
TEK Command
Reference

070-7252-01
Product Group 47

**THE
& DSA 601
DSA 602**
DIGITIZING SIGNAL
ANALYZERS

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CHANGE INFORMATION
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Printed in U.S.A.

Second Edition SEP 1989

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Syntax and Conventions

This *Command Reference* contains complete descriptions of the commands available via the GPIB and RS-232-C interfaces for the DSA 601 and DSA 602 Digitizing Signal Analyzers. Use this manual with the *DSA 601 and DSA 602 Digitizing Signal Analyzer Programmer Reference*, which contains programmer tutorial and reference material, and with the *DSA 601 and DSA 602 Digitizing Signal Analyzer User Reference*.

Syntax Definitions

This manual uses the following Backus-Naur Form (BNF) symbols:

BNF Symbols

Symbol	Meaning
< >	Defined element (e.g., <arg>)
::=	Is defined as (e.g., <arg> ::= argument)
	Exclusive OR (e.g., PLUS MINUS)
{ }	One of group is required (e.g., {ON OFF})
[]	Optional item (e.g., [<link>:]<arg>)
...	Previous element(s) may be repeated

Data Element Definitions

The data element types are: numeric, global, and quoted strings. Each is defined as follows:

Numeric Data Types

Element	Meaning
<ui>	Unsigned Integer, range is 1 through 65,535; no leading space permitted (e.g., 9999).
<NR1>	Signed integer value (e.g., -5).
<NR2>	Floating point value, without an exponent (e.g. 3.7).
<NR3>	Floating point value, with an exponent (e.g. 2.2E-3).
<NRx>	{<NR1> <NR2> <NR3>}. Range is: -1E±300, 0, 1E±300, to 15 significant digits.

Global Data Types

Element	Meaning
<code><asc curve></code>	ASCII-formatted waveform data for one or more data points, in the form: <code><NR1>[{,<NR1>}...]</code>
<code><bblock></code>	Binary block formatted waveform or setting data, in the form: <code>% <byte count> <data></code> <code>[{ <data> }...] <checksum></code> (Refer to the CURVE and SET? commands for a full explanation of using <code><bblock></code> .)
<code><slot></code>	L, C, or R, representing the Left, Center, or Right plug-in compartments.

Quoted String Data Type

Element	Meaning
<code><qstring></code>	<p>Quoted string data. This element can be any character(s) defined in the ASCII or expanded character sets, enclosed by apostrophes or quotation marks, and following these rules:</p> <ul style="list-style-type: none"> ■ You must use the same delimiter type to open and close the string; you cannot open with an apostrophe and close with a quotation mark or vice versa. ■ You can use an apostrophe or quotation mark within the string if you follow the above rule and you enter the enclosing delimiter twice (i.e., "double " " quote") ■ You can use a maximum string length of 127 characters, unless otherwise noted. ■ You cannot use strings that include an embedded ASCII NULL character (0). However, carriage returns and line feeds can be included as text in a string.

Command Conventions

Note: For a complete discussion of command conventions, refer to the *DSA 601 and DSA 602 Programmer Reference*.

The DSA 601 and DSA 602 accept both upper and lower case letters; they are not case sensitive.

All parts of a command entry can be preceded by "white space," which is defined:

- For RS-232-C—as blanks and carriage returns or line feeds that precede a header
- For GPIB with the EOI terminator—as any combination of blanks, carriage returns, or line feeds
- For GPIB with the EOI and line feed terminator—as any combination of blanks or carriage returns

Commands can be abbreviated to the minimum spelling shown in bold capitals in the syntax blocks. Responses are returned with the full spelling unless the LONGFORM command is set to OFF. Examples in this book use abbreviated command spellings; responses are in long form.

Any combination of set and query commands can be concatenated (joined together) with semicolons.

Commands can be renamed or new commands can be created from concatenated strings of commands using the DEF command.

Measurement (<meas>) Commands

In this manual, the symbol <meas> represents one or more of the DSA measurements. For example, <meas>? represents a measurement query, such as RMS?. Each <meas>? measurement has its own entry in the command set. Refer to the <meas>? entry for a list of all the measurements. Refer to the *DSA 601 and DSA 602 Programmer Reference* or the *DSA 601 and DSA 602 User Reference* for a complete explanation of the measurement system.

For firmware version 1.2 and above only, the MS<meas>? query returns measurement statistics (min, max, mean, and standard deviation) for the specified measurement. (For example, MSRMS? returns statistics for the RMS measurement.) See the <meas>? entry for a list of measurements.

Waveforms and Traces

The terms waveform and trace both pertain to signals acquired or stored by the DSA; but are not interchangeable in command syntax. Some headers begin with WFMxxx (e.g., WFMPRE, WFMSCALING); other headers, links, or arguments use TRACE <ui> (e.g., TRACE3) form.

Syntax Key

The following figure summarizes how command information is shown in this manual. The full spelling of the header, link, or argument is given with the minimum spelling in bold capitals.

HEAdEr [[<link> :] <arg>]

[<link> :]	<arg>	[Range, if applicable]
--------------	-------	------------------------

A three-space syntax block contains link-argument or argument-only information. Range is provided for numeric arguments.

? <link>	(Response – I.e., ON OFF)
----------	-------------------------------

A two-space syntax block contains a query-only link and its range of responses.

Command Syntax Key

Set Commands and Queries

Set commands modify instrument functions. Queries return the current value(s) of functions. Most commands can be both set and queried. For these commands, only the set form is shown unless the query response differs from the set form. (For example, the query response is included if the links are returned in a different order than presented.)

Query-only commands contain a question mark appended to the header. The words **Query Only** appear in bold at the beginning of the text.

Query-only links contain a question mark preceding the link in the syntax box, and include the words **Query Only** in bold at the beginning of the text. As with any query, append the question mark to the header when querying the link.

A few commands and links can only be set. These commands include the words **Set Only** in bold at the beginning of the text description.

Examples

Examples are included for most headers and links. Examples are shown in shaded boxes, like this:

COMMANDS YOU ENTER ARE BOLD
SYSTEM RESPONSE IS REGULAR TYPE



Command Set

This section is an alphabetical listing of DSA commands. For information on the functional command groups listed with each command, see the *DSA 601 and DSA 602 Programmer Reference*.

A

ABBwfmpre {ON|OFF}

Data Transfer Commands

ABBWFMPRE determines whether the response to a WFMPRE? query is abbreviated or includes all links. When ABBWFMPRE is set to ON (i.e., abbreviated), the WFMPRE? response is:

```
WFMPRE ACSTATE: <arg>, NR.PT: <NR1>,
PTFMT: <arg>, XINCR: <NR3>,
XMULT: <NR3>, XZERO: <NR3>,
YMULT: <NR3>, YZERO: <NR3>
```

When ABBWFMPRE is set to OFF, the WFMPRE? response includes all 20 links of the WFMPRE command. The power-on default setting is ABBWFMPRE OFF.

ABB ON

ABStouch {CLEar| <NRx>, <NRx>}

Miscellaneous/System Commands

ABSTOUCH activates a location on the front panel by giving its X,Y coordinates. ABSTOUCH always works, regardless of the state of the front panel (FPANEL ON/OFF) or touch panel button. Touch coordinates, whether from ABSTOUCH or from the front panel, are stored in a first in, first out (FIFO) buffer. You can access the FIFO with the ABSTOUCH? query.

	CLEar	
--	-------	--

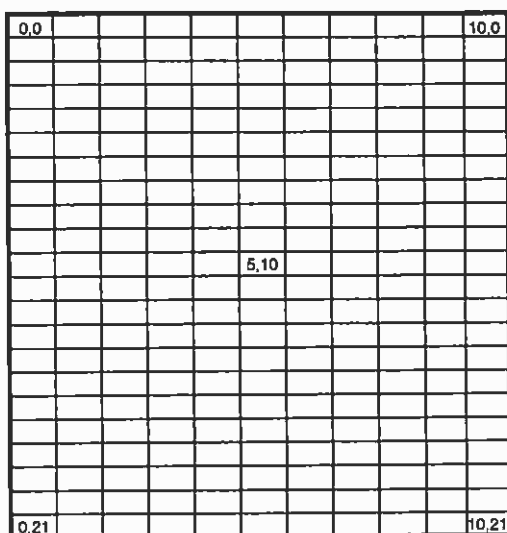
Set Only. CLEAR empties the 20-deep FIFO buffer in which front panel touches are stored.

ABS CLE

ABStouch {**CLEAr** | <NRx>, <NRx>} (cont.)

<NRx>, <NRx>	X=0 to 11; Y=0 to 21
--------------	----------------------

X,Y touch panel screen coordinates range from 0,0 (upper left) to 10,21 (lower right):



X, Y Touch Panel Screen Coordinates

Coordinates of the front panel buttons are listed in the following table:

Front Panel Button X,Y Coordinates

Button	X,Y	Button	X,Y
Waveform	11,0	Right Fine Button	11,6
Trigger	11,1	Left Fine Button	11,7
Measure	11,2	Digitizer Run/Stop	11,8
Store/Recall	11,3	Autoset	11,9
Utility	11,4	Hardcopy	11,10
Touch Panel	11,5	Enhanced Accuracy	11,11

Note: You cannot use ABSTOUCH to touch a channel button or a probe ID button.

ABS 11,0

ABStouch {CLEar| <NRx>, <NRx>} (cont.)

Query Note: Every front panel touch, whether from ABSTOUCH or the front panel, is stored in a 20-deep FIFO buffer. ABSTOUCH? returns the oldest touch coordinates and removes them from the buffer. If no touches are in the buffer, ABSTOUCH? returns:

```
ABSTOUCH -1, -1
```

```
ABS?
```

```
ABSTOUCH 11,6
```

ADJtrace <ui> <link> : <arg>

Waveform and Settings Commands

ADJTRACE <ui> adjusts the displayed position of the specified waveform without modifying the horizontal (time base) or vertical (channel) parameters. The range of <ui> is 1 to trace 8.

Note: Certain ADJTRACE <ui> links only apply to waveforms created in floating-point mode or integer mode. For information on waveform modes, refer to the WFMSCALING command.

HMAg:	<NRx>	1, 2, 2.5, 4, 5, 8, 10, 16, 20, 25, 40, 50, 80, 100, 160, 200, 250, 400, 500, 800, 1000, 2000, 2500, 5000
--------------	--------------------	---

HMAG sets the waveform horizontal magnification factor (ADJTRACE <ui> PANZOOM must be set to ON). The HMAG value depends on the record length of TBMAIN or TBWIN. The maximum HMAG value for each LENGTH is shown in the following table.

Maximum HMAG Values

Record LENGTH	Maximum HMAG	Record LENGTH	Maximum HMAG
512	50	8192	1000
1024	100	10240	1000
2048	200	16384	2000
4096	500	10464	2000
5120	500	32768	5000

```
ADJ2 HMA:2.5
```

ADJtrace <ui> <link>:<arg> (cont.)

HPOSITION:	<NRx>	(See below for range)
-------------------	-------	-----------------------

HPOSITION sets the waveform horizontal position when ADJTRACE <ui> PANZOOM is set to ON. The HPOSITION range is in waveform points; from 0 (zero) to an upper value determined by the horizontal magnification (HMAG) and the record LENGTH, using the following formula:

$$\text{LENGTH} - \text{cell} (10.24 * \text{max_HMAG} / \text{HMAG})$$

where the cell() is the smallest Integer value greater than or equal to the value in parentheses; cell rounds fractions to the next higher Integer. For example, for a record LENGTH of 4096, the max_HMAG value is 500. Assume the actual HMAG is 50. With these conditions, the HPOSITION range is 0 to:

$$\begin{aligned} [4096 - \text{cell} (10.24 * 500/50)] &= [4096 - \text{cell} \\ (102.4)] &= [4096 - 103] = 3993 \end{aligned}$$

ADJ2 HPO:300

HVPOSITION:	<NRx>	-1E+15 to 1E+15
--------------------	-------	-----------------

For XY waveforms created in floating-point mode, HVPOSITION sets the graphical position of the horizontal component of the waveform.

ADJ4 HVP:-8.9E-6

HVSIZE:	<NRx>	1E-15 to 1E+15
----------------	-------	----------------

For XY waveforms created in floating-point mode, HVSIZE sets the graphical size of the horizontal component of the specified XY waveform.

ADJ4 HVS:4.5E-2

ADJtrace <ui> <link>:<arg> (cont.)

PANzoom:	ON OFF	
-----------------	-----------------	--

PANZOOM sets Pan/Zoom mode ON or OFF for the specified waveform. When PANZOOM is set to ON, you can horizontally magnify selected sections of a displayed waveform with ADJTRACE <ui> HMAG.

PANZOOM is always set to ON for stored or scalar waveforms and frequency domain (FFT) waveforms, but you cannot set it to ON for XY waveforms.

Note: To control Pan/Zoom mode for all waveforms, refer to the PZMODE command.

ADJ2 PAN:ON

TRSep:	<NRx>	-5.0 to +5.0
---------------	-------	--------------

For waveforms created in Integer mode, TRSEP (TRace SEParation) sets the window waveform separation in graticule divisions. The waveforms must have been created on the WIN1 or WIN2 time base, and cannot be XY waveforms.

ADJ3 TRS:-2.2

VPOsition:	<NRx>	-1E+15 to 1E+15
-------------------	-------	-----------------

For waveforms created in floating-point mode, VPOSITION sets the waveform vertical graphical position.

ADJ4 VPO:3.9E+2

VSize:	<NRx>	1E-15 to 1E+15
---------------	-------	----------------

For waveforms created in floating-point mode, VSIZE sets the waveform vertical graphical size.

ADJ4 VSI:4.5E-2

ADJtrace <ui> <link>:<arg> (cont.)

ADJTRACE? Query. ADJTRACE <ui> ? returns its links and arguments in the following order:

```
ADJTRACE <ui> PANZOOM: <arg>,
HMAG: <NR3>, HPOSITION: <NR1>,
HVPOSITION: <NR3>, HVSIZE: <NR3>,
TRSEP: <NR3>, VPOSITION: <NR3>,
VSIZE: <NR3>
```

ADJTRACE? returns the same information as ADJTRACE <ui> ? for all defined waveforms in low-to-high waveform order.

ADJTRACE? Predefined Link Responses: Several ADJTRACE <ui> links can only be set under restricted conditions (for example, you can only set VSIZE on a floating-point waveform), but you can query any link at any time. The restricted links return the following predefined values if you query them under conditions when they cannot be set:

ADJTRACE? Predefined Link Responses

Link	Response
HMAG	-1.0E+0
HPOSITION	1.0E+16
HVPOSITION	1.0E+16
HVSIZE	-1.0E+0
TRSEP	1.0E+16
VPOSITION	1.0E+16
VSIZE	-1.0E+0

ALTinkjet <link> : <arg>

External I/O Commands

ALTINKJET specifies printing parameters for HP Thinkjet and LaserJet printers operating in HP graphics mode.

Note: ALTINKJET does not support Thinkjet and LaserJet printers operating in Epson emulation mode.

DIR ection:	HOR iz VER t	
--------------------	------------------------------	--

DIRECTION selects the printing orientation. HORIZ prints rows left-to-right and top-to-bottom. VERT prints columns bottom-to-top and left-to-right.

ALT DIR:HOR

FORM at:	DRA ft HIR es RED uced	
-----------------	---	--

FORMAT selects the printing format. HIRES shows front panel intensified regions; DRAFT prints selected fields in reverse video. REDUCED is a quarter the size of DRAFT, but does not show intensified regions.

Note: Due to graphics imaging constraints on standard LaserJet printers, HIRES format may not generate a suitable copy on a standard LaserJet printer

ALT FORM:DRA

POR t:	CEN TRonics GPI b RS232	
---------------	--	--

PORT specifies the output port for the printer.

ALT POR:RS232

AUTOAcq <link>:<arg>

(Firmware v. 1.2 and above) Acquisition Commands

Use AUTOACQ to select waveforms to be acquired in repetitive single trigger mode or to be transferred over the bus using the REPCURVE command. AUTOACQ also controls memory wrap in repetitive single trigger acquisition.

TRAcce <ui>:	ON OFF	
---------------------------	-----------------	--

TRACE <ui> turns on or off the trace specified by the integer <ui>. At least one trace must be specified and at most four traces may be specified to start an automated acquisition.

AUTOA TRAC:ON

MEMWRap:	ON OFF	
-----------------	-----------------	--

When MEMWRAP is ON, waveforms acquired in repetitive single trigger mode are stored in a circular memory buffer. Available memory is allocated for repetitive single trigger acquisitions, and when memory is full, the oldest acquisitions are overwritten. Acquisition will continue until the digitizer is stopped, and the most recent acquisitions remain in memory.

When MEMWRAP is OFF, repetitive single trigger acquisition stops when memory is full or when the number of waveform records specified by NREPTRIG have been acquired.

AUTOA MEMW:ON

Query Note: AUTOACQ returns settings (ON or OFF) for defined traces only.

AUTOSet [*<link>* :] *<arg>*

Acquisition Commands

AUTOSET controls vertical and horizontal automatic ranging and positioning of input signals on the selected waveform for both acquired and stored waveforms. For acquired signals, the vertical size is set and the time base is adjusted. For stored waveforms, the display is scaled.

Note: When the Main time base is not triggered, you can only autose a Window waveform that has a parent Main waveform.

Firmware version 1.2 and above:

HORiz:	EDGE	PERiod	PULse	OFF	
---------------	-------------	---------------	--------------	------------	--

Firmware version 1.1 and below:

HORiz:	PERiod	OFF	
---------------	---------------	------------	--

HORIZ determines how Autoset affects the horizontal display of the input signal.

With HORIZ:EDGE, horizontal Autoset displays one edge of the input signal expanded in the center of the display. A rising edge is displayed when TRMAIN SLOPE is PLUS. A falling edge is displayed when TRMAIN SLOPE is MINUS.

EDGE is useful for preparing input signals for RISETIME? and FALLTIME? measurements.

With HORIZ:PERIOD, horizontal Autoset displays at least three complete waveform cycles.

PERIOD is useful for preparing input signals for DUTY?, FREQ?, MEAN?, PP?, PERIOD?, and RMS? measurements. (DUTY? is available only in firmware versions 1.2 and above.)

With HORIZ:PULSE, horizontal Autoset displays one pulse on the display; whether the pulse is positive-going or negative-going is set by TRMAIN SLOPE.

PULSE is useful for preparing input signals for WIDTH? measurements.

AUTOS. HOR:PER

AUTOSet [*<link>*:] *<arg>* (cont.)

	START	
--	--------------	--

Set Only. START autosets the selected waveform. If no waveform is selected, the DSA samples all channels and autosets the first signal it encounters.

Autoset completion is signaled with event code 464, "Autoset complete."

AUTOS STAR

	UNDO	
--	-------------	--

Set Only. UNDO cancels a previous Autoset and returns to the settings in effect before the last AUTOSSET START command.

AUTOS UNDO

VERT:	ECL PP TTL OFF
--------------	-----------------------------

VERT controls how Autoset affects the vertical sensitivity (gain) and offset of the input signal.

With VERT:ECL, vertical Autoset is set to ON and the vertical and trigger settings are preset to ECL logic levels.

With VERT:PP, vertical Autoset is set to ON and the channel sensitivity and gain are set to display four to nine divisions of peak-to-peak amplitude; centered on the average value.

With VERT:TTL, vertical Autoset is set to ON and the vertical and trigger settings are preset to TTL logic levels.

VERT:OFF turns off vertical Autoset.

AUTOS VER:ECL

AUTOSet [*<link > :*] *<arg >*

Acquisition Commands

AUTOSET controls vertical and horizontal automatic ranging and positioning of input signals on the selected waveform for both acquired and stored waveforms. For acquired signals, the vertical size is set and the time base is adjusted. For stored waveforms, the display is scaled.

Note: When the Main time base is not triggered, you can only autose a Window waveform that has a parent Main waveform.

Firmware version 1.2 and above:

HORIZ:	EDGE PERIOD PULSE OFF	
---------------	------------------------------	--

Firmware version 1.1 and below:

HORIZ:	PERIOD OFF	
---------------	-------------------	--

HORIZ determines how Autoset affects the horizontal display of the input signal.

With HORIZ:EDGE, horizontal Autoset displays one edge of the input signal expanded in the center of the display. A rising edge is displayed when TRMAIN SLOPE is PLUS. A falling edge is displayed when TRMAIN SLOPE is MINUS.

EDGE is useful for preparing input signals for RISETIME? and FALLTIME? measurements.

With HORIZ:PERIOD, horizontal Autoset displays at least three complete waveform cycles.

PERIOD is useful for preparing input signals for DUTY?, FREQ?, MEAN?, PP?, PERIOD?, and RMS? measurements. (DUTY? is available only in firmware versions 1.2 and above.)

With HORIZ:PULSE, horizontal Autoset displays one pulse on the display; whether the pulse is positive-going or negative-going is set by TRMAIN SLOPE.

PULSE is useful for preparing input signals for WIDTH? measurements.

AUTOS HOR:PER

AUTOSet [*<link>*:]*<arg>* (cont.)

	START	
--	--------------	--

Set Only. START autosets the selected waveform. If no waveform is selected, the DSA samples all channels and autosets the first signal it encounters.

Autoset completion is signaled with event code 464, "Autoset complete."

AUTOS STAR

	UNDO	
--	-------------	--

Set Only. UNDO cancels a previous Autoset and returns to the settings in effect before the last AUTOSSET START command.

AUTOS UNDO

VERT:	ECL PP TTL OFF	
--------------	-----------------------------	--

VERT controls how Autoset affects the vertical sensitivity (gain) and offset of the Input signal.

With VERT:ECL, vertical Autoset is set to ON and the vertical and trigger settings are preset to ECL logic levels.

With VERT:PP, vertical Autoset is set to ON and the channel sensitivity and gain are set to display four to nine divisions of peak-to-peak amplitude; centered on the average value.

With VERT:TTL, vertical Autoset is set to ON and the vertical and trigger settings are preset to TTL logic levels.

VERT:OFF turns off vertical Autoset.

AUTOS VER:ECL

AVG {ON|OFF}

Acquisition Commands

AVG sets averaging ON or OFF for the vertical expression component (< y exp >) of the waveform description of the selected waveform. (For YT waveforms, < y exp > defines the waveform, for example, L1. For complete < y exp > syntax, see the TRACE command.)

- When < y exp > is *not* enclosed with ENV and AVG is set to ON, < y exp > is enclosed with AVG().
- When < y exp > is enclosed with ENV and AVG is set to ON, AVG() replaces ENV().
- When < y exp > is enclosed with AVG() and AVG is set to OFF, the enclosing AVG() is removed.

Note: You cannot set AVG OFF when < y exp > is not enclosed with AVG(). You cannot set AVG to ON if the selected waveform is XY or has only stored and/or scalar components.

Examples Using AVG

< y exp >	Before	Command	< y exp > After
L2		AVG ON	AVG(L2)
L1		AVG OFF	-error-
ENV(C1-C2)		AVG ON	AVG(C1-C2)
AVG(R1)		AVG OFF	R1
AVG(C4)		AVG ON	AVG(AVG(C4))

Query Note: AVG? returns the state of averaging for the entire < y exp >. AVG ON means the entire < y exp > is enclosed by AVG. AVG OFF means the entire < y exp > is not enclosed, although an AVG function may be embedded within the description.

B

BASeline <NRx>

Measurement Commands

	<NRx>	(Any legal value)
--	-------	-------------------

The BASELINE command sets the vertical baseline level for measurements.

For firmware version 1.2 and above, BASELINE sets the baseline level when MTRACK (measurement tracking) is set to OFF or TOPLINE. BASELINE is ignored when MTRACK is set to BOTH or BASELINE.

For firmware version 1.1 and below, BASELINE sets the baseline level when MTRACK is set to OFF.

BAS -8,SE-1

BITMap <link> : <arg>

External I/O Commands

BITMAP specifies printing parameters for screen captures, in which data from the front panel display is processed by an external computer. Screen capture data include a title block and a pixel block.

BITMAP Title Block. The title block contains three ASCII strings terminated by new line characters. The first string includes the DSA's instrument name, time and date, and the serial number. The second line contains the number of pixels per raster line. The third line gives the number of raster lines.

When BITMAP DATAFORMAT is set to BINARY, the title block is terminated with an ASCII NULL character following the third new line character.

When BITMAP DATAFORMAT is set to BINHEX, the title block is terminated with the third new line character.

BITMAP Pixel Block. The pixel block is a stream of data bytes. The DATACOMPRESS and DATAFORMAT links determine the format (data compression scheme).

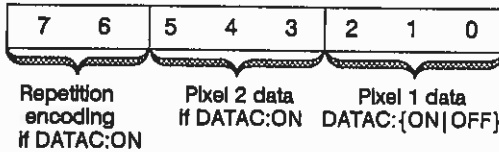
BITMap <link>:<arg> (cont.)

DATACompress:	ON OFF	
----------------------	-----------------	--

DATACOMPRESS specifies the pixel block data compression mode. When OFF, each byte contains one 3-bit pixel value in the three least-significant bits. When ON, each byte contains two 3-bit pixel values, with the first pixel in the least-significant three bits (see the illustration below). Also, when DATACOMPRESS is set to ON, the two most-significant bits in the byte encode the data repetition pattern, which is discussed below.

BITM DATA:ON

Pixel Block Data Byte. The following figure shows the bits in a pixel block data byte:

*Bits in a Pixel Block Data Byte*

Repetition Encoding. The table below lists the binary repetition encoding in bits 7 and 6 of the pixel data byte.

Data Repetition Encoding

Bit 7	Bit 6	Meaning
0	0	Following byte(s) contain repetition count
0	1	Data pattern repeats once
1	0	Data pattern repeats twice
1	1	Data pattern repeats three times

When bits 7 and 6 encode the values 1 (01), 2 (10), or 3 (11), the pixel data is repeated one, two, or three times, respectively.

When bits 7 and 6 have the value 0 (00), the next one or two data bytes contain the repetition count. If the next byte has the decimal value 4 to 255, that is the pattern repetition count. If the next byte has the decimal value 1 to 3, these are the high-order bits of a 10-bit repetition count and the following byte contains the lower eight bits.

BITMap <link>:<arg> (cont.)

Pixel Data Byte Examples. Here are some examples of pixel data bytes with BITMAP DAC: ON. The data that result are shown to the right.

Data Bytes	Resulting Pixel Values
01011101	5,3
10001010	2,1,2,1
11010101	5,2,5,2,5,2

Repetition Encoding in One Byte

In these examples, the first byte produces one repetition of data 5,3; the second byte produces two repetitions of 2,1; the third byte produces three repetitions of 5,2.

