
Programming Guide

RIGOL

Publication Number: PGA02100-1210

June, 2008

DS1000, DS1000CA Series Digital Oscilloscope

**DS1000CD, DS1000C, DS1000MD, DS1000M
DS1302CA, DS1202CA, DS1102CA, DS1062CA**

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Chapter 1 Programming Introduction

This book provides guidance to the remote control programming of the DS1000 and DS1000CA series digital oscilloscopes.

It includes the necessary conceptual information, the command structure for the subsystem and the case in the application. Users can carry on the remote control to the oscilloscope or do the further development according to this manual.

NOTE: The Programming Reference is applicable to the Oscilloscope of the firmware version above 01.02.18.

Communication Ports

Computers communicate with the oscilloscope by sending and receiving messages over an I/O port, such as USB, GPIB port or a RS-232 port. Commands appear as ASCII character strings embedded inside the output statements of a "host" language available on your computer. The input commands of the host language are used to read responses from the oscilloscope.

Basic operations that you can do with a computer and an oscilloscope include:

- Set up the oscilloscope.
- Make measurements.
- Retrieve data (waveforms or measurements) from the oscilloscope.

Symbol Instruction

1. Command Separator :

Commands usually begin with a colon (:). Queries are formed by adding a question mark (?) to the end of the commands. The return values of the queries are mostly expressed in scientific count such as 2.64e+00.

2. Blank Space □

Blank space is used to separate the instruction from the program data. If the instruction does not require any program data, blank space is not needed.

3. Braces { }

When several elements, separated by a vertical line (|) are enclosed by braces, { }, only one element may be selected. For example, {ON | OFF} indicates that only ON or OFF may be selected, not both.

4. Square Brackets []

Items enclosed in square brackets [] are optional.

5. Triangle Brackets < >

Items enclosed in < > should be replaced by a numerical value or character string.

The Abbreviation of the Commands

Some commands are too long to memory and spell. In order to reduce your work and memory difficulty, we set the abbreviation of the commands.

The abbreviation rule is to omit all the small letters in the instruction header.

For example:

:TRIGger:ALTeRnation:SLOPe:LEVeIA

can be entered as:

:TRIG:ALT:SLOP:LEVA

Chapter 2 Set the Command Systems

For remote control programming, DS1000 and DS1000CA Series oscilloscopes have the following command groups:

- System Commands
- Keyboard Commands
- Measurement Commands
- Acquire Commands
- Display Commands
- Vertical Commands
- Horizontal Commands
- Trigger Commands
- LA Commands (Only for DS1000*D Series)
- Math Commands
- Waveform Commands

System Commands

System commands are the fundamental commands for the operation of an oscilloscope. They can either be used as individual instructions or in conjunction with other instructions to form a script.

System Commands include:

- *IDN?
- :RUN
- :STOP
- :AUTO
- :FORCetrig
- :Trig%50
- :HARDcopy
- :INFO:LANGuage
- :COUNter:ENABLE
- :BEEP:ENABLE
- :BEEP:ACTion

We will give specific explanations for each command in the following part.

1. *IDN?

Command Format:

*IDN?

Explanation:

The query returns the company name, oscilloscope model number, sequence number, and software revision number.

Returned Format:

RIGOL TECHNOLOGIES,<model>,<sequence_number>,<rev_number>

Example:

RIGOL TECHNOLOGIES, DS1102C, DS1102200000122, 03.03.05

2. :RUN

Command Format:

:RUN

Explanation:

The command initiates the oscilloscope to acquire waveform data according to its current settings. Acquisition runs continuously until the oscilloscope receives a :STOP command, or a single acquisition has occurred when the Trigger mode is set to "Single".

3. :STOP

Command Format:

:STOP

Explanation:

The command controls the oscilloscope to stop acquiring data. To restart the acquisition, use the :RUN command.

4. :AUTO

Command Format:

:AUTO

Explanation:

The command controls the oscilloscope to evaluate all input waveforms characteristics and set the optimum conditions to display the waveforms.

5. :FORCetrig

Command Format:

:FORCetrig

Explanation:

The command forces the oscilloscope to display a steady waveform when there is no suitable trigger condition. The usual trigger modes are "Normal" and "Single".

6. :Trig%50

Command Format:

:Trig%50

Explanation:

The command sets the trigger level to the vertical middle of the signal amplitude.

7. :HARDcopy

Command Format:

:HARDcopy

Explanation:

The command is to extract the current information on the screen.

8. :INFO:LANGuage

Command Format:

:INFO:LANGUage□ <lang>

Explanation:

The command is to set the System language. The options are: "SIMPLifiedChinese", "TRADitionalChinese" and "ENGLish".

Query Format:

:INFO:LANGUage?

Returned Format:

Query returns "Simplified Chinese", "Traditional Chinese" or "English". The double quotes are not returned.

Example:

:INFO:LANGUage□ SimplifiedChinese

Set the System language to SimplifiedChinese.

:INFO:LANGUage?

Query returns "Simplified Chinese".

9. :COUNter:ENABle**Command Format:**

:COUNter:ENABle□ {ON|OFF}

Explanation:

This command is to turn the counter function on or off.

Query Format:

:COUNter:ENABle?

Returned Format:

Query returns "ON" or "OFF". The double quotes are not returned.

Example:

:COUNter:ENABle□ ON

Enable the counter function

:COUNter:ENABle?

Query returns "ON"

10. :BEEP:ENABle

Command Format:

:BEEP:ENABle□{ON|OFF}

Explanation:

This command is to turn the buzzer on or off.

Query Format:

:BEEP:ENABle?

Returned Format:

Query returns "ON" or "OFF". The double quotes are not returned.

Example:

:BEEP:ENABle□ON

Turn the buzzer On

:BEEP:ENABle?

Query returns "ON"

11. :BEEP:ACTion

Command Format:

:BEEP:ACTion

Explanation:

This command is to control the buzzer to sound once (no matter the buzzer is on or off).

Keyboard Commands

The Keyboard Commands are the controls of the keys and knobs on the front panel of the oscilloscope.

Keyboard Commands include:

- :KEY:LOCK
- :KEY:RUN
- :KEY:AUTO
- :KEY:CHANnel1
- :KEY:CHANnel2
- :KEY:MATH
- :KEY:REF
- :KEY:F1
- :KEY:F2
- :KEY:F3
- :KEY:F4
- :KEY:F5
- :KEY:MNUoff
- :KEY:MEASure
- :KEY:CURSor
- :KEY:ACQuire
- :KEY:DISPlay
- :KEY:STORage
- :KEY:UTILity
- :KEY:MNUTIME
- :KEY:MNUTRIG
- :KEY:Trig%50
- :KEY:FORCe
- :KEY:V_POS_INC
- :KEY:V_POS_DEC
- :KEY:V_SCALE_INC
- :KEY:V_SCALE_DEC
- :KEY:H_SCALE_INC
- :KEY:H_SCALE_DEC
- :KEY:TRIG_LVL_INC
- :KEY:TRIG_LVL_DEC
- :KEY:H_POS_INC
- :KEY:H_POS_DEC
- :KEY:PROMPT_V
- :KEY:PROMPT_H
- :KEY:FUNCTion
- :KEY:+FUNCTion
- :KEY:-FUNCTion
- :KEY:LA (only for DS1000*D series)
- :KEY:PROMPT_V_POS
- :KEY:PROMPT_H_POS
- :KEY:PROMPT_TRIG_LVL
- :KEY:OFF

We will give specific explanations for each command in the following part.

1. :KEY:LOCK

Command Format:

:KEY:LOCK□{ENABLE|DISable}

Explanation:

This command is to enable or disable the remote control of the front panel keys.

Query Format:

:KEY:LOCK?

Returned Format:

Query returns "ENABLE". The double quotes are not returned.

Example:

:KEY:LOCK□ENABLE

Enable the key on the front panel

:KEY:LOCK?

Query returns "ENABLE"

2. :KEY:RUN

Command Format:

:KEY:RUN

Explanation:

This command is to control the **RUN/STOP** mode of the oscilloscope. Toggle between RUN/STOP every time this command is sent.

3. :KEY:AUTO

Command Format:

:KEY:AUTO

Explanation:

This command is equivalent to the **AUTO** key, enables the oscilloscope to set the optimum conditions to display the input signal (waveform).

4. :KEY:CHANnel1**Command Format:**

:KEY:CHANnel1

Explanation:

This command is to set the **Channel 1** and the menu on or off.

5. :KEY:CHANnel2**Command Format:**

:KEY:CHANnel2

Explanation:

This command is to set the **Channel 2** and the menu on or off.

6. :KEY:MATH**Command Format:**

:KEY:MATH

Explanation:

This command is to set the **Math** function and the menu on or off.

7. :KEY:REF**Command Format:**

:KEY:REF

Explanation:

This command is to set the **Reference** waveform function and the menu on or off.

8. :KEY:F1**Command Format:**

:KEY:F1

Explanation:

This command is similar to press and select the option of Menu F1. Repeating this command would enter next level of menu.

9. :KEY:F2

Command Format:

:KEY:F2

Explanation:

This command is similar to press and select the option of Menu F2. Repeating this command would enter next level of menu.

10. :KEY:F3

Command Format:

:KEY:F3

Explanation:

This command is similar to press and select the option of Menu F3. Repeating this command would enter next level of menu.

11. :KEY:F4

Command Format:

:KEY:F4

Explanation:

This command is similar to press and select the option of Menu F4. Repeating this command would enter next level of menu.

12. :KEY:F5

Command Format:

:KEY:F5

Explanation:

This command is similar to press and select the option of Menu F5. Repeating this command would enter next level of menu.

