TECHMIZE by TONGHUI

OM

OPERATION MANUAL

TH2840X Series

Automatic Transformer Test System — TH2840AX / TH2840BX / TH2840NX. Covers transformer single-group testing, automatic transformer scanning, scan fixtures, the HANDLER interface and system configuration. LCR-bridge operation (optional TH2840X-LCR) is described in the TH2840 Series Operation Manual.

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TH2840X Series Operation Manual

Automatic Transformer Test System — TH2840AX / TH2840BX / TH2840NX

This is the English-language operation manual for the transformer-test models of the TH2840 platform, marketed by Techmize as the **TH2840X series**. It describes transformer single-group testing, automatic transformer scanning and the related scan fixtures, HANDLER interface, system setup and file management.

The standard TH2840X does not include a standalone LCR-meter function. The optional **TH2840X-LCR** module adds four-parameter LCR bridge measurement; its operation follows the *TH2840 Series Operation Manual* and is not repeated here. The remote-command sets (SCPI and MODBUS) are described in the companion TH2840X command reference.

Unless a model name is given, statements apply to TH2840AX, TH2840BX and TH2840NX alike. Where a function or specification differs between models, the models are named explicitly.

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CHAPTER 1

Safety & Compliance

1.1 About this manual

This is the original-language (English) edition of the operation manual for the Techmize TH2840X series of automatic transformer test systems, covering models **TH2840AX**, **TH2840BX** and **TH2840NX**. 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 TH2840X 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 or TURNS terminals. The maximum DC voltage 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 fuse holder, see §2.4), 47–63 Hz, not less than 100 VA. Use only the fuse type and rating shown on the rear-panel rating label, and confirm that the fuse position matches the supply voltage before applying power.

Environment: operate at 0–40 °C, ≤75% RH, away from dust, vibration, direct sunlight and corrosive gases. Keep the ventilation openings on the left and right sides clear. For long-term storage, use the original packaging (or equivalent) at 5–40 °C, <85% RH. Allow a warm-up time of **60 minutes** 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. Keep the instrument and especially the test leads away from strong electromagnetic fields.

1.4 Scan-fixture safety

The following precautions apply when a TH1901 / TH1831 scan fixture or the NX internal scan board is used with the instrument:

- Do not plug or unplug the scan control cable (TH26016) or any test cable while the instrument or the scan fixture is powered.
- **TH1901A (pneumatic clamp)** operates from an external compressed-air supply connected to its air inlet and is driven by a 24 V DC solenoid valve. Install a water-filtering device between the air inlet and the inlet valve to extend the life of the cylinder and valve (recommended).
- The RESET button on the scan fixture terminates all tests and returns the system to the ready state; use it to abort a scan.
- If a foot switch is connected to the FOOT.C connector, the START button on the fixture is disabled.
- Connect the ground terminals of the instrument and the scan box, and the metal frame of the test fixture, to a reliable ground (see Appendix A, A.9).

1.5 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)

1.6 Low Voltage & EMC compliance

The TH2840X 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 instrument, the TH2840X series is intended for industrial and 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 §1.11).

1.7 WEEE — disposal of electrical and electronic equipment



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

1.8 RoHS compliance

The TH2840X series is designed to comply with Directive 2011/65/EU (RoHS), as amended, restricting the use of certain hazardous substances in electrical and electronic equipment. Supporting documentation is available from Techmize on request.

1.9 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 shipment. 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 or wear items such as fuses and connectors, or operation outside the environmental limits given in §1.3. Repair must be carried out by qualified personnel; no internal component may be replaced without authorization. After any repair, the instrument should be recalibrated before further use. If the instrument will not be used for a long period, store it in its original packaging.

1.10 Limitation of liability

Except as expressly stated in §1.9, 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.

1.11 Manufacturer & EU contact

Techmize Electronic GmbH

Office 125–126, Regus
Carl-Zeiss-Ring 15a, 85737 Ismaning,
Germany
An international subsidiary of Changzhou
Tonghui Electronic Co., Ltd. (China)

Contact

Mobile: +49 171 4981898
Email: dx.han@tonghui.com.cn
Web: en.tonghui.com.cn

Registration

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

CHAPTER 2

Out of the Box

2.1 Inspecting the package

Inspect the shipping container for damage after unpacking. Do not power on the instrument if the container or the instrument is damaged. If the contents do not match the packing list, notify Techmize or your distributor.

2.2 Models and configurations

The three models share one measurement platform (dual-CPU, embedded Linux, 10.1" capacitive touchscreen) and differ in frequency range, enclosure and scanning hardware.

	TH2840AX	TH2840BX	TH2840NX
Frequency range	20 Hz – 500 kHz	20 Hz – 2 MHz	20 Hz – 500 kHz
Test pins	20 PIN (via external TH1901 scan box)	20 PIN (via external TH1901 scan box)	48–288 PIN (internal scan boards, 48 PIN each)
Internal scan board	None	None	1 board standard, expandable to 6 (24×2 PIN per board)
Windings	Primary up to 60, secondary up to 9	Primary up to 60, secondary up to 9	Primary up to 60, secondary up to 9
HANDLER sorting signals	NS1–NS9, GOOD, NG, TEST, TRIGGER, RESET	NS1–NS9, GOOD, NG, TEST, TRIGGER, RESET	NS1–NS30, GOOD, NG, TEST, TRIGGER, RESET
Dimensions (W×H×D)	430×177×265 mm	430×177×265 mm	430×177×405 mm
Weight	11 kg	11 kg	17 kg

TH2840NX uses a deeper chassis to house the internal scan-board bay; the two enclosure families are not interchangeable. All three models support the optional **TH2840X-LCR** bridge upgrade and ship with SCPI and MODBUS remote protocols as standard.

2.3 Standard accessories and options

Standard accessories

Item	Description
—	EU power cable (Schuko, CEE 7/7)
TH26011BS	Four-terminal Kelvin test cable
TH26004B	Two-terminal test cable
TH26016	36-PIN scan control cable (AX/BX only)
TH1801-001	Foot switch (AX/BX only)
TH1901B	Manual transformer scan fixture (AX/BX only)
TH2829AX-001	Foot switch (NX only)

Optional accessories

Item	Description
TH2840X-LCR	Optional LCR bridge module (four-parameter LCR measurement)
TH1901A	Pneumatic transformer scan fixture (needs compressed-air supply)
TH1778A	External DC-bias unit (up to 6 units / 120 A)
TH26007A	Toroidal-core test fixture
TH26008A	SMD component test fixture
TH26009B	SMD component test tweezers
TH26077	Dielectric test fixture

Further fixtures, including four-terminal-pair fixtures and custom fixture heads for a specific transformer footprint, are available on request from Techmize or your authorized distributor; supply mechanical drawings of the DUT and pin layout when ordering a custom fixture head.

2.4 Power connection and fuse

1. Supply voltage: 100–120 V AC or 198–242 V AC, selected by the orientation of the fuse holder on the rear panel. Supply frequency 47–63 Hz; supply capacity not less than 100 VA.
2. Connect the phase (L), neutral (N) and protective-earth (E) conductors as indicated at the power inlet, using the supplied EU power cable (Schuko, CEE 7/7).
3. Use only the fuse type specified on the rear-panel rating label:

Supply	Fuse
110 V / 60 Hz setting	T4AL 250 V
220 V / 50 Hz setting	T2AL 250 V

> **WARNING**
> Before powering on, check that the fuse position matches the supply voltage range. Disconnect the power cable before replacing the fuse, and make sure the protective-earth conductor is reliably connected.

The instrument can attenuate noise entering through the AC supply, but a low-noise environment is still recommended; install a power-line filter if interference cannot be avoided.

2.5 Operating environment

- Operating temperature 0–40 °C, relative humidity ≤75%. Do not use the instrument where it is subject to vibration, dust, direct sunlight or corrosive gases.
- A fan on the rear panel and ventilation openings on the sides prevent internal temperature rise. Do not obstruct them.
- Storage: 5–40 °C, <85% RH, preferably in the original packaging if the instrument is not used for a long time.
- Keep the instrument, and especially the test leads, away from strong electromagnetic fields.

2.6 Warm-up

Allow **60 minutes** of warm-up before relying on the specified accuracy. Avoid switching the instrument on and off frequently.

2.7 Test fixtures and cables

Use the supplied or approved test fixtures and cables; fixtures made by the user or by other suppliers can cause incorrect measurement results. Keep fixtures, cables and DUT pins clean. Connect a fixture or cable to the four UNKNOWN terminals (**HCUR, HPOT, LPOT, LCUR**) on the front panel; the TURNS (+) and (−) terminals measure the transformer secondary. For a DUT with a shielding shell, connect the shield to the ground terminal. With no fixture or cable installed the instrument displays unstable results.

> **NOTE**
> The TURNS terminals are used for transformer single-group turns-ratio measurement (Chapter 4). Automatic scanning uses the scan fixture and the Trans Scanner connection (Chapter 5).

2.8 Power on and power off

TH2840X instruments use a soft power switch. After the power cable is connected, some front-panel indicators flash for a few seconds, then the POWER key lights **red** (standby) and all other LED keys go out.

- **Power on:** press the POWER key at the lower-left corner of the front panel. The startup screen is shown and the POWER key lights **green**. The POWER key remembers the last state.
- **Power off:** press and hold the POWER key. The key returns to red and the instrument is in standby. If the instrument will not be used for a long time, disconnect the power cable.

> **NOTE**
> The factory password is **2840**. It can be changed on the *System Setup* page (see §9.1.2).

CHAPTER 3

Getting to Know the Instrument

3.1 Front panel

The front panels of TH2840AX, TH2840BX and TH2840NX carry the same controls. TH2840NX is shown.

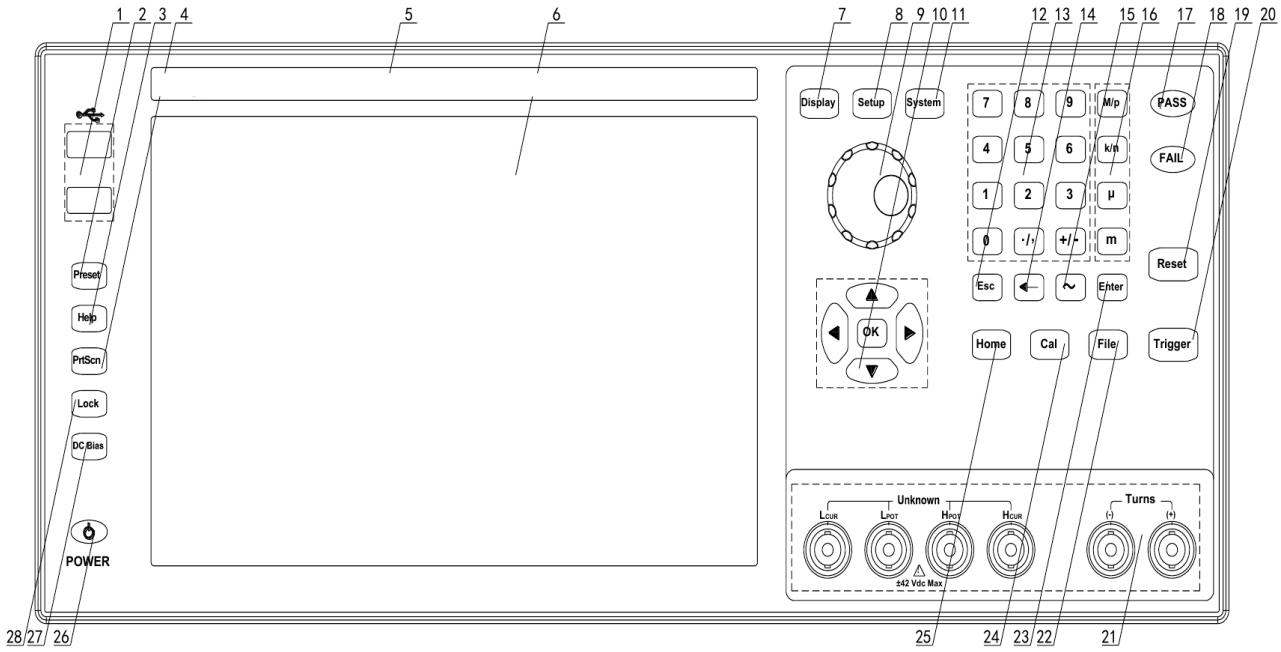

Figure 3-1 Front panel (TH2840NX shown)

1 **USB HOST** — two USB host ports for a USB flash drive (settings, results, screenshots) and for a mouse, keyboard or scanner. Only one flash drive can be inserted at a time.

