Operating the Scope Remotely

The final chapter of this manual lists the commands for performing remote programming of the DDM and PRML options. Refer to your Remote Control Manual for a complete description of remote control capabilities. These commands — DEF, PACU and PAVA by their short names — are to be used when remotely programming DDM and PRML functions.
The DEFINE command specifies the mathematical expression to be evaluated by a function. This command is used to control all functions in the standard oscilloscopes and WP0X processing packages.

**COMMAND SYNTAX**

```
<function> : DEFINE EQN, 'equation'
[,<param_name>,<value>,...]
```

Note 1: Parameters are grouped in pairs. The first in the pair names the variable to be modified, <param_name>, while the second one gives the new value to be assigned. Pairs can be given in any order and restricted to the variables to be changed.

Note 2: Space (blank) characters inside equations are optional.

**QUERY SYNTAX**

```<function> : DEFINE?```

**RESPONSE FORMAT**

```
<function> : DEFINE EQN, 'equation'[,[MAXPTS,<max_points>]]
[,[SWEEPS,<max_sweeps>],[,WEIGHT,<weight>],[,BITS,<bits>]]
```

<table>
<thead>
<tr>
<th>&lt;param_name&gt;</th>
<th>&lt;value&gt;</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQN</td>
<td>'equation'</td>
<td>Function equation as defined below</td>
</tr>
<tr>
<td>DELAY</td>
<td>&lt;delay&gt;</td>
<td>Delay by time</td>
</tr>
<tr>
<td>MAXPTS</td>
<td>&lt;max_points&gt;</td>
<td>Max. number of points to compute</td>
</tr>
<tr>
<td>SWEEPS</td>
<td>&lt;max_sweeps&gt;</td>
<td>Maximum number of sweeps</td>
</tr>
</tbody>
</table>

**Parameters To Support Additional Functions in WP01**

<table>
<thead>
<tr>
<th>&lt;param_name&gt;</th>
<th>&lt;value&gt;</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BITS</td>
<td>&lt;bits&gt;</td>
<td>Number of ERES bits</td>
</tr>
<tr>
<td>UNITS</td>
<td>&lt;units&gt;</td>
<td>Physical units</td>
</tr>
<tr>
<td>WEIGHT</td>
<td>&lt;weight&gt;</td>
<td>Continuous Average weight</td>
</tr>
</tbody>
</table>

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### Remote Control Commands

#### Parameters To Support Additional Functions in WP02

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WINDOW</td>
<td><code>&lt;window_type&gt;</code> FFT window function</td>
</tr>
</tbody>
</table>

#### Parameters To Support Additional Functions in WP03 or DDM

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAXBINS</td>
<td><code>&lt;bins&gt;</code> Number of bins in histogram</td>
</tr>
<tr>
<td>MAX_EVENTS</td>
<td><code>&lt;max_values&gt;</code> Max. no. of values in histogram</td>
</tr>
<tr>
<td>CENTER</td>
<td><code>&lt;center&gt;</code> Horizontal center position for</td>
</tr>
<tr>
<td></td>
<td>histogram display.</td>
</tr>
<tr>
<td>WIDTH</td>
<td><code>&lt;width&gt;</code> Width of histogram display</td>
</tr>
<tr>
<td>VERT</td>
<td><code>&lt;vert_scale&gt;</code> Vertical scaling type</td>
</tr>
</tbody>
</table>

#### Parameters To Support Additional Functions in PRML

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENGTH</td>
<td><code>&lt;length&gt;</code> No. points to use from first waveform</td>
</tr>
<tr>
<td>START</td>
