TECHMIZE by TONGHUI

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OPERATION MANUAL

TH2838 Series

Complete installation, operation and remote-control reference for the TH2838 series precision LCR meter — models TH2838A, TH2838 and TH2838H, 20 Hz – 2 MHz.

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CHAPTER 1

Safety & Out-of-Box

1.1 Inspecting the package

Inspect the shipping container for damage after unpacking. It is not recommended to power on the instrument if the container is damaged. If the contents do not conform to the packing list, notify Techmize or your dealer.

1.2 Power connection

- Supply voltage range: 100–120 Vac or 198–242 Vac, set by the rear-panel voltage selector.
- Supply frequency range: 47–63 Hz.
- Power consumption: ≤80 VA.
- Phase (L), neutral (N) and ground (E) must match the instrument's power plug.
- Install a power-line filter if the installation cannot guarantee a low-noise supply.

> **Warning:** to prevent injury or instrument damage from leakage current, the ground line of the supply must be reliably grounded.

1.3 Fuse

The instrument ships with the correct fuse installed. Use only Techmize-specified replacement fuses.

> **Warning:** confirm the fuse rating matches the selected supply-voltage range before powering on.

1.4 Operating environment

- Avoid vibration, dust, direct sunlight and corrosive atmospheres.
- Operating temperature 0–40 ℃, relative humidity ≤75% — required to guarantee rated accuracy.
- Do not obstruct the left/right ventilation openings; the rear-panel heatsink needs free airflow.
- A low-noise location is recommended even though the instrument is designed to reject AC line noise; use a power filter if this cannot be arranged.
- Storage: 5–40 ℃, <85% RH, ideally in the original packaging.
- Keep the instrument — and especially the test leads — away from strong electromagnetic fields.

1.5 Test fixtures and cables

Use only Techmize-supplied test fixtures or cables; third-party or user-made fixtures can cause incorrect results. Keep the fixture/cable and the DUT leads clean to ensure good contact. Connect the fixture to the four test terminals (Hcur, Hpot, Lcur, Lpot) on the front panel; for shielded DUTs, also connect the shield to the ground terminal “⊥”.

> If no test fixture or cable is connected, the instrument will display an unstable reading.

1.6 Warm-up

- Allow at least 15 minutes' warm-up before relying on measurement accuracy.
- Avoid frequent power-cycling, which can disturb internal calibration data.

1.7 Other characteristics

Item	Value

Power consumption	≤80 VA
Dimensions (W×H×D)	400 × 132 × 385 mm (see the TH2838 Series Datasheet for the packaged/current figure)
Weight	≈13 kg

CHAPTER 2

Getting to Know the Instrument

2.1 Front panel



1. **USB Host** – connect a USB drive to save/load files.
2. **KEYLOCK** – locks/unlocks the front-panel keys (password-protected if enabled).
3. **DC BIAS** – enables/disables DC bias output.
4. **DC SOURCE** – independent −10–+10 V DC source output (TH2838H only).
5. **Brand & model** plate.
6. **LCD** – 800×480 colour TFT display.
7. **COPY** – copies the current display page to USB.
8. **DISP** – opens the measurement display pages.
9. **SETUP** – opens the measurement setup pages.
10. **SYSTEM** – opens the system setup page.
11. **Numeric keypad** – 0–9, decimal point, +/−.
12. **ESC** – escape key.
13. **← (backspace)** – deletes the last entered digit.
14. **CAL** – reserved.
15. **Knob** – rotate to adjust/select; press to confirm.
16. **TRIGGER** – manual trigger (MAN trigger mode).
17. **RESET** – stops an automatic sweep in progress.
18. **ENTER** – confirms/saves the value on the input line.
19. **Test terminals (UNKNOWN)** – Hcur, Hpot, Lpot, Lcur four-terminal-pair, plus DC SOURCE output.
20. **PASS / FAIL** – comparator result LEDs.
21. **Cursor keys** – move between fields.
22. **Jump key** – jumps the cursor quickly between fields.
23. **Ground terminal** – chassis ground for shielding.
24. **FILE** – opens the file-management page.
25. **Softkeys** – six context-sensitive keys; function shown on-screen.
26. **POWER** – power switch.

2.2 Rear panel



1. **LAN** – network control/communication.
2. **USB Device** – PC communication (USBTMC-USB488).
3. **IEEE-488 (GPIB)** – optional PC communication interface.
4. **TRIGGER** – external trigger input (e.g. foot switch).
5. **Nameplate** – production date, serial number, manufacturer.
6. **RS232** – serial PC communication.
7. **SCANNER** – reserved interface.
8. **TEMP. INPUT** – reserved temperature-measurement interface.
9. **HANDLER** – sorting-result output for automated test systems.
10. **Fan window** – heat exhaust.
11. **Power socket** – AC mains input.
12. **Fuse base** – fuse holder, also switches 110/220 V by fuse-holder orientation.
13. **Ground terminal** – chassis ground.

> **Warning:** confirm the fuse-holder orientation matches the supply voltage before powering on.

2.3 Display zones

TH2838 uses a 65k-colour, 7-inch TFT display divided into four zones:

Zone	Function
Page name	Shows the name of the currently displayed page.
Softkeys	Shows the function assigned to each of the six softkeys; definitions change with context and cursor position.
Result / condition	Shows the test result and the current measurement condition.
Help / prompt line	Shows system messages and echoes numeric-key input.

