TECHMIZE by TONGHUI

CMD

COMMAND REFERENCE

TH2848 Series SCPI & MODBUS Command Reference

Complete remote-control command set for TH2848-02L / TH2848-02 / TH2848-05 / TH2848-10 — SCPI subsystems (Part I) and the MODBUS RTU register map (Part II). Companion to the TH2848 Series Operation Manual, whose Chapter 8 gives a condensed overview and the most common commands.

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TH2848 Series SCPI & MODBUS Command Reference

Complete remote-control command set — TH2848-02L / TH2848-02 / TH2848-05 / TH2848-10

This document is the complete companion reference to Chapter 8 of the TH2848 Series Operation Manual. Commands are shown with the shortest legal abbreviation in capitals (e.g. `DISPlay` can be sent as `DISP`); a query form appends `?`.

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PART I — SCPI COMMAND REFERENCE

1. Conventions & Common Commands

1.1 Remote interfaces

RS-232C, RS-485, USB Device (USBTMC/USBCDC), LAN and GPIB are standard on all four TH2848 models. Select the active interface with Bus Mode (§11.1); select SCPI or MODBUS with Cmd Mode (§11.1).

1.2 SCPI syntax conventions

`{ }`	Encloses a parameter choice; braces are not sent with the command.
`|`	Separates parameter alternatives, e.g. `{VPP|VRMS|DBM}` means "VPP", "VRMS" or "DBM".
`< >`	A value must be supplied for the enclosed parameter, e.g. `<frequency>`.
`[ ]`	The enclosed node or parameter is optional and may be omitted; the instrument applies a default if omitted.
`^END`	The IEEE-488 bus EOI (end-of-identify) signal.
NR1 / NR2 / NR3	Integer (`123`) / fixed-point (`12.3`) / floating-point (`12.3E+5`). **NRf** denotes any of the three.
Bool	`1` / `0` or `ON` / `OFF`.
SPD / CPD	String program data (quoted string) / character program data (short- or long-form discrete parameter).
SRD / CRD	String response data (quoted string) / character response data (returned only in short/abbreviated form).
Expr	A channel list, group list, or mathematical expression.
NL	Newline, ASCII 10 — terminates a string input or output.

Example: `[SOURce[1|2]:]FREQuency:CENTer {<frequency>|MINimum|MAXimum|DEFault}` *— the SOURce node, and its channel-1/2 suffix, are both optional; channel 1 is the default if omitted.*

1.3 GPIB common commands

Command	Details
`*RST`	Resets the instrument.
`*TRG`	Triggers one measurement and returns the result directly. Format depends on the active display page — see §1.4.
`*IDN?`	Returns `<model>,<firmware>,<sn>`, e.g. model = TH2848, firmware = V1.0.0, sn = sn12345678.
`*TST?`	Runs the internal self-test.
`*ESE` / `*ESE?`	Sets/reads the Standard Event Status Enable register.
`*SRE` / `*SRE?`	Sets/reads the Service Request Enable register.
`*ESR?`	Reads the Standard Event Status register.
`*STB?`	Reads the Status Byte register.
`*OPC`	Operation-complete handshake (standard IEEE-488.2 behaviour).
`*CLS`	Clears status registers.

1.4 *TRG / FETCh? data format by page

Active page	Format
Meas Display (component test)	`<P1>,<P2>,<P3>,<P4>,<bin>`, e.g. `1.12345E2,1.23456E-2,1.11023E2,-1.12345E2,1`. Bin: 0 = out of tolerance, 1–10 = BIN1–BIN10; the <bin> field is present only when the comparator is ON.
List Display — Step mode	`<point>,<P1>,<P2>,<P3>,<P4>,<compare>`. Compare: 0 = not compared, 1 = pass, other = fail.
List Display — Seq mode	All points' data returned together, in the same per-point format, after the full sweep completes.
Trace Display — Step mode	`<point>,<P1>,<P2>,<P3>,<P4>` (no compare field).
Trace Display — Seq mode	All points' data returned together after the sweep completes.

2. DISPlay, FREQuency, VOLTage, CURRent, APERture

2.1 DISPlay subsystem

Command	Details
`:DISPlay:PAGE?` `:DISPlay:PAGE <PageName>`	Switches the active page. `PageName`: **MEASurement** (Meas Display), **LIST** (List Display), **TSMEas** (Trace Display), **MSETup** (Meas Setup), **LTABle** (Limit Setup), **LSETup** (List Setup), **TSSEtup** (Trace Setup), **CSETup** (User Corr setup), **SYSTem** (System Setup), **FLISt** (File list). Example: `:DISP:PAGE MEAS` selects Meas Display.

2.2 FREQuency subsystem

Command	Details
`:FREQuency?` `:FREQuency <float|MIN|MAX>`	Sets/reads the test frequency. Example: `:FREQ 1200` or `:FREQ 1200HZ` or `:FREQ 1.2K` all set 1200 Hz.

2.3 VOLTage subsystem

Command	Details
`:VOLTage?` `:VOLTage <float|MIN|MAX>`	Sets/reads the AC test voltage. Example: `:VOLT 1.2` sets 1.2 V.
`:VOLTage:DC?` `:VOLTage:DC <float|MIN|MAX>`	Sets/reads the DC level (Rd test). Example: `:VOLT:DC 0.8` sets 0.8 V.

2.4 CURRent subsystem

Command	Details
`:CURRent?` `:CURRent <float|MIN|MAX>`	Sets/reads the AC test current. Example: `:CURR 0.01` sets 10 mA.

2.5 APERture subsystem

Command	Details
`:APERture?` `:APERture <FAST|MED|SLOW>[,int]`	Sets measurement speed and, optionally, averaging count (1–255). Example: `:APER FAST,2` sets Fast speed with 2-reading averaging.

