CMD

SCPI / MODBUS COMMAND REFERENCE

TH2518 Series

DC Resistance / Temperature Scanner — TH2518 / TH2518A. Companion document to the TH2518 Series Operation Manual. Covers the full SCPI command set, the MODBUS register map, protocol framing, CRC16 calculation, and communication debug procedures.

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TH2518 Series Command Reference

SCPI & MODBUS command sets — TH2518 / TH2518A

This document is the companion command reference to the *TH2518 Series Operation Manual*. It lists the complete SCPI command set and the complete MODBUS holding-register map for the TH2518 series. For instrument setup, the physical remote interfaces (RS232C, LAN, USBTMC, USBVCOM) and general operation, see the Operation Manual, Chapter 7.

Commands and registers marked *(TH2518 only)* are not available on TH2518A, which measures resistance (R) only and has no temperature function.

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SECTION 1

SCPI Command Set

All SCPI commands are case-insensitive ASCII strings terminated with LF (0x0A). Maximum command length 2 KB. See the Operation Manual §7.1–7.4 for the RS232C/LAN/USBTMC/USBVCOM physical setup.

1.1 DISP — display page & status

Command	Parameters	Description
`DISP:PAGE <page>`	MEAS, MSET, CSET, LSET, SYST, FLIS	Set the active display page: Measurement Display, Measurement Setup, Channel Setup, Boundary Setup, System Setup, internal file list.
`DISP:PAGE?`	—	Query the active page. Returns one of the strings above.
`DISP:STAT ON|OFF`	ON / OFF	Show/hide the measurement result on the <Measurement Display> page Tools area.
`DISP:STAT?`	—	Query display state. Returns 0 (OFF) or 1 (ON).

1.2 FUNC — measurement parameter & function

Command	Parameters	Description
`FUNC:IMP <mode>`	R, RT[1], T[1]	Set the <Measurement Setup> parameter mode.
`FUNC:IMP?`	—	Query parameter mode. Returns R / RT / T.
`FUNC:RANG <value>`	0–2E+5	Set a fixed R/R-T range (parameter R or R-T). *Example: FUNC:RANG 123 sets the range to 200 Ω.*
`FUNC:RANG?`	—	Query range. Returns one of: 200.00E−3, 2000.0E−3, 20.000E+0, 200.00E+0, 2000.0E+0, 20.000E+3, 200.00E+3.
`FUNC:RANG:MODE <mode>`	AUTO, NOM, HOLD	Set the R/R-T range mode.
`FUNC:RANG:MODE?`	—	Returns AUTO / NOM / HOLD.
`FUNC:ADJ:EXE`	—	Turn 0 ADJ ON and execute short-circuit zero correction.
`FUNC:ADJ:STAT?`	—	Query 0 ADJ state. Returns 0 (OFF) or 1 (ON).
`FUNC:ADJ:SUCC?`	—	Query whether the last 0 ADJ succeeded. Returns 0 (failed) or 1 (succeeded).
`FUNC:ADJ:CLEAR`	—	Turn 0 ADJ OFF and clear the stored zero-correction baseline.
`FUNC:MUNIT UNIT<value>`	1–6	In Alone mode, select the test unit (1–6) supplying the <Measurement Display> reading. *Example: FUNC:MUNIT UNIT2.*
`FUNC:MUNIT?`	—	Query the selected test unit, 1–6.
`FUNC:USERADJ <v1>,<v2>;<v3>,<v4>;…`	Calibration point pairs	Apply user 2-point linearization correction pairs to the current range. *Example: FUNC:USERADJ 1,2e-3;2,1e-3;.*
`FUNC:BIAS <value>`	−0.220E+6–0.220E+6 Ω	Set the <System Setup> resistance offset. *Example: FUNC:BIAS 1 sets an offset of 1 Ω.*
`FUNC:COE <value>`	0.001–99.999	Set the <System Setup> resistance (multiplier) coefficient. *Example: FUNC:COE 1.1.*

1. RT and T are not available on TH2518A.

1.3 APER — measurement speed & averaging

Command	Parameters	Description
`APER <speed>`	FAST, MED, SLOW	Set the measurement speed.
`APER?`	—	Query speed. Returns FAST/MED/SLOW.
`APER:AVER <value>`	1–255	Set the averaging count. *Example: APER:AVER 10.*
`APER:AVER?`	—	Query averaging count, 1–255.

