multicomp PRO

MP720681 Two-Channel Series

PC Based Oscilloscope

User Manual

1. SCPI (Standard Commands for Programmable Instruments)

SCPI Structure

SCPI comes in tree structure, with sub-structures (command lines) covered. Each sub-structure (command line) comprises one root keyword and one keyword, or more layers keyword.

The command line starts in ":", with ":" as the separator between keywords, after the last keyword, followed by available parameters, with "space" as the separator between keyword and parameter. The "?" after one command line means the checking inquiry for the command line.

Giving an example,
:TRIGger:SINGle:EDGE:SOURce <source>
From which, **TRIGger** is the root keyword, **SINGle**, **EDGE** and **SOURce** is the second-layer, third-layer and fourth-layer keywords. This command line starts in ":", with next 3 respective ":" to separate the keywords, <source> as available parameters, with "space" to separate <source> and previous part.

:TRIGger:SINGle:EDGE:SOURce?
"?" is to inquire ":TRIGger:SINGle:EDGE:SOURce".

Syntax Rule

SCPI language defines the keyword of command lines, the keyword quantity within one command line is flexible, could be more or less. The keywords mainly come from meaningful English words, easy to remember, so-called "mnemonic". Mnemonic gets 2 category: long type and short type, generally speaking, the short type is always the abbreviation of the long type. Some special symbols been introduced to separate keywords, keyword and parameter, parameters, command lines.

Mnemonic Formation Rule

i. Judged by the character length of one word, for the word not longer than 4 characters, it could be mnemonic by itself. Giving an example, the word "free" been used as mnemonic "FREE".
ii. For the word longer than 4 characters, its first 4 characters work as mnemonic, like "FREQ" from the word "frequency".
iii. Provided the 4th character from any mnemonic is vowel (a, e, i, o, u), delete the character from mnemonic. Giving an example, the word "power" been shorted as "POW" when working as mnemonic.
iv. For word group, or sentence, the first character from every word, and the full character from last word forms the mnemonic. Giving ans example, the word group "input voltage" gets "IVOLtage" as mnemonic.

Special Symbol (as separator)

i. space (" ")
Been introduced to separate command and parameter.

ii. colon (":")

The different position of colon matches different meaning: when it locates the beginning of one command line, the command after it will be root command; when it is between two keywords, the keyword after it always mean the next layer.

iii. asterisk ("*")

The command line starts with asterisk been called "common command", been given to execute IEEE488.2 standard command.

iv. braces ("{ }")

The contents covered in braces is parameter. The vertical "|" separates parameters. When the command been introduced, at least one parameter from "{ }" should be chosen.

v. vertical ("|")

The vertical "|" separates parameters.

vi. square brackets ("[ ]")

The contents covered in the square brackets isn't a must, in other words, contents here could been chosen, or not been chosen .

vii. triangle brackets ("< >")

The contents covered in the triangle brackets is effective parameter, one of these effective parameters should be chosen.

Parameter Type

3 type parameter been referred: Discrete, Integer and Bool

i. Discrete

One of given options should be chosen as the parameter. Giving an example,

:TRIGger:SINGle:EDGE:SOURce <source>

From which, the option for <source> could be one of CH1|CH2.

:TRIGger:SINGle:EDGe:SOURce?

When this command line comes, the result will be "CH1", or "CH2".

ii. Integer

Unless specified, the parameter could be any NR1 format integer within the effective value range.

Note: Any parameter with decimal set will cause errors / abnormal result.

Giving an example,

:LAN:PORT<port>

From which, <port> could be any integer ranges from 0 till 65535.

:LAN:PORT?
When this command line comes, the result will be any integer ranges from 0 till 65535.

iii. Bool
The parameter value reads "OFF", or "ON", giving an example,
:CH1:DISPlay <bool>
From which, <bool> could be one of {OFF|ON}

:CH1:DISPlay?
When this command line comes, the result will be “OFF”, or “ON”.

iv. Real
The parameter could be any real within the effective value range,
Note: Any NR2 format decimal, or any NR3 format scientific notation parameter is acceptable.

giving an example
:TRIGger:SINGle:HOLDoff <time>
From which, <time> could be any real ranges from 0.0000001, or 1.000000e-07 (i.e. 100ns) till 10, or 0.1e+02 (i.e. 10s)

:TRIGger:SINGle:HOLDoff?
When this command line comes, the result will be certain real within a.m. ranges.

SCPI Abbreviation

When editing command line, the syntax rule should be well-followed, with capital and small letter combined, among which, capital letter always act as the abbreviation of the current command. When abbreviated the current command, the full capital letter should be there. For the abbreviation of parameter with unit, please refer to the capital/small letter rule within parameter range from sub-structures.

Giving examples,
Example 1
:ACQuire:MODE SAMPle
Abbreviated as
:ACQ:MODE SAMP

Example 2
:CH1:SCALe 1v
Abbreviated as
:CH1:SCAL 1v

Third-party API for SCPI

USB or LAN communication supported.

2. IEEE488.2 Common Commands

*IDN

Syntax

*IDN?

Description

The inquiry returns the device ID, in the form of ASCII string.

Return Result

<model no.> <serial number> VX.XX.XX

Among which, <model no.> matches the model no. of the current device;

<serial number> indicates the device serial number;

VX.XX.XX tells the device software version info.s.

Example

*IDN?

*RST

Syntax

*RST

Description

Restore the device to its default status.

3. SCPI for Oscilloscope Part

:HORIzontal command sub-structures

i. :HORIzontal:SCALe

Syntax

:HORIzontal:SCALe <scale_value>

:HORIzontal:SCALe?

Description

Set the division of time base.

Parameter

Parameter Name	Type	Range	Default
<scale_value>	discrete	refer to **Explanation**	1.0ms

Explanation

With main time base setting as default value.

The options for time base -

{2.0ns|5.0ns|10ns|20ns|50ns|100ns|200ns|500ns|1.0us|2.0us|5.0us|10us|20us|50us|100us|200us|500us|1.0ms|2.0ms|5.0ms|10ms|20ms|50ms|100ms|200ms|500ms|1.0s|2.0s|5.0s|10s|20s|50s|100s}

Return Result

The inquiry returns the time base division value, in the form of ASCII string.

Example

:HORI:SCAL 200us /* Set the main time base division at 200us. */

:HORI:SCAL?

(The Return Result) 200us

ii. :HORIzontal:OFFSet

Syntax

:HORIzontal:OFFSet <value>

:HORIzontal:OFFSet?

Description

Set the horizontal trigger position from the time base.

Parameter

Parameter Name	Type	Range	Default
<value>	Real	refer to **Explanation** (no. of division for horizontal movement)	0

Explanation

Range:

move rightwards (negative division no.): - memory depth / 2 / (sampling rate x time base)

move leftwards (positive division no.): 50 000 000 / (sampling rate x time base)

If the current main time base set at 500 us/div, assume the horizontal movement is 2 division, the horizontal offset time will be 1.000 ms.

Return Result

The inquiry returns the horizontal trigger position, in the form of ASCII string.

Example

:HORI:OFFS 2 / * set the horizontal position moves by +2 division */

:HORI:OFFS? /* time base set at 500us, horizontal position displays "1.000ms"*/

(The Return Result) 2

:CH command sub-structures

i. :CH<n>:BANDwidth

Syntax

:CH<n>:BANDwidth <type>

:CH<n>:BANDwidth?

Description

To set / inquire the bandwidth limit parameter of the specified channel.

Parameter

Parameter Name	Type	Range	Default
<n>	Discrete	{1|2|3|4}	1
< type>	Discrete	{OFF|20M}	OFF

Explanation

The range of <type> decided by the device model no.

20M: Activate the bandwidth limit at 20MHz, the high-frequency components from the measured signal will be shielded.

OFF: Disable the bandwidth limit function, the high-frequency component from the measured signal will be displayed.

Return Result

The inquiry returns "OFF", or "20M".

Example

:CH1:BAND 20M /*activate the bandwidth limit at 20MHz from Channel 1*/

:CH1:BAND?