13. :KEY:MNUoff

Command Format:

:KEY:MNUoff

Explanation:

This command is to set the menu on or off.

14. :KEY:MEASure

Command Format:

:KEY:MEASure

Explanation:

This command is to set the **Measurement** function and the menu on or off.

15. :KEY:CURSor

Command Format:

:KEY:CURSor

Explanation:

This command is to set the **Cursor** function and the menu on or off. Select the cursor mode by repeating the command.

16. :KEY:ACQuire

Command Format:

:KEY:ACQuire

Explanation:

This command is to set the **Acquirement** function and the menu on or off.

17. :KEY:DISPlay

Command Format:

:KEY:DISPlay

Explanation:

This command is to set the **Display** function and the menu on or off.

18. :KEY:STORage

Command Format:

:KEY:STORage

Explanation:

This command is to set the **Storage** function and the menu on or off.

19. :KEY:UTILity

Command Format:

:KEY:UTILity

Explanation:

This command is to initiate the system **Utility** function and the menu on or off.

20. :KEY:MNUTIME

Command Format:

:KEY:MNUTIME

Explanation:

This command is to set the delayed scan function and the menu on or off.

21. :KEY:MNUTRIG

Command Format:

:KEY:MNUTRIG

Explanation:

This command is to set the **Trigger** function and the menu on or off.

22. :KEY:Trig%50**Command Format:**

:KEY:Trig%50

Explanation:

This command is to set the trigger level to the mid point of the trigger signal amplitude.

23. :KEY:FORCe**Command Format:**

:KEY:FORCe

Explanation:

This command is to release the locked mode of remote control.

24. :KEY:V_POS_INC**Command Format:**

:KEY:V_POS_INC

Explanation:

This command is to move the waveform display up gradually.

25. :KEY:V_POS_DEC**Command Format:**

:KEY:V_POS_DEC

Explanation:

This command is to move the waveform display down gradually.

26. :KEY:V_SCALE_INC

Command Format:

:KEY:V_SCALE_INC

Explanation:

This command is to increase the vertical scale of the current channel with the 5-2-1 step sequence.

27. :KEY:V_SCALE_DEC

Command Format:

:KEY:V_SCALE_DEC

Explanation:

This command is to decrease the vertical scale of the current channel with the 5-2-1 step sequence.

28. :KEY:H_SCALE_INC

Command Format:

:KEY:H_SCALE_INC

Explanation:

This command is to increase the horizontal scale of the current channel with the 5-2-1 step sequence.

29. :KEY:H_SCALE_DEC

Command Format:

:KEY:H_SCALE_DEC

Explanation:

This command is to decrease the horizontal scale of the current channel with the 5-2-1 step sequence.

30. :KEY:TRIG_LVL_INC**Command Format:**

:KEY:TRIG_LVL_INC

Explanation:

This command is to increase the trigger level gradually.

31. :KEY:TRIG_LVL_DEC**Command Format:**

:KEY:TRIG_LVL_DEC

Explanation:

This command is to decrease the trigger level gradually.

32. :KEY:H_POS_INC**Command Format:**

:KEY:H_POS_INC

Explanation:

This command is to increase the horizontal offset of the current channel gradually.

33. :KEY:H_POS_DEC**Command Format:**

:KEY:H_POS_DEC

Explanation:

This command is to decrease the horizontal offset of the current channel with gradually.

34. :KEY:PROMPT_V**Command Format:**

:KEY:PROMPT_V

Explanation:

This command is to toggle the vertical scale Coarse/Fine. Coarse step sequence is 1-2-5, Fine is to adjust gradually.

Example:

Suppose the current mode is coarse, send the commands as follows:

:KEY:PROMPT_V Toggle to fine
:KEY:V_SCALE_INC Adjust the vertical scale gradually

35. :KEY:PROMPT_H

Command Format:

:KEY:PROMPT_H

Explanation:

This command is to set the delayed scan on or off.

36. :KEY:FUNCTION

Command Format:

:KEY:FUNCTION

Explanation:

This command is to select the multi-function knob.

37. :KEY:+FUNCTION

Command Format:

:KEY:+FUNCTION

Explanation:

This command is to increase the offset of the multi-function knob. (Equivalent turning the knob clockwise)

38. :KEY:-FUNction**Command Format:**

:KEY:-FUNction

Explanation:

This command is to decrease the offset of the multi-function knob. (Equivalent turning the knob anti-clockwise)

39. :KEY:LA**Command Format:**

:KEY:LA

Explanation:

This command is to set the **LA** function and the menu on or off.

40. :KEY:PROMPT_V_POS**Command Format:**

:KEY:PROMPT_V_POS

Explanation:

This command is to re-set the vertical display of the waveform (analog channel) to the zero point.

41. :KEY:PROMPT_H_POS**Command Format:**

:KEY:PROMPT_H_POS

Explanation:

This command is to adjust the trigger offset (or the delayed scan offset) to the horizontal zero point.

42. :KEY:PROMPT_TRIG_LVL

Command Format:

:KEY:PROMPT_TRIG_LVL

Explanation:

This command is to adjust the trigger level to the central position of the screen.

43. :KEY:OFF

Command Format:

:KEY:OFF

Explanation:

This command is to turn of CH1, CH2, MATH, REF and LA keys one by one.

Measurement commands

Measurement system commands are the fundamental measurement operations. These commands are only for the analog channel measurement, and the measurement results are expressed in scientific numeric notation.

Measurement Commands include:

- :MEASure:CLEar
- :MEASure:VPP?
- :MEASure:VMAX?
- :MEASure:VMIN?
- :MEASure:VAMPlitude?
- :MEASure:VTOP?
- :MEASure:VBASe?
- :MEASure:VAverage?
- :MEASure:VRMS?
- :MEASure:OVERshoot?
- :MEASure:PREShoot?
- :MEASure:FREQuency?
- :MEASure:RISetime?
- :MEASure:FALLtime?
- :MEASure:PERiod?
- :MEASure:PWIDth?
- :MEASure:NWIDth?
- :MEASure:PDUTyCycle?
- :MEASure:NDUTyCycle?
- :MEASure:PDELay?
- :MEASure:NDELay?
- :MEASure:TOTal
- :MEASure:SOURce

We will give specific explanations for each command in the following part.

NOTE: A 1kHz, 5Vpp square wave input is used as example for the following commands.

1. :MEASure:CLEAr

Command Format:

:MEASure:CLEAr

Explanation:

This command is to clear the current value.

2. :MEASure:VPP?

Command Format:

:MEASure:VPP?□[<source>]

Explanation:

This command is to measure the CH1 or the CH2 Peak-Peak value, and the defined source is CHANnel1 or CHANnel2 respectively.

Returned Format:

Query returns 5.28e+00, unit is V.

3. :MEASure:VMAX?

Command Format:

:MEASure:VMAX?□[<source>]

Explanation:

This command is to measure the maximum value for the waveform.

Returned Format:

Query returns 2.64e+00, unit is V.

4. :MEASure:VMIN?

Command Format:

:MEASure:VMIN?□[<source>]

Explanation:

This command is to measure the minimum value for the waveform.

Returned Format:

Query returns -2.64e+00, unit is V.

5. :MEASure:VAMPlitude?**Command Format:**

:MEASure:VAMPlitude?□[<source>]

Explanation:

This command is to measure the amplitude of the waveform.

Returned Format:

Query returns 5.28e+00, unit is V.

6. :MEASure:VTOP?**Command Format:**

:MEASure:VTOP?□[<source>]

Explanation:

This command is to measure the top value of the waveform.

Returned Format:

Query returns 2.64e+00, unit is V.

7. :MEASure:VBASe?**Command Format:**

:MEASure:VBASe?□[<source>]

Explanation:

This command is to measure the base value of the waveform.

Returned Format:

Query returns -2.64e+00, unit is V.

8. :MEASure:VAverage?

Command Format:

:MEASure:VAverage?□[<source>]

Explanation:

This command is to measure the average value of the waveform.

Returned Format:

Query returns -4.20e-03, unit is V.

9. :MEASure:VRMS?

Command Format:

:MEASure:VRMS?□[<source>]

Explanation:

This command is to measure the mean square root value of the waveform.

Returned Format:

Query returns 2.46e+00, unit is V.

10. :MEASure:OVERshoot?

Command Format:

:MEASure:OVERshoot?□[<source>]

Explanation:

This command is to measure the overshoot value of the waveform.

Returned Format:

Query returns 8.00e-03.

11. :MEASure:PREShoot?

Command Format:

:MEASure:PREShoot?□[<source>]

Explanation:

This command is to measure the preshoot value of the waveform.

Returned Format:

Query returns 8.00e-03.

12. :MEASure:FREQuency?**Command Format:**

:MEASure:FREQuency?□[<source>]

Explanation:

This command is to measure the frequency of the waveform.

Returned Format:

Query returns 1.00e+03, unit is Hz.

13. :MEASure:RISetime?**Command Format:**

:MEASure:RISetime?□[<source>]

Explanation:

This command is to measure the risetime of the waveform.

Returned Format:

Query returns <4.00e-05, unit is s.

14. :MEASure:FALLtime?**Command Format:**

:MEASure:FALLtime?□[<source>]

Explanation:

This command is to measure the falltime of the waveform.

Returned Format:

Query returns $<4.00e-05$, unit is s.

15. :MEASure:PERiod?

Command Format:

:MEASure:PERiod?□[<source>]

Explanation:

This command is to measure the period of the waveform.

Returned Format:

Query returns $1.00e-03$, unit is s.

16. :MEASure:PWIDth?

Command Format:

:MEASure:PWIDth?□[<source>]

Explanation:

This command is to measure the positive pulse width of the waveform.

