TECHMIZE by TONGHUI

OM

OPERATION MANUAL

TH2515

Touch-screen Micro-Ohm DC Resistance Meter. Covers front- and rear-panel operation, the MEAS/COMP/BIN/STATIS display and setup pages, temperature correction and conversion, file management, remote control and the HANDLER interface; see the companion SCPI Command Reference for remote-control commands.

Techmize Electronic GmbH · Ismaning, Germany

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TH2515 Operation Manual

Micro-Ohm DC Resistance Meter

This is the English-language edition of the TH2515 Operation Manual. It is aligned with the published TH2515 Datasheet; where information differs between documents, the TH2515 Datasheet applies.

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The full SCPI command reference (DISPlay, FUNCtion, APERture, TRIGger, FETCh?, TEMPerature, COMParator, BIN, STATistics, IO, MEMory and SYSTem subsystems, plus the IEEE 488.2 common commands) is issued as a separate companion document, TH2515 SCPI Command Reference, in line with Techmize's standard practice for command sets of this size. The MODBUS protocol, also supported on this instrument's RS232C port, is documented in that companion document as well.

CHAPTER 1

Overview & Safety

1.1 About this manual

This manual covers the Techmize TH2515 touch-screen DC resistance meter. Where this manual and the instrument itself appear to disagree, contact Techmize or your authorized distributor (§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.

1.2 Product overview

TH2515 is a DC resistance meter with a 4.3-inch colour touch-screen LCD. A basic accuracy of 0.01% meets general low-resistance test requirements, and offset-voltage compensation (OVC) improves results on temperature-sensitive resistive materials, where thermal EMF at dissimilar-metal junctions would otherwise distort the reading. A built-in statistics function analyses large batches of test data (average, standard deviation, process-capability indices Cp/CpK).

TH2515 is intended for resistor and resistive-component design, inspection, quality control and production test. Its high test speed suits in-line spot-check stations, and its comparator and sorting (BIN) functions, together with the HANDLER interface, support automated go/no-go testing on production lines.

1.3 Unpacking

Inspect the shipping container for damage after unpacking. Do not power on the instrument if the container shows signs of damage. If the contents do not match the packing list, contact Techmize or your dealer.

1.4 Power connection

Item	Value
Supply voltage	90 V–240 V AC (per the rear-panel nameplate rating)
Supply frequency	50 Hz / 60 Hz, selectable (§3.8)
Power consumption	≤ 10 VA

The line (L), neutral (N) and earth (E) conductors of the supply outlet must correspond to the instrument's power plug. TH2515 is designed to reduce AC-line noise ingress, but it should still be used in a low-noise environment; fit a power-line filter if noise cannot otherwise be avoided.

> **WARNING — ELECTRIC SHOCK**
>
> To prevent injury to personnel or damage to the instrument from a leakage-current fault, always ensure the supply earth conductor is reliably connected to ground.

1.5 Fuse

The instrument is shipped with a fuse fitted as standard. Use only the replacement fuse type supplied by Techmize.

1.6 Environment

- Do not store or operate the instrument where it is exposed to heavy dust, strong vibration, direct sunlight or corrosive gas.
- Operating conditions: 0 °C to 40 °C, ≤ 80% RH, non-condensing.
- Storage conditions: −10 °C to 50 °C, ≤ 90% RH, non-condensing.
- Do not block the left-side air vent — adequate ventilation is required to maintain rated accuracy.
- Keep the test leads connecting to the DUT away from strong electromagnetic fields to avoid measurement interference.

1.7 Use of test fixture

Use only the test fixture or cable supplied by Techmize — a self-made or third-party fixture or cable can produce incorrect measurement results. Keep the fixture or cable, and the leads of the device under test, clean to ensure good contact. Connect the fixture or cable to the **HI** and **LO** test terminals on the front panel, matching the arrow and colour marking on the fixture plug to the corresponding panel sockets — a mismatch can cause abnormal readings.

1.8 Test-lead contact check

TH2515 can check the test-lead contact before each measurement. The four-terminal fixture has two pairs of leads: **D+/D−** (drive, red/black) and **S+/S−** (sense, white/blue).

Condition	Instrument message
D+ or D− not contacting the DUT	“Drive terminal open”
S+ not contacting the DUT	“HI Sense line open”
S− not contacting the DUT	“LO Sense line open”

The check mode (which terminals are monitored) is configured on the <MEAS SETUP> page — see §3.5, item “Contact check”.

1.9 Warm-up

- For accurate measurement, warm up the instrument for at least **30 minutes** before relying on the rated accuracy (Chapter 5).
- Do not switch the instrument on and off repeatedly — this can cause internal data upset.

1.10 Safety symbols used in this manual

WARNING — a hazard that, if not avoided, could result in personal injury.

CAUTION — a hazard that, if not avoided, could damage the instrument or the device under test, or invalidate a measurement — for example, mismatching the arrow/colour marking of the test leads.

NOTE — supplementary information that helps with correct or efficient use.

Protective ground — this terminal must be connected to protective earth.