(The Return Result) 20M

ii. :CH<n>:DISPlay

Syntax

:CH<n>:DISPlay <bool>

:CH<n>:DISPlay?

Description

Turns on/off / inquires the display of the channel input signal.

Parameter

Parameter Name	Type	Range	Default
<n>	Discrete	{1|2|3|4}	1
<bool>	Bool	{OFF|ON}	ON

Return Result

The inquiry returns "OFF", or "ON".

Example

:CH1:DISP ON /* turns on the display of Channel1 signal */

:CH1:DISP?

(The Return Result) ON

iii. :CH<n>:COUPling

Syntax

:CH<n>:COUPling <coupling>

:CH<n>:COUPling?

Description

To set / inquire the coupling mode of the channel input to “AC”, “DC” or “GND”.

Parameter

Parameter Name	Type	Range	Default
<n>	Discrete	{1|2|3|4}	1
<coupling>	Discrete	{AC|DC|GND}	AC

Return Result

The inquiry returns "AC", "DC" or "GND".

Example

:CH1:COUP DC /* sets the coupling mode of Channel 1 input to "DC" */

:CH1:COUP?

(The Return Result) DC

iv. :CH<n>:SCALe

Syntax

:CH<n>:SCALe <scale>

:CH<n>:SCALe?

Description

To set / inquire the vertical scale of the displayed signal from the specified channel.

Parameter

Parameter Name	Type	Range	Default
<n>	Discrete	{1|2|3|4}	1
<scale>	Discrete	{2mv|5mv|10mv|20mv|50mv|100mv|200mv|500mv|1v|2v|5v}	1v

Explanation

When setting the parameter, the probe rate is one factor should be considered. Giving an example, the probe rate in X10, to set 10mv division, the command line goes in :CH<n>:SCALe 1mv

Return Result

The inquiry returns the vertical division value, in the form of ASCII string.

Example

:CH1:SCAL 1v /* sets the vertical position of Channel 1 at 1V/div */

:CH1:SCAL?

(The Return Result) 1v

v. :CH<n>:OFFSet

Syntax

:CH<n>:OFFSet <offset>

:CH<n>:OFFSet?

Description

To set / inquire the vertical offset of the displayed signal from the specified channel.

Parameter

Parameter Name	Type	Range	Default
<n>	Discrete	{1|2|3|4}	1
<offset>	Real	refer to **Explanation** (no. of division for vertical offset of the displayed signal from the specified channel)	1-CH display CH<n>: 0 2-CH display CH1: 2 CH2: - 2

Explanation

Range -

2mv division: -1000 to 1000
5mv division: -400 to 400
10mv division: -200 to 200
20mv division: -100 to 100
50mv division: -40 to 40
100mv division: -200 to 200
200mv division: -100 to 100
500mv division: -40 to 40
1v division: -40 to 40
2v division: -20 to 20
5v division: -8 to 8

Return Result

The inquiry returns the division position from zero point, in the form of ASCII string.

Example

:CH1:OFFS 1 /* sets the vertical offset of Channel 1 at 1 div. */

:CH1:OFFS?

(The Return Result) 1.000000e+00

vi. :CH<n>:INVErse

Syntax

:CH<n>:INVErse <bool>

:CH<n>:INVErse?

Description

Turns on/off / inquires the inverse of the displayed channel signal.

Parameter

Parameter Name	Type	Range	Default
<n>	Discrete	{1|2|3|4}	1
<bool>	Bool	{OFF|ON}	OFF

Return Result
The inquiry returns "OFF", or "ON".

Example
:CH1:INVE ON /* turns the inverse of channel1 on. */
:CH1:INVE?
(The Return Result) ON

:ACQuire command sub-structures

i. :ACQuire:MODE

Syntax
:ACQuire:MODE <type>
:ACQuire:MODE?

Description
To set / inquire the acquisition mode of the device.

Parameter

Parameter Name	Type	Range	Default
<type>	Discrete	{SAMPle|PEAK}	SAMPle

Return Result
The inquiry returns "SAMPle", or "PEAK".

Example
:ACQ:MODE SAMP /* sets the acquisition mode to sample */
:ACQ:MODE?
(The Return Result) SAMPle

ii. :ACQuire:DEPMEM

Syntax
:ACQuire:DEPMEM <mdep>
:ACQuire:DEPMEM?

Description
To set / inquire the stored sampling points captured in one trigger from input signal.

Parameter

Parameter Name	Type	Range	Default
<mdep>	Discrete	{1K|10K|100K|1M|10M}	1K

Return Result
The inquiry returns the actual quantity of sampling points.

Example
:ACQ:DEPMEM 10K /* sets the memory depth to "10K" */
:ACQ:DEPMEM?
(The Return Result) 10K

:TRIGger command sub-structures

i. :TRIGger:STATUS

Syntax
:TRIGger:STATUS?

Description
Inquires the current trigger status.

Parameter

Parameter Type	Range	Default
Discrete	{AUTO|STOP|SCAN|TRIG}	--

Return Result
“AUTO”, or “STOP”, or “SCAN”, or “TRIG”.

Example
:TRIG:STATUS?
(The Return Result) AUTO

ii. :TRIGger:FORCe

Syntax
:TRIGger:FORCe

Description
Sets the forced trigger.

Explanation
This command forces the device to acquire the signal, even the currently-set trigger condition hasn't been met.

iii. :TRIGger:HALF

Syntax
:TRIGger:HALF

Description
Sets the trigger level at the vertical mid-point from the amplitude value of the triggered signal.

iv. :TRIGger:TYPE

Syntax
:TRIGger:TYPE <type>
:TRIGger:TYPE?

Description
To set / inquire the current trigger type.

Parameter

Parameter Name	Type	Range	Default
<type>	Discrete	{SINGle}	SINGle

Return Result
The inquiry returns the current trigger type.

Example
:TRIG:TYPE SING /* sets the current trigger type to single trigger */
:TRIG:TYPE?
(The Return Result) SINGle

v. :TRIGger:SINGle

i). :TRIGger:SINGle:MODE <type>

Syntax
:TRIGger:SINGle:MODE <type>
:TRIGger:SINGle:MODE?

Description
To set / inquire the trigger type under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<type>	Discrete	{EDGE|VIDeo|PULSe|SLOPe}	EDGE

Return Result
The inquiry returns the current trigger type under single trigger condition.

Example
:TRIG:SING:MODE EDGE /* set edge as the current trigger type under single trigger condition. */
:TRIG:SING:MODE?
(The Return Result) EDGE

ii). :TRIGger:SINGle:SWEep

Syntax
:TRIGger:SINGle:SWEep <mode>
:TRIGger:SINGle:SWEep?

Description
To set / inquire the trigger mode under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<mode>	Discrete	{AUTO|NORMal|SINGle}	AUTO

Return Result
The query returns the current trigger mode.

Example
:TRIG:SING:SWE NORM /* sets normal as the current trigger mode under single trigger condition. */
:TRIG:SING:SWE?
(The Return Result) NORMal

iii). :TRIGger:SINGle:HOLDoff

Syntax
:TRIGger:SINGle:HOLDoff <time>
:TRIGger:SINGle:HOLDoff?

Description
To set / inquire the trigger hold-off time. The default unit reads ”s”.

Parameter

Parameter Name	Type	Range	Default
<time>	Real	100ns - 10s	100ns

Return Result

The inquiry returns the trigger hold-off time, value comes in scientific notation, like 1.000000e+04 .

Example

:TRIG:SING:HOLD 0.001 /* sets the trigger hold-off time at 1ms */

:TRIG:SING:HOLD?

(The Return Result) 1.000000e-03

iv). :TRIGger:SINGle:EDGE

:TRIGger:SINGle:EDGE:SOURce

Syntax

:TRIGger:SINGle:EDGE:SOURce <source>

:TRIGger:SINGle:EDGE:SOURce?

Description

To set / inquire the source of edge trigger under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<source>	Discrete	{CH1|CH2|CH3|CH4}	CH1

Return Result

The inquiry returns "CH1", "CH2", "CH3", or "CH4".

