TECHMIZE by TONGHUI

OM

OPERATION MANUAL

TH510 Series

Semiconductor C–V Characteristic Analyzer — TH511 / TH512 / TH513. Covers front-panel operation, CV function modules, system setup, user correction, and the HANDLER interface for automated testing; see the companion SCPI Command Reference for remote-control commands.

Techmize Electronic GmbH · Ismaning, Germany
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TH510 Series Operation Manual

Semiconductor C–V Characteristic Analyzer — TH511 / TH512 / TH513

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The full SCPI command reference (DISPlay, TRIGger, CVMeas, COMParator, CVList, CVTrace, CVCORR, Handler, FETCh, MassMEMory and SYSTem subsystems, plus the IEEE 488.2 common commands) is issued as a separate companion document, TH510 Series SCPI Command Reference, in line with Techmize's standard practice for command sets of this size. MODBUS is not covered in this manual or in the companion command reference.

CHAPTER 1

Overview & Safety

1.1 About this manual

This manual covers the Techmize TH510 series semiconductor C–V characteristic analyzer, comprising three models: **TH511**, **TH512** and **TH513**, which differ principally in their maximum drain-bias voltage (Vd) and, for TH513, in rear-panel construction. 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 (§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

The TH510 series tests the capacitance–voltage (C–V) characteristics of power semiconductor devices (MOSFETs, IGBTs and similar), reporting **Ciss** (input capacitance, Cgs + Cgd), **Coss** (output capacitance, Cds + Cgd), **Crss** (reverse transfer / Miller capacitance, Cgd), **Rg** (gate input resistance, measured drain-open as Rg-DSO or drain-short as Rg-DSS), and **Ciss-Vgs** (input capacitance with the gate–drain short-circuited by relay). Two pre-test filters — **OpSh** (open/short continuity test) and **Contact** (fixture contact-quality test) — can gate the CV tests so that a bad connection does not produce a misleading CV result.

Three test modes are available: **CV Measurement** (single-point, up to 6 independent parameters per channel), **CV List** (up to 50-point automatic parameter/condition scan with PASS/FAIL binning), and **CV Trace** (continuous curve scan across 8 selectable curve models — Ciss-Vd, Coss-Vd, Crss-Vd, Rg/Ciss-Vg, Ciss+Coss+Crss-Vd ("MOSCAP"), Cs-Vd, Cs-Freq, and Ciss+Coss+Crss-Freq ("MOSCAPFREQ")).

Model	Drain bias (Vd)	Channels (as shipped)	Notes
TH511	−200 V to +200 V	2 (one dual-channel board)	Shares rear-panel layout with TH512
TH512	−1500 V to +1500 V	2 (one dual-channel board)	Shares rear-panel layout with TH511
TH513	−3000 V to +3000 V	1 (single-channel board, consumable/replaceable)	Distinct rear panel: adds Interlock Input/Latch for 3 kV safety (§2.2, §7)

Gate bias (Vg) is identical across all three models: −40 V to +40 V. Each dual-channel board on TH511/TH512 provides two independent scan channels; additional channel boards can be field- or factory-activated via software license (§3.1.1). A channel board occupies one physical slot; TH513's single-channel board is listed by Tonghui as a consumable/replaceable part owing to the higher voltage stress it carries.

1.3 Safety symbols used in this manual

WARNING — a hazard that, if not avoided, could result in personal injury or death. The TH513's output can reach 3 kV; treat all test terminals as live until confirmed otherwise.

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.

1.4 General safety requirements

The TH510 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 operate the instrument with the protective ground disconnected. For TH513, never open the test-fixture cover or disconnect the Interlock while the instrument is energised — the Interlock Input is designed to stop the test when the fixture cover is opened, but this is a safety interlock, not a substitute for de-energising the circuit before servicing (§2.2, §7).

Rated supply: **AC 100–120 V or 198–242 V** (rear-panel voltage-range setting), **47–63 Hz**. Power consumption: **≤ 130 VA**.