2 **[Preset]** — opens the Preset menu to restore settings (§9.1.5).

3 **[Help]** — lights up and shows the function and operating instructions for the field under the cursor; press again to close.

4 **[PrtScn]** — saves a picture of the current screen to the USB flash drive.

5 **Brand and model**

6 **LCD** — 1280×800 colour capacitive touchscreen showing results and conditions.

7 **[Display]** — opens the display page of the active function.

8 **[Setup]** — opens the setup pages of the active function.

9 **Knob** — moves the cursor and selects/sets parameters; pressing it confirms the entry.

10 **Cursor keys and [OK]** — move the cursor between fields; [OK] works like [Enter].

11 **[System]** — opens the system setup page.

12 **[Esc]** — escape / cancel.

13 **Numeric keys** — [0]–[9], decimal point [./,] and [+/−].

14 **[←]** — backspace; deletes the last digit entered.

15 **[~]** — continuous pin input in transformer scan setup (e.g. 1~9).

16 **Magnitude keys** — M/p, k/n, µ, m — enter the magnitude (prefix) of a value.

17 **PASS** — LED: the result is PASS.

18 **FAIL** — LED: the result is FAIL.

19 **[Reset]** — in transformer scan, stops the scan; the next trigger starts from the beginning.

20 **[Trigger]** — triggers a measurement when the trigger mode is Single.

21 **Test terminals** — UNKNOWN: HCUR, HPOT, LPOT, LCUR four-terminal measurement terminals. TURNS (+)/(−): transformer secondary test terminals.

22 **[File]** — opens file management.

23 **[Enter]** — terminates input and confirms the entered data.

24 **[Cal]** — shortcut to user correction.

25 **[Home]** — selects the function: transformer single-group test or transformer scan (and LCR bridge when the TH2840X-LCR option is installed).

26 **POWER** — soft power key: red = standby, green = on; press and hold to switch off.

27 **[DC Bias]** — allows or inhibits DC bias output (0–100 mA, ±40 V, 0–2 A). Lit = bias output allowed. No effect on pages where DC bias cannot be applied.

28 **[Lock]** — locks the front-panel keys (lit). With password ON, the password is required to unlock. Lit automatically under remote control; press again to return to local.

3.2 Rear panels

3.2.1 TH2840AX / TH2840BX

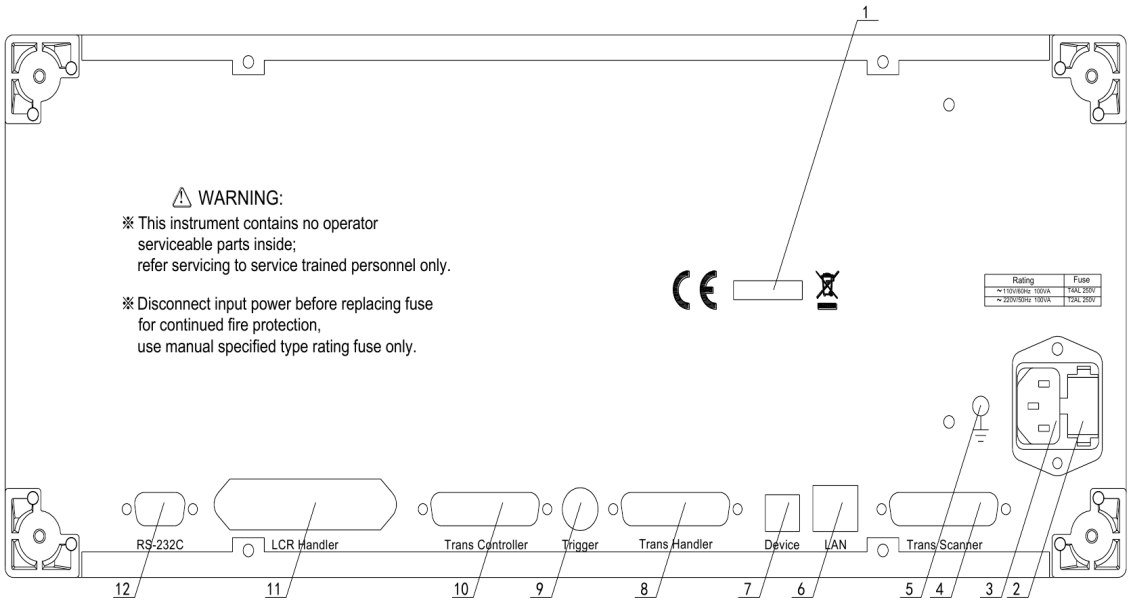

Figure 3-2 Rear panel, TH2840AX / TH2840BX

3.2.2 TH2840NX

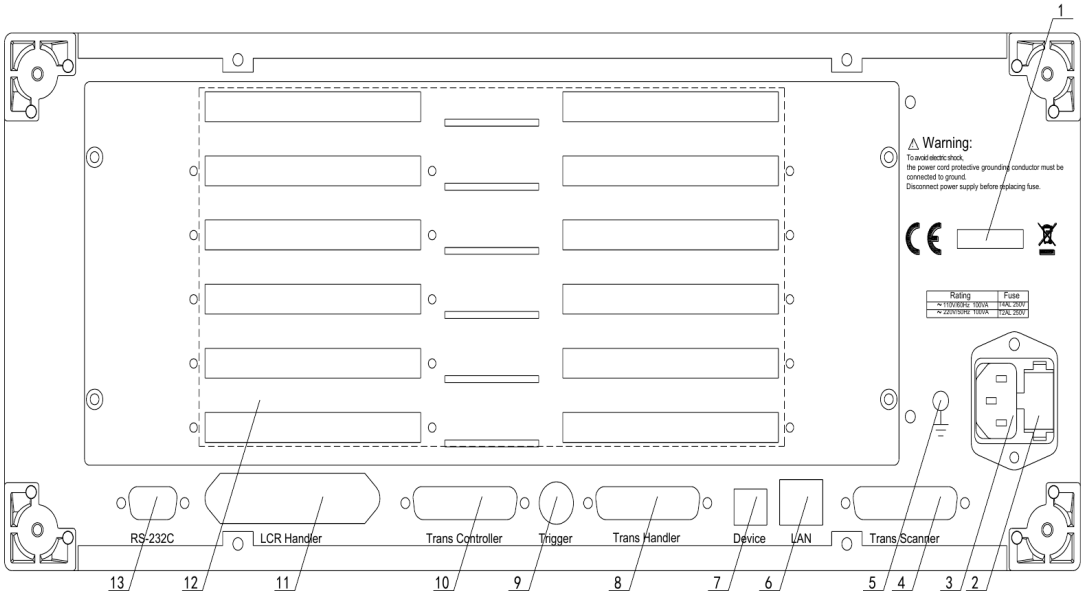

Figure 3-3 Rear panel, TH2840NX

Items 1–11 are identical on both rear panels. On **TH2840AX/BX** the RS-232C connector is item 12. On **TH2840NX** item 12 is the scanning-cable interface bank (FRC-50P connectors for the internal scan boards, slots A–L) and RS-232C is item 13.

3.2.3 Rear-panel connector legend

1 **Nameplate** — production date, serial number and manufacturer information.

2 **Fuse holder** — holds the power fuse; the orientation of the fuse holder selects 110 V or 220 V supply.

3 **Power inlet** — AC power input. Check that the fuse position matches the supply voltage before power-on.

4 **Trans Scanner** — controls the transformer scan box (TH1901 / TH1831); different scan boxes need different connection cables.

5 **Ground terminal** — connected to the instrument chassis; for protective or shield ground connections.

6 **LAN** — network communication and control (10/100BaseT).

7 **Device (USB Device)** — communication with a PC.

8 **Trans Handler** — HANDLER interface of the transformer scan: sorting output (§11.2).

9 **Trigger** — external trigger input, e.g. foot switch.

10 **Trans Controller** — HANDLER extension interface of the transformer scan, for additional sorting signals (§11.2).

11 **LCR Handler** — HANDLER interface for single-group transformer testing (and bridge sorting) (§11.1).

12 **RS-232C (AX/BX) / scan-board bank (NX)** — AX/BX: serial communication with a computer. NX: scanning-cable interface bank, FRC-50P sockets.

13 **RS-232C (TH2840NX)** — serial communication with a computer.

> NOTE
> Each internal scan board of TH2840NX has two FRC-50P sockets; with six boards installed the bank provides twelve sockets (A–L), 288 test pins in total.

3.3 Display zone

The 10.1-inch capacitive touchscreen is divided into the following areas: title area, test-condition area, parameter result area, sorting-result area, menu (soft-key) area and status bar. Fields can be selected by touch, by the knob or by the cursor keys.

3.4 Main menu keys and pages

The pages available depend on the active function, selected with the [Home] key.

Key	Transformer single-group test	Transformer scan
[Display]	Single Display · Save	Trans Scan display with soft keys Pri., Load Std, Deviation, Speed, Test Fail, Focus, Split, Save
[Setup]	Single Setup · User Corr · Handler	Trans ID · Pin To Fixture · Pin Setup · Condition · Copy · Handler Mode · Stat · Tools
[System]	System Setup (and system information pages)	System Setup (and system information pages)

3.5 Basic operation

- Select a page with the menu keys ([Display], [Setup], [System]) and the soft keys.
- Move the cursor with the cursor keys, the knob, or by touching a field. The selected field is highlighted; the soft keys for that field appear in the soft-key area on the right.
- Enter numbers with the numeric keys, then press a magnitude key or [Enter] to finish. Use [←] to correct and [Esc] to cancel.
- In transformer scan setup, pin lists accept the separator key and the range key [~]; see §7.1.2.

3.6 Selecting the function with [Home]

Press [Home] to open the function selection page. Select the single-group function for the transformer single-group test (Chapter 4) or the scan function for automatic transformer scanning (Chapters 5–8). On instruments fitted with the optional TH2840X-LCR module the LCR bridge function can be selected here as well; its operation is described in the TH2840 Series Operation Manual.

CHAPTER 4

Transformer Single-Group Test

4.1 Principle of the transformer single-group test

In single-group mode the instrument measures one transformer (one primary and one secondary winding) connected directly to the UNKNOWN terminals (HCUR, HPOT, LPOT, LCUR) and, for turns-ratio measurement, to the TURNS (+) and (–) terminals. Up to 12 parameters can be set up and measured per trigger.

4.1.1 Transformer parameters

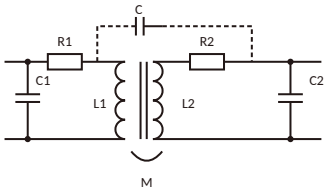

Figure 4-1 Equivalent circuit of a transformer

The equivalent circuit of a transformer comprises the winding resistances R1 and R2, the winding inductances L1 and L2 with their mutual inductance M, the shunt capacitances C1 and C2, and the interwinding capacitance C. The single-group test measures these quantities as the parameters listed in §4.2.7.

