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COMMAND REFERENCE

TH199X Series SCPI Command Reference

Precision Source/Measure Units — TH1991C / TH1991B / TH1991A / TH1991 (single channel) and TH1992B / TH1992A / TH1992 (dual channel). Covers the complete remote-command set of the platform family; see the TH199X Series Operation Manual for front-panel operation, interfaces and connection procedures.

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TH199X Series SCPI Command Reference

Precision Source/Measure Units — TH1991C / TH1991B / TH1991A / TH1991 / TH1992B / TH1992A / TH1992

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CHAPTER 1

Introduction & Conventions

1.1 About this reference

This document is the remote-command reference for the Techmize TH199X series of precision source/measure units — TH1991C, TH1991B, TH1991A, TH1991 (single channel) and TH1992B, TH1992A, TH1992 (dual channel). The commands are SCPI (Standard Commands for Programmable Instruments) commands; the command set has been streamlined and consists of the subsystems DISPlay, FORMat, FETCh, MEASure, OUTPut, READ, SENSe, SOURce, SYSTem, TRIGger and CALCulate, plus three common commands (*RST, *IDN?, *OPC).

Commands that address channel 2 apply to the TH1992 series only. Front-panel operation, the remote interfaces and the connection procedures are described in the TH199X Series Operation Manual (Chapter 9); the specifications that limit the values of the parameters are given in the TH199X Series Technical Guide.

1.2 Remote interfaces

Interface	Notes
RS232C	Standard. DB9 connector; baud rate 4800 / 9600 / 19200 / 38400 / 115200, 8 data bits, 1 stop bit, no parity.
USB device	Standard. USB-B connector; USBTMC or USBCDC (virtual serial port) mode.
LAN	Standard. 10/100 Base-T.
GPIB	Optional, via the TH26075F GPIB adapter.

Commands are sent as ASCII text terminated by NL (line feed, ASCII 10); replies to queries are terminated by NL. Send `*IDN?` to check the connection.

1.3 Command structure

SCPI commands are tree-structured. The highest level is called the subsystem command; each further level is separated by a colon.

- **Case is ignored.** `SENS1:RES:RANG:AUTO ON` is equivalent to `sens1:res:rang:auto on`.
- **A space separates the command from its parameter.** In `:SENSe1:FUNCtion Power`, FUNCtion is the command and Power is its parameter.
- **No spaces before or after a colon.** `SENS1 : RES : RANG:AUTO ON` is wrong; `SENS1:RES:RANG:AUTO ON` is correct.
- **Commands may be abbreviated or spelled out in full.** The abbreviation is given in capital letters in this reference; `SENS1:RES:RANG:AUTO ON` is equivalent to `SENSe1:RESistance:RANGe:AUTO ON`.
- **A question mark** after a command makes it a query, for example `:SENSe1:RES:RANG:AUTO?` queries the setting made with `:SENSe1:RES:RANG:AUTO`.
- All punctuation in command syntax is English punctuation.

1.4 Multiple commands on one line

- A semicolon (;) separates multiple commands on the same command line. Commands at the same level under the same subsystem may follow each other after the semicolon.
- A semicolon immediately followed by a colon (;:) restarts the command from the top of the command tree. Example: `:SENS:RES:RANG:AUTO ON;:SENS:FUNC Power`
- Common commands can be inserted before, in the middle of or at the end of the command line, separated by semicolons, without affecting the hierarchy of the command line. Examples: `*trg;:SENS1:RES:RANG:AUTO ON` and `:SENS1:RES:RANG:AUTO ON;*trg`

1.5 Abbreviation rules

- If the full command or parameter name (the long form) has four characters or fewer, the abbreviation and the long form are the same.
- If the long form has more than four characters: when the fourth character is a vowel, the abbreviation takes the first three characters; otherwise it takes the first four. Examples: MODE → `MODE`; TRIGger → `TRIG`; LEVel → `LEV`.
- If a name consists of more than two words, the long form takes the first character of the first word and all of the last word, and the abbreviation is derived from that long form. Example: Percent TOLerance → PTOLerance → `PTOL`.
- Commands, parameters and units are not case sensitive.

1.6 Symbols, data types and channel parameters

Symbol	Meaning
`:`	Command level separator — goes to the next level of the command tree.
`;`	Separates multiple commands on one line.
`*`	Marks a common command.
`?`	Marks a query.
`,`	Separates multiple parameters.
space	Separates the command from its parameter.
`" "`	Quoted content is taken as written; the command parser does not process it.
`< >`	Program-code parameter; when several options are listed inside, only one of them is selected.
`[ ]`	The enclosed item is optional.
`{ }`	Several of the enclosed parameters may be given.

Data type	Description
NR1	Integer, for example 123.
NR2	Fixed-point number, for example 12.3.
NR3	Floating-point number, for example 12.3E+5.
NRf	Any of NR1, NR2 or NR3.
Bool	1 or 0, or ON or OFF.
SPD	String program data — string parameters enclosed in single or double quotation marks.
CPD	Character program data — discrete parameters; both short and long forms are accepted.
SRD	String response data — string parameters enclosed in single or double quotation marks.
CRD	Character response data — discrete data; the short form is returned.
Expr	Channel list, group list or mathematical expression.
NL	Line separator, ASCII 10 — the terminator of string input and output.

Channel suffix [c]

[c] is 1 or 2 and selects channel 1 or channel 2 (channel 2 exists on the TH1992 series only). If [c] is omitted, channel 1 is used. An abbreviated numeric suffix is equivalent to the number 1.

Channel list parameters

Symbol	Channels included
`(@1)`	Channel 1
`(@2)`	Channel 2
`(@1,2)`	Channels 1 and 2

Symbol	Channels included
`(@1:2)`	Channel 1 through channel 2
`(@2,1)`	Channels 2 and 1
`(@2:1)`	Channel 2 through channel 1

1.7 Data output format

Measurement data returned by the instrument contains the elements specified with `:FORMat:ELEMents:SENSe`. Available elements are voltage, current and resistance measurement data, time data, status data and source-output-setting data. A terminator <NL> (0x0A, 1 byte) is appended to the end of each data set.

- **ASCII format** (selected with `:FORMat[:DATA] ASCii`): comma-separated results, with three special values: `+9.910000E+37` means “not a number”, `+9.900000E+37` means positive infinity and `-9.900000E+37` means negative infinity. Example of three elements: `+1.000001E-06,+1.000002E-06,+9.999999E-07<NL>`
- **IEEE-754 single-precision format** (selected with `:FORMat[:DATA] REAL,32`): each data element is a 4-byte value in a binary block. Special values: NAN (not a number), +infinity and −infinity.
- **IEEE-754 double-precision format** (selected with `:FORMat[:DATA] REAL,64`): each data element is an 8-byte value in a binary block, with the same special values.

If a measurement function is not enabled or the requested data does not exist, the value returned is `+9.910000E+37` (ASCII) or NaN (IEEE-754), which indicates no data.

1.8 How the commands are documented

Each command entry gives the full command name with its abbreviation in capital letters, a description, the set syntax (**Set**), the query syntax (**Query**), the parameters with their ranges and default values, the data returned by a query (**Response**) and notes. Numeric values are given in SI base units (A, V, s, Hz); the unit is not part of the command. Commands that have only a query form are marked with a question mark in the command name; commands without a query form have no **Query** row.

CHAPTER 2

Measurement & Data Commands

This chapter covers the commands that select what is displayed and returned (DISPlay, FORMat), those that read measurement results (FETCh, MEASure) and the automatic data-return command (READ).

2.1 DISPlay subsystem

Front-panel display settings.

2.1.1 :DISPlay:DIGits

Sets the display resolution of the data shown on the front panel.

SET	`:DISPlay:DIGits <digits>`
QUERY	`:DISPlay:DIGits?`
PARAMETERS	**`<digits>`** — 4 to 7 (NR1), default 7. 4 = 3½-digit, 5 = 4½-digit, 6 = 5½-digit, 7 = 6½-digit resolution.
RESPONSE	`<digits>` (NR1) — the current setting: 4, 5, 6 or 7.

2.1.2 :DISPlay:VIEW

Sets the display mode.

SET	`:DISPlay:VIEW <mode>`
QUERY	`:DISPlay:VIEW?`
PARAMETERS	**`<mode>`** — `SINGle1` · `SINGle2` · `DUAL` (CPD). `SINGle1`: channel 1 display (default on single-channel instruments). `SINGle2`: channel 2 display (two-channel models only). `DUAL`: channel 1 and 2 display (two-channel models only; default on two-channel instruments).
RESPONSE	`<mode>` (CRD) — `SING1`, `SING2` or `DUAL`.

