TECHMIZE by TONGHUI

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OPERATION MANUAL

TH66000 Series

Bidirectional Regenerative DC Power System. Covers front-panel operation, wiring, output configuration, master/slave parallel operation and the advanced test functions (function generator, data logging, battery test, PV simulation, MPPT); see Chapter 6 for the remote-control interfaces.

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

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TH66000 Series Operation Manual

Bidirectional Regenerative DC Power System

This is the English-language edition of the TH66000 series operation manual. It documents the standard bidirectional **TH66000** instrument, which combines a programmable DC power supply and an electronic DC load in one 3U/19" chassis, with automatic source/load mode switching and regenerative (energy-recovering) operation.

> **NOTE — PLATFORM & VARIANTS**
>
> TH66000, TH66000L (load-only) and TH66000P (source-only) share the same hardware platform and model-numbering scheme (e.g. TH6680-120-05). This manual covers the full bidirectional TH66000 instrument. On TH66000P (source-only), functions that require an active load stage — internal-resistance (R) load mode, battery discharge/dynamic-discharge testing, and PV/MPPT simulation under load — are not available; see the *TH66000 Series Family Datasheet* for the function-availability matrix across all three series. Model-specific operating differences for TH66000L and TH66000P are not covered in this manual.

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The full SCPI and MODBUS command tables are issued as a separate companion document, TH66000 Series SCPI & MODBUS Command Reference, in line with Techmize's standard practice for command sets of this size. Chapter 6 of this manual covers the remote-interface hardware and command-subsystem structure only.

CHAPTER 1

Safety & Compliance

1.1 About this manual

This is the original-language (English) edition of the operation manual for the Techmize TH66000 series bidirectional regenerative DC power system. Where this manual and the instrument itself appear to disagree, or where a described function is not present on your particular model, contact Techmize or your authorized distributor using the details in §1.9 before relying on the instrument for a measurement, source or load application.

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

The TH66000 series DC output/input can reach up to **1500 V** and **360 A** depending on model, at up to **15 kW** per unit. This is a lethal shock and arc-flash hazard. Never touch the DC output terminals, connecting cables or the device under test while the unit is enabled, and never work on the DC wiring with the output switch on. In multi-unit master/slave systems, the shared DC bus can remain live even if one unit's own output switch is off — isolate the complete system, not a single unit, before working on DC wiring (§1.3, Chapter 4).

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, the device under test, or the AC installation feeding it.

NOTE — supplementary information that helps with correct or efficient use, but is not itself a hazard.

Protective ground — this terminal must be connected to protective earth. Also printed next to the instrument's rear-panel ground point.

1.3 General safety requirements

Protective earthing of the chassis, via the three-phase AC power connection, is essential to safety and must not be defeated. The TH66000 series is a regenerative instrument: in source (power-supply) mode it draws energy from the AC mains, and in load (electronic-load) mode it returns absorbed energy back to the AC mains rather than dissipating it as heat. This means the AC-side installation must be able to accept returned current, not just supply it — see §4.2 before connecting the unit, and especially before connecting multiple units to a shared AC circuit.

WARNING — ELECTRIC SHOCK & RETURNED CURRENT

Always connect the AC supply with a reliable protective-earth connection. If the AC-side installation (outlet, breaker, upstream wiring) is not designed to accept the current a regenerative load can return to the grid, the returned current can overload that installation and create a fire or shock hazard — review §4.2 before commissioning the unit, particularly in multi-unit installations.

Power	
Supply voltage (L-L)	342–528 V AC, three-phase (§4.2)
Supply frequency	44–66 Hz
Supply power	≥50 VA
Fuse	Factory-fitted; use only the fuse type supplied by Techmize/Tonghui

> **WARNING — DC WIRING**
>
> Switch the output off and allow the unit to fully discharge before connecting or disconnecting DC output/input cables, parallel-bus cables, or the shared/master-slave bus terminals. Size the DC connecting cable to the actual system current, not just a single unit's rated current, per §4.2 — an undersized cable can overheat. The DC output terminals are not internally fused; external protection and correct cable sizing are the installer's responsibility.

Multi-unit systems. Up to 16 units can be linked on the digital master/slave bus (1 master, 15 slaves), and multiple units can share a common AC installation. Before connecting several TH66000 units to the same AC circuit, confirm the installation can carry the combined supplied *and* returned current for every phase — see §4.2 for the recommended per-phase wiring patterns. The unit at each end of a master/slave bus run must have its termination DIP switch set to Terminated (§4.9.1).

Remote/automated operation. When output is enabled or disabled remotely (analog interface, SCPI/MODBUS, or a master unit controlling slaves), the operator at the instrument itself may not be aware the DC terminals are live. In an automated line or multi-person work area, treat the DC output area as always potentially live, and use the analog interface's REM-SB and ALARM lines, or an external interlock of your own design, to prevent access while output is enabled.

Environment

Item	Requirement
Operating temperature / humidity	0–40 °C, 20–80% RH
Reference conditions (for rated accuracy)	20 °C±8 °C, <80% RH
Transport conditions	0–55 °C, ≤93% RH
Storage	5–40 °C, ≤85% RH, in a well-ventilated room free of corrosive gases
Warm-up	≥30 minutes before relying on rated accuracy

Do not use the instrument in a dusty, vibrating, direct-sunlight or corrosive-gas environment. Keep the ventilation openings and the rear-panel fans clear. Do not power the unit on/off repeatedly in quick succession, as this can disturb internally stored data.

> **CAUTION — STRAY/RETURNED CURRENT WITH MIXED UNIT SIZES**
>
> When multiple units of different power ratings share an AC circuit, Techmize's wiring guidance (§4.2) assumes matched power ratings per phase group for automatic current balancing. Mixing different power ratings on the same phase set does not automatically balance current — calculate the per-phase load before commissioning a mixed installation.

