TECHMIZE by TONGHUI

OM

OPERATION MANUAL

TH521 Series

Power Device Analyzer. Covers installation, the front-panel home screen and test modes, the modular SMU architecture, performance specifications and the remote command interface for the TH521-35 (3500 V) model line.

Techmize Electronic GmbH · Ismaning, Germany · an international subsidiary of Changzhou Tonghui Electronic Co., Ltd.

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TH521 Series Operation Manual

Power Device Analyzer — TH521-35 model line

This manual describes the installation, front-panel operation and remote control of the TH521 series power device analyzer. The TH521 is a modular characterization platform: a mainframe hosting the gate/base step-generator source-measure units plus a plug-in extender carrying the model-specific drain/collector power module. It performs automated I/V curve tracing, three-terminal capacitance (C/V), gate-charge (Qg) and power-loss analysis on power semiconductors and related components.

> NOTE — SCOPE OF THIS EDITION
>
> Only the **3500 V-tier (TH521-35-xx)** models are currently in production and on the European market; this edition of the manual covers that model line (8 models). Documentation for the 200 V-tier (TH521-02-xx) models will be added in a future revision once those models are released.

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The TH521 command set is a flat, mnemonic GPIB command language (not hierarchical SCPI syntax). The full command reference is issued as a separate companion document, TH521 Series Command Reference, in line with Techmize's standard practice for command sets of this size; Chapter 7 of this manual covers the syntax conventions and command-set structure only. This manual is also documented alongside the TH521 Datasheet, which carries the full 16-model TH521-02/TH521-35 platform overview.

CHAPTER 1

Safety, Compliance & Warranty

1.1 About this manual

This is the operation manual for the Techmize TH521 series power device analyzer, TH521-35 model line. Where this manual and the instrument itself appear to disagree, contact Techmize or your authorized distributor using the details in §1.9 before relying on the instrument for a measurement or sorting decision.

Techmize continually improves the performance, features and construction of its instruments; content, specifications and accessories described here are subject to change without notice.

WARNING — HIGH VOLTAGE AND HIGH CURRENT

Depending on the installed modules, the TH521 can source up to **±3500 V** (HVSMU) and, in pulsed mode, up to **1800 A** (UHCU) at the drain/collector test terminals, and up to **±2200 V** pulsed (optional HVMCU). The front-panel **High Voltage** indicator lights whenever hazardous voltage is present at the test port — never touch the test terminals, test fixture or device under test while it is lit. Only qualified personnel familiar with high-voltage/high-current test practice should operate this instrument.

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.

1.3 General safety requirements

WARNING — GROUNDING

Connect the instrument only to an earthed three-wire outlet, using the supplied EU power cable. Never defeat the protective-earth connection. The GNDU (slot 1) module's rear-panel ground terminal provides the measurement reference ground for floating/guarded measurements — this is separate from, and does not substitute for, the chassis protective-earth connection.

Power	
Supply voltage	100–240 V AC (auto-ranging)
Supply frequency	50/60 Hz
Power consumption	≤900 VA
Fuse	Internal fuse, rated for the input supply — replace only with the type specified on the instrument

CAUTION

Before connecting the AC power cable: confirm the power switch is off, confirm the supply is within the instrument's rated range, and use only the power cable supplied with the instrument. Use an internal fuse of the correct rating when replacement is needed — never substitute an incorrect rating.

Operating precautions

- **Do not power-cycle the instrument repeatedly.** Frequent on/off switching risks loss of stored data.
- **Warm up before precision measurement.** Allow at least **40 minutes** of warm-up after power-on before relying on the instrument's rated accuracy.
- **Keep ventilation openings clear.** The instrument draws cooling air in at the sides and exhausts at the rear; blocked ventilation raises internal temperature and degrades accuracy.
- **Avoid electrically noisy environments.** If a quiet supply cannot be guaranteed, fit a power-line filter.
- **Avoid dust, vibration, direct sunlight and corrosive gases.** These degrade long-term accuracy and reliability.

1.4 Environment

Item	Requirement
Operating temperature / humidity	+5–+40 °C, 20–70% RH (no condensation)
Operating altitude	0–2000 m
Warm-up time	≥40 minutes

For extended storage, keep the instrument in its original packaging or an equivalent container, in a well-ventilated room free of corrosive gases and direct sunlight.

1.5 Prohibited and restricted actions

- Do not apply an external voltage or current to the test terminals when the corresponding module is not actively sourcing — this can damage the module.
- Do not touch the test terminals, fixture or device under test while the front-panel **High Voltage** or **Measurement** indicator is lit.
- Do not disassemble the instrument or replace internal modules without authorization from Techmize or a qualified service engineer.

> NOTE — MODULE SLOT ASSIGNMENT
>
> The mainframe and extender host up to 10 source-measure modules across slots 1–10 (§3.2); do not insert or remove a module while the instrument is powered.