4.1.2 Turns-ratio (TURN) test

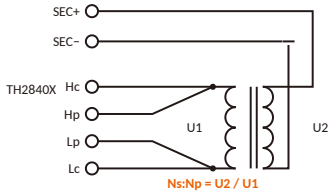

Figure 4-2 Connection for single-group TURN test

The instrument measures the primary voltage U1 and the secondary voltage U2 automatically. The primary and secondary turns Np and Ns are entered in advance on the *Single Setup* page. The TURN result can be displayed in four modes:

Mode	Result
Ns:Np	= U2 / U1
Np:Ns	= U1 / U2
Ns	= Np × U2 / U1
Np	= Ns × U1 / U2

It is recommended to assign the winding with the larger number of turns to the primary side. Because of the output impedance (30 Ω / 100 Ω), a small primary inductance takes only a small part of the signal voltage, the transformer receives little energy, and cable and relay attenuation then degrade stability and accuracy; increasing the primary signal instead can drive a multi-turn secondary beyond the acceptable voltage range. With the multi-turn winding on the primary side the transformer receives more energy and both problems are avoided.

4.1.3 Leakage inductance (Lk) test

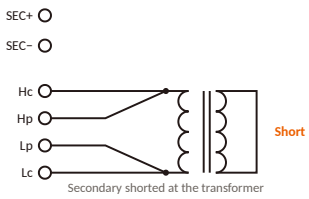

Figure 4-3 Leakage inductance test connection

When the leakage inductance of the primary inductance L1 is tested, the instrument shorts the secondary winding automatically with an internal relay. The path from the transformer secondary to the internal relay inevitably contains some magnetic leakage, so the result includes a small error. To obtain an accurate leakage value, short the secondary winding directly at the transformer as shown.

4.1.4 Interwinding capacitance test

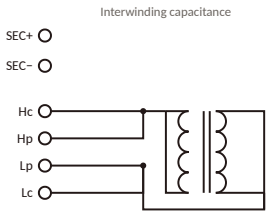

Figure 4-4 Connection for interwinding capacitance test

To measure the capacitance between the primary and secondary windings, short both ends of each winding, connect the primary to the high terminals (HCUR / HPOT) and the secondary to the low terminals (LPOT / LCUR) as shown.

4.2 Single Setup page

Press [Home] and select the single-group function, then press [Setup] to open the *Single Setup* page. This page sets the transformer measurement parameters.



Figure 4-5 Single Setup page

4.2.1 Trigger

Continue: the instrument measures continuously. **Single**: a measurement is made each time the [Trigger] key is pressed, a trigger pulse is received on the HANDLER or TRIGGER interface (for example from a foot switch), or a bus trigger command is received. A trigger received while a measurement is running is ignored.

4.2.2 Speed

Select **Fast+**, **Fast**, **Med** or **Slow**. Slower speeds give more stable and accurate results (see §10.1 for the measurement times). Fast+, Fast and Medium slow down at test frequencies below 10 kHz.

4.2.3 Test Mode

- **Seq**: one trigger measures all enabled parameters in sequence.
- **Step**: one trigger measures one parameter; each further trigger measures the next parameter.

4.2.4 Rsou — source (output) impedance

Select **100 Ω** or **30 Ω**. For inductance comparisons with other testers use the same source impedance on both. For magnetic cores with very high permeability, 100 Ω reduces core polarization and can improve accuracy and stability.

4.2.5 Bias Source

Select **100mA(40V)** or **2A**. The 100 mA source outputs up to 40 V in voltage mode and up to 100 mA in current mode; the 2 A source is a constant-current source of up to 2 A. This field only selects the source; the bias value itself is set in the *Other* column of the parameter row (§4.2.7), and is applied when [DC Bias] is lit.

4.2.6 Comp — comparison

OFF: no sorting result is produced; the PASS/FAIL LEDs are off, the comparison column shows “---” and the HANDLER sorting lines are inactive. **ON**: results are compared with the limits; the PASS or FAIL LED lights, the comparison column shows “pass” or “fail” and the HANDLER sorting lines output the result (see §11.1).

4.2.7 Parameter setup

The parameter area has 12 rows and 11 columns. Each row is one parameter, so up to 12 parameters can be measured per trigger. Each column is a setting of that parameter:

Column	Function
Parameter	Selects the parameter measured in this row (list below).
Freq(Hz)	Measurement frequency of the row. Empty for Rd, which is a DC measurement.
Level(V)	Measurement level of the row.
Other	Items specific to some parameters, e.g. DC bias.
Dev	Deviation mode: read-only, absolute deviation (Δ) or percentage deviation (Δ%).
Nominal / Low / High	Nominal value and lower / upper limits used for sorting.
Delay	Delay added before the measurement of this row.
Avg	Number of measurements averaged; more averaging increases stability.
Meas	ON: the row is measured; OFF: the row is skipped.

The 17 selectable parameters are Ls, Lp, Lk, Cs, Cp, Zx, Rs, Rp, Rd, D, Q, dZ, Ns, Ns:Np, Np, Np:Ns and M. Move the cursor to the Parameter column of a row and select from the soft keys; *Move Up* and *Move Down* change the row order and *Help* opens the built-in help.

Parameter	Meaning
Ls / Lp	Equivalent series / parallel inductance
Lk	Leakage inductance
Cs / Cp	Equivalent series / parallel capacitance
Zx	Absolute value of impedance
Rs / Rp	Equivalent series / parallel resistance
Rd	DC resistance
D	Loss factor
Q	Quality factor
dZ	Impedance angle
Ns	Secondary turns
Ns:Np	Secondary turns / primary turns
Np	Primary turns
Np:Ns	Primary turns / secondary turns
M	Mutual inductance

Frequency and level ranges are those of the instrument: 20 Hz – 500 kHz (TH2840AX, TH2840NX) or 20 Hz – 2 MHz (TH2840BX); 5 mV – 20 V (see §10.1 for the level range at high frequency).

4.3 Single Display page

Press **Display** to open the *Single Display* page. Each row shows the parameter, frequency, level, measurement value and comparison result. The soft keys offer *Settings* (jump to *Single Setup*) and *Save*.



Figure 4-6 Single Display page

4.3.1 Saving results to a USB flash drive

Press *Save* to write the results to a USB flash drive (CSV). Columns: `Time`, `pt` (point index), `para` (parameter name), `val` (result), `COMP` (comparison result). Default path: `usb/CSV/`. File name: `trt-<serial number>-<date>.csv`, for example `trt-SN12345678-20210811.csv`.

CHAPTER 5

Transformer Scan System

5.1 Introduction to the scan function

The transformer scan function tests transformers automatically across many pins. TH2840NX can use its internal scan board(s) or an external scan box; TH2840AX and TH2840BX have no internal scan board and use an external scan box (TH1901 series, TH1831).

Test items available in the automatic scan test: turns ratio (TURN), phase (PHASING), inductance (Lx), quality factor (Q), leakage inductance (Lk), stray capacitance (Cx) with loss (D), impedance (Zx), AC resistance (ACR), DC resistance (DCR), balance (BAL), pin short-circuit test (PS) and current bias (DCI-BIAS).

Further functions of the scan system:

- automatic conversion between transformer pins and fixture pins (Pin To Fixture), with custom pin labels;
- automatic repeat testing at a set rescan interval, multi-group primary windings and multi-group leakage-inductance tests;
- deviation compensation of test values using a standard transformer, and PASS/FAIL statistics;
- saving and loading of test setups (*.t40 files) and repeated testing of FAIL products;
- testing several transformers at the same time (Split display).

5.2 System configurations

Model	Scan hardware	Pins
TH2840AX / TH2840BX	External scan box: TH1901B (manual clamp, standard) or TH1901A (pneumatic clamp), connected with the TH26016 scan control cable; TH1831 also supported	20 PIN
TH2840NX	Internal scan board(s) on the rear panel, or an external scan box (TH1901 series, TH1831)	48–288 PIN (internal), 20 PIN (TH1901)

NOTE

The scan box in use must be selected in the *Scan Box Mode* field of the *Trans ID* page (§6.1.11); for a TH1901 scan box select *TH1806*, the firmware label of this setting. An incorrect selection prevents the instrument from obtaining correct test results.

5.3 Installing and connecting the scan test system



Figure 5-1 Scan box connected to the rear panel

1. With all equipment switched off, connect the **SCANNER** connector on the rear panel of the scan box to the **Trans Scanner** connector on the rear panel of the instrument with the 36-pin double-headed cable (TH26016 transformer test control cable).
2. To use a foot switch, connect it to the **FOOT.C** connector on the rear panel of the scan box. Once a foot switch is used, the START button on the fixture no longer works.
3. For TH1901A, connect the air hose to the valve controller (§5.4).
4. Connect the TH1901L 6-terminal scan box to the corresponding terminals on the front panel of the instrument and lock the connectors.

WARNING

Do not plug or unplug the control cable while the equipment is powered. Route the cable in the correct direction.

5.4 TH1901 scan fixtures



Figure 5-2 TH1901A pneumatic scan fixture

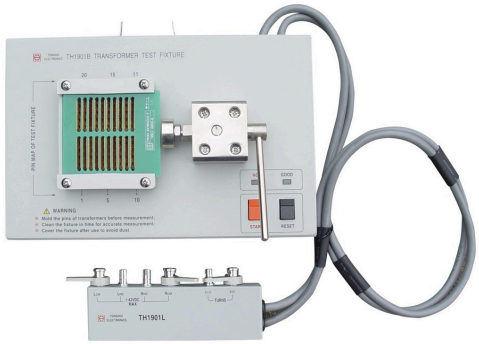

Figure 5-3 TH1901B manual scan fixture with TH1901L 6-terminal box

	TH1901B	TH1901A
Clamp	Manual lever clamp (default configuration)	Pneumatic auto-clamp with START/RESET buttons and NG/GOOD indicators
Air supply	Not required	External compressed-air source required
Typical use	Bench use, engineering and incoming inspection	Production-line integration with repeatable clamping force
Pins	20 PIN	20 PIN

The transformer-contact fixture head of TH1901A and TH1901B can be custom-machined to match a specific transformer footprint; supply mechanical drawings of the DUT and pin layout when ordering a custom head. TH1901B is supplied as standard with TH2840AX and TH2840BX; TH1901A is optional.

5.5 Top panel of the scan fixture

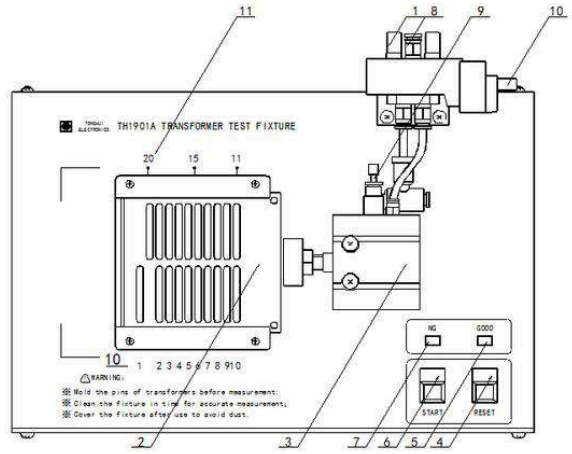

Figure 5-4 TH1901A top panel

1 **Silencer** — noise reduction and dust protection (TH1901A only).

2 **Test fixture** — flexible, replaceable fixture head.

3 **Cylinder** — drives the clamp on TH1901A; on TH1901B/TH1831 a manual push rod is used.

4 **RESET button** — terminates all tests and returns to the ready state.

5 **GOOD indicator** — lights when the result meets the preset requirements.

6 **START button** — starts the test.

7 **NG indicator** — lights when one or more results fail.

8 **Air inlet** — connection for the external air hose (TH1901A only). A water-filtering device between the inlet and the inlet valve is recommended.

9 **Speed control knob** — adjusts the cylinder speed (TH1901A only).

10 **Valve-controller socket** — 24 V DC control of the solenoid valve (TH1901A only).

11 **Fixture pin numbers** — pin numbers 1–20 of the fixture.

5.6 Rear panel of the scan box

Connector	Function
TEST LINE	Inlet for the test cable. The TH1901L 6-terminal box is connected to the inside of TH1901A/B through this line.
CYLINDER	24 V DC output supplying the TH1901A solenoid valve.
FOOT.C	Foot-switch connection.
SCANNER	Signal control port; connect to the instrument with the TH26016 control cable.
HANDLER	Scan-box HANDLER port (§5.7, §11.2).