1.4 TRIG — trigger

Command	Parameters	Description
`TRIG`	—	Trigger one measurement. Effective when <Measurement Setup> trigger = BUS.
`TRIG:SOUR <source>`	INT, MAN, EXT, BUS	Set the trigger source (internal continuous / START key / HANDLER external / remote-command bus).
`TRIG:SOUR?`	—	Query trigger source. Returns INT/MAN/EXT/BUS.
`TRIG:DELAY <value>`	0–9.999 s	Set the measurement delay. *Example: TRIG:DELAY 0.01 sets 10 ms.*
`TRIG:DELAY?`	—	Query measurement delay, 0–9.999 s.
`TRIG:DELAY:AUTO ON|OFF`	ON = automatic, OFF = fixed value	Set whether measurement delay is automatic.
`TRIG:DELAY:AUTO?`	—	Returns 0 (automatic) or 1 (fixed value).

1.5 FETC — fetch measurement result

Command	Parameters	Description
`FETC?`	—	Fetch the last measurement result and system status. Returns data only while the instrument is on the <Measurement Display> page — see §7 for the full return format (Alone single-/dual-parameter, and Scan mode with per-channel results).
`FETC:AUTO ON|OFF`	ON / OFF	Enable/disable automatic return of each measurement result.
`FETC:AUTO?`	—	Returns 0 (automatic) or 1 (not automatic).

1.6 TEMP — temperature parameter setup *(TH2518 only)*

Command	Parameters	Description
`TEMP:SENS <sensor>`	PT100, PT500, ANAL	Set the <Measurement Setup> temperature sensor.
`TEMP:SENS?`	—	Returns PT100 / PT500 / ANAL.
`TEMP:APAR <V1>,<T1>,<V2>,<T2>`	V1,V2: 0–2 V · T1,T2: −99.9–999.9 °C	Set the AnLG_In sensor's 2-point linearization (V1,T1) and (V2,T2). *Example: TEMP:APAR 0,0,1,500.*
`TEMP:APAR?`	—	Query V1, T1, V2, T2 (floating point).
`TEMP:CORR:STAT ON|OFF`	ON / OFF	Set the <Measurement Setup> temperature compensation.
`TEMP:CORR:STAT?`	—	Returns 0 (OFF) or 1 (ON).
`TEMP:CORR:PAR <t0>,<αt0>`	t0: −10.0–99.9 °C · αt0: −99999–99999 ppm	Set the reference temperature t0 and material temperature coefficient αt0 used for resistance temperature-correction (Operation Manual §4.3.2). *Example: TEMP:CORR:PAR 10,3930.*
`TEMP:CORR:PAR?`	—	Query t0, αt0 (floating point).

1.7 COMP — comparator (Alone mode, <Boundary Setup>)

The commands below set the single set of comparator limits used in **Alone mode**. For Scan-mode per-channel limits, see §1.8 (CHAN<n>). Each limit field exists in two unit variants — `COMP:RES:…` (Ω, used when parameter = R or R-T) and `COMP:TEMP:…` (°C, used when parameter = T) — and three boundary-mode variants: `ATOL` (AbsDev), `PTOL` (Perc), and `ABS`.

Command	Parameters	Description
`COMP:STAT ON|OFF`	ON / OFF	Enable/disable the Alone-mode comparator.
`COMP:STAT?`	—	Returns 0 (OFF) or 1 (ON).
`COMP:BEEP ON|OFF`	ON / OFF	Enable/disable the comparator beep.
`COMP:BEEP?`	—	Returns ON or OFF.
`COMP:BEEP:MODE NG|GD`	NG, GD	Set the beep mode (beep on fail / beep on pass).
`COMP:BEEP:MODE?`	—	Returns NG or GD.
`COMP:MODE ATOL|PTOL|ABS`	ATOL = AbsDev, PTOL = Perc, ABS = ABS	Set the Alone-mode boundary mode.
`COMP:MODE?`	—	Returns ATOL / PTOL / ABS.

1.7 COMP — limit values (continued)

Command (set / query)	Unit / Parameter	Range	Description
`COMP:RES:REF / ?`	Ω · R/R-T	0–2.0E+5	Nominal value (ABS / AbsDev modes).
`COMP:RES:ATOL:UPP / :LOW / ?`	Ω · R/R-T	−2.0E+5–2.0E+5	AbsDev upper / lower offset from the nominal value (signed; the lower offset is normally negative).
`COMP:RES:PTOL:UPP / :LOW / ?`	% · R/R-T	−99.99–99.99	Perc upper / lower limit.
`COMP:RES:ABS:UPP / :LOW / ?`	Ω · R/R-T	0–2.0E+5	ABS upper / lower limit.
`COMP:TEMP:REF / ?`	℃ · T	−999.9–999.9	Nominal value (ABS / AbsDev modes).
`COMP:TEMP:ATOL:UPP / :LOW / ?`	℃ · T	−999.9–999.9	AbsDev upper / lower limit.
`COMP:TEMP:PTOL:UPP / :LOW / ?`	% · T	−99.99–99.99	Perc upper / lower limit.
`COMP:TEMP:ABS:UPP / :LOW / ?`	℃ · T	−100–999.9	ABS upper / lower limit.

