TECHMIZE by TONGHUI

OM

OPERATION MANUAL

TH343X / TH344X Series

Wideband Multi-Channel Digital Power Meter — TH3431 / TH3433 / TH3434 / TH3441 / TH3443 / TH3444. Covers front-panel operation, measurement setup and system configuration; see Chapter 10 for the remote-control interfaces and Chapter 11 for the HANDLER interface.

Techmize Electronic GmbH · Ismaning, Germany
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TH343X / TH344X Series Operation Manual

Wideband Multi-Channel Digital Power Meter — 6 models, 2 current tiers

This is the combined TH343X/TH344X Series Operation Manual. **TH343X** (2 A current tier — TH3431/TH3433/TH3434) and **TH344X** (20 A current tier — TH3441/TH3443/TH3444) share an identical chassis, screen, interface set and control software, differing only in current/power range and micro-current capability; this manual therefore covers both tiers in one document, marking differences where they occur with `TH343X` / `TH344X` tags.

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A full SCPI/MODBUS command reference for this series, following the same format as the published TH342X Series SCPI Command Reference, is available as a separate companion document on request — in line with Techmize's standard practice for command sets of this size. Chapter 10 of this manual covers the remote interfaces and command structure only.

CHAPTER 1

Safety & Compliance

1.1 About this manual

This is the original-language (English) edition of the operation manual for the Techmize TH343X/TH344X series of multi-channel digital power meters, covering six models: **TH3431** (1-ch), **TH3433** (3-ch) and **TH3434** (4-ch) in the 2 A current tier (TH343X), and **TH3441** (1-ch), **TH3443** (3-ch) and **TH3444** (4-ch) in the 20 A current tier (TH344X). Where this manual and the instrument itself appear to disagree, or where a described function is not present on your particular unit, 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 next to the instrument's AC power inlet.

1.3 General safety requirements

The TH343X/TH344X series is a **Protection Class I** instrument: protective earthing of the chassis, via the three-wire AC power cord, is essential to safety and must not be defeated.

> **WARNING — ELECTRIC SHOCK**
>
> Always use a supply outlet with a protective earth contact. Never connect the AC supply, or operate the instrument, with the protective ground disconnected or with a two-wire (ungrounded) adapter. Disconnect the power cord before replacing the fuse or opening the case.

Before switching on, confirm that the L (line), N (neutral) and E (earth) conductors of the supply outlet correspond correctly to the instrument's power inlet. Rated supply: **AC 220 V ±10%, 50/60 Hz ±5%**, consumption ≤ 50 VA.

> **NOTE — SUPPLY TOLERANCE**
>
> Rated supply: **AC 220 V ±10%, 50/60 Hz ±5%** (i.e. 198–242 V, 47.5–63 Hz); the rear-panel rating label itself reads "220V/50Hz 65VA".

> **CAUTION — FUSE RATING**
>
> The instrument fuse is a factory-fitted standard part, rated **1 A, time-lag, 250 V** (rear-panel marking: T1AL 250V). Replace it only with a fuse of the same rating and type supplied by Techmize/Tonghui.

Environment. Normal operation: 0–40 °C, 20–80% RH (reference condition for rated accuracy: 20 °C ±8 °C, <80% RH). Storage/transport: 0–55 °C, ≤93% RH in transit; for long-term storage, 5–40 °C and ≤85% RH in the original packaging, away from direct sunlight and corrosive gases. Keep the left-side ventilation opening clear for accurate, stable operation.

WARNING — INPUT TERMINALS

The voltage and current input terminals on the rear panel can carry hazardous voltage and current from the device under test. Do not exceed the maximum allowable input listed in Chapter 9 (1000 V / 1 s instantaneous, 700 V continuous on the voltage inputs; current limits differ by tier — see §9.2.2). Disconnect the device under test before changing wiring.

Warm-up. Allow at least **30 minutes** of warm-up after switch-on before relying on the rated accuracy given in Chapter 9. Do not power-cycle the instrument frequently, as this may cause internal data confusion.

1.4 Electrical safety test data

Dielectric-withstand, insulation-resistance and leakage-current test figures are not published in the operation manual for this series. Contact Techmize/Tonghui engineering if a formal electrical safety test report is required.

1.5 Low Voltage & EMC compliance

The TH3400 family — which explicitly includes all six TH343X/TH344X models — carries the CE mark, tested to the following harmonised standards:

Directive	Standard(s)
Low Voltage Directive (LVD)	EN 61010-1:2010+A1:2019
EMC Directive	EN IEC 61326-1:2021 EN IEC 61000-3-2:2019+A1:2021 EN 61000-3-3:2013+A1:2019+A2:2021

Source: LVD test certificate MTZS23023891 (issued 2023-06-05) and EMC test certificate MTZS23023892 (issued 2023-04-13), both from Shenzhen Most Technology Service Co., Ltd., covering the TH3400 family (TH3411/TH3421/TH3422/TH3431/TH3433/TH3434/TH3441/TH3443/TH3444) — the same certificates already cited in the TH342X Series Operation Manual.

1.6 WEEE — disposal of electrical and electronic equipment



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

1.7 RoHS compliance

The TH343X/TH344X series is covered by Techmize's own RoHS (Directive 2011/65/EU, as amended) self-declaration. No independent third-party RoHS certificate is currently available for this series.

1.8 Warranty

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

This warranty does not cover: damage from misuse, accident, unauthorized modification or repair; consumable/wear items such as the fuse; or damage from operation outside the environmental limits given in §1.3.

1.9 Limitation of liability

Except as expressly stated in §1.8, Techmize makes no other warranty, express or implied, regarding this instrument or its documentation. Techmize is not liable for indirect, incidental or consequential damages arising from the use of this instrument, to the extent permitted by applicable law.

1.10 Manufacturer & EU contact

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Tonghui Electronic Co., Ltd. (China)

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Registration

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

CHAPTER 2

Out of the Box

2.1 Unpacking

Inspect the shipping container for damage after unpacking. It is not recommended to power on the instrument if the container shows signs of damage — contact your carrier and your Techmize distributor before proceeding. If the contents do not conform to the packing list, notify Techmize or your distributor.

1× TH343X/TH344X-series digital power meter (model as ordered) · 1× EU power cable (Schuko, CEE 7/7) · 1× quick guide · certificate of conformity · test report · warranty card. The full operation manual is available on request or pre-loaded on the instrument (§6.9.3).

Keep the original packaging — it is the recommended way to store or return the instrument.