Returned Format:

Query returns $5.00e-04$, unit is s.

17. :MEASure:NWIDth?

Command Format:

:MEASure:NWIDth?□[<source>]

Explanation:

This command is to measure the negative pulse width of the waveform.

Returned Format:

Query returns $5.00e-04$, unit is s.

18. :MEASure:PDUTyCycle?**Command Format:**

:MEASure:PDUTyCycle?□[<source>]

Explanation:

This command is to measure the positive duty cycle of the waveform.

Returned Format:

Query returns 5.00e-01.

19. :MEASure:NDUTyCycle?**Command Format:**

:MEASure:NDUTyCycle?□[<source>]

Explanation:

This command is to measure the negative duty cycle of the waveform.

Returned Format:

Query returns 5.00e-01.

20. :MEASure: PDElay?**Command Format:**

:MEASure:PDElay?□[<source>]

Explanation:

This command is to measure the delay between channel 1, channel 2 at the positive edge.

Returned Format:

Query returns <-1.00e-04, unit is s.

21. :MEASure:NDElay?**Command Format:**

:MEASure:NDElay?□[<source>]

Explanation:

This command is to measure the delay between channel 1, channel 2 at the negative edge.

Returned Format:

Query returns <-1.00e-04, unit is s.

22. :MEASure:TOTal

Command Format:

:MEASure:TOTal□{ON|OFF}

Explanation:

This command is to measure all the parameter value.

Query format:

:MEASure:TOTal?□{ON|OFF}

Returned Format:

Query returns "ON" or "OFF". The double quotes are not returned.

Example:

:MEASure:TOTal□ON	Set the total measurement function on
:MEASure:TOTal?	Query returns "ON"

23. :MEASure:SOURce

Command Format:

:MEASure:SOURce□<source>

Explanation:

This command is to select the channel.

Query format:

:MEASure:SOURce?

Returned Format:

Query returns "CH1" or "CH2". The double quotes are not returned.

Example:

:MEASure:SOURce□CHANnel1 Measure the waveform of channel 1
:MEASure:SOURce? Query returns "CH1"

Acquire Commands

Acquire System Commands Setting is used to adjust the acquisition mode of the oscilloscope.

Acquire Commands include:

- :ACQuire:TYPE
- :ACQuire:MODE
- :ACQuire:AVERages
- :ACQuire:SAMPLingrate?

We will give specific explanations for each command in the following part.

1. :ACQUIRE:TYPE

Command Format:

:ACQUIRE:TYPE□ <type>

Explanation:

The command is used to set the current acquisition type. The options are: "NORMAL", "AVERAGE" and "PEAKDETEC".

Query Format:

:ACQUIRE:TYPE?

Returned Format:

Query returns "NORMAL", "AVERAGE" or "PEAKDETECT". The double quotes are not returned.

Example:

:ACQUIRE:TYPE□ AVERAGE

Set the AVERAGE mode

:ACQUIRE:TYPE?

Query returns "AVERAGE"

2. :ACQUIRE:MODE

Command Format:

:ACQUIRE:MODE□ <mode>

Explanation:

The command is used to set the current acquisition mode. The options are "REAL_TIME" and "EQUAL_TIME".

Query Format:

:ACQUIRE:MODE?

Returned Format:

Query returns "REAL_TIME" or "EQUAL_TIME". The double quotes are not returned.

Example:

:ACQuire:MODE□EQUAL_TIME Set the "EQUAL_TIME" mode
:ACQuire:MODE? Query returns "EQUAL_TIME"

3. :ACQuire:AVERages

Command Format:

:ACQuire:AVERages□ <count>

Explanation:

The command is used to set the average acquisition time. The time range is from 2 to 256 at the multiples of 2.

Query Format:

:ACQuire:AVERages?

Returned Format:

Query returns 2, 4, 8, 16, 32, 64, 128 or 256.

Example:

:ACQuire:AVERages□16 Set average acquisition time to 16
:ACQuire:AVERages? Query returns 16

4. :ACQuire:SAMPLingrate?

Query Format:

:ACQuire:SAMPLingrate?□{CHANnel<n>|DIGITAL}

Explanation:

The command is used to query the current sampling rate of the analog channel and digital channel. <n> is 1 or 2 means channel 1 or channel 2.

Returned Format:

Query returns the value of the sampling rate.

Example:

:ACQuire:SAMPLingrate?□CHANnel1 Query the Sampling Rate for Channel 1
400000000.000000 Returns 400M

Display System Commands

Display System Commands are used to adjust the display mode.

Display Commands include:

- :DISPlay:TYPE
- :DISPlay:GRID
- :DISPlay:PERSist
- :DISPlay:MNUDisplay
- :DISPlay:MNUStatus
- :DISPlay:CLEar
- :DISPlay:SCReen
- :DISPlay:BRIGHtness
- :DISPlay:INTensity

We will give specific explanations for each command in the following part.

1. :DISPlay:TYPE

Command Format:

:DISPlay:TYPE□ <type>

Explanation:

The command is to set the display type as VECTors or DOTS.

Query Format:

:DISPlay:TYPE?

Returned Format:

Query returns "VECTORS" or "DOTS". The double quotes are not returned.

Example:

:DISPlay:TYPE□ VECTors

Set the display type as "VECTors"

:DISPlay:TYPE?

Query returns "VECTORS"

2. :DISPlay:GRID

Command Format:

:DISPlay:GRID□ <grid>

Explanation:

The command is to set the display grid to "FULL" (set the grid and coordinate on), "HALF" (set the grid on) or "OFF" (set the grid and coordinate off).

Query Format:

:DISPlay:GRID?

Returned Format:

Query returns "FULL", "HALF" or "NONE". The double quotes are not returned.

Example:

:DISPlay:GRID□ FULL

Set the grid and coordinate on

:DISPlay:GRID?

Query returns "FULL"

3. :DISPlay:PERSist

Command Format:

:DISPlay:PERSist□{ON|OFF}

Explanation:

The command is to set the waveform persistently ON or OFF.

Query Format:

:DISPlay:PERSist?

Returned Format:

Query returns "ON" or "OFF".

Example:

:DISPlay:PERSist□ON Set the waveform persist ON

:DISPlay:PERSist? Query returns "ON"

4. :DISPlay:MNUDisplay

Command Format:

:DISPlay:MNUDisplay□<time>

Explanation:

The command is to set the display time of the menu. The options are: 1s, 2s, 5s, 10s, 20s or INFinite.

Query Format:

:DISPlay:MNUDisplay?

Returned Format:

Query returns 1s, 2s, 5s, 10s, 20s or INFinite.

Example:

:DISPlay:MNUDisplay□10 Set the display time of the menu to 10s

:DISPlay:MNUDisplay? Query returns 10s

5. :DISPlay:MNUStatus

Command Format:

:DISPlay:MNUStatus□{ON|OFF}

Explanation:

The command is to set the menu ON or OFF.

Query Format:

:DISPlay:MNUStaus?

Returned Format:

Query returns "ON" or "OFF". The double quotes are not returned.

Example:

:DISPlay:MNUStatus□ON	Set the menu on
:DISPlay:MNUStaus?	Query returns "ON"

6. :DISPlay:SCReen

Command Format:

:DISPlay:SCReen□ <scr>

Explanation:

This command is to set the screen as "Normal" or "Inverted".

Query Format:

:DISPlay:SCReen?

Returned Format:

Query returns "NORMAL" or "INVERTED". The double quotes are not returned.

Example:

:DISPlay:SCReen□NORMAL	Set the Display mode to NORMAL
:DISPlay:SCReen?	Query returns "NORMAL"

7. :DISPlay:CLEAr

Command Format:

:DISPlay:CLEAr

Explanation:

The command is to clear the waveform displayed on the screen.

8. :DISPlay:BRIGhtness

Command Format:

:DISPlay:BRIGhtness□ <ncount>

Explanation:

The command is to set the grid brightness of the display from 0~32.

Query Format:

:DISPlay:BRIGhtness?

Returned Format:

Query returns an integer between 0~32.

Example:

:DISPlay:BRIGhtness□ 10	Set the grid brightness of the display to 10
:DISPlay:BRIGhtness?	Query returns 10

9. :DISPlay:INTensity

Command Format:

:DISPlay:INTensity□ <count>

Explanation:

The command is to set the brightness of the waveform from 0~32.

Query Format:

:DISPlay:INTensity?

Returned Format:

Query returns an integer between 0~32.

Example:

:DISPlay:INTensity 12

Set the brightness of the waveform as 12

:DISPlay:INTensity?

Query returns 12

Vertical Commands

Each channel has its own vertical menu. Each item has its own setting.

Vertical Commands include:

- :CHANnel<n>:BWLimit
- :CHANnel<n>:COUPling
- :CHANnel<n>:DISPlay
- :CHANnel<n>:INVert
- :CHANnel<n>:OFFSet
- :CHANnel<n>:PROBe
- :CHANnel<n>:SCALe
- :CHANnel<n>:FILTer
- :CHANnel<n>:MEMoryDepth? (Only for DS1000 Series)
- :CHANnel<n>:VERNier

We will give specific explanations for each command in the following part.

1. :CHANnel<n>:BWLimit

Command Format:

:CHANnel<n>:BWLimit {ON|OFF}

Explanation:

The command is to set the bandwidth limit "ON" to limit the bandwidth as 20MHz to reduce noise display or "OFF" to display at full bandwidth.

Query Format:

:CHANnel<n>:BWLimit?

Returned Format:

Query returns "ON" or "OFF". The double quotes are not returned.