Environment. Normal operation: 0–40 °C. Storage/transport: 5–40 °C.

Warm-up. Allow at least **30 minutes** of warm-up after switch-on before relying on the rated accuracy given in Chapter 6.

1.5 Electrical safety test data

Test	Requirement
Insulation resistance	≥ 50 MΩ (reference conditions) / ≥ 2 MΩ (hot/humid transport conditions)
Dielectric withstand	1.5 kV AC, 50 Hz, 1 minute — no breakdown or flashover
Leakage current	≤ 3.5 mA AC RMS

1.6 Low Voltage & EMC compliance

Directive	Standard(s)
Low Voltage Directive (LVD)	2014/35/EU, via EN 61010-1:2010+A1:2019
EMC Directive	2014/30/EU, via EN 61326-1:2021; CISPR 11:2015+A1:2016+A2:2019 (Group 1, Class A); EN 61000-4-2:2009 (ESD); EN 61000-4-3:2020 (radiated immunity); EN 61000-4-4:2012 (EFT/burst); EN 61000-4-5:2014+A1:2017 (surge); EN 61000-4-6:2014 (conducted RF immunity); EN 61000-4-11:2020 (voltage dips); EN 61000-3-2:2019+A1:2021 (harmonic emissions); EN 61000-3-3:2013+A1:2019+A2:2021 (voltage fluctuations/flicker)

Test method references: GB/T 29332 (IGBT test methods) and IEC 60747-8 (field-effect transistor test methods).

1.7 WEEE & RoHS



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). The TH510 series is covered by Techmize's own RoHS (Directive 2011/65/EU, as amended) self-declaration.

1.8 Dimensions & weight

430 × 177 × 405 mm (W×H×D); approximately 16 kg — consistent across all three models and with the published TH510 Series Datasheet.

1.9 Warranty & limitation of liability

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, excluding consumable/wear parts (e.g. the TH513 channel board) and damage from misuse or operation outside the limits in this chapter. Except as stated here, Techmize makes no other warranty, express or implied.

1.10 Manufacturer & EU contact

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CHAPTER 2

Panel Description

2.1 Front panel

All three models share a common front panel: a 1280×800 capacitive-touch colour LCD, a numeric/cursor keypad, a 4-terminal UNKNOWN test connector (Hcur/Hpot/Lpot/Lcur), and dedicated function keys. Front-panel markings include: USB HOST (×2), Preset, Help, PrtScn, the LCD itself, Display, Setup, System menu keys, a navigation knob with confirm, cursor/marker keys with OK, Esc, numeric keys 0–9 with decimal point and sign, backspace, order-of-magnitude keys, **PASS**/**FAIL** indicator LEDs, Reset, Trigger, File, Enter, Cal (user-correction shortcut), Home, the 4-terminal UNKNOWN test terminal, the power switch (red = standby, green = on), a **DC Bias** indicator key (lights when a non-zero Vg/Vd bias is actively applied — a naming convention carried over from Tonghui's LCR meter product line), and a LOCK key for front-panel key-lock, gated by the system password when password protection is enabled (§4.6).

2.2 Rear panel

TH511 and TH512 share one rear-panel layout: Fuse Holder, Power Outlet, Grounding Terminal, GPIB, LAN, USB Device, TRIGGER, Controller (reserved), HANDLER, nameplate, RS232C, a High-Voltage Source Terminal (auxiliary detection input only — not a stand-alone HV output), and the 4-terminal Test Terminal.

> **WARNING — TH513 REAR PANEL DIFFERS**
>
> **TH513** uses a distinct rear-panel layout to accommodate its 3 kV output: in addition to the High-Voltage Source Terminal, Test Terminal, Fuse Holder, Power Outlet, Grounding Terminal, GPIB, LAN, USB Device, TRIGGER, Controller, HANDLER, nameplate and RS232C, it adds an **Interlock Input** (the instrument will not start a test unless the test-fixture box cover is confirmed closed) and an **Interlock Latch**, plus the single-channel, replaceable/consumable channel board (§1.2). Do not bypass the Interlock on a TH513 installation.