2.1.3 :DISPlay[c]:PARAmeter

Sets the two measurement parameters shown for a channel.

SET	`:DISPlay[c]:PARAmeter <para>`
QUERY	`:DISPlay[c]:PARAmeter?`
PARAMETERS	**`<para>`** — Any combination of two of `I` (current), `V` (voltage), `R` (resistance) and `P` (power) (CPD).
RESPONSE	`<para>` (CRD) — the current display parameters.
EXAMPLE	`:DISPlay:PARAmeter I,V` — *show the I and V measurement results of channel 1*

2.2 FORMat subsystem

Selects which elements are contained in returned measurement data.

2.2.1 :FORMat:ELEMents:SENSe

Specifies the elements contained in the measurement result data returned by `FETCh?` and `MEASure?`.

SET	`:FORMat:ELEMents:SENSe <type>[,<type>...]`
QUERY	`:FORMat:ELEMents:SENSe?`
PARAMETERS	**`<type>`** — `VOLTage` · `CURRent` · `RESistance` · `TIME` (CPD).
RESPONSE	`<format>` (CRD) — the currently specified elements, separated by commas.
NOTE	The elements are returned in the fixed order VOLTage, CURRent, RESistance, TIME; elements that are not selected are left out.

2.3 FETCh subsystem

Reads back measurement data without starting a new measurement. The data is retained until `:INITiate` or `:MEASure` is executed. The elements returned are those selected with `:FORMat:ELEMents:SENSe`; the data format is described in §1.7.

2.3.1 :FETCh:ARRay?

Returns the array of all voltage, current, resistance, time, status and source-output-setting data specified by `:FORMat:ELEMents:SENSe`.

QUERY	`:FETCh:ARRay? [<chanlist>]`
PARAMETERS	**`[chanlist]`** — `(@1)` (default) · `(@2)` · `(@1,2)` · `(@1:2)` · `(@2,1)` · `(@2:1)` — channel list (Expr). Channel 2 is available on TH1992-series instruments only.
RESPONSE	`<response>` (NR3) — the array data. With several channels and steps the data is interleaved step by step, for example a 10-step sweep on channel 1 and a 5-step sweep on channel 2 with current and source data selected returns `ch1curr1, ch1sour1, ch2curr1, ch2sour1, ... ch1curr6, ch1sour6, +9.910000E+37, +9.910000E+37, ...`.
NOTE	If the measurement function is not enabled or the data does not exist, the value returned is `+9.910000E+37` (ASCII) or NaN (IEEE-754), which indicates no data.

2.3.2 :FETCh:ARRay:<CURRent|RESistance|TIME|VOLTage>?

Returns the array of the data of the selected element (current, resistance, time or voltage).

QUERY	`:FETCh:ARRay:<CURRent|RESistance|TIME|VOLTage>? [<chanlist>]`
PARAMETERS	**`[chanlist]`** — `(@1)` (default) · `(@2)` · `(@1,2)` · `(@1:2)` · `(@2,1)` · `(@2:1)` — channel list (Expr). Channel 2 is available on TH1992-series instruments only.
RESPONSE	`<response>` (NR3) — the array data of the selected element, for example `ch1curr1, ch2curr1, ch1curr2, ch2curr2, ...`.
NOTE	If the measurement function is not enabled or the data does not exist, the value returned is `+9.910000E+37` (ASCII) or NaN (IEEE-754), which indicates no data.

2.3.3 :FETCh[:SCALar]?

Returns the latest voltage, current, resistance, time, status and source-output-setting data specified by `:FORMat:ELEMents:SENSe`.

QUERY	`:FETCh[:SCALar]? [<chanlist>]`
PARAMETERS	**`[chanlist]`** — `(@1)` (default) · `(@2)` · `(@1,2)` · `(@1:2)` · `(@2,1)` · `(@2:1)` — channel list (Expr). Channel 2 is available on TH1992-series instruments only.
RESPONSE	`<response>` (NR3) — the latest data, for example `ch1curr10, ch1sour10, ch2curr5, ch2sour5`.
NOTE	If the measurement function is not enabled or the data does not exist, the value returned is `+9.910000E+37` (ASCII) or NaN (IEEE-754), which indicates no data.

2.3.4 :FETCh[:SCALar]:<CURRent|RESistance|TIME|VOLTage>?

Returns the latest data of the selected element (current, resistance, time or voltage).

QUERY	`:FETCh[:SCALar]:<CURRent|RESistance|TIME|VOLTage>? [<chanlist>]`
PARAMETERS	**`[chanlist]`** — `(@1)` (default) · `(@2)` · `(@1,2)` · `(@1:2)` · `(@2,1)` · `(@2:1)` — channel list (Expr). Channel 2 is available on TH1992-series instruments only.
RESPONSE	`<response>` (NR3) — the latest data of the selected element, for example `ch1curr10, ch2curr5`.
NOTE	If the measurement function is not enabled or the data does not exist, the value returned is `+9.910000E+37` (ASCII) or NaN (IEEE-754), which indicates no data.

2.4 MEASure subsystem

Performs a point (single) measurement and returns the result. Before executing these commands, set the measurement conditions with SCPI commands or on the front panel.

2.4.1 :MEASure?

Performs a point measurement and returns the measurement result data. The elements returned are selected with `:FORMat:ELEMents:SENSe`.

QUERY	`:MEASure? [<chanlist>]`
PARAMETERS	**`[chanlist]`** — `(@1)` (default) · `(@2)` · `(@1,2)` · `(@1:2)` · `(@2,1)` · `(@2:1)` — channel list (Expr). Channel 2 is available on TH1992-series instruments only.
RESPONSE	`<response>` (NR3) — the present measurement data, for example `ch1curr, ch1sour, ch2curr, ch2sour`.
NOTE	If the measurement function is not enabled or the data does not exist, the value returned is `+9.910000E+37` (ASCII) or NaN (IEEE-754), which indicates no data.

2.4.2 :MEASure:<CURRent[:DC]|RESistance|VOLTage[:DC]>?

Performs a point measurement of the selected function (current, resistance or voltage) and returns the result.

QUERY	`:MEASure:<CURRent[:DC]|RESistance|VOLTage[:DC]>? [<chanlist>]`
PARAMETERS	**`[chanlist]`** — `(@1)` (default) · `(@2)` · `(@1,2)` · `(@1:2)` · `(@2,1)` · `(@2:1)` — channel list (Expr). Channel 2 is available on TH1992-series instruments only.
RESPONSE	`<response>` (NR3) — the present measurement data of the selected function, for example `ch1curr, ch2curr`.
NOTE	If the measurement function is not enabled or the data does not exist, the value returned is `+9.910000E+37` (ASCII) or NaN (IEEE-754), which indicates no data.

2.5 READ subsystem

2.5.1 READ:AUTO

Sets automatic data return.

SET	`READ:AUTO ON`
PARAMETERS	**`ON`** — Enables automatic data return.
NOTE	While automatic data return is used, the `FETCh` commands cannot be executed (error message “Cannot Executed!”, see Chapter 8).

CHAPTER 3

OUTPut Commands

The OUTPut commands control the output filter, high-capacitance mode, the low terminal, the output-off state and the output itself. Where a command has the optional channel suffix [c], `OUTPut1` selects channel 1 (the default when [c] is omitted) and `OUTPut2` selects channel 2 (TH1992 series only).

3.1 OUTPut subsystem

3.1.1 :OUTPut[c]:FILTer[:LPASs]:FREQuency

Sets the cut-off frequency of the output filter.

SET	`:OUTPut[c]:FILTer[:LPASs]:FREQuency <frequency>`
QUERY	`:OUTPut[c]:FILTer[:LPASs]:FREQuency?`
PARAMETERS	**`<frequency>`** — Numeric value in Hz (NRf); the unit is not part of the command.
RESPONSE	`<frequency>` (NR3) — the current cut-off frequency.
NOTE	Cut-off frequency and time constant are related by `frequency = 1 / (2 × π × time_constant)`. The last command sent (this one or `:OUTPut:FILTer[:LPASs]:TCONstant`) is valid for both.

3.1.2 :OUTPut[c]:FILTer[:LPASs][:STATe]

Enables or disables the output filter.

SET	`:OUTPut[c]:FILTer[:LPASs][:STATe] <mode>`
QUERY	`:OUTPut[c]:FILTer[:LPASs][:STATe]?`
PARAMETERS	**`<mode>`** — `1` / `ON` (default) · `0` / `OFF` (Bool).
RESPONSE	`<mode>` (NR1) — `0` or `1`.

