

Programmer Manual



TDS200-, TDS1000-, and TDS2000-Series Digital Oscilloscope

071-1075-00

This document supports TDS210 and TDS220 with FV:v1.09 and above when used with TDS2CM version CMV:v1.04 and above, or TDS2CMA and TDS2MM any version; TDS224, TDS1000- and TDS2000-series, all versions

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Preface

This programmer manual provides information on how to operate your TDS 200-, TDS1000- or TDS2000-series digital oscilloscope with the RS-232 or General Purpose Interface Bus (GPIB) protocols.

Related Documents

The TDS1000- and TDS2000-series oscilloscopes offer the following standard and optional documents:

- For information on the general operation of the oscilloscopes and how to use a TDS2CMA communications module with the oscilloscope, refer to the *TDS1000- and TDS2000-Series Digital Storage Oscilloscope User Manual*, a standard accessory available in eleven languages as follows:

Language	User manual part number
English	071-1064-XX
French	071-1065-XX*
Italian	071-1066-XX*
German	071-1067-XX*
Spanish	071-1068-XX*
Japanese	071-1069-XX*
Portuguese	071-1070-XX*
Simplified Chinese	071-1071-XX*
Traditional Chinese	071-1072-XX*
Korean	071-1073-XX*
Russian	071-1074-XX

* Contains a language overlay for the front-panel controls.

- For information on how to service the oscilloscope, refer to the *TDS1000- and TDS2000-Series Digital Storage Oscilloscopes Service Manual* (071-1076-XX), an optional accessory in English only

The TDS200-series oscilloscopes offer the following standard and optional documents:

- For information on the general operation of the oscilloscopes, refer to the *TDS200-Series Digital Real-Time Oscilloscope Manual*, a standard accessory available in eleven languages
- For information on how to use a TDS2CMA communications module, or a TDS2MM measurements module with the oscilloscope, refer to the *TDS200 Series Extension Modules Instructions Manual* (071-0409-XX), a standard accessory for extension modules in English only
- For information on how to service the oscilloscope, refer to the *TDS200-Series Digital Real-Time Oscilloscopes Service Manual* (071-0492-XX), an optional accessory in English only

Conventions

Refer to the *Command Syntax* section of the *Syntax and Commands* chapter (page 2-1) for information about command conventions.

NOTE. *References to the TDS2CMA Communications Extension Module in this manual also apply to the TDS2CM extension module.*

Contacting Tektronix

Phone	1-800-833-9200*
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Service support	1-800-833-9200, select option 2*
Technical support	Email: techsupport@tektronix.com 1-800-833-9200, select option 3* 6:00 a.m. - 5:00 p.m. Pacific time

-
- * **This phone number is toll free in North America. After office hours, please leave a voice mail message. Outside North America, contact a Tektronix sales office or distributor; see the Tektronix web site for a list of offices.**



Getting Started

Getting Started

Before you use the commands in this programming manual to remotely control your oscilloscope, you must have installed a TDS2CMA Communications Extension Module onto your TDS1000 or TDS2000 oscilloscope. Follow the instructions in the *TDS1000- and TDS2000-Series Digital Storage Oscilloscope User Manual* to install, test, and configure your extension module. You can also refer to this manual for general information on how to operate a TDS1000 or TDS2000 oscilloscope.

NOTE. *References to the TDS2CMA Communications Extension Module in this manual also apply to the TDS2CM extension module.*

The TDS1000- and TDS2000-series oscilloscopes include all of the Math and measurement functions of the TDS2MM extension module.

For a TDS200 oscilloscope, you must have installed a TDS2CMA Communications Extension Module or TDS2MM Measurement Extension Module. Follow the instructions in the *TDS200 Series Extension Module Instructions Manual* to install, test, and configure your extension module.

Refer to the *TDS200-Series Digital Real-Time Oscilloscope User Manual* for general information on how to operate a TDS200 oscilloscope.



Syntax and Commands

Command Syntax

You can control the oscilloscope through the GPIB or RS-232 interface using a large group of commands and queries. This section describes the syntax these commands and queries use and the conventions the oscilloscope uses to process them. The commands and queries themselves are listed in the *Command Descriptions* section.

You transmit commands to the oscilloscope using the enhanced American Standard Code for Information Interchange (ASCII) character encoding. *Appendix A* contains a chart of the ASCII character set.

The Backus-Naur Form (BNF) notation is used in this manual to describe commands and queries. Table 2-1 lists the BNF notation.

Table 2-1: BNF notation

Symbol	Meaning
< >	Defined element
::=	Is defined as
	Exclusive OR
{ }	Group; one element is required
[]	Optional; can be omitted
...	Previous element(s) may be repeated
()	Comment

Command and Query Structure

Commands consist of set commands and query commands (usually simply called commands and queries). Commands change oscilloscope settings or perform a specific action. Queries cause the oscilloscope to return data and information about its status.

Most commands have both a set form and a query form. The query form of the command is the same as the set form except that it ends with a question mark. For example, the set command `ACQUIRE:MODE` has a query form `ACQUIRE:MODE?`. Not all commands have both a set and a query form; some commands are set only and some are query only.

A few commands do both a set and query action. For example, the `*CAL?` command runs a self-calibration program on the oscilloscope, then returns the result of the calibration.

A command message is a command or query name, followed by any information the oscilloscope needs to execute the command or query. Command messages consist of five different element types.

Table 2-2 lists and describes the five element types.

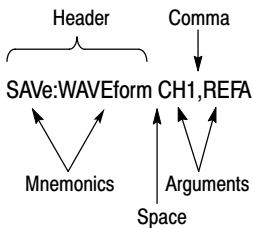
Table 2-2: Command message elements

Symbol	Meaning
<Header>	The basic command name. If the header ends with a question mark, the command is a query. The header may begin with a colon (:) character; if the command is concatenated with other commands the beginning colon is required. The beginning colon can never be used with command headers beginning with a star (*).
<Mnemonic>	A header subfunction. Some command headers have only one mnemonic. If a command header has multiple mnemonics, they are always separated from each other by a colon (:) character.

Table 2-2: Command message elements (Cont.)

Symbol	Meaning
<Argument>	A quantity, quality, restriction, or limit associated with the header. Not all commands have an argument, while other commands have multiple arguments. Arguments are separated from the header by a <Space>. Arguments are separated from each other by a <Comma>.
<Comma>	A single comma between arguments of multiple-argument commands. It may optionally have white space characters before and after the comma.
<Space>	A white space character between command header and argument. It may optionally consist of multiple white space characters.

Figure 2-1 shows the five command message elements.

**Figure 2-1: Command message elements**

Commands

Commands cause the oscilloscope to perform a specific function or change one of its settings. Commands have the structure:

```
[:]<Header>[<Space><Argument>[<Comma><Argument>]...]
```

A command header is made up of one or more mnemonics arranged in a hierarchical or tree structure. The first mnemonic is the base or root of the tree and each subsequent mnemonic is a level or branch off of the previous one. Commands at a higher level in the tree may affect those at a lower level. The leading colon (:) always returns you to the base of the command tree.

Queries

Queries cause the oscilloscope to return information about its status or settings. Queries have the structure:

```
[:]<Header>?
```

```
[:]<Header>?[<Space><Argument>[<Comma><Argument>]...]
```

You can specify a query command at any level within the command tree unless otherwise noted. These branch queries return information about all the mnemonics below the specified branch or level. For example, MEASUREMENT:MEAS<x>:UNITS? returns the measurement units, while MEASUREMENT:MEAS<x>:TYPE? returns the measurement type selected for the measurement, and MEASUREMENT:MEAS<x>? returns all the measurement parameters for the specified measurement.

Headers in Query Responses

You can control whether the oscilloscope returns headers as part of the query response. Use the HEADER command to control this feature. If header is on, the oscilloscope returns command headers as part of the query and formats the query response as a valid set command. When header is off, the oscilloscope sends back only the values in the response. This format can make it easier to parse and extract the information from the response.

Table 2-3 shows the difference in responses.

Table 2-3: Comparison of Header Off and Header On responses

Query	Header Off response	Header On response
ACQuire:NUMAVg?	64	:ACQUIRE:NUMAVG 64
CHx1:COUPling?	DC	:CH1:COUPLING DC

Clearing the Output Queue

To clear the output queue and reset the oscilloscope to accept a new command or query, send a Device Clear (DCL) from a GPIB host or a break signal from an RS-232 host.

Command Entry

Follow these general rules when entering commands:

- Enter commands in upper or lower case.
- You can precede any command with white space characters. White space characters include any combination of the ASCII control characters 00 through 09 and 0B through 20 hexadecimal (0 through 9 and 11 through 32 decimal).
- The oscilloscope ignores commands that consists of just a combination of white space characters and line feeds.

Abbreviating Commands

You can abbreviate many oscilloscope commands. These abbreviations are shown in capital letters in the command listing in the *Command Groups* section on page 2-15 and *Command Descriptions* section on page 2-35. For example, the command ACQuire:NUMAVg can be entered simply as ACQ:NUMA or acq:numa.

If you use the HEADER command to have command headers included as part of query responses, you can also control whether the returned headers are abbreviated or are full-length using the VERBOSE command.

Concatenating Commands

You can concatenate any combination of set commands and queries using a semicolon (;). The oscilloscope executes concatenated commands in the order received. When concatenating commands and queries you must follow these rules:

- Completely different headers must be separated by both a semicolon and by the beginning colon on all commands but the first. For example, the commands `TRIGger:MODE NORMAl` and `ACQuire:NUMAVg 16` can be concatenated into a single command:

```
TRIGger:MODE NORMAl;:ACQuire:NUMAVg 16
```

- If concatenated commands have headers that differ by only the last mnemonic, you can abbreviate the second command and eliminate the beginning colon. For example, the commands `ACQuire:MODE AVERage` and `ACQuire:NUMAVg 16` could be concatenated into a single command:

```
ACQuire:MODE AVERage; NUMAVg 16
```

The longer version works equally well:

```
ACQuire:MODE AVERage;:ACQuire:NUMAVg 16
```

- Never precede a star (*) command with a colon:

```
ACQuire:MODE AVERage;*TRG
```

The oscilloscope processes commands that follow the star command as if the star command was not there, so:

```
ACQuire:MODE AVERage;*TRG;NUMAVg 16
```

sets the acquisition mode to average and sets acquisition averaging to 16. The `*TRG` command is ignored.

- When you concatenate queries, the responses to all queries are combined into a single response message. For example, if channel 1 coupling is set to DC and the bandwidth is set to 20 MHz, the concatenated query:

```
CH1:COUPling?;BANdwidth?
```

returns :CH1:COUPLING DC;;CH1:BANDWIDTH ON if header is on, or DC;ON if header is off.

- You can concatenate set commands and queries in the same message. For example:

```
ACQuire:MODe AVERage;NUMAVg?;STATE?
```

is a valid message that sets the acquisition mode to normal, queries the number of acquisitions for averaging, and then queries the acquisition state. The oscilloscope executes concatenated commands and queries in the order it receives them.

- Any query that returns arbitrary data, such as ID?, must be the last query when part of a concatenated command. If the query is not last, the oscilloscope generates event message 440.

Here are some INVALID concatenation examples:

- CH1:COUPling DC;ACQuire:NUMAVg 16
(missing colon before ACQuire)
- CH1:COUPling DC;;BANdwidth ON
(invalid colon before BANdwidth)
- CH1:COUPling DC;:*TRG
(invalid colon before a star (*) command)
- HORizontal:MAIn:POSition 0;MAIn:SCAlE 1E-13
(levels of mnemonics are different—either remove the second occurrence of MAIn:, or put :HORizontal: in front of MAIN:SCAlE)

Message Terminators

This manual uses the term <EOM> (End of message) to represent a message terminator.

GPIB End of Message Terminators. GPIB EOM terminators can be the END message (EOI asserted concurrently with the last data byte), the ASCII code for line feed (LF) sent as the last data byte, or both. The oscilloscope always terminates messages with LF and EOI. White space is allowed before the terminator; for example, CR LF is acceptable.

RS-232 End of Message Terminators. RS-232 EOM terminators can be a CR (carriage return), LF (line feed), CRLF (carriage return followed by a line feed), or LFCR (line feed followed by a carriage return). When receiving, the oscilloscope accepts all four combinations as valid input message terminators regardless of the currently selected terminator. When a combination of multiple characters is selected (CRLF or LFCR), the oscilloscope interprets the first character as the terminator and the second character as a null command.

Constructed Mnemonics

Some header mnemonics specify one of a range of mnemonics. For example, a channel mnemonic could be CH2. You can use these mnemonics in the command just as you do any other mnemonic. For example, there is a CH1:VOLts command and there is also a CH2:VOLts command. In the command descriptions, this list of choices is abbreviated CH<x>.

Channel Mnemonics

Commands specify the channel to use as a mnemonic in the header.

Symbol	Meaning
CH<x>	2-channel models: A channel specifier; <x> is 1 or 2. 4-channel models: A channel specifier; <x> is 1, 2, 3, or 4.

Reference Waveform Mnemonics

Commands can specify the reference waveform to use as a mnemonic in the header.

Symbol	Meaning
REF<x>	2-channel models: A reference waveform specifier; <x> is A or B. 4-channel models: A reference waveform specifier; <x> is A, B, C, or D.

Waveform Mnemonics

In some commands you can specify a waveform without regard to its type: channel waveform, math waveform, or reference waveform. The “y” is the same as “x” in Reference Waveform Mnemonics.

Symbol	Meaning
<wfm>	Can be CH<x>, MATH, or REF<y>

Cursor Position Mnemonic

When the oscilloscope displays cursors, commands may specify which cursor of the pair to use.

Symbol	Meaning
POSITION<x>	A cursor selector; <x> is 1 or 2.

Measurement Specifier Mnemonics

Commands can specify which measurement to set or query as a mnemonic in the header. The oscilloscope can display up to four (TDS200 series) or five (TDS1000 and TDS2000 series) automated measurements.

Symbol	Meaning
MEAS<x>	A measurement specifier; <x> is 1-4 (TDS200 Series) or 1-5 (TDS1000 and TDS2000 series).

Argument Types

A command argument can be in one of several forms. The individual descriptions of each command tell which argument types to use with that command.

Numeric Arguments

Many oscilloscope commands require numeric arguments. Table 2-4 lists the three types of numeric argument.

Table 2-4: Types of numeric arguments

Symbol	Meaning
<NR1>	Signed integer value
<NR2>	Floating point value without an exponent
<NR3>	Floating point value with an exponent

The syntax shown is the data format that the oscilloscope returns in response to a query. This format is also the preferred format when sending a command to the oscilloscope.

When you enter an incorrect numeric argument, the oscilloscope automatically forces the numeric argument to a correct value. Table 2-5 lists how the oscilloscope handles incorrect numeric arguments.

Table 2-5: Oscilloscope handling of incorrect numeric arguments

Argument value	Oscilloscope response
Numeric argument is less than lowest correct value for that command	Sets the specified command to the lowest correct value and executes the command
Numeric argument is greater than the highest correct value for that command	Sets the specified command to the highest correct value and executes the command
Numeric value is between two correct values	Rounds the entered value to the nearest correct value and executes the command

Quoted String Arguments

Some commands accept or return data in the form of a quoted string, which is simply a group of ASCII characters enclosed by single quotes (') or double quotes ("). For example:

```
"this is a quoted string"
```

Symbol	Meaning
<QString>	Quoted string of ASCII text

Follow these rules when you use quoted strings:

1. A quoted string can include any character defined in the 7-bit ASCII character set. Refer to *Appendix A*.
2. Use the same type of quote character to open and close the string:

```
"this is a valid string"
```

3. You can mix quotation marks within a string as long as you follow the previous rule:

```
"this is an 'acceptable' string"
```

4. You can include a quote character within a string simply by repeating the quote. For example,


```
"here is a "" mark"
```
5. Strings can have upper or lower case characters.
6. If you use a GPIB network, you cannot terminate a quoted string with the END message before the closing delimiter.
7. A carriage return or line feed embedded in a quoted string does not terminate the string, but is treated as just another character in the string.
8. The maximum length of a quoted string returned from a query is 1000 characters.

Here are some examples of invalid strings:

```
"Invalid string argument"
(quotes are not of the same type)
```

```
"test<E0I>"
(termination character is embedded in the string)
```

Block Arguments

Several oscilloscope commands use a block argument form. Table 2-6 lists and describes each part of a block argument.

Table 2-6: Parts of a block argument

Symbol	Meaning
<NZDig>	A non-zero digit character, in the range 1–9 Specifies the number of <Dig> elements that fo
<Dig>	A digit character, in the range 0–9
<DChar>	A character with the hex equivalent of 00 through FF hexadecimal (0 through 255 decimal)
<Block>	A block of data bytes, defined as: <pre><Block> ::= { #<NZDig><Dig>[<Dig>...][<DChar>...] #0[<DChar>...]<terminator> }</pre>

Figure 2-2 shows an example of a block argument.

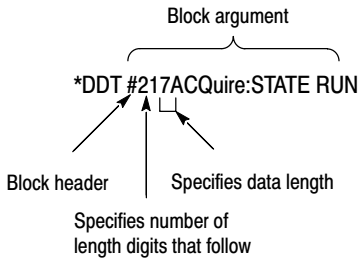


Figure 2-2: Block Argument example

<NZDig> specifies the number of <Dig> elements that follow. Taken together, the <Dig> elements form a decimal integer that specifies how many <DChar> elements follow.

#0 means that the <Block> is an indefinite length block. The <terminator> ends the block. You should not use indefinite length blocks with RS-232, because there is no way to include a <terminator> character as a <DChar> character.

The first occurrence of a <terminator> character signals the end of the block and any subsequent <DChar> characters will be interpreted as a syntax error. With the GPIB, the EOI line signals the last byte.

Command Groups

This section lists the commands organized by functional group. The *Command Descriptions* section, starting on page 2-35, lists all commands alphabetically.

The oscilloscope GPIB and RS-232 interfaces conform to Tektronix standard codes and formats except where noted. The GPIB interface also conforms to IEEE Std 488.2–1987 except where noted.

Acquisition Commands

Acquisition commands affect the acquisition of waveforms. These commands control mode, averaging, and single-waveform acquisition. Table 2-7 lists and describes Acquisition commands.

Table 2-7: Acquisition commands

Header	Description
ACQUIRE?	Return acquisition parameters
ACQUIRE:MODE	Set/query acquisition mode
ACQUIRE:NUMAcq?	Return # of acquisitions obtained
ACQUIRE:NUMAVg	Set/query number of acquisitions for average
ACQUIRE:STATE	Start or stop acquisition system
ACQUIRE:STOPAfter	Set/query acquisition control

Calibration and Diagnostic Commands

Calibration and Diagnostic commands let you initiate the oscilloscope self-calibration routines and examine the results of diagnostic tests. Table 2-8 lists and describes Calibration and Diagnostic commands.

Table 2-8: Calibration and Diagnostic commands

Header	Description
*CAL?	Perform an internal self-calibration and return result status
CALibrate:ABOrt	Stop an in-progress factory calibration
CALibrate:INTERNAL	Perform an internal self-calibration
CALibrate:FACTory	Initialize the factory calibration sequence
CALibrate:CONTINUE	Perform the next step in the factory calibration sequence
CALibrate:STATUS?	Return PASS or FAIL status of the last self- or factory-calibration operation
DIAG:RESUlt:FLAG?	Return diagnostic tests status
DIAG:RESUlt:LOG?	Return diagnostic test sequence results
ERRLOG:FIRST?	Returns first entry from error log
ERRLOG:NEXT?	Returns next entry from error log

Cursor Commands

Cursor commands provide control over the oscilloscope cursor display and readout. Table 2-9 lists and describes Cursor commands.

Table 2-9: Cursor commands

Header	Description
CURSor?	Returns cursor settings
CURSor:FUNCTion	Set/query cursors on or off; select cursor type
CURSor:HBArs?	Return horizontal bar settings
CURSor:HBArs:DELTA?	Return vertical distance between horizontal bar cursors

Table 2-9: Cursor commands (Cont.)

Header	Description
CURSor:HBArS:POSITiON<x>	Set/query position of a horizontal bar cursor
CURSor:HBArS:UNItS?	Query vertical scale units
CURSor:SELEct:SOUrce	Select waveform
CURSor:VBArS?	Return vertical bar settings
CURSor:VBArS:DELTA?	Return horizontal distance between cursors
CURSor:VBArS:POSITiON<x>	Set/query position of a vertical bar cursor
CURSor:VBArS:UNItS	Set/query vertical cursors to time or frequency

Display Commands

Display commands let you change the graticule style, displayed contrast, and alter other display attributes. Table 2-10 lists and describes Display commands.

Table 2-10: Display commands

Header	Description
DISPlay?	Returns display settings
DISPlay:CONTRast	Set/query the LCD display contrast
DISPlay:FORMat	Set/query YT or XY display
DISPlay:INVert ¹	Set/query normal or inverted display
DISPlay:PERSiStence	Set/query the accumulate time
DISPlay:STYLe	Set/query waveform display style

¹ **TDS1000 and TDS2000 series only.**

Hard Copy Commands

The hard copy commands let you control the format of hard copy output and control the starting and stopping of hard copies. Table 2-11 lists and describes Hard Copy commands.

Table 2-11: Hard Copy commands

Header	Description
HARDCopy	Start or terminate hard copy
HARDCopy:FORMat	Set/query the hard copy output format
HARDCopy:INKSaver ¹	Set/query the hard copy ink saver option
HARDCopy:LAYout	Set/query the hard copy orientation
HARDCopy:PORT	Set/query the hard copy port for output (RS232, GPIB, or Centronics)

¹ TDS1000 and TDS2000 series only.

Horizontal Commands

Horizontal commands control the time bases of the oscilloscope. You can set the position and time per division of both the main and window time bases. You can substitute SECdiv for SCALE in all appropriate horizontal commands. This provides program compatibility with previous Tektronix digitizing oscilloscopes. Table 2-12 lists and describes Horizontal commands.

Table 2-12: Horizontal commands

Header	Description
HORizontal?	Return horizontal settings
HORizontal:DELay:POSition	Position window
HORizontal:DELay:SCALE	Set/query window time base time/division
HORizontal:DELay:SECdiv	Same as HORizontal:DELay:SCALE

Table 2-12: Horizontal commands (Cont.)

Header	Description
HORizontal:MAIn	Set/query main time base time/division
HORizontal:MAIn:POSition	Set/query main time base trigger point
HORizontal:MAIn:SCAlE	Set/query main time base time/division
HORizontal:MAIn:SECdiv	Same as HORizontal:MAIn:SCAlE
HORizontal:POSition	Set/query position of waveform to display
HORizontal:RECOrdlength	Return waveform record length
HORizontal:SCAlE	Same as HORizontal:MAIn:SCAlE
HORizontal:SECdiv	Same as HORizontal:MAIn:SCAlE
HORizontal:VIEW	Select view

Math Commands

Math commands provide math function definition. Table 2-13 lists and describes Math commands.

Table 2-13: Math commands

Header	Description
MATH?	Query the definition for the math waveform
MATH:DEFINE	Set/query math waveform definition
MATH:FFT:HORizontal:POSition ¹	Set/query FFT horizontal display position
MATH:FFT:HORizontal:SCAlE ¹	Set/query FFT horizontal zoom factor
MATH:FFT:VERTical:POSition ¹	Set/query FFT vertical display position
MATH:FFT:VERTical:SCAlE ¹	Set/query FFT vertical zoom factor

¹ **TDS1000 and TDS2000 series, or TDS200 series with a TDS2MM measurement module.**

Measurement Commands

Measurement commands control the automated measurement system. Up to four (TDS200 series) or five (TDS1000 and TDS2000 series) automated measurements can be displayed on the oscilloscope screen. In the commands, these measurement readouts are named MEAS<x>, where <x> can be 1, 2, 3, or 4 (or 5 for TDS1000 and TDS2000 series).

The best method for taking measurements over the computer interface is to use the MEASUREMENT:IMMED commands and queries. The immediate measurement has no front-panel equivalent, and the oscilloscope never displays immediate measurements.

Because they are computed only when they are requested, immediate measurements slow the waveform update rate less than displayed measurements.

Use the VALue? query to obtain measurement results of either displayed or immediate measurements.

Several measurement commands set and query measurement parameters. You can assign some parameters, such as waveform sources, differently for each measurement readout.

Table 2-14 lists and describes Measurement commands.

Table 2-14: Measurement commands

Header	Description
MEASUrement?	Return all measurement parameters
MEASUrement:IMMed?	Return immediate measurement parameters
MEASUrement:IMMed:SOUrce	Set/query channel to take the immediate measurement from
MEASUrement:IMMed:TYPe	Set/query the immediate measurement to be taken
MEASUrement:IMMed:UNIts?	Return the immediate measurement units

Table 2-14: Measurement commands (Cont.)

Header	Description
MEASUrement:IMMed:VALue?	Return the immediate measurement result
MEASUrement:MEAS<x>?	Return parameters on the periodic measurement
MEASUrement:MEAS<x>:SOUrce	Set/query channel to take the periodic measurement from
MEASUrement:MEAS<x>:TYPE	Set/query the type of periodic measurement to be taken
MEASUrement:MEAS<x>:UNIts?	Returns the units for periodic measurement
MEASUrement:MEAS<x>:VALue?	Returns periodic measurement results

Miscellaneous Commands

Miscellaneous commands are a group of commands that do not fit into any other category.

Several commands and queries are common to all 488.2–1987 devices on the GPIB BUS and the device on the RS-232 interface. These commands and queries are defined by IEEE Std. 488.2–1987 and Tek Standard Codes and Formats 1989 and begin with an asterisk (*) character. Table 2-15 lists and describes Miscellaneous commands.

Table 2-15: Miscellaneous commands

Header	Description
AUTOSet	Automatic oscilloscope setup
AUTOSet:SIGNAL? ¹	Returns the type of signal found by autoset
AUTOSet:VIEW ¹	Set/query Autoset view

Table 2-15: Miscellaneous commands (Cont.)

Header	Description
*DDT	Set/query group execute trigger (GET)
FACTory	Reset to factory default
HDR	Same as HEADer
HEADer	Set/query command header
ID?	Returns identification information
*IDN?	Returns identification information
LANGUAGE	Set/query language for display messages
LOCK	Lock front panel (local lockout)
*LRN?	Query device settings
REM	No action; remark only
*RST	Reset
SET?	Same as *LRN?
*TRG	Perform Group Execute Trigger (GET)
*TST?	Return self-test results
UNLock	Unlock front panel (local lockout)
VERBose	Return full command name or minimum spellings with query

¹ **TDS1000 and TDS2000 series only.**

RS-232 Commands

RS-232 commands allow you to set or query the parameters that control the RS-232 port. Table 2-16 lists and describes RS-232 commands.

Table 2-16: RS-232 commands

Header	Description
RS232?	Query RS232 parameters
RS232:BAUd	Set/query baud rate
RS232:HARDFlagging	Set/query hard flagging
RS232:PARity	Set/query parity type
RS232:SOFTFlagging	Set/query soft flagging
RS232:TRANsmit:TERMinator	Set/query end-of-line terminator

Save and Recall Commands

Save and Recall commands allow you to store and retrieve internal waveforms and settings. When you “save a setting,” you save most of the settings of the oscilloscope. When you then “recall a setting,” the oscilloscope restores itself to the state it was in when you saved that setting.