2.3 Power on / off

Confirm reliable earth-ground connection, then press the front-panel power switch (green = on, red = standby). Password protection, if enabled, gates the key-lock function (§4.6) with the system password; the factory-default system password is `510`.

2.4 Home / main menu page

The Home page groups the instrument's functions into two columns:

Group	Pages
C–V	CV Measurement, CV Measurement Setup, CV List, CV List Setup, CV Trace, CV Limit Setup (comparator/BIN setup)
Other	System Setup, File Management

2.5 Basic operation

- Use the menu keys (**Display** , **Setup** , **System** , **Home**) and the touch screen to reach the page you want.
- Use the cursor keys, the navigation knob, or direct touch to move the on-screen cursor to the field you want to set; the selected field highlights.
- The soft-key area on the right shows the functions available for the currently selected field. Numeric keys, the order-of-magnitude keys, and **Enter** complete a numeric entry; pressing an order-of-magnitude key also ends the entry.

2.6 Screen layout

Each measurement page is divided into: a **title bar** (current page name), a **channel identification area** (left edge — identifies which scan channel/board a given row belongs to), a **parameter setting and result display area** (centre), a **comparator/BIN result area** (right or bottom, depending on page), a **menu area** (right edge — context-sensitive soft keys), and a **status bar** (bottom — date/time, line resistance/cable-length indication, tool-correction status).

CHAPTER 3

CV Function Module Description

3.1 Parameter definitions

Parameter	Definition
Ciss	Input capacitance. With the drain and source shorted (AC), the capacitance measured between gate and source. Ciss is the parallel combination of Cgd and Cgs: **Ciss = Cgs + Cgd**. Because the input capacitance must charge above the threshold voltage before the device turns on, and discharge below it before it turns off, Ciss directly affects turn-on/turn-off delay.
Coss	Output capacitance. With the gate and source shorted (AC), the capacitance measured between drain and source. Coss is the parallel combination of Cds and Cgd: **Coss = Cds + Cgd**. Important for soft-switching applications, as it can cause circuit resonance.
Crss	Reverse transfer capacitance. With the source grounded, the capacitance measured between drain and gate: **Crss = Cgd**. Also called the Miller capacitance; a key parameter for switching rise/fall time, since it influences turn-off delay.
Rg-DSS / Rg-DSO	Gate input resistance, measured with drain–source shorted (Rg-DSS) or open (Rg-DSO). Measures the series resistance Rs in series with Cs between gate and source; the result Rs is reported as Rg. The gate-voltage dependence of Ciss can also be obtained by measuring with the gate–source shorted via relay simultaneously.
Ciss-Vgs	Input capacitance measured with the drain and source shorted via an internal relay (rather than by an AC short), used to characterise Ciss as a function of gate–source voltage.
OpSh	Open/short (continuity) pre-test. Checks that the drain and source terminals form a valid open or short circuit as expected for the device under test; a basic functional screen. If OpSh fails, the remaining CV parameters are not meaningful and the instrument flags the result as such; used as a CV-test filter condition.
Contact	Contact-quality pre-test. Checks that the test fixture's Kelvin connections, and the wiring between the test terminals and the fixture, make good contact. If Contact fails, the remaining CV parameters are not meaningful; used as a CV-test filter condition.

3.2 <CV Measurement> page

From the Home page, press **Display** or touch the CV Measurement tile to open the <CV Measurement> page. The page shows: a title bar, a channel-identification strip at the left edge, up to four independently configurable parameter/result rows (frequency, level, Vg, Vd shown alongside each live result, with a schematic symbol indicating the measurement topology), a comparator result row (BIN1–BIN10, Cont, FAIL), and a status bar.

3.2.1 Channel

The channel-identification area at the left edge identifies the scan channel currently shown, corresponding to the physical channel board. TH511/TH512 ship with one dual-channel board (2 channels) as standard; TH513 has exactly one channel, on its single-channel board. Additional channel boards can be enabled by software activation where hardware allows. Switch the active channel by touching its position in the display.

