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OM

OPERATION MANUAL

TH9130 Series

Multifunction Safety Compliance Analyzer — TH9130 / TH9131 / TH9130A / TH9131A. Covers safety precautions, front-panel operation, measurement setup and system configuration; see the companion SCPI Command Reference for the full remote-command set.

Techmize Electronic GmbH · Ismaning, Germany
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TH9130 Series Operation Manual

Multifunction Safety Compliance Analyzer — TH9130 / TH9131 / TH9130A / TH9131A

This manual describes the setup, operation and maintenance of the TH9130 Series. The remote-command set is published separately — see the companion *TH9130 Series SCPI Command Reference*.

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The full remote-command set is published separately as the companion TH9130 Series SCPI Command Reference.

CHAPTER 1

Safety & Compliance

1.1 About this manual

This is the English edition of the operation manual for the Techmize TH9130 series multifunction safety compliance analyzer, covering models **TH9130**, **TH9131**, **TH9130A** and **TH9131A**. Where this manual and the instrument itself appear to disagree, or where a described function is not present on your particular model, contact Techmize or your authorized distributor using the details in §1.9 before relying on the instrument for a test decision.

The TH9130 series generates hazardous test voltages up to **5 kV AC** or **6 kV DC**. Incorrect or careless operation can cause serious injury or death. Read this chapter and Chapter 2 in full, and keep this manual available to every operator, before the instrument is put into service.

Techmize continually improves the performance, features and construction of its instruments; content, specifications and accessories described here are subject to change without notice. This manual does not necessarily describe every optional accessory or every firmware revision.

1.2 Safety symbols used in this manual

The following symbols and signal words appear in this manual and on the instrument itself:

WARNING — a hazard that, if not avoided, could result in personal injury or death, in particular from the instrument's high-voltage test output.

NOTE — supplementary information that helps with correct or efficient use, but is not itself a hazard.

CAUTION — a hazard that, if not avoided, could damage the instrument or the device under test (DUT), or invalidate a measurement.

Protective ground — this terminal must be connected to protective earth. Also printed on the instrument's chassis ground terminal.

> **WARNING**
>
> This instrument outputs test voltages up to 5 kV AC or 6 kV DC. Incorrect or careless operation can cause an accident, including fatal electric shock. Read Chapter 2 (Operating Procedures & Safety Precautions) in full before energizing the high-voltage output for the first time.

1.3 Conditions of use

1.3.1 Power source

Parameter	Rating
Supply voltage	100–240 VAC
Supply frequency	47–63 Hz
Rated power	1200 W

Input voltage range	Frequency	Fuse (slow-blow)	Rated power
110 VAC class (100–120 VAC)	47–63 Hz	10 A	1200 VA
220 VAC class (200–240 VAC)	47–63 Hz	10 A	1200 VA

1.3.2 Ambient temperature and humidity

Condition	Temperature	Humidity
Normal operating	0–45 °C	20–90% RH
Reference operating	20 °C ± 8 °C	< 80% RH
Storage	−10–55 °C	< 90% RH

1.3.3 Warm-up

Allow at least **20 minutes** warm-up after power-on before relying on the instrument's specified accuracy.

1.3.4 Points of attention

- Do not use the instrument in a dusty or vibrating location, in direct sunlight, or where corrosive or flammable gases are present.
- If the instrument is not used for an extended period, store it in its original packaging (or similar) in a dry, well-ventilated room at a suitable temperature, free of corrosive contaminants and direct sunlight.
- Before switching on, confirm that the supply voltage and the fitted fuse match the ratings in §1.3.1, including fuse shape, rating and characteristics — a different fuse type, or a short-circuited fuse holder, can damage the instrument.
- The instrument is designed to minimize AC-line-borne interference, but should still be used in as low-noise an environment as practical; fit a power-line filter if this cannot be achieved.
- Do not use the instrument near strong magnetic or electric fields — electromagnetic pulses can cause a malfunction and, in the worst case, a fire hazard.
- Do not operate the instrument close to sensitive test or receiving equipment. Above 3 kV, the electric field between test leads can ionize the surrounding air (corona), generating broadband RF interference; keep test leads well separated from each other and from conductive surfaces, especially sharp metal edges.
- The instrument is cooled by a rear fan and side ventilation slots; ensure good airflow around the case to prevent an internal temperature rise from degrading accuracy.
- Do not cycle the power switch rapidly. After switching off, wait several seconds before switching on again — repeated rapid on/off cycling, especially while a high-voltage output is active, can prevent the instrument's protection circuits from operating correctly. Do not switch off while a test voltage is being generated, except in an emergency.
- Use the INTERLOCK function whenever practical. In a confined workspace, build an enclosure around the DUT; for large or complex DUTs, fence off the test area and route the fence's safety switch into the INTERLOCK loop so that opening the enclosure immediately removes the high-voltage output.

1.4 Volume and weight

Parameter	Value
Dimensions (W×H×D)	430 mm × 132 mm × 550 mm
Weight	40 kg (TH9130) · 38 kg (TH9131) · 34 kg (TH9130A) · 32 kg (TH9131A)

1.5 Electrical safety test data

Test	Requirement
Insulation resistance	≥ 50 MΩ between the power-supply terminals and the chassis, under reference operating conditions; ≥ 2 MΩ under humid transport conditions
Dielectric strength	Withstands 1.5 kV AC, 50 Hz, for 1 minute between the power-supply terminals and the chassis, with no breakdown or flashover
Leakage current	≤ 3.5 mA

1.6 Low Voltage & EMC compliance

The TH9130 series is designed and tested to meet the essential requirements of the following EU directives:

Directive	Harmonised standard(s)
Low Voltage Directive 2014/35/EU	EN 61010-1:2010+A1:2019
EMC Directive 2014/30/EU	EN 61326-1:2021; CISPR 11:2015+A1:2016+A2:2019 (Group 1, Class A); EN 61000-4-2:2009, EN 61000-4-3:2020, EN 61000-4-4:2012, EN 61000-4-5:2014+A1:2017, EN 61000-4-6:2014, EN 61000-4-11:2020; EN 61000-3-2:2019+A1:2021, EN 61000-3-3:2013+A1:2019+A2:2021

> **NOTE**
>
> As a Class A / Group 1 ISM-adjacent instrument, the TH9130 series is intended for industrial/laboratory environments; it may not provide adequate protection against radio interference in a residential setting.

The CE mark on the rear-panel nameplate indicates conformity with the directives above. A full EU Declaration of Conformity is available from Techmize on request (see §1.9).

1.7 WEEE — disposal of electrical and electronic equipment



This symbol indicates that the instrument must not be disposed of as unsorted municipal waste at the end of its service life. Within the European Union, return the instrument to Techmize, your distributor, or a designated collection point for electrical and electronic equipment, in accordance with the WEEE Directive (2012/19/EU) and its national transposition in your country. Correct disposal helps prevent potential harm to the environment and human health from uncontrolled waste handling.

1.8 RoHS compliance

The TH9130 series is designed to comply with Directive 2011/65/EU (RoHS), as amended, restricting the use of certain hazardous substances in electrical and electronic equipment. Supporting documentation is available from Techmize on request.

1.9 Manufacturer & EU contact

For warranty terms, see the Appendix. For service, calibration or accessories, contact Techmize using the details below.

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An international subsidiary of Changzhou
Tonghui Electronic Co., Ltd. (China)

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Registration

Managing Director: Haohua Zhao
Register Court: Amtsgericht München
HRB 312530 · VAT ID DE463170824

CHAPTER 2

Operating Procedures & Safety Precautions

This chapter describes the procedures and precautions to be followed while operating the instrument. Pay particular attention to safety whenever the instrument is in use.

> **WARNING**
> This instrument outputs a test voltage of up to 5 kV AC or 6 kV DC. Incorrect or careless operation can cause an accident, including fatal electric shock. For your own safety, read this chapter carefully and keep its precautions in mind at all times.