To display a saved waveform, use the `SElect:<wfm>` command described on page 2-134. Table 2-17 lists and describes Save and Recall commands.

Table 2-17: Save and Recall commands

Header	Description
*RCL	Recall setting
RECALL:SETUp	Recall saved oscilloscope setting
*SAV	Save oscilloscope setting
SAVe:SETUp	Save oscilloscope setting
SAVe:WAVEform	Save waveform

Status and Error Commands

Status and error commands let you determine the status of the oscilloscope and control events.

Several commands and queries are common to all devices on the GPIB bus. These commands and queries are defined by IEEE Std. 488.2–1987 and Tek Standard Codes and Formats 1989, and begin with an asterisk (*) character. Table 2-18 lists and describes Status and Error commands.

Table 2-18: Status and Error commands

Header	Description
ALLEv?	Return all events
BUSY?	Return oscilloscope busy status
*CLS	Clear status
DESE	Set/query device event status enable
*ESE	Set/query standard event status enable
*ESR?	Return standard event status register; this is the usual way to determine whether a set command executed without error
EVENT?	Return event code
EVMsg?	Return event message
EVQty?	Return number of events in queue
*OPC	Set/query operation complete
*PSC	Set/query power-on status clear
*SRE	Set/query service request enable
*STB?	Read status byte
*WAI	Wait to continue

Trigger Commands

Trigger commands control all aspects of oscilloscope triggering.

The two types of triggers are edge and video. Edge triggering is the default type. Edge triggering lets you acquire a waveform when the signal passes through a voltage level of your choosing. Video triggering adds the capability of triggering on video fields and lines. Table 2-19 lists and describes Trigger commands.

Table 2-19: Trigger commands

Header	Description
TRIGger	Force trigger event
TRIGger:MAIn	Set main trigger level to 50%; Query returns main trigger settings
TRIGger:MAIn:EDGE?	Return edge trigger settings
TRIGger:MAIn:EDGE:COUPLing	Set/query edge trigger coupling
TRIGger:MAIn:EDGE:SLOpe	Set/query edge trigger slope
TRIGger:MAIn:EDGE:SOUrce	Set/query edge trigger source
TRIGger:MAIn:FREQuency? ¹	Return trigger frequency value
TRIGger:MAIn:HOLDOff?	Return trigger holdoff value
TRIGger:MAIn:HOLDOff:VALue	Set/query trigger holdoff value
TRIGger:MAIn:LEVel	Set/query trigger level
TRIGger:MAIn:MODE	Set/query trigger mode
TRIGger:MAIn:TYPe	Set/query main trigger type
TRIGger:MAIn:PULse? ¹	Return pulse trigger settings
TRIGger:MAIn:PULse:SOUrce ¹	Set/query pulse trigger source
TRIGger:MAIn:PULse:WIDth:POLarity ¹	Set/query pulse trigger polarity
TRIGger:MAIn:PULse:WIDth:WHEN ¹	Set/query pulse trigger when
TRIGger:MAIn:PULse:WIDth:WIDth ¹	Set/query pulse trigger width

Table 2-19: Trigger commands (Cont.)

Header	Description
TRIGger:MAIn:VIDeo?	Query video trigger parameters
TRIGger:MAIn:VIDeo:LINE ¹	Set/query video trigger line
TRIGger:MAIn:VIDeo:POLarity	Set/query video trigger polarity
TRIGger:MAIn:VIDeo:SOUrce	Set/query video trigger source
TRIGger:MAIn:VIDeo:STANdard ¹	Set/query video trigger standard
TRIGger:MAIn:VIDeo:SYNC	Set/query video trigger sync
TRIGger:STATE?	Return trigger system status

¹ **TDS1000 and TDS2000 series only.**

Vertical Commands

Vertical commands control the attributes of the channels. The SELEct:<wfm> command also displays a specified waveform or removes it from the display. Table 2-20 lists and describes Vertical commands.

Table 2-20: Vertical commands

Header	Description
CH<x>?	Return vertical parameters
CH<x>:BANdwidth	Set/query channel bandwidth
CH<x>:COUPling	Set/query channel coupling
CH<x>:INVert ¹	Set/query channel invert
CH<x>:POSition	Set/query channel position
CH<x>:PRObe	Set/query channel probe parameters
CH<x>:SCAle	Set/query channel volts/div

Table 2-20: Vertical commands (Cont.)

Header	Description
CH<x>:VOLts	Same as CH<x>:SCAlE
SElect:<wfm>	Set/query waveform display state

¹ **All oscilloscope, firmware version, and module combinations except TDS210 and TDS220 with firmware below V 2.00 and a TDS2CMA communications module.**

Waveform Commands

Waveform commands let you transfer waveform data points to and from the oscilloscope. Waveform data points are a collection of values that define a waveform. One data value usually represents one data point in the waveform record. When working with peak-detect waveforms, each data value is either the min or max of a min/max pair. Before you can transfer waveform data, you must specify the data format and waveform locations.

Table 2-21 lists and describes Waveform commands. Refer to the text following this table for more information about waveform commands.

Table 2-21: Waveform commands

Header	Description
CURVe	Transfer waveform data to or from the oscilloscope
DATA	Set/query the waveform data format and location
DATA:DESTination	Set/query the destination for waveforms sent to the oscilloscope
DATA:ENCdg	Set/query the waveform data encoding method
DATA:SOURce	Set/query the source of CURVe? data

Table 2-21: Waveform commands (Cont.)

Header	Description
DATA:START	Set/query the starting point in waveform transfer
DATA:STOP	Set/query the ending point in waveform transfer
DATA:TARget	Same as DATA:DESTination
DATA:WIDTH	Set/query the byte width of waveform points
WAVFrm?	Returns waveform preamble and curve data
WFMPre?	Returns waveform preamble
WFMPre:BIT_Nr	Set/query the preamble bit width of waveform points
WFMPre:BN_Fmt	Set/query the preamble binary encoding type
WFMPre:BYT_Nr	Set/query the preamble byte width of waveform points
WFMPre:BYT_Or	Set/query the preamble byte order of waveform points
WFMPre:ENCdg	Set/query the preamble encoding method
WFMPre:NR_Pt	Query the number of points in the curve transfer
WFMPre:PT_Fmt	Set/query the format of curve points
WFMPre:PT_Off	Query the trigger offset
WFMPre:WFId?	Query the waveform identifier
WFMPre:XINcr	Set/query the horizontal sampling interval
WFMPre:XUNit	Set/query the horizontal units
WFMPre:XZEro	Set/query time of first point in waveform
WFMPre:YMUlt	Set/query the vertical scale factor

Table 2-21: Waveform commands (Cont.)

Header	Description
WFMPre:YOFf	Set/query the vertical offset
WFMPre:YUNit	Set/query the vertical units
WFMPre:YZEro? ¹	Set/query the waveform conversion factor
WFMPre:<wfm>?	Returns waveform formatting data
WFMPre:<wfm>:PT_Fmt	Set/query the format of curve points
WFMPre:<wfm>:PT_Off?	Query the trigger offset
WFMPre:<wfm>:WFId?	Query the waveform identifier
WFMPre:<wfm>:XINcr	Set/query the horizontal sampling interval
WFMPre:<wfm>:XUNit	Set/query the horizontal units
WFMPre:<wfm>:XZEro	Set/query the time of first datapoint in waveform
WFMPre:<wfm>:YMUlt	Set/query the vertical scale factor
WFMPre:<wfm>:YOFf	Set/query the vertical position
WFMPre:<wfm>:YUNit	Set/query the vertical units
WFMPre:<wfm>:YZEro? ¹	Set/query the waveform conversion factor

¹ **TDS1000 and TDS2000 series, or TDS200 series with a TDS2MM measurement module.**

Waveform Data Formats

Internally, the oscilloscope uses one 8-bit data byte to represent each waveform data point, regardless of the acquisition mode.

The DATA:WIDTH command lets you specify the number of bytes per data point when transferring data to and from an oscilloscope. This provides compatibility with other digitizing oscilloscopes.

When DATA:WIDth is set to two:

- If sending data, the oscilloscope multiplies each point by 256; the most significant byte then has meaningful data and the least significant byte is 0
- If receiving data, the oscilloscope truncates the data (divides by 256) and saves the most significant byte

NOTE. *The oscilloscopes uses these methods to handle waveforms transmitted in ASCII or binary format.*

The oscilloscope can transfer waveform data in either ASCII or binary format. Use the DATA:ENCdg command to specify one of the following formats:

- ASCII data is represented by signed integer values. The range of values depends on the byte width specified. One-byte-wide data ranges from -128 to 127. Two-byte-wide data ranges from -32768 to 32767.

Each data value requires two to seven characters. This includes one character for the minus sign if the value is negative, one to five ASCII characters for the waveform value, and a comma to separate data points.

An example of an ASCII waveform data string follows:

```
CURVE<space>-110,-109,-110,-110,-109,-107,-109,-107,  
-106,-105,-103,-100,-97,-90,-84,-80
```

- Binary data can be represented by signed integer or positive integer values. The range of the values depends on the byte width specified.

Table 2-22 lists the ranges for one- and two-byte-wide data.

Table 2-22: Binary data ranges

Byte width	Signed integer range	Positive integer range
1	-128 to 127	0 to 255
2	-32,768 to 32,767	0 to 65,535

The defined binary formats also specify the order in which the bytes are transferred giving a total of four binary formats: RIBinary, RPBinary, SRIBinary, and SRPBinary.

RIBinary is signed integer where the most significant byte is transferred first, and RPBinary is positive integer where the most significant byte is transferred first. SRIBinary and SRPBinary correspond to RIBinary and RPBinary respectively but use a swapped byte order where the least significant byte is transferred first. The byte order is ignored when DATA:WIDTH is set to 1.

Waveform Data Record

You can transfer multiple points for each waveform record. You can transfer a portion of the waveform or you can transfer the entire record. The DATA:START and DATA:STOP commands let you specify the first and last data points of the waveform record.

When transferring data into the oscilloscope you must specify the location of the first data point within the waveform record. For example, when DATA:START is set to 1, data points will be stored starting with the first point in the record, and when DATA:START is set to 500, data will be stored starting at the 500th point in the record. The oscilloscope ignores DATA:STOP when reading in data as the oscilloscope will stop reading data when there is no more data to read or when it has reached 2500 data points.

You must specify the first and last data points in the waveform record when transferring data from the oscilloscope to an external device. Setting DATA:START to 1 and DATA:STOP to 2500 always sends the entire waveform, regardless of the acquisition mode.

Waveform Data Locations and Memory Allocation

The DATA:SOURce command specifies the location of the data when transferring waveforms from the oscilloscope. You can transfer one waveform at a time.

You can transfer only one waveform into the oscilloscope at a time. Each waveform is stored in one of two stored waveform locations for 2-channel models or one of four stored waveform locations for 4-channel models. You specify the stored waveform location with the DATA:DESTination command.

NOTE. *The oscilloscope stores waveforms that are ≤ 2500 data points long. The oscilloscope truncates waveforms longer than 2500 data points.*

Waveform Preamble

Each waveform that is transferred has an associated waveform preamble that contains information such as the horizontal scale, vertical scale, and other settings in place when the waveform was created. Refer to the WFMPre commands on page 2-158 for more information about the waveform preamble.

Scaling Waveform Data

Once you transfer the waveform data to the controller, you can convert the data points into voltage values for analysis using information from the waveform preamble.

Transferring Waveform Data

Data transfer times depend on data format, data width, and the speed of the controller. Refer to *Programming Examples* on page 4-1.

From the Oscilloscope. To transfer waveforms from the oscilloscope to an external controller, follow these steps:

1. Use the DATA:SOURce command to select the waveform source.
2. Use the DATA:ENCdg command to specify the waveform data format.

3. Use the DATA:WIDTH command to specify the number of bytes per data point.
4. Use the DATA:START and DATA:STOP commands to specify the portion of the waveform that you want to transfer.
5. Use the WFMPRE? command to transfer waveform preamble information.
6. Use the CURVe? command to transfer waveform data.

To the Oscilloscope. To transfer waveform data to an oscilloscope waveform storage location, follow these steps:

1. Use the DATA:DESTination command to specify the stored waveform location.
2. Use the DATA:ENCdg command to specify the waveform data format.
3. Use the DATA:WIDTH command to specify the number of bytes per data point.
4. Use the DATA:START command to specify the first data point in the waveform record.
5. Use the WFMPRe command to transfer waveform preamble information.
6. Use the CURVe? command to transfer waveform data.

Command Descriptions

Commands either set or query oscilloscope values. Some commands both set and query, some only set, and some only query.

Manual Conventions

This manual uses the following conventions:

- No Query Form indicates set-only commands
- A question mark (?) appended to the command and Query Only indicates query-only commands
- Fully spells out headers, mnemonics, and arguments with the minimal spelling shown in upper case; for example, to use the abbreviated form of the ACQ*u*ire:MO*D*e command, just type ACQ:MOD
- Syntax of some commands varies, depending on the model of oscilloscope and extension module you are using; differences are noted

NOTE. While Trigger View is active (when you push the TRIG VIEW button on the front panel), the oscilloscope ignores the set form of most commands. If you send a command at this time, the oscilloscope generates execution error 221 (Settings conflict).

ACQ*u*ire? (Query Only)

Returns all the current acquisition parameters.

Group

Acquisition

Syntax

ACQ*u*ire?

Returns

Returns current acquisition parameters.

Examples

ACquire?

might return the string :ACQUIRE:STOPAFTER RUNSTOP;STATE 1;MODE SAMPLE;NUMAVG 16 for the current acquisition parameters.

ACquire:MODE

Sets or queries the oscilloscope acquisition mode. This affects all live waveforms and is equivalent to setting the Mode option in the Acquire menu.

Waveforms are the displayed data point values taken from acquisition intervals. Each acquisition interval represents a time duration that is determined by the horizontal scale (time per division).

The oscilloscope sampling system can operate at a rate greater than that indicated by the horizontal scale. Therefore, an acquisition interval can include more than one sample.

The acquisition mode, which you set using this ACquire:MODE command, determines how the final value of the acquisition interval is generated from the many data samples.

Group

Acquisition

Syntax

ACquire:MODE { SAMple | PEAKdetect | AVErage }

ACquire:MODE?

Arguments

SAMple specifies that the displayed data point value is the first sampled value that was taken during the acquisition interval. The waveform data has 8 bits of precision in all acquisition modes. You can request 16 bit data with a CURVe? query, but the lower-order 8 bits of data will be zero. SAMple is the default mode.

PEAKdetect specifies the display of the high-low range of the samples taken from a single waveform acquisition. The oscilloscope displays the high-low range as a vertical range that extends from the highest to the lowest value sampled during the acquisition interval. PEAKdetect mode can reveal the presence of aliasing.

AVERage specifies averaging mode, where the resulting waveform shows an average of SAMple data points from several separate waveform acquisitions. The number of waveform acquisitions that go into making up the average waveform is set or queried using the ACQUIRE:NUMAVg command.

Examples

ACQUIRE:MODE PEAKdetect
displays a vertical area representing the range of the highest to lowest value of the acquired signal.

ACQUIRE:MODE?
might return SAMPLE

Related Commands

WFMPRE:PT_Fmt

ACQUIRE:NUMACq? (Query Only)

Indicates the number of acquisitions that have taken place since starting oscilloscope acquisition. The maximum number of acquisitions that can be counted is $2^{31}-1$. This value is reset to zero when you change most Acquisition, Horizontal, Vertical, or Trigger arguments that affect the waveform except for the following:

- Changing the trigger level or trigger holdoff when in Sample or Peak Detect mode does not reset the value

NOTE. Any change made when in Average mode aborts the acquisition and resets ACQUIRE:NUMACq to zero.

- TDS200 series: changing the vertical position does not reset the value

- TDS1000 and TDS2000 series: if the Trigger mode is set to Auto, and the Horizontal Scale is 10 ms/div or slower, changing the vertical position does not reset the value

NOTE. *In Scan mode, ACQUIRE:NUMAcq? always returns zero.*

Group

Acquisition

Syntax

ACQUIRE:NUMAcq?

Returns

<NR1>

Examples

ACQUIRE:NUMAcq?

might return 350, indicating that 350 acquisitions took place since an ACQUIRE:STATE RUN command was executed.

ACQUIRE:NUMAVg

Sets the number of oscilloscope waveform acquisitions that make up an averaged waveform. This command is equivalent to setting the Averages option in the Acquire menu.

Group

Acquisition

Syntax

ACQUIRE:NUMAVg <NR1>

ACQUIRE:NUMAVg?

Arguments

<NR1> is the number of waveform acquisitions. Correct values are 4, 16, 64, and 128.

Examples

ACQuire:NUMAVg 16
specifies that an averaged waveform will show the result of combining 16 separately acquired waveforms.

ACQuire:NUMAVg?
might return 64, indicating that there are 64 acquisitions specified for averaging.

ACQuire:STATE

Starts or stops oscilloscope acquisitions. This command is the equivalent of pressing the front-panel RUN/STOP button. If ACQuire:STOPAfter is set to SEQuence, other signal events may also stop acquisition.

NOTE. *The best way to determine when a single sequence acquisition is complete is to use *OPC? rather than ACQuire:STATE?. For more information on the *OPC? command, refer to page 2-121.*

Group

Acquisition

Syntax

ACQuire:STATE { OFF | ON | RUN | STOP | <NR1> }

ACQuire:STATE?

Arguments

OFF | STOP | <NR1> = 0 stops acquisitions.

ON | RUN | <NR1> ≠ 0 starts acquisition and display of waveforms. If the command was issued in the middle of an acquisition sequence (for instance averaging), RUN restarts the sequence, discarding any data accumulated before the STOP. It also resets the number of acquisitions.

Examples

ACQuire:STATE RUN

starts acquisition of waveform data and resets the number of acquisitions count (NUMACq) to zero.

ACQuire:STATE?

returns 0 or 1, depending on whether or not the acquisition system is running.

Related Commands

*OPC?

ACQuire:STOPAfter

Tells the oscilloscope when to stop taking acquisitions.

Group

Acquisition

Syntax

ACQuire:STOPAfter { RUNStop | Sequence}

ACQuire:STOPAfter?

Arguments

RUNStop specifies that the run and stop states should be determined by pressing the front-panel RUN/STOP button or issuing the ACQuire:STATE command.

SEQUENCE specifies “single sequence” operation, where the oscilloscope stops after it has acquired enough waveforms to satisfy the conditions of the acquisition mode. For example, if the acquisition mode is set to sample, the oscilloscope stops after digitizing a waveform from a single trigger event. However, if the acquisition mode is set to average 64 waveforms, then the oscilloscope stops only after acquiring all 64 waveforms.

The ACQUIRE:STATE command and the front-panel RUN/STOP button also stop acquisitions when the oscilloscope is in single sequence mode.

Examples

ACQUIRE:STOPAfter RUNStop
sets the oscilloscope to stop the acquisition when you press the front-panel RUN/STOP button.

ACQUIRE:STOPAfter?
might return SEQUENCE

ALLEv? (Query Only)

Causes the oscilloscope to return all events and their messages, and removes the returned events from the Event Queue. The messages are separated by commas. Use the *ESR? query to enable the events to be returned. For a complete discussion of how to use these registers, refer to page 3-1. This command is similar to repeatedly sending *EVMsg? queries to the oscilloscope.

Group

Status and error

Syntax

ALLEv?

Returns

The event code and message in the following format:

<Event Code><Comma><QString>[<Comma><Event Code><Comma><QString>...]

<QString> ::= <Message>; [<Command>]

<Command> is the command that caused the error and may be returned when a command error is detected by the oscilloscope. As much of the command is returned as possible without exceeding the 60 character limit of the <Message> and <Command> strings combined. The command string is right-justified.

Examples

ALLEV?

might return the string :ALLEV 2225,"Measurement error, No waveform to measure; ",420,"Query UNTERMINATED; "

Related Commands

*CLS, DESE, *ESE, *ESR?, EVENT?, EVMsg?, EVQty?, *SRE, *STB?

AUTOSet (No Query Form)

Causes the oscilloscope to adjust its vertical, horizontal, and trigger controls to display a stable waveform. This command is equivalent to pushing the front-panel AUTOSET button.

For a detailed description of the Autoset function, refer to the user manual for your oscilloscope.

Group

Miscellaneous

Syntax

AUTOSet EXECute

Arguments

EXECute invokes Autoset.

AUTOSet:SIGNAL? (Query Only)

NOTE. You can use this command *ONLY* with the TDS1000 and TDS2000 series.

Returns the type of signal discovered by the most recent execution of AutoSet.

Group

Miscellaneous

Syntax

AUTOSet:SIGNAL?

Returns

{ LEVEL | SINE | SQUARE | VIDPAL | VIDNTSC | OTHER | NONE }

LEVEL

The oscilloscope discovered a DC level.

SINE

The oscilloscope discovered a sine-like waveform.

SQUARE

The oscilloscope discovered a square-like waveform.

VIDPAL

The oscilloscope discovered a PAL or SECAM standard video signal.

VIDNTSC

The oscilloscope discovered an NTSC standard video signal.

OTHER

The oscilloscope was unable to classify the signal.

NONE

The AUTOSET menu is not displayed.

AUTOSet:VIEW

NOTE. You can use this command *ONLY* with the TDS1000 and TDS2000 series.

Sets and queries the current view.

If the current menu is not the Autoset menu, or if the view is not valid for the detected waveform, the set command causes the oscilloscope to generate error 221 (Settings conflict).

Group

Miscellaneous

Syntax

```
AUTOSet:VIEW { MULTICYcle | SINGLECYcle | FFT |  
RISINGedge | FALLINGedge | FIELD | ODD | EVEN | LINE |  
LINENum | DCLine | DEFault | NONE }
```

Arguments

MULTICYcle

Sine or square display of several cycles. Default for sine-like and square-like signals.

SINGLECYcle

Sine or square display of approximately one cycle.

FFT

FFT of a sine wave.

RISINGedge

Display of the rising edge of a square wave.

FALLINGedge

Display of the falling edge of a square wave.

FIELD

Video signal display that is synced on all fields. Default for video signals.

ODD

Video signal display that is synced on odd fields.

EVEN

Video signal display that is synced on even fields.

LINE

Video signal display synced on all lines.

LINENum

Video signal display synced on the specified line number.

DCLIne

Query response when the oscilloscope found a DC level.

DEFault

Query response when the oscilloscope could not determine the signal type.

NONE

Query response when the AUTOSET menu is not displayed. Set is ignored.

BUSY? (Query Only)

Returns the status of the oscilloscope. This command allows you to synchronize the operation of the oscilloscope with your application program. Refer to *Synchronization Methods* on page 3-10 for more information.

Group

Status and error

Syntax

BUSY?

Returns

0 means that the oscilloscope is not busy processing any of the commands listed in Table 2-25 (*OPC) on page 2-121.

1 means that the oscilloscope is busy processing one of the commands listed in Table 2-25 (*OPC) on page 2-121.

Examples

BUSY?

might return 1, indicating that the oscilloscope is busy.

Related Commands

*OPC, *WAI

***CAL? (Query Only)**

Performs an internal self-calibration and returns its status. This is equivalent to selecting the Do Self Cal option in the Utility menu. Although *CAL? is a query command, it does perform an action.

NOTE. *The self-calibration can take several minutes to complete. During this time, the oscilloscope does not execute any commands.*

Disconnect all signals from the oscilloscope before performing an internal self-calibration.

Group

Calibration and Diagnostic

Syntax

*CAL?

Returns

0 indicates that the self-calibration completed without any errors detected.

Any value other than zero indicates that the self-calibration did not complete successfully or completed with errors.

Examples

*CAL?

performs a self-calibration and might return 0 to indicate that it completed successfully.

Related Commands

CALibrate:INTERNAL

CALibrate:ABOrt (No Query Form)

NOTE. *You should only use this command in a qualified service environment. For more information about the factory calibration sequence, refer to the service manual for your oscilloscope.*

Aborts the factory calibration process. When you abort the factory calibration, the oscilloscope restores the calibration settings to the previous factory calibration constants stored in non-volatile memory.

Group

Calibration and Diagnostic

Syntax

CALibrate:ABOrt

Examples

CALibrate:ABOrt

stops the in-process factory calibration procedure.

CALibrate:CONTINUE (No Query Form)

NOTE. *You should only use this command in a qualified service environment. For more information about the factory calibration sequence, refer to the service manual for your oscilloscope.*

Performs the next step in the factory calibration operation.

Group

Calibration and Diagnostic

Syntax

CALibrate:CONTINUE

Examples

CALibrate:CONTINUE

performs the next step in the factory calibration operation.

CALibrate:FACTory (No Query Form)

NOTE. *You should only use this command in a qualified service environment. For more information about the factory calibration sequence, refer to the service manual for your oscilloscope.*

Starts the oscilloscope's internal factory calibration operation. The calibration operation consists of a sequence of steps. You send the CALibrate:CONTINUE command to advance to the next calibration step. The calibration program automatically sets up the oscilloscope for each calibration step. Use the CALibrate:ABOrt command to abort the factory calibration.

You can only send synchronization commands or queries (such as *OPC, OPC?, *WAI, BUSY?) while doing a factory calibration.

Group

Calibration and Diagnostic

Syntax

CALibrate:FACTory

Examples

CALibrate:FACTory

starts the factory calibration process.

CALibrate:INTERNAL (No Query Form)

Performs an internal self-calibration but does not return any status. This is equivalent to selecting the Do Self Cal option in the Utility menu.

NOTE. *The self-calibration can take several minutes to complete. During this time, the oscilloscope does not execute any commands.*

Disconnect all signals from the oscilloscope before performing an internal self-calibration.

Syntax

CALibrate:INTERNAL

Examples

CALibrate:INTERNAL
performs an internal self-calibration.

Related Commands

*CAL?

CALibrate:STATUS? (Query Only)

Returns the status of the last calibration operation performed (either self- or factory-calibration) since power up.

Group

Calibration and Diagnostic

Syntax

CALibrate:STATUS?

Returns

PASS indicates that the oscilloscope completed the last calibration operation without detecting any errors.

FAIL indicates that the oscilloscope detected errors during the last calibration operation, or that no calibration operations have been performed since power up.

Examples

CALibrate:STATUS?

might return CALIBRATE:STATUS FAIL if the oscilloscope failed the last calibration operation.

CH<x>? (Query Only)

Returns the oscilloscope vertical parameters. Because CH<x>:SCALE and CH<x>:VOLts are identical, only CH<x>:SCALE is returned.

Group

Vertical

Syntax

CH<x>?

Returns

Oscilloscope vertical parameters

Examples

CH1?

might return the string :CH1:SCALE 1.0E0;POSITION 0.0E0;COUPLING DC;BANDWIDTH OFF;PROBE 1.0E0 for channel 1.

Related Commands

SElect:CH<x>

CH<x>:BANdwidth

Sets or queries the bandwidth setting of the specified oscilloscope channel. This command is equivalent to setting the BW Limit option in the Vertical menu.

Group

Vertical

Syntax

CH<x>:BANDwidth { ON | OFF }

CH<x>:BANDwidth?

Arguments

ON sets the channel bandwidth to 20 MHz.

OFF sets the channel bandwidth to the full bandwidth of the oscilloscope.

In most acquisition modes, full bandwidth is 60 MHz, 100 MHz, or 200 MHz (depending on the oscilloscope model). There are exceptions.

TDS1000 and TDS2000 Series

At vertical scales from 2.00 to 4.99 mV/div (sensitivity at the BNC; that is, after the probe factor is removed), the full bandwidth is 20 MHz.

