TR-2600 Series

Multi-Channel DC Resistance Meter

Operation Manual

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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.

1.1 Introduction to Instrument

TR-2600 series adopts 32 bits CPU and high density SMD technology. 24 bits, 4.3-inch LCD screen brings ease for your eyes and convenience to your operation. The maximum 0.05% accuracy and minimum 1 μΩ resolution shore up its leading role in testing relay contact resistance, interconnecting resistance, conductor resistance, PCB resistance and welding-hole resistance. Temperature compensation functions make your tests be free from the effect of the environment temperature. The offset voltage compensation (OVC) has effectively eliminated the electromotive force of the DUT and its contact potential difference. For the contact influence of the thermoelectricity on DUT, its elimination is achieved; especially when the resistance changes with the temperature greatly, better measurement results will be achieved.

TR-2600 series can simultaneously measure the resistance of 20 channels (TR-2610: 10 channels; TK-2620: 20 channels;) and display the measurement data and sorting results on the screen. Each channel has a test accuracy of 0.05% and a measurement range of 1 μΩ ~ 2MΩ, which are displayed in 5 digits.

Automation on production lines can be greatly improved by the realization of ultra-high measurement speed and independent comparator setting for each channel, and the results of the 20 channels comparator are output through the HANDLER interface respectively.

TR-2600 series is equipped with RS-232 interface, USB-VCOM, HANDLER interface and TC (temperature compensation) Function as standard.

TR-2600 series is a powerful test tool for all kinds of resistor design, detection, quality control and production. With multiple output data display, comparison mode and bin comparator, TR-2600 series can meet different test requirements of different resistor manufacturers.

The excellent performance makes the test results meet IEC and IML standard.

1.2 Unpacking

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

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

1.3 Power

1) Power supply: 90V-125V, 190V-250V.
2) Power supply frequencies: 50Hz and 60Hz
3) Power supply power range: ≤30VA.
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 specially 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 source filter please.

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

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, directly sunshine and corrosive gas
2) Working Condition:

   temperature：0℃～40℃，humidity:≤80%RH，no condensation
3) Storage Condition:

   temperature：-10℃～50℃，humidity:≤90%RH，no condensation。
4) For getting best performance, do not block the left air vent so to ensure good ventilation
5) The instrument has been specially 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 noise cannot be avoided, install a power filter please.
6) Test leads on the instrument that are connected to DUTs should be kept away from strong electromagnetic fields to avoid interference.

1.6 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 Hi and Lo terminals on the instrument front panel. Ensure the color and arrow conformity of the test fixture with that of sockets on panels, thus to avoid abnormal measurement.

1.7 Warm-up

1) For accurate measurement performance, 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 corrupt

1.8 Other Features

1) Consumption：≤30VA
2) Dimensions（W*H*D）：235mm*105mm*360mm；this dimension is the final packaging size.
3) Weight: Approx. 3.5kg

Chapter 2 Front and Rear Panels Introduction

This chapter will introduce the basic operation of TR-2600 series. To use the instrument properly, please read this chapter carefully.

2.1 Front Panel

Figure 2-1 shows the front panel o TR-2600 series

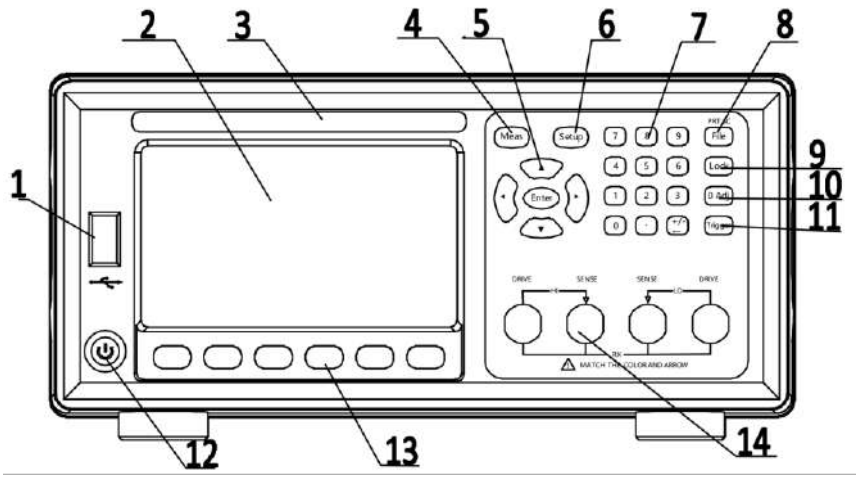


Figure 2-1 Front Panel

1) **USB interface**

HOST interface of USB

2) **LCD true color screen**

480*272 dot-matrix, 24-bit, 4.3-inch TFT LCD is used for measurement setup and result display

3) **Trademark and Model**

Show instrument trademark and model.

4) **Meas**

Press Meas key to enter into the Meas Disp page.

5) **Universal Arrow Keys and enter key**

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

Press this key to terminate and store input data.

6) **Setup**

Press Setup key to enter into the Meas Setup page.

7) **Digital Keys**

Used to input Digit

8) **File**

Press File key to enter into the page of internal and external File Manage

Long press File key to do screen copy

9) **Lock**

Press Lock key to switch key lock status

10) **0 ADJ**

Press [0 ADJ] to execute correction function.

11) **Trigger**

When the trigger mode is set as MANU (manual), pressing this key can trigger the instrument manually.

12) **Power**

Power Switch。

13) **SoftKeys**

Softkeys used to set instrument based on page and cursor position

14) **Front Panel Test terminals (INPUT)**

4-terminal test terminal is used to measure DUT by a 4-terminal test cable.
The color and arrow of the test cable should correspond to that of socket on panel, thus to avoid abnormal measurement.

2.2 Rear Panel

Figure 2-2 shows the front panel of TR-2620.

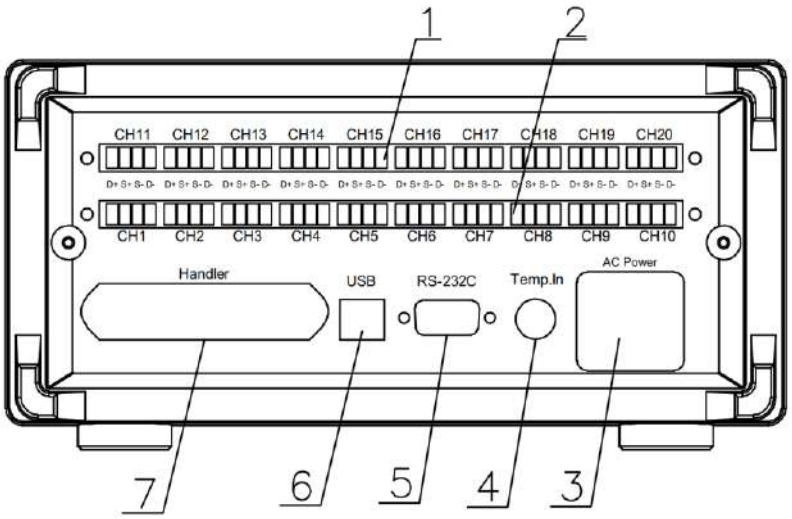


Figure 2-2 Rear Panel

1) Scan test terminal 11~20, each channel including four Pins:

D+：High Driver Terminal

S+：High Sense Terminal

S-：Low Sense Terminal

D-：Low Driver Terminal

2) Scan test terminal 1~10

3) **Fuse socket and Power Socket**

Fuse will be placed in this socket to protect the instrument; be used to input AC power.

4) TEMP.INPUT

There are two kinds of temperature signal input: Pt500 and Pt100 Input.