> **NOTE**
> A hole in the left panel of TH1901A/B gives access to an internal potentiometer that adjusts the beep volume.

5.7 Scan-box HANDLER

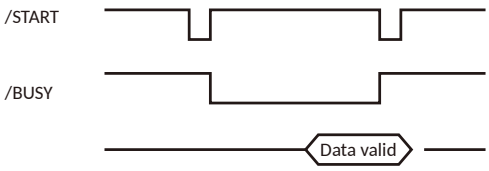

Figure 5-5 /START and /BUSY timing (schematic)

The scan-box HANDLER connector carries the supply (VCC, GND), the sorting lines N1–N9, the result lines GO and NG, and the control lines S (START) and R (RESET). A START pulse starts a scan; /BUSY is active during the scan and the sorting data are valid after the scan has ended. Pin assignment and electrical data of the corresponding instrument interface are given in §11.2.

5.8 Example transformer used in this manual

The setup screens in Chapters 6 and 7 are based on the sample transformer **THB1001**: two primary windings (Np1, Np2) and five secondary windings (Ns1–Ns5).

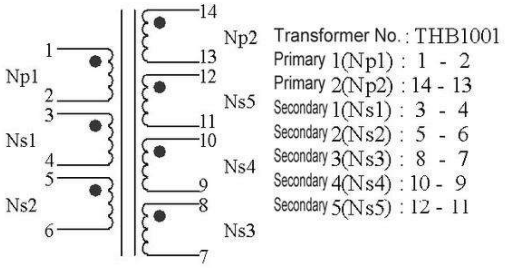

Figure 5-6 Sample transformer THB1001

Winding	Pins
Primary 1 (Np1)	1 – 2
Primary 2 (Np2)	14 – 13
Secondary 1 (Ns1)	3 – 4
Secondary 2 (Ns2)	5 – 6
Secondary 3 (Ns3)	8 – 7
Secondary 4 (Ns4)	10 – 9
Secondary 5 (Ns5)	12 – 11

5.9 Clear Settings

Before entering the test conditions of a new transformer ID, clear the instrument memory of unpredictable data so that earlier settings cannot cause errors in the new setup. On any transformer scan page press **Preset** on the left of the front panel and select **Clear Settings**. Restarting the instrument also resets the transformer setting parameters.

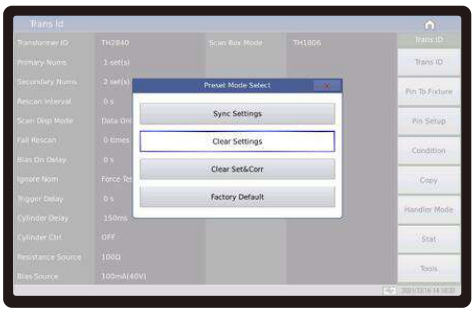

Figure 5-7 Preset mode selection on the Trans ID page

CHAPTER 6

Scan Setup: Trans ID, Pins and Fixture

6.1 Trans ID page

With the scan function active, press Setup to open the *Trans ID* page. It holds the general settings of the transformer under test and of the scan system. The soft keys on the right lead to the other setup pages: *Pin To Fixture*, *Pin Setup*, *Condition*, *Copy*, *Handler Mode*, *Stat* and *Tools*.



Figure 6-1 Trans ID page

6.1.1 Transformer ID

Enter the ID of the transformer to be tested: select the field, press *Input*, choose characters on the soft keyboard, then press Enter to apply or Esc to cancel.

6.1.2 Primary Nums

Number of primary winding groups, 1 to 60. Transformers with several cores can use several primaries.

6.1.3 Secondary Nums

Number of secondary winding groups, 1 to 9.

6.1.4 Rescan Interval

Interval for automatic continuous testing, 0 to 60 s. 0 means no automatic continuous test.

6.1.5 Scan Disp Mode

Selects how results are displayed during and after the scan:

Mode	Display
Data only	Test data of each parameter is shown as the scan proceeds; no large PASS/FAIL indication.
Judgement result	Test data is shown as the scan proceeds; the overall PASS/FAIL is shown in large characters when the scan is finished.
Fail list	Test data is shown as the scan proceeds; when finished, the failed parameters and their limits are listed in the centre of the screen.

6.1.6 Fail Rescan

Number of automatic retests of a failed product, 0 to 9. Retesting prevents a single parameter that failed because of interference from rejecting a good product.

6.1.7 Bias On Delay

Delay applied when a DC bias current is applied during the test, 0 to 60 s. 0 means no delay.

6.1.8 Ignore Nom

Combines two functions that both relate to the nominal value:

Option	Behaviour
FORCE DEV	Deviation deduction is not restricted by the nominal value (STD): a deviation can be deducted even when the test value differs greatly from the nominal value, for example when the wrong pin of the transformer was inserted.
FORCE TEST	A parameter is measured as soon as the winding pins are set, even without a nominal value. Convenient for observing a transformer sample whose nominal values are unknown; generally not used in production.
SKIP TEST LMTED DEV	A parameter whose winding pins are set but whose nominal value is not set is not measured. Deviation deduction is limited by the nominal value: it does not succeed when the test value differs greatly from the nominal value.

6.1.9 Trigger Delay

Delay from the trigger to the start of the scan measurement, 0 to 60 s. 0 means no delay.

6.1.10 Cylinder Ctrl

Option	Behaviour
ON	The 24 V cylinder power output is allowed during scanning.
OFF	The 24 V cylinder power output is inhibited during scanning.
FAIL HOLD	The test stops when a failed product is found.
FAIL LOCK	The test stops when a failed product is found and the system is locked.

6.1.11 Scan Box Mode

Selects the scan hardware used by the scan test. This must match the hardware actually used; an inconsistent selection prevents correct results.

Option	Hardware
Internal	Internal scan board of the instrument (TH2840NX only).
TH1831	TH1831 scan box.
TH1806	Select this setting when a **TH1901** scan box (TH1901A or TH1901B) is used. The firmware still labels this option “TH1806”.

6.1.12 Resistance Source

Output (source) resistance **100 Ω** or **30 Ω**. For inductance measurements that are compared with other testers, use the same output resistance on both. For magnetic cores of very high permeability, 100 Ω reduces core polarization and can improve accuracy and stability. When bias current output is used the default is 100 Ω.

6.1.13 Bias Source

Selects the DC bias source for the scan: **100mA(40V)** (DC bias current 0–100 mA) or **2A** (DC bias current 0–2 A).

> NOTE
> When the DC bias source is enabled, only the 100 Ω output resistance can be used.

6.2 Pin To Fixture page

On the *Trans ID* page press *Pin To Fixture*. This page connects the pins of the transformer to the pins of the test fixture and converts pin numbers into custom pin labels. Each tab (A+B, C+D … K+L) shows two FRC connectors of one scan board with their 24 pins each (TH2840NX).

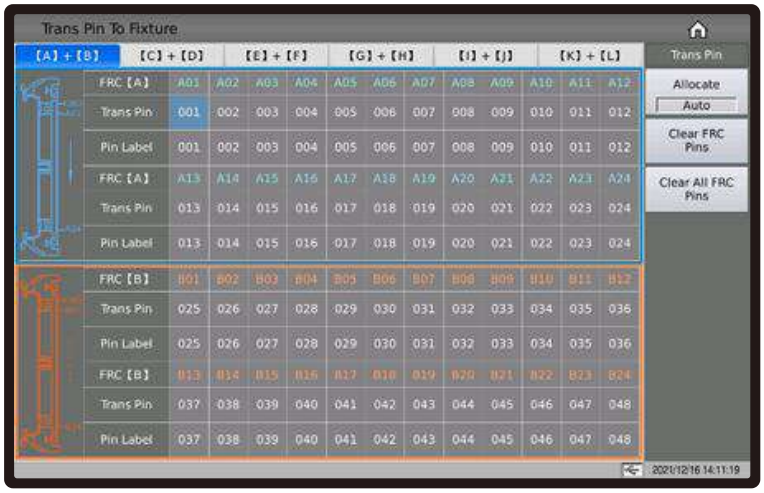

Figure 6-2 Pin To Fixture page

6.2.1 Pin To Fixture setup

By default transformer pins correspond one-to-one to fixture pins. With the internal scan board, connecting the transformer pins one-to-one to the fixture pins on the rear panel is enough; with an external scan box, connect according to the pin numbers 1–20 marked on the box. In that case the manual setup below can be skipped.

1. Select any transformer-pin cell in the table; the related functions appear in the soft-key area.
2. Press *Clear All FRC Pins* to clear the default assignment.
3. Press *Allocate* and change the option from **Auto** to **Manual**.
4. Move the cursor to the fixture-pin position and enter the corresponding transformer pin. Enter 0 to clear an entry.

With *Allocate* set to **Auto**, entering a first number automatically increments the number by one for each following input cell up to the last transformer pin.

6.2.2 Pin Label setup

Pin labels convert transformer pins that are normally shown as numbers into custom numbers or letters. Select the *Pin Label* row of a pin and press *Input* to enter the label. After the labels and test conditions are set, the custom labels appear in the PIN column of the transformer test pages.

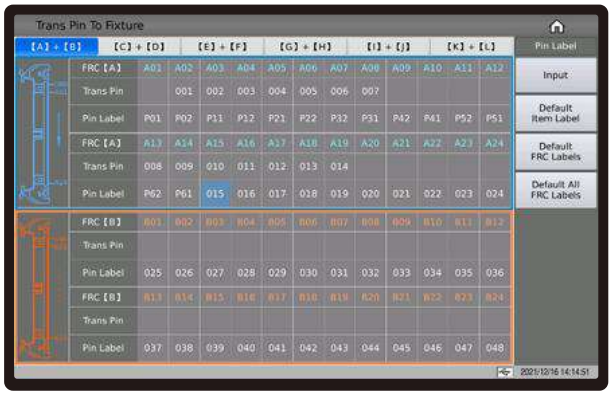

Figure 6-3 Pin Label setup

6.3 Pin Setup page

On the *Trans ID* page press *Pin Setup* to open the *Trans Pin* page. It defines the pins of each winding of the transformer and the series and parallel pin connections. The examples use the sample transformer THB1001 (§5.8).

6.3.1 Winding pins

Each row is a winding: PRI. and SEC. 1 to 9. Use the *PRI.* soft key to select the primary page: page **A1** is set for primary winding Np1, page **A2** for Np2. *Clear Trans Pins* clears the winding pins; *Clear Page* clears the page.

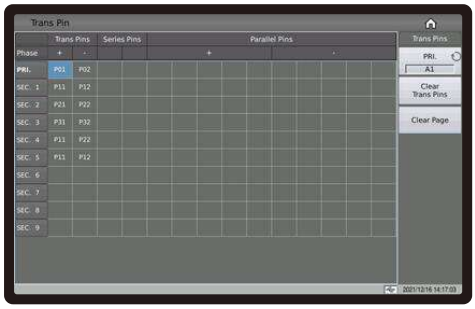

Figure 6-4 Trans Pin page, PRI. A1 (Np1)



Figure 6-5 Trans Pin page, PRI. A2 (Np2)

6.3.2 Series pins

Before setting series pins, decide which parameter is tested with the series connection. For example, for Lx select *Lx* with the *Para* soft key, then enter the series pins (the order of the pins is not significant). Series pins are set per parameter; the figures show the short-circuit pin setting when the secondaries Ns1 and Ns2 are connected in series for the Lx test and for the TURN test.

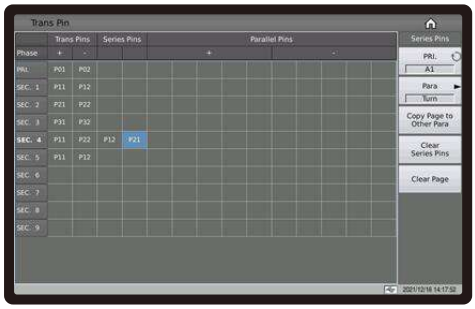

Figure 6-6 Series pins for Lx



Figure 6-7 Series pins for TURN

6.3.3 Parallel pins

Before setting parallel pins, decide which parameter is tested with the parallel connection. For example, for TURN select *Turn* with the *Para* soft key, then enter the parallel pins. The figure shows the pin setup of the “+” and “−” terminals when the secondaries Ns1 and Ns2 are connected in parallel for the TURN test.



