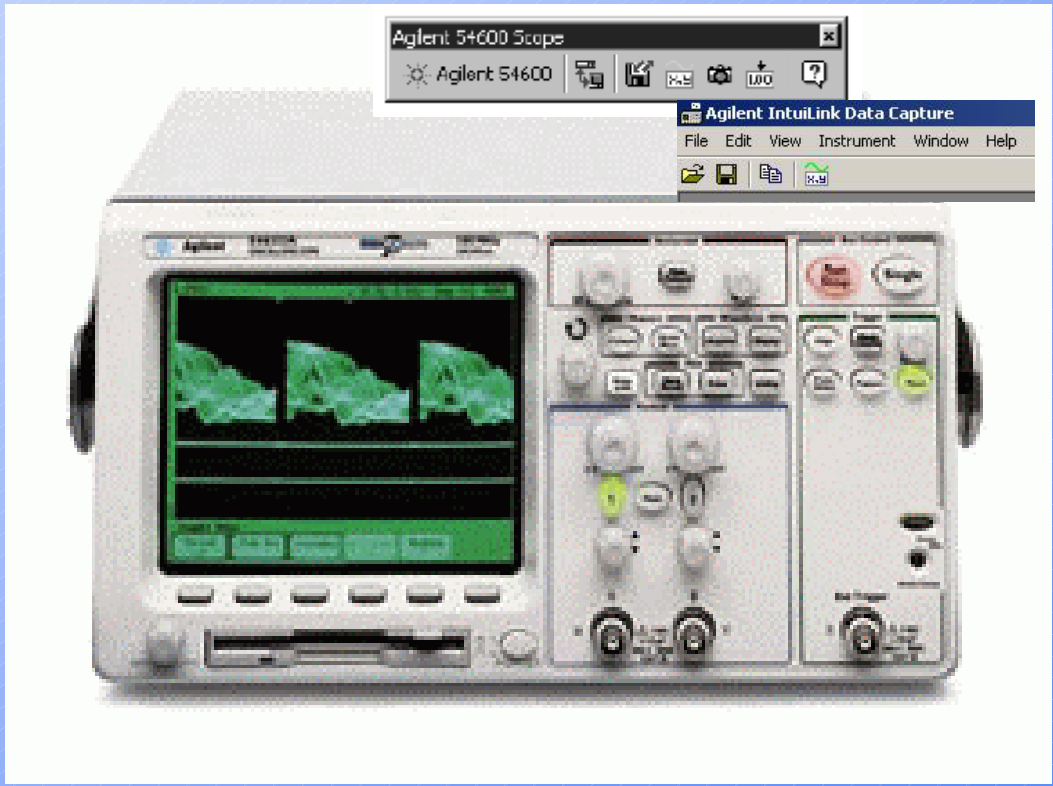
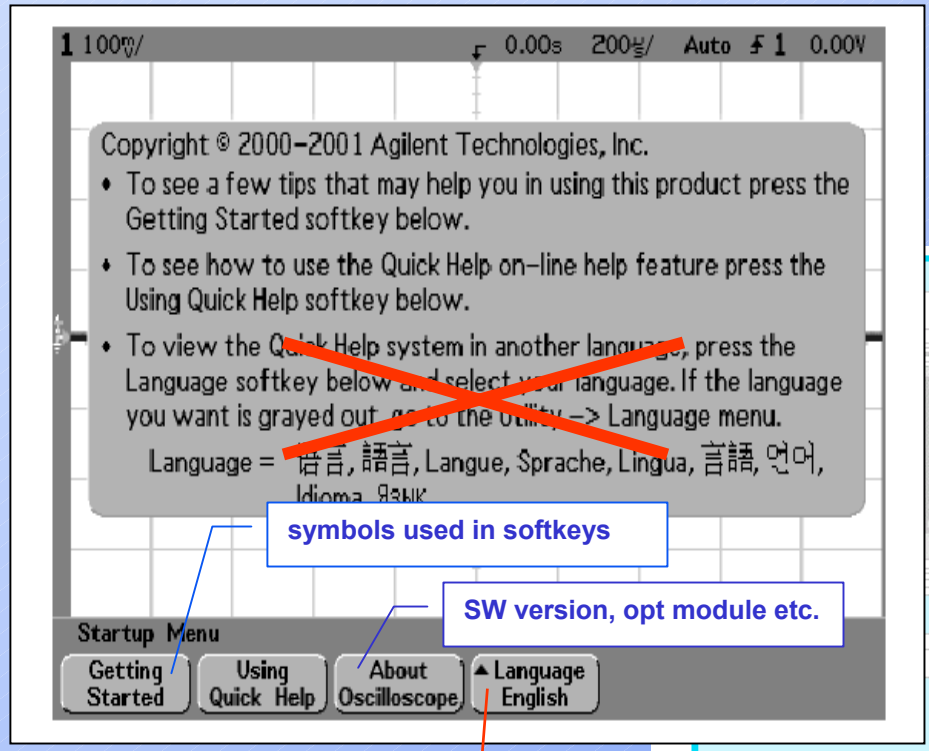
Agilent **54622A** Portable DSO

2 ch, 100 MHz; max 200 Msa/s, max 2 MB/ch (**Mega*Zoom***)
Hi-Def display, flexible Trig; autoMeas, 2K FFT
floppy disk; GPIB, **IntuiLink (Toolbar; Data Capture)**



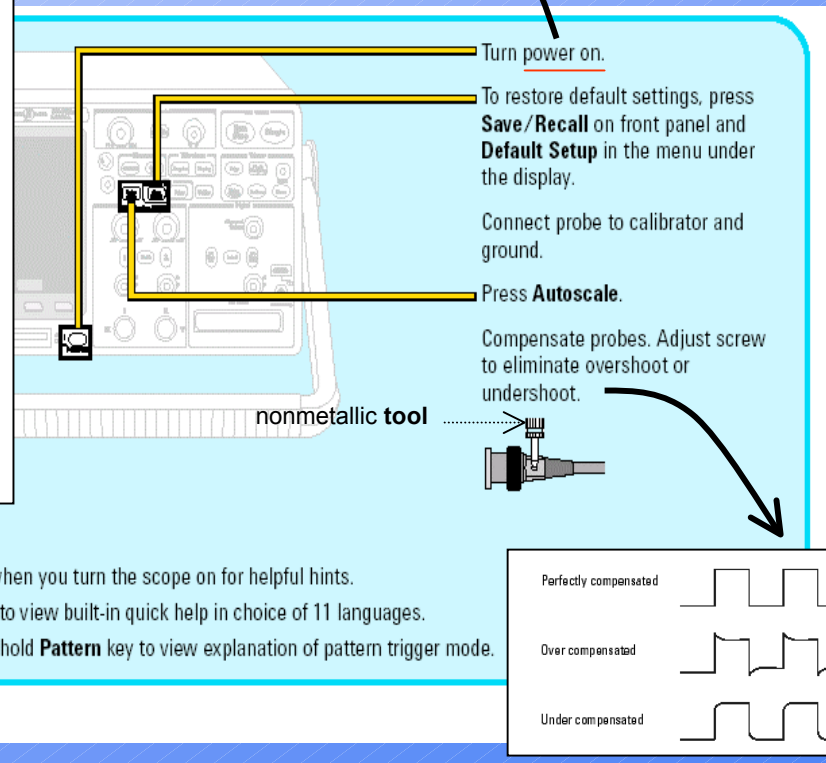
Getting started



symbols used in softkeys

SW version, opt module etc.

PLEASE DO **NOT** change (or delete) the language



Default configuration

A good way to start is to return the scope to its **Default** condition.

To apply the default factory configuration

To set the instrument to the factory-default configuration, press the **Save/Recall** key, then press the **Default Setup** softkey.

The default configuration returns the oscilloscope to its default settings. This places the oscilloscope in a known operating condition. The major default settings are:

Horizontal main mode, 100 us/div scale, 0 s delay, center time reference

Vertical (Analog) Channel 1 on, 5 V/div scale, dc coupling, 0 V position, probe factor to 1.0 if an AutoProbe probe is not connected to the channel

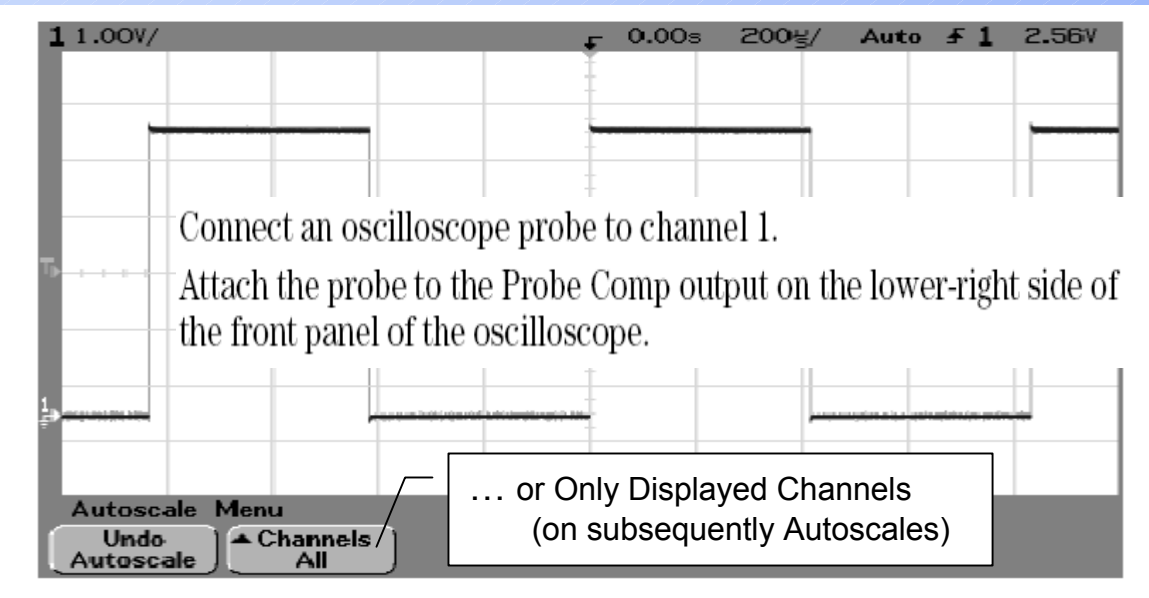
Trigger Edge trigger, Auto level sweep mode, 0 V level, channel 1 source, dc coupling, rising edge slope, 60 ns holdoff time

Display Vectors on, 20% grid intensity, infinite persistence off

Other Acquire mode normal, Run/Stop to Run, cursor measurements off

Note: the Default Setup does **NOT** change the file format (for floppy disk saving)

Press **Autoscale** hardkey

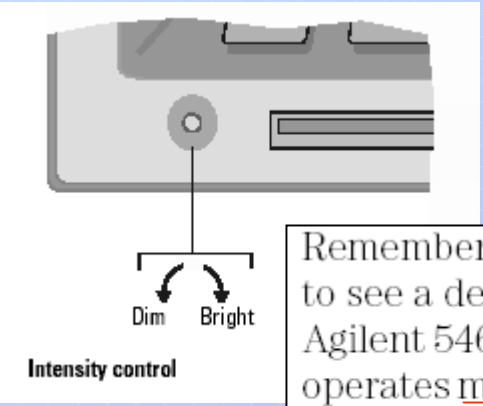


Autoscale may not give a desirable result; use **Undo Autoscale** if this happens.