Example:

:CHANnel2:BWLimi OFF Set Channel 2 bandwidth limit to "OFF"
:CHANnel2:BWLimit? Query returns "OFF"

2. :CHANnel<n>:COUPling

Command Format:

:CHANnel<n>:COUPling {DC|AC|GND}

Explanation:

The command is to set the coupling as "DC", "AC" or "GND". The options of "n" are 1 or 2.

Query Format:

:CHANnel<n>:COUPling?

Returned Format:

Query returns "DC", "AC" or "GND". The double quotes are not returned.

Example:

:CHANnel2:COUPling DC Set DC coupling at Channel 2
:CHANnel2:COUPling? Query returns "DC"

3. :CHANnel<n>:DISPlay

Command Format:

:CHANnel<n>:DISPlay□{ON|OFF}

Explanation:

The command is to set channel n (n is 1 or 2) ON or OFF.

Query Format:

:CHANnel<n>:DISPlay?

Returned Format:

Query returns "ON" or "OFF". The double quotes are not returned.

Example:

:CHANnel2:DISPlay□ON	Set Channel 2 Display On
:CHANnel2:DISPlay?	Query returns "ON"

4. :CHANnel<n>:INVert

Command Format:

:CHANnel<n>:INVert□{ON|OFF}

Explanation:

The command is to set the waveform invert ON or OFF.

Query Format:

:CHANnel<n>:INVert?

Returned Format:

Query returns "ON" or "OFF". The double quotes are not returned.

Example:

:CHANnel2:INVert□OFF	Set the waveform invert of Channel 2 to "OFF".
:CHANnel2:INVert?	Query returns "OFF".

5. :CHANnel<n>:OFFSet

Command Format:

:CHANnel<n>:OFFSet□ <offset>

Explanation:

The command is to set the vertical offset of the waveform.

When scale >100mV, the range of <Offset> is -40V~ +40V;

When Scale ≤100mV, the range of <Offset> is -2V ~ +2V;

The options of n are 1 or 2.

Query Format:

:CHANnel<n>:OFFSet?

Returned Format:

Query returns the value of <Offset>.

Example:

:CHANnel2:OFFSet□20

Set the vertical offset of Channel 2 to 20V

:CHANnel2:OFFSet?

Query returns 2.000e+01

6. :CHANnel<n>:PROBe

Command Format:

:CHANnel<n>:PROBe□ <attn>

Explanation:

The command is to set the attenuation factor of the probe: 1X, 5X, 10X, 50X, 100X, 500X or 1000X to keep the gauge exact. The options of n are 1 or 2.

Query Format:

:CHANnel<n>:PROBe?

Returned Format:

Query returns the set value of <attn> in scientific numeric notation.

Example:

:CHANnel2:PROBe□10

Set probe attenuation as 10X for channel 2

:CHANnel2:PROBe?

Query returns 1.000e+01

7. :CHANnel<n>:SCALE

Command Format:

:CHANnel<n>:SCALE□<range>

Explanation:

The command is to set the vertical range of the amplified waveform.

<range> is 2mV ~ 5V	Probe 1X
10mV ~10V	Probe 5X
20mV ~50v	Probe 10X
100mV ~ 100V	Probe 50X
200mV ~ 500v	Probe 100X
1V ~1000V	Probe 500X
2V ~5000V	Probe 1000X

The options of n are 1 or 2.

Query: Format:

:CHANnel<n>:SCALE?

Returned Format:

Query returns the set value of <range> in scientific numeric notation.

Example:

:CHANnel2:PROBe□10	Set probe attenuation as 10X
:CHANnel2:SCALE□20	Set vertical scale as 20V
:CHANnel2:SCALE?	Query returns 2.000e+01

8. :CHANnel<n>:FILTer

Command Format:

:CHANnel<n>:FILTer□{ON|OFF}

Explanation:

The command is to set the digital filter ON or OFF. The options of n are 1 or 2.

Query Format:

:CHANnel<n>:FilTer?

Returned Format:

Query returns "ON" or "OFF". The double quotes are not returned.

Example:

:CHANnel2:FILTer□OFF Set the digital filter "OFF" at Channel 2
:CHANnel2:FILTer? Query returns "OFF"

9. :CHANnel<n>:MEMoryDepth?

Query Format:

:CHANnel<n>:MEMoryDepth?

Explanation:

The command is to query the current Channel memory depth. The options of n are 1 or 2.

Returned Format:

Query returns the set value of <Memoey Depth>.

Example:

:CHANnel2:MEMoryDepth? Query returns 524288

10. :CHANnel<n>:VERNier

Command Format:

:CHANnel<n>:VERNier□{ON|OFF}

Explanation:

The command is to set the adjustment mode of the vertical scaling. When the setting is "OFF", the scale adjustment manner is "Coarse" and vertical sensitivity will be adjusted in 1-2-5 regulation. When the setting is "ON", the manner is "Fine". The fine adjustment will subdivide during the "Coarse" range to improve the vertical resolution.

Query Format:

:CHANnel<n>:VERNier?

Returned Format:

Query returns "Coarse" or "Fine". The double quotes are not returned.

Example:

:CHANnel2:VERNier□ON

Set the adjustment mode to be "Fine"

:CHANnel2:VERNier?

Query returns "Fine"

Horizontal Commands

Horizontal Commands set the Horizontal Scale (time base) and the waveform horizontal position in the memory (trigger offset). The waveform will enlarge or shrink when the horizontal Scale changed.

Horizontal Commands include:

- :TIMEbase:MODE
- :TIMEbase[:DELaYed]:OFFSet
- :TIMEbase[:DELaYed]:SCALe
- :TIMEbase:FORMat

We will give specific explanations for each command in the following part.

1. :TIMEbase:MODE

Command Format:

:TIMEbase:MODE□ <mode>

Explanation:

The command is to set the horizontal scan as "MAIN" (main timebase) or "DELAYED" (delayed scan).

Query Format:

:TIMEbase:MODE?

Returned Format:

Query returns "MAIN" or "DELAYED". The double quotes are not returned.

Example:

:TIMEbase:MODE□ MAIN

Set the horizontal timebase mode as "MAIN"

:TIMEbase:MODE?

Query returns "MAIN"

2. :TIMEbase[:DELAyed]:OFFSet

Command Format:

:TIMEbase[:DELAyed]:OFFSet□ <offset>

Explanation:

The command is to adjust the timebase offset in "MAIN" or "Delayed" mode.

<offset> is 1s ~ momery terminal	when it is Normal mode
-500s ~ +500s	when it is Stop mode
-6*Scale ~ +6*Scale	when it is Roll mode ("Scale" indicates the current horizontal scale. The default unit is s/div)

When it is "MAIN", omit [:DELAyed].

Query Format:

:TIMEbase[:DELAyed]:OFFSet?

Returned Format:

Query returns the set value of <offset> in scientific numeric notation.

Example:

:TIMEbase:MODE□MAIN	Set the main timebase
:TIMEbase:OFFSet□1	Set the timebase offset as 1s
:TIMEbase:OFFSet?	Query returns 1.000e+00

3. :TIMEbase[:DELaYed]:SCALe

Command Format:

:TIMEbase[:DELaYed]:SCALe□ <scale_val>

Explanation:

The command is to set the time base scale in "MAIN" or "DELaYed" mode. The unit is "S/div". When the "DELaYed" is "ON", change the Delayed Timebase Scale will change the width of window to amplify waveform.

<scale_val> is 2ns - 50s when it is Normal mode
 500ms - 50s when it is Roll mode

When "MAIN" is "ON", omit [: DELaYed].

Query Format:

:TIMEbase[:DELaYed]:SCALe?

Returned Format:

Query returns the set value of < scale_val> in scientific numeric notation.

Example:

:TIMEbase:MODE□DELaYed	Set the "MAIN" timebase
:TIMEbase:SCALe□2	Set the timebase scale as 2s
:TIMEbase:SCALe?	Query returns 2.000e+00

4. :TIMEbase:FORMat

Command Format:

:TIMEbase:FORMat□ <value>

Explanation:

The command is to set the timebase format as "XY", "YT" or "SCANning".

Query Format:

:TIMEbase: FORMat?

Returned Format:

Query returns "XY", "YT" or "SCANNING". The double quotes are not returned.

Example:

:TIMEbase:FORMat□YT

Set the format of the timebase as Y-T mode

:TIMEbase:FORMat?

Query returns "Y-T"

Trigger Commands

Trigger control commands

The trigger determines when the oscilloscope starts to acquire data and display a waveform. When a trigger is set up properly, it converts unstable displays into meaningful waveforms.

When the oscilloscope starts to acquire a waveform, it collects enough data so that it can display the waveform to the left of the trigger point. The oscilloscope continues to acquire data while waiting for the trigger condition to occur. After it detects a trigger, the oscilloscope continues to acquire enough data so that it can display the waveform to the right of the trigger point.

Trigger control commands include:

- :TRIGger:MODE
- :TRIGger<mode>:SOURce
- :TRIGger<mode>:LEVel
- :TRIGger<mode>:SWEep
- :TRIGger<mode>:COUPling
- :TRIGger:HOLDoff
- :TRIGger:STATus?

We will give specific explanations for each command in the following part.

1. :TRIGger:MODE

Command Format:

:TRIGger:MODE□ <mod>

Explanation:

The command is used to set the trigger mode, including Edge, Pulse, Slope, Video, Alternation, Pattern (DS1000*D) and Duration (DS1000*D).

Query Format:

:TRIGger:MODE?

Returned Format:

Query returns "EDGE", "PULSE", "SLOPE", "VIDEO", "ALTERNATION", "PATTERN" or "DURATION". The double quotes are not returned.

