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SCPI & MODBUS COMMAND REFERENCE

TH7200 Series

Covers the TH7205 and TH7210 single-phase, linear-amplifier programmable AC/DC power sources: remote interfaces, SCPI command syntax and subsystem commands, and the full MODBUS register map. Companion volume to the TH7200 Series Operation Manual.

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> **NOTE**
>
> SCPI and MODBUS are standard capabilities supported across both TH7200 series models (Operation Manual, Ch. 6), not model-exclusive features. All command/address tables in this volume apply equally to TH7205 and TH7210 unless a row states otherwise. Where a parameter's numeric range depends on the model's current rating or the active voltage range (LOW/HIGH), the applicable range is noted directly in the table — see the Operation Manual, Chapter 7, for the exact per-model figures.

SECTION 1

Remote Interfaces

1.1 RS232

Full-duplex asynchronous serial communication via the rear-panel connector. The instrument implements a minimal subset of the standard RS-232 signal set — only TXD, RXD and GND are used.

PIN	SIGNAL
2	TXD — Transmit Data
3	RXD — Receive Data
5	GND — Ground

PARAMETER	VALUE
Transmission mode	Full-duplex, asynchronous, with start and stop bits
Data bits	8 bit
Stop bits	1 bit
Parity	None
Baud rate	4800 / 9600 / 14400 / 19200 / 38400 / 57600 / 96000 / 115200 bps (set via System Setup > Communication)
End character	LF (line feed, ASCII 10)
Bus address	1–31, set via System Setup > Communication — used as the MODBUS slave address (Section 4)

> **WARNING**
> To avoid electrical shock, switch the instrument off before connecting or disconnecting any communication cable. Never short the output terminals or the output to chassis ground.

1.2 LAN

Configure the network under System Setup > Communication: select TCP/IP for standard IPv4 networking, or LXI if the host software is LabVIEW-based. Set the TCP port, IP address, subnet mask and default gateway as required for the local network. LAN carries SCPI only (MODBUS is not available over LAN).

1.3 USB TMC

The rear-panel USB device interface supports USBTMC-USB488 over USB 2.0, for SCPI control from a host PC through a VISA-based environment such as LabVIEW. The applicable driver must be installed on the host before first use.

1.4 USB CDC (virtual COM port)

Selecting USB CDC as the bus mode configures the USB device port as a virtual serial (COM) port, after the matching virtual-COM driver is installed. All RS232 command syntax, settings and the MODBUS protocol described in this document apply unchanged to the USB virtual COM port.

SECTION 2

SCPI Command Syntax Rules

SCPI (Standard Commands for Programmable Instruments) commands address the instrument's Display, Basic/Step/Simulate setup, measurement, system, function, limit, waveform, output and alarm subsystems, using a colon-separated keyword hierarchy.

2.1 Basic rules

1. Commands are case-insensitive.
2. At least one space must separate a command keyword from its parameter.
3. No space may be placed immediately before or after a colon (`:`).
4. A comma (`,`) separates multiple parameters within one command (e.g. a multi-field `PROG:EDIT` write).
5. Appending a question mark (`?`) to a command executes a query of its current value.
6. A keyword followed by `{1|2|3|4}` or a similar brace indicates a selectable index (e.g. a measurement-display slot, or a waveform-library number `n`).
7. Every command sent to the instrument must be terminated with a newline (LF) character.

2.2 SCPI common (IEEE-488.2) commands

COMMAND	DESCRIPTION
`*RST`	Resets the instrument to its factory default settings.
`*IDN?`	Queries the instrument model.

> **NOTE**
> Each command in Section 3 is given with its syntax and the function it performs, as defined by the instrument firmware. Where a parameter's range depends on the active voltage range (LOW/HIGH) or voltage mode (AC/DCAC/DC), both ranges are given in the Parameters column.

SECTION 3

SCPI Subsystem Commands

3.1 DISPlay (DISP) — Display command set

COMMAND	PARAMETERS	DESCRIPTION
DISP:PAGE <page> / ?	MEAS , BASIC_BASIC , BASIC_COMMON , PROG_BASIC , PROG_COMMON , SIM_BASIC , SIM_COMMON , ENV , FUNC , COMM , LMT , WAVE , TOOL , INTF , EXTF	Set/query the active display page (Measurement Display, Basic/Step/Simulate Setup tabs, System Setup tabs, Internal/External File).
DISP:PARA FULL / PART · ?	FULL, PART	Set/query the Measurement Display page's readout mode — full-parameter or partial-parameter display.
DISP:PARA{1|2|3|4} <param> / ?	URMS , UDC , UPK+ , UPK- , IRMS , IDC , IPK+ , IPK- , P , PF , CFU , CFI , UAC , IAC , IPKM+ , IPKM-	Set/query which measured parameter is shown in readout slot 1–4 when partial-parameter display is active.
DISP:HOLD ON / OFF · ?	ON, OFF	Enable/disable, or query, display hold on the Measurement Display page.