Figure 6-8 Parallel pins for TURN

CHAPTER 7

Transformer Scan Test Conditions

7.1 Trans Condition page

On the *Trans ID* page press *Condition*. The page contains two tables. The upper table is the **parameter test-condition table**: it sets which parameters are measured and their test conditions. The lower table is the **limit table** of the parameter selected in the upper table: it sets nominal values, upper and lower limits, pins and further conditions used for sorting.

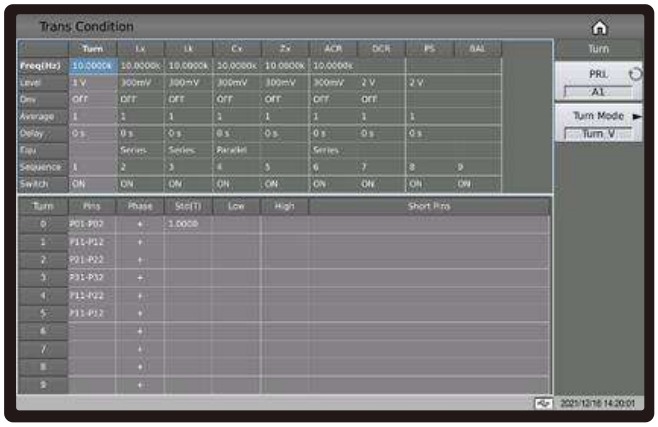

Figure 7-1 Trans Condition page (Turn selected)

Parameters that can be measured: **Turn** (turns ratio), **Phase**, **Lx** (inductance), **Q**, **Lk** (leakage inductance), **Cx** (capacitance between windings), **D** (loss), **Zx** (impedance), **ACR** (AC resistance), **DCR** (DC resistance), **PS** (pin short-circuit detection) and **BAL** (balance).

7.1.1 Settings common to all parameters

Setting	Description
Freq(Hz)	Test frequency: 20 Hz – 500 kHz (TH2840AX, TH2840NX) or 20 Hz – 2 MHz (TH2840BX).
Level	Test level, 5 mV – 20 V.
Dev	Sorting method: **OFF** compares the result directly with the upper and lower limits; **Δ%** divides the difference between the test value and the nominal value by the nominal value and compares that with the limits.
Average	Number of measurements averaged, 1 – 255. Also adjusts the test speed of a single parameter.
Delay	Delay between the trigger and the measurement, 0 – 60 s. Improves stability and accuracy.
Equ	Equivalent circuit: series or parallel.
Sequence	Scan order of the parameters. The default is 1–9 from left to right; enter 1–8 to change the order. BAL is fixed as the last item (9).
Switch	ON: the parameter is measured; OFF: the parameter is not measured.

7.1.2 Entering pin lists

Pin fields accept single pins, ranges and combinations. Use the separator soft key (**.**) between single pins and the [~] key for a continuous range, then press [Enter].

Input	Displayed
1 . 3 . 5 . 7 . 9	1, 3, 5, 7, 9
1 ~ 9	1~9
1 ~ 5 . 7 . 9	1~5, 7, 9

Pin list	Maximum number of pins
TURN short pins	48
Lk short pins	48
Cx pins and short pins	24
PS positive and negative pins	12

Pins beyond the maximum are ignored.

7.2 TURN test conditions

Touch the Turn column of the condition table to set the TURN parameters.

7.2.1 Turn Mode

Touch the TURN setting area; the right-hand menu offers eight modes:

Mode	Result
TURN_V	= primary standard value × secondary voltage / primary voltage. Used to test the number of turns.
TURN	= primary standard value × secondary turns / primary turns. More accurate for a small primary inductance; with high-permeability cores the data can be unstable because the core is polarized.
VOLT	= primary test voltage × secondary voltage / primary voltage
Vs:Vp	= secondary voltage / primary voltage
Ns:Np	= secondary turns / primary turns
TURN_L	Inductance-ratio mode
Np:Ns	= primary turns / secondary turns
Lp:Ls	= primary inductance / secondary inductance

Assign the winding with more turns to the primary side (see §4.1.2).

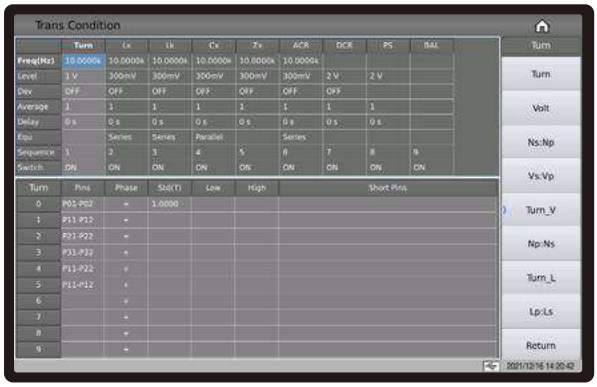

Figure 7-2 Turn Mode selection

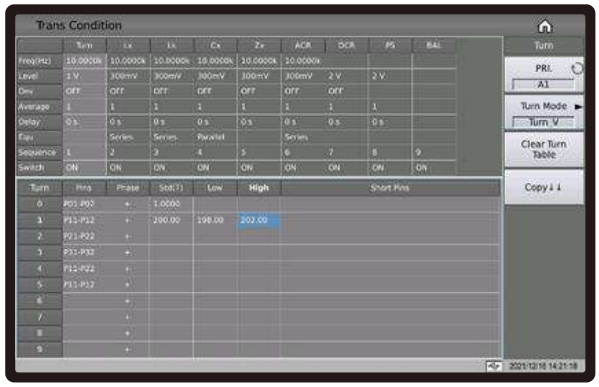

Figure 7-3 Turn limit table

7.2.2 Turn limits

The turns-ratio limit table sets the nominal value, upper and lower limits, phase and short pins of each winding. Magnitudes: M, k, μ, m; Enter = ×1.

7.2.3 Turn phase

For each secondary winding the phase can be set for sorting: “+” means the same direction as the primary, “−” the reverse direction. The primary winding is the reference phase and cannot be changed. A secondary whose measured phase differs from the set phase is judged unqualified. The default setting is opposite to the primary phase, so a winding in phase with the primary fails until its phase is set to “+”.

7.2.4 Turn-ratio short pins

Pins to be shorted during the turns-ratio test are entered as a pin list (§7.1.2; maximum 48 pins).

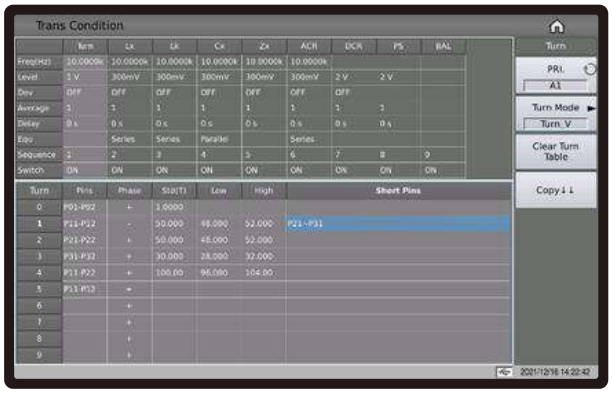

Figure 7-4 Turn short pins

7.3 Lx test conditions

The Lx limit table sets, for each transformer winding, the Lx standard value (**Std**), upper and lower limits, bias, multi-frequency, multi-level, and the Q standard value and Q limits. Magnitudes: p, n, µ, m; [Enter] = ×1.



Figure 7-5 Lx limit table

7.3.1 DC bias on Lx

The built-in bias source (100 mA or 2 A, selected as *Bias Source* on the *Trans ID* page) can be applied to a winding by entering the bias current in the *Bias* column. For compatibility of stored files the value can be set up to 2 A. During scanning the instrument applies the bias automatically and lights the [DC Bias] key.

7.3.2 Multi-frequency and multi-level

To test different windings at different frequencies or levels, enter a value in the *Freq* or *Level* column of that winding. If left empty, the frequency or level of Lx in the condition table is used.

7.3.3 Q limits

Set *Q-STD*, *Q-Low* and *Q-High* in the Lx limit table. The Q test switch is the Lx switch.

7.4 Lk test conditions

The Lk limit table sets the Lk standard value, upper and lower limits, multi-frequency, multi-level and the short pins of each winding. Magnitudes: p, n, µ, m; [Enter] = ×1.



Figure 7-6 Lk limit table

Frequency and level can be set per winding as for Lx. Pins that must be shorted during the leakage-inductance test are entered as a pin list in *Short Pins* (§7.1.2; maximum 48 pins).

7.5 Cx test conditions

The Cx limit table sets the positive and negative pins (*Pins(+)*, *Pins(−)*), short pins, standard value, limits, multi-frequency, multi-level and the D limits. In the example the capacitance between the two primary windings Np1 and Np2 is tested. The table is wider than the screen: move the cursor left/right or swipe the table to see all columns. Magnitudes: p, n, µ, m; Enter = ×1.

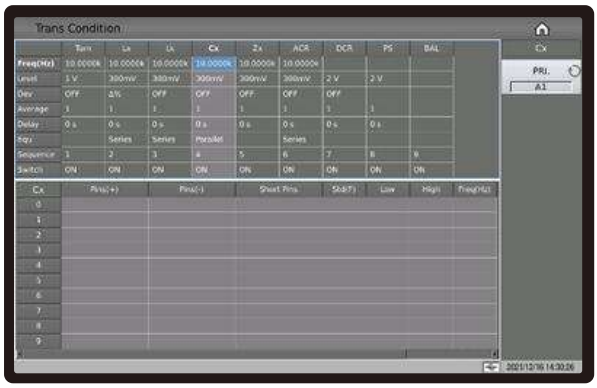

Figure 7-7 Cx condition

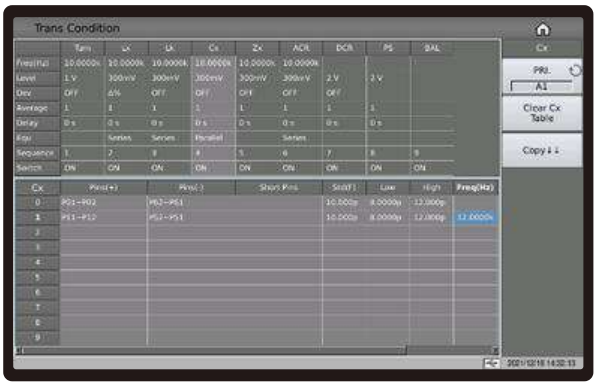

Figure 7-8 Cx limit table

Pins and short pins. Pin lists follow §7.1.2; at most 24 Cx and short pins are stored. **Multi-frequency / multi-level:** enter a value in the *Freq* or *Level* column of a row; otherwise the Cx values of the condition table are used. **D limits:** set *D-Std*, *D-Low* and *D-High*; the D test switch is the Cx switch.

7.6 Zx test conditions

The Zx limit table sets the Zx standard value, upper and lower limits, bias, multi-frequency and multi-level. Magnitudes: M, k, µ, m; Enter = ×1. A DC bias current from the built-in 100 mA or 2 A source can be applied as for Lx (value up to 2 A for file compatibility).