Example:

:TRIGger:MODE□ EDGE

Set the trigger mode to be "Edge"

:TRIGger:MODE?

Query returns "EDGE"

2. :TRIGger<mode>:SOURce

Command Format:

:TRIGger<mod>:SOURce□ <src>

Explanation:

The command is to set the trigger source from CH1, CH2, D15~D0 (DS1000*D), EXT, EXT/5, AC Line.

<m> is 0~15, <n> is 1 or 2,

When <mode> is ":EDGE",

<src> can be CHANnel<n>, EXT, EXT5, ACLine or DIGital<m>;

When <mode> is ":PULSE",

<src> can be CHANnel<n>, EXT, EXT5, ACLine or DIGital<m>;

When <mode> is ":SLOPE",

<src> can be CHANnel<n>, EXT, EXT5;

When <mode> is ":VIDEO",

<src> can be CHANnel<n>, EXT, EXT5.

Query Format:

:TRIGger<mod>:SOURce?

Returned Format:

Query returns "CH1", "CH2", "EXT", "EXT5", "AC" or "DIGITAL". The double quotes are not returned.

Example:

:TRIGGER:EDGE:SOURCE□CHANnel1 Set Channel 1 as the Edge trigger source
:TRIGGER:EDGE:SOURCE? Query returns "CH1"

3. :TRIGger<mode>:LEVel**Command Format:**

:TRIGger<mode>:LEVel□<level>

Explanation:

The command is to set the voltage level of Edge, Pulse Video trigger.

<mode> can be ":EDGE", ":PULSe" or ":VIDEO";

<level> is -6*Scale ~ +6*Scale;

"Scale" indicates the current vertical scale. The default unit of "level" is V/div.

Query Format:

:TRIGger<mode>:LEVel?

Returned Format:

Query returns the set value of <level> in scientific numeric notation.

Example:

:TRIGger:EDGE:LEVel□2 Set the Edge trigger level to 2 V
:TRIGger:EDGE:LEVel? Query returns 2.00e+00

4. :TRIGger<mode>:SWEep**Command Format:**

:TRIGger<mode>:SWEep□{AUTO|NORMal|SINGle}

Explanation:

The command is to set the trigger type. The options of <mode> are ":EDGE", ":PULSe", ":SLOPe", ":PATtern" or ":DURation".

AUTO: Acquire waveform even no trigger occurred;

NORMAL: Acquire waveform when trigger occurred;

SINGLE: When trigger occurs, acquire one waveform then stop.

Query Format:

:TRIGger<mode>:SWEep?

Returned Format:

Query returns "AUTO", "NORMAL" or "SINGLE". The double quotes are not returned.

Example:

:TRIGger:EDGE:SWEep□AUTO

Set the "AUTO" Edge trigger mode

:TRIGger:EDGE:SWEep?

Query returns "AUTO"

5. :TRIGger<mode>:COUPling**Command Format:**

:TRIGger<mode>:COUPling□{DC|AC|HF|LF}

Explanation:

The command is to set the coupling mode to be "DC", "AC", "HF" or "LF". The options of <mode> are ":EDGE", ":PULSe" or ":SLOPe".

DC: Allow all signals pass

AC: Block DC signals

HF: Reject high frequency signals (Higher than 150 KHz)

LF: Reject DC and low frequency signals (Lower than 8KHz)

Query Format:

:TRIGger<mode>:COUPling?

Returned Format:

Query returns "DC", "AC", "HF" or "LF". The double quotes are not returned.

Example:

:TRIGger:EDGE:COUPling□DC

Set the coupling mode to be "DC"

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:TRIGger:EDGE:COUPling?

Query returns "DC"

6. :TRIGger:HOLDoff

Command Format:

:TRIGger:HOLDoff□ <count>

Explanation:

The command is used to trigger and stabilize complicated waveform, such as pulse burst. Holdoff time is the oscilloscope's waiting period before starting a new trigger. During Holdoff, oscilloscope will not trigger until Holdoff ends.

The range of <Count> is 100ns~1.5s.

Query Format:

:TRIGger:HOLDoff?

Returned Format:

Query returns the set value of <Count> in scientific numeric notation.

Example:

:TRIGger:HOLDoff□ 0.0001

Set the time of holdoff to 100 us

:TRIGger:HOLDoff?

Query returns 1.000e-04

7. :TRIGger:STATus?

Query Format:

:TRIGger:STATus?

Explanation:

The command is used to query the current status of the oscilloscope. The status may be RUN, STOP, T'D, WAIT, SCAN or AUTO.

Returned Format:

Query returns "RUN", "STOP", "T'D", "WAIT", "SCAN" or "AUTO". The double quotes are not returned.

Trigger Mode Commands

Trigger modes include: Edge, Pulse, Slope, Video, Alternation, Pattern and Puration. Trigger modes commands include:

- :TRIGger:EDGE:SLOPe
- :TRIGger:PULSe:MODE
- :TRIGger:PULSe:WIDTh
- :TRIGger:SLOPe:TIME
- :TRIGger:SLOPe:MODE
- :TRIGger:SLOPe:WINDow
- :TRIGger:SLOPe:LEVelA
- :TRIGger:SLOPe:LEVelB
- :TRIGger:VIDEO:MODE
- :TRIGger:VIDEO:POLarity
- :TRIGger:VIDEO:STANdard
- :TRIGger:VIDEO:LINE
- :TRIGger:ALternation:SOURce
- :TRIGger:ALternation:TYPE
- :TRIGger:ALternation:TimeSCALE
- :TRIGger:ALternation:TimeOFFSet
- :TRIGger:ALternation<mode>:LEVel
- :TRIGger:ALternation:EDGE:SLOPe
- :TRIGger:ALternation<mode>:MODE
- :TRIGger:ALternation<mode>:TIME
- :TRIGger:ALternation:VIDEO:POLarity
- :TRIGger:ALternation:VIDEO:STANdard
- :TRIGger:ALternation:VIDEO:LINE
- :TRIGger:ALternation:SLOPe:WINDow
- :TRIGger:ALternation:SLOPe:LEVelA
- :TRIGger:ALternation:SLOPe:LEVelB
- :TRIGger:ALternation<mode>:COUPling
- :TRIGger:PATTern:PATTern (Only for DS1000*D series)
- :TRIGger:DURation:PATTern (Only for DS1000*D series)
- :TRIGger:DURation:QUALifier (Only for DS1000*D series)
- :TRIGger:DURation:TIME (Only for DS1000*D series)

We will give specific explanations for each command in the following part.

In the trigger System, there is a general command to the edge, pulse width, video, slope and alternate trigger.

1. :TRIGger<mode_1>[<mode_2>]:SENSitivity

Command Format:

:TRIGger<mode_1>[<mode_2>]:SENSitivity□<count>

Explanation:

The command is to set the trigger sensitivity from 0.1~1div.

<mode_1> can be ":EDGE", ":PULSE", ":VIDEO", ":SLOPE" and ":ALTERNATION";
When <mode_1> is ":ALTERNATION", [<mode_2>] can be ":EDGE", ":PULSE",
":VIDEO" or ":SLOPE", else omit [<mode_2>].

Query Format:

:TRIGger<mode_1>[<mode_2>]:SENSitivity?

Returned Format:

Query returns the set value of <Count> in scientific numeric notation.

Example:

:TRIGger:EDGE:SENSitivity□0.2

Set the edge trigger sensitivity as 0.2div

:TRIGger:EDGE:SENSitivity?

Query returns 2.00e-01

2. Set the edge trigger condition

An edge trigger occurs when the trigger input meets a specified voltage level in the specified slope direction.

2.1 :TRIGger:EDGE:SLOPe

Command Format:

:TRIGger:EDGE:SLOPe< >{POSitive|NEGative}

Explanation:

The command is to set the trigger edge to be Positive or Negative.

Query Format:

:TRIGger:EDGE:SLOPe?

Returned Format:

Query returns "POSITIVE" or "NEGATIVE". The double quotes are not returned.

Example:

:TRIGger:EDGE:SLOPe< >POSitive Set the trigger edge as positive

:TRIGger:EDGE:SLOPe? Query returns "POSITIVE"

3. Set the Pulse width trigger condition

This trigger type is used to catch pulses with certain pulse width requirement.

3.1 :TRIGger:PULSe:MODE

Command Format:

:TRIGger:PULSe:MODE□<mod>

Explanation:

The command is to set the pulse condition; +Greater than (positive pulse width greater than), +Less than (positive pulse width less than), + Equal (positive pulse width equal to), -Greater than (negative pulse width greater than), -Less than (negative pulse width less than) or -Equal (negative pulse width equal to).

<mod> can be set to "+GREATERthan", "+LESSthan", "+EQUAL", "-GREATERthan", "-LESSthan" or "-EQUAL".

Query Format:

:TRIGger:PULSe:MODE?

Returned Format:

Query returns "+GREATER THAN", "+LESS THAN", "+EQUAL", "-GREATER THAN", "-LESS THAN" or "-EQUAL". The double quotes are not returned.

Example:

:TRIGger:PULSe:MODE□+GREATERTHAN

Set the pulse width condition as "+GREATER THAN"

:TRIGger:PULSe:MODE?

Query returns "+GREATER THAN"

3.2 :TRIGger:PULSe:WIDTH

Command Format:

:TRIGger:PULSe:WIDTH□<wid>

Explanation:

The command is to set the pulse width from 20ns ~ 10s.

Query Format:

:TRIGger:PULSe:WIDTh?

Returned Format:

Query returns the set value of <wid> in scientific numeric notation.

Example:

:TRIGger:PULSe:WIDTh 0.001

Set the pulse width as 1ms

:TRIGger:PULSe:WIDTh?