2.1 Operating procedures

1) Insulating gloves

Wearing insulating gloves while operating the instrument helps protect against contact with high voltage — but avoid touching a live conductor by hand during a high-voltage test even when wearing them.

2) Grounding

A protective-ground terminal is provided on the rear panel. Use a suitable tool to connect this terminal to electrical ground (protective earth). Without a reliable ground connection, a short circuit between the supply and ground, or between any connected cable and ground, can leave the instrument's chassis at a hazardous voltage — anyone touching the chassis under that condition risks electric shock. Always confirm the protective-ground connection before use.

3) Connecting test leads

Press STOP and confirm the DANGER indicator is off before connecting test leads. When connecting leads to the DUT, connect the Return-terminal lead to the DUT first — an incomplete or disconnected Return lead is dangerous, since the entire DUT can then become charged to a high voltage. Insert the high-voltage test lead's plug fully into the HV terminal and turn it 90° clockwise to lock it in place, preventing accidental disconnection. Before every test, check that both the HV and Return leads are properly seated, with no looseness.

4) Stopping or pausing a test

To change test conditions, press STOP first so the instrument exits the test-ready state, and confirm the DANGER indicator is off. If you will be away from the instrument for a period, switch off the power to prevent an accidental start.

5) Remote control

Take particular care during remote-control operation: the high-voltage output is started and stopped remotely, and the operator cannot see the instrument's actual working state from the interface alone. In particular:

- The STOP control must be reliably connected; press it before changing the DUT.
- In a workspace with several people present, the INTERLOCK loop and protective ground must both be in place, together with a high-voltage indicator lamp. Open the INTERLOCK loop before changing the DUT.
- While a test voltage is being output, no one may touch the DUT, test leads, probes, output terminals, or the surrounding area.

6) Confirming a test has finished

If you must touch the DUT, test leads, probes or output terminals — for example to reconnect a DUT — first confirm that the power switch is off, or that the instrument's displayed state is not a test-in-progress state, and that the DANGER indicator is off. Even then, be aware the DUT may still hold a residual charge after a test and check that it has fully discharged.

7) High-voltage discharge after a test

During a high-voltage test, the test leads, probes and DUT are all charged to the test voltage. The instrument includes a discharge circuit, but discharging can take a short time even after the output has been cut off — this remains a shock hazard, so do not touch any part that could carry residual charge. At the end of a test, the discharge circuit begins forced discharge automatically; do not disconnect the DUT during the test or before discharge is complete.

Discharge time: the time needed for a full discharge depends on the test voltage used and the characteristics of the DUT. During a test, the DUT discharges through the transformer secondary (approximately 2 kΩ); a 10 µF capacitor charged to 6000 V discharges to 30 V in about 0.1 s, and the instrument's fixed 0.2 s discharge time is sufficient to complete this. The instrument's internal filter capacitors are discharged through the same circuit, also within 0.2 s.

For a DUT modeled as a 0.01 µF capacitor in parallel with a 100 MΩ resistor, if the DUT is disconnected during the test or before discharge completes, discharging to a safe 30 V takes approximately 5 s at a 5000 V test voltage, or approximately 3.5 s at 1000 V.

$$t = -\ln(30 / U) \times R \times C$$

where t is the discharge time, 30 is the residual safe voltage in volts, U is the test voltage set, R is the DUT's discharge resistance (approximately 2 kΩ), and C is the DUT's capacitance. If the DUT's time constant is known, the discharge time to 30 V after the output is cut off can be calculated from this formula.

8) Switching the power on or off

After switching off, wait several seconds before switching on again. Never cycle the power switch repeatedly — this is especially dangerous while a high-voltage output is active. Do not connect anything to the high-voltage output terminals while switching the power on or off, to avoid a hazard from an abnormal output transient.

9) Do not touch the high-voltage area during a test

While the instrument is in a test state, the output terminals, high-voltage test leads, probes, the DUT, and any exposed conductors around them all carry a hazardous voltage — do not approach or touch these areas.

> **WARNING**
> Never touch the alligator clips on the test leads while the instrument is in a test state — the rubber insulation on the clips is not sufficient to make this safe.

10) Do not short the test output to ground

Do not allow the instrument's high-voltage output lead or ground lead to short against the ground conductor of a transmission line, another connector, or the AC mains supply — this can charge the entire instrument chassis to a hazardous voltage. If the HV and Return terminals must be shorted together deliberately, first confirm the instrument's chassis is reliably connected to protective earth.

11) Do not connect external voltage to the test terminals

Do not connect any external voltage source to the instrument's output terminals. Outside a discharge cycle, the instrument's output is not designed to sink external voltage, and doing so can damage the instrument.

2.2 Handling emergency and fault conditions

1) Emergency situations

If an emergency occurs (such as an electric shock or the DUT catching fire) and the instrument has not removed the high-voltage output, perform both of the following:

1. Switch off the instrument's power switch.
2. Unplug the instrument's power cord from the outlet.

2) A faulty instrument in a hazardous state

The following conditions are hazardous even after STOP is pressed, because a high-voltage output may still be present at the terminals:

- The DANGER indicator stays lit continuously after STOP is pressed.
- The voltage reading shows no value, but the DANGER indicator is lit.

> **WARNING**
>
> If either condition above occurs, switch off the power immediately and unplug the power cord, then move away from the instrument and keep others away as well. Do not attempt to disassemble the test circuit yourself — hazardous voltage may remain inside the instrument, and this is dangerous for anyone without the proper training. Contact your Techmize distributor immediately. Either have a qualified technician confirm the circuit is safe, or leave the instrument powered off and undisturbed for at least one hour and confirm there is no output voltage at the test terminals, before removing any connections and returning the instrument to Techmize for service.

3) DANGER indicator fault

If pressing START produces a voltage reading but the DANGER indicator does not light, this may indicate a fault in the indicator itself. Switch off the instrument immediately and return it to Techmize or your local office for service.

4) Extended fault-free use

If the withstand-voltage current limit is set to 100.0 mA, watch the ambient temperature during extended use. If it exceeds 40 °C, pause testing until the temperature has returned to normal before continuing, and inspect the instrument as a precaution.

5) Replacing the fuse

To prevent electric shock, switch off the power and unplug the AC power cord before inspecting or replacing the fuse. Remove the fuse holder from the power inlet, take out the old fuse, press the new fuse into the holder, then refit the holder into the power inlet.

> **WARNING**
>
> Use only a replacement fuse matching the rating in §1.3.1, including shape, rating and characteristics. A different fuse type, or a short-circuited fuse holder, can damage the instrument.

6) AC supply quality

The instrument's AC input accepts 100–240 VAC at 47–63 Hz. A very unstable supply can cause incorrect or erratic operation — use a suitable line conditioner, such as a voltage regulator, if supply quality is in doubt.

7) 500 VA output capability

If the DUT draws a large current, a brief inrush (on the order of tens of amperes, for up to a few tens of milliseconds) can occur before a fail judgment or output cutoff takes effect, and the same can happen before a test begins. Size the supply cable and any shared connections accordingly.

8) Keep test leads clear of the panel

Keep high-voltage leads and the DUT at least 30 cm from the instrument's front panel during operation, to avoid interfering with the display.

9) Connecting automated equipment

- The instrument's and the automated equipment's grounding systems must be bonded together.
- Fit ferrite suppression rings, with at least one turn, at both ends (instrument output and DUT end) of the high-voltage lead and the Return lead.
- Route the high-voltage and Return leads separately from control lines.
- Keep the high-voltage and Return leads an adequate distance from the instrument chassis and front panel.

CHAPTER 3

Getting to Know the Instrument

This chapter introduces the front panel, rear panel, and the overall structure of the touchscreen user interface.

3.1 Front panel



TH9130 front panel

1 **POWER** — mains switch. Pressed in = on, released = off.