5) **RS232C Serial Interface**

It realizes serial communication of the instrument with PC.

6) **USB Interface**

PC can remotely control TR-2600 series through USB DEVICE.

7) **HANDLER Interface**

Through HANDLER interface, an automatic test system can be conveniently constructed to realize auto test. TR-2600 series will output bin comparator result signals and handshake signals by this interface, meanwhile, external trigger signal will also be sent to the instrument by it.

2.3 Alone Measurement Mode Display Zone

TR-2600 series adopts 24-bit 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.

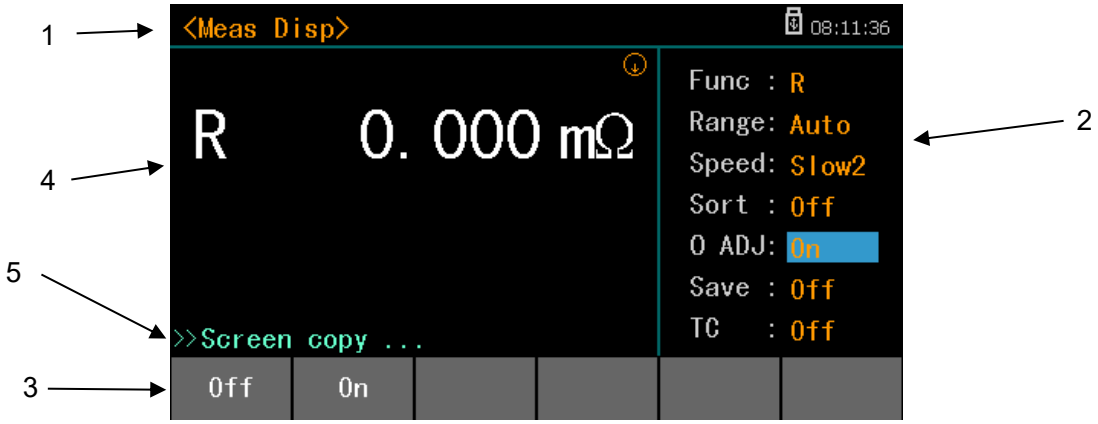


Fig.2-3 display zone definition

1) Page Title

This zone shows the current page name.

2) Function zone

This zone is used to change the measurement mode and measurement parameters.

3) Soft keys

This zone displays the function menu corresponding to the cursor-located zone.

4) Result display

This zone displays the measurement result such as resistance and temperature.

5) Prompt zone

This zone displays all prompt information.

2.4 Scan Measurement Mode Display Zone

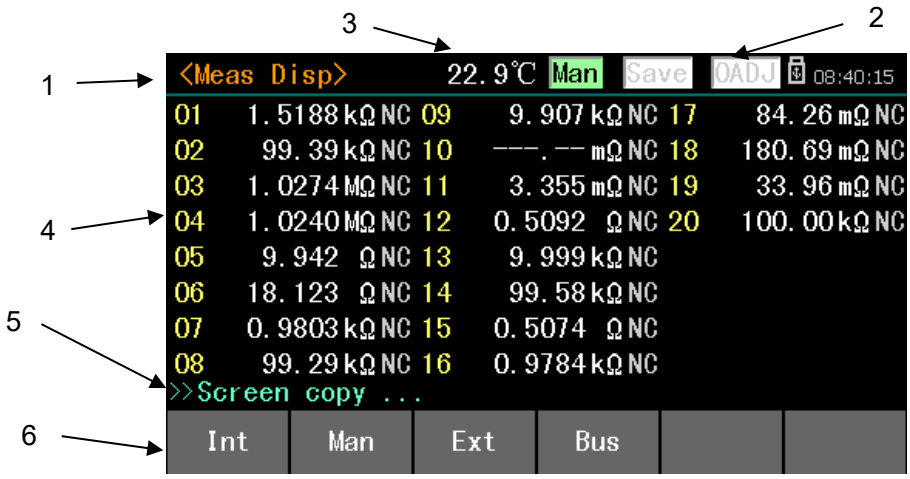


Fig.2-3 TR-2620 display zone definition

1) Page Title

This zone shows the current page name.

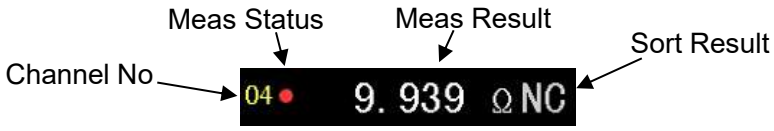
2) Function zone

This zone is used to set these three configurations:

- Trigger Mode
- Data Save
- 0 ADJ Status

3) Temperature Display when function is R-T or LPR-T

4) Resistance Measurement Result Settings and Display



4.1 Channel No

When move cursor to this zone, the measurement setting of that channel can be set, there are three options:

Off ： turn off that channel.

Scan： Add that channel to Scan list

Cycle： Only measure that channel

4.2 Measurement status.

stand for that channel is measuring…

stand for that channel is cycle measuring, only this channel in scan list.

4.3 Meas Result

There will display “ -OFF-” when that channel is turn off

4.4 Sort Result

NC： Sort function is off

Lo：the sort result of that channel is low (< low limit)

GD：the sort result of that channel is Good (low limit <R<high limit)

Hi： the sort result of that channel is High (> high limit)

5) Prompt zone

This zone displays all prompt information.

6) Soft keys

This zone displays the function menu corresponding to the cursor-located zone.

2.5 Introduction to Buttons on Front Panel

1) Meas

Press [MEAS] to enter into main measurement page. Selectable functions in this page are shown as follows:

< Meas Disp>
<Statics Dlisp>
<Meas Setup >
<Sort Setup >
<System Setup>

2) Setup

Press [Setup] to enter into measurement setup page. Selectable functions in this page are shown as follows:

< Meas Disp>
<Statics Dlisp>
<Meas Setup >
<Sort Setup >
<System Setup>

3） File

Enter file page or screen print (long press)

4） Lock

Switch the lock status of buttons

5） O ADJ

Execute 0 ADJ

6） Trigger

Trigger one time measurement if Trigger Mode is Man

2.6 Basic operation

Simple operation steps for TR-2600 series:

1) Use [Meas], [Setup] or [File] or soft keys to enter into the page required to enter. (Refer to figure 3-1)
2) Use arrow buttons ([←] [↑] [→] [↓]) to move the cursor to desired zone.
3) When the cursor is moved to a soft key zone, press Enter to confirm the selection. If it is required to input a number or a file name, use the keyboard to input and press Enter to finish entry. You can use arrow buttons to select a number or a letter.

2.7 Power Up

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

Chapter 3 Basic Operation

3.1< MEAS DISP> For Scan Mode

press down [Meas], the <Meas Disp> page will be displayed in the screen shown as figure 3-1~3.