Query returns 1.000e-03

4. Set the slope trigger condition

The oscilloscope begins to trigger according to the signal rising or falling time.

4.1 :TRIGger:SLOPe:TIME

Command Format:

:TRIGger:SLOPe:TIME \square <count>

Explanation:

The command is to set the slope time from 20ns~10s.

Query Format:

:TRIGger:SLOPe:TIME?

Returned Format:

Query returns the set value of <Count> in scientific numeric notation.

Example:

:TRIGger:SLOPe:TIME \square 0.01 Set the slope time to 10ms

:TRIGger:SLOPe:TIME? Query returns 1.000e-02

4.2 :TRIGger:SLOPe:MODE

Command Format:

:TRIGger:SLOPe:MODE \square <mod>

Explanation:

The command is to set the slope condition as +Greater than (positive slope greater than), +Less than (positive slope Less than), + Equal (positive slope equal to), -Greater than (negative slope greater than), -Less than (negative slope less than), or -Equal (negative slope equal to).

<mod> can be set to "+GREaterthan", "+LESSthan", "+EQUal", "-GREaterthan", "-LESSthan" or "-EQUal".

Query Format:

:TRIGger: SLOPe: MODE?

Returned Format:

Query returns "+GREATER THAN", "+LESS THAN", "+EQUAL", "-GREATER THAN", "-LESS THAN" or "-EQUAL". The double quotes are not returned.

Example:

```
:TRIGger:SLOPe:MODE□+GREATERTHAN
```

Set the slope condition as "+Greater than"

```
:TRIGger:SLOPe:MODE?
```

Query Returns "+GREATER THAN"

4.3 :TRIGger:SLOPe:WINDow**Command Format:**

```
:TRIGger:SLOPe:WINDow□<count>
```

Explanation:

The command is to set the border of the vertical window as PA, PB, PAB, NA, NB or NAB. <count> can be set to "PA", "PB", "PAB", "NA", "NB" or "NAB".

Query Format:

```
:TRIGger:SLOPe:WINDow?
```

Returned Format:

Query returns "P_WIN_A", "P_WIN_B", "P_WIN_AB", "N_WIN_A", "N_WIN_B" or "N_WIN_AB". The double quotes are not returned.

Example:

```
:TRIGger:SLOPe:WINDow□PA
```

Set the border of the vertical window to "PA"

```
:TRIGger:SLOPe:WINDow?
```

Query returns "P_WIN_A"

4.4 :TRIGger:SLOPe:LEVeIA**Command Format:**

```
:TRIGger:SLOPe:LEVeIA□<value>
```

Explanation:

The command is to set the upper trigger level A.

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The range of <value> is $-6 * \text{Scale} \sim +6 * \text{Scale}$. "Scale" indicates the current vertical scale. The default unit of "level" is V/div.

Query Format:

:TRIGger:SLOPe:LEVelA?

Returned Format:

Query returns the set value of <value> in scientific numeric notation.

Example:

:TRIGger:SLOPe:LEVelA 2	Set the upper trigger level as 2
:TRIGger:SLOPe:LEVelA?	Query returns 2.000e+00

4.5 :TRIGger:SLOPe:LEVelB

Command Format:

:TRIGger:SLOPe:LEVelB <value>

Explanation:

The command is to set the lower trigger Level B.

The range of <value> is $-6 * \text{Scale} \sim +6 * \text{Scale}$. "Scale" indicates the current vertical scale. The default unit of "level" is V/div.

Query Format:

:TRIGger:SLOPe:LEVelB?

Returned Format:

Query returns the set value of <value> in scientific numeric notation.

Example:

:TRIGger:SLOPe:LEVelB -1.5	Set the lower level of the trigger level as -1.5
:TRIGger:SLOPe:LEVelB?	Query returns -1.500e+00

Note: Minimum of Level A couldn't be less than maximum of Level B.

5. Set the video trigger condition

Use video trigger on fields or lines for standard video signals. Set the DC as the trigger coupling.

5.1 :TRIGger:VIDEO:MODE

Command Format:

:TRIGger:VIDEO:MODE□<mod>

Explanation:

The command is to set the trigger synchronization as "ODDfield", "EVENfield", "LINE" or "ALLlines".

Query Format:

:TRIGger:VIDEO:MODE?

Returned Format:

Query returns "ODD FILED", "EVEN FILED", "LINE", "ALL LINES". The double quotes are not returned.

Example:

:TRIGger:VIDEO:MODE□EVENFIELD

Set the trigger synchronization as "EVENfield".

:TRIGger:VIDEO:MODE?

Query returns "EVEN FIELD".

5.2 :TRIGger:VIDEO:POLarity

Command Format:

:TRIGger:VIDEO:POLarity□{POSitive|NEGative}

Explanation:

The command is to set the Video polarity as "POSitive" or "NEGative".

Query Format:

:TRIGger:VIDEO:POLarity?

Returned Format:

Query returns "POSITIVE" or "NEGATIVE". The double quotes are not returned.

Example:

:TRIGger:VIDEO:POLarity□POSitive Set the Video polarity as POSitive
:TRIGger:VIDEO:POLarity? Query returns "POSITIVE"

5.3 :TRIGger:VIDEO:STANdard

Command Format:

:TRIGger:VIDEO:STANdard□{NTSC|PALSecam}

Explanation:

The command is to set the video type as NTSC or PAL/SECAM.

Query Format:

:TRIGger:VIDEO:STANdard?

Returned Format:

Query returns "NTSC" or "PAL/SECAM". The double quotes are not returned.

Example:

:TRIGger:VIDEO:STANdard□PALSECAM Set the video type as PAL/SECAM
:TRIGger:VIDEO:STANdard? Query returns "PAL/SECAM"

5.4 :TRIGger:VIDEO:LINE

Command Format:

:TRIGger:VIDEO:LINE□<value>

Explanation:

The command is to set up number of synchronous appointed lines.

The range of <value>: 1~525 for NTSC standard

The range of <value>: 1~ 625 for PAL standard

Query Format:

:TRIGger:VIDEO:LINE?

Returned Format:

Query returns the set value of <LINES>.

Example:

:TRIGger:VIDEO:LINE□25

Set up number of synchronous appointed lines to 25

:TRIGger:VIDEO:LINE?

Query returns 25

6. Set the Alternate trigger condition

When alternate trigger is on, the trigger sources come from the two vertical channels. This mode can be used to observe two non-related signals. You can choose two different trigger modes for individual channels. The options are as follows: Edge, Pulse, Slope and video.

6.1 :TRIGger:ALTerNation:SOURce

Command Format:

:TRIGger:ALTerNation:SOURce□<src>

Explanation:

The command is to choose the source channel. <src> can be CHANnel1 or CHANnel2.

Query Format:

:TRIGger:ALTerNation:SOURce?

Returned Format:

Query returns "CH1" or "CH2". The double quotes are not returned.

Example:

:TRIGger:ALTerNation:SOURce□CHANNEL2	Choose Channel 2 as the source
:TRIGger:ALTerNation:SOURce?	Query returns "CH2"

6.2 :TRIGger:ALTerNation:TYPE

Command Format:

:TRIGger:ALTerNation:TYPE□<value>

Explanation:

The command is to set up trigger type.
<type> can be "EDGE", "PULSe", "SLOPe" or "VIDEO".

Query Format:

:TRIGger:ALTerNation:TYPE?

Returned Format:

Query returns "EDGE", "PULSE", "SLOPE" or "VIDEO". The double quotes are not returned.

Example:

```
:TRIGger:ALTerNation:TYPE□EDGE      Set trigger type as Edge trigger
:TRIGger:ALTerNation:TYPE?          Query returns "EDGE"
```

6.3 :TRIGger:ALTerNation:TimeSCALE**Command Format:**

```
:TRIGger:ALTerNation:TimeSCALE□ <value>
```

Explanation:

The command is to modify the time base of current channel.

The range of <value>: 2ns - 50s (when it is Normal)
500ms - 50s (when it is Roll mode)

Query Format:

```
:TRIGger:ALTerNation:TimeSCALE?
```

Returned Format:

Query returns the set value of <value> in scientific numeric notation.

Example:

```
:TRIGger:ALTerNation:TimeSCALE□0.001  Set the time base to 1ms
:TRIGger:ALTerNation:TimeSCALE?       Query returns 1.000e-03
```

6.4 :TRIGger:ALTerNation:TimeOFFSet**Command Format:**

```
:TRIGger:ALTerNation:TimeOFFSet□ <value>
```

Explanation:

The command is to set up time offset for the current channel.

The range of <value> is:

1s ~ EMS memory terminal (when it is Normal)
-500s ~ +500s (when it is Stop)
-6*scale ~ +6*Scale (when it is Roll mode)

"Scale" indicates the current horizontal scale. The default unit is s/div

Query Format:

:TRIGgervALternation:TimeOFFSet?

Returned Format:

Query returns the set value of <value> in scientific numeric notation.

Example:

:TRIGger:ALternation:TimeOFFSet 0.0002

Set up current horizontal time base as 200us

:TRIGger:ALternation:TimeOFFSet?

Query returns 2.000e-04

6.5 :TRIGger:ALternation<mode>:LEVel

Command Format:

:TRIGger:ALternation<mode>:LEVel <value>

Explanation:

The command is to set the trigger level of current channel.

<mode> can be ":EDGE", ":PULSE" or ":VIDEO".

The range of <value> is $-6 * \text{Scale} \sim + 6 * \text{Scale}$.

"Scale" indicates the current vertical scale. The default unit is V/div.

Query Format:

:TRIGger:ALternation<mode>:LEVel?