3.1.3 :OUTPut[c]:FILTer[:LPASs]:TCONstant

Sets the time constant of the output filter.

SET	`:OUTPut[c]:FILTer[:LPASs]:TCONstant <time_constant>`
QUERY	`:OUTPut[c]:FILTer[:LPASs]:TCONstant?`
PARAMETERS	**`<time_constant>`** — 5 µs to 500 µs (NR3), in seconds; the unit is not part of the command.
RESPONSE	`<time_constant>` (NR3) — the current time constant.
NOTE	`time_constant = 1 / (2 × π × frequency)`. The last command sent (this one or `:OUTPut:FILTer[:LPASs]:FREQuency`) is valid for both.

3.1.4 :OUTPut[c]:HCAPacitance[:STATe]

Enables or disables high-capacitance mode, which is effective for high-capacitance DUTs.

SET	`:OUTPut[c]:HCAPacitance[:STATe] <mode>`
QUERY	`:OUTPut[c]:HCAPacitance[:STATe]?`
PARAMETERS	**`<mode>`** — `1` / `ON` · `0` / `OFF` (default) (Bool).
RESPONSE	`<mode>` (NR1) — `0` or `1`.

3.1.5 :OUTPut[c]:LOW

Sets the state of the low terminal. Turn the source output off with `:OUTPut[:STATe]` before executing this command, otherwise an error is generated.

SET	`:OUTPut[c]:LOW <low_state>`
QUERY	`:OUTPut[c]:LOW?`
PARAMETERS	**`<low_state>`** — `FLOat` · `GROund` (default) (CPD).
RESPONSE	`<low_state>` (CRD) — `FLO` or `GRO`.

3.1.6 :OUTPut[c]:OFF:MODE

Sets the source mode that applies after the source output is disabled.

SET	`:OUTPut[c]:OFF:MODE <mode>`
QUERY	`:OUTPut[c]:OFF:MODE?`
PARAMETERS	**`<mode>`** — `ZERO` · `HIZ` · `NORMal` (default) (CPD). **`ZERO`** — Source function: voltage source. Output voltage: 0 V. Current compliance: 100 µA (on the 100 µA range). **`HIZ`** — Output relay: off (open circuit). If a voltage of 40 V or less is applied, the voltage-source setting is not changed. If the source uses the 100 mA range or a lower current range, the current-source setting is not changed. **`NORMal`** — Source function: voltage source. Output voltage: 0 V. Current compliance: 100 µA (on the 100 µA range). Output relay: off (open circuit).
RESPONSE	`<mode>` (CRD) — `ZERO`, `HIZ` or `NORM`.
NOTE	This setting does not apply when the output is shut down by over-voltage/over-current protection, interlock open circuit, over-temperature protection or a similar emergency. In such a case the output voltage is set to 0 V immediately and the output switch is set to off.

3.1.7 :OUTPut[c]:STATe

Enables or disables the source output of a channel.

SET	`:OUTPut[c]:STATe <mode>`
QUERY	`:OUTPut[c]:STATe?`
PARAMETERS	**`<mode>`** — `1` / `ON` · `0` / `OFF` (default) (Bool).
RESPONSE	`<mode>` (NR1) — `0` or `1`.

3.1.8 :OUTPut[c]:PROTection:STATe

Sets the overload (over-voltage / over-current) protection to ON or OFF.

SET	`:OUTPut[c]:PROTection:STATe <mode>`
PARAMETERS	**`<mode>`** — `ON` · `OFF`.

CHAPTER 4

SENSe Commands

The SENSe commands configure the measurement side of a channel: aperture time, protection (compliance) level, ranging, remote sensing and the channel function, and read back stored measurement data. The optional channel suffix [c] selects channel 1 (default) or channel 2 (TH1992 series only).

4.1 SENSe subsystem

4.1.1 :SENSe[c]:<CURRent[:DC]|RESistance|VOLTage[:DC]>:APERture

Sets the aperture time of a single measurement.

SET	`:SENSe[c]:<CURRent[:DC]|RESistance|VOLTage[:DC]>:APERture <time>`
QUERY	`:SENSe[c]:<CURRent[:DC]|RESistance|VOLTage[:DC]>:APERture?`
PARAMETERS	**`<time>`** — 1E-6 s to 2 s (NRf); default 0.1 PLC. Numeric value in seconds; the unit is not part of the command.
RESPONSE	`<time>` (NRf) — the current aperture time.
NOTE	If the number of power-line cycles is set with `:SENSe:<CURRent[:DC]|RESistance|VOLTage[:DC]>:NPLCycles`, the aperture time follows from `time = nplc / power line frequency`. The last command sent (aperture or NPLC) is valid for both.

4.1.2 :SENSe[c]:<CURRent[:DC]|RESistance|VOLTage[:DC]>:NPLCycles

Sets the measurement integration time as a number of power-line cycles (NPLC).

SET	`:SENSe[c]:<CURRent[:DC]|RESistance|VOLTage[:DC]>:NPLCycles <nplc>`
QUERY	`:SENSe[c]:<CURRent[:DC]|RESistance|VOLTage[:DC]>:NPLCycles?`
PARAMETERS	**`<nplc>`** — 5E-5 to 200 (NRf); default 0.1.
RESPONSE	`<nplc>` (NRf) — the current number of power-line cycles.

4.1.3 :SENSe[c]:<CURRent[:DC]|VOLTage[:DC]>:PROTection[:LEVel]

Sets the compliance (limit) value of the specified channel.

SET	`:SENSe[c]:<CURRent[:DC]|VOLTage[:DC]>:PROTection[:LEVel] <compliance>`
QUERY	`:SENSe[c]:<CURRent[:DC]|VOLTage[:DC]>:PROTection[:LEVel]?`
PARAMETERS	**`<compliance>`** — Numeric value (NRf) from the minimum to the maximum measurement value of the channel (see the Technical Guide); default 100 µA (current) or 2 V (voltage). Current in A, voltage in V — the unit is not part of the command.
RESPONSE	`<compliance>` (NRf) — the current compliance value.

4.1.4 :SENSe[c]:<CURRent[:DC]|RESistance|VOLTage[:DC]>:RANGe:AUTO

Enables or disables the auto-range function of the specified measurement channel.

SET	`:SENSe[c]:<CURRent[:DC]|RESistance|VOLTage[:DC]>:RANGe:AUTO <mode>`
QUERY	`:SENSe[c]:<CURRent[:DC]|RESistance|VOLTage[:DC]>:RANGe:AUTO?`
PARAMETERS	**`<mode>`** — `1` / `ON` (default) · `0` / `OFF` (Bool). `OFF`: measurements use the range set with `:SENSe:<CURRent[:DC]|RESistance|VOLTage[:DC]>:RANGe[:UPPer]`. `ON`: the channel automatically selects the range that gives the best resolution.
RESPONSE	`<mode>` (NR1) — `0` or `1`.

4.1.5 :SENSe[c]:<CURRent[:DC]|VOLTage[:DC]>:RANGe:AUTO:MODE

Selects the operating mode of the auto-range function. The setting is valid only when auto-ranging is enabled.

SET	`:SENSe[c]:<CURRent[:DC]|VOLTage[:DC]>:RANGe:AUTO:MODE <mode>`
QUERY	`:SENSe[c]:<CURRent[:DC]|VOLTage[:DC]>:RANGe:AUTO:MODE?`
PARAMETERS	**`<mode>`** — `NORMal` (default) · `RESolution` · `SPEed` (CPD). The behaviour of each mode is described in the Operation Manual (Table 4-2).
RESPONSE	`<mode>` (CRD) — `NORM`, `RES` or `SPE`.
NOTE	Basic operation: the channel automatically selects the range with the best resolution. Upward change: if the measured data ≥ value1, the range is shifted up after the measurement, where value1 = measurement range × rate / 100. Downward change: if the measured data ≤ value2, the range is shifted down after the measurement, where value2 = measurement range × rate / 1000. The rate is set with `:SENSe:<CURRent[:DC]|VOLTage[:DC]>:RANGe:AUTO:THReshold`.

4.1.6 :SENSe[c]:<CURRent[:DC]|VOLTage[:DC]>:RANGe:AUTO:THReshold

Sets the threshold (rate) used by the auto-range operation.

SET	`:SENSe[c]:<CURRent[:DC]|VOLTage[:DC]>:RANGe:AUTO:THReshold <rate>`
QUERY	`:SENSe[c]:<CURRent[:DC]|VOLTage[:DC]>:RANGe:AUTO:THReshold?`
PARAMETERS	**`<rate>`** — 11 to 100 (NR1), in %; default 90. The % sign is not part of the command.
RESPONSE	`<rate>` (NR1) — the current threshold.