2.4 Main menu keys and their pages

Key	Softkey pages available
[DISP]	<MEAS DISPLAY>, <BIN NO.>, <BIN COUNT>, <LIST SWEEP>, <TRACE SWEEP>, <SAVE LOG>
[SETUP]	<MEAS SETUP>, <CORRECTION>, <LIMIT TABLE>, <LIST SETUP>, <TRACE SETUP>, <TOOLS>
[SYSTEM]	<SYSTEM SETUP>, <LAN SETUP>, <HANDLER SETUP>, <CHANNEL SETUP>, <DEFAULT SETTINGS>, <SYSTEM RESET>

2.5 Basic operation

- Use the menu keys ([DISP], [SETUP], [SYSTEM]) and softkeys to reach the desired page.
- Use the cursor keys to move between fields; the active field is highlighted.
- The knob adjusts the highlighted field: rotate to change/select, press to confirm. When not editing a value, clockwise/counter-clockwise mirror the [←]/[→] keys.
- Numeric keys, [←] and [ENTER] enter data directly. After a numeric key is pressed, the relevant unit softkeys (Hz, kHz, MHz, mV, V, μA, mA, A, etc.) appear; selecting one both sets the unit and terminates entry. Using [ENTER] instead applies the field's default unit.

2.6 Starting the instrument

1. Connect the 3-pin power cable.
2. Confirm supply voltage/frequency and phase/neutral/ground wiring match the instrument's requirements.
3. Press the POWER switch (front-panel, bottom left). A boot screen shows the Techmize logo, instrument model and firmware version.
4. If password protection is enabled, enter the password and press [ENTER] to reach the main menu.

> **Note:** the factory-default password is **2838**. Change it under <SYSTEM SETUP> → PASS WORD once the instrument is commissioned.

CHAPTER 3

Display & Measurement Setup

3.1 <MEAS DISPLAY>

Press [DISP] to open <MEAS DISPLAY>. The primary parameter is shown on the upper line, the secondary parameter below, both in large upper-case characters. Seven fields are available: FUNC, FREQ, AC LEV/DC LEV, AC RNG/DC RNG, SPEED, DC BIAS, DC SRC. The condition zone additionally shows Vac/Iac and Vdc/Idc monitoring and OPEN/SHORT/LOAD correction status (set elsewhere).

3.1.1 Test function (FUNC)

One primary and one secondary parameter are measured per cycle:

Primary	Available secondary combinations
Cp (parallel C)	D, Q, G, Rp
Cs (series C)	D, Q, Rs
Lp (parallel L)	D, Q, G, Rp, Rdc
Ls (series L)	D, Q, Rs, Rdc
Z (impedance)	θd, θr
Y (admittance)	θd, θr
R	X, or Rp–Q, Rs–Q
G	B
DCR	— (no secondary parameter)

Selected via a soft-key tree from FUNC: Cp–..., Cs–..., Lp–..., Ls–..., Z–..., then ↓ for Y–..., R–..., G–B, DCR.

3.1.2 AC test range

15 ranges: 0.1 Ω to 100 kΩ (0.1 Ω, 1, 10, 20, 50, 100, 200, 500 Ω, 1, 2, 5, 10, 20, 50, 100 kΩ). TH2838H offers all 15 ranges above 2 V test level; TH2838/TH2838A have the other 14 (no 0.1 Ω). Range mode: AUTO or HOLD (with ↑/↓ to step manually).

3.1.3 Test frequency

Frequency range	Resolution
20–99.999 Hz	0.001 Hz
100–999.99 Hz	0.01 Hz
1–9.9999 kHz	0.1 Hz
10–99.999 kHz	1 Hz
100–999.99 kHz	10 Hz
1–2 MHz	100 Hz

TH2838A: 20 Hz–1 MHz. TH2838/TH2838H: 20 Hz–2 MHz. Set via coarse/fine ↑↑/↑/↓/↓↓ softkeys or numeric entry.

3.1.4 AC test level

RMS sine-wave level, set as voltage or current. TH2838/TH2838A: 5 mV–2 V; TH2838H: 5 mV–20 V. Resolution 100 µVrms (5–100 mVrms), 1 mVrms (100 mV–1 Vrms), 10 mVrms (1–20 Vrms). The auto level control (ALC) function, enabled on <MEAS SETUP>, holds a constant voltage/current across the DUT (marked with "*" next to the level reading); it auto-disables if the level falls outside the supported ALC range.

3.1.5 DC bias

Internal source: ±10 V (TH2838/TH2838A) or ±40 V (TH2838H). The AC level and DC bias share a combined output-voltage limit — see the numerical-limit formulas in §6.2.7. Press the front-panel [DC BIAS] key to enable output.

3.1.6 Test speed

Speed	20 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	2 MHz
FAST	380	100	20	7.7	5.7	5.6	5.6
MED	380	180	110	92	89	88	88
SLOW	480	300	240	230	220	220	220

Values in ms, DC bias OFF, measurement average = 1. SLOW gives the most stable/accurate reading.

3.1.7 DC source (TH2838H only)

Independent DC output, −10 V to +10 V, 1 mV resolution — useful for biasing 3-terminal devices independently of the main DC bias.

3.1.8 Tools

Decimal-point display control for the 6-digit floating-point result: **DECIMAL AUTO** (restore default), **DECIMAL HOLD** (lock current decimal position), **DECIMAL LOCATION +/−** (shift by ×10), **FONT** (LARGE / TINY / OFF — OFF suppresses the on-screen reading but keeps bus read-back available, and speeds up TINY-mode measurement to 5 ms/reading vs 12 ms/reading for LARGE). Decimal lock is automatically cleared when the test function or deviation mode changes.

3.2 <BIN NO. DISPLAY>

Shows the sorted BIN number (upper case) plus the test result (lower case). The comparator can sort a DUT into up to 10 bins (BIN1–BIN9, BIN OUT), based on limits set in <LIMIT TABLE> (§3.8). Behaviour when COMP is ON:

Primary result	Secondary result	AUX ON	AUX OFF
PASS	PASS	Sorted BIN1–BIN9	
FAIL	PASS	BIN AUTO	BIN1–BIN9 (as applicable)
PASS	FAIL	AUX bin	BIN OUT
FAIL	FAIL	BIN AUTO	

With an optional HANDLER interface installed, the sort result is output directly to an automated handling system (see Chapter 8).

