TH9410A

Ground Bond Tester

Operation Manual

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Content

Chapter 1 Setup

This chapter describes the procedures from unpacking to installation to operation checking.

1.1 Precautions for Use

Be sure to observe the following precautions when using the tester.

- **Do not use the tester in a flammable atmosphere.**

To prevent explosion or fire, do not use the tester near alcohol, thinner, or other combustible materials, or in an atmosphere containing such vapors.

- **Avoid locations where the tester is exposed to high temperatures or direct sunlight.**

Do not locate the tester near a heater or in areas subject to drastic temperature changes.

Operating temperature range: 5 ℃ to +35 ℃

Storage temperature range: -20 ℃ to +60 ℃

- **Avoid humid environments.**

Do not locate the tester in a high-humidity environment—near a boiler, humidifier or water supply.

Operating humidity range: 20% to 80% RH (no dew condensation permitted)

Storage humidity range: 90%RH or less (no dew condensation permitted)

Condensation may occur even within the operating humidity range. In that case, do not start using the tester until the location is completely dry.

- **Do not place the tester in a corrosive atmosphere.**

Do not install the tester in a corrosive atmosphere or one containing sulfuric acid mist or the like. This may cause corrosion of various conductors and imperfect contact with connectors, leading to malfunction and failure, or in the worst case, a fire.

- **Do not locate the tester in a dusty environment.**

Dirt and dust in the tester may cause electrical shock or fire.

- **Do not use the tester where ventilation is poor.**

This tester features a forced-air cooling system. Provide sufficient space for the air inlet on the lateral side and the air outlet on the rear side to allow air to flow.

- **Do not place the tester on a tilted surface or in a location subject to vibrations.**

If placed on a non-level surface or in a location subject to vibration, the tester may fall, resulting in damage and injury.

- **Do not use the tester in locations affected by strong magnetic or electric fields.**

Operation in a location subject to magnetic or electric fields may cause the tester to malfunction, resulting in electrical shock or fire.

- **Do not use the tester in locations near a sensitive measuring instrument or receiver.**

Operation in a location subject, may cause such equipment may be affected by noise generated by the tester.

At a test voltage exceeding 3 kV, corona discharge may be generated to produce substantial amounts of RF broadband emissions between grips on the test leadwire. To minimize this effect, secure a sufficient distance between alligator clips.

In addition, keep the alligator clips and test leadwire away from the surfaces of conductors (particularly sharp metal ends).

1.2 Precautions for Moving

When moving the tester to the installation site or otherwise transporting it, take the following precautions:

- **Before moving the tester, turn off the power switch.**

Transporting the tester with its POWER switch on can lead to electric shock and damage.

- **When moving the tester, Disconnect all wires from it.**

Moving the tester without disconnecting the cables may result in breakage of the wire or injury due to the tester tipping over.

1.3 Connecting the AC Power Cord

The power cord that is provided varies depending on the destination for the product at the factory-shipment.

Do not use AC power cords that are not standard with this instrument.

Connection procedure:

1. Make sure the power switch of the instrument is turned off.
2. Make sure the power supply is within the line power range of the instrument.
3. Confirm the nominal value of the instrument fuse, and the installation position of the fuse box is correct.
4. Toggle the power switch to match the input power.
5. Please use the supplied AC power cord, or an AC power cord selected by a sufficiently qualified professional.
6. Connect the AC power cord to the ACLINE terminal on the rear panel.
7. Plug the AC power cord into an AC outlet.

1.4 Grounding

⚠ **WARNING:**

This tester is designed as a Class Ⅱ equipment (equipment protected against electric shock with protective grounding in addition to basic insulation). Therefore, electric shock may occur without proper grounding.

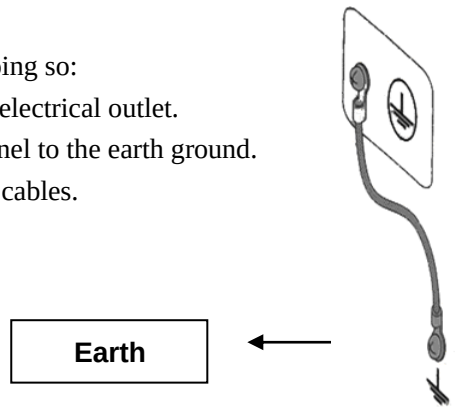
To ensure safety, be sure to ground the tester.

Choose either of the following two available methods of doing so:

1. Connect the AC power cord to a three-contact grounded electrical outlet.
2. Connect the protective conductor terminal on the rear panel to the earth ground.

Have specialized engineers select, manufacture, and install cables.

To ensure secure connection, use proper tools.

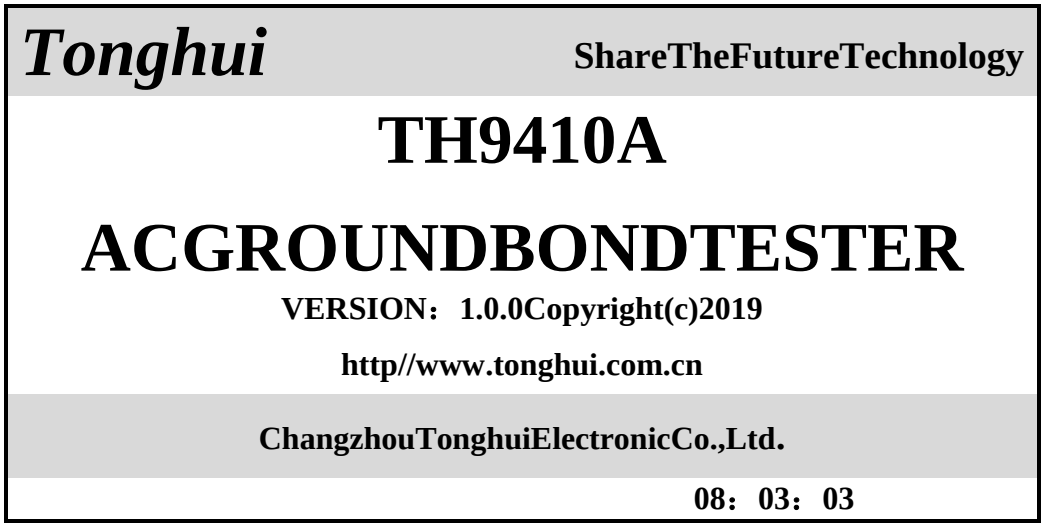


1.5 Checking Operations

Checking procedure:

1. Confirm that the allowable voltage range indicated on the power supply is the same as the input voltage range set by the fuse holder.
2. Confirm that the AC power cord is properly connected to the AC LINE connector on the rear panel.
3. Plug in the AC power cord.
4. Turn on the POWER switch. Confirm that all LEDs on the front panel are lit. Following the opening screen, display the ACW screen.

5. Following the opening screen, display the ACW screen and confirm that the tester is kept in the READY status.
6. Turn on the POWER switch again.



1.6 Other Specifications

1. Power: ＜900VA (TH9410A)

＜800VA (TH9411A)

2. Dimensions(W*H*D): 280mm*88mm*420mm;

3. Weight: approx. 15kg

Input voltage	Frequency range	Fuse	Model	Rated power
110V	47-63Hz	10A	TH9410A	900VA
			TH9411A	800VA
220V		5A	TH9410A	900VA
			TH9411A	800VA

Chapter 2 Precautions on Handling

This chapter describes the precautions to be followed in the handling of this tester. When using the tester, take utmost care to ensure safety.

⚠ **WARNING : This instrument can generate a current of 45A. If the contact resistance is too large, a high temperature will be generated at the contact point. When operating the instrument, extreme care must be taken and the cautions, warnings, and other instructions given in this chapter must be followed.**

2.1 Prohibited Operations

- **Do not turn on/off the power repeatedly**

After turning OFF the power switch, be sure to allow several seconds or more before turning it ON again. Do not repeat turning ON/OFF the power switch rapidly. If you do this, the protectors of the tester may not be able to render their protective functions properly. Do not turn OFF the power switch when the tester is delivering its test voltage–you may do this only in case of emergency.

- **Do not apply an External Voltage**

Do not apply a voltage from any external device to the output terminals of the tester. The analog voltmeter on the front panel cannot be used as stand-alone voltmeter. They may be damaged if their output terminals are subject to an external voltage.

2.2 To Ensure Long-Term Use without Failures

Due to the volume, weight, and actual use of the instrument, the module heat dissipation requirements of the instrument are very high. The instrument is recommended to be used within the following ranges.

Prerequisites for Contact Resistance Testing

Ambient temperature	**Current limit**	Output time limit
≤40℃	>40A	up to 5 minutes
	>30A	up to 15 minutes
	<10A	support continuous output

NOTE:

1. After a test with a current of 30A or more, you must rest for an equal amount of time before the next test. Otherwise, overheat protection may be triggered.

2. If the fan works continuously for 30 minutes, it is recommended to suspend the use of the instrument. If it is protected from overheating, the instrument must be stopped for 30 minutes.

2.3 Daily Checking

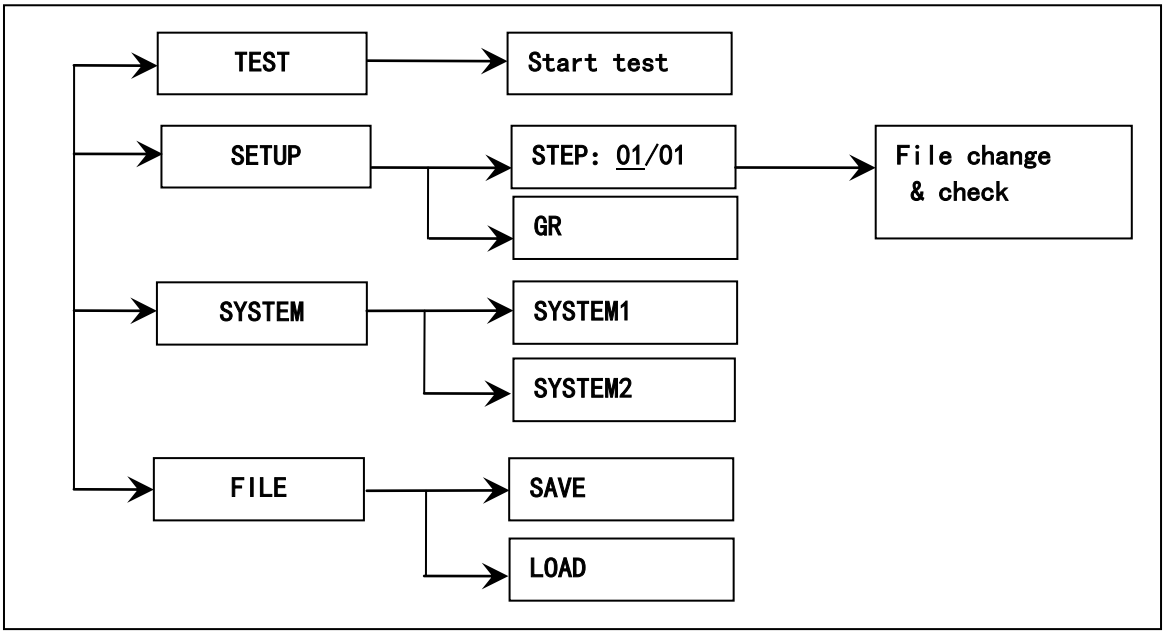
To avoid accidents, confirm at least the following before starting operation:

1. The input source complies with the standard and the tester power configuration is correct.
2. The tester is connected to an earth ground.
3. The coating of the high-voltage test lead wire is free from cracks, fissures, and breakage.
4. Without connecting the test lines, the instrument can finish the test successfully when starting test by default.
5. When connecting the test line to start the test, make sure that the test interface is in reliable contact, and the instrument can generate an OVERFAIL (failure) signal when the low-voltage end of the test line and the high-end of the test line are disconnected.

