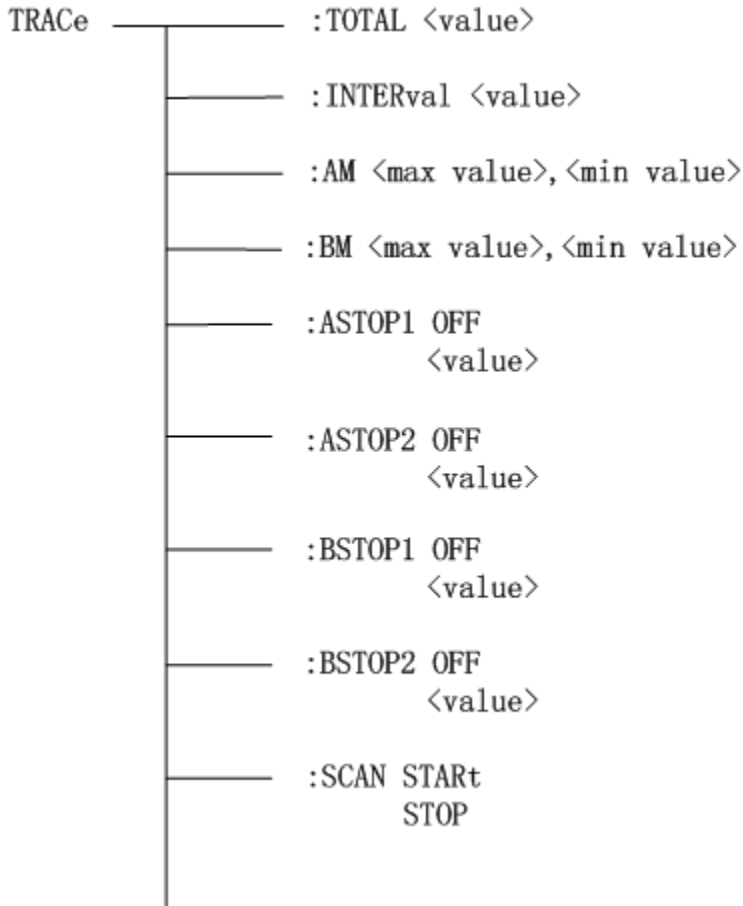
Query syntax: : STATIstics:CP?

Response: <Cp(NR2)>,<Cpk(NR2)>

For example: Syntax: :STATI:CP?

Response: 0.86, 0.14

### 7.1.9 TRACe Subsystem Commands



The :TRACe:TOTAL <value> command is used to set and return the total time of scanning.

For example: :TRACe:TOTAL 20

Query syntax: :TRACe:TOTAL?

Response: <value NR2>

The TRACe:INTERval <value> command is used to set and return the interval time between trace scanning.

For example: :TRACe:INTER 1.5

Response: <value NR2>

The :TRACe:AM<max value>, <min value> command is used to set the A Max value and the A Min value in trace scanning setting.

For example: :TRACe:AM 3.1600E+03,2.0000E+02

Query syntax: :TRACe:AM?

Response: <max value NR3>, <min value NR3>

The :TRACe:BM<max value>, <min value> is used to set and return the BMax value and the BMin value in the trace scanning setting.

For example: :TRACe:BM 5.1600E+01,1.0000E+01

Query syntax: :TRACe:BM?

Response: <max value NR3>, <min value NR3>

The :TRACe:ASTOP1 OFF

<value>

:TRACe:ASTOP2 OFF

<value>

:TRACe:BSTOP1 OFF

<value>

:TRACe:BSTOP2 OFF

<value> commands are used to set or return the stop point of trace scanning.

Command syntax:

:TRACe:ASTOP1 OFF Turn off the judging function of this stop point.

:TRACe:ASTOP1 <value> Set the value of the stop point as value.

Query syntax:::TRACe:ASTOP1?

Response: OFF or <value NR3>

The :TRACe:SCAN START (valid only in TRACE DISP page)

STOP command is used to start or stop trace scanning or to return the current state of trace scanning.

Command syntax:

:TRACe:SCAN START

:TRACe:SCAN STOP

Query syntax:



<value>        The serial number of file ranging from 1 to 100 (NR1).

For example: WrtCmd("MMEM:LOAD:STAT 1");

The :STORE:STATE command saves the current settings into a file.

Command syntax: MMEMory:STOR:STATE <value>, <name>

Where,

<value>        The serial number of file ranging from 1 to 20 (NR1).

<name>        File name (.STA is not attached, and the name length is not more than 15 characters)

For example: WrtCmd("MMEM:STOR:STAT 1,ABC");

## 7.2 GPIB Common Commands

- \*RST      ● \*TRG      ● \*IDN      ● \*TST
- \*ESE      ● \*SRE      ● \*ESR      ● \*STB
- \*OPC      ● \*CLS

- The \*RST command resets the instrument.