3. OUTPut, BIAS, TRIGger, AMPLitude, ORESistor

3.1 OUTPut subsystem

Command	Details
`:OUTPut:HPOWer?` `:OUTPut:HPOWer <INT|EXT>`	Bias-source mode: **INT** = internal 40 V/100 mA source, **EXT** = external bias-current source (TH1778).
`:OUTPut:DC:ISOLation?` `:OUTPut:DC:ISOLation <0|1|ON|OFF>`	DCI isolation on/off (§4.4.13 of the Operation Manual).

3.2 BIAS subsystem

Command	Details
`:BIAS:STATe?` `:BIAS:STATe <0|1|ON|OFF>`	DC bias output on/off.
`:BIAS:VOLTage?` `:BIAS:VOLTage <float|MIN|MAX>`	Internal bias voltage. Example: `:BIAS:VOLT 1.2` sets 1.2 V.
`:BIAS:CURRent?` `:BIAS:CURRent <float|MIN|MAX>`	Bias current. Example: `:BIAS:CURR 0.01` sets 10 mA.
`:BIAS:POLarity:AUTO?` `:BIAS:POLarity:AUTO <0|1|AUTO|FIX>`	Bias polarity: **AUTO** (0) or **FIX** (1) — see Operation Manual §4.4.14.

3.3 TRIGger subsystem

Command	Details
`:TRIGger`	Triggers one measurement.
`:TRIGger:SOURce?` `:TRIGger:SOURce <CONTinuous|SINGle>`	Trigger source.
`:TRIGger:DELay?` `:TRIGger:DELay <float|MIN|MAX>`	Trigger delay. Example: `:TRIG:DEL 1ms`, `:TRIG:DEL 1` (= 1 s).
`:TRIGger:STATus?`	Returns `RUN 0` (idle/finished) or `RUN 1` (test in progress) — poll this instead of a fixed wait when test time is unpredictable; query the result once it returns 0.
`:TRIGger:ReSet`	Aborts the current test/sweep early.

3.4 AMPLitude subsystem

Command	Details
`:AMPLitude:ALC?` `:AMPLitude:ALC <0|1|ON|OFF>`	Auto Level Control on/off.

3.5 Output RESistor subsystem

Command	Details
`:ORESistor?` `:ORESistor <100|30>`	Output source resistance, 100 Ω or 30 Ω.

4. FUNCtion subsystem

Sets the measured parameter(s), range, voltage/current monitor switches, and deviation-test mode.

4.1 Function-parameter enum

CP — Cp (parallel C)	CS — Cs (series C)	X — reactance
LP — Lp (parallel L)	LS — Ls (series L)	RD — DC resistance
RP — Rp (parallel R / ESR)	RS — Rs (series R / EPR)	D — dissipation factor
GP — conductance	BP — susceptance	Q — quality factor
Z — |Z|	Y — |Y|	ZTD/DZ — θz° · ZTR/RZ — θz (rad)
YTD/DY — θy° · YTR/RY — θy (rad)		

4.2 Commands

Command	Details

`:FUNCtion:IMPedance[1|2|3|4]?`
`:FUNCtion:IMPedance <p1,p2,p3,p4>`
`:FUNCtion:IMPedance<1|2|3|4> <para>`
	Sets all four, or one, function parameter(s) — see the enum above. Example: `:FUNC:IMP CP,CS,LP,LS` sets all four; `:FUNC:IMP1 RP` sets Parameter 1 only.

`:FUNCtion:IMPSW?` `:FUNCtion:IMPSW <0|1>,<0|1>,<0|1>,<0|1>`	Per-parameter display on/off, in Parameter 1–4 order. Example: `:FUNC:IMPSW 1,1,0,0` shows only Parameters 1–2.
`:FUNCtion:IMPedance:RANGe?` `:FUNCtion:IMPedance:RANGe <float>`	AC range — set to the DUT's approximate equivalent impedance; the instrument selects the best-fit range. Example: `:FUNC:IMP:RANG 1k`.
`:FUNCtion:IMPedance:RANGe:AUTO?` `:FUNCtion:IMPedance:RANGe:AUTO <0|1|OFF|ON>`	AC auto-range on/off.
`:FUNCtion:DCR:RANGe?` `:FUNCtion:DCR:RANGe <float>`	DC (Rd) range, set the same way as AC range.
`:FUNCtion:SMONitor:VDC?` `:FUNCtion:SMONitor:VDC <0|1|OFF|ON>`	Voltage-monitor display on/off.
`:FUNCtion:SMONitor:IDC?` `:FUNCtion:SMONitor:IDC <0|1|OFF|ON>`	Current-monitor display on/off.
`:FUNCtion:DEV[1|2|3|4]:MODE?` `:FUNCtion:DEV[1|2|3|4]:MODE <ABS|PER|OFF>`	Deviation-test mode per parameter — ABS (Δ), PER (Δ%) or OFF. Example: `:FUNC:DEV:MODE OFF,PER,ABS,OFF` sets all four at once.

`:FUNCtion:DEV[1|2|3|4]:REF?`
`:FUNCtion:DEV[1|2|3|4]:REF <float>`
`:FUNCtion:DEV<1|2|3|4>:REF:FILL`
	Deviation reference value; `:REF:FILL` runs one measurement and uses its result as the reference. Example: `:FUNC:DEV:REF 10,11,12,13` sets all four references at once.

`:FUNCtion:SDELay?` `:FUNCtion:SDELay <float|MIN|MAX>`	Step delay.

5. COMParator subsystem

Programs the bin comparator: switch, count, limit mode and per-bin limits.