<td><code>&lt;start&gt;</code> Starting point in second waveform</td>
</tr>
</tbody>
</table>

#### Function Equations And Names Available On All Models

<table>
<thead>
<tr>
<th>Equation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;source&gt;</code></td>
<td>Identity</td>
</tr>
<tr>
<td><code>&lt;source&gt;</code></td>
<td>Identity</td>
</tr>
<tr>
<td><code>&lt;source&gt;</code></td>
<td>Negation</td>
</tr>
<tr>
<td><code>&lt;source1&gt;</code> + <code>&lt;source2&gt;</code></td>
<td>Addition</td>
</tr>
<tr>
<td><code>&lt;source1&gt;</code> - <code>&lt;source2&gt;</code></td>
<td>Subtraction</td>
</tr>
<tr>
<td><code>&lt;source1&gt;</code>/ <code>&lt;source2&gt;</code></td>
<td>Multiplication</td>
</tr>
<tr>
<td><code>&lt;source1&gt;</code>/ <code>&lt;source2&gt;</code></td>
<td>Ratio</td>
</tr>
<tr>
<td>AVGS(&lt;source&gt;)</td>
<td>Average Summed</td>
</tr>
<tr>
<td>RESAMP(&lt;source&gt;)</td>
<td>Resample (deskew)</td>
</tr>
<tr>
<td>SINX(&lt;source&gt;)</td>
<td>Sin(x)/x interpolator</td>
</tr>
<tr>
<td>ZOOMONLY (&lt;extended_source&gt;)</td>
<td>Zoom only (No Math)</td>
</tr>
</tbody>
</table>

#### Extended Functions Available On Instruments With WP01 Processing Firmware

<table>
<thead>
<tr>
<th>Equation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS(&lt;source&gt;)</td>
<td>Absolute Value</td>
</tr>
<tr>
<td>Function</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>AVGC(&lt;source&gt;)</td>
<td>Continuous Average</td>
</tr>
<tr>
<td>DERI(&lt;source&gt;)</td>
<td>Derivative</td>
</tr>
<tr>
<td>ERES(&lt;source&gt;)</td>
<td>Enhanced Resolution</td>
</tr>
<tr>
<td>EXP(&lt;source&gt;)</td>
<td>Exponential (power of e)</td>
</tr>
<tr>
<td>EXP10(&lt;source&gt;)</td>
<td>Exponential (power of 10)</td>
</tr>
<tr>
<td>EXTR(&lt;source&gt;)</td>
<td>Extrema (Roof and Floor)</td>
</tr>
<tr>
<td>FLOOR(EXTR(&lt;source&gt;))</td>
<td>Floor (Extrema source only)</td>
</tr>
<tr>
<td>INTG(&lt;source&gt;{+,-}&lt;addend&gt;)</td>
<td>Integral</td>
</tr>
<tr>
<td>LN(&lt;source&gt;)</td>
<td>Logarithm base e</td>
</tr>
<tr>
<td>LOG10(&lt;source&gt;)</td>
<td>Logarithm base 10</td>
</tr>
<tr>
<td>RESSource{+,-}&lt;addend&gt; respectful</td>
<td>Rescale</td>
</tr>
<tr>
<td>ROOF(EXTR(&lt;source&gt;))</td>
<td>Roof (Extrema source only)</td>
</tr>
<tr>
<td>1/&lt;source&gt;</td>
<td>Reciprocal</td>
</tr>
<tr>
<td>SQR(&lt;source&gt;)</td>
<td>Square</td>
</tr>
<tr>
<td>SQRT(&lt;source&gt;)</td>
<td>Square Root</td>
</tr>
</tbody>
</table>

**FFT Functions Available on Instruments with WP02 Processing Firmware**

*Note: The source waveform must be a time-domain signal, single segment.*

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFT(&lt;source&gt;)</td>
<td>Fast Fourier Transform (complex result)</td>
</tr>
<tr>
<td>REAL(FFT(&lt;source&gt;))</td>
<td>Real part of complex result</td>
</tr>
<tr>
<td>IMAG(FFT(&lt;source&gt;))</td>
<td>Imaginary part of complex result</td>
</tr>
<tr>
<td>MAG(FFT(&lt;source&gt;))</td>
<td>Magnitude of complex result</td>
</tr>
<tr>
<td>PHASE(FFT(&lt;source&gt;))</td>
<td>Phase angle (degrees) of complex result</td>
</tr>
<tr>
<td>PS(FFT(&lt;source&gt;))</td>
<td>Power spectrum</td>
</tr>
<tr>
<td>PSD(FFT(&lt;source&gt;))</td>
<td>Power density</td>
</tr>
<tr>