1.6 CE marking

The TH521 series carries the CE mark, as shown on the instrument's rear-panel nameplate.

1.7 WEEE — disposal of electrical and electronic equipment



This symbol, shown on the instrument's rear-panel nameplate, 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.

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 shipment. During the warranty period, Techmize will repair a product that proves defective, provided it has been used within the specified operating conditions. A warranty card is required to claim warranty service.

Repair must be carried out by qualified technical personnel; do not replace internal modules or components without authorization. Damage resulting from unauthorized repair or component replacement is not covered by the warranty, and the repair cost is borne by the user. After any repair, the instrument must be recalibrated before further use, to avoid affecting measurement accuracy.

> **NOTE**
>
> Protect the instrument from direct sunlight and humidity, and use it only within the environmental conditions of §1.4. For extended non-use, store the instrument sealed in its original factory packaging.

1.9 Manufacturer & EU contact

Techmize Electronic GmbH

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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
HRB 312530 · VAT ID DE463170824

CHAPTER 2

Out of the Box

2.1 Unpacking

The TH521 ships as two units — a mainframe and an extender — each in its own packaging. Inspect both shipping containers for damage after unpacking; it is not recommended to power on the instrument if a container shows signs of damage. Check the contents against your order; if anything does not conform, notify Techmize or your distributor promptly.

Item	Qty
TH521-35 mainframe and extender (modules fitted as ordered)	1 each
EU power cable (Schuko, CEE 7/7)	2 (one per unit)
Tri-axial test cable	12
High-voltage tri-axial test cable	1
Digital I/O cable	1
Keyboard / mouse	1 set
TH521-1 three-terminal device test fixture	1
This operation manual	1
Certificate of conformity & warranty card	1 each

Standard accessories match the TH521 Series Datasheet. Optional accessories — the TH521-5 MFCMU connection cable and TH521-3 Ceg test fixture — are available on request. This operation manual is supplied as a PDF document, not as a printed copy. Keep the original packaging for storage or return shipment (§1.8).

2.2 Connecting the power supply

Item	TH521-35 mainframe / extender
Supply	100–240 V AC, 50/60 Hz (auto-ranging, each unit)
Power consumption	≤900 VA
Dimensions (W×H×D)	Mainframe: 430×311×600 mm · Extender: 425×365×590 mm
Weight	Mainframe: ≈34.5–35 kg · Extender: ≈22 kg (20 A-tier models) / 33.5 kg (200/600/1800 A-tier models)

Connect the EU power cable to the rear-panel IEC inlet of each unit and confirm both are reliably grounded (§1.3) before switching on.

> **WARNING**
> Make sure the protective-earth path is reliably grounded before connecting the power cable, to prevent electric shock from leakage current.

2.3 Starting the instrument for the first time

1. Connect the EU power cable to the mainframe's rear-panel inlet, confirming the instrument is reliably grounded.
2. Press the front-panel power switch. The instrument boots to its touchscreen home page.
3. Allow the instrument to warm up for at least 40 minutes before relying on rated accuracy (§1.4).
4. From the home page, select a test mode — Test Script, Data Sheet, I/V, C/V, Qg or Power Loss Calculation — to begin (§3.3, Chapter 4).

> **NOTE — TOUCHSCREEN OPERATION**
>
> The TH521 is operated primarily through its front-panel touchscreen GUI; a keyboard and mouse are supplied as standard accessories for data entry, device naming and file management, and a VGA/HDMI output is available for an external monitor (§3.2).

2.4 Connecting the device under test

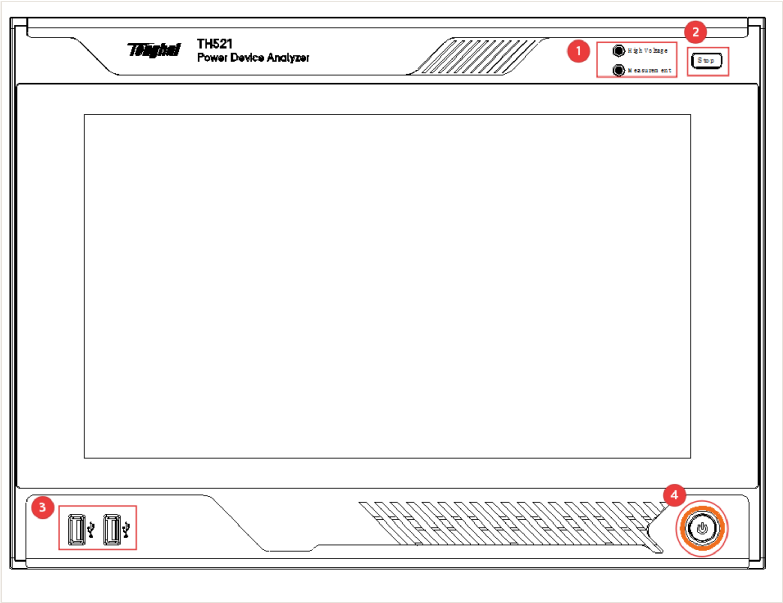
Each installed drain/collector and gate/base module provides its own Force/Sense tri-axial (or, for the HVSMU and UHCU modules, high-voltage/high-current) test terminals on the extender's and mainframe's rear panels (§3.2). Use the supplied tri-axial test cables, or the TH521-1 three-terminal fixture, to connect the device under test; use the high-voltage tri-axial cable only with the HVSMU module.