When you use **Autoscale**, the 'scope looks for repetitive waveforms 10 mVpp or larger, a duty cycle greater than 0.5%, at no less than 50 Hz, and will turn off any channel not meeting those criteria. It will choose as its trigger source whichever of these has a valid signal on it, in the order listed: External Trigger, Channel 2, then Channel 1. The delay set to 0.00 s.

If you have signals on channels 1 and 2, when you use **Autoscale** the 'scope automatically chooses channel 2 as the trigger source. You may need to manually change the trigger source to channel 1.

Intensity knob



Remember how you had to constantly adjust the brightness on old analog scopes to see a desired level of detail in a signal, or to see the signal at all? With the Agilent 54620/40-series oscilloscopes, this is not necessary. The Intensity knob operates much like the brightness knob on your computer screen, so you should set it to a level that makes for comfortable viewing, given the room lighting, and leave it there.

Probe attenuation

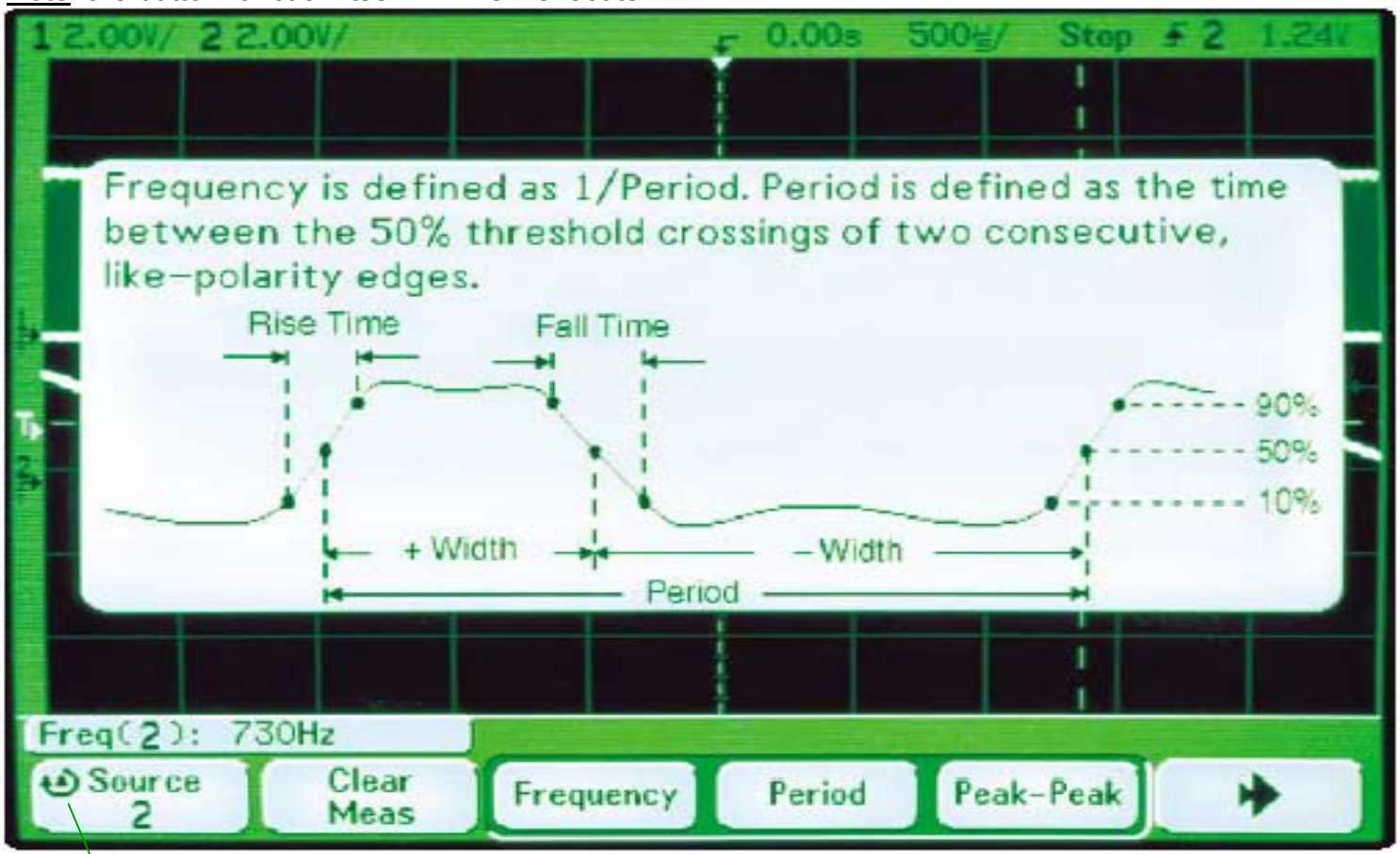
Probe Attenuation If you have an AutoProbe self-sensing probe (such as the 10073C or 10074C) connected to the analog channel, the oscilloscope will automatically configure your probe to the correct attenuation factor. In the previous figure, the oscilloscope has sensed an AutoProbe 10:1 probe.

If you do not have a self-sensing probe connected, press the **Probe** softkey and turn the Entry knob to set the attenuation factor for the connected probe. The attenuation factor can be set from 0.1:1 to 1000:1 in a 1-2-5 sequence.

The probe correction factor must be set properly for measurements to be made correctly.

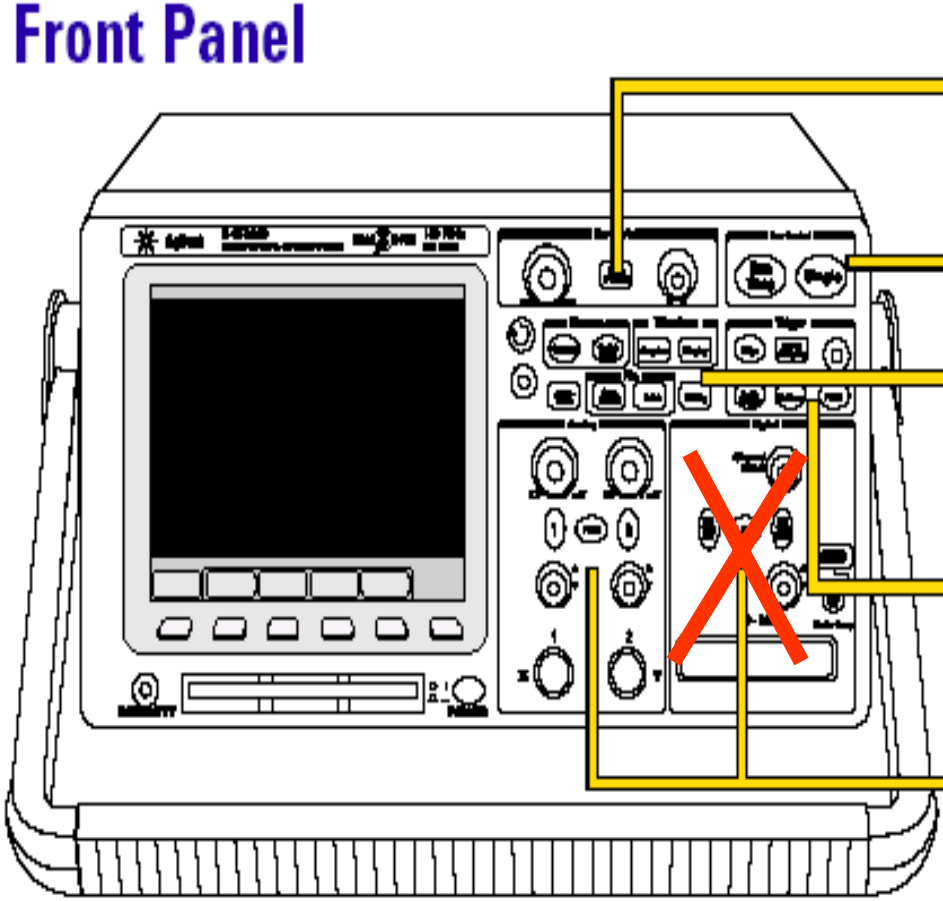
Built-in **Help** (pressing **and holding** ANY key)