4.1.7 :SENSe:<CURRent[:DC]|VOLTage[:DC]>:RANGe:AUTO:LLIM

Sets the lower limit of the auto-range function — the smallest range auto-ranging will select. Applies to both current and voltage measurement, though it is normally used for current.

SET	`:SENSe:<CURRent[:DC]|VOLTage[:DC]>:RANGe:AUTO:LLIM <value>`
PARAMETERS	**`<value>`** — For `CURRent`: 1E-8 to 3, in amperes (A). For `VOLTage`: within the channel's voltage measurement range, in volts (V) — see the Technical Guide. The unit is not part of the command.

4.1.8 :SENSe[c]:<CURRent[:DC]|RESistance|VOLTage[:DC]>:RANGe[:UPPer]

Specifies the expected measurement value and selects the range that gives the best resolution for measuring that value.

SET	`:SENSe[c]:<CURRent[:DC]|RESistance|VOLTage[:DC]>:RANGe:UPPer <range>`
QUERY	`:SENSe[c]:<CURRent[:DC]|RESistance|VOLTage[:DC]>:RANGe:UPPer?`
PARAMETERS	**`<range>`** — Numeric value (NRf); see the Technical Guide for the current, voltage and resistance measurement ranges.
RESPONSE	`<range>` (NRf) — the current measurement range.

4.1.9 :SENSe[c]:DATA?

Returns the array of all current, voltage and resistance measurement data, source-output-setting data, status data and time data specified by `:FORMat:ELEMents:SENSe`. The data is retained until `:INITiate` or `:MEASure` is executed.

QUERY	`:SENSe[c]:DATA? <offset,size>`
PARAMETERS	**`[offset]`** — Where reading starts (NR1 or CPD): `n` — reading starts from data point n+1 (n is an integer from 0 to the maximum, which depends on the buffer state); `CURRent` — from the current data position; `STARt` — from the top of the data buffer (default; equivalent to n = 0). **`[size]`** — Number of data points to return (NR1): 1 to the maximum, which depends on the buffer state.
RESPONSE	`<response>` (NR3) — the data specified by `:FORMat:ELEMents:SENSe`, for example `ch1curr1, ch1sour1, ch1curr2, ch1sour2, ... ch1curr10, ch1sour10` for a 10-step sweep on channel 1.
NOTE	If the measurement function is not enabled or the data does not exist, the value returned is `+9.910000E+37` (ASCII) or NaN (IEEE-754), which indicates no data.

4.1.10 :SENSe:DATA:LATest?

Returns the latest current, voltage and resistance measurement data, source-output-setting data, status data or time data specified by `:FORMat:ELEMents:SENSe`. The data is retained until `:INITiate` or `:MEASure` is executed.

QUERY	`:SENSe:DATA:LATest?`
RESPONSE	`<response>` (NR3) — the latest measurement data, for example `ch1curr10, ch1sour10`.
NOTE	If the measurement function is not enabled or the data does not exist, the value returned is `+9.910000E+37` (ASCII) or NaN (IEEE-754), which indicates no data.

4.1.11 :SENSe[c]:REMote

Enables or disables remote sensing. Remote sensing must be enabled to use the 4-wire (Kelvin) connection.

SET	`:SENSe[c]:REMote <mode>`
QUERY	`:SENSe[c]:REMote?`
PARAMETERS	**`<mode>`** — `1` / `ON` · `0` / `OFF` (default) (Bool).
RESPONSE	`<mode>` (NR1) — `0` or `1`.

4.1.12 :SENSe[c]:FUNCtion

Sets the function of the specified channel (see Operation Manual §4.2, Function).

SET	`:SENSe[c]:FUNCtion <function>`
QUERY	`:SENSe[c]:FUNCtion:ON?`
PARAMETERS	**`<function>`** — `Power` · `VOLTmeter` · `AMMeter` · `OHMmeter` (CPD).
RESPONSE	`<function>` (CPD) — the function of the selected channel.

CHAPTER 5

SOURce Commands

The SOURce commands set the source function, level, range and the parameters of the pulse, sweep and list outputs. The optional channel suffix [c] selects channel 1 (default) or channel 2 (TH1992 series only). Values are in SI base units (A, V, s); the unit is not part of the command.

5.1 Source level, range and mode

5.1.1 [:SOURce[c]]:<CURRent|VOLTage>[:LEVel][:IMMediate][:AMPLitude]

Changes the output level of the specified source channel immediately.

SET	`[:SOURce[c]]:<CURRent|VOLTage>[:LEVel][:IMMediate][:AMPLitude] <level>`
QUERY	`[:SOURce[c]]:<CURRent|VOLTage>[:LEVel][:IMMediate][:AMPLitude]?`
PARAMETERS	**`<level>`** — Numeric value within the output range of the selected source range (see the Technical Guide and Operation Manual §8.2); current in A, voltage in V — the unit is not part of the command. (NRf)
RESPONSE	`<level>` (NRf) — the current output level.

5.1.2 [:SOURce[c]]:<CURRent|VOLTage>:MODE

Selects the source mode of the specified source channel.

SET	`[:SOURce[c]]:<CURRent|VOLTage>:MODE <mode>`
QUERY	`[:SOURce[c]]:<CURRent|VOLTage>:MODE?`
PARAMETERS	**`<mode>`** — `SWEep` (sweep source) · `LIST` (list source) · `FIXed` (DC source, default) (CPD).
RESPONSE	`<mode>` (CRD) — `FIX`, `LIST` or `SWE`.

5.1.3 [:SOURce[c]]:<CURRent|VOLTage>:RANGe

Sets the current or voltage output range of the specified source channel. The command is valid when the auto output-range function is disabled.

SET	`[:SOURce[c]]:<CURRent|VOLTage>:RANGe <range>`
QUERY	`[:SOURce[c]]:<CURRent|VOLTage>:RANGe?`
PARAMETERS	**`<range>`** — Numeric value (NR3): a source range listed in the Technical Guide / Operation Manual §8.2; current in A, voltage in V.
RESPONSE	`<range>` (NR3) — the current source output range.

5.1.4 [:SOURce[c]]:<CURRent|VOLTage>:RANGe:AUTO

Enables or disables the auto output-range function of the specified source channel.

SET	`[:SOURce[c]]:<CURRent|VOLTage>:RANGe:AUTO <mode>`
QUERY	`[:SOURce[c]]:<CURRent|VOLTage>:RANGe:AUTO?`
PARAMETERS	**`<mode>`** — `1` / `ON` (default) · `0` / `OFF` (Bool).
RESPONSE	`<mode>` (NR1) — `0` or `1`.
NOTE	If the range of the source channel is selected manually with `[:SOURce]:<CURRent|VOLTage>:RANGe`, disable this auto-range function first.

5.1.5 [:SOURce[c]]:FUNCtion:MODE

Selects the source output mode of the specified channel.

SET	`[:SOURce[c]]:FUNCtion:MODE <mode>`
QUERY	`[:SOURce[c]]:FUNCtion:MODE?`
PARAMETERS	**`<mode>`** — `CURRent` · `VOLTage` (CPD).
RESPONSE	`<mode>` (CRD) — `CURR` or `VOLT`.

5.1.6 [:SOURce[c]]:FUNCtion[:SHAPe]

Selects the source output shape of the specified channel.

SET	`[:SOURce[c]]:FUNCtion[:SHAPe] <shape>`
QUERY	`[:SOURce[c]]:FUNCtion[:SHAPe]?`
PARAMETERS	**`<shape>`** — `PULSe` (pulse) · `DC` (default) (CPD).
RESPONSE	`<shape>` (CRD) — `DC` or `PULS`.

5.2 Sweep parameters

Start, stop, centre, span, step and number of points are related: `center = (start + stop) / 2`, `span = stop − start`, `points = span / step + 1` (step ≠ 0; when points = 1, step = 0) and `step = span / (points − 1)`. The last command sent is valid for all of these sweep parameters. Calculated point counts are rounded down to an integer. The sweep is performed from the start value to `stop = start + step × (points − 1)`, even if the specified stop value does not satisfy this formula. For logarithmic sweeps the step value is ignored.

5.2.1 [:SOURce[c]]:<CURRent|VOLTage>:<CENTer|SPAN>

Sets the centre or the span of the current or voltage sweep output.

SET	`[:SOURce[c]]:<CURRent|VOLTage>:<CENTer|SPAN> <data>`
QUERY	`[:SOURce[c]]:<CURRent|VOLTage>:<CENTer|SPAN>?`
PARAMETERS	**`<data>`** — Numeric value within the output range of the selected source range (see the Technical Guide and Operation Manual §8.2); current in A, voltage in V — the unit is not part of the command. (NR3)
RESPONSE	`<data>` (NR3) — the current centre or span value.