Each entry sets and queries both the upper (`:UPP`) and lower (`:LOW`) limit with the same syntax, e.g. `COMP:RES:ATOL:UPP 2000` / `COMP:RES:ATOL:UPP?` . The RES rows are effective only when <Measurement Setup> parameter = R or R-T and the corresponding boundary mode is selected; the TEMP rows only when parameter = T.

1.8 CHAN<n> — per-channel setup (Scan mode)

`<n>` addresses one scanning channel directly in the command, 1–90.

Command	Parameters	Description
`CHAN<n>:STAT ON|OFF`	ON / OFF	Enable/disable channel n on the <Channel Setup> page. *Example: CHAN2:STAT ON turns CH02 on.*
`CHAN<n>:STAT?`	—	Returns 0 (OFF) or 1 (ON).
`CHAN<n>:ASSIGN <unit>,<hi>,<lo>`	unit: 1–6 · hi,lo: 1–15 (terminal position number)	Assign channel n to test unit <unit>, with high-side terminal <hi> and low-side terminal <lo>. *Example: CHAN2:ASSIGN 5,3,4 assigns CH02 to unit 5, terminal 3 (high) and terminal 4 (low).*
`CHAN<n>:ASSIGN?`	—	Query unit, high terminal, low terminal for channel n (integers).

Boundary-limit commands for channel n follow the same <mode>/<unit> structure as the Alone-mode COMP commands in §1.7, with `COMP:` replaced by `CHAN<n>:`:

Command (set / query)	Unit / Parameter	Range	Description
`CHAN<n>:RES:REF / ?`	Ω · R/R-T	0–2.0E+5	Channel n nominal value.
`CHAN<n>:RES:ATOL:UPP / :LOW / ?`	Ω · R/R-T	−2.0E+5–2.0E+5	Channel n AbsDev upper / lower offset from nominal (signed).
`CHAN<n>:RES:PTOL:UPP / :LOW / ?`	% · R/R-T	−99.99–99.99	Channel n Perc upper / lower limit.
`CHAN<n>:RES:ABS:UPP / :LOW / ?`	Ω · R/R-T	0–2.0E+5	Channel n ABS upper / lower limit.
`CHAN<n>:TEMP:REF / ?`	°C · T	−999.9–999.9	Channel n nominal value.
`CHAN<n>:TEMP:ATOL:UPP / :LOW / ?`	°C · T	−999.9–999.9	Channel n AbsDev upper / lower limit.
`CHAN<n>:TEMP:PTOL:UPP / :LOW / ?`	% · T	−99.99–99.99	Channel n Perc upper / lower limit.
`CHAN<n>:TEMP:ABS:UPP / :LOW / ?`	°C · T	−100–999.9	Channel n ABS upper / lower limit.

Example: CHAN1:RES:ATOL:UPP 2000 sets CH01's AbsDev upper limit to 2000 Ω. The RES rows apply when parameter = R or R-T; the TEMP rows when parameter = T (temperature compensation channel CH01 only, or all channels in parameter-T Scan mode).

1.9 SYST — system setup

Command	Parameters	Description
`SYST:MEASMODE SCAN|ALON`	SCAN, ALON	Set the <System Setup> measurement mode (Scan / Alone).
`SYST:MEASMODE?`	—	Returns SCAN or ALON.
`SYST:BEEP:STAT ON|OFF`	ON / OFF	Set the touch-tone (key beep).
`SYST:BEEP:STAT?`	—	Returns 0 (OFF) or 1 (ON).
`SYST:SHIF ON|OFF`	ON / OFF	Set the HANDLER shift output.
`SYST:SHIF?`	—	Returns 0 (OFF) or 1 (ON).
`SYST:LFR <50|60>`	50, 60	Set the AC line frequency (Hz).
`SYST:LFR?`	—	Returns 0 (50 Hz) or 1 (60 Hz).
`SYST:EXTVCC INT|EXT`	INT / EXT	Set the HANDLER power source (internal/external).
`SYST:EXTVCC?`	—	Returns INT or EXT.
`SYST:SAVE <slot>,<name>`	slot: 1–30 · name: ≤8 chars, no extension	Save the current settings to internal file <slot>. *Example: SYST:SAVE 2,abc.*
`SYST:LOAD <slot>`	slot: 1–30	Load internal file <slot> (must already contain a saved file; ignored otherwise).
`SYST:RESET`	—	Trigger the <System Setup> page's system reset.
`SYST:PUMP ON|OFF`	ON / OFF	Drive the HANDLER connector's PUMP output (pin 7) high/low.