Example

:TRIG:SING:MODE EDGE

:TRIG:SING:EDGE:SOUR CH2 /* sets “CH2” as the source of edge trigger under single trigger condition */

:TRIG:SING:EDGE:SOUR?

(The Return Result) CH2

:TRIGger:SINGle:EDGE:COUPling

Syntax

:TRIGger:SINGle:EDGE:COUPling <coupling>

:TRIGger:SINGle:EDGE:COUPling?

Description

To set / inquire the coupling mode of edge trigger under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<coupling>	Discrete	{DC|AC|HF}	DC

Return Result

The inquiry returns "DC", or "AC", or "HF".

Example

:TRIG:SING:MODE EDGE

:TRIG:SING:EDGE:COUP AC /* sets “AC” as the coupling mode of edge trigger under single trigger condition */

:TRIG:SING:EDGE:COUP?

(The Return Result) AC

:TRIGger:SINGle:EDGE:SLOPe

Syntax

:TRIGger:SINGle:EDGE:SLOPe <slope>

:TRIGger:SINGle:EDGE:SLOPe?

Description

To set / inquire the slope status of edge trigger under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<slope>	Discrete	{RISE|FALL}	RISE

Return Result

The inquiry returns "RISE", or "FALL".

Example

:TRIG:SING:MODE EDGE / * sets edge as trigger mode under single trigger condition * /

:TRIG:SING:EDGE:SLOP FALL /* sets “FALL” as the slope of edge trigger under single trigger condition */

:TRIG:SING:EDGE:SLOP?

(The Return Result) FALL

:TRIGger:SINGle:EDGE:LEVel

Syntax

:TRIGger:SINGle:EDGE:LEVel <level>

:TRIGger:SINGle:EDGE:LEVel?

Description

To set / inquire the trigger level of edge trigger under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<level>	Real	±5 Divs - OFFSET (Div)	0

Return Result

The inquiry returns the division position of trigger level, in the form of ASCII string.

Example

:TRIG:SING:MODE EDGE / * sets edge as trigger mode under single trigger condition * /

:TRIG:SING:EDGE:SOUR CH1 /* sets “CH1” as the source of edge trigger under single trigger condition */

:TRIG:SING:EDGE:LEV 1 /* sets the trigger level at 1 division above zero position*/

:TRIG:SING:EDGE:LEV?

(The Return Result) 1

v). :TRIGger:SINGle:VIDeo

:TRIGger:SINGle:VIDeo:SOURce

Syntax

:TRIGger:SINGle:VIDeo:SOURce <source>

:TRIGger:SINGle:VIDeo:SOURce?

Description

To set / inquire the source under of video trigger under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<source>	Discrete	{CH1|CH2|CH3|CH4}	CH1

Return Result

The inquiry returns "CH1", "CH2", "CH3", or "CH4".

Example

:TRIG:SING:VID:SOUR CH2 /* sets “CH2” as the source of video trigger under single trigger condition */

:TRIG:SING:VID:SOUR?

(The Return Result) CH2

:TRIGger:SINGle:VIDeo:MODU

Syntax

:TRIGger:SINGle:VIDeo:MODU <standard>

:TRIGger:SINGle:VIDeo:MODU?

Description

To set / inquire video standard of video trigger under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<standard>	Discrete	{PAL|SECam|NTSC}	NTSC

Return Result

The inquiry returns "PAL", or "SECam", or "NTSC".

Example

:TRIG:SING:MODE VID / * sets video as trigger mode under single trigger condition * /

:TRIG:SING:VID:MODU NTSC /* selects “NTSC” as the video standard of video trigger under single trigger condition */

:TRIG:SING:VID:MODU?

(The Return Result) NTSC

:TRIGger:SINGle:VIDeo:SYNC

Syntax

:TRIGger:SINGle:VIDeo:SYNC <mode>

:TRIGger:SINGle:VIDeo:SYNC?

Description

To set / inquire the synchronization type of video trigger under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<mode>	Discrete	{LINE|FIELd|ODD|EVEN|LNUM}	LINE

Return Result

The inquiry returns "LINE", or "FIELd", or "ODD", or "EVEN" or “LNUM”.

Example

:TRIG:SING:MODE VID /* sets video as trigger mode under single trigger condition */

:TRIG:SING:VID:SYNC ODD /* selects “ODD” as the synchronization type of video trigger under single trigger condition */

:TRIG:SING:VID:SYNC?
(The Return Result) ODD

:TRIGger:SINGle:VIDeo:LNUM

Syntax
:TRIGger:SINGle:VIDeo:LNUM <line>
:TRIGger:SINGle:VIDeo:LNUM?

Description
To set / inquire the line number when the synchronization type is “LNUM”, in video trigger mode under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<line>	Integer	NTSC: 1 to 525 PAL: 1 to 625 SECam: 1 to 625	1

Return Result
The inquiry returns the line number in the form of ASCII string when the synchronization type is “LNUM”, in video trigger mode under single trigger condition.

Example
:TRIG:SING:MODE VID /* sets video as trigger mode under single trigger condition */
:TRIG:SING:VID:LNUM 100 /* sets “100” as the line number when the synchronization type is “LNUM”, in video trigger mode under single trigger condition. */
:TRIG:SING:VID:LNUM?
(The Return Result) 100

vi). :TRIGger:SINGle:SLOPe

:TRIGger:SINGle:SLOPe:ULevel

Syntax
:TRIGger:SINGle:SLOPe:ULevel <volt>
:TRIGger:SINGle:SLOPe:ULevel?

Description
To set / inquire the voltage value of the upper limit from the trigger level in slope trigger mode under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<volt>	Real	varies from different voltage division	--

Return Result

The inquiry returns the voltage value of the upper limit from the trigger level in slope trigger mode under single trigger condition, value comes in scientific notation, like 1.000000e+04.

Example

:TRIG:SING:MODE SLOP /* sets slope as trigger mode under single trigger condition */

:TRIG:SING:SLOP:UL 1 /* sets the voltage value of the upper limit from the trigger level in slope trigger mode at 1 division */

:TRIG:SING:SLOP:UL?

(The Return Result) 1.000000e-01

:TRIGger:SINGle:SLOPe:LLevel

Syntax

:TRIGger:SINGle:SLOPe:LLevel <volt>

:TRIGger:SINGle:SLOPe:LLevel?

Description

To set / inquire the voltage value of the lower limit from the trigger level in slope trigger mode under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<volt>	Real	varies from different voltage division	--

Return Result

The inquiry returns the voltage value of the lower limit from the trigger level in slope trigger mode under single trigger condition, value comes in scientific notation, like 1.000000e+04.

Example

:TRIG:SING:MODE SLOP /* sets slope as trigger mode under single trigger condition */

:TRIG:SING:SLOP:LL 1 /* sets the voltage value of the lower limit from the trigger level in slope trigger mode at 1 division */

:TRIG:SING:SLOP:LL?

(The Return Result) 1.000000e-01

:TRIGger:SINGle:SLOPe:SOURce

Syntax

:TRIGger:SINGle:SLOPe:SOURce <source>

:TRIGger:SINGle:SLOPe:SOURce?

Description

To set / inquire the trigger source in slope trigger mode under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<source>	Discrete	{CH1|CH2|CH3|CH4}	CH1

Return Result

The inquiry returns "CH1", "CH2", "CH3", or "CH4".

Example

:TRIG:SING:SLOP:SOUR CH2 /* sets “CH2” as the trigger source in slope trigger mode under single trigger condition */

:TRIG:SING:SLOP:SOUR?

(The Return Result) CH2

:TRIGger:SINGle:SLOPe:TIME

Syntax

:TRIGger:SINGle:SLOPe:TIME <time>

:TRIGger:SINGle:SLOPe:TIME?

Description

To set / inquire the time parameter in slope trigger mode under single trigger condition

Parameter

Parameter Name	Type	Range	Default
<time>	String	30ns to 10s	30ns

Return Result

The inquiry returns the time in slope trigger mode under single trigger condition, value comes in scientific notation, like 1.000000e+04.