5.2.2 [:SOURce[c]]:<CURRent|VOLTage>:<STARt|STOP>

Sets the start or the stop value of the current or voltage sweep output.

SET	`[:SOURce[c]]:<CURRent|VOLTage>:<STARt|STOP> <data>`
QUERY	`[:SOURce[c]]:<CURRent|VOLTage>:<STARt|STOP>?`
PARAMETERS	**`<data>`** — Numeric value within the output range of the selected source range (see the Technical Guide and Operation Manual §8.2); current in A, voltage in V — the unit is not part of the command. (NR3)
RESPONSE	`<data>` (NR3) — the current start or stop value.
NOTE	`start = center − span / 2`, `stop = center + span / 2`.

5.2.3 [:SOURce[c]]:<CURRent|VOLTage>:POINts

Sets the number of steps of the current or voltage sweep output.

SET	`[:SOURce[c]]:<CURRent|VOLTage>:POINts <points>`
QUERY	`[:SOURce[c]]:<CURRent|VOLTage>:POINts?`
PARAMETERS	**`<points>`** — 1 to 2500 (NR1); default 1.
RESPONSE	`<points>` (NR1) — the current number of sweep steps.

5.2.4 [:SOURce[c]]:<CURRent|VOLTage>:STEP

Sets the step value of the current or voltage sweep output.

SET	`[:SOURce[c]]:<CURRent|VOLTage>:STEP <step>`
QUERY	`[:SOURce[c]]:<CURRent|VOLTage>:STEP?`
PARAMETERS	**`<step>`** — Numeric value within the output range of the selected source range (see the Technical Guide and Operation Manual §8.2); current in A, voltage in V — the unit is not part of the command. (NRf)
RESPONSE	`<step>` — the current sweep step value.
NOTE	`step = span / (points − 1)` (points ≠ 1). Step and span must have the same polarity, otherwise an error is generated.

5.2.5 [:SOURce[c]]:SWEep:POINts

Sets the number of sweep steps of the specified channel; valid for both current and voltage sweeping.

SET	`[:SOURce[c]]:SWEep:POINts <points>`
QUERY	`[:SOURce[c]]:SWEep:POINts?`
PARAMETERS	**`<points>`** — 1 to 2500 (NR1).
RESPONSE	`<points>` (NR1) — the current number of sweep steps.
NOTE	If points changes, span stays constant and step changes. If step changes, span stays constant and points changes. If span changes, points stays constant and step changes.

5.2.6 [:SOURce[c]]:SWEep:SPACing

Selects the sweep output mode of the specified channel.

SET	`[:SOURce[c]]:SWEep:SPACing <mode>`
QUERY	`[:SOURce[c]]:SWEep:SPACing?`
PARAMETERS	**`<mode>`** — `LOGarithmic` — logarithmic sweep (the sweep step is ignored) · `LINer` (default) — linear sweep (CPD).
RESPONSE	`<mode>` (CRD) — `LOG` or `LIN`.

5.2.7 [:SOURce[c]]:SWEep:STAir

Sets the sweep mode of the specified channel.

SET	`[:SOURce[c]]:SWEep:STAir <mode>`
QUERY	`[:SOURce[c]]:SWEep:STAir?`
PARAMETERS	**`<mode>`** — `SINGle` (default) — single sweep · `DOUBle` — double sweep, from start to stop and back again (CPD).
RESPONSE	`<mode>` (CRD) — `SING` or `DOUB`.

5.2.8 [:SOURce[c]]:SWEep:AFTer

Sets where the output rests once the sweep of the specified channel has finished (see Operation Manual §4.3.3, After Sweep).

SET	`[:SOURce[c]]:SWEep:AFTer <mode>`
QUERY	`[:SOURce[c]]:SWEep:AFTer?`
PARAMETERS	**`<mode>`** — `STARt` — rests at the start value · `STOP` — rests at the stop (end) value (CPD).
RESPONSE	`<mode>` (CRD) — the current sweep end condition.

5.3 List parameters

A list holds up to 2500 data points.

5.3.1 [:SOURce[c]]:LIST:<CURRent|VOLTage>

Sets the list of source output current or voltage data of the specified channel.

SET	`[:SOURce[c]]:LIST:<CURRent|VOLTage> <list>`
QUERY	`[:SOURce[c]]:LIST:<CURRent|VOLTage>?`
PARAMETERS	**`<list>`** — Output current or voltage data, separated by commas; up to 2500 data points; default value 0 (NRf). Current in A, voltage in V; the unit is not part of the command. Values are limited by the output range (see the Technical Guide).
RESPONSE	`<list>` (NR3) — the current list data, separated by commas.

5.3.2 [:SOURce[c]]:LIST:<CURRent|VOLTage>:APPend

Adds source output current or voltage data to the data list set with `[:SOURce]:LIST:<CURRent|VOLTage>`.

SET	`[:SOURce[c]]:LIST:<CURRent|VOLTage>:APPend <append_list>`
PARAMETERS	**`<append_list>`** — Output current or voltage data, separated by commas; default value 0 (NRf).
NOTE	The combined list (set list plus appended list) holds a maximum of 2500 data points.

5.3.3 [:SOURce[c]]:LIST:<CURRent|VOLTage>:POINts?

Returns the number of data points in the combined list set with `[:SOURce]:LIST:<CURRent|VOLTage>` and `[:SOURce]:LIST:<CURRent|VOLTage>:APPend`.

QUERY	`[:SOURce[c]]:LIST:<CURRent|VOLTage>:POINts?`
RESPONSE	`<number_of_data>` (NR1) — the number of list data points.

5.3.4 [:SOURce[c]]:LIST:<CURRent|VOLTage>:STARt

Specifies the starting point of the list sweep as a list index.

SET	`[:SOURce[c]]:LIST:<CURRent|VOLTage>:STARt <start>`
QUERY	`[:SOURce[c]]:LIST:<CURRent|VOLTage>:STARt?`
PARAMETERS	**`<start>`** — 1 to 2500 (NR1); default 1 (first data point, top of the list). A value of 0 or greater than 2500 results in an error.
RESPONSE	`<start>` (NR1) — the current list start index.

5.4 Pulse parameters

Model applicability: pulse output is available only on TH1991A, TH1991, TH1992A and TH1992. These commands do not apply to TH1991C, TH1991B or TH1992B (see Operation Manual, Chapter 1).

5.4.1 [:SOURce[c]]:PULSe:DELay

Sets the pulse delay time of the specified channel.

SET	`[:SOURce[c]]:PULSe:DELay <delay>`
QUERY	`[:SOURce[c]]:PULSe:DELay?`
PARAMETERS	**`<delay>`** — 0.0 s to 99999.9 s (NRf); default 0. Numeric value in seconds; the unit is not part of the command.
RESPONSE	`<delay>` (NR3) — the current pulse delay time.

5.4.2 [:SOURce[c]]:PULSe:WIDTh

Sets the pulse width of the specified channel.

SET	`[:SOURce[c]]:PULSe:WIDTh <width>`
QUERY	`[:SOURce[c]]:PULSe:WIDTh?`
PARAMETERS	**`<width>`** — 5E-5 s to 100000 s (NRf); default 0 — subject to the source range, peak/base current and duty-cycle limits in Operation Manual §8.2 (for example, a 6 V / 10.5 A pulse is limited to a 1 ms width and a 2.5% duty cycle). Numeric value in seconds; the unit is not part of the command.
RESPONSE	`<width>` (NR3) — the current pulse width.
NOTE	The minimum time of the basic pulse output is 50 µs and the minimum pulse period is 100 µs.

5.4.3 [:SOURce[c]]:PULSe:PEAK

Sets the pulse peak value of the specified channel.

SET	`:SOURce[c]:PULSe:PEAK <peak>`
QUERY	`:SOURce[c]:PULSe:PEAK?`
PARAMETERS	**`<peak>`** — For voltage sources −210 to 210 (V); for current sources −10.5 to 10.5 (A).
RESPONSE	`<peak>` — the current pulse peak value.

5.4.4 [:SOURce[c]]:PULSe:BIAS

Sets the pulse bias (base) value of the specified channel.

SET	`:SOURce[c]:PULSe:BIAS <bias>`
QUERY	`:SOURce[c]:PULSe:BIAS?`
PARAMETERS	**`<bias>`** — For voltage sources −210 to 210 (V); for current sources −10.5 to 10.5 (A).
RESPONSE	`<bias>` — the current pulse bias value.