1.11 WEEE & compliance

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 in accordance with the WEEE Directive (2012/19/EU). TH2515 carries the CE marking, as shown on the published TH2515 Datasheet. Test-house certificates held by the manufacturer (Most Technology Service Co., Ltd., 2014) cite LVD directive 2006/95/EC (EN 61010-1:2010, EN 61010-2-030:2010) and EMC directive 2004/108/EC (EN 61326-1:2013, EN 61000-3-2:2006+A1:2009+A2:2009, EN 61000-3-3:2008) — both directive numbers were superseded EU-wide in 2016 (by 2014/35/EU and 2014/30/EU respectively), and Techmize has confirmed this certification is currently being updated. Techmize is currently updating the compliance documentation. Please contact Techmize or your authorized distributor for the latest declaration status.

1.12 Warranty

The warranty period is **two years** from the date of shipment (from Techmize, or from the distributor if purchased through one), evidenced by the instrument's warranty card. Within the warranty period, repair costs arising from the user's own mishandling are borne by the user. Repairs must be carried out by qualified personnel; do not substitute internal components without authorization, and have the instrument re-calibrated after any repair to avoid affecting test accuracy. Damage from unauthorized repair or component substitution is excluded from the warranty.

1.13 Manufacturer & EU contact

Techmize Electronic GmbH

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CHAPTER 2

Panel Description

This chapter describes TH2515's basic layout and operation. Read it before first use.

2.1 Front panel

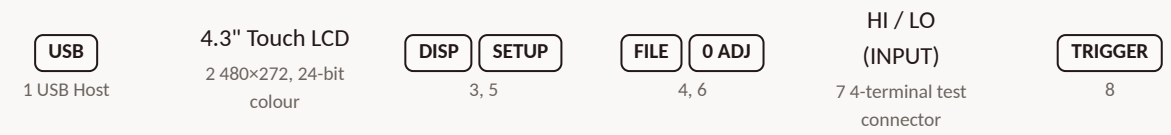

Figure 2-1 — Front panel (schematic; see the published TH2515 Datasheet for a product photograph)

1 **USB interface** — USB Host port.

2 **LCD / touch screen** — 480×272 pixels, 24-bit colour, 4.3" TFT with touch, used for setting test conditions and displaying results.

3 **DISP** menu key — opens the <MEAS DISP> page.

4 **FILE** menu key — opens the <Internal Files> page.

5 **SETUP** menu key — opens the <MEAS SETUP> page.

6 **0 ADJ** key — runs the zero (short-circuit) calibration.

7 **Test terminal (INPUT)** — 4-terminal connector for the test cable; match the plug colour/arrow to the panel sockets to avoid abnormal results.

8 **TRIGGER** key — manually triggers a measurement when the trigger source is set to MAN.

9 **ENTER** key — confirms and stores an entry.

10 **Cursor keys** — up/down/left/right navigation.

11 **Logo & model** plate.

12 **POWER** switch.

> **NOTE — KEY NAMING**
>
> The key is labelled **DISP** on the front panel; this manual uses DISP throughout.

2.2 Rear panel

Connector	Function
GPIB (option)	Parallel communication with a PC; builds a GPIB test system.
Grounding terminal	Connects to the instrument's metal chassis, for protective/shield grounding.
RS232C	Serial communication with a PC.
Nameplate	Shows the instrument's serial number.
Fuse holder	Houses the power fuse.
Power inlet	AC mains input.
TEMP. INPUT	Accepts a temperature-sensor plug, or an analogue voltage input simulating temperature (§3.6.1).
USB (Device)	PC control of TH2515 (USBTMC or USBVCOM, §3.8).
LAN	Network communication with a PC.
HANDLER	Automated-test-system interface: outputs the comparator/BIN result (including as BCD), and simple control signals. See Chapter 7.

2.3 Display zone

The 4.3" 480×272 colour touch LCD is divided into eight functional zones:

Zone	Function
Main menu area	Shows the name of the current page.
File area	File management and full-screen (screenshot) copy.
Tools area	Shortcut functions: result display on/off, 0 ADJ on/off and execute, OVC on/off, calibration mode (auto/manual), data-save on/off.
Soft-key area	Context-sensitive function menu for the currently selected (cursor-highlighted) zone.
Function area	Edits the test-related parameters: measurement parameter, range, speed, temperature correction/conversion on-off.
Result area	Displays the measured result(s) — resistance and/or temperature.
Status area	Shows the short-circuit (ADJ), offset-voltage-compensation (OVC), self-calibration (SelfCalib) and linear-conversion (mR+b) status.
Message area	System prompts and messages during test.

2.4 Basic operation

- Use the menu keys (DISP , SETUP , FILE) and the soft-key touch zone to reach the page you want.
- Use the cursor keys to move the on-screen cursor to the field you want to set; the selected field is highlighted.
- The soft-key area shows the functions available for the currently selected field. Press ENTER to select the first soft key, then use the cursor keys and ENTER to confirm. For a numeric or filename entry, pressing ENTER opens an on-screen keypad; use the cursor keys to pick characters, then ENTER to confirm.
- The touch screen can be used directly instead of the keys/cursor — touch the relevant on-screen function.

> **CAUTION**
> Do not use a sharp object or a fingernail on the touch screen — this can damage it. Techmize is not responsible for damage caused this way.