Example

:TRIG:SING:MODE SLOP / * sets slope as trigger mode under single trigger condition * /

:TRIG:SING:SLOP:TIME 1ms /* sets the slope trigger time at 1ms */

:TRIG:SING:SLOP:TIME?
(The Return Result)　1.000000e-03

:TRIGger:SINGle:SLOPe:WHEN

Syntax
:TRIGger:SINGle:SLOPe:WHEN <when>
:TRIGger:SINGle:SLOPe:WHEN?

Description
To set / inquire the trigger condition of the slope trigger, in slope trigger mode under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<when>	Discrete	{PGReater|PLESs|PGLess|NGReater|NLESs|NGLess}	PGReater

Return Result
The inquiry returns PGReater, or PLESs, or NGReater, or NLESs, or PGLess, or NGLess.

Explanation
PGReater：With given time parameter, the trigger happens when the positive slope time of the input signal larger than the given time.
PLESs：With given time parameter, the trigger happens when the positive slope time of the input signal smaller than the given time.
PGLess：With given time upper limit and lower limit, the trigger happens when the positive slope time of the input signal lager than given time lower limit, and smaller than given time upper limit.
NGReater：With given time parameter, the trigger happens when the negative slope time of the input signal larger than the given time.
NLESs：With given time parameter, the trigger happens when the negative slope time of the input signal smaller than the given time.
NGLess：With given time upper limit and lower limit, the trigger happens when the negative slope time of the input signal lager than given time lower limit, and smaller than given time upper limit.

Example
:TRIG:SING:MODE SLOP　　/* sets slope as trigger mode under single trigger condition */
:TRIG:SING:SLOP:WHEN PLES　/* sets the slope trigger condition to PLESs*/
:TRIG:SING:SLOP:WHEN?
(The Return Result)　PLESs

vii). :TRIGger:SINGle:PULSe

:TRIGger:SINGle:PULSe:SOURce

Syntax

:TRIGger:SINGle:PULSe:SOURce <source>

:TRIGger:SINGle:PULSe:SOURce?

Description

To set / inquire the trigger source of the pulse trigger under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<source>	Discrete	{CH1|CH2|CH3|CH4}	CH1

Return Result

The inquiry returns "CH1", "CH2", "CH3", or "CH4".

Example

:TRIG:SING:PULS:SOUR CH2 /* sets “CH2” as the trigger source of the pulse trigger under single trigger condition */

:TRIG:SING:PULS:SOUR?

(The Return Result) CH2

:TRIGger:SINGle:PULSe:TIME

Syntax

:TRIGger:SINGle:PULSe:TIME <time>

:TRIGger:SINGle:PULSe:TIME?

Description

To set / inquire the time parameter of the pulse width in pulse trigger mode under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<time>	String	30ns to 10s	30ns

Return Result

The inquiry returns the time parameter of the pulse width in pulse trigger mode under single trigger condition, value comes in scientific notation, like 1.000000e+04.

Example

:TRIG:SING:MODE PULS /* sets pulse as trigger mode under single trigger condition */

:TRIG:SING:PULS:TIME 1ms /* sets the pulse width time in pulse trigger mode at 1ms */

:TRIG:SING:PULS:TIME?

(The Return Result) 1.000000e-03

:TRIGger:SINGle:PULSe:COUPling

Syntax

:TRIGger:SINGle:PULSe:COUPling <coupling>

:TRIGger:SINGle:PULSe:COUPling?

Description

To set / inquire the coupling of pulse width trigger in pulse trigger mode under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<coupling>	Discrete	{DC|AC|HF}	DC

Return Result

The inquiry returns "DC", or "AC", or “HF”.

Example

:TRIG:SING:MODE PULS /* sets pulse as trigger mode under single trigger condition */

:TRIG:SING:PULS:COUP AC /* sets the coupling of pulse width trigger to AC */

:TRIG:SING:PULS:COUP?

(The Return Result) AC

:TRIGger:SINGle:PULSe:WHEN

Syntax

:TRIGger:SINGle:PULSe:WHEN <when>

:TRIGger:SINGle:PULSe:WHEN?

Description

To set / inquire the coupling condition of pulse width trigger in pulse trigger mode under single trigger condition.

Parameter

Parameter Name	Type	Range	Default
<when>	Discrete	{PGReater|PLESs|PGLess|NGReater|NLESs|NGLess}	PGReater

Return Result

The inquiry returns PGReater, PLESs, NGReater, NLESs, PGLess, or NGLess.

Explanation

PGReater：With given pulse width, the trigger happens when the positive pulse width of the input signal larger than the given pulse width.

PLESs：With given pulse width, the trigger happens when the positive pulse width of the input signal smaller than the given pulse width.

PGLess：With given upper and lower pulse width, the trigger happens when the positive pulse width of the input signal lager than given lower pulse width, and smaller than given upper pulse width.

NGReater：With given pulse width, the trigger happens when the negative pulse width of the input signal larger than the given pulse width.

NLESs：With given pulse width, the trigger happens when the negative pulse width of the input signal smaller than the given pulse width.

NGLess：With given upper and lower pulse width, the trigger happens when the negative pulse width of the input signal lager than given lower pulse width, and smaller than given upper pulse width.

Example

:TRIG:SING:MODE PULS /* sets pulse as trigger mode under single trigger condition */

:TRIG:SING:PULS:WHEN PLES /* sets the coupling condition of pulse width trigger to PLESs */

:TRIG:SING:PULS:WHEN?

(The Return Result) PLESs

:LAN command sub-structures

i. :LAN:DEVice

Syntax

:LAN:DEVice <string>

:LAN:DEVice?

Description

To set / inquire the current network communication interface.

Parameter

Parameter Name	Type	Range	Default
string	Discrete	{eth0|eth1|wlan0}	eth0

Return Result

The inquiry returns "eth0", or "eth1", or "wlan0".

Example

:LAN:DEV eth0 /* set the current network communication interface to eth0. */

:LAN:DEV?

(The Return Result) eth0

ii. :LAN:PROTocol

Syntax
:LAN:PROTocol <device>
:LAN:PROTocol?

Description
To set / inquire the method to get the network IP.

Parameter

Parameter Name	Type	Range	Default
<device>	Discrete	{STATIC|DHCP}	STATIC

Return Result
The inquiry returns "STATIC", or "DHCP".

Example
:LAN:PROT STATIC /* sets the method to get network IP to STATIC */
:LAN:PROT?
(The Return Result) STATIC

iii. :LAN:IPADdress

Syntax
:LAN:IPADdress <string>
:LAN:IPADdress?

Description
To set / inquire the IP address of the device.

Parameter

Parameter Name	Type	Range	Default
<string>	ASCII String	refer to **Explanation**	192.168.1.172

Explanation
The <string> goes in nnn.nnn.nnn.nnn (like 192.168.1.172), the first nnn ranges from 0 till 223 (excl. 127), the other thee nnn ranges from 0 till 255. This command line works for STATIC IP address configuration mode.

Return Result
The inquiry returns the current IP address in the form of ASCII string.

Example
:LAN:PROT STATIC /* sets the method to get network IP to STATIC */
:LAN:IPAD 192.168.1.10 /* sets the IP address at 192.168.1.10 */
:LAN:IPAD?
(The Return Result) 192.168.1.10

iv. :LAN:MASK

Syntax
:LAN:MASK <string>
:LAN:MASK?

Description
To set / inquire the subnet mask.

Parameter

Parameter Name	Type	Range	Default
<string>	ASCII String	refer to **Explanation**	255.255.255.0

Explanation
The <string> goes in nnn.nnn.nnn.nnn (like 255.255.255.0), each nnn ranges from 0 till 255. This command line works for STATIC IP address configuration mode.

Return Result
The inquiry returns the current subnet mask in the form of ASCII string.

Example
:LAN:PROT STATIC /* sets the method to get network IP to STATIC */
:LAN:MASK 255.255.0.0 /* sets the subnet mask at 255.255.0.0 */
:LAN:MASK?
(The Return Result) 255.255.0.0

v. :LAN:GATeway

Syntax
:LAN:GATeway <string>
:LAN:GATeway?

Description
To set / inquire the current gateway.