> **WARNING — BURN AND SHOCK HAZARD**
>
> Do not connect or disconnect test leads while the front-panel **High Voltage** or **Measurement** indicator is lit. At the UHCU module's higher current tiers (200/600/1800 A pulsed), poor contact at the test connection can also create a localized burn hazard.

CHAPTER 3

Getting to Know the Instrument

3.1 Mainframe front panel



1 **High Voltage / Measurement indicators** — **High Voltage** lights when the test port carries hazardous voltage (do not touch the test terminals or device under test); **Measurement** lights while a test is in progress.

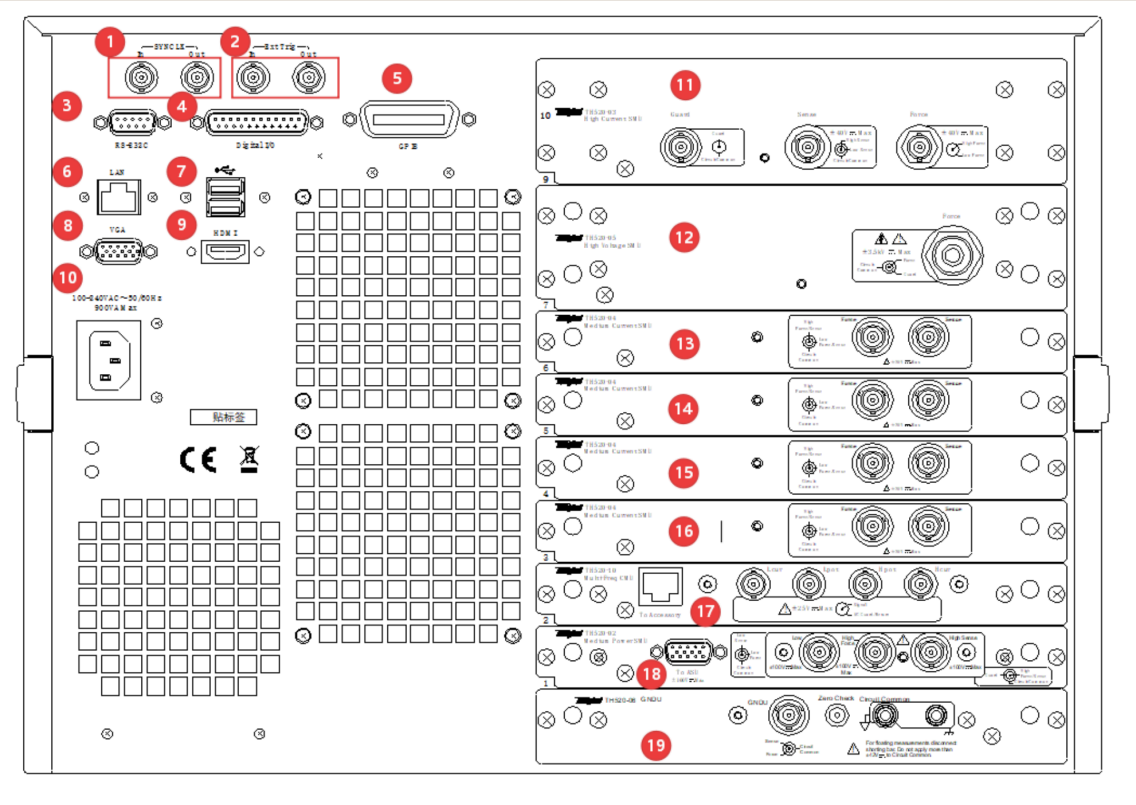
2 **Stop** — aborts the running measurement; does not change the instrument's output state otherwise.

3 **USB ports** — front-panel USB Host ports, for a keyboard, mouse or USB storage device.

4 **Power switch** — illuminated rocker switch; powers the mainframe on/off.

The centre of the front panel is a colour touchscreen showing the home page and all test interfaces (§3.3).

3.2 Mainframe rear panel



1, 2 **SYNCLK / ExtTrig In & Out** — synchronization clock and external trigger, for linking multiple units.