Note: the button function itself will NOT execute



circular arrow: use **Entry** knob

Front Panel



Horizontal (time) controls

Run control

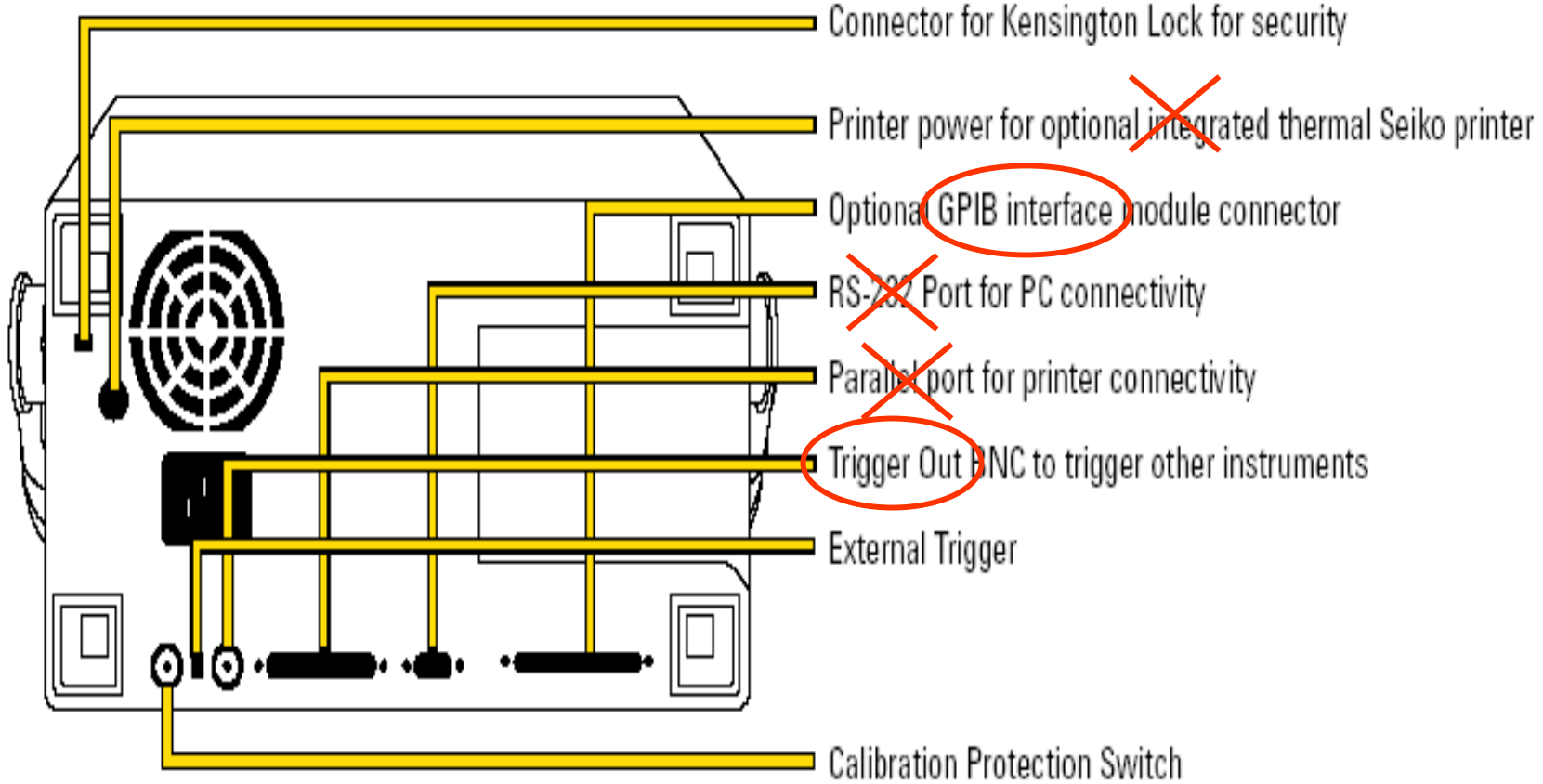
Special purpose menus/controls
- Waveform
- Measure
- File

Trigger controls

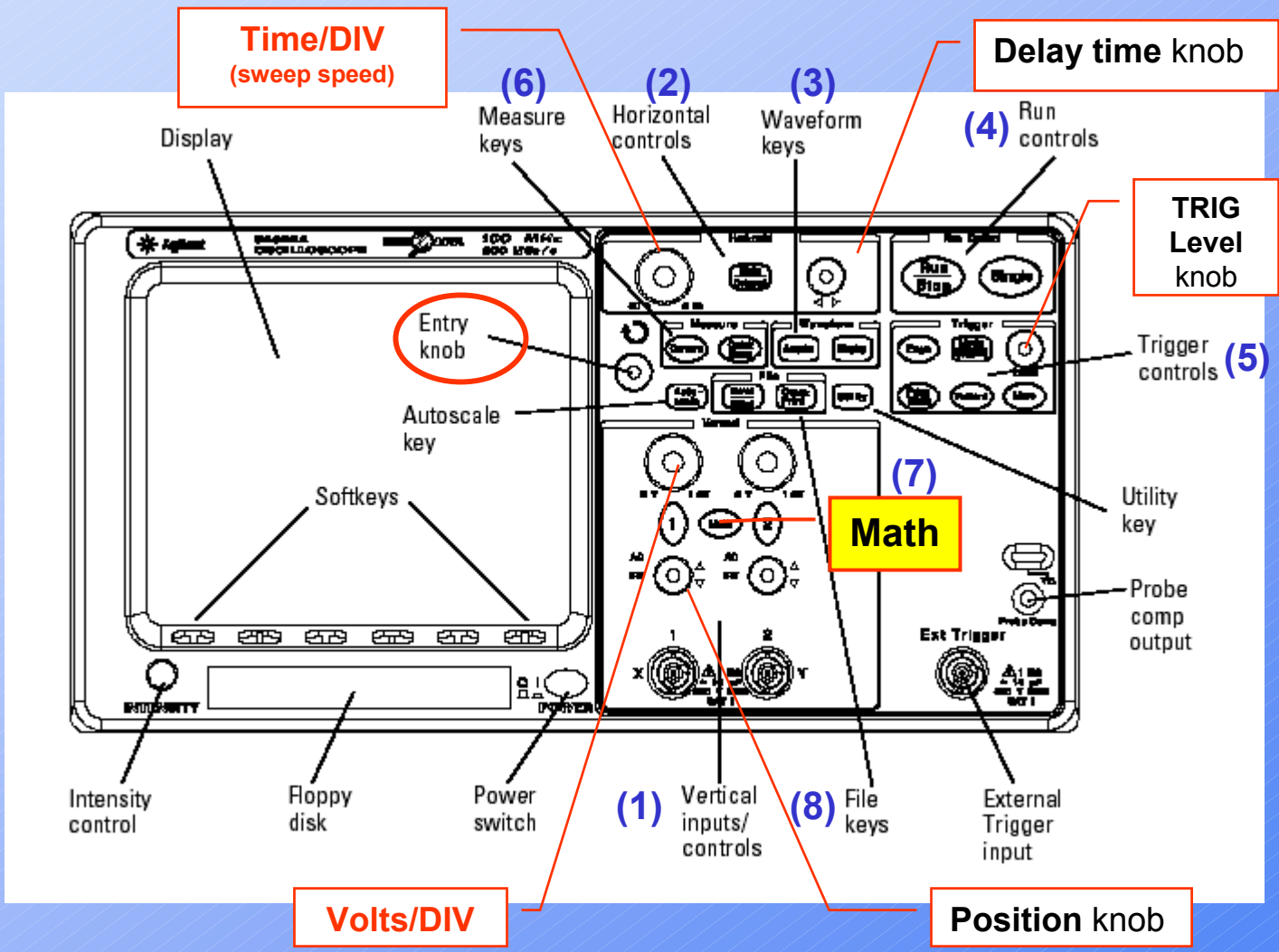
Vertical (volt) controls

Note: buttons appearing with a **GREEN** light are **ACTIVE**.

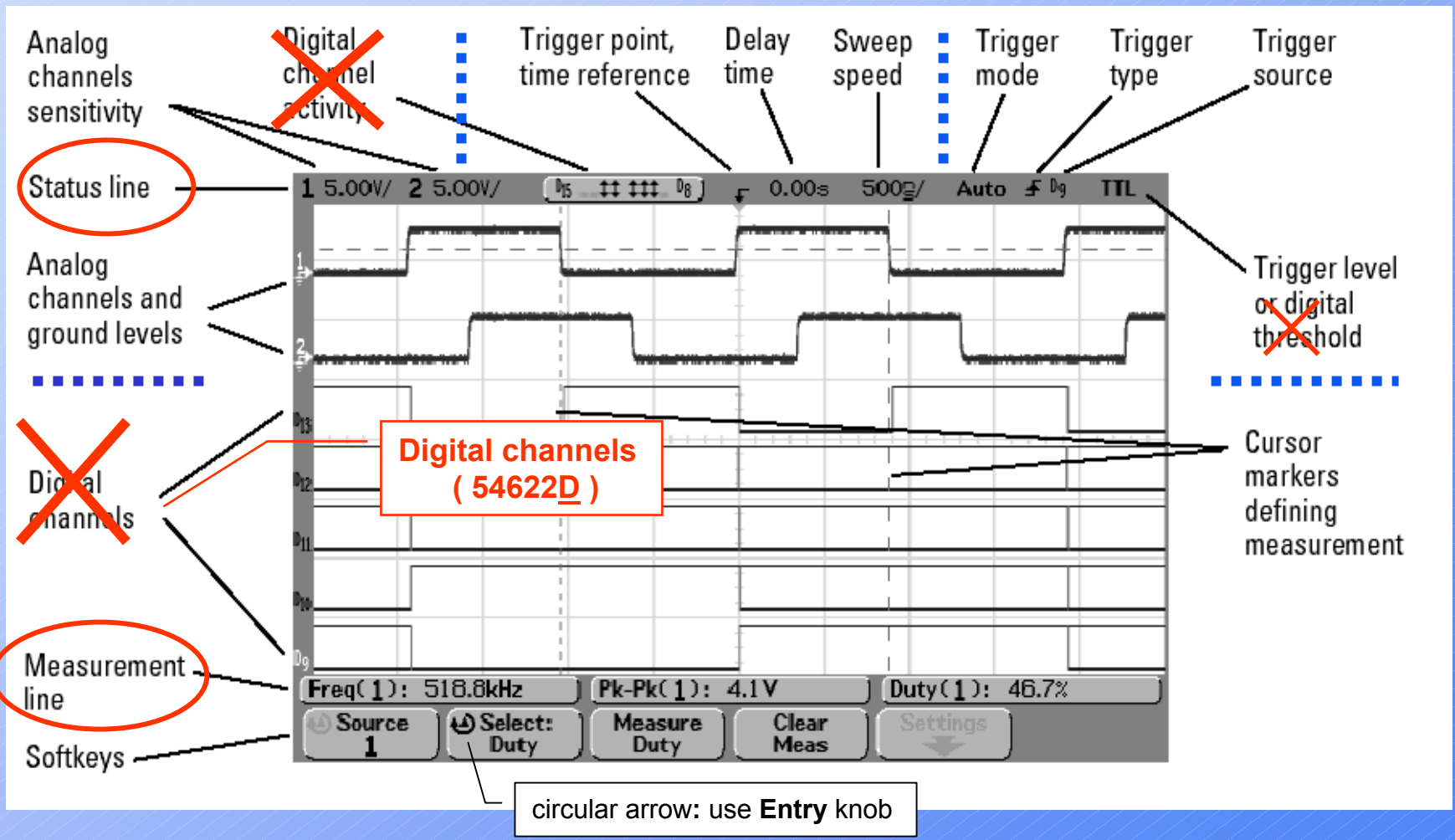
Rear Panel


Connector for Kensington Lock for security
Printer power for optional integrated thermal Seiko printer
Optional GPIB interface module connector
RS-232 Port for PC connectivity
Parallel port for printer connectivity
Trigger Out BNC to trigger other instruments
External Trigger
Calibration Protection Switch

