TECHMIZE by TONGHUI

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OPERATION MANUAL

TH2840 Series

Precision LCR Digital Bridge — TH2840A / TH2840B / TH2840BL. Covers front-panel operation, measurement setup and system configuration; see the companion TH2840 Series SCPI & MODBUS Command Reference for the full remote-command set.

Techmize Electronic GmbH · Ismaning, Germany

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TH2840 Series Operation Manual

Precision LCR Digital Bridge — TH2840A / TH2840B / TH2840BL

This is the English-language edition of the TH2840 Series Operation Manual, covering the LCR-bridge models of the TH2840 platform only. The TH2840 platform also includes TH2840AX / TH2840BX transformer-scan variants (marketed by Techmize as the **TH2840X series**); those models, their transformer single-test and automatic scanning functions, are documented separately and are out of scope for this manual.

TH2840BL is a third LCR-only model (2 MHz range, no built-in DC bias/current source, GPIB standard, 20 Ω output impedance). Its menu structure follows TH2840A/TH2840B throughout, except for the hardware differences described in this manual: frequency range (§4.4.2), DC bias/current source (§4.4.6, §7.2.2), output impedance (§7.2) and GPIB (§3.2, §5.1.1).

Part I — Operation	
1. Safety & Compliance	3 pages
2. Out of the Box	2 pages
3. Getting to Know the Instrument	3 pages
4. LCR Function Module ([Display] / [Setup] menus)	11 pages
5. System Setup & File Management	3 pages
6. Measurement Examples	3 pages
7. Performance & Specifications	4 pages
Part II — Remote Control & Handler	
8. Remote Command Reference	1 page
9. Handler Interface	3 pages
Appendix — Terms, Symbols & Quick Reference	2 pages

CHAPTER 1

Safety & Compliance

1.1 About this manual

This is the original-language (English) edition of the operation manual for the Techmize TH2840 series of precision LCR digital bridges, covering models **TH2840A**, **TH2840B** and **TH2840BL**. 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 §1.10 before relying on the instrument for measurement decisions.

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.

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

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

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

1.3 General safety precautions

The TH2840 series is a Class I safety instrument: it relies on a protective-earth connection through its power cable. Before switching on, confirm that the phase (L), neutral (N) and protective-earth (E) leads of the mains supply match the instrument's power inlet, and that the earth lead is reliably connected to ground — an unearthed instrument can give the operator an electric shock on fault.

> **WARNING**
>
> Discharge any charged device under test (electrolytic capacitors, charged inductors, etc.) before connecting it to the UNKNOWN terminals. The maximum DC bias the test terminals can tolerate is **±42 V**; exceeding this can damage the instrument.

Power supply: 100–120 V AC or 198–242 V AC (set by the rear-panel voltage selector), 47–63 Hz, not less than 100 VA. Use only the fuse type and rating specified for the selected voltage range (see the rear-panel rating label); confirm the fuse matches the selected voltage range before applying power.

Environment: operate at 0–40 °C, ≤75% RH, away from dust, vibration, direct sunlight and corrosive gases. Keep the left-side ventilation openings clear of obstruction. For long-term storage, use the original packaging (or equivalent) at 5–40 °C, ≤85% RH, away from corrosive contaminants and direct sunlight. Allow **60 minutes** of warm-up before relying on the rated accuracy, and avoid cycling the power switch unnecessarily.

Test fixtures and cables: use only a Techmize/Tonghui-supplied or approved fixture or cable; a third-party or user-made fixture can produce incorrect measurement results. Keep fixture contacts and DUT leads clean. The instrument will show an unstable reading with no fixture or cable connected.

1.4 Electrical safety test data

Test	Requirement
Insulation resistance	≥ 50 MΩ between mains and chassis under reference conditions; ≥ 2 MΩ under high-humidity transport conditions
Dielectric strength	Withstands 1.5 kV AC, 50 Hz, for 1 minute between mains and chassis, with no breakdown or flashover
Leakage current	≤ 3.5 mA AC (rms)

1.5 Low Voltage & EMC compliance

The TH2840 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 TH2840 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 §1.10).

1.6 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.

1.7 RoHS compliance

The TH2840 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.

1.8 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.

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. Repair must be carried out by qualified personnel; after any repair, the instrument should be recalibrated before further use.

1.9 Limitation of liability

Except as expressly stated in §1.8, 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.

1.10 Manufacturer & EU contact

Techmize Electronic GmbH

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Registration

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

CHAPTER 2

Out of the Box

2.1 Unpacking

Inspect the shipping carton for transport damage immediately after unpacking. Do not power on the instrument if the carton or its contents show signs of damage — contact Techmize or your distributor first. Check the contents against the packing list; if anything does not match, contact Techmize or your distributor promptly.

1× TH2840-series LCR meter (model as ordered: TH2840A / TH2840B / TH2840BL) · 1× power cable · spare fuses · 1× this operation manual · 1× test report · 1× warranty certificate.

Keep the original packaging — it is the recommended way to store or return the instrument, and storage outside this packaging should still meet the environmental limits given in §1.3.

2.2 Connecting the power supply

Item	All models
Supply voltage	100–120 V AC or 198–242 V AC, set by the rear-panel fuse-holder orientation (see §1.3)
Supply frequency	47–63 Hz
Power consumption	≤ 130 VA

Match the phase (L), neutral (N) and protective-earth (E) leads of the supply cable to the instrument's power inlet, and confirm the fitted fuse matches the selected voltage range before connecting. If mains conditions are noisy, fitting a power-line filter ahead of the instrument is recommended.

> **WARNING**
> Confirm the fuse position matches the supply voltage range before applying power. Disconnect input power before replacing a fuse, and use only the manufacturer-specified fuse rating.

2.3 Connecting a test fixture

Use only a test fixture or test cable supplied or approved by Techmize/Tonghui for this instrument; a third-party or user-made fixture can produce incorrect measurement results. Connect the fixture or cable to the four front-panel UNKNOWN terminals — **Hcur, Hpot, Lpot, Lcur** — and keep both the fixture contacts and the DUT's leads clean to ensure good electrical contact. If the DUT has a shielding shell, connect the shield to the instrument's chassis ground terminal "⏚".

> **NOTE**
> With no test fixture or cable connected, the instrument shows an unstable reading. This is expected and does not indicate a fault.

2.4 Starting the instrument for the first time

1. Connect the power cable at the rear panel, and connect the supply's protective earth reliably to ground.
2. Press the **POWER** switch at the front-left of the instrument. The TH2840 series uses a software-controlled power switch: once the power cable is connected, some front-panel indicators blink briefly, then the POWER key settles to a steady red (standby) state.
3. Pressing **POWER** from standby starts the instrument; a splash screen shows the company logo, instrument model and firmware version while it loads, then the display opens on the <Measurement Display> page (Chapter 3, §4.1).

To power down, hold **POWER**; the key returns to steady red (standby). For long periods of non-use, disconnect the supply cable and store the instrument per the environmental limits in §1.3.

> **NOTE — FACTORY PASSWORD**
> This series ships with a factory password of **2840** for the keylock/password feature described in §5.1.2. Change it from <System Setup> if required for your site's procedures.

Allow 60 minutes of warm-up before relying on the rated accuracy (§1.3). For an overview of the front panel, rear panel and basic navigation, continue to Chapter 3.

CHAPTER 3

Getting to Know the Instrument

3.1 Front panel

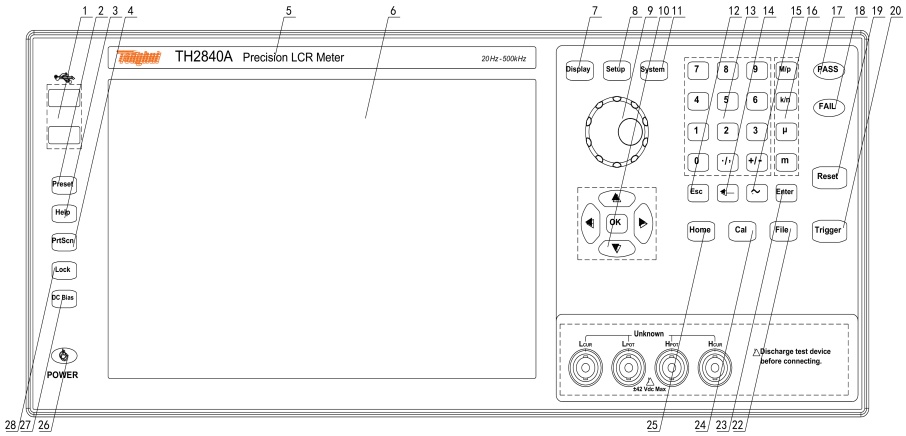


图 3-1 前面板说明

1 **USB HOST ports** — two ports for a USB flash drive (file save/recall) or a mouse, keyboard or barcode scanner. Only one flash drive can be used at a time.

2 **Preset** — resets the instrument to its factory default settings.

3 **Help** — lights up and opens a help popup describing the function and operation of the field under the cursor; press again to close it.

4 **PrtScn** — screen-capture key; saves the current screen as an image to a connected USB drive.

5 **Trademark & model** — instrument brand and model designation (TH2840A / TH2840B / TH2840BL), with the frequency range shown at the top right of the header bar.

