Electronics
Oscilloscopes

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Oscilloscope

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- a very fancy voltmeter *with one important difference*

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- a very fancy voltmeter *with one important difference*
- allows you to see how a voltage *varies in time*

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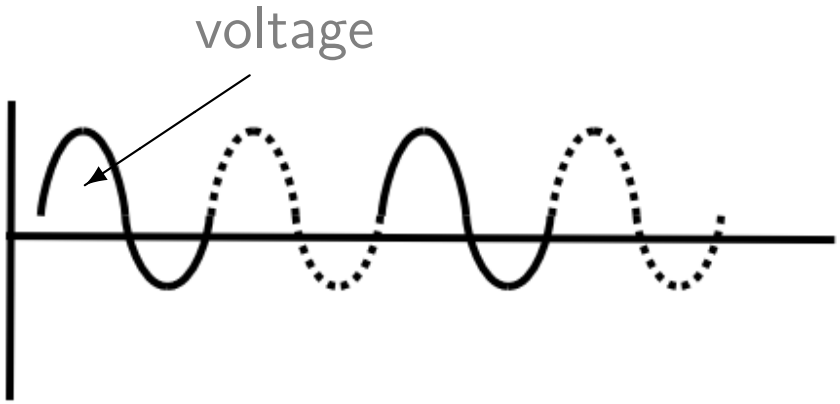
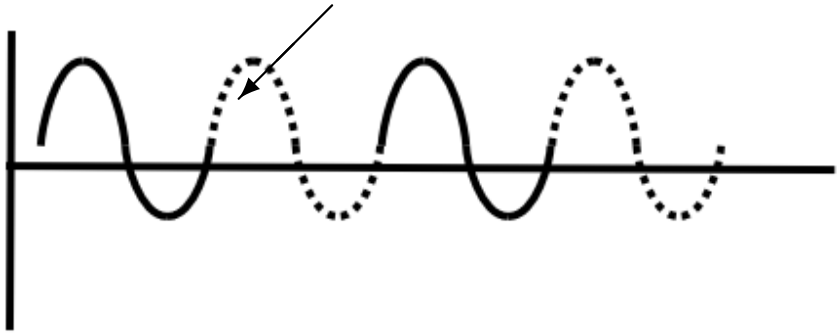
   An oscilloscope uses the second approach.

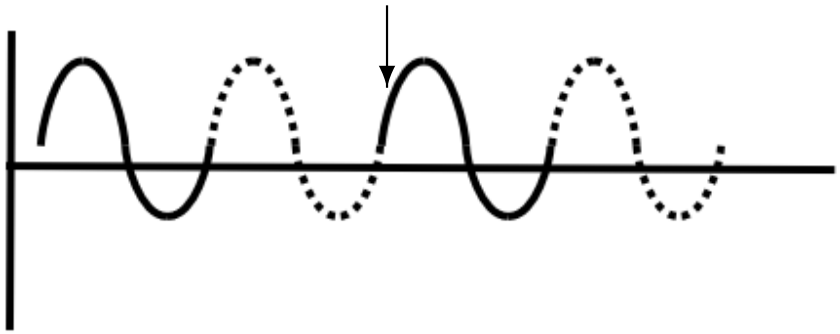
   Actually a digital storage scope can use the first one as well.


voltage

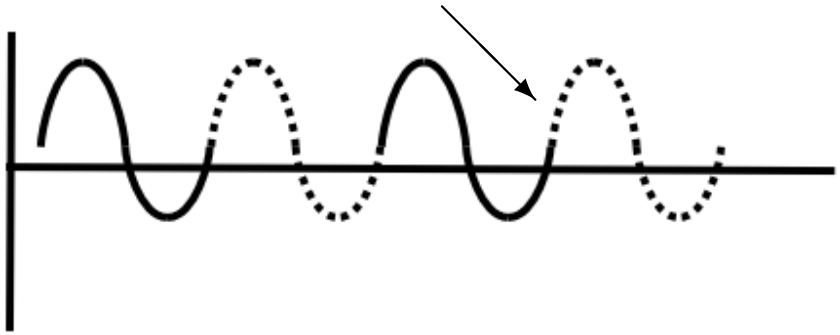
Same voltage

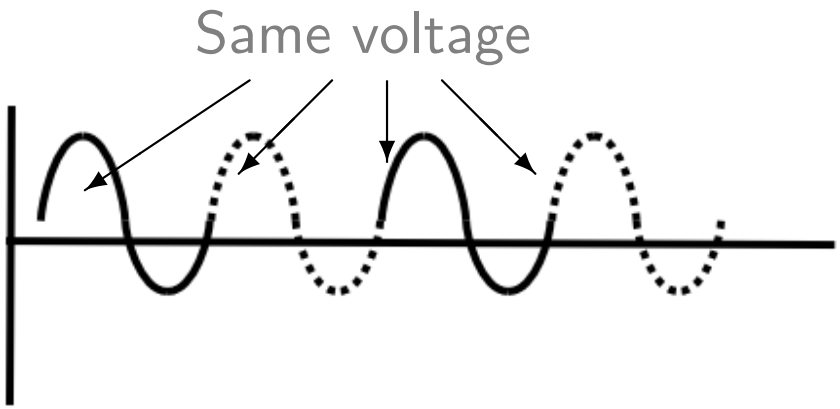


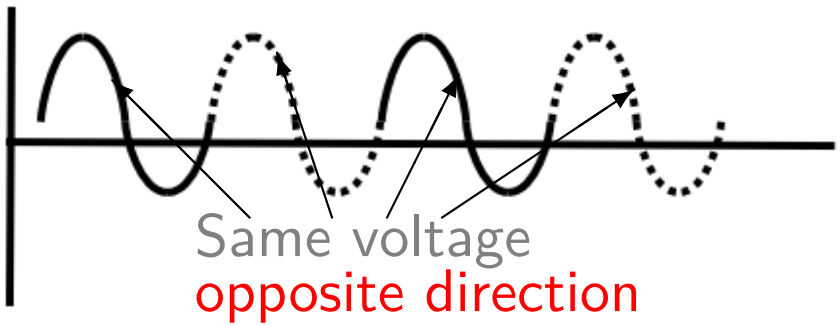
Same voltage



Same voltage




Same voltage


Same voltage
opposite direction

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- Consider a sine wave:

  Except for the peak and the trough, every value within the waveform will be repeated twice in one cycle;

  once on the way up,

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- If we pick a value and a direction, (going up or down), we can specify any point in the cycle uniquely.

- If we now start drawing the signal on a screen at that point, we will show some of the wave.

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- Most scopes have at least two input channels, so that two signals can be compared.

Triggering

Triggering

- channel

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- channel
- level

Triggering

- channel
- level
- polarity

Leads and inputs

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- single voltage and ground; *not differential voltage!*