Command	Details
`:COMParator?` `:COMParator <0|1|ON|OFF>`	Comparator on/off.
`:COMParator:COUNt?` `:COMParator:COUNt <0|1|ON|OFF>`	Bin-count accumulation on/off.
`:COMParator:COUNt:DATA?`	Returns the current per-bin counts.
`:COMParator:COUNt:CLEar`	Zeroes all bin counts.
`:COMParator:MODE?` `:COMParator:MODE <TOL|SEQ>`	Limit mode: Tolerance or Sequential (Operation Manual §4.5.1).
`:COMParator:TOL:BIN<n>?` `:COMParator:TOL:BIN<n> <loA,hiA>[,loB,hiB][,loC,hiC][,loD,hiD]`	Tolerance-mode limits for bin n (1–10), for up to all four parameters at once. Example: `:COMP:TOL:BIN3 1,2,3,4` sets bin 3's Parameter 1 and 2 limits.
`:COMParator:SEQ:BIN[A|B|C|D]?` `:COMParator:SEQ:BIN[A|B|C|D] <lo1>[,hi1,hi2,…,hi10]`	Sequential-mode cascading limits for parameter A/B/C/D (A = default if omitted). Example: `:COMP:SEQ:BINB 1,2,3,4,5,6` sets Parameter 2's bin1 low and bins 1–5 highs.
`:COMParator:BIN:CLEar`	Clears every limit in the limit table.
`:COMParator:BIN<n>:SW?` `:COMParator:BIN<n>:SW <0|1|ON|OFF>`	Per-bin (1–10) enable switch.

6. LIST subsystem

Programs the <List Setup> sweep: point count, mode, per-point conditions and limits, up to 201 points.

6.1 Sweep setup

Command	Details
`:LIST:TOTAL?` `:LIST:TOTAL <int>`	Total sweep points, 1–201.
`:LIST:MODE?` `:LIST:MODE <SEQ|STEP>`	Sweep mode.
`:LIST:COMP?` `:LIST:COMP <0|1|OFF|ON>`	List-level compare on/off.

6.2 Delta (difference) mode

Command	Details
`:LISTDELTA:SWitch?` `:LISTDELTA:SWitch <0|1|ON|OFF>`	Delta-mode on/off.
`:LISTDELTA:MODE[n]?` `:LISTDELTA:MODE[n] <mode>`	`n` = point index (1–201, default 1 if omitted). `mode` 0–9: 0 = (Pn−P1), 1 = (Pn−P1)/P1, 2 = (Pn−P1)/P1×100%, 3 = (Pn−P1)/Pn, 4 = (Pn−P1)/Pn×100%, 5 = (Pn), 6 = (Pn−P2)/P2, 7 = (Pn−P2)/P2×100%, 8 = (Pn−P2)/Pn, 9 = (Pn−P2)/Pn×100%.
`:LISTDELTA:LOW[n]?` `:LISTDELTA:LOW[n] <value>`	Delta lower limit for point `n`, same units as Parameter 1.
`:LISTDELTA:HIGH[n]?` `:LISTDELTA:HIGH[n] <value>`	Delta upper limit for point `n`.

6.3 Dielectric-constant mode

Command	Details
`:LISTDIE:SWitch?` `:LISTDIE:SWitch <0|1|ON|OFF>`	Dielectric-constant mode on/off (all models except TH2848-02L).
`:LISTDIE:THICKness?` `:LISTDIE:THICKness <value>`	Sample thickness, metres (NRf).
`:LISTDIE:DIAMeter?` `:LISTDIE:DIAMeter <value>`	Sample diameter, metres (NRf).
`:LISTDIE:AREA?` `:LISTDIE:AREA <value>`	Electrode area, m² (NRf).
`:LISTDIE:FUNCSW?` `:LISTDIE:FUNCSW[n] <sw1,sw2,…>`	Per-parameter display switch, starting at row `n` (1–8: Cp, D, ε, |ε|, εr′, εr″, tanδ, Q). Example: `:LISTDIE:FUNCSW2 0,1,0,1` sets D=off, ε=on, |ε|=off, εr′=on.
`:LISTDIE:LOW[n]?` `:LISTDIE:LOW[n] <value>`	Lower limit for dielectric row `n` (1–8, same numbering as FUNCSW).
`:LISTDIE:HIGH[n]?` `:LISTDIE:HIGH[n] <value>`	Upper limit for dielectric row `n`.

6.4 Column display switches

Command	Details
`:LIST:DISP:PARA?` `:LIST:DISP:PARA <0|1>,<0|1>,<0|1>,<0|1>`	Per-parameter (1–4) display switch — OFF also stops that column being saved/reported.
`:LIST:DISP:FREQ?` `:LIST:DISP:FREQ <0|1>`	Frequency-column display switch.
`:LIST:DISP:ACLV?` `:LIST:DISP:ACLV <0|1>`	AC-level column display switch.
`:LIST:DISP:BIAS?` `:LIST:DISP:BIAS <0|1>`	Bias-column display switch.

6.5 Clearing and per-point conditions

Command	Details
`:LIST:CLEar [n|ALL]`	Clears one point's (n, 1–201) or all points' setup data.
`:LIST:FREQuency[n]?` `:LIST:FREQuency[n] <fn>[,fn+1][,fn+2]…`	Sets a run of points' frequency, starting at point n (default 1). Example: `:LIST:FREQ6 20,30,40,1k,2k` sets points 6–10.
`:LIST:VOLTage[n]?` `:LIST:VOLTage[n] <fn>[,fn+1]…`	Sets a run of points' AC voltage, same addressing as FREQuency.
`:LIST:CURRent[n]?` `:LIST:CURRent[n] <fn>[,fn+1]…`	Sets a run of points' AC current, same addressing.
`:LIST:BIAS:VOLTage[n]?` `:LIST:BIAS:VOLTage[n] <fn>[,fn+1]…`	Sets a run of points' bias voltage, same addressing.
`:LIST:BIAS:CURRent[n]?` `:LIST:BIAS:CURRent[n] <fn>[,fn+1]…`	Sets a run of points' bias current, same addressing.
`:LIST:DELay[n]?` `:LIST:DELay[n] <fn>[,fn+1]…`	Sets a run of points' per-point delay, same addressing.