6 **LCD display** — 10.1" 1280×800 colour capacitive touchscreen; shows the reading, test conditions and instrument status (§3.3).

7 **Display** — opens the measurement display pages for the active function (§3.4, Chapter 4).

8 **Setup** — opens the measurement setup pages for the active function (Chapter 4).

9 **System** — opens the <System Setup> page (Chapter 5).

10 **Rotary knob with OK centre button** — moves the cursor and adjusts the value of the selected field; the centre press confirms and saves the value, similar to **Enter**.

11 **Cursor keys** (▲ ▼ ◀ ▶) with centre **OK** — move the highlighted field between regions of the screen; the active field is highlighted on the display.

12 **Numeric keypad** — digits 0–9, decimal point **·/,** and **+/-** (sign toggle, or backspace once entry has started).

13 **Magnitude keys** — **M/p**, **k/n**, **μ**, **m** apply the corresponding SI prefix/unit to a numeric entry.

14 **Esc** — cancels the current entry or backs out of a menu.

15 **←** — backspace; deletes the last digit of the value being entered.

16 **~** — reserved for transformer-scan pin entry; has no function on TH2840A/B/BL.

17 **Enter** — confirms and saves the value shown in the entry line.

18 **PASS / FAIL LEDs** — show the comparator (bin-sorting) result for the current reading.

19 **Reset** — pauses a running list sweep or graphical sweep; press **Trigger** again to resume from where it paused.

20 **Trigger** — manually triggers a reading when the trigger mode is set to single/manual (§4.4.8).

21 **UNKNOWN terminals** — four independent test connections: **Hcur** (current-source high), **Hpot** (voltage-sense high), **Lpot** (voltage-sense low), **Lcur** (current-source low). Maximum ±42 V DC at the test terminals (see §1.3).

22 **File** — shortcut directly into <File Management> (§5.2).

23 **Enter** — confirms/saves the data shown on the input line.

24 **Cal** — shortcut directly into <User Correction> (§4.8).

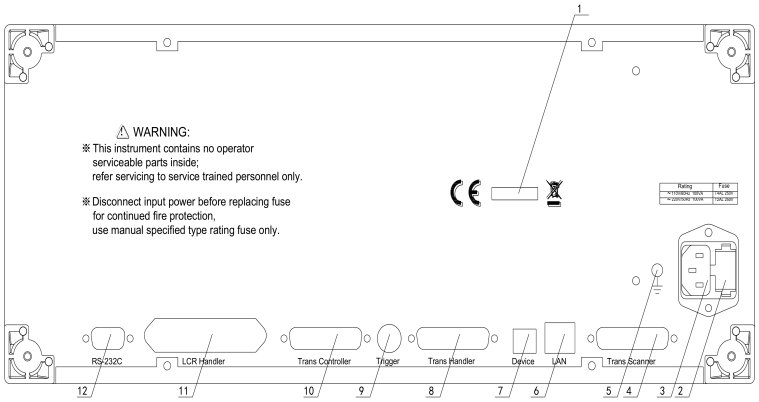
25 **Home** — switches between the instrument's top-level functions; on TH2840A/B/BL this stays within LCR bridge mode (no transformer-test functions are present).

26 **POWER switch** — red in standby, green when running; hold to power down (§2.4).

27 **DC Bias** — enables/disables the internal DC bias/current-source output (TH2840A/TH2840B). Has no function on TH2840BL, which has no built-in bias or current source.

28 **Lock** — locks/unlocks the front-panel keys and touchscreen; if a system password is set (§5.1.2), unlocking requires it. Also lights while the instrument is under remote (RS-232/USB/LAN) control.

3.2 Rear panel



1 **Rating label** — production date, serial number, CE mark and manufacturer information.

2 **Fuse holder** — the fitted fuse protects the instrument; the orientation of the fuse carrier also switches between 110 V/220 V ranges (§1.3, §2.2).

3 **AC power inlet** — mains input.

4,

5 **Trans Scanner interface** — connects a transformer scan box (compatible with the TH1901/TH1831 series, each needing its own cable). **Present on the connector panel but non-functional** on TH2840A/TH2840B/TH2840BL, which have no transformer-scan capability.

6 **Chassis ground terminal** — for protective or shield grounding (§1.3).

7 **LAN** — 10/100 M Ethernet for network control and communication.

8 **USB DEVICE** port — PC communication (USBTMC/USBCDC), small type-B connector.

9 **Trans Handler interface** — sorting-result output for transformer-scan testing. **Non-functional on TH2840A/TH2840B/TH2840BL.**

10 **TRIGGER** input — connect a foot switch or other external trigger source.

11 **Trans Controller interface** — expansion interface for transformer-scan sorting signals when the Trans Handler's signal count is insufficient. **Non-functional on TH2840A/TH2840B/TH2840BL.**

12 **LCR HANDLER** interface — outputs the bin/sorting result for bridge and list-sweep comparison to automatic handling equipment (Chapter 9). Standard on all three models.

13 **RS-232C** interface — PC communication; standard on all models.

> **NOTE — SHARED CONNECTOR PANEL**
>
> TH2840A, TH2840B and TH2840BL are built on the same connector platform as the Techmize TH2840X transformer-scan series, so the Trans Scanner / Trans Handler / Trans Controller connectors are physically present on the rear panel of every unit. On TH2840A/TH2840B/TH2840BL these three interfaces have no function — do not attempt to use them.

> **NOTE — GPIB (TH2840BL)**
>
> GPIB is standard on TH2840BL only. A TH2840BL unit additionally offers GPIB alongside RS-232C/USB/LAN in the bus-mode selection described in §5.1.1.

3.3 Display zones

The 10.1" 1280×800 colour capacitive touchscreen is divided into the following zones, common to every page reached from Display or Setup:

Zone	Contents
Title zone	The name of the current page (e.g. "<Meas Display>"), shown across the top of the screen.
Measurement-condition zone	The active test conditions — frequency, speed, DC bias, AC level, AC range, voltage/current monitor, DC level, DC range (§4.3.1).
Function/result display zone	The up to four measurement parameters in large digits, each with its own deviation/reference and bin-limit readout.
Bin-sort result zone	Per-bin pass counts (LAST, BIN1–BIN10, FAIL) across the bottom of the screen.
Menu zone	The current function of each context-sensitive softkey, shown on the right edge of the screen; the labels change with the page and with cursor position.
Status bar	USB-drive status and the current date/time, shown along the bottom edge.

3.4 Main menu keys and their pages

3.4.1 Display

Opens the component-measurement display pages: **<Meas Display>**, **<List Display>**, **<Trace Display>**, and **<Save>** (Chapter 4, §4.1–§4.3).

3.4.2 Setup

Opens the component test setup pages: **<Meas Setup>**, **<Limit Setup>**, **<List Setup>**, **<Trace Setup>**, **<User Correction>**, **<Handler>** and **<Tools>** (Chapter 4, §4.4–§4.9).

3.4.3 System

Opens the system setup pages: **<System Info>**, **<Message Log>**, **<System Check>** and **<License>** (Chapter 5).

3.5 Basic operation

1. Use the menu keys (Display, Setup, System) and the touchscreen to open the page you want.
2. Use the cursor keys, the rotary knob, or touch the screen directly to move the highlight to the field you want to set. The highlighted field is shown in reverse/accent colour.
3. The softkeys available for the highlighted field appear in the menu zone; select the one you need. Numeric keys, ←, the magnitude keys and Enter are used for data entry — after pressing a digit key you can press a magnitude key or Enter to finish the entry.

CHAPTER 4

LCR Function Module

This chapter covers every page reached from [Display] and [Setup] while the instrument is in LCR bridge mode. §4.1–§4.3 are display pages; §4.4–§4.9 are the matching setup pages.

4.1 <Meas Display>

Press [Display] to open <Meas Display>, the instrument's default measurement page. It shows the title zone, the measurement-condition zone, up to four parameter results, the bin-sort result zone and the menu zone together (§3.3), so settings, monitoring, bin-sort parameters and status never need repeated page switching.

4.1.1 Common test conditions

Nine cursor fields in the measurement-condition zone give quick access to: **Frequency, Speed, DC Bias, AC Level, AC Range, Vm (voltage monitor), DC Level, DC Range, Im (current monitor)**. Each is described in full under <Meas Setup> (§4.4).

4.1.2 Test function

Touch (or cursor to) a parameter name in the result zone to open its function menu in the softkey area, then select the parameter for that slot. See §4.4.1 for the full parameter list; any of the four results can be assigned independently.

4.1.3 Decimal-point position

Controls the displayed resolution and, indirectly, how easily small fluctuations are visible. The position can be shifted left/right without changing the number of significant digits.

Option	Function
Auto	Default — decimal point position floats automatically
Fixed	Locks the decimal point at its current position
Incr +	Shifts the locked decimal point left
Decr −	Shifts the locked decimal point right

> NOTE
> A decimal-point lock is cleared automatically whenever the test function or the deviation mode changes.

4.1.4 Bin-sort result display

Touch or cursor to the bin-sort result zone to reach its quick controls: the **compare switch**, **count switch** and **count reset**.