Data Bytes	Resulting Pixel Values
00111111	7,7,7,7,7,7,7,7,7,7,7,7,7,7,7,7
00001010	

Repetition Encoding in Two Bytes

In this example, the first byte contains data 7,7 and repetition encoding of 0 to find the repetition count in the next byte. The second byte contains the repetition count of 10.

Data Bytes	Resulting Pixel Values
00101101	5,5,5,5,5,5,5,5,5... (260 more 5,5 pairs)
00000001	
00001001	

Repetition Encoding in Three Bytes

In this example, the first byte contains data 5,5 and repetition encoding of 0 to find the repetition count in the next byte. The second byte has the value 1, which means it contains the two high-order bits of a 10-bit repetition value. The third byte contains the lower eight bits, for a repetition count of 265.

DATAFormat:	BINARY BINHex
--------------------	------------------------

DATAFORMAT specifies the pixel block data format. BINARY data are output in a stream without delimiters. BINHEX data are output as ASCII hexadecimal bytes and each raster line is terminated with a new line character.

BITM:DATAF:BIN

BITMap <link>:<arg> (cont.)

DIR ection:	HOR iz VER t	
--------------------	------------------------------	--

DIRECTION selects the printing orientation. **HORIZ** prints rows left to right and from top to bottom. **VERT** prints columns bottom to top and from left to right.

BITM DIR:HOR

FORM at:	DIT hered DRA ft HIR es RED uced SCR een	
-----------------	--	--

FORMAT selects print formatting. **DITHERED** reduces saturation for icon and text backgrounds to improve print contrast for the TEK4692 and TEK 4696 printers. **HIRES** dithers icon and text backgrounds and increases foreground saturation to improve contrast for monochrome printers with limited gray-scale capability. **DRAFT** prints black-on-white background except for selected icons or text which are printed white-on-black background. **REDUCED** prints black-on-white background only. **SCREEN** is a one-to-one mapping of 3-bit pixel information.

BITM FORM:DIT

PORT :	CEN TRonics GPI b RS232	
---------------	--	--

PORT specifies the output port for the printer.

BITM POR:GPI

BYT.or {**LSB**|**MSB**}

Data Transfer Commands

BYT.OR selects whether the least significant byte (LSB) or most significant byte (MSB) of binary waveform (<bblock>) data is transmitted first during a CURVE data transfer. Power-on default is MSB; LSB has a faster data transfer rate. Correct byte order depends on the controller.

BYT. LSB

C

CALibrator <link>:<arg>

Miscellaneous/System Commands

CALIBRATOR controls the front panel calibrator output signal.

AMPLitude:	<NRx>	(See below for range)
-------------------	-------	-----------------------

AMPLITUDE selects the amplitude of the calibrator square wave signal, depending on the value of the CALIBRATOR FREQ link. When FREQ is 0 Hz, you can set the AMPLITUDE to a DC level. When FREQ is 1 kHz or 1 MHz, AMPLITUDE is forced to a +5 V or +0.5 V square wave, respectively.

AMPLITUDE Range

FREQ	AMPLITUDE Value
0 Hz	-10.000 V to +9.9951 V (DC level)
1 kHz	+5 V (0 to +5 V square wave)
1.024 MHz	+0.5 V (0 to +0.5 V square wave)

CALIAMPL:5

FREQ:	<NRx>	0, 1.0E+3, 1.024E+6
--------------	-------	---------------------

FREQ selects the frequency of the square wave calibrator output: 0 Hz, 1 kHz, or 1.024 MHz.

CALI FREQ:1000

? IMPedance	50 450
--------------------	----------

IMPEDANCE returns the output Impedance in ohms. The IMPEDANCE response depends on the CALIBRATOR FREQUENCY. IMPEDANCE returns 50 when FREQUENCY is 1 MHz; it returns 450 when FREQUENCY is 0 Hz or 1 kHz.

CALI? IMP <EOI>
CALI IMP:50

CALProbe <link>:<arg>

Calibration/Enhanced Accuracy Commands

CALPROBE initiates the probe calibration routine. The routine includes probe calibration, deskew, and an optional probe compensation adjustment.

Successful completion of probe calibration is signaled with event code 475, "Probe calibration completed and passed."

FULL:	<slot> <ui>	
--------------	-------------	--

FULL provides a pause in the calibration routine for manual probe compensation adjustment. When you have completed the probe compensation adjustment, touch the front panel display to terminate the CALPROBE routine.

CALP FULL:R2

SHORT:	<slot> <ui>	
---------------	-------------	--

SHORT does not pause in the calibration routine for manual probe compensation adjustment. The routine terminates after providing probe calibration and deskewing.

CALP SHO:C4

CALStatus?

Calibration/Enhanced Accuracy Commands

Query **Only**. CALSTATUS? returns the calibration (accuracy) status of the DSA. Possible responses are: NENHANCED (the DSA is in normal accuracy state while warming up), ENHANCED (the DSA is in Enhanced Accuracy state after warming up), or NEWCONFIG (a new plug-in unit has been installed and is warming up).

CALS?
CALSTATUS ENHANCED

CALTempdelta?

Calibration/Enhanced Accuracy Commands

Query Only. CALTEMPDELTA? returns the change of temperature in degrees Celsius from the last calibration.

```
CAL? <EOI>
CAL 3.0E+0
```

CCAlconstants <ui>:<NRx>

Calibration/Enhanced Accuracy Commands

CCALCONSTANTS sets or queries the calibration constants of the center plug-in unit.

Note: You can only set CCALCONSTANTS when an internal jumper has been installed by a qualified service person.

<ui>:	<NRx>	(Any legal value)
-------	-------	-------------------

<ui> is the constant (range is plug-in unit specific) and <NRx> is the value of the constant.

```
CCA? 33
CCALCONSTANTS 33:5.003517E-2
```

CH <slot> <ui> <link>:<arg>

Channel/Vertical Commands

CH <slot> <ui> sets channel vertical parameters of the plug-in units.

11A33 Amplifier Considerations. The IMPEDANCE, SENSITIVITY, MNSCOUPLING, PLSCOUPLING, and PROTECT links of the 11A33 differential amplifier affect one another. Modifying one of these links may change the value of another. If a link is changed, no warning message is issued. Refer to the link entries for examples.

Level 2 TekProbe. In some cases, attaching a Level 2 TekProbe to an input channel may cause a plug-in unit to reject coupling or impedance values that are normally valid. See the appropriate plug-in unit *User Reference Supplement* for information.

CH <slot> <ui> <link>:<arg> (cont.)

The following three links affect the *bandwidth* of all amplifiers. (Refer also to the FILTER command.)

Note: Plug-in units that support the BW link do not support BWHI or BWLO, and vice versa.

BW:	<NRx>	(Range depends on plug-in)
------------	-------	----------------------------

BW sets the channel bandwidth. Out-of-range values are forced to acceptable maximum or minimum values; no warning message is returned.

```
CHC1 BW:20000000
```

BWHI:	<NRx>	(Range depends on plug-in)
--------------	-------	----------------------------

BWHI sets the high bandwidth of a channel. This link is only valid for plug-in units with BWHI function. Out-of-range values are forced to acceptable values; no warning message is returned.

```
CHC1 BWH:1.0E+9
```

BWLO:	<NRx>	(Range depends on plug-in)
--------------	-------	----------------------------

BWLO sets the low bandwidth of a channel. This link is only valid for plug-in units with BWLO function. Out-of-range values are forced to acceptable values; no warning message is returned.

```
CHC1 BW:20E+6
```

CH <slot> <ui> <link>:<arg> (cont.)

The following three links affect all amplifiers:

IMPedance:	<NRx>	50, 1E+6, 1E+9
-------------------	-------	----------------

IMPEDANCE sets the channel input impedance in ohms. Out-of-range values are forced to acceptable values; no warning message is given.

11A33 Amplifier Note: When PROTECT is set to ON or when either MNSCOUPLING or PLSCOUPLING is set to AC, 1 G Ω is not allowed. (IMPEDANCE is forced to 1 M Ω .)

CH12 IMP:1E6

SENSitivity:	<NRx>	1E-3 V to 10 V † 10E-3 V to 1 V ††
---------------------	-------	---------------------------------------

SENSITIVITY sets the channel vertical size.

† Range for 11A32, 11A33, 11A34, 11A52 amplifiers. Refer to the appropriate plug-in unit *User Reference Supplement* for the resolution (step size).

†† Range for 11A71 and 11A72 amplifiers in 1-2-5 steps.

For the **SENSITIVITY** range and step size of other plug-in units, refer to the appropriate *User Reference Supplement*.

11A33 Amplifier Notes: When PROTECT is set to ON, the **SENSITIVITY** range is restricted to 100E-3 V to 10 V. (Values below 100 mV are forced to 100 mV.)

When PROTECT is set to OFF, neither MNSCOUPLING or PLSCOUPLING is set to AC, and **SENSITIVITY** is between 100 mV and 10 V; changing **IMPEDANCE** to 1 G Ω then changes **SENSITIVITY** to 99.5 mV.

CH12 SEN:2

CH <slot> <ui> <link>:<arg> (cont.)

? UNIts	<qstring>
---------	-----------

Query Only. UNITS returns the units of the channel.

```
CHL2? UNI
CHL2 UNITS:"VOLTS"
```

The following three links affect *nondifferential amplifiers* (for example, the 11A32, 11A52, and 11A71 Amplifiers) only:

COUplng:	AC DC OFF	
----------	---------------	--

COUPLING selects the channel input coupling.

```
CHL1 COU:DC
```

OFFSet:	<NRx>	(See below for range)
---------	-------	-----------------------

OFFSET sets the voltage to be subtracted from the input signal, to vertically position the signal on the display.

The OFFSET range for 11A32, 11A34, and 11A52 Amplifiers depends on the SENSITIVITY setting:

OFFSET Range for 11A32, 11A34, & 11A52

SENSITIVITY Range	OFFSET Range
1E-3 V to 99.5E-3 V	-1 V to +1 V
100E-3 V to 995E-3 V	-10 V to +10 V
1 V to 10 V	-100 V to +100 V

OFFSET range for 11A71 Amplifier uses the SENSITIVITY value of the appropriate channel (CH <slot> <ui> ? SEN):

$$\text{range} = -10 * (\text{SEN}) \text{ to } +10 * (\text{SEN})$$

OFFSET range for 11A72 Amplifier uses the SENSITIVITY value of the appropriate channel (CH <slot> <ui> ? SEN):

$$\text{range} = -25 * (\text{SEN}) \text{ to } +25 * (\text{SEN})$$

CH <slot> <ui> <link>:<arg> (cont.)

For the OFFSET range of other plug-in units, see the applicable *User Reference Supplement*.

```
CH1:OFFS:-0.9
```

? PROBE	<qstring>
---------	-----------

Query Only. PROBE returns the type of probe currently connected to the specified channel: "Level 1", "Level 2/<probe type>/<serial number>", or "NONE".

```
CH1?PROB
CH1:PROBE:"LEVEL 2/P6231/B011623"
```

The following 10 links affect *differential amplifiers* (for example, the 11A33 Amplifier) only:

AMPOffset:	<NRx>	(See plug-in manual)
------------	-------	----------------------

AMPOFFSET sets the voltage to be subtracted from the input signal, after the plus and minus differential input signals have been subtracted from each other. AMPOFFSET vertically positions the signal on the display.

```
CH1:AMP:1.0
```

MNSCoupling:	AC DC VC OFF	
--------------	--------------------	--

MNSCOUPLING sets the minus input coupling of the specified channel. When this link is set to OFF or VC (voltage comparator), the specified minus input is internally disconnected from its external signal source. (Refer to the CH<slot> <ui> VCOFFSET link.)

11A33 Amplifier Note: When MNSCOUPLING is set to AC, IMPEDANCE is restricted to 50 Ω or 1 M Ω .

```
CH1:MNSC:AC
```

CH <slot> <ui> <link>:<arg> (cont.)

MNSOffset:	<NRx>	(See plug-in manual)
------------	-------	----------------------

MNSOFFSET sets the probe offset voltage that will be subtracted from the minus input of the specified channel. MNSOFFSET requires an offset-type Level 2 probe (such as a Tek P6231). If a non-offset-type probe is attached, the MNSOFFSET value is saved, and applied later when an appropriate probe is connected.

CHR1 MNSO:-3.4

? MNSProbe	<qstring>
------------	-----------

Query Only. MNSPROBE returns the type of probe currently connected to the minus input: "Level 1", "Level 2/ <probe type> / <serial number>" or "NONE".

CHR1? MNSP
CHR1 MNSPROBE:"LEVEL 1"

OFFSet:	<NRx>	(See plug-in manual)
---------	-------	----------------------

The differential OFFSET link modifies the AMPOFFSET, MNSOFFSET, PLSOFFSET, or VCOFFSET links, depending on coupling and probes. Refer to the appropriate plug-in unit *User Reference Supplement* for more information.

CHR1 OFFS:0.4

PLSCoupling:	AC DC VC OFF
--------------	--------------------

PLSCOUPLING sets the plus input coupling of the specified channel. When set to OFF or VC (voltage comparator), the specified plus input is internally disconnected from its external signal source. (Refer to the CH VCOFFSET link.)

11A33 Amplifier Note: When PLSCOUPLING is set to AC, IMPEDANCE is restricted to 50 Ω or 1 M Ω .

CHR1 PLSC:AC

CH <slot> <ui> <link>:<arg> (cont.)

PLSO ffset:	<NRx>	
--------------------	-------	--

PLSOFFSET sets the probe offset voltage that is subtracted from the plus input of the specified channel. PLSOFFSET requires an offset-type Level 2 probe (such as a Tek P6231). If a non-offset-type probe is attached, the PLSOFFSET value is saved and applied later when an appropriate probe is connected.

CHR1 PLSO:2.1

? PLSP robe	<qstring>	
--------------------	-----------	--

Query Only. PLSPROBE returns the type of probe currently connected to the plus input of the channel: "Level 1", "Level 2/<probe type>/<serial number>" or "NONE".

CHR1? PLSP
CHR1 PLSPROBE "NONE"

PRO Tect:	ON OFF	
------------------	----------	--

PROTECT restricts the SENSITIVITY and IMPEDANCE settings of an 11A33 Amplifier. When PROTECT is set to ON, the SENSITIVITY range is 100 mV to 10 V and IMPEDANCE is restricted to 50 Ω (active probe) or 1 M Ω (passive probe). When PROTECT is set to OFF, the normal ranges apply without restrictions.

CHR1 PROT:ON

VCO ffset:	<NRx>	
-------------------	-------	--

When either PLSCOUPLING or MNSCOUPLING is set to VC, VCOFFSET sets an internal comparison voltage; VCOffset has no other effect.

CHR1 VCO:-1.5

CH <slot> <ui> <link>:<arg> (cont.)

Query Notes: CH <slot> <ui>? returns links and arguments for the specified channel, depending on the plug-in unit. (Plug-in units that support BWHI/BWLO return these in place of the BW link.)

A non-differential amplifier returns these links:

```
CH <slot> <ui> COUPLING <arg>,
  OFFSET: <NR3>, BW: <NR3>,
  IMPEDANCE: <NR3>, PROBE: <qstring>,
  SENSITIVITY: <NR3>, UNITS: <qstring>
```

A differential amplifier returns these links:

```
CH <slot> <ui> MNSCOUPLING: <arg>,
  PLSCOUPLING: <arg>, PROTECT: <arg>,
  OFFSET: <NR3>, AMPOFFSET: <NR3>,
  BW: <NR3>, IMPEDANCE: <NR3>,
  MNSOFFSET: <NR3>, MNSPROBE: <qstring>,
  PLSOFFSET: <NR3>, PLSPROBE: <qstring>,
  SENSITIVITY: <NR3>, UNITS: <qstring>,
  VCOFFSET: <NR3>
```

CH <slot>? returns the same information as CH <slot> <ui>?, for all channels in the specified <slot> in low-to-high numeric order.

CH? returns the same information as CH <slot> <ui>?, for all channels in low-to-high numeric order and in L, C, R <slot> sequence.

CHSkew?

Calibration/Enhanced Accuracy Commands

Query Only. CHSKEW? returns the measured skew (time delay) values in seconds for each channel that is included on a waveform description.

CHS?

```
CHSKEW C1:0.0E+0,0.1:0.0E+0
```

CLEAR {ALL | <qstring> | TRACE <ui> }

Waveform and Settings Commands

Set Only. CLEAR discards acquired data for ALL displayed waveforms, the specified labeled waveform, or for the specified waveform. (Refer also to the REMOVE command.)

ALL <qstring> TRACE <ui>	1 to 8
---	--------

No error is reported for sending CLEAR ALL when no waveforms are defined. Wildcard characters are valid with <qstring>. (Refer to Label Wildcard Characters on page 84 for wildcard definitions.)

CLEAR TRACE**COLOR <ui> <link> : <arg>**

Display and Color Commands

COLOR <ui> controls the front panel colors. The <ui> range is 0 to 7, and specifies the color index.

For firmware version 1.2 and above, the meaning of the color indexes depends on the color system, Standard or Original, selected. Use the COLORMAP command to select the color system.

For firmware versions below 1.2, only the Original color system applies.

Color Indexes—Original System

<ui>	Color Specified
0	Background
1	Graticule
2	Unselected Main waveform
3	Selectable field
4	Selected Main waveform
5	Unselected Window waveform
6	Selected Window waveform
7	Cursors and Measurement bars

COLOR <ui> <link>:<arg> (cont.)

Color Indexes—Standard System †

<ui>	Color Specified
0	Background
1	Waveform Color1
2	Waveform Color2
3	Waveform Color3
4	Waveform Color4
5	Window waveforms
6	Graticule and Selectors
7	Cursors and Measurement Annotation

† Firmware version 1.2 and above.

Note: Refer to the *Tektronix Color Standard HLS* coordinate system for the definitions of hue, saturation, and lightness.

	DEFAULT	
--	---------	--

DEFAULT sets the factory default hue, lightness, and saturation for the specified color.

COL1:DEFA

HUE:	<NRx>	0 to 360 degrees
------	-------	------------------

HUE sets the hue of the specified color.

COL4:HUE:120

LIGHTNESS:	<NRx>	0 to 100 percent
------------	-------	------------------

LIGHTNESS sets the lightness of the specified color.

COL4:LIG:30

SATURATION:	<NRx>	0 to 100 percent
-------------	-------	------------------

SATURATION selects the saturation of the specified color.

COL4:SAT:80

COLor DEFAULT

Display and Color Commands

COLOR DEFAULT sets all colors in the display to their factory-default values.

```
COL:DEFA
```

COLORMap <link> : <arg>

(Firmware v. 1.2 and above)

Display and Color
Commands

The **COLORMAP** command selects the display color system (the color model).

SYSTEM:	ORIGINAL	STANDARD
---------	----------	----------

In the **STANDARD** color system, colors are assigned on a waveform basis and the selected waveform is brightened on the screen. The **TRACE <ui>** link, described below, assigns colors to waveforms in this system.

In the **ORIGINAL** color system, colors are assigned on a functional basis. That is, the selected main waveform has a different color from unselected waveforms, and the selected window waveform has a different color from unselected window waveforms.

```
COLORM SYS:STAN
```

TRACE <ui> :	COLOR <ui>
--------------	------------

TRACE <ui> assigns a color to the specified trace. The four available colors have numbers 1, 2, 3, and 4. Any of these colors may be assigned to any of the eight possible traces.

```
COLORM TRA1:COL4
```

COMpare {ON|OFF}

Measurement Commands

COMPARE controls the measurement comparison mode. When COMPARE is set to OFF, a measurement query returns the value of the measurement followed by an accuracy qualifier. COMPARE OFF is the normal measurement mode. When COMPARE is set to ON, a measurement query compares the measurement value with a reference value set with the REFSET command, and then returns the difference with an accuracy qualifier. If the reference measurement is undefined or the measurement qualifier is UN (uncertain), the returned comparison qualifier is also UN.

Note: For the list of measurement accuracy qualifiers and their definitions, refer to page 88.

COM ON

CONDacq <link>:<arg>

Acquisition Commands

CONDACQ sets the following conditions for waveform acquisition: completion of a specified condition, continuous acquisition, acquisition on a single trigger, or acquisition on a specified number of triggers.

Completion of any conditional acquisition TYPE (i.e., all types except CONTINUOUS) is signaled by event code 450, "Conditional acquire complete."

FIL:	<NRx>	1 to 100 percent
-------------	-------	------------------

FILL sets the percentage of waveform record completion for CONDACQ TYPE:FILL.

COND FIL:80

CONDacq <link>:<arg> (cont.)

? REMAining	<NR1>
-------------	-------

Query Only. REMAINING returns a value indicating how much of the selected acquisition TYPE must still be acquired to complete acquisition.

REMAINING Meanings for CONDACQ TYPE

TYPE	Meaning
AVG	Number of averages remaining
BOTH	Number of averages and envelopes remaining
CONTINUOUS	Not meaningful; always returns 0
DELTA	Not meaningful; always returns 0
ENV	Number of envelopes remaining
FILL	Percentage of fill remaining
REPTRIG	Number of repetitive triggers remaining in count
SEQUENCE	Not meaningful; always returns 0
SINGLE	Not meaningful; always returns 0

Note: When conditional acquisition is complete and the digitizer has stopped, the REMAINING query always returns 0 (zero).

```
COND? REMA
CONDACQ REMAINING:22
```

TRIGGER:	MAIn WINdow
----------	---------------

TRIGGER selects the trigger used when TYPE is set to SINGLE, SEQUENCE, or REPTRIG.

```
COND TRI:WIN
```

CONDacq <link>:<arg> (cont.)

TYPE:	AVG BOTH CONTInuous DELTA ENV FILL REPtrig SEquence SINgle
--------------	---

TYPE selects the acquisition type, as follows:

Acquisition Types

TYPE	Meaning
AVG	Acquires NAVG number of averages for all waveforms that include AVG in their description.
BOTH	Acquires NAVG number of averages or NENV number of envelopes for all waveforms that include either AVG and ENV in their description.
CONTINUOUS	Acquires continuously until halted with DIGITIZER STOP.
DELTA	Acquires until the delta condition is met. Needs DIGITIZER RUN to start acquisition.
ENV	Acquires NENV number of envelopes for all waveforms that include ENV in their description.
FILL	Acquires a waveform record to the percentage set by CONDACQ FILL.
REPTRIG	Acquires and stores NREP number of waveforms. Each acquisition requires a valid trigger. Needs DIGITIZER RUN to start.
SEQUENCE	Acquires a single trigger for all defined waveforms. Needs DIGITIZER RUN to start acquisition.
SINGLE	Acquires on a single trigger from the selected time base. Needs DIGITIZER RUN to start.

Note: Setting TYPE to AVG, BOTH, CONTINUOUS, ENV, or FILL starts acquisition.

COND TYP:ENV

CONFIg?

Status and Event Commands

Query Only. CONFIG? returns information on which types of plug-in units are installed. If a compartment is empty, CONFIG? returns "N/7K".

```
CONF?
CONFIG LEFT:"11A32",CENTER:
"11A71",RIGHT:"N/7K"
```

COPy [<link>:] <arg>

External I/O Commands

COPY sends a copy of the front panel display to the port specified in the appropriate printer command.

	ABORT	
--	-------	--

Set Only. ABORT terminates the hardcopy output in process and clears the queue of copy requests.

```
COP ABQ
```

FORMAT:	DIThered DRAft HIRes REDUced SCReen
---------	--

Set Only. COPY FORMAT selects the output format for the currently selected printer.

DITHERED Improves print contrast for TEK4692 and TEK4696 printers by reducing saturation for icon and text backgrounds. HIRES improves contrast for monochrome printers with limited gray-scale capability by dithering icon and text backgrounds and increasing saturation of the foregrounds. DRAFT prints black-on-white background except for selected icons or text, which are printed white-on-black background. REDUCED is a quarter-size version of DRAFT and prints black-on-white background only. SCREEN is a one-to-one mapping of 3-bit pixel information. (Refer to the BITMAP command.)

CONDacq <link>:<arg> (cont.)

TYPE:	AVG BOTH CONTInuous DELTa ENV FILl REPRig SEQuence SINGle
--------------	--

TYPE selects the acquisition type, as follows:

Acquisition Types

TYPE	Meaning
AVG	Acquires NAVG number of averages for all waveforms that include AVG in their description.
BOTH	Acquires NAVG number of averages or NENV number of envelopes for all waveforms that include either AVG and ENV in their description.
CONTINUOUS	Acquires continuously until halted with DIGITIZER STOP.
DELTA	Acquires until the delta condition is met. Needs DIGITIZER RUN to start acquisition.
ENV	Acquires NENV number of envelopes for all waveforms that include ENV in their description.
FILL	Acquires a waveform record to the percentage set by CONDACQ FILL.
REPTRIG	Acquires and stores NREP number of waveforms. Each acquisition requires a valid trigger. Needs DIGITIZER RUN to start.
SEQUENCE	Acquires a single trigger for all defined waveforms. Needs DIGITIZER RUN to start acquisition.
SINGLE	Acquires on a single trigger from the selected time base. Needs DIGITIZER RUN to start.

Note: Setting TYPE to AVG, BOTH, CONTINUOUS, ENV, or FILL starts acquisition.

COND TYP:ENV

CONFIg?

Status and Event Commands

Query Only. CONFIG? returns information on which types of plug-in units are installed. If a compartment is empty, CONFIG? returns "N/7K".

```
CONF?
CONFIG LEFT:"11A32",CENTER:
"11A71",RIGHT:"N/7K"
```

COPY [*<link>* :] *<arg>*

External I/O Commands

COPY sends a copy of the front panel display to the port specified in the appropriate printer command.

	ABORT	
--	--------------	--

Set Only. ABORT terminates the hardcopy output in process and clears the queue of copy requests.

```
COPY ABO
```

FORMat:	DIThered DRAFT HIRes REDUced SCReen
----------------	---

Set Only. COPY FORMAT selects the output format for the currently selected printer.

DITHERED Improves print contrast for TEK4692 and TEK4696 printers by reducing saturation for icon and text backgrounds. **HIRES** improves contrast for monochrome printers with limited gray-scale capability by dithering icon and text backgrounds and increasing saturation of the foregrounds. **DRAFT** prints black-on-white background except for selected icons or text, which are printed white-on-black background. **REDUCED** is a quarter-size version of DRAFT and prints black-on-white background only. **SCREEN** is a one-to-one mapping of 3-bit pixel information. (Refer to the BITMAP command.)