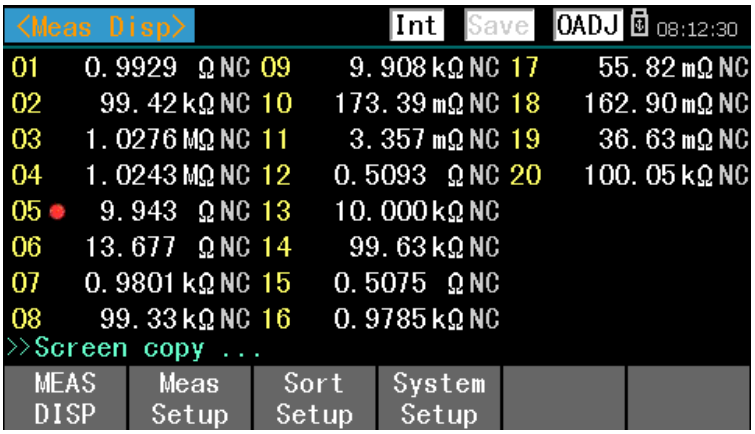


Figure 3-1 TR-2620 Scan mode Measure Display

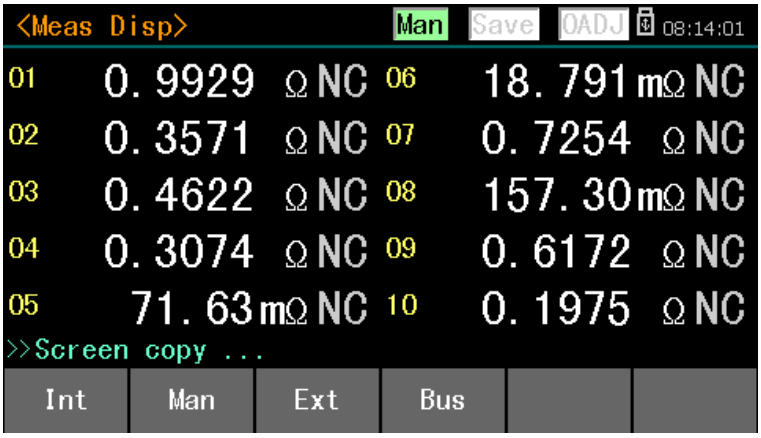


Fig.3-2 TR-2610 Scan mode Measure Display

Fig.3-3 TR-2604 Scan mode Measure Display

3.1.1 Trigger Mode

When move cursor to this zone， the menu will be displayed as following:

- Int

  Auto measurement mode

- Man

  Manual measurement mode

- Ext

  External trigger mode

- Bus

  BUS trigger mode

3.1.2 Data Save

Move cursor to Save(Save measurement data to U disk), Softkeys will be displayed as following：：

- Off

  Turn off save status。

- On

  Turn on save status

Once SAVE DATA OFF is selected, you must press SAVE DATA ON to terminate or the saved data will be lost.

3.1.3 0 ADJ

Move cursor to 0 ADJ, Softkeys will be displayed as following：

- On

  turn on the function of short correction.

- Off

  turn off the function of short correction.

Use above soft keys to modify 0 ADJ function.

3.2 < MEAS DISP> For Alone Mode

press down [Meas], the <Meas Disp> page will be displayed in the screen shown as figure 3-2.

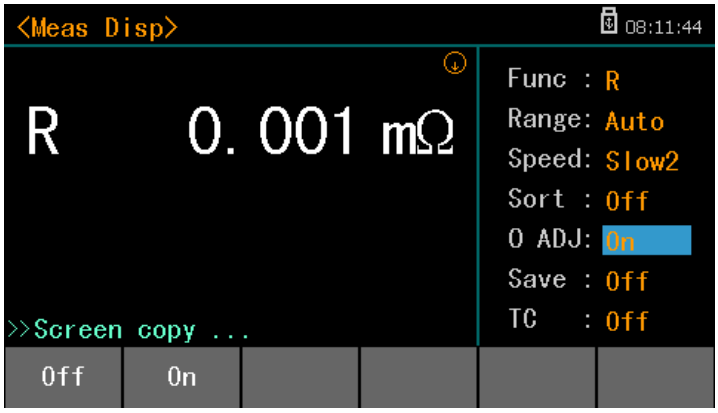


Figure 3-4 Alone mode Measure Display

3.2.1 Measurement Functions

1) Measurable parameters on TR-2620 are as follows：

- R (Resistance)
- R-T (Resistance and temperature)
- T (Temperature)
- LPR (resistance test at low current mode)
- LPR-T (Temperature and resistance test at low current mode)

Setting steps for measurement function:
You use buttons or touch the screen to select **FUNC**, available soft keys will be displayed in the right soft key zone.
：

- R
- R-T
- T
- LPR
- LPR-T

3.2.2 Measurement Range

There are two resistance modes: resistance measurement mode and resistance measurement at low voltage mode. Measure and display two types of parameters: resistance parameters and temperature parameters.
TR-2600 series has 9 DC resistance ranges: **20mΩ, 200mΩ, 2Ω, 20Ω, 200Ω, 2kΩ, 20kΩ, 200kΩ, 2MΩ**
TR-2600 series has 4 DC low voltage resistance ranges: **2Ω, 20Ω, 200Ω, 2KΩ**
TR-2600 series The testing range of temperature (Pt500 and Pt100): **-10℃ to 99.9℃.**

Operation steps for setting measurement ranges:

1) Touch the range zone, the following soft keys will be displayed.
   - **Auto** Set the range mode as Auto.
   - **Hold** Switch the range mode from Auto to Hold. When the range mode is set as HOLD, the range will be locked at the current measurement range which is displayed in the **Range** zone.
   - **↑ (+)** Increase the range.
   - **↓ (-)** Decrease the range.
2) Touch the corresponding soft key to select the required range.

3.2.3 Measurement Speed

TR-2600 series displays the measurement result as a 5-digit number in the decimal point floating mode. The measurement result of the speed is shown as a 4-digit number with one digit after the decimal point.

Touch the speed zone, the following soft keys will be displayed.

- **Fast**

- **Med**
- **Slow1**
- **Slow2**

Use above soft keys to modify the speed.

3.2.4 Sort

Move Cursor to Sort，Softkeys will be displayed as following：

- Off turn off sort function
- On turn on comparator function with high and low threshold

Hi : measurement result above high threshold

Lo: measurement result below low threshold

In: measurement result follow in [Lo, Hi]

3.2.5 0 ADJ

Move cursor to 0 ADJ, Softkeys will be displayed as following：

- On

turn on the function of short correction.

- Off

turn off the function of short correction.

Use above soft keys to modify 0 ADJ function.

3.2.6 Data Save

Move cursor to Save (Save measurement data to U disk), Softkeys will be displayed as following：：

- Off

Turn off save status。

- On

Turn on save status

Once SAVE DATA OFF is selected, you must press SAVE DATA ON to terminate or the saved data will be lost.

3.2.7 TC

Move cursor to TC，the following menu will be displayed。See 3.6.3 for detail。

- Off

Turn off temperature related function.

- On

Turn on temperature correction function.

3.3 < MEAS SETUP>

Press the [Setup] or the soft key Meas Setup to enter into the Meas Setup page shown as figure 3-5.

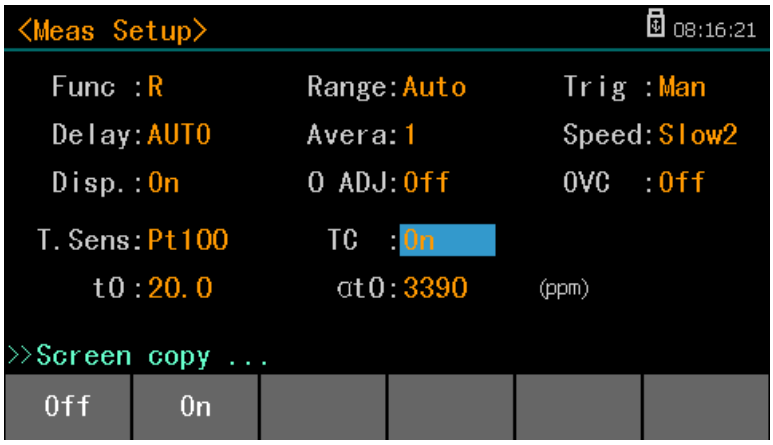


Figure 3-5 Measurement Setup page

3.3.1 Measurement Functions

See 3.2.1 for detail。

3.3.2 Measurement Range

See 3.2.2 for details。

3.3.3 Trigger Mode

When move cursor to this zone， the menu will be displayed as following:

- Int

  Auto measurement mode

- Man

  Manual measurement mode

- Ext

  External trigger mode

- Bus

  BUS trigger mode

3.3.4 Delay

When move cursor to this zone， the menu will be displayed as following:

- Auto

  Use default delay value， i.e. 5ms

- Manual

  Use digital key to input delay, range from 0ms to 9.999s.