2.5 Power-on

Connect the three-wire power plug, ensuring the earth conductor is reliably connected, then press the power switch at the lower-left of the front panel. The instrument displays a start-up screen showing the Tonghui logo, instrument model and firmware version.

If password protection is enabled, the instrument requests the power-on password at start-up.

> **NOTE — DEFAULT PASSWORD**
> The factory-default power-on password is `2515` . It can be changed on the <SYSTEM SETUP> page (§3.8).

2.6 Home / menu structure

From the DISP key, the soft-key area offers the four MEAS-group display pages (§3.1–3.4); from the SETUP key, it offers the MEAS/TCΔt/BIN/SYSTEM setup pages (§3.5–3.9).

CHAPTER 3

Basic Operation

3.1 <MEAS DISP> page

Reached via the touch screen or the DISP key. Sets the measurement parameters and shows live results.

3.1.1 Measurement parameters

Parameter	Description
R	Resistance
R-T	Resistance and temperature
T	Temperature
LPR	Low-power(-voltage) resistance test
LPR-T	Temperature and low-power(-voltage) resistance test

3.1.2 Measurement range

Two test modes are available: standard DC resistance (11 ranges) and low-voltage resistance (4 ranges). Temperature display range: −10.0 °C to 99.9 °C with the Pt500 sensor, −99.9 °C to 999.9 °C with the analogue input (§3.6.1). Range selection: **AUTO** (automatic), **HOLD** (locks the current range), or step ↑/↓. See the published TH2515 Datasheet for the full range/current/resolution/accuracy table (§5.3).

3.1.3 Measurement speed

Speed is set by the integration time, averaging count, measurement delay and result display time. Options: **FAST**, **MED**, **SLOW1**, **SLOW2**. The result is displayed as 5 digits at FAST speed and 6 digits at MED/SLOW1/SLOW2; temperature is shown with one decimal place.

3.1.4 File

File area soft keys: **File Manage** (opens the file-operation page, Chapter 4) and **Full-screen Copy** (saves a screenshot to a USB drive, if one is inserted; otherwise the screenshot is not saved).

3.1.5 Tools

Item	Description
Display (ON/OFF)	Shows or hides the live measurement result.
0 ADJ (ON/OFF)	OFF: the zero-calibration offset is not subtracted. ON: it is subtracted.
0 ADJ	Runs the short-circuit zero calibration. The test terminals must be reliably short-circuited first (see the caution below), or later readings will carry an unwanted offset error.
OVC (ON/OFF)	ON applies offset-voltage compensation to the result; OFF does not. OVC corrects for the thermal EMF generated where dissimilar metals meet at the test contacts — this EMF grows with ambient temperature. The compensation works by reversing the drive current direction across the DUT.
Calibration	Auto or manual self-calibration (§3.5, Self-calibration).
Save data	Continuously logs each measurement to a `.CSV` file on a USB drive (not saved if no USB drive is inserted); touching it again stops logging and opens a new `.CSV` file on the next save. Always use "stop saving" to end a logging session, or data may be lost. Format: see §3.4.2.

CAUTION — SHORT-CIRCUIT (0 ADJ) PROCEDURE

The test fixture must be correctly short-circuited before running 0 ADJ, or the subtracted offset will be wrong and bias every later reading. Correct short: D+ (red) to D− (black), S+ (white) to S− (blue), at the fixture end.

3.2 <COMP DISP> page

Reached from <MEAS DISP> or the DISP key, then the COMP DISP soft key.

Setting	Options
Comparator (COMP)	ON — comparison is active (required for the Tools count and beep functions below). OFF — comparator disabled.
Comparison mode	**ABS** — set independent high/low limits; the result is flagged HI, LO or IN (within limits; high limit must be ≥ low limit). **%** — set a nominal value and a ±% tolerance; the nominal value also serves as the deviation-display reference.
Tools → Comparison beep	NG (beep on fail), GD (beep on pass), or OFF.
Tools → Count / Count clear	Starts/stops counting tested parts; clears the TOT/IN/HI/LO counters to zero.
Tools → NG lock	ON locks the instrument on a fail (NG) result until unlocked; OFF disables the lock.
Tools → Save data	As §3.1.5.

3.3 <BIN DISP> page

Reached from <MEAS DISP> or the DISP key, then the BIN DISP soft key. Displays the measured resistance (R) and the BIN sorting result: a BIN position shows “GD” (good) in its configured colour when the result matches that bin's limits, “NG” (not good) when it does not, or “–” when that bin is not enabled.

Setting	Options
BIN (ON/OFF)	Enables/disables sorting.
BIN beep	OFF, NG (beep if any enabled bin fails), or GD (beep only if all enabled bins pass).
NG colour / GD colour	OFF, grey, red or green — the colour shown for a fail / pass result at each bin position.
Tools → Display, Save data	As §3.1.5.

Bin limits themselves are configured on the <BIN SETUP> page (§3.7).

3.4 <STATIS DISP> page

Reached from the main menu area or the DISP key, then the STATIS DISP soft key (STATIS = Statistics; the corresponding remote-control subsystem is `STAT`). Analyses the average, pass rate and process-engineering coefficients across a batch of measurements.

> **NOTE**
> Set the statistics status to OFF before switching away from the <STATIS DISP> page to another page.