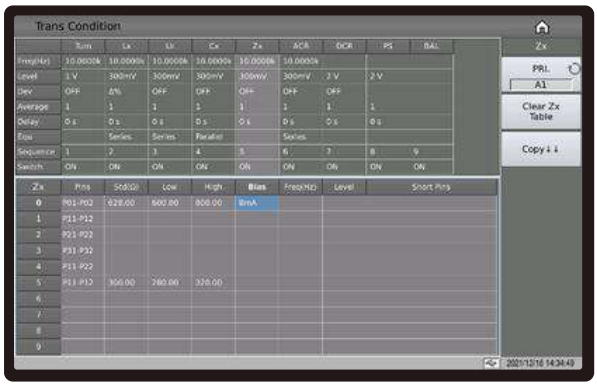

Figure 7-9 Zx limit table with bias



Figure 7-10 Zx multi-frequency

7.7 ACR test conditions

The ACR limit table sets the standard value, upper and lower limits, multi-frequency and multi-level of the AC resistance. Magnitudes: M, k, µ, m; Enter = ×1. Per-winding frequency and level are entered as for Lx.



Figure 7-11 ACR limit table

7.8 DCR test conditions

The DCR limit table sets the standard value and the upper and lower limits of the DC resistance. Magnitudes: M, k, µ, m; Enter = ×1.



Figure 7-12 DCR limit table

7.9 PS (pin short-circuit) test conditions

The PS limit table sets the positive and negative pins and the upper and lower limits. During the scan the instrument tests the DCR between the set pins and compares it with the PS lower limit. The default lower limit is 10 kΩ; normally no upper limit needs to be set. Pin lists follow §7.1.2 (maximum 12 pins). Magnitudes: M, k, µ, m; Enter = ×1.



Figure 7-13 PS limit table

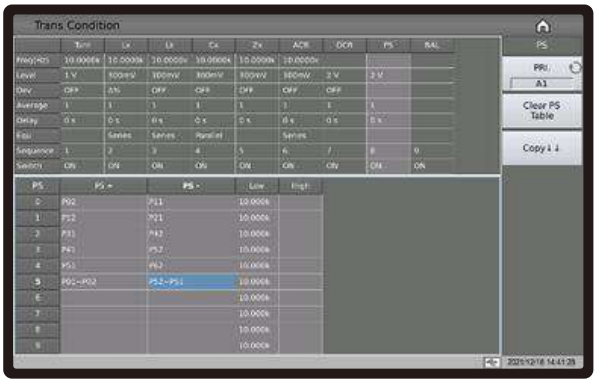

Figure 7-14 PS pin setup

7.10 BAL (balance) test conditions

BAL compares the consistency of two windings. The table sets the balance windings (B1, B2), the absolute-value switch, the balance formula, and the standard value and limits. The table has ten rows. Magnitudes: p, n, μ, m; Enter = ×1.

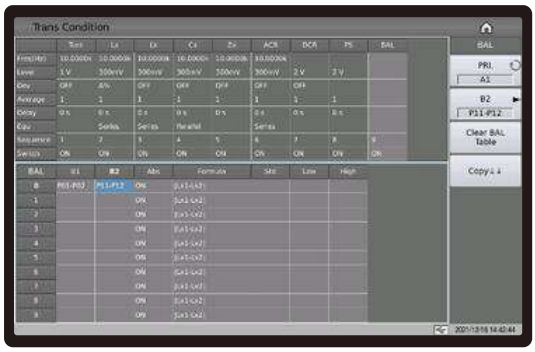

Figure 7-15 BAL table

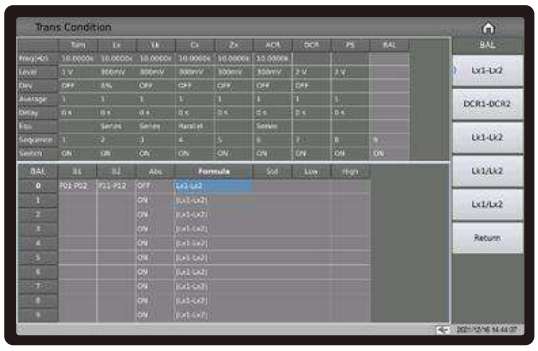

Figure 7-16 BAL formula selection

Absolute value. With the switch **ON** a formula such as Lx1−Lx2 becomes |Lx1−Lx2| and its absolute value is compared with the limits; with **OFF** the signed result is compared directly and can be positive or negative.

Formula. Five formulas are available: `Lx1−Lx2`, `DCR1−DCR2`, `Lk1−Lk2`, `Lk1/Lk2` and `Lx1/Lx2`. The absolute-value switch affects the final result of the formula.

7.11 Handler Mode

After a scan the HANDLER outputs the sorting signals according to the selected mode (*Setup → Handler Mode*). The page also shows the pin definition of the selected mode.

Mode	Output of the unqualified signals
Default	According to the parameters shown in the signal column of the table.
X30	Per group of two pages of the table.
X12	Per group of five pages of the table.



Figure 7-17 Handler Mode page

7.12 Copy

After the settings of transformer board A (Pin To Fixture, transformer pins, test conditions) are complete, the *Copy* function copies them to boards B to L, saving the time of setting each board separately.

7.13 Statistics page

Press *Stat* on a transformer scan setup page to open the *Trans Stat* page.

- **Pass** / **Fail**: number of passes / fails of each parameter (L.K. to DCR).
- **Whole**: counts a pass when every enabled parameter passed in one measurement, and a fail when one or more parameters failed.
- **SUM**: total number of measurements of a parameter; the SUM of the Whole row equals the total number of passes plus fails.

Touch the statistics table and press *Reset Count* to reset all counts to zero.

CHAPTER 8

Transformer Scan Operation

8.1 Trans Scan page

When all settings are complete, press **Display** to open the *Trans Scan* page. Before starting, press **File** and save the setup so that it can be recalled after the next power-up (§8.10).

- With the **internal scan board** (TH2840NX), press **Trigger** on the front panel to start the test.
- With a **scan box**, make sure the instrument and scan box are installed and connected correctly (§5.3), place the transformer in the test fixture and press the **START** button on the scan box (or the foot switch).

Test values are shown on screen; a failed value is shown in red. The instrument shows the scan data and the overall PASS/FAIL according to the *Scan Disp Mode* set on the *Trans ID* page. If a winding of Lx or Zx is set with a DC bias current, the instrument applies the bias automatically and lights the **DC Bias** key.



Figure 8-1 Trans Scan page

Display zones. PIN area: the left columns show the pins of each winding (the pins of Cx are not shown there; see §8.5). **Result areas:** the results of the enabled parameters (TURN, Lx, Q, Lk, Cx, D, Zx, ACR, DCR, PS, BAL). When all parameters are enabled, press the left/right cursor keys or slide the table to see the columns that do not fit on the screen.

8.2 Keys and soft keys on the Trans Scan page

Key	Function
Trigger	Starts a scan test.
Reset	Interrupts a scan in progress; the next trigger starts from the beginning.
Lock	Locks the keyboard. Scan tests can still be run, but parameters cannot be modified, which prevents accidental changes or deletion of the test conditions. If the instrument is switched off while locked, the current test file is called automatically at the next power-up.
File	Opens file management (§8.10).
Cal	Opens the scan correction (open / short), §8.3.

Soft key	Function
Pri.	Selects the primary-winding page (§8.4).
Deviation	Opens the deviation-deduction page (§8.7).
Speed	Selects the test speed.
Test Fail	Continue: testing continues when a parameter fails. Stop: the test stops at the first failed parameter.
Focus	Focus scan of selected cells, parameters or pins (§8.8).
Split	Display split for testing several transformers at once (§8.9).
Save	ON/OFF switch for saving results.

8.3 Open and short correction of the scan fixture

Press **Cal** to open the scan-correction page. The corrections remove the influence of the fixture and cabling. After the corrections have been measured, turn on the corresponding switch (Open / Short) to use the correction data in the test.



Figure 8-2 Scan correction (Open / Short)

1. **Open correction.** Place an open-circuit transformer sample with the same pin positions as the product under test in the test fixture, then press *Meas Open*. The instrument performs an open-circuit scan correction of the fixture. This improves the accuracy for small interwinding capacitance and large inductance (>300 mH range) and the open-circuit values of DCR and PS. An open correction at high frequency improves accuracy at high frequency.
2. **Short correction.** Place a short-circuit transformer sample with the same pin positions in the fixture, then press *Meas Short*. This improves the accuracy for small DC resistance and small inductance.

8.4 Primary page turning

After testing a transformer with several primary windings, turn the knob on the *Trans Scan* page to switch the primary (PRI) page and view the results; untested pages are skipped. Press the knob to return to page A1.

8.5 Pin display for stray capacitance

After testing stray capacitance (Cx), press **Display** to show some of the pins of the current Cx measurement in the result cell (only the first of the positive and the negative pins is shown).

8.6 BAL balance display

After the scan has finished, press **Display** to switch the BAL column to show the result value between the two windings.

8.7 Deviation deduction

If a standard sample of the transformer is available whose data can serve as the measurement standard, the deviation-deduction function removes the systematic deviation between the test system and the standard.



Figure 8-3 Trans Scan page after deviation deduction

1. Set the parameters and open the *Trans Scan* page.
2. Place the standard transformer in the test fixture and lock it; press **START** on the scan box several times until the test value is stable.
3. Press *Deviation* to open the *Trans Deviation* page.
4. Set *Deviation* to **ON**.
5. Set the correction-parameter switch to **DIV** or **SUB**.
6. Set the upper and lower limits allowed for the deduction of each parameter.
7. Press *Deviation* to perform the correction; the display returns to the *Trans Scan* page.
8. After a successful deduction, a new trigger shows the same measured values as the standard product. The deviation values in use can be checked on the *Trans Deviation* page.

> **NOTE**
> A DIV value cannot be set to 0. To keep the deduction values for the next power-up, save the setup with the **File** key (§8.10).

8.8 Focus

Focus makes it easier to repeat a test on specified windings or parameters. On the *Trans Scan* page turn the *Focus* switch on, then:

- touch a **cell**: when its background turns blue it is selected; press **Trigger** to measure only that cell;
- touch a **parameter title**: only that parameter is scanned repeatedly;
- touch **Pin**: all data to be tested on that page are scanned.

8.9 Split

When there are few transformer test parameters and several transformers are to be tested at the same time, the *Split* function divides the display. The available splits are **2-1, 3-1, 4-1, 2-2, 3-2 and 4-2**; the default is 2-1. If the table does not show all parameters, touch it and slide left/right, or use the left/right soft keys.

8.10 File page of the transformer scan

Press [File] to open the file-management page. Transformer scan setups are stored as ***.t40** files, either in the internal memory (the number of files depends on the remaining internal storage) or on a USB flash drive. A *.t40 file contains the settings of the *Trans ID*, *Pin To Fixture*, *Pin Setup*, *Trans Condition*, *Trans Deviation* and *Handler Mode* pages and some menu functions of the *Trans Scan* page.

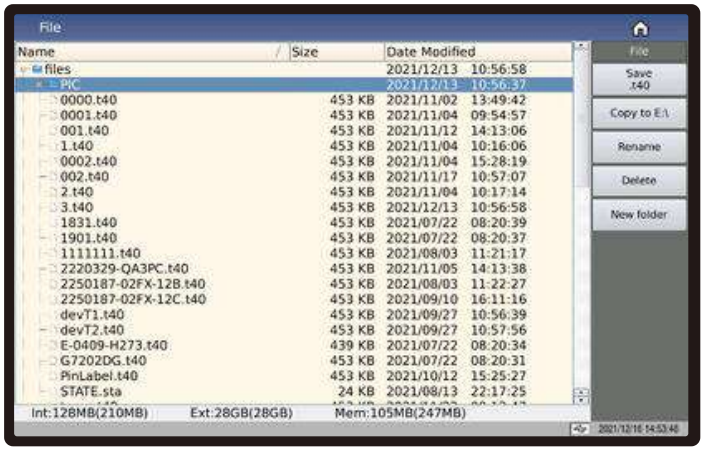

Figure 8-4 File page

8.10.1 USB flash drive requirements

USB 2.0 mass-storage device, capacity 2 / 4 / 8 / 16 / 32 GB, formatted FAT32 under Microsoft Windows. Only one flash drive can be inserted at a time.