3.2 BASIC — Basic Setup command set

Addresses the Basic Setup page's Basic and General tabs (Operation Manual §3.2.1). Voltage, current and protection ranges below depend on the active voltage range (LOW/HIGH, System Setup > Function).

COMMAND	PARAMETERS	DESCRIPTION
BASIC:VM AC / DCAC / DC · ?	AC, DCAC, DC	Set/query the Basic Setup voltage mode.
BASIC:MODE:DC:VOLT <value> / ?	−212.0–212.0 V (LOW) / −424.0–424.0 V (HIGH)	DC mode: set/query the DC voltage.
BASIC:MODE:DC:CURR:LMT <value> / ?	0.01–7.0 A (LOW) / 0.01–3.5 A (HIGH), TH7210; scaled for TH7205	DC mode: set/query the current limit.
BASIC:MODE:DC:OVP <value> / ?	−262.0–262.0 V (LOW) / −474.0–474.0 V (HIGH)	DC mode: set/query the over-voltage setting (OVP).
BASIC:MODE:DC:UVP <value> / ?	−262.0–262.0 V (LOW) / −474.0–474.0 V (HIGH)	DC mode: set/query the low-voltage setting (LVP).
BASIC:MODE:AC:VOLT <value> / ?	0.0–150.0 V (LOW) / 0.0–300.0 V (HIGH)	AC mode: set/query the AC voltage.
BASIC:MODE:AC:FREQ <value> / ?	1.00–999.9 Hz	AC mode: set/query the output frequency.
BASIC:MODE:AC:PHS:START <value> / ?	0–359°	AC mode: set/query the start phase angle.
BASIC:MODE:AC:PHS:END <value> / ?	0–359°	AC mode: set/query the stop phase angle.
BASIC:MODE:AC:WAVE:NUM <value> / ?	0–63	AC mode: set/query the waveform library number.
BASIC:MODE:AC:CURR:LMT <value> / ?	0.01–10.0 A (LOW) / 0.01–5.0 A (HIGH), TH7210; scaled for TH7205	AC mode: set/query the current limit.
BASIC:MODE:AC:CURR:TIME:TRIP <value> / ?	0–10 s	AC mode: set/query the trip time.
BASIC:MODE:AC:CURR:TIME:OCP <value> / ?	1–3 s	AC mode: set/query the OCP time.
BASIC:MODE:AC:OVP <value> / ?	0.0–150.0 V (LOW) / 0.0–300.0 V (HIGH)	AC mode: set/query the over-voltage setting.
BASIC:MODE:AC:UVP <value> / ?	0.0–150.0 V (LOW) / 0.0–300.0 V (HIGH)	AC mode: set/query the low-voltage setting (LVP).

3.2 BASIC — Basic Setup command set (continued)

COMMAND	PARAMETERS	DESCRIPTION
`BASIC:MODE:DCAC:DCVOLT <value>` / `?`	−212.0–212.0 V (LOW) / −424.0–424.0 V (HIGH); |DC|+√2·AC must stay within range	DC+AC mode: set/query the DC voltage component.
`BASIC:MODE:DCAC:ACVOLT <value>` / `?`	0.0–150.0 V (LOW) / 0.0–300.0 V (HIGH); see above	DC+AC mode: set/query the AC voltage component.
`BASIC:MODE:DCAC:FREQ <value> / ?`	1.00–999.9 Hz	DC+AC mode: set/query the output frequency.
`BASIC:MODE:DCAC:PHS:START <value>` / `?` · `BASIC:MODE:DCAC:PHS:END <value>` / `?`	0–359°	DC+AC mode: set/query the start/stop phase angle.
`BASIC:MODE:DCAC:WAVE:NUM <value> / ?`	0–63	DC+AC mode: set/query the waveform library number.
`BASIC:MODE:DCAC:CURR:LMT <value>` / `?`	0.01–7.0 A (LOW) / 0.01–3.5 A (HIGH), TH7210; scaled for TH7205	DC+AC mode: set/query the current limit.
`BASIC:MODE:DCAC:OVP <value> / ?` · `BASIC:MODE:DCAC:UVP <value> / ?`	0.0–200.0 V (LOW) / 0.0–350.0 V (HIGH)	DC+AC mode: set/query the over-voltage (OVP) / low-voltage (LVP) setting.
`BASIC:CURR:PEAK:POSI <value>` / `?`	1.0–44.0 A (TH7210) / 1.0–22.0 A (TH7205)	Set/query the +Ipk limit (General tab, all voltage modes).
`BASIC:CURR:PEAK:NEGA <value> / ?`	−44.0–−1.0 A (TH7210) / −22.0–−1.0 A (TH7205)	Set/query the −Ipk limit (General tab, all voltage modes).
`BASIC:AVE <value>` / `?`	0–30	Set/query the measurement average count.