1.10 Common commands

Command	Description
`*RST`	Reset the instrument to factory default settings.
`*TRG`	Trigger one measurement and return the result; effective when <Measurement Setup> trigger source = BUS.
`*IDN?`	Query the instrument model.

SECTION 2

SCPI Communication Debug Procedure

2.1 Instrument setup

On the instrument: set Bus Mode to RS232C, Baud Rate to 9600, and (under <System Setup> Tools) 232 Protocol to SCPI.

2.2 Terminal software

Any standard serial terminal can be used. Configure: the COM port matching the instrument's connection, the baud rate matching the instrument's setting, no parity, 8 data bits, 1 stop bit, and line-ending/"send new line" mode enabled (a command sent without a line ending will not get a response).

2.3 Connection test

1. Connect the instrument to the PC with a null-modem (crossover) RS232 cable.
2. Open the terminal, select the correct COM port, and set the baud rate to match the instrument.
3. Send `*IDN?` with the line ending enabled.
4. A response confirms the link is working, returning the instrument's model, firmware version and related identification text.

> **NOTE**
> If there is no response, check: that pins 2 and 3 of the serial cable are crossed (TXD ↔ RXD) — this applies to a USB-to-serial adapter cable too; and that the baud rate, COM port and 232 Protocol (SCPI) settings match the instrument.

2.4 Fetching a measurement result

Data is returned only while the instrument is on the <Measurement Display> page.

Mode	Procedure
Manual	Set <Measurement Setup> trigger to BUS. Send `TRIG`, then `FETC?` (allow time between the two for the measurement to complete), or send `*TRG` once as initialization and repeat `FETC?`. Repeat for each new reading.
Semi-automatic (recommended)	Set trigger to BUS. Set <System Setup> Tools → FetcAuto to ON (persists across power-off). Send `TRIG` for each reading — wait for the previous result before sending the next TRIG.
Fully automatic	Set trigger to INT. Set FetcAuto to ON. The instrument sends the result automatically after every measurement, with no command needed.

See §7 for the exact data-return format for both Alone and Scan mode.

SECTION 3

MODBUS Protocol Framing

The TH2518 series MODBUS implementation uses a fixed-length holding-register frame with function code `0x10` (write, preset multiple registers) and `0x03` (read, read holding registers). It is carried over RS232C only, when <System Setup> Tools → 232 Protocol is set to MODBUS.

3.1 Write frame (function 0x10)

Request: `[addr][0x10][reg-hi][reg-lo][reg-count-hi][reg-count-lo][byte-count][data 1..n][CRC-lo][CRC-hi]`

Response: `[addr][func][reg-hi][reg-lo][reg-count-hi][reg-count-lo][CRC-lo][CRC-hi]`

Field	Meaning
Send address	The instrument's bus address, set under <System Setup> → 232 Address. Range 1–31 (0x01–0x1F).
Function code	`0x10` for a write.
Register address (hi/lo)	The register's address in the instrument's internal map (§4).
Register count (hi/lo)	Number of 16-bit registers used by this value: 1 for a 2-byte (16-bit integer) value, 2 for a 4-byte (single float) value, 4 for an 8-byte (two floats) value, 6 for a 12-byte (three-field) value.
Byte count	Total data bytes written — always register count × 2.
Data bytes 1..n	The value(s) to write, most-significant byte first. A 2-byte value is a 16-bit integer; a 4-byte value is an IEEE-754 single-precision float; an 8/12-byte value is two/three consecutive floats (or integers, for CHAN<n>:ASSIGN). *Example: decimal 25.16 = hex 41 C9 47 AE (byte 1 = 0x41 … byte 4 = 0xAE).*
CRC (lo/hi)	CRC16 checksum of the preceding bytes — see §5.

3.2 Read frame (function 0x03)

Request: `[addr][0x03][reg-hi][reg-lo][reg-count-hi][reg-count-lo][CRC-lo][CRC-hi]`

Response: `[addr][func][byte-count][data 1..n][CRC-lo][CRC-hi]`

Fields follow the same meanings as the write frame; the byte-count and data fields describe the returned value rather than a value to write.

SECTION 4

MODBUS Register Map

Each register corresponds one-to-one to an SCPI command in §1; the parameter ranges, units and enumerations there apply equally here. Data width: "2B" = one 16-bit register (integer), "4B" = two registers (one float), "8B" = four registers (two floats), "12B" = six registers (three fields), "16B" = eight registers (four floats).