3.3 <BIN COUNT DISPLAY>

Shows a live tally for every bin. Fields: PARAM (function, shown swapped as e.g. “D–Cp” if swap-parameter mode is active), NOM (nominal value), BIN, HIGH/LOW, COUNT, AUX (auxiliary-bin count), OUT (out-of-bin count). COUNT softkeys: **ON**/**OFF** to enable counting, **RESET** (confirm Yes/No) to zero all bins.

3.4 <LIST SWEEP DISPLAY>

Runs the up-to-201-point list sweep configured under <LIST SWEEP SETUP> (§3.9) and compares each result against its limits. “►” marks the point currently under test.

Field	Description
MODE	**SEQ**: one [TRIGGER] press sweeps every point. **STEP**: one press per point. (Ignored when trigger source is INT; active for MAN.)
FREQ (Hz)	Currently swept parameter and unit, with the sweep-point list below it.
R[:] X[:]	Swept function parameter/unit and its per-point results.
CMP	Compare result per point: L (below limit), H (above limit), blank (within limit).

3.5 <TRACE SWEEP>

Graphical frequency/level/bias sweep with 51/101/201/401/801 points, linear or logarithmic. Press [TRIGGER] to start; [RESET] pauses/resumes.

Field	Description
FORMAT	LIN (linear) or LOG (base-10) coordinate mode.
SCALE	AUTO (fits curve once, then reverts to HOLD) or HOLD (manual A/B MIN/MAX in <TRACE SWEEP SETUP>).
READ	ON/OFF — shows extreme values and a knob-driven cursor for reading primary/secondary values at a given frequency.
TRACE	A (primary only), B (secondary only), A+B (both).
POINTS	51 / 101 / 201 / 401 / 801 (default 201) — more points = finer curve, longer sweep.
TRIGGER	SINGLE or CONTINUE (via MORE softkey).
SAVE CSV / SAVE AS	Export as CSV TEXT (spreadsheet-ready) or CSV DATA (scientific notation).

For ultrasonic/piezo components, selecting frequency + impedance sweep additionally derives: static capacitance `Ct` and dissipation `Dt` at 1 kHz; resonant frequency `fs` (Zmin) and anti-resonant frequency `fp` (Zmax); $\Delta F = fp - fs$; effective bandwidth $kp = 2.51 \times \sqrt{((fp - fs)/fs)}$; and mechanical quality factor $Qm = fp^2/(2\pi fs \cdot Zmin \cdot Ct \cdot (fp^2 - fs^2))$.

3.6 <MEAS SETUP>

Press [SETUP] to open <MEAS SETUP>. In addition to the fields already covered under <MEAS DISPLAY> (FUNC, FREQ, AC LEV, AC RNG, SPEED, DC BIAS, DC SRC), this page adds:

Field	Description
TRIG	Trigger mode — **INT** (continuous), **MAN** (one test per [TRIGGER] press), **EXT** (positive pulse on HANDLER), **BUS** (SCPI `TRIGger:SOURce BUS`, front-panel not selectable). A trigger received mid-measurement is ignored.
ALC	Auto level control. Constant-voltage range 5 mVrms–1 Vrms (TH2838H: to 20 Vrms); constant-current range 5 µArms–10 mArms (TH2838H: to 100 mArms). Auto-disables outside these ranges.
DCI ISO	Bias-current isolation. ON allows up to 100 mA bias current through the DUT (at some accuracy cost) — see the max-current-by-range table below when OFF.
AVERAGE	1–255 readings averaged per result.
VDC MON / IDC MON	ON/OFF — live DC voltage/current monitoring, shown in the Vdc/Idc fields on <MEAS DISPLAY>.
TRIG DLY	Delay from trigger to measurement start: 0–60 s, 1 ms resolution. Repeats at every list-sweep point. Ensures reliable DUT contact when triggered externally.
STEP DLY	Delay from signal-source output to each measurement. DCR uses two measurement cycles (positive/negative); Ls-Rdc/Lp-Rdc use three — the step delay applies at each.
DCI RNG	DC-bias-current range: 20 µA / 200 µA / 2 mA / 20 mA / 100 mA, AUTO or HOLD. Only adjustable while DCI ISO is ON; tracks DC RNG's AUTO/HOLD state.
DC LEV	DCR test-signal level, 100 mV–2 V (100 µV resolution to 1 V, then 1 mV).
DC RNG	DCR range: 13 ranges, 10 Ω–100 kΩ, AUTO or HOLD. Starting a DCR measurement automatically cuts any active DC bias (Ls-Rdc/Lp-Rdc cannot be combined with DC bias at all — an error is raised).
BIAS POL	AUTO or FIX. AUTO uses a small internal sense bias (≈1 V) to detect a varactor diode's orientation and automatically applies the DC bias with the correct polarity, regardless of how the diode is wired — shown as "*" after the bias reading.
DEV A / DEV B, REF A / REF B	Deviation-test mode for the primary/secondary parameter: **ΔABS** (= test − reference), **Δ%** (= (test − reference)/reference×100%), or OFF. REF A/B accept a typed reference or MEAS (measure the connected reference part live).

Maximum DC bias current by range (DCI ISO = OFF)

Range	10 Ω	30 Ω	100 Ω	300 Ω	1 kΩ	3 kΩ	10 kΩ	30 kΩ	100 kΩ
Max. current	2 mA	2 mA	2 mA	2 mA	1 mA	300 µA	100 µA	30 µA	10 µA

> **Note:** DCI ISO ON affects test accuracy — leave it OFF at low frequency/bias current where the table above is not exceeded.

3.7 <CORRECTION>

Open/short/load correction removes stray admittance, spurious impedance and other systematic errors. TH2838 supports two correction strategies, which can be combined:

- **Full-frequency (interpolated) correction** — open/short measured at 51 fixed frequency points (up to 2 MHz on TH2838/H, 48 points to 1 MHz on TH2838A) and interpolated to any test frequency.
- **Single-point (dot-frequency) correction** — open/short/load measured at up to 201 user-defined SPOT frequencies; when a spot's frequency matches the current test frequency, its data takes priority over interpolated data.