3.3 PROG — Step Setup command set

Addresses the Step Setup page (Operation Manual §3.2.2). Up to 600 steps, numbered 0–599.

COMMAND	PARAMETERS	DESCRIPTION
`PROG:EDIT <step>,<DCV>,<ACV>,<freq>,<startangle>,<endangle>,<cycle>,<hour>,<ms>,<output>,<DCchange>,<ACchange>,<freqchange>,<min>,<sec>,<wavenum>,<phasejump>`	step 0–599; DCV −212.0–212.0 V (LOW) / −424.0–424.0 V (HIGH); ACV 0.0–150.0 V (LOW) / 0.0–300.0 V (HIGH); freq 1.00–999.9 Hz; angles 0–359°; cycle 1–99999; hour/ms 0–999; output/change/phasejump 0 or 1; min/sec 0–59; wavenum 0–63	Write all fields of one step in a single command (trailing comma required). The companion query `PROG:EDIT?<step>` returns the same field set for the given step number.
`PROG:LOOP <value> / ?`	1–99999	Set/query the total cycle count (General tab).
`PROG:STEP:START <value> / ?` · `PROG:STEP:END <value> / ?`	0–599	Set/query the sequence's start/end step (General tab).
`PROG:CURR:LMT <value> / ?`	0.01–7.0 A (LOW) / 0.01–3.5 A (HIGH), TH7210; scaled for TH7205	Set/query the shared current limit (General tab).
`PROG:CURR:PEAK:POSI <value> / ?` · `PROG:CURR:PEAK:NEGA <value> / ?`	+1.0–44.0 A / −44.0–−1.0 A (TH7210); scaled for TH7205	Set/query the shared +Ipk / −Ipk limit.
`PROG:OVP <value> / ?` · `PROG:UVP <value> / ?`	−262.0–262.0 V (LOW) / −474.0–474.0 V (HIGH)	Set/query the shared over-voltage (OVP) / low-voltage (LVP) setting.

3.4 SIM — Simulate Setup command set

Addresses the Simulate Setup page (Operation Manual §3.2.3). Simulate mode is AC-only.

COMMAND	PARAMETERS	DESCRIPTION
`SIM:VOLT <value> / ?`	0.0–150.0 V (LOW) / 0.0–300.0 V (HIGH)	Set/query the (normal) AC voltage.
`SIM:FREQ <value> / ?`	1.00–999.9 Hz	Set/query the output frequency.
`SIM:CURR:LMT <value> / ?`	0.01–10.0 A (LOW) / 0.01–5.0 A (HIGH), TH7210; scaled for TH7205	Set/query the current limit.
`SIM:CURR:TIME:TRIP <value> / ?`	0–10 s	Set/query the trip time.
`SIM:CURR:TIME:OCP <value> / ?`	1–3 s	Set/query the OCP time.
`SIM:OVP <value> / ?` · `SIM:UVP <value> / ?`	0.0–200.0 V (LOW) / 0.0–350.0 V (HIGH)	Set/query the over-voltage (OVP) / low-voltage (LVP) setting.
`SIM:CURR:PEAK:POSI <value> / ?` · `SIM:CURR:PEAK:NEGA <value> / ?`	+1.0–44.0 A / −44.0–−1.0 A (TH7210); scaled for TH7205	Set/query the +Ipk / −Ipk limit.
`SIM:T1:TYPE TIME / PHAS` · `?`	TIME, PHAS	Set/query whether T1 is entered as a time or a phase angle.
`SIM:T1:TIME <value> / ?`	0.0–999.9 ms	Set/query T1 time (when T1 Type = TIME).
`SIM:T1:PHS <value> / ?`	0–359°	Set/query T1 phase (when T1 Type = PHAS).
`SIM:T2:TIME <value> / ?`	0–99999 ms	Set/query T2 time (normal-to-disturbance ramp).
`SIM:T3:TIME <value> / ?`	1.0–9999.9 ms	Set/query T3 time (disturbance hold duration).
`SIM:T3:VOLT <value> / ?`	0.0–150.0 V (LOW) / 0.0–300.0 V (HIGH)	Set/query T3 voltage (the disturbance voltage; 0 V simulates an outage).
`SIM:T4:TIME <value> / ?`	0–99999 ms	Set/query T4 time (disturbance-to-normal ramp).
`SIM:T5:TYPE TIME / CYCLE` · `?`	TIME, CYCLE	Set/query whether T5 is entered as a time or a cycle count.
`SIM:T5:TIME <value> / ?`	0–99999 ms	Set/query T5 time (when T5 Type = TIME).
`SIM:T5:CYCLE <value> / ?`	0–99999	Set/query T5 cycle count (when T5 Type = CYCLE).
`SIM:LOOP:CYCLE <value> / ?`	0–99999	Set/query the number of times the T1–T5 sequence repeats.
`SIM:PHS:START <value> / ?` · `SIM:PHS:END <value> / ?`	0–359°	Set/query the start/stop phase angle.
`SIM:POL POSI / NEGA` · `?`	POSI, NEGA	Set/query the cross polarity (NEGA shifts the disturbance phase by 180°).