TDS200 Series

At vertical scales of 5 mV/div or less (sensitivity at the BNC; that is, after the probe factor is removed), the full bandwidth is 20 MHz. When the acquisition mode is Peak Detect, and the vertical scale at the BNC is 10 mV/div or less, the full bandwidth is also 20 MHz.

Examples

CH2:BANDwidth ON

sets the bandwidth of channel 2 to 20 MHz.

CH1:BANDwidth?

might return OFF, which indicates that there is no bandwidth limiting on channel 1.

CH<x>:COUPling

Sets or queries the input attenuator coupling setting of the specified oscilloscope channel. This command is equivalent to setting the Coupling option in the Vertical menu.

Group

Vertical

Syntax

CH<x>:COUPling { AC | DC | GND }

CH<x>:COUPling?

Arguments

AC sets the specified oscilloscope channel to AC coupling.

DC sets the specified oscilloscope channel to DC coupling.

GND sets the specified oscilloscope channel to ground. Only a flat ground-level waveform is displayed.

Examples

CH1:COUPlING AC
establishes AC coupling on channel 1.

CH2:COUPlING?
might return DC, indicating that channel 2 is set to DC coupling.

CH<x>:INVert

NOTE. You can *NOT* use this command with a TDS210 or TDS220 oscilloscope with firmware below V 2.00 and a TDS2CMA (or TDS2CM) communications module.

Sets or queries the inversion state of the specified oscilloscope channel. This command is equivalent to setting the Invert option in the Vertical channel menus.

Group

Vertical

Syntax

CH<x>:INVert { ON | OFF }

CH<x>:INVert?

Arguments

ON inverts the specified oscilloscope channel.

OFF sets the specified oscilloscope channel to non-inverted.

Examples

CH1:INVert ON

inverts the signal on channel 1.

CH2:INVert?

might return OFF, indicating that channel 2 is not inverted.

CH<x>:POsition

Sets or queries the vertical position of the specified oscilloscope channel. The position voltage value is applied to the signal before digitization. This command is equivalent to adjusting the front-panel VERTICAL POSITION knob.

Group

Vertical

Syntax

CH<x>:POsition <NR3>

CH<x>:POsition?

Arguments

<NR3> is the position in divisions from the center graticule.

Table 2-23 lists the vertical position ranges using a 1X probe.

Table 2-23: Vertical position ranges using a 1X probe

CH<x>:SCALE	Position range
2 mV/div	±1000 divs
5 mV/div	±400 divs
10 mV/div	±400 divs
20 mV/div	±400 divs
50 mV/div	±400 divs
100 mV/div	±400 divs
200 mV/div	±10 divs
500 mV/div	±100 divs
1 V/div	±100 divs
2 V/div	±100 divs
5 V/div	±10 divs

Examples

CH2:POSition 1.32E0

positions the channel 2 input signal 1.32 divisions above the center of the display.

CH1:POSition?

might return -1.32E0, indicating that the current position of channel 1 is at -1.32 divisions.

CH<x>:PRObe

Sets or queries the attenuation factor of the specified channel.

Group

Vertical

Syntax

CH<x>:PRObe { 1 | 10 | 100 | 1000 }

CH<x>:PRObe?

Arguments

1 sets the specified oscilloscope channel to 1X attenuation.

10 sets the specified oscilloscope channel to 10X attenuation.

100 sets the specified oscilloscope channel to 100X attenuation.

1000 sets the specified oscilloscope channel to 1000X attenuation.

Returns

<NR1>

Examples

CH2:PRObe 1000
sets channel 2 to x1000 attenuation.

CH1:PRObe?
might return CH1:PROBE 10

CH<x>:SCALE

Sets or queries the vertical gain of the specified oscilloscope channel. This command is equivalent to adjusting the front-panel VOLTS/DIV knob.

Group

Vertical

Syntax

CH<x>:SCALE <NR3>

CH<x>:SCALE?

Arguments

<NR3> is the gain, in volts per division. The range is 5 V/div to 2 mV/div when using a 1X probe.

Examples

CH1:SCALE 100E-3
sets the channel 1 gain to 100 mV/div.

CH2:SCALE?
might return 1.0E0, indicating that the current V/div setting of channel 2 is 1 V/div.

Related Commands

CH1:VOLts

CH<x>:VOLts

Sets or queries the vertical gain of the specified channel. This command is identical to the CH<x>:SCALE command and is included for compatibility purposes. Only CH<x>:SCALE is returned in response to a CH<x>? query.

*CLS (No Query Form)

The *CLS command clears the following oscilloscope status data structures:

- The Event Queue
- The Standard Event Status Register (SESR)
- The Status Byte Register (except the MAV bit described on page 2-56)

If the *CLS command immediately follows an <EOI>, the Output Queue and MAV bit (Status Byte Register bit 4) are also cleared. MAV indicates information is in the output queue. The device clear (DCL) GPIB control message will clear the output queue and also MAV.

*CLS does not clear the output queue or MAV. *CLS can suppress a service request that is to be generated by an *OPC command. This will happen if a hardcopy output or single sequence acquisition operation is still being processed when the *CLS command is executed.

Refer to *Registers* on page 3-1 for more information.

Group

Status and Error

Syntax

*CLS

Related Commands

DESE, *ESE, *ESR?, EVENT?, EVMsg?, *SRE, *STB?

CURSor? (Query Only)

Returns all current oscilloscope cursor settings.

Group

Cursor

Syntax

CURSor?

Returns

Oscilloscope cursor parameters

Examples

CURSor?

might return `CURSOR:FUNCTION VBARS;SELECT:SOURCE CH1;
:CURSOR:VBARS:UNITS SECONDS;POSITION1 0.0E0;POSITION2
4.48E-3;;CURSOR:HBARS:UNITS VOLTS;POSITION1 0.0E0;POSI-
TION2 5.0E-1` as the current cursor settings.

CURSor:FUNCTION

Selects and displays the oscilloscope cursor type. Cursors are attached to the waveform selected by `CURSor:SElect:SOURce`. This command is equivalent to setting the Type option in the Cursor

menu. Setting the function to anything other than OFF causes the Cursor menu to be displayed.

NOTE. *Setting the display format to XY removes the cursors. Sending the CURSor:FUNctIon command when the display format is XY causes the oscilloscope to generate event 221 (Settings conflict) and leaves the display in XY format.*

Group

Cursor

Syntax

CURSor:FUNctIon { HBArS | OFF | VBArS }

CURSor:FUNctIon?

Arguments

HBArS specifies horizontal bar cursors that measure the vertical units in volts, divisions, or decibels (decibels are TDS2MM measurement module only).

OFF removes the cursors from the display.

VBArS specifies vertical bar cursors that measure time or frequency.

Examples

CURSor:FUNctIon VBArS
selects vertical bar type cursors.

CURSor:HBArS? (Query Only)

Returns the current settings for the oscilloscope horizontal bar cursors.

Group

Cursor

Syntax

CURSOR:HBARs?

Returns

Current horizontal bar cursor settings.

Examples

CURSOR:HBARs?

might return CURSOR:HBARs:UNITS VOLTS;POSITION1 0.0E0;
POSITION2 0.0E0

CURSOR:HBARs:DELTA? (Query Only)

Returns the difference (in vertical units) between the two horizontal bar cursors in the oscilloscope display.

NOTE. *If Trigger View is active, this query returns 9.9E37 and generates event 221 (Settings conflict).*

Group

Cursor

Syntax

CURSOR:HBARs:DELTA?

Returns

<NR3>

Examples

CURSOR:HBARs:DELTA?

might return 5.08E0 for the difference between the two cursors.

CURSOR:HBARs:POSITION<x>

Positions a horizontal bar cursor.

NOTE. *If Trigger View is active, the query form returns 9.9E37 and generates event 221 (Settings conflict).*

Group

Cursor

Syntax

CURSor:HBARs:POSITION<x> <NR3>

CURSor:HBARs:POSITION<x>?

Arguments

<x> specifies which cursor position, and has the value of 1 or 2.

<NR3> specifies the horizontal bar cursor position, relative to ground (in volts when the units are volts), relative to the center of the screen (in divs when units are divisions), or relative to 1 V RMS (in decibels when the source is an FFT math waveform), for the waveform specified by the CURSor:SELEct:SOUrce command.

The cursor position is limited to the graticule whenever an attempt is made to move it outside the graticule.

NOTE. *The source always determines the measurement units.*

Examples

CURSor:HBARs:POSITION1 25.0E-3

positions one of the horizontal cursors at 25.0 mV (assuming the vertical units are volts).

CURSor:HBARs:POSITION2?

might return -6.40E-2, indicating that the second horizontal bar cursor is at -64.0 mV (assuming the vertical units are volts).

CURSor:HBARs:UNIts? (Query Only)

Returns the vertical scale units for the selected cursor source waveform.

Group

Cursor

Syntax

CURSor:HBARs:UNIts?

Returns

VOLts indicates volts from ground as the unit of measure.

DIVs indicates divisions as the unit of measure, with center of screen as 0 divisions and bottom of screen as -4 divisions.

DECIBELS indicates decibels as the unit of measure, relative to a 1 V_{RMS} sine wave (FFT only).

UNKNOWN indicates that Trigger View is active. This also generates event message 221 (Settings conflict).

Examples

CURSor:HBARs:UNIts?

might return CURSOR:HBARS:UNITS VOLTS

CURSor:SElect:SOUrce

Sets or queries the waveform that is the source of the vertical and horizontal scale factors used in determining cursor values. This command is equivalent to setting the Source option in the Cursor menu.

Group

Cursor

Syntax

CURSor:SElect:SOUrce <wfm>

CURSor:SElect:SOUrce?

Arguments

<wfm> specifies the waveform data source on which cursor measurements will be taken.

Examples

CURSor:SElect:SOUrce CH1
selects channel 1.

CURSor:SElect:SOUrce?
might return MATH

CURSor:VBArS? (Query Only)

Returns the current vertical bar cursor horizontal position and units settings.

Group

Cursor

Syntax

CURSor:VBArS?

Examples

CURSor:VBArS?
might return CURSOR:VBARS:UNITS SECONDS;
POSITION1 1.00E-6;POSITION2 9.00E-6

CURSor:VBArS:DELTA? (Query Only)

Returns the time or frequency difference between the two vertical bar cursors. The units (seconds or Hertz) are specified by the CURSor:VBArS:UNITS command. If the cursor source is an FFT math waveform, CURSor:VBArS:DELTA is always in Hertz, regardless of the value set by CURSor:VBArS:UNITS.

NOTE. *If Trigger View is active, this query returns 9.9E37 and generates event 221 (Settings conflict).*

Group

Cursor

Syntax

CURSor:VBArS:DELTA?

Returns

<NR3>

Examples

CURSor:VBArS:DELTA?

might return 8.92E-1, indicating that the time difference between the vertical bar cursors is 0.892 seconds.

CURSor:VBArS:POSITION<x>

Positions a vertical bar cursor. The unit is specified by the CURSor:VBArS:UNItS command, and can be in units of seconds or frequency (Hertz). If the cursor source is an FFT math waveform, CURSor:VBArS:POSITION is always in Hertz, regardless of the value set by CURSor:VBArS:UNItS.

NOTE. *If Trigger View is active, the query form returns 9.9E37 and generates event 221 (Settings conflict).*

Group

Cursor

Syntax

CURSor:VBArS:POSITION<x> <NR3>

CURSor:VBArS:POSITION<x>?

Arguments

<x> specifies which cursor to position. Correct values are 1 and 2.

<NR3> specifies the cursor position in the units specified by the CURSor:VBArS:UNIts command. The position is relative to the trigger except when the cursor source is a math FFT waveform. The cursor position is limited to the graticule whenever an attempt is made to move it outside the graticule.

Examples

CURSor:VBArS:POSITION2 9.00E-6
positions the second vertical bar cursor at 9 μ s.

CURSor:VBArS:POSITION1?
might return 1.00E-6, indicating the first vertical bar cursor is at 1 μ s.

CURSor:VBArS:UNIts

Sets or queries the units for the vertical bar cursors.

NOTE. When Trigger View is active, CURSorS:VBArS:UNIts? generates event 221(Settings conflict).

Group

Cursor

Syntax

CURSor:VBArS:UNIts { SECOnds | HERTz }

CURSor:VBArS:UNIts?

Arguments

SECOnds specifies units of time.

HERTZ specifies units of frequency (reciprocal of time).

Examples

`CURSOR:VBARS:UNITS SECONDS`

sets the units for the vertical bar cursors to seconds.

`CURSOR:VBARS:UNITS?`

returns HERTZ when the vertical bar cursor units are Hertz.

CURVe

Transfers oscilloscope waveform data to and from the oscilloscope in binary or ASCII format. Each waveform that is transferred has an associated waveform preamble that contains information such as data format and scale. For information about the waveform preamble, refer to *WFMPRE? (Query Only)* on page 2-158. The data format is specified by the `DATA:ENCdg` and `DATA:WIDth` commands.

The `CURVe?` query sends data from the oscilloscope to an external device. The data source is specified by the `DATA:SOURce` command. The first and last data points that are transferred are specified by the `DATA:STARt` and `DATA:STOP` commands.

NOTE. *If the waveform specified by the `DATA:SOURce` command is not displayed, the `CURVe?` query returns nothing, and generates events 2244 (Waveform requested is not activated) and 420 (Query UNTERMINATED).*

In Scan Mode (Sec/div ≥ 100 ms and AUTO Mode), approximately one division's worth of data points will be invalid due to the blanked moving cursor.

The `CURVe` set command sends waveform data from an external device to the oscilloscope. The data is stored in the stored waveform location specified by `DATA:DESTination`, starting with the data point specified by `DATA:STARt`. Only one waveform can be transferred at a time. The waveform will only be displayed if the reference waveform is displayed.

Refer to *Waveform Commands* on page 2-27 for a description of the waveform transfer process.

Group

Waveform

Syntax

CURVe { <Block> | <asc curve> }

CURVe?

Arguments

<Block> is the waveform data in binary format. The waveform is formatted as: #<x><yyy><data> where <x> is the number of characters in <yyy>. For example, if <yyy> = 500, then <x> = 3, where <yyy> is the number of bytes to transfer. Refer to *Block Arguments* on page 2-12 for more information.

If width is 1, then all bytes on the bus are single data points. If width is 2, then all bytes on the bus are 2-byte pairs. Use the DATA:WIDTH command to set the width. <data> is the curve data.

<asc curve> is the waveform data in ASCII format. The format for ASCII data is <NR1>[,<NR1>...] where each <NR1> represents a data point.

Examples

```
SElect:CH1 ON
```

```
DATA:ENCdg ASCII
```

```
DATA:SOURce CH1
```

```
CURVe?
```

might return the ASCII data

```
:CURVE 13,6,3,2,-1,-9,-14,-19,-29,-35,-67,-1,-78,-62,  
-50,-31,-27,-7,0,12,29,39,45,43,41,47,41,38,33,26
```

Related Commands

DATA, WFMPre

DATA

Sets or queries the format and location of the waveform data that is transferred with the CURVe command. Since DATA:DESTination and DATA:TARget are equivalent, only DATA:DESTination is returned by the DATA? query.

Group

Waveform

Syntax

```
DATA { INIT }
```

DATA?

Arguments

INIT initializes the waveform data parameters to their factory defaults.

Examples

```
DATA INIT
```

initializes the waveform data parameters to their factory defaults:

```
DESTINATION = REFA (=TARGET)
```

```
ENCDG = RIBINARY
```

```
SOURce = CH1
```

```
START = 1
```

```
STOP = 2500
```

```
WIDTH = 1
```

```
DATA?
```

```
might return the string :DATA:ENCDG RPBINARY;
```

```
DESTINATION REFA; SOURCE REFB;START 1;STOP 500;WIDTH 2
```

Related Commands

CURVe, WAVFrm

DATA:DESTination

Sets or queries the reference memory location for storing oscilloscope waveform data that is transferred into the oscilloscope by the CURVe command. This command is identical to the DATA:TARget command.

Group

Waveform

Syntax

DATA:DESTination REF<x>

DATA:DESTination?

Arguments

REF<x> is the reference memory location where the waveform will be stored.

Examples

DATA:DESTINATION REFA
stores incoming waveform data into reference memory REFA.

DATA:DESTINATION?
might return REFB as the waveform location that is currently selected.

Related Commands

CURVe?

DATA:ENCdg

Sets or queries the format of the waveform data. This command is equivalent to setting WFMPre:ENCdg, WFMPre:BN_Fmt, and WFMPre:BYT_Or as shown in Table 2-24 on page 2-70.

Setting the DATA:ENCdg value causes the corresponding WFMPre values to update. Setting the WFMPre value causes the corresponding DATA:ENCdg values to update.

Group

Waveform

Syntax

```
DATA:ENCdg { ASCIi | RIBinary | RPBinary | SRIBinary | SRPbinary }
```

DATA:ENCdg?

Arguments

ASCIi specifies the ASCII representation of signed integer (RIBinary) data. If this is the value at power-on, the WFMPre values for BN_Fmt, BYT_Or, and ENCdg are set as RP, MSB, and ASC respectively.

RIBinary specifies signed integer data-point representation with the most significant byte transferred first. This format results in the fastest data transfer rate when DATA:WIDTH is set to 2.

The range is -128 to 127 when DATA:WIDTH is 1. Zero is center screen. The range is -32768 to 32767 when DATA:WIDTH is 2. The upper limit is one division above the top of the screen and the lower limit is one division below the bottom of the screen.

RPBinary specifies positive integer data-point representation with the most significant byte transferred first.

The range is 0 to 255 when DATA:WIDTH is 1. Center screen is 127. The range is 0 to 65,535 when DATA:WIDTH is 2. The upper limit is one division above the top of the screen and the lower limit is one division below the bottom of the screen.

SRIBinary is the same as RIBinary except that the byte order is swapped, meaning that the least significant byte is transferred first. This format is useful when transferring data to IBM compatible PCs.

SRPbinary is the same as RPBinary except that the byte order is swapped, meaning that the least significant byte is transferred first. This format is useful when transferring data to IBM compatible PCs.

Table 2-24 lists DATA and WFMPre parameter settings.

Table 2-24: DATa and WFMPre parameter settings

DATa:ENCdg setting	WFMPre settings		
	:ENCdg	:BN_Fmt	:BYT_Or
ASCLi	ASC	N/A	N/A
RIBinary	BIN	RI	MSB
RPBinary	BIN	RP	MSB
SRIbinary	BIN	RI	LSB
SRPbinary	BIN	RP	LSB

Examples

DATa:ENCdg RPBINARY

sets the data encoding format to be positive integer where the most significant byte is transferred first.

DATa:ENCdg?

might return SRPBINARY for the format of the waveform data.

Related Commands

WFMPre:ENCdg, WFMPre:BN_Fmt, WFMPre:BYT_Or

DATa:SOURce

Sets or queries which waveform will be transferred from the oscilloscope by the CURVe?, WFMPre?, or WAVFrm? queries. You can transfer only one waveform at a time.

Group

Waveform

Syntax

DATa:SOURce <wfm>

DATa:SOURce?

Arguments

<wfm> is the location of the waveform data that will be transferred from the oscilloscope to the external device. Allowable values are CH<x>, MATH, and REF<x>.

Examples

DATA:SOURce REFB

specifies that reference waveform REFB will be transferred in the next CURVe? query.

DATA:SOURce?

might return REFA, indicating the source for the waveform data that is transferred using CURVe?.

Related Commands

CURVe?, WFMPre?, WAVFrm?

DATA:START

Sets or queries the starting data point for waveform data transfers. This command lets you transfer partial waveforms to and from the oscilloscope.

Group

Waveform

Syntax

DATA:START <NR1>

DATA:START?

Arguments

<NR1> is an integer value that ranges from 1 to 2500, and specifies the first data point that will be transferred. Data is transferred from <NR1> to DATA:STOP or 2500, whichever is less. When DATA:STOP is less than DATA:START, the values are swapped internally for CURVe?.

Examples

DATA:START 10

specifies that the waveform transfer will begin with data point 10.

DATA:START?

might return 214 as the first waveform data point that will be transferred.

Related Commands

CURVe?

DATA:STOP

Sets or queries the last data point in the waveform that will be transferred when executing the CURVe? command. This lets you transfer partial waveforms from the oscilloscope.

When using the CURVe command, the oscilloscope stops reading data when there is no more data to read or when the 2500 data point limit is reached.

Group

Waveform

Syntax

DATA:STOP <NR1>

DATA:STOP?

Arguments

<NR1> is an integer value that ranges from 1 to 2500, and specifies the last data point that will be transferred. When DATA:STOP is less than DATA:START, the values are swapped internally for CURVe?.

If you always want to transfer complete waveforms, set DATA:START to 1 and DATA:STOP to 2500.

Examples

DATA:STOP 150

specifies that the waveform transfer will stop at data point 150.

DATA:STOP?

might return 285 as the last data point that will be transferred.

Related Commands

CURVe?

DATA:TARget

Sets or queries the location for storing waveform data transferred from an external device to the oscilloscope when executing the CURVe command. This command is equivalent to the DATA:DESTINATION command and is included here for compatibility with older Tektronix oscilloscopes.

DATA:WIDth

Sets the number of bytes per waveform data point to be transferred when executing the CURVe command. (Changing DATA:WIDth may change the following WFMPre parameters: BIT_Nr, BYT_Nr, YMULt, YOFF, and YZERo.)

Group

Waveform

Syntax

DATA:WIDth <NR1>

DATA:WIDth?

Arguments

<NR1> = 1 sets the number of bytes per waveform data point to 1 byte (8 bits).

<NR1> = 2 sets the number of bytes per waveform data point to 2 bytes (16 bits). If DATA:WIDTH is set to 2, the least significant byte is always zero.

Examples

DATA:WIDTH 1

sets the data width to 1 byte per data point for CURVe data.

Related Commands

CURVe, WFMPre:BIT_Nr, WFMPre:BYT_Nr

*DDT

Lets you specify a command or a list of commands to execute when the oscilloscope receives a *TRG command or the GET GPIB interface message. This is a special alias that *TRG uses.

Group

Miscellaneous

Syntax

*DDT { <Block> | <QString> }

*DDT?

Arguments

<Block> or <QString> is a complete sequence of program messages. The messages must contain only valid commands that must be separated by semicolons and must follow all rules for concatenating commands (refer to page 2-6). The sequence must be ≤80 characters. <Block> format is always returned as a query response.

Examples

*DDT #217ACquire:STATE RUN<EOI>

specifies that the acquisition system will be started each time a *TRG command is sent.

Related Commands

*TRG

DESE

Sets and queries the bits in the Device Event Status Enable Register (DESER). The DESER is the mask that determines whether or not events are reported to the Standard Event Status Register (SESR), and entered into the Event Queue. Refer to the *Status and Events* chapter on page 3-1 for more information.

Group

Status and Error

Syntax

DESE <NR1>

DESE?

Arguments

<NR1> is an integer value in the range from 0 to 255. The binary bits of DESER are set according to this value. For example, DESE 209 sets the DESER to the binary value 11010001 (that is, the most significant bit in the register is set to 1, the next most significant bit to 1, the next bit to 0, and so on).

The power-on default for DESER is all bits set to 1 if *PSC is 1. If *PSC is 0, the DESER maintains its value through a power cycle.

NOTE. Setting DESER and ESER to the same value allows only those codes to be entered into the Event Queue and summarized on the ESB bit (bit 5) of the Status Byte Register. Use the *ESE command to set ESER. For more information on event handling, refer to the Status and Events chapter.

Examples

DESE 209

sets the DESER to binary 11010001, which enables the PON, URQ, EXE, and OPC bits.

DESE?

might return the string :DESE 186, showing that DESER contains the binary value 10111010.

Related Commands

*CLS, *ESE, *ESR?, EVENT?, EVMsg?, *SRE, *STB?

DIAG:RESULT:FLAG? (Query Only)

Returns the Pass/Fail status from the last diagnostic test sequence execution (those run automatically at power on, or those requested through the Service Menu). Use the DIAG:RESULT:LOG? query to determine which test(s) has failed.

Group

Calibration and Diagnostic

Syntax

DIAG:RESUl t:FLAG?

Returns

PASS means that the oscilloscope passes all diagnostic tests.

FAIL means that the oscilloscope has failed at least one of the diagnostic tests.

Examples

DIAG:RESUl t:FLAG?

returns either PASS or FAIL.

DIAG:RESULT:LOG? (Query Only)

Returns the internal results log from the last diagnostic test sequence execution (those run automatically at power on, or those requested through the Service Menu). The list contains all modules and module interfaces that were tested along with the pass or fail status of each.

Group

Calibration and Diagnostic

Syntax

DIAG:RESULT:LOG?

Returns

<QString> in the following format:

<Status>,<Module name>[,<Status>,<Module name>...]

Examples

DIAG:RESULT:LOG?

might return "pass-CPU, pass-ACQ1, pass-EXTENSION" for power-up diagnostics.

DISPLAY? (Query Only)

Returns the current display settings.

Group

Display

Syntax

DISPLAY?

Returns

The current display settings

Examples

DISplay?

might return :DISPLAY:FORMAT YT;STYLE VECTORS;
PERSISTENCE OFF;CONTRAST 50; INVERT OFF

DISplay:CONTRast

Sets or queries the contrast of the LCD display. This command is equivalent to setting the Contrast option in the Display menu.

Group

Display

Syntax

DISplay:CONTRast <NR1>

DISplay:CONTRast?

Arguments

<NR1> is an integer in the range from 1 through 100. The larger the value, the greater the screen contrast.

Examples

DISplay:CONTRast 63
sets the display contrast to 63.

Related Commands, TDS1000 and TDS2000 Series Only

DISPLAY:INVert

DISplay:FORMat

Sets or queries the oscilloscope display format. This command is equivalent to setting the Format option in the Display menu.

Group

Display

Syntax

DISplay:FORMat { XY | YT }

DISplay:FORMat?

Arguments

XY displays the voltage of channel 1 (horizontal axis) against the voltage of channel 2 (vertical axis).

NOTE. *Setting the display format to XY turns cursors off. Sending the CURSor:FUNction command when the display format is XY causes the oscilloscope to generate event 221 (Settings conflict) and leaves the display in XY format.*

YT sets the display to vertical values versus time format and is the default mode.

Examples

DISplay:FORMat YT

selects a voltage versus time format for the display.

DISplay:FORMat?

might return XY for the display format.

DISplay:INVert

Sets or queries the TDS1000 display format. This command is equivalent to setting the Display Style option in the Utility Options menu for the TDS1000 series.

The TDS2000-Series does not have a Display Style option, but accepts the DISplay:INVert command and query for compatibility. The query always returns OFF.

The TDS200 series is not supported.

Group

Display

Syntax

DISplay:INVert { ON | OFF}

DISplay:INVert?

Arguments

OFF chooses a default black-on-white display.

ON chooses a white-on-black display.

DISplay:PERSistence

Sets the length of time that data points are displayed.

Group

Display

Syntax

DISplay:PERSistence { 1 | 2 | 5 | INF | OFF }

DISplay:PERSistence?

Arguments

1 | 2 | 5 specifies the length, in seconds, that the waveform points are displayed on the screen.

INF specifies infinite persistence.

OFF specifies that persistence is turned off.

Returns

0 means that the persistence is turned off.

2 or 5 means that the persistence is set to two or five seconds.