Compare switch — the built-in comparator sorts the DUT into up to **11 bins** (BIN1–BIN10 plus BIN OUT). Up to 10 limit groups can be set, each with independent high/low limits for all four parameters (clear a parameter's limits to exclude it from that bin's comparison); a DUT whose compared parameters all fall within a bin's limits is sorted to that bin. The result can be output over the HANDLER interface to an automatic test system (Chapter 9). Limits themselves are set only on <Limit Setup> (§4.5). Default: **OFF**.

Count switch — records a running count per bin. Default: **OFF**.

Count reset — zeroes all bin counts to restart counting.

4.1.5 Saving bridge results to USB

Saved rows are formatted `Time,P1,P2,P3,P4,BIN` (test time; parameter 1–4 results; bin result). Controlled by a save on/off switch; default save path is `usb/CSV/`; the file name follows `rx-<serial>-<date>.csv`, e.g. `rx-SN12345678-20260811.csv`.

4.2 <List Display>

Shows the results of a list sweep across up to **201 points** of test frequency, level, DC bias, trigger delay and per-point high/low limits (set on <List Setup>, §4.6). Points are swept automatically and compared against their limits; a "*" at the left marks the current sweep point, and the rightmost P/F column shows **"---"** (not yet compared), **PASS** (green) or **FAIL** (red) for each point. If difference mode is enabled, parameters 3 and 4 are hidden and parameter 1's difference-calculation result is shown instead (§4.6.4).

4.2.1 Saving list data to USB

Saved rows are formatted `Time,pt,para1-4,P1,P2,P3,P4,COMP` (test time; point index; the four parameter functions; parameter 1–4 results; comparison result). Default path `usb/CSV/`; file name `list-<serial>-<date>.csv`.

4.3 <Trace Display>

Press **Display** then the Trace Display softkey. This page sweeps the DUT across a user-defined range of 51, 101, 201, 401 or 801 points (linear or logarithmic), plotting the response curve of up to four parameters live as the sweep condition increases; any point on the curve can be read out, and the sweep's maximum/minimum values and their corresponding condition are shown together with the curve.

> NOTE
> After setting the sweep conditions, press **Trigger** to start the sweep. Press **Reset** once to pause; press again to restart the sweep from the beginning.

4.3.1 Trigger

Quick access to the trace trigger mode; see the trigger settings under <Meas Setup> (§4.4.8).

4.3.2 Scale

Option	Function
Auto	The Y-axis range adjusts dynamically to keep the plotted curve within view as results change
Fixed	The Y-axis range is fixed, but can still be fine-tuned manually with the up/down cursor keys

With a reasonably stable DUT, it is usually easiest to let the scale auto-adjust once, then switch to Fixed and fine-tune from there.

4.3.3 Extreme values

See §4.7.8 (equivalent trace-setup field).

4.3.4 Coordinate format

Sets the X-axis format and, independently, each of the four parameters' Y-axis format (linear or logarithmic); see §4.7.7.

4.3.5 Read (cursor)

Sets up cursor-based readout. The cursor is a red vertical line, moved with the rotary knob or the left/right cursor keys, that reads each parameter's result at the same sweep condition.

Read option	Meaning
Off	No cursor shown
Manual	Cursor position adjusted manually (knob or left/right keys)
Param 1/2/3/4 Min	Cursor auto-tracks that parameter's minimum
Param 1/2/3/4 Max	Cursor auto-tracks that parameter's maximum

4.3.6 Trace function (sweep points, parameter switches, split screen)

Sweep points — sets the number of steps between the start and stop sweep condition: **51, 101, 201, 401** or **801**. More points give a more precise curve at the cost of sweep time. Default: **201**.

Parameter switches — turns each parameter's curve on/off independently.

Split screen:

Mode	Description
1-split	All curves share one plot window
2-split	The four parameters are grouped in pairs, each pair in its own plot window
4-split	Each of the four parameters gets its own independent plot window

4.3.7 Saving trace data to USB

Saved rows are formatted `Time,pt,x,P1,P2,P3,P4,COMP` (test time; point index; X-axis value; parameter 1–4 results). A continuous-save switch chooses between: continuous save, file name `trace-<serial>-<date>.csv`; or single-shot save (one trigger), file name `trace-trg-<serial>-<date>.csv`. Default path `usb/CSV/`.

4.3.8 Other test results (ultrasonic devices)

When the sweep parameter is frequency and the trace parameter is impedance, the instrument automatically also shows a set of derived ultrasonic-device parameters:

Symbol	Meaning
C_t	Static capacitance at 1 kHz
D_t	Dissipation factor at 1 kHz
Z_{min}, f_s	Minimum impedance and its frequency (the "m" point on screen)
Z_{max}, f_p	Maximum impedance and its frequency (the "M" point on screen)
ΔF, k_p, Q_m	Derived from f_s, f_p, Z_{min} and C_t per the standard piezoelectric-resonator formulas

4.4 <Meas Setup>

Press Setup to open <Meas Setup>, where all common test conditions are configured.

4.4.1 Test function

Each measurement cycle can report up to four parameters simultaneously, in any combination:

Symbol	Meaning	Symbol	Meaning
Cp	Parallel-equivalent capacitance	Cs	Series-equivalent capacitance
Lp	Parallel-equivalent inductance	Ls	Series-equivalent inductance
Rp	Parallel-equivalent resistance (EPR)	Rs	Series-equivalent resistance (ESR)
Gp	Conductance	Bp	Susceptance
Z	Impedance magnitude	Y	Admittance magnitude
D	Dissipation factor	Q	Quality factor
θz°, θz	Impedance angle (degrees, radians)	θy°, θy	Admittance angle (degrees, radians)
X	Reactance	Rd	DC resistance

Touch (or cursor to) a result's parameter name and choose from the softkey list. There is no restriction on which four parameters can be combined. Each of the four results has its own display on/off switch, settable from <Meas Display> (§4.1.2) — when off, that result zone shows "OFF" instead of a reading.

4.4.2 Frequency

Numeric entry. Maximum range across the series is 20 Hz to 2 MHz; resolution narrows as frequency rises (down to 0.0001 Hz at the bottom of the range).

Model	Frequency range
TH2840A	20 Hz – 500 kHz
TH2840B	20 Hz – 2 MHz
TH2840BL	100 Hz – 2 MHz

Frequency range	Test frequency points	Resolution
20 Hz ≤ F ≤ 99.999 Hz	20.0000 Hz … 99.9999 Hz	0.0001 Hz
100 Hz ≤ F ≤ 999.9 Hz	100.000 Hz … 999.999 Hz	0.001 Hz
1 kHz ≤ F ≤ 9.999 kHz	1.0000 kHz … 9.99999 kHz	0.01 Hz
10 kHz ≤ F ≤ 99.99 kHz	10.0000 kHz … 99.9999 kHz	0.1 Hz
100 kHz ≤ F ≤ 999.9 kHz	100.000 kHz … 1 MHz	1 Hz
1 MHz ≤ F ≤ 2 MHz	1.00000 MHz … 2 MHz	10 Hz

Set frequency either by direct numeric entry, or with the softkey increment/decrement steps.

4.4.3 Level (AC / DC)

AC level drives AC LCR testing; **DC level** drives DC-resistance testing. Both are set as the RMS value of the internally generated sine test signal, in either voltage or current.

AC level	Range	Resolution
Voltage	5 mVrms – <1 Vrms	1 mV
	1–20 Vrms	10 mVrms
Current	50 µA – 100 mA	—

Voltage and current levels are linked through the source resistance (§4.4.11) — e.g. at 30 Ω the current range is 166.7 µA–66.67 mA; at 100 Ω it is 50 µA–100 mA. The set current is the output current with the test terminals shorted; the set voltage is the output voltage with the test terminals open. Switching between voltage and current units requires the menu softkeys (not the increment/decrement keys alone).

DC level (RDC)	Range
30 Ω source resistance	0.1–2 V
100 Ω source resistance, all 4 parameters = Rd	0.1–20 V
100 Ω source resistance, otherwise	0.1–2 V

4.4.4 Speed

Test speed is governed by the A/D integration time, averaging count, measurement delay and result display time. Slower speeds give a more stable, more accurate reading. Four speeds are available: **FAST+, FAST, MED, SLOW** — see §7.1.9 for timing and §7.1 for the accuracy trade-off.

4.4.5 Range

AC range is used for AC LCR testing; DC range for DC-resistance testing. Select the range to match the DUT's expected impedance.

Range set	Values
AC test range	0.1 Ω, 1 Ω, 10 Ω, 20 Ω, 50 Ω, 100 Ω, 200 Ω, 500 Ω, 1 kΩ, 2 kΩ, 5 kΩ, 10 kΩ, 20 kΩ, 50 kΩ, 100 kΩ
DC test range	Same 15-step list. Not applicable on TH2840BL, which has no standalone RDC mode.

Softkey	Function
Auto	Sets the range to AUTO mode
Hold	Switches from AUTO to HOLD, locking the range at the current value
Incr +	Increases the range one step (HOLD mode only)
Decr –	Decreases the range one step (HOLD mode only)

4.4.6 DC bias

Not present on TH2840BL, which has no built-in DC bias or current source.

Bias source (TH2840A/TH2840B) — two internal sources plus an external-source option:

Source	Type	Range
Internal 100 mA (voltage, current and source resistance follow Ohm's law)	Voltage	−40 V to +40 V
	Current	−100 mA to +100 mA
Internal 2 A	Current	0–2 A (frequency response up to 200 kHz)
External TH1778A	Current	0–120 A, set by the external bias-current source

Bias type — with the internal 100 mA source, either current-bias or voltage-bias mode can be selected, subject to the source-resistance relationship. Internal bias voltage range: −40 V to +40 V. Press the front-panel **DC Bias** key to enable bias output; the key lights while bias is enabled.