The front panel is labelled with the exact model and measurement range — confirm this matches what was ordered, against the packing list, before use:

Model	Channels	Measurement range	Micro current	Tier
TH3431	1	600 V / 2 A	Yes	TH343X
TH3433	3			
TH3434	4			
TH3441	1	600 V / 20 A	No	TH344X
TH3443	3			
TH3444	4			

> **NOTE**
>
> When a channel does not exist on a given model, the related settings/parameters (CH4, P4, PS2, U4, I4, etc. on 1- or 3-channel models) are simply not available — this is normal and is not a fault.

2.2 Connecting the power supply

Item	All models
Supply	AC 220 V ±10%, 50/60 Hz ±5%
Power consumption	≤ 50 VA
Power switch	Soft (software-controlled) power switch — the key is green when on, red when off

Match the L (line), N (neutral) and E (earth) conductors of the supply cable to the instrument's rear-panel power inlet, and confirm reliable grounding before switching on. If mains conditions are noisy, fitting a power-line filter ahead of the instrument is recommended.

> **WARNING**
> Make sure the protective-earth conductor is reliably grounded before connecting the power cable. Disconnect the power cable before replacing the fuse.

2.3 Connecting the device under test

Each channel provides four input terminals on the rear panel: **V+, V−** (voltage measurement, positive/negative) and **I+, I−** (current measurement, positive/negative). Since voltage and current inputs are floating, several wiring combinations are possible — see Chapter 8 for the recommended wiring methods per wire-system combination (1P2W / 1P3W / 3P3W / 3P4W / 3V3A) and for the internal-vs-external ammeter connection trade-off.

> **CAUTION**
> Do not exceed the maximum allowable input. Voltage terminals (all models): 1000 V (1 s instantaneous) / 700 V (continuous). Current terminals: `TH343X` 3 A (1 s) / 2 A (continuous); `TH344X` 30 A (1 s) / 20 A (continuous) — see Chapter 9 for the full range table.

2.4 Starting the instrument for the first time

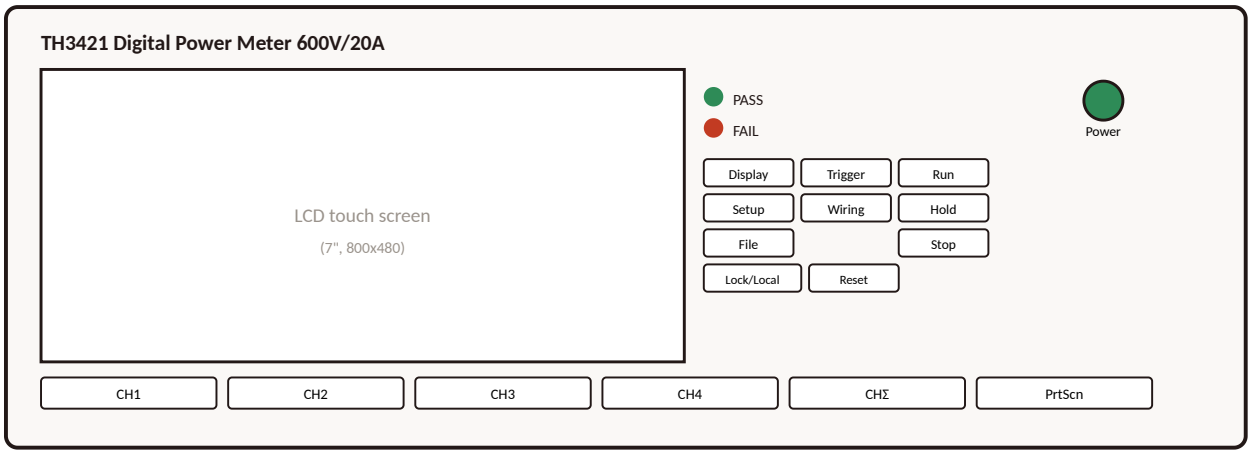
1. Connect the EU power cable to the rear-panel inlet, confirming reliable earth-ground connection.
2. Press the front-panel **Power** switch (illuminates green when on).
3. The instrument starts in two stages: first the embedded operating system, then the application program — each stage shows its own startup screen with the firmware/version and company information.
4. The display opens on the default <Measurement Display> page, showing the balanced per-channel view (§5.1.1).

Allow at least 30 minutes of warm-up before relying on the rated accuracy (§1.3). For an overview of the front panel, rear panel and screen layout, continue to Chapter 3.

CHAPTER 3

Getting to Know the Instrument

3.1 Front panel



Simplified front-panel layout (schematic, not to scale; a 4-channel model shown) — see Table 3-1 for the full item legend. On 1- and 3-channel models, the unused CHx keys are not fitted.

1 **Trademark & model** — instrument brand, model and test range (e.g. "TH3431 Digital Power Meter 600V/2A").

2 **Front-panel rubber sleeve** — bump protection.

3 **LCD display** — 7" resistive touch screen, shows test results and the human-machine interface.

4 **PASS light** — green; comparator result qualified.

5 **USB HOST** — USB storage and firmware upgrade.

6 **FAIL light** — red; comparator result unqualified.

7 **Display** — opens the measurement display pages (Chapter 5).

8 **Setup** — opens the measurement/system setup pages (Chapters 4, 6).

9 **File** — opens file management (Chapter 7).

10 **Trigger** — manual trigger; active when trigger source = MAN (§4.1.2).

11 **Wiring** — shortcut to the wire-system selection dialog (§4.1.1).

12 **Run** — starts energy integration; LED lit while integrating (§4.1.4).

13 **Stop** — stops energy integration (can resume with Run, or clear with Reset).

14 **Reset** — after Stop, zeroes the integration result and timer.

15 **Lock/Local** — locks/unlocks the front-panel keys.

16 **Power switch** — green when on, red when off (soft power switch).

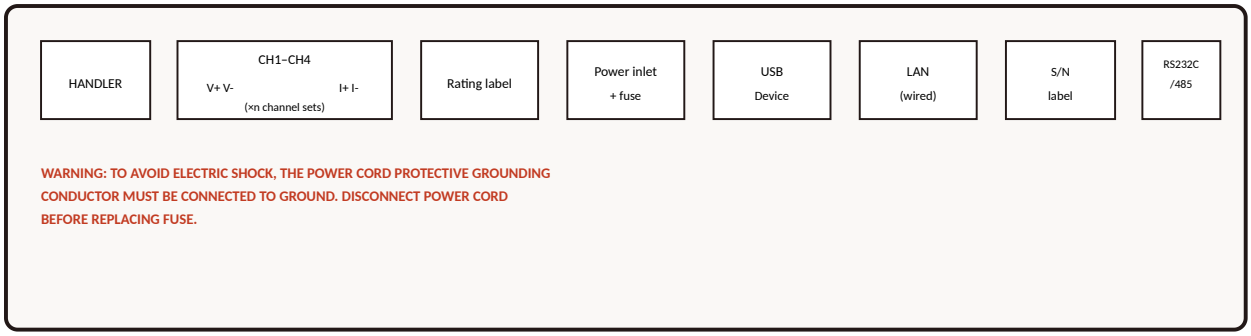
17 **Hold** — freezes the displayed reading; press again to release.