<td>RESSource{+,-}&lt;addend&gt; respectful</td>
<td>Rescale</td>
</tr>
</tbody>
</table>

**Power Average Functions Available on Instruments with WP02 Processing Firmware**

*Note: The source waveform must be another function defined as a Fourier transform.*
Source values

Note: The numbers in CUST1, CUST2, CUST3, CUST4, and CUST5 refer to the line numbers of the selected custom parameters.

<sourceN> := \{TA, TB, TC, TD, M1, M2, M3, M4, C1, C2, C3, C4\}

<function> := \{TA, TB, TC, TD\}

<custom_line> := \{CUST1, CUST2, CUST3, CUST4, CUST5\}

<extended_source> := \{C1, C2, C3, C4, TA, TB, TC, TD, M1, M2, M3, M4\}

Values to define number of points/sweeps

<max_points> := 50 to 10,000,000
<max_sweeps> := 1 to 1000 (For standard instruments)
<max_sweeps> := 1 to 1,000,000 (For WP01 only)
<max_sweeps> := 1 to 50,000 (WP02 Power Spectrum only)

Values for Resample Function

<delay> := \(-2e^{-6}\) to \(+2e^{-6}\) seconds

Values for Rescale Function

<addend> := 0.0 to 1e15
<multiplier> := 0.0 to 1e15

Values for Summation Average and ERES

<weight> := \{1, 3, 7, 15, 31, 63, 127, 255, 511, 1023\}
<brts> := \{0.5, 1.0, 1.5, 2.0, 2.5, 3.0\}

Values for FFT window function

>window_type> := \{BLHA, FLTP, HANN, HANN, RECT\}
### FFT Window Function Notation

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LHA</td>
<td>Blackman–Harris window</td>
</tr>
<tr>
<td>FLTP</td>
<td>Flat Top window</td>
</tr>
<tr>
<td>HABMM</td>
<td>Hamming window</td>
</tr>
<tr>
<td>HANN</td>
<td>von Hann window</td>
</tr>
<tr>
<td>RECT</td>
<td>Rectangular window</td>
</tr>
</tbody>
</table>
Remote Control Commands

Values for WP03 histogramming
<max_bins> := \{20, 50, 100, 200, 500, 1000, 2000\}
<max_events> := 20 to 2e9 (in a 1–2–5 sequence)
<center> := $-1e15$ to $1e15$
<width> := $1e-30$ to $1e30$ (in a 1–2–5 sequence)
<vert_scale> := \{LIN, LOG, CONSTMAX\}

<table>
<thead>
<tr>
<th>Histogram Notation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIN</td>
<td>Use linear vertical scaling for histogram display</td>
</tr>
<tr>
<td>LOG</td>
<td>Use log vertical scaling for histogram display</td>
</tr>
<tr>
<td>CONSTMAX</td>
<td>Use constant maximum linear scaling for histogram display</td>
</tr>
</tbody>
</table>

Values for PRML correlation
<length> := 0 to 10 divisions
<start> := 0 to 10 divisions

**AVAILABILITY**
<sourceN> := \{C3, C4\} only on four-channel instruments.
<extended_source> := \{C3, C4\} only on four-channel instruments
SWEEPS is the maximum number of sweeps (Average and Extrema only).

Note: The pair SWEEPS,<max_sweeps> applies only to the summed averaging (AVGS).

**EXAMPLE (GPIB)**
The following instruction defines Trace A to compute the summed average of Channel 1 using 5000 points over 200 sweeps:

CMD$="TA:DEF EQN, 'AVGS(C1)', MAXPTS, 5000, SWEEPS, 200": CALL IBWRIT(SCOPE%, CMD$)

**WP01 EXAMPLE**
The following instruction defines Trace A to compute the product of Channel 1 and Channel 2, using a maximum of 10 000 input points:

CMD$="TA:DEF EQN, 'C1*C2', MAXPTS, 10000": CALL IBWRIT(SCOPE%, CMD$)
WP02 FFT EXAMPLE (GPIB)  The following instruction defines Trace A to compute the Power Spectrum of the FFT of Channel 1. A maximum of 1000 points will be used for the input. The window function is Rectangular.