COPY [*<link>*:] *<arg>* (cont.)

Note: The COPY FORMAT link is included for compatibility with the 11401 and 11402 Oscilloscopes. For new applications, use the FORMAT link of the appropriate printer command.

COPY FORMAT:HPGL

Printer:	ALTIinkjet BITMap HPGL PIN8 PIN24 TEK4692 TEK4696
-----------------	--

PRINTER selects the target printer. Refer to the individual printer commands to select the printer parameters.

COPY PRINTER:TEK4696

[START]

Set Only. COPY START initiates a front panel copy, spooling the data into memory even if another copy request is printing or spooling.

Note: If you enter COPY with no argument when no other copy request is printing or spooling, a copy is started. However, if a copy request is spooling, entering COPY aborts the spooling copy and does not initiate a copy.

COPY STATUS

? STATUS	ABORTING IDLE PRINTING SPOOLING
----------	--

Query Only. STATUS returns the printing status of front-panel copies. IDLE means no copies are printing or spooling; ABORTING, PRINTING, and SPOOLING are self-explanatory.

COPY STATUS:IDLE

CROss?

Measurement Commands

Query Only. CROSS? returns the time from the trigger point to a specified reference level crossing, followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.) The reference level is set with the REFLEVEL command. The crossing slope is set with the MSLOPE command.

```
CRO?
CROSS 6.9284065E-8,EQ
```

CURSor <link>:<arg>

Cursor Commands

CURSOR sets cursor operating characteristics for the selected trace, such as the cursor type (dot or bar), the reference cursor, and whether front panel readouts are displayed.

READout:	ON OFF	
----------	----------	--

READOUT controls whether front panel cursors and their corresponding knob readouts are displayed and active from the front panel. When READOUT is set to OFF, the cursors and their values in the Cursors menu are not displayed. However, cursors can be set or queried with remote commands regardless of READOUT setting.

Note: When FPUUPDATE is set to NEVER, setting CURSOR READOUT to ON displays the cursors but not their readouts.

```
CURS REA:ON
```

CURSOR <link> :<arg> (cont.)

REFERENCE:	TRAcE <ui>	1 to 8
-------------------	-------------------------	--------

REFERENCE selects the reference waveform for split cursors. When the specified REFERENCE waveform is not the selected waveform, the CURSOR TYPE is automatically set to SPLIT. When the CURSOR TYPE is set to PAIRED, the REFERENCE waveform is set to the selected waveform. The default REFERENCE for a newly-created waveform is itself.

XY Note: You cannot change the REFERENCE waveform for an XY waveform.

Note: It is not an error if you specify a REFERENCE waveform that is not yet defined. The REFERENCE waveform is only checked when CURSOR READOUT is set ON or at a DOT2ABS? query. If the REFERENCE waveform is then undefined, it is changed to the selected waveform.

CURS REFE:TRAS

TYPE:	PAIred SPLit VBArs HBArs
--------------	---------------------------------------

TYPE selects the cursor type. Setting the TYPE to PAIRED automatically sets the REFERENCE waveform to the selected waveform.

XY Note: SPLIT cursors are not permitted on XY waveforms.

CURS TYP:VBA

? XUNIT	AMPS DEGrees DIVS HERTz OHMs SEConds VOLts WATts
----------------	---

Query Only. XUNIT returns the horizontal units of the selected waveform.

**CURS? XUN
CURSOR XUNIT:SECONDS**

CURSOr <link>:<arg> (cont.)

? YUNIT	AMPS DB DEGrees DIVS OHMs VOLts WATts
---------	--

Query Only. YUNIT returns the vertical units of the selected waveform.

```
CURS? YUN
CURSOR YUNITVOLTS
```

CURVe <curve data>

Data Transfer Commands

CURVE transfers unscaled waveform data to and from the controller in binary or ASCII format. Each waveform that is transferred has an associated waveform preamble that contains information such as scaling factors and the number of data points transferred. Refer to the WFMPRE command for the waveform preamble.

The *query* form retrieves data from the DSA. The data source is specified by the OUTPUT command. The entire CURVE? response can be sent back to the DSA as a set command.

The *set* form sends data to the DSA from the controller. An incoming waveform is always stored; it is never active or acquired. The STO (store) location for the data is specified by the INPUT command. The power-on default INPUT location is STO1.

<curve data>

<Curve data> can be in ASCII (<asc curve>) or binary (<bblock>) format. The format is set by the ENCDG WAVFRM command.

The following example is an excerpt from an ASCII-formatted data transfer. (The shortest data transfer contains 512 points.)

```
CURV?
CURVE 4022,3130,2756,1297,709,1073,822,6
85,1112,777,1666,2249,3615,4180,4231,4113,98
8,-2241,-5609,-128,-3076,-9924,-8434,-8112,
```

CURVE <curve data> (cont.)

ASCII Transfer. Data transferred as an <asc curve> use the following format:

<asc curve> ::= <NR1> [,<NR1>] ...

where <NR1> values are data points within the range -32768 to +32767.

For most YT waveforms, each <NR1> value represents one data point in the waveform record. For enveloped YT waveforms, every two <NR1> values represent one min/max pair in the waveform record. For XY waveforms, every two consecutive <NR1> values represents one X,Y coordinate pair in the waveform record. (The X-coordinate is the first point in the pair.)

Binary Transfer. Data transferred as a binary block (<bblock> [, <bblock>]) use the format:

<bblock> ::= %<byte cnt> <bin pt> ... <checksum>

where <byte cnt> is a two-byte binary integer (MSB first) giving the length in bytes of the remainder of the binary block, including checksum; <bin pt> is a two-byte binary data point in the range -32768 to +32767; <checksum> is an 8-bit, twos complement of the modulo 256 sum of <byte cnt> and all <bin pt> data.

The transmission order for data points is set by the BYT.OR command. There are no separators (such as commas) between data points.

The figure on the following page illustrates binary data transfer.

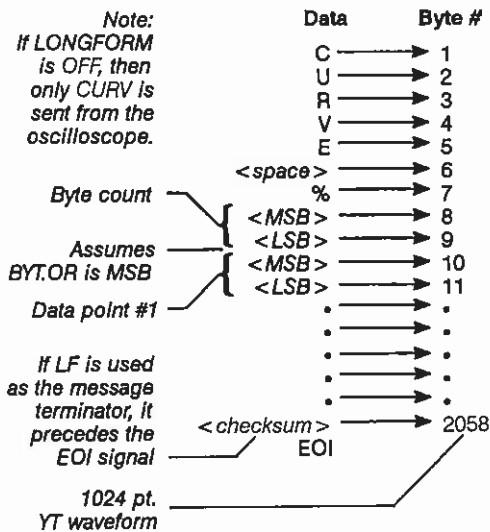
Predefined CURVE? Data Values. The following data point values are predefined for CURVE?:

Predefined CURVE? Data Values

Data Value	Meaning
+32767	Vertical Overage. Data point is high off-screen and cannot be displayed with current scaling parameters.
-32767	Vertical Underrange. Data point is low off-screen and cannot be displayed with current scaling parameters.
-32768	Null Data. Data point that has not been acquired.

CURVe <curve data> (cont.)

The figure below illustrates binary data transfer:



Binary Data Transfer

Waveform Scaling. CURVE transfers unscaled waveform data which must be scaled in order to be analyzed. The following formulas use values from the waveform preamble (see the WFMPRE command) to scale the coordinate values of each point transferred.

There are two scaling formulas for YT waveforms:

$$X_n = XZERO + XINCR * n$$

$$Y_n = YZERO + YMULT * data_pt_n$$

where X_n is the scaled horizontal coordinate of the n th data point in XUNITS; Y_n is the scaled vertical coordinate of the n th data point in YUNITS; XZERO, XINCR, YZERO, and YMULT are values from the WFMPRE command; n is the sequence number of the n th retrieved data point (range is 0 to WFMPRE NR.PT - 1); $data_pt_n$ is the value of the n th unscaled point (as retrieved by CURVE?).

CURVe <curve data> (cont.)

There are two scaling formulas for XY waveforms:

$$X_n = XZERO + XMULT * data_pt_nx$$

$$Y_n = YZERO + YMULT * data_pt_ny$$

where X_n is the scaled X-coordinate of the n th unscaled X,Y pair in XUNITS; Y_n is the scaled Y-coordinate of the n th unscaled X,Y pair in YUNITS; XZERO, XMULT, YZERO, and YMULT are values from the WFMPRE command; *data_pt_nx* is the value of the n th unscaled X-coordinate (as retrieved by CURVE?); *data_pt_ny* is the value of the n th unscaled Y-coordinate.

Sending a Waveform Without a Preamble. It is possible to send a waveform to the DSA without supplying a preamble. If a stored waveform exists at the INPUT STO location, it is overwritten and its preamble is used with the new waveform. If no stored waveform exists at the INPUT STO location, the following default preamble is used with the new waveform:

Default Preamble Parameters

<i><link></i> : <i><arg></i>	<i><link></i> : <i><arg></i>
ACSTATE: ENHANCED	YUNIT: VOLTS
NR.PT: 1024	YZERO: 0.0
PT.FMT: Y	LABEL: "" (null)
XINCR: 5.0E-7	TIME: -current-
XZERO: 0.0	DATE: -current-
YMULT: 1.5625E-4	

These are the power-on default values. When any of these links are modified (set) with the WFMPRE command, the new values are used.

D

DAInt {**SINGLE**|**WHOLE**}

Measurement Commands

DAINT sets the data measurement interval to a SINGLE period of the waveform or to the WHOLE measurement interval set by the LMZONE and RMZONE commands.

DAINT affects the MEAN?, RMS?, YTENERGY?, YTMNS_AREA?, and YTPLS_AREA? measurements. These measurements return an ER qualifier if DAIINT is set to SINGLE and no period can be found.

Note: The measurement qualifiers are defined on page 88.

DAI WHO

DATE < *qstring* >

Miscellaneous/System Commands

DATE sets the date on the internal calendar.

< <i>qstring</i> >	< <i>dd</i> > _ < <i>mon</i> > _ < <i>yy</i> >
--------------------	--

where < *dd* > is the day of the month, < *mon* > is the first three letters of the month, and < *yy* > is the last two digits of the year.

DATE '24-DEC-88'

DEBug <link>:<arg>

External I/O Commands

DEBUG copies input data from the specified interface to the front panel display for program development troubleshooting. The incoming ASCII commands are displayed on the top four lines of the screen.

Note: Setting DEBUG to ON for either Interface slows system throughput considerably.

GPIB:	ON OFF	
--------------	-----------------	--

GPIB sets DEBUG to ON or OFF for the GPIB Interface.

```
DEB GPIB:OFF
```

RS232:	ON OFF	
---------------	-----------------	--

RS232 sets DEBUG to ON or OFF for the RS-232-C Interface.

```
DEB RS232:ON
```

DEF <qstring> , <qstring>

Miscellaneous/System Commands

Set Only. DEF defines a logical name to substitute for a DSA command string.

	<qstring> , <qstring>	
--	-----------------------	--

The first <qstring> is the logical name; the second <qstring> is the expansion command string that is executed.

```
DEF 'TR?' , 'TBM?;TBW?'
```

Once the logical name has been defined with DEF, you enter the logical name without quotes the same as any other command.

```
TR?
TBM:MAIN TIME:5.0E-3,LENGTH:1024,
XINCR:1.0E-10,TBWIN TIME:1.0E-3,
LENGTH:512,XINCR:5.0E-10
```

DEF <qstring> , <qstring> (cont.)

DEF Usage. Here are some rules and suggestions for using DEF:

- The first character of the logical name must be alphabetic. Case is ignored.
- You cannot use logical names in <qstring> input.
- You cannot have an expansion string that is null (i.e., ''). Also, the first character of an expansion string cannot be any of the following six characters:

Restricted Expansion String Characters

Character	Character
colon (:)	space (octal 40)
comma (,)	linefeed (octal 12)
semicolon (;)	carriage return (octal 15)

- You can define a short name for a group of concatenated commands, or you can rename a command to one or two letters. However, do not redefine the single characters L, C, or R. These characters represent the plug-in compartments in various commands. If L, C, or R are redefined, the commands that contain them will always return a syntax error.
- Recursive DEF logical names are acceptable only when recursion occurs to the right of an unquoted semicolon. All other recursive definitions are illegal.

Acceptable and Illegal Recursion

Acceptable Recursion	Illegal Recursion
DEF 'z', 'ibmain?;z'	DEF 'z', 'z?'
DEF 'j', 'abstouch 3,10;j'	DEF 'j', 'text j'

Note: A valid recursive logical name causes an infinite command processing loop. Thus, once a recursive logical name is transmitted, the DSA will not respond to command input until a DCL (Device Clear) signal is sent to the port that received the recursive logical name. (Refer also to the FEOI command.)

Note: Logical names and expansion strings are not stored in nonvolatile RAM. Therefore they are lost when the DSA is powered off.

DEF <qstring> , <qstring> (cont.)

Predefined Logical Names. Each time the DSA is turned on, the following two logical names are automatically placed in the definition table:

Predefined Logical Names

Logical Name	Expansion String
e	RS232 ECHO:ON
v	RS232 VERBOSE:ON

DELAY?

Measurement Commands

Query Only. DELAY? returns the time between the first and last MESIAL crossing of a waveform within the measurement zone, followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.)

```
DELAY?
DELAY 1.954E-6.BQ
```

DELeTe [<link> :] <arg>

Waveform and Settings Commands

Set Only. DELETE removes stored front panel setting(s) or stored waveforms from memory.

Note: You cannot delete a stored waveform that is a combined component of an active waveform. (However, you can delete a stored waveform if it is the only component of an active waveform.)

ALL:	FPS STO	
-------------	------------------	--

Set Only. ALL:FPS deletes all stored front panel settings. ALL:STO deletes all stored waveforms. It is not an error to issue DEL ALL:FPS or DEL ALL:STO when no settings or waveforms are stored.

```
DEL ALL:STO
```

DELEte [*<link>*:]*<arg>* (cont.)

	FPS <i><ui></i>	1 to 20
--	------------------------------	---------

Set Only. FPS*<ui>* deletes the specified front panel setting.

```
DEL FPS2
```

	<i><qstring></i>	
--	------------------------	--

Set Only. *<qstring>* deletes the stored waveform or front panel setting that matches the label. Wildcard characters are interpreted; refer to page 84 for wildcard definitions. If the label matches both a stored waveform and a front panel setting, the stored waveform is deleted. To delete the labeled front panel setting, you must send DELETE *<qstring>* again. (You cannot delete only the labeled FPS label when both the stored waveform label and FPS match.)

```
DEL "TRIGGER39"
```

	STO <i><ui></i>	1 to 455 or 1 to 918 †
--	------------------------------	------------------------

Set Only. STO*<ui>* deletes the specified stored waveform.

† The range is 1 to 918 with Option 4C, Nonvolatile RAM, installed.

```
DEL STO150
```

DELTA <link> : <arg>

Acquisition Commands

Not Available with Option 3C, Acquisition Memory External Power Input. DELTA compares an acquired (test) waveform against an enveloped reference waveform. If specified conditions are met (e.g., the required number of points occur outside the reference envelope), a delta condition occurs and specified actions are performed. Possible actions include sounding a beep, making a hardcopy of the display, signaling the GPIB SRQ line, or saving the acquired waveform as a stored waveform.

CHIME:	ON OFF	
---------------	-----------------	--

CHIME determines whether the DSA beeps when a delta event occurs.

DELT CHI:OFF

CONSEpts:	<NRx>	(See below)
------------------	-------	-------------

CONSEPTS selects the number of consecutive points of the test waveform that fall outside the reference waveform envelope that must be acquired for a delta event to occur. Both CONSEPTS and DELTA TOTALPTS must be satisfied for the event to occur. The range is 1 to the record LENGTH of the test waveform.

DELT CONS:10

COPY:	ON OFF	
--------------	-----------------	--

COPY selects whether a hardcopy of the current display and menus is spooled to the printer when a delta event occurs. If DELTA COPY and DELTA REPEAT are both set to ON, the digitizer is re-armed before the copy is spooled. However, subsequent delta events will not result in a hardcopy until the previous hardcopy has finished spooling.

DELT COP:ON

DELTA <link>:<arg> (cont.)

DE Scription:	<qstring>	(Syntax below)
----------------------	-----------	----------------

DESCRIPTION defines the delta comparison, in the form:

WFM<ui> OUTSIDE {WFM<ui>|STO<ui>}

where WFM<ui> is a defined acquired waveform (normally referred to in the form TRACE <ui>); and OUTSIDE is the keyword for delta comparison. The first WFM <ui> is the test trace and the second WFM <ui> or STO <ui> is the reference waveform.

DELTA DES:WFM6 OUTSIDE STO55'

RE peat:	ON OFF	
-----------------	----------	--

REPEAT selects whether the DSA halts after the first delta event or if it performs the specified action(s) and re-arms the digitizer. If **REPEAT** is set to ON, the DSA continues to test for delta conditions until **REPEAT** is set OFF or it receives **DIGITIZER STOP**, or the front panel **DIGITIZER** button is pressed.

DELTA REP:OFF

SA ve:	ON OFF	
---------------	----------	--

SAVE selects whether to save the acquisition that caused the delta event as a stored waveform. If **SAVE** is set to ON, the waveform is labeled using a base label and an index with a time and date stamp. (Refer to the **LABEL** command.)

DELTA SAV:ON

DELTA <link> : <arg>

Acquisition Commands

Not Available with Option 3C, Acquisition Memory External Power Input. DELTA compares an acquired (test) waveform against an enveloped reference waveform. If specified conditions are met (e.g., the required number of points occur outside the reference envelope), a delta condition occurs and specified actions are performed. Possible actions include sounding a beep, making a hardcopy of the display, signaling the GPIB SRQ line, or saving the acquired waveform as a stored waveform.

CHIME:	ON OFF	
---------------	-----------------	--

CHIME determines whether the DSA beeps when a delta event occurs.

DELT CH:OFF

CONSecpts:	<NRx>	(See below)
-------------------	-------	-------------

CONSECPTS selects the number of consecutive points of the test waveform that fall outside the reference waveform envelope that must be acquired for a delta event to occur. Both CONSECPTS and DELTA TOTALPTS must be satisfied for the event to occur. The range is 1 to the record LENGTH of the test waveform.

DELT CONS:10

COPY:	ON OFF	
--------------	-----------------	--

COPY selects whether a hardcopy of the current display and menus is spooled to the printer when a delta event occurs. If DELTA COPY and DELTA REPEAT are both set to ON, the digitizer is re-armed before the copy is spooled. However, subsequent delta events will not result in a hardcopy until the previous hardcopy has finished spooling.

DELT COP:ON

DELTA <link>:<arg> (cont.)

DE Scription:	<qstring>	(Syntax below)
----------------------	-----------	----------------

DESCRIPTION defines the delta comparison, in the form:

WFM<ui> OUTSIDE {WFM<ui>|STO<ui>}

where WFM<ui> is a defined acquired waveform (normally referred to in the form TRACE<ui>); and OUTSIDE is the keyword for delta comparison. The first WFM<ui> is the test trace and the second WFM<ui> or STO<ui> is the reference waveform.

DELTA DES: WFM6 OUTSIDE STO55'

RE peat:	ON OFF	
-----------------	----------	--

REPEAT selects whether the DSA halts after the first delta event or if it performs the specified action(s) and re-arms the digitizer. If REPEAT is set to ON, the DSA continues to test for delta conditions until REPEAT is set OFF or it receives DIGITIZER STOP, or the front panel DIGITIZER button is pressed.

DELTA REP:OFF

SA ve:	ON OFF	
---------------	----------	--

SAVE selects whether to save the acquisition that caused the delta event as a stored waveform. If SAVE is set to ON, the waveform is labeled using a base label and an index with a time and date stamp. (Refer to the LABEL command.)

DELTA SAV:ON

DELTA <link>:<arg> (cont.)

SRQ:	ON OFF	
-------------	-----------------	--

SRQ selects whether the SRQ line is signaled for a delta event. SRQMASK OPCMPL must be set to ON for SRQ to be transmitted. To set SRQ to OFF, DELTA REPEAT should be set to ON.

DELT SRQ:OFF

TOTALpts:	<NRx>	(See below)
------------------	--------------------	-------------

TOTALPTS specifies the total number of points to be acquired for a delta event; both CON-SECPTS and TOTALPTS must be satisfied for the delta event to occur. The range is 1 to the record LENGTH of the test waveform.

DELT TOT:100

DIAG?

Diagnostics Commands

Query Only. DIAG? returns pass/fail information from Self-tests Diagnostics or Extended Diagnostics. Power-on Diagnostics are always performed unless bypassed with hardware jumpers. DIAG? returns pass/fail/bypassed information and a list of the tests which were not performed.

The passing DIAG? response is:

```
DIAG PASSED: "{NONE | <omitted test >}"
```

where:

NONE means no tests were omitted
<omitted test > is a comma-delimited list of tests that were not performed because of missing (optional) hardware

```
DIAG?  
DIAG PASSED: "NONE"
```

The failing DIAG? response is:

```
DIAG FAILED: "{ <failed test > | <omitted test > }"
```

where:

<failed test > is a comma-delimited list of tests that failed diagnostics

```
DIAG?  
DIAG FAILED: "DI62X,DI22X,R????"
```

Note: The DIAG? FAILED response can include both failed and omitted tests. In the preceding example, DI62X and DI22X are failed tests and R???? is an omitted test.

Refer to the *DSA 601 and DSA 602 Service Reference* for information on the syntax and meaning of omitted tests and failed tests.

The bypassed test DIAG? response is:

```
DIAG BYPASSED
```

where:

BYPASSED means Self-tests Diagnostics were bypassed with hardware jumpers at power-on

```
DIAG?  
DIAG BYPASSED
```

DELTA *<link>*:*<arg>* (cont.)

SRQ:	ON OFF	
-------------	-----------------	--

SRQ selects whether the SRQ line is signaled for a delta event. SRQMASK OPCMPL must be set to ON for SRQ to be transmitted. To set SRQ to OFF, DELTA REPEAT should be set to ON.

DELT SRQ:OFF

TOTALpts:	<i><NRx></i>	(See below)
------------------	--------------------	-------------

TOTALPTS specifies the total number of points to be acquired for a delta event; both CONSECPTS and TOTALPTS must be satisfied for the delta event to occur. The range is 1 to the record LENGTH of the test waveform.

DELT TOT:100

DIAG?

Diagnostics Commands

Query Only. DIAG? returns pass/fail information from Self-tests Diagnostics or Extended Diagnostics. Power-on Diagnostics are always performed unless bypassed with hardware jumpers. DIAG? returns pass/fail/bypassed information and a list of the tests which were not performed.

The passing DIAG? response is:

```
DIAG PASSED:"{NONE| <omitted test >}"
```

where:

NONE means no tests were omitted
 <omitted test > is a comma-delimited list of tests that were not performed because of missing (optional) hardware

```
DIAG?  
DIAG PASSED:"NONE"
```

The failing DIAG? response is:

```
DIAG FAILED:"{ <failed test > | <omitted test >}"
```

where:

<failed test > is a comma-delimited list of tests that failed diagnostics

```
DIAG?  
DIAG FAILED:"DI62X,DI22X,R????"
```

Note: The DIAG? FAILED response can include both failed and omitted tests. In the preceding example, DI62X and DI22X are failed tests and R???? is an omitted test.

Refer to the *DSA 601 and DSA 602 Service Reference* for information on the syntax and meaning of omitted tests and failed tests.

The bypassed test DIAG? response is:

```
DIAG BYPASSED
```

where:

BYPASSED means Self-tests Diagnostics were bypassed with hardware jumpers at power-on

```
DIAG?  
DIAG BYPASSED
```

DIGitizer {ARMed|RUN|STOP}

Acquisition Commands

DIGITIZER starts and stops waveform acquisition (digitizing). At least one waveform must be defined and at least one component must be acquired. Both the RUN and ARMED arguments enable waveform acquisition. A DIGITIZER? query returns ARMED, if CONDACQ TYPE is set to SINGLE or SEQUENCE, and the DSA has received a DIGITIZER RUN or DIGITIZER ARMED command but has not yet received a trigger signal to begin acquisition.

DIG RUN**DISPlay <link>:<arg>**

Display and Color Commands

DISPLAY sets the number of graticules, the display intensity, and the display mode.

GRaticule:	DUAL SINGLE	
-------------------	----------------------	--

GRATICULE selects dual or single graticules.

DISP GRA:SIN

INTensity:	<NRx>	0 to 100 percent
-------------------	--------------------	-------------------------

INTENSITY sets the display intensity.

DISP INT:65

MODe:	DOTs VECtors	
--------------	-----------------------	--

MODE selects a DOTS or VECTORS type display. DOTS displays individual data points, while VECTORS connects adjacent data points.

Note: When more than 512 data points are acquired, the points are compressed to fit the 500-point scan line of the display. The largest and smallest adjacent vertical values are displayed as a single scan line connected with a vector. Thus to get a true dots display, you may need to set TBMAIN LENGTH or TBWIN LENGTH to 512.

DISP MOD:VEC

DISPlay *<link>*:*<arg>* (cont.)

Firmware version 1.2 and above:

PERS istence:	<i><NRx></i>	.2 to 30
----------------------	--------------------	----------

PERSISTENCE sets the persistence time for waveforms displayed in variable persistence mode (see the discussion of ACCUMULATE under the TRACE *<ui>* command). Persistence time is in seconds.

DISP PERS:15

DISTal <NRx>

Measurement Commands

	<NRx>	0 to 100 percent
--	-------	------------------

DISTAL sets the distal (furthest from origin) level used by RISETIME? and FALLTIME? measurements.

The DISTAL range is a percentage of the difference between the TOPLINE and BASELINE values.

DIST #5**DLYtrace TRACE** <ui>

Measurement Commands

DLYTRACE specifies the delayed waveform used with the PDELAY? measurement.

For firmware version 1.1 and below, this waveform is also used for the GAIN? and PHASE? measurements. For firmware version 1.2 and above, these measurements use a reference trace set by the REFTRACE command.

Each waveform has an associated delayed waveform; when you change the selected waveform, you may need to change the delayed waveform. Measurements are taken from the selected waveform to the delayed waveform. You cannot specify the selected waveform as the delayed waveform.

	TRACE <ui>	0 to 8
--	------------	--------

The valid <ui> *setting* range is 1 to 8. However, DLYTRACE? returns TRACE0 when fewer than two waveforms are displayed. You can send DLYTRACE TRACE0 to the DSA; it is ignored.