4.1 Common & display registers

Addr	Function	Width	Equivalent SCPI
0x0001	Reset instrument (write-only)	2B	*RST
0x0002	Trigger & auto-return result (read) — semi-automatic workflow, see §7	Alone: 4 / 8 / 12B · Scan: 8B (comparator OFF) or 12B (comparator ON) per enabled channel	TRIG + FETC?
0x0003	Instrument model (read). 0 = TH2518, 1 = TH2518A	2B	*IDN?
0x0004	Display page	2B	DISP:PAGE
0x0005	Measurement-result display ON/OFF	2B	DISP:STAT

4.2 Measurement parameter & range registers

Addr	Function	Width	Equivalent SCPI
0x0006	Parameter (R/R-T/T)	2B	FUNC:IMP
0x0007	R/R-T range	4B	FUNC:RANG
0x0008	Range mode (AUTO/NOM/HOLD)	2B	FUNC:RANG:MODE
0x0009	0 ADJ execute / clear	2B	FUNC:ADJ:EXE / :CLEAR
0x000A	0 ADJ state (read)	2B	FUNC:ADJ:STAT? / :SUCC?
0x000B	Measurement unit (Alone mode, 1–6)	2B	FUNC:MUNIT
0x000C	Measurement speed	2B	APER
0x000D	Average count (1–255)	2B	APER:AVER
0x0047	Resistance offset	4B	FUNC:BIAS
0x0048	Resistance coefficient	4B	FUNC:COE

4.3 Trigger & fetch registers

Addr	Function	Width	Equivalent SCPI
0x000E	Trigger (non-automatic workflow, write-only)	2B	TRIG
0x000F	Trigger source	2B	TRIG:SOUR
0x0010	Measurement delay	4B	TRIG:DELAY
0x0011	Measurement delay AUTO/fixed	2B	TRIG:DELAY:AUTO
0x0012	Read single-parameter value, comparator OFF	4B	FETC? (Alone, 1 param, cmp off)
0x0013	Read single-parameter value, comparator ON	8B	FETC? (Alone, 1 param, cmp on)
0x0014	Read dual-parameter value, comparator OFF	8B	FETC? (Alone, R-T, cmp off)
0x0015	Read dual-parameter value, comparator ON	12B	FETC? (Alone, R-T, cmp on)
0x0016	Scan-mode channel-number selector (write before 0x0017/0x0018)	2B	—
0x0017	Read scan-mode value for selected channel, comparator OFF	4B	FETC? (Scan, cmp off)
0x0018	Read scan-mode value for selected channel, comparator ON	8B	FETC? (Scan, cmp on)
0x0019	Automatic-fetch enable	2B	FETC:AUTO

4.4 Temperature registers *(TH2518 only)*

Addr	Function	Width	Equivalent SCPI
0x001A	Sensor (PT100/PT500/ANAL)	2B	TEMP:SENS
0x001B	V1, T1, V2, T2	16B	TEMP:APAR
0x001C	Temperature compensation ON/OFF	2B	TEMP:CORR:STAT
0x001D	t0, αt0	8B	TEMP:CORR:PAR

4.5 Comparator registers (Alone mode)

Addr	Function	Width	Equivalent SCPI
0x001E	Comparator ON/OFF	2B	COMP:STAT
0x001F	Comparator beep ON/OFF	2B	COMP:BEEP
0x0020	Beep mode (NG/GD)	2B	COMP:BEEP:MODE
0x0021	Boundary mode (ATOL/PTOL/ABS)	2B	COMP:MODE
0x0022	Nominal, Ω	4B	COMP:RES:REF
0x0023 / 0x0024	AbsDev upper / lower, Ω	4B each	COMP:RES:ATOL:UPP / :LOW
0x0025 / 0x0026	Perc upper / lower, %	4B each	COMP:RES:PTOL:UPP / :LOW
0x0027 / 0x0028	ABS upper / lower, Ω	4B each	COMP:RES:ABS:UPP / :LOW
0x0029	Nominal, °C	4B	COMP:TEMP:REF
0x002A / 0x002B	AbsDev upper / lower, °C	4B each	COMP:TEMP:ATOL:UPP / :LOW
0x002C / 0x002D	Perc upper / lower, %	4B each	COMP:TEMP:PTOL:UPP / :LOW
0x002E / 0x002F	ABS upper / lower, °C	4B each	COMP:TEMP:ABS:UPP / :LOW

4.6 Per-channel registers (Scan mode)

Unlike the SCPI `CHAN<n>` commands, MODBUS has no per-channel register address space — register **0x0030 must be written first** to select the target channel (1–90), and registers 0x0031–0x0040 then read/write that selected channel's settings.