3.5 FETC — Measurement query command set

All commands in this group are queries only, returning the live measurement in the corresponding unit.

COMMAND	DESCRIPTION
`FETC?`	Query all measured parameters in one call: Urms, Upk+, Upk−, Udc, Uac, Irms, Ipk+, Ipk−, Idc, Iac, P, VAR, VA, PF, CFu, CFi, Ipkmax+, Ipkmax−.
`FETC:VOLT:RMS?` · `FETC:VOLT:POSPK?` · `FETC:VOLT:NEGPK?` · `FETC:VOLT:DC?` · `FETC:VOLT:AC?` · `FETC:VOLT:FCT?`	Query output voltage: RMS, +peak, −peak, DC component, AC component, crest factor (CFu).
`FETC:CURR:RMS?` · `FETC:CURR:POSPK?` · `FETC:CURR:NEGPK?` · `FETC:CURR:DC?` · `FETC:CURR:AC?` · `FETC:CURR:FCT?`	Query output current: RMS, +peak, −peak, DC component, AC component, crest factor (CFi).
`FETC:CURR:POSPKMX?` · `FETC:CURR:NEGPKMX?`	Query the maximum +peak / −peak current recorded.
`FETC:POW:ACT?` · `FETC:POW:VAR?` · `FETC:POW:VA?` · `FETC:POW:FCT?`	Query active power (P), reactive power (VAR), apparent power (VA), power factor (PF).

3.6 SYST — System command set

COMMAND	PARAMETERS	DESCRIPTION
`SYST:TIME <hh>:<mm>:<ss>` / `?`	e.g. `08:01:24`	Set/query the system time.
`SYST:DATE <yyyy>-<mm>-<dd>` / `?`	e.g. `2026-01-01`	Set/query the system date.
`SYST:SETUP BASIC` / `STEP` / `SIM` · `?`	BASIC, STEP, SIM	Set/query the active test mode.

3.7 FUNC — Function (System Setup) command set

COMMAND	PARAMETERS	DESCRIPTION
`FUNC:VOLT:RANG LOW` / `HIGH` · `?`	LOW, HIGH	Set/query the active voltage range (output off only).
`FUNC:VOLT:VCC:MODE AUTO` / `FIXED` · `?`	AUTO, FIXED	Set/query the internal VCC mode.
`FUNC:VOLT:VCC <value>` / `?`	0.0–300.0 V	Set/query the internal VCC voltage (when fixed).
`FUNC:SST <value>` / `?`	0.0–3.0 s	Set/query the soft-start voltage-rise time.
`FUNC:RESP SLOW` / `MED` / `FAST` · `?`	SLOW, MED, FAST	Set/query the amplifier response speed.
`FUNC:TIMER <hour>,<min>,<sec>` / `?`	hour 0–999, min/sec 0–59	Set/query the output timer.