Returned Format:

Query returns the set value of <value> in scientific numeric notation.

Example:

:TRIGGER:ALTERNATION:EDGE:LEVEL 2

Set the trigger level of current Channel to 2.

:TRIGGER:ALTERNATION:EDGE:LEVEL

Query returns 2.00e+00.

6.6 :TRIGger:ALTerNation:EDGE:SLOPe

Command Format:

:TRIGger:ALTerNation:EDGE:SLOPe□ <value>

Explanation:

The command is to set the edge polarity of EDGE and SLOPE trigger in current channel.

<value> can be "POSitive" or "NEGative". The double quotes are not returned.

Query Format:

:TRIGger:ALTerNation:EDGE:SLOPe?

Returned Format:

Query returns "POSITIVE" or "NEGATIVE".

Example:

:TRIGger:ALTerNation:EDGE:SLOPe□ POSitive

Set the edge polarity to "Positive".

:TRIGger:ALTerNation:EDGE:SLOPe?

Query returns "POSITIVE".

6.7 :TRIGger:ALTerNation<mode>:MODE

Command Format:

:TRIGger:ALTerNation<mode>:MODE□ <value>

Explanation:

The command is to set the trigger modes and the corresponding conditions.

<mode> can be ":PULSe", ":VIDEO" or ":SLOPe".

When <mode> is ":PULSe" or ":SLOPe",

the options of <value> are "+GREaterthan", "+LESSthan", "+EQUal",
"-GREaterthan", "-LESSthan" or "-EQUal".

When <mode> is ":VIDEO",

the options of <value> are "ODDfield", "EVENfield", "LINE" or "ALLlines".

Query Format:

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:TRIGger:ALTerNation<mode>:MODE?

Returned Format:

Query Returns the set value of <value>. The double quotes are not returned.

Example:

:TRIGger:ALTerNation:PULSe:MODE□+GREATERTHAN

Set up Pulse trigger, and condition of "+GREATERTHAN".

:TRIGger:ALTerNation:PULSe:MODE?

Query Returns "+GREATER THAN".

6.8 :TRIGger:ALTerNation<mode>:TIME**Command Format:**

:TRIGger:ALTerNation<mode>:TIME□<value>

Explanation:

The command is to set pulse width or slope time.

The options of <mode> are ":SLOPe" and ":PULSe".

The range of <value> is 2ns~10s.

Query Format:

:TRIGger:ALTerNation<mode>:TIME?

Returned Format:

Query returns the set value of <value> in scientific numeric notation.

Example:

:TRIGGER:ALTERNATION:SLOPE:TIME□0.002 Set the slope time to 2ms

:TRIGGER:ALTERNATION:SLOPE:TIME? Query returns 2.000e-03

6.9 :TRIGger:ALTerNation:VIDEO:POLarity**Command Format:**

:TRIGger:ALTerNation:VIDEO:POLarity□{POSitive|NEGative}

Explanation:

The command is to set the video polarity to "Positive" or "Negative".

Query Format:

:TRIGgervALTerNation:VIDEO:POLarity?

Returned Format:

Query returns "POSITIVE" or "NEGATIVE". The double quotes are not returned.

Example:

:TRIGger:ALTerNation:VIDEO:POLarity□POSitive

Set the video polarity as "Positive".

:TRIGger:ALTerNation:VIDEO:POLarity?

Query returns "POSITIVE".

6.10 :TRIGger:ALTerNation:VIDEO:STANdard**Command Format:**

:TRIGger:ALTerNation:VIDEO:STANdard□{NTSC|PALSecam}

Explanation:

The command is to set the video standard as NTSC or PAL/SECAM.

Query Format:

:TRIGger:ALTerNation:VIDEO:STANdard?

Returned Format:

Query returns "NTSC" or "PAL/SECAM". The double quotes are not returned.

Example:

:TRIGger:ALTerNation:VIDEO:STANdard□NTSC

Set the video standard to "NTSC".

:TRIGger:ALTerNation:VIDEO:STANdard?

Query returns "NTSC".

6.11 :TRIGger:ALTerNation:VIDEO:LINE

Command Format:

:TRIGger:ALTerNation:VIDEO:LINE□ <value>

Explanation:

The command is to set the number of appointed synchronous lines.

The range of <value>: 1~525 for NTSC standard

The range of <value>: 1~ 625 for PAL standard

Query Format:

:TRIGger:ALTerNation:VIDEO:LINE?

Returned Format:

Query returns the set value of <value>.

Example:

:TRIGGER:ALTERNATION:VIDEO:LINE□ 100

Set the number of synchronous appointed lines as 100.

:TRIGger:ALTerNation:VIDEO:LINE?

Query returns 100.

6.12 :TRIGger:ALTerNation:SLOPe:WINDow

Command Format:

:TRIGger:ALTerNation:SLOPe:WINDow□ <count>

Explanation:

The command is to set the border of the vertical window as PA, PB, PAB, NA, NB or NAB. <count> can be set to "PA", "PB", "PAB", "NA", "NB" or "NAB".

Query Format:

:TRIGger:ALTerNation:SLOPe:WINDow?

Returned Format:

Query returns "P_WIN_A", "P_WIN_B", "P_WIN_AB", "N_WIN_A", "N_WIN_B" or "N_WIN_AB". The double quotes are not returned.

Example:

:TRIGger:ALTerNation:SLOPe:WINDow□PA
 Set the border of the vertical window to "PA".

:TRIGger:ALTerNation:SLOPe:WINDow?
 Query returns "P_WIN_A".

6.13 :TRIGger:ALTerNation:SLOPe:LEVelA**Command Format:**

:TRIGger:ALTerNation:SLOPe:LEVelA□ <value>

Explanation:

The command is to set the upper trigger level A of Slope trigger.
 The range of <value> is $-6 * \text{Scale} \sim +6 * \text{Scale}$. "Scale" indicates the current vertical scale. The default unit is V/div.

Query Format:

:TRIGger:ALTerNation:SLOPe:LEVelA?

Returned Format:

Query returns the set value of <value> in scientific numeric notation.

Example:

:TRIGGER:ALTERNATION:SLOPE:LEVELA□2
 Set the trigger level A to 2.

:TRIGGER:ALTERNATION:SLOPE:LEVELA?
 Query returns 2.000e+00.

6.14 :TRIGger:ALTerNation:SLOPe:LEVelB**Command Format:**

:TRIGger:ALTerNation:SLOPe:LEVelB□ <value>

Explanation:

The command is to set the lower trigger level B of Slope trigger.

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The range of <value> is $-6 * \text{Scale} \sim +6 * \text{Scale}$. "Scale" indicates the current vertical scale. The default unit is V/div.

Query Format:

:TRIGger:ALTerNation:SLOPe:LEVElB?

Returned Format:

Query returns the set value of <value> in scientific numeric notation.

Example:

:TRIGGER:ALTERNATION:SLOPE:LEVELB -1.5

Set Level B to -1.5.

:TRIGGER:ALTERNATION:SLOPE:LEVEL?

Query returns -1.500e+00.

Note: Minimum of Level A couldn't be less than maximum of Level B.

6.15 :TRIGger:ALTerNation<mode>:COUPling

Command Format:

:TRIGger:ALTerNation<mode>:COUPling {DC|AC|HF|LF}

Explanation:

The command is to set the coupling mode to be "DC", "AC", "HF" or "LF". The options of <mode> are ":EDGE", ":PULSe" or ":SLOPe".

DC: Allow all signals pass

AC: Block DC signals and attenuate AC signals lower than 10Hz

HF: Reject high frequency signals (Higher than 150 KHz)

LF: Reject DC and low frequency signals (Lower than 8K Hz)

Query Format:

:TRIGger<mode>:COUPling?

Returned Format:

Query returns "DC", "AC", "HF" or "LF". The double quotes are not returned.

Example:

:TRIGger:ALTerNation:EDGE:COUPling DC

Set the coupling condition as "DC".

:TRIGger:ALTerNation:EDGE:COUPling?

Query returns "DC".

7. Set the Pattern trigger condition

Pattern trigger identifies trigger conditions by checking the specified code. The code is the logical combination of all the channels, each channel has three values of high (H), low (L) and ignore(X).

7.1 :TRIGger:PATtern:PATtern

Command Format:

:TRIGger:PATtern:PATtern □ <value>,<mask>,[<edge source>,<edge>]

Explanation:

The command is to set the pattern of the digital signal in each channel (D0~D15).

<value>: a 16 bit unsigned integer, High is 1, Low is 0

<mask>: a 16 bit unsigned integer, enable is 1, X is 0

<edge source>: 0~15

<edge>: rising edge is 1, falling edge is 0

Query Format:

:TRIGger:PATtern:PATtern?

Returned Format:

Query returns the set value of <value>, <mask>, <edge source> and <edge> one by one separated by commas. <value> and <mask> are expressed in decimal.

Example:

:TRIGGER:PATTERN:PATTERN □ 100010,100,2,1

Set the pattern.

:TRIGger:PATtern:PATtern?

Query returns: 68, 4, DIG2, Positive.

8. Set the Duration Trigger condition

Trigger at specified time when predetermined codes are met.

8.1 :TRIGger:DURation:PATtern

Command Format:

:TRIGger:DURation:PATtern□ <value>,<mask>

Explanation:

The command is to set the pattern of the digital signal in each channel.

<value>: a 16 bit unsigned integer, "High" is 1, "Low" is 0

<mask>: a 16 bit unsigned integer, "enable" is 1, "X" is 0

Query Format:

:TRIGger:DURation:PATtern?

Returned Format:

Query returns the set value of <value>, <mask> separated by commas and expressed in decimal.