Command syntax: \*RST

For example: WrtCmd(“\*RST”);

- The \*TRG command triggers the measurement and then sends the result to the output buffer.

Command syntax: \*TRG

For example: WrtCmd(“\*TRG”);

NOTE: It is essential to set bus trigger (trig:sour bus) firstly before using “\*trg”.

- The \*CLS command clears the standard event status register and the service request status register.

Command syntax: \*CLS

For example: WrtCmd(“\*CLS”);

- The \*IDN? query returns TH2523’s identification string.

Query syntax: \*IDN?

Return format: <manufacturer>,<model>,<firmware><NL^END>

Where,

<manufacturer>      Name of Manufacturer

<model>                Instrument Model

<firmware>            Firmware Version

For example: WrtCmd(“\*IDN?”);

- The \*TST? query executes an internal self test and returns the test result as the sum of all existing errors codes. If there are no error TH2523 returns 0.

Query syntax: \*TST?

Return format: 0<NL^END>

Where, 0    0 (NR1 format)

For example: WrtCmd(“\*TST?”);

- The \*ESE (standard Event Status Enable command) command sets each open bit of the standard event status register. This command returns setups of each open bit for the standard event status permission register.

Command syntax: \*ESE<value>

Where,

<value>    NR1 format: decimal expression for each bit of operation status register.

Descriptions for each byte of the standard event status register are shown as follows:

Bit number	Description
7	Power On(PON) Bit
6	User Request(URQ) Bit
5	Command Error(EME) Bit
4	Execution Error(EXE) Bit
3	Device Dependent Error(DDE) Bit
2	Query Error(QYE) Bit
1	Request Control(RQC) Bit
0	Operation Complete(OPC) Bit

Query syntax: \*ESE?

Return format: <value><NL^END>

For example: WrtCmd(“\*ESE?”);

- The \*SRE (Service Request Enable command) command sets each open bit of the service status byte register. This command returns the current setups for each open bit of the status byte permission register.

Command syntax: \*SRE<value>

Where,

<value> NR1 format: decimal expression for each permission bit of the status byte register.

Descriptions for each byte of the status byte register are shown as follows:

Bit number	Description
7	Operation Status Register Summary Bit
6	RQS(Request Service) Bit
5	Standard Event Status Register Summary Bit
4	MAV(Message Available) Bit
3-0	Always 0(zero):

Query syntax: \*SRE?

Return format: <value><NL^END>

For example: WrtCmd(“\*SRE?”);

- The \*ESR? query returns the contents of the standard event status register.

Query syntax: \*ESR?

Return format: <value><NL^END>

Where,

<value> NR1 format: decimal expression for contents of the standard event status

register.

Descriptions for each bit of the standard event status register are shown as follows:

Bit number	Description
7	Power On(PON) Bit
6	User Request(URQ) Bit
5	Command Error(EME) Bit
4	Execution Error(EXE) Bit
3	Device Dependent Error(DDE) Bit
2	Query Error(QYE) Bit
1	Request Control(RQC) Bit
0	Operation Complete(OPC) Bit

For example: WrtCmd(“\*ESR?”);

- The \*STB? query returns contents of the standard service status byte register. The execution of this command will not affect contents of the standard status byte register.

Query syntax: \*STB?

Return format: <value><NL^END>

Where,

<value> NR1 format: decimal expression for contents of the standard status byte register.

Descriptions for each bit of the standard status byte register are shown as follows:

Bit number	Description
7	Operation Status Register Summary Bit
6	RQS(Request Service) Bit
5	Standard Event Status Register Summary Bit
4	MAV(Message Available) Bit
3-0	Always 0(zero)

For example: WrtCmd(“\*STB?”);

- The \*OPC command equals to set the OPC bit of the standard event status register when TH2523 finishes all parameter measurements. Ever since all pending operations have been completed, this command will inform the instrument to add a ASCII number “1” (decimal number: 49) into the output buffer.

Command syntax: \*OPC

For example: OUTPUT 717;“\*OPC”! Set the OPC bit of the instrument when the last command is done.

Query syntax: \*OPC?



Return format: 1 <NL^END>

Where,

0            ASCII number 1 (decimal number: 49)

For example: WrtCmd(“\*OPC?”)

## Chapter 8 Handler Interface

TH2523 AC milliohmmeter equips with a Handler interface which is mainly used to output the sorting result. When the instrument is applied to an automatic component sorting test system, this interface will output the handshake signal and the sorting result output signal. The sorting result output corresponds to the comparison result output of the current comparator bin. The interface style of the HANDLER is PIN36 (total 36 pins).