3 **RS-232C** — serial remote-control interface (§6.2).

4 **Digital I/O** — general-purpose digital input/output connector.

5 **GPIB** — parallel remote-control interface; all parameters and commands can be set and read over GPIB.

6 **LAN** — network remote-control interface (§6.3).

7 **USB Device** — remote-control interface for PC connection.

8, 9 **VGA / HDMI** — external monitor outputs.

10 **AC power inlet** — 100–240 V AC, 50/60 Hz, ≤900 VA; internal fuse (§1.3).

11 **Slot 10 — HCSMU** module (20 A-tier drain/collector supply)

12 **Slot 9 — HVSMU** module (±3500 V drain/collector supply)

13–16 **Slots 7,6,5,4 — MCSMU** modules ×4 (gate/base step generator)

17 **Slot 3 — MFCMU** module (C/V and Qg measurement, C-models)

18 **Slot 2 — MPSMU** module (gate/base bias source)

19 **Slot 1 — GNDU** module (measurement reference ground)

The UHCU module (200/600/1800 A-tier models) is housed in the separate extender unit.

3.3 Home page & interface overview

On power-up, the touchscreen opens on the **TH521 Smart Test Navigator** home page, which provides direct access to every test mode. A second home page (swipe to view) holds the direct-control, calibration and programming tools.

Tile (home page 1)	Function
Test Script	Python-based scripting environment for custom automated test sequences, with AI-assisted script generation (§4.2)
Data Sheet	Guided device-characterization mode — IV/CV/Qg parameters and curves for a named device, auto-saved as a data sheet (§4.3)
I/V Measurement	Direct I/V curve-tracer interface (§4.4)
C/V Measurement	Capacitance measurement interface — Ciss/Coss/Crss and Rg (§4.5, C-models)
Qg (Gate Charge Measurement)	Gate-charge curve measurement interface (§4.6, C-models)
Power Loss Calculation	Conduction/switching/drive power-loss calculator (§4.7)
Minimize	Minimizes the current interface to the desktop

Tile (home page 2)	Function
Direct Control	Independent output/measurement control of each installed module
Calibration	Calibration settings (password-protected)
Programming	Access to the programming/scripting environment

Every test interface provides a common menu bar (File — new/open/save; Edit — cut/copy/paste; Measure — start/stop; and context-specific Tools/Configuration/Help menus) and automatically saves measurement data to a dedicated directory, with the file name assigned from the device ID, date and time; file names and comments can be edited manually, and earlier saved data can be reopened from the same interface.

CHAPTER 4

Operation & Configuration

This chapter summarizes each test mode's purpose, parameters and workflow at an operating level. For the complete field-by-field walkthrough of every measurement, see the full TH521 GUI reference (available from Techmize on request).

4.1 Test Script builder

The Test Script tile opens a Python-based scripting environment with a script window, a command-line window for interactive testing, and a built-in AI-assisted script-writing function. Global variables pre-map each installed module (for example `smu1` – `smu9` for the SMUs in slots 2–10, `uhcu` for the extender module and `gndu` for the slot-1 ground unit), with module properties and methods (such as `smu1.power_status`) available for direct scripting. Scripts are created, edited, saved and run from the File and run-control toolbar; the **AI** button invokes AI-assisted script generation from a natural-language description.

4.2 Data Sheet — device characterization mode

Data Sheet mode automatically measures and records the full set of electrical parameters that define a device, organized under five device-type categories:

Device type	Typical parameters
MOSFET	BVDSS, IDSS, IGSS(±), VGS(th), gfs, RDS(on), VDS(on), VSD, Rg, Ciss/Coss/Crss, Qg/Qgs/Qgd, Vgs(pl)
IGBT	BVCES, ICES, IGES(±), VGE(th), gfs, VF, Rg, Cies/Coes/Cres, Qg/Qgs/Qgc, Vge(pl)
BJT	ICEO, IEBO, hFE, VCE(sat), VBE(sat)/VBE(on), V(BR)CEO, V(BR)EBO
Diode	VDC, VF, IR, C
Components	Inductors (L, RDC) · capacitors (C, C(biased), leakage, R(insulation)) · shunts/resistors (R) · connectors/cables (contact/insulation resistance, withstand voltage, capacitance) · relays/SSRs/optocouplers (contact & coil resistance, pull-in/drop-out voltage, LED VF/IR, isolation)

Workflow: select the device type → create a data sheet → enter device identification and maximum ratings (used as safety limits during the test) → select the parameters and characteristic curves to measure → adjust test conditions if needed → connect the device under test → run the measurement. The instrument automatically checks each result against the entered minimum/maximum limits and flags any out-of-limit value in the results table; measured data is auto-saved, with the file name assigned from the device ID, date and time.