CHAPTER 6

SYSTem Commands

The SYSTem commands configure the beeper, the LAN, RS232 and USB communication settings, the HANDLER pins, the display backlight, the power-on state, the internal clock, the line frequency and the master/slave role.

6.1 Beeper, LAN, RS232 and USB

The LAN and RS232 settings are the same as those on the System page (Operation Manual §6.4).

6.1.1 :SYSTem:BEEPer:STATe

Enables or disables the buzzer. The setting is not changed by power-off or by the `*RST` command.

SET	`:SYSTem:BEEPer:STATe <mode>`
QUERY	`:SYSTem:BEEPer:STATe?`
PARAMETERS	**`<mode>`** — `1` / `ON` · `0` / `OFF` (Bool).
RESPONSE	`<mode>` (NR1) — `0` or `1`.

6.1.2 :SYSTem:COMMunicate:LAN:ADDRess

Sets the static LAN (IP) address of the instrument. The setting is not changed by power-off or by the `*RST` command.

SET	`:SYSTem:COMMunicate:LAN:ADDRess <address>`
QUERY	`:SYSTem:COMMunicate:LAN:ADDRess?`
PARAMETERS	**`<address>`** — `"A.B.C.D"` format, separated by dots; A, B, C and D are numbers from 0 to 255; at most 15 characters (SPD).
RESPONSE	`<address>` (SRD) — the static LAN (IP) address.

6.1.3 :SYSTem:COMMunicate:LAN:DHCP

Enables or disables the Dynamic Host Configuration Protocol (DHCP). The setting is not changed by power-off or by the `*RST` command.

SET	`:SYSTem:COMMunicate:LAN:DHCP <mode>`
QUERY	`:SYSTem:COMMunicate:LAN:DHCP?`
PARAMETERS	**`<mode>`** — `1` / `ON` · `0` / `OFF` (Bool). `OFF`: DHCP is disabled and the instrument uses the static IP address, subnet mask and default gateway at power-up. `ON`: the instrument tries to obtain an IP address from the DHCP server, which assigns a dynamic IP address, subnet mask and default gateway; if no address is assigned, the static IP address, subnet mask and default gateway are used after about 2 minutes.
RESPONSE	`<mode>` (NR1) — `0` or `1`.

6.1.4 :SYSTem:COMMunicate:LAN:DNS[c]

Sets the IP address of the DNS server. The setting is not changed by power-off or by the `*RST` command.

SET	`:SYSTem:COMMunicate:LAN:DNS[c] <address>`
QUERY	`:SYSTem:COMMunicate:LAN:DNS[c]?`
PARAMETERS	**`[c]`** — 1 or 2 selects DNS server 1 or DNS server 2; DNS server 1 if omitted. **`<address>`** — `"A.B.C.D"` format, separated by dots; A, B, C and D are numbers from 0 to 255; at most 15 characters (SPD).
RESPONSE	`<address>` (SRD) — the IP address of the DNS server.

6.1.5 :SYSTem:COMMunicate:LAN:DOMain?

Returns the domain name of the network to which the instrument is connected.

QUERY	`:SYSTem:COMMunicate:LAN:DOMain?`
RESPONSE	`<domain_name>` (SRD) — the domain name of the network the instrument is currently connected to.

6.1.6 :SYSTem:COMMunicate:LAN:<GATE|GATeway>

Sets the IP address of the default gateway. The setting is not changed by power-off or by the `*RST` command.

SET	`:SYSTem:COMMunicate:LAN:<GATE|GATeway> <address>`
QUERY	`:SYSTem:COMMunicate:LAN:<GATE|GATeway>?`
PARAMETERS	**`<address>`** — `"A.B.C.D"` format, separated by dots; A, B, C and D are numbers from 0 to 255; at most 15 characters (SPD).
RESPONSE	`<address>` (SRD) — the IP address of the default gateway.

6.1.7 :SYSTem:COMMunicate:LAN:<HNAMe|HOSTname>

Sets the host name of the instrument. The setting is not changed by power-off or by the `*RST` command.

SET	`:SYSTem:COMMunicate:LAN:<HNAMe|HOSTname> <hostname>`
QUERY	`:SYSTem:COMMunicate:LAN:<HNAMe|HOSTname>?`
PARAMETERS	**`<hostname>`** — Up to 15 characters (SPD).
RESPONSE	`<hostname>` (SRD) — the host name of the instrument.

6.1.8 :SYSTem:COMMunicate:LAN:MAC?

Returns the MAC address of the instrument.

QUERY	`:SYSTem:COMMunicate:LAN:MAC?`
RESPONSE	`<mac_address>` (SRD) — the current MAC address of the instrument.

6.1.9 :SYSTem:COMMunicate:LAN:SMASk

Sets the static subnet mask. The setting is not changed by power-off or by the `*RST` command.

SET	`:SYSTem:COMMunicate:LAN:SMASk <subnet_mask>`
QUERY	`:SYSTem:COMMunicate:LAN:SMASk?`
PARAMETERS	**`<subnet_mask>`** — `"A.B.C.D"` format, separated by dots; A, B, C and D are numbers from 0 to 255; at most 15 characters (SPD).
RESPONSE	`<subnet_mask>` (SRD) — the subnet mask.

6.1.10 :SYSTem:COMMunicate:RS232:BAUDrate

Sets the baud rate of the RS232 interface.

SET	`:SYSTem:COMMunicate:RS232:BAUDrate <baudrate>`
QUERY	`:SYSTem:COMMunicate:RS232:BAUDrate?`
PARAMETERS	**`<baudrate>`** — `4800` · `9600` · `19200` · `38400` · `115200` (NR1).
RESPONSE	`<baudrate>` (NR1) — the current baud rate.

6.1.11 :SYSTem:COMMunicate:USB[:TYPe]

Sets the USB communication type.

SET	`:SYSTem:COMMunicate:USB[:TYPe] <type>`
QUERY	`:SYSTem:COMMunicate:USB:TYPe?`
PARAMETERS	**`<type>`** — `TMC` · `CDC` (CPD).
RESPONSE	`<type>` (CRD) — `TMC` or `CDC`.

6.2 HANDLER pins

These commands configure the pins of the rear-panel HANDLER connector (Operation Manual, Chapter 10).

6.2.1 :SYSTem:HANDler:FUNCtion

Sets the function of the specified HANDLER pin.

SET	`:SYSTem:HANDler:FUNCtion <pin>,<function>`
QUERY	`:SYSTem:HANDler:FUNCtion? <pin>`
PARAMETERS	**`<pin>`** — 1 to 14. **`<function>`** — `DIO` (digital signal input/output) · `DI` (digital signal input) · `TO` (trigger output) · `TI` (trigger input) · `HV` (high-voltage status output) (CPD).
RESPONSE	`<function>` (CRD) — `DIO`, `DI`, `TO`, `TI` or `HV`.

6.2.2 :SYSTem:HANDler:POLArity

Sets the polarity of the specified HANDLER pin.

SET	`:SYSTem:HANDler:POLArity <pin>,<polarity>`
QUERY	`:SYSTem:HANDler:POLArity? <pin>`
PARAMETERS	**`<pin>`** — `EXT1` to `EXT14`. **`<polarity>`** — `NEGative` / `0` · `POSitive` / `1` (CPD).
RESPONSE	`<polarity>` (NR1) — `0` or `1`.

6.2.3 :SYSTem:HANDler:TIMing

Sets the trigger timing of the specified HANDLER pin.

SET	`:SYSTem:HANDler:TIMing <pin>,<timing>`
QUERY	`:SYSTem:HANDler:TIMing? <pin>`
PARAMETERS	**`<pin>`** — `EXT1` to `EXT14`. **`<timing>`** — `BEFore` · `AFTer` · `BOTH` (CPD). `BEFore`: the trigger is issued at the start of the ARM layer, trigger layer and instrument operations. `AFTer`: at the end of these operations. `BOTH`: at the start and at the end.
RESPONSE	`<timing>` (CRD) — `BEF`, `AFT` or `BOTH`.

6.2.4 :SYSTem:HANDler:WIDth

Sets the pulse width of the DIO trigger output signal.

SET	`:SYSTem:HANDler:WIDth <pin>,<width>`
QUERY	`:SYSTem:HANDler:WIDth? <pin>`
PARAMETERS	**`<pin>`** — 1 to 11 (NR1). **`<width>`** — 10E-6 to 1 (NR3), in seconds.
RESPONSE	`<width>` (NR3) — the pulse width of the trigger signal of the specified pin.