18 **PrtScn** — saves a screenshot (to USB drive if present, otherwise to internal storage, PIC folder).

19 **CHΣ** — switches between the wire-system combination display and the normal per-channel display (§5.1.3). Not meaningful in 1P2W mode (every channel independent).

20–23 **CH1**–**CH4** — highlights the corresponding channel's display (§5.1.2); only as many keys are fitted as the model has channels.

3.2 Rear panel



Simplified rear-panel layout (schematic, not to scale; a 4-channel model shown) — see Table 3-2 for the full item legend

1 **HANDLER interface** — outputs the comparator result and accepts an external trigger input (Chapter 11).

2 **V− terminal** — voltage measurement, negative (one per channel).

3 **V+ terminal** — voltage measurement, positive.

4 **I− terminal** — current measurement, negative.

5 **I+ terminal** — current measurement, positive.

6 **Rating/warning label.**

7 **Power socket & fuse** — AC power inlet (§2.2).

8 **USB Device** — PC communication (Chapter 10).

9 **LAN interface** — wired Ethernet for LAN communication (Chapter 10). *Wireless (WLAN) is not offered for this series.*

10 **S/N label** — instrument serial number.

11 **RS232C/RS485 interface** — serial communication with a host PC; RS232 standard, RS485 factory-installed option (Chapter 10).

A **USB Host** port is also provided on the front panel (item 5, §3.1) for U-disk storage and firmware upgrade.

3.3 Screen display

The TH343X/TH344X series uses a 24-bit colour, 7" resistive touch screen at 800×480 resolution. The main test page offers two selectable display styles. The screen content is divided into three zones:

Zone	Contents
Title bar (top)	Page tabs: Meas · Comp · Harm · Wave · Vector.
Result / setting area (middle)	Measurement result display and parameter setting area — content depends on the active page (Chapters 4, 5).
Status bar (bottom)	Instrument status: range, wire system, USB drive presence, etc.

3.4 Main keys and basic operation

Key	Opens
Display	Measurement display pages: Meas · Comp · Harm · Wave · Vector (Chapter 5)
Setup	Measurement parameter setup (Chapter 4) and System Setup (Chapter 6), reached via the page's own tabs
File	File Management (Chapter 7)

1. Use Display / Setup / File and the on-screen page tabs to reach the page you want.
2. Touch a field to select it; double-touch most fields to open a selection window or the numeric keypad.
3. Confirm a selection or entry to apply it; most settings save automatically.

3.5 Measurement functions at a glance

Signal sampling is based on digital phase-locking and oversampling, synchronized to a full cycle of the input signal; all displayed values and waveform data are calculated from this sampled data. For the full symbol/formula reference, see §9.1.3 and the Appendix.

Function group	Summary
Independent channel	General parameters (URMS, IRMS, P, S, Q, PF, frequency, peak/peak-to-peak, etc.) and integral (energy) parameters per channel.
Wire-system combination (Σ)	Combined voltage/current/power/PF/efficiency across a wire-system group (5 wiring modes available — Chapter 8).
Comparison & output	Up to 8 parameters compared against limits, with 8 independent programmable HANDLER relay outputs (§4.2, Chapter 11).
Harmonic analysis	Up to the 50th harmonic, 10 Hz–1.2 kHz fundamental range, list or bar-graph display, IEC/CSA calculation standards.
Waveform display	U&I (voltage/current) or Power waveforms; not plotted above ~50 kHz (sampling-principle limit).
Vector analysis	Phase-relationship vector diagram for 3-phase systems (3P4W/3V3A).

CHAPTER 4

Measurement Parameter Setup

Reached via [Setup]. This chapter documents the Measurement Setup, Compare Setup, Harmonic Settings and Waveform Setup tabs. System-level settings are covered separately in Chapter 6.

4.1 Measurement Setup

4.1.1 Wiring setup

Selects one of 5 wire-system combinations: **1P2W** (one-phase two-wire), **1P3W** (one-phase three-wire), **3P3W** (three-phase three-wire), **3P4W** (three-phase four-wire), **3V3A** (three-voltage three-current). 1-channel models (TH3431, TH3441) support **1P2W only**. On 3- and 4-channel models, two wire-system combinations can be active on the remaining channels at once where channel count allows (e.g. 1P3W_1P3W, 1P3W_3P3W, 3P3W_3P3W on 4-channel models) — see Chapter 8, Tables 8-1/8-2 for the full channel-usage mapping.

Shortcut: press the front-panel [Wiring] key to open the wire-system selection dialog directly.

> NOTE
> 1P2W does not perform any wire-system combination calculation — every channel is tested independently, so pressing [CHΣ] has no combined-display effect in 1P2W mode (§5.1.3).

For non-1P2W combinations, the energy-efficiency (η) formula is user-programmable (§9.1.3.3).

4.1.2 Trigger setup

Source	Behaviour
Internal	Continuous, free-running measurement (default).
Manual (MAN)	One measurement per front-panel [Trigger] press.
External	One measurement per falling-edge pulse on the HANDLER /EXT.TRIG input (Chapter 11).
Bus	One measurement per remote trigger command (Chapter 10).

Data update rate: selectable 0.1 / 0.25 / 0.5 / 1 / 2 / 10 / 20 s, or Auto (one full cycle of the synchronization signal per update). Faster rates suit higher-frequency inputs; slower rates suit low-frequency inputs.

Trig Freq: an optional per-channel trigger-frequency threshold switch (off by default), generally used for non-sinusoidal/irregular waveforms.

4.1.3 Synchro setup

Selects the synchronization (phase-lock) source per channel — any available voltage or current input (U1/I1…U4/I4, limited by the fitted channel count). All channels within one wire-system combination share the same synchronization source. If the instrument cannot find a stable frequency on the selected source, it treats the input as a DC signal; choose the input that most closely resembles a clean sine wave for the most stable lock (e.g. for a distorted-voltage source such as a motor, lock to the current channel instead, and vice-versa for a distorted-current load such as an inverter).

4.1.4 Integral (energy) setup

Control mode	Behaviour
Manual	The integral time setting is ignored; the user fully controls start/stop via **Run** / **Stop**, timing counts up.
Continuous	After **Run**, timing counts down from the set integral time and stops automatically when it reaches zero.