3.8 LMT — Limit command set

COMMAND	PARAMETERS	DESCRIPTION
`LMT:DCV:MAX <value>` / `?`	DCV Min to 212.0 V (LOW) / to 424.0 V (HIGH)	Set/query the DCV upper limit.
`LMT:DCV:MIN <value>` / `?`	−212.0 V (LOW) / −424.0 V (HIGH) to DCV Max	Set/query the DCV lower limit.
`LMT:ACV:MAX <value>` / `?`	ACV Min to 150.0 V (LOW) / to 300.0 V (HIGH)	Set/query the ACV upper limit.
`LMT:ACV:MIN <value>` / `?`	0.0 V to ACV Max	Set/query the ACV lower limit.
`LMT:FREQ:MAX <value>` / `?`	Frequency Min to 999.9 Hz	Set/query the frequency upper limit.
`LMT:FREQ:MIN <value>` / `?`	1.00 Hz to Frequency Max	Set/query the frequency lower limit.

3.9 WAVE — Waveform command set

Each command addresses one of 64 waveform libraries, numbered `n` = 1–63 (library 0 is fixed to sine and not programmable).

COMMAND	PARAMETERS	DESCRIPTION
`WAVE n:TYPE SIN / CUT / SQUARE / TRI / SURGETRAP / DIMMER · ?`	n=1–63	Set/query library n's waveform type (Sine/Clip/Square/Triangle/Surge-Notch/Dimmer).
`WAVE n:CLIP <value> / ?`	1.0–1.4	Set/query the clip factor (CUT type).
`WAVE n:DUTY <value> / ?`	1–99%	Set/query the duty cycle (SQUARE type).
`WAVE n:SURGETRAP:VOLTRATE <value> / ?`	0.001–999.9	Set/query the surge/notch voltage ratio: ≤1 produces a notch, >1 a surge, applied to the active AC Voltage setting (SURGETRAP type).
`WAVE n:SURGETRAP:SITE <value> / ?`	0 to (1023–width)	Set/query the surge/notch position (SURGETRAP type).
`WAVE n:SURGETRAP:WIDTH <value> / ?`	1 to (1023–position)	Set/query the surge/notch width (SURGETRAP type).
`WAVE n:SURGETRAP:PERIOD <value> / ?`	1–9999	Set/query the surge/notch repeat period, in output cycles (SURGETRAP type).
`WAVE n:DIMMER FRONT / BACK · ?`	FRONT, BACK	Set/query the dimmer phase-cut mode (DIMMER type).
`WAVE n:USER <v1>,<v2>,…,<v1024>`	1024 integers, each −6074001 to 6074001	Load a custom 1024-point waveform into library n.

3.10 OUTP — Output command set

COMMAND	PARAMETERS	DESCRIPTION
`OUTP ON / OFF · ?`	ON, OFF	Turn the output on/off, or query its state (Basic/Step modes).
`OUTP:SIM ON / OFF · ?`	ON, OFF	Turn the output on/off, or query its state, in Simulate mode.

3.11 ALM — Alarm command set

COMMAND	DESCRIPTION
`ALM:CLR`	Clear the current alarm state.
`ALM:STAT?`	Query the active alarm. Returns one of: ALM-03 (internal DC-DC over-voltage), ALM-04 (amplifier output fault), ALM-05/06 (right/left amplifier module over-temperature), ALM-09 (PFC module fault), ALM-10/11 (DC-DC/amplifier fuse open), ALM-13 (fan fault), ALM-17 (OCKP, over peak-current), ALM-18 (OCP, over-current), ALM-19 (OVP, over-voltage), ALM-20 (LVP, low-voltage), ALM-21 (OPP, over-power), ALM-22 (HI-A, over set-current).

3.12 SCPI common commands

COMMAND	DESCRIPTION
`*RST`	Reset the instrument to factory defaults.
`*IDN?`	Query the instrument model.

SECTION 4

MODBUS Protocol — Frame Format

MODBUS is a serial communication protocol, originally published by Modicon for PLC communication, and now a de facto industry standard for connecting industrial electronic equipment. The TH7200 series supports MODBUS over the same RS232 / USB virtual COM port used for SCPI (Section 1); MODBUS is not available over LAN or USB TMC.