6.6 Per-point function and limits

Command	Details
`:LIST:FUNC:IMP<n>?` `:LIST:FUNC:IMP<n> <p1,p2,p3,p4>`	Sets all four function parameters at point n (1–201) — enum as in §4.1.
`:LIST:FUNC:IMP<A|B|C|D><n>?` `:LIST:FUNC:IMP<A|B|C|D><n> <pn>[,pn+1,…]`	Sets a run of points' function for one parameter slot (A–D), starting at point n.
`:LIST:FUNC:LIN<A|B|C|D> <start,stop,para>`	Sets one parameter slot's function across a contiguous point range in one command. Example: `:LIST:FUNC:LINA 1,15,LP` sets Parameter A to LP for points 1–15.

`:LIST:BAND<n>?`
`:LIST:BAND<n> OFF`
`:LIST:BAND<n> <A|B|C|D,lo,hi>`
	Sets or clears point n's limit for one parameter slot. Example: `:LIST:BAND2 A,1,2`; `:LIST:BAND1 OFF` clears point 1's limits.

6.7 List-level batch commands

Batch read/write of an entire column (frequency, level, bias, delay, upper/lower limits, or function) across many points in one MODBUS transaction is available via registers `0x3000` – `0x3011` — see §14.3.

7. TRACe subsystem

The trace subsystem uses the node name `TSSE` throughout.

Command	Details
`:TSSE:POINT?` `:TSSE:POINT <51|101|201|401|801>`	Sweep point count.
`:TSSE:MODE?` `:TSSE:MODE <FREQ|VOLT|CURR|BVOL|BCUR>`	Swept condition: frequency, AC voltage, AC current, bias voltage, bias current.
`:TSSE:SWEEP?` `:TSSE:SWEEP <float,float>`	Sweep start and stop values.
`:TSSE:SMODE?` `:TSSE:SMODE <SEQ|STEP>`	Sweep mode.
`:TSSE:FORMat?` `:TSSE:FORMat <LIN|LOGX>`	X-axis scale: linear or log.
`:TSSE:LIMIt?` `:TSSE:LIMIt <0|1|OFF|ON>`	Extreme-value (Max-Min) readout on/off.

`:TSSE:IMP[1|2|3|4]?`
`:TSSE:IMP <p1,p2,p3,p4>`
`:TSSE:IMP<1|2|3|4> <para>`
	Trace function parameter(s) — same enum as §4.1.

`:TSSE:COMP:SWitch?` `:TSSE:COMP:SWitch <0|1|OFF|ON>`	Trace comparator on/off.
`:TSSE:CTDT:SWitch?` `:TSSE:CTDT:SWitch <0|1|OFF|ON>`	Piezoelectric admittance-circle (CtDt) test on/off.

7.1 Piezoelectric (CtDt) formula selection

Command	Details
`:TSSE:CTDT:KPQM?` `:TSSE:CTDT:KPQM <0-3>,<0|1>,<0/1/2/3/5>`	Formula selection for Kp (planar coupling coefficient) and Qm (mechanical Q). 1st digit: Kp formula (0–3, see Operation Manual §4.7.3). 2nd digit: Qm formula (0/1). 3rd digit: the k-constant used in Kp formula 3 — 0=2.33, 1=2.46, 2=2.51, 3=2.53, 5=2.55.

`:TSSE:CTDT:KtK31K33Kta?`
`:TSSE:CTDT:KtK31K33Kta <0|1>,<0|1>,0,`
`<0|1>`
	Formula selection for Kt, K31, K33. 1st digit: Kt formula (0/1). 2nd digit: K31 formula (0/1). 3rd digit: K33 formula (fixed at 0). 4th digit: the α-constant in Kt formula 2 — 0=1.42, 1=2.

`:TSSE:CTDT:SizeDS?` `:TSSE:CTDT:SizeDS <value1,value2>`	Dielectric thickness D (m) and electrode area S (m^2). Example: `:TSSE:CTDT:SizeDS 0.1,0.05`.

7.2 Reading trace results (see also §9 FETCh?)

Trace results — X-axis values, per-trace Y values, cursor readout, and per-trace min/max — are read with the `FETCh:TRACe` and `FETCh:CTDT` commands documented in §9.4–9.5.

8. Handler subsystem (SCPI)

Programs the HANDLER interface's output-signal behaviour over SCPI. For the physical pinout and electrical characteristics, see Chapter 9 of the Operation Manual.

Command	Details
`:HANDler:STATe?` `:HANDler:STATe <0|1|2|OFF|ON|BUS>`	HANDLER output mode: **0/OFF** = default (factory) mapping, **1/ON** = user-custom mapping, **2/BUS** = the host directly drives each output high/low over the bus.
`:HANDler:STATe:OFfLO <list>` `:HANDler:STATe:OFfHI <list>`	In custom mode, sets the listed output indices to constant LOW / constant HIGH. `<list>` is a comma-separated index list, e.g. `1,3,5,9`, matching the positions shown in the <Handler> page table.
`:HANDler:STATe:LVLO <list>` `:HANDler:STATe:LVHI <list>`	Sets the listed outputs to level-active-LOW / level-active-HIGH.
`:HANDler:STATe:PUHI <list>` `:HANDler:STATe:PULO <list>`	Sets the listed outputs to pulse-active-HIGH / pulse-active-LOW.
`:HANDler:OUTPut:LVHI <list>` `:HANDler:OUTPut:LVLO <list>`	In BUS mode, directly drives the listed outputs HIGH / LOW.