4.3 I/V measurement

The I/V interface provides a complete curve-tracer function, covering nine standard measurement types (MOSFET naming shown; equivalent IGBT/BJT/diode curves are also supported):

Curve	Typically used for
ID-VDS	Output characteristic — ID vs. VDS at stepped VGS
ID-VGS	Transfer characteristic — ID vs. VGS at constant VDS
VGS(th)	Gate threshold voltage, at VGS=VDS or at a constant VDS
RDS(on)-ID	On-resistance vs. drain current, at fixed VGS
VDS-VGS	VDS(on) vs. VGS, at fixed ID
RDS(on)-VGS	On-resistance vs. VGS, at fixed ID
IDSS	Drain leakage current, gate shorted
IGSS	Gate leakage current, forward and reverse bias
IS-VSD	Body/intrinsic-diode forward characteristic

For each curve, the interface groups settings under **General settings** (trace mode, step timing), **Gate/Base Voltage or Pulse Step** (bias mode and sweep range for the gate/base step generator), and **Drain/Collector** (source mode and sweep range for the drain/collector supply); the lower pane plots the resulting I-V trace, and an oscilloscope (time-domain) view is available alongside the trace to inspect the actual voltage/current pulse waveform during the test.

4.4 C/V measurement (C-models only)

The C/V interface measures Ciss/Coss/Crss (Cies/Coes/Cres on IGBT devices) by sweeping the collector/drain voltage at a fixed measurement frequency (1 kHz–10 MHz) while the gate/base bias is held at 0 V, and measures gate resistance Rg by sweeping the gate/base voltage at a fixed collector/drain bias. Settings cover frequency, AC level, NPLC and phase compensation (Auto or Adaptive, §5.3); sweep parameters (start/stop, number of steps, hold/delay/zero-bias time) are set under Collector/Drain Voltage Sweep.

4.5 Qg (gate-charge) measurement (C-models only)

The Qg interface drives the device with a constant gate current while the drain/collector is held at a fixed voltage and current, and traces the resulting gate-voltage-vs-charge curve. Test conditions are grouped under **Drain** (Vds(off), Id(on)), **Gate** (Vgs(off), Vgs(on), Ig) and, when enabled, a **Current Load** block for testing with an external FET/IGBT load (LoadVgs(off)/LoadVgs(on)). The results view derives Vgs(pl), Qg, Qgs, Qgd/Qgc and the Qg-curve slope from both a high-current and a high-voltage measurement pass; a switching-waveform tab shows the underlying Vds, Vgs, Id and Ig vs. time traces, and a timing-setup panel configures the pulse parameters (delay, hold, on-period) used during the high-current pass.

4.6 Power-loss calculation

The Power Loss tile walks through a device power-loss test in four steps:

1. Expand **Measurement Conditions** and select the load type.
2. Under **Parameters**, select the device type.
3. Expand **Parameters** and set the drive-condition and device parameters. Each parameter can be entered as a fixed value, or swept: enable **Sweep** for that parameter and set its start value, stop value, range mode and step count. Drive-condition and device parameters can also be imported directly from a saved measurement — select the parameter to import on the right and use the folder icon to pick the source data file; the values populate the table automatically.
4. Click **Start** to run the power-loss calculation.

4.7 Measurable device & component types

Beyond discrete power semiconductors, Data Sheet mode also supports a range of passive and electromechanical components:

Type	Key parameters
Inductors	L (zero-bias inductance), RDC
Capacitors	C (zero-bias), C(biased), leakage current, R(insulation), C-V curve
Shunt resistors	R at a specified current
Resistors	R at a specified voltage
Connectors / cables	Contact resistance, withstand voltage, leakage current, insulation resistance & capacitance, R-I curve
Relays	Contact/coil resistance, open-contact and coil-contact insulation resistance & capacitance, pull-in/drop-out voltage, operating current, R-I curve
Optocouplers	LED VF/IR, LED capacitance, detector BVCEO/BVECO/ICEO/Cce/VCE(sat), input-output capacitance & insulation resistance/voltage, IF-VF, IFP-VFP, IC-VCE, IC-IF, Cce-VCE
Solid-state relays	LED VF/VR, LED on/off current, R(on), I(leak), C(out), C(iso), B(iso), IF-VF, IL-V, I(off)-VL, C(out)-VL

> **NOTE**
> This chapter summarizes each test mode's scope and workflow. Step-by-step GUI instructions for every individual curve type, with illustrative on-screen parameter values, are covered in the full TH521 GUI reference.