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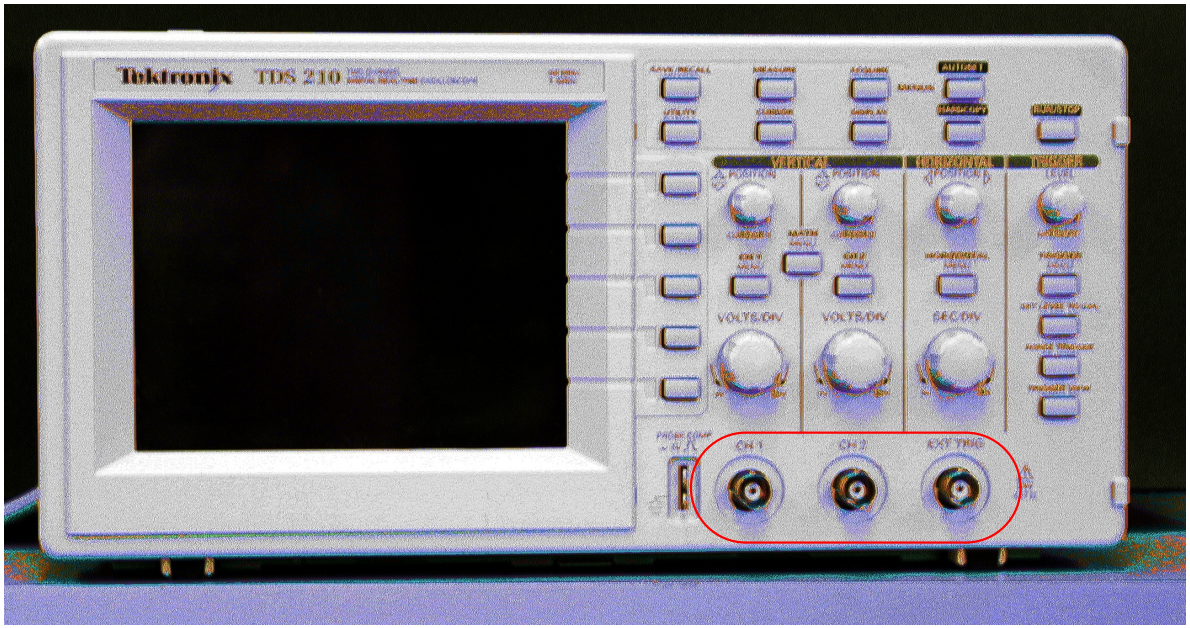
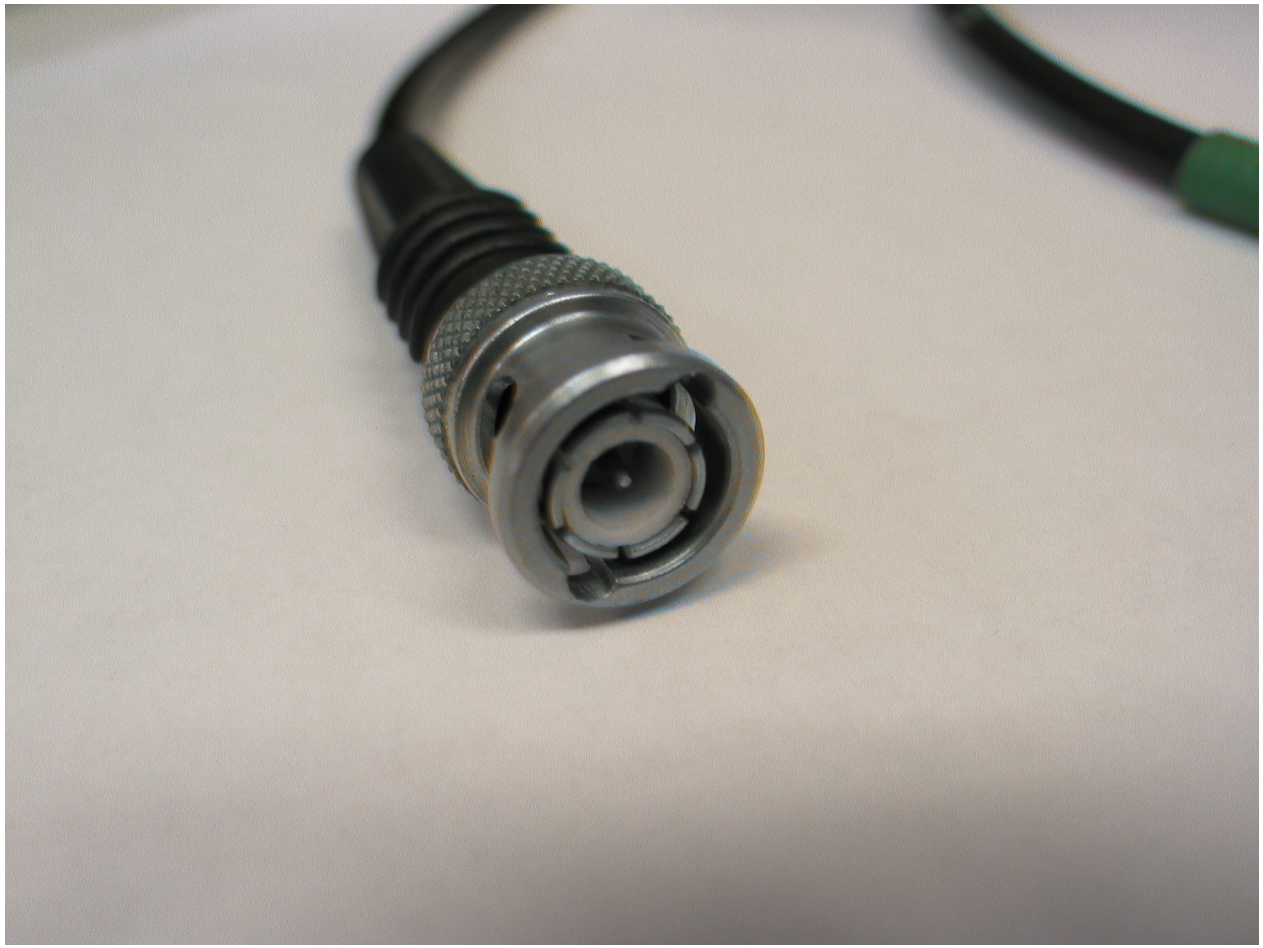
- external trigger