Note: If the delay time is set as 0ms, the detection for wrong measurement cannot be executed. Therefore, it is recommended to set the delay time being more than 1ms

3.3.5 Average

Input the average number ranging from 1 to 255. The larger the average number is set, the better the accuracy will be obtained but the longer time it will cost to display the result. Use digital button to input

3.3.6 Speed

See 3.2.3 for detail

3.3.7 Display

When move cursor to this zone， the menu will be displayed as following:

- On

  Display measurement result on main screen.

- Off

  Do not display measurement result on main screen to speed up measurement.

3.3.8 0 ADJ

See 3.1.3 for detail.

3.3.9 OVC

When move cursor to this zone， the menu will be displayed as following:

- On

  Turn on the offset voltage compensation. **TR-2604 has no this function**

- Off

  Turn off the offset voltage compensation

3.3.10 T.Sense

Move cursor to zone T.Sense, the menu will be displayed as following:

- Pt 100

  Set temperature sensor as Pt 100, in this case, please plug “Pt100 temperature sensor” into TEMP.INPUT interface, which reside on rear panel

  Note: Attached accessories includes PT100

- Pt 500

  Set temperature sensor as Pt 500, in this case, please plug “Pt500 temperature sensor” into TEMP.INPUT interface, which reside on rear panel

3.3.11 TC

Move cursor to zone TC， the menu will be displayed as following:

◆ Off

Turn off TC

◆ On (Temperature Correction)

Temperature correction (TC): By this function, the resistance tested under the current environment temperature will be converted to a resistance value under the user-set environment temperature. For instance, a resistor is tested as 100Ω under 20℃. If user sets the temperature as 10℃, after correction, the value will be displayed as 96.22Ω. This is realized by formulary conversion.

Formula: Rt=Rt0*{1+αt0*(t-t0)}

Rt Resistance measured under the current environment temperature
Rt0 Resistance after correction
t0 Preset temperature
t Current environment temperature
α_{t0} Temperature coefficient of the material

For example: A resistor is measured as 100Ω under 20℃ (Suppose the temperature coefficient as 3930ppm), the resistance under 10℃ will be 96.22Ω.

$$R_{t0} = \frac{R_t}{1 + at0 * (t - t0)} = \frac{100}{1 + (3930 \times 10^{-6}) \times (20 - 10)} = 96.22\Omega$$

NOTE: Before measurement, it is necessary to warm up the instrument and the probe for about half an hour. The temperature sensor should be placed to the DUT as close as possible but cannot contact it. After the displayed result comes to be stable, you can read or record the result.

NOTE: Conductivity and temperature coefficient of metal and alloy

Metallic material	Metal [%]	Material density ($x10^3$) [kg/m^3]	Conductivity	Temperature coefficient (20℃) [ppm]
Annealed copper	Copper>99.9	8.89	1.00 to 1.02	3810 to 3970
Hard-drawn copper	Copper>99.9	8.89	0.96 to 0.98	3370 to 3850
Cadmium copper	Cadmium: 0.7 to 1.2	8.94	0.85 to 0.88	3340 to 3460
Silver copper	Silver: 0.03 to 0.1	8.89	0.96 to 0.98	3930
Chromium copper	Chromium: 0.4 to 0.8	8.89	0.40 to 0.50 0.80 to 0.85	20 30
Anti-corrosion alloy	Nickel: 2.5 to 4.0 Silicon: 0.5 to 1.0	---	0.25 to 0.45	980 to 1770
Soft aluminum	Aluminum>99.5	2.7	0.63 to 0.64	42
Hard-drawn aluminum	Aluminum>99.5	2.7	0.60 to 0.62	40
Aluminum alloy	Silicon: 0.4 to 0.6 Magnesium: 0.4 to 0.5 Aluminum: 99.2 to 98.9	---	0.50 to 0.55	36

NOTE: Calculating the conductivity and the temperature coefficient of the copper wire:

Diameter [mm]	Annealed copper (Conductivity)	Tinning and annealed copper (conductivity)	Hard-drawn copper (Conductivity)
0.01 to 0.26	0.98	0.93	---
0.26 to 0.50	0.993	0.94	0.96
0.50 to 2.00	1.00	0.96	0.96
2.00 to 8.00	1.00	0.97	0.97

- Temperature coefficient (α_t) varies with environment temperature and material conductivity. It is supposed that the temperature coefficient of a material at 20℃ is α_{20}, its temperature coefficient (α_{ct}) at t℃ will be as the following expression:
- $$\alpha_{ct} = \frac{1}{\frac{1}{\alpha_{20} \times c} + (t - 20}$$

3.4 <Sort Setup> For Alone Mode

Move cursor to zone title, press softkey [Sort setup] to enter Sort Setup page. As shown in Figure 3-7、Figure 3-8:

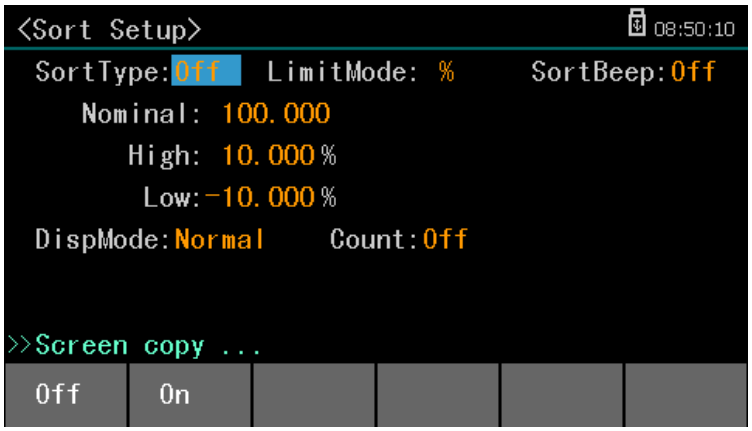


Figure 3-7 Sort setup page for Alone Mode

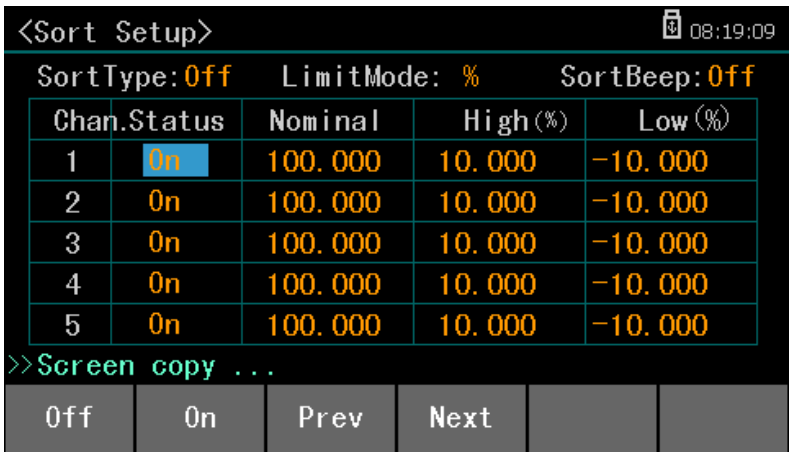


Figure 3-8 Sort setup page for Scan Mode

3.4.1 Sort

Move cursor to zone Sort, the menu will be displayed as following:

- None

  Turn off Comparator

- On

  Press this softkey to turn on comparator, which compare measurement value with hi and low limit to get sort result

3.4.2 Limit mode

ABS->absolute limit mode, %->percentage limit mode

3.4.3 Comp beep

Off-> turn off beep

NG-> beep when comp result is Hi or Lo

GD-> beep when comp result is GD

3.4.4 Status (only for Alone Mode)

Off-> Turn off that channel

On-> Turn on that channel

Prev-> Previous channels

Next-> Next channels

3.4.5 Sort Limit Value

Nominal : Nominal of limit when limit mode is percentage

Up： upper limit

Low： lower limit

Note: set the above parameter with digital button

3.4.6 Display mode(only for Alone Mode)

Normal-> display the measurement resistance result

Dev-> display the deviation related to **Nominal**

3.4.7 Count(only for Alone Mode)

off-> turn off count

On-> turn on count

Clear-> clear count data

Chapter 4 System Setup and File Manage

4.1 System Setup

Entering the system setup page, you can press **[System Setup]** when cursor is on title to select system setup page as shown in figure 4-1.

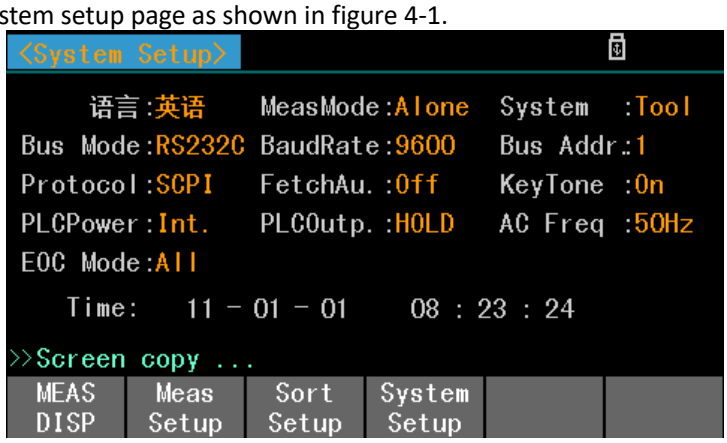


Fig. 4-1 System setup page

4.1.1 Language

When move cursor to this zone， the menu will be displayed as following:

- English

  Set the language as English.

- Chinese

  Set the language as Chinese.

4.1.2 Meas Mode

When move cursor to this zone， the menu will be displayed as following:

- Alone

  Set the instrument as **Alone** Measurement mode, Measurement Terminal will be Front Panel Measurement terminal

- Scan

  Set the instrument as **Scan** Measurement mode, Measurement Terminal will be Rear Panel Measurement terminal.

4.1.3 Tool

When move cursor to this zone， the menu will be displayed as following:

- System Reset

  To reboot the instrument.

- Default Settings

Reset all settings to default value.

- System Info

  To display system information, such as type, version etc.

- Update

  To update Firmware of instrument。

4.1.4 Bus Mode

Bus mode is used to set the communication interface.

When move cursor to this zone， the menu will be displayed as following:

- RS232C

  To select the RS232C interface.

- USBVCOM

  To select the USBVCOM interface。The instrument communicates with PC through the USB interface on the rear panel.

- RS485

  To select the RS485 interface. When use this interface, RS232/RS485 converter is needed

4.1.5 Baud Rate

Use soft key to select Baud rate， the following six baud rates is selectable:

- 9600
- 19200
- 28800
- 38400
- 57600
- 115200

4.1.6 Bus Address

To set bus address when comm protocol is Modbus.

When move cursor to this zone， the menu will be displayed as following:

- **++**

  Press this soft key, the address will increase rapidly by 5

- **+**

  Press this soft key, the address will increase by 1。

- **-**

Press this soft key, the address will decrease by 1。

- --

Press this soft key, the address will decrease rapidly by 5。

4.1.7 Comm protocol

When move cursor to this zone， the menu will be displayed as following：

- SCPI

To select protocol SCPI.

- Modbus

To select protocol Modbus

Note: the related command set see related file

4.1.8 Auto Fetch

(Measurement result will send out through communication interface automatically when this function is on)

When move cursor to this zone， the menu will be displayed as following:

- Off

To turn on Auto Fetch.

- On

To turn off Auto Fetch.

4.1.9 Key Tone

When move cursor to this zone， the menu will be displayed as following:

- On

To turn on the key tone.

- Off

To turn off the key tone.

4.1.10 PLC power

When move cursor to this zone， the menu will be displayed as following:

- Ext

To set Handler Power as external power supply.

- Int

To set Handler Power as external power supply.

4.1.11 PLC Output

When move cursor to this zone， the menu will be displayed as following:

- Hold

  Keep current Sort result on Handler till next Sort result is available.

- Pulse

  Keep current Sort result on Handler this period and then reset to default status. Period range：1ms~2000ms. Use digital key to input.

4.1.12 AC Frequency

TR-2600 series supplies two power supply frequencies: **50Hz** and **60Hz**. Please select the correct frequency so as to eliminate the influence of the power noise on the instrument.

When move cursor to this zone， the menu will be displayed as following:

- 50Hz

  Select 50Hz as AC frequency.

- 60Hz

  Select 60Hz as AC frequency.

4.1.13 EOC Mode

Customers can set the EOC output timing to single channel and all channels according to the timing requirements of automation equipment. See Chapter 6.6 and 6.7 for the specific timing diagram under the two settings.
When it is set to **Single** channel, when the fetch command obtains the measurement results, the measurement results will be returned immediately when the test of each channel is completed.
When it is set to **All** channels, when the fetch command obtains the measurement results, the measurement results of all channels will be returned at one time after the test of all channels is completed.
When move cursor to this zone， the menu will be displayed as following:

- Single

  Select Single as EOC Mode

- All

  Select All as EOC Mode

4.1.14 Setting Time and Date

Set the time.
For example: 8 o’clock 21 minute and 20 second a.m. on February 8, 2021 will be shown as 21-02-08 08:21:20.
Operations are as follows: Touch the time zone to be modified, the following items will be displayed.

- ↑↑ (++)
  Touch this key, the time will increase rapidly by 5.
- ↑ (+)
  Touch this key, the time will increase by 1.
- ↓ (-)
  Touch this key, the instrument will decrease by 1.
- ↓↓ (--)

Touch this key, the instrument will decrease rapidly by 5.

- **<<**

  Touch this key, the cursor under the time will move left.

- **>>**

  Touch this key, the cursor under the time will move right.。

4.2<File Manage>

TR-2600 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 of TR-2600 series.

Note: The instrument will load setting which is saved by last power off.

4.2.1 Introduction to Save/Recall

By the function of save/recall, user can save measurement results and configuration information to TR-2600 series internal Flash or external U disk; meanwhile user can recall data from TR-2600 series internal Flash or external U disk.

Introduction to Methods and Applications of Save

The table below shows the applicable save methods and applications:

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.

Table 4-1 Methods and Applications of Save

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.

Folder	Maximum Amount of File	Description
CSV	999	Including measurement result, like *.CSV file.
STA	999	Including configuration data, like *.STA file.
IMAGE	999	Including screen information, like *.GIF file.

