TECHMIZE by TONGHUI

OM

OPERATION MANUAL

TH342X Series

4-Channel Digital Power Meter — TH3421 / TH3422. 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

Rev. 2026-10

TH342X Series Operation Manual

4-Channel Digital Power Meter — TH3421 / TH3422

This is the TH342X Series Operation Manual. **TH3411 (3-channel model) has been discontinued and is not covered by this manual** — both TH3421 and TH3422 described here are fixed 4-channel instruments. Wireless LAN (WLAN) is not offered for this series; see the note in Chapter 6.

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The full SCPI/MODBUS command reference (~70 commands across 9 subsystems) is issued as a separate companion document, TH342X Series SCPI Command Reference, 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 TH342X series of 4-channel digital power meters, covering models **TH3421** and **TH3422**. 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 TH342X 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).

> **CAUTION — FUSE RATING**
>
> The instrument fuse is a factory-fitted standard part, rated **1 A**. 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). 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 series (including TH342X) 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).

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 TH342X 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

Techmize Electronic GmbH

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Registration

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

CHAPTER 2

Out of the Box

2.1 Unpacking

Inspect the shipping 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× TH342X-series digital power meter (model as ordered: TH3421 / TH3422) · 1× EU power cable (Schuko, CEE 7/7) · 1× this operation manual · spare fuse(s) as fitted · test report · warranty certificate.

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

2.2 Connecting the power supply

Item	TH3421 / TH3422
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 of the 4 channels 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: 1000 V (1 s instantaneous) / 700 V (continuous) on the voltage terminals; on the current terminals, 40 A (1 s) / 30 A (continuous) for TH3421, or 4 A (1 s) / 3 A (continuous) for TH3422 (see Chapter 9 for the full range table).

2.4 Starting the instrument for the first time

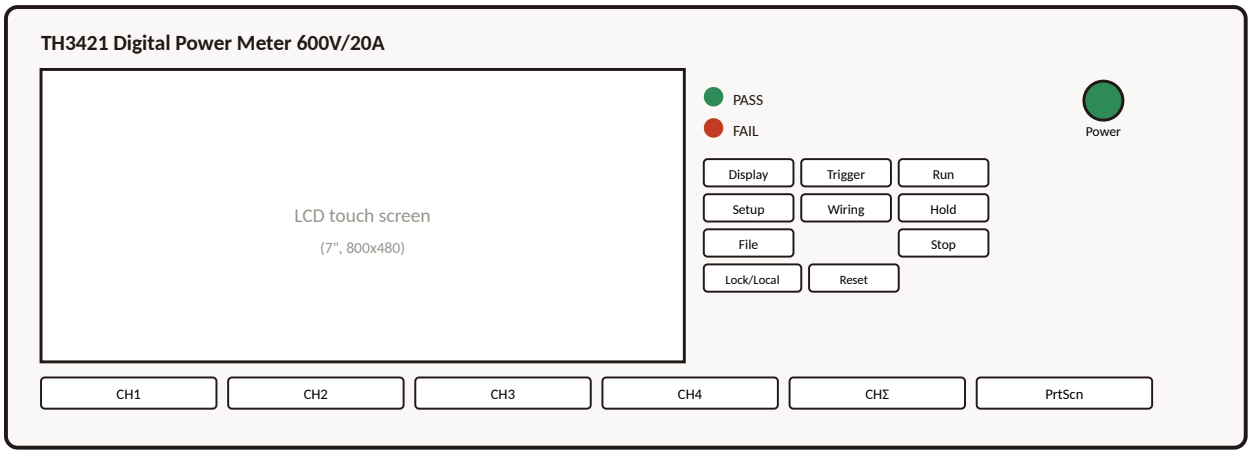
1. Connect the EU power cable to the rear-panel inlet, confirming reliable earth-ground connection.
2. Press the front-panel **Power** switch (illuminates green when on).
3. The instrument starts in two stages: first the embedded operating system, then the application program — each stage shows its own 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) — see Table 3-1 for the full item legend

1 **Trademark & model** — instrument brand, model and test range (e.g. "TH3421 Digital Power Meter 600V/20A").

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).