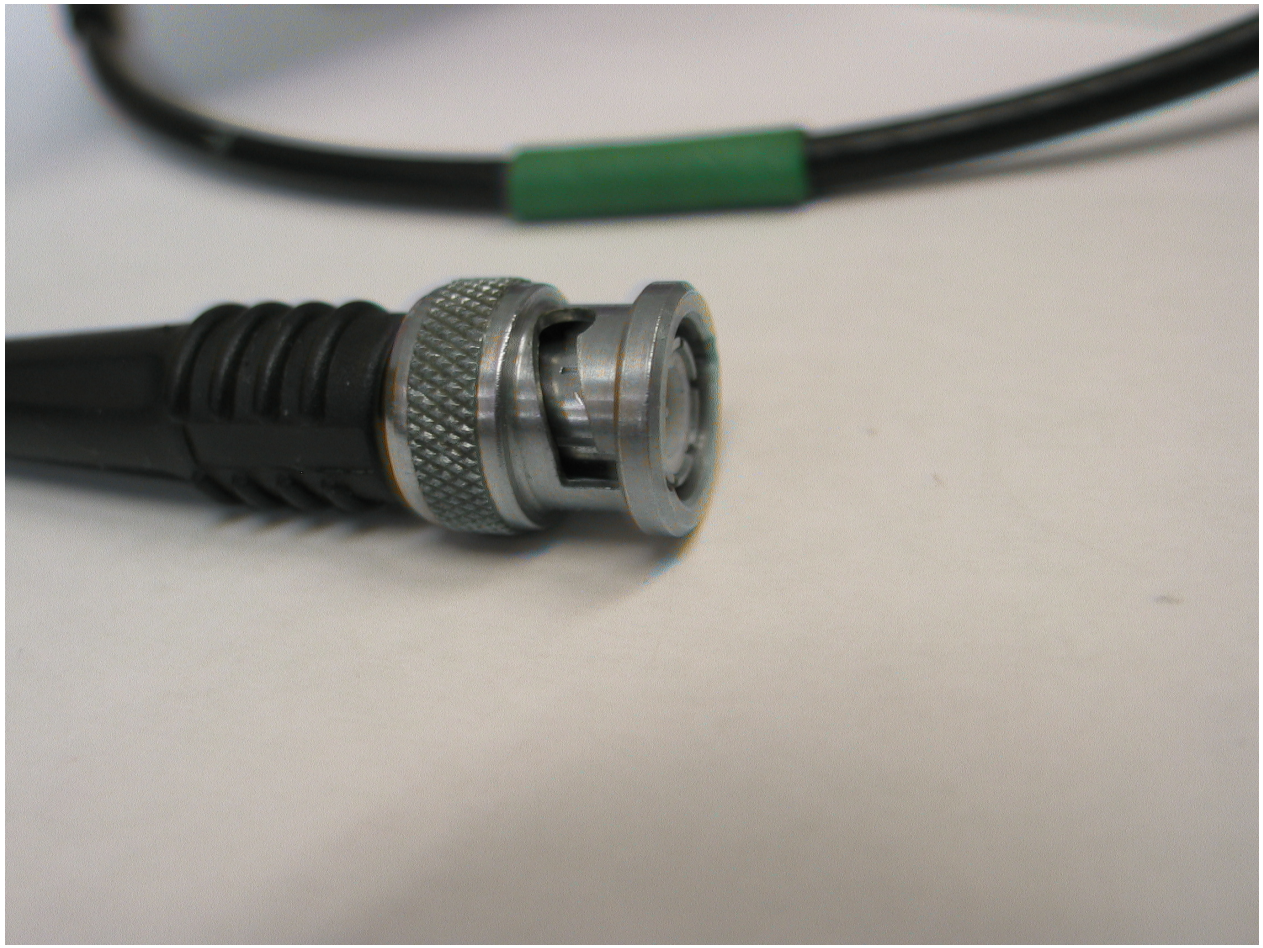

Tektronix
TDS 210
VERTICAL
HORIZONTAL
TRIGGER
VOLTS/DIV
VOLTS/DIV
SEC/DIV
CH 1
CH 2
EXT TRIG



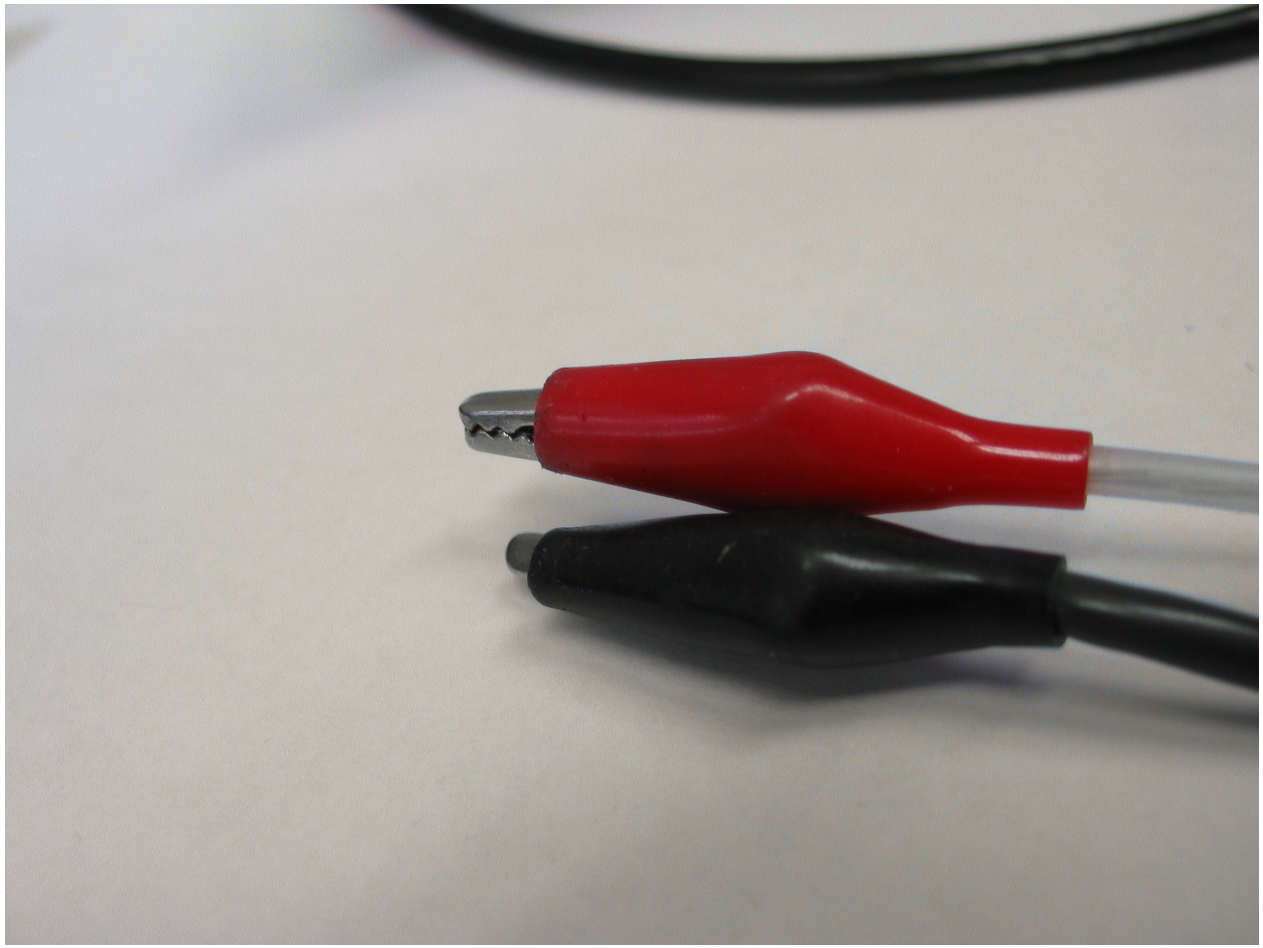
Input section



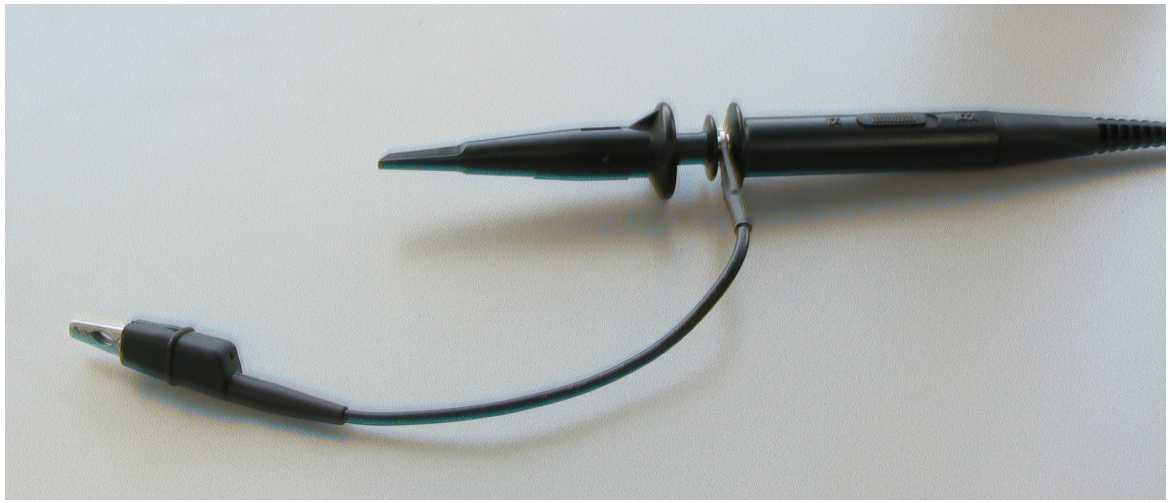
- BNC connector (end view)



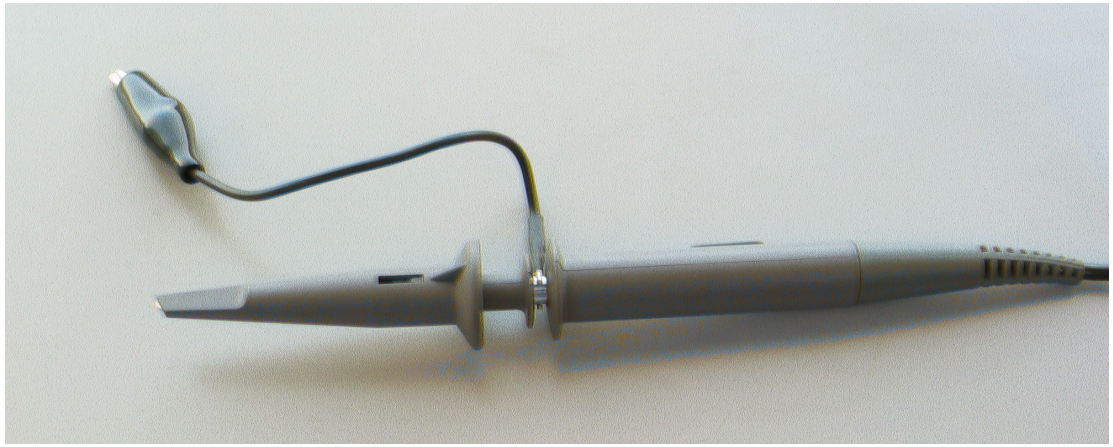
- BNC connector (side view)



- Lead with alligator clip



- Scope lead (black)



- Scope lead (grey)

- Scope lead probe switch

Channels

Channels

- X, Y ; *Make sure to use ground clips!*

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- 1x, 10x probe (must agree with lead)

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- X, Y ; *Make sure to use ground clips!*
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- vertical resolution

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- vertical resolution
- vertical position

Channels

- X, Y ; *Make sure to use ground clips!*
- 1x, 10x probe (must agree with lead)
- vertical resolution
- vertical position
- AC/DC coupling (like meter)

Other controls and features

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- horizontal position

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- XY mode (instead of timebase mode)

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- signal math; X + Y, X - Y

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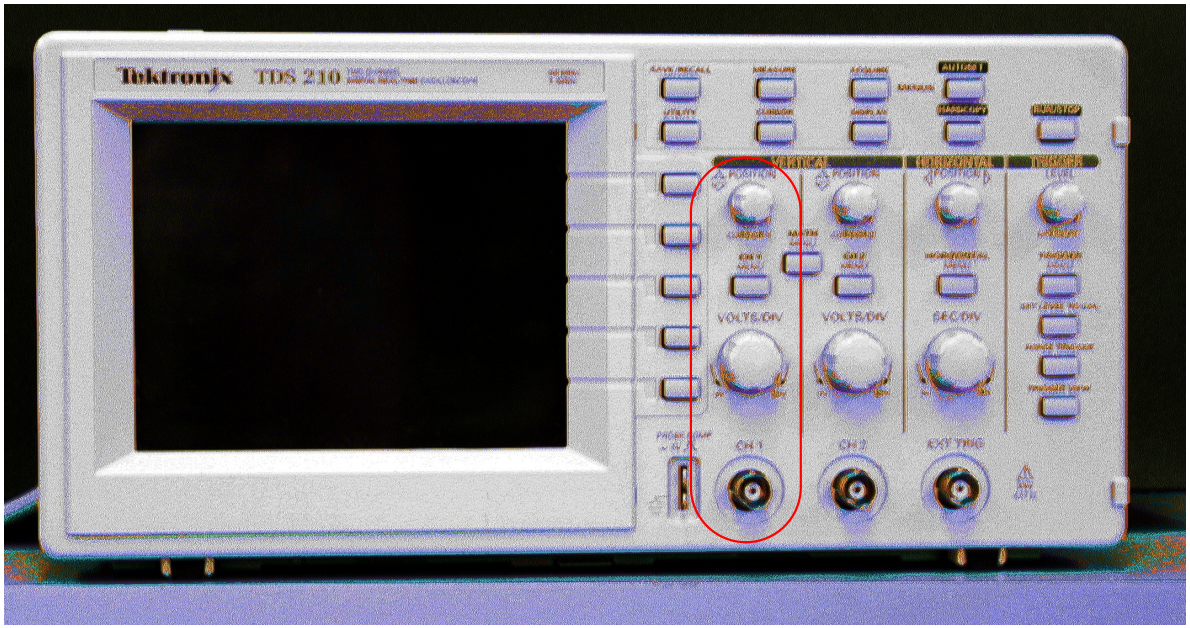
- horizontal position
- XY mode (instead of timebase mode)
- signal math; X + Y, X - Y