3.2.2 Function parameters

Touching a result's parameter name opens a selection menu for that row: **Ciss, Coss, Crss, Rg-DSO, Rg-DSS, Ciss-Vgs**, plus a per-row measurement on/off switch. The four parameter rows carry no combination restriction — any of the six parameters may be assigned to any row, including duplicates. **OpSh** and **Contact** are configured as pre-test filter conditions on the <CV Measurement Setup> page (§3.3), not as a selectable row here.

Basic test logic: if Contact is enabled, the contact-quality check must pass before any further test proceeds (otherwise the instrument reports a contact-check failure alarm); if OpSh is enabled, the open/short check must then pass before the CV parameters are tested (otherwise it reports an open/short-test failure alarm). If both are enabled, Contact is evaluated first, then OpSh, and only then the regular CV parameters.

3.2.3 Condition quick-set

Touching the frequency, level, Vg or Vd fields directly on the <CV Measurement> page opens the same quick-setting controls as the equivalent fields on the <CV Measurement Setup> page (§3.3.4–3.3.7).

3.2.4 Result display

The decimal-point position of each displayed result can be set to Auto (default, floating), Fixed (locks the current position), Increase (shifts left) or Decrease (shifts right). A locked decimal-point position automatically releases back to floating if the measured function or the deviation mode is changed.

3.2.5 BIN sort display, counting & USB export

The comparator can sort each tested device into up to **10 bins** (BIN1–BIN10), each with independently settable upper and lower limits for up to 4 parameters; clearing a limit removes that parameter from the comparison for that bin. A device is sorted to a bin only when all of its participating parameters fall inside that bin's limits. The comparator (ON/OFF, default OFF) and the per-bin pass count (ON/OFF, default OFF, with a count-clear function) are controlled from the measurement page; the bin limits themselves are set only on the <CV Limit Setup> page.

Test results can be exported to a USB drive in CSV format: `Time,Para,P1,P2,P3,P4,BIN,OpSh,Contact` — test time, parameter names, results for parameters 1–4, bin result, open/short result, contact-check result. Default save path: `usb/CSV/`; file naming convention: `cvm+<serial number>+<date>.csv` (e.g. `cvm-SN12345678-20210811.csv`).

3.3 <CV Measurement Setup> page

Reached via Setup or by touching <CV Measurement Setup>. Each of up to 4 rows (one per configured function) can be independently set.

3.3.1 Trigger & delay

Trigger source: Continuous (free-running) or Bus/Manual, set per the global trigger configuration. Trigger delay: default 300 ms, user-adjustable.

3.3.2 Speed

Sets the AD integration time (plus associated data-calculation time); a slower speed trades throughput for stability.

Speed	AD integration time (incl. calculation)
FAST+	≈ 0.56 ms
FAST (factory default)	≈ 3.3 ms
MED	≈ 90 ms
SLOW	≈ 220 ms

3.3.3 Channel & function

Channel: CH1–CH6 enumerated, factory default CH1 (TH513's 3 kV channel has only one channel available). Function: Ciss, Coss, Crss, Rg-DSO, Rg-DSS, Ciss-Vgs, OpSh-Short, OpSh-Open, each independently switchable ON/OFF.

3.3.4 Test frequency

Test signal frequency, factory default 1 MHz.

Frequency range (F)	Test frequency points	Resolution
1 kHz ≤ F ≤ 9.999 kHz	1.0000 kHz … 9.99999 kHz	0.01 Hz
10 kHz ≤ F ≤ 99.99 kHz	10.0000 kHz … 99.9999 kHz	0.1 Hz
100 kHz ≤ F ≤ 999.9 kHz	100.000 kHz … 999.9 kHz	1 Hz
1 MHz ≤ F ≤ 2 MHz	1.00000 MHz … 2 MHz	10 Hz

Two entry methods: direct numeric-key entry, or step increase/decrease via the soft-key menu.