Integral timing range: 0–9999:59:59 (h:mm:ss), 1 s resolution. See §3.1/Appendix for the WP, WP+, WP−, WS, WQ, q, PAVG, PMAX, PMIN parameter definitions.

4.1.5 Filter and average

A 500 Hz hardware line filter can be switched in or out per the signal under test; a test averaging count can also be set. For harmonic analysis of mains-frequency signals, enable the filter before switching to the Harmonic display page (§8.2.3).

4.1.6 Measurement range

Each channel's voltage and current range can be set to Auto or Manual. The fixed voltage ranges and the tier-dependent current ranges are listed in §9.2.2.

4.1.7 Scale ratio

Per-channel voltage and current scale (ratio) coefficients can be set, for use with external voltage/current transformers or probes — the displayed reading is scaled accordingly.

4.1.8 Data saving settings

Controls whether measurement data is logged to the external USB drive while running (closed/off by default at power-on). See §7.5 for the full data-logging procedure.

4.2 Comparison Setup

4.2.1–4.2.3 Comparison parameters, limits & function

Up to 8 comparison channels, each independently configured with: comparison parameter (any measured or integral parameter), upper limit, lower limit, and output function. Output function options: pass-on-output, fail-on-output, pass-pulse-output, fail-pulse-output, or off. Each of the 8 comparison channels corresponds to one of the 8 programmable relay outputs on the rear-panel HANDLER connector (Chapter 11).

4.2.4 HANDLER interface description

The HANDLER output circuit uses relay-isolated outputs: the comparison result drives a relay coil, and the two ends of the corresponding relay contact form one pair of rear-panel HANDLER outputs. This isolates the signal and lets the user configure a level or edge signal externally, with a simple pull-up or pull-down resistor.

The rear-panel HANDLER connector is a 25-pin D-type connector. Pin definitions (identical across the TH34XX family):

Pin	Def.	Pin	Def.	Pin	Def.	Pin	Def.	Pin	Def.
1	+5V	6	M7−	11	M5−	16	M3+	21	M8−
2	M4+	7	M2+	12	M6+	17	/EXT.TRIG	22	M1−
3	reserve	8	M8+	13	+5V	18	M7+	23	M5+
4	M3−	9	M1+	14	EXTV	19	NULL	24	GND
5	GND	10	GND	15	M4−	20	M2−	25	M6−

Full port-meaning descriptions and the trigger/comparison timing diagram are given in Chapter 11.

4.3 Harmonic Settings

Set directly on the Harmonic display page (too few parameters to warrant a separate setup page).

Setting	Options
Display form	List (factory default) or bar graph
Data mode	% (percentage, factory default) or Δ (absolute value)
Calculation criteria	IEC (factory default) or CSA
Parameter selection	U1/I1...U4/I4 (multi-selectable, limited by fitted channel count); factory default U1

Harmonic analysis covers up to the 50th harmonic, over a fundamental range of 10 Hz–1.2 kHz.

4.4 Waveform Settings

Set directly on the Waveform display page.

Setting	Options
Waveform type	U&I (voltage/current, factory default) or Power
Waveform parameter	U&I: U1/I1...U4/I4 · Power: P1...P4 (per fitted channel)

Waveform plotting is not meaningful above ~50 kHz, due to the limits of the sampling principle, and is referenced to whichever enabled signal has synchronization priority (U1, I1, U2, I2, U3, I3, U4, I4, in that order). The power waveform is based on the most recent 256 samples before the current moment and reflects the data since integration started; a brief non-correspondence between the displayed waveform and the calculated average power is therefore normal.

4.5 System Settings

See Chapter 6, System Setup.

4.6 Wire-system combination reference (3-channel models)

Applies to TH3433 and TH3443. Channel usage per wire-system selection:

Wire system	CH1	CH2	CH3
1P2W	1P2W, 1P2W, 1P2W (independent)		
1P3W or 3P3W	Σ (1P3W or 3P3W)		1P2W
3P4W or 3V3A	Σ (3P4W or 3V3A)		

4.7 Wire-system combination reference (4-channel models)

Applies to TH3434 and TH3444. Since 1P3W/3P3W only use 2 of the 4 channels, 4-channel models allow the remaining pair to form a second, independent wire-system group:

Wire system	CH1	CH2	CH3	CH4
1P2W	1P2W, 1P2W, 1P2W, 1P2W (independent)			
1P3W_1P2W or 3P3W_1P2W	Σ1 (1P3W or 3P3W)		1P2W	1P2W
3P4W_1P2W or 3V3A_1P2W	Σ1 (3P4W or 3V3A)			1P2W
1P3W_1P3W	Σ1 (1P3W)		Σ2 (1P3W)	
1P3W_3P3W	Σ1 (1P3W)		Σ2 (3P3W)	
3P3W_3P3W	Σ1 (3P3W)		Σ2 (3P3W)	

> **NOTE**
>
> In theory 3V3A is also a form of 3P3W; the industry convention (followed here) is to call the 3-channel version 3V3A and the 2-channel version 3P3W.

4.8 HANDLER timing diagram

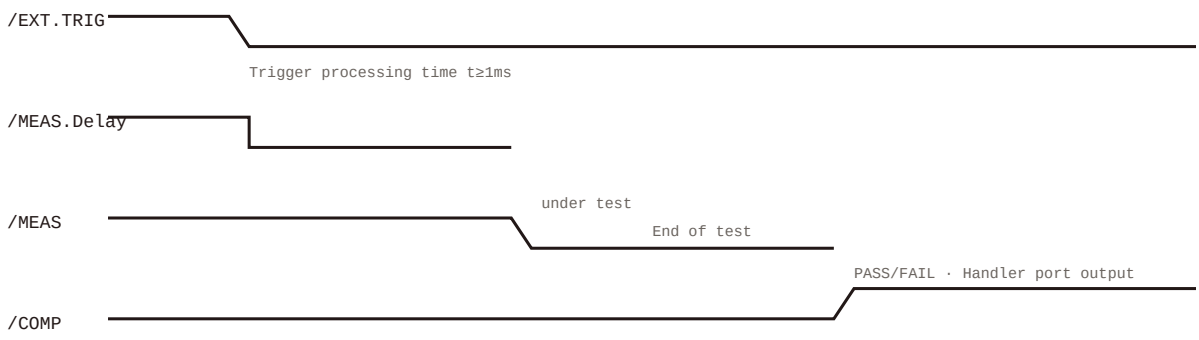


Figure 4-16 — HANDLER timing (identical across the TH34XX family)

- The external trigger pin accepts falling-edge triggering only.
- A measurement begins once the trigger signal is received.
- Up to 8 comparison output channels, each with an independent output condition.

Full HANDLER port-meaning descriptions (+5V, GND, EXTV, /EXT.TRIG, Mx+/Mx−, relay rating 30 VDC/2 A max) are given in Chapter 11.