99 means that the persistence is set to infinite.

Examples

DISplay:PERSistence 5

specifies that the waveform points are displayed on the screen for five seconds before they fade.

DISplay:STYLE

Selects how to display the waveform data. This command is equivalent to setting the Type option in the Display menu.

Group

Display

Syntax

```
DISplay:STYLE { DOTs | VECtors }
```

```
DISplay:STYLE?
```

Arguments

DOTs displays individual data points.

VECtors connects adjacent data points.

Examples

```
DISplay:STYLE VEC
```

sets the display to connect adjacent data points.

```
DISplay:STYLE?
```

might return DOTs indicating that the display shows individual waveform data points.

ERRLOG:FIRST? (Query Only)

Returns the first entry in the error log, or an empty string if the error log is empty. Use this command along with ERRLOG:NEXT? to retrieve error log messages.

Group

Calibration and Diagnostic

Syntax

```
ERRLOG:FIRST?
```

Returns

Refer to the service manual for your oscilloscope for information about error log message format.

ERRLOG:NEXT? (Query Only)

Returns the next entry in the error log, or an empty string if the error log is empty or you have reached the end of the log. To start at the top of the error log, run the ERRLOG:FIRST? query to return the first error log message. Then use the ERRLOG:NEXT? query to step through the error log.

Group

Calibration and Diagnostic

Syntax

ERRLOG:NEXT?

Returns

Refer to the service manual for your oscilloscope for information about error log message format.

***ESE**

Sets and queries the bits in the Event Status Enable Register (ESER). The ESER prevents events from being reported to the Status Byte Register (STB). Refer to the *Status and Events* chapter on page 3-1 for more information.

Group

Status and Error

Syntax

*ESE <NR1>

*ESE?

Arguments

<NR1> is a value in the range from 0 through 255. The binary bits of the ESER are set according to this value.

The power-on default for ESER is 0 if *PSC is 1. If *PSC is 0, the ESER maintains its value through a power cycle.

NOTE. *Setting the DESER and the ESER to the same value allows only those codes to be entered into the Event Queue and summarized on the ESB bit (bit 5) of the Status Byte Register. Use the DESE command to set the DESER. Refer to Event Handling Sequence on page 3-8 for more information.*

Examples

*ESE 209

sets the ESER to binary 11010001, which enables the PON, URQ, EXE, and OPC bits.

*ESE?

might return the string *ESE 186, showing that the ESER contains the binary value 10111010.

Related Commands

*CLS, DESE, *ESR?, EVENT?, EVMsg? *SRE, *STB?

***ESR? (Query Only)**

Returns the contents of the Standard Event Status Register (SESR). *ESR? also clears the SESR (since reading the SESR clears it). Refer to the *Status and Events* chapter on page 3-1 for more information.

Group

Status and Error

Syntax

*ESR?

Returns

Contents of the Standard Event Status Register.

Examples

*ESR?

might return the value 213, showing that the SESR contains binary 11010101.

Related Commands

ALLEv?, *CLS, DESE, *ESE, EVENT?, EVMsg?, *OPC, *SRE, *STB?

EVENT? (Query Only)

Returns from the Event Queue an event code that provides information about the results of the last *ESR? read. EVENT? also removes the returned value from the Event Queue. Refer to *Event Handling Sequence* on page 3-8 for more information.

Group

Status and Error

Syntax

EVENT?

Returns

<NR1>

Examples

EVENT?

might return the response :EVENT 110, showing that there was an error in a command header.

Related Commands

ALLEv?, *CLS, DESE, *ESE, *ESR?, EVMsg?, *SRE, *STB?

EVMsg? (Query Only)

Removes from the Event Queue a single event code associated with the results of the last *ESR? read, and returns the event code along with an explanatory message. Refer to *Event Handling Sequence* on page 3-8 for more information.

Group

Status and Error

Syntax

EVMsg?

Returns

The event code and message in the following format:

```
<Event Code><Comma><QString>[<Event Code><Comma>
<QString>...]
```

```
<QString>::= <Message>;[<Command>]
```

where <Command> is the command that caused the error and may be returned when a command error is detected by the oscilloscope. As much of the command as possible is returned without exceeding the 60 character limit of the <Message> and <Command> strings combined. The command string is right-justified.

Examples

EVMsg?

might return the message :EVMSG 110, "Command header error"

Related Commands

ALLEv?, *CLS, DESE, *ESE, *ESR?, EVENT?, *SRE, *STB?

EVQty? (Query Only)

Returns the number of event codes that are in the Event Queue. This is useful when using ALLEv? since it lets you know exactly how many events will be returned.

Group

Status and Error

Syntax

EVQty?

Returns

<NR1>

Examples

EVQty?

might return 3 as the number of event codes in the Event Queue.

Related Commands

ALLEv?, EVENT?, EVMsg?

FACTory (No Query Form)

Resets the oscilloscope to its factory default settings. Refer to *Appendix B* for a list of the factory default settings.

Group

Miscellaneous

Syntax

FACTory

Setting the oscilloscope to factory default has the following impact on the programming interface:

- Clears the Event Status Enable Register
- Clears the Service Request Enable Register
- Sets the Device Event Status Enable Register to 255
- Sets the Power On Status Clear Flag to TRUE
- Enables all Command Headers (HEADer ON)
- Sets the macro defined by *DDT to a “zero-length field”
- Clears the pending operation flag and associated operations
- Performs the equivalent of DATA INIT

The FACTory command does not alter the following items:

- State of the RS-232 or GPIB interface
- Selected GPIB address
- Front panel LOCK state
- Verbose state
- Display Contrast, TDS1000 and TDS2000 series only
- Calibration data that affects device specifications
- Stored settings
- Stored waveforms or data
- Hard copy parameters
- Display messages language selection

Examples

Refer to *Appendix B: Factory Setup*.

Related Commands

*PSC, *RCL, RECALL:SETUp, *RST, *SAV, SAVe:SETUp

HARDCopy

Sends a copy of the screen display followed by an EOI to the port specified by HARDCopy:PORT. The format and layout of the output is specified with the HARDCopy:FORMat and HARDCopy:LAYout commands. This command is equivalent to pressing the PRINT button on the front panel of the TDS1000 and TDS2000 series or the HARDCOPY button on the front panel of the TDS200 series.

HARDCopy? returns format, layout, and port information.

NOTE. *This command is not IEEE Std 488.2–1987 compatible.*

Group

Hard copy

Syntax

HARDCopy { ABOrt | START }

HARDCopy?

Arguments

ABOrt terminates the hard copy output in process.

NOTE. *DCL does not clear the output queue once a hard copy is in process. The only way to abort the hard copy process is to send the HARDCopy ABOrt command. The output queue can then be cleared by sending a DCL message.*

START initiates a screen copy that is sent to the port specified by the HARDCOPY:PORT command.

NOTE. Use the *WAI command between **HARDCopy START** commands to ensure that the first hard copy is complete before starting another.

Examples

HARDCopy ABOrt
stops any hard copy output that is in process.

Related Commands

*WAI

HARDCopy:FORMat

Sets the hard copy output data format. This command is the same as setting the Format option in the **UTILITY ► Options ► Hard Copy Setup** menu.

Group

Hard copy

Syntax

HARDCopy:FORMat { BMP | BUBBLEJet | DESKJet | DPU3445 |
DPU411 | DPU412 | EPSIMAGE | EPSOn | INTERLEAF |
LASERJet | PCX | RLE | THINKjet | TIFF }

HARDCopy:FORMat?

Arguments

BMP sets the hard copy output format to Microsoft Windows Bitmap format.

BUBBLEJet (TDS1000 and TDS2000 series only) sets the hard copy output format to Canon Bubblejet format.

DESKjet sets the hard copy output format to HP DeskJet format.

DPU3445 (TDS1000 and TDS2000 series only), DPU411 and DPU412 set the hard copy output format to various Seiko formats.

EPSIMAGE sets the hard copy format data to Postscript format.

EPS0n sets the hard copy output format to 9-pin or 24-pin dot matrix printer format.

INTERLEAF (TDS200 series only) sets the hard copy format data to Interleaf file format.

LASERJet sets the hard copy output format to HP LaserJet II printer format.

PCX sets the hard copy output format to DOS Paintbrush format.

RLE (TDS1000 and TDS2000 series only) sets the hard copy output format to Run Length Encoded.

THINKjet sets the hard copy output format to HP Thinkjet printer format.

TIFF (TDS1000 and TDS2000 series only) sets the hard copy output format to Tagged Image File Format.

Examples

HARDCopy:FORMat LASERJet
sets the hard copy output format to LaserJetII.

HARDCopy:FORMat?
might return EPS0N as the hard copy output format.

HARDCopy:INKSaver

NOTE. This command *ONLY* affects the TDS2000 series.

Sets the TDS2000 Ink Saver feature to on or off. This command is equivalent to setting the Ink Saver option in the TDS2000 series UTILITY ► Options ► Printer Setup menu. This command has no effect in TDS1000 oscilloscopes, but is accepted for compatibility.

Group

Hard copy

Syntax

HARDCopy:INKSaver { ON | OFF }

HARDCopy:INKSaver?

Arguments

OFF prints “WYSIWYG” hardcopies, with color waveforms on a black background.

ON (default) prints color waveforms on a white background.

Examples

HARDCopy:INKSaver?
might return ON

HARDCopy:LAYout

Selects the printing orientation. This command is equivalent to setting the Layout option in the UTILITY ► Options ► Hard Copy Setup menu.

Group

Hard copy

Syntax

HARDCopy:LAYout { LANDscape | PORTRait }

HARDCopy:LAYout?

Arguments

LANDscape specifies that the bottom of the hard copy is along the long side of the piece of paper.

PORTRait specifies that the bottom of the hard copy is along the short side of the piece of paper. This is the standard format.

Examples

HARDCopy:LAYout?

might return PORTRAIT as the page layout format of the hard copy output.

HARDCopy:PORT

Selects where to send the hard copy data when the oscilloscope receives the next HARDCOPY START command. This command is equivalent to setting the Port option in the UTILITY ► Options ► Hard Copy Setup menu.

Group

Hard copy

Syntax

HARDCopy:PORT { CENTronics | RS232 | GPIb }

HARDCopy:PORT?

Arguments

CENTronics specifies that the hard copy data is sent out the Centronics port.

RS232 specifies that the hard copy data is sent out the RS232 port.

GPIb specifies that the hard copy data is sent out the GPIB port.

Examples

HARDCopy:PORT?

might return RS232 as the selected hard copy output port.

HDR

This command is identical to the HEADer query and is included for compatibility with other Tektronix oscilloscopes.

HEADer

Sets and queries the Response Header Enable State that causes the oscilloscope to either include or omit headers on query responses. This command does not affect IEEE Std 488.2–1987 Common Commands (those starting with an asterisk); they never return headers.

Group

Miscellaneous

Syntax

HEADer { <NR1> | OFF | ON }

HEADer?

Arguments

ON or <NR1> ≠ 0 sets the Response Header Enable State to true. This causes the oscilloscope to include headers on applicable query responses. You can then use the query response as a command.

OFF or <NR1> = 0 sets the Response Header Enable State to false. This causes the oscilloscope to omit headers on query responses so that only the argument is returned.

Examples

HEADer OFF

causes the oscilloscope to omit headers from query responses.

HEADer?

might return the value 1, showing that the Response Header Enable State is true.

Related Commands

VERBoSe

HORizontal? (Query Only)

Returns all settings for the horizontal commands. The commands HORizontal:MAIn:SCAle, HORizontal:MAIn:SECdiv, HORizontal:SCAle, and HORizontal:SECdiv are equivalent, so HORizontal:MAIn:SCAle is the value that is returned.

The commands HORizontal:MAIn:POSi-tion and HORizontal:POSi-tion are equivalent, so HORizontal:MAIn:POSi-tion is the value that is returned.

Group

Horizontal

Syntax

HORizontal?

Returns

Returns all horizontal settings

Examples

HORizontal?

might return the string

```
:HORIZONTAL:VIEW MAIN;RECORDLENGTH 2500;MAIN:POSITION  
0.0E0;SCALE 5.0E-4;HORIZONTAL:DELAY:POSITION 0.0E0;  
SCALE 2.5E-4
```


HORizontal:DELay? (Query Only)

Returns all settings for the window time base. The commands HORizontal:DELay:SECdiv and HORizontal:DELay:SCALE are equivalent, so only the values for HORizontal:DELay:SCALE are returned.

Group

Horizontal

Syntax

HORizontal:DELay?

Returns

All settings for the window time base

Examples

HORizontal:DELay?
might return :HORIZONTAL:DELAY:POSITION 0.0E0;
SCALE 5.0E-4

HORizontal:DELay:POSition

Sets or queries the window time base horizontal position. This command is equivalent to adjusting the Horizontal Position when Window Zone or Window is selected from the Horizontal menu.

Group

Horizontal

Syntax

HORizontal:DELay:POSition <NR3>

HORizontal:DELay:POSition?

Arguments

<NR3> is the position in seconds. This value is the difference between the trigger point and the center graticule. Positive values place the trigger before the center graticule.

Examples

`HORizontal:DELay:POSition 2.0E-6`

sets the window position to 2 μ s before the center graticule.

`HORizontal:DELay:POSition?`

might return `-1.0E-3`, indicating that the window position is 1 ms after the center graticule.

HORizontal:DELay:SCALE

Sets the time per division for the oscilloscope window time base. This command is equivalent to setting SEC/DIV when Window Zone or Window is selected from the Horizontal menu.

Group

Horizontal

Syntax

`HORizontal:DELay:SCALE <NR3>`

`HORizontal:DELay:SCALE?`

Arguments

<NR3> is the time per division. The range depends on the oscilloscope model. The acceptable values are in a 1–2.5–5 sequence. If the window time base scale is set slower than the main time base scale, both the main and window time base scales are set to the window scale value.

Examples

`HORizontal:DELay:SCALE 2.0E-6`

sets the window scale to 2 μ s per division.

`HORizontal:DELay:SCAle 9.0E-6`

sets the window scale to 10 μ s per division. Since 9 μ s is not a correct value within the 1-2.5-5 sequence, it is automatically set to the closest correct value.

`HORizontal:DELay:SCAle?`

might return `1.0E-3`, indicating that the window scale is 1 ms per division.

HORizontal:DELay:SECdiv

This command is identical to the `HORizontal:DELay:SCAle`. It is provided to maintain program compatibility with some older models of Tektronix oscilloscopes.

HORizontal:MAIn? (Query Only)

Returns all settings for the oscilloscope main time base. The `HORizontal:MAIn:SECdiv` and `HORizontal:MAIn:SCAle` commands are identical so only `HORizontal:MAIn:SCAle` is returned.

Group

Horizontal

Syntax

`HORizontal:MAIn?`

Returns

All settings for the main time base.

Examples

`HORizontal:MAIn?`

might return `:HORIZONTAL:MAIN:POSITION 0.0E0;SCALE 5.0E-4`

HORizontal:MAIn:POSition

Sets or queries the main time base horizontal position. This command is equivalent to adjusting the Horizontal Position when Main is selected from the Horizontal menu.

Group

Horizontal

Syntax

HORizontal:MAIn:POSition <NR3>

HORizontal:MAIn:POSition?

Arguments

<NR3> is the position in seconds. This value is the difference between the trigger point and the center graticule. Positive values place the trigger before the center graticule.

Examples

HORizontal:MAIn:POSition 2.0E-6

sets the main trigger position to 2 μ s before the center graticule.

HORizontal:MAIn:POSition?

might return $-1.0E-3$, indicating that the main trigger position is 1 ms after the center graticule.

HORizontal:MAIn:SCAlE

Sets the time per division for the main time base. This command is equivalent to setting SEC/DIV when Main is selected from the Horizontal menu.

Group

Horizontal

Syntax

```
HORizontal:MAIn:SCAlE <NR3>
```

```
HORizontal:MAIn:SCAlE?
```

Arguments

<NR3> is the time per division. The range depends on the oscilloscope model. The acceptable values are in a 1–2.5–5 sequence. Other values are forced to the closest acceptable value.

Examples

```
HORizontal:MAIn:SCAlE 2.5E-6
```

sets the main scale to 2.5 μ s per division.

HORizontal:MAIn:SECdiv

Sets the time per division for the oscilloscope main time base. This command is identical to the HORizontal:MAIn:SCAlE command. It is provided to maintain program compatibility with some older models of Tektronix oscilloscopes.

HORizontal:POStion

Sets or queries the main time base horizontal position. This command is identical to the HORizontal:MAIn:POStion command. This command is included for compatibility.

Group

Horizontal

Syntax

```
HORizontal:POStion <NR3>
```

```
HORizontal:POStion?
```

Arguments

<NR3> is the position in seconds. This value is the difference between the trigger point and the center graticule. Positive values place the trigger before the center graticule.

Examples

`HORizontal:POStion 2.0E-6`
sets the main trigger position to 2 μ s before the center graticule.

`HORizontal:POStion?`
might return $-1.0E-3$, indicating that the main trigger position is 1 ms after the center graticule.

HORizontal:RECOrdlength? (Query Only)

Returns the number of acquisition data points. For TDS200, TDS1000 and TDS2000 series oscilloscopes, this value is always 2500, even in FFT mode. This command is provided to maintain program compatibility with other Tektronix digital oscilloscopes.

Group

Horizontal

Syntax

`HORizontal:RECOrdlength?`

Returns

2500

Examples

`HORizontal:RECOrdlength?`
returns 2500 as the number of data points in each record.

Related Commands

`WFMPre:NR_Pt?`, `WFMPre:<wfm>:NR_Pt?`

HORizontal:SCAle

Sets the time per division for the main time base and is identical to the `HORizontal:MAIn:SCAle` command. It is included for compatibility purposes.

HORizontal:SECdiv

Sets the time per division for the main time base and is identical to the HORizontal:MAIn:SCALE command. It is included for compatibility purposes.

HORizontal:VIEW

Specifies whether the horizontal display uses the Main, Window Zone, or Window view. This is equivalent to setting the View in the Horizontal menu.

Group

Horizontal

Syntax

```
HORizontal:VIEW { MAIn | WINDOW | ZONE }
```

```
HORizontal:VIEW?
```

Arguments

MAIn specifies that the waveform is acquired and displayed using the Main time base.

WINDOW specifies that the waveform is acquired and displayed using the Window (delay) time base.

ZONE is the same as MAIn, but adds display of vertical cursor bars to show the portion of the waveform that would be acquired and displayed using the window (delay) time base.

Examples

```
HORizontal:VIEW MAIn
```

is the default view.

ID? (Query Only)

Returns identifying information about the oscilloscope and its firmware in Tektronix Codes and Formats notation.

NOTE. *ID?* must be the last command when it is part of a concatenated statement. Otherwise the oscilloscope generates event message 440.

Group

Status and Events

Syntax

ID?

Returns

The oscilloscope identification in the following format:

```
TEK/<model number>,CF:91.1CT,FV:v<oscilloscope firmware version number>,TDS2XX:XXV:v<module firmware version number>
```

Where XX is the module type, CM (communications module) or MM (measurement module).

The *IDN? and ID? responses are slightly different.

Examples

ID?

might return the response

```
ID TEK/TDS 220,CF:91.1CT,FV:v1.00 TDS2CM:CMV:v1.00
```

Related Commands

*IDN?

***IDN? (Query Only)**

Returns the oscilloscope identification code in IEEE 488.2 notation.

NOTE. *IDN?* must be the last command when it is part of a concatenated statement. Otherwise the oscilloscope generates event message 440.

Group

Status and Events

Syntax

*IDN?

Returns

The oscilloscope identification in the following format:

```
TEKTRONIX,<model number>,0,CF:91.1CT FV:v<oscilloscope  
firmware version number> TDS2XX:XXV:v<module firmware  
version number>
```

Where XX is the module type, CM (communications module) or MM (measurement module).

The *IDN? and ID? responses are slightly different.

Examples

*IDN?

might return the response

```
TEKTRONIX,TDS 220,0,CF:91.1CT FV:v1.00 TDS2CM:CMV:v1.00
```

Related Commands

ID?

LANGUage

Sets or queries the languages that the oscilloscope uses to display information on the screen. This is equivalent to the Language option in the Utility menu.

Group

Miscellaneous

Syntax

```
LANGUage { ENGLish | FRENch | GERMan | ITALian |  
PORTUguese | SPANish | JAPANese | KOREan |  
TRADitionalchinese | SIMPLifiedchinese }
```

LANGUage?

Arguments

The argument specifies which language will be used to display oscilloscope information on the screen.

Examples

LANGUage FRENCh
specifies that the oscilloscope display information in French.

LANGUage?
might return SPANISH

LOCK

Enables and disables all front-panel buttons and knobs. There is no front-panel equivalent.

Group

Miscellaneous

Syntax

```
LOCK { ALL | NONe }
```

LOCK?

Arguments

ALL disables all front-panel controls.

NONE enables all front-panel controls. This is equivalent to the UNLOCK ALL command.

Examples

LOCK ALL

locks the front-panel controls.

LOCK?

returns NONE when the front-panel controls are enabled by this command.

Related Commands

UNLOCK

***LRN? (Query Only)**

This is identical to the SET? query described on page 2-134.

Group

Miscellaneous

Syntax

*LRN?

MATH? (Query Only)

Returns the definition for the math waveform.

Group

Vertical

Syntax

MATH?

Returns

Definition for the math waveform.

Examples

MATH?

returns :MATH:DEFINE "CH1 + CH2" if the math waveform is defined as channel 1 plus channel 2.

MATH:DEFINE

Performs the specified mathematical operation on the input signal or signals. To activate or deactivate the math waveform, use the SELEct:<wfm> command (refer to page 2-134).

Group

Vertical

Syntax

MATH:DEFINE <QString>

MATH:DEFINE?

NOTE. Remember that <QString> must be enclosed in quotes. You can use white space characters between words.

Arguments

<QString> specifies a math waveform, and can be one of the following:

TDS1002, TDS1012, TDS2002, TDS2012 and TDS2022 models; TDS210 and TDS220 models (firmware V2.00 and above) with a TDS2MM measurement module.

CH1+CH2

CH1-CH2

CH2-CH1

FFT (CH<x> [, <window>])

TDS2014 and TDS2024 models; TDS224 model with a TDS2MM measurement module.

CH1+CH2
CH3+CH4
CH1-CH2
CH2-CH1
CH3-CH4
CH4-CH3
FFT (CH<x> [, <window>])

TDS210 and TDS220 models, firmware below V2.00 with a TDS2CMA communications module.

CH1-CH2
CH2-CH1
CH1+CH2
-CH1
-CH2

TDS210 and TDS220 models (firmware below V2.00) with a TDS2MM measurement module.

CH1+CH2
(to subtract, invert one of the waveforms through CH<x>:INVert,
and then add)
FFT (CH<x> [, <window>])

TDS210 and TDS220 models (firmware V2.00) and above with a TDS2CMA communications module.

CH1+CH2
CH1-CH2
CH2-CH1

TDS224 model with a TDS2CMA communications module.

CH1+CH2
CH3+CH4
CH1-CH2
CH2-CH1
CH3-CH4
CH4-CH3

For FFT, the optional <window> argument is HANning, FLATtop, or RECTangular.

Examples

MATH:DEFINE "CH1+CH2"

sets the math waveform so that it displays the sum of channel 1 and channel 2.

MATH:DEFINE "FFT (CH1, HANNING)"

sets the math waveform to display an FFT of channel 1 using a Hanning window.

NOTE. You can use this example with a TDS1000 or TDS2000 series, as well as a TDS200 series with a TDS2MM measurement module.

MATH:FFT:HORizontal:POSition

NOTE. You can use this command with a TDS1000 or TDS2000 series, as well as a TDS200 series with a TDS2MM measurement module.

Sets or queries the FFT math waveform horizontal position.

Group

Horizontal

Syntax

MATH:FFT:HORizontal:POSition <NR3>

MATH:FFT:HORizontal:POSition?

Arguments

<NR3> specifies the point in the FFT waveform data record to display at the center vertical graticule line. The data record point is a percentage of the total record length, in the range of 0 to 100. The default value is 50. How much data is displayed depends on the FFT Zoom factor setting. The oscilloscope rounds <NR3> to the nearest workable value.

Examples

MATH:FFT:HORizontal:POSition 25
sets the FFT waveform horizontal position such that the data at the 25% point of the record is centered on the display.

MATH:FFT:HORizontal:POSition?
might return 5.0E1, indicating that the 50% point in the data record is horizontally centered on the display.

MATH:FFT:HORizontal:SCAlE

NOTE. You can use this command with a TDS1000 or TDS2000 series, as well as a TDS200 series with a TDS2MM measurement module.

Sets or queries the FFT math waveform horizontal zoom factor.

Group

Horizontal

Syntax

MATH:FFT:HORizontal:SCAlE <NR3>

MATH:FFT:HORizontal:SCAlE?

Arguments

<NR3> specifies the horizontal magnification factor, where the axis of magnification is the center vertical graticule line. Valid zoom factors are 1, 2, 5, and 10. If other values are entered the oscilloscope rounds the value of <NR3> to the nearest valid zoom factor.

Examples

MATH:FFT:HORizontal:SCALE 5

sets the FFT waveform horizontal zoom factor to X5.

MATH:FFT:HORizontal:SCALE?

might return 2.0E0, indicating that the zoom factor setting is X2.

MATH:FFT:VERTical:POSition

NOTE. You can use this command with a TDS1000 or TDS2000 series, as well as a TDS200 series with a TDS2MM measurement module.

Sets or queries the FFT math waveform vertical position.

Group

Vertical

Syntax

MATH:FFT:VERTical:POSition <NR3>

MATH:FFT:VERTical:POSition?

Arguments

<NR3> specifies the FFT waveform vertical position in divisions.

Examples

MATH:FFT:VERTical:POSition 2

sets the FFT waveform vertical position to 2 major divisions above the center horizontal graticule line.

MATH:FFT:VERTical:POSition?

might return 5, indicating that the FFT waveform 0 reference point is 5 major divisions from the center horizontal graticule line.

MATH:FFT:VERTical:SCAlE

NOTE. You can use this command with a TDS1000 or TDS2000 series, as well as a TDS200 series with a TDS2MM measurement module.

Sets or queries the FFT math waveform vertical zoom factor.

Group

Vertical

Syntax

MATH:FFT:VERTical:SCAlE <NR3>

MATH:FFT:VERTical:SCAlE?

Arguments

<NR3> specifies the vertical zoom factor, where the axis of magnification is the center horizontal graticule line. Valid zoom factors are 0.5, 1, 2, 5, and 10. If other values are entered the oscilloscope rounds the value of <NR3> to the nearest valid zoom factor.

Examples

MATH:FFT:VERTical:SCAlE 5

sets the FFT waveform vertical zoom factor to X5.

MATH:FFT:VERTical:SCAlE?

might return 2.0E0, indicating that the zoom factor setting is X2.

MEASUrement? (Query Only)

Returns all oscilloscope measurement parameters.

Group

Measurement

Syntax

MEASUrement?

Returns

Oscilloscope measurement parameters

Examples

MEASUrement?

might return the following:

```
:MEASUREMENT:MEAS1:TYPE PERIOD;UNITS "s";SOURCE CH1;  
:MEASUREMENT:MEAS2:TYPE FREQUENCY;UNITS "Hz";SOURCE CH1;  
:MEASUREMENT:MEAS3:TYPE PK2PK;UNITS "V";SOURCE CH2;  
:MEASUREMENT:MEAS4:TYPE MEAN;UNITS "V";SOURCE CH2;  
:MEASUREMENT:IMMED:TYPE CRMS;UNITS "V";SOURCE CH1
```

MEASUrement:IMMed? (Query Only)

Returns all immediate measurement setup parameters. Immediate queries and commands are the preferred methods for programming. An immediate measurement selection is not visible or accessible through the display screen or front panel.