```
CMD$="TA:DEF EQN,'PS(FFT(C1))',MAXPTS,1000,WINDOW,RECT": CALL IBWR (SCOPE%,CMD$")
```

WP02 PS EXAMPLE (GPIB)  The following instruction defines Trace B to compute the Power Spectrum of the Power Average of the FFT being computed by Trace A, over a maximum of 244 sweeps.

```
CMD$="TB:DEF EQN,'PS(AVGP(TA))',SWEEPS,244": CALL IBWR (SCOPE%,CMD$")
```

WP03 EXAMPLE  The following command defines Trace C to construct the histogram of the all rise time measurements made on source Channel 1. The rise time measurement is defined on custom line 2. The histogram has a linear vertical scaling and the rise time parameter values are binned into 100 bins.

```
CMD$="PACU 2,RISE,C1":CALL IBWR (SCOPE%,CMD$")
CMD$="TC:DEF EQN, 'HIST(CUST2)'), VERT, LIN, MAXBINS, 100": CALL IBWR (SCOPE%,CMD$")
```

RELATED COMMANDS  FIND_CTR_RANGE, FUNCTION_RESET, INR?, PARAMETER_CUSTOM, PARAMETER_VALUE?, PASS_FAIL_CONDITION
**Remote Control Commands**

**PARAMETER_CUSTOM, PACU**

**Command/Query**

**DESCRIPTION**

The PARAMETER_CUSTOM command controls the parameters that have customizable qualifiers, (for example, Dt@lev or r@level) and may also be used to assign any parameter for histogramming.

*Note: The measured value of a parameter setup with PACU may be read using PAVA?*

**COMMAND SYNTAX**

```
PARAMETER_Custom <line>, <parameter>, <qualifier>[, <qualifier>, ...]