4.1 Write command (function code 0x10)

Send: Slave Address · Function Code (0x10) · Address High · Address Low · Register Count High · Register Count Low · Byte Count · Data Byte 1...n · CRC Low · CRC High

Return: Slave Address · Function Code · Address High · Address Low · Register Count High · Register Count Low · CRC Low · CRC High

4.2 Read command (function code 0x03)

Send: Slave Address · Function Code (0x03) · Address High · Address Low · Register Count High · Register Count Low · CRC Low · CRC High

Return: Slave Address · Function Code · Byte Count · Data Byte 1...n · CRC Low · CRC High

4.3 Field definitions

FIELD	DEFINITION
Slave address	Instrument bus address, configurable under System Setup > Communication; range 1–31.
Function code	Write-multiple-registers: `0x10` . Read-holding-registers: `0x03` .
Address High / Low	The parameter's register address (see the Register Map, Section 5) — 8-bit high byte and 8-bit low byte.
Register Count High / Low	Number of 16-bit registers involved: 1 register for a 2-byte (16-bit integer) value, 2 registers for a 4-byte (IEEE-754 floating-point) value.
Byte count	Total data bytes written or returned — always twice the register count.
Data byte 1...n	The value written to, or read from, the instrument, high byte first. A 2-byte integer occupies data bytes 1–2. A 4-byte floating-point value occupies data bytes 1–4; e.g. the decimal value 25.16 converts to `0x41 0xC9 0x47 0xAE` (byte 1=0x41 ... byte 4=0xAE).
CRC High / Low	16-bit CRC checksum, computed by table lookup over the preceding bytes of the frame.

> **NOTE**
> In the Register Map (Section 5), the "Regs." column states 1 for a single 16-bit integer value and 2 for a 4-byte floating-point value, following the pattern defined for each address. The "R/W" column states whether the address is read/write or read-only.

SECTION 5

MODBUS Register Map

All register addresses below are hexadecimal and common to TH7205 and TH7210 (current-related ranges differ per the model's rating — see Operation Manual Ch. 7, and Section 3 of this document for the exact LOW/HIGH ranges). Sent over RS232 or USB CDC only (Section 1).

ADDR.	REGS.	R/W	DESCRIPTION
Common (0x0001–0x0002)			
0x0001	1	Write	Reset the instrument to factory defaults.
0x0002	1	Read	Instrument model: 0 = TH7205, 1 = TH7210.
DISP — Display (0x0003–0x0004)			
0x0003	1	R/W	Active display page (0=Measurement Display … 14=External File — see SCPI §3.1 for the full value list).
0x0004	1	R/W	Measurement Display readout mode: 0=full-parameter, 1=partial-parameter.
BASIC — Basic Setup (0x0005–0x001F)			
0x0005	1	R/W	Voltage mode: 0=AC, 1=DCAC, 2=DC.
0x0006	2	R/W	+Ipk limit: 1.0–44.0 A (TH7210); scaled for TH7205.
0x0007	2	R/W	−Ipk limit: −44.0–−1.0 A (TH7210); scaled for TH7205.
0x0008	1	R/W	Average count: 0–30.
0x0009	2	R/W	DC mode — DC voltage: −212.0–212.0 V (LOW) / −424.0–424.0 V (HIGH).
0x000A	2	R/W	DC mode — current limit: 0.01–7.0 A (LOW) / 0.01–3.5 A (HIGH), TH7210; scaled for TH7205.
0x000B	2	R/W	DC mode — over-voltage setting (OVP): −262.0–262.0 V (LOW) / −474.0–474.0 V (HIGH).
0x000C	2	R/W	DC mode — low-voltage setting (LVP): −262.0–262.0 V (LOW) / −474.0–474.0 V (HIGH).
0x000D	2	R/W	AC mode — AC voltage: 0.0–150.0 V (LOW) / 0.0–300.0 V (HIGH).
0x000E	2	R/W	AC mode — output frequency: 1.00–999.9 Hz.
0x000F	1	R/W	AC mode — start phase angle: 0–359°.
0x0010	1	R/W	AC mode — stop phase angle: 0–359°.
0x0011	1	R/W	AC mode — waveform library number: 0–63.
0x0012	2	R/W	AC mode — current limit: 0.01–10.0 A (LOW) / 0.01–5.0 A (HIGH), TH7210; scaled for TH7205.
0x0013	1	R/W	AC mode — trip time: 0–10 s.
0x0014	1	R/W	AC mode — OCP time: 1–3 s.
0x0015	2	R/W	AC mode — over-voltage setting: 0.0–150.0 V (LOW) / 0.0–300.0 V (HIGH).
0x0016	2	R/W	AC mode — low-voltage setting (LVP): 0.0–150.0 V (LOW) / 0.0–300.0 V (HIGH).
0x0017	2	R/W	DC+AC mode — DC voltage component: −212.0–212.0 V (LOW) / −424.0–424.0 V (HIGH).
0x0018	2	R/W	DC+AC mode — AC voltage component: 0.0–150.0 V (LOW) / 0.0–300.0 V (HIGH).
0x0019	2	R/W	DC+AC mode — output frequency: 1.00–999.9 Hz.
0x001A	1	R/W	DC+AC mode — start phase angle: 0–359°.
0x001B	1	R/W	DC+AC mode — stop phase angle: 0–359°.
0x001C	1	R/W	DC+AC mode — waveform library number: 0–63.
0x001D	2	R/W	DC+AC mode — current limit: 0.01–7.0 A (LOW) / 0.01–3.5 A (HIGH), TH7210; scaled for TH7205.
0x001E	2	R/W	DC+AC mode — over-voltage setting: 0.0–200.0 V (LOW) / 0.0–350.0 V (HIGH).
0x001F	2	R/W	DC+AC mode — low-voltage setting (LVP): 0.0–200.0 V (LOW) / 0.0–350.0 V (HIGH).