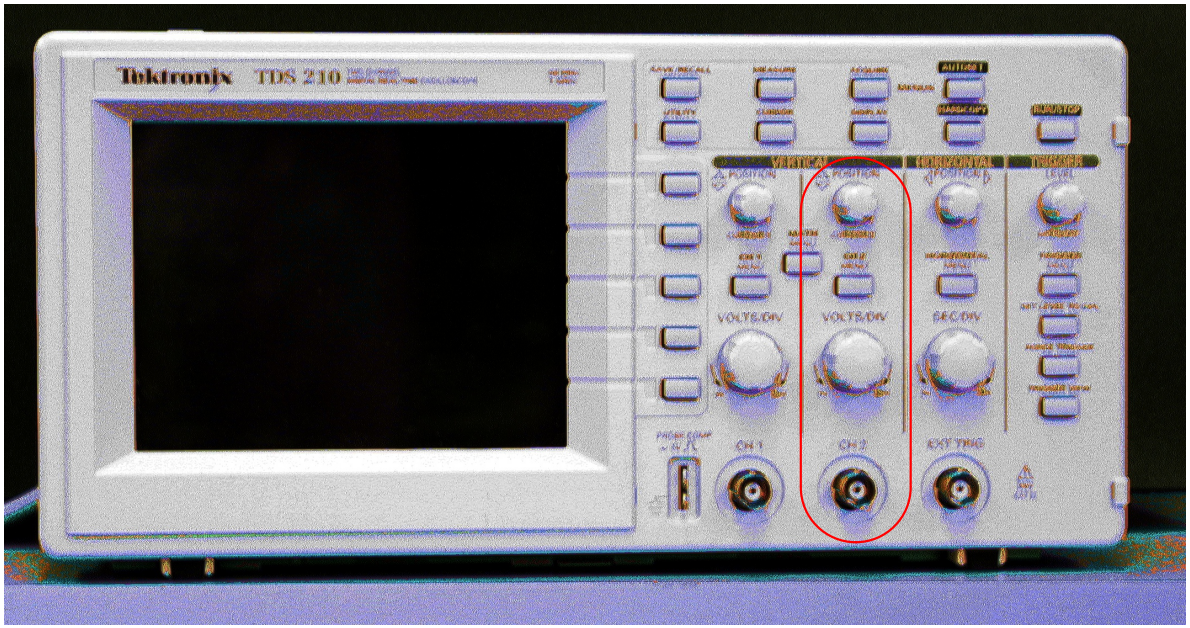
  last one allows differential measurement


Tektronix
TDS 210
VERTICAL
HORIZONTAL
TRIGGER
VOLTS/DIV
VOLTS/DIV
SEC/DIV
CH 1
CH 2
EXT TRIG



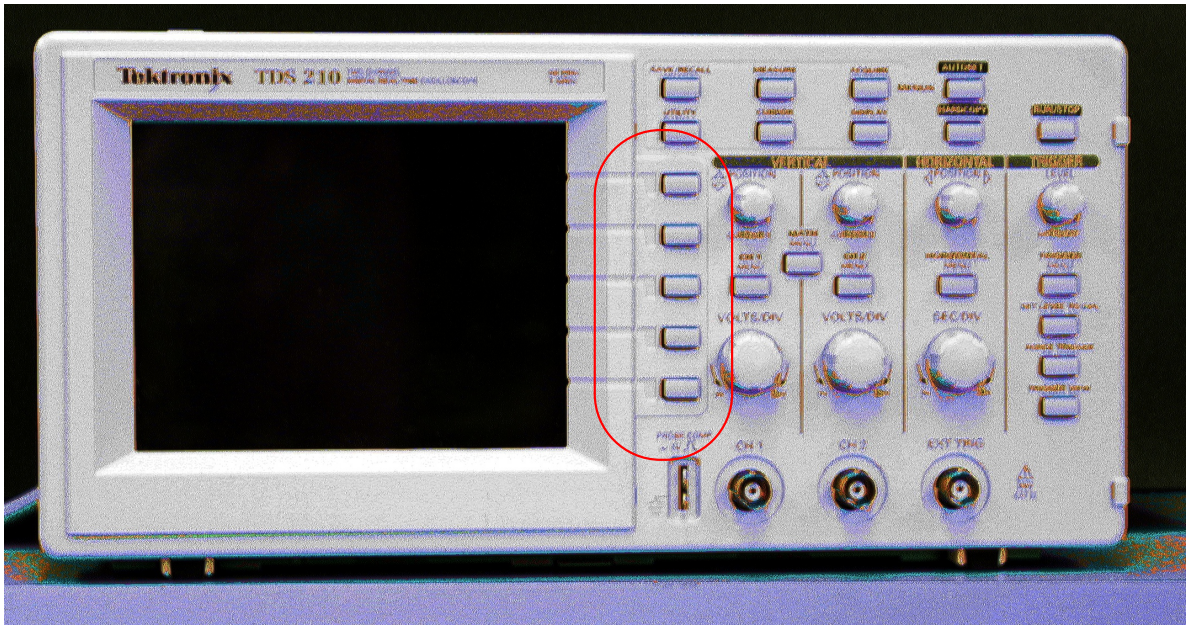
Channel 1 section


Tektronix
TDS 210
VERTICAL
HORIZONTAL
TRIGGER
VOLTS/DIV
VOLTS/DIV
SEC/DIV
CH 1
CH 2
EXT TRIG



Channel 2 section


Tektronix
TDS 210
VERTICAL
HORIZONTAL
TRIGGER
VOLTS/DIV
VOLTS/DIV
SEC/DIV
CH 1
CH 2
EXT TRIG



Menu controls

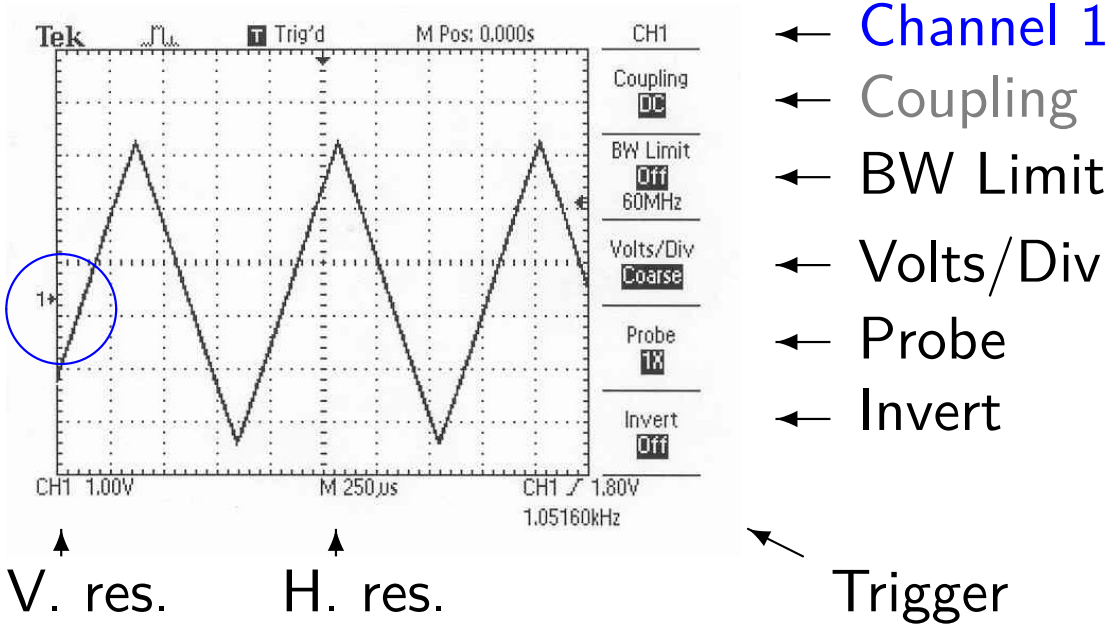


Figure: Channel 1 settings

- Indicates to which channel everything else applies
- Ground for this channel is at left