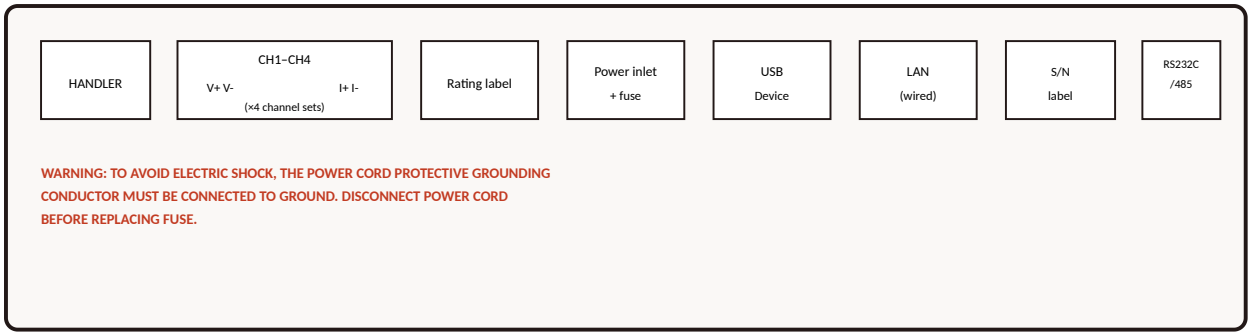
17 **Hold** — freezes the displayed reading; press again to release.

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).

20–23 **CH1**–**CH4** — highlights the corresponding channel's display (§5.1.2).

3.2 Rear panel



Simplified rear-panel layout (schematic, not to scale) — 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 (×4, one per channel).

3 **V+ terminal** — voltage measurement, positive (×4).

4 **I− terminal** — current measurement, negative (×4).

5 **I+ terminal** — current measurement, positive (×4).

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).

3.3 Screen display

The TH342X series uses a 24-bit colour, 7" resistive touch screen at 800×480 resolution. The main test page offers two selectable display styles (switchable on the system setup page, §6.3.1). The screen content is divided into three zones:

Zone	Contents
Title bar (top)	Name of the current page.
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 Starting the instrument

Confirm reliable earth-ground connection, then press **Power** (§2.4). The instrument starts in two stages (embedded OS, then application), then opens on the default <Measurement Display> page. Allow at least 30 minutes of warm-up before relying on rated accuracy (§1.3, Chapter 9).

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). Because TH3421/TH3422 are both fixed 4-channel instruments, 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) — see Chapter 8, Table 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).

Trigger delay: 0–60 s, 1 ms resolution — the wait from the trigger event to the start of the measurement.

4.1.3 Synchro setup

Selects the synchronization (phase-lock) source per channel. If the selected channel's signal is lost or falls outside a valid range, the instrument automatically falls back to line-frequency synchronization. Where the input source is run in parallel with the AC mains, locking the synchro source to Line (50/60 Hz) is recommended for the fastest, most stable lock. For distorted signals (e.g. motor or inverter testing), the synchro source can instead be locked to whichever channel (voltage or current) has the cleaner sine wave.

4.1.4 Integrator setup

Control mode	Description
Manual	Integration time setting has no effect. Run / Stop fully controls start/stop; timing counts up.
Continuous	Integration runs for the set integral time (countdown); stops automatically when time expires or on Stop.

Integral time (continuous mode only): 0–9999:59:59, factory default 0 (maximum). After Stop, press Reset to zero the accumulated result.

4.1.5 Filter and average

Line filter: a 5 kHz hardware filter, on by default (calibration data assumes it is on). Turn it off only to inspect harmonic content of non-power-frequency signals — note that the instrument's harmonic accuracy specifications apply to power-frequency (50/60 Hz) signals only.

Average: number of samples averaged per displayed result, 1–32, factory default 1.

4.1.6 Measurement range

Voltage range (all models)			
75 V	150 V	300 V	600 V

Current range					
TH3421	10 mA	30 mA	100 mA	400 mA	1.5 A / 5 A / 20 A
TH3422	1 mA	3 mA	10 mA	40 mA	150 mA / 500 mA / 2 A

Factory default: voltage at the maximum range (600 V); current at the maximum range for the model (20 A for TH3421, 2 A for TH3422). In fixed (manual) range mode, select a range matched to the expected signal — an unsuitable manual range affects accuracy.

4.1.7 Data save

Setting	Description
Save switch	ON/OFF; not retained after power-off (defaults to OFF at startup).
Save parameters	Choice of which parameters to record to the USB drive.
Control mode	Time (record at a fixed time interval) or Times (record every N measurements).
Count snap	1–999 measurements between records (Times mode).
Time snap	0.2 s–60.0 s between records (Time mode).

> NOTE
>
> Data recording requires an external USB drive — there is no internal fallback for test-data logging. Files are saved as `DATAx.csv` in the USB root directory, split into multiple files once a size threshold is reached. Enabling data save reduces test throughput; select only the parameters actually needed.