9. FETCh? subsystem

9.1 Basic result query

Command	Details
`:FETCh?`	Returns the last measurement's result; format depends on the active page — see §1.4.
`:FETCh:SMONitor:VAC?`	AC voltage monitor result.
`:FETCh:SMONitor:IAC?`	AC current monitor result.
`:FETCh:SMONitor:VDC?`	DC bias voltage monitor result.
`:FETCh:SMONitor:IDC?`	DC bias current monitor result.

9.2 Automatic result streaming

Command	Details
`:FETCh:AUTO?` `:FETCh:AUTO <0|OFF|1|ON|2>`	**0/OFF** — no auto-return (factory default; not retained across power-off). **1/ON** — automatically returns the test result after each trigger completes, same format as `:FETCh?`. **2** — returns only an end-of-measurement marker (`Trig Eom\n`) after each trigger, without the data itself.

9.3 List-sweep results

Command	Details
`:FETCh:LIST:PARA<1|2|3|4>?`	All points' results for one parameter.
`:FETCh:LIST:PT<1-201>?`	All four parameters' results at one point.
`:FETCh:LIST:COMP[1-201]?`	Compare result at one point, or (with no index) all points.
`:FETCh:LIST[1-201]?`	All four parameters + compare result at one point, or (with no index) for every point. Format per point: `P1,P2,P3,P4,cmp`; a display-disabled parameter leaves its comma-separated slot empty.

9.4 Trace-sweep results

Command	Details
`:FETCh:TRACe:X[1-801]?`	X-axis value(s) — all points, or one point if indexed.
`:FETCh:TRACe:Y<1|2|3|4>?`	All points' Y values for one trace.
`:FETCh:TRACe:PT<1-801>?`	One point's result, all four traces: `x,y1,y2,y3,y4`.
`:FETCh:TRACe:MARK?`	Cursor-position result, all four traces: `x,y1,y2,y3,y4`.
`:FETCh:TRACe:YMAX<1|2|3|4>?` `:FETCh:TRACe:YMIN<1|2|3|4>?`	Maximum / minimum value of one trace: `x,y`.

9.5 Piezoelectric admittance results

Command	Details
`:FETCh:CTDT:ALL?`	All CtDt piezoelectric parameters (Ct, Dt, Fs, Fp, Kp, Qm, etc. — see Operation Manual §4.7.3).
`:FETCh:CTDT:Gx?` `:FETCh:CTDT:By?`	All points' conductance (G, x-axis) / susceptance (B, y-axis) values from the admittance-circle plot.

10. CORRection subsystem

Programs open/short/load correction (Operation Manual §4.8).

10.1 Full-range correction

Command	Details
`:CORRection:OPEN [ACK]`	Runs full-range open correction. With `ACK`, returns 1 on success / 0 on failure; without it, no return value.
`:CORRection:OPEN:STATe?` `:CORRection:OPEN:STATe <0|1|ON|OFF>`	Open-correction enable switch.
`:CORRection:SHORt [ACK]`	Runs full-range short correction (same ACK behaviour as OPEN).
`:CORRection:SHORt:STATe?` `:CORRection:SHORt:STATe <0|1|ON|OFF>`	Short-correction enable switch.
`:CORRection:LOAD:STATe?` `:CORRection:LOAD:STATe <0|1|ON|OFF>`	Load-correction enable switch.
`:CORRection:LOAD:TYPE?` `:CORRection:LOAD:TYPE <LSRS|LSQ|CPD>`	Load-correction reference parameter type: Ls-Rs, Ls-Q or Cp-D.
`:CORRection:LENGth?` `:CORRection:LENGth <0|1>`	Correction cable length: 0 m or 1 m.
`:CORRection:CLEar [pt]`	Clears correction data — all points, or one point-frequency spot (1–10) if `pt` is given.

10.2 Correction data & timestamp queries

Command	Details
`:CORRection[:USE]:DATA[n]?`	Without n: returns every spot's open/short/load A/B values in sequence. With n (1–10): returns that spot's index, frequency, open A/B, short A/B, load A/B, and reference A/B.
`:CORRection:DATE <LAST|OPEN|SHORT|DCR|DCROPEN|DCRSHORT>` `:CORRection:DATE<n> <OPEN|SHORT|LOAD>`	Queries when a correction was last performed. Without n: LAST = most recent of any kind, OPEN/SHORT = full-range, DCR/DCROPEN/DCRSHORT = DC-resistance correction. With n (1–10): that point-frequency spot's OPEN/SHORT/LOAD timestamp. Returns `yyyy-MM-dd hh:mm:ss`, or `----` if never performed.

10.3 Point-frequency correction (spots 1–10)

Command	Details
`:CORRection:SPOT<n>:STATe?` `:CORRection:SPOT<n>:STATe <0|1|ON|OFF>`	Enable switch for point-frequency spot n (1–10).
`:CORRection:SPOT<n>:FREQuency?` `:CORRection:SPOT<n>:FREQuency <float|MIN|MAX>`	Spot n's correction frequency.
`:CORRection:SPOT<n>:OPEN [ACK]`	Runs open correction for spot n.
`:CORRection:SPOT<n>:SHORt [ACK]`	Runs short correction for spot n.
`:CORRection:SPOT<n>:LOAD:STANdard?` `:CORRection:SPOT<n>:LOAD:STANdard <refA,refB>`	Sets/reads spot n's load-correction reference values.
`:CORRection:SPOT<n>:LOAD [ACK]`	Runs load correction for spot n, using the reference values above.