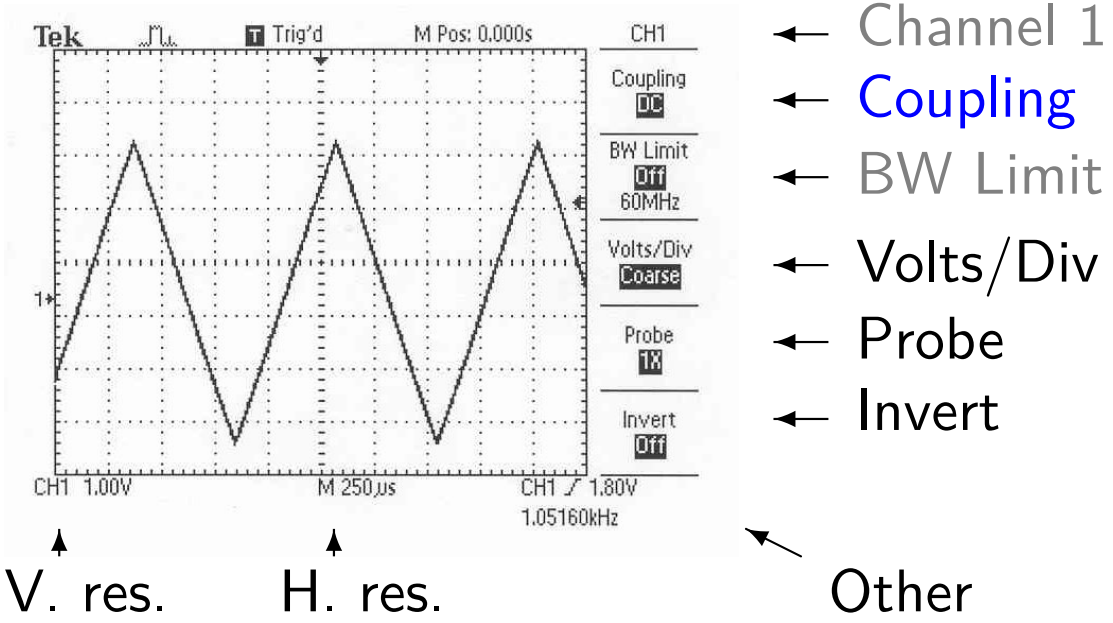


Figure: Channel 1 settings

- AC, DC or GROUND
- Get rid of DC offset (or not), or show ground

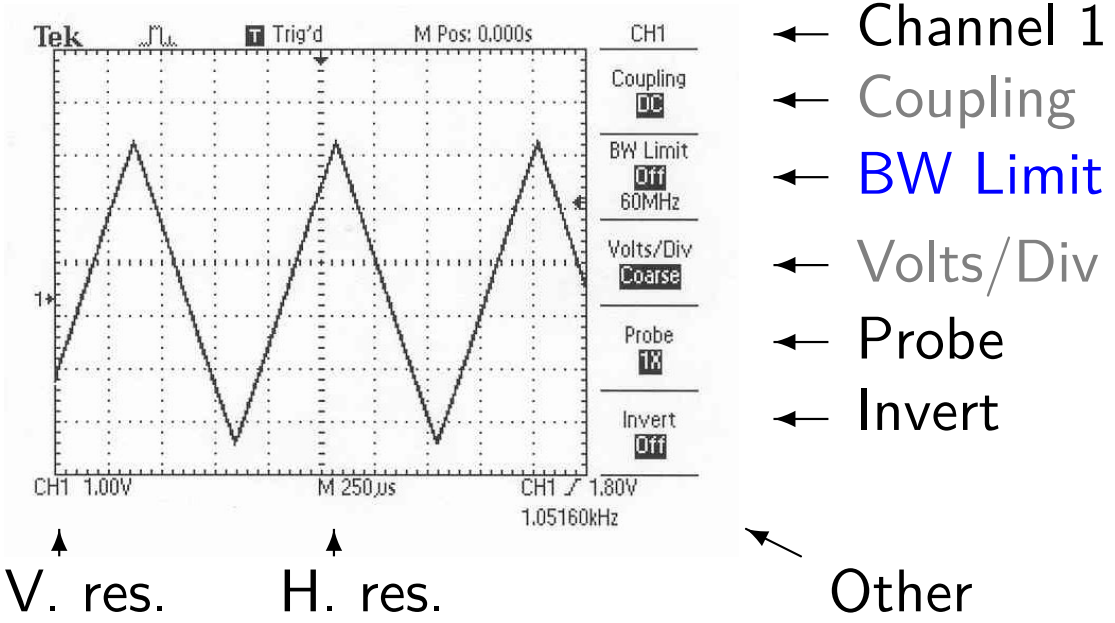


Figure: Channel 1 settings

- Bandwidth limit

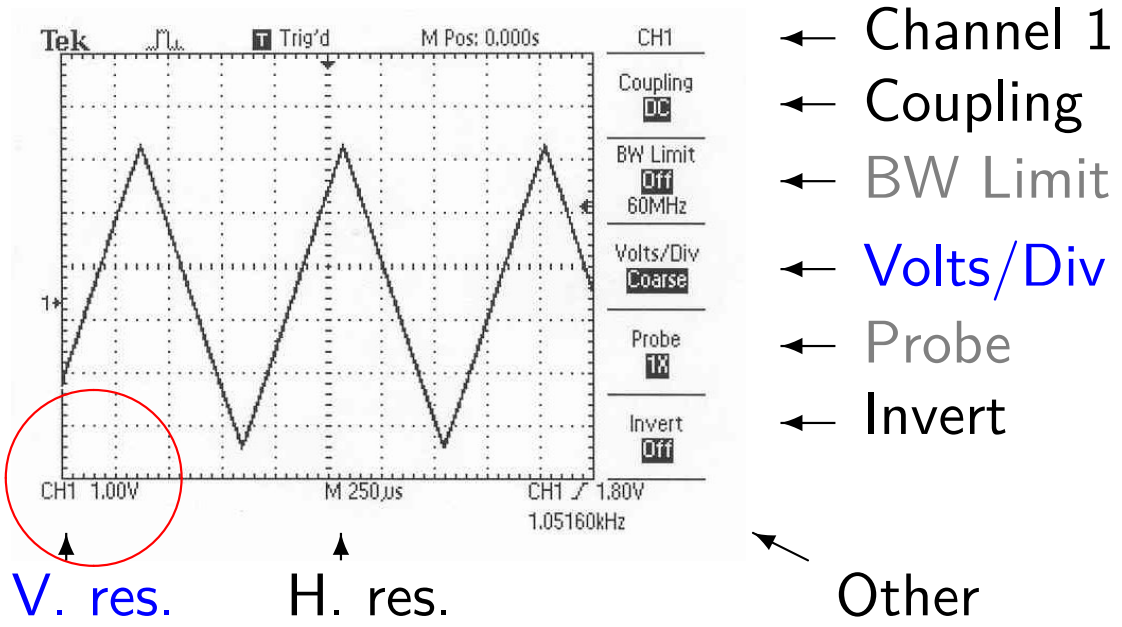


Figure: Channel 1 settings

- Vertical resolution
- Setting is shown at lower left

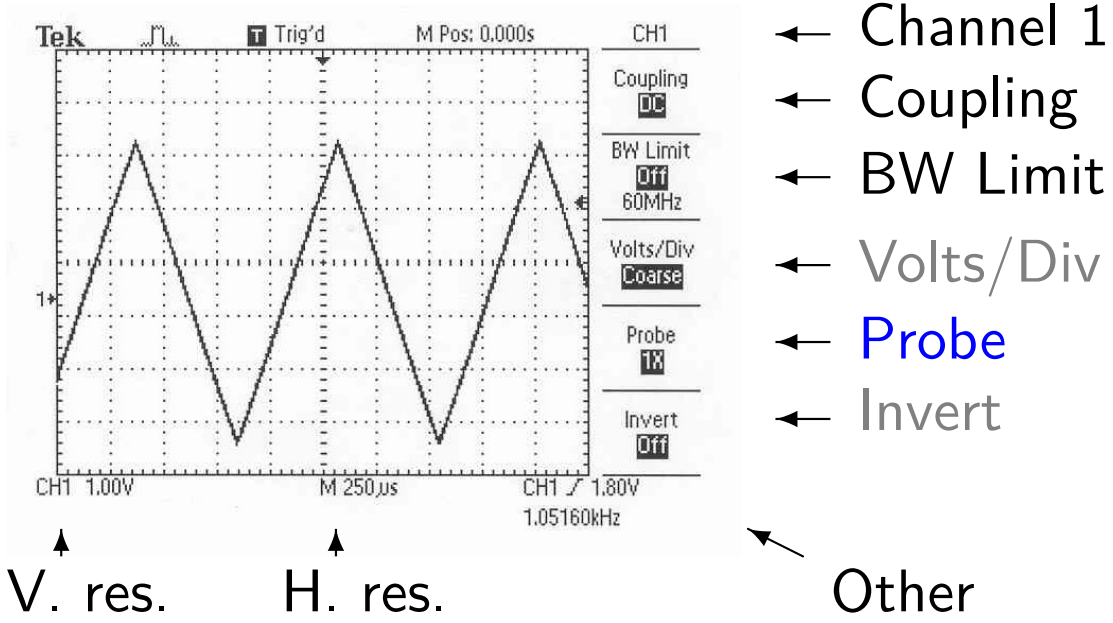


Figure: Channel 1 settings

- The PROBE setting must match the setting on the cable switch, or be '1X' if there's no cable switch.