Group

Measurement

Syntax

MEASUrement:IMMed?

Returns

Immediate measurement setup parameters

Examples

MEASUrement:IMMed?

might return PERIOD;"s";CH1

MEASUREMENT:IMMED:SOURCE

Sets or queries the source for all immediate measurements.

Group

Measurement

Syntax

```
MEASUREMENT:IMMED:SOURCE CH<x>
```

```
MEASUREMENT:IMMED:SOURCE?
```

Arguments

CH<x> is an input channel.

Examples

```
MEASUREMENT:IMMED:SOURCE CH1
```

specifies channel 1 as the immediate measurement source.

MEASUREMENT:IMMED:TYPE

Sets or queries the immediate measurement type.

Group

Measurement

Syntax

```
MEASUREMENT:IMMED:TYPE { FREQUENCY | MEAN | PERIOD |  
PK2pk | CRMS | MINIMUM | MAXIMUM | RISE | FALL | PWIDTH  
| NWIDTH }
```

```
MEASUREMENT:IMMED:TYPE?
```

Arguments

FREQUENCY is the reciprocal of the period measured in Hertz.

MEAN is the arithmetic mean over the entire waveform.

PERIOD is the duration, in seconds, of the first complete cycle in the waveform.

PK2pk is the absolute difference between the maximum and minimum amplitude.

CRMS is the true Root Mean Square voltage of the first complete cycle in the waveform.

MINIMUM (TDS1000 and TDS2000 series only) is the value of the smallest point in the waveform.

MAXIMUM (TDS1000 and TDS2000 series only) is the value of the largest point in the waveform.

RISE (TDS1000 and TDS2000 series, or TDS200 series with a TDS2MM measurement module only) is the rise time between 10% and 90% of the first rising edge of the waveform. Rising edge must be displayed to measure. The oscilloscope automatically calculates the 10% and 90% measurement points.

FALL (TDS1000 and TDS2000 series, or TDS200 series with a TDS2MM measurement module only) is the fall time between 90% and 10% of the first falling edge of the waveform. Falling edge must be displayed to measure. The oscilloscope automatically calculates the 10% and 90% measurement points.

PWIDTH (TDS1000 and TDS2000 series, or TDS200 series with a TDS2MM measurement module only) is the positive pulse width between the first rising edge and the next falling edge at the waveform 50% level. Rising and falling edges must be displayed to measure. The oscilloscope automatically calculates the 50% measurement point.

NWIDTH (TDS1000 and TDS2000 series, or TDS200 series with a TDS2MM measurement module only) is the negative pulse width between the first falling edge and the next rising edge at the waveform 50% level. Falling and rising edges must be displayed to measure. The oscilloscope automatically calculates the 50% measurement point.

Examples

MEASUREMENT:IMMED:TYPE FREQUENCY

defines the immediate measurement to be a frequency measurement.

MEASUrement:IMMed:UNIts? (Query Only)

Returns the units for the immediate oscilloscope measurement.

Group

Measurement

Syntax

MEASUrement:IMMed:UNIts?

Returns

<QString> returns "V" for volts, "s" for seconds, or "Hz" for Hertz.

Examples

MEASUrement:IMMed:UNIts?

might return "s", indicating that the unit for the immediate measurement is seconds.

MEASUrement:IMMed:VALue? (Query Only)

Executes the immediate oscilloscope measurement specified by the MEASUrement:IMMed:TYPE command. The measurement is taken on the source specified by the MEASUrement:IMMed:SOURce command. Immediate queries and commands are the preferred measurement method for programming.

To check whether the measurement was successful, use the *ESR? query followed by the EVENT? or ALLEv? queries to read the Standard Event Status Register (SESR).

NOTE. *If the channel specified by MEASUrement:IMMed:SOURce is not currently displayed, the oscilloscope generates event 2225 and returns 9.9E37.*

If Trigger View is active, Scan mode is in effect, or the display format is set to XY, this query returns 9.9E37 and generates event 221 (Settings conflict).

Group

Measurement

Syntax

MEASUREMENT:IMMED:VALue?

Returns

<NR3>

Examples

MEASUREMENT:IMMED:VALue?

might return 28.75E6 if you are measuring the frequency of a 28.75 MHz signal.

MEASUREMENT:IMMED:VALue?

might return 9.9E37, which means that the channel specified by MEASUREMENT:IMMED:SOURCE is not currently displayed.

*ESR?

after a measurement query might return 16, indicating that there are error messages in the queue.

ALLEV?

might return :ALLEV 541,"Measurement warning, Low signal amplitude: "

Related Commands

*ESR?, EVENT?, ALLEV?

MEASUREMENT:MEAS<x>? (Query Only)

Returns all measurement parameters for the displayed oscilloscope periodic measurement specified by <x>, where <x> is 1 through 4 for the TDS200 series, and 1 through 5 for the TDS1000 and TDS2000 series.

Group

Measurement

Syntax

MEASUrement:MEAS<x>?

Returns

Settings for the specified measurement source.

Examples

MEASUrement:MEAS3?
might return PERIOD;"s";CH1

MEASUrement:MEAS<x>:SOUrce

Sets or queries the source for the measurement. This is equivalent to selecting the measurement source in the MEASURE menu.

Group

Measurement

Syntax

MEASUrement:MEAS<x>:SOUrce CH<y>

MEASUrement:MEAS<x>:SOUrce?

Arguments

CH<y> specifies the measurement source channel.

Examples

MEASUrement:MEAS2:SOUrce CH1
Sets the source of MEAS2 to channel 1.

MEASUrement:MEAS<x>:TYPE

Sets or queries the on-screen periodic oscilloscope measurement type for the measurement specified by <x>. This is equivalent to selecting the measurement type in the MEASURE menu. Setting the type to anything other than NONE displays the MEASURE menu on the screen.

NOTE. You should use the *MEASUREMENT:IMMED* command with programming to take measurements, as this is preferred to the *MEASUREMENT:MEAS<x>* command.

Group

Measurement

Syntax

MEASUREMENT:MEAS<x>:TYPE { FREQUENCY | MEAN | PERIOD | PK2pk | CRMS | MINIMUM | MAXIMUM | RISE | FALL | PWIDTH | NWIDTH | NONE }

MEASUREMENT:MEAS<x>:TYPE?

Arguments

FREQUENCY is the reciprocal of the period measured in Hertz.

MEAN is the arithmetic mean over the entire waveform.

PERIOD is the duration, in seconds, of the first complete cycle in the waveform.

PK2pk is the absolute difference between the maximum and minimum amplitude.

CRMS is the true Root Mean Square voltage of the first complete cycle in the waveform.

MINIMUM (TDS1000 and TDS2000 only) is the value of the smallest point in the waveform.

MAXIMUM (TDS1000 and TDS2000 only) is the value of the largest point in the waveform.

RISE (TDS1000 and TDS2000 series, or TDS200 series with a TDS2MM measurement module only) is the rise time between 10% and 90% of the first rising edge of the waveform. Rising edge must be displayed to measure. The oscilloscope automatically calculates the 10% and 90% measurement points.

FALL (TDS1000 and TDS2000 series, or TDS200 series with a TDS2MM measurementmodule only) is the fall time between 90% and 10% of the first falling edge of the waveform. Falling edge must be displayed to measure. The oscilloscope automatically calculates the 10% and 90% measurement points.

PWIdth (TDS1000 and TDS2000 series, or TDS200 series with a TDS2MM measurementmodule only) is the positive pulse width between the first rising edge and the next falling edge at the waveform 50% level. Rising and falling edges must be displayed to measure. The oscilloscope automatically calculates the 50% measurement point.

NWIdth (TDS1000 and TDS2000 series, or TDS200 series with a TDS2MM measurementmodule only) is the negative pulse width between the first falling edge and the next rising edge at the waveform 50% level. Falling and rising edges must be displayed to measure. The oscilloscope automatically calculates the 50% measurement point.

NONE disables the measurement specified by <x>.

Examples

MEASUREMENT:MEAS3:TYPE CRMS
specifies MEAS3 to calculate the true Root Mean Square value.

MEASUREMENT:MEAS<x>:UNITS? (Query Only)

Returns the units for the oscilloscope measurement specified by MEASUREMENT:MEAS<x>:TYPE.

Group

Measurement

Syntax

MEASUREMENT:MEAS<x>:UNITS?

Returns

<QString> returns "V" for volts, "s" for seconds, "Hz" for Hertz, or a null string if MEASUREMENT:MEAS<x>:TYPE is set to NONE.

Examples

MEASUREMENT:MEAS3:UNITs?

might return "V", indicating the units for measurement 3 are volts.

MEASUREMENT:MEAS<x>:VALUE? (Query Only)

Returns the value that has been calculated for the oscilloscope on-screen periodic measurement specified by <x>.

This value is a display value and will be updated about every 1/2 second if both the MEASURE menu and the MEAS<x> source channel are displayed. If you are acquiring at a slow sweep rate, the oscilloscope may take longer than 1/2 second to update. MEASUREMENT:IMMED is usually more useful than MEASUREMENT:MEAS<x> when using the oscilloscope with external devices.

If MEASUREMENT:MEAS<x>:TYPE is set to NONE, MEASUREMENT:MEAS<x>:VALUE? generates event message 2231 (Measurement error, measurement is not activated) and returns 9.9E37.

If the channel specified by MEASUREMENT:MEAS<x>:SOURCE is not displayed on the oscilloscope, the oscilloscope generates event message 2225 (Measurement error, no waveform to measure) and returns 9.9E37.

NOTE. *If Trigger View is active, scan mode is in effect, or the display format set to XY, this query generates event 221 (Settings conflict) and returns 9.9E37.*

Group

Measurement

Syntax

MEASUREMENT:MEAS<x>:VALUE?

Returns

<NR3>

Examples

MEASurement:MEAS3:VALue?

might return 28.75E6 if measurement number three is frequency.

***OPC**

The *OPC? query and the *OPC set command provide two different methods for checking for the completion of the commands listed in Table 2-21 on page 2-121, such as single sequence acquisitions.

The *OPC? query uses a more simple method than the *OPC set command. The *OPC? query places the ASCII character “1” into the output queue when all pending operations listed in Table 2-21 are complete. If none of the operations are pending, the *OPC? query immediately places a “1” in the output queue.

NOTE. When using the *OPC? query method, the time-out on your controller must be set for longer than the operation for which the controller is waiting, such as a single sequence acquisition.

Unlike the *OPC command, the *OPC? query does not affect the OPC Event bit in the Standard Event Status Register (ESR).

The *OPC set command uses a more complex method than the *OPC? query. However, there are advantages to using this method in some situations. For more information, refer to *Using the *OPC Set Command* on page 3-14. Table 2-25 lists commands that generate an Operation Complete message.

Table 2-25: Commands that generate an Operation Complete message

Command	Operation
*CAL?, CALibrate:CONTINUE, CALibrate:FACTory, CALibrate:INTERNAL	Internal self-calibration
ACQuire:STATE ON or ACQuire:STATE RUN (when ACQuire:STOPAfter is set to SEQUENCE)	Busy single sequence acquisition
HARDCopy START	Busy hardcopy output

Group

Status and Error

Syntax

*OPC

*OPC?

Examples

Using the *OPC? query to check for completion of a single sequence acquisition:

```
ACQuire:STOPAfter SEQUENCE
```

```
ACQuire:STATE ON
```

*OPC? will return a 1 after the acquisition is complete.

Refer to page 3-14 for examples of how to use the *OPC set command.

Related Commands

ALLEv, BUSY?, DESE, *ESR?, *WAI

*PSC

Sets and queries the power-on status flag that controls the automatic power-on handling of the DESER, SRER, and ESER registers. When *PSC is true, the DESER register is set to 255 and the SRER and ESER registers are set to 0 at power on. When *PSC is false, the current values in the DESER, SRER, and ESER registers are preserved in nonvolatile memory when power is shut off and are restored at power on. Refer to the *Status and Events* chapter on page 3-1 for more information.

Group

Status and Error

Syntax

*PSC <NR1>

*PSC?

Arguments

<NR1> = 0 sets the power-on status clear flag to false, disables the power on clear, and allows the oscilloscope to possibly assert SRQ after power on.

<NR1> ≠ 0 sets the power-on status clear flag true. Sending *PSC 1, therefore, enables the power-on status clear and prevents any SRQ assertion after power on.

Examples

*PSC 0

sets the power-on status clear flag to false.

*PSC?

might return the value 1, showing that the power-on status clear flag is set to true.

Related Commands

DESE, *ESE, FACTory, *RST, *SRE

***RCL (No Query Form)**

Restores the state of the oscilloscope from a copy of its settings stored in memory. (The settings are stored using the *SAV command.) This command is equivalent to RECALL:SETUp, and performs the same function as the Recall Saved Setup item in the front-panel Save/Recall Setup menu.

Group

Save and Recall

Syntax

*RCL <NR1>

Arguments

<NR1> is an integer value in the range from 1 to 5 (TDS200 series) or 1 to 10 (TDS1000 and TDS2000 series), and specifies a setup storage location.

Examples

*RCL 3

restores the oscilloscope from a copy of the settings stored in memory location 3.

Related Commands

FACTory, *LRN?, RECALL:SETUp, *RST, *SAV, SAVE:SETUp

RECALL:SETUp (No Query Form)

Restores a stored or factory front-panel setup of the oscilloscope. This command is equivalent to selecting Recall Setup or Recall Factory in the Save/Recall Setup menu.

Group

Save and Recall

Syntax

RECALL:SETUp { FACTory | <NR1> }

Arguments

FACTory selects the factory setup.

<NR1> is a value in the range from 1 to 5 (TDS200 series) or 10 (TDS1000 and TDS2000 series) and specifies a setup storage location.

Examples

RECALL:SETUp FACTory

recalls the front-panel setup to its factory defaults.

Related Commands

FACTory, *RCL, *RST, *SAV, SAVE:SETUp

REM (No Query Form)

Specifies a comment. This line is ignored by the oscilloscope.

Group

Miscellaneous

Syntax

REM <QString>

Arguments

<QString> is a string that can have a maximum of 80 characters.

Examples

REM "This is a comment"
is ignored by the oscilloscope.

RS232? (Query Only)

Queries the RS232 settings.

Group

RS-232

Syntax

RS232?

Returns

The current RS-232 settings

Examples

RS232?
might return :RS232:BAUD 9600; SOFTFLAGGING 0;
HARDFLAGGING 1; PARITY NONE; TRANSMIT:
TERMINATOR LF

RS232:BAUd

Sets or queries the RS-232C interface transmission speed. If no flow control (flagging) is used, commands may be received faster than the oscilloscope can process them. Also, if another command is sent immediately after this command, without waiting for the baud rate to be programmed, the first couple of characters may be lost.

Group

RS-232

Syntax

RS232:BAUd <NR1>

RS232:BAUd?

Arguments

<NR1> which can be 300, 600, 1200, 2400, 4800, 9600, or 19200.

Examples

RS232:BAUd 9600

sets the transmission rate to 9600 baud.

RS232:HARDFlagging

Sets or queries the state of RS232 hard flagging. When hard flagging is enabled, the oscilloscope sends data as long as CTS (Clear To Send) is asserted. When receiving data, the oscilloscope asserts RTS (Request To Send) until the input buffer is almost full. When the oscilloscope no longer asserts RTS, it continues to read incoming data until the input buffer is full and then reports an input overrun error. The oscilloscope asserts DTR (Data Terminal Ready) at all times when the oscilloscope power is on.

Hard flagging and soft flagging cannot be on at the same time. However, hard and soft flagging can both be off at the same time. Turning hard flagging on turns soft flagging off. Turning soft flagging on turns hard flagging off.

Group

RS-232

Syntax

RS232:HARDFlagging { ON | OFF | <NR1> }

RS232:HARDFlagging?

Arguments

<ON> or <NR1>≠ 0 activates hard flagging and turns off soft flagging.

<OFF> or <NR1> = 0 deactivates hard flagging (RTS always asserted).

Examples

RS232:HARDFlagging ON

activates hard flagging and deactivates soft flagging.

RS232:PARity

Sets or queries the parity used for all RS-232C data transfers. When parity is odd or even, the oscilloscope generates the selected parity on output and checks all input against the selected parity. When parity is none, the oscilloscope performs no input parity error checks and generates no output parity.

When the parity (ninth) bit does not match the parity type, the oscilloscope reports a parity error. If another command is sent immediately after this command, without waiting for the parity to be programmed, the first few characters may be lost.

Group

RS-232

Syntax

RS232:PARity { EVEN | ODD | NONE }

RS232:PARity?

Arguments

EVEN sets even parity.

ODD sets odd parity.

NOne sets no parity (no ninth bit transmitted).

Examples

RS232:PARity EVEN
sets even parity.

RS232:SOFTFlagging

Sets or queries the input and output soft flagging over the RS-232C port. After receiving an XOFF (DC3), the oscilloscope sends two or less characters. The oscilloscope begins transmitting data again when it receives an XON (DC1) character.

The oscilloscope sends an XOFF character when its input buffer is running out of space. After sending an XOFF character it can receive at least 20 more bytes. It sends XON when its input buffer has an acceptable number of free bytes.

When soft flagging is enabled and binary data is transferred, data transmission will lock up if the data contains XOFF or XON characters.

Hard flagging and soft flagging cannot be active at the same time. However, hard and soft flagging can both be inactive at the same time. Activating soft flagging deactivates hard flagging. Activating hard flagging deactivates soft flagging.

Group

RS-232

Syntax

RS232:SOFTFlagging { ON | OFF | <NR1> }

RS232:SOFTFlagging?

Arguments

ON or NR1 \neq 0 activates soft flagging and deactivates hard flagging.

OFF or NR1 = 0 deactivates soft flagging.

Examples

RS232:SOFTFlagging ON
activates soft flagging and deactivates hard flagging.

RS232:TRANsmit:TERMinator

Sets or queries the end-of-line (EOL) terminator. When transmitting, the oscilloscope appends the terminator to the end of each message. When receiving, the oscilloscope accepts all four terminators, regardless of the currently selected terminator. When a combination of multiple characters is selected (CRLF or LFCR), the oscilloscope interprets the first character as the terminator; it treats the second character as a null command.

CR represents an ASCII carriage return character (0x0D) and LF represents an ASCII linefeed character (0x0A).

Group

RS-232

Syntax

RS232:TRANsmit:TERMinator { CR | LF | CRLf | LFCr }

RS232:TRANsmit:TERMinator?

Arguments

CR selects the carriage return character as the EOL terminator.

LF selects the line feed character as the EOL terminator.

CRLf selects the carriage return and line feed characters as the EOL terminator.

LFCr selects the line feed and carriage return characters as the EOL terminator.

Examples

RS232:TRANsmit:TERMinator CR
sets the carriage return as the EOL terminator.

***RST (No Query Form)**

(Reset) Returns the oscilloscope to a known set of oscilloscope settings, but does not purge any stored settings. This command executes a subset of the FACTory command.

Group

Status and Error

Syntax

*RST

Sending the *RST command does the following:

- Returns the oscilloscope settings to the factory defaults (refer to *Appendix B*)
- Sets the macro defined by *DDT to a zero-length field
- Clears the pending operation flag and associated operations

The *RST command does not alter the following items:

- The state of the RS-232 or GPIB interface
- Calibration data that affects device specifications
- The selected GPIB oscilloscope address
- Stored settings or waveforms
- The Output queue
- The Service Request Enable Register settings
- The Standard Event Status Enable Register settings
- The Power-On Status Clear flag setting
- Hard copy parameters
- Response Header Enable State
- Front panel LOCK state
- Verbose State

Related Commands

FACTory, *PSC, *RCL, RECALL:SETUp, *SAV, SAVe:SETUp

***SAV (No Query Form)**

(Save) Stores the state of the oscilloscope into a specified nonvolatile memory location. You can later use the *RCL command to restore the oscilloscope to this saved state. This is equivalent to selecting the Save Setup option in the Save/Recall Setup menu.

Group

Save and Recall

Syntax

*SAV <NR1>

Arguments

<NR1> is an integer value in the range from 1 to 5 (TDS200 series) or from 1 to 10 (TDS1000 and TDS2000 series) and specifies a memory location. Any settings that have been stored previously at this location are overwritten.

Examples

*SAV 2

saves the current settings in memory location 2.

Related Commands

FACTory, *RCL, RECALL:SETUp, SAVe:SETUp

SAVe:SETUp (No Query Form)

Saves the current state of the oscilloscope into the specified nonvolatile memory location. This is equivalent to selecting the Save Setup option in the Save/Recall Setup menu.

Group

Save and Recall

Syntax

SAVe:SETUp <NR1>

Arguments

<NR1> is an integer value in the range from 1 to 5 (TDS200 series) or 10 (TDS1000 and TDS2000 series) and specifies a memory location. Any settings that have been stored previously at this location are overwritten.

Examples

SAVe:SETUp 5

saves the current front-panel setup to memory location 5.

Related Commands

RECALL:SETUp, *RCL, *SAV

SAVe:WAVEform (No Query Form)

Stores a waveform in one of the nonvolatile reference memory locations. This command is equivalent to selecting the Save Waveform option in the Save/Recall Waveform menu.

Group

Save and Recall

Syntax

SAVe:WAVEform <wfm>, REF<x>

Arguments

<wfm> is CH<y> (one of the allowable channels) or MATH. This is the waveform that will be saved.

REF<x> is one of the allowable reference waveform storage locations.

SAVe:WAVEform MATH, REFB

saves the math waveform in stored waveform memory location REFB

SElect:<wfm> causes a saved reference waveform to be displayed.

Examples

SAVE:WAVEform MATH, REFB
saves the math waveform in stored waveform memory location REFB.

Related Commands

SElect:<wfm> can be used to display a saved reference waveform.

SElect? (Query Only)

Returns the display status of all waveforms.

Group

Vertical

Syntax

SElect?

Returns

Waveform display status

Examples

SElect?

2-channel models with CH2, Math and REFB waveforms displayed would return :SELECT:CH1 0;CH2 1;MATH 1;REFA 0;REFB 1

4-channel models with CH1 through CH4 displayed, Math disabled, REFA displayed, and REFD displayed would return :SELECT:CH1 1;CH2 1;CH3 1;CH4 1;MATH 0;REFA 1;REFB 0;REFC 0;REFD 1

SElect:<wfm>

Controls the display of waveforms. This command is equivalent to activating or deactivating a waveform from the oscilloscope front panel.

Group

Vertical

Syntax

SElect:<wfm> { OFF | ON | <NR1> }

SElect:<wfm>?

Arguments

OFF or <NR1> = 0 deactivates the display of the specified waveform.

ON or <NR1> ≠ 0 activates the display of the specified waveform.

<wfm> can be CH<x>, MATH, or REF<y>. Refer to *Constructed Mnemonics* on page 2-8 for more information.

Examples

SElect:CH2 ON
displays channel 2.

SElect:REFA?
returns either 0 or 1, indicating whether the REFA waveform is displayed.

SET? (Query Only)

Returns most oscilloscope settings. You can send these responses back to the oscilloscope to return the oscilloscope to the state it was in when you sent SET?. This query is identical to the *LRN? query.

Group

Miscellaneous

Syntax

SET?

NOTE. The SET? query always returns command headers, regardless of the setting of the HEADer command. This is because the returned data is intended to be able to be sent back to the oscilloscope as concatenated commands. The VERBose command can still be used to specify whether the returned headers should be abbreviated or full length.

Returns

Most oscilloscope settings.

Examples

SET?

a partial return string may look like this:

```
:ACQUIRE:STOPAFTER RUNSTOP;STATE 1;MODE SAMPLE;  
NUMAVG 16;:HEADER 1;:VERBOSE 1;:DISPLAY:FORMAT YT;STYLE  
VECTORS;PERSISTENCE 500.0E-3;CONTRAST 50;:LOCK  
NONE;:HARDCOPY:FORMAT EPSON;PORT RS232;LAYOUT PORTRAIT;
```

Related Commands

HEADer, *LRN?, VERBose

***SRE**

(Service Request Enable) sets and queries the bits in the Service Request Enable Register (SRER). Refer to the *Status and Events* chapter on page 3-1 for more information.

Group

Status and Error

Syntax

*SRE <NR1>

*SRE?

Arguments

<NR1> is an integer value in the range from 0 to 255. The binary bits of the SRER are set according to this value. Using an out-of-range value causes an execution error. The power-on default for SRER is 0 if *PSC is 1. If *PSC is 0, the SRER maintains its value through a power cycle.

Examples

*SRE 48

sets the bits in the SRER to 00110000 binary.

*SRE?

might return a value of 32, showing that the bits in the SRER have the binary value 00100000.

Related Commands

*CLS, DESE, *ESE, *ESR?, EVENT?, EVMSg?, FACtory, *PSC, *STB?

*STB? (Query Only)

(Read Status Byte) query returns the contents of the Status Byte Register (SBR) using the Master Summary Status (MSS) bit. Refer to the *Status and Events* chapter on page 3-1 for more information.

Group

Status and Error

Syntax

*STB?

Returns

<NR1>

Examples

*STB?

might return the value 96, showing that the SBR contains the binary value 01100000.

Related Commands

*CLS, DESE, *ESE, *ESR?, EVENT?, EVMSg?, FACtory, *SRE

***TRG (No Query Form)**

(Trigger) Executes commands that are defined by *DDT.

Group

Miscellaneous

Syntax

*TRG

Examples

*TRG

immediately executes all commands that have been defined by *DDT.

Related Commands

*DDT

TRIGger

Forces a trigger event to occur. When used as a query, TRIGger? returns the current trigger parameters.

Group

Trigger

Syntax

TRIGger FORCE

TRIGger?

Arguments

FORCE creates a trigger event. If TRIGger:STATE is REAdy, the acquisition will complete; otherwise this command will be ignored. This is equivalent to selecting FORCE TRIG on the front panel.

Examples

TRIGger FORCe
forces a trigger event to occur.

TRIGger?
might return
:TRIGGER:MAIN:MODE AUTO;TYPE EDGE;LEVEL 0.0E0;HOLD-
OFF:VALUE 5.0E-7;:TRIGGER:MAIN:EDGE:SOURCE CH1;COUPLING
DC;SLOPE RISE;:TRIGGER:MAIN:VIDEO:SOURCE CH1;SYNC
FIELD;POLARITY NORMAL

TRIGger:MAIn

Sets the oscilloscope trigger level to 50% of the minimum and maximum values of the signal. Returns the current main trigger parameters when used as a query.

Group

Trigger

Syntax

TRIGger:MAIn SETLevel

TRIGger:MAIn?

Arguments

SETLevel sets the main trigger level to half way between the MIN and MAX amplitudes of the trigger source input. This is equivalent to pressing the front-panel SET LEVEL TO 50% button.

If the oscilloscope acquisition state is STOP and you send TRIGger:MAIn SETLevel, the oscilloscope ignores the command and generates event 221 (Settings conflict).

Examples

TRIGger:MAIn SETLEVel
sets the main trigger level mid way between MAX and MIN.