11. MassMEMory, SYSTem subsystems

11.1 MassMEMory subsystem

Command	Details
`:MMEMory:LOAD?` `:MMEMory:LOAD <file>`	Loads a setup file — either an internal-storage index (1–50, e.g. `1` = `LCR.sta`, `9` = `LCR9.sta`) or a path, e.g. `files/sss.sta`, `usb/sss.sta`.
`:MMEMory:STORe <n>[,file]`	Saves the current setup — `n` selects the default index-named file (1–50) unless a `file` path is also given. Example: `:MMEM:STOR5,files/sss.sta`.

11.2 SYSTem subsystem — bus & sound

Command	Details

`:SYSTem:BUSMODE?`
`:SYSTem:BUSMODE`
`<RS232|GPIB|LAN|USBTMC|USBCDC|RS485|AUTO>`
	Sets/reads the active communication interface, or AUTO to select automatically.

`:SYSTem:BEEP?` `:SYSTem:BEEP <0|OFF|1|ON>`	Key-press beep on/off.
`:SYSTem:BEEP:PASS?` `:SYSTem:BEEP:PASS <OFF|TS|LL|HS|HL>`	Pass-result beep: OFF, Two-Short, Low-Long, High-Short, High-Long.
`:SYSTem:BEEP:FAIL?` `:SYSTem:BEEP:FAIL <OFF|TS|LL|HS|HL>`	Fail-result beep, same option set as PASS.
`:SYSTem:DATETIME?` `:SYSTem:DATETIME <yr,mo,day,hr,min,sec>`	System clock. Example: `:SYST:DATETIME 2021,11,08,12,35,56`.

11.3 SYSTem subsystem — RS232 & LAN configuration

Command	Details
`:SYSTem:RS232:BAUD?` `:SYSTem:RS232:BAUD <4800|9600|19200|38400|57600|115200>`	RS-232 baud rate.
`:SYSTem:RS232:ADDRess?` `:SYSTem:RS232:ADDRess <1-32>`	Bus address (also used for RS-485/GPIB/MODBUS).
`:SYSTem:RS232:CMDMODE?` `:SYSTem:RS232:CMDMODE <SCPI|MODBUS>`	Active command protocol.
`:SYSTem:LAN:PORT?` `:SYSTem:LAN:PORT <int>`	LAN port number, factory default 45454.
`:SYSTem:LAN:UDhcpc?`	Triggers a one-time DHCP address request.
`:SYSTem:LAN:IPADdress?` `:SYSTem:LAN:IPADdress <ip>`	Static IP address.
`:SYSTem:LAN:GATeway?` `:SYSTem:LAN:GATeway <ip>`	Gateway address.
`:SYSTem:LAN:SMASK?` `:SYSTem:LAN:SMASK <mask>`	Subnet mask.
`:SYSTem:LAN:DNS?` `:SYSTem:LAN:DNS <primary>,<secondary>`	Primary and secondary DNS addresses.
`:SYSTem:LAN:MAC?`	Reads the LAN MAC address (read-only).

11.4 Firmware update

Command	Details
`:SYSTem:UPDATE APP`	Starts a firmware update from the default file on a connected USB drive. A PC-side update utility is also available from Techmize, which pushes an update file directly (stored internally as `update2848.sec`) without needing a USB drive.

12. Measurement Communication Example

Worked example: measure four parameters (Cs, Cp, Ls, Lp) at 1 MHz / 30 mV, with a 1 m cable and 1.2 V internal bias, single-triggered.

Step	Command
0. Confirm communication	`*IDN?` — a healthy link returns the instrument info, e.g. `TH2848CS,V1.0.0,12-345-67890,2022-10-17`
1. Select the test page	`:DISP:PAGE MEAS`
2. Set cable length (1 m)	`:CORR:LENG 1`
3. Set the four parameters	`:FUNC:IMP CS,CP,LS,LP`
4. Enable all four parameters	`:FUNC:IMPSW 1,1,1,1`
5. Set frequency	`:FREQ 1M`
6. Set level	`:VOLT 30m`
7. Set internal bias voltage	`:BIAS:VOLT 1.2`
8. Set step delay	`:FUNC:SDEL 1m`
9. Set trigger mode (Single)	`:TRIG:SOUR SING`
10. Trigger the test	One of: front-panel **Trigger** key · bus command `:TRIG` · a HANDLER external-trigger pulse. For automatic result reporting after each trigger, send `:FETC:AUTO ON` once during setup instead of polling.
11. Poll trigger status	`:TRIG:STAT?` — returns `RUN 0` (idle/finished) or `RUN 1` (running). Poll repeatedly until it returns 0, then query the result — this is preferred over relying on auto-return alone, since it guarantees the result is ready.
12. Read the result	Single query: `:FETC?`. Continuous: if auto-return is enabled, no query is needed — the instrument streams each result unprompted. Format: see §1.4.

PART II — MODBUS REFERENCE

13. Frame Format & CRC16

The TH2848 series implements Techmize's internal MODBUS protocol version 2.0 (MODBUS RTU framing) as an alternative to SCPI — select it with Cmd Mode (§11.3, or the <System Setup> page). The instrument's bus address (1–31) is set the same way as for SCPI (§11.3).

13.1 Write frame — function code 0x10

Writes one or more registers (2 bytes each) in a single transaction.