Chapter 3 Basic operation

3.1 Interface structure overview

This chapter describes the procedure for contact resistance testing. The interface structure of the instrument is shown as follows:



Operation Steps

Introduction to the interface:

- The first column in the interface structure shows the initial states corresponding to the function keys on the panel. The TEST interface cannot modify parameters.
- The second column in the interface shows the parameter structures of the interface. For example, the SETUP interface defaults to STEP01/01: program step 1, total number of steps 1, and GR parameters.
- The third column of the interface structure is the multi-step function interface switching.

NOTE:

1. **Turn on the power while pressing F4 key, the instrument will restore factory defaults.**
2. **Clear extent: SETUP (test condition) and SYSTEM (system setup).**
3. **When the software is updated or display error caused by recalling archive of low fileversion is encountered, using this method to restore the normal work of the instrument.**

3.2 Instruction of panel function interface and parameter

This section is mainly describes the function interface and relevant parameter in accordance with the order of sofeware process and interface relevance.

- **Initial state introduction of the instrument**

1. **After starting up, the system enters into the last used setup interface before shutdown last time.**
2. **The default set of the instrument is single step, contact resistance and default parameters.**
3. **The default cursor of the default interface is the interface switch. Other interface can be chosen directly.**

Four function keys can be directly used to realize the interface switch, namely TEST, SETUP, SYSTEM and FILE. The interface function will be introduced separately below.

TEST	Put the instrument into the test waiting state, ready to start the contact resistance test.
SETUP	Change the previous interface of test programme, test item, and test parameter. The modification of the test plan is completed in this interface. (This interface is entered by default at boot)
SYSTEM	The settings related to testing safety and the working mode of the instrument
FILE	Save and load the test programme, relating to the data storage
▼▲◀▶	Cursor can move freely among each parameter.
F1~F5	Change the selected data by coordinating with the contents in soft key function display zone.

3.2.1 SETUP

Modification Instruction of the test programme:

STEP: 01/01 Test procedure: current setting No. / total items.

The maximum number of total test items is 5 steps, and the number of files that can be stored is 20 groups.

Item identification of the test programme, current test programme No./ total items

Key	Function	Instruction
F1	INS	Add a new test item. The current item and subsequent items will move one step backward.
F2	DEL	Delete the current test item. The subsequent item will move one step forward.
F3	NEW	Create a blank test programme (PROG). The system will automatically create a default test item. Please remember to save the test programme after finishing writing.
F4	+	Visit the parameter of the step after the current displayed step.
F5	-	Visit the parameter of the step before the current displayed step.

Test parameter modification instructions:

CURR	1A-45A（TH9410A）	Ground current value setting
	1A-32A（TH9411A）	
UPPER	6V/CURR	Ground resistance upper limit value
LOWR	same as UPPER	The lower limit of grounding resistance must be less than the UPPER value.
	OFF	No lower limit required
TIME	0.1~999.9S	Test time, when time is up, end the test RISE≠OFF
	OFF	Unlimited test time
OFFSET	OFF~ON	Base clear setting.
	GET	Get the test base under the current test conditions
	<Data>	Directly input
FREQ:	50/60	AC working frequency

3.2.2 GRTEST

1. **Press ▼ to enter the SETUP interface.**
2. **The function key F5 can lock the keyboard. When the keyboard is locked, only three keys: START, STOP and F5 (unlock） are usable.**

The three large font data in the middle of the front panel is the real time test data. After finishing testing, the last test result will be displayed on the panel before pressing the STOP key.

The one above is the output current, which is measured in amperes (A).

The one in the middle is the measured contact resistance at the low end of the test, measured in milliohms (mΩ).

The lower one is the remaining time of the corresponding step during the high voltage test. If the user closes the test time, the test time shows the time after entering the test state, and the count will not be accumulated after the count is greater than 999.9. If not "FAIL", the test state must be exited with "STOP". Users can intuitively analyze the test situation of the tested object. It is in seconds (S).

3.2.3 SYSTEM

System interface is to set the test programme of the instrument, not the specific test component parameters.

SYSTEM 1 Interface
Instruction：

Label	Instruction	Definition
PASSHOLD	0.2S～99.9S	Pass judge hold time.
	KEY	Pause, press the 'STOP' key to end.
FAILMODE	STOP	If FAIL, quit the testing directly.
	CONTINUE	If FAIL, continue to test, result in table form.
	RESTART	If FAIL, press start key to test from the current step.
	NEXT	If FAIL, press start key to test from the next step.
STEPHOLD	0.2S～99.9S	Waiting time between steps.
	OFF	No waiting time between steps.
	KEY	Pause, press ‘START’ key to test the steps.
CTRLMODE	FILE	HANDLER interface output the test results after test file ends up.
	STEP	HANDLER interface output the current test result after each step ends up.
PASSBEEP	OFF	Turn off
	LOWLONG	Low and long volume
	TWOSHORT	Two short volume
FAILBEEP	OFF	Turn off
	LOWLONG	Low and long volume
	TWOSHORT	Two short volume
KEYBEEP	OFF	Turn off the key beep.
	ON	Turn on the key beep.
STRTDLY	0.1~99.9S	Set the test delay time from srarting test to the beginning of the test of step 1.
	OFF	By default, the instrument starts testing after being ready.