4.2 Compare setup

Configures the 8 comparison channels, each with: comparison parameter, upper limit, lower limit, and output function. Each comparison channel corresponds to one of the 8 programmable outputs on the rear-panel HANDLER connector (Chapter 11).

4.2.1 Comparison parameter & limits

Select the parameter to compare per channel (any measured/derived parameter — see §9.1.3 for the full parameter set). Enter the upper and lower limit for each; factory default is 0 for both. If the lower limit is entered greater than the upper limit, the instrument automatically swaps them.

4.2.2 Compare function

Function	Behaviour
OFF	Channel does not participate in comparison.
Pass Contact	Output pins conduct (closed) while the result is qualified.
Fail Contact	Output pins conduct (closed) while the result is unqualified.
Pass Pulse	On a qualified result, output pins close for 5 ms then re-open (default state: open).
Fail Pulse	On an unqualified result, output pins open for 5 ms then re-close (default state: closed).

The comparator buzzer is configured separately, under System Setup → Sound Settings (§6.4.2). For the HANDLER circuit principle, pin definitions and timing diagram, see Chapter 11.

4.3 Harmonic settings

Setting	Options
Display form	List (table, with % or Δ data mode) or Bar (percentage bar graph). Default: List.
Data mode	% (percentage) or Δ (absolute value). Default: %.
Calculation standard	IEC or CSA (see §9.1.3.4 for the formulas). Default: IEC.
Parameter selection	U1/I1 … U4/I4, multiple selection. Default: U1.

These fields are set directly on the harmonic display page rather than a separate setup tab (§5.3). Harmonic analysis covers the 2nd–50th order of power-frequency (50/60 Hz) signals; turn off the 5 kHz line filter (§4.1.5) first if you need to inspect non-power-frequency harmonic content, noting that accuracy is not specified in that case.

4.4 Waveform setup

Waveform type	Optional parameters
U&I (voltage & current)	U1, I1, U2, I2, U3, I3, U4, I4 (multiple selection)
Power	P1, P2, P3, P4 (multiple selection) — valid only while the integration function is running

These fields are set directly on the waveform display page (§5.4). Default waveform type: U&I.

4.5 System setup

See Chapter 6, System Setup.

CHAPTER 5

Measurement Display

Reached via Display. Five display-page categories are available: **Meas** (conventional measurement), **Comp** (comparison result), **Harm** (harmonic analysis), **Wave** (waveform), **Vector** (three-phase vector diagram).

5.1 Measurement display page

Display effect	Description
Balanced (default)	All channels shown equally, 4 selectable parameters per channel. TH342X's 4-channel layout uses a 2×2 grid arrangement.
Highlighted channel	Enlarges one channel's full parameter set; other channels shrink to RMS-only in a side panel. Switch with CH1–CH4.
Wire-system combination	Highlights the combined (Σ) result for the active wire system; other channels shrink to a side panel showing which channels compose the combination. Switch with CHΣ. Not available in 1P2W mode (§4.1.1).

To change which 4 parameters a channel displays in the balanced view, double-touch the channel's display area to open the parameter-selection window.

5.2 Compare display

Shows up to 8 comparison windows (Comp1–Comp8), each with: channel number, PASS/FAIL/not-compared result, relay-output state, comparison parameter & reading, and the upper/lower limit.

Condition	Panel LED / buzzer
All compared parameters qualified	Green PASS lit
≥1 compared parameter unqualified	Red FAIL lit
No parameter participating in comparison	Neither PASS nor FAIL lit

The comparator buzzer ("Key sound" / compare-sound setting) is configured on the System Setup page (§6.4.2): PASS sounds only when all qualified, FAIL sounds whenever at least one fails, OFF disables the buzzer for comparison results.

5.3 Harmonic display

Split layout: harmonic result on the left (List or Bar, §4.3), harmonic-related settings on the right. Uses a phase-locked loop to synchronize with the fundamental and analyze harmonic distortion up to the 50th order, under IEC or CSA calculation standards (§9.1.3.4).

- **List display:** tabular results for each selected parameter; touching a column shows that parameter's effective value, DC component and total harmonic size.
- **Bar display:** percentage bar graph, harmonic order (2–50) on the x-axis; supports zoom by touch. Voltage and current of the same channel share one coordinate system (colour-coded); different channels use separate coordinate windows.

> **NOTE**
> For non-power-frequency signals, turn off the 5 kHz line filter (§4.1.5) to avoid attenuating the harmonic content — but note that harmonic accuracy is specified for power-frequency signals only, and the maximum analysable order is lower for non-power-frequency inputs.