TRIGger:MAIn:EDGE? (Query Only)

Returns the trigger coupling, source, and slope settings for the edge trigger.

Group

Trigger

Syntax

TRIGger:MAIn:EDGE?

Returns

Trigger coupling, source, and slope settings for the main edge trigger

Examples

TRIGger:MAIn:EDGE?
might return SOURCE CH1;COUPLING DC;SLOPE RISE

TRIGger:MAIn:EDGE:COUPling

Sets or queries the type of coupling for the edge trigger. This is equivalent to setting the Coupling option in the Trigger menu.

Group

Trigger

Syntax

TRIGger:MAIn:EDGE:COUPling { AC | DC | HFRej | LFRej | NOISErej }

TRIGger:MAIn:EDGE:COUPling?

Arguments

AC selects AC trigger coupling.

DC selects DC coupling.

HFRej coupling removes the high-frequency components of the DC signal.

LFRej coupling removes the low-frequency components of the AC signal.

NOISErej selects DC low sensitivity. It requires added signal amplitude for more stable, less false triggering.

Examples

TRIGger:MAIn:EDGE:COUPling DC
sets the main edge trigger coupling to DC.

TRIGger:MAIn:EDGE:SLOpe

Selects a rising or falling slope for the edge trigger. This is equivalent to setting the Slope option in the Trigger menu.

Group

Trigger

Syntax

TRIGger:MAIn:EDGE:SLOpe { FALL | RISE }

TRIGger:MAIn:EDGE:SLOpe?

Arguments

FALL specifies to trigger on the falling or negative edge of a signal.

RISe specifies to trigger on the rising or positive edge of a signal.

Examples

TRIGger:MAIn:EDGE:SLOpe RISE
sets the main edge trigger to occur on the rising slope.

TRIGger:MAIn:EDGE:SOUrce

Sets or queries the source for the edge trigger. This is equivalent to setting the Source option in the Trigger menu.

Group

Trigger

Syntax

```
TRIGger:MAIn:EDGE:SOUrce { CH<x> | EXT | EXT5 | LINE }
```

```
TRIGger:MAIn:EDGE:SOUrce?
```

Arguments

CH<x> specifies one of the allowable input channels.

EXT specifies the external input (not available on TDS224 oscilloscopes).

EXT5 specifies the external input attenuated by a factor of 5 (not available on TDS224 oscilloscopes).

LINE specifies the power line signal as a trigger source.

Examples

```
TRIGger:MAIn:EDGE:SOUrce CH1  
specifies channel 1 as the edge trigger source.
```

```
TRIGger:MAIn:EDGE:SOUrce?  
might return CH2 for the edge trigger source.
```

TRIGger:MAIn:FREQuency? (Query Only)

NOTE. You can use this command *ONLY* with the TDS1000 and TDS2000 series.

Returns the edge or pulse width trigger frequency. This is the same as the readout in the lower right corner of the screen.

If the trigger frequency is less than 10 Hz, the query returns 9.9e37 and generates error 2207 (Measurement error, Measurement overflow).

If the trigger type is video, the query returns 9.9e37 and generates event 221 (Settings conflict).

Group

Trigger

Syntax

TRIGger:MAIn:FREQuency?

Returns

Edge or pulse width trigger frequency

Examples

TRIGger:MAIn:FREQuency?

might return :TRIGGER:MAIN:FREQUENCY 1.0E3

Related Commands

MEASUrement:IMMed:VALue?

TRIGger:MAIn:HOLDOff? (Query Only)

Returns the trigger holdoff value.

Group

Trigger

Syntax

TRIGger:MAIn:HOLDOff?

Returns

Main trigger holdoff value

Examples

TRIGger:MAIn:HOLDOff?

might return :TRIGGER:MAIN:HOLDOFF:VALUE 5.0E-7

TRIGger:MAIn:HOLDOff:VALue

Sets or queries the oscilloscope trigger holdoff value.

Group

Trigger

Syntax

TRIGger:MAIn:HOLDOff:VALue <NR3>

TRIGger:MAIn:HOLDOff:VALue?

Arguments

<NR3> is the main trigger holdoff value, in the range of 500 ns to 10 s.

Examples

TRIGger:MAIn:HOLDOff:VALue 10

sets the holdoff value to 10 s.

TRIGger:MAIn:LEVel

Sets the oscilloscope edge (all models) and pulse width (TDS1000 and TDS2000 series only) trigger level. This command is equivalent to adjusting the front-panel TRIGGER LEVEL knob.

NOTE. When the edge trigger source is set to AC LINE, the oscilloscope ignores the set form of the command and generates event 221 (Settings conflict).

When the edge trigger source is set to AC LINE, the query form of the command returns zero.

Group

Trigger

Syntax

TRIGger:MAIn:LEVEl <NR3>

TRIGger:MAIn:LEVEl?

Arguments

<NR3> the main trigger level, in volts.

Examples

TRIGger:MAIn:LEVEl?

might return 1.4, indicating that the main edge trigger is set to 1.4 V.

TRIGger:MAIn:MODE

Sets or queries the trigger mode for the Edge (all models) and Pulse width (TDS1000 and TDS2000 series only) trigger types.

Group

Trigger

Syntax

TRIGger:MAIn:MODE { AUTO | NORMa1 }

TRIGger:MAIn:MODE?

Arguments

AUTO generates a trigger if a trigger is not detected within a specific time period. AUTO also enables scan mode for sweep speeds of 100 ms/div and slower.

NORMa1 waits for a valid trigger event.

Examples

TRIGger:MAIn:MODE AUTO

specifies that a trigger event is automatically generated.

Related Commands

ACquire:STOPAfter

TRIGger:MAIn:PULse? (Query Only)

NOTE. You can use this command *ONLY* with the TDS1000 and TDS2000 series.

Returns the pulse trigger parameters.

Group

Trigger

Syntax

TRIGger:MAIn:PULse?

Examples

TRIGger:MAIn:PULse?

might return :TRIGGER:MAIN:PULSE:SOURCE CH1;WIDTH:POLARITY
POSITIVE;WHEN EQUAL;WIDTH 1.0E-3

TRIGger:MAIn:PULse:SOURce

NOTE. You can use this command *ONLY* with the TDS1000 and TDS2000 series.

Sets or queries the source for the pulse trigger. This is equivalent to setting the Source option in the Trigger menu.

Group

Trigger

Syntax

TRIGger:MAIn:PULse:SOUrce
{ CH<x> | EXT | EXT5 }

TRIGger:MAIn:PULse:SOUrce?

Arguments

CH<x> specifies one of the allowable input channels.

EXT specifies the external input (not available on TDS224 oscilloscopes).

EXT5 specifies the external input attenuated by a factor of 5 (not available on TDS224 oscilloscopes).

TRIGger:MAIn:PULse:WIDth? (Query Only)

NOTE. You can use this command *ONLY* with the TDS1000 and TDS2000 series.

Returns the pulse trigger width parameters.

Group

Trigger

Syntax

TRIGger:MAIn:PULse:WIDth?

Examples

TRIGger:MAIn:PULse:WIDth?

might return :TRIGGER:MAIN:PULSE:WIDTH:POLARITY POSITIVE;WHEN EQUAL;WIDTH 1.0E-3

TRIGger:MAIn:PULse:WIDth:POLarity

NOTE. You can use this command *ONLY* with the TDS1000 and TDS2000 series.

Sets or queries the polarity for the pulse trigger. This is equivalent to setting the Polarity option in the Pulse Trigger menu.

Group

Trigger

Syntax

```
TRIGger:MAIn:PULse:WIDth:POLarity  
{ POSITive | NEGATive }
```

```
TRIGger:MAIn:PULse:WIDth:POLarity?
```

Arguments

Positive polarity specifies pulses with a rising leading edge.

Negative polarity specifies pulses with a falling leading edge.

TRIGger:MAIn:PULse:WIDth:WHEN

NOTE. You can use this command *ONLY* with the TDS1000 and TDS2000 series.

Sets or queries the trigger conditions for the pulse trigger. This is equivalent to setting the When option in the Pulse Trigger menu.

Group

Trigger

Syntax

```
TRIGger:MAIn:PULse:WIDth:WHEN  
{ Equal | NOTEqual | INside | OUTside }
```

TRIGger:MAIn:PULse:WIDth:WHEN?

Arguments

Equal triggers on the trailing edge of pulses of the specified width.

NOTEEqual triggers when a pulse's trailing edge occurs before the specified width, or a pulse continues longer than the specified width without a trailing edge.

INside (less than) triggers on the trailing edge of any pulses that are narrower than the specified width.

OUTside (greater than; also called time-out trigger) triggers when a pulse continues longer than the specified width.

TRIGger:MAIn:PULse:WIDth:WIDth

NOTE. You can use this command *ONLY* with the TDS1000 and TDS2000 series.

Sets or queries the width for the pulse trigger. This is equivalent to setting the Width option by using the Pulse Trigger menu and the TRIGGER knob.

Group

Trigger

Syntax

TRIGger:MAIn:PULse:WIDth:WIDth < NR3 >

TRIGger:MAIn:PULse:WIDth:WIDth?

Arguments

Time, in seconds. Range is 33 ns to 10 s. Resolution varies. Value is forced to nearest achievable value.

Examples

TRIGger:MAIn:PULse:WIDth:WIDth .000000123
followed by TRIGGER:MAIN:PULse:WIDth:WIDth? might return
1.155E-7

TRIGger:MAIn:TYPE

Sets or queries the type of oscilloscope trigger. This is equivalent to setting the Type option in the Trigger menu.

Group

Trigger

Syntax

TRIGger:MAIn:TYPE { EDGE | VIDEo | PULse }

TRIGger:MAIn:TYPE?

Arguments

EDGE is a normal trigger. A trigger event occurs when a signal passes through a specified voltage level in the specified direction and is controlled by the TRIGger:MAIn:EDGE commands.

VIDEo specifies that a trigger occurs when a specified signal is found and is controlled by the TRIGger:MAIn:VIDEo commands.

PULse specifies that a trigger occurs when the specified signal meets the pulse width criteria that is controlled by the TRIGger:MAIn:PULse commands.

Examples

TRIGger:MAIn:TYPE?
might return VIDEO indicating that the main trigger type is a video trigger.

TRIGger:MAIn:VIDeo? (Query Only)

Returns the main video trigger parameters.

Group

Trigger

Syntax

TRIGger:MAIn:VIDeo?

Examples

TRIGger:MAIn:VIDeo?

might return :TRIGGER:MAIN:VIDEO:SOURCE CH1;SYNC FIELD;POLarity NORMAL

TRIGger:MAIn:VIDeo:LINE

NOTE. You can use this command *ONLY* with the TDS1000 and TDS2000 series.

Sets or queries the line number for the video trigger when TRIGger:MAIn:VIDeo:SYNC is set to LINENUM. This is equivalent to selecting a line number in the Trigger/Video menu.

Group

Trigger

Syntax

TRIGger:MAIn:VIDeo:LINE <NR1>

TRIGger:MAIn:VIDeo:LINE?

Arguments

<NR1> specifies the line number. The minimum is 1. The maximum is 525 for NTSC, 625 for PAL and SECAM.

Examples

The following sequence sets the oscilloscope to trigger on video line 123:

```
TRIGger:MAIn:TYPe VIDEo
```

```
TRIGger:MAIn:VIDeo:SYNC LINENum
```

```
TRIGger:MAIn:VIDeo:LINE 123
```

TRIGger:MAIn:VIDeo:POLarity

Sets or queries the video trigger polarity. This is equivalent to selecting the Polarity option in the Trigger/Video menu.

Group

Trigger

Syntax

TDS 210 and TDS 220 models with firmware below V 2.00 and a TDS2CMA communications module:

```
TRIGger:MAIn:VIDeo:POLarity { INVERTed | NORMAl }
```

All other oscilloscope, firmware version, and module combinations:

```
TRIGger:MAIn:VIDeo:POLarity { INVert | NORMAl }
```

```
TRIGger:MAIn:VIDeo:POLarity?
```

Arguments

INVERTed or INVert specifies a positive sync pulse.

NORMAl specifies a negative sync pulse.

Examples

```
TRIGger:MAIn:VIDeo:POLarity NORMAL
```

selects negative sync polarity for the video trigger.

TRIGger:MAIn:VIDeo:SOUrce

Sets or queries the source for the video trigger. This is equivalent to selecting the Source option in the Video trigger menu.

Group

Trigger

Syntax

TRIGger:MAIn:VIDeo:SOUrce {CH<x> | EXT | EXT5}

TRIGger:MAIn:VIDeo:SOUrce?

Arguments

CH<x> specifies one of the allowable input channels.

EXT specifies the external input (not available with TDS224 oscilloscopes).

EXT5 specifies the external input, attenuated by a factor of 5 (not available with TDS224 oscilloscopes).

Examples

TRIGger:MAIn:VIDeo:SOUrce CH1

selects channel 1 as the source for the main video trigger.

TRIGger:MAIn:VIDeo:STANDard

NOTE. You can use this command *ONLY* with the TDS1000 and TDS2000 series.

Sets or queries the video trigger standard. This is equivalent to selecting the Standard option in the Trigger/Video menu.

Group

Trigger

Syntax

```
TRIGger:MAIn:VIDeo:STANdard { NTSc | PAL }
```

```
TRIGger:MAIn:VIDeo:STANdard?
```

Arguments

NTSC (default) specifies the NTSC video standard.

PAL specifies the PAL or SECAM video standard.

Examples

```
TRIGger:MAIn:VIDeo:STANdard NTSC
```

selects the NTSC standard for the video trigger.

TRIGger:MAIn:VIDeo:SYNC

Sets or queries the type for the video trigger sync. This is equivalent to selecting the Sync option in the Trigger/Video menu.

Group

Trigger

Syntax

```
TRIGger:MAIn:VIDeo:SYNC { FIELD | LINE | ODD | EVEN |  
LINENum }
```

```
TRIGger:MAIn:VIDeo:SYNC?
```

Arguments

FIELD specifies that triggering occur on the vertical sync pulse.

LINE specifies that triggering occur on the horizontal sync pulse.

ODD (TDS1000 and TDS2000 series only) specifies triggering on odd fields.

EVEN (TDS1000 and TDS2000 series only) specifies triggering on even fields.

LINENum (TDS1000 and TDS2000 series only) sets the oscilloscope to trigger on a specific line number, which is specified through TRIGger:MAIn:VIDeo:LINE.

Examples

TRIGger:MAIn:VIDeo:SYNC FIELD
selects the vertical sync pulse for the video trigger sync.

TRIGger:STATE? (Query Only)

Returns the current state of the triggering system.

NOTE. *Accurate real time reporting of the trigger state within any single waveform acquisition is limited by several factors, including horizontal sweep speed, and communications and task latencies. To check for the completion of a single sequence acquisition, use the *OPC? query.*

Group

Trigger

Syntax

TRIGger:STATE?

Returns

ARMED indicates that the oscilloscope is acquiring pretrigger information. All triggers are ignored when TRIGger:STATE is ARMED.

READY indicates that all pretrigger information has been acquired and the oscilloscope is ready to accept a trigger.

TRIGGER indicates that the oscilloscope has seen a trigger and is acquiring the posttrigger information.

AUTO indicates that the oscilloscope is in auto mode and acquires data even in the absence of a trigger.

SAVE indicates that acquisition is stopped or that all channels are off.

SCAN indicates that the oscilloscope is in scan mode.

Examples

TRIGger:STATE?

might return READY, indicating that pretrigger data has been acquired and the oscilloscope is waiting for a trigger.

Related Commands

*OPC?

***TST? (Query Only)**

(Self-Test) Tests the GPIB interface and always returns a 0.

Group

Miscellaneous

Syntax

*TST?

Returns

0

UNLock (No Query Form)

Unlocks the front panel. This command is equivalent to LOCK NONE.

NOTE. *If the oscilloscope is in the Remote With Lockout State (RWLS), the UNLock command has no effect. For more information refer to ANSI-IEEE Std. 488.1–1987, Standard Digital Interface for Programmable Instrumentation, section 2.8.3, on RL State descriptions.*

Group

Miscellaneous

Syntax

UNLock ALL

Arguments

ALL specifies all front-panel buttons.

Examples

UNLock ALL

unlocks all front-panel buttons and knobs so they can be used.

Related Commands

LOCK

VERBose

Sets and queries the Verbose state that controls the length of keywords on query responses. Keywords can be both headers and arguments. This command does not affect IEEE Std 488.2–1987 Common Commands (those starting with an asterisk).

Group

Miscellaneous

Syntax

VERBose { OFF | ON | <NR1> }

VERBose?

Arguments

ON or <NR1> ≠ 0 sets the Verbose state true, which returns full-length keywords for applicable setting queries.

OFF or <NR1> = 0 sets the Verbose state false, which returns minimum-length keywords for applicable setting queries.

Examples

VERBoSe ON
sets the Verbose state true.

VERBoSe?
might return the value 1, showing that the Verbose state is true.

Related Commands

HEADer, *LRN?, SET?

***WAI (No Query Form)**

*WAI (wait) prevents the oscilloscope from executing further commands or queries until all pending operations finish. This command lets you synchronize the operation of the oscilloscope with your application program. Refer to *Synchronization Methods* on page 3-10 for more information.

Unlike *OPC?, *WAI returns no value when pending operations finish. Table 2-25 (*OPC) on page 2-121 lists commands that generate an operation complete message.

Group

Status and Error

Syntax

*WAI

Related Commands

BUSY?, *OPC

WAVFrm? (Query Only)

Returns WFMPre? and CURVe? data for the waveform specified by the DATA:SOURce command. This command is equivalent to sending WFMPre?; CURVe?. If the waveform specified by the DATA:SOURce command is not displayed, the oscilloscope returns only the waveform transmission parameters (BYT_Nr, BIT_Nr, ENCdg, BN_Fmt, BYT_Or).

Group

Waveform

Syntax

WAVFrm?

Returns

See WFMPre? and CURVe? commands.

Related Commands

CURVe?, DATA:SOURce, WFMPre?

WFMPre? (Query Only)

Returns waveform transmission and formatting parameters for the waveform specified by the DATA:SOURce command.

If the waveform specified by the DATA:SOURce command is not displayed, the oscilloscope returns only the waveform transmission parameters (BYT_Nr, BIT_Nr, ENCDg, BN_Fmt, BYT_Or).

Group

Waveform

Syntax

WFMPre?

Returns

The format of the response when the DATA:SOURce waveform is activated is:

```
BYT_NR <NR1>;BIT_NR <NR1>;ENCDG { ASC | BIN };  
BN_FMT { RI | RP };BYT_OR { LSB | MSB };NR_PT <NR1>;  
WFID <QSTRING>;PT_FMT { ENV | Y };XINCR <NR3>;  
PT_OFF <NR1>;XZERO <NR3>;XUNIT<QSTRING>;YMULT <NR3>; YZERO  
<NR3>;YOFF <NR3>;YUNIT <QSTRING>
```

Related Commands

WAVFrm?

WFMPre:BIT_Nr

Sets or queries the number of bits per waveform point for the waveform to be transferred. Changing the value of WFMPre:BIT_Nr also changes the values of WFMPre:BYT_Nr and DATA:WIDTH.

Group

Waveform

Syntax

WFMPre:BIT_Nr <NR1>

WFMPre:BIT_Nr?

Arguments

<NR1> is either 8 or 16, and is equivalent to WFMPre:BYT_Nr * 8 and DATA:WIDTH * 8.

Examples

WFMPre:BIT_Nr?

might return 8, indicating that there are 8 bits per waveform point.

Related Commands

DATA:WIDTH

WFMPre:BN_Fmt

Sets or queries the format of binary data for the waveform to be transferred. Changing the value of WFMPre:BN_Fmt also changes the value of DATA:ENCdg.

Group

Waveform

Syntax

WFMPre:BN_Fmt { RI | RP }

WFMPre:BN_Fmt?

Arguments

RI specifies signed integer data-point representation.

RP specifies positive integer data-point representation.

Examples

WFMPre:BN_Fmt RP

specifies that the binary waveform data are positive integer data-points.

WFMPre:BN_Fmt?

returns either RI or RP as the current waveform data format.

Related Commands

DATA:ENCdg

WFMPre:BYT_Nr

Sets or queries the data width for the waveform to be transferred.

This command is equivalent to DATA:WIDth. Changing

WFMPre:BYT_Nr also changes WFMPre:BIT_Nr and DATA:WIDth.

Group

Waveform

Syntax

WFMPre:BYT_Nr <NR1>

WFMPre:BYT_Nr?

Arguments

<NR1> is an integer in the range of 1 to 2 that sets the number of bytes per point.

Examples

WFMPre:BYT_Nr 2

specifies that there are 2 bytes per waveform data point.

Related Commands

DATA:WIDth

WFMPre:BYT_Or

Sets or queries which byte of binary waveform data is transmitted first during a waveform data transfer when DATA:WIDth or WFMPre:BYT_Nr is set to 2, or WFMPre:BIT_Nr is set to 16. Changing WFMPre:BYT_Or changes DATA:ENCdg.

Group

Waveform

Syntax

WFMPre:BYT_Or { LSB | MSB }

WFMPre:BYT_Or?

Arguments

LSB selects the least significant byte to be transmitted first.

MSB selects the most significant byte to be transmitted first.

Examples

WFMPre:BYT_Or MSB

specifies that the most significant byte in the waveform data is transferred first.

WFMPre:BYT_Or?

returns either MSB or LSB depending on which data byte is transferred first.

Related Commands

DATA:ENCdg

WFMPre:ENCdg

Sets or queries the type of encoding for waveform data transferred with the CURVe command. Changing WFMPre:ENCdg also changes DATA:ENCdg.

Group

Waveform

Syntax

WFMPre:ENCdg { ASC | BIN }

WFMPre:ENCdg?

Arguments

ASC specifies ASCII curve data.

BIN specifies binary curve data.

Examples

WFMPre:ENCdg ASC

specifies that the waveform data is in ASCII format.

WFMPre:ENCdg?

might return BIN, indicating that the waveform data is in binary format.

Related Commands

DATA:ENCdg

WFMPre:NR_Pt? (Query Only)

Returns the number of points that are in the transmitted waveform record, as specified by DATA:SOURce. The number of points depends on DATA:START, DATA:STOP, and whether DATA:SOURce is YT or FFT. NR_Pt is at most 2500 for YT and 1024 for FFT. NR_Pt is always at least one.

When the DATA:SOURCE is not displayed, the TDS210 and TDS220 (firmware below V 2.00) with a TDS2CMA communications module will return a value. All other oscilloscope, firmware version, and module combinations will generate an error and will return event code 2244.

Group

Waveform

Syntax

WFMPre:NR_Pt?

Examples

WFMPre:NR_Pt?

returns <NR1>, which is the number of data points. If DATA:WIDTH is 2, then there are <NR1>*2 bytes in the curve.

Related Commands

DATA:ENCdg, DATA:SOURCE, DATA:START, DATA:STOP

WFMPre:PT_Fmt

The set form of this command sets the format (Y or ENV) of the reference waveform specified by the DATA:DESTINATION command.

The query form returns the format of the waveform specified by the DATA:SOURCE command, if that waveform is on or displayed. If the waveform is not displayed, the query form of this command generates an error and returns event code 2244.

Group

Waveform

Syntax

WFMPre:PT_Fmt { ENV | Y }

WFMPre:PT_Fmt?

Arguments

Y specifies a normal waveform where one ASCII or binary data point is transmitted for each point in the waveform record.

For Y format, the time (absolute coordinate) of a point, relative to the trigger, can be calculated using the following formula. N ranges from 0 to 2499.

$$X_n = XZEr0 + XINcr (n - PT_OfF)$$

For Y format, the magnitude (usually voltage, relative to ground) (absolute coordinate) of a point can be calculated:

$$Y_n = YZEr0 + YMUlty (y_n - YOfF)$$

ENV specifies that the oscilloscope transmit the waveform as minimum and maximum point pairs. Peak detect waveforms use ENV format. Peak Detect mode specifies a maximum of 1250 (minimum, maximum) pairs, with the time between pairs being $2 * XINcr$.

The magnitudes and times of ENV format waveform points can be calculated using the same formulas used for Y format, as long as you recognize that the points consist of (minimum, maximum) pairs, where each pair was collected over a time period of $2 * XINcr$.

Thus, the samples for $n=0$ (a minimum) and $n=1$ (a maximum), the first (minimum, maximum) pair, were collected over a time interval of width $2 * XINcr$, that began at the time found by setting n to zero in the formula. The next pair were collected over the interval that began at the time found by setting n to 2 in the formula, and so on.

Examples

```
WFMPre:PT_Fmt Y
```

sets the waveform data point format to Y.

```
WFMPre:PT_Fmt?
```

returns either Y or ENV

Related Commands

CURVe, ACQuire:MODe

WFMPre:PT_Off

The set form of this command is ignored.

The query form always returns a 0, unless the DATA:SOURce waveform is not displayed, in which case the query generates an error and returns event code 2244.

This command is included for compatibility with other Tektronix oscilloscopes.

Group

Waveform

Syntax

WFMPre:PT_Off?

Arguments

Arguments are ignored.

WFMPre:WFId? (Query Only)

Returns a descriptive string from the waveform specified in the DATA:SOURce command, if that waveform is active or displayed. If that waveform is not active or displayed, the query fails and the oscilloscope generates an execution error with event code 2244 (waveform requested is not active).

Group

Waveform

Syntax

WFMPre:WFId?

Examples

WFMPre:WFID?

For a YT waveform, this might return

```
:WFMPRE:WFID "Ch1, DC coupling, 1.0E0 V/div, 5.0E-4  
s/div, 2500 points, Sample mode"
```

For a Math waveform, this might return

```
:WFMPRE:WFID "Math, DC coupling, 1.0E0 V/div, 5.0E-4  
s/div, 2500 points, Sample mode"
```

(For an FFT spectrum (TDS1000 and TDS2000 series, or TDS200 series with a TDS2MM measurement module), this might return

```
:WFMPRE:WFID "Math, DC coupling, 1.0E1 dB/div,  
2.52525253E4 Hz/div, 1024 points, Sample mode"
```

WFMPre:XINcr

The set form of this command specifies the interval (seconds per point for non-FFT, Hertz per point for FFT) between samples of the reference waveform specified by the DATA:DESTination command. The oscilloscope uses this value to calculate the seconds/division or Hertz/division units shown in the status bar and cursor readouts when displaying a reference waveform.

The query form returns the interval between samples of the waveform specified by the DATA:SOURce command, if that waveform is active or displayed. If that waveform is inactive or displayed, the query fails and the oscilloscope generates an execution error with event code 2244 (waveform requested is not active).

NOTE. For waveform records acquired in Peak Detect mode, even though there is a pair of samples for each conceptual time period, the XINcr is such that $(XINcr * recl) =$ the total time over which the data was collected.

Group

Waveform

Syntax

WFMPre:XINcr <NR3>

WFMPre:XINcr?

Arguments

<NR3> is the interval between points in the waveform record, in the units specified by WFMPre:XUNit. Note that at some fast sweeps, some points in the waveform record are produced by interpolation.

Examples

DATA:SOURce CH1 WFMPre:XINcr
might return :WFMPRE:XINCR 2.0E-6

WFMPre:XUNit

For all model and firmware combinations except the TDS200 series with a TDS2CMA communications module, the set form of this command specifies the horizontal units ("s" for seconds and "Hz" for Hertz) for the reference waveform specified by the DATA:DEStination command. Setting a reference waveform to Hz causes the oscilloscope to display the waveform as an FFT waveform.