3.4.1 Statistical quantities

Symbol	Meaning
$\bar{X}$	Mean of the batch
σ	Population standard deviation
s	Sample standard deviation
Cp	Process-capability index (dispersion)
CpK	Process-capability index (centring/bias)
Hi(num) / Lo(num) / In(num)	Count of readings above the upper limit / below the lower limit / within limits
Max / MaxIndex, Min / MinIndex	Largest/smallest reading in the batch, and its sequence number
num / valn	Total trigger count / count of valid (statistically used) readings

Cp = |Hi−Lo| / 6s. **CpK** = (|Hi−Lo| − |Hi+Lo−2$\bar{X}$|) / 6s. Cp > 1.33 and CpK > 1.33 indicates the process capability is ideal; Cp ≤ 1.33 with CpK > 1.00 indicates it is acceptable; Cp ≤ 1.00 and CpK ≤ 1.00 indicates it is insufficient.

3.4.2 Tools & CSV export format

Item	Description
Clear	Clears all values on the <STATIS DISP> page. Active only while statistics status is OFF.
Trigger	Triggers one statistics measurement. Active only while statistics status is ON.
Save data	As §3.1.5.

CSV field order: `R,T,COMP,DEV,DT,BIN1,BIN2,BIN3,COUNT,VCOUNT,STAT,Time` — resistance, temperature, comparison result, comparison deviation, Δt result, bin 1–3 result, statistics count, valid count, system status, test time. Comparison/bin result codes: `0` NC (function off), `1` NG (outside limits), `2` GD (within limits), `3` HI (above upper limit), `4` LO (below lower limit).

3.4.3 Boundary mode & status

Boundary mode: **ABS** (independent high/low limits) or **%** (nominal value ±% tolerance) — same logic as §3.2. Statistics status: **ON** enables statistics collection (only the Trigger soft key then responds; each trigger adds one reading to the batch); **OFF** disables it.

3.5 <MEAS SETUP> page

Reached via the main menu area, then the MEAS SETUP soft key (or the SETUP key). Parameter and range settings are shared with §3.1.1–3.1.2.

Setting	Options / description
Trigger source	**INT** (continuous, automatic), **MAN** (manual, via the TRIGGER key), **EXT** (via the HANDLER interface), **BUS** (via the remote interface).
Measurement delay	**Auto** (internal default, 5 ms) or **Manual** entry, 0–9999 ms. A 0 ms delay disables error-measurement detection — Techmize recommends at least 1 ms.
Average	1–255. A higher value improves stability at the cost of measurement time.
0 ADJ (ON/OFF)	Enables/disables the short-circuit zero-offset function (§3.1.5).
Max. range	Pre-sets the maximum measurement range available.
Self-calibration (SelfCalib)	**AUTO** — self-calibrates every 30 minutes, taking approximately 55 ms. **MANU** — triggered via the HANDLER interface.

Setting	Options / description
200 mΩ dual current source	The 200 mΩ range offers two test currents: 1 A (open-circuit voltage 5 V max.) and 100 mA (2.6 V max.) — the 100 mA option exists for remote-terminal control or where the 200 mΩ range's open-circuit voltage would otherwise rise too high.
Noise-abatement mode	Switches in a 10 nF capacitor between the HI and LO drive terminals to reduce noise.
Overrange behaviour	On <COMP DISP>: enabled shows **HI** for an overrange reading, disabled shows **NC**. On <BIN DISP>: enabled shows **NG**, disabled shows **NC**. In both cases, enabling overrange also makes the overrange value available over the remote interface; disabling it withholds that value.
Base-value threshold ratio	1–100. 0 ADJ (§3.1.5) succeeds only while the stored offset is within this ratio of the current range value; outside that range the instrument reports a zero-calibration failure — raise the ratio to allow the calibration to complete.
FetcAuto (auto result return)	ON — the result is pushed to the host automatically on completion. OFF — automatic push is disabled.
mR+b (linear conversion)	ON/OFF. When ON, converts the measured resistance R to a user-defined quantity Rs via **Rs = mR + b**, with m and b set by the user — e.g. to express the reading in another physical unit.
HDL Hold	0–9999 ms (0 = off). On <COMP DISP>, sets how long the HANDLER HI/IN/LO outputs are held; on <BIN DISP>, how long the BIN0–BIN9/OB outputs are held.
Contact check	**OVER** — checks only the two DRIVE terminals (reports “Drive terminal open” if disconnected). **SENSE** — checks only the two SENSE terminals (reports “HI/LO Sense line open”). **ALL** — checks all four terminals. See §1.8.

3.6 <TC/Δt SETUP> page

Reached via the main menu area, then the TC/Δt SETUP soft key.

3.6.1 Temperature sensor type

Setting	Description
Pt	Platinum resistance temperature sensor. Connect the supplied PT500 temperature sensor to the rear-panel TEMP. INPUT port.
AnLG_In	Analogue voltage input, 0–2 V, converted to temperature via a user-defined two-point line: T = (T2−T1)/(V2−V1) × V + (T1×V2−T2×V1)/(V2−V1), with V1/V2 (0.00–2.00 V) and T1/T2 (−99.9–999.9 °C) set by the user.