<line> := 1 to 5
<parameter> := {a parameter from the table below or any parameter listed in the PAVA? command}
<qualifier> := Measurement qualifier(s) specific to each <param>. See below.
```

<table>
<thead>
<tr>
<th>&lt;param&gt;</th>
<th>definition</th>
<th>&lt;qualifier&gt; list</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC2DPOS</td>
<td>delta clock to data positive</td>
<td>&lt;source1&gt;,&lt;clockedge&gt;,&lt;level1&gt;,&lt;source2&gt;,&lt;slope2&gt;,&lt;level2&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>DC2DNEG</td>
<td>delta clock to data negative</td>
<td>&lt;source1&gt;,&lt;clockedge&gt;,&lt;level1&gt;,&lt;source2&gt;,&lt;slope2&gt;,&lt;level2&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>DDLY</td>
<td>delta delay</td>
<td>&lt;source1&gt;,&lt;source2&gt;</td>
</tr>
<tr>
<td>DTLEV</td>
<td>delta time at level</td>
<td>&lt;source1&gt;,&lt;slope1&gt;,&lt;level1&gt;,&lt;source2&gt;,&lt;slope2&gt;,&lt;level2&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>FLEV</td>
<td>fall at level</td>
<td>&lt;source&gt;,&lt;high&gt;,&lt;low&gt;</td>
</tr>
<tr>
<td>PHASE</td>
<td>phase difference</td>
<td>&lt;source1&gt;,&lt;edge1&gt;,&lt;level1&gt;,&lt;source2&gt;,&lt;edge2&gt;,&lt;level2&gt;,&lt;hysteresis&gt;,&lt;angular unit&gt;</td>
</tr>
<tr>
<td>RLEV</td>
<td>rise at level</td>
<td>&lt;source&gt;,&lt;low&gt;,&lt;high&gt;</td>
</tr>
<tr>
<td>TLEV</td>
<td>time at level</td>
<td>&lt;source&gt;,&lt;slope&gt;,&lt;level&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>FWXX</td>
<td>full width at xx% of max</td>
<td>&lt;source&gt;,&lt;threshold&gt;</td>
</tr>
<tr>
<td>PCTL</td>
<td>percentile</td>
<td>&lt;source&gt;,&lt;threshold&gt;</td>
</tr>
</tbody>
</table>

*Parameters available on all models*

*Parameters available on instruments equipped with WP03 or DDM processing firmware*
<table>
<thead>
<tr>
<th>&lt;param&gt;</th>
<th>definition</th>
<th>&lt;qualifier&gt; list</th>
</tr>
</thead>
<tbody>
<tr>
<td>XAPK</td>
<td>x position at peak</td>
<td>&lt;source&gt;,&lt;rank&gt;</td>
</tr>
</tbody>
</table>

**Parameters available on instruments equipped with DDM processing firmware**

<table>
<thead>
<tr>
<th>&lt;param&gt;</th>
<th>definition</th>
<th>&lt;qualifier&gt; list</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBASE</td>
<td>local base</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>LBSEP</td>
<td>local baseline separation</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>LMAX</td>
<td>local maximum</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>LMIN</td>
<td>local minimum</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>LNUM</td>
<td>number of local events</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>LPP</td>
<td>local peak to peak</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>LTBE</td>
<td>local time between events</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>LTBP</td>
<td>local time between peaks</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>LTBT</td>
<td>local time between troughs</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>LTMN</td>
<td>local time at minima</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>LTMX</td>
<td>local time at maxima</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>LTOT</td>
<td>local time over threshold</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;,&lt;threshold&gt;</td>
</tr>
<tr>
<td>LTPT</td>
<td>local time peak to trough</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>LTTP</td>
<td>local time trough to peak</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>LTUT</td>
<td>local time under threshold</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;,&lt;threshold&gt;</td>
</tr>
<tr>
<td>NBPH</td>
<td>narrow band phase</td>
<td>&lt;source&gt;,&lt;freq&gt;</td>
</tr>
<tr>
<td>NBPW</td>
<td>narrow band power</td>
<td>&lt;source&gt;,&lt;freq&gt;</td>
</tr>
<tr>
<td>OWRITE</td>
<td>overwrite</td>
<td>&lt;source 1&gt;,&lt;source 2&gt;,&lt;freq&gt;</td>
</tr>
<tr>
<td>PW50</td>
<td>pulse width 50</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>PW50NEG</td>
<td>pulse width 50 for troughs</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>PW50POS</td>
<td>pulse width 50 for peaks</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>RES</td>
<td>resolution</td>
<td>&lt;source 1&gt;,&lt;source 2&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>TAA</td>
<td>track average amplitude</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
</tbody>
</table>
Remote Control Commands

<table>
<thead>
<tr>
<th>&lt;param&gt;</th>
<th>definition</th>
<th>&lt;qualifier&gt; list</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAANEG</td>
<td>track average amplitude for troughs</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
<tr>
<td>TAAPOS</td>
<td>track average amplitude for peaks</td>
<td>&lt;source&gt;,&lt;hysteresis&gt;</td>
</tr>
</tbody>
</table>

Parameters available on instruments equipped with PRML processing firmware