5.4 Waveform display

Split layout: waveform plot on the left, waveform settings on the right (§4.4). Displays 256 points captured over one source period. This is reference-quality source data, not an oscilloscope-grade display.

- **U&I waveform:** selected voltage/current channels (U1, I1…U4, I4), multiple selection; voltage and current share one coordinate system with separate axes. The trigger-signal lock priority is U1, I1, U2, I2, U3, I3, U4, I4.
- **Power waveform:** P1–P4; valid only while the integration function is running, displayed as a scrolling window of the latest 256 points.

5.5 Vector display

Shows the voltage and current vectors (magnitude and phase angle) of a three-phase wire-system combination on a polar-coordinate plot, with the basic test results shown alongside. The vector display is primarily meaningful for the **3P4W** and **3V3A** wire systems; it carries no special settings of its own.

CHAPTER 6

System Setup

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

6.1 RS232/RS485 serial port settings

RS232 and RS485 are a hardware (factory-time) choice — one of the two is fitted, not both; **RS232 is standard, RS485 is available as a factory-installed option** (confirm at order time if RS485 is required instead of RS232). Communication parameters:

Parameter	Value
Baud rate	4800 / 9600 / 38400 / 115200
Data format	8 data bits, 1 stop bit, no parity, no flow control (fixed)
Command mode	SCPI (standard) or MODBUS (optional) — 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 LAN settings

The wired LAN interface uses the standard SCPI command protocol; the network port is fixed at **45454** (not user-configurable). Wired LAN is used by default at startup — 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 LAN NOT OFFERED
>
> **WLAN is not offered for the TH342X series**; only the wired LAN interface is available. Contact Techmize if your application requires wireless connectivity.

6.3 User settings

Setting	Options
6.3.1 Display style	2 selectable main-page display styles; default Style 1.
6.3.2 System language	English.
6.3.3 Backlight	20% / 40% / 60% / 80% / 100%.

6.4 Sound settings

Setting	Options
6.4.1 Key sound	ON (default) / OFF.
6.4.2 Compare sound	PASS (beep only when fully qualified) / FAIL (beep on any unqualified result) / OFF.

6.5 Date/time

Sets the instrument's local-time clock; format `YYYY-MM-DD HH:MM:SS`. Requires the modify key to unlock the field before editing.

6.6 Password

Controls password protection for unlocking the instrument. Options: Closed (default) / Open, with a Modify function to set a new password. The factory-default password is the instrument's own model number (e.g. `3421` or `3422`).

6.7 Update

Firmware upgrade operations: application (APP), channel board (DSP, per-channel or all-channel one-click), and front-panel keypad. All upgrade files must be placed in an `update34files` folder in the root directory of a USB drive — the instrument will not find upgrade files elsewhere. Each upgrade type requires a confirmation dialog before proceeding.

6.8 Tools

Tool	Function
Default setting	Restores all settable parameters to factory defaults.
System reset	Restarts the system.
User manual	On-instrument help viewer — opens this manual's on-board equivalent directly, or jumps to a specific chapter from certain setting buttons via long-press.
Software version	Displays the current firmware version.

CHAPTER 7

File Management

Reached via File. Lets the user save and recall complete instrument configurations as named files, avoiding the need to re-enter settings for a repeat job.

7.1 Storage types

File type	Format	Reloadable	Use
System configuration	`*.prf`	Yes	Saves the instrument's system configuration state.
Measurement configuration	`*.sta`	Yes	Saves the test configuration state.
Screenshot	`*.png`	No	Saves a screen capture (§3.1, PrtScn key).
Test data	`*.csv`	No	Logged measurement data (§4.1.7).

Configuration files can be saved to either internal memory (`files`) or an external USB drive (`usb`), selected by the current file-cursor location. Screenshots prefer the USB drive root when one is present, otherwise the internal `PIC` folder. Test-data logging requires a USB drive — there is no internal fallback.

7.2 Operations

- **Save** — with the file-list focus on the desired location, save the current measurement or system settings under a new or existing file name.
- **Copy to USB** — copies the selected file or folder from internal memory to the USB root directory (overwrites a same-named file; a same-named folder is not permitted).
- **Delete** — removes the selected file.
- **Load** — re-applies the settings from the selected file to the instrument.

> NOTE
> Back up data on a USB drive before connecting it to the instrument — Tonghui is not responsible for data loss on the USB device. Because internal storage is limited, copy saved files to USB regularly and clean up internal files as needed.