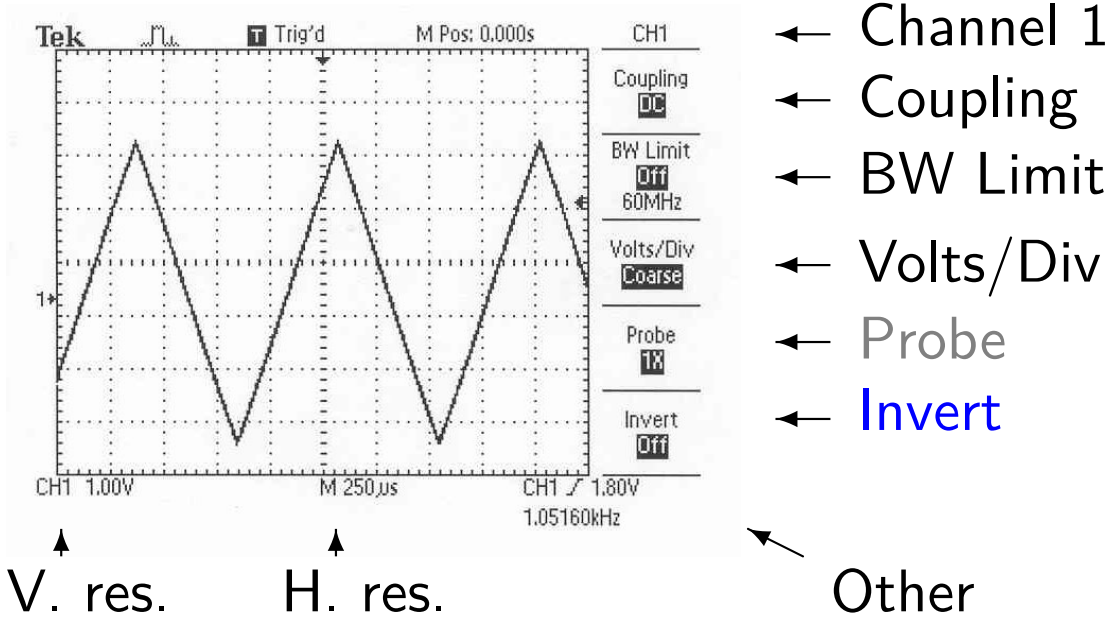


Figure: Channel 1 settings

- Invert the voltage or not

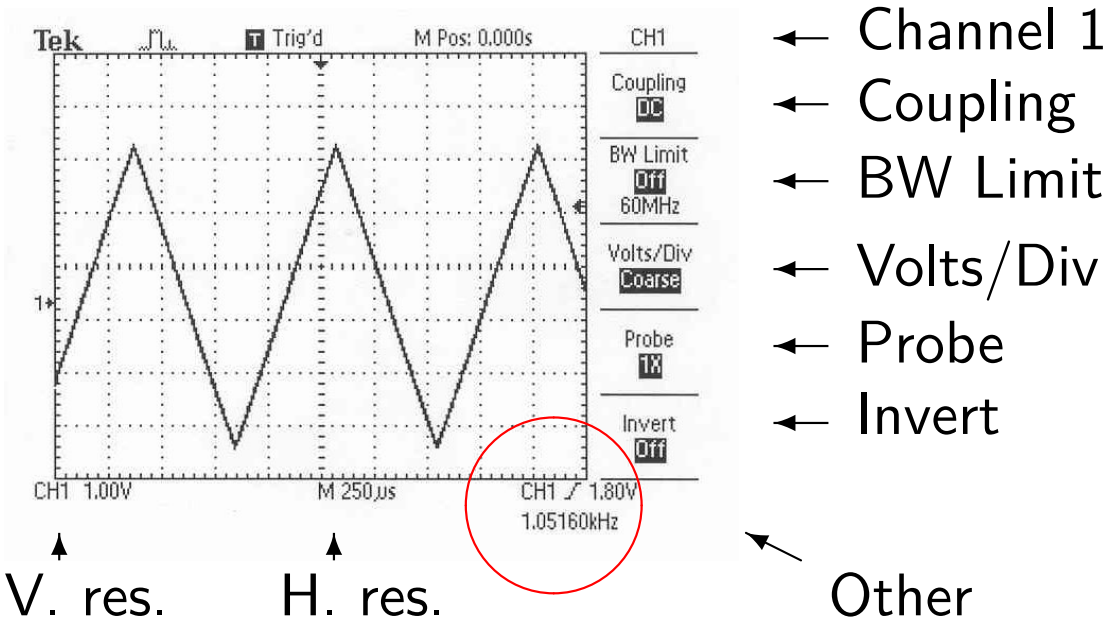


Figure: Channel 1 settings

- Trigger settings are displayed

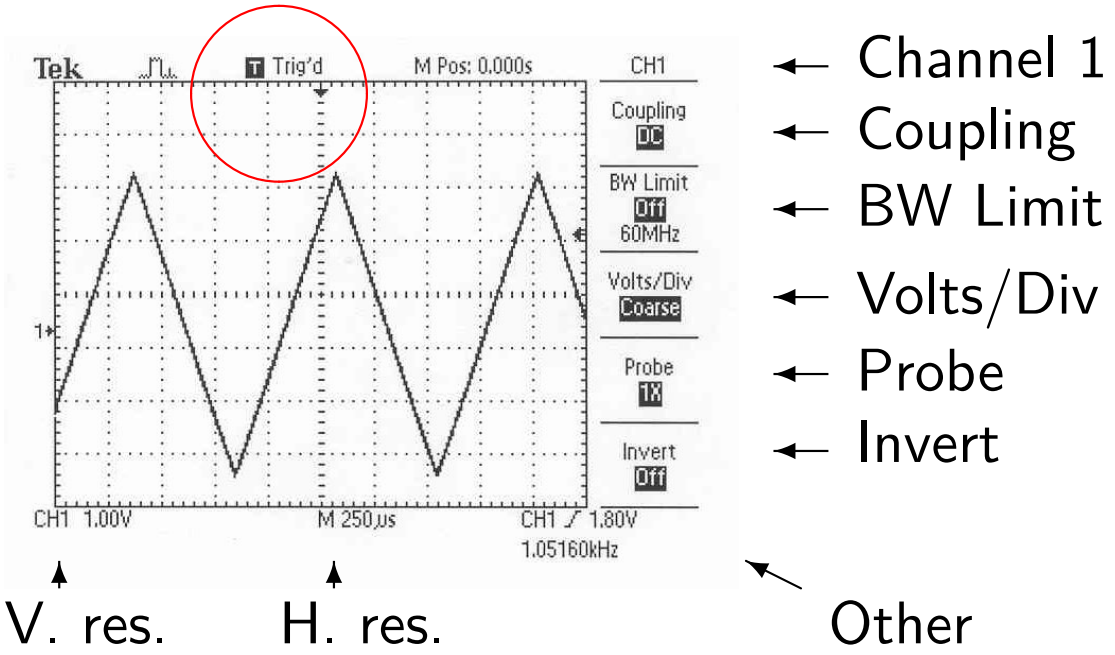


Figure: Channel 1 settings

- Trigger status is displayed

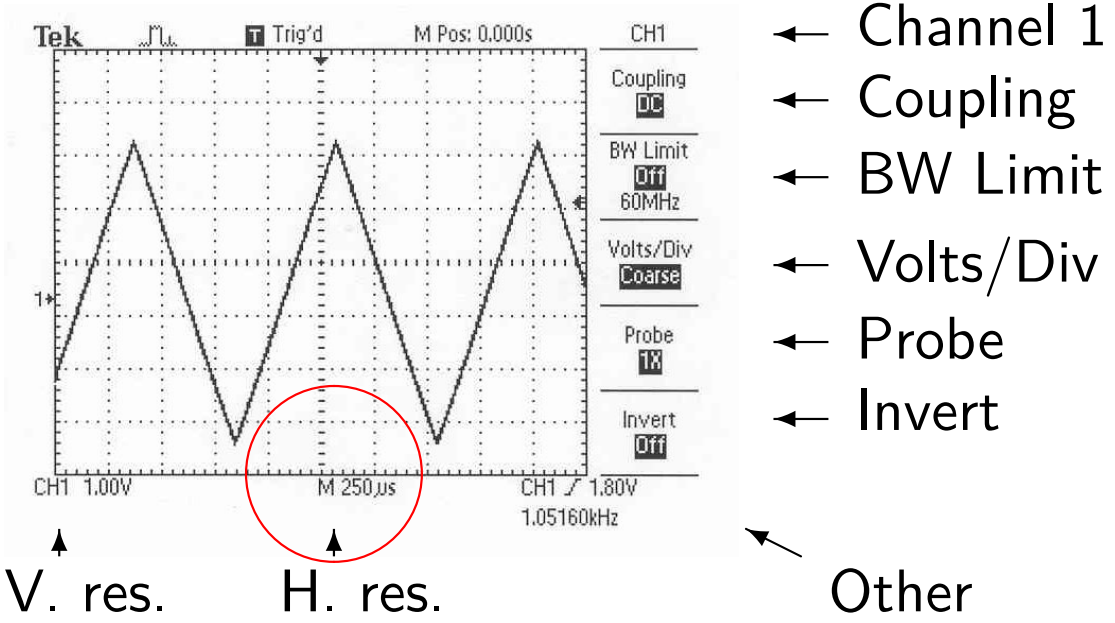
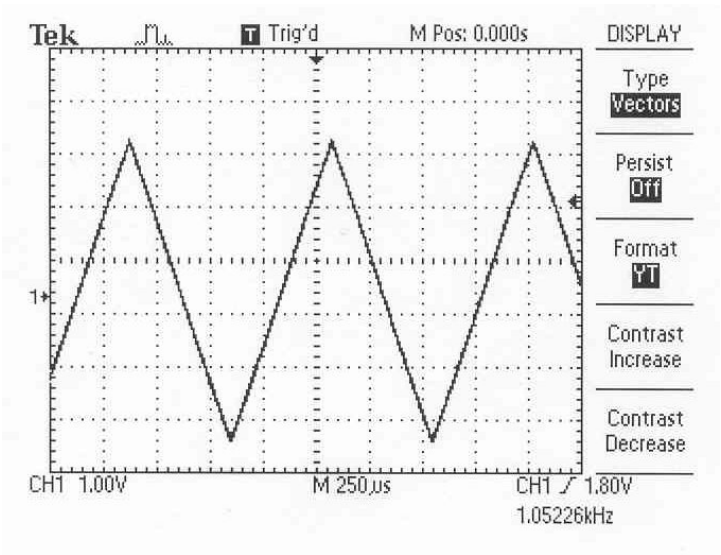