2 **START** (green) / **STOP** (red) — START begins a test (the DANGER indicator lights once testing starts); STOP halts a test in progress and can also clear a PASS/FAIL prompt.

3 **USB** — front-panel USB port for a USB storage device.

4 Instrument logo and model designation.

5 **PrtScn** — captures the current screen to the USB storage device (must already be plugged into the front-panel port).

6 **F1–F6** — context-sensitive soft keys; the corresponding on-screen label at the right edge of the display shows each key's current function. A blank or greyed-out label means that key is inactive on the current screen.

7 **FILE** — shortcut to browse internal and external (USB) files.

8 **FUNCTION** keys — **TEST** (lit = test-ready state), **SETUP** (lit = parameter-setup screen), **SYSTEM** (lit = system-setup screen).

9 Arrow keys — move the on-screen cursor; the selected parameter is highlighted with an orange background.

10 Numeric keypad — enters numeric values, and characters such as file names when needed.

11 Indicators — **PASS** (all readings within the configured limits), **FAIL** (a reading exceeded a configured limit), **DANGER** (lit throughout a test — a high-voltage output is present).

12 **HV** — high-voltage output terminal. Never touch while the DANGER indicator is lit.

13 **Return** — high-voltage reference (low-potential) terminal.

14 Ground-bond test terminals — four terminals: **Current** output, **Return** current-return, and the voltage-sense pair **Sense+** / **Sense−**.

15 Touchscreen LCD — displays test information and is also used to make settings directly.

3.2 Rear panel



TH9130 rear panel

1 **HV** — high-voltage output terminal, as on the front panel. Never touch while the DANGER indicator is lit.

2 Ground-bond test terminals — **Current**, **Return**, **Sense+**, **Sense−** (same function as the front-panel set).

3 **Return** — high-voltage reference (low-potential) terminal.

4 **INTERLOCK** — the high-voltage output is enabled only while these two terminals are shorted together (e.g. through a safety-fence switch).

5 **HANDLER** — starts/stops the instrument and outputs test results to automated equipment; see the HANDLER Interface chapter.

6 **RS-232C** — serial communication interface to a PC.

7 **LAN** — network communication interface to a PC.

8 **USB DEVICE** — lets a PC control the instrument using the remote command set.

9 AC inlet — 3-wire power inlet with integrated fuse holder.

10 Protective-ground terminal — connect reliably to electrical ground using a suitable tool.

11* **DUT Power I/P** — supply input for the device under test; also the input for an external AC source.

12* **Remote Output** — connects an external AC power source and sequences its output.

13* **EXTERNAL** — an additional external test point on the DUT, for withstand-voltage or insulation-resistance testing.

14* **L** — line output terminal to the DUT.

15* **N** — neutral output terminal to the DUT.

16* **Case** — connects the DUT's chassis/ground point to the instrument. During a leakage-current test, this point is fully isolated from the leakage-current measurement circuit.

17* **GND** — connects the DUT supply's ground conductor to the instrument; fully isolated from the protective-ground terminal (10).

18* **Probe HI** — body-impedance network (MD) probe, high-potential input, typically used for surface-to-ground and surface-to-surface leakage tests.

19* **Probe LO** — body-impedance network (MD) probe, low-potential input, typically used for surface-to-ground and surface-to-surface leakage tests.

* Terminals 11–19 are fitted on TH9130 / TH9131 only (electrical performance and leakage-current test terminals) — not on TH9130A / TH9131A.

3.3 User-interface structure overview

The three **FUNCTION** keys — [TEST], [SETUP] and [SYSTEM] — select which of the instrument's three main screens is shown; the key for the active screen lights up. Each screen behaves as follows:

Screen	What it shows	How it behaves
TEST	The active test file's steps, live readings, and PASS/FAIL/step status.	Read-only during a test — parameters cannot be edited from this screen; press [START] / [STOP] to run or halt testing.
SETUP	The parameters for the currently selected test step and test mode (e.g. `STEP 01/01`, mode `AC` with its AC withstand-voltage parameters).	Selecting a different test mode (e.g. changing `AC` to `DC`) switches the whole parameter set shown — the same screen area now displays the DC withstand-voltage parameters instead.
SYSTEM	Test-related, environment-related and communication-related system settings (§3.4).	Settings here apply globally, independent of the currently selected test file or step.

Within SETUP, each test file holds one or more sequential steps (`STEP nn/NN`); each step is independently assigned a test mode — **AC** (AC withstand voltage), **DC** (DC withstand voltage), **IR** (insulation resistance), **GB** (ground bond), **Cont** (continuity), **EL** (electrical performance, TH9130/TH9131 only) or **LC** (leakage current, TH9130/TH9131 only) — with that mode's own parameter set. Steps can be inserted, deleted, and saved to a file from the SETUP screen; see §3.5 onward for each test mode's parameters and §3.8 for file storage.

3.4 System settings (SYSTEM)

3.4.1 Test-related system settings

1. Press [SYSTEM] to open the system-settings screen.
2. Use the [▲] / [▼] arrow keys, the rotary knob, or the touchscreen directly to change test-, environment- or communication-related settings.
3. Move the cursor to the parameter to change, then set it via the touchscreen, the [F1]–[F6] keys, or the numeric keypad. The same screen also offers firmware update, factory reset and save.
4. For a numeric entry, press [ENTER] to confirm, [ESC] to re-enter it, or [←] to delete a mistyped character.

Setting	Range	Default	Description
Trigger source	Manual / External / Bus	Manual	Only a trigger signal matching the selected source starts a test.
Trigger delay	0.0–99.9 s	0.0 s	Delay between receiving the trigger and the start of measurement.
Test mode	Normal / Repeat / Loop / Single-step / Breakdown	Normal	Normal: runs the file once. Repeat: runs a set number of times. Loop: repeats continuously. Single-step: runs only the current step. Breakdown: sweeps to find the DUT's insulation breakdown point.
Repeat count	0–999	0	Number of repetitions, for Repeat test mode.
Test interval	0.0–99.9 s	0.0 s	Time between successive tests, for Repeat and Loop test modes.
On test failure	Continue / Retest / Stop / Lock	Continue	After a FAIL result: continue to the next step, wait for START to retest, wait for STOP then START, or lock the instrument until a password is entered.
Pass-buzzer time	0.2–99.9 s	0.5 s	Duration of the buzzer tone on a PASS result.
Inter-step hold	0.1–99.9 s / key	0.2 s	Delay between test steps; "key" means the instrument waits at STOP for START to continue. The hold after an electrical-performance or leakage-current step is at least 0.8 s regardless of this setting.
AC power supply (TH9130 only)	Off / On	Off	Enables the instrument's built-in AC power supply.
Rear-panel output (TH9130/TH9131 only)	Off / On	Off	Enables high-voltage output at the rear-panel DUT and EXTERNAL terminals.
Shock protection	Off / On	On	Enables the electric-shock protection function.

> **WARNING**
>
> With the AC power supply function enabled, the instrument can output up to 500 VA at up to 100 mA (AC withstand-voltage mode) — an electric shock at this level is severe and can cause unconsciousness or death. With shock protection **On**, if an operator contacts the high-voltage output, the instrument compares two current readings around the contact point; the current actually flowing through the body is their difference (i3 = i2 − i1). If i3 exceeds the configured limit, the high-voltage output is cut off immediately.

The **AC power supply** setting (TH9130 only) enables the instrument's internal 500 VA open-loop supply for the electrical-performance (RUN) and leakage-current (LC) test modes; its output voltage, frequency, current limit and related parameters are then set from within those two test-mode screens (§4.6, §4.7). If a test needs more than 500 VA, set this to **Off** and feed the DUT from a larger external AC source instead.