SYSTEM 2 Interface

Instruction：

Label	Instruction	Definition
BUSMODE	RS232C	Serial mode: data format: 8.n. 1
	USBTMC	Standard USB slave mode
	USBVCOM	USB analog serial mode: data format: 8.n. 1
BAUD	9600~115200	Baud rate of the serial bus.
BUSADDR	1~32	Bus address
DEFAULT		Restore factory defaults. **Not valid on PASSWORD.**
LANGUAGE	Chinese, ENGLISH	Interface language selection
PASSWORD	OFF	Turn off the key lock function. The default password is **9410.**
	SYSTEM（lock system）	Need the password when entering the system.
	FILE（lock file）	Need the password when recalling the file.
	MODIFY	Change the original password for the new password.
ADJSET	SET	Adjustment interface.
	UPDATA	Instrument firmware upgrade entry.
CMD	SCPI	SCPI command set
	MODBUS	MODBUS command set

3.2.4 FILE

Press the FILE key to enter into the file manage interface:

Instruction:

Serial number	Description		Shortcut option	Definition
1	Memory selection	F1	Internal	Internal file interface.
		F2	External	External file interface.
2	File list	F1	Load	Load the current file as the internal use file.
		F2	Save	Save the internal use file to the current file.
		F3	Delect	Delete the current file.
		F4	Copy To E:	Copy the current file to the U-disk (internal file).
			Copy To I:	Copy the current file to the interior instrument (external file).
		F5	Select	Select the current file (be used for batch processing)
3	Page number		PgUp	Pageup the file list.
			PgDn	Pagedown the file list.

Operation interface of the internal file:

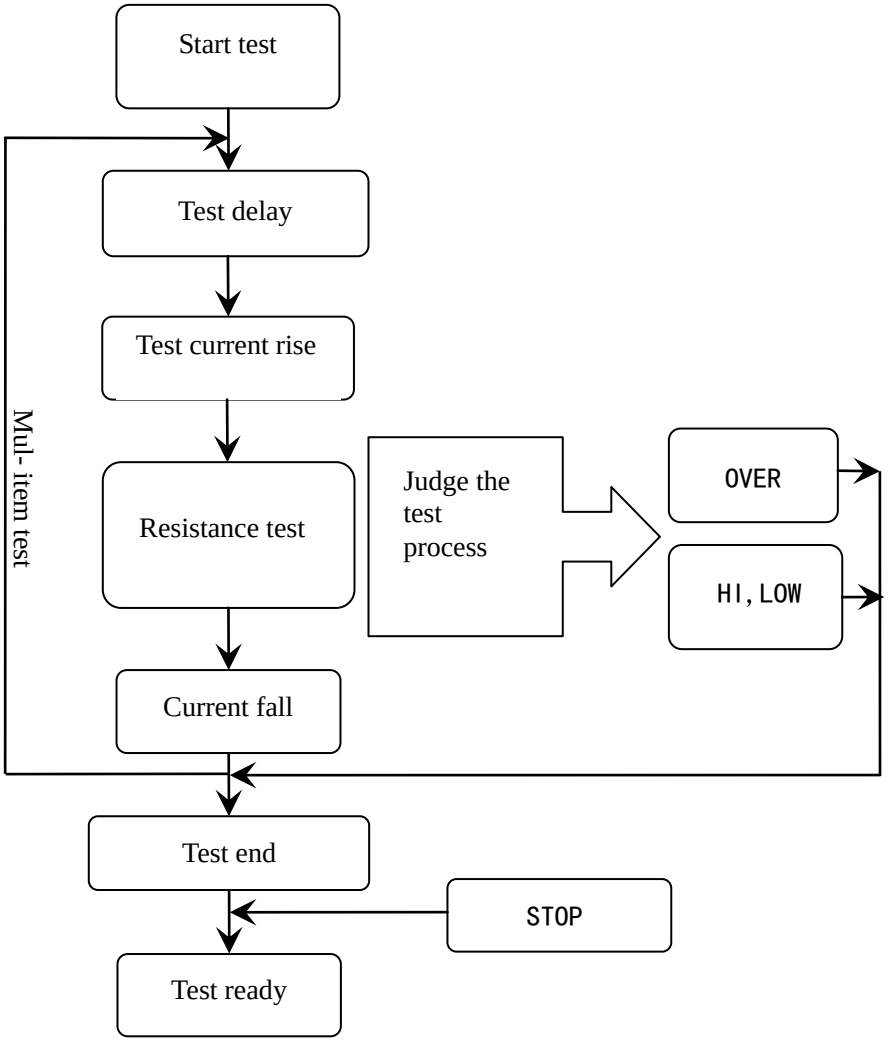
<INTERNAL FILE>					
1	FILE-N1.STA	2011/ 11/11	11 : 11	**Load**	F1
2	FILE-N2.STA	2012/ 05/ 20	13 : 14	**Save**	F2
3	FILE-N3.STA	2013/09/19	19 : 09	**Delect**	F3
4	FILE-N4.STA	2099/ 09/ 09	09 : 09	**Copy To E:**	F4
PAGE 1				**Select**	F5

Operation interface of the external file:

<EXTERNAL FILE>					
	STA	2011/ 11/11	11 : 11	**Load**	F1
	FILE-A1.STA	2012/ 05/ 20	13 : 14	**Save**	F2
	FILE-A2.STA	2013/09/19	19 : 09	**Delect**	F3
	FILE-A3.STA	2099/ 09/ 09	09 : 09	**Copy To I:**	F4
PAGE 1				**Select**	F5

3.3 Test function theory and instruction

This section describes the test theory and instruction of ground connection, ground wire current detection and arc detection according to the order of the test procedure.



Block flow diagram of the instrument

3.3.1 Start up test

In measurement mode, after the tester check the test conditions and the connection with DUT, press START to start up test.

3.3.2 Test delay

After the delay set by STA DELY in SYSTEM, the tester will start measurement.

3.3.3 Test current rise

When the instrument starts to output, the output current is zero. When the current output starts, the instrument will control the output current to increase step by step in units of 5A/0.1S.