Field	Description
OPEN / SHORT	ON/OFF plus **MEAS OPEN**/**MEAS SHORT** (full-frequency, ≈30 s, abortable) and **DCR OPEN**/**DCR SHORT** (open/short under the DCR function).
LOAD	ON/OFF. Uses the transport-coefficient between a standard component's known reference value (REF A/B) and its measured value at a preset frequency (**MEAS LOAD**) to remove residual error — only valid for components of the same specification as the standard used.
CABLE	Test-cable length: 0 m or 1 m factory-calibrated as standard; 2 m/4 m calibration data is available on special order.
SPOT No.	1–201 — selects which single-point correction slot is being edited.
FREQ (per spot)	ON/OFF plus MEAS OPEN / MEAS SHORT / MEAS LOAD at that spot's frequency.
REF A/B, OPEN A/B, SHORT A/B, LOAD A/B	Reference and measured correction data for the current spot (read-only monitor fields for the measured values).

CLEAR CORR (under [SETUP]) erases all correction data across all 201 points after a Yes/No confirmation.

> **Note:** if both full-frequency correction and a matching single-point (dot-frequency) correction are ON at the current test frequency, the single-point data takes priority.

3.8 <LIMIT TABLE>

Configures the comparator's sort limits: up to 9 primary-parameter bins (BIN1–BIN9) plus one secondary-parameter limit pair, feeding the <BIN NO.>/<BIN COUNT> pages and (if fitted) the HANDLER interface.

Field	Description
PARAM / SWAP PARAM	Swaps which of the primary/secondary measured parameters gets the 9-bin table vs. the single secondary limit (e.g. Cp–D → D–Cp).
MODE	**%TOL** (percentage-tolerance around NOM), **ABS TOL** (absolute-tolerance around NOM), or **SEQ MODE** (bin limits are the raw test-value ranges, entered smallest to largest — the low limit of BIN2 becomes the high limit of BIN1, etc.).
NOM	Nominal value for tolerance-mode comparison (any value within the display range).
COMP	ON/OFF — master switch for the comparator function.
AUX	ON/OFF — routes parts whose primary parameter passes but secondary parameter fails into the auxiliary bin instead of BIN OUT (see the truth table in §3.2).
HIGH / LOW (BIN1–9, 2nd)	Per-bin limits; in tolerance mode limits should be entered smallest-error-first (a BIN1 range that already covers everything sends all DUTs to BIN1). Clear-line/clear-table softkeys are available while the cursor is in a limit field.

3.9 <LIST SWEEP SETUP>

Configures the up-to-201-point automatic sweep (frequency, level, or DC bias) that runs on <LIST SWEEP DISPLAY> (§3.4).

Field	Description
MODE	SEQ or STEP — as described in §3.4.
Sweep parameter	FREQ [Hz], LEVEL [V], LEVEL [A], BIAS [V] or BIAS [A] — the quantity that varies across the 201 points.
Per-point table	Value, LMT (compare against primary parameter “A”, secondary “B”, or OFF), HIGH, LOW, DELAY [s] (extra settle time after the previous point — adds to the measurement-display delay; useful with an external bias source such as TH1779A).
Page navigation	201 points across 21 pages; PAGE softkey + knob to jump pages; CLEAR TABLE to blank all points; FILL LINEAR / FILL LOG to auto-populate a swept range.

3.10 TRACE SWEEP SETUP

Configures the graphical sweep shown on <TRACE SWEEP> (§3.5). Most fields reuse the same settings described elsewhere in this chapter:

Field	Description
FUNC	Sweep test function — see §3.1.1.
LEVEL	Sweep level (used when MODE is not LEVEL [V]/[A]) — see §3.1.4.
DC BIAS	Sweep DC bias, superimposed when MODE is not BIAS [V]/[A] — see §3.1.5.
TRACE	Which curve is drawn: A (primary), B (secondary).
RANGE	Sweep test range — see §3.1.2.
SCALE	See §3.5.2.
FREQUENCY	Sweep frequency (used when MODE is not FREQ [Hz]) — see §3.1.3.
SPEED	Sweep test speed — see §3.1.6.
FORMAT	LIN or LOG — see §3.5.1.
TRIG	SINGLE or CONTINUE.
MODE	Which quantity is swept: FREQ [Hz], LEVEL [V], LEVEL [A], BIAS [V], BIAS [A].
START DEL	Extra settle delay when the bias source is an external TH1779A and MODE is BIAS [A].
POINT	51 / 101 / 201 / 401 / 801.
STEP DEL	Delay added at each sweep point.
MAX_MIN	Show/hide the max/min markers for the primary and secondary parameter.
START / END	Sweep start and end value; END must exceed START and stay within the instrument's frequency ceiling (1 MHz on TH2838A, 2 MHz on TH2838/H).
A MIN/MAX, B MIN/MAX, A DIV, B DIV	Manual vertical-axis range for the primary (A) and secondary (B) trace when SCALE is HOLD; DIV sets the per-division span, useful for zooming in on trace shape.

CHAPTER 4

System Setup & File Management

4.1 <SYSTEM SETUP>

Press [SYSTEM] to open <SYSTEM SETUP>. Settings here are saved automatically and restored at the next power-on.