The **Rear-panel output** setting (TH9130/TH9131 only) controls whether the rear-panel L&N and EXTERNAL terminals can output high voltage during AC/DC withstand-voltage and insulation-resistance tests. With it **Off**, only the front- and rear-panel HV terminals output high voltage. With it **On**, each of those three test modes gains its own rear-panel-output option — **P-G** (primary-to-ground, the default once enabled), **S-G** (secondary-to-ground) or **P-S** (primary-to-secondary) — adding a second high-voltage output point at the rear L&N/EXTERNAL terminals for multi-point testing.

3.4.2 Environment-related system settings

Setting	Range	Default	Description
Key click	Off / On	Off	Enables a sound on each key press.
System language	English	English	Fixed at English on the units Techmize ships.
Buzzer volume	Off / Low / Medium / High	High	Adjusts the buzzer loudness.
Key-lock source	Manual / Bus	Manual	Sets whether the panel key-lock is controlled manually or over the remote bus.
Pass tone	Off / Long / Double-short	Long	Enables the PASS alarm tone; its long-tone duration follows the pass-buzzer-time setting in §3.4.1.
Screen brightness	1–100	50	Adjusts display brightness.
Fail tone	Off / Long / Double-short	Long	Enables the FAIL alarm tone; the long tone sounds continuously until STOP is pressed.
Date	—	—	Sets the system date.
Time	—	—	Sets the system time (24-hour format).

3.4.3 Communication-related system settings

This section of the SYSTEM screen shows the status of the instrument's four communication interfaces — **RS232C**, **GPIB** (optional), **USB** and **LAN** — and lets you configure each one (e.g. baud rate, GPIB address, IP address). See Chapter 7 (Interfaces & Remote Control) for full configuration details and the companion SCPI Command Reference for the remote-command set.

CHAPTER 4

Measurement Setup & Operation

Press SETUP to open the parameter-setup screen for the currently selected test step. Use F1–F6 or the touchscreen to insert/delete steps, start a new file, or page through a multi-step file; touch the test-mode field (or the ▶ arrow key) to choose the step's test mode — **AC**, **DC**, **IR**, **GB**, **Cont**, electrical performance, leakage current, or OSC — and set the cursor on any field to change it. This chapter covers each test mode's parameters (§4.1–§4.8), the TEST screen (§4.9), and the step-by-step test procedure (§4.10).

4.1 AC withstand-voltage (ACW) setup

Parameter	Range	Default	Description
Test voltage	0.050–5.000 kV, 0 = off	Off	AC withstand-voltage test level.
Current upper limit	0.001–120.0 mA	0.500 mA	Up to 120 mA at ≤4 kV; up to 100 mA above 4 kV.
Current lower limit	0.001 mA – upper limit, 0 = off	Off	Must not exceed the upper limit.
Arc limit	1–20 mA, 0 = off	Off	Arc-current threshold; off = no arc requirement.
Test frequency	50 Hz or 60 Hz	50 Hz	Withstand-voltage test frequency.
Rise time	0.1–999.9 s, 0 = off	Off	Time to ramp to the set voltage; off = ramps within the first test cycle.
Test time	0.3–999.9 s, 0 = continuous	3.0 s	0 runs continuously until STOP is pressed.
Fall time	0.1–999.9 s, 0 = off	Off	Time to ramp down after the test; off = output is cut immediately.
Continuity test *	On / Off	Off	Checks the DUT's ground-lead connection to the instrument's ground test terminal (see below).
Rear-panel output *	P-G / S-G / P-S	P-G	Only settable once "Rear-panel output" is enabled under SYSTEM (§3.4.1).

* TH9130 / TH9131 only.

Rear-panel output modes

With the SYSTEM-level "Rear-panel output" setting On, ACW gains a second high-voltage output point at the rear panel, in addition to the front/rear HV terminal:

Mode	High side	Low side	Description
P-G	Rear L & N	Rear Case	Rear L and N are shorted together as the high-voltage output; Case is the low side.
S-G	Rear EXTERNAL	Rear Case	EXTERNAL is the high-voltage output; Case is the low side.
P-S	Rear L & N	Rear EXTERNAL	Rear L and N are shorted together as the high-voltage output; EXTERNAL is the low side.

Typical wiring for a mains-powered DUT: rear **L/N** to the DUT's AC input, rear **GND** to the DUT's protective-earth line, rear **Case** to the DUT's chassis/ground point, and rear **EXTERNAL** to a secondary DUT output (e.g. a DC output). P-G then tests between L&N and Case; S-G between EXTERNAL and Case; P-S between L&N and EXTERNAL.

Continuity test (within ACW/DCW)

With this option On, connect a ground test lead from the instrument's ground test terminal to the DUT's ground input before testing — the instrument measures the resistance from rear Case to GND and requires it to be below 1 Ω. This runs alongside the withstand-voltage test: if the ground connection is not made, the withstand-voltage test does not start; if the ground lead opens during the test, the withstand-voltage test is aborted immediately. With this option Off, no ground-lead check is performed and no ground lead is required.

4.2 DC withstand-voltage (DCW) setup

Parameter	Range	Default	Description
Test voltage	0.050–6.000 kV, 0 = off	Off	DC withstand-voltage test level.
Current upper limit	0.0001–25 mA	0.500 mA	Up to 20 mA below 1.5 kV; up to 25 mA at ≥1.5 kV.
Current lower limit	0.0001 mA – upper limit, 0 = off	Off	Must not exceed the upper limit.
Ramp-up judgment	On / Off	Off	On: checks the current against the upper limit throughout the rise-time ramp. Off: no check is made during the ramp.
Ramp arc limit	1–10 mA, 0 = off	Off	Arc-current threshold during the voltage ramp.
Arc limit	1–10 mA, 0 = off	Off	Arc-current threshold for the DC test overall.
Rise time	0.1–999.9 s, 0 = off	Off	Time to ramp to the set voltage; off = ramps within the first test cycle.
Delay time	0.1–999.9 s, 0 = off	Off	A wait period during which current limits are not judged, but the instrument's hardware current ceiling for the range still applies.
Test time	0.3–999.9 s, 0 = continuous	3.0 s	0 runs continuously until STOP is pressed.
Fall time	0.1–999.9 s, 0 = off	Off	Time to ramp down after the test; off = output is cut immediately (the DUT may remain charged).
Continuity test *	On / Off	Off	Same behaviour as ACW — see §4.1.
Rear-panel output *	P-G / S-G / P-S	P-G	Same behaviour as ACW — see §4.1.

* TH9130 / TH9131 only. Rear-panel output modes and wiring are identical to ACW — see §4.1.

4.3 Insulation resistance (IR) setup

Parameter	Range	Default	Description
Test voltage	0.050–6.000 kV, 0 = off	Off	Insulation-resistance test voltage.
Resistance lower limit	0.05 MΩ – 50 GΩ	1.000 MΩ	
Resistance upper limit	lower limit – 50 GΩ, 0 = off	Off	Must exceed the lower limit.
Rise time	0.1–999.9 s, 0 = off	Off	Time to ramp to the set voltage.
Delay time	0.1–999.9 s, 0 = off	Off	Settling time before the reading is judged.
Test time	0.3–999.9 s, 0 = continuous	3.0 s	0 runs continuously until STOP is pressed.
Fall time	0.1–999.9 s, 0 = off	Off	Time to ramp down after the test.
Current range	Auto, 10 mA, 3 mA, 300 µA, 30 µA, 3 µA, 300 nA	Auto	Auto switches range automatically as the reading changes; a fixed range stays on the selected range.
Rear-panel output *	P-G / S-G / P-S	P-G	Same behaviour as ACW — see §4.1.

* TH9130 / TH9131 only.