Table 4-2 Folder in U disk

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:

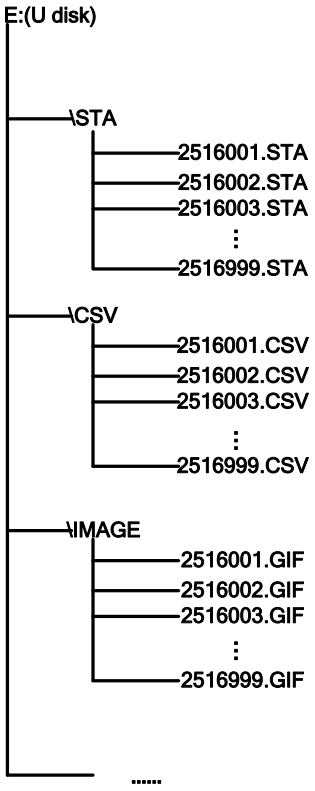


Figure 4-2 file structure in a U disk

When using a U disk on TR-2600 series, you should pay special attention to the following points:

1. Use a U disk with the USB2.0/USB3.0 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 TR-2600 series, you are recommended to save the data on it and Tessio 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.

4.2.2.1 Operation Procedures

Press **FILE** button in any page and select **File Manage** to enter into the internal file page shown in below figure.

Touch [Inter File] and [External File] to respectively display files stored in the internal FLASH and the external U disk. Touch [Exit] to exit the file manage page.

Figure 4-3 Internal file page

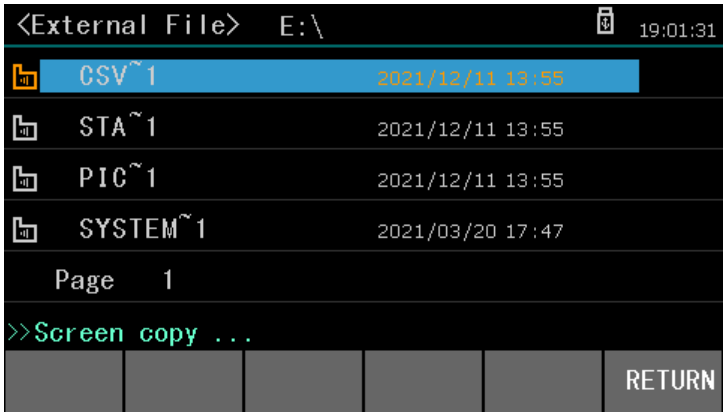


Figure 4-4 External file page

Four files' information will be displayed in the internal file page or the 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.

4.2.2.2 Operations on file are as follows

Move cursor to the file name to be edited (If the file name does not exist in the current page, you can move cursor to [Page 1] and select [Previous Page] and [Next Page] to toggle between file pages, and then select the desired file.), the following items will be displayed.

- **Load**

  Press this soft key, 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**

  Press this soft key, [Yes] and [No] will be displayed in the soft key zone. When [No] is selected, the current operation of save file will be cancelled; when [Yes] is selected, the numerical keyboard will pop up and then you can input the file name and press [Enter] to finish inputting. Thus, the current settings in all pages will be saved to the file. (NOTE: When storing a file, if the inputting file number has already existed, the save operation will overwrite the original file.)

- **Delete**

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

- **Copy to E**:

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

- **Select**

  Press soft key “Select”, the file the cursor locates will be selected. TR-2600 series can simultaneously copy several files to a U disk.

  Press soft key “Select” once again, the selected file will be cancelled from selection.

- **Save Measurement Results**

  In the “Meas Disp” page, turn on “Save” to save measurement results to a U disk. Turn off “Save”, the instrument will stop saving measurement results.

- **Save Screen Information:**

  Long press button “File” to store the current screen information to a U disk.

  Operations of External File and Folder

  Operations of external file are similar to that of internal file.

Chapter 5 Performance Index

5.1 Performance Index

5.1.1 Channel Number

Type	Channel No.
TR-2620	20
TR-2610	10
TR-2604	4

5.1.2 Measurement Speed

Speed	Time per channel (display off)	Time per channel (display on)
Fast	12ms	15ms
Med	27ms	30ms
Slow1	122ms	125ms
Slow2	244ms	247ms

5.1.3 Measurement Parameters and Notations

R：Resistance
T: Temperature
LPR: Low current mode

5.1.4 Measurement Combination

Five Combinations:

TR-2600 series：R，R-T，T，LPR，LPR-T

5.1.5 Range

Range Mode: Auto, Manu (Hold, Up, Down)

5.1.6 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 HANDLER interface on the rear panel.
BUS: The measurement of the instrument will be triggered through the communication interface.

5.1.7 Mode of Test Terminal

4-terminal measurement mode for both Alone and Scan mode
Drive HI：Current-drive high terminal
Drive LO: Current-drive low terminal
Sense HI：Voltage-sense high terminal
Sense LO：Voltage-sense low terminal

5.1.8 Resistance Measurement Time

When OVC is Off:

50Hz	60Hz	
5ms+t1	5ms+t1	Fast
20ms+t1	16.6ms+t1	Med
110ms+t1	110ms+t1	Slow1
220ms+t1	220ms+t1	Slow2

When OVC is On：

50Hz	60Hz	
10ms+t+t1	10ms+t+t1	快速
40ms+t+t1	33ms+t+t1	中速
220ms+9*t +t1	220ms+11*t +t1	慢速 1
440ms+39*t +t1	440ms+47*t +t1	慢速 2

NOTE: t is the measurement waiting time, t1 is the data processing time, approximately is 5ms.

More detailed information about time parameters, please refer to Chapter 6 “Handler Interface”.

5.1.9 Average

Range from 1 to 255, programmable: this value reflects the measurement times from measuring resistance to measuring display.

5.2 Measurement Signal

5.2.1 Current range

5.2.1.1 R

range / model	20mΩ	200 mΩ	2 Ω	20Ω	200Ω	2KΩ	20KΩ	200KΩ	2MΩ
TR-2600	1A	1A	100mA	10mA	1mA	100uA	100uA	10uA	1uA

5.2.1.2 LPR

range / model	2 Ω	20Ω	200Ω	2KΩ
TR-2600	10mA	1mA	100uA	10uA

5.2.2 Output Voltage of Open Circuit

5.2.2.1 R

range / model	20mΩ	200 mΩ	2 Ω	20Ω	200Ω	2KΩ	20KΩ	200KΩ	2MΩ
TR-2600	0.7V	0.7V	0.7V	2.7V	2.7V	2.7V	2.7V	2.7V	2.7V

5.2.2.2 LPR

Range / model	2 Ω	20Ω	200Ω	2KΩ
TR-2600	36mV	36mV	36mV	36mV

5.2.3 Measurement Display Resolution

range / model	20mΩ	200 mΩ	2 Ω	20Ω	200Ω	2kΩ	20kΩ	200kΩ	2MΩ
TR-2600	0.001 mΩ	0.01 mΩ	0.0001Ω	0.001Ω	0.01Ω	0.0001 kΩ	0.001 kΩ	0.01 kΩ	0.0001 MΩ

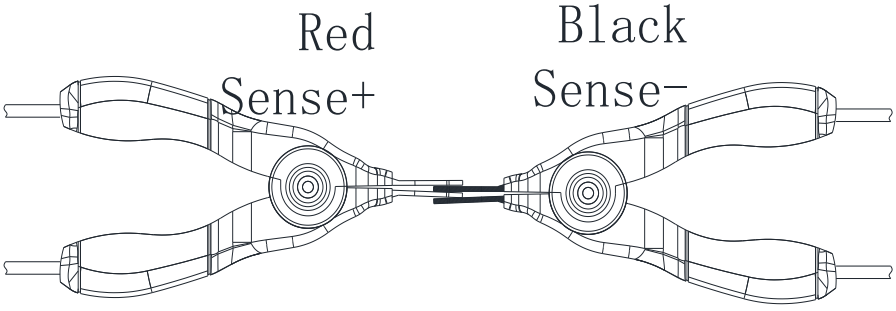
5.3 Measurement Accuracy

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, turn 0 ADJ to ON and perform short calibration by pressing the touch key or 0 ADJ panel.