Field	Description
MAIN FUNC	Displays available instrument functions — LCR only on TH2838.
KEY SOUND	ON/OFF key-press beep.
PASS BEEP	Beep on a passing result: HIGH LONG, HIGH SHORT, LOW LONG, TWO SHORT, or OFF.
FAIL BEEP	Beep on a failing result: same options as PASS BEEP.
LANGUAGE	English or Chinese. `Techmize units ship configured for English.`
PASS WORD	OFF, Hold SYSTEM (startup + file protection), Hold FILE (file protection only), Hold SETUP (restricts setup-file edits), or MODIFY (change the password). Default password: **2838**.
BUS MODE	Selects the active remote interface: RS232C, GPIB (requires the optional GPIB board), LAN, USBTMC or USBCDC.
GPIB ADDR	GPIB bus address (↑/↓ to adjust).
TALK ONLY	ON: the instrument pushes every result out over the active bus without needing to be addressed by a controller (no PC control possible while ON).
BIAS SRC	**INT** (internal source, −40–+40 V / −100–+100 mA) or **TH1779A** (external bias-current source mode — requires a TH1779A unit connected).
BAUD RATE	RS232C baud rate, 9,600–115,200 bps.
DATA/TIME	System clock; password entry required to change.

4.2 <FILE MANAGE>

Press [FILE] to open the file-management page. Instrument settings can be saved to and recalled from named setup files (*.STA).

Storage	Capacity
Internal non-volatile memory	40 setup files
External USB drive (optional accessory)	500+ setup files, plus screen captures and data logs

A saved *.STA file captures: all <MEAS SETUP> fields (FUNC, FREQ, AC LEV, AC RNG, SPEED, DC BIAS, BIAS SRC, TRIG, ALC, TRIG DLY, STEP DLY, AVERAGE, BIAS POL, DC RNG, DC LEV, DCI ISO, VDC MON, IDC MON, DEV A/B, REF A/B); the BIN COUNT on/off state; the full <LIMIT TABLE> (PARAM, NOM, MODE, AUX, COMP, all bin limits); the full <LIST SWEEP SETUP> table (mode, parameter, all 201 points and their limits); and the currently displayed page format.

USB storage requirements: USB 1.0/1.1, 32 MB–4 GB, FAT16/FAT32 (format on a Windows PC before use).

Common file operations

Task	Steps
Find a file	Scroll with the knob, page with [←]/[→], or press **FIND** and type a name/number.
Save current settings	Select a file slot → **SAVE** → confirm Yes → type a file name → [ENTER].
Load a file	Select the file → **LOAD** → confirm Yes.
Copy to USB	Select the internal file → **COPY TO E:** — a progress bar shows copy status.

> **Note:** confirm the USB drive meets the requirements above and is not write-protected before use.

CHAPTER 5

Operation Examples

5.1 Correction workflow

Two correction strategies (introduced in §3.7):

5.1.1 Sweep (full-frequency) correction

1. [SETUP] → CORRECTION.
2. Cursor to OPEN, leave the fixture open, press **MEAS OPEN** and wait for confirmation.
3. Press **ON** to enable open correction.
4. Fit the short plate (TH26010), cursor to SHORT, press **MEAS SHORT**, then **ON**.
5. Cursor to LOAD, press **OFF** (unless load correction is also needed).
6. Cursor to FREQ, press **OFF** to disable single-point (dot-frequency) correction.

5.1.2 Single-point correction (example: 5.5 kHz)

Gives better results for a fixed single-frequency test than interpolated full-frequency correction.

1. [SETUP] → CORRECTION; turn ON OPEN and SHORT (without measuring yet); LOAD OFF.
2. Cursor to SPOT No., select a calibration slot.
3. Cursor to FREQ, press ON, enter 5.5, press the kHz softkey (or [ENTER] for Hz).
4. With the fixture open, press **MEAS OPEN**.
5. Fit the short plate (TH26010), press **MEAS SHORT**.

5.2 Connecting the DUT correctly

The four test terminals (Hcur, Hpot, Lpot, Lcur), each with its own shield, must all be connected directly to the DUT leads to form a true four-terminal measurement — this removes lead and contact-point effects from the result (especially for dissipation). For low-impedance DUTs, keep Hpot/Lpot connected at the DUT lead itself so they sense the actual DUT voltage rather than a drop across lead impedance. Do not pre-connect Hcur–Hpot or Lpot–Lcur before attaching the DUT except for the specific two-terminal case below, since doing so increases error.

If lead/contact resistance is negligible next to the DUT's impedance (rule of thumb: $R_{lead} < Z_x/1000$ for <0.1% added error), a two-terminal connection (Hcur–Hpot and Lpot–Lcur bridged) is acceptable.

A Kelvin test fixture gives the best results, and is reliable up to about 10 kHz with test leads; above that, use a proper fixture rather than leads, since lead spacing directly affects stray L/C at high frequency. Whichever fixture is used, keep it identical between correction and measurement, minimise distributed impedance and contact resistance, and ensure clean open/short reference states.

> **Warning:** discharge any polarised DUT before connecting it, to avoid damaging the instrument. Connect the high-potential lead to the terminal(s) marked “+”, Hc or Hp.

5.3 Eliminating stray impedance

For high-impedance DUTs (e.g. small capacitors), stray capacitance between the four terminals and any nearby conductive plate can add directly in parallel with the DUT, biasing the reading. Fitting a grounded shield/plate between the high and low terminals and bonding it to the instrument's ground terminal minimises this coupling.

For low-impedance DUTs (e.g. small inductors, large capacitors), the large currents in Hcur/Lcur create electromagnetic coupling between leads, which is usually the dominant error source (contact resistance mainly affects the resistive part of the reading; lead coupling mainly affects the reactive part). TH2838's four-terminal-pair (4TP) connection routes the shield return current equal and opposite to the drive current, cancelling the magnetic field and removing this coupling — another reason to keep the shielded 4TP fixture intact rather than substituting plain leads.

5.4 Example — measuring an inductor

Condition: function Ls–Q, frequency 5.5 kHz, level 1.5 Vrms, internal impedance 100 Ω.

1. Power on. [DISP] → <MEAS DISP>.
2. Cursor to FUNC → Ls–... → Ls–Q.
3. Cursor to FREQ, type 5.5, press the kHz softkey.
4. Cursor to LEVEL, type 1.5, press [ENTER] (defaults to V).
5. [SETUP] → <MEAS SETUP> to review the remaining conditions.
6. Fit the TH26005 test fixture to the front-panel terminals.
7. Perform open/short correction at 5.5 kHz (§5.1.2).
8. Connect the inductor under test and read the continuous result on <MEAS DISP>.