3.3.4 Contact resistance test

Conduct a contact resistance test on the DUT. At this time, it should be ensured that the test circuit is correct, the test results will not be affected by some special incidental parameters, and the display content is the actual contact resistance required by the test.

3.3.5 Test current fall

When the current drops at the end of the test, the instrument will control the output current to drop within 0.1S.

3.3.6 Contact resistance over limit

Contact resistance classification: contact resistance lower limit, contact resistance upper limit, voltage overlimit.

- Resiatance low limit judge **(LOW):** Generally used as a test low-end short circuit judgment. When the instrument tests the equipment, the equipment will definitely have a certain on-resistance. When the on-resistance tested by the instrument is less than the lower limit set resistance value, the test is considered Fail. If the contact resistance of the tested element itself is very small, this function must be turned off. Judgment display (LOWFAIL) when the limit is exceeded, this judgment is only valid in test mode, timing sampling, and the rate is 100mS each time.
- Resistance high limit judge **(HIGH):** The most commonly used test is the judgment of contact resistance overlimit. When the instrument tests the equipment, the equipment will definitely have a certain contact resistance. When the contact resistance tested by the instrument is greater than the contact resistance set by the upper limit, it is considered that the contact resistance of the equipment is insufficient and the test fails. Judgment display (HIFAIL) when the limit is exceeded, timing sampling, the rate is 100mS each time.
- Voltage over limit (**OVER**)**:** The voltage sampling judgment is slow, and the sampling circuit cannot respond in time when the contact point is disconnected. When the voltage peak exceeds the allowable output range of the instrument, this type of overrun judgment will be triggered, and the judgment will display (OVERFAIL) when the limit is exceeded. Data cannot be collected due to such voltage exceeding the limit. The result output by the system at this time is: the test result within 100mS before the current exceeds the limit. The voltage limit is the allowable output voltage limit of the instrument. The fall time is invalid, and this judgment cannot be masked.

3.3.7 Test end

Display the test data of the test process, and display the test judgment result.

If the test process exceeds the limit, it is judged as (FAIL). If FAIL appears in the multi-step test, the final result is FAIL.

There are many test items in the test file, and the FAIL judgment processing mode is controlled by the failure mode of the system. Otherwise, the instrument will display FAIL judgment and category waiting for the user to process.

After the test, there is no unqualified mark, and the test result is judged as (PASS).

The PASS judgment processing mode is controlled by PASSHOLD of SYSTEM, and then it is ready to start the next measurement or return to the test waiting state.

The HANDLER signal output is controlled by the control mode. Select FILE mode, then the test result will be output only when the entire file test is over. In STEP mode, each step will control the interface to output the corresponding signal.

3.3.8 STOP

Press the 'STOP' key at any state during the entire test process, the instrument will automatically end the test and enter the test end state. Press the 'STOP' key again, the instrument will return to the test waiting state. No test result judgment output is given when the test is stopped.

At the end of the test, the customer can use the software to query the last test data obtained before 'STOP'.

3.3.9 OFFSET

Before the test, due to the change of the working environment of the instrument and the placement of the test cable, there may be some base numbers during the short-circuit test of the instrument test line. For customers who require accurate measurement, it can be cleared. The offset value cannot be greater than 100mΩ.

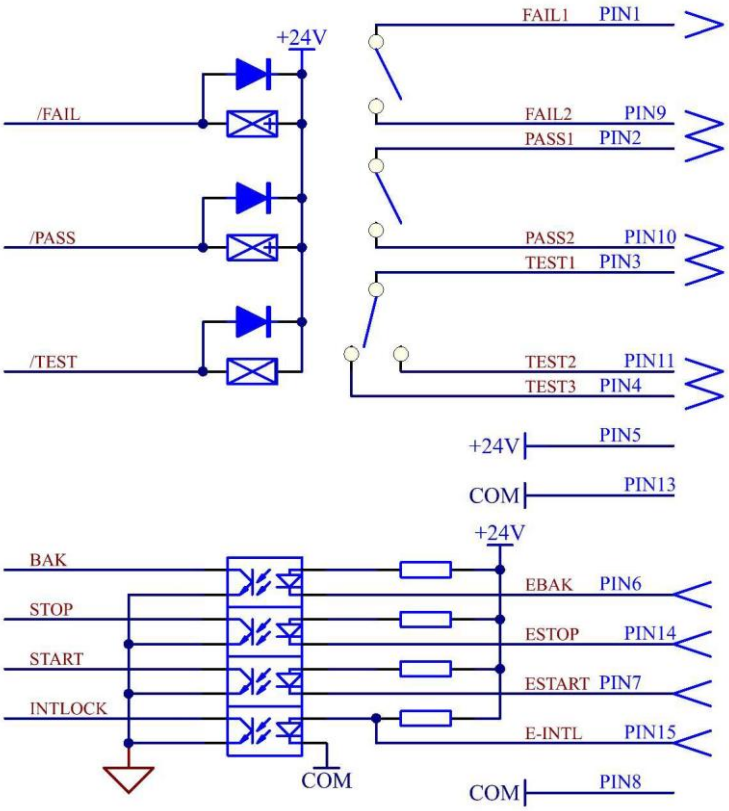
The specific operation steps are as follows:

1. Select the OFFSET item and set it to ON.
2. Press GET and the instrument will automatically start the contact resistance test and take the current test value as the zero value.
3. You can also directly enter a contact resistance base.

3.4 Structure and Use of HANDLER Interface Circuit

3.4.1 Control interface theory

The HANDLER interface is DB15 interface, the internal principle of the instrument is as follows:



HANDLER interface signal function description:

1. Function description of output signal: the signal constitutes the remote output control. It is valid in closing the relay switch output.

a) TEST: The normally open switch is closed when the instrument starts the test, and is disconnected when the test is stopped.

b) PASS: After one test of the instrument, if the test is qualified (PASS), the normally open switch is closed, and the next test starts to restore the normally open state.

c) FAIL: Once the test of the instrument is over, if the test is FAIL, the normally open switch will be closed, and the next test will resume the normally open state.

d) The system interface (SYSTEM) control mode (CTRL) can control the above signal output state when the test file (FILE) is multi-step mode, and output control signals in steps (STEP) according to a single test item; or the entire test file (FILE) as a whole, output control signals.