Parameter

Parameter Name	Type	Range	Default
<string>	ASCII String	refer to **Explanation**	192.168.1.1

Explanation
The <string> goes in nnn.nnn.nnn.nnn (like 192.168.1.1), the first nnn ranges from 0 till 223 (excl. 127), the other thee nnn ranges from 0 till 255.

Return Result
The inquiry returns the current gateway in the form of ASCII string.

Example
:LAN:GAT 192.168.1.1 /* sets the gateway at 192.168.1.1 */
:LAN:GAT?
(The Return Result) 192.168.1.1

vi. :LAN:DNS

Syntax
:LAN:DNS <string>
:LAN:DNS?

Description
To set / inquire the current DNS address.

Parameter

Parameter Name	Type	Range	Default
<string>	ASCII String	refer to **Explanation**	192.168.1.1

Explanation
The <string> goes in nnn.nnn.nnn.nnn (like 192.168.1.1), the first nnn ranges from 0 till 223 (excl. 127), the other thee nnn ranges from 0 till 255.

Return Result
The inquiry returns the current DNS address in the form of ASCII string.

Example
:LAN:DNS 192.168.1.1 /* sets the DNS address to 192.168.1.1 */
:LAN:DNS?
(The Return Result) 192.168.1.1

vii.:LAN:MAC

Syntax
:LAN:MAC?

Description
To inquire the MAC address of the device.

Return Result
The inquiry returns the MAC address 0019AF300000 and (00-19-AF-30-00-00) in the form of ASCII string.

:WAVeform command sub-structures

i. :WAVeform:DATA

Syntax
:WAVeform:DATA?

Description
To read the processed data (data processed by interpolation, or compression).

Explanation
The read data format goes in the length of the TMC header + data packet.
The TMC header comes in the form of #NXXXXXX, among which, “**#**” is the standard header ID, “N” indicates the bytes quantity, to describe the length of the data packet in the form of ASCII string.

Return Result
The read data consists of two parts - TMC header and data packet, like #900000ddddXXXX..., among which, “dddd” indicates the length of the valid data packet in the data stream.
When reading memory data, each time’s read-back data may be only one sector from memory. The read-back data by sectors, the beginning of each sector gets a descriptor like #9XXXXXXXXX, among which, “XXXXXXXXX” reflects the data packet length in this transferring sector. The read-back data between two adjacent sectors is consecutive. Giving an example,

The read data by one time is #9000001024XXXX: among which, “9” indicates the bytes quantity, “000001024” describes the length of the waveform (input signal) data, say, 1024 bytes. The value of “N” calculated by introducing 2 functions: "partial string" and "decimal numeric string to numeric conversion".

Example
:WAVeform:DATA? /* reads the processed data */
(The Return Result) The data packet with TMC header, like #9000003040... (could refer to 7. Supplement: WAVeform:DATA? Return Result for details).

ii. the combination of commands to read the original data

the combination of commands covers -

:WAVeform:BEGin
:WAVeform:PREamble
:WAVeform:RANGe
:WAVeform:FETCh
:WAVeform:END

Note: The original data here, and hereinafter means the captured data without processing.

:WAVeform:BEGin

Syntax

:WAVeform:BEGin <CHn>

Description

To start reading the original data.

Parameter

Parameter Name	Type	Range	Default
<CHn>	Discrete	{CH1|CH2|CH3|CH4}	--

:WAVeform:PREamble

Syntax

:WAVeform:PREamble?

Explanation

To inquire all of the waveform parameters.

The read data format goes in the length of the TMC header + data packet.
The TMC header comes in the form of #NXXXXXX, among which, “#” is the standard header ID, “N” indicates the bytes quantity, to describe the length of the data packet in the form of ASCII string.

Return Result

The inquiry returns the waveform parameter.

The read data consists of two parts - TMC header and data packet, like #900000ddddXXXX..., among which, “dddd” reflects the length of the valid data packet in the data stream, “XXXX...” indicates the data from the data packet, which plays the role of waveform parameter (could refer to 7. Supplement: WAVeform:DATA? Return Result for details).

:WAVeform:RANGe

Syntax

:WAVeform:RANGe <offset>,<size>

Description

To set/ read the offset and data length from the original data.

Parameter

Parameter Name	Type	Range	Default
<offset>	Integer	0M - 10M	--
<size>	Integer	1 - 256k	--

:WAVeform:FETCh

Syntax

:WAVeform:FETCh?

Description

To read the original data, the PC keeps reading the data at certain length one time until the ending of data.

Return Result

The inquiry returns waveform data.

The read data consists of two parts - TMC header and data packet, like #900000ddddXXXX..., among which, “dddd” reflects the length of the valid data packet in the data stream, “XXXX...” indicates the data from the data packet, every 2 bytes forms one effective data, to be 16-bit signed integer data (could refer to iv. Calculation Tips Towards Waveform Data under 7. Supplement: WAVeform:DATA? Return Result for details).

:WAVeform:END

Syntax

:WAVeform:END

Description

To stop reading the waveform data.

Via following 3 examples, to know the application of this combination of commands -

Example 1. to read the original data of 10k length from Channel 1

```
:WAV:BEG CH1          /* to start reading the original data from CH1 */
:WAV:PRE?             /* to inquire the waveform parameters (this line not a must provided only need to
                         read the data) */
:WAV:RANG 0,10000     /* to set/ read the offset and data length from the original data */
:WAV:FETC?            /* to read the original data */
:WAV:END              /* to stop reading the original data, and to unlock the protection of data
                         consistency */
```

Example 2. to read the original data of 100k length from CH1 / CH2 / CH3 / CH4* at the same time

```
:WAV:BEG CH1          /* to start reading the original data from CH1 */
```

```
:WAV:PRE?                 /* to inquire the waveform parameters (this line not a must provided only need to
                          read the data) */
:WAV:RANG 0,100000        /* to set/ read the offset and data length from the original data */
:WAV:FETC?                /* to read the original data */
:WAV:BEG CH2              /* to start reading the original data from CH2 */
:WAV:RANG 0,100000
:WAV:FETC?
:WAV:BEG CH3              /* to start reading the original data from CH3 */
:WAV:RANG 0,100000
:WAV:FETC?
:WAV:BEG CH4              /* to start reading the original data from CH4 */
:WAV:RANG 0,100000
:WAV:FETC?
:WAV:END                  /* to stop reading the original data, and to unlock the protection of data
                          consistency */
```

Example 3. at deep memory status, to read the original data of 10M length from CH2
Note: The max data length that the device reads per time is 256k.

```
:WAV:BEG CH2              /* to start reading the original data from CH2 */
:WAV:PRE?                 /* to inquire the waveform parameters (this line not a must provided only
                          need to   read the data) */
:WAV:RANG 0,200000        /* to set/ read the offset and data length from the original data */
:WAV:FETC?                /* to read the original data */
:WAV:RANG 200000,200000   /* to read the original data from the position of 200k length till 400k length */
:WAV:FETC?
:WAV:RANG 400000,200000   /* to read the original data from the position of 400k length till 600k length */
:WAV:FETC?
:WAV:RANG 600000,200000   /* to read the original data from the position of 600k length till 800k length */
:WAV:FETC?
……
……                        /* multi-times :WAV:RANG XXXXXXX, 200000 */ {XXXXXXX goes like
                          the previous no. at the same position adds 200000}
                          /* multi-times :WAV:FETC? */
:WAV:RANG 9600000,200000
:WAV:FETC?
:WAV:RANG 9800000,200000
:WAV:FETC?
:WAV:END                  /* to stop reading the original data, and to unlock the protection of data
                          consistency */
```

:MEASure command sub-structures

i. :MEASure:DISPlay

Syntax

:MEASure:DISPlay <bool>

:MEASure:DISPlay?

Description

To turn on/off the display of channel signal measurement.

To inquire the display status of channel signal measurement.

Parameter

Parameter Name	Type	Range	Default
<bool>	Bool	{ON|OFF}	OFF

Return Result
The inquiry returns "ON", or "OFF".