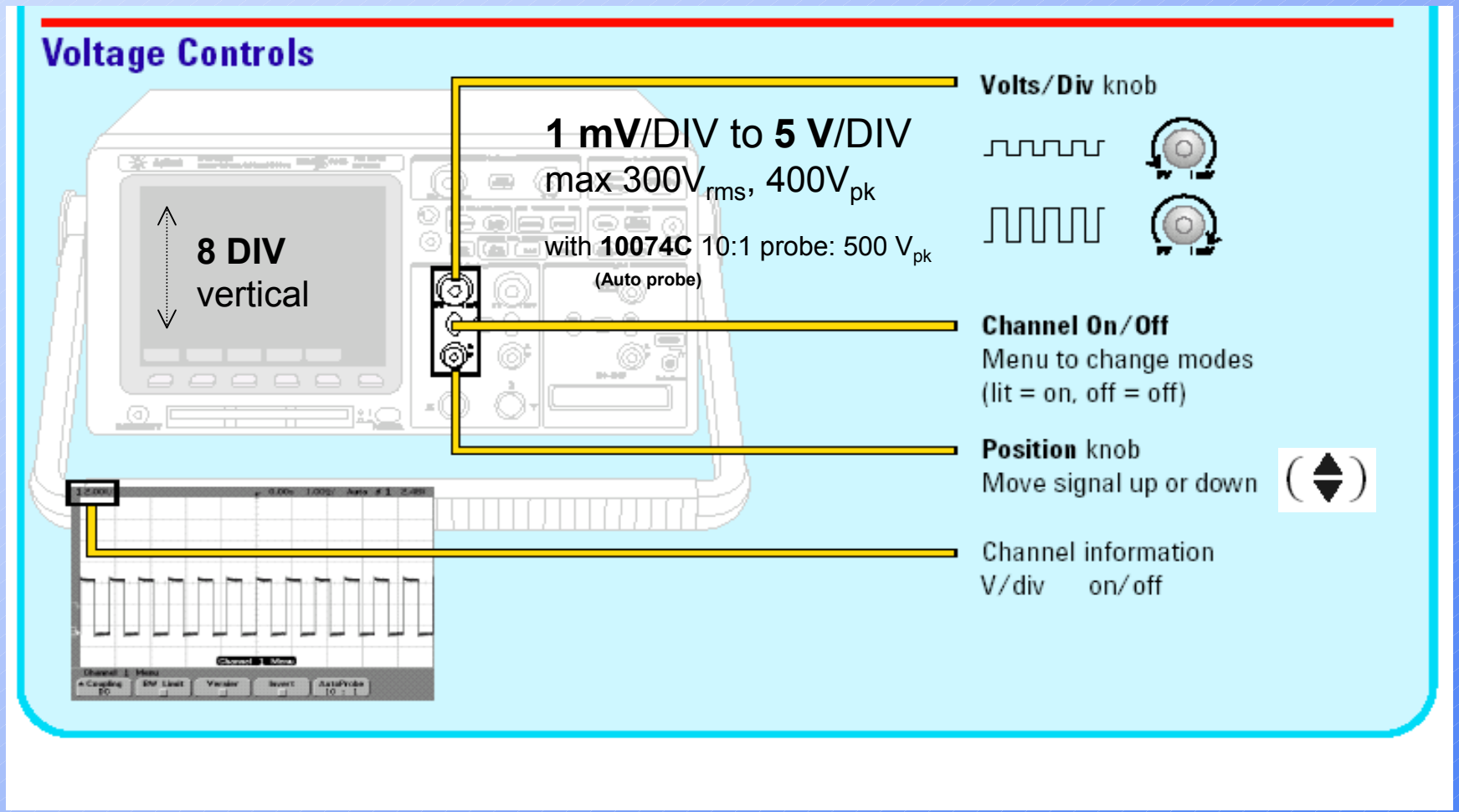
Front Panel


Time/DIV
(sweep speed)
(6)
Measure
keys
(2)
Horizontal
controls
(3)
Waveform
keys
Delay time knob
(4)
Run
controls
TRIG
Level
knob
Display
Entry
knob
Trigger
controls
(5)
Autoscale
key
Softkeys
(7)
Math
Utility
key
Probe
comp
output
Ext Trigger
Intensity
control
Floppy
disk
Power
switch
(1)
Vertical
inputs/
controls
(8)
File
keys
External
Trigger
input
Volts/DIV
Position knob