Figure: Channel 1 settings

- Horizontal resolution is displayed



← Display
← Type
← Persist
← XY or YT
← Contrast +
← Contrast -

Figure: Display settings

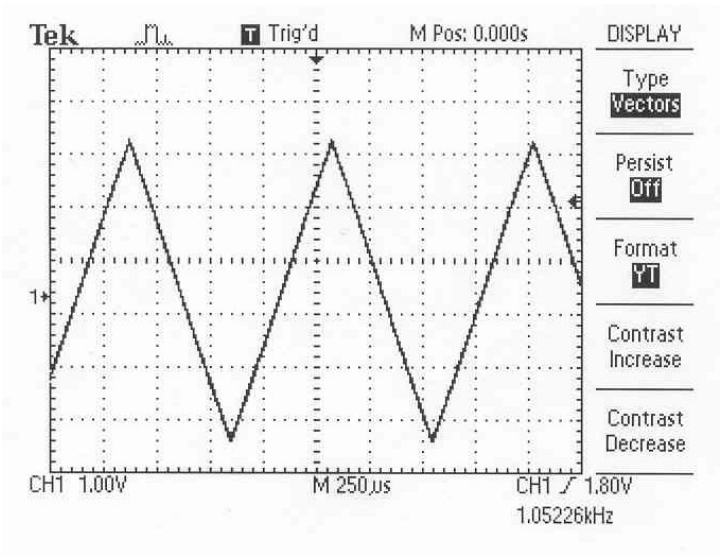
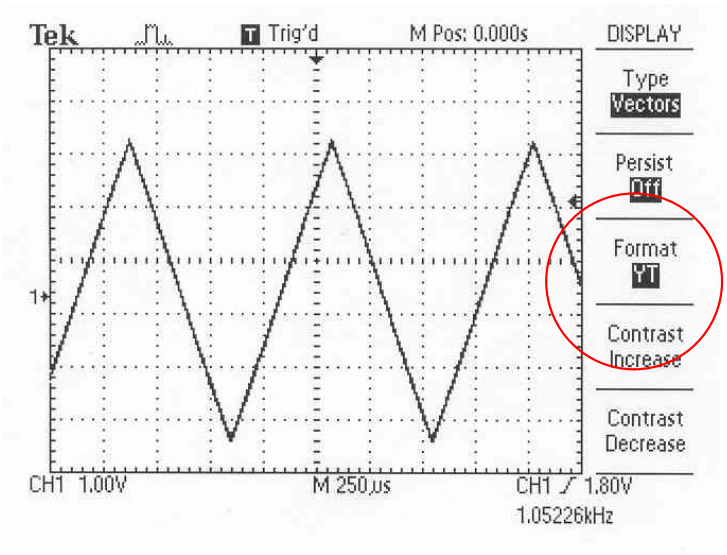


Figure: Display settings

- Allows you to choose *timebase* mode or *XY* mode



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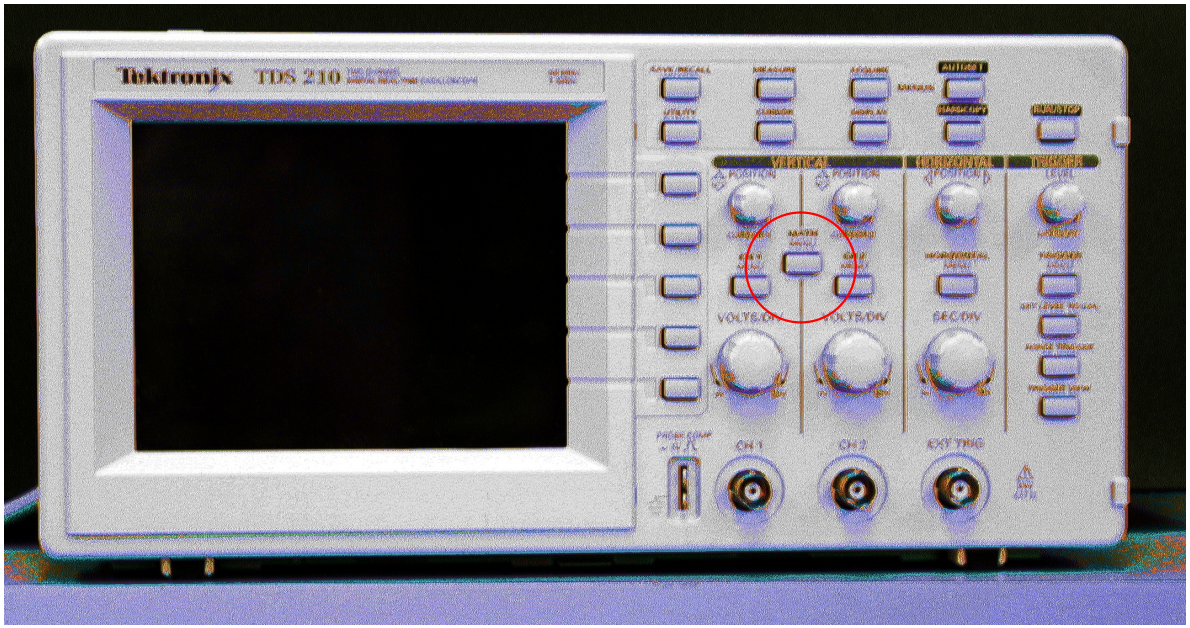
Tektronix
TDS 210
VERTICAL
HORIZONTAL
TRIGGER
POSITION
VOLTS/DIV
SEC/DIV
CH 1
CH 2
EXT TRIG



Math mode control

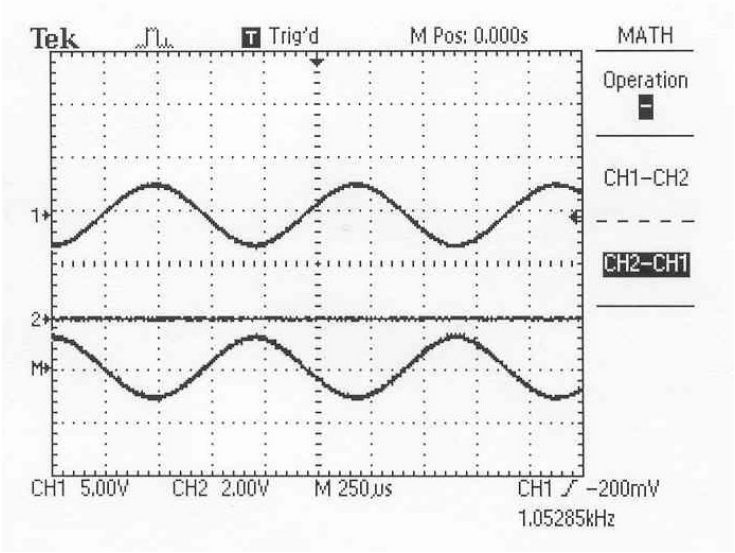


Figure: Math settings

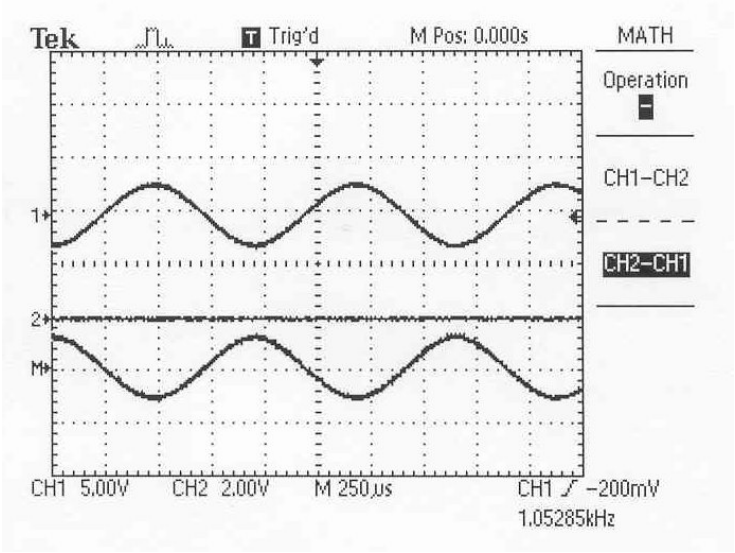
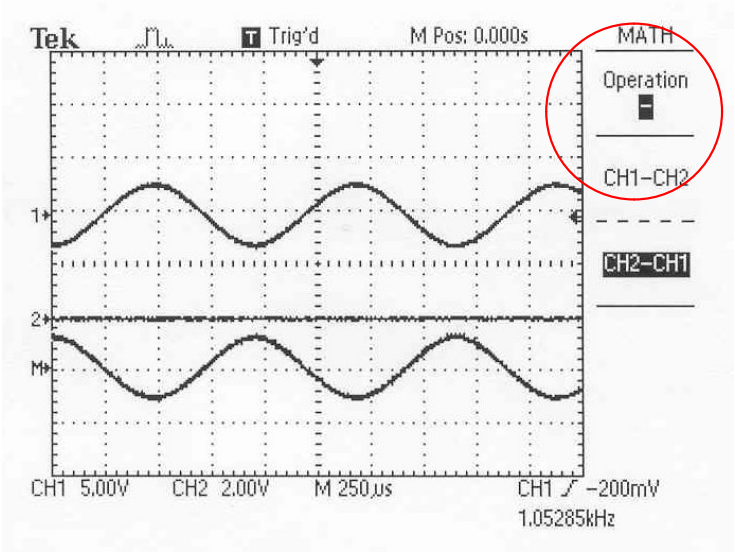