DCI isolation — prevents DC bias current from affecting the test input circuit. Settable ON/OFF on <Meas Display>; during list sweep and graphical sweep it switches automatically once the bias current exceeds a threshold. **Turn DCI isolation OFF** when testing high-impedance parts at low frequency with small bias current, since the isolation function affects accuracy.

Bias polarity — Fixed or Automatic.

4.4.7 Level monitor

Shows the actual voltage across, or current through, the DUT: voltage in the Vm field, current in the Im field on <Meas Display>. ON/OFF. Correction status (open/short/load on or off, or a change in correction data) affects the monitored value.

4.4.8 Trigger

Mode	Description
Continuous	Repeats testing continuously
Single	One test per [Trigger] press, per positive-pulse HANDLER trigger, or per remote trigger command

> NOTE
> A trigger signal received while a measurement is in progress is ignored — send it only after the current test completes. Set trigger mode to **Single** when triggering from the optional HANDLER interface.

Trigger delay — the time from trigger to the start of measurement. Range 0–60 s, 1 ms resolution. Useful in automated systems to ensure reliable DUT contact before the HANDLER-triggered measurement begins.

Step delay — the delay from test-signal output to the start of measurement. Range 0–60 s, 1 ms resolution.

> NOTE
> Rd measurement applies the step delay twice (once per polarity), so its effective delay is double the set value.

4.4.9 Average

Averages 2 or more consecutive readings. Range 1–255, resolution 1.

4.4.10 Automatic Level Control (ALC)

Adjusts the actual test level (the voltage across, or current through, the DUT) toward the set level, so the voltage/current at the DUT stays constant regardless of DUT impedance. When active, an asterisk "*" follows the displayed level value. If the set level falls outside the range ALC supports, ALC is automatically turned OFF and the set value is treated as a non-regulated level.

4.4.11 Source resistance

With the internal 100 mA bias, the signal source has an output resistance; other bias modes bypass it. Selectable **100 Ω** (default) or **30 Ω**. For inductance measurements that must be compared against other test instruments, match the output resistance used by that instrument — 100 Ω is the recommended default for the internal 100 mA source.

4.4.12 Deviation & reference

Deviation mode — displays the deviation from a preset reference value instead of the raw reading, useful for tracking a parameter's change with temperature, frequency or bias.

Mode	Formula
Δ (absolute)	Δ = X − Y, where X is the current reading and Y is the reference value
Δ% (percentage)	Δ% = (X − Y) / Y × 100 [%]. Displays "Inf" if Y = 0.

Reference value — numeric entry, or auto-record: selecting "measure" in the reference menu runs one test and stores its result as the reference.

4.5 <Limit Setup>

Press Setup then the Limit Setup softkey. Configures the comparator: up to 10 bin limit groups, sorting the DUT into up to 11 bins (BIN1–BIN10, BIN OUT). Fields: Compare ON/OFF, Count ON/OFF, Mode, Parameter, Deviation, Reference, per-bin switch, per-bin low limit, per-bin high limit.

4.5.1 Compare switch

Setting	Meaning
OFF	Comparator disabled
ON	Comparator enabled

4.5.2 Compare count switch

Setting	Meaning
OFF	Bin counting disabled
ON	Bin counting enabled

4.5.3 Comparator limit mode

Mode	Description
Tolerance	Limits are set as a deviation (absolute or percentage) from the nominal value set in the Reference field
Continuous	Limits are set directly as a measured-value range; bin limits must be entered in ascending order

> NOTE
> In Tolerance mode, bin limits must be entered from smallest to largest tolerance — if BIN1 is given the widest tolerance, every DUT will sort into BIN1. Lower/upper limits need not straddle the nominal value, and bin ranges may be non-contiguous or overlap.

4.5.4 Compare parameters

The comparator always uses the same four parameters assigned under <Meas Setup> (§4.4.1); change the sort parameters from <Meas Display> or <Meas Setup>.

4.5.5 Deviation & reference

Same meaning and setting method as §4.4.12.

4.5.6 Bin switch

Setting	Meaning
OFF	Disables comparison for that specific bin — sorting skips its limit check
ON	Enables comparison for that bin

4.5.7 High/low limit

Numeric entry; the primary basis for comparison. If neither limit is set for a bin/parameter, that parameter does not participate in comparison for that bin. If only one of the two limits is set, the result is a one-sided comparison.

4.6 <List Setup>

Press Setup then the List Setup softkey. Configures an automatic sweep of up to 201 points of test frequency, level and bias voltage; fields: point count, trigger mode, list mode, compare, difference mode, sweep conditions (frequency/level-V/level-I/bias-V/bias-I), parameter function, parameter high/low limit, per-point delay.

4.6.1 Total points

Sets the number of points to sweep, 1–201.

4.6.2 Trigger mode

Same as the trigger mode under <Meas Setup> (§4.4.8). After a normal trigger starts the sweep, Reset can interrupt it: one press pauses (trigger again to continue the current point); a second press fully resets (trigger again to restart from point 1).

4.6.3 List mode

Mode	Description
Sequence	While triggered, sweeps from the first point to the last in order
Step	Each trigger advances and measures only one point

The difference between modes is most visible under single-trigger operation; under continuous trigger, both modes produce a visually similar sweep.

4.6.4 Difference mode

For parameter 1's list sweep, each point *n* (1–201) is compared as a difference against the parameter 1 reading at point 1 or point 2. With the compare switch (§4.6.8) ON and difference mode OFF, <List Display> shows PASS/FAIL based on parameters 1–4's own high/low limits (§4.2). With difference mode ON, <List Display> additionally shows the difference result, and PASS/FAIL is based on the difference's high/low limits instead.

4.6.5 Sweep conditions

Frequency, level and bias can each be set independently per point, or set once and copied across points to isolate the effect of a single changing condition (e.g. sweep frequency only, holding level and bias constant). Each condition's column can be shown or hidden on <List Display> via its header menu.

4.6.6 Parameter function

Each of the 4 result parameters can be set independently, or copied across for consistency. Because laying out all four parameters' high/low limits side by side would be too wide, a parameter-select menu is used instead to choose which parameter's function and limits are currently being edited — this selector only picks which parameter is being configured, it does not itself change what is measured.

4.6.7 Parameter high/low limit

Settable independently per point, or copied for consistency across points.

4.6.8 Compare

Setting	Meaning
OFF	Comparator disabled
ON	Comparator enabled — if difference mode is on, PASS/FAIL is driven by parameter 1's difference limits, and parameter 2 becomes display-only

4.6.9 Delay

The delay from one sweep step's measurement finishing to the start of the next step's sweep — mainly used to accommodate the settling time of an external bias source (e.g. TH1778A). This delay adds to the step delay set under <Meas Setup> (§4.4.8).

4.7 <Trace Setup>

Press Setup then the Trace Setup softkey. Configures split-screen mode, sweep points, sweep type, start/stop condition, trace mode, X-axis mode, extreme-value display, the four trace parameters and the Y-axis display range.

4.7.1 Common test conditions

Frequency, level, speed, range, bias, trigger and delay are general test conditions, with the same meaning and setting method as on <Meas Setup> (§4.4).

4.7.2 Trace 4 parameters

Specifies the result parameters being plotted — independent of, and not linked to, the regular component-test 4 parameters (§4.4.1). All parameters except Rd are selectable. Each of the four traces has its own display switch, display scale and Y-axis, but shares one common X-axis (since all four represent the same sweep condition).

4.7.3 Split screen

Same three options as §4.3.6: 1-split, 2-split, 4-split.

4.7.4 Sweep points

51, 101, 201, 401 or 801, depending on model.

4.7.5 Sweep type

Sweep type	Linear	Log
Frequency [Hz]	✓	✓
Level [V]	✓	×
Level [A]	✓	×
Bias [V]	✓	×
Bias [A]	✓	×

Start condition — after choosing the sweep type, set its start and stop value (i.e. the start and end point of the sweep).

4.7.6 Trace mode

Sequence or Step — same meaning as List mode (§4.6.3), visible mainly under single-trigger operation.

4.7.7 X format

Changes the sweep's X-axis coordinate style (log mode applies only when the sweep parameter is frequency).

Format	Description
Linear	Sweep condition distributed linearly between start and stop
Log	Sweep condition distributed on a base-10 logarithmic scale between start and stop

4.7.8 Max-Min

Setting	Meaning
On	Shows the trace's maximum and minimum result values
Off	Hides them

4.7.9 Curve comparison configuration

Provides comparison functions for curve data: whole-trace range comparison, extreme-value comparison for a given curve, comparison of the sweep condition at the extreme value, and the piezoelectric-test parameters described in §4.3.8.

4.8 <User Correction>

Press Setup then the User Correction softkey (or the front-panel Cal shortcut). Open, short and load correction remove distributed capacitance, parasitic impedance and other systematic measurement error. Ten user correction points are available; for each, a frequency field can be turned on with a manually entered frequency, then corrected with the open/short-correction softkeys.