1.4 CE marking

> **NOTE — CERTIFICATION STATUS**
>
> CE certification for the TH66000 series is currently in progress. This section will be completed with the applicable directives and harmonized standards once certification is confirmed by Techmize.

1.5 WEEE — disposal of electrical and electronic equipment



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

1.6 RoHS

Techmize applies RoHS-compliant component sourcing to this product family as a matter of internal policy; formal RoHS declaration documentation for the TH66000 series is available from Techmize on request.

1.7 Warranty

The instrument is covered by a warranty period of **one year** from the date of shipment, as stated on the instrument's warranty card, which must be presented for warranty service. During the warranty period, Techmize repairs or replaces, at its discretion, a product that proves defective through normal use. Damage caused by improper operation during the warranty period is chargeable to the user.

Repair must be carried out by qualified technical personnel; do not replace internal components without authorization. After any repair, the instrument must be re-measured and recalibrated before further use — damage from unauthorized repair or component replacement is not covered by the warranty.

1.8 Manufacturer & EU contact

Techmize Electronic GmbH

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Registration

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

CHAPTER 2

Out of the Box

2.1 Unpacking

Inspect the shipping container for damage after unpacking. It is not recommended to power on the instrument if the container shows signs of damage — contact your carrier and your Techmize distributor before proceeding. Check the contents against your order; if anything does not conform, notify Techmize or your distributor promptly.

Item	Qty
TH66000 series instrument (model as ordered)	1
Quick guide	1
Certificate of conformity	1
Test report	1
Warranty card	1

AC and DC connecting cables are not included as standard accessories — size and supply these per §4.2 for your specific installation. Keep the original packaging; it is the recommended way to store or return the instrument, and protects against damage from shock, vibration and moisture in transit.

2.2 Connecting the AC supply

Item	Specification
Supply voltage (L-L)	342–528 V AC
Supply frequency	44–66 Hz
Supply power	≥50 VA

The instrument connects to the mains via a rear-panel 5-pin connector. The instrument requires a three-phase supply. See §4.2 for the exact pin connections, minimum cable diameters and multi-unit phase-balancing guidance — this is more involved than a conventional single-phase instrument because of the unit's regenerative (energy-returning) operation.

> **WARNING**
>
> Confirm a reliable protective-earth connection before switching on. Because the instrument can return current to the AC installation in load mode, confirm with a qualified electrician that the installation and any shared circuit breaker can accept the combined returned current of every connected unit, not just its rated supply current (§1.3, §4.2).

2.3 Connecting the DC output/input

The DC +/− terminals on the rear panel carry the output (source mode) or input (load mode) current — up to 360 A per unit depending on model. These terminals are not internally fused. Size the connecting cable to the actual current and length of run per §4.2, and keep runs as short as practical (Techmize recommends ≤1.5 m at an ambient ≤50 °C for the cable cross-sections given there).

> **WARNING — NEVER TOUCH LIVE DC TERMINALS**
>
> Switch the output off and confirm the unit has discharged before connecting or disconnecting the DC leads, the device under test, or any shared/parallel bus wiring. The DC terminals can be live at up to 1500 V depending on model.

2.4 Starting the instrument for the first time

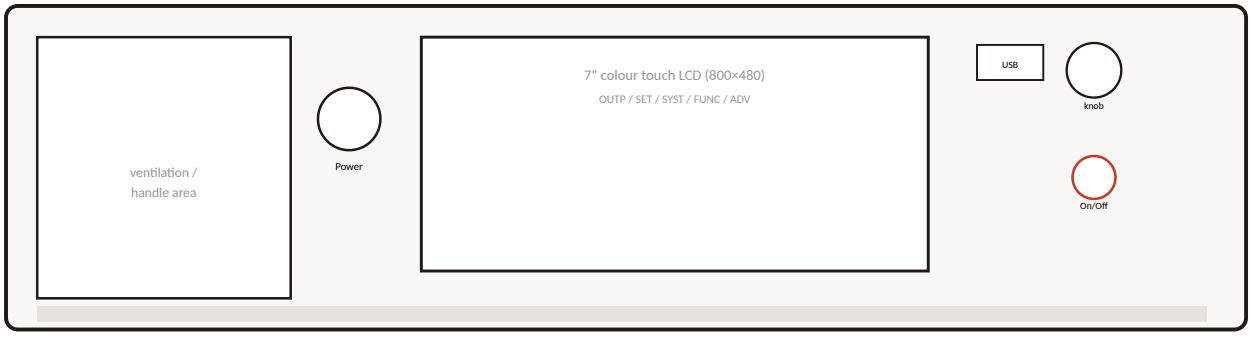
1. Connect the AC supply per §2.2/§4.2, confirming reliable protective-earth grounding.
2. Turn the rear-panel main power switch on. The instrument boots to its startup screen, then the measurement/OUTP page.
3. Allow the recommended ≥30-minute warm-up (§1.3) before relying on rated accuracy.
4. Connect the DC output/input wiring per §2.3/§4.2 only after the unit is configured and the output is confirmed off.

For an overview of the front panel, rear panel and on-screen interface structure, continue to Chapter 3.

CHAPTER 3

Getting to Know the Instrument

3.1 Front panel



Simplified front-panel layout (schematic, not to scale) — see the legend below for the full item list

1 **Front-panel handles** — for transport and rack handling; ventilation intake behind.

2 **Main power switch** — turns the whole instrument on/off.