The correct short of the test cable is as follows:



■ Measurement Condition：

Temperature Range：23℃±5℃

Relatively Humidity：≤80％RH

5.3.1 Basic Accuracy for Resistance Measurement

TR-2600 series (within one year 23±5℃，≤80%RH)

Range	20mΩ	200mΩ	2Ω	20Ω	200Ω	2kΩ	20kΩ	200kΩ	2MΩ
Current	1A	1A	100mA	10mA	1mA	100μA	100μA	10μA	1μA
OCV	0.7V			3V					
Resolution	1μΩ	10μΩ	100μΩ	1mΩ	10mΩ	100mΩ	1Ω	10Ω	100Ω
Accuracy	0.1%+3	0.05%+2	0.05%+2						0.2%+2
Temperature coefficient	300ppm		100ppm						

5.3.2 Accuracy for Resistance Tested at Low Current Mode

TR-2600 series (within 1 year; 23±5℃，≤80%RH)

Range	2Ω	20Ω	200Ω	2kΩ
Current	10mA	1mA	100μA	10μA
OCV	40mV			
Resolution	100μΩ	1mΩ	10mΩ	100mΩ
Accuracy	0.2%+5			
Temperature coefficient	200ppm			

Accuracy[1]：Out of temperature range, should take Temperature coefficient into consideration

5.3.3 Accuracy for Temperature Measurement (PT100&PT500)

TR-2600 series (within 1 year; 23±5℃，≤80%RH)

Temperature range	-99.9 to 39.9℃	40.0 to 250.0℃
Resolution	0.1℃	0.1℃
Accuracy in 1 years	±0.45%Rd±0.8℃	±0.45%Rd±1.5℃

Chapter 6 Handler Interface

TR-2600 series Multi-Channel DC Resistance Meter 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.

6.1 Interface Description

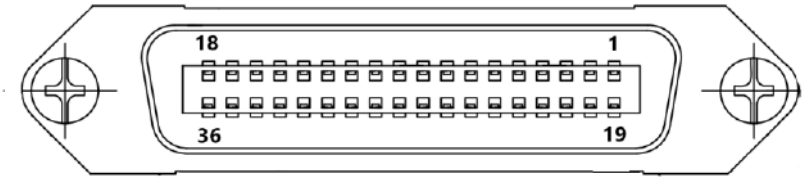


Figure 6-1 Handler interface

6.2 Output Pin Description

Pin No.	Name	Description
1	**CH8**	**1：GD, 0：NG**
2	**CH9**	**1：GD, 0：NG**
3	**CH10**	**1：GD, 0：NG**
5	**NG**	**NG signal output when the sort result of Alone mode or all channel of scan mode is NG(No Good): 1：GD, 0：NG**
7	**EOC**	**0：In Measuring，1：Completed measure**
19	**CH7**	**1：GD, 0：NG**
20	**CH6**	**1：GD, 0：NG**
21	**CH5**	**1：GD, 0：NG**
22	**CH4**	**1：GD, 0：NG**
23	**CH3**	**1：GD, 0：NG**
24	**CH2**	**1：GD, 0：NG**
25	**CH1**	**1：GD, 0：NG**
8	**CH11**	**1：GD, 0：NG**
9	**CH12**	**1：GD, 0：NG**
10	**CH13**	**1：GD, 0：NG**
11	**CH14**	**1：GD, 0：NG**
12	**CH16**	**1：GD, 0：NG**
13	**CH16**	**1：GD, 0：NG**
14	**CH17**	**1：GD, 0：NG**
15	**CH18**	**1：GD, 0：NG**
16	**CH19**	**1：GD, 0：NG**
17	**CH20**	**1：GD, 0：NG**

Table 6-1 output pin description

6.3 Output Pin Description

Pin No.	Name	Description
18	**Trigger (Start)**	**Trigger input terminal, built-in pull-up resistance, external grounding switch circuit or OC circuit**

Table 6-2 input pin description

6.4 Handler Power

Pin No.	Name	Description
27-30	**External GND**	**External power input GND**
33-34	**External VCC**	**External power input VCC**
35-36	**Internal VCC**	**Internal power input VCC(5V，500mA)**
31-32	**Internal GND**	**Internal power input GND**

6.5 Wiring

6.5.1 Use External Power(Recommend)

1. In<System Setup>Page，set<PLC Power>as“Ext”
2. Connect external power to the following pin：
   VCC：33-34
   GND：27-30
   Internal power 35-36：NC(No connect)
3. Allowed voltage range of external power supply: +5V~+25V。

6.5.2 Use Internal Power

1. **Be sure external power dissipation≤500mA*5V，or the internal circuit will be irreversibly damaged**
2. In<System Setup>Page，set<PLC Power>as“Int
3. Connect external supply to the following pin：
   VCC（5V）: 34-35
   GND: 31-32

6.5.3 Electrical parameters

1. External power required： +3.3V~25VDC
2. Output signal： Collector output with built-in pull-up resistor, low level **valid**
   Maximum Voltage： power voltage。
3. Input Signal： Optocoupler isolation; low level **valid**（short to GND）。
   Maximum current： 50mA

6.5.4 Internal Reference Circuit

1. Internal/External power switch circuit

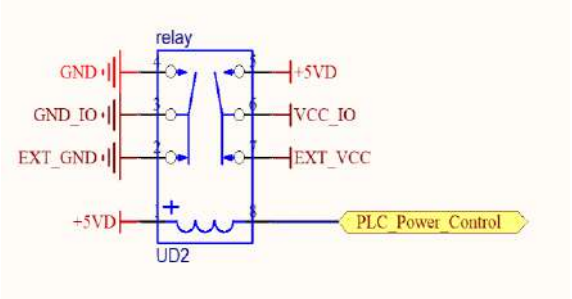


Figure 6-2 Handler Internal/External power switch circuit

2. Input Signal circuit

The input optocoupler is connected with a voltage stabilizing circuit to be compatible with + 5V ~ + 25V external power supply