CHAPTER 5

Measurement Display

Reached via [Display], with page tabs for Meas (test), Comp (compare), Harm (harmonic), Wave (waveform) and Vector.

5.1 Test Display page

5.1.1 Balanced display for each channel

By default, all fitted channels are shown balanced on one page (e.g. a 2×2 grid on a 4-channel model), each showing its key parameters (URMS, IRMS, FU, FI, P, PF, and the active range) at once.

5.1.2 Specify the channel to highlight

Pressing a front-panel [CH1]–[CH4] key (as fitted) zooms that channel's display to fill the page, showing an expanded parameter set; pressing it again returns to the balanced view.

5.1.3 Wire combination test display

Pressing [CHΣ] switches between the normal per-channel display and the wire-system combination (Σ) display, which shows the combined parameters (ΣURMS, ΣIRMS, ΣP, ΣS, ΣQ, ΣPF, η, ΣWP) for the active wiring group (§8.1, Appendix). Not applicable in 1P2W mode.

5.2 Compare Display interface

5.2.1 Compare output description

Shows the live PASS/FAIL state of each of the 8 configured comparison channels (§4.2), mirrored on the front-panel PASS/FAIL lights and (if configured) the comparator buzzer (§6.5.2) and HANDLER relay outputs (Chapter 11).

5.3 Harmonic Display page

5.3.1 Harmonic list display

Shows RMS and percentage-of-fundamental results per harmonic order (up to the 50th), for the selected channel/signal(s) (§4.3). List layout adapts to the number of parameters selected.

5.3.2 Harmonic bar-graph display

Shows the same harmonic-percentage data as a bar graph; layout adapts to the number of parameters selected.

5.4 Waveform Display page

5.4.1 U&I waveforms

Voltage and current waveforms, horizontal axis referenced to the data-cycle time; each enabled channel signal can be shown or hidden independently.

5.4.2 Power waveform

Available only while energy integration is active; shows the selected channel's instantaneous power trace over the most recent 256 samples (§4.4).

5.5 Vector Image Display page

Displays the phase-vector diagram and numeric phase relationships between the voltage/current signals of a 3-phase wiring group. Primarily meaningful for 3P4W and 3V3A combinations; used to assess 3-phase balance.

5.6 Quick page-navigation summary

Page tab	Shows	Key settings (Chapter 4 reference)
Meas	Balanced or per-channel test results	Wiring, trigger, synchro, range (§4.1)
Comp	PASS/FAIL comparison results	Comparison parameters & limits (§4.2)
Harm	Harmonic list/bar graph	Display form, data mode, standard, parameters (§4.3)
Wave	U&I or Power waveform	Waveform type & parameter (§4.4)
Vector	3-phase vector diagram	Wiring = 3P4W or 3V3A (§4.1.1)

All display pages reflect live measurement data at the configured update rate (§4.1.2); pressing **Hold** freezes the current reading on any page without stopping measurement internally.

CHAPTER 6

System Setup

Reached via Setup → System tab. These settings generally do not affect measurement results.

6.1 RS232/RS485 Serial Port Settings

RS232/RS485 is a factory-time hardware choice (one of the two, not both) — **RS232 is fitted as standard**; RS485 requires confirming the option at order time.

Baud rate	4800 / 9600 / 38400 / 115200 bps
Data format	8 data bits, 1 stop bit, no parity, no flow control (fixed)
Command mode	SCPI (standard) or MODBUS — see Chapter 10
Bus address	1–32 (RS485 and/or MODBUS communication only; address 0 is reserved as the broadcast address and cannot be assigned). Not applicable to RS232 in SCPI mode.

6.2 USB Devices

The rear-panel USB Device port can be switched between **USB CDC** and **USB TMC** modes for PC communication (Chapter 10). The front-panel USB Host port accepts FAT16/FAT32 U-disks for file storage and firmware upgrade.

6.3 LAN Setting

The wired LAN interface uses the standard SCPI command protocol; the network port is fixed at **45454** (not user-configurable). Configure the IP address manually, or use the automatic-configuration option if the connected router/switch supports it (falling back to 127.0.0.1 and a default-settings reset if automatic configuration fails).

> **NOTE — WIRELESS**
>
> Wireless LAN (WLAN) is not offered for this series; only the wired LAN interface is available.

6.4 User Settings

6.4.1 System language

English operator-interface language.

6.4.2 Backlight adjustment

LCD backlight brightness: 20% / 40% / 60% / 80% / 100%.

6.5 Signal Setting

6.5.1 Key sound

On/off; on by default.

6.5.2 Comparator sound

Pass / Fail / Off — audible alarm tied to the comparator result (§4.2, §5.2).

6.6 Time and Date

Sets the instrument's local-time clock; format `YYYY-MM-DD HH:MM:SS` (e.g. `2026-08-15 09:13:25`).

6.7 Password

Password protection, when enabled, prevents the instrument from being unlocked without the correct password. The factory-default password is **0000**, with password protection **off** by default.

6.8 Software Upgrade

Covers application (APP), channel-board (DSP) and front-panel (keyboard) firmware, via a one-key upgrade process. The upgrade file must be placed in the root directory of a USB flash drive, named `update3431.sec`. The same file name is used for all models of the series.

6.9 Tools

Default Setting	Restores all settable parameters to factory defaults.
System Reset	Reboots the instrument.
User Manual	On-instrument help; some setup buttons jump directly to the relevant section when long-pressed.
Software Version	Displays the current firmware version.

6.10 System settings quick reference

Category	Covers
RS232/RS485	Baud rate, bus address, command mode (§6.1)
USB devices	USB CDC/TMC mode (§6.2)
LAN settings	Wired network configuration, port 45454 fixed (§6.3)
User settings	Language, backlight (§6.4)
Date & time	System clock (§6.6)
Password	Lock-out protection (§6.7)
Software upgrade	APP/DSP/keyboard firmware (§6.8)
Tools	Defaults, reset, manual, version (§6.9)

These settings generally persist through power cycles and are unaffected by Default Setting unless explicitly reset, with the exception of items the factory default explicitly restores.

CHAPTER 7

File Management

Reached via File. The instrument's current parameter configuration can be saved to, and recalled from, internal flash or an external USB drive, so the same setup can be reloaded without re-entering every parameter.

Type	File format	Recallable	Purpose
System configuration	`*.prf`	Yes	Save the instrument's system configuration state
Measurement configuration	`*.sta`	Yes	Save the instrument's test configuration state
Screenshot	`*.png`	No	Save a screen capture (§3.1, PrtScn)
Test data	`*.csv`	No	Logged measurement data (USB drive only)

Folder structure: configuration files save to either internal storage or the USB drive root, depending on the current file-browser location; screenshots save to the `PIC` folder (USB root if present, otherwise internal); test-data logging requires a USB drive and saves to its root directory.