To choose the current range, estimate the DUT's insulation resistance and compute I = U/R to find the expected current, then pick the range that covers it:

Current range	Resistance @ 50–499 V	Resistance @ 500–6000 V
10 mA (3–10 mA)	0.05–1 MΩ	0.05–4.5 MΩ
3 mA (0.3–3 mA)	0.5–4.5 MΩ	3.0–15.0 MΩ
300 µA (30–300 µA)	3.0–15.0 MΩ	10.0–45 MΩ
30 µA (3–30 µA)	10.0–45 MΩ	35.0–450 MΩ
3 µA (0.3–3 µA)	45 MΩ – 0.45 GΩ	0.40–4.5 GΩ
300 nA (20–300 nA)	0.40–4.9 GΩ	4.0–50.0 GΩ

4.4 Ground bond (GB) setup

Parameter	Range	Default	Description
Test current	1.00–40.00 A	25.00 A	
Test voltage	3.00–8.00 V	5.00 V	Limits the open-circuit output voltage in this constant-current test; raise toward 8 V if the set current cannot be reached.
Test time	0.5–999.9 s, 0 = continuous	3.0 s	0 runs continuously until STOP is pressed.
Test frequency	50 Hz / 60 Hz	50 Hz	
Resistance upper limit	0–600 mΩ	100 mΩ	0–600 mΩ (1.00–10.00 A) · 0–200 mΩ (10.01–30.00 A) · 0–150 mΩ (30.01–40.00 A)
Resistance lower limit	0 mΩ – upper limit	0 mΩ	
Synchronous test	Off / ACW / DCW	Off	Runs ground bond at the same time as a withstand-voltage test (see below).
Offset	0–200 mΩ	0 mΩ	Manual zero-offset value; auto-zero is available from the TEST screen.

Synchronous test: when set to ACW or DCW, the instrument automatically adds a withstand-voltage step immediately after the current GB step and runs both together — configure that added step's own parameters as usual (§4.1/§4.2). The TEST screen then shows both the ground-bond and withstand-voltage readings together for that combined step.

4.5 Continuity setup

Parameter	Range	Default	Description
Resistance upper limit	0.00–10,000 Ω	1000 Ω	
Resistance lower limit	0.00 Ω – upper limit	0.00 Ω	
Test time	0.3–999.9 s, 0 = continuous	3.0 s	0 runs continuously until STOP is pressed.
Continuity point *	GND / Off / L-N	Off	GND: rear Case-to-GND resistance. Off: instrument's own Current-to-Return resistance. L-N: rear L-to-N internal resistance on the DUT.

* TH9130 / TH9131 only.

The **L-N** option checks the DUT's own internal L-to-N impedance, guarding against a short between L and N inside the DUT that could otherwise make energizing it dangerous.

4.6 Electrical performance setup (TH9130 / TH9131 only)

Parameter	Range	Default	Description
Voltage upper / lower limit	0.0–277.0 V	125.0 V / 0.0 V	
Current upper / lower limit	0.00–16.00 A	10.00 A / 0.00 A	
Wait time	0.2–999.9 s	0.2 s	Current limits are not judged during this wait, but exceeding the instrument's hardware current ceiling still fails the test.
Test time	0.1–999.9 s, 0 = continuous	3.0 s	0 runs continuously until STOP is pressed.
Power upper / lower limit	0–4500 W	1000 W / 0 W	
Power-factor upper / lower limit	0.000–1.000	1.000 / 0.000	
Leakage upper / lower limit	0.00–10.00 mA, 0 = off	10.00 mA / 0.00 mA	
Remote control	Memory group 1–7	Group 1	Remote-controls the output of a TH71XX-series AC source.

Built-in AC power supply (TH9130 only, when enabled under SYSTEM)

With the SYSTEM-level "AC power supply" setting On, the electrical-performance and leakage-current setup screens gain the following extra parameters, which configure the instrument's built-in 500 VA supply feeding the DUT:

Parameter	Range	Default	Description
Test voltage	0.0–277.0 V (high range) / 0.0–140.0 V (low range)	Off	
Test frequency	45.0–500.0 Hz	50 Hz	
Current upper limit	0.0–2.1 A (high range) / 0.0–4.2 A (low range)	Off	
Neutral grounding	Open / Closed	Closed	Whether the AC supply's neutral is grounded.
Voltage range	High / Low	High	
Overload constant-current	On / Off	Off	On: if the output current exceeds the limit, the supply holds that current (the voltage sags) rather than shutting down. Off: the output stops immediately once the current limit is exceeded.

4.7 Leakage current setup (TH9130 / TH9131 only)

Parameter	Range	Default	Description
Leakage upper / lower limit	0.0–10,000 µA	6000 µA / 0.0 µA	
Voltage upper / lower limit	0.0–277.0 V	125.0 V / 0.0 V	
Wait time	0.5–999.9 s	0.5 s	Selectable range depends on the AC/DC and auto/fixed-range settings below.
Test time	0.1–999.9 s, 0 = continuous	3.0 s	0 runs continuously until STOP is pressed.
Neutral switch (S1)	Open / Closed	Closed	Simulates the DUT supply's neutral-line state.
Reverse-polarity switch (S2)	On / Off / Auto	Off	Simulates reversed line polarity; Auto runs both states and reports the larger leakage reading.
Ground switch (S3)	Open / Closed	Closed	Simulates the DUT supply's ground state.
Body-impedance network (MD)	see §4.7.2	UL544NP	National/international standard the network corresponds to — see Chapter 6 specifications.
Leakage-current mode	RMS / Peak	RMS	
Probe setting	Ground-to-Line / Probe-to-Line / Probe-to-Probe	Ground-to-Line	Probe position — see §4.7.3.
Waveform	AC / DC / AC+DC	AC+DC	
Auto range	On / Off	On	On switches current range automatically; Off stays on the selected fixed range.
Remote control	Memory group 1–7	Group 1	Remote-controls the output of a TH71XX-series AC source.

> **NOTE**
> If Peak mode is selected together with a DC waveform, the instrument forces the leakage-current mode back to RMS. Minimum wait time is 0.5 s for AC+DC with auto range, 1.8 s for AC-only or DC-only with auto range, and 1.3 s for AC-only or DC-only with a fixed range.

4.7.1 DUT power-state simulation

Switches S1 (Neutral), S2 (Reverse-polarity) and S3 (Ground) together simulate the DUT's supply condition. Their combinations give 8 distinct states plus 4 further settings where S2 = Auto (which tests two states and reports the larger leakage current):

#	Neutral (S1)	Reverse (S2)	Ground (S3)	DUT power state
1	Closed	Off	Open	State 1 — standard test (Class I)
2	Closed	On	Open	State 2 — L/N reversed (Class I)
3	Open	Off	Open	State 3 — single-fault (Class I)
4	Open	On	Open	State 4 — single-fault + L/N reversed (Class I)
5	Closed	Off	Closed	State 5 — single-fault (Class II)
6	Closed	On	Closed	State 6 — L/N reversed (Class II)
7	Open	Off	Closed	State 7 — single-fault (Class II)
8	Open	On	Closed	State 8 — single-fault + L/N reversed (Class II)
9	Closed	Auto	Open	States 1 & 2, larger value reported
10	Open	Auto	Open	States 3 & 4, larger value reported
11	Closed	Auto	Closed	States 5 & 6, larger value reported
12	Open	Auto	Closed	States 7 & 8, larger value reported

Once a state is selected, press TEST then START; the instrument stores the selected power state internally.

4.7.2 Body-impedance network (MD) models

Selecting "Body-impedance network" and then the network field itself opens a picker showing the available network circuits. Each corresponds to one or more test standards:

Network	Standard(s)
UL544NP	UL544NP
UL544P	UL544P
IEC60601 / GB9706.1	IEC60601-1, GB9706.1 (→ EN60601-1 for the EU market, §1.6)
UL1563	UL1563
IEC60990 Fig.4-U1 / GB4706.1	IEC60990 (Fig.4-U1), GB4706.1 (→ IEC60335-1)
IEC60990 Fig.4-U2 / GB12113.1	IEC60990 (Fig.4-U2), GB/T12113 (→ IEC60990)
IEC60990 Fig.5-U1 / GB7000.1	IEC60990 (Fig.5-U1), GB7000.1 (→ IEC60598-1)
IEC60990 Fig.5-U3 / GB12113.1	IEC60990 (Fig.5-U3), GB/T12113 (→ IEC60990)
IEC61010-1 A.2 / GB4793.1	IEC61010-1 Annex A.2, GB4793.1 (→ IEC61010-1)
IEC60598 Fig.G.4 / GB7000.1	IEC60598-1 Fig.G.4, GB7000.1 (→ IEC60598-1) — contact Techmize to add this network if required
Custom network	A customer-specific impedance model can be added on request via a firmware update.
Frequency detection	Not a body-impedance model — checks the instrument's own measurement bandwidth. Fixes the internal MD impedance at 1 kΩ so a signal generator and a reference voltmeter can be connected to the Probe HI / Probe LO terminals directly.