Request	Addr · Func(0x10) · RegAddr Hi · RegAddr Lo · RegCount Hi · RegCount Lo · ByteCount · Data byte 1…n · CRC Lo · CRC Hi
Response	Addr · Func(0x10) · RegAddr Hi · RegAddr Lo · RegCount Hi · RegCount Lo · CRC Lo · CRC Hi

Example — set voltage range to index 2 (300 V) at register `0x0003`, instrument address 8:

Request: `08 10 00 03 00 01 01 02 C5 FD` → *Response:* `08 10 00 03 00 01 F1 50`

13.2 Read frame — function code 0x03

Request	Addr · Func(0x03) · RegAddr Hi · RegAddr Lo · RegCount Hi · RegCount Lo · CRC Lo · CRC Hi
Response	Addr · Func(0x03) · ByteCount · Data byte 1…n · CRC Lo · CRC Hi

Example — read the current voltage-mode test value at register `0x00A0`, instrument address 8:

Request: `08 03 00 A0 00 02 C4 B0` → *Response:* `08 03 04 <4 data bytes> <CRC Lo> <CRC Hi>`

13.3 CRC16 checksum

Both CRC bytes use the standard **CRC-16/MODBUS** checksum (polynomial 0xA001, initial value 0xFFFF, calculated over every byte of the frame except the two CRC bytes themselves, LSB-first). This is a widely implemented industry-standard algorithm — most MODBUS master libraries and languages provide it directly (e.g. Python's `crcmod` / `pymodbus`, or a standard bit-shift/lookup-table implementation), so it is not reproduced byte-for-byte here.

13.4 Register data types

1 register	2 bytes
Integer / enum (char)	1 register (2 bytes), value in the low byte unless noted otherwise
float	2 registers (4 bytes), IEEE-754 single precision
float + char (level-type pair)	2 registers float + 1 register type flag (0 = voltage, 1 = current) — used for AC level, DC bias, etc.

14. Register Map

All addresses are register (not byte) addresses. R = read-only, W = write-only, R/W = both. "float" = 2 registers, IEEE-754; all other single-value fields are 1 register unless noted.

14.1 General measurement (0x0000–0x0019, 0x1000–0x1003)

Addr	R/W	Details
0x0000	R	Instrument IDN string
0x0001	R/W	Function parameters 1–4 (1 reg each), enum: 0=CP 1=CS 2=LP 3=LS 4=RP 5=RS 6=Xs 7=Gp 8=Bp 9=Z 10=Y 11=D 12=Q 13=dZ(θz°) 14=rZ(θz rad) 15=dY(θy°) 16=rY(θy rad) 17=RD
0x0002	R/W	Frequency (float)
0x0003	R/W	Speed: 0=FAST 1=MED 2=SLOW 3=SFAST
0x0004	R/W	Trigger mode: 0=CONT 1=SINGLE
0x0005	R/W	Constant level (ALC): 0=OFF 1=ON
0x0006	R/W	Trigger delay, float, 0–60.000 s
0x0007	R/W	Step delay, float, 0–60.000 s
0x0008	R/W	Voltage monitor: 0=OFF 1=ON
0x0009	R/W	Current monitor: 0=OFF 1=ON
0x000A	R/W	AC level: float + 1 type reg (0=V, 1=I) — 5 registers total
0x000B	R/W	AC range, 0–14: 0=100k 1=50k 2=20k 3=10k 4=5k 5=2k 6=1k 7=500 8=200 9=100 10=50 11=20 12=10 13=0.1 (Ω, unless noted k=kΩ)
0x000C	R/W	DC bias: float + 1 type reg (0=V, 1=I) — 5 registers total (0x000C–0x000D)
0x000E	R/W	Averaging count, 1–256
0x000F	R/W	Bias polarity: 0=AUTO 1=FIX
0x0010	R/W	DC range, 0–14 (same table as AC range)
0x0011	R/W	DC level, float (0x0011–0x0012)
0x0013	R/W	DCI isolation: 0=OFF 1=ON
0x0014 / 0x0015	R/W	Deviation mode, Parameter 1 / 2: 0=OFF 1=ABS 2=PER
0x0016 / 0x0017	R/W	Reference value, Parameter 1 / 2 (float)
0x1000 / 0x1001	R/W	Deviation mode, Parameter 3 / 4 (same enum as 0x0014)
0x1002 / 0x1003	R/W	Reference value, Parameter 3 / 4 (float)
0x0019	R/W	Batch reference values, `float×n` (n=1–4 registers-worth, sets 1–4 references in one write)

14.2 Results & batch measurement registers (0x1020–0x1022)

Addr	R/W	Details
0x1022	R	Reads the current measurement result. Register count 2n selects how much is returned: n=2/4/6/8 → 1/2/3/4 parameters' float results; n=9 → all 4 parameters' results plus the bin result.
0x1020	R/W	Batch read/write of measurement settings, registers 1–n (n=1–45; must start from register 1). Register layout: 1–4 Function 1–4 · 5–8 Function 1–4 switch · 9 Frequency · 10 AC level type · 11 AC level · 12 AC current · 13 DC level · 14 Speed · 15 AC-range-auto switch · 16 AC range · 17 DC range · 18 Trigger mode · 19 Averaging · 20 Bias source · 21 Bias output state · 22 Bias polarity · 23 DC bias type · 24–25 DC bias voltage · 26–27 DC bias current · 28 Trigger delay · 29 Step delay · 30 Deviation mode 1 · 31 Deviation mode 2 · 32 Deviation mode 3 · 33 Deviation mode 4 · 34–35 Reference 1 · 36–37 Reference 2 · 38–39 Reference 3 · 40–41 Reference 4 · 42 Constant-level switch · 43 DCI-isolation switch · 44 Voltage-monitor switch · 45 Current-monitor switch.
0x1021	R/W	An alternative batch layout for the same measurement settings, registers 1–n (n=1–45). Functionally equivalent to 0x1020 with a different register ordering.

14.3 Comparator (0x001A–0x0030, 0x1004–0x1005)

Addr	R/W	Details
0x001A	R/W	Compare mode: 0=TOL 1=SEQ
0x001C	R/W	Compare switch: 0=OFF 1=ON
0x001D–0x0030	R/W	Bin 1–10 low/high limits, one float register-pair per bound, in order: bin1 low (0x001D), bin1 high (0x001E), bin2 low (0x001F), bin2 high (0x0020) … bin10 low (0x002F), bin10 high (0x0030).
0x1004	R/W	Batch bin 1–10 low limits, 6 registers: byte layout is bin-index (0–9) + parameter-index (0–3, i.e. A–D) + float value.
0x1005	R/W	Batch bin 1–10 high limits, same 6-register layout as 0x1004.