DLY TRA2

DLYtrace TRACE<ui> (cont.)

Changing Measurement Parameters on the Delayed Waveform. The GAIN?, PDELAY?, and PHASE? measurements return the difference between the currently selected waveform and the waveform selected with the DLYTRACE command. Every waveform has its own measurement parameters (e.g., MESIAL, LMZONE) which can be changed only when that waveform is the selected waveform. Therefore, use the following procedure if you need to change measurement parameters on the delayed waveform:

1. Use the SELECT command to make the delayed waveform the selected waveform.
2. Change the measurement parameters.
3. Use the SELECT command to reassign the correct selected waveform.

Here is an example of the entire process of taking a PDELAY measurement. Assume you want to measure PDELAY between TRACE2, the selected waveform, and TRACE4, its delayed waveform. The required MESIAL values are 40% and 45%, respectively.

```

SELECT TRACE2 /* Specify selected
                waveform */
MESIAL 40 /* Specify its mesial value */
DLYTRACE TRACE4 /* Specify its delayed
                 waveform */
SELECT TRACE4 /* Select TRACE4 to change
                its parameters */
MESIAL 45 /* Specify its mesial value */
SELECT TRACE2 /* Return to original selected
                waveform */
PDELAY? /* Measure PDELAY from
         TRACE2 to TRACE4 */

```

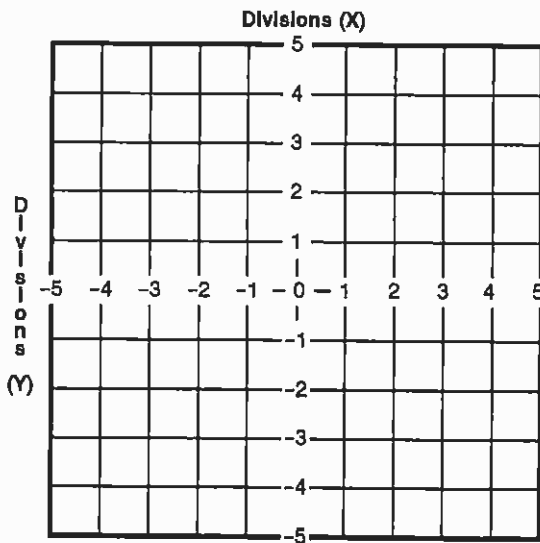
DOT1Abs <link>:<arg>;

DOT2Abs <link>:<arg>

Cursor Commands

DOT1ABS and DOT2ABS set absolute horizontal positions (with respect to the waveform record) for split or paired (dot) cursors. DOT1ABS and DOT2ABS have the same parameters.

The following figure illustrates the graticule coordinates:



Graticule X, Y Coordinates

PCTg:	<NRx>	0 to 100 percent
--------------	-------	------------------

PCTG positions the first or second dot cursor as a percentage of the waveform record.

XY Note: You can use only the PCTG link to position the cursors for XY waveforms. Attempting to use XCOORD or XDIV will give unpredictable results.

DOT2A PCT:10

DOT1Abs <link>:<arg>;**DOT2Abs** <link>:<arg> (cont.)

XCOord:	<NRx>	(See below for range)
----------------	-------	-----------------------

XCOORD positions the first or second dot cursor with respect to horizontal units of the selected waveform.

(The following range formulas assume ADJ-TRACE PANZOOM is set to OFF and the waveform is acquired. Refer to the cursor positioning discussion on page 63 for calculating XCOORD range when PANZOOM is set to ON or the waveform is unacquired. Refer to page 131 for formulas to calculate *duration*.)

XCOORD range when the selected waveform record is MAIN:

MAINPOS to (MAINPOS + *main_duration*)

XCOORD range when the selected waveform record is WIN1:

WIN1POS to (WIN1POS + *win_duration*)

XCOORD range when the selected waveform record is WIN2:

WIN2POS to (WIN2POS + *win_duration*)

DOT1A XCO:1.2E-2

DOT1Abs <link>:<arg>;

DOT2Abs <link>:<arg> (cont.)

XDIV:	<NRx>	(See below for range)
--------------	-------	-----------------------

XDIV positions the first or second dot cursor in graticule divisions (refer to the graticule illustration on page 59). Range depends on record (TBMAIN or TBWIN) LENGTH:

XDIV Ranges

Record LENGTH	XDIV Range
4096, 8192, or 16384	-5.12 to +3.07
32768	-5.12 to +1.42
Any other LENGTH	-5.12 to +5.10

These ranges are valid only when ADJTRACE PANZOOM is OFF and the selected waveform is acquired. (Refer to the Range of Cursor Positioning discussion on page 63 for calculating XCOORD range when PANZOOM is set to ON or the waveform is unacquired.)

DOT2A XDI:2.85

DOT1Abs <link>:<arg>;

DOT2Abs <link>:<arg> (cont.)

? XQUAL	EQ LT GT UN
---------	-------------------

Query Only. XQUAL returns the accuracy of XCOORD or XDIV positioning information. YT waveforms always return the EQ qualifier because the cursor horizontal position is always known.

Positioning Accuracy Qualifiers

Qualifier	Meaning
EQ	True position and response are equal
LT	True position is lower than response (i.e., the cursor is below the bottom of the screen)
GT	True position is greater than response (i.e., the cursor is above the top of the screen)
UN	True position is uncertain (i.e., the cursor is on an unacquired waveform point)

```
DOT1A? XQU
DOT1ABS XQUAL=EQ
```

? YCOORD	<NR3>
----------	-------

Query Only. YCOORD returns the vertical position of the first or second dot cursor, in units of the selected waveform.

```
DOT2A? YCO
DOT2ABS YCOORD=2.22E-4
```

? YDIV	<NR3>
--------	-------

Query Only. YDIV returns the vertical position of the first or second dot cursor in graticule divisions. (Refer to the graticule illustration on page 59.)

```
DOT1A? YDI
DOT1ABS YDIV=-1.4
```

DOT1Abs <link>:<arg>;

DOT2Abs <link>:<arg>

(cont.)

? YQUAL	EQ LT GT UN
---------	-------------------

Query Only. YQUAL returns the accuracy of YCOORD or YDIV positioning information. Refer to the description of the link DOT1ABS XQUAL for the meanings of the qualifiers.

```
DOT1A? YQU
DOT1ABS YQUAL:EQ
```

Range of Cursor Positioning. Under some circumstances, such as when PANZOOM is set to ON, you cannot conveniently compute the valid range of cursor positions. However, you can force the cursors to their minimum and maximum values (use the PCTG:0 and PCTG:100 links) and then query the DSA for the cursor positions. These new positions constitute the valid range of cursor positions for that particular DSA setup.

The following example demonstrates this technique. This method applies to both dot and bar cursors and is always successful, regardless of DSA settings.

```
DOT1A PCT:0
DOT2A PCT:100
DOT1A? XCO:DOT2A? XCO
DOT1ABS XCOORD:-6.0E-6;
DOT2ABS XCOORD:5.055E-4
```

DOT1Rel <link>:<arg> ;**DOT2Rel** <link>:<arg>

Cursor Commands

Set Only. DOT1REL and DOT2REL set the paired or split (dot) cursor position relative to (offset to the right of) the absolute cursor location. DOT1REL and DOT2REL have the same links.

PCTg:	<NRx>	(See DOT1A PCT range)
--------------	-------	-----------------------

Set Only. PCTG positions the first or second dot cursor as a percentage of the waveform record, relative to but not exceeding the DOT1ABS/DOT2ABS value.

DOT1R PCT:50

XCOord:	<NRx>	(See DOT1A XCO range)
----------------	-------	-----------------------

Set Only. XCOORD positions the first or second dot cursor with respect to the units of the selected waveform, relative to but not exceeding the DOT1ABS/DOT2ABS value.

DOT2 XCO:0.5

XDIv:	<NRx>	(See DOT1A XDI range)
--------------	-------	-----------------------

Set Only. XDIV positions the first or second cursor in graticule divisions with respect to the selected waveform, relative to but not exceeding the DOT1ABS/DOT2ABS value.

DOT2R XDI:2.85

DSYmenu?

Miscellaneous/System Commands

Query Only. DSYMENU? returns the major menu active on the front panel display.

CURSor	UTILITY1	ALL_wavfrm
MEAS	UTILITY2	WAVfrm
TRIGGER	STORE_recall	WFMSCAN

Possible DSYMENU? Responses

Note: ALL_WAVFRM is the paged waveform menu.

```
DSY?
DSYMENU CURSOR
```

DSYSTOFmt {HUNdredths|DATE}

(Firmware v. 1.2 and above)

Miscellaneous/System
Commands

DSYSTOFMT determines the format of the stored waveform timestamp. Both date and hundredths of seconds are recorded whenever a waveform is stored, but only one appears in the timestamp.

HUNDREDTHS selects hours, minutes, seconds, and hundredths of seconds. This is especially useful when a number of waveforms have been stored using repetitive single trigger or Act on Delta acquisition.

DATE selects hours, minutes, seconds, and date.

```
DSYSTOF HUN
```

Note: The DSYSTOFMT setting when the waveform was stored does not affect the available timestamp information, so either DATE or HUNDREDTHS may be selected at any time.

DSYSStod {ON|OFF}

(Firmware v. 1.1 and below)

Miscellaneous/System
Commands

DSYSTOD controls the display of stored waveform time and dates. When DSYSTOD is set to ON, the time and date strings are displayed.

```
DSYS ON
```

Note: For firmware versions 1.2 and above, DSYSTOD is ignored (display of stored waveform time and date cannot be turned off). The DSYSTOFMT command, which controls the format of the stored waveform timestamp, replaces this command.

DUTy?

(Firmware v. 1.2 and above)

Measurement Commands

Query Only. DUTY? returns the percentage of a period that a waveform spends above the MEASIAL level, followed by an accuracy qualifier. (See page 88 for qualifier definitions.)

```
DUTY?  
DUTY 3.071E+1,BQ
```


E

ENCdg <link>:<arg>

Data Transfer Commands

ENCDG determines the data encoding for information returned by CURVE?, WAVFRM?, and SET? queries.

SET:	ASCII BINary	
-------------	-----------------------	--

SET sets the encoding for front panel setting (FPS) transfers with the SET? query.

ENC SET:ASC

WAVfrm:	ASCII BINary	
----------------	-----------------------	--

WAVFRM sets the encoding for waveform transfers with the CURVE? and WAVFRM? queries.

ENC WAV:BIN

ENV {ON|OFF}

Acquisition Commands

ENV sets enveloping ON or OFF for the vertical expression component <y exp> (e.g., "L1") of the waveform description of the selected waveform. (Refer also to the TRACE and AVG commands.)

- When <y exp> is not enclosed with AVG and ENV is set to ON, <y exp> is enclosed with ENV().
- When <y exp> is enclosed with AVG and ENV is set to ON, ENV() replaces AVG().
- When <y exp> is enclosed with ENV() and ENV is set to OFF, the enclosing ENV() is removed.

ENV {ON|OFF}

(cont.)

Note: You cannot set ENV to OFF when the $\langle y \text{ exp} \rangle$ is not enclosed with ENV(). You cannot set ENV to ON if the selected waveform is XY or has only stored and/or scalar components.

Examples of ENV Usage

$\langle y \text{ exp} \rangle$	Before	Command	$\langle y \text{ exp} \rangle$	After
L2		ENV ON	ENV(L2)	
L1		ENV OFF	-error-	
AVG(C1-C2)		ENV ON	ENV(C1-C2)	
ENV(R1)		ENV OFF	R1	
ENV(C4)		ENV ON	ENV(ENV(C4))	

Query Note: ENV? returns the state of enveloping. ENV ON means the entire $\langle y \text{ exp} \rangle$ is enclosed by ENV. ENV OFF means the entire $\langle y \text{ exp} \rangle$ is not enclosed by ENV, though the ENV() function may be embedded within the description.

EVENT?

Status and Event Commands

Query Only. EVENT? returns the event code $\langle NR1 \rangle$ if LONGFORM is set to OFF, or returns the event code and a descriptive $\langle qstring \rangle$ if LONGFORM is set to ON.

Refer to Event Reporting, later in this manual, for a list of event codes.

EVENT?

EVENT 269, "NO SUCH TRACE"

E

ENCdg <link>:<arg>

Data Transfer Commands

ENCDG determines the data encoding for information returned by CURVE?, WAVFRM?, and SET? queries.

SET:	ASCLi BINary	
-------------	-----------------------	--

SET sets the encoding for front panel setting (FPS) transfers with the SET? query.

```
ENC SET:ASC
```

WAVfrm:	ASCLi BINary	
----------------	-----------------------	--

WAVFRM sets the encoding for waveform transfers with the CURVE? and WAVFRM? queries.

```
ENC WAV:BIN
```

ENV {ON|OFF}

Acquisition Commands

ENV sets enveloping ON or OFF for the vertical expression component <y exp> (e.g., "L1") of the waveform description of the selected waveform. (Refer also to the TRACE and AVG commands.)

- When <y exp> is not enclosed with AVG and ENV is set to ON, <y exp> is enclosed with ENV().
- When <y exp> is enclosed with AVG and ENV is set to ON, ENV() replaces AVG().
- When <y exp> is enclosed with ENV() and ENV is set to OFF, the enclosing ENV() is removed.

ENV {ON|OFF} (cont.)

Note: You cannot set ENV to OFF when the $\langle y \text{ exp} \rangle$ is not enclosed with ENV(). You cannot set ENV to ON if the selected waveform is XY or has only stored and/or scalar components.

Examples of ENV Usage

$\langle y \text{ exp} \rangle$	Before	Command	$\langle y \text{ exp} \rangle$	After
L2		ENV ON	ENV(L2)	
L1		ENV OFF	-error-	
AVG(C1-C2)		ENV ON	ENV(C1-C2)	
ENV(R1)		ENV OFF	R1	
ENV(C4)		ENV ON	ENV(ENV(C4))	

Query Note: ENV? returns the state of enveloping. ENV ON means the entire $\langle y \text{ exp} \rangle$ is enclosed by ENV. ENV OFF means the entire $\langle y \text{ exp} \rangle$ is not enclosed by ENV, though the ENV() function may be embedded within the description.

EVENT?

Status and Event Commands

Query Only. EVENT? returns the event code $\langle NR1 \rangle$ if LONGFORM is set to OFF, or returns the event code and a descriptive $\langle qstring \rangle$ if LONGFORM is set to ON.

Refer to Event Reporting, later in this manual, for a list of event codes.

EVENT?

EVENT 269, "NO SUCH TRACE"

E

ENCdg <link>:<arg>

Data Transfer Commands

ENCDG determines the data encoding for information returned by CURVE?, WAVFRM?, and SET? queries.

SET:	ASCIi BINary	
-------------	-----------------------	--

SET sets the encoding for front panel setting (FPS) transfers with the SET? query.

ENC SET:ASC

WAVfrm:	ASCIi BINary	
----------------	-----------------------	--

WAVFRM sets the encoding for waveform transfers with the CURVE? and WAVFRM? queries.

ENC WAV:BIN

ENV {ON|OFF}

Acquisition Commands

ENV sets enveloping ON or OFF for the vertical expression component <y exp> (e.g., "L1") of the waveform description of the selected waveform. (Refer also to the TRACE and AVG commands.)

- When <y exp> is not enclosed with AVG and ENV is set to ON, <y exp> is enclosed with ENV().
- When <y exp> is enclosed with AVG and ENV is set to ON, ENV() replaces AVG().
- When <y exp> is enclosed with ENV() and ENV is set to OFF, the enclosing ENV() is removed.

ENV {ON|OFF} (cont.)

Note: You cannot set ENV to OFF when the $\langle y \text{ exp} \rangle$ is not enclosed with ENV(). You cannot set ENV to ON if the selected waveform is XY or has only stored and/or scalar components.

Examples of ENV Usage

$\langle y \text{ exp} \rangle$	Before	Command	$\langle y \text{ exp} \rangle$	After
L2		ENV ON	ENV(L2)	
L1		ENV OFF	-error-	
AVG(C1-C2)		ENV ON	ENV(C1-C2)	
ENV(R1)		ENV OFF	R1	
ENV(C4)		ENV ON	ENV(ENV(C4))	

Query Note: ENV? returns the state of enveloping. ENV ON means the entire $\langle y \text{ exp} \rangle$ is enclosed by ENV. ENV OFF means the entire $\langle y \text{ exp} \rangle$ is not enclosed by ENV, though the ENV() function may be embedded within the description.

EVENT?

Status and Event Commands

Query Only. EVENT? returns the event code $\langle NR1 \rangle$ if LONGFORM is set to OFF, or returns the event code and a descriptive $\langle qstring \rangle$ if LONGFORM is set to ON.

Refer to Event Reporting, later in this manual, for a list of event codes.

EVENT?

EVENT 269, "NO SUCH TRACE"

FFT <link> : <arg>

Acquisition Commands
 This command is not Available with Option 3C, Acquisition Memory External Power Input. The FFT command controls the Fast Fourier Transform (FFT) parameters. The FFT function is part of the waveform description. (Refer to the TRACE DESCRIPTION command.)

AVG:	ON OFF
-------------	----------

AVG controls averaging of the FFT source. Averaging is applied to all FFT calculations (rather than on a per-waveform basis) and is done prior to the FFT calculation. FFT AVG does not affect the waveform description.

FFT AVG:ON

Format:	DBM Linear
----------------	--------------

FORMAT specifies the magnitude output format. DBM causes the FFT magnitude to be displayed in dB (decibel) units relative to 1 mW; i.e., a sine wave of 0.316 V_{peak} (0.224 V_{rms}) will give 1 mW into 50 Ω and will display an FFT magnitude of 0 dB. Signals of a lesser magnitude have a negative dB value. LINEAR causes display of the FFT magnitude in volts.

FFT FORM:LIN

WINDOW:	BLACKMAN BLHARTS HANNING HANNING RECTANGULAR TRIANGULAR
----------------	---

WINDOW specifies the window (or taper) used to remove the effects of time sampling. The algorithms associated with these windows are included in the DSA 601 and DSA 602 User Reference.

FFT WIND:BLH

FEO

Set Only. FEO forces the DSA to output a message terminator for any pending query response. (The message terminator for GPIB is an EOI sig- nal with or without LF; the message terminator for RS232 is the EOL string. Refer to the DSA 601 and DSA 602 Programmer Reference or to the RS232 command for the EOL options.) FEO is useful to force the output of a recursive query (created with the DEF command) onto individual lines.

Note: FEO has no argument.

Miscellaneous/System Commands

FEO!

FALLTIME 5.883E-9:BO

Query Only. FALLTIME? returns the transition time of a falling pulse edge, from the DISTAL to PROXIMAL level, followed by an accuracy qual- fier. (Refer to page 88 for qualifier definitions.)

Measurement Commands

FALLtime?



FILTER {ENABLE|DISABLE}

Acquisition Commands

FILTER controls anti-alias filter mode. When FILTER is set to ENABLE, the digitizer bandwidth is limited to approximately 100 MHz. When FILTER is set to DISABLE, the digitizer bandwidth is not limited. (Refer to the CH command to set the system bandwidth).

When FILTER is set to ENABLE, the following conditions are forced:

- Sample rate for a single-channel acquisition of <1 Gsamples/s for a DSA 601 or <2Gsamples/s for a DSA 602.
- Sample rate for three- and four-channel acquisitions of ≤ 500 M samples/s for a DSA 602.

FILT ENA

FPANEL {ON|OFF}

Miscellaneous/System Commands

FPANEL OFF functionally mimics the GPIB RWLS (Remote With Lockout State) and FPANEL ON mimics the GPIB LOCS (Local State).

When FPANEL is set to OFF, the front panel is locked out and only these controls are operable:

- RQS Icon, if it was enabled (displayed) with the SRQMASK USER:ON command. (The RQS Icon is not displayed at power on.) If enabled, you can disable the RQS Icon with SRQMASK USER:OFF.
- Probe ID button, if SRQMASK PROBE is set to ON. When FPANEL is set to OFF, the only effect of pressing the button is that event code 457 will be returned to both the GPIB and RS-232-C ports.

When FPANEL is set to ON, all front panel controls are operable, assuming the TOUCH PANEL ON/OFF button is set to ON.

The differences between the FPANEL command and the TOUCH PANEL ON/OFF button are:

- FPANEL provides a way to lock out active front panel controls (knobs, buttons, and screen touches) from the remote interfaces. There is no front panel equivalent to FPANEL.

FPanel {ON|OFF} (cont.)

- The TOUCH PANEL ON/OFF button only locks out screen touches. No command mimics the effect of this button. However, you can use the ABSTOUCH command to simulate a touch to this button from the remote interfaces.

```
FPA ON
```

FPSList?

Waveform and Settings Commands

Query Only. FPSLIST? returns a list of all front panel settings stored in nonvolatile RAM (NVRAM) identified by FPS number (1 to 20), sequence storage number (1 to 20), and the amount of NVRAM used. FPSL? returns EMPTY if no settings are stored.

```
FPS <ui>: <seq>, <bytes>... | EMPTY
```

```
FPSL?  
FPSLIST FPS2,1056,FPS52,979
```

FPSNum?

Waveform and Settings Commands

Query Only. Returns the number of front panel settings (FPS) stored in nonvolatile RAM, in <NR1> form. The range is 0 to 20.

```
FPSN?  
FPSNUM 2
```

FPUdate {ALWays|EMPTy|NEVer}

Miscellaneous Commands

FPUUPDATE determines whether the front panel display readouts are updated following set command execution. The power-on default is FPUUPDATE EMPTY.

When FPUUPDATE is set to ALWAYS, the front panel display is updated after each successful set command.

When FPUUPDATE is set to EMPTY, the front panel display is only updated when:

- The DSA receives DCL or SDC
- The DSA receives a syntactically or semantically incorrect query or set command
- The DSA input buffer is empty after a successful set or query execution.

When FPUUPDATE is set to NEVER, the front panel display is not updated until FPUUPDATE is changed to ALWAYS or EMPTY, or power is cycled off and on the DSA. (However, data will be written to the display by the DEBUG or TEXT commands.)

Note: Front panel controls function with FPUUPDATE ALWAYS or FPUUPDATE EMPTY, but do not function with FPUUPDATE NEVER.

Note: Command throughput is faster with FPUUPDATE set to EMPTY and is fastest with FPUUPDATE set to NEVER.

Firmware versions 1.2 and above also support the links ON and OFF. These links are included for compatibility with 11401 and 11402 oscilloscopes and will not be returned to a query. ON is equivalent to ALWAYS; OFF is equivalent to EMPTY.

FPU EMP

FREQ?

Measurement Commands

Query Only. FREQ? returns the frequency of the signal, followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.)

```
FREQ?  
FREQ 1.024E+6,EQ
```

G

GAIN?

Measurement Commands

Firmware version 1.2 and above:

Query Only. GAIN? returns the ratio of the peak-to-peak amplitude of the reference waveform to the peak-to-peak amplitude of the selected waveform; followed by an accuracy qualifier.

Firmware version 1.1 and above:

Query Only. GAIN? returns the ratio of the peak-to-peak amplitude of the selected waveform to the peak-to-peak amplitude of the delayed waveform; followed by an accuracy qualifier.

(Refer to page 88 for qualifier definitions.)

```
GAIN?  
GAIN 1.007E+0,EQ
```

H

H1Bar <link>:<arg>;

H2Bar <link>:<arg>

Cursor Commands

H1BAR and H2BAR sets the absolute vertical position of horizontal bar cursors. H1BAR and H2BAR have the same parameters.

YCOord:	<NRx>	(See below for range)
---------	-------	-----------------------

YCOORD positions the first or second horizontal bar cursor with respect to the units of the selected waveform. The range depends on whether the waveform was created in Integer mode or floating-point mode.

Note: For information on waveform modes, see the WFMSCALING command.

The YCOORD range for an integer mode waveform is:

$$(\text{SEN} * -5.12 + \text{OFFS}) \text{ to } (\text{SEN} * 5.10 + \text{OFFS})$$

where SEN and OFFS are the channel sensitivity and offset (CH <slot> <ui> ? SEN,OFFS) of the channel(s) in the integer mode waveform.

The YCOORD range for a floating-point mode waveform is:

$$(\text{VSI} * -5.12 + \text{VPO}) \text{ to } (\text{VSI} * 5.10 + \text{VPO})$$

where VSI and VPO are the vertical size and vertical position (ADJ <ui> ? VSI,VPO) of the floating-point waveform.

H2B YCO:0.75

YDIV:	<NRx>	-5.12 to +5.10
-------	-------	----------------

YDIV positions the first or second horizontal bar cursor in graticule divisions.

H1B YDI:-4.0

HPGL <link>:<arg>

External I/O Commands

HPGL specifies printing parameters for the Tek HC100 plotter or other devices that conform to the HPGL format.

COLOR <ui>:	<NRx>	(Range below)
--------------------	-------	---------------

COLOR<ui> assigns plotter pens to the DSA color index. Pen range (<NRx>) is 1 to 8. COLOR<ui> range is 0 to 7. Refer to page 32 for the color index.

Note: Assigning pen 0 to the color index means that color is not plotted (no pen is assigned).

```
HPG COL3:1
```

COLOR:	DEFAULT	
---------------	----------------	--

Set Only. COLOR:DEFAULT assigns the following default pens to the color index:

Default Plotter Pen Assignments

Color Index	Pen No.	Color Index	Pen No.
0	1	4	5
1	2	5	6
2	3	6	7
3	4	7	8

```
HPG COL:DEFA
```

HPGI <link>:<arg> (cont.)

FORMat:	DRAft HIRes SCReen
----------------	---

FORMAT selects the output format. HIRES plots the entire screen, including every waveform point. SCREEN plots the entire screen, but includes only the min/max point-pairs of each YT waveform column (XY and PA waveforms are not affected.) DRAFT is the same as SCREEN except the front panel status menu is not plotted.

Note: Pop-up menus are not plotted.

Note: Plotting PA (Point Accumulate) waveforms is very time-consuming and tends to wear down plotter pen points more rapidly than other types of plots.

HPG FORM:DRA

PORt:	CENTRonics GPIb RS232
--------------	--

PORT specifies the output port for the plotter.

HPG POR:CENTR

HSBatt?

Miscellaneous/System Commands

Query Only. HSBATT? returns the status of the Acquisition Memory External Power Input option. If the correct voltage is detected, the query returns ON. If the correct voltage is not detected, HSBATT? returns OFF. If the option is not installed, the query generates event code 222, "Option 3C, Acquisition Memory External Power Input needed to support that function."