ADDR.	REGS.	R/W	DESCRIPTION
PROG — Step Setup (0x0020–0x0028)			
0x0020	16	Write	Write one complete step's fields in a single frame: step number, DC voltage, AC voltage, output frequency, start angle, stop angle, step cycle, hour, ms, step output, DC change, AC change, frequency change, minute, second, waveform number, phase jump — same field set and ranges as SCPI `PROG:EDIT` (§3.3).
0x0021	2	R/W	Total cycle count (General tab): 1–99999.
0x0022	1	R/W	Start step: 0–599.
0x0023	1	R/W	End step: 0–599.
0x0024	2	R/W	Shared current limit (General tab): 0.01–7.0 A (LOW) / 0.01–3.5 A (HIGH), TH7210; scaled for TH7205.
0x0025	2	R/W	Shared +Ipk limit: 1.0–44.0 A (TH7210); scaled for TH7205.
0x0026	2	R/W	Shared −Ipk limit: −44.0–−1.0 A (TH7210); scaled for TH7205.
0x0027	2	R/W	Shared over-voltage setting: −262.0–262.0 V (LOW) / −474.0–474.0 V (HIGH).
0x0028	2	R/W	Shared low-voltage setting (LVP): −262.0–262.0 V (LOW) / −474.0–474.0 V (HIGH).
SIM — Simulate Setup (0x0029–0x003F)			
0x0029	2	R/W	AC voltage: 0.0–150.0 V (LOW) / 0.0–300.0 V (HIGH).
0x002A	2	R/W	Output frequency: 1.00–999.9 Hz.
0x002B	2	R/W	Current limit: 0.01–10.0 A (LOW) / 0.01–5.0 A (HIGH), TH7210; scaled for TH7205.
0x002C	1	R/W	Trip time: 0–10 s.
0x002D	1	R/W	OCP time: 1–3 s.
0x002E	2	R/W	Over-voltage setting: 0.0–200.0 V (LOW) / 0.0–350.0 V (HIGH).
0x002F	2	R/W	Low-voltage setting: 0.0–200.0 V (LOW) / 0.0–350.0 V (HIGH).
0x0030	2	R/W	+Ipk limit: 1.0–44.0 A (TH7210); scaled for TH7205.
0x0031	2	R/W	−Ipk limit: −44.0–−1.0 A (TH7210); scaled for TH7205.
0x0032	1	R/W	T1 type: 0=time, 1=phase.
0x0033	2	R/W	T1 time: 0.0–999.9 ms.
0x0034	1	R/W	T1 phase: 0–359°.
0x0035	2	R/W	T2 time: 0–99999 ms.
0x0036	2	R/W	T3 time: 1.0–9999.9 ms.
0x0037	2	R/W	T3 voltage: 0.0–150.0 V (LOW) / 0.0–300.0 V (HIGH).
0x0038	2	R/W	T4 time: 0–99999 ms.
0x0039	1	R/W	T5 type: 0=time, 1=cycle.
0x003A	2	R/W	T5 time: 0–99999 ms.
0x003B	2	R/W	T5 cycle: 0–99999.
0x003C	2	R/W	Loop (cycle) count: 0–99999.
0x003D	1	R/W	Start phase angle: 0–359°.
0x003E	1	R/W	Stop phase angle: 0–359°.
0x003F	1	R/W	Cross polarity: 0=positive, 1=negative.