Correction style	Description
Full-range correction	Open/short correction at all frequencies, using interpolation
Point-frequency correction	Open, short and load correction at the currently set frequency point only

4.8.1 Open correction

Removes error from stray admittance (G, B) in parallel with the DUT. Two correction-data sources are used: a fixed set of frequency points (listed below) measured directly, regardless of the instrument's currently set frequency; other frequencies/ranges are interpolated from this fixed-point data. Move the cursor to the Open field and use the **full-range open correction** softkey to run it (≈75 seconds).

Fixed correction points: 20, 25, 30, 40, 50, 60, 80, 100, 120, 150, 200, 250, 300, 400, 500, 600, 800 Hz · 1, 1.2, 1.5, 2, 2.5, 3, 4, 5, 6, 8, 10, 12, 15, 20, 25, 30, 40, 50, 60, 80 kHz · 100, 120, 150, 200, 250, 300, 400, 500, 600, 800 kHz · 1, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2 MHz (60 points total; the top of this list is limited to each model's own maximum frequency, §4.4.2).

Softkey	Function
Off	Open correction not applied to subsequent measurements
On	Applies open correction; uses interpolated data unless a point-frequency field is ON and matches the current test frequency, in which case that point's own data is used
Full-range open-zero	Measures open admittance at every fixed frequency point above (≈75 s)
DCR open	Measures DC-resistance-mode open

> **NOTE**
> Connect the test fixture to the instrument with nothing connected to it (fixture open) before running open correction.

4.8.2 Short correction

Removes error from parasitic impedance (R, X) in series with the DUT, using the same fixed-point/interpolation approach as open correction.

Softkey	Function
Off	Short correction not applied
On	Applies short correction, with the same interpolated/point-specific data logic as open correction
Full-range short-zero	Measures short parasitic impedance at every fixed frequency point (≈75 s). Connect the test fixture, then short it with the short-circuit board (TH26010).
DCR short	Measures DC-resistance-mode short

4.8.3 Load correction

Uses the transfer coefficient between the actual measured value and a standard reference value at a set frequency point to remove other measurement error — open, short and load correction can all be performed at a chosen frequency point. Set the reference value in the Reference field before running load correction; with the cursor on Frequency or Reference, the Load Correction softkey runs the test against the standard.

Setting	Meaning
Off	Load-correction data at the current frequency is not used
On	Load-correction data at the current frequency is used

4.8.4 Load type

Before running load correction, enter the standard device's reference value; the reference parameter must match the configured load-correction test function. Three load types are available:

Type
Ls–Rs
Ls–Q
Cp–D

4.8.5 Cable length

Selectable **0 m** or **1 m**; factory default is 0 m calibration.

4.8.6 Point-frequency operation

With the cursor on the Frequency field: **Off** invalidates open/short/load correction data at the current frequency; **On** validates it and shows the stored point-frequency correction value; **Open-zero**, **Short-zero** and **Load Correction** run a single correction test at the current frequency.

Load correction procedure:

1. Move the cursor to the Frequency field and set the frequency to be corrected.
2. With the fixture open, press Open-zero to correct at that frequency.
3. Short the fixture, then press Short-zero to correct at that frequency.
4. Prepare a standard reference device; move the cursor to Load Type and select the matching function.
5. Move the cursor to the Frequency field, connect the standard device to the fixture, and press Load Correction; the instrument runs one load correction and shows the standard's measured result.

4.9 Handler settings

<Handler> sets the active-level polarity of the HANDLER I/O signals (default: active-low) to match your automatic handling equipment. See Chapter 9 for the full HANDLER interface description, pinout and wiring.

CHAPTER 5

System Setup & File Management

5.1 <System Setup>

Press System to open <System Setup>, which groups most system-level settings: bus mode, beeper, pass/fail tone, system language, password, bus address, baud rate and time.

5.1.1 Mode setup

Bus mode — selects the instrument's remote communication method.

Option	Description
Auto	Automatically selects RS-232/LAN/USB based on which external signal is received
RS232	RS-232C
External 485	RS-485 (via converter or modified interface, §9.2 of the Command Reference)
External GPIB	GPIB — standard on TH2840BL only
LAN	Network (10/100 M Ethernet)
USB Device	USBCDC or USBTMC, selectable

When using RS-485 or GPIB, the instrument uses the bus address set under RS232 (§5.1.3) as its own device address.

5.1.2 User setup

Key beep — OFF = key beep disabled; ON = key beep enabled.

Pass tone / Fail tone — chooses the audible indication when a comparison result is PASS or FAIL:

Option	Description
Off	No tone
Two short	Two short, low-pitched beeps
Low long	One low, long tone
High short	One high, short tone
High long	One high, long tone

System language — **English**. The user interface of Techmize instruments is English only.

Password — enumerated + numeric entry.

Option	Description
Off	Password protection disabled
Lock system	Password required for both power-on and file protection
Lock files	Password required for file operations (save, delete, etc.)
Lock settings	Restricts an operator from modifying setup files
Change	Prompts for the new password, then a confirmation re-entry

> NOTE — FACTORY PASSWORD
> The factory default password is **2840** (§2.4).

Time — the system clock can be edited directly from this field.

5.1.3 RS232 serial setup

General serial parameters: 8 data bits, 1 stop bit, no parity.

Field	Options
Baud rate	4800, 9600, 19200, 38400, 57600, 115200
Bus address	1–32 — also used as the RS-485, GPIB and MODBUS device address
Command mode	SCPI (plain-text ASCII command protocol) or MODBUS. See the companion *TH2840 Series SCPI & MODBUS Command Reference* for the full command set.

5.1.4 LAN

Configure the network address parameters to match your LAN, then connect a network cable at the rear panel. Double-tap an address field to open the numeric keypad and edit it directly. If your router/switch supports automatic IP assignment, use the Auto-configure button (takes a few seconds; do not operate the instrument while it runs). If auto-configuration fails, the instrument may fall back to the loopback address 127.0.0.1 — use the Default button to restore default settings, then adjust as needed, consulting your network administrator if necessary. Default port: **45454**. The hostname generally matches the instrument model.

5.1.5 Tools

Preset — initializes the instrument to a single known state, so all units leave a known configuration regardless of how they were last used.

Menu item	Resets	Command
Clear Setting	Front-panel-set and SCPI-set parameters	`*RST`
Clear Set&Corr	Front-panel/SCPI-set parameters, power-on-state memory, and user correction data	`:SYST:PRES`
Factory Default	Front-panel/SCPI-set parameters, power-on-state memory, user correction data, and all user-saved files	`:SYST:DEFT`

Preset never clears the instrument's factory calibration data or the real-time clock.

Firmware update — the instrument carries multiple CPUs; a one-touch update is provided. Trigger the update, wait roughly 15 seconds as prompted, and the instrument restarts automatically; this menu then confirms whether the restarted firmware is the latest version. Two update paths are supported: selecting a specific update file directly in the file manager, or placing the file as `usb/update2840.sec` on a USB drive for one-touch update from the default path. A PC utility supporting remote-triggered updates is also available from Techmize.

5.2 <File Management>

Setup parameters can be stored as files, either internally or on an external USB drive, and reloaded later instead of re-entering them each time — saving setup time and improving production throughput.

5.2.1 USB drive support

The standard USB HOST ports accept a USB flash drive as external storage, extending beyond the instrument's internal capacity; files can also be copied to a PC for unlimited archiving. Supported USB drives: USB 2.0, formatted FAT32 (e.g. under Microsoft Windows); FAT16 is not supported.

5.2.2 Store/recall overview

Instrument configuration can be stored to, and recalled from, internal flash memory or an external USB drive; test-result data and screen captures can only be saved to an external USB drive. The file browser shows two roots: `files` (internal) and `usb` (external).

Content	Extension	Recallable	Purpose
LCR setting file	`.sta`	Yes	Saves the instrument's LCR test configuration
Screen capture	`.png`	No	Saves a screenshot
Test data	`.csv`	No	Saves measurement data (§4.1.5, §4.2.1, §4.3.7)

> NOTE
> TH2840A/TH2840B/TH2840BL run LCR bridge mode only, so only the `.sta` setting-file type applies. Transformer-related file types (`.trt` , `.t40`) that may appear in shared-platform documentation belong to the TH2840X series and do not apply here.

5.2.3 Basic file-menu operation

Up/down cursor keys or the rotary knob move the file cursor; left/right cursor keys expand/collapse a folder. Selecting a file shows its available operations in the right-hand toolbar.

5.2.4 File operation steps

Save — move the cursor to the target folder or an existing file in it; the file menu shows Load (if the item is a recallable type), Save, Copy to E:\, Rename, Delete, New Folder. Press Save; a numeric/text keypad appears for the file name (the extension is generated automatically).

Load — move the cursor to a recallable file (or enter its index directly) and press Load; confirm at the prompt. Once loaded, the instrument returns to the matching measurement display page.

Copy — *Copy to E:* copies a file/folder from the internal root to the USB root; *Copy to I:* copies from USB to the internal root. Ensure the USB drive meets the requirements in §5.2.1 and is not write-protected. Copying a file onto an existing same-named file overwrites it; copying a folder onto an existing same-named folder fails — rename first.

CHAPTER 6

Measurement Examples

6.1 Zeroing (correction) procedure

Run a correction before measuring, to prevent stray impedance from degrading accuracy. Two approaches are available.