HSB?
HSBATT ON

ID?

Status and Event Commands

Query Only. ID? returns identifying information about the DSA and its firmware, delimited by commas. The list contains the following items:

- The DSA model number
- TEK Codes & Formats version number
- Digitizer processor (DIG) firmware version
- Display processor (DSY) firmware version
- Executive processor (EXP) firmware version

```
ID TEK/DSA602,V81.1,DIG/<NR2>,  
DSY/<NR2> ,EXP/<NR2>
```

```
ID?  
ID TEK/DSA602,V81.1,DIG/1.0,DSY/1.0,  
EXP/1.0
```

IDProbe?

Status and Event Commands

Query Only. IDPROBE? returns the channel number (<slot> <ui>) of the last probe ID button pressed by the operator. IDPROBE? returns L0 if no probe ID button was pressed.

Note: IDPROBE? does not distinguish between the plus and minus probes of a differential amplifier.

```
IDP?  
IDPROBE C2
```


INCAcq {ENABLE|DISABLE}

Acquisition Commands

INCACQ controls incremental acquire mode of the digitizer. In addition to INCACQ set to ENABLE, Incremental acquire mode requires the following:

- No windows are being acquired
- Main time base is ≤ 2 ms/sample
- Total number of samples is ≤ 63 k for all acquired waveforms
- No calculated waveforms (e.g., L1*L2) are being acquired

INCA:ENA

INIt

Miscellaneous/System Commands

Set Only. INIT initializes the DSA to its factory-assigned default parameters and settings. Completion of INIT is signaled by event code 474, "INIT complete."

For both GPIB and RS-232-C, the defaults are:

- ABSTOUCH FIFO buffer is empty
- DEBUG is OFF
- IDPROBE button press is cleared
- SRQMASK USER is OFF; this removes the RQS icon if it was displayed
- All pending events except Power On are discarded
- All user TEXT is cleared from the display
- For GPIB only, RQS is set to ON

Note: INIT has no argument.

Refer to the *DSA 601 and DSA 602 User Reference* for a complete list of INIT effects.

INI

INPut {STO <ui> | <qstring> }

Data Transfer Commands

INPUT selects the destination for preamble and waveform data sent to the DSA by the WFMPRE and CURVE commands.

STO <ui> <qstring>	1 to 455 or 918†
---	-------------------------

The power-on default INPUT location is STO1. <qstring> is a label that identifies the stored waveform destination.

† The range is 1 to 918 when Option 4C, Nonvolatile RAM, is installed.

Query Note: INPUT? always returns STO <ui>, even if the location was specified with a label.

```
INP STO92
```

INTERleave {ENABLE|DISABLE}

Acquisition Commands

INTERLEAVE controls digitizer interleave mode. Interleave mode must be enabled to achieve a sample rate of 1 Gsamples/s for a DSA 601 or 2 Gsamples/s for a DSA 602. However, the sample rate is not *forced* to any specific rate; this mode only *allows* these rates to be attained when other conditions are met.

```
INTER ENA
```

L

LABAbs <link>:<arg>

Label and Text Commands

LABABS positions the label associated with the selected waveform.

PCTg:	<NRx>	0 to 100 percent
-------	-------	------------------

PCTG sets the horizontal position of the label as a percentage of the waveform record.

LABA PCT:50

XCOord:	<NRx>	(See below for range)
---------	-------	-----------------------

XCOORD sets the horizontal position of the label in horizontal units. The label maintains the specified position, tracking changes in the waveform.

(The following range formulas assume ADJ-TRACE PANZOOM is set to OFF and the waveform is acquired. Refer to the discussion on cursor positioning on page 63 for a method to calculate XCOORD range when PANZOOM is set to ON or the waveform is unacquired. Refer to page 131 for formulas to calculate *duration*.)

The XCOORD range when the selected waveform record is MAIN is calculated:

MAINPOS to (MAINPOS + *main_duration*)

The XCOORD range when the selected waveform record is WIN1 is calculated:

WIN1POS to (WIN1POS + *win_duration*)

The XCOORD range when the selected waveform record is WIN2 is calculated:

WIN2POS to (WIN2POS + *win_duration*)

LABA XCO:0,5

LABAbs <link>:<arg> (cont.)

YDiv:	<NRx>	-10.22 to +10.22
-------	-------	------------------

YDIV sets the vertical position of the label in divisions, relative to the point specified by the XCOORD link. The label maintains the specified vertical distance, tracking changes in the waveform.

LABA YDI:2.85

LABel <link>:<arg>

Label and Text Commands

LABEL defines and deletes labels, and controls label display.

BASELabel:	<qstring>	≤7 characters
------------	-----------	---------------

BASELABEL defines the base part of the label generated for stored waveforms created in Repetitive Trigger acquisition mode or through Act On Delta. (Refer to the CONDACQ and DELTA commands.) An index value is appended to this base label to form the full stored waveform label. Numerals are not permitted in BASELABEL.

LAB BASELA:TESTA

DElete:	ALL FPS[<ui>] <qstring> STO[<ui>] TRAcE[<ui>]
---------	--

Set Only. DELETE deletes labels for active waveforms, stored waveforms, stored settings, or ALL labels. Specifying FPS, STO, or TRACE with <ui> deletes the label associated with the specified argument. Specifying FPS, STO, or TRACE without <ui> deletes all labels associated with the argument type. Specifying <qstring> deletes that label. Wildcard characters are interpreted. (Refer to page 84 for wildcards.)

The range for FPS <ui> is 1 to 20; for STO <ui> is 1 to 455 (or 1 to 918 if Option 4C, Nonvolatile RAM, is installed); for TRAcE <ui> is 1 to 8.

LAB DEL:TRA2

LABel <link>:<arg> (cont.)

DISPlay:	ON OFF	
-----------------	-----------------	--

DISPLAY controls the display of labels associated with active waveforms. When DISPLAY is set to ON, labels are displayed. When DISPLAY is set to OFF, labels are not displayed but all labels are retained.

```
LAB DISP:ON
```

FPS <ui>:	<qstring>	≤10 characters
------------------	-----------	----------------

FPS <ui> defines a label for a stored front panel setting. The range for <ui> is 1 to 20.

```
LAB FPS1:SETUP1'
```

? NEXTRep	<qstring>	
------------------	-----------	--

Query Only. NEXTREP returns the value of the next label to be used by the Repetitive Trigger acquisition mode, or Act on Delta mode.

```
LAB? NEXTR
LAB NEXTREP:*TESTA20**
```

STO <ui>:	<qstring>	≤10 characters
------------------	-----------	----------------

STO <ui> defines the label for a stored waveform. The range for <ui> is 1 to 455 (or 1 to 918 if Option 4C, Nonvolatile RAM, is installed).

```
LAB STO1:DATA1'
```

TRAcE <ui>:	<qstring>	≤10 characters
--------------------	-----------	----------------

TRACE <ui> defines the label for an active waveform. The range for <ui> is 1 to 8.

```
LAB TRA1:CLOCK'
```

LABel <link>:<arg> (cont.)

Label Wildcard Characters. For some commands that take labels, the characters ? and * have a special meaning in a <qstring> when searching for a matching label. The ? will match any single character. The * will match any number (including 0) of any character. To search for a literal ? or *, use a backslash \ in front of the ? or *.

a?c	matches	abc, axc, a2c, aEc, etc.
rep1?	matches	rep11, rep12, rep1b, etc.
rep*	matches	rep, rep65, rep1a92, repZZ, etc.
a*c	matches	abc, a3478c, axyzc, etc.
a*c	matches	a*c

Examples of Wildcard Usage

LABRel <link>:<arg>

Label and Text Commands

Set Only. LABREL positions the label of the selected waveform relative to its position prior to the command.

PCTg:	<NRx>	(See LABA PCT range)
--------------	-------	----------------------

Set Only. PCTG changes the horizontal position of the label, relative to its previous horizontal position, in units of percent of record length, but not exceeding the LABABS PCTG range.

LABR PCT:50

XCOord:	<NRx>	(See LABA XCO range)
----------------	-------	----------------------

Set Only. XCOORD changes the horizontal position of the label, relative to its previous horizontal position, but not exceeding the LABABS XCOORD range.

LABR XCO:0.5

LABRel *<link>*:*<arg>* (cont.)

YDiv:	<i><NRx></i>	(See LABA YDI range)
-------	--------------------	----------------------

Set Only. YDIV changes the vertical position of the label relative to its previous vertical position, but not exceeding the LABABS YDIV range.

LABR YDI:2.85

LCAlconstants *<ui>*:*<NRx>*

Calibration/Enhanced Accuracy Commands

LCALCONSTANTS sets or queries the calibration constants of the left plug-in unit.

Note: You can only set LCALCONSTANTS when an internal jumper has been installed by a qualified service person.

<i><ui></i>	<i><NRx></i>	(Any legal value)
-------------------	--------------------	-------------------

where *<ui>* is the constant (range is plug-in unit specific) and *<NRx>* is the value of the constant.

LCA? 12

LCALCONSTANTS 12:-1.011494E-2

LMZone *<NRx>*

Measurement Commands

	<i><NRx></i>	0 to 100 percent
--	--------------------	------------------

LMZONE sets the left measurement zone limiter as a percentage of the waveform record.

LMZ 0

LONGform {ON|OFF}

Miscellaneous/System Commands

LONGFORM controls the return of the longer versions of query responses. With LONGFORM set to ON, queries respond with full header and link spellings; the EVENT? and RS232 VERB:ON commands return a descriptive *<qstring>* in addition to the event code. With LONGFORM set to OFF, query responses are in abbreviated form, and EVENT? and RS232 VERB:ON responses include only the event codes. The power-on default is LONGFORM ON.

LONG ON

M

MAINPos <NRx>

Time Base/Horizontal Commands

MAINPOS sets the horizontal position of the Main waveform record with respect to the Main trigger.

<NRx>	- (main duration) to 0 seconds
-------	--------------------------------

Refer to page 131 for formulas to calculate duration.

MAINP -7.9E-6

MAX?

Measurement Commands

Query Only. MAX? returns the maximum amplitude (most positive peak voltage) of the selected waveform, followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.)

MAX?
MAX 5.04E-1EQ

MCAlconstants <ui> : <NRx>

Calibration/Enhanced Accuracy Commands

MCALCONSTANTS sets or queries DSA calibration constants.

Note: You can only set MCALCONSTANTS after an internal jumper has been installed by a qualified service person.

<ui>	<NRx>	(See below for range)
------	-------	-----------------------

where <ui> specifies the constant and <NRx> is the value of the constant. The range of <ui> is 1 to x, where x depends on the current firmware. The range of <NRx> is -2^{31} to $2^{31}-1$.

MCA? 12
MCA 12:-1.011494E-2

MEAN?

Measurement Commands

Query Only. MEAN? returns the average amplitude (arithmetic mean voltage) of the selected waveform, followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.)

```
MEAN?
MEAN 2.212E-1,EQ
```

MEAS?

Measurement Commands

Query Only. MEAS? executes the measurements (<meas>) in the current measurement list (MSLIST). MEAS? returns a scalar value followed by an accuracy qualifier (<qual>) for each measurement in the list. MEAS? returns EMPTY if MSLIST contains no measurements.

```
MEAS {<meas>:<NR3>,<qual>[,{<meas>:
<NR3>,<qual>...}] | EMPTY
```

The <qual> accuracy qualifier indicates whether or not the underlying waveform data contain null, overrange, or underrange values.

The measurement <qual> accuracy qualifiers are defined in the following table:

Measurement Accuracy Qualifiers (<qual>)

<qual>	Meaning
EQ	True measurement equals value returned
LT	True measurement is less than value returned
GT	True measurement is greater than value returned
UN	True measurement is uncertain
ER	Error occurred; value returned is meaningless

The UN qualifier is returned for the following conditions:

- Attempted any timing measurement when the measurement zone of the selected waveform contained null (unacquired) values.

MEAS?

(cont.)

- Attempted a FALLTIME?, FREQ?, PERIOD?, RISETIME?, WIDTH?, or an area/energy measurement when the waveform description for the selected waveform is enveloped or contains enveloped components.
- Attempted a MEAN? or RMS? measurement when DAIN? was set to SINGLE and the waveform description of the selected waveform was enveloped or contained enveloped components.

The ER qualifier is returned for the following conditions:

- Attempted FREQ?, or PERIOD? measurement and no period was found within the specified measurement zone.
- Attempted a MEAN?, RMS?, YTP?_AREA?, YTMNS?_AREA?, or YTENERGY? measurement when DAIN? was SINGLE and no period was found within the specified measurement zone.
- Attempted a CROSS? measurement and no transition of the specified slope was found.
- Attempted a CROSS? measurement and REFLEVEL did not fall within the computed MAX and MIN of the specified measurement zone.
- Attempted a RISETIME? measurement and the measurement system could not compute a valid PROXIMAL time, followed by a valid DISTAL time, within the specified measurement zone.
- Attempted a FALLTIME? measurement and the measurement system could not compute a valid DISTAL time followed by a valid PROXIMAL time, within the specified measurement zone.
- Attempted a WIDTH? measurement and two MESIAL crossings of opposite slope could not be found within the specified measurement zone.
- Attempted a GAIN?, PDELAY?, or PHASE? measurement when only one waveform was defined.
- Attempted any measurement when the selected waveform was an XY waveform, a frequency domain waveform, or in Point Accumulate (PA) mode.

MEAS?

(cont.)

- Attempted any measurement when no waveforms were displayed.

```
MEAS?
MEAS MEAN:7.3333E-4,EQ,
CROSS:7.6685E-4,EQ
```

<meas> ?

Measurement Commands

Query Only. <meas> ? is shorthand for a query of any of the measurements listed below. Querying a specific measurement executes the measurement and returns its value followed by an accuracy qualifier. (Refer to the MEAS? command for the list of qualifiers.) The <meas> measurements are listed by function below:

<meas> Measurement Types

Amplitude	Timing	Area/Energy
GAIN	CROSS	YTENERGY
MAX	DELAY	YTMNS_AREA
MEAN	DUTY ‡	YTPLS_AREA
MID	FALLTIME	
MIN	FREQ	
OVERSHOOT ‡	PDELAY	
PP	PERIOD	
RMS	PHASE	
UNDERSHOOT ‡	RISETIME	
	SKEW ‡	
	TTRIG †	
	WIDTH	

† TTRIG? sends event code 463, "Measurements complete," when it is queried or MEAS? is queried and TTRIG is on the measurement list.

‡ Firmware version 1.2 and above.

Refer to each measurement entry for information.

```
MEAN?
MEAN:7.3333E-4,EQ
```

MESial <NRx>

Measurement Commands

	<NRx>	(See below for range)
--	-------	-----------------------

MESIAL sets the mesial (middle) reference level (i.e., the endpoint of the waveform period) for DELAY?, FREQ?, MEAN?, PERIOD?, PDELAY?, PHASE?, RMS?, and WIDTH? measurements; and when DAIN? is set to SINGLE, for YTENERGY?, YTMNS_AREA?, YTPLS_AREA? measurements. For firmware version 1.2 and above, MESIAL also sets the mesial reference level for DUTY? and SKEW? measurements.

Firmware version 1.2 and above:

MESIAL range depends on the current argument to MLEVEL. When MLEVEL is RELATIVE, the range is a percentage of the difference between the TOPLINE and BASELINE values. When MLEVEL is ABSOLUTE, the range is in vertical units of the selected waveform:

MESIAL Ranges

MESIAL Range with MLEVEL RELATIVE	MESIAL Range with MLEVEL ABSOLUTE
0 to 100 %	-5.0E+20 to +5.0E+20

The MESIAL range when the MLEVEL argument is BASEDELTA or TOPDELTA is the same as for MLEVEL ABSOLUTE.

MES 50

Firmware version 1.1 and below:

Mesial range is a percentage of the difference between the TOPLINE and BASELINE values.

MES 50

MID?

Measurement Commands

Query Only. MID? returns the amplitude mid-point, halfway between the maximum amplitude and the minimum amplitude of the selected waveform, followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.)

```
MID?  
MID 2.2E-1,EQ
```

MIN?

Measurement Commands

Query Only. MIN? returns the minimum amplitude (most negative peak voltage) of the selected waveform, followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.)

```
MIN?  
MIN -6.398E-2,EQ
```

MLEVEL <arg>

(Firmware v. 1.2 and above) Measurement Commands

MLEVEL controls how ranges are determined for DISTAL, MESIAL, and PROXIMAL commands.

ABS olute	BASE Delta	REL ative
	TOP Delta	

ABSOLUTE makes the DISTAL, MESIAL, and PROXIMAL ranges absolute values scaled in vertical units (typically volts) of the selected waveform.

RELATIVE makes DISTAL, MESIAL, and PROXIMAL ranges a percentage of the difference between the current TOPLINE and BASELINE values.

BASEDELTA and TOPDELTA make DISTAL, MESIAL, and PROXIMAL ranges "delta" values which are added to the current BASELINE and TOPLINE values, respectively, to give the DISTAL, MESIAL, or PROXIMAL value used for measurements. BASEDELTA and TOPDELTA are absolute values scaled in vertical units.

Here are some examples, assuming BASELINE is 0 V and TOPLINE is 10 V:

Examples of MLEVEL Usage

MLEVEL Argument	Desired Parameter	Command To Use
RELATIVE	MESIAL 4.5 V	MESIAL 45
ABSOLUTE	MESIAL 4.5 V	MESIAL 4.5
TOPDELTA	PROXIMAL 1.1 V	PROXIMAL -8.9
BASEDELTA	DISTAL 8.7 V	DISTAL 8.7

MLE ABSO

MSCount <NRx>

(Firmware v. 1.2 and above) Measurement Commands

MSCOUNT specifies the number of samples to be used in computing all measurement statistics.

Note: Intermediate results are not computed. Each time a statistics query is entered, the entire MSCOUNT number of samples will be acquired and the computations completed before results are returned to the interface.

MSC 10

MSList { <meas> [, <meas> ...] | EMPTY }

Measurement Commands

MSLIST selects up to six measurements (<meas>) that are executed continuously in the Measure major menu. (The values of these measurements are returned with a MEAS? query.) EMPTY deletes all measurements from the list; all measurements are cleared from the Measure major menu.

Note: MSLIST is always EMPTY for XY waveforms, for FFT waveforms, and for Point Accumulate (PA) waveforms. If you change a YT waveform to an XY, FFT, or PA waveform, MSLIST is automatically cleared.

MSLI PP,FRE,WID,PER

MSLOpe {PLUS|MINUs}

Measurement Commands

MSLOPE sets the crossing slope for the CROSS? measurement.

MSLO PLU

MS <meas> ?

(Firmware v. 1.2 and above) Measurement Commands

Query Only. MS<meas>? returns the measurement statistics (minimum, maximum, mean, and standard deviation) of the measurement specified by <meas>. (See the <meas>? entry for a list of all measurements.) STATISTICS must be set to ON. Completion of MS<meas>? is signaled with event code 463, "Measurements completed."

Note: Intermediate results are not computed. Each time MS<meas>? is entered, the required number of samples is acquired and the computations completed before results are returned.

MSRMS?

```
MSRMS 5.085E+0, EQ, 5.116E+0, EQ,
5.102E+0, EQ, 5.976E-3, EQ
```

MSNum?

Measurement Commands

Query Only. MSNUM? returns the number of items in the current MSLIST. The range is 0 to 6 items.

MSN?

```
MSNUM 4
```

MStat?

(Firmware v. 1.2 and above) Measurement Commands

Query Only. MSTAT? returns the measurement statistics (minimum, maximum, mean, and standard deviation) of the measurement(s) on the measurement list (MSLIST). STATISTICS must be set to ON. Completion of MSTAT? is signaled with event code 463, "Measurements completed."

Note: Intermediate results are not computed. Each time MSTAT? is entered, the required number of samples is acquired and the computations completed before results are returned.

MSTAT?

```
MSTAT RMS:5.085E+0,EQ,5.116E+0,EQ,
5.102E+0,EQ,5.976E-3,EQ,OVERSHOOT:
0.0E+0,EQ,1.429E+0,EQ,5.991E-1,EQ,
3.432E-1,EQ,
```

MSYS {ON|OFF}

Measurement Commands

MSYS sets the measurement system ON or OFF at the front panel display. In effect, MSYS presses the front panel **Measure** button. Whether MSYS is ON or OFF has no effect on measurements taken with MEAS? or if you query a specific measurement.

Set MSYS to ON when you need to use the front panel in conjunction with remote commands (e.g., semi-automatic ATE applications). Set MSYS to OFF for faster remote system throughput.

```
MSY OFF
```

MTime {ABSOLute|RELative}

(Firmware v. 1.2 and above) Measurement Commands

MTime determines the left and right measurement zone operation modes. When MTime is set to ABSOLUTE, the LMZONE and RMZONE values are scaled in units of the horizontal time base. When MTime is set to RELATIVE, LMZONE and RMZONE values are a percentage of the waveform record.

MTI REL**MTRack {BASeline|BOTH|OFF|TOPline}**

(Firmware v. 1.2 and above) Measurement Commands

MTRACK controls measurement tracking (continuous building of histograms). When MTRACK is set to BASELINE or TOPLINE, the DSA determines the BASELINE or TOPLINE, respectively; you set the other value. When MTRACK is set to BOTH, the DSA determines both BASELINE and TOPLINE values. When MTRACK is set to OFF, you set both BASELINE and TOPLINE values.

ON may be substituted for BOTH when MTRACK is used to set measurement tracking, but the query MTRACK? will return BOTH.

MTRack {ON|OFF}

(Firmware v. 1.1 and below) Measurement Commands

MTRACK controls measurement tracking (continuous building of histograms). When you set MTRACK to ON, the DSA determines the TOPLINE and BASELINE; when set to OFF, you set the TOPLINE and BASELINE values.

MTR OFF

N

NAVg <NRx>

Acquisition Commands

NAVg sets the number of waveform samples to be averaged when averaging is enabled either in the waveform description (refer to the TRACE command) or as an acquisition condition (refer to the CONDACQ command).

	<NRx>	2 to 4096
--	-------	-----------

NAV 50

NENV <NRx>

Waveform and Settings Commands

NENV sets the number of waveform samples to be enveloped when enveloping is enabled either in the waveform description (refer to the TRACE command) or as an acquisition condition (refer to the CONDACQ command).

	<NRx>	2 to 4096
--	-------	-----------

NEN 300

NREptrig <NRx>

Acquisition Commands

NREPTRIG sets the number of repetitive triggers to be acquired when CONDACQ TYPE is set to REPTRIG.

	<NRx>	(See below for range)
--	-------	-----------------------

Minimum NREPTRIG value is 1. Maximum value depends on the record LENGTH of the selected waveform and whether Option 4C, Nonvolatile RAM, is installed.

NRE 500

NVRam?

Waveform and Settings Commands

Query Only. NVRAM? returns the number of bytes, in *<NR1>* form, of unallocated nonvolatile RAM (NVRAM) available for storing front panel settings.

```
NVR?  
NVRAM 104723
```



OPTIONS?

Miscellaneous/System Commands

Query Only. OPTIONS? returns the number of options installed, and if more than zero, returns a *<qstring>* list of the options delimited by commas.

```
OPTIONS?  
OPTIONS 1;"Option 4C - Non-volatile  
RAM"
```

OUTput <arg>

Data Transfer Commands

OUTPUT selects the source of data returned by WFMPE?, CURVE? or WAVFRM? queries. The source can be a stored waveform (STO <ui>) or a displayed waveform (TRACE <ui>); either source can be identified with a label (<qstring>). The power-on default is STO1.

	STO <ui>	1 to 455 or 1 to 918 †
--	-----------------	------------------------

STO <ui> identifies the data source as the specified stored waveform.

† The range with Option 4C, Nonvolatile RAM, installed.

OUT STO55

	TRAcE <ui>	1 to 8
--	-------------------	--------

TRACE <ui> Identifies the data source as the specified displayed waveform.

OUT TRAcE

	<qstring>	
--	-----------	--

<qstring> Identifies the data source as the specified labeled waveform. If the label matches both a stored waveform and a displayed waveform, the displayed waveform is used by OUTPUT.

OUT 'CTRL44'

OVERshoot?

(Firmware v. 1.2 and above) Measurement Commands

Query Only. OVERSHOOT? returns the difference between the maximum signal amplitude and the TOPLINE value, given as a percentage of the difference between the TOPLINE and BASELINE values, and followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.)

```
OVE?  
OVERSHOOT 6.221E-1,EQ
```

P

PATH {ON|OFF}

Miscellaneous/System Commands

PATH controls whether headers, links, and arguments are returned to queries, or only argument values. With PATH is set to OFF, only the arguments are returned to a query. The default state is PATH ON.

The following two examples show the effect of the PATH command.

With PATH ON:

```
CHL1? IMP,BW
CHL1 IMPEDANCE:1.0E+6,BW:2.0E+7
```

```
TBM?
TBMAIN LENGTH:1024,TIME:2.0E-9,
XINCR:2.0E-11
```

With PATH OFF:

```
CHL1? IMP,BW
1.0E+6,2.0E+7
```

```
TBM?
1024,2.0E-9,2.0E-11
```

Notes:

- PATH does not affect the ASCII or binary SET? query response. Headers and links are returned regardless of the setting of PATH.
- When PATH is set to OFF, only the headers of the DIAG? and FPSLIST? queries are removed. The links of these queries are always returned.
- When PATH is set to OFF, data returned from a query is not acceptable as set command input and will generate error(s) if returned to the DSA.

```
PAT ON
```


PDElay?

Measurement Commands

Query Only. PDELAY? returns the propagation delay between MESIAL crossings of the selected waveform and the waveform specified with the DLYTRACE command, followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.)

```
PDE?
PDELAY 6.9E-11,EQ
```

PERiod?

Measurement Commands

Query Only. PERIOD? returns the time taken for one complete signal cycle, defined by the MESIAL crossing level, followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.) PERIOD is the reciprocal of the frequency (FREQ).

```
PER?
PERIOD 9.766E-7,EQ
```

PHase?

Measurement Commands

Query Only. PHASE? returns the phase relationship (from 0 to 360 degrees) of the selected waveform to the reference waveform, followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.)

```
PHA?
PHASE 1.064E-2,EQ
```

PIN8 <link>:<arg>

External I/O Commands

PIN8 specifies parameters for printers that support standard Epson 8-pin Bit Image Graphics commands, such as the Tektronix 4644 and Epson EX-800.