8.10.2 Saving a setup

1. Set all control parameters on the pages you want to save.
2. Press [File]. When the cursor is on a file or folder the menu offers *Save.t40*, *Copy to E:*, *Rename*, *Delete* and *New folder*. Click the [+] before a folder (or touch the folder) to see the files in it.
3. Select *Save.t40*. A soft keyboard appears; enter a file name and press *OK* (the extension is added automatically) or [Esc] to cancel.
4. If the name already exists, the *File Existing* dialog offers *Overwrite*, *Rename* or *Cancel*.
5. Press *Display* to return to the transformer scan page.

8.10.3 Loading a setup

1. Press [File] and select the *.t40 file; the menu now also offers *Load*.
2. Press *Load*, then confirm with *Load* (or press *Cancel* to abort). The selected file is loaded and the *Trans Scan* page opens.

CHAPTER 9

System Setup & File Management

9.1 System Setup

Press System to open the *System Setup* page. Further system pages (*System Info*, *Message*, *System check*, *License*) are reached from the same key.

9.1.1 Mode Setup — Bus Mode

Selects the communication mode of the instrument.

Option	Description
AUTO	Selects RS232 / LAN / USB automatically according to the external signal input.
RS232	Serial interface.
LAN	Network interface.
USB Device	USB communication with a PC: USBCDC or USBTMC.

The list also offers *External 485* (RS-485 via a converter or modified interface) and *External GPIB*. GPIB is not one of the standard interfaces of the TH2840X series (§10.6). When RS-485 or GPIB is used, the bus address set under RS232 is used as the local address.

9.1.2 User Setup

Item	Options and description
Key Sound	OFF / ON — key-press sound.
Pass Sound	Sound when the comparison result is PASS: OFF, Two short, Low long, High short, High long.
Fail Sound	Sound when the comparison result is FAIL: OFF, Two short, Low long, High short, High long.
Password	OFF: password protection off. **Lock system**: file protection and power-on password. **Lock files**: password for file operations. **Lock settings**: restricts modification of setting files. **Change**: change the password — enter the new password, then repeat it when prompted. The factory password is **2840**.
Datetime	Move the cursor to the date/time field to set the system time.

9.1.3 RS232

Serial settings: 8 data bits, 1 stop bit, no parity.

Item	Description
Baudrate	4800, 9600, 19200, 38400, 57600 or 115200.
Address	Bus address for RS485, GPIB and MODBUS communication, 1 – 32.
Cmd mode	Command protocol: **SCPI** (general ASCII string commands) or **MODBUS**. Both protocols are standard.

9.1.4 LAN

Configure the address parameters according to the connected network and connect the network cable to the LAN port on the rear panel. To change an address, double-click the corresponding address field, enter the value on the numeric keypad and confirm with OK. If the network device (router or switch) supports automatic IP allocation, use the automatic-configuration button; this takes a few seconds and the instrument must not be operated meanwhile. If automatic configuration fails, the instrument may show the loopback address 127.0.0.1; press the default-setting button to restore the default configuration and adjust from there. Ask your network administrator for the address parameters. Default port number: **45454**. The host name generally corresponds to the instrument model.

9.1.5 Tools

Preset initializes the instrument to a known state. The Preset menu (also opened with the Preset key) offers:

Option	Restores to factory default	SCPI command
CLEAR SETTING	Parameters set from the front panel and by SCPI commands	`*RST`
CLEAR SET&CORR	Front-panel and SCPI parameters; power-off protection parameters; clears user correction data	`:SYST:PRES`
FACTORY DEFAULT	Front-panel and SCPI parameters; power-down protection data; user reset data; deletes files saved by the user	`:SYST:DEFT`

> NOTE
> Initialization never clears the system calibration data, and the real-time clock date and time are never cleared or initialized.

Update upgrades the instrument software. The instrument has several CPUs and provides a one-key upgrade: follow the prompts and wait about 15 seconds; the instrument then reboots automatically. After the reboot, return to this menu to check the software version. Upgrades can be made from a file selected in the file-management list, with the default path (place the file `update2840.sec` in the root directory of a USB flash drive and run the update), or with a Techmize PC tool.

9.2 File management

The embedded system stores settings as files in the internal memory (approx. 100 MB non-volatile memory, up to 500 setting files) or on a USB flash drive, so that a setup can be recalled without re-entering parameters. Press File (or the *File* soft key) to open the *File* page. In the file list, `files` is the internal storage and `usb` is the external flash drive.

Type	Extension	Recall	Content
Transformer single-group setup	*.trt	Yes	Configuration of the transformer single-group test
Transformer scan setup	*.t40	Yes	Configuration of the transformer scan test
Screenshot	*.png	No	Picture of the screen (USB only)
Test data	*.csv	No	Test results (USB only)

Setup files can be recalled from the internal memory or from a flash drive; test results and screenshots can only be saved to the external flash drive. Files of the optional LCR function (*.sta) are described in the TH2840 Series Operation Manual.

9.2.1 USB flash drive

USB 2.0 mass-storage device, formatted FAT32 under Microsoft Windows (FAT16 is not supported). The files can be copied to a PC for unlimited expansion.

9.2.2 File operations

Operation	Description
Save .trt / .t40	Saves the current setup of the active function. After entering a file name (the extension is added automatically) the file is created in the current directory.
Load	Loads the selected setup file after confirmation; the instrument then returns to the corresponding display page.
Copy to E:	Copies the file or folder at the cursor from the internal storage to the root directory of the USB flash drive. An existing file of the same name is overwritten; an existing folder of the same name makes the copy fail.
Copy to I:	Copies the file or folder at the cursor from the USB flash drive to the internal root directory.
Rename	Renames the file or folder at the cursor. The root directory cannot be renamed.
Delete	Deletes the file at the cursor.
New folder	Creates a folder at the cursor position; new setup files can be saved in it.

Move the cursor with the up/down keys or the knob; the left/right keys expand and collapse folders. Make sure the USB flash drive meets the requirements above and is not write-protected.

CHAPTER 10

Performance & Specifications

10.1 Measurement functions

Item	Specification
Single-group parameters	Ls, Lp, Lk, Cs, Cp, Zx, Rs, Rp, Rd, D, Q, dZ, Ns, Ns:Np, Np, Np:Ns, M — up to 12 parameters per trigger
Scan parameters	Cs/Cp, Ls/Lp, DCR, Zx, Rs/Rp, D, Q, dZ (phase angle), Lk (leakage inductance), Phase, Balance, Turns-Ratio (Ns:Np = U2/U1), Turns (Ns = Np × U2/U1)
Test mode	Continuous: one trigger measures all set parameters. Step: one trigger per parameter
Equivalent circuit	Series, parallel
Deviation functions	Absolute deviation Δ, percent deviation Δ%
Trigger	Continuous or single (front-panel key, HANDLER / TRIGGER interface, foot switch, remote command)
Delay	Trigger delay and per-parameter delay, 0 – 60 s
Averaging	Each parameter has independent averaging (1 – 255 readings) and an independent delay time
Test terminals	Four-terminal: HCUR, HPOT, LPOT, LCUR; transformer secondary on TURNS (+) / (–)
Test speed — transformer measurement	Fast+ 1 ms (>10 kHz) · Fast 3.3 ms · Medium 90 ms · Slow 220 ms. Fast+, Fast and Medium are slower below 10 kHz
Display	6 digits, maximum 999999
Range switching	Electronic — no relay noise or wear

10.2 Test signal

Item	TH2840AX	TH2840BX	TH2840NX
Signal	Sine wave	Sine wave	Sine wave
Frequency range	20 Hz – 500 kHz	20 Hz – 2 MHz	20 Hz – 500 kHz
Frequency accuracy	0.01%	0.01%	0.01%
Frequency resolution	0.1 mHz (20 – 99.9999 Hz) · 1 mHz (100 – 999.999 Hz) · 10 mHz (1 – 9.99999 kHz) · 100 mHz (10 – 99.9999 kHz) · 1 Hz (100 – 999.999 kHz) · 10 Hz (1 – 2 MHz, BX only)		
Test voltage range	5 mV_{rms} – 20 V_{rms}	5 mV_{rms} – 20 V_{rms} (≤1 MHz); 5 mV_{rms} – 15 V_{rms} (>1 MHz)	5 mV_{rms} – 20 V_{rms}
Test voltage accuracy	±(10%×setting + 2 mV) at ≤1 MHz · ±(6%×setting + 2 mV) at >1 MHz (Normal and ALC mode; measured with HCUR/HPOT shorted, 1 m BNC cable recommended)		
Test current range	50 μA_{rms} – 100 mA_{rms}, accuracy ±(10%×setting + 10 µA), 20 Hz – 2 MHz		
RDC test signal	Voltage 100 mV – 20 V (1 mV / 10 mV resolution); current 0 – 100 mA (10 µA / 100 µA resolution)		
DC bias	Voltage 0 – ±40 V (1 mV / 10 mV resolution); current 0 – ±100 mA (10 µA / 100 µA resolution)		
Built-in current source	0 – 2 A, accuracy ±(2%×setting + 2 mA) at I > 5 mA, resolution 1 mA		
Output impedance	30 Ω ±4% @1 kHz or 100 Ω ±2% @1 kHz, selectable		

The AC test-signal mode is selectable: **Normal** (ALC OFF) — the set voltage is the open-circuit voltage at the test terminals and the set current is the short-circuit current; **ALC** (constant level) — the internal level is adjusted automatically so that the voltage across the DUT matches the set value. The internal 2 A current source is specified up to 200 kHz.

10.3 Transformer measurement ranges

Parameter	Display range
L, Lk	0.00001 µH – 99.9999 kH
C	0.00001 pF – 9.99999 F
D	0.00001 – 9.99999
Q	0.00001 – 99999.9
Z, R, X, RDC	0.01 mΩ – 99.9999 MΩ
Y, B, G	0.00001 µS – 99.9999 S
θ	−179.999° … 179.999° (−3.14159 … 3.14159 rad)
Turns ratio	1 : 0.001 – 1000 : 1

10.4 Measurement accuracy

The stated accuracies apply under these conditions: warm-up time ≥ 60 minutes; cable length 0 m or 1 m; open and short correction performed after warm-up; DC bias OFF; range set to AUTO.

Parameter	Accuracy
|Z|, |Y|, L, C, R, X, G, B	$\pm[A_L \times A + (K_a + K_b + K_c) \times 100 + K_d + K_f] \times K_e$ [%]. Valid for $D_x \le 0.1$ (L, C, X, B) or $Q_x \le 0.1$ (R, G); above 0.1 multiply by $\sqrt{(1+D_x^2)}$ or $\sqrt{(1+Q_x^2)}$. The basic accuracy A and the factors A_L, K_a – K_f are identical to TH2840A/B; see the TH2840 Series Operation Manual, §7.3 and §7.3.1
D, Q, θ	$D_e = A_e/100$ ($D_x \le 0.1$; multiply by $(1+D_x)$ above) · $Q_e = Q_x^2 \times D_e / (1 \mp Q_x \times D_e)$ · $\theta_e = (180/\pi) \times (A_e/100)$ [deg]
DCR	±A (1 + Rx/5 MΩ + 16 mΩ/Rx) [%] ±0.2 mΩ, where Rx is the measured resistance; A = 0.25 at Medium and Slow speed, A = 0.5 at Fast speed
Lk	Inductance (L) accuracy + 0.2%
Turns ratio	$\pm A_T \times A_r$ (1 + 1 Ω/Z_p + 1/Q) [%] ±0.002, where Z_p is the impedance of the measured primary inductance, A_r is the correction value for the test-signal accuracy, A_T = 0.5 at Fast speed and 0.25 at Medium and Slow speed. Valid when the coupling coefficient of the transformer under test is 1 or close to 1

10.5 Transformer scanning

Item	TH2840AX / TH2840BX	TH2840NX
Internal scan board	None — external TH1901 scan box	1 board standard, expandable to 6 (24×2 PIN per board, 288 PIN maximum)
Test PIN	20 PIN (TH1901)	48 – 288 PIN
HANDLER pin definition	NS1–NS9, GOOD, NG, TEST, TRIGGER, RESET	NS1–NS30, GOOD, NG, TEST, TRIGGER, RESET
Windings	Primary up to 60, secondary up to 9	Primary up to 60, secondary up to 9
Test-lead interface	25×2-pin FRC socket, pin order compatible with the TH2840X series	25×2-pin FRC socket, pin order compatible with the TH2840X series
External scan box	TH1901 series, TH1831	TH1901 series, TH1831

10.6 General specifications

Item	Specification
Display	10.1" capacitive touchscreen, 1280×800 (16:9)
Storage	Internal ~100 MB non-volatile memory, up to 500 setting files; USB for settings, screenshots and log files
Interfaces	RS232C · LAN (10/100BaseT) · 2× USB Host · USB Device · HANDLER · external DC-bias control (TH1778A, up to 6 units / 120 A)
Remote protocols	SCPI, MODBUS — standard on all models
Power supply	100 – 120 V AC or 198 – 242 V AC (selectable), 47 – 63 Hz, ≥100 VA
Warm-up	60 minutes
Operating environment	0 – 40 °C, ≤75% RH
Storage environment	5 – 40 °C, <85% RH
Dimensions (W×H×D)	TH2840AX / BX: 430×177×265 mm · TH2840NX: 430×177×405 mm
Weight	TH2840AX / BX: 11 kg · TH2840NX: 17 kg

CHAPTER 11

HANDLER Interface

11.1 Single-group HANDLER (LCR Handler connector)

Sorting of the transformer single-group test uses the **LCR Handler** connector (57BR-4036L, 36 pins) on the rear panel. It provides separate sorting results for up to 12 parameters (/FAIL1 – /FAIL12) plus the overall /PASS and /FAIL signals.