CHAPTER 8

Correct Measurement

8.1 Wire connection methods

Both TH3421 and TH3422 are fixed 4-channel instruments supporting 5 wire-system combinations: **1P2W**, **1P3W**, **3P3W**, **3P4W**, **3V3A**. (3V3A is, in principle, also a 3P3W measurement — the industry convention is to call a 3-channel 3P3W measurement "3V3A" to distinguish it from the 2-channel 3P3W method.)

Wire system	CH1	CH2	CH3	CH4
1P2W	1P2W	1P2W	1P2W	1P2W
1P3W or 3P3W (2-channel)	Σ1 (1P3W or 3P3W)		1P2W	1P2W
3P4W or 3V3A	Σ1 (3P4W or 3V3A)			1P2W
1P3W_1P3W / 1P3W_3P3W / 3P3W_3P3W	Σ1 (1P3W or 3P3W)		Σ2 (1P3W or 3P3W)	

Since 1P3W and 3P3W (2-channel) only use CH1–CH2, the remaining CH3–CH4 can run a second, independent 1P3W or 3P3W combination at the same time — a capability specific to the 4-channel TH3421/TH3422.

8.1.1 1P2W wiring

Each channel provides 4 terminals: V+, V−, I+, I− (floating inputs). Because all channels are independent in 1P2W mode, each channel behaves as a standalone single-phase power meter.

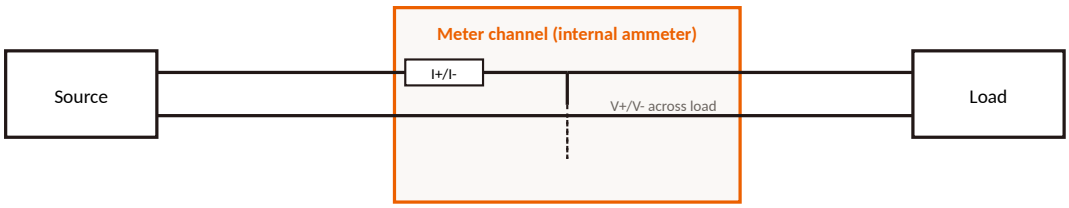


Fig. 8-1 — 1P2W, internal ammeter connection (recommended for small test current)

Two typical wiring variants exist, chosen by test current: **internal ammeter connection** (ammeter in series with the load, inside the voltmeter's sense loop — recommended for low current, since the voltage drop across the ammeter is then a small, usually negligible error) and **external ammeter connection** (voltmeter in parallel with the load, outside the ammeter's loop — recommended for high current, since the voltmeter's loading current then adds a small, usually negligible error to the current reading). Choose internal connection when load impedance is comparable to the current terminal's input impedance (200 mΩ–4 mΩ depending on range); choose external connection when load impedance is comparable to the voltage terminal's input impedance (3 MΩ).

Recommended wiring sequence: (1) connect the current terminal in series with the load first, with the current negative terminal toward the neutral line; (2) then connect the voltage terminal across the load or source as required, with the voltage positive terminal to the live wire; (3) confirm the live wire connects to V+ and the neutral wire to I− before powering on.

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

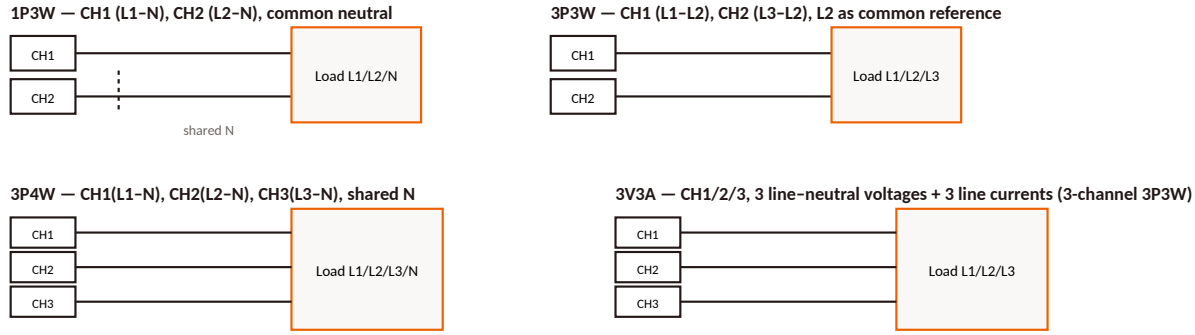


Fig. 8-2 — Schematic wire-system diagrams for 1P3W, 3P3W, 3P4W and 3V3A (simplified; each channel block represents its own V+/V-/I+/I- terminal pair)

Wire system	Channels used	Notes
1P3W	CH1, CH2 (or CH3, CH4)	Two single-phase legs sharing a common neutral.
3P3W	CH1, CH2 (or CH3, CH4)	2-channel method; one line taken as the common voltage/current reference.
3P4W	CH1, CH2, CH3	Three-phase, four-wire; requires 3 channels on both 3- and 4-channel instruments.
3V3A	CH1, CH2, CH3	3-channel 3P3W equivalent; industry naming convention distinguishes it from the 2-channel 3P3W method above.