6.3 Display, power-on state, clock and synchronisation

6.3.1 :SYSTem:BACKlight

Sets the backlight brightness of the display, as a percentage.

SET	`:SYSTem:BACKlight <percent>`
QUERY	`:SYSTem:BACKlight?`
PARAMETERS	**`<percent>`** — 50 to 100 (NR1).
RESPONSE	`<percent>` (NR1) — the current brightness percentage.

6.3.2 :SYSTem:POWeron

Sets the state of the instrument at power-on.

SET	`:SYSTem:POWeron <status>`
QUERY	`:SYSTem:POWeron?`
PARAMETERS	**`<status>`** — `FACTory` · `LAST` (CPD).
RESPONSE	`<status>` (CRD) — the current power-on setting.

6.3.3 :SYSTem:DATE

Sets the date of the internal clock. The setting is not changed by power-off or by the `*RST` command.

SET	`:SYSTem:DATE <year>,<month>,<day>`
QUERY	`:SYSTem:DATE?`
PARAMETERS	**`<year>`** — 4-digit integer. **`<month>`** — 1 to 12. **`<day>`** — 1 to 31 (all NR1).
RESPONSE	`<response>` (NR1) — year, month and day, separated by commas.

6.3.4 :SYSTem:TIME

Sets the time of the internal clock. The setting is not changed by power-off or by the `*RST` command.

SET	`:SYSTem:TIME <hour>,<minute>,<second>`
QUERY	`:SYSTem:TIME?`
PARAMETERS	**`<hour>`** — 0 to 23. **`<minute>`** — 0 to 59. **`<second>`** — 0 to 59 (all NR1).
RESPONSE	`<response>` (NR1) — hour, minute and second, separated by commas.

6.3.5 :SYSTem:VERSion?

Returns the SCPI standard version.

QUERY	`:SYSTem:VERSion?`
RESPONSE	`<response>` (NR2) — the SCPI standard version.

6.3.6 :SYSTem:LFRequency

Sets the line (power-line) frequency.

SET	`:SYSTem:LFRequency <frequency>`
QUERY	`:SYSTem:LFRequency?`
PARAMETERS	**`<frequency>`** — `50` or `60` (NR1), in Hz.
RESPONSE	`<frequency>` (NR1) — `50` or `60`.

6.3.7 :SYSTem:SYNCrole

Sets the master/slave mode of the instrument.

SET	`:SYSTem:SYNCrole <role>`
QUERY	`:SYSTem:SYNCrole?`
PARAMETERS	**`<role>`** — `MasTer` — master mode · `SLAVe` — slave mode (CPD).
RESPONSE	`<role>` (CPD) — the current master/slave mode.

CHAPTER 7

TRIGger, CALCulate & Common Commands

7.1 TRIGger subsystem

The optional channel suffix [c] selects channel 1 (default) or channel 2 (TH1992 series only). `ACQuire` applies to measurement and `TRANsient` to source output.

7.1.1 :INITiate[:IMMediate]<:ACQuire|:TRANsient|[:ALL]>

Starts the specified device operation of the specified channel; the trigger status changes from idle to started.

SET	`:INITiate[:IMMediate]<:ACQuire|:TRANsient|[:ALL]> [<chanlist>]`
PARAMETERS	**`[chanlist]`** — `(@1)` (default) · `(@2)` · `(@1,2)` · `(@1:2)` · `(@2,1)` · `(@2:1)` — channel list (Expr). Channel 2 is available on TH1992-series instruments only.
NOTE	`ACQuire` applies to measurement and `TRANsient` to source output.

7.1.2 :TRIGger[c]<:ACQuire|:TRANsient|[:ALL]>:COUNt

Sets the trigger count of the specified device operation.

SET	`:TRIGger[c]<:ACQuire|:TRANsient|[:ALL]>:COUNt <trigger_count>`
QUERY	`:TRIGger[c]<:ACQuire|:TRANsient|[:ALL]>:COUNt?`
PARAMETERS	**`<trigger_count>`** — 1 to 100000 (NRf); default 1.
RESPONSE	`<response>` (NR1) — the current trigger count.
NOTE	The inequality arm count × trigger count < 100001 must hold. `ACQuire` applies to measurement and `TRANsient` to source output.

7.1.3 :TRIGger[c]<:ACQuire|:TRANsient|[:ALL]>:DELay

Sets the trigger delay of the device operation.

SET	`:TRIGger[c]<:ACQuire|:TRANsient|[:ALL]>:DELay <delay>`
QUERY	`:TRIGger[c]<:ACQuire|:TRANsient|[:ALL]>:DELay?`
PARAMETERS	**`<delay>`** — 0 s to 100,000 s (NRf); default 0. Numeric value in seconds; the unit is not part of the command.
RESPONSE	`<response>` (NR3) — the current trigger delay.
NOTE	`ACQuire` applies to measurement and `TRANsient` to source output.

7.1.4 :TRIGger[c]<:ACQuire|:TRANsient|[:ALL]>:TIMer

Sets the time interval of the TIMer trigger source for the specified device operation.

SET	`:TRIGger[c]<:ACQuire|:TRANsient|[:ALL]>:TIMer <interval>`
QUERY	`:TRIGger[c]<:ACQuire|:TRANsient|[:ALL]>:TIMer?`
PARAMETERS	**`<interval>`** — 1E-5 s to 1E+5 s (NRf); default 1E-5. Numeric value in seconds; the unit is not part of the command.
RESPONSE	`<response>` (NR3) — the current time interval.
NOTE	`ACQuire` applies to measurement and `TRANsient` to source output. The minimum time interval of each model is listed in the Technical Guide.

7.1.5 TRIG:ALL:SOUR:SIGN1

Sets the trigger mode of the instrument. The command sets the source and the measurement trigger signals simultaneously.

SET	`TRIG:ALL:SOUR:SIGN1 <signal>`
PARAMETERS	**`<signal>`** — `BUS` · `MAN` · `AINT` · `EXT1`.
NOTE	To set the measurement trigger mode separately use `ARM:ACQ:SOUR:SIGN2 BUS`; to set the source trigger mode separately use `TRIG:TRAN:SOUR:SIGN2 BUS`.

7.2 CALCulate subsystem

7.2.1 :CALCulate[c]:LIMit:STATe

Enables or disables the sorting function (limit test).

SET	`:CALCulate[c]:LIMit:STATe <mode>`
PARAMETERS	**`<mode>`** — `ON` · `OFF`.

7.3 Common commands

The instrument supports the following common commands.

7.3.1 *RST

Resets the instrument.

SET	`*RST`

7.3.2 *IDN?

Queries the instrument information.

QUERY	`*IDN?`
RESPONSE	The manufacturer, model and software version of the instrument, separated by commas, terminated by `<NL^END>`.
EXAMPLE	`Techmize,TH1992B,Ver 4.0.1`

7.3.3 *OPC

Starts monitoring the pending operations and sets or clears the operation-complete bit in the standard event status register: if there is no pending operation, the OPC bit is set to 1; if there is a pending operation, the OPC bit is set to 0 and is set to 1 again when all pending operations are complete.

SET	`*OPC`
QUERY	`*OPC?`
RESPONSE	`<state>` (NR1) — the current state of the operation: `0` or `1`.

CHAPTER 8

Error Messages

A command string sent to the instrument may contain an incorrect command, incorrect syntax or an incorrect parameter. The instrument executes the command string while it analyses it; when an error is found, the error message is shown in a pop-up window on the display and analysis of the command string is aborted, so the part of the string after the error is ignored.

Error message	Description
`Unknow Message!`	Unknown message — an unrecognised command (for example a misspelled or omitted command, or a forgotten numeric suffix).
`Syntax Error!`	Syntax error — a misspelled, doubled or omitted syntax symbol.
`Data Error!`	Data error — a value out of range or an unsupported value.
`Error Parameter.`	Parameter error — an unrecognised command parameter (for example a value set without the required unit, or a measurement parameter type the instrument does not support).
`Error Suffix.`	Suffix error — usually a mismatched unit or multiplier.
`Data Too Long!`	The number of data characters exceeds the limit (for example a numeric parameter over 20 characters, or a file name over 18 characters).
`Cannot Executed!`	The command cannot be executed in the current state (for example the FETCh command cannot be executed while the READ command is in use).
`Record Not Exist!`	The record does not exist — the file record to be loaded does not exist.