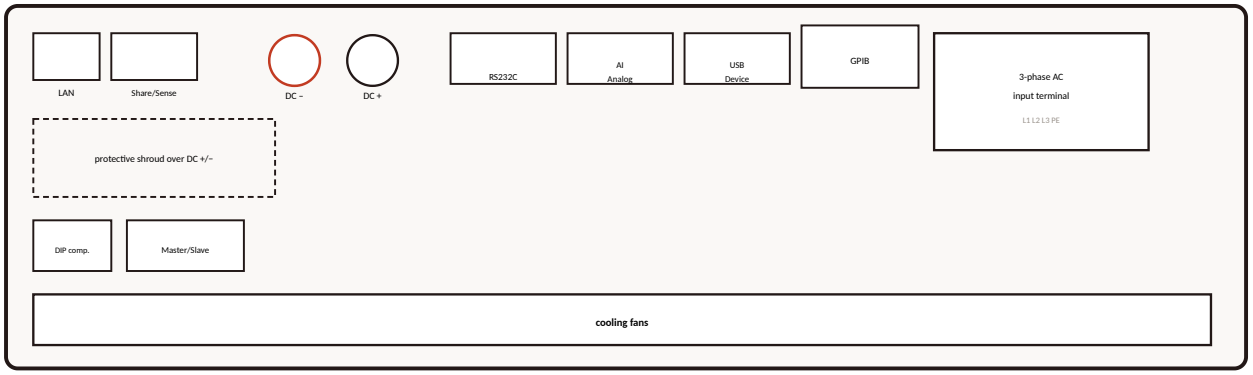
3 **7" touch LCD**, 800×480, capacitive — shows the OUTP/SET/SYST/FUNC/ADV pages (§3.4).

4 **USB HOST port** — for a USB flash drive: file storage, firmware upgrade, data-recording export.

5 **Rotary knob** — fine-adjusts the selected setting value.

6 **Output on/off switch** — enables/disables the DC terminals; only active while the OUTP page is shown (§4.4).

3.2 Rear panel



Simplified rear-panel layout (schematic, not to scale) — see the legend below for the full item list

1 **LAN** — wired network connector, for remote control (§6).

2 **Share / Sense terminal** — Share is the master/slave common/shared bus connection; Sense enables 4-wire (remote-sense) voltage measurement.

3 **DC output/input terminals (+/−)** — main power terminal, source or load current depending on mode (§2.3, §4.3).

4 **RS232C** — 9-pin serial remote-control port (§6.1).

5 **AI — analog interface** — 15-pin galvanically isolated analog remote-control/monitoring port (§6.4).

6 **USB Device** — computer remote control (USBTMC/CDC) (§6.3).

7 **GPIB** — IEEE-488 remote-control port (§6.2).

8 **Three-phase AC input terminal** — mains connection, L1/L2/L3/PE (§4.2).

9 **DC terminal compensation DIP switch** — sets remote master/slave-bus termination (§4.9.1).

10 **Master/Slave port** — digital master/slave bus connector for multi-unit systems (§4.9).

3.3 Startup screen & on-screen display

After the main power switch is turned on, the instrument briefly shows a startup screen with the series name, system firmware revision and build date, then opens on the OUTP (measurement) page. The 7" capacitive touch screen is divided into three areas on every page:

Area	Function
Header paging bar	Switches between the five main pages: **OUTP** **SET** **SYST** **FUNC** **ADV**
Measurement / setting area	Shows live voltage (U), current (I), power (P) and resistance (R), each with its own source/load set value; becomes the parameter-entry area on the SET page
Status line	Output run time, USB-connected indicator, screen-lock indicator, alarm and master/slave status

3.4 Main pages

Page	Description
OUTP	Live measurement display: U, I, P, R, each with its source (PS) and load (EL) set values, plus output time and status icons (§4.3)
SET	Edits power-output values (PS_OUT), load-input values (EL_IN), protection values (PS_PROT/EL_PROT: OVP/OCP/OPP) and limit values (PS_LIMIT/EL_LIMIT) (§4.3)
SYST	Display language, touch/alarm sound, power-on state, backlight behaviour and run mode (§4.4)
FUNC	Basic settings (R mode, master/slave), communication interface, file management, user events, extra functions (function generator, data recording, timing, upgrade) (§4.5–§4.13)
ADV	Advanced test functions: list sequencer, battery test, PV simulation, function generator, MPPT (§4.14–§4.17)

> **NOTE**
> The instrument only commits data changes when the page is switched or the on-screen confirmation is pressed. After changing values on SET, SYST or FUNC, switch pages (or confirm as prompted) to save the change, and avoid powering the unit off immediately afterwards.

3.5 Starting the instrument

Confirm reliable earth-ground connection, then turn on the rear-panel main power switch (§2.4). The instrument self-tests, shows the startup screen, then opens on the OUTP page with the output switched off.

CHAPTER 4

Operation & Configuration

This chapter covers AC/DC wiring, the OUTP/SET/SYST/FUNC/ADV pages, and every function reached from FUNC and ADV: R mode, master/slave parallel operation, the communication interface, file management, user events, the function generator, data recording, timing, firmware upgrade, the list sequencer, battery test, PV simulation and MPPT.

4.1 Interface structure overview

The header paging bar on every page switches between OUTP, SET, SYST, FUNC and ADV (§3.4). OUTP is read-only and shows live measurements; output can only be switched on/off while OUTP is displayed, using the front-panel output switch. SET, SYST, FUNC and ADV are where settings and advanced functions are configured; FUNC and ADV each open a further grid of function icons (§3.4 table).