8.2 Test conditions

Test type	Condition to confirm
Conventional	Range (Auto is usually adequate); trigger mode/delay (default: internal, 0 s delay); wire system setting matches the actual wiring; per-channel synchro source is appropriate (§4.1.3). Factory defaults are normally sufficient.
Comparison	Comparison parameters, upper/lower limits and output function configured (§4.2).
Harmonic	5 kHz line filter on (default) for power-frequency analysis; harmonic parameters set on the harmonic display page (§4.3, §5.3).
Waveform	U&I waveform needs only parameter selection; power waveform additionally requires the integration function to be running (§4.4, §5.4).
Vector	No special configuration; most meaningful for 3P4W and 3V3A wire systems (§5.5).

CHAPTER 9

Performance & Specifications

Ratings apply after at least **30 minutes** of warm-up (§1.3, §2.4), within the environmental limits of §1.3.

9.1 Overview of overall parameters

Model	TH3421	TH3422
Basic features	AC/DC, 4 channels, harmonic analysis, waveform display, vector analysis, power test	
Current type	600 V / 20 A	600 V / 2 A (micro current)
Display	7" (800×480) colour TFT resistive touch screen	
Measured parameters	Basic data, integral data, waveform graph, histogram, vector diagram	
Basic measurement accuracy	0.15% reading + 0.2% range + 1 digit (1-year; see §9.3 for full per-range table)	
Voltage range	5 V–600 V, minimum resolution 0.01 V	
Current range	0.5 mA–20 A, min. resolution 10 µA	0.05 mA–2 A, min. resolution 1 µA
Power range	5 mW–12 kW	0.5 mW–1.2 kW
Frequency range	Fundamental: DC/45 Hz–420 Hz; bandwidth 21 kHz; 5 kHz line filter	
Power factor range	−1.000–1.000	
Lock function	Data lock	
Range mode	Auto / Manual	
Test speed	DC 5 readings/s, AC 7 readings/s (50 Hz); 4 readings/s (50 Hz) with harmonic/waveform display active	
Input impedance	3 MΩ (voltage)	
Comparator output	Over-limit sound & light alarm, relay output (8 channels via HANDLER)	
Communication	RS232 (standard) / RS485 (option), USB, wired LAN, setting-file storage. *WLAN not offered — see §6.2.*	
Power supply	AC 220 V ±10%, 50/60 Hz ±5%, soft power switch	
Dimensions & weight	215×132×441 mm (W×H×D); 236×154×475.5 mm with packing; 8.1 kg	

9.2 Specific input indicators

Item	Voltage	Current (TH3421)	Current (TH3422)
Range	75/150/300/600 V	10/30/100/400 mA, 1.5/5/20 A	1/3/10/40 mA, 150/500 mA, 2 A
Input impedance	3 MΩ	200 mΩ (10–400 mA) / 4 mΩ (1.5–20 A)	2 Ω (1–40 mA) / 200 mΩ (150 mA–2 A)
Max. input, 1 s instantaneous	1000 V	40 A	4 A
Max. input, continuous	700 V	30 A	3 A
Max. display	Range × 110%		

9.3 Accuracy index

9.3.1 Voltage test accuracy (both models)

Range	Resolution	Accuracy, DC & 45–75 Hz	Accuracy, 75–420 Hz
75 V	0.01 V	±(0.15% reading + 0.2% range + 1 digit)	±(0.3% reading + 0.2% range + 1 digit)
150 V	0.1 V		
300 V	0.1 V		
600 V	0.1 V		

9.3.2 Current test accuracy

TH3422 (micro-current, 2 A):

Range	Resolution	Accuracy, DC & 45–75 Hz	Accuracy, 75–420 Hz
1/3/10/40 mA	0.001 mA	±(0.15% reading + 0.2% range + 1 digit)	±(0.3% reading + 0.2% range + 1 digit)
150 mA	0.01 mA		
500 mA / 2 A	0.1 mA	±(0.15% reading + 0.2% range + 1 digit)	±(0.3% reading + 0.2% range + 1 digit)

TH3421 (20 A):