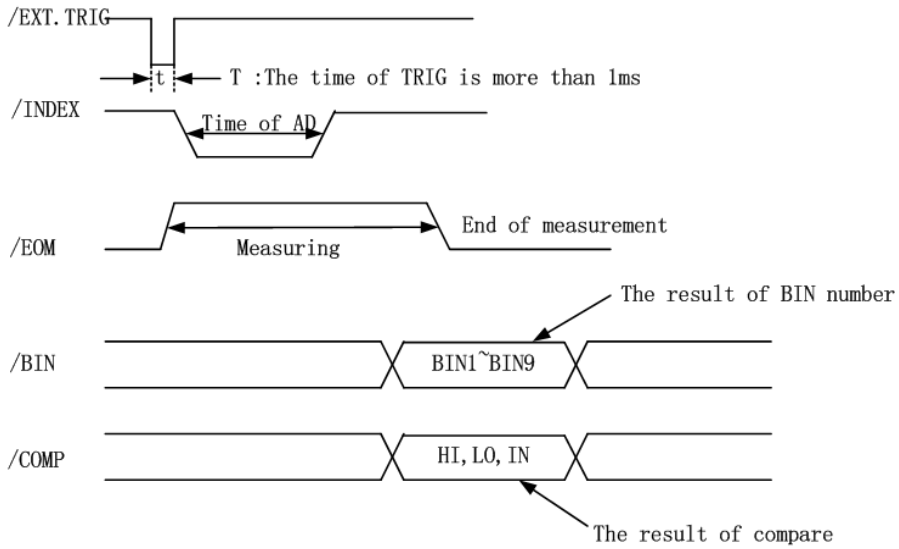
Terminals and Their Descriptions: Higher; the low bin comparison result output signal will be valid.

pin	signal name	description
1~9	/BIN1~/BIN9	In Compare mode, the low bin number signal is effective.
10	/OUT	In compare mode or bin mode, if the compare result of BIN1~BIN9 are FAIL, this signal will be output and low output signal is effective. Otherwise, high signal is output.
11	NC	Null pin.
12 13	/EXT.TRIG	External trigger signal input (the trigger mode must be EXT.TRIG), low signal is effective.
14 15	EXTV2	External power supply 2, the voltage range: +5V~+30V. <b>EXTV2</b> and <b>EXTV1</b> are external power supply. When using external power supply, they must be connected to the external power supply together, not just one of them.
16 17 18	VCC	The internal power +5V
19	/PHI	The main parameter is higher: the low bin comparison result output signal is

		effective.
20	/PLO	The main parameter is lower: the low bin comparison result output signal is effective.
21	/PIN	The main parameter PASS: the low bin comparison result output signal is effective.
22	/SHI	The secondary parameter is higher: the low bin comparison result output signal is effective.
23	/SIN	The secondary parameter PASS: the low bin comparison result output signal is effective.
24	/SLO	The secondary parameter is lower: the low bin comparison result output signal is effective.
25	/KEYLOCK	When this single is effective, the keys in the front panel are locked. Low signal is effective.
26	NC	Null pin.
27, 28	EXTV1	External power supply 1, the voltage range: +5V~+30V. <b>EXTV2</b> and <b>EXTV1</b> are external power supply. When using external power supply, they must be connected to the external power supply together, not just one of them.
29	NC	Null pin.
30	/INDEX	When AD data is conversing, the low signal output is effective.
31	/EOM	When the test finishes, this low signal output is effective.
32,33	COM2	The reference ground for external power EXTV2.
34~36	COM1	The reference ground for external power

	EXTV1.
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Timing chart:



## Chapter 9 Package Contents and Warranty

### 9.1 Marks

The following marks can be seen on each instrument panel and nameplate:

- a. Manufacturer name and trademark
- b. Product name and model
- c. Product number and date
- d. the License for Manufacturing Measurement Instruments and its number
- e. Marks for test terminal

### 9.2 Package

The instrument, generally wrapped in a plastic bag, should be packed in a strong packing box that could resist dust, vibration and moisture. Accessories, spare parts, operation manual and manufacturer certificates, etc. should also be included in it.

### 9.3 Shipping

In the shipment, the instrument should be handled with care and some precautions must be taken to resist moisture and water.

### 9.4 Storage

The instrument should be stored in an airy room where the environment temperature ranges from 5°C to 40°C, relative humidity is not greater than 85% and the air contains no detrimental impurities that might corrode the instrument.

### 9.5 Warranty

This Tonghui instrument product is warranted against defects in material and workmanship for a period of two years from the date of shipment. You should supply us with the warranty card before you enjoy the free maintenance service. This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alterations or repairs. Tonghui will, without charge, repair or replace, at its option, defective product or component parts.

The maintenance for this instrument should be performed by professional maintenance personnel. Do not substitute the internal components unauthorized when maintaining. In order to ensure the measurement accuracy, the instrument must be measured and corrected after maintenance. You should bear the maintenance expense for damages caused by unauthorized repairing or substituting components.