4.2 Wiring the AC supply

The instrument connects to the mains via the rear-panel 5-pin AC input terminal. At least a 3-wire (L2+L3+PE) connection is required; some models require a 4-wire (L1+L2+L3+PE) connection. The AC side is three-phase; the terminal connection depends on the power rating of the unit as marked on the unit:

Rated power	AC input pins used	Supply type required
5 kW models	L2, L3, PE	Three-phase
≥10 kW models	L1, L2, L3, PE	Three-phase

Minimum recommended AC cable cross-section per phase, by rated power:

Rated power	L1 (ø / I_{max})	L2 (ø / I_{max})	L3 (ø / I_{max})
5 kW	—	2.5 mm² / 16 A	2.5 mm² / 16 A
10 kW	4 mm² / 28 A	4 mm² / 16 A	4 mm² / 16 A
15 kW	4 mm² / 28 A	4 mm² / 28 A	4 mm² / 28 A

The supplied AC connector accepts conductors up to 6 mm². A longer cable run increases voltage drop — keep the cable as short as practical, or use a larger cross-section.

Multi-unit AC phase balancing

When connecting several units to the same three-phase supply, Techmize recommends rotating each unit's L2/L3 (or L1/L2/L3) connection across phases so the total load is balanced — for example, three 5 kW units can each be wired to a different phase pair so the combined load is spread evenly across L1/L2/L3. Units of the same power rating balance automatically this way; mixed power ratings on the same phase set do not balance automatically and must be calculated manually before commissioning.

WARNING — REGENERATIVE (RETURNED) CURRENT

The TH66000 series can return energy to the local grid when operating as a load. The returned current adds to whatever else is on that circuit. If the installation is only designed for a conventional load (e.g. a simple two-outlet circuit with no fuse sized for reverse current), a fault on the AC side of a connected load device, or the combined current of several connected units, can exceed what the connection cable and terminals are rated for — this can damage the installation or start a fire. Review the planned installation against this regenerative-current behaviour, together with a qualified electrician, before commissioning.

DC output/input cable sizing

The DC +/− terminals are at the rear of the unit and are not internally fused. Techmize's recommended minimum cable cross-section, for a run ≤1.5 m at an average ambient ≤50 °C:

Current	Min. cross-section	Current	Min. cross-section
≤30 A	6 mm²	≤70 A	16 mm²
≤90 A	25 mm²	≤140 A	50 mm²
≤170 A	70 mm²	≤210 A	95 mm²
≤340 A	2×70 mm²	≤510 A	2×120 mm²

For a longer run, a higher ambient temperature, or a run shared with other heat sources, increase the cross-section accordingly — cable cross-section is determined by current, run length and ambient temperature together.

4.3 Setting output/input values

On SET, choose the item to configure from the left-hand list, then the field to set in the centre column, then enter the value with the on-screen numeric keypad or fine-adjust it with the rotary knob after selecting a digit on OUTP.

Item	Covers
PS_OUT	Power (source/output) setting values: U, I, P, R
EL_IN	Load (input) setting values: U, I, P, R
PS_PROT	Power output protection values: OVP, OCP, OPP
EL_PROT	Load input protection values: OVP, OCP, OPP
PS_LIMIT	Power output limit values: U_{min}/U_{max}, I_{min}/I_{max}, P_{max}, R_{max}
EL_LIMIT	Load input limit values: U_{min}/U_{max}, I_{min}/I_{max}, P_{max}, R_{max}

Limit values (PS_LIMIT/EL_LIMIT) bound the adjustable range on OUTP/SET — if a value cannot be adjusted into the desired range, check these limits first. Protection values (PS_PROT/EL_PROT) are the OVP/OCP/OPP thresholds at which the instrument alarms and stops output.

4.4 Output

Output can only be switched on/off from the OUTP page, using the front-panel output switch; its indicator lights when output is on, and the run-time counter in the status line starts counting. Switching to another page does not switch output off.

4.5 SYST page settings

Setting	Options	Description
LANG	English UI	Techmize units ship with English UI only (no selectable Chinese/English UI)
T_VOICE	On / Off	Touch sound
W_VOICE	On / Off	Alarm sound
P_STATE	Default / User	Power-on state: factory defaults, or the user parameters last saved to internal file 1 (§4.7)
BL	Always on / Off after 60 s	Backlight behaviour
RUN MODEL	P&L / P / L	Restricts operation to source-only (P), load-only (L), or both (P&L)

4.6 R mode (internal resistance)

From FUNC → Basic Set, turn R MODE on to enable constant-internal-resistance operation. In source mode, R mode simulates a series internal resistance R_i in the power path, so the output voltage droops from the set value as output current rises: $U_{act} = U_{set} - I_{act} \times R_i$, calculated by the control microprocessor (slower than the main analog control loop). In load mode, R mode makes the unit behave as a constant-resistance (CR) load, drawing current according to $I_{in} = U_{in}/R_{set}$ based on the externally applied voltage:

- If the applied DC voltage exceeds the set voltage, $I_{in} = (U_{in} - U_{set})/R_{set}$.
- If the applied voltage is at or below the set voltage, the unit draws no current and switches to constant-voltage (CV) mode; avoid setting the voltage equal to the external supply voltage, as the unit may then oscillate between CV and CR.

Internal resistance is limited between zero and a per-model maximum (§5), and cannot be set to exactly zero.

4.7 Master/slave parallel operation

Multiple TH66000 units of the **same model** can be linked on the digital master/slave bus to form a higher-current, higher-power system. Up to **16 units** can be linked (1 master, 15 slaves). The bus regulates the whole system's voltage balance as one large machine, which is particularly relevant in CV mode and when the master performs function-generator waveforms (§4.10).