FORMAT:	DRA ft	HI Res	RED uced	
----------------	---------------	---------------	-----------------	--

FORMAT selects the output format. HIRES shows front panel intensified regions by dithering icon and text backgrounds and increasing foreground saturation. DRAFT prints black-on-white background except for selected icons or text which are printed white-on-black background. REDUCED is a quarter-size version of DRAFT and prints black-on-white background only.

Note: Use FORMAT:HIRES for IBM Proprinter and Epson RX80 printers.

PIN8 FORM:DRA

PORT:	CEN TRonics	GP Ib	RS 232	
--------------	--------------------	--------------	---------------	--

PORT specifies the output port for the plotter.

PIN8 POR:CENTR

PIN24 <link>:<arg>

External I/O Commands

PIN24 specifies parameters for printers that support extended Epson 24-pin Dot Graphics commands, such as the Epson LQ-1500.

FORMat:	DRAft HIRes REDUced
----------------	--

FORMAT selects the output format. HIRES shows front panel intensified regions by dithering icon and text backgrounds and increasing foreground saturation. DRAFT prints black-on-white background except for selected icons or text which are printed white-on-black background. REDUCED is a quarter-size version of DRAFT and prints black-on-white background only.

```
PIN24 FORM:DRA
```

PORT:	CENTR onics GPIb RS232
--------------	---

PORT specifies the output port for the plotter.

```
PIN24 POR:CENTR
```

PIVersion?

Status and Event Commands

Query Only. PIVERSION? returns identifying information about plug-in unit firmware version numbers. If a plug-in compartment is empty, it returns "N/7K."

```
PIV?
PIVERSION LEFT:"3.7",CENTER:"3.7",
RIGHT:"N/7K"
```

POWERon?

Miscellaneous/System Commands

Query Only. POWERON? returns the total number of times the DSA has been powered on.

```
POW?
POWERON 149
```

PP?

Measurement Commands

Query Only. PP? returns the peak-to-peak voltage value (i.e., the difference between the MAX? and MIN? measurement values), followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.)

```
PP?  
PP 5.72E+1,EQ
```

PROBE {NT|NTAuto|SETSeq}

Miscellaneous/System Commands

PROBE selects the function performed when the ID button of an 11000-series probe is pressed.

NT either selects a displayed waveform that includes the probe input channel, or if no displayed waveform includes the probe channel, creates a new waveform that contains only the probe channel.

NTAUTO is similar to PROBE NT except that Autoset is executed on the selected waveform on the new waveform created.

SETSEQ causes a probe button press to recall the next set of stored front panel settings from memory. You can sequentially recall all stored settings by repeated button presses.

```
PROB NTA
```

PROXimal <NRx>

Measurement Commands

<NRx>	(See below for range)
-------	-----------------------

PROXIMAL <NRx> sets the proximal (near to origin) level for RISETIME? and FALLTIME? measurements.

Firmware version 1.2 and above:

PROXIMAL range depends on the current argument to MLEVEL. When MLEVEL is RELATIVE, the range is a percentage of the difference between the TOPLINE and BASELINE. When MLEVEL is ABSOLUTE, the range is in vertical units of the selected waveform.

PROXIMAL Ranges

PROXIMAL Range with MLEVEL RELATIVE	PROXIMAL Range with MLEVEL ABSOLUTE
0 to 100 %	-5.0E+20 to +5.0E+20

The PROXIMAL range when the MLEVEL argument is BASEDELTA or TOPDELTA is the same as for MLEVEL ABSOLUTE.

PROX 5

Firmware version 1.1 and below:

PROXIMAL range is a percentage of the difference between the TOPLINE and BASELINE values.

PROX 5

PZMode <link>:<arg>

Waveform and Settings Commands

PZMODE controls multiple waveform panning and zooming and selects the pivot point for Pan/Zoom.

MULT trace:	ON OFF	
--------------------	------------------------	--

MULTITRACE sets multi-waveform Pan/Zoom to ON or OFF. When set to ON, all waveforms of the same record LENGTH on the same graticule share HMAG and HPOSITION values. Changing the HMAG or HPOSITION of any of the group of waveforms changes the HMAG or HPOSITION of all of these waveforms. When MULTITRACE is set to OFF, the Pan/Zoom controls affect only the selected waveform.

PZM MULT:ON

PIVot:	CEN ter LEF t RIg ht	
---------------	---	--

PIVOT selects the pivot point for zooming. LEFT selects the left side of the display, CENTER selects the center, and RIGHT selects the right side. Changing the pivot point does not change the HMAG value nor the position of any waveforms.

PZM PIV:CEN

R

RCALconstants <ui> : <NRx>

Calibration/Enhanced Accuracy Commands

RCALCONSTANTS sets or queries the calibration constants of the right plug-in unit.

Note: You can only set RCALCONSTANTS after an internal jumper has been installed by a qualified service person.

<ui>	<NRx>	(Any legal value)
------	-------	-------------------

where <ui> is the constant (range is plug-in unit specific) and <NRx> is the value of the constant.

```
RCA? 12
RCALCONSTANTS 12:-1.011494E-2
```

RECall {FPS<ui> |FPNext| <qstring>}

Waveform and Settings Commands

Set Only. RECALL recalls stored front panel settings from memory.

Completion of RECALL is signaled with event code 473, "Recall complete."

	FPS<ui>	1 to 20
--	----------------------	---------

Set Only. FPS<ui> recalls from memory the front panel settings specified by <ui>.

```
REC FPS3
```

	FPNext	
--	---------------	--

Set Only. FPNEXT recalls from memory the next front panel setting in sequence. (The SETSEQ command must be set to ON.)

```
REC FPN
```

RECall {FPS<ui>|FPNext|<qstring>} (cont.)

	<qstring>	
--	-----------	--

Set Only. <qstring> recalls from memory the front panel settings labeled by <qstring>.

```
REC 'SETUP44'
```

REFLevel <NRx>

Measurement Commands

	<NRx>	(Any legal value)
--	-------	-------------------

REFLEVEL sets the signal reference level for CROSS?, YTENERGY?, YTPLS_AREA?, and YTMNS_AREA? measurements.

```
REFL 55
```

REFset <link> :<arg>

Measurement Commands

REFSET sets reference value(s) for comparison measurements returned when COMPARE is set to ON. (Refer to the COMPARE command.)

CURRENT:	<meas>	
-----------------	--------	--

CURRENT executes the specified measurement (<meas>), and stores the resultant value as the measurement reference.

Note: Completion of REFSET CURRENT:TTRIG is signaled with event code 463, "Measurements complete." No other CURRENT argument generates an operation complete.

```
REF CURR:PP
```


REFset <link>:<arg> (cont.)

<meas>:	<NRx>	(Any legal value)
---------	-------	-------------------

<meas> sets the reference value for the specified measurement.

REF PP:2.0

Query Note: The general REFSET? query returns all reference values, whether assigned a reference value or not. A measurement without an assigned reference value returns 0.0E+0.

REFTrace TRAcE <ui>

(Firmware v. 1.2 and above) Measurement Commands

REFTRACE specifies the reference (delayed) waveform used with the GAIN?, PHASE?, and SKEW? measurements. The reference waveform is used by all three measurements, and is independent of the selected waveform. Measurement is taken *from* the reference waveform to the selected waveform. The reference waveform can be the selected waveform. When the reference waveform is the selected waveform, GAIN? returns 1.0, PHASE? returns 0.0, and SKEW? returns 0.0.

	TRAcE <ui>	0 to 8
--	-------------------	--------

The valid <ui> *setting* range is 1 to 8. However, REFTRACE? returns TRACE0 when no waveforms are displayed; REFTRACE TRACE0 is ignored when sent back to the DSA.

REF PP:2.0

REFTrace TRACE <ui> (cont.)

(Firmware v. 1.2 and above)

Changing Measurement Parameters on the Reference Waveform. The GAIN?, PHASE? and SKEW? measurements compare the reference waveform to the selected waveform. Every waveform has its own measurement parameters (e.g., MESIAL, LMZONE) which can be changed only when that waveform is the selected waveform. Therefore, if you need to change measurement parameters on the reference waveform:

1. Use the SELECT command to make the reference waveform the selected waveform.
2. Change the measurement parameters.
3. Use the SELECT command to reassign the correct selected waveform.

Here is an example of the process of taking a SKEW measurement. Assume you want to measure SKEW between TRACE2, the reference waveform and TRACE4, the selected waveform. The required MESIAL values are 40% and 45%, respectively.

```

SELECT TRACE2 /* Select TRACE2 to change
                its parameters */
MESIAL 40 /* Specify its mesial value */
REFTRACE TRACE2 /* Make TRACE2 the
                 reference waveform */
SELECT TRACE4 /* Select TRACE4 to change
                its parameters */
MESIAL 45 /* Specify its mesial value */
SKEW? /* Measure SKEW from
        TRACE2 to TRACE4 */

```

REMOve {ALL|TRACE <ui> | <qstring>}

Waveform and Settings Commands

Set Only. REMOVE discards existing data and the waveform definitions to remove waveforms from the display. If a waveform is also stored in memory, the stored waveform is not removed. (Use the DELETE command to remove stored waveforms.)

	ALL	
--	------------	--

ALL removes all displayed waveforms. It is not an error to specify ALL when no waveforms are defined.

REM ALL

REMOve {ALL|TRAcE<ui> | <qstring>} (cont.)

	TRAcE<ui>	1 to 8
--	-----------	--------

TRAcE<ui> removes the specified waveform from the display only, not from memory.

```
REM TRA7
```

	<qstring>	
--	-----------	--

The <qstring> argument removes the waveform labeled <qstring> from the display only, not from memory. Wildcard characters are interpreted. (Refer to page 84 for wildcard definitions.)

```
REM 'SAMPLE16'
```

REPCurve {START|NREPCurve:<NRx>} (Firmware v. 1.2 and above) Data Transfer Commands

REPCURVE controls fast transfer of trace data from the DSA to the controller.

	START	
--	-------	--

Set Only. START starts acquisition. On each trigger, the traces specified by the AUTOACQ command will be acquired and transferred over the bus. Acquisitions will stop when either the count specified (by NREPCURVE) is reached or when the DSA receives a DCL.

Note: It must be possible to acquire all defined traces concurrently in real time. Therefore, no more than four channels for the DSA 602 or two channels for the DSA 601 may be used in defined traces. The channels which may be used together are also restricted. See the *DSA 601 and DSA 602 User Reference* for information on concurrent acquisition.

```
REPC STAR
```

REPCurve {**START** | **NREPCurve**: <NRx>}
 (Firmware v. 1.2 and above) (cont.)

NREPCurve :	<NRx>	0 to 32767
--------------------	-------	------------

NREPCURVE specifies the number of acquisitions to be transferred. If 0 is specified, acquisition will continue indefinitely until the DSA receives a DCL.

```
REPC NREPC:64
```

Query Note: **REPCURVE?** **NREPCURVE** returns the current number of acquisitions (the number selected for transfer.)

RISetime?

Measurement Commands

Query Only. **RISETIME?** returns the transition time of a rising-pulse edge, from the PROXIMAL to DISTAL level, followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.)

```
RIS?
RISETIME 7.922E-9,EQ
```

RMS?

Measurement Commands

Query Only. **RMS?** returns the true root mean square voltage, followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.)

```
RMS?
RMS 3.516E-1,EQ
```

RMZone <NRx>

(Firmware v. 1.2 and above)

Measurement Commands

	<NRx>	(See below for range)
--	-------	-----------------------

RMZONE sets the right measurement zone limiter. The range depends on current MTIME value. When MTIME is set to RELATIVE, RMZONE is a percentage of the waveform record. When MTIME is set to ABSOLUTE, RMZONE is an absolute position in horizontal units of the selected waveform.

RMZONE Ranges

RMZONE Range for MTIME RELATIVE	RMZONE Range for MTIME ABSOLUTE
0 to 100 %	XZE to (XZE + XIN * (NR.pt - 1))

The MTIME ABSOLUTE range is calculated using XZERO, XINCR, and NR.PT values from the waveform preamble (WFMPRE) of the selected trace.

RMZ 75**RMZone <NRx>**

(Firmware v. 1.1 and below)

Measurement Commands

	<NRx>	0 to 100 percent
--	-------	------------------

RMZONE sets the right measurement zone limiter as a percentage of the waveform record.

RMZ 75

RQS {ON|OFF}

Status and Event Commands

RQS determines the DSA response to events detected during DSA operation. With RQS ON, the DSA asserts SRQ after an event; with RQS set to OFF, it does not. The power-on default for GPIB is RQS set to ON.

RQS is meaningless for the RS-232-C port; the RQS command is always set to OFF for RS-232-C.

RQS ON

RS232 <link> :<arg>

External I/O Commands

RS232 sets parameters for the RS-232-C interface.

BAUD:	<NRx>	110,150,300,600,1200, 2400,4800,9600,19200
--------------	--------------------	---

BAUD sets both the transmit and receive baud rates.

Note: Set the baud rate on the DSA before setting the baud rate on the controller.

RS232 BAU:9600

DELAY:	<NRx>	0 to 60 seconds
---------------	--------------------	-----------------

DELAY sets the minimum delay from receipt of a query to its response, with 20 ms granularity.

RS232 DELA:0.5

ECHO:	ON OFF	
--------------	-----------------	--

ECHO determines whether characters are echoed on the controller screen.

Note: You cannot send binary data to the DSA when ECHO is set to ON.

RS232 ECH:ON

RS232 <link> : <arg> (cont.)

EOL:	CR CRLf LF LFCr	
-------------	------------------------------	--

EOL selects the end of line output message terminator:

CR	Carriage return
LF	Line feed
CRLF	Carriage return followed by line feed
LFCR	Line feed followed by carriage return

End of Line (EOL) Terminators

All of the above are accepted as an input message terminator.

RS232 EOL:CRL

FLAgging:	SOFT HARD OFF	
------------------	--------------------------	--

FLAGGING controls I/O flagging. SOFT uses XON (DC1) and XOFF (DC3) handshaking. HARD uses the DTR and CTS control lines. Both SOFT and HARD flagging halt input when the buffer is three-quarters full, and restart input when the buffer is one-quarter full. OFF means there is no transmission control.

Note: SOFT flagging is usually not used with binary transfers because the binary data may contain unintended XON or XOFF controls.

RS232 FLA:SOF

PARity:	ODD EVEN NONE	
----------------	--------------------------	--

PARITY sets the parity used for all RS-232-C data transfers. The DSA generates parity on output data and checks the parity on input data. An input parity error produces event code 653, "RS-232-C input parity error."

RS232 PAR:EVEN

RS232 <link> : <arg> (cont.)

STOPBits:	<NRx>	1, 1.5, 2
------------------	--------------------	-----------

STOPBITS selects the number of transmission stop bits sent with each character to identify the end of data.

RS232 STOPB:1.5

VERBose:	ON OFF	
-----------------	-----------------	--

When VERBOSE is set to ON, the DSA returns error and warning messages to the controller at the time they occur. When VERBOSE is set to OFF, the controller must query the DSA for event messages.

RS232 VERB:ON

S

SCANSstowfm [*<link>*:] *<arg>*

Waveform and Settings Commands

SCANSTOWFM controls scanning of stored waveforms.

? CURRENT	<i><ui></i>
------------------	-------------------

Query Only. CURRENT returns the stored waveform number of the current waveform, or returns -1 if the current waveform is not defined.

```
SCANS? CURR
SCANS CURR:212
```

FROM:	<i><ui></i>	
--------------	-------------------	--

FROM specifies the starting stored waveform, which must exist. Event code 229, "No Stored Waveforms" is returned if the specified waveform does not exist.

```
SCANS FRO:153
```

	KEEP	
--	-------------	--

Set Only. KEEP causes the current stored waveform to be kept as an displayed waveform.

```
SCANS KEE
```

MODE:	SCAN STOP	
--------------	-------------	--

MODE starts or stops stored waveform scanning.

```
SCANS MOD:SCA
```

SCANSstowfm [*<link>*:]*<arg>* (cont.)

	NEXt	
--	-------------	--

NEXT causes the next stored waveform (if any) to become the current waveform and updates the display. When queried, NEXT returns the number of the next stored waveform in the scan list.

```
SCANS NEX
```

	PREvious	
--	-----------------	--

PREVIOUS causes the previous stored waveform (if any) to become the current waveform and updates the display. When queried, PREVIOUS returns the number of the previous stored waveform in the scan list.

```
SCANS PRE
```

RATe:	<i><NRx></i>	0.1 to 10
--------------	--------------------	-----------

RATE sets the rate (number of waveforms per second) at which waveforms are scanned.

```
SCANS RAT:2
```

TO:	<i><ui></i>	
------------	-------------------	--

TO specifies the ending stored waveform, which must exist. Event code 229, "No Stored Waveforms" is returned if the specified waveform does not exist.

```
SCANS TO:350
```

USIng:	ALL <i><qstring></i>	
---------------	-------------------------------------	--

USING specifies the list of waveforms to be scanned, either ALL stored waveforms or those whose base label is specified by *<qstring>*.

```
SCANS USI:ALL
```

SCLOCKd {ENABLE|DISABLE}

Miscellaneous/System Commands

SCLOCKD controls whether or not the sample clock is dithered. Set SCLOCKD to ENABLE to improve equivalent time repetitive signal capture (this is the default state). Set SCLOCKD to DISABLE for maximum single-shot timing accuracy.

```
SCL DISA
```

SELECT {TRACE <ui> | <qstring>}

Waveform and Settings Commands

SELECT specifies the waveform used by AUTOSET, measurement and cursor commands. By default, the most recently created waveform is the selected waveform until changed with SELECT.

	TRAcE <ui>	0 to 8
--	-------------------------	--------

The valid SELECT TRACE <ui> setting range is 1 to 8. However, SELECT? returns TRACE0 when no waveforms are defined. You can send SELECT TRACE0 to the DSA without an error; it is ignored.

```
SEL TRAs
```

	<qstring>	
--	------------------------	--

<qstring> designates the waveform labeled with <qstring> as the selected waveform.

```
SEL 'SAMPLE1'
```

SELFcal [*<link>*:] *<arg>*

Calibration/Enhanced Accuracy Commands

SELFcal either forces a self-calibration or selects the mode when self-calibration will occur.

	FORCE	
--	--------------	--

Set Only. FORCE causes an immediate self-calibration to occur.

SELF FOR

MODE:	AUTO MANUAL	
--------------	----------------------	--

MODE selects whether self-calibration is performed automatically when due (e.g., after instrument warm-up) or is performed manually using SELFcal FORCE.

SELF MOD:MAN

SET?

Data Transfer Commands

Query Only. SET? returns front panel settings to the controller in ASCII or binary format, depending on the state of the ENCDG SET command.

Note: SET? is *not* query-only. You can send settings back to the DSA (with some restrictions) to restore a previously-defined DSA state. However, the header SET is used only when sending binary data.

ASCII SET? Response. SET? returns strings of DSA commands separated by semicolons. The following is an excerpt of a SET? response:

```
SET?
REM ALL;CH1 COU:DC,OFFS:0.0E+0
,BW:3.5E+8,IMP:5.0E+1,PROB:"LEVEL
2/P6231/B011623",SEN:1.0E+1,UNI:"V
OL",CH2 COU:DC,OFFS:-2.5E-3,BW
```

SET?

(cont.)

Binary SET? Response. SET? returns binary data in the following format:

```
<block> ::= %<byte cnt> <settings> <checksum>
```

where <byte cnt> is a two-byte integer (MSB first) giving the length in bytes of the remainder of the binary block, including checksum; <settings> are binary-encoded data; and <checksum> is an 8-bit, twos complement of the modulo 256 sum of <byte cnt> and <settings> data.

Sending Settings Back to the DSA.

Send settings as a complete set; do not edit or modify the data. For ASCII settings, simply send the entire set of strings. The binary SET? response returns the SET header at the beginning of the response; you must include the SET header when sending binary settings to the DSA. Completion of binary settings recall is signaled with event code 473, "Front panel recall complete."

SETSEQ {ON|OFF}

Waveform and Settings Commands

SETSEQ controls the sequencing of front panel settings. When SETSEQ is set to ON, the settings are sequenced and the RECALL FPNEXT or PROBE SETSEQ commands recall the next set of stored front panel settings from memory.

Note: If SETSEQ is set to ON and all stored settings are deleted, SETSEQ is set to OFF. If SETSEQ is set to OFF and PROBE SETSEQ is issued, SETSEQ is set to ON.

SETS ON

SKEw?

(Firmware v. 1.2 and above) Measurement Commands

Query Only. SKEW? returns the propagation (time) delay between MESIAL crossings of the selected waveform and the reference waveform set with the REFTRACE command, followed by an accuracy qualifier. (Refer to page 88 for qualifier definition.) Measurement is taken *from* the reference waveform to the selected waveform.

```
SKE?
SKEW 4.228E-8,BQ
```

SNRatio <NRx>

Measurement Commands

	<NRx>	1 to 99
--	-------	---------

SNRATIO sets the signal-to-noise ratio for a noise rejection band for measurements. The reciprocal of the number selected is the fraction of the TOPLINE-to-BASELINE distance the noise rejection band extends above and below the MESIAL level.

```
SNR 50
```

SPEaker {ON|OFF}

Miscellaneous/System Commands

SPEAKER controls the DSA audio feedback (i.e., whether you hear a click when you touch the front panel).

```
SPE ON
```

SRQMask <link> :{ON|OFF}

Status and Event Commands

SRQMASK controls the reporting of selected classes of events, regardless of the state of the RQS command. If an SRQMASK link is set OFF, that class of events is not reported. At power-on, all SRQMASK links are set to ON except ABSTOUCH, IDPROBE, and USER. The following table lists all SRQMASK links, their meanings, and associated event code(s).

SRQMASK Links

Link	Meaning	Event Code(s)
ABStouch:	Controls reporting of front panel touches either via the ABSTOUCH command or screen touches	451
CALDue:	Controls reporting of calibration-due events	465-472
CMDerr:	Controls reporting of command errors	100-199
EXErr:	Controls reporting of execution errors	200-299
EXWarn:	Controls reporting of execution warnings	500-599
IDProbe:	Controls reporting of probe ID button presses	457
INErr:	Controls reporting of internal errors	300-399
INWarn:	Controls reporting of internal warnings	600-699
OPCmpl:	Controls reporting of operation-complete events	450, 460-464, 473-475
USER:	Controls whether the RQS icon is displayed and whether RQS icon touches are reported	403

SRQM ABS:ON

STATISTICS {ON|OFF}

(Firmware v. 1.2 and above) Measurement Commands

STATISTICS controls whether measurement statistics are computed. When STATISTICS is set to ON, measurement statistics are computed and measurement queries return mean values. Also, STATISTICS must be ON to use the MSTAT? and MS < meas > ? queries.

```
STATI ON
```

STByte?

Status and Event Commands

Query Only, RS-232-C Only. STBYTE? enables an RS-232-C controller to read the status byte of the current RS-232-C event by mimicking a GPIB serial poll at the RS-232-C port. STBYTE? is not valid at the GPIB port.

Note: The status byte is defined in the section on Event Reporting later in this document

```
STB?  
STBYTE 2
```

Note: In the above example, the 2 indicates an operation-complete event with RQS set to OFF.

STOList?

Waveform and Settings Commands

Query Only. STOLIST? returns a list of all stored waveforms, or EMPTY if there are no stored waveforms.

```
STOL?  
STOLIST STO2,STO9,STO56,STO200
```

STONum?

Waveform and Settings Commands

Query Only. STONUM? returns the number of waveforms stored in memory.

```
STON?  
STONUM 4
```


STORE [*<link>:*] *<arg>*

Waveform and Settings Commands

Set Only. STORE saves front panel settings (FPS) in nonvolatile RAM. STORE also copies a displayed waveform to memory; the waveform is not removed from the display.

STORE Constraints: You cannot store an XY waveform. An existing STO *<ui>* location can be overwritten only if the record lengths of the new and stored waveforms are the same; the previous waveform data is destroyed. If the previously stored waveform was a component of a displayed waveform, the displayed waveform changes to include the newly stored waveform.

	FPS <i><ui></i> <i><qstring></i>	1 to 20 †
--	--	-----------

Set Only. FPS *<ui>* stores the current front panel settings tagged with the specified number or *<qstring>* label. If *<ui>* is an existing FPS number, or if the label identifies an existing FPS number, the new data overwrites the previous data. If the label does not identify an existing FPS number, the data is stored in the next available FPS number with that label assigned to it. Wildcard characters are not interpreted. (Refer to page 84 for the definition of wildcards.)

† Option 4C, Nonvolatile RAM, is required to store more than six front panel settings.

STOR FPS5

TRAcE <i><ui></i> :	STO <i><ui></i> <i><qstring></i>	
---------------------------	--	--

Set Only. TRACE *<ui>* stores a copy of the TRACE *<ui>* waveform in memory at the location specified either by STO *<ui>* or by the *<qstring>* label. Wildcard characters are not interpreted. If the label identifies an existing STO location, the new data overwrites the previous location. If the label does not identify an existing STO location, the data is stored in the next available STO location with that label assigned to it.

The TRAcE *<ui>* range is 1 to 8. The STO *<ui>* range is 1 to 455; or if Option 4C, Nonvolatile RAM, is installed, the range is 1 to 918.

STOR TRAcE:STO10

STORE [*<link>*:]*<arg>* (cont.)

<i><qstring></i> :	STO <i><ui></i>	1 to 455 or 918
--------------------------	------------------------------	-----------------

Set Only. *<qstring>* stores a copy of the waveform labeled *<qstring>* in memory tagged with the number specified by **STO** *<ui>*. Wildcard characters are not interpreted. The **STO** *<ui>* range is 1 to 455; or if Option 4C, Nonvolatile RAM, is installed, the range is 1 to 918.

T

TBMain <link>:<arg>;**TBWin** <link>:<arg>

Time Base/Horizontal Commands

TBMAIN sets the Main time base parameters and TBWIN sets the Window time base parameters. Both commands use the same links and arguments.

LENGth:	<NRx>	512, 1024, 2048, 4096 5120, 8192, 10240 16384, 20464, 32768
----------------	-------	---

LENGTH sets the selected time base to the specified record length, scaled in points per waveform.

TBM LEN:1024; TBW 512

TIME:	<NRx>	200E-12 to 100 sec †
--------------	-------	----------------------

TIME sets the horizontal scale (time per division). The following table lists which LENGTH values you can use with each TIME value. (All LENGTH values can be used when TIME is between 100 μ s and 100 s.)