2. Function description of input signal: remote input control, switch input closure is valid.

a) START: Start the test of the current test file, or restart a subsequent test if the test is paused.

b) STOP: stop this test, or return to the test waiting interface on the test end interface.

c) INTLOCK: When this signal is open circuit, it is forbidden to start the output of the instrument, and the default is short circuit when single-unit use.

d) COM: signal ground or signal common terminal.

3. Description of the backup power supply interface: The instrument interface provides about 24VDC power supply.

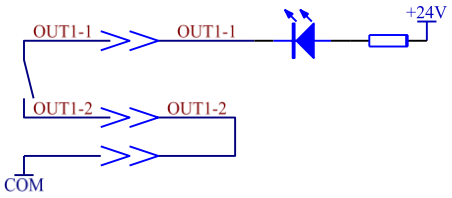
a) This power supply is a pull-up power supply for input signals and is not connected to the ground of the instrument.

b) The external output current is less than 0.2A, which can be used to drive indicator lights and photoelectric switches with a current less than 50mA.

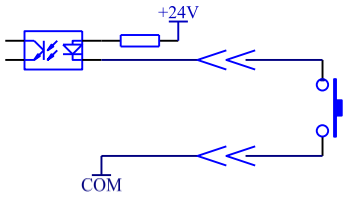
3.4.2 Control interface instruction

Control interface is generally used as remote control and test synchronization or indication.

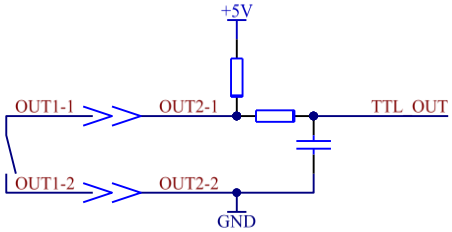
The external connection of the interface is as follows:



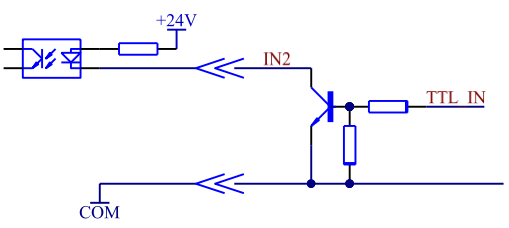
Output: the internal power connected with indicator light



Input: external switch connection diagram



Output: external 5V power supply to level



Input: external logic level connection diagram

Instruction:

1. The switch can be replaced with secondary optical coupling and other isolated form switch element. For the current direction, refer to the principle of above diagram (COM terminal is LOW end).
2. The indicator light can be replaced with other drive control components. The current direction is subject to the power.
3. Internal power supply performance:

   The unregulated output is about 24V, please confirm before use.

   The maximum transient output current of the internal power shall not be larger than 0.5A and the current of long working hours shall be less than 0.2A. Self- contained power is necessary if larger current is needed.

   If the external control signal needs to be larger than 2A or 220V, the internal relay of the instrument can not bear it. Please transfer it by yourself.

3.5 Other interface and function

1. USB DEV on the front panel is used for connecting the U-disk, exporting and importing the setting files and upgrading the software.
2. USB HOST on the rear panel is used for the communication with the computer. There are two working modes.

a) USBTMC: standard USB slave mode. Compatible software format IEE488.

b) USBVCOM: USB simulated serial port, data format: 8.n.1. Compatible software format IEE485.

3. RS232 is used for the communication with the computer. See the baud rate in SYSTEM SETUP, data format: 8.n.1. Compatible software format IEE485.

Chapter 4 Serial Port Command Description

This instrument can use RS232C serial interface (standard) or GPIB parallel interface (option) for data communication and remote control without instrument panel, but the two cannot be used at the same time; they have the same program control commands, but use different hardware configuration and communication protocols. This chapter introduces how to use the interface.

4.1 Brief description of command format

1. The instrument command set describes only the actual characters that the instrument receives or sends.

2. The command characters are all ASCII characters.

3. The data "<???>" of the instruction are all ASCII strings. The default format of the system is integer or floating point number, and the unit of data is the default value which does not appear in the instruction.

4. There must be an instruction end marker at the end of the instruction: an identifier for the end of an instruction, and the instrument will not parse the instruction without this symbol.

a) The default closing tags are: carriage return (NL), print control character (\n), decimal number (10), hexadecimal number (0x0A).

b) End marker of IEEE-488 bus: keyword (^END), signal (EOI).

Multiple instructions can simplify sending examples as follows:

FUNC:SOUR:STEP1:CURR10;UPPC100;TTIM9.9(NL^END)

FUNC:SOUR:STEPINS(NL^END)

FUNC:SOUR:STEP2:CURR20;UPPC200;TTIM9.9(NL^END)

FUNC:START(NL^END)

Note: In the example, "" is the (space) mark, and (NL^END) is the end mark.

4.2 SCPI Commands

Subsystem Commands for TH9410A/9411A:

- ●DISPlay
- ●FUNCtion
- ●SYSTem
- ●MMEM
- ●FETC

4.2.1DISPlay Subsystem Commands

The DISPlay subsystem command set is mainly used to set the display page of the instrument.
The :DISPlay? query returns to the current page.

DISPlay：PAGE

Command Syntax: DISPlay：PAGE<pagename>

Functions of <page name> are as follows:

MEASurement	Set the display page to measurement display.
MSETup	Set the display page to measurement setup.
SYST1	Set the display page to system setup.