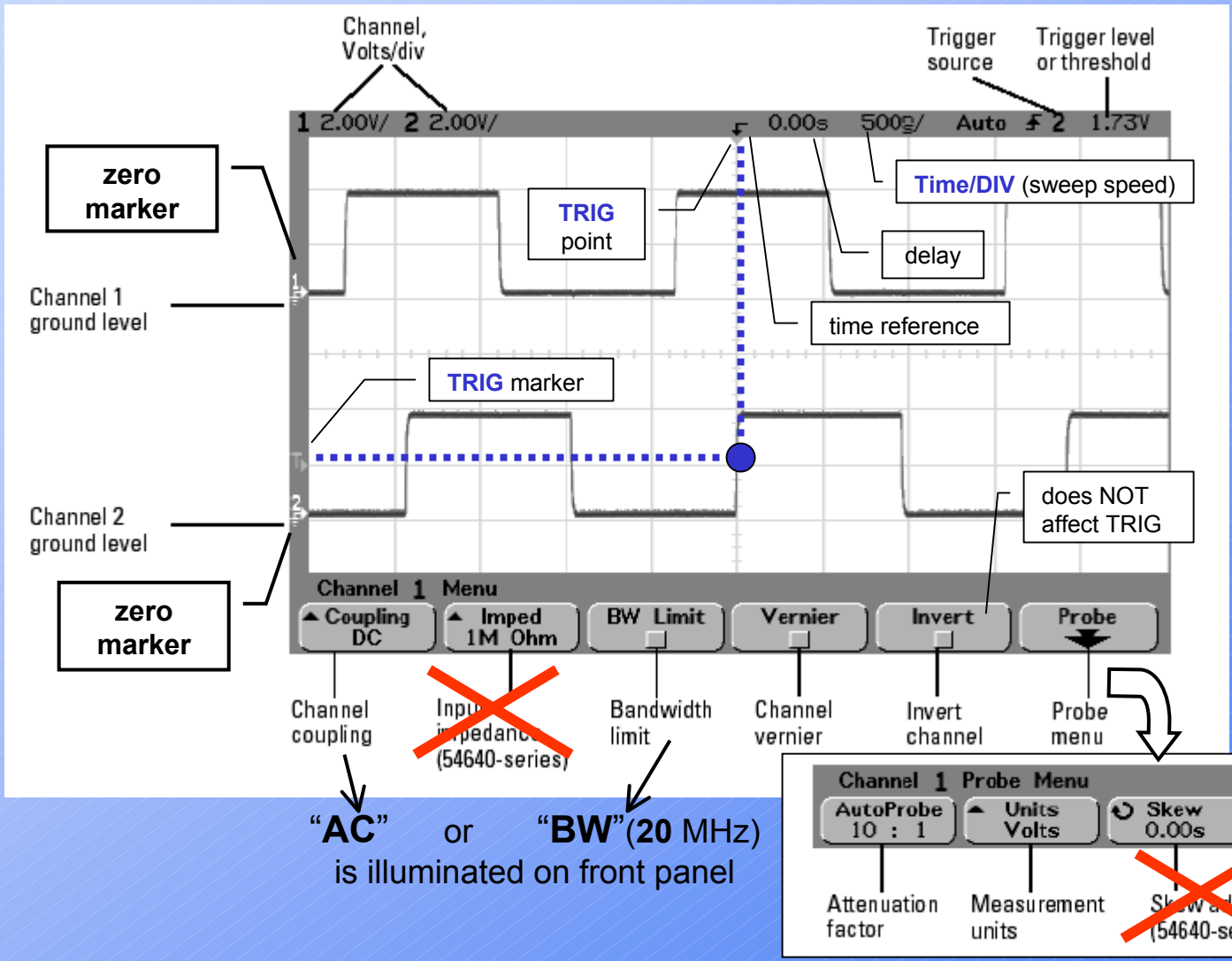
Interpreting the **Display**



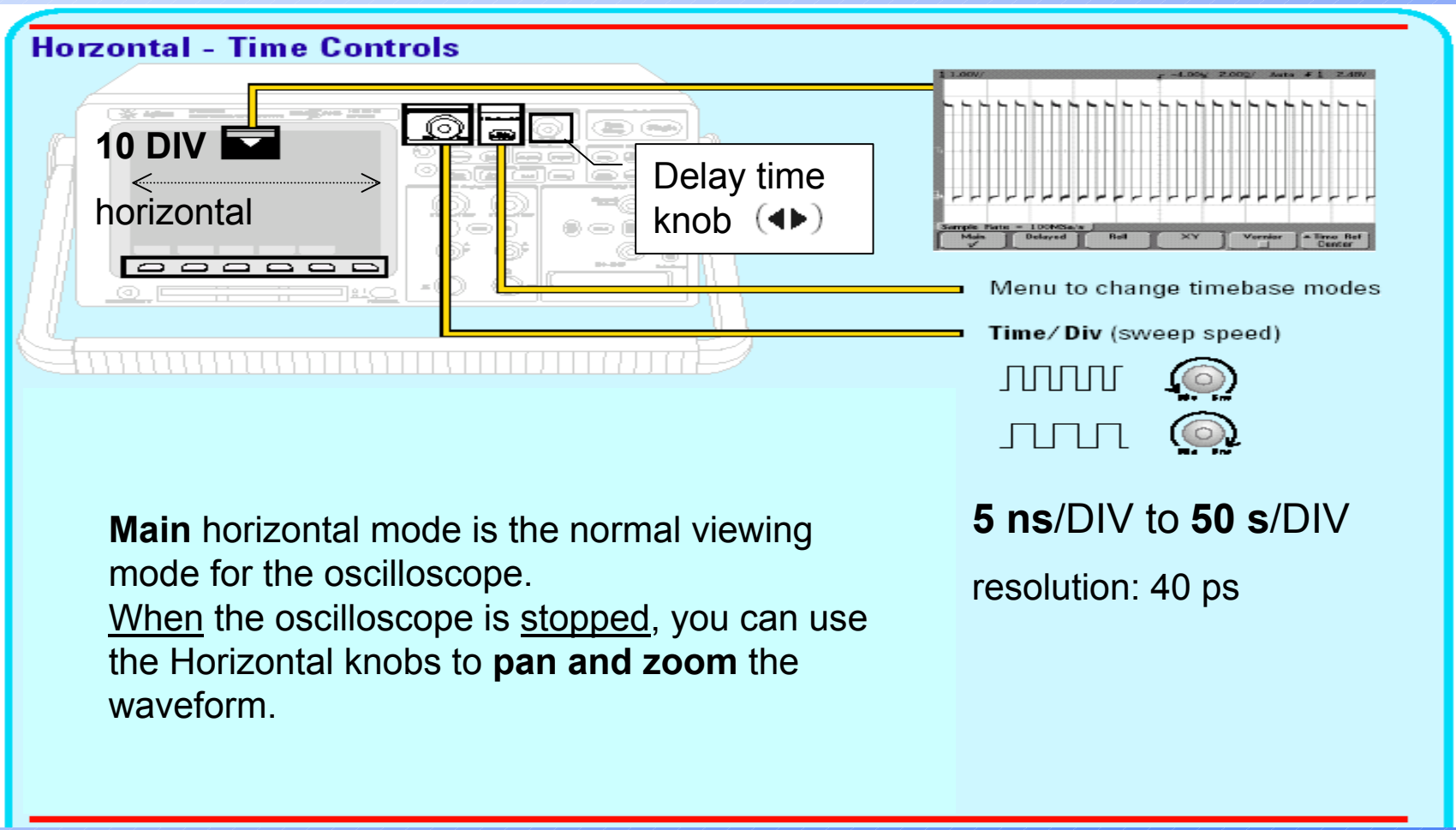
(1) **Vertical** - Voltage controls



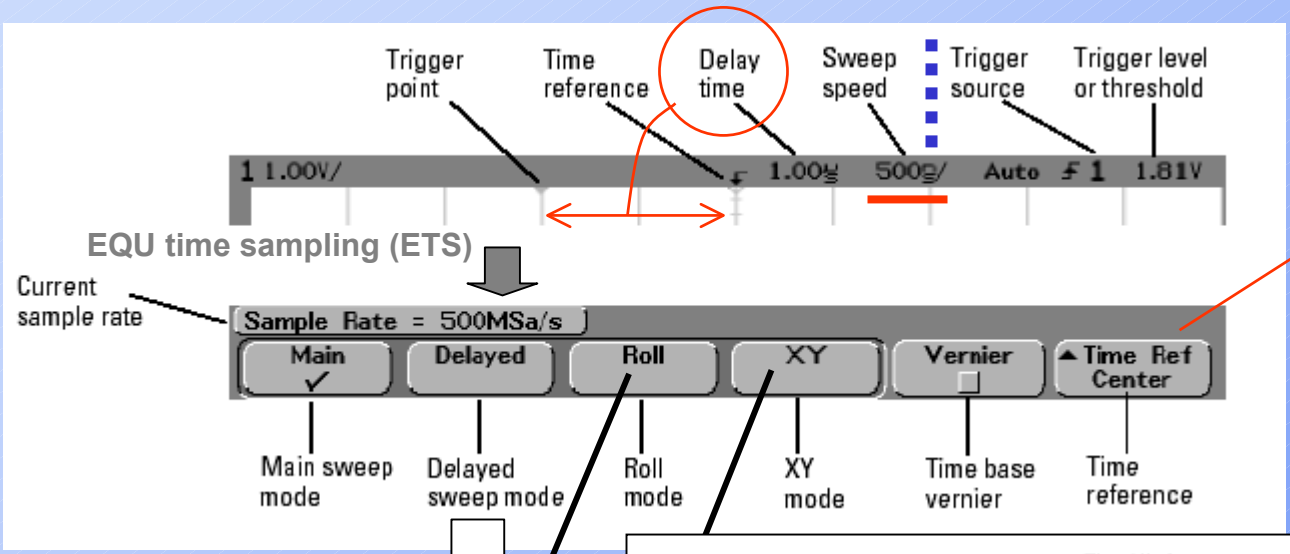
Vertical (press **1** [or **2**] hardkey)



(2) Horizontal – Time controls



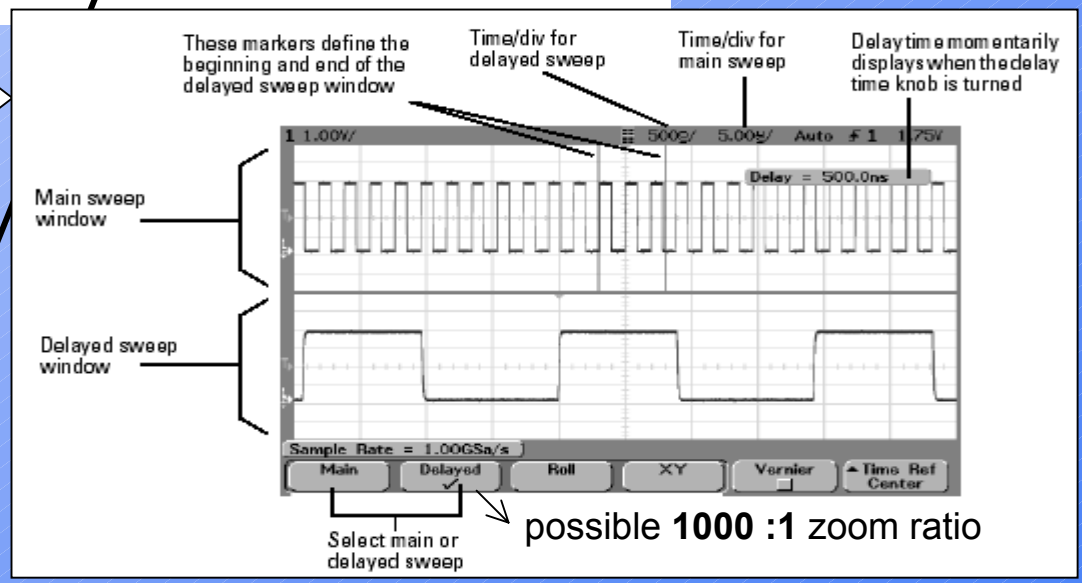
Horizontal (press **Main/Delayed** hardkey)



Time ref:
Left
Center
Right

500 ms/DIV
or slower
(w/o TRIG)

CH1: **X**
CH2: **Y**



(3) **Waveform** (press **Acquire** hardkey)

1 ms/DIV or slower
(10 ms/5 ns = 2M)

#AVG	resolution
1	8
4	9
16	10
64	11
256	12

(@ stable TRIG,
up to **16K** #AVG)

#AVG = 1 **HiRes**

2 us/DIV	8 bit
5 us/	9 bit
20 us/	10 bit
100 us/	11 bit
500 us/	12 bit

OS: oversampling &
DF: decimation filter

2 us/Div or faster *
(20 us/5 ns = 4K),
with reduced BW
(200MSPS/4= 50MHz)

(@ one TRIG event,
SINC interpolation)

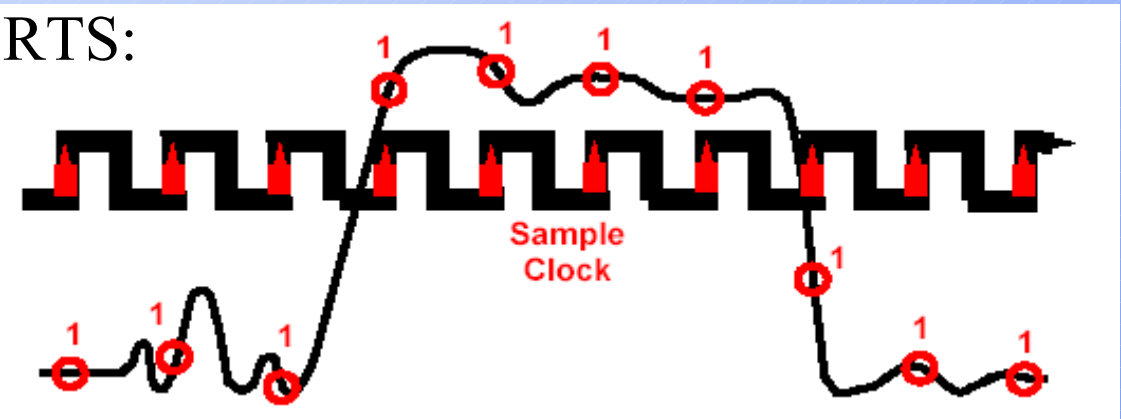
*or infrequent trigger,
complex waveform