4.7.3 Probe position setting

The probe setting selects which two points the leakage-current measurement is made between:

Setting	SH	SL	Probe switch	Ground switch	Measures
Ground-to-Line	A	A	A	Open or Closed, selectable	Earth leakage current
Probe-Hi-to-Line	B	A	A	Open or Closed, selectable	Surface-to-line leakage current
Probe-Hi-to-Probe-Lo	B	B	A	Open or Closed, selectable	Surface-to-surface leakage current
Ground-to-Neutral *	A	A	B	fixed Open	Earth leakage current
Auto *	A	A	A then B, one pass each	fixed Open	Earth leakage current (Ground-to-Line & Ground-to-Neutral)

* Ground-to-Neutral and Auto require Reverse-polarity (S2) set to Off and Ground (S3) set to Open; they then appear as extra options alongside the three primary settings above.

- **Ground-to-Line** connects the MD network between the DUT supply's ground line and the system neutral — an earth-leakage measurement.
- **Probe-Hi-to-Line** connects one MD terminal to Probe HI (clipped to the DUT chassis) and the other to system neutral — a surface-leakage measurement.
- **Probe-Hi-to-Probe-Lo** connects the MD network directly between two probes placed on two points of the DUT — a surface-to-surface leakage measurement.

4.8 Open/short-circuit detection (OSC) setup

Parameter	Range	Default	Description
Open-circuit threshold	10–100%, step 1%	50%	Reading as a percentage of the sampled reference capacitance.
Short-circuit threshold	100–500%, step 10%, 0 = off	300%	0 disables short-circuit judgment.
Reference sample	0.001–40 nF	10.000 nF	Enter a known value directly, or obtain one by sampling (below).

Sampling a reference value: move the cursor to the reference-sample field and press the on-screen Sample key. The instrument outputs a 100 V, 600 Hz AC signal and measures the current through the DUT for 1 s (this output is live — observe normal high-voltage precautions). The displayed value is not the DUT's true capacitance but the impedance-derived equivalent, which approximates the actual capacitance across the test terminals.

For OSC to give useful pass/fail separation, take reference samples from an open circuit, from several good DUTs, and from a deliberately shorted DUT, then choose thresholds between those clusters. Worked example: for a 3-winding inductor with $C_{1\text{-}2}$≈300 pF, $C_{1\text{-}3}$≈200 pF, and a possible short between 2–3 — open sample C_s≈100 pF; good-DUT samples range 350–450 pF; shorted samples range 550–650 pF. Taking a reference of C_s=400 pF: open threshold 100/400=25% (lower bound) to 350/400=88% (upper bound) — 60% is a reasonable working value; short threshold 450/400=112% to 550/400=138% — 125% is a reasonable working value.

4.9 The TEST screen

Press TEST to open the measurement screen for the active file. The layout is consistent across test modes: the left side shows the test step and mode; the upper-centre area shows that mode's configured parameters; the centre shows the live voltage, current or resistance reading in large digits; the lower-centre area shows test status and PASS/FAIL result; the right side holds the zero (offset) and page controls.

Press START to begin — the DANGER indicator lights (or flashes, depending on state) for as long as a hazardous output is present. Once the step completes, PASS or FAIL is shown at bottom right; if PASS is not shown, the DANGER indicator light stays on the last measured values until STOP is pressed. Press the "List mode" soft key to switch to the list display, which shows every step's step number, mode, up to three parameters, and result in one screen — press "Step" to return to the single-step view.

4.10 How to run a test

4.10.1 Zeroing test-lead/fixture offset

1. Remove the DUT from the test leads or fixture, and confirm the test conditions are as intended.
2. Press TEST, then the "Zero" soft key, then START. The instrument measures the test leads' own leakage current and stores this reading as the zero offset.
3. After pressing "Zero", the DANGER indicator flashes; the output runs for 5 s (or for the configured test time, if that is shorter than 5 s).
4. The DANGER indicator stops flashing once zeroing is complete.

4.10.2 Sampling a reference capacitance (for OSC)

1. Before an OSC test — or whenever the DUT type changes — take a fresh reference-capacitance sample, or enter one manually.
2. Zero the test leads first (§4.10.1); repeat this any time the leads or fixture are changed, to keep accuracy.
3. Connect a known-good sample of the DUT, then run the Sample function under OSC setup (§4.8) to measure and store its capacitance as the reference value.
4. Subsequent OPEN/SHORT judgments compare each DUT's sampled capacitance against this stored reference.

4.10.3 Connecting the DUT

1. Confirm the instrument has no voltage output and the DANGER indicator is off (not flashing).
2. Connect the low-potential test lead to the Return terminal; short it to the high-potential lead momentarily, then insert the high-voltage lead into the HV terminal — confirm there is still no output.
3. Connect the Return-side lead to the DUT first, then the HV-side lead.
4. For a ground-bond test, connect the Return lead first, then the Current lead, to the DUT.

For rear-panel-output testing, wire a mains-powered DUT as follows: rear **L/N** to the DUT's AC input, rear **GND** to the DUT's protective-earth line, rear **Case** to the DUT's chassis, and rear **EXTERNAL** to a secondary DUT output. When using the optional TH90022 fixture, connect the DUT's AC input directly to the TH90022 socket, EXTERNAL to the DUT's secondary output, and rear Case to the DUT's chassis. Electrical-performance and leakage-current testing use the same L/N (or TH90022) and GND connections.

4.10.4 Running the test

Standard test sequence

1. Connect the DUT as in §4.10.3. Press TEST — the configured step is shown as described in §4.9.
2. Press STOP to arm the instrument, then START to begin. A hazardous voltage or current is now present and the DANGER indicator flashes. **The screen shows live readings while the output is active.**
3. **PASS:** once every configured step completes within limits, the instrument shows PASS at bottom right, cuts the high-voltage output, asserts the rear-panel PASS signal, and sounds the buzzer.
4. **FAIL:** if a reading falls outside its configured limit, the instrument shows FAIL, cuts the output immediately, asserts the rear-panel FAIL signal, and sounds the buzzer continuously until STOP is pressed.

Press STOP at any time to abort a test in progress.

OSC test sequence

1. Connect the DUT. Press TEST — the screen shows the step's open/short thresholds, test voltage, measured capacitance and elapsed time.
2. Press STOP to arm, then START. A high-voltage output is present and the DANGER indicator flashes; the live output voltage, measured capacitance and elapsed time are shown.
3. **PASS / FAIL** follow the same behaviour as the standard sequence above.

Result	Meaning
OPEN	Open-circuit fault: the sampled capacitance, as a percentage of the reference, is below the open-circuit threshold.
SHORT	Short-circuit fault: the sampled capacitance, as a percentage of the reference, is above the short-circuit threshold.

CHAPTER 5

File Storage & HANDLER Interface

5.1 File storage

Press FILE to open the file-management screen. Use the arrow keys, the rotary knob, or the touchscreen to move between the internal file list (Files) and an external USB drive (usb), then press OK or touch a file entry and use F1–F6 for the operations below.