3.6.2 TC (temperature correction) & Δt (temperature conversion)

OFF — both functions disabled.

TC (Temperature Correction) — converts the resistance measured at the current ambient temperature to the equivalent value at a user-set reference temperature:

$$R_{t0} = R_t / [1 + \alpha_{t0} \times (t - t0)]$$

where t = current ambient temperature, R_t = resistance measured at t, R_{t0} = resistance referred to the set temperature t0, t0 = the set reference temperature, and α_{t0} = the material's temperature coefficient — both t0 and α_{t0} are entered on this page. Example: a resistance of 100 Ω measured at 20 °C, for a material with α = 3930 ppm, referred to 10 °C:
$R_{t0} = 100 / [1 + (3930 \times 10^{-6}) \times (20-10)] \approx 96.22$ Ω. Allow roughly 30 minutes for the instrument and probe to reach thermal equilibrium before measuring, keep the temperature sensor close to — but not touching — the DUT, and wait for the displayed value to stabilise before reading it.

Δt (Temperature Conversion) — uses the DUT's own thermal coefficient of resistance to infer the temperature rise of the DUT above ambient from the change in its resistance:

$$\Delta t = (R2/R1) \times (k + t1) - (k + ta)$$

where Δt = temperature rise of the DUT above ambient, t1 = DUT temperature at the initial resistance R1 (both set by the user), ta = current ambient temperature, R2 = current DUT resistance, and k = the reciprocal of the DUT material's temperature coefficient referred to 0 °C ($k = 1/\alpha_{t0} - t0$; also set on this page). Example: R1 = 200 mΩ at t1 = 20 °C, R2 = 210 mΩ once stable, ta = 25 °C, k = 235:
Δt = (210/200)×(235+20) − (235+25) = 7.75 °C, so the DUT's temperature is 25 + 7.75 = 32.75 °C.

Set α_{t0} according to the temperature coefficient of the DUT material.

3.6.3 File

As §3.1.4 (File Manage, Full-screen Copy).

3.7 <BIN SETUP> page

Reached via SETUP, then the BIN SETUP soft key. Configures the limits for each bin position (00–09).

Setting	Description
Bin status (ON/OFF)	ON shows a numbered-circle icon for that bin on <BIN DISP>; OFF shows a dash.
Upper / lower limit	Numeric entry per bin, used in ABS mode.
Nominal value / %	Used in % mode — tolerance may be set as one %(upper&lower) value or independent %(upper)/%(lower) values.
Bin number 00–09, clear	Identifies each bin position; a clear soft key empties that bin's settings.
Tools → Bin mode	ABS (absolute limits) or % (percentage tolerance).
Tools → Bin beep	OFF, GD or NG.
Tools → Bin clear	Clears all bin settings.
Tools → Bin output	**BCD** — outputs the bin-comparison result in BCD code. **BIN** — outputs it in binary, via the HANDLER interface (Chapter 7).

3.8 <SYSTEM SETUP> page

Reached via SETUP, then the SYSTEM SETUP soft key.

Setting	Options / description
Touch tone	ON/OFF — audible feedback on touch-screen presses.
Language	English (on-screen UI language).
Password	OFF, Lock system (gates both power-on and file protection), Lock files (file protection only), or Modify (enter old password, then new password twice). Factory default: `2515`.
Bus mode	RS232C, GPIB, LAN, USBTMC (via the rear USB Device port) or USBVCOM (virtual COM port via the same port).
Baud rate	9600 / 19200 / 28800 / 38400 / 96000 / 115200.
Bus address	Sets the MODBUS send address.
RS232 protocol	SCPI or MODBUS; default SCPI.
Power-line frequency	50 Hz or 60 Hz — reduces mains-noise interference with the measurement.
Password lock (comparator)	On a comparator NG (fail) result, locks the instrument and pauses testing until the password is entered. Default password `12345678` (must be exactly 8 numeric digits).
Date & time	Sets the real-time clock (format `YY-MM-DD HH:MM:SS`).

3.9 <NETWORK SETUP> page

Reached via SETUP, then SYSTEM SETUP, then the Network Setup soft key. Before switching <SYSTEM SETUP> → Bus Mode to LAN, set Bus Mode to RS232C first and configure the settings below; only then switch Bus Mode to LAN (§3.8, §6.3).

Setting	Description
Network protocol	**TCP/IP** (IPv4) or **LXI** — LXI requires LabVIEW on the host PC.
Port	0–65535.
IP address / subnet mask / gateway	Each octet 1–255. Default subnet mask 255.255.255.000; the gateway's 4th octet is always 001 and its 3rd octet always matches the IP address's 3rd octet.

CHAPTER 4

File Management

TH2515 can store user-set parameters as files in its internal non-volatile memory, so a saved configuration can be reloaded without re-entering every setting. “I” denotes internal (Flash) storage; “E” denotes external storage (a USB drive).

4.1 Save/recall methods

Save type	File format	Recallable	Purpose
Configuration (internal)	`.STA`	Yes	Saves the instrument's configuration state to internal Flash.
Configuration (external)	`.STA`	Yes	Saves the configuration state to a USB drive.
Data (external)	`.CSV`	No	Logs measurement results to a USB drive.
Screenshot (external)	`.gif`	No	Saves a screen snapshot to a USB drive.