† Maximum TBWIN TIME must be less than TBMAIN TIME

TBM TIM:20E-3; TBW TIM:5.0E-3*TIME & LENGTH Requirements*

TIME	LENGTH Values
200 ps	512, 1024, 2048
400 ps	2048
500 ps	512, 1024, 4096, 5120
1 ns	512, 1024, 2048, 4096, 5120, 8192, 10240
2 ns	512, 1024, 2048, 4096, 5120, 8192, 10240, 16384, 20464
4 ns	16384, 20464

TIME & LENGTH Requirements (Cont.)

TIME	LENGTH Values
5 ns	512, 1024, 2048, 4096, 5120, 8192, 10240, 32768
10 ns	512, 1024, 2048, 4096, 5120, 8192, 10240, 16384, 20464, 32768
20 ns	1024, 2048, 4096, 5120, 8192, 10240, 16384, 20464, 32768
25 ns	512
50 ns	512, 1024, 2048, 4096, 5120, 8192, 10240, 16384, 20464, 32768
100 ns	512, 1024, 2048, 4096, 5120, 8192, 10240, 16384, 20464, 32768
200 ns	1024, 2048, 8192, 10240, 16384, 20464, 32768
250 ns	4096, 5120
400 ns	1024, 2048
500 ns	512, 4096, 5120, 8192, 10240, 16384, 20464, 32768
800 ns	2048
1 μ s	512, 1024, 4096, 5120, 8192, 10240, 16384, 20464, 32768
2 μ s	512, 1024, 2048, 4096, 5120, 8192, 10240, 16384, 20464
2.5 μ s	32768
4 μ s	2048, 8192, 10240, 16384, 20464, 32768
5 μ s	512, 1024, 4096, 5120, 32768
8 μ s	16384, 20464
10 μ s	512, 1024, 2048, 4096, 5120, 8192, 10240, 32768
20 μ s	512, 1024, 2048, 4096, 5120, 8192, 10240, 16384, 20464, 32768
40 μ s	16384, 20464
50 μ s	512, 1024, 2048, 4096, 5120, 8192, 10240, 32768
100 μ s to 100 s	512, 1024, 2048, 4096, 5120, 8192, 10240, 16384, 20464, 32768

? XINcr

<NR3>

Query Only. XINCR returns the sample interval of the selected time base, in seconds per point.

```
TBM? XIN; TBW? XIN
TBM:MAIN XINCR:2.0E-10;
TBW:IN XINCR:4.0E-9
```

TBMain <link>:<arg>;

TBWin <link>:<arg> (cont.)

Calculating Duration. *Duration* is used when calculating the range of other commands, such as MAINPOS.

Use the following formula for *main duration*:

$$(\text{TBMAIN XINCR}) * (\text{TBMAIN LENGTH} - 1)$$

Use the following formula for *window duration*:

$$(\text{TBWIN XINCR}) * (\text{TBWIN LENGTH} - 1)$$

TEK4692

External I/O Commands

TEK4692 specifies parameters for the Tektronix 4692 color graphics copier and Tektronix 4693D color wax printer operating in 4692 emulation mode.

COLor:	DEFAult SCREen
---------------	--------------------------------

Set Only. COLOR:DEFAULT assigns default copier colors to the DSA color index as shown below. COLOR:SCREEN assigns copier colors to match the current colors on the display.

For firmware version 1.2 or above, the color assignments for the original color system differ from those for the standard color system. For earlier firmware versions, only the original color system applies.

Default TEK4692 Color Assignments – Original Color System

Color Index	4692 Color	Color Index	4692 Color
0	4095 (0xFFFF)	4	1020 (0x3FC)
1	243 (0x0F3)	5	0 (0x000)
2	1638 (0x666)	6	207 (0x0CF)
3	972 (0x3CC)	7	3840 (0xF00)

TEK4692

(cont.)

Default TEK4692 Color Assignments
 — Standard Color System †

Color Index	4692 Color	Color Index	4692 Color
0	4095 (0xFFFF)	4	2362 (0x93C)
1	0 (0x000)	5	1020 (0x3FC)
2	3945 (0xF69)	6	2457 (0x999)
3	1776 (0x6F0)	7	3840 (0xF00)

† Firmware version 1.2 and above.

Note: Refer to page 32 for the color index.**TEK4692 COL:DEFA**

COLOR <ui> :	<NRx>	(Range below)
---------------------	-------	---------------

COLOR <ui> assigns copier colors to the DSA color index. The COLOR <ui> range is 0 to 7. Copier color range (<NRx>) is 0 to 4095.

TEK4692 COL3:3840

Examples of 4692 Index Coding

4692 Color	Maps to
4095 (0xFFFF)	White
240 (0x0F0)	Green
4080 (0xFF0)	Yellow
15 (0x00F)	Purple
0 (0x000)	Black
255 (0x0FF)	Blue
3840 (0xF00)	Red

Note: RGB color charts are included in the *4692 Color Graphics Copier Device Driver Development Guide* (Tektronix part no. 070-4818-00).

DIR ection:	HOR iz VER t
--------------------	------------------------------

DIRECTION selects the printing orientation. HORIZ prints rows left to right and from top to bottom. VERT prints columns bottom to top and from left to right.

TEK4692 DIR:VER

TEK4692

(cont.)

FORMat:	DIT hered DRA ft HIR es SCR een
----------------	---

Set Only. FORMAT selects the output format. DITHERED modifies print contrast for TEK4692. HIRES shows front panel intensified regions; DRAFT prints monochrome. SCREEN is a one-to-one mapping of 3-bit pixel information. (Use SCREEN for the 4693D printer in 4692 emulation mode.)

TEK4692 FORM:DIT

PORT:	CEN TRonics GPI b RS232
--------------	--

PORT specifies the output port for the printer.

TEK4692 POR:CENTR

TEK4696

External I/O Commands

TEK4696 specifies parameters for the Tektronix 4696 and Tektronix 4695 color Inkjet printers.

COLor:	DEFA ult
---------------	-----------------

Set Only. COLOR assigns default inkjet colors to the DSA color index.

For firmware version 1.2 or above, the color assignments for the original color system differ from those for the standard color system. For earlier firmware versions, only the original color system applies.

*Default Inkjet Colors Assigned by Color
– Original Color System*

Color Index	4696 Color	Color Index	4696 Color
0	White	4	Blue
1	Green	5	Black
2	Cyan	6	Magenta
3	Cyan	7	Red

TEK4696

(cont.)

*Default Inkjet Colors Assigned by Color
– Standard Color System †*

Color Index	4696 Color	Color Index	4696 Color
0	White	4	Blue
1	Black	5	Cyan
2	Magenta	6	Black
3	Green	7	Red

† Firmware version 1.2 and above.

Note: Refer to page 32 for definitions of the color index.

TEK4696 COL:DEFA

COLOR <ui> : <NRx> (Range below)

COLOR assigns inkjet colors to the DSA color index. The COLOR <ui> range is 0 to 7. The Printer color range (<NRx>) is 0 to 12.

The colors associated with each 4696 Printer color number are listed below:

Colors Associated With 4696 Color Numbers

4696 No.	Actual Color	4696 No.	Actual Color
0	white	7	purple
1	cyan	8	black
2	yellow	9	black & cyan
3	green	10	black & yellow
4	magenta	11	black, cyan, yellow
5	blue	12	black & magenta
6	red		

TEK4696 COL:3

TEK4696

(cont.)

DIR ection:	HOR iz VER t	
--------------------	------------------------------	--

DIRECTION selects the printing orientation. **HORIZ** prints rows left to right and from top to bottom. **VERT** prints columns bottom to top and from left to right.

TEK4696 DIR:HOR

FORM at:	DIT hered DRA ft HIR es RED uced SCR een	
-----------------	--	--

Set Only. **FORMAT** selects the output format. **DITHERED** improves print contrast for TEK4696. **HIRES** shows front panel intensified regions; **DRAFT** prints monochrome. **REDUCED** is a quarter-size version of **DRAFT**. **SCREEN** is a one-to-one mapping of 3-bit pixel information.

TEK4696 FORM:SCR

PORT :	CEN TRonics GPI b RS232	
---------------	--	--

PORT specifies the output port for the printer.

TEK4696 POR:RS232

TEK4697

(Firmware v. 1.2 and above) External I/O Commands

TEK4697 specifies parameters for the Tektronix 4697 color Inkjet printers.

The syntax for **TEK4697** is identical to that for **TEK4696**, described previously. Color assignments match those for **TEK4692**.

TEK4697 FORM:DIT

TEST [XTND]

Diagnostics Commands

Set Only. TEST initiates the Self-tests diagnostics or, with the XTND argument, the Extended Diagnostics.

Completion of diagnostics is signaled with either event code 460 or 474, successful completion of tests, or event code 394, completion with failed tests.

Note: TEST destroys all stored waveforms and user-defined expansion strings created with the DEF command, resets the TEXT X, Y: coordinates to 0,0, and removes user-entered text from the display.

TES XTN

TEXT [<link>:] <arg>

Display and Color Commands

Set Only. TEXT writes character(s) to the selected area of the screen.

	CLEAR	
--	--------------	--

Set Only. CLEAR removes all user-defined text from the display.

TEX CLEAR

STRING:	<qstring>	
----------------	-----------	--

Set Only. STRING specifies the text that is to be displayed at the X: and Y: coordinates.

TEX STR: 'Select a waveform'

X:	<NRx>	0 to 49
-----------	-------	---------

Set Only. X specifies the horizontal position (X coordinate) of a character in discrete character cells. The range is 0 (left edge of the graticule) to 49 (right edge of the graticule).

TEX X:10

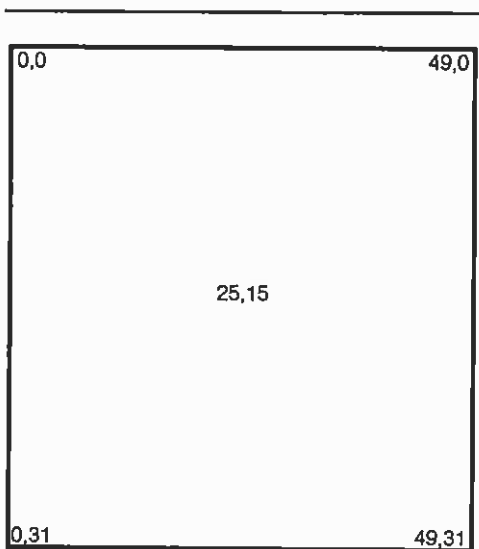
TEXT [*<link>* :] *<arg>* (cont.)

Y:	<i><NRx></i>	0 to 31
----	--------------------	---------

Set Only. Y specifies the vertical position (Y coordinate) of a character in discrete character cells. The range is 0 (top edge of the graticule) to 31 (bottom edge of the graticule).

```
TEX Y:20
```

The figure on the following page shows some TEXT X,Y: cell coordinates.



TEXT X,Y: Display Coordinates

TIME *<qstring>*

Miscellaneous/System Commands

TIME sets the time of day on the internal clock.

<i><qstring></i>	<i><hh></i> : <i><mm></i> : <i><ss></i>
------------------------	---

where *<hh>* is the hour, *<mm>* is minutes, and *<ss>* is seconds in 24-hour format.

```
TIM '17:25:30'
```

TOPLINE <NRx>

Measurement Commands

	<NRx>	(Any legal value)
--	-------	-------------------

The TOPLINE command sets the vertical topline level for measurements.

For firmware version 1.2 and above, TOPLINE sets the topline level when MTRACK (measurement tracking) is set to OFF or BASELINE. TOPLINE is ignored when MTRACK is set to BOTH or TOPLINE.

For firmware version 1.1 and below, TOPLINE sets the topline level when MTRACK is set to OFF.

TOPLINE sets the top vertical level for measurements on the selected waveform when MTRACK is set to OFF.

```
TOP: 2.0
```

TR?

Triggering Commands

Query Only. The TR? query is equivalent to entering: TRMAIN?;TRWIN?. The response is:

```
TRMAIN MODE: <arg>, ALEVEL: <NR3>,
ANLEVEL: <NR3>, {DIVS|VOLTS},
COUPLING: <arg>, SLOPE: <arg>,
SOURCE: <qstring>, STATUS: <arg>,
TIHOLDOFF: <NR3>;
TRWIN MODE: <arg>, ALEVEL: <NR3>,
COUPLING: <arg>, EVHOLDOFF: <NR1>,
NLEVEL: <NR3>, {DIVS|VOLTS},
SLOPE: <arg>, SOURCE: <qstring>,
STATUS: <arg>, TIHOLDOFF: <NR3>
```

Note: The TR header is not part of the response.

TRAcE <ui> <link> : <arg>

Waveform and Settings Commands

TRACE <ui> defines a waveform and its characteristics. The range of <ui> is 1 to 8.

ACC umulate:	(see below)	
---------------------	-------------	--

For firmware version 1.2 and above:

ACC umulate:	VAR Persist INF Persist OFF	
---------------------	---	--

ACCUMULATE controls the display persistence of the specified trace.

In normal display mode, waveform record points are cleared from the display each time a new waveform record is displayed. **ACCUMULATE: OFF** returns the trace to normal display mode.

VARPERSIST selects variable persistence mode. In this mode, waveform record points remain on the display for the length of time specified by **DISPLAY PERSISTENCE** before being cleared from the display.

INFPERSIST selects Infinite persistence. In this mode, waveform record points remain on the display indefinitely until some event clears the trace display.

You cannot set **ACCUMULATE** to **VARPERSIST** or **INFPERSIST** in the following cases:

- For a stored or scalar waveform (e.g., STO9)
- When the record length is greater than 2048

You cannot mix **INFPERSIST** and **VARPERSIST** waveforms on the same graticule. Changing one waveform from one persist mode to the other automatically changes all persist mode waveforms on the same graticule (waveforms in normal display mode are not affected).

Note: You can take automated measurements of traces in the normal display mode only.

In firmware version 1.2 and above, all three accumulate modes are available for XY waveforms. **INFPERSIST** is equivalent to **ON** in version 1.1 and below.

TRAcE ACC:VARP

TRAcE <ui> <link>:<arg> (cont.)

For firmware version 1.1 and below:

ACCUMULATE sets point accumulate (PA) mode to ON or OFF. You cannot set ACCUMULATE to ON in the following cases:

- For an XY waveform (e.g., L1 VS L2)
- For a stored or scalar waveform (e.g., ST09)
- When the record length is greater than 2048
- When there is already a PA mode waveform or an XY waveform on the same graticule

In addition, you cannot perform measurements on a PA mode waveform.

```
TRA3 ACC:OFF
```

7 ACState	ENHanced NENHanced
-----------	----------------------

Query Only. ACSTATE returns the accuracy mode in which the specified waveform was created.

```
TRA3? ACS
TRACES ACSTATE:ENHANCED
```

TRAcE <ui> <link>:<arg> (cont.)

DEScRiption:	<qstring>	≤ 120 characters
---------------------	-----------	------------------

DESCRIPTION defines the source expression(s) of the selected waveform.

<y exp> [VS <x exp>] [ON <time base>]

where:

<y exp> , <x exp> ::= Expressions

[VS <x exp>] ::= Indicates an XY waveform; if omitted, the waveform is YT

[ON <time base>] ::= Indicates time base – {MAIN|WIN1|WIN2}; if omitted, defaults to MAIN

<slot> <ui>	Channel designator, e.g. L1
STO <ui>	Stored waveform, range 1 to 918
<NRx>	Scalar number
<function>	Any of the following functions: ABS AVG DEJITTER DIFF ENV EXP FFTMAG FFTPHASE INTG INTP LN LOG PIADD† PISUB† SIGNUM SMOOTH SQRT

Terms Available to Form Expressions

† The PIADD and PISUB functions are not available from the front panel.

+ (addition)	* (multiplication)
- (subtraction, negation)	/ (division)

Operators Available to Form Expressions

TRACE <ui> <link>:<arg> (cont.)

Note: You cannot use a waveform description that consists of only stored or scalar elements as the argument of an AVG or ENV function. You also cannot create a waveform with only stored or scalar elements on the WIN1 or WIN2 time base.

```
TRA2 DES:'ENV(L2)';
TRA3 DES:'STO9+C1'
```

XY Waveform Considerations. The DSA permits only one acquired XY waveform or two unacquired XY waveforms to be displayed via TRACE <ui> DESCRIPTION. (An acquired XY trace description has at least one acquired signal component; an unacquired XY trace description has only stored or scalar components.)

Acquired XY Description	Unacquired XY Description
"L1 VS L2"	"STO50 VS STO12"
"L1 VS STO3"	"STO90 VS 200"

Components of XY Descriptions

In addition, the horizontal and vertical components (<x exp> and <y exp>) must have the same scaling mode; both must be Integer mode or both floating-point mode waveforms.

PIADD and PISUB Functions. These functions, which are not available from the front panel, allow you to add or subtract the signals from any two channels in a plug-in unit and treat them as a single channel. This operation is an analog addition or subtraction performed in the plug-in unit. The syntax of these functions (using channels L1 and L2 as an example) is:

```
TRACE1 DESCRIPTION:'PIADD(L1,L2)'
```

```
TRACE2 DESCRIPTION:'PISUB(L1,L2)'
```

Because system calibration constants do not apply in this mode, there may be a DC offset. To check if there is a DC offset, turn off the two channels and acquire the baseline value. This value will be the DC offset.

TRAcE <ui> <link>:<arg> (cont.)

GRLocation:	UPPer LOWer	
--------------------	----------------------	--

GRLOCATION moves the selected waveform to the upper or lower graticule pair.

```
TRA2 GRL:LOW
```

GRTYPE:	LINEar	
----------------	---------------	--

GRTYPE sets the graticule type of the selected waveform to linear. (Linear is the only option currently available.)

```
TRA2 GRT:LIN
```

? WFMCalc	FAST HIPrec	
------------------	----------------------	--

Query Only. **WFMCALC** returns whether a waveform was created in Integer mode (FAST) or floating-point mode (HIPREC). Once a waveform is created in one mode, you cannot change the waveform to the other mode. (Refer to **WFMSCALING** command.)

```
TRA2? WPMC
TRACE2 WFMCALC:HIPREC
```

? XUNIT	AMPS DIVS HERTz OHMs SECOnds VOLts WATts	
----------------	---	--

Query Only. **XUNIT** returns the horizontal units (X-axis) of the specified waveform.

```
TRA5? XUN
TRACE5 XUNIT:SECONDS
```

TRACe <ui> <link>:<arg> (cont.)

? YUNIT	AMPS DEGrees DIVS OHMs VOLts WATts
---------	--

Query Only. YUNIT returns the vertical units (Y-axis) of the specified waveform.

```
TRAS? YUN
TRACES YUNIT:VOLTS
```

Query Note: TRACE<ui>? returns the links and arguments of the specified waveform in the following order:

```
TRACE<ui> DESCRIPTION:<qstring>,
ACCUMULATE:<arg>,ACSTATE:<arg>,
GRLOCATION:<arg>,GRTYPE:<arg>,
WFMCALC:<arg>,XUNIT:<arg>,
YUNIT:<arg>
```

TRACE? returns the same information as TRACE <ui>? for all defined waveforms in low-to-high order.

TRANUM?

Waveform and Settings Commands

Query Only. TRANUM? returns the number of waveforms displayed on the front panel. Range is 0 to 8 in <NR1> form.

```
TRANU?
TRANUM 4
```

TRLevel {ABSOLUTE|SCREEN}

(Firmware v. 1.2 and above)

Triggering Commands

TRLEVEL sets the trigger DC level mode.

In SCREEN mode, the trigger level remains constant on screen when changes are made to the vertical sensitivity or offset of the input channel(s) (changes to the vertical size or position of a trace). This is the factory default TRLEVEL mode.

In ABSOLUTE mode, the trigger level remains constant in input units (usually volts) when changes are made to vertical size or position. In this mode, the trigger level is constrained to remain on the screen.

```
TRL ABSO
```

TRMain <link> : <arg>

Triggering Commands

TRMAIN sets the parameters of the Main trigger.

ALevel:	<NRx>	20 to 80 percent
---------	-------	------------------

When TRMAIN MODE is set to AUTOLEVEL, ALEVEL sets the trigger level to a percentage of the peak-to-peak value of the trigger source signal.

When TRMAIN MODE is not set to AUTOLEVEL, the ALEVEL value is saved and applied later when MODE is changed to AUTOLEVEL.

```
TRM ALE:25
```

ANLevel:	<NRx>,{DIVS VOLTS}	(Range ↓)
----------	--------------------	-----------

Note: Be sure to set the TRMAIN MODE, COUPLING, and SOURCE links before setting ANLEVEL.

When TRMAIN MODE is set to AUTO or NORMAL, ANLEVEL sets the trigger level to the specified value in the specified units (DIVS or VOLTS; see below for scaling information).

TRMain *<link>*:*<arg>* (cont.)

When TRMAIN MODE is set to AUTOLEVEL, you cannot set ANLEVEL; the *set* value for ANLEVEL is ignored. However, querying ANLEVEL when MODE is set to AUTOLEVEL returns the current level value scaled in DIVS.

Trigger Level Scaling. If TRMAIN SOURCE is a single channel (e.g., L1) and TRMAIN COUPLING is DC, DCHF, or DCNOISE, the DSA scales the ANLEVEL value in VOLTS. For any other combination of TRMAIN SOURCE and COUPLING, the DSA scales the ANLEVEL value in DIVS.

When the DSA scales ANLEVEL in VOLTS, you can set ANLEVEL in either VOLTS or DIVS. DIVS are converted to VOLTS using the formula:

$$\langle \#_of_DIVS \rangle * CH \langle slot \rangle \langle ui \rangle SEN + OFFS$$

where CH *<slot>* *<ui>* is the trigger source channel and SEN and OFFS are the sensitivity and offset links of the specified channel.

When the DSA scales ANLEVEL in DIVS, you can only set ANLEVEL in DIVS. Attempting to set ANLEVEL in VOLTS is an error.

The range for ANLEVEL: *<NRx>*, DIVS is from -5 to +5 graticule divisions.

The range for ANLEVEL: *<NRx>*, VOLTS is calculated with the following formulas using the sensitivity and offset of the trigger source channel (CH *<slot>* *<ui>* ? SEN, OFFS):

$$(-5 * SEN + OFFS) \text{ to } (+5 * SEN + OFFS)$$

Note: This formula also applies to the volts range for ANBLEVEL.

TRMain <link>:<arg>

(cont.)

Trigger Level Usage Examples. The following are examples of trigger level usage. The first three columns contain the MODE, COUPLING, and SOURCE arguments. The fourth column gives an ANLEVEL value in either DIVS or VOLTS, and the last column shows the effect.

Trigger Level Usage Examples

MODE:	COU:	SOU:	Level Setting	Result
AUTOL	DC	L1	ANL:3,DIVS	Ignored
AUTOL	DC	L1	ANL:3,VOLTS	ignored
AUTO	DC	L1 + L2	ANL:3,DIVS	value OK
NOR	DC	L1	ANL:3,DIVS	converted
AUTO	DC	L1	ANL:3,VOLTS	value OK
NOR	AC	L1	ANL:3,DIVS	value OK
AUTO	AC	L1	ANL:3,VOLTS	-error-
NOR	AC	L1	ANL:3,VOLTS	-error-

Under Result, "Ignored" means the set value is not used; "value OK" means both the value and units are acceptable; "converted" means that the DIVS units were converted to VOLTS; and "error" means that VOLTS was an unacceptable unit.

TRM ANL:150E-3,VOL

ANBlevel:	<NRx>,{DIVS VOLTS}	(Range ↓)
-----------	--------------------	-----------

When TRMAIN MODE is AUTO or NORMAL and extended triggering mode is active (i.e., TRMAIN SOURCE: <exp> includes WHILE, AND, OR, TO, or XOR), ANBLEVEL sets the level of the B trigger source to the specified value. DIVS range is -5 to +5 graticule divisions. VOLTS range is calculated with the same formula as ANLEVEL.

TRM ANB:150E-3,VOL

TRMain <link>:<arg> (cont.)

COUplng:	AC ACLf ACHf ACNoise DC DCHf DCNoise
-----------------	---

COUPLING selects the Main trigger coupling.

Note: Be sure to set TRMAIN MODE, COUPLING, and SOURCE before setting ANLEVEL.

TRM COU:DCH

MODe:	AUTO AUTOLevel NORmal
--------------	----------------------------------

MODE selects Main triggering mode. When MODE is set to AUTOLEVEL, the trigger level is set with ALEVEL. When MODE is set to AUTO or NORMAL, the trigger level is set with ANLEVEL.

Note: Be sure to set TRMAIN MODE, COUPLING, and SOURCE before setting ANLEVEL.

TRM MOD:AUTOL

SLOpe:	PLUs MINUs
---------------	---------------------

SLOPE sets the Main trigger slope.

TRM SLO:MINU

TRMain <link>:<arg> (cont.)

SOURCE:	<qstring>	<exp>
---------	-----------	-------

SOURCE sets the trigger source to the specified expression <exp>. The following is the main trigger source <exp> syntax:

```
[ ± ] {L|C} <ui> [ { [ ± ] {L|C} <ui> }... ] |
{ <bin op> { [ ± ] {L|C} <ui> } <bin op> }... |
{ TO [ ± ] {L|C} <ui> <timer1> |
[ ± ] R <ui> [ { [ ± ] R <ui> }... ] |
{ <bin op> { [ ± ] R <ui> } <bin op> }... |
{ TO [ ± ] R <ui> <timer1> |
{ <timer1> | <timer2> } | LINE
```

where <bin op> is one of the binary operators, AND, OR, TO, WHILE, or XOR, used in extended triggering mode, and <timer1> and <timer2> are values set with the TIMER1 and TIMER2 links. (Refer also to the ANBLEVEL link.)

In brief,

- You can use a channel only once in a trigger expression. †
- You can combine L and C channels (add/subtract) with each other but not with R channels.
- You can combine R with other R channels, but not with L or C channels.
- You can invert any channel except the single input channel of an 11A71 Amplifier,
- You cannot reference a channel that is not installed.
- Triggers cannot be chopped between Main and Window time bases.

† Firmware version 1.2 and above supports use of the same source (channel or combination of channels) on both sides of a Boolean trigger expression.

Chopped Triggers. Each plug-in unit has a single trigger output line. Trigger expressions define the use of this trigger line by specifying the number and polarity of each channel used from the plug-in unit. Once the trigger line is assigned, no other trigger access is available from that plug-in unit. Thus, two waveforms cannot use the trigger line from one plug-in unit in different ways.

TRMain <link>:<arg> (cont.)