Addr	Function	Width	Equivalent SCPI
0x0030	Select target channel n, 1–90 (write-only)	2B	— (implicit in CHAN<n>)
0x0031	Channel n ON/OFF	2B	CHAN<n>:STAT
0x0032	Channel n test unit, high terminal, low terminal	12B	CHAN<n>:ASSIGN
0x0033	Channel n nominal, Ω	4B	CHAN<n>:RES:REF
0x0034 / 0x0035	Channel n AbsDev upper / lower, Ω	4B each	CHAN<n>:RES:ATOL:UPP / :LOW
0x0036 / 0x0037	Channel n Perc upper / lower, %	4B each	CHAN<n>:RES:PTOL:UPP / :LOW
0x0038 / 0x0039	Channel n ABS upper / lower, Ω	4B each	CHAN<n>:RES:ABS:UPP / :LOW
0x003A	Channel n nominal, ℃	4B	CHAN<n>:TEMP:REF
0x003B / 0x003C	Channel n AbsDev upper / lower, ℃	4B each	CHAN<n>:TEMP:ATOL:UPP / :LOW
0x003D / 0x003E	Channel n Perc upper / lower, %	4B each	CHAN<n>:TEMP:PTOL:UPP / :LOW
0x003F / 0x0040	Channel n ABS upper / lower, ℃	4B each	CHAN<n>:TEMP:ABS:UPP / :LOW

4.7 System registers

Addr	Function	Width	Equivalent SCPI
0x0041	Touch tone ON/OFF	2B	SYST:BEEP:STAT
0x0042	Measurement mode (SCAN/ALON)	2B	SYST:MEASMODE
0x0043	Shift output ON/OFF	2B	SYST:SHIF
0x0044	AC line frequency	2B	SYST:LFR
0x0045	HANDLER power (internal/external)	2B	SYST:EXTVCC
0x0046	System reset (write-only)	2B	SYST:RESET

SYST:SAVE, SYST:LOAD and SYST:PUMP have no documented MODBUS register equivalent — use the SCPI interface (§1.9) for these functions.

SECTION 5

CRC16 Calculation

Every MODBUS frame ends with a 2-byte CRC16 checksum (low byte first, then high byte) covering every preceding byte of the frame, calculated with the standard lookup-table method shown below.

```
U16 CalcCrc16Code(char *pbuf, U16 size)
{
  U8 crc_high = 0xFF;
  U8 crc_low  = 0xFF;
  U8 crc_index;
  U16 crc_code;

  while (size--) {
    crc_index = crc_low ^ *pbuf++;
    crc_low  = crc_high ^ Crc16HighTable[crc_index];
    crc_high = Crc16LowTable[crc_index];
  }
  crc_code = ((crc_high << 8) | crc_low);
  return (crc_code);
}
```

Lookup tables (each 256 bytes, indexed by `crc_index`):

```
Crc16HighTable[] = {
0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,
0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
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0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,
0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,
0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,
0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,
0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40,0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,
0x00,0xC1,0x81,0x40,0x01,0xC0,0x80,0x41,0x01,0xC0,0x80,0x41,0x00,0xC1,0x81,0x40 };

Crc16LowTable[] = {
0x00,0xC0,0xC1,0x01,0xC3,0x03,0x02,0xC2,0xC6,0x06,0x07,0xC7,0x05,0xC5,0xC4,0x04,
0xCC,0x0C,0x0D,0xCD,0x0F,0xCF,0xCE,0x0E,0x0A,0xCA,0xCB,0x0B,0xC9,0x09,0x08,0xC8,
0xD8,0x18,0x19,0xD9,0x1B,0xDB,0xDA,0x1A,0x1E,0xDE,0xDF,0x1F,0xDD,0x1D,0x1C,0xDC,
0x14,0xD4,0xD5,0x15,0xD7,0x17,0x16,0xD6,0xD2,0x12,0x13,0xD3,0x11,0xD1,0xD0,0x10,
0xF0,0x30,0x31,0xF1,0x33,0xF3,0xF2,0x32,0x36,0xF6,0xF7,0x37,0xF5,0x35,0x34,0xF4,
0x3C,0xFC,0xFD,0x3D,0xFF,0x3F,0x3E,0xFE,0xFA,0x3A,0x3B,0xFB,0x39,0xF9,0xF8,0x38,
0x28,0xE8,0xE9,0x29,0xEB,0x2B,0x2A,0xEA,0xEE,0x2E,0x2F,0xEF,0x2D,0xED,0xEC,0x2C,
0xE4,0x24,0x25,0xE5,0x27,0xE7,0xE6,0x26,0x22,0xE2,0xE3,0x23,0xE1,0x21,0x20,0xE0,
0xA0,0x60,0x61,0xA1,0x63,0xA3,0xA2,0x62,0x66,0xA6,0xA7,0x67,0xA5,0x65,0x64,0xA4,
0x6C,0xAC,0xAD,0x6D,0xAF,0x6F,0x6E,0xAE,0xAA,0x6A,0x6B,0xAB,0x69,0xA9,0xA8,0x68,
0x78,0xB8,0xB9,0x79,0xBB,0x7B,0x7A,0xBA,0xBE,0x7E,0x7F,0xBF,0x7D,0xBD,0xBC,0x7C,
0xB4,0x74,0x75,0xB5,0x77,0xB7,0xB6,0x76,0x72,0xB2,0xB3,0x73,0xB1,0x71,0x70,0xB0,
0x50,0x90,0x91,0x51,0x93,0x53,0x52,0x92,0x96,0x56,0x57,0x97,0x55,0x95,0x94,0x54,
0x9C,0x5C,0x5D,0x9D,0x5F,0x9F,0x9E,0x5E,0x5A,0x9A,0x9B,0x5B,0x99,0x59,0x58,0x98,
0x88,0x48,0x49,0x89,0x4B,0x8B,0x8A,0x4A,0x4E,0x8E,0x8F,0x4F,0x8D,0x4D,0x4C,0x8C,
0x44,0x84,0x85,0x45,0x87,0x47,0x46,0x86,0x82,0x42,0x43,0x83,0x41,0x81,0x80,0x40 };
```