4.2 USB-drive folder structure

Folder	Max. files	Contents
`CSV`	40	Measurement-result `.CSV` files.
`STA`	40	Configuration `.STA` files.
`PIC`	40	Screenshot `.GIF` files.

These folders are created automatically when a USB drive is connected. To save a configuration file into a custom folder created on a PC, navigate into that folder on the instrument first, then perform the file operation.

- Use a USB 2.0 drive, formatted FAT32.
- Back up the data already on the drive before connecting it to TH2515 — Techmize is not responsible for USB-drive data loss while in use with the instrument.
- Keep the number of files/folders on the drive low for efficient saving.

4.3 File operations

Touch File on any page, then File Manage in the soft-key area — or press the FILE key directly — to open the <Internal Files> page. The Internal Files / External Files soft keys switch between the instrument's internal Flash listing and the USB drive listing; each page shows 4 files at a time (name and save time). Touching Upgrade File opens the firmware-upgrade list if a `.SEC` upgrade file is present on the USB drive.

Operation	Behaviour
Load	Confirms (Yes/No), then recalls the selected file's settings.
Save	Confirms, then opens an on-screen keyboard for the filename; ENTER saves the current configuration. Saving to a slot that already holds a file overwrites it.
Delete	Confirms, then deletes the selected file.
Copy to E:	Copies the selected file(s) to the USB drive.
Select	Marks a file for a multi-file copy to USB; touch again to deselect. Multiple files can be copied in one operation.

Data logging (§3.1.5) and screenshot saving (File → Full-screen Copy) are both described above and in Chapter 3.

CHAPTER 5

Performance & Specifications

Ratings apply after at least 30 minutes of warm-up (§1.9), with the test cable short-circuited and 0 ADJ run (§3.1.5), within: ambient temperature 23 °C ± 5 °C, relative humidity ≤ 80% RH. For full detail and the authoritative figures, see the published TH2515 Datasheet, which takes priority over this chapter in case of any difference.

5.1 Measurement function & test method

Item	Value
Measurement parameters	R, R-T, T, LPR, LPR-T (§3.1.1)
Equivalent circuit	Series
Test method	4-terminal (Kelvin): DRIVE HI/LO (current source), SENSE HI/LO (voltage sense)
Range mode	AUTO, or manual HOLD/↑/↓ (§3.1.2)
Trigger	INT (continuous), MAN (front-panel key), EXT (HANDLER), BUS (remote interface) — §3.5
Average	1–255, settable on <MEAS SETUP>
Display digits	Resistance: 6 digits (MED/SLOW1/SLOW2) or 5 digits (FAST), max. display 110 MΩ. Temperature: one decimal place, max. display ±999.9 °C.

5.2 Test signal & measurement time

Item	Value
Range current	100 nA–1 A (range-dependent — see the published TH2515 Datasheet for the full range table)
Open-circuit voltage	5 V, 2.6 V, 13 V or 60 mV (range-dependent)
Display range	R: 0.1 µΩ–110 MΩ. LPR: 2 Ω–2 kΩ. T: −99.9 °C–999.9 °C.
Measurement time (OVC OFF)	FAST 5 ms · MED 20 ms (50 Hz) / 16.7 ms (60 Hz) · SLOW1 100 ms · SLOW2 400 ms (plus measurement delay)
Measurement time (OVC ON)	FAST 10 ms+delay · MED 40 ms (50 Hz)/33.3 ms (60 Hz)+delay · SLOW1 200 ms+delay · SLOW2 800 ms+7×delay
Load time	Min. 70 ms, max. 190 ms

5.3 Accuracy & dimensions

The basic one-year resistance-measurement accuracy by range (OVC OFF, SLOW2 speed) and the temperature-measurement accuracy are published in full on the TH2515 Datasheet; this manual does not repeat the complete range table to avoid a second copy drifting out of sync. The applicable temperature-correction factor K for operation outside the 18–28 °C reference band is:

Ambient temperature	0–5 °C	5–18 °C	18–28 °C	28–35 °C	35–40 °C
Correction factor K	4	2	1	2	4

Outside the reference band, multiply the basic accuracy figure by K. Rd = reading, Fs = full scale.

5.4 Dimensions & weight

Item	Value
Dimensions (bench, incl. foam sheath)	235(W) × 105(H) × 360(D) mm
Dimensions (rack, net)	215(W) × 87(H) × 335(D) mm
Weight	Approx. 3.6 kg

CHAPTER 6

Remote Control

TH2515 can be remote-controlled over RS232C, GPIB (option), LAN, USBTMC or USBVCOM, selected on the <SYSTEM SETUP> page (§3.8). SCPI commands are documented in the companion *TH2515 SCPI Command Reference*; this chapter covers the physical connections and set-up for each interface.

6.1 RS232C

Signal	Code	Connector pin
Transmitted data	TXD	2
Received data	RXD	3
Signal ground	GND	5

Only this 3-wire subset of RS-232 is implemented; the instrument's pin numbering differs from a PC's 9-pin serial connector, so TXD/RXD must be crossed over when wiring a cable (a Techmize-supplied interface cable handles this). Baud rate: 9600–115200 (§3.8); no parity; 8 data bits; 1 stop bit. Commands follow the SCPI standard and must be terminated with LF (0x0A); the instrument accepts at most 2 KB per command string.