CHAPTER 5

Performance & Specifications

5.1 TH521-35 model line

Model	Max. current	C/V & Qg
TH521-35-20	3500 V / 20 A	—
TH521-35-20C	3500 V / 20 A	10 MHz + Qg
TH521-35-200	3500 V / 200 A	—
TH521-35-200C	3500 V / 200 A	10 MHz + Qg
TH521-35-600	3500 V / 600 A	—
TH521-35-600C	3500 V / 600 A	10 MHz + Qg
TH521-35-1800	3500 V / 1800 A	—
TH521-35-1800C	3500 V / 1800 A	10 MHz + Qg

A trailing "C" adds the MFCMU capacitance (C/V, up to 10 MHz) and gate-charge (Qg) module to the base I/V kit. The 20/200/600/1800 A designation is the model's pulsed drain/collector current tier (§5.2–5.4); DC current limits are lower, per module.

5.2 Source-measure building blocks

Each model combines the modules below according to its voltage/current tier. The gate/base step generator (MCSMU + MPSMU) is common to every model; HVSMU (±3500 V supply) is fitted to every TH521-35 model, together with either HCSMU (20 A-tier) or UHCU (200/600/1800 A-tier) as the drain/collector current source; MFCMU is fitted only to C-models.

Module	Role	Voltage range	Current range
MPSMU	Gate/base bias source	±100 V	±100 mA
MCSMU	Gate/base step generator (×4 per unit)	±30 V	±1 A
HCSMU	Drain/collector supply, 20 A-tier models	±40 V	±20 A pulsed (±1 A DC)
UHCU	Drain/collector supply, 200/600/1800 A-tier models	60 V (6 V measure-only)	200 / 600 / 1800 A pulsed
HVSMU	Drain/collector supply, all TH521-35 models	±3500 V	8 mA
MFCMU	C/V and Qg measurement (C-models)	DC bias 0–±25 V	AC level 0–1 V
HVMCU (optional)	Pulsed source for capacitive-load switching tests	±1500 V / ±2200 V	2.5 A / 1.1 A pulsed
GNDU	Measurement reference ground (slot 1, fitted to every model)	—	

*The TH521 does **not** have a Handler interface. The HVMCU is a factory-fit option (not standard) for pulsed capacitive-load switching tests, independent of the base I/V/C/V/Qg kit.*

5.3 Module specifications — HCSMU & HVSMU

HCSMU (20 A-tier drain/collector supply)

Voltage range	Resolution	Accuracy	Max. current
200 mV	200 nV	±(0.06%+0.6 mV+I_O×0.05)	20 A
2 V	2 µV	±(0.06%+0.6 mV+I_O×0.5)	20 A
20 V	20 µV	±(0.06%+3 mV+I_O×5)	20 A
40 V	40 µV	±(0.06%+3 mV+I_O×10)	1 A

Current range	Resolution	Accuracy	Max. voltage
10 µA–100 mA	10 pA–100 nA	±(0.06%+2E-8..2E-5 A+V_O×1E-10..1E-6)	40 V
1 A	1 µA	±(0.4%+2E-4 A+V_O×1E-5)	40 V
20 A	20 µA	±(0.4%+2E-3 A+V_O×1E-4)	20 V

Resolution	6½-digit	Max. voltage	±40 V
Min. current	10 pA	Max. pulse peak (duty ≤1%)	±20 A
Pulse width	50 µs–1 ms	DC max. current	±1 A

HVSMU (±3500 V drain/collector supply, all TH521-35 models)

Voltage range	Resolution	Accuracy	Max. current
200 V	200 µV	±(0.03%+40 mV)	8 mA
500 V	500 µV	±(0.03%+100 mV)	8 mA
1500 V	1.5 mV	±(0.03%+300 mV)	8 mA
3500 V	3.5 mV	±(0.03%+600 mV)	4 mA

Current range	Resolution	Accuracy	Max. voltage
10 nA / 1 µA	10 fA / 1 pA	±(0.05–0.1%+1E-9 A+V_O×8E-12)	3500 V
100 µA	100 pA	±(0.03%+3E-9 A+V_O×1E-11)	3500 V
10 mA	10 nA	±(0.03%+2E-7 A+V_O×1E-9)	1500 V

Typical resolution 6½-digit; max. voltage ±3500 V; min. current 10 fA.

5.4 Module specifications — HVMCU, MPSMU & MCSMU

HVMCU (optional, pulsed capacitive-load source)

Voltage range	Output value	Measured value	Max. current
1500 V	0≤|V|≤1500 V	0≤|V|≤2200 V	±2.5 A
3000 V	0≤|V|≤2200 V	0≤|V|≤2200 V	±1.1 A

Measurement is always taken on the 3000 V measurement range; pulse base value is always 0 V. Max. output current ±110 mA on the lowest current range.

MPSMU (gate/base bias source)

Voltage range	Resolution	Accuracy	Max. current
100 mV–10 V	100 nV–10 µV	±(0.06%+0.14..3 mV+I_O×0.05..5)	100 mA
100 V	100 µV	±(0.012%+2.5 mV+I_O×10)	20–100 mA (current-dependent)

Current range	Resolution	Accuracy	Max. voltage
10 nA–100 mA	10 fA–100 nA	±(0.03–0.1%+1E-12..6E-6 A+V_O×1E-14..1E-7)	20–100 V (current-dependent)

Typical resolution 6½-digit; max. voltage ±100 V; min. current 10 fA.