SECTION 6

MODBUS Communication Debug Procedure

> **NOTE**
> Verify RS232C wiring and settings with the SCPI procedure (§2) first, then switch 232 Protocol to MODBUS.

6.1 Instrument setup

Set <System Setup> 232 Address (example used below: 8) and set Tools → 232 Protocol to MODBUS.

6.2 Connection test

Send (hex): `08 03 00 03 00 01 74 93` — a read of register 0x0003 (instrument model) from bus address 8.

Expected response: `08 03 02 00 00 64 45` (model 0 = TH2518). A response confirms the link; no response means the bus address or 232 Protocol setting does not match.

6.3 Fetching a measurement result — Alone mode

Mode	Procedure
Manual	Set trigger to BUS. Write register 0x000E to trigger: `08 10 00 0E 00 01 02 00 00 CD 2E` → `08 10 00 0E 00 01 60 93`. Then read register 0x0013 (comparator ON) for the result: `08 03 00 13 00 04 B5 55` → `08 03 08 43 16 FF 56 40 00 00 00 C1 6C`. Repeat both steps for each new reading.
Semi-automatic (recommended)	Set trigger to BUS and FetcAuto ON. Read register 0x0002 to trigger and fetch in one transaction: `08 03 00 02 00 01 25 53` → `08 03 08 3B 54 C6 1E 40 40 00 00 41 59`. Wait for each response before sending the next read.
Fully automatic	Set trigger to INT and FetcAuto ON. The instrument sends the result automatically after every measurement, with no request needed.

6.4 Fetching a measurement result — Scan mode

Mode	Procedure
Manual	Trigger via register 0x000E as above. Write register 0x0016 to select the channel to read, e.g. channel 5: `08 10 00 16 00 01 02 00 05 0E F5` → `08 10 00 16 00 01 E0 94`. Then read register 0x0018 (comparator ON) for that channel's result: `08 03 00 18 00 04 C4 97` → `08 03 08 44 81 E4 29 3F 80 00 00 68 5E`. Repeat the channel-select and read steps for each channel, and the trigger step for each new scan.
Semi-/fully automatic	Read (or auto-receive) register 0x0002 as in §6.3 — in Scan mode this returns every enabled channel's number, value and (if comparator is ON) result in one frame, formatted as in §7.3.

> **NOTE — CHANNEL-COUNT LIMIT**
> The semi-automatic and fully-automatic Scan-mode return via register 0x0002 is limited to 32 enabled channels or fewer when the comparator is OFF, and 21 enabled channels or fewer when the comparator is ON. For a larger channel count, or to poll channels individually, use the manual workflow (register 0x0016 channel-select + 0x0017/0x0018 read) instead.

SECTION 7

Measurement Data Return Format

Sections 7.1–7.4 describe the **SCPI text format** returned by `FETC?` (ASCII, comma/semicolon separated). The **MODBUS binary format** of the measurement-result registers (0x0002, 0x0012–0x0015, 0x0017–0x0018) is different and is described separately in §7.5. Both apply only while the instrument is on the <Measurement Display> page.