4.7.1 Wiring

1. **DC connection:** connect the DC output terminals of each unit together with a connecting cable or copper bar sized to the total system current (§4.2), kept as short as possible.
2. **Shared/common bus (Share terminal):** connect with a twisted pair of 0.5–1.0 mm² — the exact diameter is not critical. The negative DC terminal of every unit must be tied to this shared bus, since it is the bus's reference point.
3. **Digital master/slave bus:** connect unit-to-unit with a network cable via the Master/Slave port.
4. **Termination:** the unit at each end of the bus run must have its 3-pin DIP switch (next to the Master/Slave port) set to Terminated; all other units are left Not terminated (standard/factory position).

Only units of the same model can be linked. Configure all slave units first, then the master; if a slave is added after the master is configured, or the configuration order is reversed, re-initialize the master so it rescans and reconfigures every slave.

4.7.2 Software configuration

1. On each slave unit: FUNC → Basic Set → MS MODE → **Slave**.
2. On the master unit: FUNC → Basic Set → MS MODE → **Master**. The master scans for slaves and initializes the system, then displays the scanned slave count, system voltage, total current and total power. If the slave count is wrong, use Re-Initialize, then check the bus wiring.
3. Once configured, the master displays the whole system's voltage, current and power; the M/S status icon appears in the lower-right corner of the OUTP page on every unit. Whether a slave can be adjusted locally, independently of the master, depends on system configuration.

> **WARNING — MSP ALARM**
>
> If more than one slave reports an alarm, or the master reports an error, the entire system's output stops. An MSP alarm indicates a communication fault between master and slave — re-initialize the master, and note that every slave must also be re-initialized whenever it is restarted.

4.8 Communication interface

From FUNC → COM, select the active communication interface (RS232, LAN, GPIB, USB or Analog) and its parameters — for example, the SCPI protocol and baud rate for RS232. See Chapter 6 for the hardware specification of each interface and the companion *TH66000 Series SCPI & MODBUS Command Reference* for the command set.

4.9 File management

From FUNC → File, store frequently used U/I/P/R settings (VIPR) to the instrument's internal flash memory or an external USB drive, for later recall. The instrument provides **8 internal file slots** and an equivalent external (USB) file area.

Key	Function
SAVE	Saves the current VIPR settings to the selected file slot
REC	Recalls the selected file; the instrument's settings change to the values stored in it
DEL	Deletes the selected file
TRAN	Saves the file as a .STA file on a connected USB drive

If P_STATE on the SYST page (§4.5) is set to User, the data in internal file 1 is loaded automatically at power-on.

4.10 User event

From FUNC → User Event, define custom protection thresholds (e.g. a custom OVP/UVP window) for the DC terminal. A user event is distinct from an instrument alarm (OVP/OCP, §5): an instrument alarm protects the instrument itself, while a user event protects the connected external device according to the customer's own application limits.

Field	Description
U_{min}/U_{max}, I_{min}/I_{max} (PS and EL), P_{max} (PS and EL)	The user-defined window; ACT selects the response: NONE, ALARM, etc.
DELAY	The user event does not begin monitoring until this long after output starts — avoids false triggers from startup overshoot
DURATION	The measured value must continuously exceed the limit for this long before the event triggers

Example: U_{min}=13.3 V, U_{max}=15 V, ACT=ALARM, DELAY=1000 ms, DURATION=100 ms — the event is armed 1000 ms after output starts, and triggers only if the voltage stays outside 13.3–15 V continuously for 100 ms.

4.11 Function generator

From ADV → FUNC GENE, the unit can output a user-defined waveform in voltage or current mode: sine (SIN), triangle (TRI), square (SQU), trapezoid (TRAP), step (STEP), or a custom arbitrary waveform read from a .CSV file on a USB drive (ANY).

Waveform	Basic parameters
SIN / TRI / SQU (voltage or current)	Amplitude U(A)/I(A), offset U(offs)/I(offs), frequency f
TRAP	Amplitude, offset, rise/dwell/fall timing (t1–t4)
STEP	Amplitude, offset, step time t1, step size
ANY	Custom waveform loaded by name from a USB-drive .CSV file

Basic operation: (1) select the waveform and VOLT/CURR mode; (2) set the BASIC parameters; (3) set the LIMIT fields (U/I/P for PS and EL) — these define the output's initial (idle) state when the generator is armed; (4) press Load to return to OUTP, where the output shows the idle state and the function-generator icon appears; (5) press the front-panel output switch to start the waveform, press it again to stop (output itself stays on); (6) in ADV → FUNC GENE, press Stop to fully exit function-generator mode.

4.12 Data recording

From FUNC → Extra Func, turn RECORD on to log VIPR and status data to a .CSV file on a USB drive. Set INTERVAL (sampling period) and COUNT (number of samples). Insert a USB drive, switch output on to begin buffering data, and switch output off to flush the buffered data to the drive. Logged fields: set/actual voltage, set/actual current, set/actual power, set/actual resistance, R-mode state, output/input state, device mode (CC/CV/CR/CP), error status and timestamp.

4.13 Timing

From FUNC → Extra Func, turn TIMING on and set TIME to automatically switch output off a fixed time after it is switched on — the OUTP page counts down to zero. Useful for unattended fixed-duration tests.

4.14 Firmware upgrade

From FUNC → Update, the display-panel CPU firmware and control-board CPU firmware can each be upgraded, and the touch screen can be recalibrated (TOUCH CAL). Two upgrade methods are supported:

Method	Procedure
USB drive	Copy the .sec upgrade file (supplied by Techmize) to a FAT32-formatted USB drive ≤32 GB, insert it into the front-panel USB host port, select Display Board or Control Board, and confirm to begin. Do not remove the USB drive during the upgrade. Power-cycle the unit once the upgrade completes.
Serial port	Connect a PC to the rear-panel RS232C port, set both the PC's and the instrument's baud rate to 115200, send the serial upgrade command for the target board (see the companion SCPI/MODBUS reference), then transfer the .sec file with a serial terminal's file-transfer function. Allow roughly 10 minutes; power-cycle the unit once complete.