If the reading looks wrong: check the DUT–fixture and fixture–instrument connections, then redo the open/short correction.

5.5 Example — capacitance list sweep with limits

Condition: function Cp–D, level 1 Vrms; three sweep points with independent limits, beep on fail, alarm mode OUT:

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

1. [DISP] → <MEAS DISP>: confirm FUNC = Cp–D, LEVEL = 1 V.
2. [SETUP] → SWEEP SETUP; sweep parameter = FREQ [Hz].
3. For sweep point 1: enter 1, press kHz; move to LMT, press **LIMIT DATA A** (compares Cp); enter low limit 325, press n; enter high limit 333, press n.
4. For sweep point 2: enter 10, press kHz; LMT → **LIMIT DATA B** (compares D); low limit 0.0001, high limit 0.0003.
5. For sweep point 3: enter 100, press kHz; LMT → B; low limit 0.0060, high limit 0.0100.
6. [SYSTEM] → <SYSTEM SETUP> → set FAIL BEEP to HIGH LONG.
7. Fit the TH26005 fixture; perform sweep (full-frequency) open/short correction (§5.1.1).
8. Insert the capacitor under test. [DISP] → LIST SWEEP: the instrument sweeps continuously, beeping on any H (above limit) or L (below limit) result.

5.6 Example — comparator setup for capacitor sorting

DUT: 0805CG271. Requirement: sort by capacitance into BIN J / BIN K by tolerance; parts that pass capacitance but fail loss (tg δ < 0.15%) are routed separately. Test at 100 kHz, 1 Vrms, SLOW speed, FAIL alarm, external trigger.

Parameter	Setting
Primary / secondary	Cp / D
Frequency / level / speed	100 kHz / 1 V / SLOW
Auxiliary bin	ON
Primary tolerance mode / nominal	%TOL / 270 pF
BIN1 low / high	−4.6% / +4.8%
BIN2 low / high	−9% / +10%
Secondary (D) low / high	0.0000 / 0.0015
Trigger / alarm	EXT / HIGH LONG on fail

1. On <MEAS DISP>, select Cp–D and set frequency/level/speed.
2. [SETUP] → <MEAS SETUP>, set TRIG to EXT.
3. [SETUP] → LIMIT → <LIMIT TABLE SETUP>: enter NOM, primary tolerance mode, the bin limits above, COMP ON, AUX ON.
4. [SYSTEM] → <SYSTEM SETUP>, set FAIL BEEP to HIGH LONG.

> Because the given limits are percentages of the 270 pF nominal, the primary parameter uses %TOL mode, not SEQ MODE. With AUX ON, a part whose capacitance passes but whose loss fails is archived in the AUX bin rather than counted as an outright FAIL.

5.7 Example — load correction

Standard reference: Cp = 11 nF, D = 0.0005 at 100 kHz.

1. [SETUP] → CORRECTION. Set OPEN, SHORT and LOAD all to ON; FUNC = Cp–D.
2. Cursor to FREQ, press ON; enter 100, press kHz.
3. Enter REF A = 11, press n (nF); REF B = 0.0005, press [ENTER].
4. Cursor to SPOT No., select the correction slot; return to FREQ.
5. With the fixture open (kept clear of hands/interference), press **MEAS OPEN**.
6. Fit the short plate (TH26010), ensuring good contact, press **MEAS SHORT**.
7. Insert the standard 11 nF capacitor, ensuring good contact, press **MEAS LOAD**.

> **Note:** load correction is valid only for DUTs of the same specification as the standard used to derive it — redo it if the DUT type changes.

CHAPTER 6

Performance & Specifications

6.1 Test function

Symbol	Meaning	Symbol	Meaning
C	Capacitance	D	Dissipation factor
L	Inductance	Q	Quality factor
R	Resistance	θ	Phase angle
Z / Y	Impedance / Admittance	DCR	DC resistance
X / B	Reactance / Susceptance	G	Conductance

Valid combinations: Z/Y with θ(deg or rad); L/C with D, Q, Rs, Rp, G, Rdc; R with X; G with B. DCR has no secondary parameter. Mathematical operations: absolute deviation ΔABS and percentage deviation Δ% against a programmable nominal.

Item	Specification
Equivalent circuit	Series or parallel
Range	Auto or manual (hold, step up/down)
Trigger	Internal (continuous), Manual ([TRIGGER] presses), External (HANDLER “start” pulse)
Trigger delay	0–60 s, 1 ms resolution
Test terminals	Four-terminal-pair: HD/Hcur (current high), LD/Lcur (current low), HS/Hpot (voltage high), LS/Lpot (voltage low)
Test speed (≥10 kHz)	FAST ≈130/s (7.7 ms); MED ≈11/s (92 ms); SLOW ≈4/s (230 ms) — slower below 10 kHz, see §3.1.6
Average	1–255, programmable
Display digits	6 digits, max. displayed value 999999

6.2 Test signal

Item	Specification
Signal frequency	Sine wave, 0.01% accuracy; 20 Hz–1 MHz (TH2838A) or 20 Hz–2 MHz (TH2838/H); 0.01 Hz min. resolution
Signal mode	Normal (level may sag under load) or Constant level (ALC adjusts output so the DUT sees the preset level)
Output impedance	100 Ω ±2%
DC bias source	0–±40 V (0.5 mV resolution, ±1%×setting+5 mV); 0–±100 mA (5 µA resolution, ±5%×setting+50 µA)

Mode	Range	Accuracy	Resolution
Voltage, normal	5 mVrms–2 Vrms	±(10%×setting+2 mV)	100 µV
Voltage, constant	10 mVrms–1 Vrms	±(6%×setting+2 mV)	
Current, normal	50 µArms–20 mArms	±(10%×setting+10 µArms)	1 µA
Current, constant	100 µArms–10 mArms	±(6%×setting+10 µArms)	

Signal-level monitor	Range	Frequency	Accuracy
Voltage	5 mVrms–2 Vrms	≤1 MHz	±(3%×reading+0.5 mVrms)

		>1 MHz	±(6%×reading+0.1 mV)
Current	50 µArms–20 mArms	≤1 MHz	±(3%×reading+5 µA)
		>1 MHz	±(6%×reading+1 µA)

6.3 Measurement accuracy

Overall test accuracy is the combination of stability, temperature coefficient, linearity, repeatability and calibration inter-error. Verify accuracy only after: ≥30 min warm-up, with the correct cable-length setting (0/1/2/4 m), fresh open/short correction taken after warm-up, DC bias OFF, and range in AUTO.