<table>
<thead>
<tr>
<th>ACSN</th>
<th>auto correlation signal to noise</th>
<th>&lt;source&gt;,&lt;length&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>NLTS</td>
<td>non-linear transition shift</td>
<td>&lt;source&gt;,&lt;length&gt;,&lt;delay&gt;</td>
</tr>
</tbody>
</table>

Where:

\[
\begin{align*}
  \text{<sourceN>} & : = \{ C1, C2, C3, C4, TA, TB, TC, TD \} \\
  \text{<slopeN>} & : = \{ \text{POS, NEG, FIRST} \} \\
  \text{<edgeN>} & : = \{ \text{POS, NEG} \} \\
  \text{<clock edge>} & : = \{ \text{POS, NEG, ALL} \} \\
  \text{<levelN>, <low>, <high> = 1 to 99 if level is specified in percent (PCT), or} \\
  \text{<levelN>, <low>, <high> = Level in <sourceN> in the units of the waveform.} \\
  \text{<delay>} & : = -100 \text{ PCT to 100 \text{ PCT}} \\
  \text{<freq>} & : = 10 \text{ to } 1e9 \text{ Hz (Narrow Band center frequency).} \\
  \text{<hysteresis>} & : = 0.01 \text{ to } 8 \text{ divisions} \\
  \text{<length>} & : = 1e-9 \text{ to } 0.001 \text{ seconds} \\
  \text{<rank>} & : = 1 \text{ to } 100 \\
  \text{<threshold>} & : = 0 \text{ to } 100 \text{ percent} \\
  \text{<angular unit>} & : = \{ \text{PCT, DEG, RAD} \}
\end{align*}
\]

QUERY SYNTAX

\text{P\text{Ar}ameter\text{C}\text{U}stom? <line>}

RESPONSE FORMAT

\text{P\text{A}rameter\text{C}\text{u}stom <line>, <parameter>, <qualifier>[, <qualifier>, ...]}

AVAILABLE

\text{<sourceN>} : = \{ C3, C4 \} only on four-channel instruments.

EXAMPLE 1

\text{DTLEV}

Command Example

\text{PACU 2, DTLEV, C1, POS, 345E-3, C2, NEG, -789E-3}

Query/Response Examples

\text{PACU? 2 returns:}

\text{PACU 2, DTLEV, C1, POS, 345E-3, C2, NEG, -789E-3}

\text{PAVA? CUST2 returns:}

\text{C2: PAVA CUST2, 789 NS}
EXAMPLE 2

Command Example
PACU 2, DDLY, C1, C2

Query/Response Examples
PACU? 2 returns:
PACU 2, DDLY, C1, C2
PAVA? CUST2 returns:
C2: PAVA CUST2, 123 NS

EXAMPLE 3

Command Example
PACU 3, RLEV, C1, 2PCT, 67PCT

Query/Response Examples
PACU? 3 returns:
PACU 3, RLEV, C1, 2PCT, 67PCT
PAVA? CUST3 returns:
C1: PAVA CUST3, 23 MS

EXAMPLE 4

Command Example
PACU 3, FLEV, C1, 345E−3, 122E−3

Query/Response Examples
PACU? 3 returns:
PACU 3, FLEV, C1, 345E−3, 122E−3
PAVA? CUST3 returns:
C1: PAVA CUST3, 23 MS

RELATED COMMANDS
PARAMETER_DELETE, PARAMETER_VALUE, PASS_FAIL_CONDITION
Remote Control Commands

**CURSOR**

**PARAMETER_VALUE?, PAVA?**

**Query**

**DESCRIPTION**

The PARAMETER_VALUE query returns the current value(s) of the pulse waveform parameter(s) and mask tests for the specified trace. Traces do not need to be displayed or selected to obtain the values measured by the pulse parameters or mask tests.

<table>
<thead>
<tr>
<th>Parameters Available on All Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL</td>
</tr>
<tr>
<td>AMPL</td>
</tr>
<tr>
<td>AREA</td>
</tr>
<tr>
<td>BASE</td>
</tr>
<tr>
<td>CMEAN</td>
</tr>
<tr>
<td>CMEDI</td>
</tr>
<tr>
<td>CRMS</td>
</tr>
<tr>
<td>CSDEV</td>
</tr>
<tr>
<td>CYCL</td>
</tr>
<tr>
<td>DLY</td>
</tr>
<tr>
<td>DUR</td>
</tr>
</tbody>
</table>

**Custom Parameters Defined using PARAMETER_CUSTOM Command**

<table>
<thead>
<tr>
<th>CUST1</th>
<th>CUST2</th>
<th>CUST3</th>
<th>CUST4</th>
<th>CUST5</th>
</tr>
</thead>
</table>

**Parameters Available on Instruments with WP03 or DDM Processing Firmware**

| AVG | average of distribution | HMEDI | median of a histogram | PKS | number of peaks |
| DATA | data values | HRMS | histogram rms value | RANGE | range of distribution |
| FWHM | full width at half max | HTOP | histogram top value | SIGMA | sigma of distribution |
| HAMPL | histogram amplitude | LOW | low of distribution | TOTP | total population |

1 The numbers in the terms CUST1, CUST2, CUST3, CUST4 and CUST5 refer to the line numbers of the selected custom parameters.
### Parameter Computation States

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV</td>
<td>averaged over several (up to 100) periods</td>
</tr>
<tr>
<td>GT</td>
<td>greater than given value</td>
</tr>
<tr>
<td>IV</td>
<td>invalid value (insufficient data provided)</td>
</tr>
<tr>
<td>LT</td>
<td>less than given value</td>
</tr>
<tr>
<td>NP</td>
<td>no pulse waveform</td>
</tr>
<tr>
<td>OF</td>
<td>signal partially in overflow</td>
</tr>
<tr>
<td>OK</td>
<td>deemed to be determined without problem</td>
</tr>
<tr>
<td>OU</td>
<td>signal partially in overflow and underflow</td>
</tr>
<tr>
<td>PT</td>
<td>window has been period truncated</td>
</tr>
<tr>
<td>UF</td>
<td>signal partially in underflow</td>
</tr>
</tbody>
</table>

### Mask Test Names

<table>
<thead>
<tr>
<th>Mask Test Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL_IN</td>
<td>all points of waveform inside mask (TRUE = 1, FALSE = 0)</td>
</tr>
<tr>
<td>SOME_IN</td>
<td>some points of waveform inside mask (TRUE = 1, FALSE = 0)</td>
</tr>
<tr>
<td>ALL_OUT</td>
<td>all points of waveform outside mask (TRUE = 1, FALSE = 0)</td>
</tr>
<tr>
<td>SOME_OUT</td>
<td>some points of waveform outside mask (TRUE = 1, FALSE = 0)</td>
</tr>
</tbody>
</table>

### QUERY SYNTAX