3.3.5 Test level

Sets the test AC signal's RMS level (open-circuit output voltage); the test frequency is the signal frequency, generated by an internal oscillator. Range: **5 mV–1 V**, resolution 1 mV, fixed source output impedance 100 Ω.

3.3.6 Vg bias (gate bias voltage)

Provides the gate drive/control bias for the semiconductor CV test. Range: **−40 V to +40 V**, identical on all three models.

3.3.7 Vd bias (drain bias voltage)

Provides the device's working (drain) bias.

Model	Vd bias range
TH511	−200 V to +200 V
TH512	−1500 V to +1500 V
TH513	−3000 V to +3000 V

3.3.8 Delay

Per-parameter settling delay, provided so the bias has time to stabilise before measurement. Range: 0 s to 60 s, 1 ms resolution, or an automatic-delay setting.

3.3.9 Deviation & reference

The deviation function displays a comparison between the current test result and a user-set reference value, instead of the raw result — useful for watching how a parameter drifts with temperature, frequency or bias.

Mode	Formula
Δ (absolute)	Δ = X − Y, where X is the current measured value and Y is the reference value
Δ% (percentage)	Δ% = (X − Y) / Y × 100 [%]; if Y = 0, the result displays `Inf`

3.3.10 Load correction

An optional calibration mode (default OFF) that improves measurement consistency: the instrument computes a load-correction coefficient from the last test result and a user-entered reference value, then applies that coefficient to subsequent readings of the corresponding parameter.

3.3.11 Average

Averages 2 or more successive measurements into one displayed result. Range: 1–32, resolution 1, factory default 1.

3.4 <CV List> display page

Reached via **Display** → List, or directly. Displays up to 50 scan points, each showing its test frequency, test level, Vg, Vd, function, channel, measured result and PASS/FAIL comparison state. During a scan, the current test point is marked with "`*`" at the left; the P/F column shows `---` (not yet compared), `PASS` (green) or `FAIL` (red).

3.5 <CV List Setup> page

The list-scan function automatically scans function, channel, frequency, level, Vg bias and Vd bias for up to 50 points.

Setting	Description
Point count	0–50 scan points, factory default 8 (0 = no scan point configured)
List mode	SEQuential (points run in a fixed order) or STEP (points run one at a time per trigger)
Per-point settings	Function, channel, frequency (and sweep range where applicable), level, Vg, Vd, delay, average (1–32), upper/lower comparison limits, bin assignment, reference value, load-correction switch
List comparison	ON/OFF — enables PASS/FAIL comparison across the whole list scan

A list point may also be configured as an **Open** or **Contact** pre-test point rather than a CV parameter, to gate the points that follow it.

3.6 <CV Trace> display & setup

CV Trace performs a continuous curve scan rather than a single reading or a discrete-point list, sweeping one or more of frequency, Vg or Vd while the other conditions are held fixed.

Curve model	Swept quantity	Notes
Ciss-Vd	Vd	—
Coss-Vd	Vd	—
Crss-Vd	Vd	—
Rg/Ciss-Vg	Vg	Independently togglable sub-parameters: Rg-DSO, Rg-DSS, Ciss-Vgs
Ciss+Coss+Crss-Vd ("MOSCAP")	Vd	Plots all three capacitances against Vd on one graph
Cs-Vd	Vd	Per-row selectable parameter: Ciss, Coss or Crss
Cs-Freq	Frequency	Per-row selectable parameter: Ciss, Coss or Crss
Ciss+Coss+Crss-Freq ("MOSCAPFREQ")	Frequency	Plots all three capacitances against frequency on one graph

Trace settings include: channel, curve model, per-curve switch, frequency/sweep parameters (start, stop, point count, linear/log axis), level, trigger source & count, Vg sweep range & point count, Vd sweep range, point count, delay and data format, and the Y-axis display format.

3.7 Open/short & load correction (CVCORR)

Before testing, the instrument can be corrected for residual stray capacitance (open) and residual series impedance (short) introduced by the test fixture and cabling, and for a user load reference. Correction cable length is selectable as **0 m** or **2 m**. Open and short correction data can be measured directly (single point) or, for list/trace scans, per-point across the whole scan range. See Chapter 5 for the full user-correction procedure.