Example:

:TRIGGER:DURATION:PATTERN□10010, 101	Set the pattern
:TRIGGER:DURATION:PATTERN?	Query returns: 18, 5

8.2 :TRIGger:DURation:QUALifier

Command Format:

:TRIGger:DURation:QUALifier□ <qual>

Explanation:

The command is to set the time condition, the options of <qual> are "GREATER THAN", "LESS THAN" or "EQUAL".

Query Format:

:TRIGger:DURation:QUALifier?

Returned Format:

Query returns "GREATER THAN", "LESS THAN" or "EQUAL". The double quotes are

not returned.

Example:

:TRIGger:DURation:QUALifier□GREATERTHAN

Set the time condition as "Greater than"

:TRIGger:DURation:QUALifier?

Query returns "GREATER THAN"

8.3 :TRIGger:DURation:TIME

Command Format:

:TRIGger:DURation:TIME□<time>

Explanation:

The command is to set the duration time limits. When trigger condition is being met, trigger occurs continuously within the specified time limits.

The range of <time> is 2ns~10s.

Query Format:

:TRIGger:DURation:TIME?

Returned Format:

Query returns the set value of <time> in scientific numeric notation.

Example:

:TRIGGER:DURATION:TIME□0.05

Set the limit time of the duration time as 50ms.

:TRIGGER:DURATION:TIME?

Query returns 5.00e-02.

NOTE: The Trigger system is complex, and the settings must be defined correctly. Be patient and cautious!

LA Commands (Only for DS1000*D Series)

LA (Logic Analyzer) Module Commands are used to control the logic analyzer, to acquire and analyze the digital signals.

LA Commands include:

- :LA:DISPlay
- :DIGital<n>:TURN
- :DIGital<n>:POSition
- :LA:THReshold
- :LA:GROUp
- :LA:POSition:RESet

We will give specific explanations for each command in the following part.

1. :LA:DISPlay

Command Format:

:LA:DISPlay□{ON|OFF}

Explanation:

The command is to control the display of the digital channel On or OFF.

Query Format:

:LA:DISPlay?

Returned Format:

Query returns "ON" or "OFF". The double quotes are not returned.

Example:

:LA:DISPlay□ON	Set the digital channel On
:LA:DISPlay?	Query returns "ON"

2. :DIGital<n>:TURN

Command Format:

:DIGital<n>:TURN□{ON|OFF}

Explanation:

The command is to control the specified digital channel ON or OFF

Query Format:

:DIGital<n>:TURN?

Returned Format:

Query returns "ON" or "OFF". The double quotes are not returned.

Example:

:DIGital2:TURN□ON	Set the digital Channel 2 On
:DIGital<n>:TURN?	Query returns "ON"

3. :DIGital<n>:POSition

Command Format:

:DIGital<n>:POSition□ <position>

Explanation:

The command is to set the size of the digital waveform. When the size of the waveform is large, you can see the waveform on the screen from channels 0~7. When the size of the waveform is small, you can see the waveform on the screen from channels 0~15.

The range of <n> is 0~15;

<position> is 0~7 (if display size = large)

0~15 (if display size = small)

Query Format:

:DIGital<n>:POSition?

Returned Format:

Query returns the set value of <position>.

Example:

:DIGital2:POSition□3

Set the count of waveform for the digital Channel 2 to 3.

:DIGital2:POSition?

Query returns 3.

4. :LA:THReshold

Command Format:

:LA:THReshold□ <value>[suffix]

Explanation:

The command is to set the threshold as TTL, CMOS, ECL or user defined.

<Value> can be "CMOS", "ECL", "TTL" and User Defined, the <User Defined> value is in NR3 format from -8.00 to +8.00

[suffix] can be "V", "mV" or "uV".

Query Format:

:LA:THReshold?

Returned Format:

Query returns "CMOS", "ECL", "TTL" or the set value of <User Defined>.

Example:

:LA:THReshold□COMS Set the threshold as COMS

:LA:THReshold? Query returns COMS

5. :LA:GROUp

Command Format:

:LA:GROUp<n>□{ON|OFF}

Explanation:

The command is to turn On or Off of the Group1 (D7~D0), Group2 (D15~D8).

<n> is 1 or 2.

Query Format:

:LA:GROUp<n>?

Returned Format:

Query returns "ON" or "OFF". The double quotes are not returned.

Example:

:LA:GROUp1□ON Set the digital channel D0~D7 On

:LA:GROUp1? Query returns "ON"

6. :LA:POSition:RESet

Command Format:

:LA:POSition:RESet

Explanation:

The command is to relocate the location of the waveform and make a messy screen return to normal display.

Math Commands

MATH Commands are used to display the result of adding, subtracting, multiplying and FFT from Channel 1 and Channel 2, the result can be measured by the grid or the cursor.

MATH Commands include:

- :MATH:DISPlay
- :FFT:DISPlay

We will give specific explanations for each command in the following part.

1. :MATH:DISPlay

Command Format:

:MATH:DISPlay□{ON|OFF}

Explanation:

The command is to turn the **MATH** function ON or OFF.

Query Format:

:MATH:DISPlay?

Returned Format:

Query returns "ON" or "OFF". The double quotes are not returned.

Example:

:MATH:DISPlay□ON	Set the Math function On
:MATH:DISPlay?	Query returns "ON"

2. :FFT:DISPlay

Command Format:

:FFT:DISPlay□{ON|OFF}

Explanation:

The :FFT:DISPlay command is to turn the FFT function On or Off.

Query Format:

:FFT:DISPlay?

Returned Format:

Query returns "ON" or "OFF". The double quotes are not returned.

Example :

:FFT:DISPlay□ON	Set the FFT function on
:FFT:DISPlay?	Query returns "ON"

Waveform commands

The waveform command is used to read the waveform data displayed on the screen of the oscilloscope.

1. :WAVEform:DATA?

Command Format:

```
:WAVEform:DATA?□[<source>]
```

Explanation:

This command is to read the waveform data displayed on the screen of the oscilloscope. <source> is optional, it can be CHANnel1, CHANnel2, DIGital, MATH or FFT, the default is CHANnel1.

Returned Format:

Query returns 1024 (1K) data.

Example:

```
:WAVEform:DATA?□CHANnel1      Read the data acquired from the Channel 1:
119,119,119,119,119,119,123,119,123,119,123,119,123,119,123,119,123,119,1
23,119,119,123,123,119,123,119,119,123,119,123,123,119,123,119,123,119,11
9,123,123,119,123,119,123,119,123,119,123,119,123,119,123,119,119,123,123,
119,123,119,119,123,123,119,123,119,119,123,119,123,119,123,123,119,119,1
23,119,123,119,123,123,119,119,123,119,123,123,119,119,123,119,123,123,11
9,123,119,123,119,119,123,123,119,123,119,123,119,123,119,119,123,119,123,
123,119,123,119,123,119,123,119,123,119,123,119,123,119,123,119,123,119,1
19,123,119,123,123,119,123,119,123,119,123,119,123,119,123,119,123,119,11
9,123,119,123,123,119,123,119,123,119,123,119,119,123,123,119,119,123,123,
119,123,119,123,119,123,119,123,119,119,123,123,119,119,123,123,119,123,1
19,123,119,123,119,123,119,123,119,119,123,123,119,123,119,123,119,119,12
3,123,119,123,119,119,123,123,119,123,119,119,123,119,123,119,123,123,119,
123,119,123,119,123,119,123,119,119,123,119,123,123,119,119,123,119,123,1
23,119,123,119,119,123,123,119,123,119,123,119,123,119,123,119,119,123,11
9,123,123,119,123,119,123,119,119,123,123,119,123,119,123,119,119,123,119,
123,119,123,123,119,123,119,123,119,119,123,123,119,123,119,123,119,123,1
19,123,119,119,123,119,123,119,123,119,123,119,123,119,123,123,119,123,11
9,123,119,123,119,123,119,123,123,119,123,119,119,123,119,123,123,119,
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```

123,119,123,119,119,123,123,119,123,119,119,123,119,123,123,119,123,119,1
23,119,123,119,119,123,119,123,123,119,123,119,119,123,123,119,119,123,11
9,123,123,119,123,119,123,119,119,123,119,123,119,123,123,119,123,119,123,
119,123,119,123,119,119,123,123,119,123,119,119,123,123,119,123,119,123,1
19,119,123,123,119,123,119,123,119,123,119,123,119,119,123,123,119,119,12
3,119,123,123,119,119,123,123,119,119,123,123,119,123,119,123,119,123,119,
123,119,123,119,119,123,123,119,123,119,119,123,123,119,123,119,123,119,1
19,123,123,119,119,123,123,119,123,119,119,123,119,123,123,119,123,119,11
9,123,123,119,123,119,119,123,119,123,123,119,119,123,123,119,123,119,119,
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23,119,123,119,123,123,119,123,119,119,123,119,123,119,123,119,123,123,11
9,123,119,119,123,123,119,119,123,119,123,119,123,123,119,123,119,123,119,
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19,123,123,119,123,119,123,119,119,123,119,123,119,123,123,119,119,123,11
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23,123,119,119,123,119,123,119,123,123,119,119,123,119,123,119,123,119,12
3,123,119,123,119,119,123,119,123,119,123,119,123,119,123,119,123,123,119,
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19,123,123,119,119,123,119,123,119,123,119,123,123,119,123,119,119,123,12
3,119,119,123,119,123,119,123,119,123,119,123,123,119,119,123,119,123,119,
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19,119,123,123,119,119,123,123,119,123,119,119,123,123,119,123,119,119,12
3,123,119,123,119,123,119,119,123,123,119,123,119,119,123,123,119,119,123,
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