6.1.1 Full-range (swept) zeroing

1. Press Cal; the instrument opens <User Correction>.
2. Move the cursor to the Open field (softkeys: Off, On, Full-range Open-zero, DCR Open). With the fixture left open, press **Full-range Open-zero** and wait for the status line to confirm completion. Press **On** to enable open correction.
3. Insert the short-circuit board (TH26010) into the fixture.
4. Move the cursor to the Short field (softkeys: Off, On, Full-range Short-zero, DCR Short). Press **Full-range Short-zero** and wait for completion. Press **On** to enable short correction.
5. Move the cursor to the Load field; press **Off** if load correction is not needed.
6. Move the cursor to the Frequency field; press **Off** to disable point-frequency correction for the currently set correction point (needed only when using swept, not point-frequency, correction).

6.1.2 Point-frequency zeroing (recommended for single-frequency testing)

Example: test frequency is 5.5 kHz.

1. Press Cal to open <User Correction>.
2. Move the cursor to the Frequency field (softkeys: On, Off, Open-zero, Short-zero, Load Correction). Press **On** to enable point-frequency correction.
3. Enter the frequency (5.5k); the field updates to 5.5000 kHz, matching the test frequency.
4. With the fixture open, press **Open-zero**.
5. Insert the short-circuit board (TH26010), then press **Short-zero**.

6.2 Correct DUT connection

The instrument provides four independent test terminals — Hcur, Lcur, Hpot, Lpot — plus a shield for each, used to reduce stray-capacitance-to-ground effects and electromagnetic interference. For the full four-terminal connection, connect Hcur/Hpot and Lcur/Lpot at the DUT's own leads, minimizing the effect of lead and contact-point resistance on the result (particularly for loss measurements). For low-impedance DUTs especially, connect Hpot/Lpot directly at the DUT's leads so that lead resistance is not folded into the measured impedance — the voltage Hpot/Lpot sense should be the voltage actually present across the DUT.

In other words, avoid joining Hcur to Hpot (and Lcur to Lpot) before the DUT lead — doing so increases measurement error. If contact and lead resistance R_{lead} is much smaller than the DUT impedance (e.g. $R_{lead} < Z_x/1000$, for <0.1% error), Hcur/Hpot and Lcur/Lpot may be joined and connected as a two-terminal measurement.

For higher-accuracy work, a proper test fixture generally outperforms test leads (even the supplied Kelvin leads). Kelvin leads give good results up to about 10 kHz, but become difficult to use reliably above that — at high frequency, small changes in lead spacing directly change the stray capacitance/inductance at the test terminals, and leads are inherently hard to fix in place. Use a test fixture wherever possible at higher frequencies; if a fixture genuinely cannot be used, keep the lead geometry during zeroing as close as possible to the geometry during actual measurement.

Whichever connection method is used (Techmize fixture, Kelvin leads, or a user-made fixture), it should: minimize distributed impedance (especially for high-impedance DUTs); minimize contact resistance; and support both a clean open and a clean short. For an open zero, the test terminals should be held the same distance apart as during actual measurement. For a short zero, a low-impedance short-circuit board should bridge the terminals, or Hcur/Lcur and Hpot/Lpot should be joined directly and then connected together.

WARNING

Discharge a polarized or charged component before connecting it, to avoid damaging the instrument. Connect a polarized DUT's positive/high-potential lead to the "+" (Hcur/Hpot) terminal and its negative/low-potential lead to the "−" (Lcur/Lpot) terminal.

6.3 Worked example — measuring an inductor

Test conditions: Function Ls-Q · Frequency 5.5 kHz · Level 1.5 Vrms · Source resistance 100 Ω.

1. Power on the instrument (§2.4).
2. Press **Display** to open <Meas Display>; cursor to the parameter-name field and select **Ls** from the softkeys.
3. Cursor to Frequency (default 1.0000 kHz) and set it as needed.
4. Cursor to Level (default 1.000 V) and set it as needed.
5. Press **Setup** to open <Meas Setup>; cursor to Source Resistance and select **100 Ω**.
6. Fit the test fixture (e.g. TH26005) to the UNKNOWN terminals.
7. Zero the instrument (point-frequency zeroing, §6.1.2, to avoid stray impedance affecting accuracy).
8. Connect the DUT inductor to the fixture.
9. Press **Display** to return to <Meas Display>; the instrument tests continuously and shows the result.

If the reading looks clearly wrong: confirm the DUT is reliably seated in the fixture; confirm the fixture is reliably seated on the test terminals; redo the open/short correction. If you used swept open/short correction, be sure point-frequency correction is set OFF (§6.1).

6.4 Worked example — multi-frequency list sweep for a capacitor

Test conditions: Function Cp, D · Level 1 Vrms.

Frequency	Compared parameter	Low limit	High limit
1 kHz	Cp (capacitance)	325.0 nF	333.0 nF
10 kHz	D (dissipation)	0.0001	0.0003
100 kHz	D (dissipation)	0.0060	0.0100

Fail tone: HIGH LONG. Alarm mode: out-of-tolerance.

1. Power on the instrument (§2.4).
2. Press **Display** to open <Meas Display>; confirm parameters are Cp, D and level is 1.000 V.
3. Press **Setup**, then the List Setup softkey, to open <List Setup>.
4. Using the rotary knob, cursor to point 1's parameter field and set its frequency, level, bias, limits and delay.
5. Press **System**; cursor to the Fail Tone field (default High Long).
6. Fit the test fixture (e.g. TH26005) to the UNKNOWN terminals.
7. Zero the instrument (full-range zeroing, §6.1.1, since multiple frequencies are being tested).
8. Connect the DUT capacitor to the fixture.
9. Press **Display**, then the List Display softkey; the instrument sweeps continuously, shows the comparison result per point, and sounds the Fail tone on a FAIL result.

CHAPTER 7

Performance & Specifications

7.1 Measurement function

Item	Specification
Parameter combination	Any 4 of the parameters in §4.4.1, freely combined — no primary/secondary distinction
Math	Absolute deviation Δ and percentage deviation Δ% against a programmable nominal value
Equivalent circuit	Series, Parallel
Range	Auto; Manual (Hold, Incr, Decr)
Trigger	Single or Continuous. Continuous: tests and outputs results without interruption. Single: triggered by the front-panel **Trigger** key, a HANDLER "start" input, a foot switch, or a bus trigger command; otherwise waits.
Delay time	Trigger delay: 0–60 s, 1 ms step, programmable. Step delay: 0–60 s, 1 ms step, programmable.
Test terminal connection	Four-terminal pair: Hcur/Lcur (current), Hpot/Lpot (voltage)
Measurement speed (F ≥ 10 kHz)	Fast+: ≈1800 readings/s (0.56 ms) · Fast: ≈300 readings/s (3.3 ms) · Med: ≈11 readings/s (90 ms) · Slow: ≈4.5 readings/s (220 ms)
Averaging	1–255, programmable
Display digits	6 digits, maximum displayed value 999999

> NOTE
> Med/Fast/Fast+ speeds drop below their rated figures when frequency is under 10 kHz.

7.2 Test signal

Item	Specification
Signal frequency	Sine wave; frequency accuracy 0.01%; range per model, §4.4.2; minimum resolution 1 mHz
Signal mode	**Normal** — the set level is the test terminals' open-circuit voltage; the actual level at the DUT may be lower. **ALC (constant level)** — the internal level auto-adjusts so the voltage across the DUT matches the set value (§4.4.10).

Test-signal level accuracy (measured with Hcur/Hpot shorted; a 1 m BNC-to-BNC RF cable is recommended, since cable length affects signal attenuation):

Quantity	Mode	Frequency	Range	Accuracy	Step
Voltage	Normal / ALC	≤1 MHz	5 mVrms–20 Vrms	±(10%×setting+2 mV)	100 µV
		>1 MHz	5 mVrms–15 Vrms	±(6%×setting+2 mV)	
Current	Normal / ALC	20 Hz–2 MHz	50 µArms–100 mArms	±(10%×setting+10 µA)	10 µA

Model	Output impedance
TH2840A / TH2840B	30 Ω ±4% @1kHz or 100 Ω ±2% @1kHz, selectable
TH2840BL	20 Ω

Test-signal level monitor accuracy:

Quantity	Frequency	Range	Accuracy
Voltage	≤1 MHz	5 mVrms–20 Vrms	±(3%×reading+0.5 mV)
	>1 MHz	5 mVrms–15 Vrms	±(6%×reading+0.5 mV)
Current	≤1 MHz	50 µArms–100 mArms	±(3%×reading+5 µA)
	>1 MHz	50 µArms–100 mArms	±(6%×reading+5 µA)

7.2.1 Maximum measurement display range

Parameter	Range
L, Lk	0.00001 µH – 99.9999 kH
C	0.00001 pF – 9.99999 F
Z, R, X, RDC	0.00001 Ω – 99.9999 MΩ
Y, B, G	0.00001 µS – 99.9999 S
D	0.00001 – 9.99999
Q	0.00001 – 99999.9
θ	−179.999° to 179.999° / −3.14159 to 3.14159 rad
Turns Ratio	1:0.001 – 1000:1

7.2.2 DC bias & current source

Not present on TH2840BL.