3.8 <CV Limit Setup> (comparator / BIN) page

Configures the up to 10 bins (BIN1–BIN10) referenced from the CV Measurement and CV List pages: per-bin upper/lower limits for up to 4 parameters, and per-bin enable switch. Limits are entered here; the comparator ON/OFF switch and pass-count display are controlled from the measurement/list display pages themselves (§3.2.5).

CHAPTER 4

System Setup & File Management

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

4.1 Communication (BUSMODE)

Setting	Options
Bus mode	RS232 / LAN / USBTMC / USBCDC / AUTO
RS232 baud rate & address	Configurable; command mode fixed to **SCPI** for this manual's scope (see note below)
RS232 mode	RS232 / EXT485 / EXTGPIB
LAN	Port, DHCP enable, IP address, gateway, subnet mask, DNS, MAC address

> NOTE
> The instrument's own command-mode setting also offers a MODBUS option on RS232. MODBUS is not covered in this manual or in the companion SCPI Command Reference — only SCPI is documented.

4.2 Display & interface settings

Setting	Options
UI language	English

4.3 Beeper

Separate PASS-tone and FAIL-tone beeper settings for the comparator result.

4.4 Date & time

Sets the instrument's real-time clock.

4.5 Firmware update

Application firmware update (`UPDATE APP`) via USB drive.

4.6 Password

Controls password-gated front-panel key-lock (§2.1, §2.3). Factory-default system password: `510` .

4.7 File management

Supports loading a stored CV configuration file (mapped to internal file indices, e.g. `CV.cv` , `CV2.cv` ...) and storing the current configuration to internal memory or a USB drive. Up to 50 file-index slots are supported for configuration recall.

CHAPTER 5

User Correction

User correction removes the residual effect of the test fixture and cabling from the measurement, improving accuracy at the device terminals rather than at the instrument's own terminals.

5.1 Cable length

Select the correction cable length matching your test fixture: **0 m** or **2 m**.

5.2 Open correction

With the test fixture open-circuited (device removed, fixture terminals not shorted), run the open-correction measurement to capture residual stray admittance. Open-correction data can be captured as a single point (for CV Measurement), or across the full scan range (for CV List and CV Trace).

5.3 Short correction

With the test fixture short-circuited using the manufacturer-recommended short standard, run the short-correction measurement to capture residual series impedance. As with open correction, data can be captured as a single point or across the full scan range.

5.4 Load correction

See §3.3.10 — an optional per-parameter correction coefficient computed from a known reference device, applied to subsequent readings of that parameter.

5.5 Correction workflow

1. Select the correct cable length (0 m or 2 m) for your fixture.
2. Open-circuit the fixture terminals (no device, no short standard) and run open correction.
3. Fit the recommended short standard and run short correction.
4. Optionally, fit a known reference device and configure load correction (§3.3.10).
5. Verify with a known device before production testing. Re-run correction if the fixture, cable, or test frequency/level range changes.

CHAPTER 6

Performance & Testing

Ratings apply after at least 30 minutes of warm-up (§1.4), within the environmental limits of §1.4.

6.1 Power-semiconductor accuracy

Measured at ≥10 kHz test frequency, MED (mid) speed, using the manufacturer's recommended test fixture:

Parameter	Range	Accuracy	Condition
Rg-DSS / Rg-DSO	0.1–100 Ω	±(4% + 0.1 Ω)	Cg ≥ 0.3 nF
Ciss / Coss	0–20 nF	±(4% + 0.01 nF)	—
Crss	0–200 pF	±(4% + 0.01 pF)	—

6.2 Test method references

Test methodology for power-semiconductor CV characterisation follows: **GB/T 29332** (IGBT test methods) and **IEC 60747-8** (field-effect transistor test methods).