Example
:MEAS:DISP ON /* turns on the display of channel signal measurement */
:MEAS:DISP?
(The Return Result) ON

ii. :MEASure:TIMer

Syntax
:MEASure:TIMer <value>
:MEASure:TIMer?

Description
To set / inquire the time interval of signal measurement.

Parameter

Parameter Name	Type	Range	Default
<value>	Real	{20ms-}	200ms

Return Result
The inquiry returns the time interval of signal measurement, value comes in scientific notation, like 1.000000e+04.

Example
:MEAS:TIM 0.2 /* sets the time interval of signal measurement at 0.2S*/
:MEAS:TIM?
(The Return Result) 2.000000e-01

iii. :MEASure:SOURce

Syntax
:MEASure:SOURce <CHn>
:MEASure:SOURce?

Description
To set or inquire the signal source of the current measurement.

Parameter

Parameter Name	Type	Range	Default
<CHn>	Discrete	{CH1|CH2|CH3|CH4}	CH1

Return Result
The inquiry returns the signal source of the current measurement, "CH1", or "CH2".

Example
:MEAS:SOUR CH2 /*sets CH2 as the signal source of the current measurement */
:MEAS:SOUR?
(The Return Result) CH2

iv. :MEASure:OVERflow

Syntax
:MEASure:OVERflow?

Description
To inquire whether there is overflow for the ADC data on which the measurement calculation is based.

Return Format
The inquiry returns "TRUE" (there is overflow), or "FALSE" (there isn't overflow).

Example
:MEAS:OVER? /* inquires whether there is overflow for the measured ADC (suppose now there isn't overflow) */
(The Return Result) FALSE

v. :MEASure:<items>

Syntax
:MEASure:<items>?

Description
To inquire the value of the current channel measurement, which has been used for device's most basic measurement. The measurement result comes in scientific notation, on condition that the measurement value not possible to be calculated, the return result goes in 9.900000e+36.

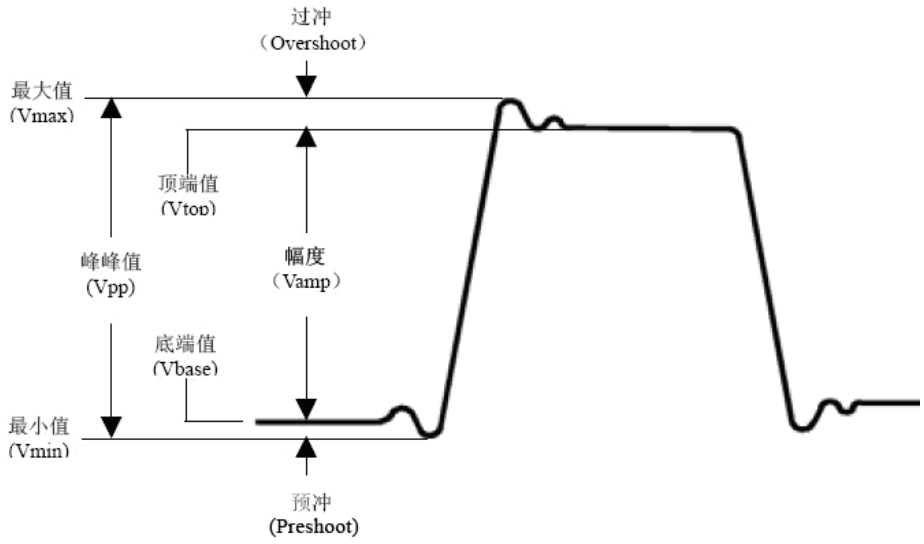
Parameter

Parameter Name	Type	Range	Default
<items>	Discrete	{VMAX|VMIN|VPP|VTOP|VBASE|VAMP|VAVG|VRMS|CRMS|OVERshoot|PREShoot|PERiod|FREQuency|RTIMe|FTIMe|PWIDth|NWIDth|AREA|CARea|PDUTy|NDUTy|PPULsecount|NPULsecount|REDGecount|FEDGecount}	--

full meaning to Range items -

item	note	unit	item	note	unit
VMAX	maximum value	V	PERiod	cycle	s
VMIN	minimum value	V	FREQuency	frequency	Hz
VPP	peak to peak	V	RTIMe	rise time	s
VTOP	top value	V	FTIMe	fall time	s
VBASE	bottom value	V	PWIDth	positive pulse width time	s
VAMP	amplitude value	V	NWIDth	negative pulse width time	s
VAVG	average value	V	AREA	area	Vs
VRMS	valid value	V	CARea	cycle area	Vs
CRMS	cycle effective value	V	PPULsecount	positive pulse number	One
OVERshoot	data overshoot	100%	NPULsecount	number of negative pulses	One
PREShoot	data pre-shoot	100%	REDGecount	number of rising edges	One
PDUTy	positive duty cycle	100%	FEDGecount	number of falling edges	One
NDUTy	negative duty cycle	100%			

the measurement item from voltage parameter -



Average: The arithmetic mean value over the full waveform or chosen area.

Peak-to-peak (Vpp): The voltage value between upper peak and lower peak from measured signal.

Root Mean Square Value (Vrms): The accurate “root mean square” voltage over the full waveform or

chosen area.

Maximum value (Vmax): The voltage value between upper peak and ground (GND).

Minimum value (Vmin): The voltage value between lower peak and ground (GND).

Top value (Vtop): The voltage value between flat top and ground (GND).

Bottom value (Vbase): The voltage value between flat base and ground (GND).

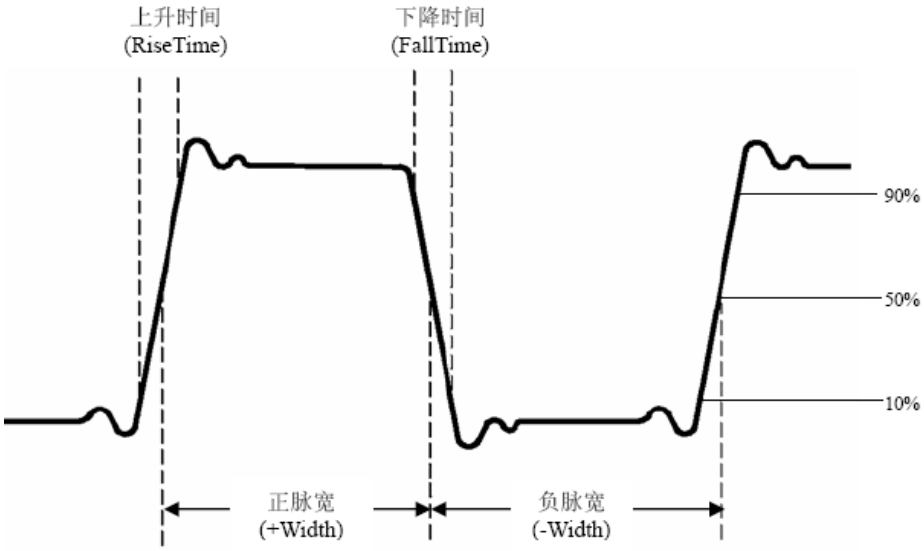
Amplitude (Vamp): The voltage value between flat top and flat base from measured signal.

Overshoot: Equals (Vmax - Vtop) / Vamp.

Preshoot: Equals (Vmin - Vbase) / Vamp.

Cycle rms: The root mean square value calculated by the first complete waveform cycle.

the measurement item from time parameter -



RiseTime: The time span for signal amplitude rise from 10% to 90%, judged by the rising edge of its first pulse.

Fall Time: The time span for signal amplitude fall from 90% to 10%, judged by the falling edge of its first pulse.

Positive Pulse Width (+Width): The pulse width that the first positive pulse at 50% amplitude point.

Negative pulse width (-Width): The pulse width that the first negative pulse at 50% amplitude point.

Positive Duty Cycle (+Duty): Equals the value of +Width / Period.

Negative Duty Cycle (-Duty): Equals the value of -Width / Period.

other measurements -

number of positive pulses: Within the chosen waveform area, the quantity of positive pulses moved above the middle-cross-reference-pulse.

Number of negative pulses: Within the chosen waveform area, the quantity of negative pulses moved below the middle-cross-reference-pulse.