The basic accuracy A_e for |Z|, |Y|, L, C, R, X, G, B follows $A_e = \pm[A + (K_a+K_{aa}+K_b\times K_{bb}+K_c)\times 100 + K_d]\times K_e$ [%], where A is the base accuracy figure (0.05% under the reference test conditions used in the TH2838 Series Datasheet's accuracy-factor chart) and K_a–K_e are correction factors for impedance ratio, cable length, calibration interpolation and temperature. D, Q, θ, G, Rp and Rs accuracies derive from A_e by the standard formulas below (valid while $D_x \le 0.1$ / $Q_x \le 0.1$, with defined correction multipliers above that):

Derived accuracy	Formula
D_e	A_e / 100
Q_e	$(Q_x^2\times D_e) / (1-Q_x\times D_e)$, valid for $Q_x\times D_e < 1$
θ_e	$(180/\pi)\times(A_e/100)$ [deg], or $(A_e/100)$ [rad]
G_e (Cp–G, Lp–G only)	$B_x\times D_e$ [S]
Rp_e	$(Rp_x\times D_e) / (D_x\pm D_e)$ [Ω]
Rs_e	$X_x\times D_e$ [Ω]
DCR	$A(1+R_x/5\ M\Omega+16\ m\Omega/R_x)$ [%] ±0.2 mΩ, A=0.25 (MED/SLOW) or 0.5 (FAST)

> The full impedance-rate, cable-length, calibration-interpolation and temperature correction-factor charts (K_a through K_e) and the graphical basic-accuracy chart are reproduced in the TH2838 Series Datasheet and the manufacturer's full-length manual; consult those for detailed accuracy derating at specific frequency/level/cable combinations.

Test time

Speed	20 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	2 MHz
FAST	380	100	20	7.7	5.7	5.6	5.6
MED	380	180	110	92	89	88	88
SLOW	480	300	240	230	220	220	220

(ms, DC bias OFF)

6.4 Safety & EMC

Item	Requirement
Safety class	Class I
Insulation resistance	≥50 MΩ (reference conditions); ≥2 MΩ (humid conditions)
Insulation strength	Withstands 1.5 kV / 50 Hz AC for 1 minute, no breakdown/flashover
Leakage current	≤3.5 mA (AC RMS)
EMC	Transient/conducted/radiated immunity per GB/T 6833 (equivalent to IEC 61000)

Performance verification follows the reference conditions of Chapter 1, checking function keys/display/terminals, signal level and frequency accuracy at the points in §6.2, then C/D, L, Z and DCR accuracy against calibrated standard capacitors, inductors and resistors at 100 Hz–100 kHz (AUTO range, SLOW speed, 1 Vrms, 0 V bias, after open/short correction).

CHAPTER 7

Remote Operation (SCPI)

TH2838 can be remotely controlled over RS232C, USB (Device/USBTMC), LAN or the optional GPIB interface, using the Standard Commands for Programmable Instruments (SCPI) language. Select the active interface under [SYSTEM] → SYSTEM SETUP → BUS MODE (§4.1); GPIB requires the optional interface board to be installed.

7.1 Command syntax conventions

Notation	Meaning
NR1	Integer, e.g. `123`
NR2	Fixed-point number, e.g. `12.3`
NR3	Floating-point number, e.g. `12.3E+5`
NL	Carriage return (decimal 10)
^END	IEEE-488 EOI (end-of-message) signal

Commands mix upper/lower case; the upper-case letters are the minimum (short-form) abbreviation — e.g. `DISPlay` can be sent as `DISP`. Square brackets `[ ]` mark optional nodes/parameters (the instrument applies a default if omitted); braces `{ }` enclose a set of parameter choices; a vertical bar `|` separates alternatives; angle brackets `< >` mark a required value placeholder and are not sent literally.

7.2 Command subsystems

The full command set spans 18 subsystems plus the IEEE-488.2 common commands — over 100 commands in total. Given this scope, the complete syntax, parameter ranges, defaults and examples for every command are published as a companion document, the **TH2838 Series SCPI Command Reference**, rather than reproduced in full here. The subsystems are:

Subsystem	Purpose
DISPlay	Select the active display page; set the custom measurement-item label and result font size.
FREQuency	Set the test frequency.
VOLTage / CURRent	Set the AC test-signal voltage / current level.
AMPLitude	Auto level control (ALC) on/off.
OUTPut	DC bias-source isolation on/off.
BIAS	DC bias state, voltage, current, auto-polarity.
FUNCtion	Measurement function/range, source monitoring, deviation mode, step delay, DCR range.
LIST	List-sweep frequency/level/bias tables, sweep mode, per-point limits and delay.
APERture	Measurement speed and averaging count.
TRIGger	Trigger source, delay, and immediate trigger.
FETCh?	Read back the last measurement result and source-monitor readings.
RS232 (Auto-Return)	Automatic result push over RS232C after each test.
CORRection	Open/short/load correction, cable length, per-spot (single-point) correction data.
COMParator	Bin-sort comparator mode, tolerance/sequential limits, auxiliary bin, bin counts.
Mass MEMory	Load/store instrument setup files.