MCSMU (gate/base step generator, ×4 per unit)

Voltage range	Resolution	Accuracy	Max. current
200 mV	200 nV	±(0.06%+0.14 mV+I_O×0.05)	1 A
2 V	2 µV	±(0.06%+0.6 mV+I_O×0.5)	1 A
20 V	20 µV	±(0.06%+3 mV+I_O×5)	1 A
40 V	40 µV	±(0.06%+3 mV+I_O×10)	1 A

Current range	Resolution	Accuracy	Max. voltage
10 µA–100 mA	10 pA–100 nA	±(0.06%+1E-8..2E-5 A+V_O×1E-10..1E-6)	30 V
1 A	1 µA	±(0.4%+2E-4 A+V_O×1E-5)	30 V

Typical resolution 6½-digit; max. voltage ±30 V; min. current 10 pA; pulse width 10 µs–100 ms; DC max. current ±100 mA; pulse max. peak ±1 A. The 40 V voltage range is the range setting; the maximum output voltage on it is ±30 V.

5.5 Module specifications — MFCMU & UHCU

MFCMU (C/V & Qg measurement, C-models only)

Frequency range	1 kHz–10 MHz (1 mHz resolution, ±0.05% accuracy)
AC level	0–1 V (0.1 mV_{rms} resolution, ±(10%×setting+2 mV))
DC bias	0–±25 V (1 mV resolution, 1%×setting+8 mV accuracy)
Output impedance	100 Ω
Test-terminal configuration	Four-terminal pair
Test time	0.05–100 PLC (1 PLC = 20 ms)
Capacitance display range	0.00001 pF–9.99999 F
Best accuracy	0.1%

UHCU (200/600/1800 A-tier drain/collector supply, extender unit)

Voltage range	Measure resolution	Output resolution	Accuracy
60 V	100 µV	200 µV	±(0.2%+10 mV)
6 V (measure-only)	10 µV	—	—

Current range	Measure resolution	Output resolution	Accuracy
200 A	500 µA	1 mA	±(0.6%+0.3 A+V_O×0.01)
600 A	500 µA	1 mA	±(0.6%+0.3 A+V_O×0.01)
1800 A	2 mA	4 mA	±(0.8%+0.9 A+V_O×0.02)

Pulse duty cycle ≤0.4% (600 A range) / ≤0.1% (1800 A range); min. pulse width 10 µs; max. pulse width 1 ms (600 A) / 500 µs (1800 A); pulse timing resolution 2 µs. The 200 A current tier is a subset of the 600/1800 A output range, not a separate module.

PART II

Remote Control

Covers the RS-232C, LAN, GPIB and USB remote interfaces and the TH521 command set.

CHAPTER 6

Interfaces & Remote Control

The TH521 can be controlled remotely over RS-232C, LAN, GPIB or USB Device. Through these interfaces, a host computer can read and set almost all parameters available from the front-panel touchscreen, using the command set documented in Chapter 7.

Interface	Connector	Notes
RS-232C	9-pin D-sub (DB9), rear panel	Serial PC connection (§6.2)
LAN	RJ45, rear panel	Network PC connection; default port 5025 (§6.3)
GPIB	IEEE-488, rear panel	General-purpose parallel bus; all parameters and commands settable/readable
USB Device	USB-B, rear panel	PC connection, requires host driver

6.2 RS-232C

Item	Specification
Connector	9-pin D-sub (DB9), rear panel
Transmission	Full-duplex asynchronous, with start and stop bits
Baud rate	4800 / 9600 / 19200 / 38400 / 115200 bps
Data format	8 data bits, no parity, 1 stop bit
Terminator	NL (line feed, ASCII 10)
Handshake	Software (character echo-back) — no hardware handshake lines used

> **NOTE — SOFTWARE HANDSHAKE PROTOCOL**
>
> Because RS-232C hardware handshaking is not used, the instrument echoes back every character it receives; the host should wait for each echoed character before sending the next, to avoid data loss. Commands are terminated with NL; the instrument begins executing a command string only once that terminator is received. A query's result is likewise sent ASCII-encoded, terminated with NL. For a command that takes time to complete (such as a reset), the host should wait for it to finish, or confirm completion via a status query, before sending the next command.

6.3 LAN

Network settings are configured from the instrument's interface-settings screen:

Field	Range / default
Local IP	Example default 192.168.9.101
Subnet mask	Default 255.255.255.0
Gateway	The 4th octet is fixed at 001, the 3rd octet always matches the Local IP's 3rd octet
Port	Default 5025

A **Reset LAN** control on the same screen restores the default network configuration. The screen shows **Listening...** once the instrument is ready to accept a remote socket connection on the configured port.