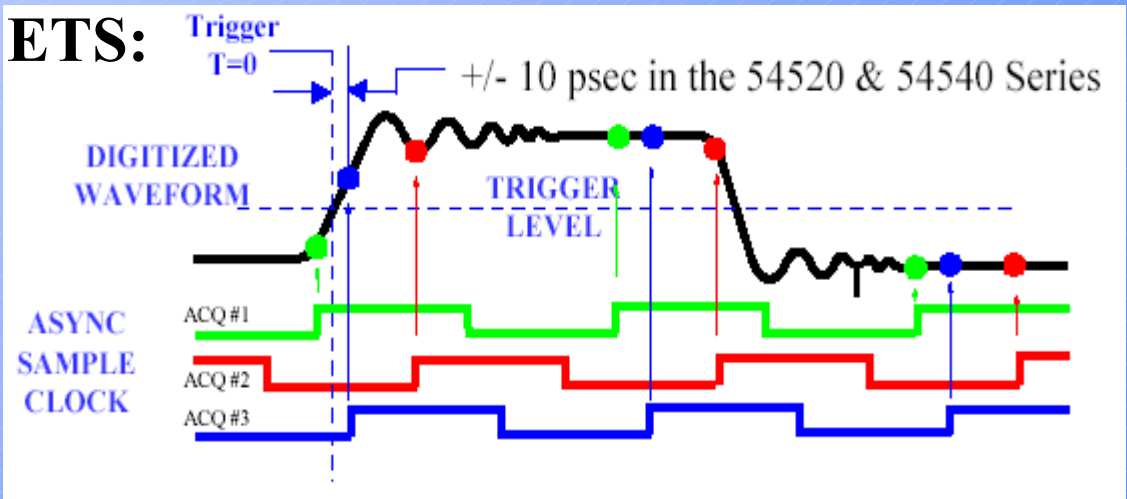
Waveform (press **Display** hardkey)

OFF

ON (“connect the dot”:
LIN interpolation)

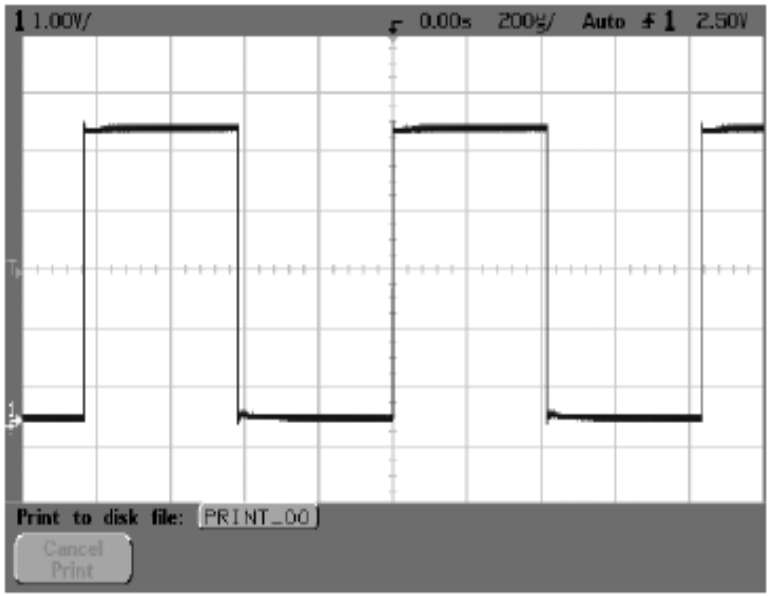
Equivalent-time sampling (**ETS**) vs. Real-time sampling (RTS)
(**Normal** mode vs. **Realtime** mode: **2 us/DIV** or faster)



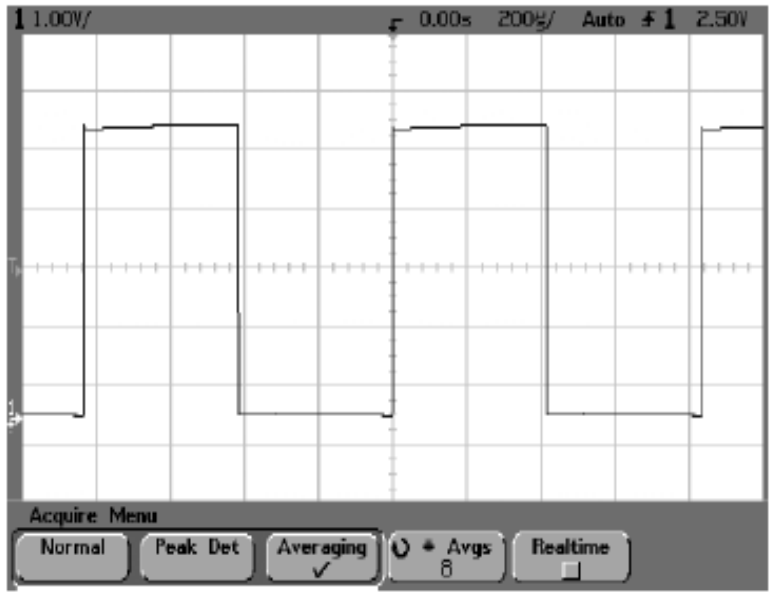


#AVG: 8 (default number)

Probe Comp Signal, No Averaging

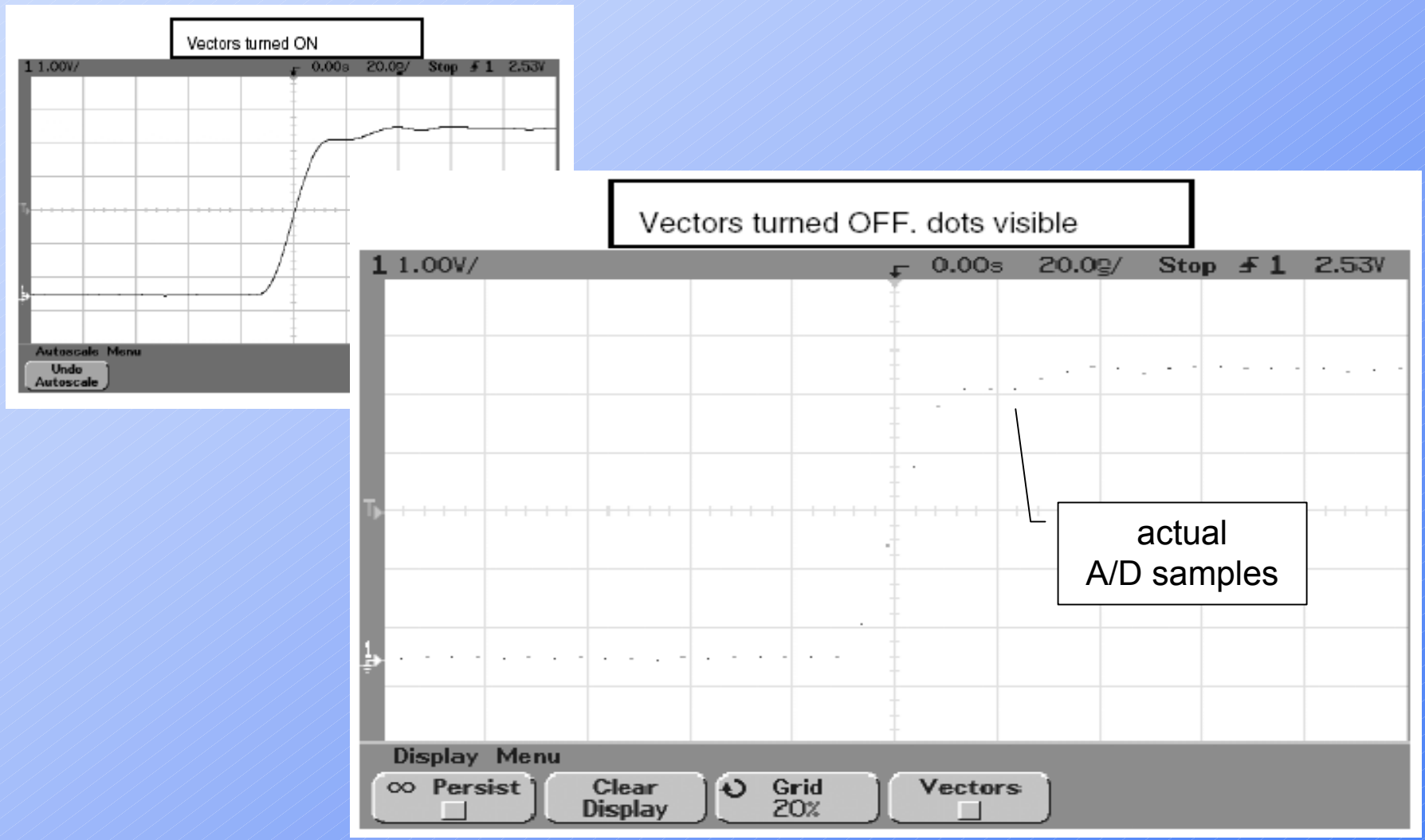


Probe Comp Signal, With Averaging



#AVG can be set from **1 to 16K** in powers-of-**2** increment

Vectors ON/OFF



(4) Run control: **Run/Stop** vs. **Single** hardkeys

Run/Stop versus Single

When the oscilloscope is running, the trigger processing or update rate is optimized over memory depth. When you press **Single**, memory depth and sample rate are maximized.

Single

For a single acquisition, all available memory is filled with each acquisition, regardless of sweep speed. To acquire data with the longest possible record length, press the **Single** key.

Running : continuous acquisition (a "ping-pong" technique)

When running, versus taking a single acquisition, the memory is divided in half. This allows the acquisition system to acquire one record while processing the previous acquisition, dramatically improving the number of waveforms per second processed by the oscilloscope. While running, maximizing the rate at which waveforms are drawn on the display provides the best picture of your input signal.

To capture a **single event** (single-shot)

Pressing the **Single** key arms the trigger circuit and the **Single** key will be illuminated. When the trigger conditions are met, data appears on the display, representing the data points that the oscilloscope obtained with one acquisition and the **Run/Stop** key will be illuminated red. Pressing the **Single** key again re-arms the trigger circuit and erases the display.