```plaintext
<trace> : Parameter_Value? [<parameter>,...,<parameter>]  
<trace> := {TA, TB, TC, TD, C1, C2, C3, C4}  
<parameter> := See table of parameter names on previous page.
```

**Alternative forms of query for mask tests:**

```plaintext
<trace> : Parameter_Value? <old_mask_test>  
<trace> : Parameter_Value? <mask_test>, <mask>  
<mask_test> := {ALL_IN, SOME_IN, ALL_OUT, SOME_OUT}  
<old_mask_test> := {ALL_I, ANY_I, ALLO, ANYO}  
<mask> := {TA, TB, TC, TD} 
```

**Note:** Old mask test keywords ALL_I, ANY_I, ALLO, ANYO imply testing of <trace> against the mask waveform TD. Old mask test keywords INSIDE and OUTSIDE are equivalent to ALL_IN and SOME_OUT; they are only supported for compatibility with older-model instruments.

10–14
### Remote Control Commands

**Response Format**

\[ \langle \text{trace}\rangle : \text{P}\text{A}\text{r}\text{a}\text{m}\text{e}\text{r}_{-}\text{V}\text{a}\text{l}u\text{e} \langle \text{parameter}\rangle , \langle \text{value}\rangle , \langle \text{state}\rangle \rangle, \langle \text{value}\rangle, \langle \text{state}\rangle \]

- **<value>**: A decimal numeric value
- **<state>**: \{OK, AV, PT, IV, NP, GT, LT, OF, UF, OU\}

*Note: If <parameter> is not specified, or is equal to ALL, all the standard voltage and standard time parameters followed by their values and states are returned.*

**Availability**

\[ \langle \text{trace}\rangle : \{C3, C4\} \text{ only available on four-channel instruments.} \]

**Example (GPIB)**

The following query reads the risetime of Trace B (TB):

\[ \text{CMD} = \text{"TB:PAVA? RISE";} \text{ CALL IBWRT(SCOPE%,CMD$);} \text{ CALL IBRD (SCOPE%,RD$);} \text{ PRINT RD$;} \]

Response message:

\[ \text{TB:PAVA RISE, 3.6E-9S, OK} \]

**Related Commands**

CURSOR_MEASURE, CURSOR_SET, PARAMETER_CUSTOM, PARAMETER_STATISTICS