NOTE. For TDS200 oscilloscopes used with a TDS2CMA communications module, the set form is ignored.

The query form returns the horizontal units for the waveform specified by DATA:SOURce. If the waveform specified by DATA:SOURce is not displayed, the query generates event message 2244.

Group

Waveform

Syntax

WFMPre:XUNit <qstring>

WFMPre:XUNit?

Arguments

<qstring> is "s" or "Hz"

WFMPre:XZEro

The set form of this command specifies the position, in XUNits, of the first sample of the reference waveform specified by the DATA:DESTination command, relative to the trigger.

The query form returns the position of the first sample of the waveform specified by the DATA:SOURce command, if that waveform is active or displayed.

If that waveform is not active or displayed, the query fails and the oscilloscope generates an execution error with event code 2244 (waveform requested is not active).

The oscilloscope sets WFMPre:XZEro to zero if the display mode was XY or if MATH FFT was the DATA:SOURce when the waveform was acquired.

NOTE. *The oscilloscope uses XZEro when calculating cursor readouts.*

Group

Waveform

Syntax

WFMPre:XZEro <NR3>

WFMPre:XZEro?

Arguments

<NR3> is the position, in XUNits, of the first sample in the waveform.

WFMPre:YMUlt

YMUlt is a value, expressed in YUNits per digitizer level, used to convert waveform record values to YUNit values using the following formula (where dl is digitizer levels):

$$\text{value_in_YUNits} = ((\text{curve_in_dl} - \text{YOFF_in_dl}) * \text{YMUlt}) + \text{YZERO_in_YUNits}$$

The set form of this command sets the vertical scale factor of the reference waveform specified by the DATA:DESTination command, expressed in YUNits per digitizing level.

The query form returns a value for the waveform specified by the DATA:SOURce command, if that waveform is active or displayed. If that waveform is not active or displayed, the query fails and the oscilloscope generates an execution error with event code 2244 (waveform requested is not active).

Group

Waveform

Syntax

WFMPre:YMUlt <NR3>

WFMPre:YMUlt?

Arguments

<NR3> is the vertical scale factor, in YUNits (usually volts) per sample value.

An argument value of zero has special meaning. A zero indicates that the waveform has unknown vertical scaling. An example of unknown vertical scaling is a math waveform of CH1+CH2 where CH1 vertical scaling is different from CH2 vertical scaling. In this case, WFMPre:YUNit? returns U.

WFMPre:YOFF

YOFF is a value, expressed in digitizer levels, used to convert waveform record values to YUNit values using the following formula (where dl is digitizer levels):

$$\text{value_in_YUNits} = ((\text{curve_in_dl} - \text{YOFF_in_dl}) * \text{YMult}) + \text{YZERO_in_YUNits}$$

The set form of this command stores a value for the reference waveform specified by the DATA:DESTination command. This value does not affect how the oscilloscope displays the waveform, but does affect the cursor readouts.

The query form returns a value for the waveform specified by the DATA:SOURce command, in digitizer levels, if that waveform is active or displayed. If that waveform is not active or displayed, the query fails and the oscilloscope generates an execution error with event code 2244 (waveform requested is not active).

Group

Waveform

Syntax

WFMPre:YOFF <NR3>

WFMPre:YOFF?

Arguments

<NR3> is a value expressed in digitizing levels.

WFMPre:YUNit

For all model and firmware combinations except the TDS200 series with a TDS2CMA communications module or a TDS2MM measurement module, the set form of this command sets the vertical units for the reference waveform specified by DATA:DESTination.

NOTE. *It is possible to set a combination of WFMPre:XUNit and WFMPre:YUNit for a reference waveform that is inconsistent (for example, seconds with dB or Hertz with volts). The oscilloscope will not warn you of this condition. The oscilloscope uses WFMPre:XUNit to determine whether the waveform is a YT or an FFT.*

For TDS200 oscilloscopes used with a TDS2CMA communications or a TDS2MM measurement module, the set form is ignored. Refer to the WFMPre:YMUlt command for equivalent functionality.

The query form returns the vertical units of the waveform specified by the DATA:SOURce command, if that waveform is active or displayed. If that waveform is not active or displayed, the query fails and the oscilloscope generates an execution error with event code 2244 (waveform requested is not active).

Group

Waveform

Syntax

WFMPre:YUNit <qstring>

WFMPre:YUNit?

Arguments

<qstring> is "Volts", "U", or "dB"

Returns

"Volts" for volts, "U" for unknown units (divisions), or "dB" for decibels.

WFMPre:YZero

For all model and firmware combinations except the TDS210 or TDS220 oscilloscope (firmware below V 2.00) with a TDS2CMA communications module, YZero is a value, expressed in YUNits, used to convert waveform record values to YUNit values using the following formula (where dl is digitizer levels):

$$\text{value_in_YUNits} = ((\text{curve_in_dl} - \text{YOFF_in_dl}) * \text{YMult}) + \text{YZERO_in_YUNits}$$

YZero is used when calculating cursor readouts.

The set form of this command affects the reference waveform specified by DATA:DESTination.

The query form of this command returns a value for the waveform specified by DATA:SOUrce. If that waveform is not active or displayed, the query fails and the oscilloscope generates an execution error with event code 2244 (waveform requested is not active).

NOTE. For the TDS210 or TDS220 oscilloscope (firmware below V 2.00) with a TDS2CMA communications module, the set form is ignored. The query always returns zero.

Group

Waveform

Syntax

WFMPre:YZero <NR3>

WFMPre:YZero?

Arguments

<NR3> is a value, expressed in YUNits.

WFMPre, Additional Commands for Compatibility

The set form of these additional commands is ignored. The query form generates event messages 100 (Command Error) and 420 (Query Unterminated). These commands are included for compatibility purposes only.

Table 2-26 lists additional WFMPre commands.

Table 2-26: Additional WFMPre commands

Command	Argument	Description
WFMPre:XMUlt	<NR3>	Horizontal (X-axis) scale factor
WFMPre:XOFF	<NR3>	Horizontal (X-axis) offset
WFMPre:ZMUlt	<NR3>	Z-axis scale factor
WFMPre:ZOFF	<NR3>	Z-axis offset
WFMPre:ZUNit	<QString>	Z-axis units
WFMPre:ZZEro	<NR3>	Z-axis origin offset

WFMPre:<wfm>? (Query Only)

Returns the waveform formatting data for the waveform specified by <wfm>, if that waveform is active or displayed. If that waveform is not active or displayed, the query fails and the oscilloscope generates event message 420 (Query unterminated) and 2244 (waveform requested is not active).

Group

Waveform

Syntax

WFMPre:<wfm>? (Refer to *Waveform Mnemonics* on page 2-9 for more information.)

Returns

The format of the response is:

```
:WFMPre:<wfm>:WFID <Qstring>;PT_FMT { ENV | Y };  
XINcr <NR3>;PT_Off <NR1>;XZEr0 <NR3>;XUNit <QString>;  
YMUlt <NR3>;YZEr0 <NR3>;YOFF <NR3>;YUNit <QString>;  
NR_Pt <NR1>
```

WFMPre:<wfm>:NR_Pt? (Query Only)

NOTE. This query is not available when using a TDS210 or TDS220 oscilloscope (firmware below V 2.00) with a TDS2CMA communications module.

Returns the number of points that are in the transmitted waveform record. The number of points depends on DATA:START, DATA:STOP, and whether DATA:SOURce is YT or FFT. NR_Pt is at most 2500 for YT and 1024 for FFT. NR_Pt is always at least one.

When the DATA:SOURce is not displayed, the oscilloscope will generate an error and return event code 2244.

Group

Waveform

Syntax

WFMPre:<wfm>:NR_Pt?

Examples

WFMPre:CH1:NR_Pt?

returns <NR1>, which is the number of data points. If DATA:WIDth is 2, then there are <NR1>*2 bytes in the curve.

Related Commands

DATA:SOURce, DATA:START, DATA:STOP

WFMPre:<wfm>:PT_Fmt

Same as WFMPre:PT_Fmt, except that <wfm> specifies the source/destination waveform instead of DATA:SOURce and DATA:DESTINATION. For set commands, if <wfm> is not a reference waveform, the oscilloscope generates error 2241.

WFMPre:<wfm>:PT_Off

Same as WFMPre:PT_Off, except that <wfm> specifies the source/destination waveform instead of DATA:SOURce and DATA:DESTINATION.

For set commands, if <wfm> is not a reference waveform, the oscilloscope generates error 2241.

Otherwise, the set form of this command is ignored.

WFMPre:<wfm>:WFId? (Query Only)

Same as WFMPre:WFId?, except that <wfm> specifies the source waveform instead of DATA:SOURce.

WFMPre:<wfm>:XINcr

Same as WFMPre:XINcr, except that <wfm> specifies the source/destination waveform instead of DATA:SOURce and DATA:DESTINATION.

For set commands, if <wfm> is not a reference waveform, the oscilloscope generates error 2241.

WFMPre:<wfm>:XUNit

Same as WFMPre:XUNit, except that <wfm> specifies the source/destination waveform instead of DATA:SOURce and DATA:DESTINATION.

WFMPre:<wfm>:XZEro

Same as WFMPre:XZEro, except that <wfm> specifies the source/destination waveform instead of DATA:SOURce and DATA:DESTINATION.

For set commands, if <wfm> is not a reference waveform, the oscilloscope generates error 2241.

WFMPre:<wfm>:YMUIt

Same as WFMPre:YMUIt, except that <wfm> specifies the source/destination waveform instead of DATA:SOURce and DATA:DESTINATION.

For set commands, if <wfm> is not a reference waveform, the oscilloscope generates error 2241.

WFMPre:<wfm>:YOFf

Same as WFMPre:YOFf, except that <wfm> specifies the source/destination waveform instead of DATA:SOURce and DATA:DESTINATION.

For set commands, if <wfm> is not a reference waveform, the oscilloscope generates error 2241.

WFMPre:<wfm>:YUNit

Same as WFMPre:YUNit, except that <wfm> specifies the source/destination waveform instead of DATA:SOURce and DATA:DESTINATION.

For set commands, if <wfm> is not a reference waveform, the oscilloscope generates error 2241.

WFMPre:<wfm>:YZero

Same as WFMPre:YZero, except that <wfm> specifies the source/destination waveform instead of DATA:SOURce and DATA:DESTINATION.

For set commands, if <wfm> is not a reference waveform, the oscilloscope generates error 2241.



Status and Events

Status and Events

The oscilloscope provides a status and event reporting system for the GPIB and RS-232 interfaces. This system informs you of certain significant events that occur within the oscilloscope.

The oscilloscope status reporting system consists of five 8-bit registers and two queues. This section describes these registers and components, and explains how the event handling system operates.

Registers

The registers in the event reporting system fall into two functional groups:

- The Standard Event Status Register (SESR) and the Status Byte Register (SBR) contain information about the status of the oscilloscope. These registers are the Status Registers.
- The Device Event Status Enable Register (DESER), the Event Status Enable Register (ESER), and the Service Request Enable Register (SRER) determine whether selected types of events are reported to the Status Registers and the Event Queue. These three registers are the Enable Registers.

Status Registers

The Standard Event Status Register (SESR) and the Status Byte Register (SBR) record certain types of events that may occur while the oscilloscope is in use. IEEE Std 488.2–1987 defines these registers.

Each bit in a Status Register records a particular type of event, such as an execution error or service request. When an event of a given type occurs, the oscilloscope sets the bit that represents that type of event to a value of one. (You can disable bits so that they ignore events and remain at zero. For more information, refer to the *Enable Registers* section on page 3-4.) Reading the status registers tells you what types of events have occurred.

The Standard Event Status Register (SESR). The SESR, shown in Figure 3-1, records eight types of events that can occur within the oscilloscope. Use *ESR? to read the SESR register. Reading the register clears the bits of the register so that the register can accumulate information about new events. Figure 3-1 shows SESR bit functions.

7	6	5	4	3	2	1	0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Figure 3-1: The Standard Event Status Register (SESR)

Table 3-1 lists and describes SESR bit functions.

Table 3-1: SESR bit functions

Bit	Function
7 (MSB)	PON (Power On). Shows that the oscilloscope was powered on.
6	URQ (User Request). Not used.
5	CME (Command Error). Shows that an error occurred while the oscilloscope was parsing a command or query. Command error messages are listed in Table 3-4 on page 3-18.
4	EXE (Execution Error). Shows that an error occurred while the oscilloscope was executing a command or query. Execution error messages are listed in Table 3-5 on page 3-18.
3	DDE (Device Error). Shows that a device error occurred. Device error messages are listed in Table 3-6 on page 3-21.
2	QYE (Query Error). Shows that either an attempt was made to read the Output Queue when no data was present or pending, or that data in the Output Queue was lost.

Table 3-1: SESR bit functions (Cont.)

Bit	Function
1	RQC (Request Control). Not used.
0 (LSB)	OPC (Operation Complete). Shows that the operation is complete. This bit is set when all pending operations complete following a *OPC command. See Table 2-25 on page 2-121 for a list of commands that generate an Operation Complete message.

The Status Byte Register (SBR). The SBR, shown in Figure 3-2, records whether output is available in the Output Queue, whether the oscilloscope requests service, and whether the SESR has recorded any events.

Use a Serial Poll (GPIB only) or *STB? to read the contents of the SBR. The bits in the SBR are set and cleared depending on the contents of the SESR, the Event Status Enable Register (ESER), and the Output Queue. When you use a Serial Poll to obtain the SBR, bit 6 is the RQS bit. When you use the *STB? query to obtain the SBR, bit 6 is the MSS bit. Reading the SBR does not clear the bits. Figure 3-2 shows the SBR bit functions.

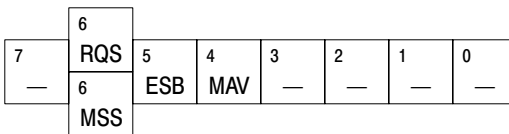


Figure 3-2: The Status Byte Register (SBR)

Table 3-2 lists and describes SBR bit functions.

Table 3-2: SBR bit functions

Bit	Function
7 (MSB)	Not used.
6	RQS (Request Service), obtained from a serial poll. Shows that the oscilloscope requests service from the GPIB controller.
6	MSS (Master Status Summary), obtained from *STB?. Summarizes the ESB and MAV bits in the SBR.
5	ESB (Event Status Bit). Shows that status is enabled and present in the SESR.
4	MAV (Message Available). Shows that output is available in the Output Queue.
3 - 0	Not used.

Enable Registers

The DESER, ESER, and SRER allow you to select which events are reported to the Status Registers and the Event Queue. Each Enable Register acts as a filter to a Status Register (the DESER also acts as a filter to the Event Queue) and can prevent information from being recorded in the register or queue.

Each bit in an Enable Register corresponds to a bit in the Status Register it controls. In order for an event to be reported to its bit in the Status Register, the corresponding bit in the Enable Register must be set to one. If the bit in the Enable Register is set to zero, the event is not recorded.

The bits in the Enable Registers are set using various commands. The Enable Registers and the commands used to set them are described below.

The Device Event Status Enable Register (DESER). The DESER, shown in Figure 3-3, controls which types of events are reported to the SESR and the Event Queue. The bits in the DESER correspond to those in the SESR, as described earlier.

Use the DESE command to enable and disable the bits in the DESER. Use the DESE? query to read the DESER. Figure 3-3 shows the DESER bit functions.

7	6	5	4	3	2	1	0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Figure 3-3: The Device Event Status Enable Register (DESER)

The Event Status Enable Register (ESER). The ESER controls which type of events are summarized by the Event Status Bit (ESB) in the SBR.

Use the *ESE command to set the bits in the ESER, and use the *ESE? query to read it. Figure 3-4 shows the ESER bit functions.

7	6	5	4	3	2	1	0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Figure 3-4: The Event Status Enable Register (ESER)

The Service Request Enable Register (SRER). The SRER controls which bits in the SBR generate a Service REquest (GPIB only) and are summarized by the Master Status Summary (MSS) bit.

Use the *SRE command to set the SRER. Use the *SRE? query to read it. The RQS bit remains set to one until either the Status Byte Register is read by a Serial Poll (GPIB only) or the MSS bit changes back to a zero. Figure 3-5 shows the SRER bit functions.

7	6	5	4	3	2	1	0
—	—	ESB	MAV	—	—	—	—

Figure 3-5: The Service Request Enable Register (SRER)

The Enable Registers and the *PSC Command

The *PSC command controls the contents of the Enable Registers at power on. Sending *PSC 1 sets the Enable Registers at power on as follows:

- DESER 255 (equivalent to a DESe 255 command)
- ESER 0 (equivalent to an *ESE 0 command)
- SRER 0 (equivalent to an *SRE 0 command)

Sending *PSC 0 lets the Enable Registers maintain their values in nonvolatile memory through a power cycle.

NOTE. *To enable the PON (Power On) event to generate a Service Request (GPIB only), send *PSC 0, use the DESe and *ESE commands to enable PON in the DESER and ESER, and use the *SRE command to enable bit 5 in the SRER. Subsequent power-on cycles will generate a Service Request (GPIB only).*

Queues

The oscilloscope status and event reporting system contains two queues: the Output Queue and the Event Queue.

The Output Queue

The Output Queue stores query responses waiting to be output. The oscilloscope empties the Output Queue each time it receives a new command or query message. This means you must read any query response before you send the next command or query, or you will lose responses to earlier queries. Also, an error may result.

NOTE. When a controller sends a query, an <EOM>, and a second query, the digitizing oscilloscope normally clears the first response and outputs the second while reporting a Query Error (QYE bit in the ESER) to indicate the lost response. A fast controller, however, may receive a part or all of the first response as well. To avoid this situation, the controller should always read the response immediately after sending any terminated query message or send a DCL (Device Clear) before sending the second query.

The Event Queue

The Event Queue stores detailed information on up to 20 events. If more than 20 events stack up in the Event Queue, the 20th event is replaced by event code 350, “Too many events.”

Read the Event Queue with EVENT? (which returns only the event number), with EVMsg? (which returns the event number and a text description of the event), or with ALLEV? (which returns all the event numbers along with a description of the event). Reading an event removes it from the queue.

Before reading an event from the Event Queue, you must use *ESR? to read the summary of the event from the SESR. This makes the events summarized by *ESR? available to EVENT? and EVMSG?, and empties the SESR.

Reading the SESR erases any events that were summarized by previous *ESR? reads but not read from the Event Queue. Events that follow an *ESR? read are put in the Event Queue, but are not available until *ESR? is used again.

Event Handling Sequence

In this description, the numbers in parentheses map to the corresponding numbers in Figure 3-6.

When an event occurs, a signal is sent to the DESER (1). If that type of event is enabled in the DESER (that is, if the bit for that event type is set to 1), the appropriate bit in the SESR is set to one and the event is recorded in the Event Queue (2). If the corresponding bit in the ESER is also enabled (3), then the ESB bit in the SBR is set to one (4).

When output is sent to the Output Queue, the MAV bit in the SBR is set to one (5).

When a bit in the SBR is set to one and the corresponding bit in the SRER is enabled (6), the MSS bit in the SBR is set to one and a service request (GPIB only) is generated (7).

Figure 3-6 shows how to use the status and event handling system.

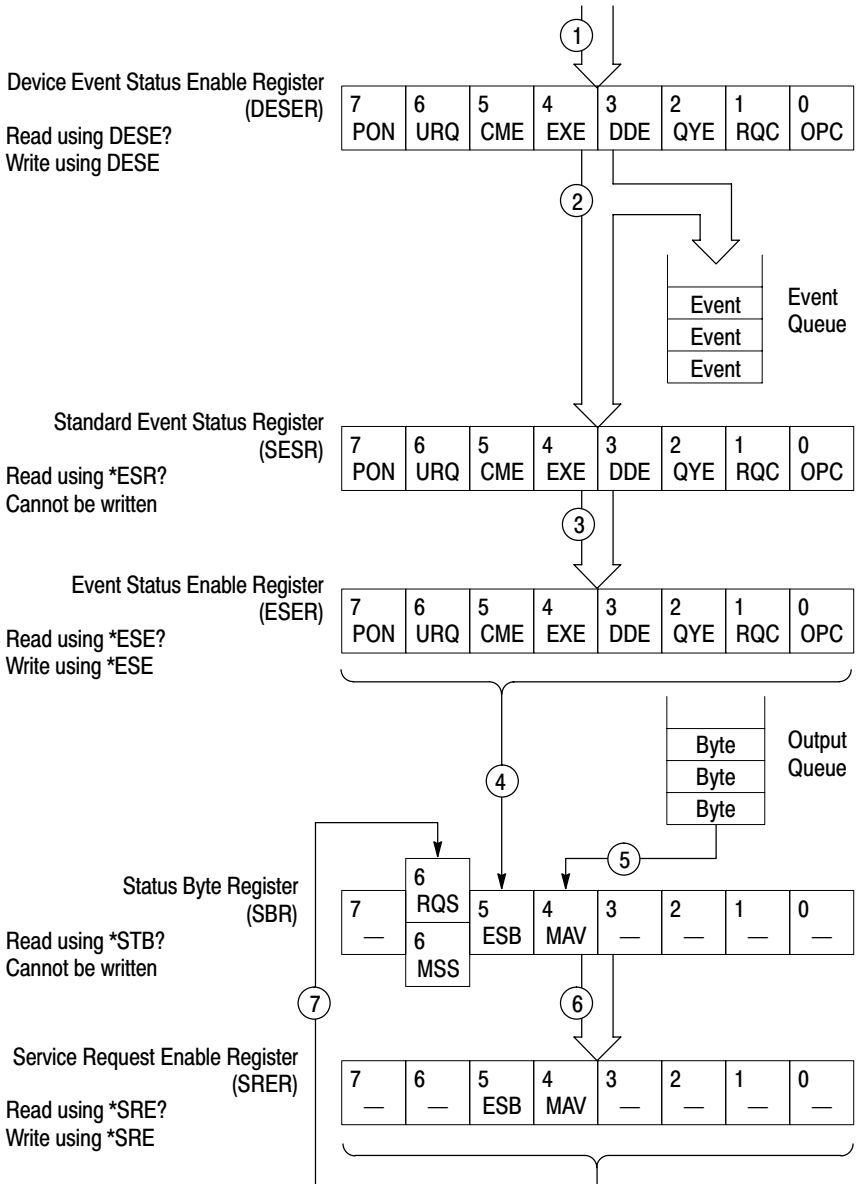


Figure 3-6: Status and event handling process

Synchronization Methods

Although most commands are completed almost immediately after being received by the oscilloscope, some commands start a process that requires more time. For example, once a `HARDCOPY START` command is executed, it may be a few seconds before the hardcopy operation is complete. Rather than remain idle while the operation is in process, the oscilloscope continues processing other commands. This means that some operations are not completed in the order that they were sent.

There may be times when the result of an operation is dependent on the result of an earlier one, and you must be assured that the first operation has completed before processing the next one. The status and event reporting system provides ways to do this.

For example, a typical application would be to acquire a single-sequence waveform, and then take a measurement on the acquired waveform. You could use the following command sequence:

```
/** Set up single-sequence acquisition **/  
SELECT:CH1 ON  
ACQUIRE:MODE SAMPLE  
ACQUIRE:STOPAFTER SEQUENCE  
/** Acquire waveform data **/  
ACQUIRE:STATE ON  
/** Set up the measurement 2  
MEASUREMENT:IMMED:TYPE PK2PK  
MEASUREMENT:IMMED:SOURCE CH1  
/** Take peak-to-peak measurement on acquired data **/  
MEASUREMENT:IMMED:VALUE?
```

The acquisition of the waveform requires extended processing time and may not complete before the amplitude measurement is taken. (See Figure 3-7.) This will result in an incorrect peak-to-peak value.

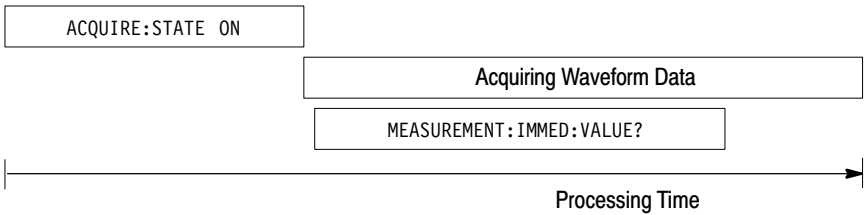


Figure 3-7: Command processing without using synchronization

The acquisition of the waveform must be completed before the measurement can be taken on the acquired data. This is achieved by synchronizing the program so that the measurement command is not processed by the oscilloscope until the acquisition is complete. Figure 3-8 shows the desired processing sequence.

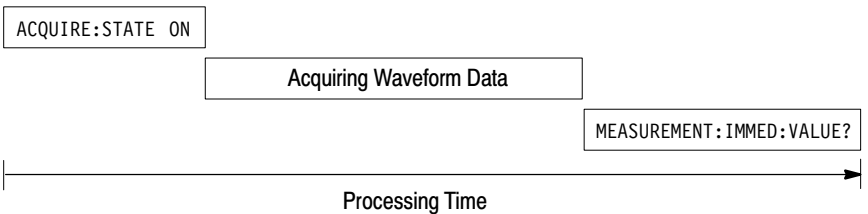


Figure 3-8: Processing sequence with synchronization

Four commands can be used to synchronize the operation of the oscilloscope with your application program: *WAI, BUSY?, *OPC, and *OPC?. The *OPC? query is the most simple.

Using the *WAI Command

You can force commands to execute sequentially by using the *WAI command. This command forces completion of the previous commands before processing new ones.

The same command sequence using the *WAI command for synchronization follows:

```
/* Set up single-sequence acquisition */
SELECT:CH1 ON
ACQUIRE:MODE SAMPLE
ACQUIRE:STOPAFTER SEQUENCE
/* Acquire waveform data */
ACQUIRE:STATE ON
/* Set up the measurement parameters */
MEASUREMENT:IMMED:TYPE PK2PK
MEASUREMENT:IMMED:SOURCE CH1
/* Wait until the acquisition is complete before taking the
measurement */
*WAI
/* Take peak-to-peak measurement on acquired data */
MEASUREMENT:IMMED:VALUE?
```

Though *WAI is one of the easiest ways to achieve synchronization, it is also the most costly. The processing time of the oscilloscope is slowed, since it is processing a single command at a time. This time could be spent doing other tasks.

The controller can continue to write commands to the input buffer, but the commands are not processed by the oscilloscope until all operations in process are complete. If the input buffer becomes full, the controller will be unable to write any more commands to the buffer and will result in a time out.

Using the BUSY Query

BUSY? allows you to find out whether the oscilloscope is busy processing a command that has an extended processing time, such as single-sequence acquisition.

The same command sequence using BUSY? for synchronization follows:

```
/* Set up single-sequence acquisition */
SELECT:CH1 ON
ACQUIRE:MODE SAMPLE
ACQUIRE:STOPAFTER SEQUENCE
/* Acquire waveform data */
ACQUIRE:STATE ON
/* Set up the measurement parameters */
MEASUREMENT:IMMED:TYPE PK2PK
MEASUREMENT:IMMED:SOURCE CH1
/* Wait until the acquisition is complete before taking the
measurement */
While BUSY? keep looping
/* Take peak-to-peak measurement on acquired data */
MEASUREMENT:IMMED:VALUE?
```

This sequence lets you create your own wait loop rather than using the *WAI command. An advantage to using BUSY? is that you eliminate the possibility of a time out caused by writing too many commands to the input buffer. The controller is still tied up, though, and the repeated BUSY? results in more bus traffic.