6.3 Summary specification table

Item	TH511	TH512	TH513
Vd range	−200–200 V	−1500–1500 V	−3000–3000 V
Vg range	−40–40 V		
Test frequency	1 kHz–2 MHz (resolution 0.01 Hz–10 Hz by band, §3.3.4)		
Test level	5 mV–1 V RMS, output impedance 100 Ω		
Test speed	FAST+ ≈0.56 ms, FAST ≈3.3 ms, MED ≈90 ms, SLOW ≈220 ms		
Power consumption	≤ 130 VA		
Dimensions (W×H×D)	430×177×405 mm		
Weight	≈ 16 kg		

CHAPTER 7

Handler Interface

The rear-panel HANDLER interface, standard on all three models, lets an automatic test system read the comparator/bin result and the OpSh/Contact pre-test results, and supply an external trigger.

7.1 Connector

57BR-4036L, 36-pin connector.

7.2 Outputs

`/BIN1` – `/BIN10`, `/OP_SH Fail`, `/Cont Fail`, `/PASS`, `/FAIL`, `/ALARM`, `/INDEX`, `/EOM` — all open-collector, photo-isolated, LOW-active.

7.3 Inputs

`/KEY_LOCK`, `/EXT_TRIG` (minimum pulse width ≥ 1 µs).

7.4 Electrical characteristics

Signal class	LOW level	HIGH level	Max. current
Comparison/control outputs	≤ 0.5 V	+5 V to +24 V	6 mA / 5 mA (output-dependent)

Internal pull-up is referenced to the TH510's own ground via COM1/COM2, or an external supply (+5 V to +24 V) can be used via EXTV1/EXTV2.

7.5 Pin assignment

Pin(s)	Signal
1–10	BIN1–BIN7 (+ spares)
11	/OP_SH Fail
12–13	EXT.TRIG
14–15	EXT.DCV2
16–18	+5 V internal (do not connect an external supply to these pins)
19	PASS
20	FAIL
21	/Cont Fail
22–24	Unused / factory test — do not connect
25	KEY LOCK
27–28	EXT.DCV1
29	ALARM
30	INDEX
31	EOM
32–33 / 34–36	COM2 / COM1

7.6 Power jumpers

Default jumper state: **JP500/JP502 shorted at 2-3 (external power)**; JP501/JP503 open. The default factory configuration therefore expects an external supply on EXTV1/EXTV2, not the internal +5 V.

7.7 Wiring (PLC input types)

The HANDLER output lines can be wired to a PLC's input module in either a common-anode (source-type) or common-cathode (sink-type) configuration, matched to the PLC's own input wiring convention.

APPENDIX

Terms, Symbols & Quick Reference

A.1 Measurement parameter symbols

Symbol	Meaning
Ciss	Input capacitance (Cgs + Cgd)
Coss	Output capacitance (Cds + Cgd)
Crss	Reverse transfer (Miller) capacitance (Cgd)
Rg-DSO / Rg-DSS	Gate input resistance, drain open / drain short
Ciss-Vgs	Input capacitance, gate–drain relay-shorted, vs. gate–source voltage
OpSh	Open/short continuity pre-test
Contact	Fixture contact-quality pre-test
Vg	Gate bias voltage
Vd	Drain bias voltage

A.2 Front-panel key quick reference

Key	Function
Display	Opens CV measurement/list/trace display pages (Chapter 3)
Setup	Opens CV measurement/list/trace setup pages (Chapter 3)
System	Opens system setup (Chapter 4)
Home	Opens the main menu page (§2.4)
Cal	Shortcut to user-correction setup (Chapter 5)
Trigger	Manual trigger
Reset	Resets the current count / comparison state
LOCK	Locks/unlocks the front panel (password-gated, §4.6)
File	Opens file management (§4.7)
PrtScn	Screen capture

A.3 Contact, warranty and support

Warranty: two years from delivery (§1.9). For service, calibration, or accessories, contact Techmize using the details below.

Techmize Electronic GmbH

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

Contact

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Registration

Managing Director: Haohua Zhao
Register Court: Amtsgericht München
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