7.1 Alone mode, single-parameter (R or T)

SCPI format: `<main value>,<status>`

Field	Description
Main value	Floating point. Resistance in Ω (parameter R) or temperature in °C (parameter T). On overflow or measurement error: `+9.900000E+37`.
Status	`-1` = no data in buffer · `0` = normal measurement · `+1` = measurement error.

Example: `+2.434457E+01,+0` — resistance 24.34457 Ω, measurement normal. With the comparator ON, a third field (comparator result, see §7.3) is appended.

7.2 Alone mode, dual-parameter (R-T)

SCPI format: `<main value>,<secondary value>,<status>`

Field	Description
Main value	Resistance, Ω. `+9.900000E+37` on overflow/error.
Secondary value	Temperature, °C. `+9.900000E+37` on overflow/error.
Status	Same codes as §7.1.

Example: `+2.434709E+01,+9.205499E+01,+0` — resistance 24.34457 Ω, temperature 92.05499 °C, measurement normal. With the comparator ON, a fourth field (comparator result) is appended.

7.3 Comparator result field

Value	Meaning
1	GD — within limits (pass)
2	HI — above the upper limit
3	LO — below the lower limit

7.4 Scan mode

SCPI format — one group per enabled channel, semicolon-separated:

`<channel 1>,<main value>,<comparator result>;<channel 2>,<main value>,<comparator result>;…<channel n>,<main value>,<comparator result>`

Field	Description
Channel number	The scanning-channel number, included for every enabled channel, 1–90.
Main value	That channel's measured value (Ω or ℃, per the current parameter). `+9.900000E+37` on overflow/error.
Comparator result	Present only when the <Measurement Display> page comparator is ON. Coded as in §7.3 (1=GD, 2=HI, 3=LO).

> **NOTE — TEMPERATURE COMPENSATION**
> If temperature compensation is ON while measuring resistance in Scan mode, channel 1 is always enabled and always reports temperature (the compensation reference), regardless of its own ON/OFF setting.

7.5 MODBUS binary format

All values are IEEE-754 single-precision floats (4 bytes, most-significant byte first); the comparator result is also returned as a 4-byte float (1.0 = GD, 2.0 = HI, 3.0 = LO). The byte count in the response equals the data length shown.

Register	Mode	Read count (registers)	Data bytes	Fields (4 bytes each)
`0x0012`	Alone, 1 parameter, comparator OFF	2	4	main
`0x0013`	Alone, 1 parameter, comparator ON	4	8	main, comparator
`0x0014`	Alone, R-T, comparator OFF	4	8	main (R), secondary (T)
`0x0015`	Alone, R-T, comparator ON	6	12	main (R), secondary (T), comparator
`0x0017`	Scan, selected channel, comparator OFF	2	4	main
`0x0018`	Scan, selected channel, comparator ON	4	8	main, comparator
`0x0002`	Alone, auto-return (read count 1)	1	4 / 8 / 8 / 12	as 0x0012 / 0x0013 / 0x0014 / 0x0015
`0x0002`	Scan, auto-return (read count 1)	1	8 × N (comparator OFF) or 12 × N (comparator ON)	per enabled channel: channel number, main value [, comparator]

N = number of enabled channels. Overflow or measurement error: +9.90000E+9 (Alone registers 0x0012–0x0015) or +9.90000E+37 (Scan register 0x0017/0x0018 and auto-return 0x0002).

7.6 Worked MODBUS example — Scan mode, comparator ON (register 0x0002)

Request: `08 03 00 02 00 01 25 53`

Response (7 channels shown): each channel returns 3 fields of 4 bytes (channel number as float, measured value as float, comparator result as float):

```
08 03 54
3F800000  3DD4BE83  3F800000   CH1 = 1,  0.103879 Ω,  GD
40000000  3F808E37  3F800000   CH2 = 2,  1.0043 Ω,    GD
40400000  430FF5C3  40000000   CH3 = 3,  143.96 Ω,    HI
40800000  42CC072B  40000000   CH4 = 4,  102.014 Ω,   HI
40A00000  4481CAE1  3F800000   CH5 = 5,  1038.34 Ω,   GD
40C00000  460BC3AE  40000000   CH6 = 6,  8944.92 Ω,   HI
40E00000  44B39AE1  3F800000   CH7 = 7,  1436.84 Ω,   GD
AC84                           CRC
```

Byte count 0x54 = 84 bytes = 7 channels × 12 bytes/channel. Each 4-byte field is an IEEE-754 single-precision float, read most-significant byte first (e.g. `3F800000` = 1.0, `3DD4BE83` ≈ 0.103879).

Related documents

- TH2518 Series Operation Manual (Techmize) — instrument setup, front-panel operation, remote-interface physical setup, HANDLER interface and TH2518-01 sorting board
- TH2518 Series Datasheet (Techmize)

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