Scope (54622A/D DSO):

The following automatic measurements can be made in the Quick Meas menu.

Press the Quick Meas key to display the automatic measurement menu.

### Time Measurements
- **Counter**
- Duty Cycle
- Frequency
- Period
- Rise Time*
- Fall Time*
- + Width
- – Width
- X at Max*
- X at Min*

### Phase and Delay
- Phase*
- Delay*

### Voltage Measurements
- Average*
- Amplitude*
- Base*
- Maximum*
- Minimum*
- Peak-to-Peak*
- RMS*
- Top*

Average, RMS (dc): over one or more full periods.

If less than one period is displayed, RMS (dc) or average is calculated on the full width of the display. The X cursors show what interval of the waveform is being measured.

### Preshoot and Overshoot
- Preshoot*
- Overshoot*

Preshoot is distortion that precedes a major edge transition expressed as a percentage of Amplitude. The X cursors show which edge is being measured (edge closest to the trigger reference point).

* Measurement on analog channels only.
You can use **automatic** measurements on any **channel** source or any running **math** function

- only channels or math functions that are displayed are available for measurements
- **Quick Meas** also makes measurements on stopped waveforms when you are panning and **zooming**
- **cursors** are turned on to focus on the most recently selected measurement (right-most on the measurement line above the softkeys on the display)
- the results of the last three measurements selected are displayed on the dedicated line above the softkeys, or in the display area when menus are selected
- if a portion of the waveform required for a measurement is not displayed or does not display enough resolution to make the measurement, the result will display “**No Edges**”, “**Clipped**”, “**Low Signal**”, “< value”, or “> value”, or a similar message to indicate that the measurement may not be reliable
- if you choose an **invalid source** channel for a measurement, the measurement will **default** to the nearest in the list that makes the source valid

<table>
<thead>
<tr>
<th>Measurement Hints</th>
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<tr>
<td>If the channel is DC coupled, you can quickly measure the DC component of the signal by simply noting its distance from the zero symbol.</td>
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<tr>
<td>If the channel is AC coupled, the DC component of the signal is removed, allowing you to use greater sensitivity to display the AC component of the signal.</td>
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</table>

**X at Max** is the X axis value (usually time) at the first displayed occurrence of the waveform Maximum, starting from the left-side of the display.

The **X cursor** shows where the current X at Max value is being measured.

The **Counter measurement** counts trigger level crossings at the selected trigger slope and displays the results in **Hz**.

The **gate time** for the measurement is automatically adjusted to be 100 ms or twice the current time window, which ever is longer, up to 1 second. Any channel except Math may be selected for the source.

Only one **Counter measurement** may be displayed at a time. The **Y cursor** shows the edge threshold level used in the measurement. The Counter measurement can measure frequencies up to 125 MHz. The minimum frequency supported is 1/(2 X gate time).

**Measurement units** for each input channel can be set to Volts or Amps using the channel **Probe Units** softkey.

A scale unit of **U** (undefined) will be displayed for math function 1-2 and for d/dt, and \( \frac{\text{d}t}{\text{d}x} \) when 1-2 or 1+2 is the selected source if channel 1 and channel 2 are set to dissimilar units in the channel **Probe Units** softkey.

Use **delayed sweep** to isolate

- an event for a frequency measurement.
- a pulse for Top measurement

**Math Measurements and Units**

Only Peak-Peak, Maximum, Minimum, Average, X at Min, and X at Max automatic measurements may be made on a math FFT function. See “Making time measurements automatically” for the FFT X at Max and X at Min measurement. Use the cursors to make other measurements on FFT. All voltage measurements may be made on other math functions. The resultant units are:

- **FFT**: dB* (decibels)
- **1 * 2**: V^2, A^2 or W (Volt-Amp)
- **1 - 2**: V (Volts) or A (Amps)
- **d/dt**: V/s or A/s (V/second A/second)
- **\( \frac{\text{d}t}{\text{d}x} \)**: V/s or A/s (t/seconds A/seconds)

* When the FFT source is channel 1 or channel 2 (or channel 3 or 4 on the 54629A), FFT units will be displayed in dBw when channel units is set to Volts and channel impedance is set to 1 MΩ. FFT units will be displayed in dBm when channel units is set to Volts and channel impedance is set to 50 Ω (54640-series only). FFT units will be displayed as dB for all other FFT sources or when a source channel’s units has been set to Amps.
The **Math** menu allows you to display math functions on analog channels. You can:
- **subtract** (–) or **multiply** (*) the signals acquired on analog channels 1 (Ch1) and 2 (Ch2), then display the result.
- **integrate**, **differentiate**, or perform an **FFT** on the signal acquired on any analog channel or on math functions 1 * 2, 1 – 2, or 1 + 2, then display the result.

### Math Operating Hints
- If the analog channel or math function is clipped (not fully displayed on screen), the resulting displayed math function will also be clipped.
- Once the function is displayed, the analog channel(s) may be turned off for better viewing.
- The vertical scaling and offset of each math function can be adjusted for ease of viewing and measurement considerations.
- Each function can be measured in the **Cursors** and **Quick Meas** menus.

Any math function may be manually scaled by pressing the **Settings** softkey, and then adjusting the Scale or Offset value.

### Math Scale and Offset are Set Automatically
Any time the currently displayed math function definition is changed, the function is automatically scaled for optimum vertical scale and offset. If you manually set scale and offset for a function, select a new function, then select the original function, the original function will be automatically rescaled.

#### Subtract
When you select 1 – 2, Ch2 voltage values are subtracted from Ch1 voltage values **point by point**, and the result is displayed.

*You can use 1 – 2 to make a differential measurement or to compare two waveforms.*

To perform the **addition** of Ch1 and Ch2, select **Invert** in the Ch2 menu and perform the 1 – 2 math function.

**Scale** allows you to set your own vertical scale factors for subtract, expressed as V/div (Volts/division) or A/div (Amps/division). Units are set in the channel **Probe** menu.

**Offset** allows you to set your own offset for the 1 – 2 math function. The offset value is in Volts or Amps and is represented by the **center** graticule of the display.

#### Multiply
When you select 1 * 2, Ch1 and Ch2 voltage values are multiplied **point by point**, and the result is displayed.

**1 * 2** is useful for seeing **power** relationships when one of the channels is proportional to the current.

**Scale** allows you to set your own vertical scale factors for multiply expressed as V²/div (Volts-squared/division), A²/div (Amps-squared/division), or W/div (Watts/division or Volt-Amps/division). Units are set in the channel **Probe** menu.

**Offset** allows you to set your own offset for the multiply math function. The offset value is in V² (Volts-squared), A² (Amps-squared), or W (Watts) and is represented by the **center** graticule of the display.