ADDR.	REGS.	R/W	DESCRIPTION
Measurement Readback (0x0040–0x0052) — all read-only			
0x0040	—	Read	Read all measured parameters in one frame — same field set as SCPI `FETC?` (§3.5).
0x0041	2	Read	Voltage RMS (Urms).
0x0042	2	Read	Voltage +peak (Upk+).
0x0043	2	Read	Voltage −peak (Upk−).
0x0044	2	Read	Voltage DC component (Udc).
0x0045	2	Read	Voltage AC component (Uac).
0x0046	2	Read	Current RMS (Irms).
0x0047	2	Read	Current +peak (Ipk+).
0x0048	2	Read	Current −peak (Ipk−).
0x0049	2	Read	Current DC component (Idc).
0x004A	2	Read	Current AC component (Iac).
0x004B	2	Read	Active power (P).
0x004C	2	Read	Reactive power (VAR).
0x004D	2	Read	Apparent power (VA).
0x004E	2	Read	Power factor (PF).
0x004F	2	Read	Voltage crest factor (CFu).
0x0050	2	Read	Current crest factor (CFi).
0x0051	2	Read	Current +peak maximum (Ipkmax+).
0x0052	2	Read	Current −peak maximum (Ipkmax−).
SYST — System (0x0053)			
0x0053	1	R/W	Active test mode: 0=Basic, 1=Step, 2=Simulate.
FUNC — Function / System Setup (0x0054–0x0059)			
0x0054	1	R/W	Voltage range: 0=LOW, 1=HIGH (output off only).
0x0055	1	R/W	Internal VCC mode: 0=auto, 1=fixed.
0x0056	2	R/W	Internal VCC voltage: 0.0–300.0 V (when fixed).
0x0057	2	R/W	Soft-start voltage-rise time: 0.0–3.0 s.
0x0058	1	R/W	Response speed: 0=slow, 1=med, 2=fast.
0x0059	3	R/W	Output timer: hour (0–999), minute (0–59), second (0–59).
LIMIT (0x005A–0x005F)			
0x005A	2	R/W	DCV upper limit: DCV Min to 212.0 V (LOW) / to 424.0 V (HIGH).
0x005B	2	R/W	DCV lower limit: −212.0 V (LOW) / −424.0 V (HIGH) to DCV Max.
0x005C	2	R/W	ACV upper limit: ACV Min to 150.0 V (LOW) / to 300.0 V (HIGH).
0x005D	2	R/W	ACV lower limit: 0.0 V to ACV Max.
0x005E	2	R/W	Frequency upper limit: Frequency Min to 999.9 Hz.
0x005F	2	R/W	Frequency lower limit: 1.00 Hz to Frequency Max.

ADDR.	REGS.	R/W	DESCRIPTION
WAVE — Waveform (0x0060–0x0067)			
0x0060	1	R/W	Waveform type for the selected library: 0=Sine, 1=Clip, 2=Square, 3=Triangle, 4=Surge/Notch, 5=Dimmer.
0x0061	2	R/W	Clip factor: 1.0–1.4 (Clip type).
0x0062	2	R/W	Duty cycle: 1–99% (Square type).
0x0063	2	R/W	Surge/notch voltage ratio: 0.001–999.9 (Surge/Notch type).
0x0064	2	R/W	Surge/notch position: 0 to (1023−width) (Surge/Notch type).
0x0065	2	R/W	Surge/notch width: 1 to (1023−position) (Surge/Notch type).
0x0066	2	R/W	Surge/notch period: 1–9999 output cycles (Surge/Notch type).
0x0067	1	R/W	Dimmer phase-cut mode: 0=front (leading-edge), 1=back (trailing-edge) (Dimmer type).
OUTP — Output Control (0x0068–0x0069)			
0x0068	1	R/W	Output state (Basic/Step modes): 0=off, 1=on.
0x0069	1	R/W	Output state (Simulate mode): 0=off, 1=on.
ALM — Alarm (0x006A–0x006B)			
0x006A	1	Write	Clear the current alarm state.
0x006B	1	Read	Active alarm code — see SCPI `ALM:STAT?` (§3.11) for the full code list.

NOTE — WAVEFORM LIBRARY SELECTOR

Addresses 0x0060–0x0067 act on whichever waveform library number is currently selected via address 0x0011 (Basic mode), 0x001C (DC+AC mode) or the Step/Simulate equivalents — these addresses operate on "library n" exactly as the corresponding SCPI `WAVE n:...` commands do, rather than exposing a separate address per library.

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