APPENDIX

Command Index & Contact

A.1 Command index

Section	Command	Function
2.1.1	:DISPlay:DIGits	Set the display resolution
2.1.2	:DISPlay:VIEW	Select the display mode
2.1.3	:DISPlay[c]:PARAmeter	Select the displayed parameters
2.2.1	:FORMat:ELEMents:SENSe	Select the elements of returned data
2.3.1	:FETCh:ARRay?	Return all data as an array
2.3.2	:FETCh:ARRay:<CURRent|RESistance|TIME|VOLTage>?	Return one element as an array
2.3.3	:FETCh[:SCALar]?	Return the latest data
2.3.4	:FETCh[:SCALar]:<CURRent|RESistance|TIME|VOLTage>?	Return the latest value of one element
2.4.1	:MEASure?	Measure and return the selected elements
2.4.2	:MEASure:<CURRent[:DC]|RESistance|VOLTage[:DC]>?	Measure current, resistance or voltage
2.5.1	READ:AUTO	Enable automatic data return
3.1.1	:OUTPut[c]:FILTer[:LPASs]:FREQuency	Set the output-filter cut-off frequency
3.1.2	:OUTPut[c]:FILTer[:LPASs][:STATe]	Enable or disable the output filter
3.1.3	:OUTPut[c]:FILTer[:LPASs]:TCONstant	Set the output-filter time constant
3.1.4	:OUTPut[c]:HCAPacitance[:STATe]	Enable or disable high-capacitance mode
3.1.5	:OUTPut[c]:LOW	Set the state of the low terminal
3.1.6	:OUTPut[c]:OFF:MODE	Set the source state when output is off
3.1.7	:OUTPut[c]:STATe	Enable or disable the source output
3.1.8	:OUTPut[c]:PROTection:STATe	Enable or disable overload protection
4.1.1	:SENSe[c]:<CURRent[:DC]|RESistance|VOLTage[:DC]>:APERture	Set the aperture time of a single measurement
4.1.2	:SENSe[c]:<CURRent[:DC]|RESistance|VOLTage[:DC]>:NPLCycles	Set the number of power-line cycles
4.1.3	:SENSe[c]:<CURRent[:DC]|VOLTage[:DC]>:PROTection[:LEVel]	Set the compliance value
4.1.4	:SENSe[c]:<CURRent[:DC]|RESistance|VOLTage[:DC]>:RANGe:AUTO	Enable or disable measurement auto-ranging
4.1.5	:SENSe[c]:<CURRent[:DC]|VOLTage[:DC]>:RANGe:AUTO:MODE	Select the auto-range operating mode
4.1.6	:SENSe[c]:<CURRent[:DC]|VOLTage[:DC]>:RANGe:AUTO:THReshold	Set the auto-range shift threshold
4.1.7	:SENSe:<CURRent[:DC]|VOLTage[:DC]>:RANGe:AUTO:LLIM	Set the minimum auto-range
4.1.8	:SENSe[c]:<CURRent[:DC]|RESistance|VOLTage[:DC]>:RANGe[:UPPer]	Set the measurement range
4.1.9	:SENSe[c]:DATA?	Return stored measurement data
4.1.10	:SENSe:DATA:LATest?	Return the latest measurement data
4.1.11	:SENSe[c]:REMote	Enable or disable remote sensing
4.1.12	:SENSe[c]:FUNCtion	Set the channel function

Section	Command	Function
5.1.1	`[:SOURce[c]]:<CURRent|VOLTage>[:LEVel][:IMMediate][:AMPLitude]`	Set the output level immediately
5.1.2	`[:SOURce[c]]:<CURRent|VOLTage>:MODE`	Select the source mode
5.1.3	`[:SOURce[c]]:<CURRent|VOLTage>:RANGe`	Set the source output range
5.1.4	`[:SOURce[c]]:<CURRent|VOLTage>:RANGe:AUTO`	Enable or disable output auto-ranging
5.1.5	`[:SOURce[c]]:FUNCtion:MODE`	Select voltage or current source
5.1.6	`[:SOURce[c]]:FUNCtion[:SHAPe]`	Select DC or pulse output shape
5.2.1	`[:SOURce[c]]:<CURRent|VOLTage>:<CENTer|SPAN>`	Set the sweep centre or span
5.2.2	`[:SOURce[c]]:<CURRent|VOLTage>:<STARt|STOP>`	Set the sweep start or stop value
5.2.3	`[:SOURce[c]]:<CURRent|VOLTage>:POINts`	Set the number of sweep points
5.2.4	`[:SOURce[c]]:<CURRent|VOLTage>:STEP`	Set the sweep step value
5.2.5	`[:SOURce[c]]:SWEep:POINts`	Set the number of sweep steps (current or voltage)
5.2.6	`[:SOURce[c]]:SWEep:SPACing`	Select linear or logarithmic sweep
5.2.7	`[:SOURce[c]]:SWEep:STAir`	Select single or double sweep
5.2.8	`[:SOURce[c]]:SWEep:AFTer`	Set the sweep end condition
5.3.1	`[:SOURce[c]]:LIST:<CURRent|VOLTage>`	Set the list of output values
5.3.2	`[:SOURce[c]]:LIST:<CURRent|VOLTage>:APPend`	Append values to the list
5.3.3	`[:SOURce[c]]:LIST:<CURRent|VOLTage>:POINts?`	Return the number of list points
5.3.4	`[:SOURce[c]]:LIST:<CURRent|VOLTage>:STARt`	Set the list start index
5.4.1	`[:SOURce[c]]:PULSe:DELay`	Set the pulse delay time
5.4.2	`[:SOURce[c]]:PULSe:WIDTh`	Set the pulse width
5.4.3	`[:SOURce[c]]:PULSe:PEAK`	Set the pulse peak value
5.4.4	`[:SOURce[c]]:PULSe:BIAS`	Set the pulse bias (base) value
6.1.1	`:SYSTem:BEEPer:STATe`	Enable or disable the buzzer
6.1.2	`:SYSTem:COMMunicate:LAN:ADDRess`	Set the static IP address
6.1.3	`:SYSTem:COMMunicate:LAN:DHCP`	Enable or disable DHCP
6.1.4	`:SYSTem:COMMunicate:LAN:DNS[c]`	Set the DNS server address
6.1.5	`:SYSTem:COMMunicate:LAN:DOMain?`	Return the network domain name
6.1.6	`:SYSTem:COMMunicate:LAN:<GATE|GATeway>`	Set the default gateway
6.1.7	`:SYSTem:COMMunicate:LAN:<HNAMe|HOSTname>`	Set the host name
6.1.8	`:SYSTem:COMMunicate:LAN:MAC?`	Return the MAC address
6.1.9	`:SYSTem:COMMunicate:LAN:SMASk`	Set the subnet mask
6.1.10	`:SYSTem:COMMunicate:RS232:BAUDrate`	Set the RS232 baud rate
6.1.11	`:SYSTem:COMMunicate:USB[:TYPe]`	Set the USB communication type
6.2.1	`:SYSTem:HANDler:FUNCtion`	Set the function of a HANDLER pin
6.2.2	`:SYSTem:HANDler:POLArity`	Set the polarity of a HANDLER pin
6.2.3	`:SYSTem:HANDler:TIMing`	Set the trigger timing of a HANDLER pin

Section	Command	Function
6.2.4	`:SYSTem:HANDler:WIDth`	Set the trigger-output pulse width
6.3.1	`:SYSTem:BACKlight`	Set the display backlight brightness
6.3.2	`:SYSTem:POWeron`	Set the power-on state
6.3.3	`:SYSTem:DATE`	Set the internal clock date
6.3.4	`:SYSTem:TIME`	Set the internal clock time
6.3.5	`:SYSTem:VERSion?`	Return the SCPI standard version
6.3.6	`:SYSTem:LFRequency`	Set the line frequency
6.3.7	`:SYSTem:SYNCrole`	Set the master/slave mode
7.1.1	`:INITiate[:IMMediate]<:ACQuire|:TRANsient|[:ALL]>`	Start the device operation
7.1.2	`:TRIGger[c]<:ACQuire|:TRANsient|[:ALL]>:COUNt`	Set the trigger count
7.1.3	`:TRIGger[c]<:ACQuire|:TRANsient|[:ALL]>:DELay`	Set the trigger delay
7.1.4	`:TRIGger[c]<:ACQuire|:TRANsient|[:ALL]>:TIMer`	Set the timer trigger interval
7.1.5	`TRIG:ALL:SOUR:SIGN1`	Set the trigger signal (source and measurement)
7.2.1	`:CALCulate[c]:LIMit:STATe`	Enable or disable the sorting (limit test) function
7.3.1	`*RST`	Reset the instrument
7.3.2	`*IDN?`	Return the instrument identification
7.3.3	`*OPC`	Operation complete

A.2 Contact and support

For service, calibration, accessories or any question about this reference, contact Techmize or your authorized distributor using the details below.

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