> **CAUTION**
>
> Firmware upgrade is a slow process — do not interrupt it or remove the USB drive while it is in progress, as this can leave the instrument in an inconsistent state.

4.15 List (sequencer)

From ADV → LIST, program a sequence of up to several dozen steps, each with its own voltage, source current (I_PS), load current (I_EL), on/off duration and cycle count, plus an overall total-cycle count. Press Load to return to OUTP (idle state shown), then switch output on to run the sequence; switch output off to stop. EXPORT saves the list to USB; LOAD recalls one.

4.16 Battery test

From ADV → Battery, run one of four battery test types: **Static Discharge**, **Dynamic Discharge**, **Static Charge** and **Dynamic Test**.

Mode	Basic parameters	Termination (limit) fields
Static Discharge	I, P, R, R-mode	I/U/T(termination), ACT (none / signal / stop)
Dynamic Discharge	I1, I2, P, T1, T2 (alternating discharge profile)	Same termination fields
Static Charge	U, I	Same termination fields
Dynamic Test	I(Charge), U(Charge), T(Charge), I(Discharge), T(Discharge), T(Rest), Cycle, Start (Charge/Discharge)	Same termination fields

Basic operation: set the BASIC fields, then the LIMIT (termination) fields — if ACT=NONE no prompt is given at termination, ACT=SIGNAL prompts but keeps testing, ACT=STOP switches output off at termination (test mode is not exited). Press Load to return to OUTP (idle state), switch output on to start the test, switch off to stop, then Stop in the Battery screen to exit test mode.

4.17 PV simulation

From ADV → PV, run a simple photovoltaic (I-V curve) source simulation. Set the four characteristic points of the simulated PV panel: U_{oc} (open-circuit voltage), I_{sc} (short-circuit current), U_{mpp} (maximum-power-point voltage), I_{mpp} (maximum-power-point current). Press Load to return to OUTP, where an Irradiance (%) field is shown and can be changed at any time — the simulated output changes accordingly. Switch output on to start the PV simulation, off to stop; Stop in the PV screen exits the mode.

> **NOTE — AVAILABILITY**
>
> PV simulation and the related MPPT function (§4.18) apply a source characteristic that a connected load then draws from — they are available on TH66000 (bidirectional) and TH66000L (load-side use is not applicable in the same sense), but are not available on TH66000P (source-only), which cannot provide the load stage these functions are tested against. See the *TH66000 Series Family Datasheet* for the confirmed function-availability matrix.

4.18 MPPT (maximum power point tracking)

From ADV → MPPT, the unit can locate and track the maximum power point of a simulated PV source, in one of four modes:

Mode	Behaviour
MPPT1	Finds the maximum power point, then stops
MPPT2	Quickly finds the maximum power point, then tracks it in real time against the configured set value
MPPT3	Tracks the maximum power point in real time against a maximum-power-point input
MPPT4	Finds the maximum power point from the user's own set-value sequence, read from a .CSV file on a USB drive

Basic operation: set U_{oc}, I_{sc} and ΔT (search rate — the duration held at each test voltage), then Load to return to OUTP, where the current tracked values (P_{mpp}, U_{mpp}, I_{mpp}) are shown; switch output on to start tracking, off to stop; Stop in the MPPT screen exits the mode.

CHAPTER 5

Performance & Specifications

All 17 TH66000 models share one 3U/19" hardware platform across seven voltage classes, each offered in up to three power tiers (5 kW, 10 kW, 15 kW). Source (power) and load (electronic-load) ratings are identical for a given model — the same hardware operates in either direction.

5.1 Rated output/input by model

Model	Power	Voltage	Current	Internal resistance
TH6680-120-05	0–5 kW	0–80 V	0–120 A	0.02–25 Ω
TH6680-240-10	0–10 kW	0–80 V	0–240 A	0.01–13 Ω
TH6680-360-15	0–15 kW	0–80 V	0–360 A	0.006–10 Ω
TH66200-70-05	0–5 kW	0–200 V	0–70 A	0.1–150 Ω
TH66200-140-10	0–10 kW	0–200 V	0–140 A	0.05–75 Ω
TH66200-210-15	0–15 kW	0–200 V	0–210 A	0.033–50 Ω
TH66360-40-05	0–5 kW	0–360 V	0–40 A	0.3–520 Ω
TH66360-80-10	0–10 kW	0–360 V	0–80 A	0.15–260 Ω
TH66360-120-15	0–15 kW	0–360 V	0–120 A	0.1–180 Ω
TH66500-30-05	0–5 kW	0–500 V	0–30 A	0.5–1000 Ω
TH66500-60-10	0–10 kW	0–500 V	0–60 A	0.25–500 Ω
TH66500-90-15	0–15 kW	0–500 V	0–90 A	0.16–340 Ω
TH66750-20-05	0–5 kW	0–750 V	0–20 A	1.2–2200 Ω
TH66750-40-10	0–10 kW	0–750 V	0–40 A	0.6–1100 Ω
TH66750-60-15	0–15 kW	0–750 V	0–60 A	0.4–740 Ω
TH661000-40-15	0–15 kW	0–1000 V	0–40 A	0.8–1300 Ω
TH661500-30-15	0–15 kW	0–1500 V	0–30 A	2.5–3000 Ω

TH66500-90-15 is confirmed as a 500 V-class model (0–500 V); some source-document tables show this entry as 0–200 V, which Techmize has confirmed is a documentation error in the source material, not an instrument specification.