Source	Range	Resolution	Accuracy
DC bias voltage	0 to ±40 V	1 mV	1%×setting+5 mV
DC bias current	0 to ±100 mA	10 µA	—
Built-in 2 A current source	0–2 A	1 mA	±(2%×setting+2 mA), I>5 mA

7.3 Measurement accuracy

Measurement accuracy accounts for measurement stability, temperature coefficient, linearity, repeatability and calibration-interpolation error. To check the instrument's accuracy: warm up ≥60 minutes; test cable length 0 m or 1 m; perform open/short zeroing correctly after warm-up; set DC bias to OFF; set range to AUTO.

Basic accuracy for |Z|, |Y|, L, C, R, X, G, B (A_e) is given by:

$$A_e = \pm [A_L \times A + (K_a+K_b+K_c)\times 100 + K_d + K_f] \times K_e \quad [\%]$$

A	Basic measurement accuracy (model/frequency/impedance-dependent — see the basic measurement accuracy chart, available from Techmize on request)
A_L	Level correction factor (Table A, §7.3.1)
K_a, K_b	Impedance proportion factors (Table B, §7.3.1)
K_c	Calibration interpolation factor (Table E, §7.3.1)
K_d	Cable-length factor (Table G, §7.3.1)
K_e	Temperature factor (Table H, §7.3.1)
K_f	Scan-fixture correction factor (0 with no scan fixture fitted; 0.2 with one fitted)

Valid for $D_x \le 0.1$ (L, C, X, B) or $Q_x \le 0.1$ (R, G); when $D_x \ge 0.1$, multiply A_e for L/C/X/B by $\sqrt{(1+D_x^2)}$; when $Q_x \ge 0.1$, multiply A_e for R/G by $\sqrt{(1+Q_x^2)}$.

Derived quantity	Formula
D accuracy D_e	$D_e = A_e/100$ ($D_x \le 0.1$); multiply by $(1+D_x)$ when $D_x > 0.1$
Q accuracy Q_e	$Q_e = Q_x^2 \times D_e / (1 \mp Q_x \times D_e)$, valid for $Q_x \times D_e < 1$
θ accuracy θ_e	$\theta_e = (180/\pi) \times (A_e/100)$ [deg]
G accuracy G_e ($D_x \le 0.1$)	$G_e = B_x \times D_e$ [S], where $B_x = 2\pi f C_x = 1/(2\pi f L_x)$
R_p accuracy ($D_x \le 0.1$)	$R_{pe} = R_{px} \times D_e / (D_x \times D_e)$ [Ω]
R_s accuracy ($D_x \le 0.1$)	$R_{se} = X_x \times D_e$ [Ω], where $X_x = 2\pi f L_x = 1/(2\pi f C_x)$
DCR accuracy	$A(1 + R_x/5\ \text{MΩ} + 16\ \text{mΩ}/R_x)$ [%] ± 0.2 mΩ, where A = 0.25 (Med/Slow) or 0.5 (Fast)

7.3.1 Accuracy factor tables

Table A — Level correction factor A_L (Vs = test signal voltage; the base accuracy chart applies for 500 mVrms–1 Vrms):

Vs (Vrms)	[5m,50m]	(50m,200m]	(200m,500m]	(500m,1]	(1,2]	(2,20]
A_L	2.5×50mV/Vs	2.5	500mV/Vs	1	Vs	4

When test frequency 100 Hz<f_m≤2 MHz, test voltage 5 Vrms<Vs≤20 Vrms, and the DUT is an inductor with $|Z_m|$<200 Ω, add 0.15 to A.

Table C — K_a cable-length addition: 0 m → 0 · 1 m → 0.0005 · 2 m → 0.0010.

Table D — K_b cable-length multiplier (f_m in MHz): f_m≤100 kHz → ×(1+5f_m) at 1 m, ×(1+10f_m) at 2 m · 100 kHz<f_m≤300 kHz → ×(1+2f_m)/×(1+4f_m) · 300 kHz<f_m≤2 MHz → ×(1+0.5f_m)/×(1+1f_m).

Table E — Calibration interpolation factor K_c: 0 at a direct-calibration frequency (the 60-point list in §4.8.1); 0.0003 at any other frequency.

Table G — Cable-length factor K_d (f_m in MHz): ≤2 Vrms → 2.5×10^{-4}(1+50f_m) at 1 m, 5×10^{-4}(1+50f_m) at 2 m, 1×10^{-3}(1+50f_m) at 4 m · >2 Vrms → 2.5×10^{-3}(1+16f_m), 5×10^{-3}(1+16f_m), 1×10^{-2}(1+16f_m) respectively.

Table H — Temperature factor K_e: 0–18 °C → 4 · 18–28 °C → 1 · 28–40 °C → 4.

Tables B (impedance proportion factors K_a/K_b, by speed/frequency band) and the base accuracy chart (A, by frequency/impedance) use multi-branch formulas and a graphical chart respectively; both are available from Techmize on request for detailed accuracy budgeting.

7.4 Performance test

Run all tests under the reference operating conditions of §1.3/§1.4, after the warm-up time of §1.3. This section lists the main performance checks; it does not cover transformer-related parameters, which are outside the scope of TH2840A/TH2840B/TH2840BL.

Equipment	Values needed	Requirement
Standard capacitors	100 pF, 1000 pF, 10 nF, 0.1 µF, 1 µF	0.02%, known D
AC standard resistors	10 Ω, 100 Ω, 1 kΩ, 10 kΩ, 100 kΩ	0.02%
DC standard resistors	0.1 Ω, 1 Ω, 10 Ω, 100 Ω, 1 kΩ, 10 kΩ, 100 kΩ	0.02%
Standard inductors	100 µH, 1 mH, 10 mH, 100 mH	0.02%
Frequency counter	0–1000 MHz	—
Digital multimeter	—	0.5%

7.4.1 Function check

Confirm every key, the display and every terminal operate correctly.

7.4.2 Test signal level & frequency

Level: connect a digital multimeter (AC range) between Hcur and chassis ground; step the level through 10 mV, 20 mV, 100 mV, 200 mV, 1 V, 2 V, 10 V, 20 V and confirm readings against §7.2. Frequency: connect a frequency counter (ground-to-ground, signal to Hcur) and step through 20 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 200 kHz, 500 kHz, 1 MHz, 2 MHz, confirming against §7.2.

7.4.3 Measurement accuracy (R, L, C, D)

Zero the instrument (open/short) before each check, then connect the listed standard and compare the reading against the standard's value at the stated test conditions (level 1 V, range AUTO, bias 0 V, speed Slow unless noted):

Check	Function	Frequencies tested
C, D accuracy	Cp-D	100 Hz, 1 kHz, 10 kHz, 100 kHz
L accuracy	Ls-Q	100 Hz, 1 kHz
Z accuracy	Z-θ	100 Hz, 1 kHz, 10 kHz, 100 kHz
DCR accuracy	DCR	n/a (DC); short-zero only before testing

CHAPTER 8 · PART II — REMOTE CONTROL & HANDLER

Remote Command Reference

The TH2840 series can be controlled remotely over RS-232C, USB (USBTMC/USBCDC), LAN, and — on TH2840BL — GPIB, using either of two command protocols selected under <System Setup> (§5.1.3):

Protocol	Description
SCPI	Plain-text ASCII command strings, following the SCPI standard; subsystems include DISPlay, FREQuency, VOLTage, CURRent, APERture, OUTPut, BIAS, TRIGger, AMPLitude, FUNCtion, COMParator, LIST, TRACe, Handler, FETCh?, CORRection, MassMEMory and SYSTem.
MODBUS	Register-based MODBUS protocol, with CRC16 and a published register map for the same functions as the SCPI subsystems above.

The full syntax, every command/query, parameter ranges and the MODBUS register map are published separately in the ***TH2840 Series SCPI & MODBUS Command Reference*** — the command set runs to several hundred commands and registers across 19 SCPI subsystems plus the MODBUS tables, too large to repeat in full here. §A.3 of this manual's Appendix gives a short quick-reference table of the most commonly used commands for getting started.

> **NOTE**
> GPIB common commands (*IDN?, *RST, *CLS, etc.) are available on all interfaces, not only GPIB — see the Command Reference's opening chapter for the full list and syntax.

CHAPTER 9

Handler Interface

The TH2840 series provides a HANDLER interface for outputting the comparator's sorting result to automatic component-handling equipment, along with the handshake signals needed to integrate with it. On TH2840A/TH2840B/TH2840BL, both bin-sort comparison and list-sweep comparison are output through the same **57BR-4036L** connector (labelled LCR HANDLER on the rear panel, §3.2). The signal functions described below are flexible — the exact meaning of each line depends on which comparison mode (bin sort vs list sweep) is active.

9.1 Bin-sort HANDLER

9.1.1 Technical description

Output signals	Active-low, open-collector, opto-isolated. /BIN1–/BIN10 (bin result), PASS, FAIL, /INDEX ("analog measurement complete"), /EOM ("all measurement complete"), /ALARM (power-fault or controller-reset warning).
Input signals	Opto-isolated. /KEY_LOCK (locks the front panel, touchscreen included), /EXT_TRIG (external trigger, pulse width ≥1 µs).