TSSE	Trace-sweep setup and resonance-search results (fs, fp, Ct, Dt, Kp, Qm, sweep data). (≈30 commands — the largest single subsystem.)
SYSTem	Query the instrument serial number.
IEEE-488.2 common	*RST, *TRG, *CLS, *IDN?, *TST?, *ESE, *ESR?, *SRE, *STB?, *OPC/*OPC?

> **Note:** the RS232 Auto-Return feature, the SYSTem subsystem and the full TSSE command tree are described in the corresponding sections of this manual and in the TH2838 Series SCPI Command Reference.

7.3 Result data format

Results stream back as ASCII: <DATA A>,<DATA B>,<Status>,<BIN/Judge>, with A/B in 12-character signed-exponential form. Status codes: −1 no data, 0 normal, +1 LCR unbalanced, +2 A/D not ready, +3 signal source overload, +4 constant level not achievable. On <BIN NO./COUNT> pages the fourth field is the sorted bin (0 = out of tolerance, 1–9 = BIN1–9, 10 = AUX); on <LIST SWEEP> it is the compare judgement (−1 low, 0 pass, +1 high).

CHAPTER 8

HANDLER Interface

The optional HANDLER interface outputs the bin/comparator sort result for integration with automated component-handling and sorting equipment. Outputs are low-effective, open-collector, opto-isolated.

8.1 Signal overview

Group	Signals
Comparison output	/BIN1–/BIN9, /AUX, /OUT, /PHI (primary too high), /PLO (primary too low), /SREJ (secondary out of range)
Control output	/INDEX (analog test complete), /EOM (test + comparison complete, data valid), /ALARM (circuit interrupted)
Control input	/EXT.TRIG (external trigger, pulse width ≥1 µs), /KEYLOCK (locks the front panel)

8.2 Pin assignment (36-pin connector)

Pin	Signal	Pin	Signal
1–9	/BIN1–/BIN9	21	/SREJ
10	/OUT	22–24	N.C.
11	/AUX	25	/KEYLOCK
12–13	/EXT.TRIG	26	N.C.
14–15	EXT.DCV2	27–28	EXT.DCV1
16–18	+5 V (internal; limit 0.3 A if used)	29	/ALARM
19	/PHI	30	/INDEX
20	/PLO	31	/EOM
		32–33	COM2 (ref. ground for EXT.DCV2)
		34–36	COM1 (ref. ground for EXT.DCV1)

> The /BIN1–/BIN9, /OUT, /AUX, /PHI, /PLO, /SREJ signals carry different meanings in BIN-comparator mode vs. list-sweep mode — see §8.3.

8.3 Signal meaning by comparator mode

BIN comparator mode

/BIN1–/BIN9 and /OUT directly report the sorted bin (Figure: /PHI, /PLO active per the bin's high/low relation; /SREJ active when the secondary parameter is out of range). /INDEX goes active once the analog measurement finishes (DUT can be released); /EOM goes active once the compared result is valid.

List-sweep comparator mode

Pin	Meaning in list-sweep mode
/BIN1–/BIN9, /OUT	IN/OUT (within/outside limit) for sweep points 1–10
/AUX	Active if at least one swept point failed (overall PASS/FAIL)
/INDEX	SEQ: active when the last point's analog test finishes. STEP: active when each point's analog test finishes.
/EOM	SEQ: active once all points are tested and results valid. STEP: active once each point's test+compare is valid.

8.4 Electrical characteristics

Signal group	Output LOW	Output HIGH	Max. current	Reference ground
Comparison (/BIN1–9, /AUX, /OUT, /PHI, /PLO, /SREJ)	≤0.5 V	+5–+24 V	6 mA	Internal: instrument GND · External: COM1 (EXTV1)
Control (/INDEX, /EOM, /ALARM)	≤0.5 V	+5–+24 V	5 mA	Internal: instrument GND · External: COM2 (EXTV2)

All DC-isolated outputs are opto-coupled, open-collector, with the output voltage set by a pull-up resistor referenced either to the internal +5 V rail or to an externally supplied EXT.DCV1/EXT.DCV2.

8.5 Timing

Interval	Minimum	Typical / maximum
T1 — external trigger pulse width	1 µs	—
T2 — delay time (trigger → start excitation)	200 µs	—
T3 — trigger wait after /EOM	0 µs	200 µs + display time
Comparison time	≈1 ms typical	
Display time (MEAS DISPLAY)	≈8 ms	
Display time (BIN NO.)	≈5 ms	
Display time (BIN COUNT)	≈0.5 ms	

Measurement time itself follows the test-speed table in §6.1/§6.3.

8.6 Setting up sorting

BIN comparator

1. [SETUP] → LIMIT TABLE; enter the nominal and high/low limits (§3.8).
2. Cursor to COMP, press **ON**.
3. [DISP] → BIN NO. or BIN COUNT to run and monitor the sort/tally.

List-sweep comparator

1. [SETUP] → LIST SETUP; configure sweep mode, frequency points, reference values and limits (§3.9).
2. [DISP] → LIST SWEEP to run.

> **Tip — maximising throughput:** lock the test range to the DUT's expected impedance rather than using AUTO; turn Vm/Im monitoring OFF on <MEAS SETUP>; and run production sorting from the <BIN COUNT> page.

APPENDIX

Contact & Registration

> The description in this manual may not cover every instrument variant, and Techmize/Tonghui reserve the right to change performance, function, internal structure, appearance, accessories and packaging without notice. If the manual and the instrument appear inconsistent, contact Techmize using the details below.

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Related documents

Document	Contents
TH2838 Series Datasheet	Model comparison, full specification table, standard/optional accessories, basic-accuracy chart
TH2838 Series SCPI Command Reference	Full syntax, parameters, defaults and examples for all 18 SCPI subsystems and the IEEE-488.2 common command set

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