5.2 Regulation, resolution & accuracy (common to all models)

Item	Specification
Load regulation — voltage / current / power	≤0.05% / ≤0.15% / ≤0.75% of full scale
Power-source (line) regulation — voltage / current / power	≤0.02% / ≤0.05% / ≤0.05% of full scale
Setting resolution — voltage	10 mV (80–750 V classes) · 100 mV (1000/1500 V classes)
Setting resolution — current / power / resistance	0.01 A / 1 W / 0.01 Ω (0.001 Ω on the 80 V class)
Readback resolution — voltage	10 mV
Readback resolution — current / power / resistance	0.01–0.1 A / 1 W / 0.0001 Ω (0.001 Ω on the 80 V class)
Set-value accuracy — voltage	≤0.1% of U_{max}
Set-value accuracy — current	≤0.2% of I_{nom}
Set-value accuracy — power	≤1% of P_{max}
Readback accuracy — voltage / current / power	≤0.1% U_{max} / ≤0.2% I_{max} / ≤1% P_{max}
Internal-resistance accuracy (set & readback)	≤1% of maximum resistance ±1% of maximum current
Accuracy reference conditions	12 months, 25 °C±5 °C

5.3 Ripple & noise (20 Hz–2 MHz), differential mode, by voltage class

Class	5 kW — voltage	5 kW — current	10 kW — voltage	10 kW — current	15 kW — voltage	15 kW — current
80 V	≤200 mVp-p, 16 mVrms	≤80 mArms	≤320 mVp-p, 25 mVrms	≤160 mArms	≤320 mVp-p, 25 mVrms	≤240 mArms
200 V	≤320 mVp-p, 45 mVrms	≤22 mArms	same	≤44 mArms	same	≤66 mArms
360 V	≤320 mVp-p, 55 mVrms	≤18 mArms	same	≤35 mArms	same	≤50 mArms
500 V	≤350 mVp-p, 70 mVrms	≤16 mArms	same	≤32 mArms	same	≤48 mArms
750 V	≤800 mVp-p, 200 mVrms	≤16 mArms	same	≤32 mArms	same	≤48 mArms
1000 V (15 kW only)	—				≤1600 mVp-p, 300 mVrms	≤16 mArms
1500 V (15 kW only)	—				≤2400 mVp-p, 400 mVrms	≤26 mArms

5.4 Protection (OVP / OCP) by voltage class

Class	OVP range	5 kW OCP	10 kW OCP	15 kW OCP
80 V	0–88 V*	0–132 A*	0–264 A*	0–396 A*
200 V	0–220 V	0–77 A	0–154 A	0–231 A
360 V	0–396 V	0–44 A	0–88 A	0–132 A
500 V	0–550 V	0–33 A	0–66 A	0–99 A
750 V	0–825 V	0–22 A	0–44 A	0–66 A
1000 V	0–1100 V	—		0–44 A
1500 V	0–1650 V	—		0–33 A

**80 V-class OVP/OCP figures are calculated from the fixed ratio that applies in every other voltage class (OVP = 1.10×U_{max}, OCP = 1.10×I_{max}), applied to the 80 V class's own rated voltage/current. OPP (overpower protection) is also provided on every model, user-configurable per §4.3 (PS_PROT/EL_PROT); a specific OPP threshold range was not separately itemised in the source documentation reviewed.*

5.5 Dynamic & general specifications (common to all models)

Item	Specification
Dynamic recovery time (50%–100% load)	≤1.5 ms (recovery to within 100 mV)
Remote sensing compensation	≤5% of U_{max}
Power conversion efficiency	≤93%
Display	7" 24-bit colour LCD capacitive touch screen, 800×480
Enclosure dimensions (W×H×D)	430×133×703.5 mm
Overall dimensions, incl. handles (W×H×D)	483×133×793.5 mm
Form factor	3U, 19" rack-mountable
Weight	5 kW: 22 kg · 10 kW: 31 kg · 15 kW: 38 kg (by power tier; shared across all voltage classes at that power tier)
Standard interfaces	LAN, RS232C, GPIB, USB Device, USB Host, 15-pin analog (AI), Master/Slave bus, Share/Sense
Multi-unit parallel operation	Up to 16 units (1 master, 15 slaves) of the same model, via the digital master/slave bus

5.6 AC supply & environment

Item	Specification
Supply voltage (L-L)	342–528 V AC
Supply frequency	44–66 Hz
Supply power	≥50 VA
Supply phasing	Three-phase — see §4.2
Operating temperature / humidity	0–40 °C, 20–80% RH
Reference conditions	20 °C±8 °C, <80% RH
Transport conditions	0–55 °C, ≤93% RH
Warm-up time	≥30 minutes

5.7 Protective functions

Code	Meaning	Response
PF	PFC failed to start	Contact Techmize or your distributor
PE	Instrument self-test failure	Contact Techmize or your distributor
OVD / UVD	Overvoltage / undervoltage	Reset values and retry
OCD / UCD	Overcurrent / undercurrent	Reset values and retry
OPD / UPD	Overpower / underpower	Reset values and retry
MSP	Master/slave communication error	Re-initialize both master and slave (§4.7)
OTP	Over-temperature	Contact Techmize or your distributor

PART II

Remote Control

Covers the RS232C, GPIB, USB, LAN and 15-pin analog remote-control interfaces. The full SCPI and MODBUS command tables are issued separately as the *TH66000 Series SCPI & MODBUS Command Reference*.

CHAPTER 6

Remote Control

The TH66000 series can be controlled remotely over RS232C, LAN, USB (USB Device) or the GPIB interface, using SCPI commands; RS232C additionally supports the MODBUS RTU protocol. The 15-pin analog interface provides a separate, non-SCPI method of remote control and monitoring. Select the active interface from FUNC → COM (§4.8). For the complete command syntax, parameter ranges and MODBUS register map, see the companion *TH66000 Series SCPI & MODBUS Command Reference*.