6.2 GPIB (option)

IEEE 488.2 parallel bus; the interface card fits any of the available expansion slots. Up to 15 instruments may share one bus; total cable length per bus ≤ 20 m, and ≤ 2 m between any two instruments on the bus; no more than 4 piggyback connectors should be stacked on one instrument.

Code	Function
SH1	Source handshake
AH1	Acceptor handshake
T5 / L4	Basic talker / basic listener
SR1	Service request
RL1	Remote/local switch-over
DC1 / DT1	Device clear / device trigger
C0	Controller function

Bus address: 1–31, set on <SYSTEM SETUP> (§3.8). Standard GPIB bus commands supported: ABORT I/O (IFC), CLEAR LOCKOUT/SET LOCAL, DEVICE CLEAR (SDC/DCL), LOCAL (GTL), LOCAL LOCKOUT (LLO), REMOTE, SPOLL, SERVICE REQUEST (SRQ), TRIGGER (GET).

6.3 LAN

Network Protocol, Port, IP Address, Subnet Mask and Gateway are configured on the <NETWORK SETUP> page (§3.9) — set <SYSTEM SETUP> → Bus Mode to RS232C first, complete those settings, then switch Bus Mode to LAN.

TCP/IP supports non-automatic, semi-automatic and fully automatic result-return sequences (equivalent to the RS232C sequences in the companion SCPI Command Reference); the LXI protocol, because of the protocol's own mechanism, supports only the semi-automatic sequence, and the host must wait for a returned result before sending the next `TRIG`.

6.4 USBTMC

Connect the rear-panel USB (Device) port to the host PC. On first connection, Windows detects new hardware and prompts to install a driver; choose automatic driver installation. Once installed, the device appears in Windows Device Manager as “USB Test and Measurement Device”. Conforms to USBTMC-USB488 over USB 2.0.

6.5 USBVCOM

Selecting USBVCOM as the bus mode presents the same rear-panel USB port as a virtual COM port. Driver installation is the same procedure as for USBTMC; the device then appears in Device Manager as a “USB VCOM Port” and behaves like a physical serial port to serial-based communication software.

6.6 Protocol debugging

For SCPI: set Bus Mode to RS232C, baud rate 9600, RS232 protocol SCPI; connect with a cross-wired serial cable; using a terminal tool (e.g. Tonghui's SSCOM3.2 utility, available from the Tonghui website's download centre), send `*IDN?` — a returned response confirms the link. If nothing returns, check the TXD/RXD crossover (§6.1) and the baud-rate/port/protocol settings.

For MODBUS: first confirm the SCPI link works as above, then set RS232 protocol to MODBUS and the bus address (e.g. 8, §3.8). A working link responds to a query frame with a data frame (see the companion SCPI Command Reference for the MODBUS register map and frame examples). If nothing returns, check that the bus address matches the frame's sent address and that the protocol is set to MODBUS.

CHAPTER 7

Handler Interface

The rear-panel HANDLER interface (50-pin) lets an automatic test system read the comparator/BIN sorting result and the input/supply signals needed to build a sorting line around TH2515.

7.1 Input signals

Signal	Function
LOAD0–LOAD4	5-bit binary code selecting one of 30 stored parameter files to load (LOAD0 = LSB). Loading a file this way cannot be done over RS232/GPIB.
TRIG	Triggers one measurement on a high-to-low transition, when the <MEAS SETUP> trigger source is EXT. Ignored if the trigger source is internal, if the active page is not a measurement page, or (it is honoured) while a file is loading.
0 ADJ	Runs one zero calibration on a high-to-low transition.
CAL	Runs one self-calibration on a high-to-low transition.
PRINT	Reserved, not used.

7.2 Output signals

Signal	Function
ERR	Measurement-error output — synchronous (coincides with EOC) or asynchronous, per §7.3 timing.
INDEX	Low-to-high transition signals that measurement has finished.
EOC	End-of-conversion (measurement-complete) signal.
HI / IN / LO	Valid only on <COMP DISP> with COMP = ON. HI = above the upper comparison limit, IN = within limits, LO = below the lower limit. BIN0–BIN9, OUT0–OUT7 and all BCD outputs are inactive while these are used.
BIN0–BIN9	Valid only on <BIN DISP> with that bin ON and Bin Output = BIN (§3.7). High = NG, low = GD for the corresponding bin (0–9).
OB	Overall bin result: low if every enabled bin is NG; high if at least one bin is GD.
OUT0–OUT7	General-purpose outputs set by the remote command `:IO:OUT <value>` (e.g. for driving relays); bit 0–7 of <value> maps to OUT0–OUT7. Available only when Bin Output = BIN. Inactive while HI/IN/LO or BCD3-3–BCD4-3 are used.
BCD1-0–BCD6-3	Valid only on <BIN DISP> with that bin ON and Bin Output = BCD. Encodes the 6-digit resistance reading as BCD, one nibble per decimal digit (BCD1 = least-significant digit through BCD6 = most-significant). Inactive while HI/IN/LO are used.