File operations (via the on-screen toolbar, with a file/folder selected): save measurement settings, save system settings, copy to USB, delete, load.

> NOTE — USB DRIVE USE
>
> Back up USB-drive data before connecting it to the instrument. Avoid an excessive number of files/folders on the drive. Internal storage is limited — periodically copy internal files to USB and clean up.

Data saving operation (§4.1.8): the data-save switch is off by default at power-on; enable it manually once a USB drive is present. While active, the status bar shows a write-operation indicator. Logging must be stopped manually; choose a sensible logging interval to avoid overloading USB write speed.

CHAPTER 8

Correct Measurement

8.1 Wire Wiring Methods

1-channel models support 1P2W only; 3- and 4-channel models support all 5 combinations (§4.1.1, §4.6–4.7). Each channel provides four floating input terminals: V+, V−, I+, I−.

> **TIP**
> To minimize the effect of distributed capacitance, keep the current test terminal as close as possible to the ground side of the input source (i.e. connect the current terminal at the low end of the test circuit).

8.1.1 1P2W wiring

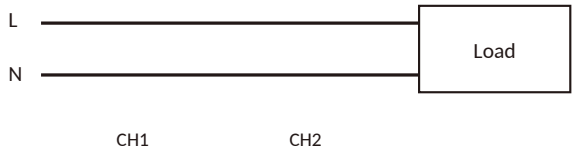
Each channel's wiring can be seen as an independent 1P2W connection, combinable into a multi-phase test system; in 1P2W mode every channel works independently (no Σ combination, §5.1.3). Two recommended connection methods:

Method	Recommended for	Trade-off
Ammeter internal	Low current (small load current)	More accurate current reading; small voltage error from the ammeter's own voltage drop (usually negligible)
Ammeter external	High current (large load current)	More accurate voltage reading; small current error from voltmeter shunt current (usually negligible)

Rule of thumb: when load impedance is low (comparable to the ammeter's own impedance), use the ammeter-external method; when load impedance is high (comparable to the voltmeter's own impedance), use the ammeter-internal method. Recommended wiring sequence: (1) connect the current terminal in series with the load first; (2) connect the voltage terminals to the load or source terminals — positive voltage terminal to the live/fire conductor, negative voltage terminal to the positive current terminal (ammeter-external) or negative current terminal (ammeter-internal); (3) confirm the fire conductor lands on V+ and the neutral conductor on I−.

8.1.2–8.1.5 1P3W, 3P3W, 3P4W, 3V3A wiring

Wire system	Channels used (3-ch model)	Channels used (4-ch model, if selected)
1P3W	CH1 + CH2	CH1+CH2, or CH3+CH4
3P3W	CH1 + CH2	CH1+CH2, or CH3+CH4
3P4W	CH1 + CH2 + CH3	CH1 + CH2 + CH3
3V3A	CH1 + CH2 + CH3	CH1 + CH2 + CH3



1P3W — one-phase three-wire

Figure 8-4 — 1P3W schematic (simplified; see the quick guide packaged with the instrument for the full connection diagram)

Full wiring diagrams for 1P3W, 3P3W, 3P4W and 3V3A are provided in the instrument's quick guide and on-instrument help (§6.9.3); the simplified schematic above illustrates the general principle only.

8.2 Test Condition

General	Confirm range (Auto available), trigger method (continuous = default), wire-system setting and wiring, and synchro source. Factory defaults are generally sufficient.
Comparison	Set comparison parameters, upper/lower limits, and output function (§4.2).
Harmonic	Enable the 500 Hz filter (§4.1.5) for mains-frequency signals, then configure the Harmonic page (§4.3).
Waveform	U&I: select the signal to display. Power: requires integration to be running (§4.1.4).
Vector	No special setup; primarily meaningful for 3P4W/3V3A wiring.

8.3 Ammeter internal vs. external — principle

With the ammeter internally connected, the ammeter is in series with the load and the pair is measured by the voltmeter — i.e. the ammeter sits inside the voltmeter's measurement loop. With the ammeter externally connected, the voltmeter is in parallel with the load alone, and the ammeter is in series outside that loop.

Both meters have non-zero internal resistance (voltage-side input impedance 2 MΩ; current-side impedance depends on range — §9.2.2). When load impedance is low and comparable to the ammeter's impedance, an ammeter-internal connection causes the voltmeter to read the load voltage plus the ammeter's own voltage drop, giving a large error — use ammeter-external instead. Conversely, when load impedance is high and comparable to the voltmeter's impedance, an ammeter-external connection causes the ammeter to read only part of the load current (shunted through the voltmeter), giving a large error — use ammeter-internal instead. Choosing the connection that matches the load impedance regime minimizes the overall measurement error.

CHAPTER 9

Performance & Specifications

9.1 Fundamentals

Each channel's voltage and current inputs are sampled via digital phase-locking and oversampling, synchronized to the full cycle of the input signal; all displayed values, integral results and waveform data are derived from this sampled data. Wire-system combinations (Σ) are formed by grouping 2–3 channels per §4.1.1/§4.6–4.7.

9.2 Overview of Overall Parameters

Parameter	TH343X TH3431 / TH3433 / TH3434	TH344X TH3441 / TH3443 / TH3444
Test range	600 V / 2 A (TH343X) · 600 V / 20 A (TH344X)	
Channels	1 / 3 / 4 (per model)	
Display	7" (800×480) colour TFT resistive touch screen	
Basic measurement accuracy	0.1% reading + 0.1% range (mains-frequency band; see §9.4 for the full frequency-segmented table)	
Voltage range	1–600 V, resolution 0.001 V	
Current range	0.01 mA–2 A, resolution 0.1 µA	0.1 mA–20 A, resolution 1 µA
Power range	0.01 mW–1.2 kW	0.1 mW–12 kW
Micro current	**Yes**	**No**
Frequency range	DC / 0.1 Hz–100 kHz (base), 500 Hz line filter available · harmonic analysis: 10 Hz–1.2 kHz fundamental	
Power factor range	−1.000–1.000	
Energy integration range	0–99999 kWh, resolution 0.001 Wh, accuracy ±(0.2% RDG + 0.3% RNG)	
Energy timing	0–9999:59:59, resolution 1 s, accuracy ±0.05%	
Update rate	0.1 / 0.25 / 0.5 / 1 / 2 / 10 / 20 s, or Auto	
Measurement range mode	Auto / Manual	
Lock function	Data lock; front-panel key/touch lock	
Voltage input impedance	2 MΩ (see note, §8.3)	
Comparator output	Sound + light alarm; 8 programmable relay outputs (HANDLER)	
Communication	RS232C/RS485, USB Host, USB Device, LAN, setting-file storage	
Power supply	AC 220 V ±10%, 50/60 Hz ±5%, soft power switch, ≤50 VA	
Dimensions / weight	236×154×475.5 mm (with sleeve) / 215×132×441 mm (shelf) · ~8.1 kg	

