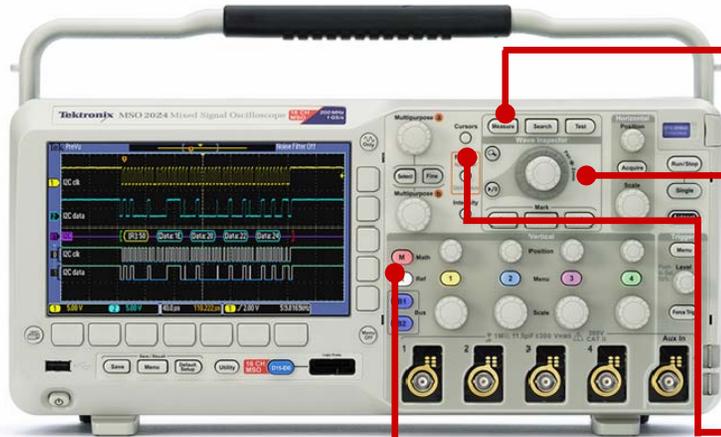


# The Oscilloscope: Advanced Features



## Waveform Math

- Addition: Add two waveforms.
- Subtraction: Subtract one waveform from another.
- Multiply: Multiply two waveforms.
- Fast Fourier Transform: Transforms a time-domain waveform into its frequency domain components.

## Automated Measurements (see back)

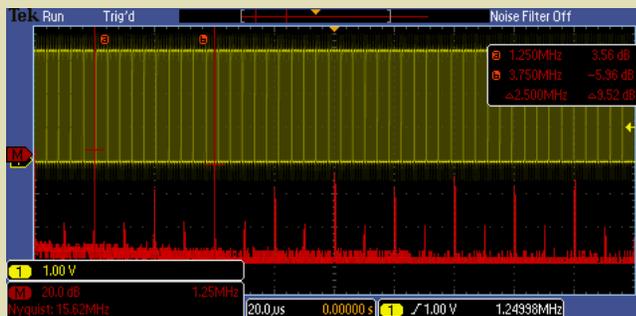
## Wave Inspector® Navigation and Search

- Zoom: Zoom in to see more detail.
- Pan: Pan through your waveform.
- Mark: Set marks throughout your waveform. Use the arrow buttons to move between your marks.
- Search: Automatically search for criteria you specify. Wave Inspector will mark every occurrence. Use the arrow buttons to move between marks.

## Cursors

- Manually align the cursors to points on your waveform; measurement values at those points will be shown in the cursor readout display. Horizontal cursors measure voltage along the vertical axis and vertical cursors measure time along the horizontal axis.

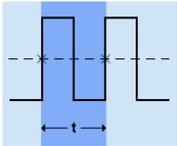
## Fast Fourier Transform



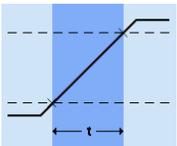
- FFT is calculated from 5000 points on the display.
- Resulting FFT spectrum is from DC (0 Hz) to one-half the oscilloscope's sample rate (Nyquist frequency).
- Windows trade off frequency resolution and amplitude accuracy in the FFT spectrum.
  - **Rectangular**: Good for non-periodic signals such as pulses and transients.
  - **Hanning and Hamming**: Good for periodic signals.
  - **Blackman-Harris**: Good for predominantly single-frequency waveforms to look for harmonics.
- **Tip**: To increase the horizontal scale of the FFT (Hz/div), increase the horizontal scale factor of the time-domain waveform with the horizontal scale knob.
- **Tip**: Cursors can be used to measure frequency and amplitude at specific points on the FFT spectrum.

# The Oscilloscope: Advanced Features

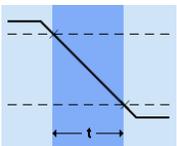
## Automated Measurements



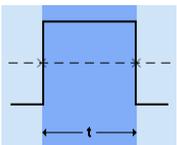
- **Period (sec):** Time (t) required to complete one cycle of the signal.
- **Frequency (Hertz):** Reciprocal of period. (Frequency = 1/t).