14.4 List sweep (0x0050–0x0058, 0x1006–0x1011)

Addr	R/W	Details
0x0050	R/W	Total sweep points, 1–201
0x0051	R/W	Sweep mode: 0=SEQ 1=STEP
0x0053	R/W	Current setup point index, 0–200
0x0055	R/W	Point frequency, float
0x0056	R/W	Point AC level: float + type (0/1 = V/I), 5 registers
0x0058	R/W	Point DC bias: float + type (0/1 = V/I), 5 registers
0x005A	R/W	Point function, 1–4 parameters (1 register each; enum as §14.1's 0x0001)
0x005C	R/W	Point step delay, float
0x1006 / 0x1007	R/W	Point lower / upper limit: 6-register layout — point index (0–200) + parameter index (0–3) + float value
0x100B	R	Reads all list results, 9×n registers for n points: per point, P1/P2/P3/P4 (2 regs each) + compare result (1 reg)
0x100C–0x100F	R	Reads Parameter 1/2/3/4's results across n points, 2×n registers
0x1010	R	Reads compare results across n points, n registers (1 each): 0=not compared, 1=pass, other=fail
0x1011	R/W	Result magnitude scaling for the 4 parameters, 4 registers: 0=raw, 1=×10^3, 2=×10^6

14.5 List sweep — batch column read/write (0x3000–0x3011)

Each of these registers reads or writes an entire column across many points in one transaction. **Write:** the first register is a u16 start-point index `pt` (0–200), followed by `n` float (or, for function, u16) values for points `pt…pt+n-1`. **Read:** always starts at point 0 and returns `n` values with no leading index register.

Addr	R/W	Details
0x3000	R/W	Frequency column, floats
0x3001	R/W	AC level (voltage) column, floats
0x3002	R/W	AC level (current) column, floats
0x3003	R/W	Bias voltage column, floats
0x3004	R/W	Bias current column, floats
0x3005	R/W	Step-delay column, floats
0x3006–0x3009	R/W	Upper-limit column, one address per parameter slot: 0x3006=A, 0x3007=B, 0x3008=C, 0x3009=D. Each behaves as above (start-index write, floats).
0x300A–0x300D	R/W	Lower-limit column, same per-parameter-slot addressing as the upper-limit registers above (A=0x300A … D=0x300D).
0x300E–0x3011	R/W	Function column, one address per parameter slot (A=0x300E … D=0x3011); values are u16 function-enum codes (§14.1's 0x0001 table) rather than floats.

14.6 Trace sweep (0x0090–0x0099)

Addr	R/W	Details
0x0090	R/W	Y-axis scale: 0=AUTO 1=HOLD
0x0092	R/W	X-axis coordinate: 0=linear 1=logarithmic
0x0094	R/W	Trace mode: 0=SEQ 1=STEP
0x0096	R/W	Point count: 0=51 1=101 2=201 3=401 4=801
0x0097	R/W	Extreme-value (Max-Min) display: 0=OFF 1=ON
0x0098 / 0x0099	R/W	Sweep start / stop value, float

14.7 User correction (0x0031–0x003A)

Addr	R/W	Details
0x0031	R/W	Open function: 0=OFF 1=ON 2=run full-range open zero 3=run DCR zero
0x0032	R/W	Short function: same enum as Open (0x0031)
0x0033	R/W	Load function: 0=OFF 1=ON
0x0034	R/W	Cable length: 0=0m 1=1m
0x0036	R/W	Point-frequency correction point index, 0–9
0x0037	R/W	Point-frequency correction frequency, float
0x0038	R/W	Point-frequency switch: 0=OFF 1=ON 2=run single-frequency open zero 3=run single-frequency short zero 4=run single-frequency load correction
0x0039 / 0x003A	R/W	Point-frequency reference A / B, float

14.8 System (0x0040–0x004E, 0x2007)

Addr	R/W	Details
0x0040	W	Start test (equivalent to the front-panel Trigger key), value 1
0x0041	W	Stop test (equivalent to the front-panel Reset key), value 1
0x2007	R	Trigger-running status: 0=idle/finished 1=running
0x0042	R	Reads the result on the current page (register count varies, 2/4/6/8/9, matching enabled parameters)
0x0043	R/W	Page switch, 0–10: 0=Meas 1=List 2=Trace 3=Meas Setup 4=Limit Setup 5=List Setup 6=Trace Setup 7=System Setup 8=File 9=User Corr 10=Handler
0x0045	R/W	Key beep: 0=OFF 1=ON
0x0046	R/W	Pass beep, 0–4: 0=OFF 1=Two-Short 2=Two-Long 3=High-Short 4=High-Long
0x0047	R/W	Fail beep, same enum as Pass beep (0x0046)
0x0048	R/W	Display language: 0=English 1=Chinese
0x004E	R/W	Bias source: 0=internal 100 mA · 2=external TH1778

14.9 File (0x1008–0x100A, 0x2005–0x2006)

Addr	R/W	Details
0x1008	W	USB auto-save switch, Meas Display results: 0=OFF 1=ON
0x1009	W	USB auto-save switch, List results: 0=OFF 1=ON
0x100A	W	USB auto-save switch, Trace results: 0=OFF 1=ON
0x2005	R/W	Load an internal setup file by index (0–50), e.g. `LCR1.sta`…`LCRn.sta` under the internal `files` folder. Reading returns the currently-loaded index, or no value (response `08 03 00 F0 F2`) if none is loaded.
0x2006	W	Load a setup file by index (0–50) from the `usb` folder on a connected USB drive.