9.3 Specific Input Indicators

Item	All models	TH343X	TH344X
Voltage range	15 / 30 / 60 / 150 / 300 / 600 V		
Current range	—	0.5 / 1 / 2 / 5 / 10 / 20 mA · 0.05 / 0.1 / 0.2 / 0.5 / 1 / 2 A	5 / 10 / 20 / 50 / 100 / 200 mA · 0.5 / 1 / 2 / 5 / 10 / 20 A
Voltage input impedance	2 MΩ		
Current input impedance	—	4 Ω (mA ranges) · 40 mΩ (A ranges)	400 mΩ (mA ranges) · 4 mΩ (A ranges)
1 s instantaneous max. input	1000 V	3 A	30 A
Continuous max. input	700 V	2 A	20 A

9.4 Precision Indicators

Reference conditions: ambient 23±5 °C, 30–75% RH, sine-wave input, crest factor 3, 5 display digits, 500 Hz filter off. Accuracy is valid for 12 months and is identical for TH343X and TH344X (same percentage-of-reading/range figures apply at each tier's own range).

Voltage & current accuracy

Frequency band	Accuracy (voltage / current)
DC	±(0.1% reading + 0.2% range)
0.1 Hz ≤ f < 45 Hz	±(0.1% reading + 0.2% range)
45 Hz ≤ f < 66 Hz	±(0.1% reading + 0.1% range)
66 Hz ≤ f < 1 kHz	±(0.1% reading + 0.2% range)
1 kHz ≤ f < 10 kHz	±[(0.07×f_{kHz})% reading + 0.3% range]
10 kHz ≤ f ≤ 100 kHz	±(0.5% reading + 0.5% range) ±[0.04×(f_{kHz}−10)]% reading

The 45–66 Hz (mains-frequency) figure, ±(0.1% reading + 0.1% range), is the headline "basic accuracy" quoted in §9.2 and the datasheet.

Active power accuracy

Frequency band	Accuracy
DC	±(0.1% reading + 0.2% range)
0.1 Hz ≤ f < 45 Hz	±(0.3% reading + 0.2% range)
45 Hz ≤ f < 66 Hz	±(0.1% reading + 0.1% range)
66 Hz ≤ f < 1 kHz	±(0.2% reading + 0.2% range)
1 kHz ≤ f < 10 kHz	±(0.1% reading + 0.3% range) ±[0.067×(f_{kHz}−1)]% reading
10 kHz ≤ f ≤ 100 kHz	±(0.5% reading + 0.5% range) ±[0.09×(f_{kHz}−10)]% reading

Applies identically to all six models (TH3431/TH3433/TH3434/TH3441/TH3443/TH3444); the source table's model-list header included an extra, non-existent "TH3432"/"TH3442" entry, corrected here to the six confirmed models.

Other parameter accuracy — conditions

Voltage/current overload limit: 1.1× full scale. Power-factor accuracy requires voltage amplitude >10% of range and current amplitude >1% of range. Frequency measurement requires voltage amplitude >10% of range, or current amplitude >1% of range.

Harmonic analysis accuracy: ±(5% reading + 0.3% range), over the 10 Hz–1.2 kHz fundamental range (§4.3, §9.2).

CHAPTER 10

Remote Control

The TH343X/TH344X series can be controlled remotely over RS232C/RS485, USBTMC, or wired LAN. Command parsing supports the standard **SCPI** protocol on all interfaces, plus an optional **MODBUS** protocol on RS232C/RS485 only. A companion SCPI/MODBUS command reference, in the format of the published *TH342X Series SCPI Command Reference*, is available on request for the full command set.

10.1 RS232C interface

Signal	Abbreviation	Connector pin
Send data	TXD	2
Receive data	RXD	3
Grounding	GND	5

Only this minimal 3-wire subset of the RS-232 standard is used (not the full handshake set); pin numbering differs from a standard IBM-AT 9-pin serial port. Baud rate: 4800 / 9600 / 38400 / 115200 bps (see §6.1). No parity, 8 data bits, 1 stop bit. Commands conform to the SCPI standard and must be terminated with LF (0x0A). Maximum command-string length: 128 bytes per transfer.

10.2 RS485 interface

Signal	Abbreviation	Connector pin
Data+	485+	1
Data−	485−	4

RS485 is a factory-time hardware option in place of RS232 (§6.1) — the two share the same physical connector. Differential balanced signalling gives better noise immunity and longer cable runs (up to ~1219 m) than RS232, with up to 32 nodes on one bus (addressed via the bus-address setting, §6.1). RS485 and MODBUS communication requires the relevant baud rate, parity, data-bit and stop-bit settings to be configured before use (§6.1).

10.3 USBTMC & LAN

The USB Device interface complies with USBTMC-USB488 and USB 2.0 (CDC or TMC mode selectable, §6.2). The wired LAN interface uses the standard SCPI command protocol over the fixed network port **45454** (§6.3). *Wireless LAN is not offered for this series.*

10.4 SCPI command structure

SCPI (Standard Commands for Programmable Instruments) is an ASCII-based, hierarchical ("tree") command language built on the IEEE 488.2-1987 standard. Related commands are grouped under a common root, forming a subsystem. Commands may be sent in short (capitalised-letter) or long form; the TH343X/TH344X series' own command descriptions mostly use the short form to avoid ambiguity.

Subsystem	Covers
IEEE488.2 Common	*IDN?, *RST, *CLS, status/event registers, etc.
DISPlay	Active display page selection
FUNCtion	Measurement/wiring/trigger/range/integral setup and readback
COMPare	Comparison parameters, limits, output function
HARMonic	Harmonic analysis setup and results
WAVE	Waveform data retrieval
SYSTem	System-level configuration (language, time, communication, etc.)
TRIGger	Trigger method and bus-trigger command
FETCh	Measurement/result readback

MODBUS is available as an alternative to SCPI on RS232C/RS485 only (not on USBTMC or LAN); see §6.1 for selecting the command mode. For the full register map, CRC16 calculation method and command-by-command reference, request the companion SCPI/MODBUS Command Reference document.