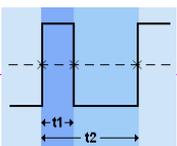
- **Rise Time (sec):** Time (t) required for rising edge to rise from the Low Reference level to the High Reference level.



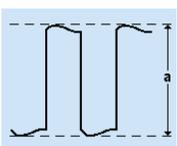
- **Fall Time (sec):** Time (t) required for falling edge to fall from the High Reference level to the Low Reference level.



- **Pulse Width (sec):** Time (t) between Mid-Reference crossings of a pulse, either a positive pulse or negative pulse.



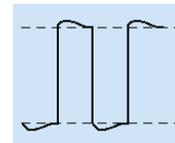
- **Duty Cycle (%):** Ratio of the pulse width to the period. (Duty Cycle =  $(t_1/t_2) * 100\%$ )



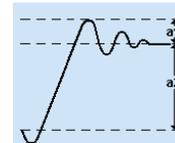
- **Max (Volts):** Maximum value of the signal.
- **Min (Volts):** Minimum value of the signal.
- **Peak-to-peak (Volts):** Difference (a) between the maximum value and the minimum value.

## Measurement Gating

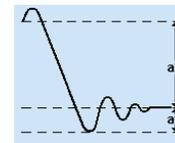
Gating can be used to define where on the waveform measurements are performed.



- **High (Volts):** Highest density of points above the midpoint of the signal.
- **Low (Volts):** Lowest density of points below the midpoint of the signal.
- **Amplitude (Volts):** Difference (a) between the high value and the low value.



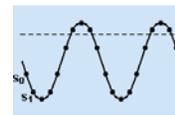
- **Positive Overshoot (%):** Difference between the maximum value and high value of the signal, divided by the signal amplitude. (Positive Overshoot =  $(a_1/a_2) * 100\%$ )



- **Negative Overshoot (%):** Difference between the minimum value and low value of the signal, divided by the signal amplitude. (Negative Overshoot =  $(a_1/a_2) * 100\%$ )



- **Mean (Volts):** Arithmetic mean value. (Mean =  $(S_0 + S_1 + \dots + S_n) / n$ )



- **RMS (Volts):** True Root Mean Square Value. (RMS =  $\sqrt{(S_0^2 + S_1^2 + \dots + S_n^2) / n}$ )

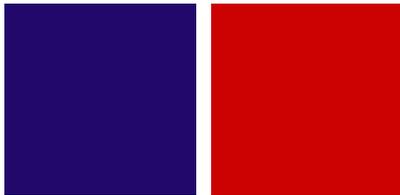
[www.tektronix.com/oscilloscopes](http://www.tektronix.com/oscilloscopes)

# The Oscilloscope: Basic Features & Functions

- Use level 1 text for main slide text in paragraph format. Level 1 text is Arial 20pt, black, flush left, with bullets.
  - Use level 2 text for main bullet points
  - Level 2 text is Arial 18pt with dashes for bullets
  - Avoid multiple-line and paragraph-formatted bullets
    - Level 3 text is Arial 16pt
      - Level 4 text is Arial 14pt
        - Level 5 text is Arial 14pt
- Use the “Increase Indent” and “Decrease Indent” buttons to change text levels.

# Tektronix colors

- The Tektronix color palette consists of Tektronix Blue, Tektronix Red, and muted support colors that let the Tektronix signature stand out
- Use the support colors for charts, graphs, and graphics
- Use Tektronix Red sparingly — Tektronix Blue should always be dominant



Tektronix Blue  
R33 G7 B106

Tektronix Red  
R204 G0 B0



Dark gray  
R94 G106 B113

Medium gray  
R116 G127 B129

Bright blue  
R84 G130 B171

Pale blue  
R164 G179 B201

Bright green  
R105 G146 B58

Pale green  
R163 G168 B107

Putty  
R170 G156 B143

Mustard  
R198 G191 B112