6.1 RS232C

Item	Specification
Signals used	TXD, RXD, GND — a minimal 3-wire subset, not the full RS-232 pinout
Baud rate	9600–115200 bps
Data format	No parity, 8 data bits, 1 stop bit
Protocol	SCPI (default) or MODBUS RTU, selectable from FUNC → COM
Terminator (SCPI)	LF (0x0A)
Max. command length (SCPI)	128 bytes

6.2 GPIB

Item	Specification
Standard	IEEE 488.2
Addressing	Single address, 1–32; factory default address 8
Cabling	Total bus length ≤2 m × number of connected instruments, ≤20 m overall; up to 15 instruments on one bus; no more than 4 connectors stacked on one instrument

6.3 USB & LAN

Item	Specification
USB Device	Configurable as USBTMC or a USBCDC virtual serial (VCom) port for SCPI control from a host PC
USB Host (front panel)	USB flash drive for file management, data logging and firmware upgrade (§4.9, §4.12, §4.14)
LAN	Standard wired network interface for SCPI remote control

6.4 Analog interface (AI)

The rear-panel 15-pin galvanically isolated analog interface allows remote control of voltage, current, power and resistance set points, remote status monitoring (CV, DC output on/off) and remote alarm monitoring (over-temperature, OVP, power failure), using 0–5 V or 0–10 V analog levels corresponding to 0–100% of the relevant nominal value. Resolution is approximately 1/26214 (10 V range) or half that (5 V range).

Pin	Name	Type	Function
1	VSEL	AI	Set voltage (0–100% of U_{nom})
2	CSEL	AI	Set current, source & load
3	VREF	AO	Reference voltage, 5 or 10 V (I_{max}=5 mA)
4	DGND	—	Digital signal ground
5	REMOTE	DI	LOW = remote control active
6	ALARMS 1	DO	Over-temperature / power-failure alarm
7	RSEL	AI	Set internal resistance (R mode)
8	PSEL	AI	Set power, source & load
9	VMON	AO	Actual voltage
10	CMON	AO	Actual current
11	AGND	—	Analog signal ground
12	R-ACTIVE	DI	LOW = R mode on
13	REM-SB	DI	HIGH = DC output on
14	ALARMS 2	DO	OV / OC / OP alarm
15	STATUS	DO	CV activation (LOW=CV) and DC-output status (LOW=on)

Using the analog interface

1. From FUNC → COM, select ANALOG as the active communication interface.
2. Connect PIN 5 (REMOTE) to a low level to enable remote control.
3. Control voltage, current, internal resistance and power by driving PIN 1, PIN 2, PIN 7 and PIN 8 respectively (to enable R mode, first drive PIN 12 to a low level).
4. Drive PIN 13 to a high level to enable DC output.
5. Read PIN 9 and PIN 10 to calculate the actual output voltage and current.
6. Read PIN 6, PIN 14 and PIN 15 to obtain instrument status (alarms, CV state, output state).
7. Drive PIN 13 to a low level to disable DC output.

> **CAUTION**
> Do not leave an unused analog setpoint input (VSEL, CSEL, PSEL, RSEL) floating in analog remote-control mode — fix it at a defined level, or tie it to VREF for a 100% setpoint, before enabling remote control. Confirm protection and alarm limits are set appropriately before controlling the unit via the analog interface, since OVP and other monitored limits cannot themselves be set through this interface.

6.5 Command-set overview

Commands are organized into SCPI subsystems: `SYSTem` (lock, alarms, nominal ratings, display/language/sound settings, user events), `FUNCtion` (R mode, timing, master/slave, function generator, data recording), `MEASure` (voltage/current/power queries), `OUTPut` (on/off), `SOURce` (power-mode voltage/current/power/resistance set & protection), `SINK` (load-mode equivalents), `BATT` (battery test), `UPgrade`, `PV` and `MPPT`, plus the common commands `*IDN?`, `*TRG` and `*RST`. RS232C additionally supports the MODBUS RTU register-based protocol described in the companion reference.

Command	Description
`*IDN?`	Returns manufacturer, model, firmware version and serial/time info
`*TRG`	Opens (enables) output
`*RST`	Resets the instrument to factory default settings

For the full command syntax, parameter ranges and the MODBUS register table, see the *TH66000 Series SCPI & MODBUS Command Reference*.

APPENDIX

Packing, Warranty & Related Documents

A.1 Standard accessories

See §2.1 for the standard packing contents (instrument, quick guide, certificate of conformity, test report, warranty card). AC and DC connecting cables are not included as standard and must be sized and supplied per §4.2 for the specific installation.

A.2 Transport & storage

Store the instrument in a dry, well-ventilated room at 5–40 °C and ≤85% RH, free of corrosive gases, for any extended period of non-use — in its original packaging where possible. During transport, protect the instrument from shock, vibration and moisture, and handle it by its front-panel handles.

A.3 Nameplate & markings

The instrument's panel or nameplate carries: the manufacturer's name/trademark; product name and model; product number and year of manufacture; measuring-instrument registration plate and number; and a test-terminal mark.

A.4 Model & series correspondence

TH66000, TH66000L and TH66000P share one hardware platform and model-numbering scheme. R mode, battery test and PV/MPPT simulation under load are standard across every TH66000 model that supports load operation — not a unique feature of any one model — and are unavailable on TH66000P (source-only) because they require an active load stage. See the *TH66000 Series Family Datasheet* for the full function-availability matrix across all three series.

A.5 Related documents

- TH66000 Series Family Datasheet (Techmize)
- TH66000 Series SCPI & MODBUS Command Reference (Techmize, companion to this manual)

A.6 Contacting Techmize

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

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