SYST2	Set the display page to system setup.
FLISt	Set the display page to (internal) file list.

Use the character? to query the current page.
For example:
Set the display page to measurement display.
Command Syntax: DISP: PAGE MEAS
Query syntax: DISPlay:PAGE?
Return format: MEAS

4.2.2 FUNCtion Subsystem Commands

4.2.2.1FUNCtion subsystem commands--mainly used to set the test parameters of test function

Command Tree:

Command	: command word	: command word	Value	: command word	
FUNC →	: SOUR →	: STEP →	NEW		Create a new test file
			INS		Insert test step after current position
	: STAR		DEL		Delete the test step of current position
			< n > →	: CURR	GR test current
	: STOP			: UPPC	GR resistance upper limit
				: LOWC	GR resistance lower limit
				: TTIM	GR test time
				: OFFSET	GR resistance bias
				: FREQ	GR working frequency

4.2.2.2PROG Function Commands

FUNC：STAR

Start the test while the instrument is in test interface.

FUNC：STOP

Stop the test while the instrument is in test interface.

FUNC：SOUR：STEPINS

Add a new test item in existing test programme (STEP).

FUNC：SOUR：STEPDEL

Delete the current test item in existing test programme (STEP).

FUNC：SOUR：STEPNEW

Create an empty test programme to write a brand new test programme

FUNC：SOUR：STEP<sn>

Edit the <sn> step of the current test programme, <sn> = 1~20

4.2.2.3GRSetup Function Commands

FUNC：SOURce：STEP：CURR Set/query the current of GR

--Syntax:

Command message: FUNC：SOUR：STEP<sn>：CURR<current>

Query message: FUNC：SOUR：STEP<sn>：CURR?

-- Data<sn>

Data format: integer
Data range: 1~5
Data accuracy: 1

--Data<current>：

Data format: float
Data range: 1~45
Data accuracy: 1
Data unit: A

--Example:

Set the current of GR in STEP1 to 20A.

Command message: FUNC：SOUR：STEP1：CURR20

Query message: FUNC：SOUR：STEP1：CURR?

Return value:20

FUNC：SOURce：STEP：UPPC Set/query the upper limit resistance of GR

--Syntax：

Command Message： FUNC：SOUR：STEP<sn>：UPPC<resistance>

Query Message： FUNC：SOUR：STEP<sn>：UPPC?

--Data< resistance：

Data format：integer

Data range：1~6000mΩ

Data accuracy：1mΩ

Data unit：mΩ

--Example：

Set the upper limit of the resistance of GR in STEP1 to 200mΩ.

Command Message：FUNC：SOUR：STEP1：UPPC200

Query Message：FUNC：SOUR：STEP1：UPPC?

Return message：200

FUNC：SOURce：STEP：LOWC Set/query the lower limit resistance of GR

--Syntax：

Command Message： FUNC：SOUR：STEP<sn>：LOWC< resistance >

Query Message： FUNC：SOUR：STEP<sn>：LOWC?

--Data< resistance >

Data format：integer

Data range： 0~6000mΩ (where 0 is OFF)

Data accuracy：1mΩ

Data unit：mΩ

--Example：

Set the resistance lower limit of GR in STEP1 to 100mΩ.

Command Message：FUNC：SOUR：STEP1：LOWC100

Query Message：FUNC：SOUR：STEP1：LOWC?

Return message：100.

FUNC：SOURce：STEP：TTIM Set/query the test time of GR

--Syntax：

Command Message： FUNC：SOUR：STEP<sn>：TTIM<time>

Query Message： FUNC：SOUR：STEP<sn>：TTIM?

--Data<time>：

Data format：float

Data range：0~999.9 (where 0 is OFF)

Data accuracy：0.1

Data unit：s

--Example：

Set the test time of GR in STEP1 to 1s.

Command Message：FUNC：SOUR：STEP1：TTIM1

Query Message：FUNC：SOUR：STEP1：TTIM?

Return message：1.

FUNC：SOURce：STEP：OFFS Set/query GR zero offset value

--Syntax：

Command Message： FUNC：SOUR：STEP<sn>：**OFFS**<resistance>

Query Message： FUNC：SOUR：STEP<sn>：**OFFS**?

--Data< resistance >

Data format：integer

Data range： 0~100mΩ (where 0 is OFF)

Data accuracy：1mΩ

Data unit：mΩ

--Example：

Command Message：//The instrument automatically obtains the offset base

FUNC：SOUR：STEP1：OFFSGET

Set the resistance lower limit of GR in STEP1 to100mΩ.

Command Message：FUNC：SOUR：STEP1：OFFS100

Query Message：FUNC：SOUR：STEP1：OFFS?

Return message：100.

FUNC：SOURce：STEP：FREQ Set/query the test frequency of GR

--Syntax：

Command Message： FUNC：SOUR：STEP1：FREQ< frequency >

Query Message： FUNC：SOUR：STEP1：FREQ?

--Data< frequency >：

Data format：character

Data range：50/60

Data accuracy：

Data unit：Hz

--Example：

Set the test frequency of GR in STEP1 to 50Hz.

Command Message：FUNC：SOUR：STEP1：FREQ50

Query Message：FUNC：SOUR：STEP1：FREQ?

Return message：50.

4.2.3SYSTem Subsystem Commands

Command Tree:

SYST	→	：PASS	0.3-99.9
		：STEP	0.3-99.9
		：FAIL	0(STOP)/1(CONT)/2(REST)/3(NEXT)
		：BEEP	0(OFF)/1(SHORT)/2(LONG)
		：DELA	0-99.9
		：CTRL	0(STEP),1(FAIL)
		：LANG	0(Chinese),1(English)
		：RES	
		：ON	
		：CMD	0(SCPI),1(MODBUS)

SYSTem：PASS Set/query the time of the PASS beep response。

--Syntax：

Command Message： SYST：PASS<time>

Query Message： SYST：PASS?