Operating Hints

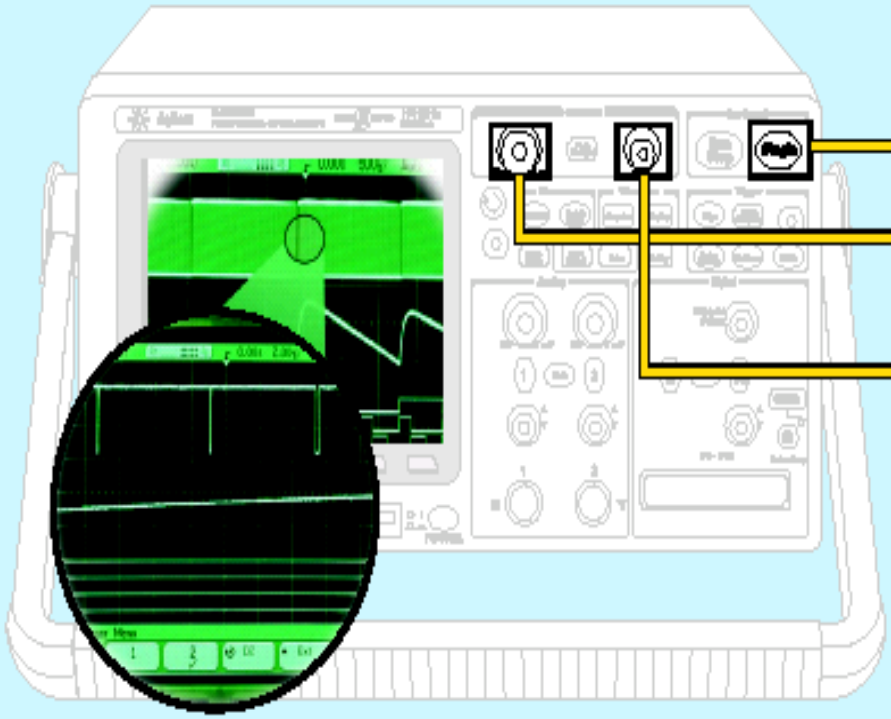
When Trigger Mode is set to Auto or AutoLvl (auto-single mode), each time **Single** is pressed the oscilloscope will wait for a valid trigger. If no trigger is found after about 40 ms, the oscilloscope will force a trigger, acquiring whatever signal is present. This is a handy mode to look for totally unknown situations.

When Trigger mode set to Normal, pressing **Single** will arm the trigger circuit and do a single acquisition when a valid trigger is seen.

You can use recalled traces to compare several single-shot events.

MegaZoom deep memory technology

MegaZoon - the deep memory advantage



zoom about the Time reference point

Press **Single** to capture the big picture

Turn **Time/Div** knob clockwise to zoom in on details of captured signal

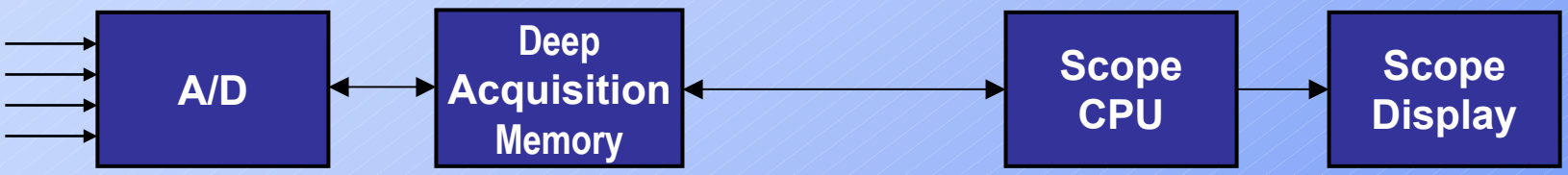
Move left or right (**pan**)

MEGAZoom

2 MB deep memory behind every channel with quick and easy zoom in to view details.

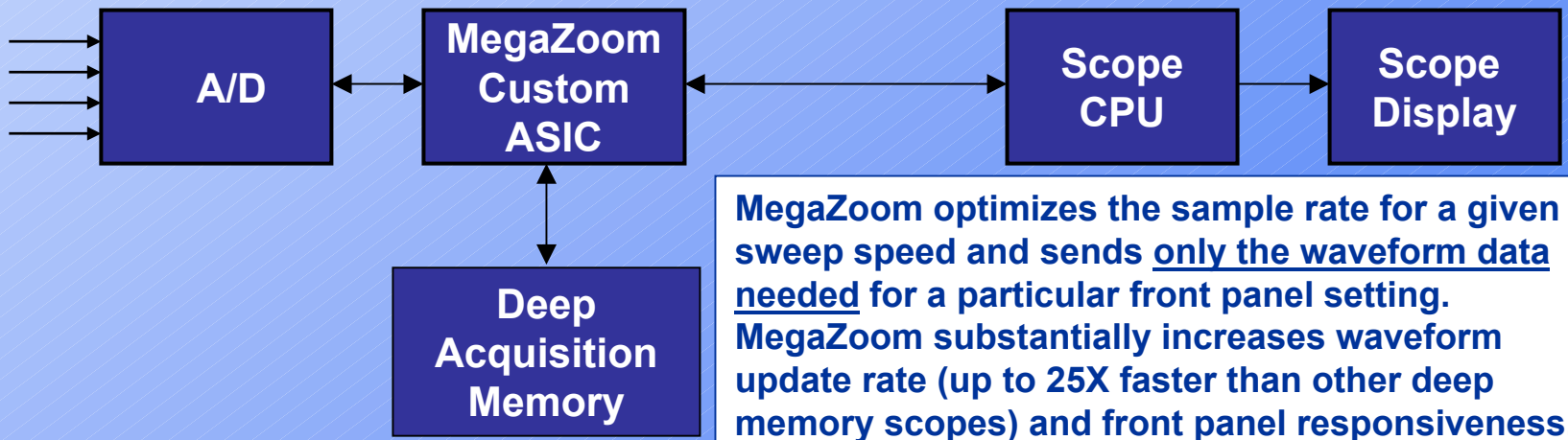
MegaZoom - How does it work?

Conventional Deep Memory Oscilloscope Architecture



The entire waveform record is sent to the CPU, creating a bottleneck. This increases user frustration by slowing scope operation and missing important waveform anomalies.

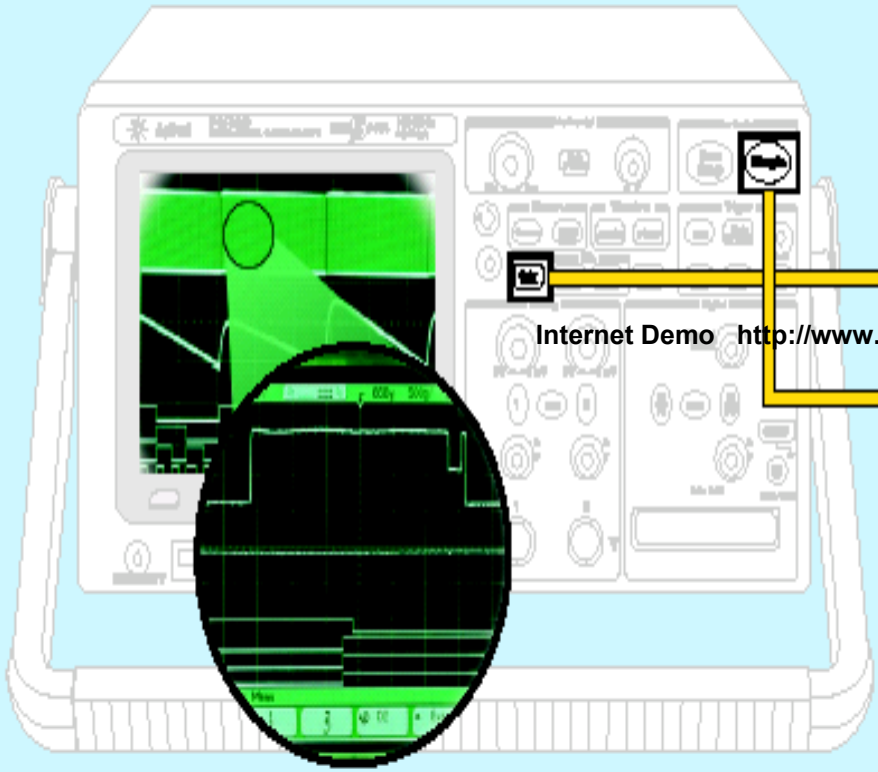
MegaZoom Deep Memory Oscilloscope Architecture



MegaZoom optimizes the sample rate for a given sweep speed and sends only the waveform data needed for a particular front panel setting. MegaZoom substantially increases waveform update rate (up to 25X faster than other deep memory scopes) and front panel responsiveness.

HiDef display

High-Definition Display



2 MB deep memory mapped to 32 levels of intensity to show subtle details

(**Display: 1K** pixel)

Press **Autoscale**

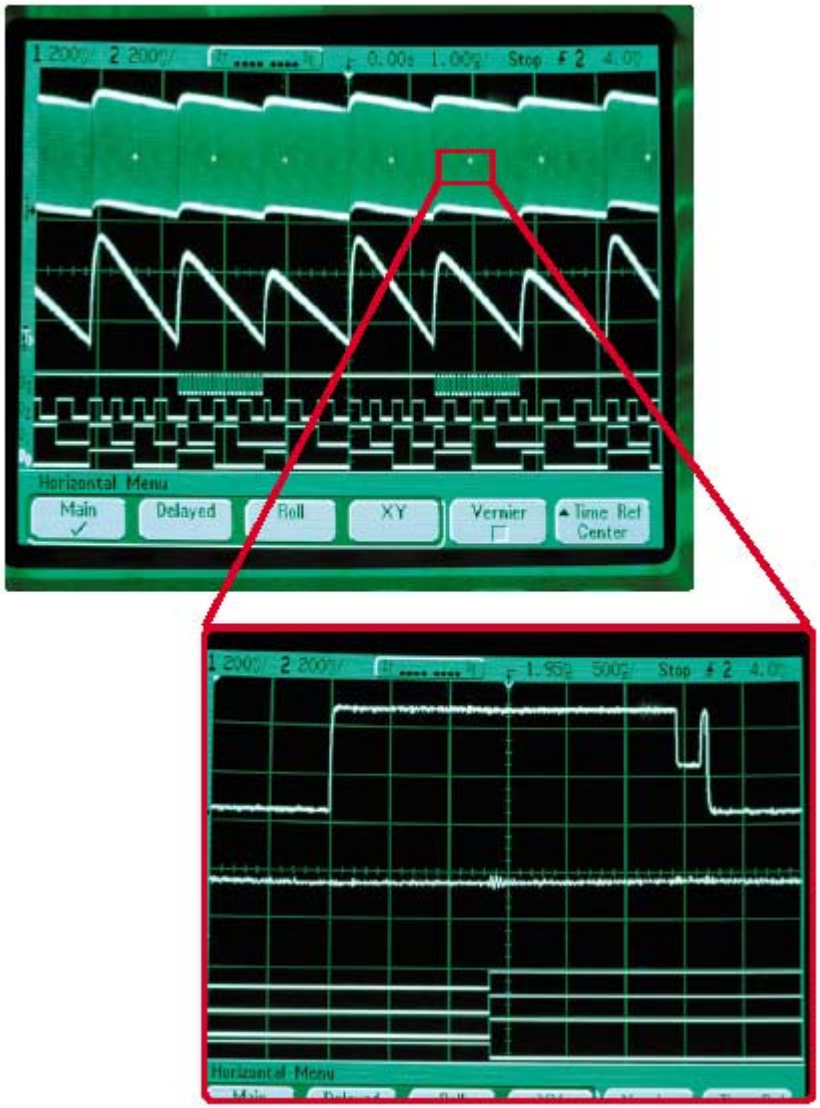
Internet Demo http://www.get.agilent.com/gpinstruments/products/54600/flash.shtml