Pin	Signal	Direction	Description
1–10	/BIN1–/BIN10	Out	Per-bin sort result; open-collector
11	— (undefined)	Out	Factory test signal — do not connect
12, 13	/EXT.TRIG	In	External trigger: in single-trigger mode, a rising edge on this pin triggers a measurement
14, 15	EXT.DCV2	In	External DC supply for the opto-isolated /EXT_TRIG, /KeyLock, /ALARM, /INDEX, /EOM signal group
16–18	+5V	Out	Instrument's internal +5 V supply — not recommended for general use; if used, keep current <0.3 A and the wiring away from interference sources
19	/PASS	Out	Asserted when the result falls in any of BIN1–BIN10
20	/FAIL	Out	Asserted when the result falls in none of BIN1–BIN10
21–24	— (undefined)	Out	Factory test signals — do not connect
25	/KEY LOCK	In	While asserted, all front-panel keys and the touchscreen are locked
27, 28	EXT.DCV1	In	External DC pull-up supply for /BIN1–/BIN10, /PASS, /FAIL
29	/ALARM	Out	Asserted on a power interruption
30	/INDEX	Out	Asserted once the analog measurement finishes and the next DUT can be connected to UNKNOWN; the bin result itself is not yet valid until /EOM asserts
31	/EOM	Out	End of measurement — asserted once the measurement data and comparison result are valid
32, 33	COM2	—	Reference ground for EXT.DCV2
34–36	COM1	—	Reference ground for EXT.DCV1

Timing: T1 (trigger pulse width) ≥1 µs · T2 (start-of-measurement delay) ≥200 µs, up to display time + 200 µs · T3 (wait time after /EOM before the next trigger) ≥0 µs. Typical compare time ≈0.1 ms; see §7.1 for measurement time by speed.

9.1.2 Electrical features

Signal group	Output LOW	Output HIGH	Max. current	Reference ground
Comparison signals (/BIN1–10, /PASS, /FAIL)	≤0.5 V	+5 to +24 V	6 mA	Internal pull-up: instrument ground · External (EXT.DCV1): COM1
Control signals (/INDEX, /EOM, /ALARM)	≤0.5 V	+5 to +24 V	5 mA	Internal pull-up: instrument ground · External (EXT.DCV2): COM2

Every DC output (pins 1–11, 19–24, 29–31) is isolated through an open-collector optocoupler; each line's output voltage is set by a pull-up resistor on the HANDLER interface board, jumper-selectable between the instrument's internal +5 V or an external supply (EXTV, +5 to +24 V). The comparison-signal and control-signal groups use two independent pull-up circuits with separate common references, COM1 and COM2.

The /EXT_TRIG input (pins 12/13) drives an optocoupler LED cathode; a LOW-to-HIGH transition triggers the instrument. The /KEY_LOCK input (pin 25) drives an optocoupler LED cathode; while LOW, all front-panel keys are locked. Both LEDs' anode side can be driven from the internal +5 V or an external EXT.DCV2 supply.

> **WARNING**
> Pins 16–18 carry the instrument's internal +5 V supply. Never connect them to any external power source — doing so can damage the instrument.

> **NOTE — FACTORY DEFAULT WIRING**
> TH2840-series units ship configured for an **external** pull-up supply (internal jumpers JP500/JP502 shorted at pins 2-3; JP501/JP503 open) — an external supply must be connected to EXT.DCV1/EXT.DCV2 for the HANDLER outputs to work as shipped. Using the instrument's internal pull-up instead requires changing the JP500–JP503 jumper configuration; contact Techmize support for details. For best noise immunity, Techmize recommends keeping the external-supply configuration.

9.1.3 Wiring to a PLC

Typical wiring depends on whether the PLC's input circuit is sourcing (common-anode, current flows from the module's common terminal into its input channels) or sinking (common-cathode, current flows into the common terminal from the input channels). EXT.DCV1 and EXT.DCV2 may share one external supply or use two separate supplies; EXT.DCV1's return is COM1, EXT.DCV2's return is COM2. For the detailed per-type wiring diagrams, contact Techmize support or your distributor.

9.1.4 Using the bin comparator

1. Press **Setup**, select <Limit Setup> from the menu.
2. Cursor to Compare and select **ON**.
3. Cursor to Count and select **ON** if a running bin count is wanted.
4. Cursor to Mode and select **Tolerance** or **Continuous** (§4.5.3).
5. On <Limit Setup>, set the deviation type, reference value, and each bin's limits.
6. Press **Display** to open <Meas Display> and test the DUT. Compare ON/OFF and Count ON/OFF can also be toggled directly from <Meas Display> (§4.1.4).

9.2 List-sweep HANDLER

List-sweep sorting uses the same 57BR-4036L connector as bin sorting, but a different signal definition: /FAIL1–/FAIL10 plus overall /PASS, /FAIL.

9.2.1 Sorting logic

Each sweep point can have up to 4 compared parameters; a parameter with high/low limits set participates in sorting, one without does not. A point passes only if every participating parameter is within limits; one failing parameter fails the whole point. <List Display>'s P/F column shows the result per point ("--" if the point has no limits set). Sweep points 1–10 map to /BIN1–/BIN10 respectively (active-low); points 11 and beyond have no individual sort signal. An overall /PASS is asserted only if every limited point passes; an overall /FAIL is asserted if any limited point fails. Points with no limits set do not affect sorting.

9.2.2 Technical description

Output signals	Active-low, open-collector, opto-isolated: /FAIL1–/FAIL10, PASS, FAIL, /INDEX, /EOM, /ALARM
Input signals	Same as bin-sort mode (§9.1.1): /EXT.TRIG, /KEY_LOCK

Pin	Signal	Description
1–10	/FAIL1–/FAIL10	Sweep point 1–10 out of limits
11	— (undefined)	Factory test — do not use
19	/PASS	Every compared point passes
20	/FAIL	At least one compared point fails
30	/INDEX	**Sequence mode:** asserted once the last point's analog measurement finishes (DUT can be changed), result not yet valid until /EOM. **Step mode:** asserted after each point's analog measurement finishes.
31	/EOM	**Sequence mode:** asserted once the whole sweep and all comparisons finish. **Step mode:** asserted after each point's measurement and comparison finish; the overall result is valid only at the last point's /EOM.
other	—	Same definitions as bin-sort mode, Table 9.1.1

Set-time includes correction on/off switching; compare-and-display time ≈4.5 ms. T1/T2/T3 as in §9.1.1.

9.2.3 Electrical features & wiring

Identical to bin-sort mode (§9.1.2, §9.1.3) — both modes share the same hardware, pin electrical characteristics, and PLC wiring approach.

9.2.4 Using list-sweep comparison

1. Press **Setup**, select <List Setup>.
2. Set the sweep mode, sweep frequency points, reference values and high/low limits (§4.6).
3. Press **Display**, select <List Display>, and run the sweep.

APPENDIX

Terms, Symbols & Quick Reference

A.1 Terms and symbols

Symbol	Meaning	Symbol	Meaning
Cp / Cs	Capacitance, parallel / series equivalent circuit	Lp / Ls	Inductance, parallel / series equivalent circuit
Rp / Rs	Resistance, parallel (EPR) / series (ESR)	Gp / Bp	Conductance / susceptance
Z / Y	Impedance / admittance magnitude	D / Q	Dissipation factor / quality factor
θz° / θz	Impedance angle, degrees / radians	θy° / θy	Admittance angle, degrees / radians
X	Reactance	Rd / RDC	DC resistance
Hcur / Hpot	Current-source high / voltage-sense high test terminal	Lcur / Lpot	Current-source low / voltage-sense low test terminal
ALC	Automatic Level Control (§4.4.10)	DCI	DC-current isolation (§4.4.6)

A.2 Front-panel key quick reference

Key	Function
Display	Opens the measurement display pages (§4.1–§4.3)
Setup	Opens the measurement setup pages (§4.4–§4.9)
System	Opens <System Setup> (Chapter 5)
Trigger	Manual trigger (trigger mode = Single, §4.4.8)
DC Bias	Enables/disables DC bias output (TH2840A/B only, §4.4.6)
Lock	Locks/unlocks the front panel and touchscreen
Reset	Pauses a running list sweep or graphical sweep
Cal	Shortcut to <User Correction> (§4.8)
File	Shortcut to <File Management> (§5.2)
Home	Switches top-level function (LCR bridge only, on these models)
Preset	Resets to factory default settings
Help	Opens context help for the field under the cursor

A.3 Common remote commands

Task	Command
Identify the instrument	`*IDN?`
Reset to power-on state	`*RST`
Set the measured parameter	`FUNCtion:IMPedance <fn>`
Set frequency / level	`FREQuency <value>` · `VOLTage <value>` · `CURRent <value>`
Trigger and read a result	`TRIGger:SOURce BUS` then `TRIGger` and `FETCh?`
Run open/short correction	`CORRection:OPEN` · `CORRection:SHORt`
Set DC bias (TH2840A/B)	`BIAS:STATe ON` · `BIAS:VOLTage <value>`
Save/load a setup file	`MMEMory:STORe` · `MMEMory:LOAD`

See the companion *TH2840 Series SCPI & MODBUS Command Reference* for the complete, confirmed command set (Chapter 8).

A.4 Contact, warranty and support

Warranty: two years from delivery, per §1.8. For service, calibration, accessories, or questions about the HANDLER default pull-up wiring (§9.1.2), contact Techmize using the details below.

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