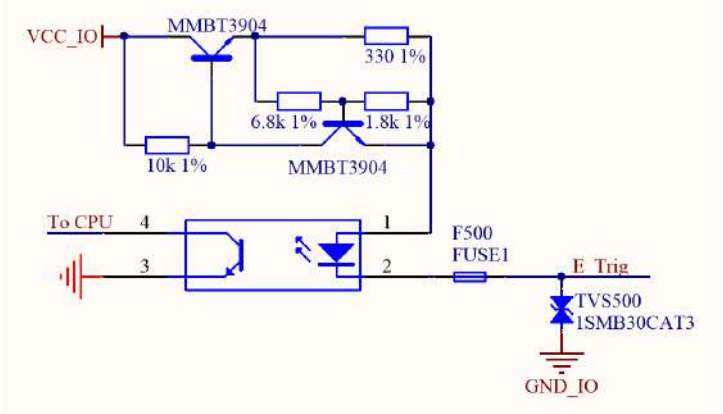


Figure 6-3 Trigger input circuit

3. Output Signal circuit

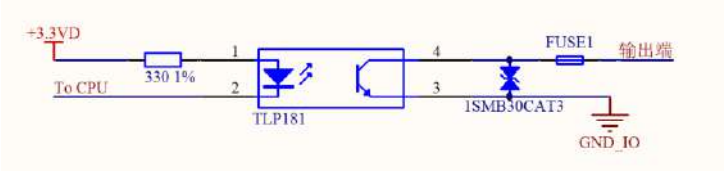


Figure 6-4 output signal circuit

6.6 Sequence timing (Alone Mode)

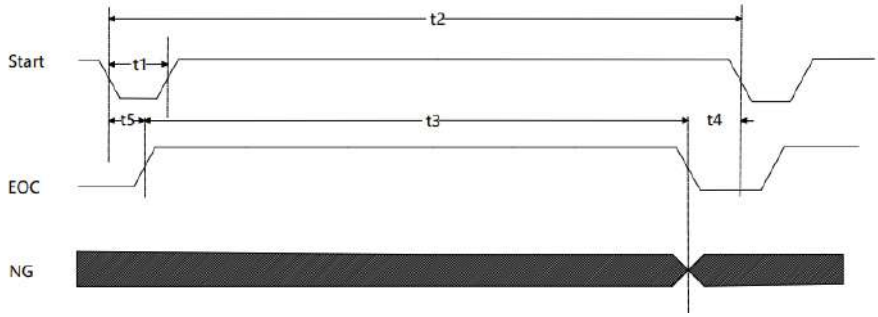


Figure 6-5 sequence timing for Alone mode

6.7 Sequence timing (Scan Mode; EOC Mode: Single)

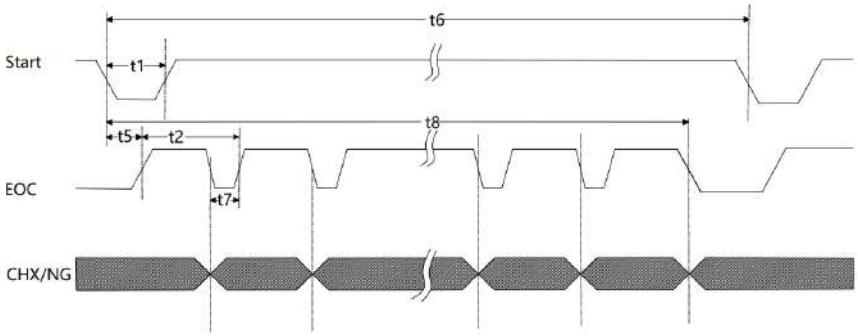


Figure 6-6 sequence timing for Scan mode and EOC mode as Single

6.8 Sequence timing (Scan Mode; EOC Mode: All)

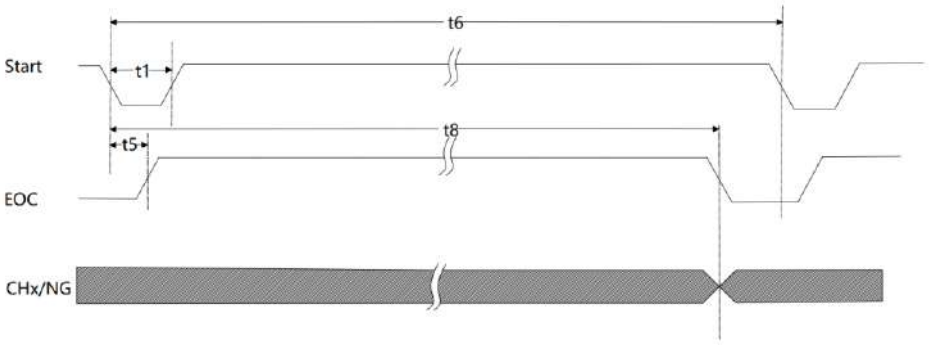


Figure 6-6 sequence timing for Scan mode and EOC mode as All

In Figure 6-5, 6-6, 6-7, t1-t8 is listed in following table:

Time	Minimum value	Maximum value
t1: trigger pulse width	10ms	---
t2: measurement time at one time	t3+data process and display time	---
t3: sampling time of one measurement	1 Sampling Time	---
t4: Time from end of sampling to control output	0ms	2s
t5: measuring delay	1ms	9999ms
t6: measuring time for each scan	n*t2, n stand for scan channel number	---
t7: EOC pulse width when EOC mode as Single	2ms	10ms
t8: Sampling time for each scan	n*t2, n stand for scan channel number	---

When OVC is off， Sampling Time shown as below table

50Hz	60Hz	
5ms	5ms	Fast
20ms	16.6ms	Med
110ms	110ms	Slow1
450ms	220ms	Slow2

When OVC is on， Sampling Time shown as below table

50Hz	60Hz	
10ms+t6	10ms+t6	Fast
40ms+t6	33ms+t6	Med
220ms+9*t6	220ms+11*t6	Slow1
900ms+39*t6	440ms+47*t6	Slow2

6.9 Interface and Command

6.9.1 SCPI

6.9.1.1 Non-Automation

1) TRIG:SOUR EXT （set trigger mode as EXT）

2) Handler interface's Start generate falling edge.
3) Waiting Handler interface's EOC goes low
4) FETC?
5) Read measurement result and repeat 2）、3）、4）。

6.9.1.2 Semi-Automation（recommend）

1) TRIG:SOUR EXT （set trigger mode as EXT）
2) FETC:AUTO ON （set FetcAuto as ON）
3) Handler interface's Start generate falling edge.
4) Read measurement result and repeat 3）。

6.10 MODBUS

6.10.1.1 Non-Automation

1) TRIG:SOUR EXT （set trigger mode as EXT ）
2) Handler interface's Start generate falling edge.
3) Send command address 0x13，read measurement result.

   Send: 08 03 00 13 00 04 B5 55

   Back: 08 03 08 41 C2 C9 3D 00 00 00 00 E1 27
4) Read measurement result and repeat2）、3）

6.10.1.2 Semi-Automation（recommend）

1) TRIG:SOUR EXT （set trigger mode as EXT）
2) FETC:AUTO ON （set FetcAuto as ON）.
3) Handler interface's Start generate falling edge.
4) Read measurement result and repeat3）.

Chapter 7 Package Contents and Warranty

7.1 Package Contents

Following items should be contained in the package:

No	Name	Quantity
1	TR-2600 serie Resistance Meter	1
2	Tessio 4-terminal test cable	1
3	Three-Wire power line	1
4	Scan test cable	n(channel No)
5	PT100	1
6	Fuse of 1A	2
7	Operation Manual	1
8	Manufacturer Certificate	1
9	Test Report	1
10	Warranty Card	1

Verify that you have received all above items and any optional accessories you may have ordered. If anyone is missing, please contact our company or operating division without delay.

7.2 Marks

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

1) Manufacturer name and trademark
2) Product name and model
3) Product number and date
4) the License for Manufacturing Measurement Instruments and its number
5) Marks for test terminal

7.3 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.

7.4 Shipping

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

7.5 Storage

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

7.6 Warranty

This instrument 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. We 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.

Chapter 8 Appendix

8.1 Update Firmware

Update procedures:

1) Copy file TR2610.sec to U disk，plug U disk to TR-2610 (on front panel of TR-2600)
2) Power on TR-2600 series, on menu <System Setup> -> Tool，press update softkey, the updating will begin

If tips "Load *.SEC File failed!"，please format U disk and make sure only update file in U.

U disk format requirement:

File system：FAT32(default)

Sector size：default

Format option：deselect fast format

8.2 Revision

version	Description	time
V1.0	First release **About communication and protocol, please refer TR-2600 series_command set.pdf**	2021.11
V1.1	Add type TR-2610	2022.02