7.3 Power & ground

Pin	Function
COM	Reference ground for the external supply input EXTV.
EXTV	External supply input, +5 V to +24 V.
INT.GND	Instrument internal ground.
INT.VCC	Instrument internal supply voltage.

WARNING

When using the instrument's internal supply, COM and INT.GND must be linked, and EXTV and INT.VCC must be linked. When using an external supply, do **not** link them — an external supply fault voltage could otherwise damage the instrument.

7.4 Pin assignment

Pin	I/O	Signal	Pin	I/O	Signal
1	IN	LOAD0	26	IN	LOAD1
2	IN	LOAD2	27	IN	LOAD3
3	IN	LOAD4	28	IN	0 ADJ
4	IN	TRIG*	29	IN	CAL
5	IN	PRINT	30	—	COM
6	—	COM	31	—	COM
7	—	INT.GND	32	—	INT.GND
8	—	INT.VCC	33	—	INT.VCC
9	—	INT.VCC	34	—	EXTV
10	—	EXTV	35	—	EXTV
11	OUT	ERR	36	OUT	INDEX
12	OUT	EOC	37	OUT	HI
13	OUT	IN	38	OUT	LO
14	OUT	BIN0 (BCD1-0)	39	OUT	BIN1 (BCD1-1)
15	OUT	BIN2 (BCD1-2)	40	OUT	BIN3 (BCD1-3)
16	OUT	BIN4 (BCD2-0)	41	OUT	BIN5 (BCD2-1)
17	OUT	BIN6 (BCD2-2)	42	OUT	BIN7 (BCD2-3)
18	OUT	BIN8 (BCD3-0)	43	OUT	BIN9 (BCD3-1)
19	OUT	OB (BCD3-2)	44	OUT	— (BCD3-3)
20	OUT	— (BCD4-0)	45	OUT	— (BCD4-1)
21	OUT	— (BCD4-2)	46	OUT	— (BCD4-3)
22	OUT	OUT0 (BCD5-0)	47	OUT	OUT1 (BCD5-1)
23	OUT	OUT2 (BCD5-2)	48	OUT	OUT3 (BCD5-3)
24	OUT	OUT4 (BCD6-0)	49	OUT	OUT5 (BCD6-1)
25	OUT	OUT6 (BCD6-2)	50	OUT	OUT7 (BCD6-3)

NOTE

Pins 20, 21 and 44–46 are reserved and have no assigned function.

NOTE — PIN 4

*Pin 4 is listed as TRIG (external trigger input, see §7.1). Please confirm the Pin 4 assignment with Techmize before designing a new HANDLER cable.

CHAPTER 8

Package & Warranty

8.1 Nameplate markings

Each instrument's panel or nameplate shows: the manufacturer's name or trademark; the product name and model; the product serial number and date of manufacture; the manufacturing licence mark and number for measuring instruments (as applicable under Chinese regulation); and the test-terminal marking.

8.2 Packaging, transport & storage

The instrument is normally packed, together with its accessories, spares, manual and certificate of conformity, in a dust-, shock- and moisture-resistant container. Handle with care during transport; protect from moisture and rain. Storage: 5 °C to 40 °C, ≤ 85% RH, in a ventilated room free of corrosive contaminants.

> **NOTE**
>
> These figures apply to the packaged instrument during transport and storage. The storage condition for the unpacked instrument is given in §1.6 (−10 °C to 50 °C, ≤ 90% RH).

8.3 Warranty

See §1.12.

8.4 Firmware update

Insert a USB drive containing the `.SEC` update file, power on, press **FILE** to open <Internal Files>, then select the Upgrade File soft key, select the listed update file and confirm with OK (**ESC** exits without updating). This manual's content applies to firmware V1.6.7 and later. Update filename:

Model	Update filename
TH2515	`2515_001.SEC`

The instrument restarts automatically when the update finishes, confirming success. After updating from a version earlier than V1.6.7, restore the <SYSTEM SETUP> → Tools default settings.

APPENDIX

Terms & Quick Reference

A.1 Measurement parameter symbols

Symbol	Meaning
R / R-T / T	Resistance / resistance & temperature / temperature
LPR / LPR-T	Low-power(-voltage) resistance / with temperature
OVC	Offset-voltage compensation (thermal-EMF correction)
TC	Temperature correction — refers a reading to a set reference temperature
Δt	Temperature conversion — infers DUT temperature rise from its resistance change
Cp / CpK	Process-capability index (dispersion / centring)
mR+b	User linear conversion of the measured resistance

A.2 Front-panel key quick reference

Key	Function
DISP	Opens the MEAS/COMP/BIN/STATIS display pages (§3.1–3.4)
SETUP	Opens the MEAS/TCΔt/BIN/SYSTEM/NETWORK setup pages (§3.5–3.9)
FILE	Opens file management (Chapter 4)
0 ADJ	Runs zero (short-circuit) calibration
TRIGGER	Manual trigger (when trigger source = MAN)
ENTER	Confirms/stores a selection or entry

A.3 Contact, warranty and support

Warranty: two years from shipment (§1.12). For service, calibration, or accessories, contact Techmize using the details below.

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