Number of rising edges: Within the chosen waveform area, the quantity of times for rising edge transited from the low reference value to the high reference value by positive.

Number of falling edges: Within the chosen waveform area, the quantity of times for falling edge transited from the high reference value to the low reference value by negative.

Area: The area of the full waveform within main display, its unit in volt-seconds. The measured area

above the zero point (vertical offset) is positive, the measured area below the zero point is negative. The measured area equals the algebraic sum of the full waveform area within main display.

Period Area: The area of the first period from the displayed waveform, its unit in volt-seconds. The measured area above the zero point (vertical offset) is positive, the measured area below the zero point is negative. The measured area equals the algebraic sum of the entire period area.

Note: When the displayed waveform less than one period, the measured period area will be zero.

Example

:MEASure:PERiod? /* to inquire the cycle of current channel */

(The Return Result) 2.000000e-03

vi. :MEASure:<items> ? <cha>,<chb>

Syntax

:MEASure:<items> ? <cha>,<chb>

Description

To inquire the value of the measurement between channels. The measurement result comes in scientific notation, on condition that the measurement value not possible to be calculated, the return result goes in 9.900000e+36.

Parameter

Parameter Name	Type	Range	Default
<items>	Discrete	{RDELay|FDELay|RPHase|FPHase|FRRDelay|FRFDelay|FFRDelay|FFFDelay|LRRDelay|LRFDelay|LFRDelay|LFFDelay}	--
<cha>	Discrete	{1|2|3|4}	--
<chb>	Discrete	{1|2|3|4}	--

full meaning to Range items -

items	note	unit
RDELay	cha rising edge to chb rising edge time	s
FDELay	cha falling edge to chb falling edge time	s
RPHase	cha rising edge to chb rising edge phase	°
FPHase	cha falling edge to chb falling edge phase	°
FRRDelay	cha first rising edge to chb first rising edge time	s
FRFDelay	cha first rising edge to chb first falling edge time	s
FFRDelay	cha first falling edge to chb first rising edge time	s
FFFDelay	cha first falling edge to chb first falling edge time	s
LRRDelay	cha first rising edge to chb last rising edge time	s
LRFDelay	cha first rising edge to chb last falling edge time	s
LFRDelay	cha first falling edge to chb last rising edge time	s
LFFDelay	cha first falling edge to chb last falling edge time	s

Example

:MEASure:RDELay? ch1,ch2 /* to inquire the time from the rising edge of CH1 to the rising edge of CH2*/

(The Return Result) 5.000000e-04

Other Commands

i. :AUToset

Syntax

:AUToset

:AUToset:PROGress?

Description

To do autoset.

To inquire whether autoset been fulfilled.

Parameter

Nil.

Return Result

The inquiry returns the no. from 1 till 100, when returns 100, it means the full process done.

ii. :CALibrate

Syntax

:CALibrate

:CALibrate:PROGress?

Description

To perform self-calibration.

To inquire whether self-calibration been fulfilled.

Parameter

Nil.

Return Result

The inquiry returns the no. from 1 till 100, when returns 100, it means the full process done.

iii. :RUN

Syntax

:RUN

Description
To start running the device.

Extension
The **:STOP** command could be introduced to stop the device running.

iv. :STOP

Syntax
:STOP

Description
To stop the device running.

Extension
The **:RUN** command could be introduced to start running the device.

v. :LAN:PORT

Syntax
:LAN:PORT<port>
:LAN:PORT?

Description
To set / inquire the LAN port number.
This command also works for inquiring WLAN port number.

Parameter

Parameter Name	Type	Range	Default
< port>	Integer	{0~65535}	8866

Return Result
The inquiry returns the current port number, in the form of ASCII string.

Example
:LAN:PORT 2000 /* sets the LAN port to 2000 */
:LAN:PORT?
(The Return Result) 2000

4. Supplement: Sampling Rate Conversion Rule

Sampling Rate: According to the time base and recording length, the device works under the proper sampling rate automatically.

i. sampling rate conversion rule -
When max. sampling rate > sampling points per division / time base,
Sampling Rate = sampling points per division / time base ;

When max. sampling Rate < sampling points per division / time base,
Sampling Rate = max. sampling rate

ii. max. sampling rate available -
vertical resolution available in 8-bit;
channel running status: 1-CH / 2-CH / more than 2-CH

max. sampling rate	8-bit	12-bit	14-bit
1-CH	1G Sa/s	500M Sa/s	100M Sa/s
2-CH	500M Sa/s	250M Sa/s	100M Sa/s
more than 2-CH	250M Sa/s	100M Sa/s	100M Sa/s

iii. sampling rate details -

sampling rate (Sa/s)	1G	500M	250M	100M	50M	25M
	10M	5M	2.5M	1M	500k	250k
	100k	50k	25k	10k	5k	2.5k
	1k	500	250	100	50	25
	10	5	2.5	1	0.5	

iv. sampling points per division VS different recording length -

recording length	1k	10k	100k	1M	10M
sampling points per division	50	500	5k	50k	500k

v. time base details -

time base (s/div)	2.0ns/div	5.0ns/div	10ns/div	20ns/div	50ns/div	100ns/div
	200ns/div	500ns/div	1.0us/div	2.0us/div	5.0us/div	10us/div
	20us/div	50us/div	100us/div	200us/div	500us/div	1.0ms/div
	2.0ms/div	5.0ms/div	10ms/div	20ms/div	50ms/div	100ms/div
	200ms/div	500ms/div	1.0s/div	2.0s/div	5.0s/div	10s/div
	20s/div	50s/div	100s/div			

5. Supplement: WAVeform:DATA? Return Result

i. empty data packet content parsing

(little endian mode, low byte been allocated in low address)

Sequence No.	Offset (unit: byte)	No. of Bytes	Value or Range	Description
0	TMC	N+2	#NXXXXXX	"#" is the standard header ID, "N" indicates the bytes quantity, to describe the length of the data packet in the form of ASCII string.
1	0	8	0x090906060A0A0550	starts synchronization and verification
2	8	2	0 - 255	dynamic synchronization check (echo to the end)
3	10	2	0 - 65535	N1 - no. of bytes that parameter gets
4	12	2	0 - 5	running status: 0 - Auto, 1 - Trig'd, 2 - Stop, 3 - Ready, 4 - Scan, 5 - Error
5	14	2		
6	**16**	**2**	**0 - 4**	**-1 (FFFF)**
25	N1+N2+N3 +16	2	0 - 255	dynamic synchronization check ends (echo to the beginning)
26	N1+N2+N3+18	8	0x0906060905A0050A	synchronization and verification ends

ii. effective data packet content parsing

(little endian mode, low byte been allocated in low address)

Sequence No.	Offset (unit: byte)	No. of Bytes	Value or Range	Description
0	TMC	N+2	#NXXXXXX	"#" is the standard header ID, "N" indicates the bytes quantity, to describe the length of the data packet in the form of ASCII string.
1	0	8	0x090906060A0A0550	starts synchronization and verification
2	8	2	0 - 255	dynamic synchronization check (echo to the end)
3	10	2	0 - 65535	N1 - no. of bytes that parameter gets
4	12	2	0 - 5	running status: 0 - Auto, 1 - Trig'd, 2 - Stop, 3 - Ready, 4 - Scan, 5 - Error
5	14	2	0 - 16	available vertical resolution: 8 - 8-bit
6	16	2	0 - 4	n1 - no. of waveform channels in the data (max. 4) (**FFFF** indicates empty data packets / no new data / discarded data)
7	18	4	0 - 4G	n2 - no. of waveform data points per channel
8	22	2	0 - 65535	n3 - no. of waveform overlaps, N2 = n3*n1*(n2*2+2)
9	24	2	0 - 1	Reserved (n4)
10	26	4	0 - 4G	Reserved (n5) N3 = n4*(n5*2+2)
11	30	2	0 - 255	waveform forming method: 0 - normal (point by point); 1 - compressed (four-point by four-point); 2 - discrete (discrete); 3 - Vpp normal mode; 4 - Vpp discrete mode; 255 - reading the recorded data.
12	32	2	0 - 1	0 - normal; 1 - scan
13	34	4	0 - 4G	no. of scrolling data in scan mode (calculated by deep memory)