6.4 GPIB & USB Device

GPIB provides a general-purpose parallel interface: all instrument parameters, test setups and commands can be set and read from a GPIB controller. USB Device provides an equivalent PC connection over USB, requiring the matching host-side driver. Both use the same command set as RS-232C and LAN (Chapter 7).

> **CAUTION**
> Only one remote interface should issue commands to the instrument at a time; mixing commands from more than one interface concurrently can produce unpredictable results.

CHAPTER 7

Command Reference

The TH521 command set is a flat, mnemonic command language addressed by module slot number — not hierarchical SCPI colon-syntax. The full command set (57 commands) is issued as a separate companion document, *TH521 Series Command Reference*, in line with Techmize's standard practice for command sets of this size. This chapter covers the syntax conventions and command-set structure only.

7.1 Syntax conventions

Convention	Meaning
Terminator	Every command is sent terminated with `\n` (line feed)
`chnum`	The module slot addressed by the command — one of `{1,3,4,5,6,7,8,9,10,11}`, as defined in the Command Reference. Module assignment per §3.2: 1 = GNDU, 2 = MPSMU, 3 = MFCMU, 4–7 = MCSMU×4, 9 = HVSMU, 10 = HCSMU, 11 = UHCU (extender module).
`[…]`	Optional part of the command
`{a|b|c}`	A set of alternatives, separated by `|` — choose exactly one
Lower-case	A lower-case part of a keyword may be abbreviated/omitted

Physical-quantity parameters (voltage, current, time) are sent as plain numbers, in the unit noted per command (V, A or s) — the unit itself is never written in the command string.

7.2 Command-set overview

Functional group	Covers
Output Control & Compliance	`POW`, `CL`, `DZ`, `*RST`, `RSTEXPAND`, `LIM`, `LIM?`, `LIMP`, `RI`, `RV`
DC Source & Measurement Mode	`CMM`, `DV`, `DI`, `MM`
Pulsed Source — Single Point & Timing	`PV`, `PI`, `MCPNX`, `MCPNT`, `PTDCV`, `MCPT`
Pulsed & Swept Source	`WV`, `WI`, `PWV`, `PWI`, `MCPWS`, `MCPWNX`
Triggering & Data Retrieval	`STC` / `STD` / `STP`, `MTC` / `MTD` / `MTP`, `XE`, `AB`, `*OPC?`, `FETCH?`, `BC`, `DSMPLSETUP`, `DSMPLFLUSH`
HVSMU Range & IV-Linked C/V Setup	`HVSMUOP`, `HVSMUOP?`, `ERPFDS`, `ERPFGD`, `ERPFGS`, `ERPFQG`, `ERPFQG?`, `CVMEAS`
MFCMU — Capacitance (C/V) Measurement	`FC`, `ACV`, `DCV`, `ACT`, `ADJ`, `ADJ?`, `IMP`, `TC?`
System & Identification	`*IDN?`, `APE`

> **NOTE**
> For the full syntax, parameters and worked examples for all 57 commands, see the companion *TH521 Series Command Reference*.

7.3 Revision history

Document	Revision	Date
TH521 Operation Manual (Chinese, source)	V1.0.0	2026-02
TH521 Command Reference (Chinese, source)	V1.0	2026-01
TH521 Series Operation Manual (this document, English)	Rev. 2026-11	2026-11

APPENDIX

Model Comparison & Related Documents

A.1 TH521-35 model comparison

Item	-20 / -20C	-200 / -200C	-600 / -600C	-1800 / -1800C
Drain/collector supply	HCSMU	UHCU		
Max. pulsed current	20 A	200 A	600 A	1800 A
Max. voltage (HVSMU, all models)	±3500 V			
C/V & Qg (C-suffix only)	MFCMU, 1 kHz–10 MHz			

Remote control (GPIB/RS-232C/LAN/USB, using the TH521's flat mnemonic command set — see Chapter 7 and the companion Command Reference) and the full I/V curve-tracer function are standard across every model — not a feature unique to any one model in the line. The optional HVMCU pulsed source and the TH521-5/TH521-3 accessories are available on any TH521-35 model, independent of the C-suffix.

A.2 Related documents

- TH521 Series Datasheet (Techmize) — full 16-model TH521-02/TH521-35 platform overview
- TH521 Series Command Reference (Techmize) — full remote-control command set, companion to this manual (Chapter 7)
- TH521 full GUI reference (available from Techmize on request) — complete field-by-field test-mode walkthrough

A.3 Contacting Techmize

For technical support, accessories, calibration or service, contact Techmize directly or through your authorized Techmize distributor.

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