Function	Description
New folder	Creates a new folder.
Delete folder	Deletes the currently selected folder.
Rename	Renames the selected file or folder.
Save to internal	Stores the current file in internal memory.
Save to USB	Stores the current file to the USB drive.
Copy to USB	Copies an internal file to the USB drive.
Copy to internal	Copies a USB file into internal memory.
Load file	Loads the selected file into the instrument as the active file.
Delete file	Deletes the selected file.

Internal storage holds up to 100 files, 50 steps per file (§1 overview). Each stored file keeps its own complete step sequence and per-step test-mode parameters, so a saved file can be reloaded to reproduce an entire multi-step test program instantly.

5.2 HANDLER interface overview

The HANDLER interface is the instrument's primary link into an automated test system: it accepts start/stop control from external automation and outputs the test result for each step. Signals fall into two groups — **internal outputs** (test-result and handshake signals driven by the instrument) and **external inputs** (control signals driven by the automation).

Signal group	Specification
Internal output signals	DC 24 V, 20–40 mA
External input signals	DC 3–26 V (HIGH), 10 mA ± 4 mA

The connector is a female D-sub type; consult the physical connector on your unit or Techmize to confirm the exact pin count and shell size before designing a mating cable.

5.3 HANDLER pin assignment

Common signals (fixed function)

Pin(s)	Signal	I/O	Description
4	/FAIL	Output	LOW when the step result is FAIL. Any active /HIGH, /LOW, /ARC_FAIL, /GFI_FAIL or /SHORT_FAIL signal is only asserted while /FAIL is LOW.
5	/PASS	Output	LOW when the step result is PASS. While /PASS is LOW, /HIGH, /LOW, /ARC_FAIL, /GFI_FAIL and /SHORT_FAIL are all held HIGH (inactive).
16	/EOT	Output	HIGH while the test programme is running; LOW once it has finished or while idle.
17	/EOS	Output	HIGH while the current step is running; LOW once that step has finished (before the next step starts) or once all steps are complete.
8	/EXT_STOP	Input	External STOP; active LOW.
9	/EXT_START	Input	External START; active LOW.
10, 11	$+V_{EXT}$ (EXT_DCV)	Input	External DC supply input, +3 V to +26 V.
12, 13	+24 V	Output	Instrument's internal DC supply output.
24, 25	GND	—	Return for the +24 V internal supply output.
22, 23	COM	—	Common low-reference for the I/O signals.

5.4 Mode-dependent signal pins

Pins 1–3, 6–7 and 14–21 are shared across test modes: which signal is actually asserted on a given pin depends on which test mode the current step is running. All are outputs, active LOW, and only asserted while /FAIL (pin 4) or /PASS (pin 5) is correspondingly active as noted in §5.3.

Pin	ACW / DCW / IR	GB	Continuity	Electrical (RUN) *	Leakage (LC) *
2	— (OSC: /OPEN)	/GR_HIGH	/ConR_HIGH	/RunU_HIGH	/LCU_HIGH
3	— (OSC: /SHORT)	/GR_LOW	/ConR_LOW	/RunU_LOW	/LCU_LOW
6	/HIGH (reading > upper limit)	—	—	—	/HIGH
7	/LOW (reading < lower limit)	—	—	—	/LOW
1	—	—	—	/RunPF_HIGH (PF > upper)	—
14	—	—	—	/RunPF_LOW (PF < lower)	—
15	—	—	—	/RunI_HIGH (current > upper)	—
18	—	—	—	/RunI_LOW (current < lower)	—
19	/SHORT_FAIL (withstand test)	—	—	/RunP_HIGH (power > upper)	/MD-ULimit (MD voltage > 30 VDC)
20	/ARC_FAIL (withstand test)	—	—	/RunP_LOW (power < lower)	—
21	/GFI_FAIL (withstand test)	—	—	—	—

* RUN (electrical performance) and LC (leakage current) apply to TH9130 / TH9131 only.

5.5 Connecting to automated equipment

HANDLER wiring can use the instrument's own internal +24 V supply (pins 12/13, referenced to COM/GND) or an external DC supply fed into pins 10/11 ($+V_{EXT}$). Bond the instrument's and the automated equipment's grounding systems together, and keep control wiring separated from the high-voltage test leads (§2.2.9).

CHAPTER 6

Performance & Specifications

Specifications below apply after the warm-up period in §1.3.3, at the reference operating condition in §1.3.2, unless noted otherwise. They match the confirmed figures in the TH9130 Series European datasheet.

6.1 AC / DC withstand voltage (ACW / DCW)

Parameter	TH9130	TH9131	TH9130A	TH9131A
AC voltage range	0.05–5.0 kV, 50/60 Hz ± 0.1% sine wave			
AC output power	500 VA (5.0 kV/100 mA)	200 VA	500 VA	200 VA
DC voltage range	0.05–6.0 kV			
DC output power	150 VA (6.0 kV/25 mA)	120 VA	150 VA	120 VA
Voltage accuracy	± (1% set value + 5 V); resolution 2 V			
AC current range	0.001–120 mA (V≤4 kV) / 100 mA (V>4 kV)		0.001–40 mA	
DC current range	0.0001–25 mA (V≥1.5 kV) / 20 mA (V<1.5 kV)		0.0001–20 mA	
Test / rise / fall / wait time	0.3–999 s / 0.1–999 s / 0.1–999 s / 0.1–999 s (0 = continuous / off)			
Arc detection (AC / DC)	1.0–20.0 mA / 1.0–10.0 mA	1.0–20.0 mA / —	1.0–20.0 mA / 1.0–10.0 mA	1.0–20.0 mA / —
Max short-circuit current (AC)	200 mA	80 mA	200 mA	80 mA
Fast discharge	Automatic discharge after DC withstand-voltage test			

6.2 Insulation resistance (IR)

Parameter	Value
Output voltage	DC 0.05–6.0 kV, resolution 2 V, accuracy ± (1% reading + 5 V)
Resistance range	0.05 MΩ – 50.0 GΩ
Accuracy (V ≥ 1 kV, and 500 V ≤ V < 1 kV)	1 MΩ–1 GΩ: ± (3% reading + 1 MΩ) · 1–10 GΩ: ± (7% reading + 0.2 GΩ) · 10–50 GΩ: ± (10% reading + 0.5 GΩ)
Accuracy (V < 500 V)	1 MΩ – 1 GΩ: ± (5% reading + 100 V/V_s × 10 MΩ)

6.3 AC ground bond (GB)

Parameter	Value			
Output current	1.00–40.00 A, ± (2% set value + 2 digits)			
Test voltage	3.00–8.00 V, 50/60 Hz ± 0.1%			
Resistance range / accuracy	0–600 mΩ (1–10 A) · 0–200 mΩ (10–30 A) · 0–150 mΩ (30–40 A); accuracy ± (2–3% reading + 2–3 digits)			
Synchronous ACW+GB test	5 kVac/50 mAac & 30 Aac/150 mΩ	5 kVac/30 mAac & 30 Aac/150 mΩ	5 kVac/50 mAac & 30 Aac/150 mΩ	5 kVac/30 mAac & 30 Aac/150 mΩ

6.4 Continuity

Parameter	Value
Test current / resistance	0.0001–0.1 A / 0.00–10,000 Ω; accuracy ± (1% reading + 3–10 digits)

6.5 Electrical performance test (TH9130 / TH9131 only)

Parameter	Value
Voltage / current / power	0–277.0 V / 0–16.00 A / 0–4500 W
Power factor / leakage current	0.000–1.000 / 0.00–10.00 mA

6.6 Leakage current test (TH9130 / TH9131 only)

Parameter	Value
Supply / leakage range	0–277 Vac, 16 Aac max / 0.0 µA – 10.00 mA
Test frequency	DC, 15 Hz – 1 MHz
Body-impedance networks (MD)	7 selectable networks A–H — see §4.7.2 for the full standards mapping

6.7 OSC open/short-circuit detection

Parameter	Value
Sample capacitance / thresholds	0.001–40 nF · open 10–100% · short 100–500%