11.1.1 Sorting logic

The first parameter on the *Single Setup* page corresponds to /FAIL1, the second to /FAIL2, and so on up to /FAIL12. A line becomes active when its parameter fails. /PASS is active when all parameters are qualified; /FAIL is active as soon as one parameter is unqualified. Set *Comp* to ON, enable each parameter (*Meas* ON) and set its lower and upper limits; a parameter without limits does not take part in sorting.

11.1.2 Signals

Outputs are active-low, open-collector and opto-isolated; inputs are opto-isolated.

Pin	Signal	Dir.	Description
1 – 11	/FAIL1 – /FAIL11	Out	Sorting result of parameters 1 – 11 (open collector)
12, 13	/EXT.TRIG	In	External trigger in single-trigger mode; pulse width ≥ 1 µs
14, 15	EXT.DCV2	In	External DC supply for the opto-coupled /EXT_TRIG, /KEY_LOCK, /ALARM, /INDEX and /EOM signals
16 – 18	+5V	Out	Internal +5 V supply. Use is not recommended; if used, keep the current below 0.3 A and the wiring away from interference sources
19	/PASS	Out	Active when none of /FAIL1 – /FAIL12 is active
20	/FAIL	Out	Active when any of /FAIL1 – /FAIL12 is active
21	/FAIL12	Out	Sorting result of parameter 12
22 – 24	Undefined	Out	Factory test signals — do not connect
25	/KEY LOCK	In	While active, all front-panel keys and the touchscreen are locked
27, 28	EXT.DCV1	In	External DC pull-up supply for the sorting outputs (/FAIL1 – /FAIL12, /PASS, /FAIL)
29	/ALARM	Out	Active on a momentary power failure or processor-board reset
30	/INDEX	Out	Analog measurement finished; the next DUT can be connected. The comparison result stays valid only until /EOM is active
31	/EOM	Out	End of measurement: test data and comparison result are valid
32, 33	COM2	—	Reference ground for EXT.DCV2
34 – 36	COM1	—	Reference ground for EXT.DCV1

11.1.3 Electrical characteristics

Signal group	Output LOW	Output HIGH	Max. current	Reference
/FAIL1 – /FAIL12, /PASS, /FAIL	≤0.5 V	+5 to +24 V	6 mA	Internal pull-up: instrument ground · External (EXT.DCV1): COM1
/INDEX, /EOM, /ALARM	≤0.5 V	+5 to +24 V	5 mA	Internal pull-up: instrument ground · External (EXT.DCV2): COM2

Each output (pins 1 – 11, 19 – 24 and 29 – 31) is isolated by an open-collector optocoupler; its output voltage is set by a pull-up resistor on the HANDLER interface board, which a jumper connects either to the internal +5 V supply or to an external supply (EXTV, +5 to +24 V). Sorting results and control signals use independent circuits with separate common lines (COM1, COM2). The input signals drive the cathode side of an optocoupler LED; the anode side can be fed from the internal +5 V or from EXT.DCV2.

> **WARNING**
> Pins 16 – 18 carry the instrument's internal +5 V supply. Never connect them to an external power source: this can damage the instrument.

11.2 Transformer-scan HANDLER (Trans Handler and Trans Controller)

The transformer scan uses two 25-pin D-type connectors, **Trans Handler** and **Trans Controller**. Up to 30 independent sorting signals NS1 – NS30 are available (NS1 – NS9 on Trans Handler, NS10 – NS30 on Trans Controller; NS10 – NS30 are available on TH2840NX only) in addition to PASS, FAIL, TEST and the control inputs. Outputs are active-low, open-collector, opto-isolated and ULN2003-driven; inputs are active-low and opto-isolated.

Model	Sorting signals per specification
TH2840AX / TH2840BX	NS1 – NS9, GOOD, NG, TEST, TRIGGER, RESET
TH2840NX	NS1 – NS30, GOOD, NG, TEST, TRIGGER, RESET

11.2.1 Trans Handler pin assignment

Pin	Signal	Dir.	Description
1 – 9	NS1 – NS9	Out	Sorting signals (open collector); meaning depends on the Handler Mode (§7.11)
10	TEST	Out	End of measurement: data and comparison result are valid
11 – 13	+5V	Out	Internal +5 V. Use not recommended; if used, below 0.3 A
14 – 17	GND	Out	Ground
18	24V–	Out	Cathode of the cylinder power supply
19	EXT_GND	In	Reference ground for EXT_VCC
20	24V+	Out	Anode of the cylinder power supply
21	EXT_VCC	In	External DC supply for the opto-coupled signals (NS1 – NS30, PASS, FAIL, TEST)
22	EXT_RESET	In	Reset signal
23	EXT_START	In	External trigger (start) signal
24	FAIL	Out	Overall FAIL
25	PASS	Out	Overall PASS

11.2.2 Trans Controller pin assignment

Pin	Signal	Dir.	Description
1 – 21	NS10 – NS30	Out	Sorting signals (open collector); meaning depends on the Handler Mode
22, 23	+5V	Out	Internal +5 V. Use not recommended; if used, below 0.3 A
24, 25	GND	Out	Ground

11.2.3 Electrical characteristics

Signal group	Output LOW	Output HIGH	Max. current	Reference
NS1 – NS30, PASS, FAIL, TEST	≤0.5 V	+5 to +24 V	50 mA	Internal pull-up: instrument ground · External: EXT_GND

The output voltage of each line depends on the supply used: the high level is +5 V with the internal supply, or the external supply voltage (+5 to +24 V). EXT_START and EXT_RESET drive an optocoupler LED on its cathode side; the instrument starts when the EXT_START signal rises from LOW to HIGH. The anode side can be fed from the internal +5 V or from EXT_VCC.

11.2.4 Wiring to a PLC

The interface can be wired to PLC inputs of two types: **common-anode** (current flows from the module's common terminal into the input channel, also called source wiring) and **common-cathode** (current flows from the input channel to the common terminal, also called sink wiring). Typical connections depend on the actual PLC and must be adapted to the application.

> **WARNING**
>
> TH2840-series instruments ship configured for an **external** supply (internal jumpers J307 and J310 shorted at pins 2–3; JP501 and JP503 open). Connect an external supply to EXT_VCC / EXT_GND for the HANDLER outputs to work as shipped. Pins 11–13 of Trans Handler and pins 22–23 of Trans Controller are the instrument's internal 5 V supply and must not be connected to any external power supply, otherwise the instrument will be damaged. Techmize recommends an external supply as the pull-up supply of the ULN2003 drivers for the best noise immunity. To use the internal supply instead, contact Techmize support about the jumper settings.

11.2.5 Sorting mode

Transformer scan sorting is always active. Select the sorting mode (Default, X30 or X12) with *Setup → Handler Mode* (§7.11); the page also shows the pin definition of the selected mode.

11.3 Scan-box HANDLER

TH2840AX, TH2840BX and TH2840NX work with TH1901 and TH1831 scan boxes (for a TH1901 scan box, select *TH1806* under *Scan Box Mode*, §6.1.11). The pin definition of the TH1831 scan box HANDLER is identical to the HANDLER definition of the TH2840 built-in scan board.

APPENDIX

Troubleshooting & Fixture Notes

A.1 Frequently asked questions in the transformer scan test

	Symptom	Reason	Solution
A.1	The test value is clearly out of limits, but the judgement shows the parameter as qualified.	Only the standard value (STD) was set, or only one of the high/low limits.	Set both the high and the low limit.
A.2	A parameter such as Lx is switched on but not tested and shows no data.	The switch is ON but no standard value is set, and *Ignore Nom* is set to FORCE DEV.	Set *Ignore Nom* to FORCE TEST, or set the standard value in the limit table.
A.3	Only the first parameter groups are tested; the last ones are not.	Pins of one or more middle groups were not set, so the following groups are not tested; or *Test Fail* is set to Stop and an earlier parameter failed.	Set *Test Fail* to Continue and set the empty pins in the limit table, or set *Ignore Nom* to FORCE TEST.
A.4	Poor DCR accuracy.	Oxidized, worn or dirty contacts, or a user-made fixture that does not use four-wire measurement.	Keep the contacts new; use four-wire measurement (Appendix B); use deviation deduction (§8.7).
A.5	Poor Lk accuracy.	Oxidized or worn contacts, or too much lead resistance in a user-made fixture.	As for DCR (A.4).
A.6	Inaccurate TURN.	With a low-permeability core the number of turns measured differs from the real winding because the inductor takes part of the ACR voltage.	Test the winding in the TURN mode.
A.7	Unstable TURN.	With a high-permeability core the winding test is unstable.	Use the TURN_V (voltage-turn) mode; use deviation deduction.
A.8	The first and second Lx readings differ strongly.	A high-permeability core is polarized by the DCR or TURN test.	Use the 100 Ω internal resistance for the TURN test and for the DCR test.
A.9	Cx or Zx open-circuit data are unstable.	Shielding and grounding of the test system are poor.	Connect the ground terminals of the instrument and the scan box and the metal frame of the test fixture together with a thick metal lead and ground them reliably.
A.10	DCR and PS open-circuit values do not reach infinity.	Distributed circuit parameters prevent an infinite display; this is normal.	Run the open scan correction of the fixture (§8.3) to display it.

B.1 User-made test fixtures

Because there are many kinds of transformers, Techmize cannot offer a fixture for every one; custom fixture heads can be ordered (§5.4) or a fixture can be made by the user following these rules:

1. Extend the test cable with the **four-wire** measurement method: separate the DRIVE and SENSE leads (for example 1D = drive terminal of pin 1, 1S = sense terminal of pin 1). Do not use a 5.0 mm test fixture to hold a test lead.
2. Use tough multi-strand enamelled wire as the extension lead and as many strands as possible to reduce cable resistance.
3. Test at high frequency and reduce the distributed parameters of the extension cable; do not extend with ribbon cable.
4. Preferably use a metal frame connected to ground through a thick metal lead.

B.1.1 TH1801-EXT2A extension ground board

The TH1801-EXT2A extension ground board is available from Techmize. Its double-row pins plug into the relay board of the scan box; its double-row bond pads accept sockets or soldered leads. Two spring thimbles per pin can be used to make a four-wire test probe.

B.1.2 TH1801-EXT11A(5.0)-B

The TH1801-EXT11A(5.0)-B uses the same four-wire principle: the DRIVE and SENSE leads of each pin are separate.