14	……			reserved (**other accompanying information from data packet**)
15	N1+10	2		reserved
16	N1+12	2	0 - 3	which channel does the first segment waveform data come from
17	N1+14	n2*2		first segment waveform data area
18	N1+14+n2*2	2	0 - 3	which channel does the second segment waveform data come from
19	N1+16+n2*2	n2*2		second segment waveform data area
20	……			……
21			CH1 - 0 CH2 - 1	second overlap which channel does the first segment waveform data come from first segment waveform data area ..... which channel does the n1 segment waveform data come from the n1 segment waveform data area ..... n3th overlap which channel does the first segment waveform data come from first segment waveform data area ..... which channel does the n1 segment waveform data come from the n1 segment waveform data area
22	N1+N2+12	4	0x0A0A0550	starts synchronization and verification, data separator reserved
23	N1+N2+16	2	0 - 4	reserved
24	N1+N2+18	n5*2		reserved
25	N1+N2+N3+16	2	0 - 255	dynamic synchronization check ends (echo to the beginning)
26	N1+N2+N3+18	8	0x0906060905A0050A	synchronization and verification ends

iii. other accompanying information from data packet

(little endian mode, low byte been allocated in low address)

Sequence No.	Offset (unit: byte)	No. of Bytes	Value or Range	Description
14	38	4	Integer	the count value of frequency counter from CH1 signal
	42	4	Integer	the count value of frequency counter from CH2 signal
	46	4	Integer	the count value of frequency counter from CH3 signal
	50	4	Integer	the count value of frequency counter from CH4 signal
	54	4	Integer	the reference count value of CH1 frequency counter
	58	4	Integer	the reference count value of CH2 frequency counter
	62	4	Integer	the reference count value of CH3 frequency counter
	66	4	Integer	the reference count value of CH4 frequency counter
	70	2	D(3..0)	overflow flag (0: normal; 1: overflow) D0 - CH1; D1 - CH2; D2 - CH3; D3 - CH4

	72	2	ADC Data	CH1 minimum value (16-bit ADC data format)
	74	2	ADC Data	CH2 minimum value (16-bit ADC data format)
	76	2	ADC Data	CH3 minimum value (16-bit ADC data format)
	78	2	ADC Data	CH4 minimum value (16-bit ADC data format)
	80	2	ADC Data	CH1 maximum value (16-bit ADC data format)
	82	2	ADC Data	CH2 maximum value (16-bit ADC data format)
	84	2	ADC Data	CH3 maximum value (16-bit ADC data format)
	86	2	ADC Data	CH4 maximum value (16-bit ADC data format)
	88	2	ADC Data	CH1 average value (16-bit ADC data format)
	90	2	ADC Data	CH2 average value (16-bit ADC data format)
	92	2	ADC Data	CH3 average value (16-bit ADC data format)
	94	2	ADC Data	CH4 average value (16-bit ADC data format)
	96	2	D(15..0)	channel trigger type (0: edge; 1: video) D3..0 - CH1; D7..4 - CH2; D11..8 - CH3; D15..12 - CH4
	98	4	Integer	system clock (unit in 1 Hz)
	.....			
	256	4		data acquisition synchronization ID (whether data packet content qualified for requested sequence)
	260	2	2mV - 5V	CH1 voltage division from the acquired data (index value 0 - 1mV, 9 - 1V)
	262	2	2mV - 5V	CH2 voltage division from the acquired data (index value 0 - 1mV, 9 - 1V)
	264	2	2mV - 5V	CH3 voltage division from the acquired data (index value 0 - 1mV, 9 - 1V)
	266	2	2mV - 5V	CH4 voltage division from the acquired data (index value 0 - 1mV, 9 - 1V)
	268	4	Float	CH1 zero position from the acquired data (floating-point, unit in division)
	272	4	Float	CH2 zero position from the acquired data (floating-point, unit in division)
	276	4	Float	CH3 zero position from the acquired data (floating-point, unit in division)
	280	4	Float	CH4 zero position from the acquired data (floating-point, unit in division)
	284	2	D(15..0)	channel working status (0: OFF; 1: ON) D3..0 - CH1; D7..4 - CH2; D11..8 - CH3;.....
	286	2	D(15..0)	channel coupling mode (0: AC; 1: DC; 2: GND) D3..0 - CH1; D7..4 - CH2; D11..8 - CH3;.....
	288	2	D(15..0)	bandwidth limit setting (0: full bandwidth; 1: 20M) D3..0 - CH1; D7..4 - CH2; D11..8 - CH3;.....
	290	2	D(15..0)	analog front end attenuation factor adjustment (0: 1:1; 1: 1:10; 2: 1:100) D3..0 - CH1; D7..4 - CH2; D11..8 - CH3;.....
	292	2	D(15..0)	waveform invert (0: OFF; 1: INVERT) D3..0 - CH1; D7..4 - CH2; D11..8 - CH3;.....
	294	2	1ns-100s	the time base of the acquired data (index value 0 - 1ns, 9 - 1us)
	296	4	Float	horizontal trigger time (floating-point, unit in μs)
	300	4	Float	the processed horizontal trigger time (floating-point, unit in μs)
	304	4	D(31..0)	the recording depth (0: 1K, 1: 10K, 2: 100K, ...)
	……	8		
	316	4	Float	sampling rate of the acquired data (floating-point, unit in MHz)
	……	8		
	524	4	Integer	the screen coordinates of the beginning point from acquired data (with blank pixels at left side) (integer, pixel value range: 0 - 999)

	528	4	Integer	the screen coordinates of the ending point from acquired data (with blank pixels at right side) (integer, pixel value range: 0 - 999)
	……	8		
	540	4	D(0)	waveform data interpolation flag
	……	4		
	548	4	Float	time interval between two adjacent data points (Result_data_time, floating-point, unit in μs)
	552	4	Integer	no. of horizontal offset of interpolated data (integer, pixel value range: 0 - 999)
	……			
	768	2	2mV - 5V	real-time CH1 voltage division (index value 0 - 1mV, 9 - 1V)
	770	2	2mV - 5V	real-time CH2 voltage division (index value 0 - 1mV, 9 - 1V)
	772	2	2mV - 5V	real-time CH3 voltage division (index value 0 - 1mV, 9 - 1V)
	774	2	2mV - 5V	real-time CH4 voltage division (index value 0 - 1mV, 9 - 1V)
	776	4	Float	real-time CH1 zero position (floating-point, unit in division)
	780	4	Float	real-time CH2 zero position (floating-point, unit in division)
	784	4	Float	real-time CH3 zero position (floating-point, unit in division)
	788	4	Float	real-time CH4 zero position (floating-point, unit in division)

iv. Calculation Tips Towards Waveform Data

i). the frequency counter from channel signal -
frequency counter = system clock * channel frequency count / channel reference count

ii). the channel voltage -
channel voltage = (channel ADC data / 6400 - channel zero offset) * channel volt scale
Note: ADC Data = waveform data, or Vmax, or Vmin, or Vavg (16-bit signed integer data)

iii). the displayed position of waveform data (vertical direction) -
the displayed vertical voltage (unit: division, range: ± 5 divisions)
= (ADC data / 6400 - acquisition zero offset) * (acquisition volt scale / real-time volt scale) + real-time zero offset

In real-time data acquisition, the real-time waveform data is the one for data acquisition.
Disp. vertical voltage = ADC data / 6400 (unit: division, range: ± 5 divisions)
Note: ADC Data = waveform data (16-bit signed integer data)

INFORMATION ON WASTE DISPOSAL FOR CONSUMERS OF ELECTRICAL & ELECTRONIC EQUIPMENT.

When this product has reached the end of its life it must be treated as Waste Electrical & Electronics Equipment (WEEE). Any WEEE marked products must not be mixed with general household waste, but kept separate for the treatment, recovery and recycling of the materials used. Contact your local authority for details of recycling schemes in your area.

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