--Data：

Data format：float

Data range：0.3~99.9

Data accuracy：0.1

Data unit：s

--Example：

Set PASSHOLD to 1.0s。

Command Message：：SYST：PASS1

--Return message

Query Message：SYST：PASS?，

Return message：the setting value of PASSHOLD, such as 1.000.

SYSTem：FAIL Set/query the status of AFTRFAIL.

--Syntax：

Command Message： SYST：FAIL<0/1/2/3>

Query Message： SYST：FAIL?

--Data<STOP/CONT/REST/NEXT>：

Data format：character

Data range：0~3

--Example：

Set AFTRFAIL to STOP

Command Message：SYST：FAIL0

--Return message

Query Message：SYST：FAIL?，

Return message：the state of AFTRFAIL, such as 0.

SYSTem：STEP Set/query the interval time of STEP.

--Syntax：

Command Message： SYST：STEP<time>

Query Message： SYST：STEP?

--Data：

Data format：float

Data range：0.3~99.9

Data accuracy：0.1

Data unit：s

--Example：

Set STEPHOLD to 1.0s

Command Message：：SYST：STEP1

--Return message

Query Message：SYST：STEP?，

Return message: STEPHOLD setting value, such as 1.000

SYSTem：BEEP Set/Query the buzzer

--Syntax：

Command Message： SYST：BEEP<beep>

Query Message： SYST：BEEP?

--Data：<OFF/SHORT/LONG>

Data format：character

Data range：0~2 (0 is OFF, 1 is SHORT, 2 is LONG)

--Example：

Set BEEP to 1.

Command Message：SYST：BEEP1

--Return message

Query Message：SYST：BEEP?，

Return message：the volume of the buzzer, such as 1.

SYSTem：DELAy Set/query the delay time of DELAy test.

--Syntax：

Command Message： SYST：DELA<time>

Query Message： SYST：DELA?

--Data：

Data format：float

Data range：0~99.9 (0 is OFF)

Data accuracy：0.1

Data unit：s

--Example：

Set DELA to 1.0s.

Command Message：：SYST：DELA1

--Return message

Query Message：SYST：DELA?，

Return message：the setting value of DELA, such as 1.000.

SYSTem：LANGuage Set/query the state of the language.

--Syntax：

Command Message：SYST：LANG<0/1>

Query Message：SYST：GFI?

--Data<ON/OFF>：

Data format：character

Data range：0 (Chinese),1(English)

--Example：

Set LANG to 0 (Chinese).

Command Message：SYST：LANG0

--Return message

Query Message：SYST：LANG?，

Return message：the status of the LANG, such as 0.

SYSTem：RESet

Restore all settings to their default state.

--Syntax：

Command Message：SYST：RES

SYSTem：ON

Instrument firmware upgrade.

--Syntax：

Command Message：SYST：ON

SYSTem：CMD Set the current command format

--Syntax：

Command Message： SYST：CMD<0(SCPI),1(MODBUS)>

Query Message： SYST：CMD?

--Data：<0(SCPI),1(MODBUS)>

Data format：character

Data range：0~1(where 0 is SCPI, 1 is MODBUS)

--Example：

Set the command Syntax to 1 (MODBUS).

Command Message：SYST：CMD1

--Return message

Query Message：SYST：CMD?，

Return message：such as 1.

4.2.4MMEM Subsystem Commands

MMEM：STOR Save the current file to file number.

--Syntax：

Command Message：MMEM：STOR：STAT<file no.>[,<file name>]

--Data<file no.>：

Data format：integer

Data range：1-20

Data accuracy：1

--Data<file name>：**Ignorable**

Data format：character string

Data range：1-15

MMEM：LOAD Load the file specified by the file number to the current one.

--Syntax：

Command Message：MMEM：LOAD：STAT<file no.>

--Data<file no.>：

Data format：integer

Data range：1-20

Data accuracy：1

4.2.5 FETCh Subsystem Commands

FETCh Used to obtain the measurement results of the instrument.

--Syntax：

Command Message：FETCh：AUTO<ON/OFF>or<1/0>

Query Message：FETCh?

--Data<ON/OFF>or<1/0>

Data format：character

Data range：0 (OFF),1(ON)

--Example：

Set test data automatic return to ON.

The command is: FETCh：AUTO ON or ：FETCh:AUTO 1

--Return message

Query Message：FETCh?, returns the current measurement result of the instrument.

--Syntax：

FETCh?

After the instrument receives this command, the instrument will automatically send out the test result until the end of the test.

Return format:

Steps: test current (A), test resistance (mΩ), sorting results;

Format is:

⑴：⑵，⑵，⑶;

⑴ : Step, the separator is (:).

⑵ The separator between test data is (,).

⑶ The separator between steps is (; + space). Data terminator defaults to (newline: 0x0A)

Note:

1. All Data are integers or floatSyntax, ASCIIcharacter strings.

2. By default, the Data unit is the same as the FUNC setting instruction set. Units are not returned when character strings are returned.

--Example:

The test results are

STEP1：The test current is 10A, the test resistance is 100mΩ, and the result is PASS.

STEP2：The test current is 20A, the test resistance is 200mΩ, and the result is FAIL.

Return DataSyntax：

10，10，PASS；20，200，FAIL

THID：PRODSNUM Query the instrument number.

Query Message： THID：PRODSNUM?

--Data< instrument number >：

Data format：character

Data length：0-20

--Example：

Query Message：THID：PRODSNUM?

Return message：N9J-888-88888

4.2.6 Other Control Commands

***IDN** Query instrument model and version information

Query return: <manufacturer>,<model>,<firmware><NL^END>

Where <manufacturer> Get the manufacturer name (i.e. Tonghui)

<model> Get the machine model (eg TH9410A/9411A)

<firmware> Get the software version number (eg Version1.0.0)

Such as: WrtCmd("*IDN?");