CHAPTER 11

Handler Interface

The rear-panel HANDLER interface outputs the 8-channel comparator result and accepts an external trigger input, enabling an automatic sorting/test system. The output circuit uses relay-isolated outputs: the comparison result drives a relay coil, and the relay contact forms the corresponding pair of HANDLER output pins — isolating the signal, and letting the user form a level or edge signal externally with a simple pull-up or pull-down resistor.

11.1 Connector & pin definitions

25-pin D-type connector, identical across the TH34XX family:

Pin	Def.	Pin	Def.	Pin	Def.	Pin	Def.	Pin	Def.
1	+5V	6	M7−	11	M5−	16	M3+	21	M8−
2	M4+	7	M2+	12	M6+	17	/EXT.TRIG	22	M1−
3	reserve	8	M8+	13	+5V	18	M7+	23	M5+
4	M3−	9	M1+	14	EXTV	19	NULL	24	GND
5	GND	10	GND	15	M4−	20	M2−	25	M6−

11.2 Pin meanings

- **+5V / GND** — internal power supply and ground.
- **EXTV** — external power input (+5 V–+30 V) for use instead of the internal supply; requires opening the case and moving a jumper on the Handler board. The external supply has no separate external GND — its high side and /EXT.TRIG together form the trigger loop.
- **/EXT.TRIG** — external trigger input, edge-triggered; idle-high, falling edge triggers a measurement. Requires trigger source = External (§4.1.2).
- **M*x*+ / M*x*−** (*x* = 1–8) — relay single-pole output pair for comparison channel *x*; contacts close (M*x*+/M*x*− shorted) when that channel's comparison result activates its relay. Factory relay rating: **30 VDC / 2 A max**.
- **reserve** — system-reserved pin.
- **NULL** — unconnected pin.

11.3 Timing diagram

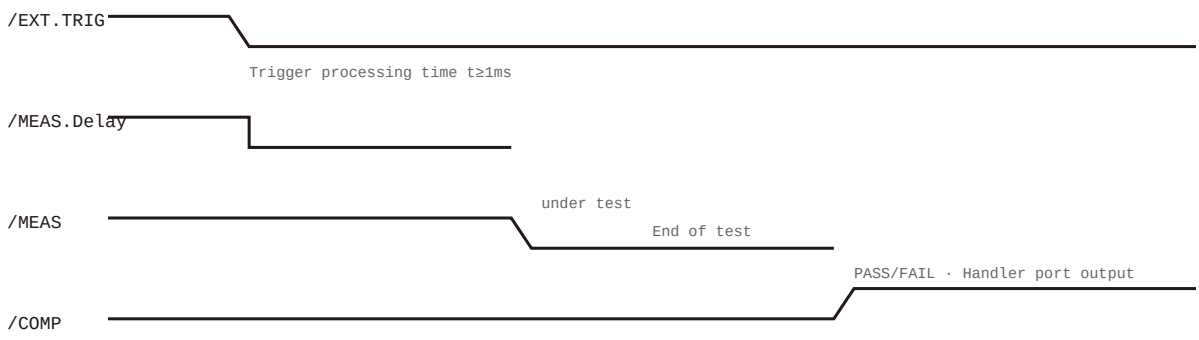


Figure 11-1 — HANDLER timing diagram

- The external trigger pin accepts falling-edge triggering only.
- A measurement begins once the trigger signal is received, and the comparison result/relay output follows at the end of that measurement.
- Up to 8 comparison output channels are available, each independently controlled (§4.2.1–4.2.3).

For the comparison-channel-to-relay-pin mapping and output-function options (pass/fail/pulse/off), see §4.2.

APPENDIX

Terms, Symbols & Quick Reference

A.1 General parameter symbols

Symbol	Meaning	Unit	Symbol	Meaning	Unit
U_{RMS}	Voltage true RMS	V	I_{RMS}	Current true RMS	A
U_{AC}	Voltage AC component RMS	V	I_{AC}	Current AC component RMS	A
U_{DC}	Voltage DC component	V	I_{DC}	Current DC component	A
U_{PK+} / U_{PK-}	Positive / negative voltage peak	V	I_{PK+} / I_{PK-}	Positive / negative current peak	A
U_{PP}	Peak-to-peak voltage	V	I_{PP}	Peak-to-peak current	A
U_{CF}	Voltage peak (crest) factor	—	I_{CF}	Current peak (crest) factor	—
P	Active power	W	λ (PF)	Power factor	—
S	Apparent power	VA	φ	Voltage–current phase difference	°
Q	Reactive power	var	F_U / F_I	Voltage / current frequency	Hz

A.2 Integral (energy) parameter symbols

Symbol	Meaning	Unit
Time	Integration elapsed time	s
WP	Active-power integral (sum of positive + negative)	Wh
WP+ / WP−	Positive (consumption) / negative (feedback) active-power integral	Wh
WS	Apparent-power integral	VAh
WQ	Reactive-power integral	varh
q	Current integral (sum of positive + negative)	Ah
PAVG / PMAX / PMIN	Average / maximum / minimum power during integration	W

A.3 Σ (wire-system combination) parameter symbols

Symbol	Meaning	Unit
ΣU_{RMS}, ΣU_{AC}, ΣU_{DC}	Combined voltage (per selected component) across the wire-system group	V
ΣI_{RMS}, ΣI_{AC}, ΣI_{DC}	Combined current (per selected component) across the wire-system group	A
ΣP / ΣS / ΣQ	Combined active / apparent / reactive power	W / VA / var
ΣPF	Combined power factor	—
η	Energy efficiency within the wire-system combination (user-programmable formula, §4.1.1.2)	%
ΣWP	Combined active-power integral	Wh

A.4 Common on-screen error messages

Message	Cause	Solution
"CHx, connection failed"	Channel CHx board exception	Try a channel-board firmware upgrade; if unresolved, contact after-sales support
"No channel n"	Instrument ordered without the n-th channel	Expected — not a fault on a lower-channel-count model
"1P2W is not supported"	1P2W mode does not support the CHΣ combination display	Select a valid wire system for the display requested
"Delete line on range status"	Test result exceeds the current range	Select an appropriate range
Result shows "--.--"	Test result exceeds the preset upper limit	Check whether the input exceeds the current range limit; select an appropriate range
Result shows "-----"	Result exceeds the preset display length	Select an appropriate range and confirm the display resolves

A.5 Model quick reference

Model	Channels	Range	Micro current	Current resolution
TH3431	1	600 V / 2 A	Yes	0.1 µA
TH3433	3			
TH3434	4			
TH3441	1	600 V / 20 A	No	1 µA
TH3443	3			
TH3444	4			

TH343X/TH344X and TH342X are separate Tonghui product series with different frequency bandwidths and accuracy classes — see the TH342X Series Operation Manual for standard mains-frequency testing.