Using the *OPC Set Command

If the corresponding status registers are enabled, the *OPC command sets the OPC bit in the Standard Event Status Register (SESR) when an operation is complete. You can use this command in conjunction with either a serial poll or service request handler to achieve synchronization.

Serial Poll Method (GPIB Only). Enable the OPC bit in the Device Event Status Enable Register (DESER) and the Event Status Enable Register (ESER) using the DESE and *ESE commands. When the operation is complete, the OPC bit in the Standard Event Status Register (SESR) is enabled, and the Event Status Bit (ESB) in the Status Byte Register is enabled.

The same command sequence using the *OPC command for synchronization with serial polling looks like this:

```
/* Set up single-sequence acquisition */
SELECT:CH1 ON
ACQUIRE:MODE SAMPLE
ACQUIRE:STOPAFTER SEQUENCE

/* Enable the status registers */
DESE 1
*ESE 1
*SRE 0

/* Acquire waveform data */
ACQUIRE:STATE ON

/* Set up the measurement parameters */
MEASUREMENT:IMMED:TYPE PK2PK
MEASUREMENT:IMMED:SOURCE CH1

/* Wait until the acquisition is complete before
taking the measurement */
*OPC
While serial poll = 0, keep looping

/* Take peak-to-peak measurement on acquired data */
```

MEASUREMENT:IMMED:VALUE?

This technique requires less bus traffic than did looping on BUSY?.

Service Request Method (GPIB Only). Enable the OPC bit in the Device Event Status Enable Register (DESER) and the Event Status Enable Register (ESER) using the DESE and *ESE commands. Also, enable service requests by setting the ESB bit in the Service Request Enable Register (SRER) using the *SRE command. When the operation is complete, a Service Request is generated.

The same command sequence using the *OPC command for synchronization looks like this:

```
/* Set up single-sequence acquisition */
```

```
SELECT:CH1 ON
ACQUIRE:MODE SAMPLE
ACQUIRE:STOPAFTER SEQUENCE
```

```
/* Enable the status registers */
```

```
DESE 1
*ESE 1
*SRE 32
```

```
/* Acquire waveform data */
```

```
ACQUIRE:STATE ON
```

```
/* Set up the measurement parameters */
```

```
MEASUREMENT:IMMED:TYPE PK2PK
MEASUREMENT:IMMED:SOURCE CH1
```

```
/* Wait until the acquisition is complete before taking the
measurement */
```

```
*OPC
```

The program can now do different tasks such as talk to other devices. The SRQ, when it comes, interrupts those tasks and returns control to this task

```
/* Take peak-to-peak measurement on acquired data */
```

```
MEASUREMENT:IMMED:VALUE?
```

This technique requires less bus traffic than did looping on BUSY?.

The program can now do different tasks such as talk to other devices. The SRQ, when it comes, interrupts those tasks and returns control to this task.

```
/* Take peak-to-peak measurement on acquired data */  
MEASUREMENT:IMMED:VALUE?
```

This technique is more efficient but requires more sophisticated programming.

Using the *OPC? Query (the Most Simple Approach)

*OPC? places a 1 in the Output Queue once an operation is complete. A timeout could occur if you try to read the output queue before there is any data in it.

The same command sequence using *OPC? for synchronization follows:

```
/* Set up single-sequence acquisition */  
SELECT:CH1 ON  
ACQUIRE:MODE SAMPLE  
ACQUIRE:STOPAFTER SEQUENCE  
/* Acquire waveform data */  
ACQUIRE:STATE ON  
/* Set up the measurement parameters */  
MEASUREMENT:IMMED:TYPE PK2PK  
MEASUREMENT:IMMED:SOURCE CH1  
/* Wait until the acquisition is complete before  
taking the measurement */  
*OPC?
```

Wait for read from Output Queue.

```
/* Take peak-to-peak measurement on acquired data */
MEASUREMENT:IMMED:VALUE?
```

Using *OPC? synchronization is the simplest approach. It requires no status handling or loops. However, you must set the controller time out for longer than the acquisition operation.

Messages

Tables 3-3 through 3-9 list all the programming interface messages the oscilloscope generates in response to commands and queries.

Each message is the result of an event. Each type of event sets a specific bit in the SESR and is controlled by the equivalent bit in the DESER. Thus, each message is associated with a specific SESR bit. In the message tables that follow, the associated SESR bit is specified in the table title, with exceptions noted with the error message text.

Table 3-3 shows the messages when the system has no events or status to report. These have no associated SESR bit.

Table 3-3: No event messages

Code	Message
0	No events to report : queue empty
1	No events to report : new events pending *ESR?

Table 3-4 shows the error messages generated by improper command syntax. Check that the command is properly formed and that it follows the rules in the *Command Syntax* section starting on page 2-1.

Table 3-4: Command error messages – CME bit 5

Code	Message
100	Command error
102	Syntax error
103	Invalid separator
104	Data type error
105	GET not allowed
108	Parameter not allowed
110	Command header error
111	Header separator error
112	Program mnemonic too long
113	Undefined header
161	Invalid block data (indefinite length blocks are not allowed over the RS-232)

Table 3-5 lists the errors that are detected during execution of a command. In these error messages, you should read “macro” as “alias.”

Table 3-5: Execution error messages – EXE bit 4

Code	Message
200	Execution error
201	Invalid while in local
210	Trigger error

Table 3-5: Execution error messages – EXE bit 4 (Cont.)

Code	Message
211	Trigger ignored
212	Arm ignored
220	Parameter error
221	Settings conflict
222	Data out of range
223	Too much data
224	Illegal parameter value
230	Data corrupt or stale
240	Hardware error
241	Hardware missing
242	Hardware configuration error
243	Hardware I/O device error
260	Expression error
261	Math error in expression
2200	Measurement error, Measurement system error
2201	Measurement error, Zero period
2202	Measurement error, No period found
2203	Measurement error, No period, second waveform
2204	Measurement error, Low signal amplitude
2205	Measurement error, Low amplitude, second waveform
2206	Measurement error, Invalid gate
2207	Measurement error, Measurement overflow
2208	Measurement error, Waveform does not cross Mid Ref
2209	Measurement error, No second Mid Ref crossing

Table 3-5: Execution error messages – EXE bit 4 (Cont.)

Code	Message
2210	Measurement error, No Mid Ref crossing, second waveform
2211	Measurement error, No backwards Mid Ref crossing
2212	Measurement error, No negative crossing
2213	Measurement error, No positive crossing
2214	Measurement error, No crossing
2215	Measurement error, No crossing, second waveform
2216	Measurement error, No crossing, target waveform
2217	Measurement error, Constant waveform
2218	Measurement error, Unused
2219	Measurement error, No valid edge: No arm sample
2220	Measurement error, No valid edge: No arm cross
2221	Measurement error, No valid edge: No trigger cross
2222	Measurement error, No valid edge: No second cross
2223	Measurement error, waveform mismatch
2224	Measurement error, WAIT calculating
2225	Measurement error, No waveform to measure
2226	Null Waveform
2227	Positive and Negative Clipping
2228	Measurement error, Positive Clipping
2229	Measurement error, Negative Clipping
2230	Measurement error, High Ref < Low Ref
2235	Math error, Invalid math description
2241	Waveform request is invalid
2242	Data start > record length

Table 3-5: Execution error messages – EXE bit 4 (Cont.)

Code	Message
2243	Waveform requested is not a data source
2244	Waveform requested is not turned on
2245	Saveref error, Selected channel is turned off
2246	Saveref error, Selected channel data invalid
2248	Saveref error, Source reference data invalid
2260	Calibration error
2301	Cursor error, Off screen
2302	Cursor error, Cursors are off
2303	Cursor error, Cursor source waveform is off

Table 3-6 lists the device errors that can occur during oscilloscope operation. These errors may indicate that the oscilloscope needs repair.

Table 3-6: Device error messages – DDE bit 3

Code	Message
300	Device-specific error
310	System error
311	Memory error
313	Calibration memory lost
314	Save/recall memory lost
315	Configuration memory lost
350	Queue overflow (does not set DDE bit)
361	Parity error in program message (check parity)

Table 3-6: Device error messages – DDE bit 3 (Cont.)

Code	Message
362	Framing error in program message (check baud rate)
363	Input buffer overrun (check flagging)

Table 3-7 lists the system event messages. These messages are generated whenever certain system conditions occur.

Table 3-7: System event messages

Code	Message
400	Query event
401	Power on (PON bit 7 set)
402	Operation complete (OPC bit 0 set)
403	User request (URQ bit 6 set)
404	Power fail (DDE bit 3 set)
405	Request control
410	Query INTERRUPTED (QYE bit 2 set)
420	Query UNTERMINATED (QYE bit 2 set)
430	Query DEADLOCKED (QYE bit 2 set)
440	Query UNTERMINATED after indefinite response (QYE bit 2 set), normally caused by using a query that returns arbitrary data in a concatenated command

Table 3-8 lists warning messages that do not interrupt the flow of command execution. These notify you that you may get unexpected results.

Table 3-8: Execution warning messages – EXE Bit 4

Code	Message
500	Execution warning
510	String data too long, truncated
525	Parameter underrange
526	Parameter overrange
527	Parameter rounded
528	Parameter out of range
530	Data start > stop, Values swapped internally
531	Data stop > record length, Curve truncated
532	Curve data too long, Curve truncated
540	Measurement warning
541	Measurement warning, Low signal amplitude
542	Measurement warning, Unstable histogram
543	Measurement warning, Low resolution
544	Measurement warning, Uncertain edge
545	Measurement warning, Invalid in minmax
546	Measurement warning, Need 3 edges
547	Measurement warning, Clipping positive/negative
548	Measurement warning, Clipping positive
549	Measurement warning, Clipping negative

Table 3-9 lists internal errors that indicate an internal fault in the oscilloscope.

Table 3-9: Internal warning messages

Code	Message
600	Internal warning



Programming Example

Programming Example

The following series of commands and queries illustrate many of the most common commands and techniques.

To use these commands and queries over RS232, you will need to use a communications program on your computer, such as tip in the Unix environment, or Hyperterminal in the Microsoft Windows environment.

To use these commands and queries over GPIB, you will need to use a program or routines that interface to the GPIB hardware in your computer. This software is usually supplied by the GPIB hardware manufacturer.

In these examples, data sent from the controller computer to the oscilloscope is prefaced with the > symbol. Replies from the oscilloscope have no preface.

```
> rem "Check for any messages, and clear them from the queue."
> *esr?
128
> allev?
:ALLEV 401,"Power on; "

> rem "Set the scope to the default state."
> factory

> rem "Set the scope parameters that differ from the defaults."
> ch1:volts 2.0
> hor:main:scale 100e-6
> trig:main:level 2.4

> rem "Start a single sequence acquisition."
> acquire:stopafter sequence
> acquire:state on
> rem "Wait for the acquisition to complete."
> rem "Note: your controller program time-out must be set long
enough to handle the wait."
> *opc?
1
```

```
> rem "Use the oscilloscope built-in measurements to measure the
waveform you acquired."
> measu:immed:type mean
> measu:immed:value?
:MEASUREMENT:IMMED:VALUE 2.4631931782E0

> rem "Be sure to use the *esr? query to check for measurement
errors."
> measu:immed:type freq
> Measu:immed:value?
:MEASUREMENT:IMMED:VALUE 9.9E37
> *esr?
16
> allev?
:ALLEV 2202,"Measurement error, No period found; "

> rem "Query out the waveform points, for later analysis on your
controller computer."
> data:encdg ascii
> curve?
:CURVE 7,6,5,5,5,6,6,6,8 [...]

> rem "Query out the parameters used for caculating the times and
voltages of the waveform points."
> wfmpre?
:WFMPRE:BYT_NR 1;BIT_NR 8;ENCDG ASC;BN_FMT RP;BYT_OR MSB;NR_PT
2500; [...]
```



Appendices

Appendix A: ASCII Code Chart

	0	1	2	3	4	5	6	7
0	⁰ NUL _{0 0}	²⁰ DLE _{10 16}	⁴⁰ SP _{20 32}	⁶⁰ 0 _{30 48}	¹⁰⁰ @ _{40 64}	¹²⁰ P _{50 80}	¹⁴⁰ , _{60 96}	¹⁶⁰ p _{70 112}
1	¹ SOH _{1 1}	²¹ DC1 _{11 17}	⁴¹ ! _{21 33}	⁶¹ 1 _{31 49}	¹⁰¹ A _{41 65}	¹²¹ Q _{51 81}	¹⁴¹ a _{61 97}	¹⁶¹ q _{71 113}
2	² STX _{2 2}	²² DC2 _{12 18}	⁴² ” _{22 34}	⁶² 2 _{32 50}	¹⁰² B _{42 66}	¹²² R _{52 82}	¹⁴² b _{62 98}	¹⁶² r _{72 114}
3	³ ETX _{3 3}	²³ DC3 _{13 19}	⁴³ # _{23 35}	⁶³ 3 _{33 51}	¹⁰³ C _{43 67}	¹²³ S _{53 83}	¹⁴³ c _{63 99}	¹⁶³ s _{73 115}
4	⁴ EOT _{4 4}	²⁴ DC4 _{14 20}	⁴⁴ \$ _{24 36}	⁶⁴ 4 _{34 52}	¹⁰⁴ D _{44 68}	¹²⁴ T _{54 84}	¹⁴⁴ d _{64 100}	¹⁶⁴ t _{74 116}
5	⁵ ENQ _{5 5}	²⁵ NAK _{15 21}	⁴⁵ % _{25 37}	⁶⁵ 5 _{35 53}	¹⁰⁵ E _{45 69}	¹²⁵ U _{55 85}	¹⁴⁵ e _{65 101}	¹⁶⁵ u _{75 117}
6	⁶ ACK _{6 6}	²⁶ SYN _{16 22}	⁴⁶ & _{26 38}	⁶⁶ 6 _{36 54}	¹⁰⁶ F _{46 70}	¹²⁶ V _{56 86}	¹⁴⁶ f _{66 102}	¹⁶⁶ v _{76 118}
7	⁷ BEL _{7 7}	²⁷ ETB _{17 23}	⁴⁷ , _{27 39}	⁶⁷ 7 _{37 55}	¹⁰⁷ G _{47 71}	¹²⁷ W _{57 87}	¹⁴⁷ g _{67 103}	¹⁶⁷ w _{77 119}
8	¹⁰ BS _{8 8}	³⁰ CAN _{18 24}	⁵⁰ (_{28 40}	⁷⁰ 8 _{38 56}	¹¹⁰ H _{48 72}	¹³⁰ X _{58 88}	¹⁵⁰ h _{68 104}	¹⁷⁰ x _{78 120}
9	¹¹ HT _{9 9}	³¹ EM _{19 25}	⁵¹) _{29 41}	⁷¹ 9 _{39 57}	¹¹¹ I _{49 73}	¹³¹ Y _{59 89}	¹⁵¹ i _{69 105}	¹⁷¹ y _{79 121}

Continued on next page

Appendix A: ASCII Code Chart

	0	1	2	3	4	5	6	7
A	12 LF	32 SUB	52 *	72 :	112 J	132 Z	152 j	172 z
	A 10	1A 26	2A 42	3A 58	4A 74	5A 90	6A 106	7A 122
B	13 VT	33 ESC	53 +	73 ;	113 K	133 [153 k	173 {
	B 11	1B 27	2B 43	3B 59	4B 75	5B 91	6B 107	7B 123
C	14 FF	34 FS	54 ,	74 <	114 L	134 \ 92	154 l	174
	C 12	1C 28	2C 44	3C 60	4C 76	5C 92	6C 108	7C 124
D	15 CR	35 GS	55 -	75 =	115 M	135]	155 m	175 }
	D 13	1D 29	2D 45	3D 61	4D 77	5D 93	6D 109	7D 125
E	16 SO	36 RS	56 .	76 >	116 N	136 ^	156 n	176 ~
	E 14	1E 30	2E 46	3E 62	4E 78	5E 94	6E 110	7E 126
F	17 SI	37 US	57 /	77 ?	117 O	137 _	157 o	177 DEL (RUBOUT) 7F 127
	F 15	1F 31	2F 47	3F 63	4F 79	5F 95	6F 111	

KEY

octal

25

NAK

ASCII character

hex

15

21

decimal

Appendix B: Factory Setup

The following listing is the instrument response to the concatenated command `FACTory;SET?`. This response describes the factory default setup in detail. (Carriage returns have been inserted for clarity.)

Items enclosed in () parentheses are returned by the `SET?` query response, but are not changed by the `FACTory` command.

TDS1000- and 2000-Series Oscilloscopes

Responses for channel 3 and 4 apply only to 4-channel models.

```
:HEADER 1;(:VERBOSE 1;)
:DATA:ENCDG RIBINARY;DESTINATION REFA;SOURCE CH1;START
  1;STOP 2500;WIDTH 1;
(:LOCK NONE;)
:DISPLAY:FORMAT YT;STYLE VECTORS;PERSISTENCE 0;(CONTRAST
  50);(INVERT OFF);
:ACQUIRE:MODE SAMPLE;NUMAVG 16;STATE 1;STOPAFTER
  RUNSTOP;
:CH1:PROBE 10;SCALE 1.0E0;POSITION 0.0E0;COUPLING
  DC;BANDWIDTH OFF;INVERT OFF;
:CH2:PROBE 10;SCALE 1.0E0;POSITION 0.0E0;COUPLING
  DC;BANDWIDTH OFF;INVERT OFF;
:CH3:PROBE 10;SCALE 1.0E0;POSITION 0.0E0;COUPLING
  DC;BANDWIDTH OFF;INVERT OFF;
:CH4:PROBE 10;SCALE 1.0E0;POSITION 0.0E0;COUPLING
  DC;BANDWIDTH OFF;INVERT OFF;
:HORIZONTAL:VIEW MAIN;MAIN:SCALE 5.0E-4;POSITION
  0.0E0;:HORIZONTAL:DELAY:SCALE 5.0E-5;POSITION 0.0E0;
:TRIGGER:MAIN:MODE AUTO;TYPE EDGE;HOLDOFF:VALUE
  5.0E-7;:TRIGGER:MAIN:EDGE:SOURCE CH1;COUPLING
```

```
DC;SLOPE RISE;;TRIGGER:MAIN:VIDEO:SOURCE CH1;SYNC
LINE;POLARITY NORMAL;LINE 1;STANDARD
NTSC;;TRIGGER:MAIN:PULSE:SOURCE CH1;WIDTH:POLARITY
POSITIVE;WHEN EQUAL;WIDTH 1.0E-3;;TRIGGER:MAIN:LEVEL
0.0E0;

:SELECT:CH1 1;CH2 0;CH3 0;CH4 0;MATH 0;REFA 0;REFB
0;REFC 0;REFD 0;

:CURSOR:FUNCTION OFF;SELECT:SOURCE
CH1;;CURSOR:VBARS:UNITS SECONDS;POSITION1
-2.0E-3;POSITION2 2.0E-3;;CURSOR:HBARS:POSITION1
-3.2E0;POSITION2 3.2E0;

:MEASUREMENT:MEAS1:TYPE NONE;SOURCE
CH1;;MEASUREMENT:MEAS2:TYPE NONE;SOURCE
CH1;;MEASUREMENT:MEAS3:TYPE NONE;SOURCE
CH1;;MEASUREMENT:MEAS4:TYPE NONE;SOURCE
CH1;;MEASUREMENT:MEAS5:TYPE NONE;SOURCE
CH1;;MEASUREMENT:IMMED:TYPE PERIOD;SOURCE CH1;

:MATH:DEFINE "CH1 - CH2";FFT:HORIZONTAL:POSITION
5.0E1;SCALE 1.0E0;;MATH:FFT:VERTICAL:POSITION
0.0E0;SCALE 1.0E0;

(:HARDCOPY:FORMAT EPSON;PORT CENTRONICS;LAYOUT
PORTRAIT;INKSAVER ON;)

(:LANGUAGE ENGLISH)
```


TDS210 and TDS220 Oscilloscopes

Items enclosed in < > brackets are present only when the TDS2MM module is installed.

```
:HEADER 1;(:VERBOSE 1;)

:DATA:ENCDG RIBINARY;DESTINATION REFA;SOURCE CH1;
  START 1;STOP 2500;WIDTH 1;

(:LOCK NONE;)

:DISPLAY:FORMAT YT;STYLE VECTORS;PERSISTENCE 0;
  CONTRAST 50;

:ACQUIRE:MODE SAMPLE;NUMAVG 16;STATE 1;
  STOPAFTER RUNSTOP;

:CH1:PROBE 10;SCALE 1.0E0;POSITION 0.0E0;
  COUPLING DC;BANDWIDTH OFF;<INVERT OFF;>

:CH2:PROBE 10;SCALE 1.0E0;POSITION 0.0E0;
  COUPLING DC;BANDWIDTH OFF;<INVERT OFF;>

:HORIZONTAL:VIEW MAIN;
  MAIN:SCALE 5.0E-4;POSITION 0.0E0;
  :HORIZONTAL:DELAY:SCALE 5.0E-5;POSITION 0.0E0;

:TRIGGER:MAIN:MODE AUTO;TYPE EDGE;
  HOLDOFF:VALUE 5.0E-7;
  :TRIGGER:MAIN:EDGE:SOURCE CH1;COUPLING DC;
  SLOPE RISE;:TRIGGER:MAIN:VIDEO:SOURCE CH1;
  SYNC LINE;POLARITY NORMAL;
  :TRIGGER:MAIN:LEVEL 0.0E0;

:SELECT:CH1 1;CH2 0;MATH 0;REFA 0;REFB 0;

:CURSOR:FUNCTION OFF;SELECT:SOURCE CH1;
  :CURSOR:VBARS:UNITS SECONDS;
  POSITION1 -2.0E-3; POSITION2 2.0E-3;
  :CURSOR:HBARS:POSITION1 -3.2E0; POSITION2 3.2E0;

:MEASUREMENT:MEAS1:TYPE NONE;SOURCE CH1;
  :MEASUREMENT:MEAS2:TYPE NONE;SOURCE CH1;
  :MEASUREMENT:MEAS3:TYPE NONE;SOURCE CH1;
  :MEASUREMENT:MEAS4:TYPE NONE;SOURCE CH1;
  :MEASUREMENT:IMMED:TYPE PERIOD;SOURCE CH1;
```

```
:MATH:DEFINE "CH1 + CH2";
  <FFT:HORIZONTAL:POSITION 5.0E1;SCALE 1.0E0;>
  <:MATH:FFT:VERTICAL:POSITION 0.0E0;SCALE 1.0E0;>

(:HARDCOPY:FORMAT EPSON;PORT CENTRONICS;
  LAYOUT PORTRAIT;)

(:LANGUAGE ENGLISH)
```

TDS224 Oscilloscopes

Items enclosed in < > brackets are present only when the TDS2MM module is installed.

```
:HEADER 1;(:VERBOSE 1;)

:DATA:ENCDG RIBINARY;DESTINATION REFA;SOURCE CH1;
  START 1;STOP 2500;WIDTH 1;

(:LOCK NONE;)

:DISPLAY:FORMAT YT;STYLE VECTORS;PERSISTENCE 0;
  CONTRAST 50;

:ACQUIRE:MODE SAMPLE;NUMAVG 16;STATE 1;
  STOPAFTER RUNSTOP;

:CH1:PROBE 10;SCALE 1.0E0;POSITION 0.0E0;
  COUPLING DC;BANDWIDTH OFF;INVERT OFF;

:CH2:PROBE 10;SCALE 1.0E0;POSITION 0.0E0;
  COUPLING DC;BANDWIDTH OFF;INVERT OFF;

:CH3:PROBE 10;SCALE 1.0E0;POSITION 0.0E0;
  COUPLING DC;BANDWIDTH OFF;INVERT OFF;

:CH4:PROBE 10;SCALE 1.0E0;POSITION 0.0E0;
  COUPLING DC;BANDWIDTH OFF;INVERT OFF;

:HORIZONTAL:VIEW MAIN;MAIN:SCALE 5.0E-4;
  POSITION 0.0E0;:HORIZONTAL:DELAY:SCALE 5.0E-5;
  POSITION 0.0E0;

:TRIGGER:MAIN:MODE AUTO;TYPE EDGE;
  HOLDOFF:VALUE 5.0E-7;
  :TRIGGER:MAIN:EDGE:SOURCE CH1;COUPLING DC;
```

```
SLOPE RISE;:TRIGGER:MAIN:VIDEO:SOURCE CH1;
SYNC LINE;POLARITY NORMAL;
:TRIGGER:MAIN:LEVEL 0.0E0;

:SELECT:CH1 1;CH2 0;CH3 0;CH4 0;MATH 0;REFA 0;
REFB 0;REFC 0;REFD 0;

:CURSOR:FUNCTION OFF;SELECT:SOURCE CH1;

:CURSOR:VBARS:UNITS SECONDS;POSITION1 -2.0E-3;
POSITION2 2.0E-3;
:CURSOR:HBARS:POSITION1 -3.2E0;POSITION2 3.2E0;

:MEASUREMENT:MEAS1:TYPE NONE;SOURCE CH1;
:MEASUREMENT:MEAS2:TYPE NONE;SOURCE CH1;
:MEASUREMENT:MEAS3:TYPE NONE;SOURCE CH1;
:MEASUREMENT:MEAS4:TYPE NONE;SOURCE CH1;
:MEASUREMENT:IMMED:TYPE PERIOD;SOURCE CH1;

:MATH:DEFINE "CH1 - CH2";
<FFT:HORIZONTAL:POSITION 5.0E1;SCALE 1.0E0;>
<:MATH:FFT:VERTICAL:POSITION 0.0E0;SCALE 1.0E0;>

(:HARDCOPY:FORMAT EPSON;PORT CENTRONICS;
LAYOUT PORTRAIT;)

(:LANGUAGE ENGLISH)
```




Glossary and Index

Glossary

ASCII

Acronym for the American Standard Code for Information Interchange. Controllers transmit commands to the digitizing oscilloscope using ASCII character encoding.

Address

A 7-bit code that identifies an instrument on the communication bus. The digitizing oscilloscope must have a unique address for the controller to recognize and transmit commands to it.

Backus-Naur Form (BNF)

A standard notation system for command syntax. The syntax in this manual use BNF notation.

Controller

A computer or other device that sends commands to and accepts responses from the digitizing oscilloscope.

EOI

A mnemonic referring to the control line “End or Identify” on the GPIB interface bus. One of the two possible end-of-message terminators.

EOM

A generic acronym referring to the end-of-message terminator. The end-of-message terminator is either an EOI or the ASCII code for line feed (LF).

IEEE

Acronym for the Institute of Electrical and Electronics Engineers.

RS-232

A serial, full-duplex, asynchronous communication port that follows ANSI/EIA/TIA-562-1989[1], ANSI/EIA/TIA-574-1990[2], and CCITT V.24-1989[3] standards.

Serial Poll

A device (such as an oscilloscope) on the GPIB bus can request service from the GPIB Controller by asserting the GPIB SRQ line (a Hardware line that is only present on the GPIB communications bus). When a controller acknowledges the SRQ, it "serial polls" each open device on the bus to determine which device on the bus requested service. Any device requesting service returns a status byte with bit 6 set and then unasserts the SRQ line. Devices not requiring service return a status byte with bit 6 cleared.

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