Figure: Math settings

- Allows you to add or subtract channels



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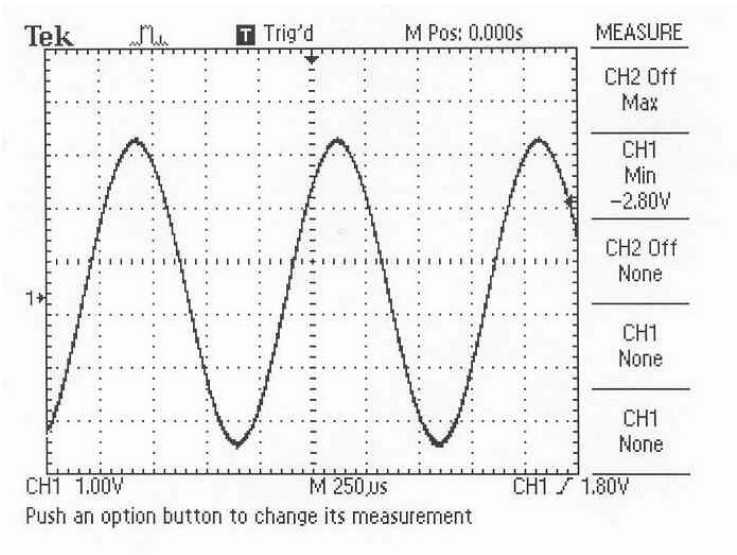
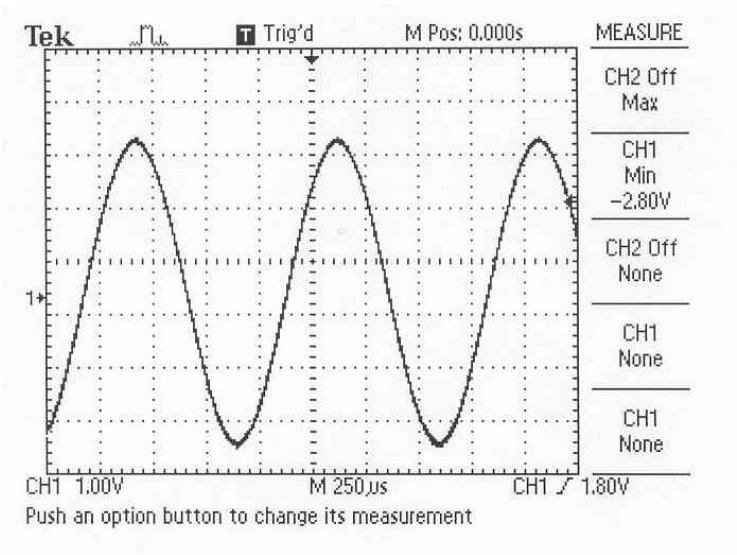


← Measure

Figure: Measure settings



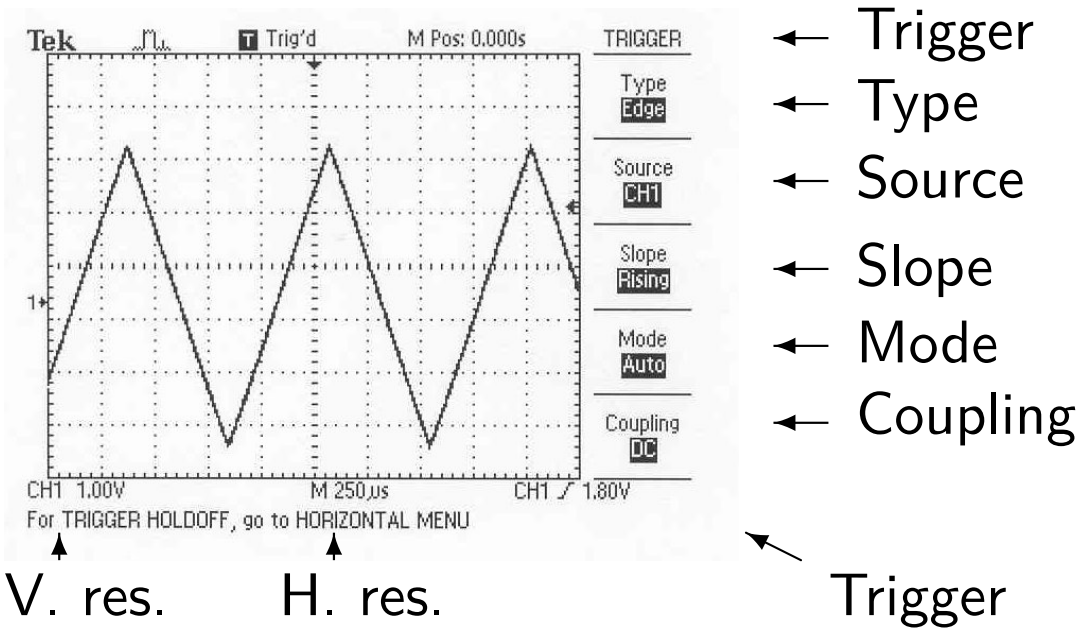
← Measure

Figure: Measure settings

- Allows automatic measurement of certain signal properties


Tektronix
TDS 210
VERTICAL
HORIZONTAL
TRIGGER
VOLTS/DIV
VOLTS/DIV
SEC/DIV
CH 1
CH 2
EXT TRIG

Trigger section



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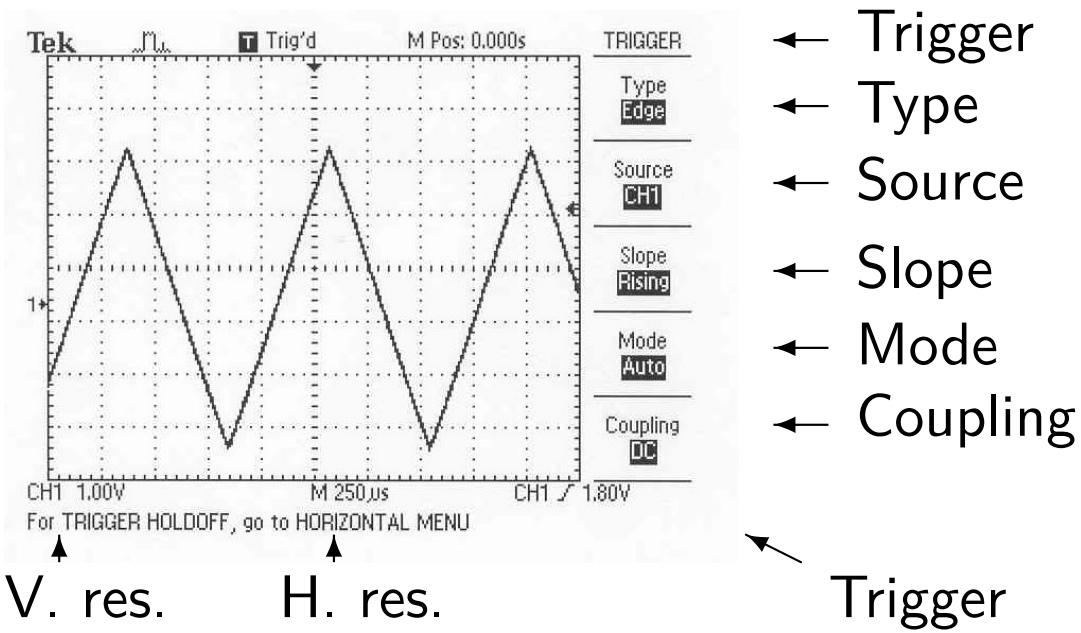
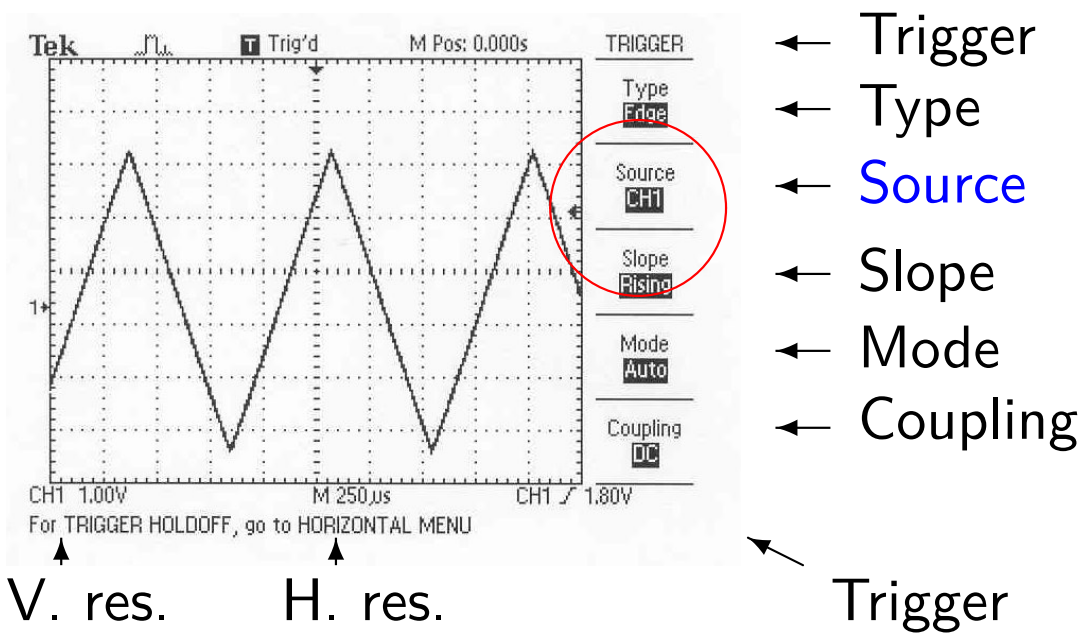


Figure: Trigger settings

- Various trigger settings can be adjusted



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