Range	Resolution	Accuracy, DC & 45–75 Hz	Accuracy, 75–420 Hz
10/30/100 mA	0.01 mA	±(0.15% reading + 0.2% range + 30 digits)	±(0.3% reading + 0.2% range + 30 digits)
400 mA	0.01 mA	±(0.15% reading + 0.2% range + 10 digits)	±(0.3% reading + 0.2% range + 10 digits)
1.5 A, reading <1 A	0.1 mA	±(0.15% reading + 0.2% range + 10 digits)	±(0.3% reading + 0.2% range + 10 digits)
1.5 A, reading ≥1 A	0.1 mA	±(0.15% reading + 0.2% range + 1 digit)	±(0.3% reading + 0.2% range + 1 digit)
5 A / 20 A	0.1 mA	±(0.15% reading + 0.2% range + 1 digit)	±(0.3% reading + 0.2% range + 1 digit)

NOTE

The current-accuracy table in §9.3.2 above specifies a higher digit-count allowance (10–30 digits) at the lowest current ranges and for sub-1 A readings on the 1.5 A range.

9.3.3 Accuracy of other parameters (both models)

Parameter	Test range	Resolution	Accuracy (1 year)
Active power	U×I×PF	0.01 mW (TH3421) / 0.001 mW (TH3422)	±(0.2% reading + 0.3% range), DC & 45–420 Hz
Power factor	0.1–1.000	0.001	±0.01
Frequency	45–420 Hz	0.01 Hz	0.1% reading + 1 digit
Energy accumulation	0–99999 kWh	0.001 Wh	±(0.2% reading + 0.3% range)
Energy timing	0–9999:59:59	1 s	±0.05%
Harmonic (power-frequency only)	2nd–50th order	—	±(5% reading + 0.3% range); not specified for 75–420 Hz

Voltage/current overload limit: 1.1× full scale. Power-factor accuracy requires voltage >10% of range *and* current >1% of range. Frequency-test accuracy requires voltage >10% of range *or* current >1% of range. Power factor's −1.000–1.000 operating range (§9.1) and its 0.1–1.000 accuracy-rated range (this table) are different quantities: the operating range, and the range over which the stated accuracy is guaranteed.

PART II

Remote Control & Handler Interface

The chapters that follow introduce the TH342X series' remote interfaces and SCPI/MODBUS command structure (Chapter 10) and the HANDLER interface used for automated comparator output and external triggering (Chapter 11). Part I (Chapters 1–9) is sufficient for front-panel operation; Part II is intended for engineers integrating the instrument into a test system. The full SCPI/MODBUS command set is documented in the companion *TH342X Series SCPI Command Reference*.

CHAPTER 10

Remote Control

The TH342X 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. See the companion *TH342X Series SCPI Command Reference* for the full command set.

10.1 RS232C interface

Signal	Pin
Transmitted Data (TXD)	2
Received Data (RXD)	3
Signal Ground (GND)	5

Baud rate: 4800–115200 (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	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

Connects via the rear-panel USB Device port, conforming to USBTMC-USB488 and USB 2.0. On first connection, Windows will prompt to install the USB Test and Measurement Device driver; once installed, the instrument is controllable from any USBTMC-capable application (e.g. LabVIEW).

10.4 Wired LAN

Uses the standard SCPI command protocol over the fixed network port **45454** (§6.2). *Wireless LAN is not offered for this series — see the note in §6.2.*

10.5 SCPI command structure

SCPI (Standard Commands for Programmable Instruments) is an ASCII-based, hierarchical ("tree") command language. Related commands are grouped under a common root, forming a subsystem. Commands may be sent in short (capitalised-letter) or long form; the TH342X series' own command descriptions mostly use the short form to avoid ambiguity.

Subsystem	Covers
IEEE488.2 common commands	`*IDN?`, `*TRG`, `*RST`
DISPlay	Page switching, main display channel, data-update switch
FUNCtion	Line filter, average time, synchronization, energy integral control, voltage/current range, basic measurement parameters
COMPare	Comparison parameters, upper/lower limits
HARMonic	Harmonic display/calculation settings
WAVE	Waveform display settings
SYSTem	Comparison beeper, touch-screen calibration, date/time, and other system settings
TRIGger	Trigger source and control
FETCh	Reading back measurement results

The MODBUS protocol (RS232C/RS485 only) uses its own write-command format and CRC16 checksum, with a command-function comparison table mapping MODBUS registers to the equivalent SCPI functionality. Full syntax for every command listed above — roughly 70 commands across these 9 subsystems — is documented in the companion *TH342X Series SCPI Command Reference*, consistent with Techmize's practice of issuing a standalone command reference once a series' command set passes roughly 50–60 commands.