6.8 Safety & general

Parameter	Value
Electric-shock protection	0.5 mA ± 0.25 mA, selectable on/off; Interlock pin must be pulled low to enable HV output
Alarm / lock	Pass: short tone + green light · Fail: long tone + red light · lock-on-fail, panel key-lock
Storage	100 files, 50 steps/file
Standard interfaces	RS232, USB Device, USB Host, LAN, HANDLER — SCPI standard
Optional interface	GPIB
Operating temp. / humidity	0–45 °C, 20–90% RH (comparison ref. 18–28 °C, 30–70% RH)
Storage temp. / humidity	−10–55 °C, < 80% RH
Power supply / power	100–240 VAC, 47–63 Hz · no-load < 100 W, rated 1200 W
Dimensions (W×H×D)	430 × 132 × 550 mm
Weight	40 kg (TH9130) · 38 kg (TH9131) · 34 kg (TH9130A) · 32 kg (TH9131A)

CHAPTER 7

Interfaces & Remote Control

The instrument can be remote-controlled over RS232C (standard) or GPIB (optional) — not simultaneously — using the same command set on different hardware and transport. USB Device and LAN are also available for remote control and file transfer. This chapter covers interface setup; the full command syntax is in the companion *TH9130 Series SCPI Command Reference*.

7.1 RS232C

The instrument implements a minimal 3-wire subset of RS-232 — transmit data (TXD, connector pin 3), receive data (RXD, pin 2) and signal ground (GND, pin 5) — on a 9-pin male D-sub connector, pinned the same as a standard IBM-AT-compatible 9-pin serial port. Use a standard 9-pin female D-sub cable to connect directly.

Parameter	Setting
Transfer mode	Full-duplex asynchronous, with start and stop bits
Baud rate	9600 / 19200 / 38400 / 115200 bps
Data bits	7 or 8
Stop bits	1 or 2
Parity	None / Odd / Even
Terminator	NL (line feed, ASCII 10)
Handshake	Software (character echo — see below)
Connector	9-pin D-sub

To select RS232C as the active bus, press SYSTEM, then F3, then set the port type to RS232C and configure the parameters above from the same screen.

> **WARNING**
> Switch the instrument off before connecting or disconnecting the RS232C cable, to avoid an electrical shock hazard. Never short an output terminal to another terminal or to the chassis — this can damage the instrument.

Software handshake protocol

RS232C on this instrument uses no hardware handshake lines; instead, it uses character-echo software handshaking to reduce data loss or corruption:

- Commands are sent as ASCII text terminated by NL (line feed, ASCII 10); the instrument begins executing only once it has received the terminator.
- The instrument echoes each character back immediately on receipt; the host should wait for that echo before sending the next character. A missing echo usually means a cabling fault, RS232C not enabled on the instrument, or the instrument busy executing a bus command (in which case resend the un-echoed character to keep the command intact).
- The instrument sends data only in response to a received character (echo) or a query command's result.
- A query's result is sent immediately once that query executes, even mid-command-string — so a command string may contain multiple queries, but the host must perform a matching number of reads; one query per command string is recommended.
- Query results are ASCII text terminated by NL, sent continuously (~1 ms between characters) — the host must be ready to receive or data can be lost.
- Before sending a new query, make sure any previous query result has been fully read (through its terminating NL) to avoid a collision between that result and subsequent echoes; likewise clear any pending echo characters before reading a query result.
- For commands that take longer to complete (e.g. a zero/offset operation), the host should wait for completion rather than sending the next command immediately.

Implement RS232C control with a standard serial library for your platform (e.g. PySerial for Python, or your language's equivalent), applying the handshake rules above and the command syntax in the SCPI Command Reference.

7.2 GPIB (optional)

The optional GPIB (IEEE 488.2) interface board lets the instrument join a shared bus with a controller PC and other GPIB instruments for automated test systems. Up to 15 instruments can share one bus; total cable length must not exceed 2 m × (number of instruments on the bus), and must never exceed 20 m overall. Cables can be connected in any topology, but no more than 4 piggyback connectors should be stacked on any one instrument.

Code	Function
SH1	Full source-handshake capability
AH1	Full acceptor-handshake capability
T5	Basic talker; talk-only; talker cancelled on MLA; no serial poll
L4	Basic listener; listener cancelled on MTA; no listen-only
RL1	Remote/local capability
DC1	Device clear
DT1	Device trigger
C0	No controller capability
E1	Open-collector driver

The instrument uses single-address addressing (no secondary address), 0–30, factory default 1; the address is retained in non-volatile memory. To set it: press SYSTEM, then F3, select port type GPIB, move to the address field, and enter the address on the numeric keypad.

Supported GPIB bus commands: **IFC** (interface clear), **SDC/DCL** (device clear — clears the I/O buffers and readies the interface), **GTL** (go to local — returns front-panel control, keys become active), **LLO** (local lockout — disables all front-panel keys until GTL is issued), **RMT** (remote).

7.3 Command syntax overview

- Only the actual characters sent or received by the instrument are described in the command reference; all command characters are ASCII.
- A command's data field, shown as `<????>`, is an ASCII string — typically an integer or floating-point number in the instrument's default unit for that parameter (units are not included in the command itself).
- Every command must end with a terminator: **NL** (line feed, decimal 10 / 0x0A) over RS232C/USB/LAN, or the IEEE-488 **EOI** signal over GPIB. Without a terminator, the instrument does not parse the command.

For fast, single-command step configuration, each of the 8 test modes also has a compact multi-parameter "CAL" command that sets every parameter for a step in one line — see the companion SCPI Command Reference for the full per-mode syntax and worked examples.

APPENDIX

Warranty & Quick Reference

A.1 Warranty

Techmize warrants this instrument to be free from defects in material and workmanship for a period of **two (2) years** from the date of delivery to the original purchaser. During the warranty period, Techmize will repair or replace, at its discretion, a product that proves defective, provided it has been used within the specified operating conditions (Chapter 1).

This warranty does not cover: damage from misuse, accident, unauthorized modification or repair; consumable/wear items such as fuses and connectors; or damage from operation outside the environmental limits given in §1.3. Standard test fixtures and cables are covered by their own applicable warranty terms.

A.2 Limitation of liability

Except as expressly stated in §A.1, Techmize makes no other warranty, express or implied, regarding this instrument or its documentation. Techmize is not liable for indirect, incidental or consequential damages arising from the use of this instrument, to the extent permitted by applicable law.

A.3 Related documents

The remote-command set is published separately in the *TH9130 Series SCPI Command Reference*.

A.4 Front-panel key quick reference

Key	Function
TEST	Opens the measurement/run screen (§4.9)
SETUP	Opens the per-step parameter setup screen (Chapter 4)
SYSTEM	Opens system settings — test, environment, communication (§3.4)
FILE	Opens file management, internal and USB (§5.1)
START	Begins a test; DANGER indicator lights/flashes while hazardous output is present
STOP	Halts a test in progress; also clears a PASS/FAIL prompt
PrtScn	Captures the current screen to a USB storage device
F1 – F6	Context-sensitive soft keys, labelled on-screen

A.5 Common remote commands

Task	Command
Identify the instrument	`*IDN?` → manufacturer, model, firmware version
Set the test mode for a step	`FUNC:SOUR:STEP <sn>:PRJ <mode>` (AC/DC/IR/GB/CONT/RUN/LC/OSC)
Configure a step's parameters	`FUNC:SOUR:STEP <sn>:<mode>:<param> <value>` — see Chapter 4 and the SCPI Command Reference
Start / stop a test	`FUNC:START` · `*STOP`
Read the test result	`FETCh?`
Save / load a setup file	`MMEM:SAVE <name>.sta` · `MMEM:LOAD <name>.sta`

See the companion *TH9130 Series SCPI Command Reference* for the complete command set.

A.6 Manufacturer & EU contact

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