In particular, when Window trigger mode (WTMODE) is set to time holdoff or event holdoff (TIHOLDOFF or EVHOLDOFF), and both the Main and Window trigger source expressions reference the same plug-in unit, both expressions must reference the same channel(s) and no other channels from that plug-in compartment; otherwise, the triggers are chopped, which is not acceptable.

The following table contains examples of acceptable and unacceptable (chopped) trigger sources. (Assume WTMODE is set to TIHOLD-OFF and each plug-in compartment has a two-channel amplifier installed.)

Chopped Trigger Source Examples

TRMAIN SOURCE:	Acceptable TRWIN SOU:	Chopped TRWIN SOU:
"L1"	"L1"	"L2"
"L1"	"L1 + C1"	"L1 + L1"
"L1"	"R2"	"L2 + C2"
"L1"	"C1 + C2"	"R1 + C1"
"C1 + C2"	"C1 + C2"	"C1"
"C1 + C2"	"C1 + C2 + L2"	"C1 + C1"
"C1 + C2"	"L1 + L2"	"L2 + C2"
"C1 + C2"	"R1"	"R1 + C1"

Note: When WTMODE is set to MAIN, the Window trigger source has no effect on the Main trigger source and no checks are made for chopped triggers.

```
TRM SOU: L1-C1
```

? STATUS	TRG NOTrg
----------	-------------

Query Only. STATUS returns the trigger status of the Main time base. TRG means the Main time base is triggered. NOTRG means the Main time base is not triggered.

```
TRM? STA
TRMAIN STATUS:TRG
```


TRMain <link>:<arg> (cont.)

TIHOLDoff:	<NRx>	490E-9 to 10 sec
-------------------	-------	------------------

TIHOLDOFF sets the Main trigger time holdoff in seconds.

TRM TIH:24E-3

TIMER1:	<NRx>	2E-9 to 1.048E-3 sec
----------------	-------	----------------------

TIMER1 sets the first Main trigger timer in seconds.

TRM TIMER1:5E-6

TIMER2:	<NRx>	4E-9 to 2.096E-3 sec
----------------	-------	----------------------

TIMER2 sets the second Main trigger timer in seconds. The TIMER2 range is:

(TIMER1 + 2E-9) to (TIMER1 + 1.048E-3)

TRM TIMER2:5E-6

Query Note: The TRMAIN? query returns all links and their arguments, in the following order:

```
TRMAIN MODE: <arg>, ALEVEL: <NR3>,
COUPLING: <arg>, SLOPE: <arg>,
SOURCE: <qstring>, ANLEVEL: <NR3>,
{DIVS|VOLTS}, ANLEVEL: <NR3>,
{DIVS|VOLTS}, STATUS: <arg>,
TIHOLDOFF: <NR3>, TIMER1: <NRx>,
TIMER2: <NRx>
```

TRWin <link>:<arg>

Triggering Commands

TRWIN sets Window trigger parameters.

ALEvel:	<NRx>	20 to 80 percent
----------------	-------	------------------

When TRWIN MODE is set to AUTOLEVEL, ALEVEL sets the trigger level to a percentage of the peak-to-peak value of the trigger source signal.

When TRWIN MODE is set to NORMAL, the ALEVEL value is saved and applied when MODE is changed to AUTOLEVEL.

TRW ALE:25

COUpling:	AC ACLf ACHf ACNoise DC DCHf DCNoise
------------------	--

COUPLING selects Window trigger coupling.

TRW COU:DCH

EVHoldoff:	<NRx>	1 to 1E9 events
-------------------	-------	-----------------

EVHOLDOFF sets the Window trigger event holdoff to the specified number of events.

TRW EVH:500

MODe:	AUTOLevel NORmal
--------------	----------------------------------

MODE selects the Window triggering mode. When MODE is set to AUTOLEVEL, the trigger level is set with ALEVEL. When MODE is set to NORMAL, the trigger level is set with NLEVEL.

TRW MOD:AUTOL

TRWin <link>:<arg> (cont.)

NLevel:	<NRx>,{DIVS VOLTS}	(Range ↓)
---------	--------------------	-----------

Note: Be sure to set TRWIN MODE, COUPLING, and SOURCE before setting NLEVEL.

When TRWIN MODE is set to NORMAL, NLEVEL sets the trigger level to the specified value in the specified units (DIVS or VOLTS; see below for scaling information).

When TRWIN MODE is set to AUTOLEVEL, the NLEVEL set value is ignored; however, querying NLEVEL returns the current level scaled in DIVS.

Trigger Level Scaling. If the TRWIN SOURCE is a single channel and TRWIN COUPLING is DC, DCHF, or DCNOISE, the DSA scales the NLEVEL value in VOLTS. For any other combination of TRWIN SOURCE, and COUPLING, the DSA scales the NLEVEL value in DIVS.

When the DSA scales NLEVEL in VOLTS, you can set NLEVEL in either VOLTS or DIVS. DIVS are converted to VOLTS using this formula:

$$\langle \#_of_DIVS \rangle * CH \langle slot \rangle \langle ui \rangle SEN + OFFS$$

where CH <slot> <ui> is the trigger source channel, and SEN and OFFS are the sensitivity and offset links of the specified channel.

When the DSA scales NLEVEL in DIVS, you can only set NLEVEL in DIVS. Attempting to set NLEVEL in VOLTS will result in an error.

The NLEVEL: <NRx>, DIVS range is -5 to +5 graticule divisions.

The NLEVEL: <NRx>, VOLTS range is calculated with the following formulas using the sensitivity and offset of the trigger source channel (CH <slot> <ui> ? SEN,OFFS):

$$(-5 * SEN + OFFS) \text{ to } (+5 * SEN + OFFS)$$

Usage. Window trigger NLEVEL usage is the same as for Main trigger ANLEVEL. Refer to page 147 for examples, substituting NLE:3, {DIVS|VOLTS} in the Level Setting column.

TRW NLE:-2.625E-3,VOL

TRWin <link>:<arg> (cont.)

SLOpe:	PLUS MINUS	
---------------	---------------------	--

SLOPE sets the Window trigger slope.

TRW SLO:MINU

SOURce:	<qstring>	<exp>
----------------	-----------	-------

SOURCE sets the Window trigger source to the specified trigger expression, <exp>. The following is the Window trigger source <exp> syntax:

```
[ ± ] {L|C} <ui> [ { [ ± ] {L|C} <ui> }... ] |
[ ± ] R <ui> [ { [ ± ] R <ui> }... ] |
{ <timer1> | <timer2> } | LINE
```

TRWIN SOURCE is a subset of TRMAIN SOURCE. Note that <bin op> expressions and TO <timer1> expressions are not allowed. Refer to TRMAIN SOURCE for source restrictions and examples.

TRW SOU:L1-C1'

? STATus	TRG NOTRG
-----------------	--------------------

Query Only. STATUS returns the trigger status of the Window time base. TRG means the Window time base is triggered. NOTRG means the Window time base is not triggered.

**TRW? STA
TRWIN STATUS:NOTRG**

TIHoldown:	<NRx>	20E-9 to (TRM TIH)
-------------------	-------	--------------------

TIHOLDOFF sets the Window trigger time holdoff in seconds. Maximum TRWIN TIHOLDOFF ≤ TRMAIN TIHOLDOFF.

TRW TIH:24E-3

TRWin <link>:<arg> (cont.)

TIMER1:	<NRx>	2E-9 to 1.048E-3 sec
----------------	-------	----------------------

TIMER1 sets the first Window trigger timer in seconds.

```
TRW TIMER1:5E-6
```

TIMER2:	<NRx>	4E-9 to 2.096E-3 sec
----------------	-------	----------------------

TIMER2 sets the second Window trigger timer in seconds. The TIMER2 range is:

(TIMER1 + 2E-9) to (TIMER1 + 1.048E-3)

```
TRW TIMER2:5E-6
```

Query Note: The TRWIN? query returns all links and their arguments, in the following order:

```
TRWIN MODE: <arg> ,ALEVEL: <NR3> ,
COUPLING: <arg> ,EVHOLDOFF: <NR1> ,
SLOPE: <arg> ,SOURCE: <qstring> ,
NLEVEL: <NR3> , {DIVS|VOLTS} ,
STATUS: <arg> ,THOLDOFF: <NR3> ,
TIMER1: <NR3> ,TIMER2: <NR3>
```

TSMain?

Triggering Commands

Query Only. TSMAIN? returns the elapsed time between the actual trigger point and the waveform sample identified as 0 seconds, for real-time single-shot acquisitions only.

```
TSM?
TSMAIN 2.228E-9, EQ
```

WFMpre <link>:<arg> (cont.)

ACState:	ENHanced NENhanced
----------	----------------------

ACSTATE Indicates whether the waveform was created with Enhanced Accuracy or normal configuration calibration accuracy.

```
WFM ACS:ENH
```

? BIT/nr	16
----------	----

Query Only. BIT/NR returns the number of bits per binary waveform point (always 16).

```
WFM? BIT
WFMPRE BIT/NR:16
```

? BN.fmt	RI
----------	----

Query Only. BN.FMT returns the Tek Codes and Formats binary number format, which is always RI (right-justified, twos-complement integers).

```
WFM? BN.
WFMPRE BN.FMTRI
```

? BYT/nr	2
----------	---

Query Only. BYT/NR returns the binary data field width (which is always two bytes per binary waveform point).

```
WFM? BYT/
WFMPRE BYT/NR:2
```

? BYT.or	LSB MSB
----------	-----------

Query Only. BYT.OR returns the transmission order of binary waveform data returned by CURVE?. The transmission order is set by the BYT.OR command.

```
WFM? BYT
WFMPRE BYT.OR:LSB
```

WFMpre <link>:<arg>

(cont.)

? CRVchk	CHKsm0 NONe NULl
----------	----------------------

Query Only. CRVCHK returns the type of checksum appended to the waveform data after it is returned by a CURVE? query. The types are defined below.

Checksum Types

Type	Meaning
CHKSM0	Standard Tek Codes and Formats checksum. Returned when ENCDG WAVFRM is set to BINARY and OUTPUT is set to STO <ui>.
NONE	No checksum appended. Returned when ENCDG WAVFRM is set to ASCII.
NULL	Zero checksum value appended. Returned when ENCDG WAVFRM is set to BINARY and OUTPUT is set to TRACE <ui>.

```
WFM? CRV
WFMpre CRVCHK:CHKSM0
```

DATE:	<qstring>	<dd-mon-yy>
-------	-----------	-------------

DATE is the date stamp for the waveform, where *dd* is the day of the month, *mon* is the first three letters of the month, and *yy* is the last two digits of the year. The date stamp is recorded when a waveform is stored, or you can set it with this link. If WFMpre? DATE is queried when OUTPUT is TRACE <ui> (i.e., a displayed waveform), the date of the most recent acquisition is returned.

```
WFM DATE:'14-FEB-89'
```

? ENCDg	ASCIi BINArY
---------	----------------

Query Only. ENCDG returns the state of the data encoding set with the ENCDG command. This link is equivalent to an ENCDG? WAVFRM query.

```
WFM? ENC
WFMpre ENCDG:ASCIi
```

WFMScaling {FORce|OPTional}

Waveform and Settings Commands

WFMSCALING determines whether a new waveform is created in floating-point mode (FORCE) or integer mode when possible (OPTIONAL). When WFMSCALING is set to FORCE, all waveforms except single channel acquisitions (e.g., L1, R2), are created in floating-point mode. Integer mode implies that no floating-point operations are used to display or position waveforms. Certain waveform types require floating-point mode or integer mode, regardless of the WFMSCALING setting. (For example, stored waveforms are stored in floating-point mode.)

Note: Waveforms created in integer mode have faster display update rates.

You can display the following waveform description types in integer mode:

Waveform Types Displayable in Integer Mode

Description	Example
A channel (<slot> <ui>)	C1
Average of a channel	AVG(C1)
Envelope of a channel	ENV(C1)
Inversion of a channel	-C1
Addition of channels	C1 + L2
Subtraction of channels	C1 - L2
Combinations of the above	AVG(C1 + L2)

The following are some of the waveform types that you cannot display in integer mode:

Waveforms Not Displayable in Integer Mode

Waveform Type	Example
Stored waveform	STO11
Scalar value	2.23
Stored waveform plus scalar value	STO11 + 2.23
Any waveform using division	L1 / L2
Any waveform using multiplication	R1 * R2
Any waveform using a floating-point function	DIFF(C1)

WFMS OPT

WIDTH?

Measurement Commands

Query Only. WIDTH? returns the time a signal takes to go from one MESIAL voltage level crossing to the next MESIAL crossing of the opposite slope, followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.)

```

WID?
WIDTH 5.009E-7,EQ

```

WIN1Pos <NRx>;**WIN2Pos <NRx>**

Time Base/Horizontal Commands

WIN1POS and WIN2POS set the position of the Window 1 or Window 2 acquisition records, respectively, relative to the Window trigger.

	<NRx>	(See below for range)
--	-------	-----------------------

WIN1POS or WIN2POS range when WTMODE is MAIN or EVHOLDOFF:

MAINPOS - *win duration* to
 MAINPOS + *main duration*

WIN1POS or WIN2POS range when WTMODE is TIHOLDOFF:

- (TRWIN TIH - MAINPOS + *win duration*) to
 (*main duration* + MAINPOS - TRWIN TIH)

Refer to page 131 for the *duration* calculation.

Refer to the WTMODE command.

```

WIN1P 0;WIN2P -1.35

```

WTMode {MAIN|EVHoldoff|TIHoldoff}

Triggering Commands

WTMODE sets window triggering mode.

When WTMODE is set to MAIN, the Window trigger coincides with the Main trigger; the Window trigger is not held off.

When WTMODE is set to EVHOLDOFF, the Window trigger is held off for the number of events specified by TRWIN EVHOLDOFF.

When WTMODE is set to TIHOLDOFF, the Window trigger is held off for the time specified by the trigger holdoff (TRWIN TIHOLDOFF).

Note: When WTMODE is set to MAIN, the DSA does not check whether the Main and Window triggers are chopped. When WTMODE is changed to EVHOLDOFF or TIHOLDOFF, the DSA checks if the triggers are chopped. Refer to page 149 for more information on trigger chopping.

WTM EVH

Y

YTEnergy?

Measurement Commands

Query Only. YTEnergy? returns the energy (in squared volts) under the curve of a YT waveform, followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.)

```
YTE?
YTEENERGY 8.442E-7,EQ
```

YTMns_area?

Measurement Commands

Query Only. YTMNS_AREA? returns the difference between the area under a YT curve above a specified reference level, and the area under the curve below that level, followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.) The reference level is set with the REFLEVEL command.

```
YTM?
YTMNS_AREA 3.332E-7,EQ
```

YTPIs_area?

Measurement Commands

Query Only. YTPLS_AREA? returns the total, absolute value of all areas between a YT waveform and a reference level set with REFLEVEL, followed by an accuracy qualifier. (Refer to page 88 for qualifier definitions.)

```
YTP?
YTPLS_AREA 1.052E-9,EQ
```



Event Reporting

Status Byte Codes

Ten status conditions are reported in the status byte—five normal events and five error or warning events.

The following table gives the status byte codes in binary and in decimal with both RQS set to ON and set to RQS OFF. The bits in the status byte are active high. Bits 1 through 4 are system status bits. Bit 5 is the busy status bit and is asserted only during diagnostics. Bit 6 is the error bit. Bit 7 ("R" in the table) indicates whether RQS is set to ON (high) or OFF (low). Bit 7 is low until specifically enabled with the RQS command. Bit 8 is always low.

Binary and Decimal Status Byte Codes

Condition	BINARY		DECIMAL	
	Status Bits		RQS	RQS
	8765	4321	ON	OFF
<i>Normal:</i>				
No Status to Report	0000	0000	0	0
Power On	0R00	0001	65	1
Operation Complete	0R00	0010	66	2
User Request	0R00	0011	67	3
Calibration Due	0R00	0110	70	6
<i>Abnormal:</i>				
Command Error	0R10	0001	97	33
Execution Error	0R10	0010	98	34
Internal Error	0R10	0011	99	35
Execution Warning	0R10	0101	101	37
Internal Warning	0R10	0110	102	38

Event Code Reporting

GPIB and RS-232-C controllers read event codes with the EVENT? query command. The query response depends on whether LONGFORM is set to ON or OFF. When LONGFORM is set to OFF, the event query returns:

EVENT <NR1>

where <NR1> is the event code.

Event Reporting

When LONGFORM is set to ON, the event query returns:

```
EVENT <NR1> , <qstring>
```

where <NR1> is the event code and <qstring> is the description from the event table.

Formatting Codes

In some cases, the text in the tables contains formatting codes. The formatting codes expand as follows:

Formatting Symbols

Symbol	Expand With:
%a	Plug-in channel number or unsigned integer
%A	Argument name
%b	Plug-in compartment indicator: L, C, or R
%B	Plug-in compartment indicator: LEFT, CENTER, or RIGHT
%C	Calibration request string: "Calibration due"
%d	Time base string: "Main" or "Window"
%D	Record length Integer
%I	Calibration request string: "Calibration due"
%M	Main DSA calibration fault string. If no error occurred, %M is replaced by "Pass"; otherwise %M is replaced by a short descriptive string of what caused the mainframe failure: (e.g., "Window Time Interpolator").
%O	Option description string (e.g., "Option 4C - Nonvolatile RAM")
%P	Plug-in compartment fault list. If there are no plug-in failures, %P is replaced with "NONE." Otherwise, %P will be replaced with a comma-delimited list of plug-in compartments, "LEFT," "CENTER," or "RIGHT," according to which compartment(s) reported failures.
%T	Time, as "X minutes and Y seconds." If X is 0, then "X minutes" is omitted. If Y is 0, then "Y seconds" is omitted
%W	Calibration request string: "Calibration due"
%?	Event code value

For example, the following set command causes an execution warning, event code 550:

```
CHL1 OFFSET: 5000
```

Event code 550 has this entry in the table of Execution Warnings on page 182:

Code	Event Description
------	-------------------

550	%A out of range—limit set
-----	---------------------------

If LONGFORM is set to OFF, the event is reported:

```
EVENT? <EOI>
EVENT 550
```

If LONGFORM is set to ON, the response is:

```
EVENT? <EOI>
EVENT 550, "OFFSET OUT OF RANGE —
LIMIT SET"
```

Command Errors

The following table lists the error codes and descriptions for command errors (SRQMASK CMDERR:ON). The status byte for all command errors is **97** with RQS set to ON and **33** with RQS set to OFF.

Command Errors

Code	Event Description
108	Checksum error in binary block transfer
109	Illegal byte count value on a binary block transfer
154	Invalid number input
155	Invalid string input
156	Symbol not found
157	Syntax error
160	Expression too complex
161	Excessive number of points in binary CURVE data input
162	Excessive number of points in ASCII CURVE data input
163	No input terminator seen
164	Binary block input not allowed with ECHO ON
167	Insufficient data to satisfy binary block byte count
168	Unsupported constant
169	Unsupported function

Execution Errors

The following table lists the error codes and descriptions for execution errors (SRQMASK EXERR:ON). The status byte for all execution errors is 98 with RQS set to ON and 34 with RQS set to OFF.

Execution Errors

Code	Event Description
203	I/O buffers full
205	%A out of range – value ignored
214	That function is incompatible with %0
215	Can't undo autoreset
216	Can't spool hardcopy
217	Can't keep scan waveform
218	Can't start scanning
219	Record length of delta description test wfm cannot be greater than record length of test wfm
220	Connect probe to calibrator and restart operation
221	Illegal delta description
222	%O needed to support that function
223	Illegal base label
224	Function not available in selected plugin range
225	Cannot change label while current acquisition mode is running
226	Trigger timer not available
227	Not available with Extended Triggering
228	Label not found
229	No stored waveforms
230	Can't set front panel calibrator amplitude
231	Autoreset – not functional with this waveform type
232	That XY waveform has incompatible components
233	Delayed trace must not be the selected trace
234	Unsupported printer function
235	Duplicate label – label not changed
236	Illegal color number
237	No labels defined
238	Label not defined
239	Improper version number
240	Can't accumulate nonacquired waveform
241	Too many acquisitions
242	ENHANCED ACCURACY available after %T

Execution Errors (Cont.)

Code	Event Description
243	That function is disabled by a hardware strap
244	%B plugin channel(s) used differently in main and window sources
245	Autoset—only functional with 11K plugins
246	Can't sequence settings
247	No settings defined
248	Misuse of AVG/ENV function
249	Illegal use of trace positioning function
250	No traces defined
251	Illegal trace number
252	Illegal stored settings number
255	Out of memory
257	Illegal stored waveform number
263	Illegal channel number
264	No further XY waveforms may be defined
265	Illegal DATE/TIME
266	DEF expansion overflow
267	Illegal DEF string
268	Illegal DEF recursion
269	No such trace
270	No such stored waveform
271	No such DEF
272	That function is not supported by this plugin
273	No such FPS
274	No appropriate 11K plugins loaded
275	%B slot not loaded with appropriate 11K plugin
276	%B slot not loaded with 7K plugin amplifier
277	Misuse of 7K plugin
278	Plugin channel used more than once in trigger source
279	Line trigger not available for window trigger source
281	Can't delete active stored waveform
282	Can't store trace
283	Can't clear nonacquired waveform
284	Requested coupling for channel %a not available on %B plugin
285	Requested input impedance for channel %a not available on %B plugin
286	Too many measurements specified
287	Hardcopy absent or off line

Execution Errors

Code	Event Description
288	Inappropriate trigger level units
289	Split cursors not permitted on XY trace
290	Current reference measurement failed
291	TEXT not permitted when acquired XY trace is active
292	%B slot not loaded with 11K plugin
294	Dual graticules not permitted with XY trace
295	Record length too long for Point Accumulate waveform
296	Point Accumulate and XY waveforms are mutually exclusive
297	Panzoom may not be enabled
298	Panzoom may not be disabled
299	CONDACQ function not available

Internal Errors

The following table lists the error codes and descriptions for internal errors (SRQMASK INERR:ON). The status byte for all internal errors is 99 with RQS set to ON and 35 with RQS set to OFF.

Internal Errors

Code	Event Description
308	Bad level 2 probe checksum on channel %b %a
327	DIG probe compensation failed
328	DIG plugin ENHANCED ACCURACY failed
329	Deskew failed: %C
330	ENHANCED ACCURACY failed. Mainframe: %M Plugin: %P
331	Probe calibration failed: %C
332	Partial ENHANCED ACCURACY failed. Plugin: %P
394	Test completed and failed
395	General DIG failure detected (code = %a
396	%B plugin communication failure
397	Internal DAC overflow on channel %a of %B plugin
398	Invalid DIG table ID detected
399	Invalid DIG field ID detected

System Events

This table lists the event codes, SRQMASK links, status byte values (with RQS set to ON and RQS set to OFF), and descriptions for normal system events; other than operation complete and calibration due events. Operation Complete events and Calibration Due events are described in separate tables.

System Events

Code	SRQM	Status Bytes	Event Description
400	-none-	0 0	System function normal
401	-none-	65 1	Power on
403	USE	67 3	Front panel RQS icon selected
451	ABS	67 3	Abstouch
457	IDP	67 3	Probe %a ID button pressed on %B plugin

Operation Complete Events

This table lists the codes and descriptions for Operation Complete events (SRQMASK OPCMPL:ON). The status byte is 66 with RQS set to ON and 2 with RQS set to OFF.

Operation Complete Events

Code	Event Description
450	Conditional acquire complete
460	Test completed and passed
461	ENHANCED ACCURACY completed and passed
462	Hardcopy complete
463	Measurements complete
464	Autoset complete
473	Front panel recall complete
474	INIT complete
475	Probe calibration completed and passed
476	Temperature change – %I
477	Warmup complete with new configuration – %W
478	Warmup complete – ENHANCED ACCURACY in effect. Compensate probe to use the max Real Time sample rate
479	Partial ENHANCED ACCURACY completed and passed

Calibration Due Events

This table lists the codes and descriptions for Calibration Due events (SRQMASK CALDUE:ON). The status byte is 70 with RQS set to ON and 6 with RQS set to OFF.

Calibration Due Events

Code	Event Description
465	Warmup complete – %C
466	New configuration – partial ENHANCED ACCURACY occurring
467	Warmup complete with new configuration – %C
468	Warmup complete with new configuration – automatic ENHANCED ACCURACY occurring
469	Temperature change – automatic ENHANCED ACCURACY occurring
470	Temperature change – %C
471	Warmup complete – ENHANCED ACCURACY in effect
472	Warmup complete – automatic ENHANCED ACCURACY occurring

Execution Warnings

This table lists the codes and descriptions for execution warnings (SRQMASK EXWARN:ON). The status byte is 101 with RQS set to ON and 37 with RQS set to OFF.

Execution Warnings

Code	Event Description
550	%A out of range — limit set
551	Insufficient data to satisfy binary block byte count
552	Checksum error in binary block transfer
553	Window trigger source set equal to main trigger source
554	Autoset — no signal detected
555	Binary curve odd data byte discarded
556	No active acquisitions — digitizer remains stopped
557	Hardcopy aborted
558	Nothing to abort
559	XY PT.FMT not permitted, PT.FMT not changed
560	Autoset — vertical search failed
561	Base label Index greater than 999, waveform not stored
562	Autoset — trigger search failed
563	Autoset — horizontal search failed
564	Autoset — ac signal too large
565	Autoset — dc signal too large
566	Interleave Enabled — Press ENHANCED ACCURACY then compensate probe to use the max Real Time sample rate
567	Trigger timer2 value modified due to change to timer1
568	Trigger mode changed to Normal
569	Argument out of range. Limit set. Valid smoothing range is: 3 - 999
570	Argument out of range. Limit set. Valid dejitter range is: 0-9
571	Interleave Enabled — Compensate probe to use the maximum Real Time sample rate
572	%d record length changed to %D
573	FFT record length must be a power of 2
574	Delta description no longer valid

Internal Warnings

This table lists the codes and descriptions for internal warnings (SRQMASK INWARN:ON). The status byte is 102 with RQS set to ON and 38 with RQS set to OFF.

Internal Errors

Code	Event Description
651	Input channel %a overload on %B plugin
652	Input channel %a overdrive on %B plugin
653	RS-232-C input parity error
654	RS-232-C input framing error
655	RS-232-C input buffer overrun
656	Internal table search failed
657	Probable nonvolatile RAM battery failure. Nonvolatile RAM completely reset
659	Cannot report unknown error code (%?)
660	Digitizer stopped – time base settings exceed available acquisition memory
665	Teksecure Erase Memory Status: Erased; In- strument ID, on-time, and number of power- ups retained



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