CHAPTER 11

Handler Interface

The rear-panel HANDLER interface — standard on both TH3421 and TH3422 — lets an automatic test system read the comparator result for each of the 8 comparison channels (§4.2) and supply an external trigger signal.

11.1 Circuit principle

Each comparator channel's output is isolated through a relay: the comparison result controls the relay coil, and the relay's switch contacts connect to one Mx+/Mx− pin pair on the HANDLER connector. This isolates the comparator logic from the external circuit and lets the user add a simple pull-up or pull-down resistor to obtain a level or edge signal as needed.

11.2 Connector & pin definitions

A 25-pin D-type connector on the rear panel carries the comparator outputs and external trigger/power input. The pin assignment below is shared across the whole TH34XX family (TH342X, TH343X, TH344X).

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	+5V	6	M7−	11	M5−	16	M3+	21	M8−
2	M4+	7	M2+	12	M6+	17	/EXT.TRIG	22	M1−
3	Reserved	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−

Signal	Description
+5V / GND	Internal +5 V supply and ground, provided for driving the Handler interface.
EXTV	External power supply input, +5 V to +30 V. Using an external supply instead of the internal one requires removing the top cover and moving a jumper on the Handler board — not a field-adjustable setting. (Note: an external supply has no dedicated external ground pin; its positive terminal forms a loop with /EXT.TRIG to provide the trigger signal.)
/EXT.TRIG	External trigger input. Edge-triggered, high level by default, falling-edge triggered. Set trigger mode to External (§4.1.2) to use this input.
Mx+ / Mx−	Comparator output pair for comparison channel x (1–8) — relay single-pole contacts; closed (Mx+ connected to Mx−) when the relay is activated by the comparison result. Factory-fitted relay rating: **30 VDC / 2 A MAX**.
Reserved	Reserved for system use.
NULL	Unused pin.

11.3 Timing

- The external trigger input (/EXT.TRIG) only accepts a falling-edge trigger.
- After the trigger, the instrument waits the configured trigger delay (0–60 s, §4.1.2) before starting the measurement.
- All 8 comparison channels have independent output states, reflecting the 8 comparison results simultaneously.

> **NOTE**
>
> A precise Handler timing chart is not included in this manual. Request the exact timing values from Techmize/Tonghui if a detailed timing diagram is required for integration work.

11.4 Setting up comparator output

1. Configure the comparison parameter, limits and output function for each channel (§4.2).
2. Wire the automatic handling equipment to the corresponding Mx+/Mx− pair(s), adding a pull-up/pull-down resistor as needed for the required signal type.
3. If using an external trigger, set the trigger source to External (§4.1.2) and wire the trigger signal to /EXT.TRIG.
4. Run production testing from the Compare display page (§5.2) to monitor results live.

APPENDIX

Terms, Symbols & Quick Reference

A.1 Measurement parameter symbols

Symbol	Meaning	Symbol	Meaning
U_{RMS}	True RMS voltage	I_{RMS}	True RMS current
U_{AC}	AC component of voltage	I_{AC}	AC component of current
U_{DC}	DC component of voltage	I_{DC}	DC component of current
U_{PK+} / U_{PK-}	Positive / negative peak voltage	I_{PK+} / I_{PK-}	Positive / negative peak current
U_{PP}	Peak-to-peak voltage	I_{PP}	Peak-to-peak current
U_{CF}	Voltage crest factor	I_{CF}	Current crest factor
P	Active power	λ (PF)	Power factor
S	Apparent (total) power	φ	Voltage/current phase difference
Q	Reactive power	F_{REQ}	Frequency
W_P	Active-power integral	q	Current integral (Ah)
η	Wiring-group energy efficiency (user-programmable formula)	THD_u / THD_i	Total harmonic distortion, voltage / current

A.2 Front-panel key quick reference

Key	Function
Display	Opens measurement display pages (Chapter 5)
Setup	Opens measurement & system setup (Chapters 4, 6)
File	Opens file management (Chapter 7)
Trigger	Manual trigger (trigger source = MAN, §4.1.2)
Wiring	Wire-system shortcut (§4.1.1)
Run / Stop / Reset	Energy integration control (§4.1.4)
Lock/Local	Locks/unlocks front-panel keys
Hold	Freezes the displayed reading
PrtScn	Screen capture to USB/internal storage
CH1 – CH4 / CHΣ	Channel highlight / wire-system combination display (§5.1)

A.3 Contact, warranty and support

Warranty: two years from delivery (§1.8). For service, calibration, accessories, or any item noted in this manual as unconfirmed (electrical safety test data, Handler timing diagram exact values, default password string), contact Techmize using the details below.

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