(1) Then press **Single**

(2) **Intensity**: 60% (bright “glitch”)

(3) Delay: “glitch” to Time reference **(pan)**

(4) Time/Div **(zoom)**



Pan (move horizontally) and zoom (expand or compress horizontally) an acquired waveform:

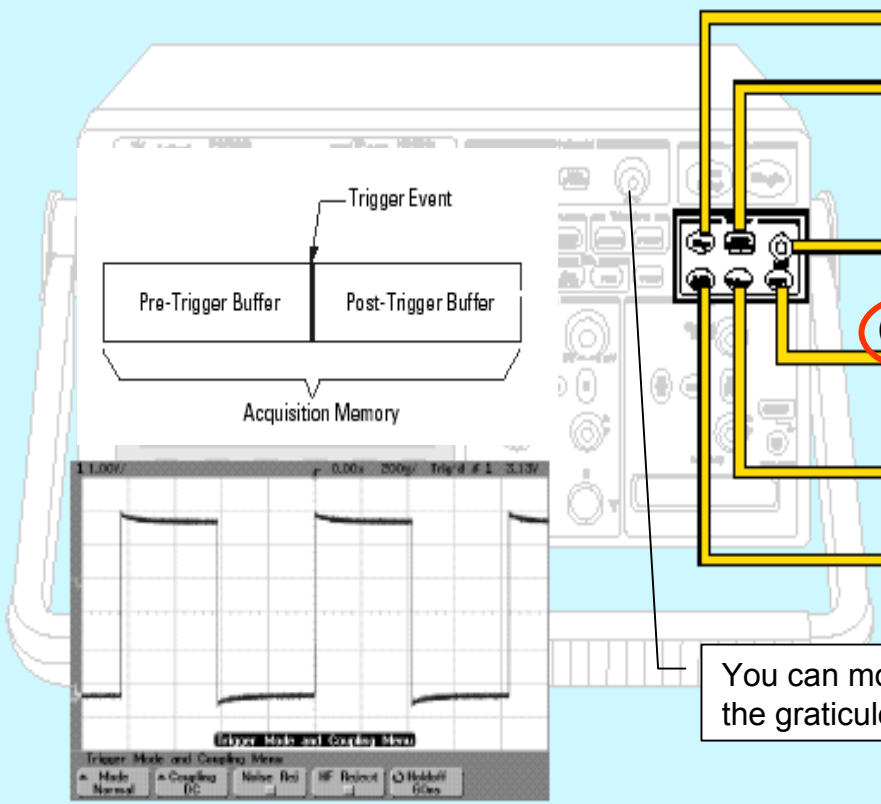
The bright dot on the high-definition display is a distortion in 1 of the 1,500 pulses captured in this single-shot measurement.

Simply dial in for a closer look using MegaZoom pan and zoom, and you'll see the details that would have escaped other scopes, such as the distortion in this square wave.

This deep memory and display system is not a special mode; it is available on every measurement pass at full speed.

(5) **Trigger** controls

Trigger Controls



Set edge source and slope

Signal conditioning: mode, coupling, conditioning, hold off

Trigger level knob
Move level up or down

(More)

Set to, I²C, sequence, duration and TV trigger • • •

Set pattern trigger

Set pulse width trigger

You can move the trigger point, which is the center of the graticule by default, using **Delay time** knob

Trigger types

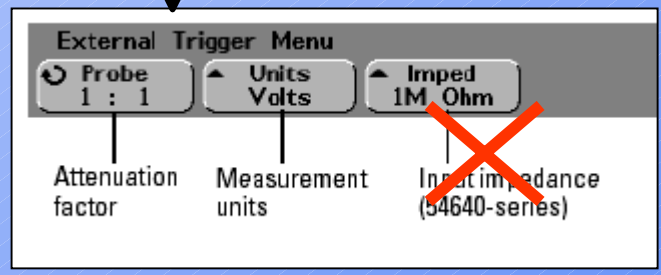
- **Edge**
- **Pulse width** (glitch)
- **Pattern**

press **More** hardkey

- CAN (Controller Area Network) – **Appl Note 1429**
- Duration
- I^2C (Inter-IC bus) – **Appl Note 1428**
- LIN (Local Interconnect Network)
- Sequence
- SPI (2 & 3 Wire Serial Peripheral Interface)
- TV
- USB (Universal Series Bus)

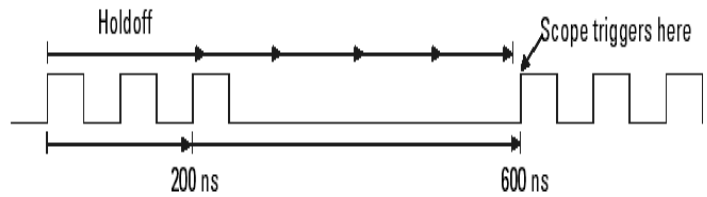
Trigger (press **Mode/Coupling** hardkey)

DC, AC, LF Reject, (TV)



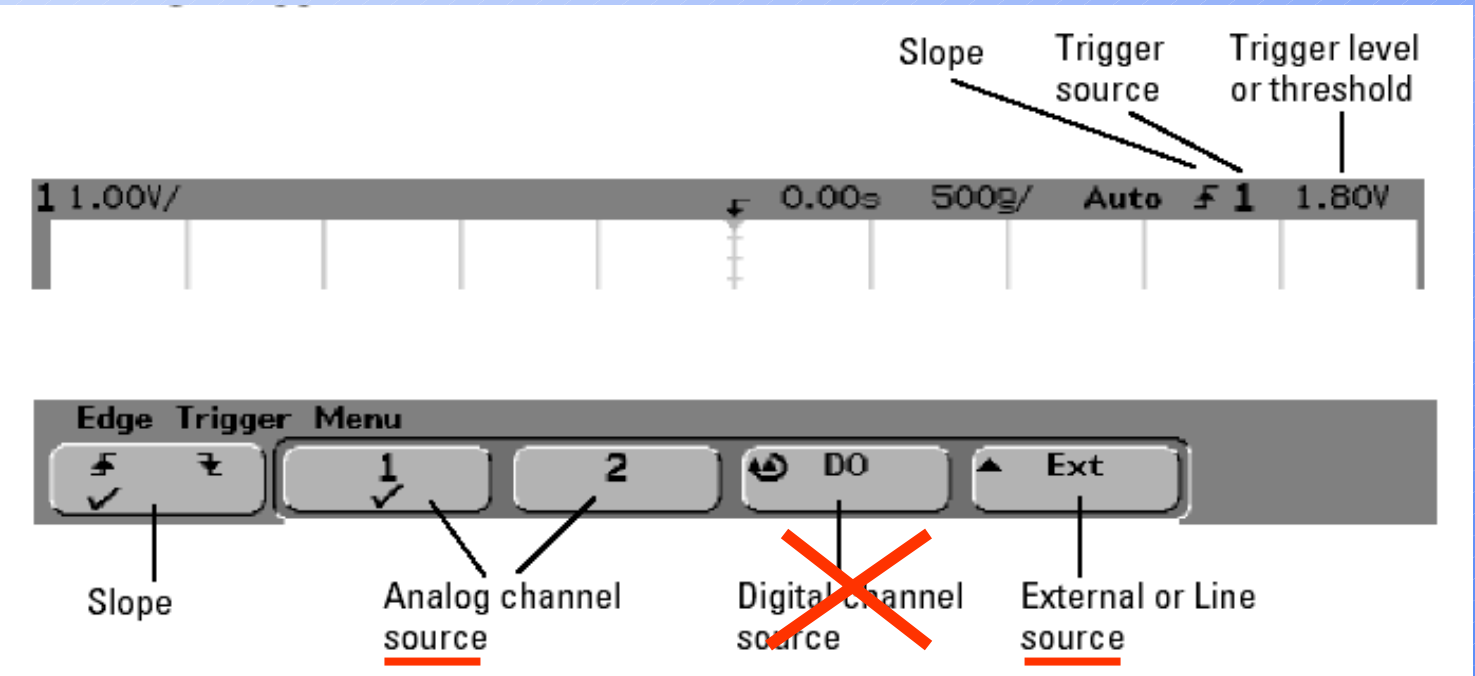
- **Normal** mode displays a waveform when the trigger conditions are met, otherwise the oscilloscope does not trigger and the display is not updated.
- **Auto** mode is the same as Normal mode, except it forces the oscilloscope to trigger if the trigger conditions are not met.
- **Auto Level** mode (54620-series only) works only when edge triggering on analog channels or external trigger. The oscilloscope first tries to Normal trigger. If no trigger is found, it searches for a signal at least 10% of full scale on the trigger source and sets the trigger level to the 50% amplitude point. If there is still no signal present, the oscilloscope auto triggers. This mode is useful when moving a probe from point to point on a circuit board.

To get a stable trigger on the pulse burst shown below, set the holdoff time to be >200 ns but <600 ns.

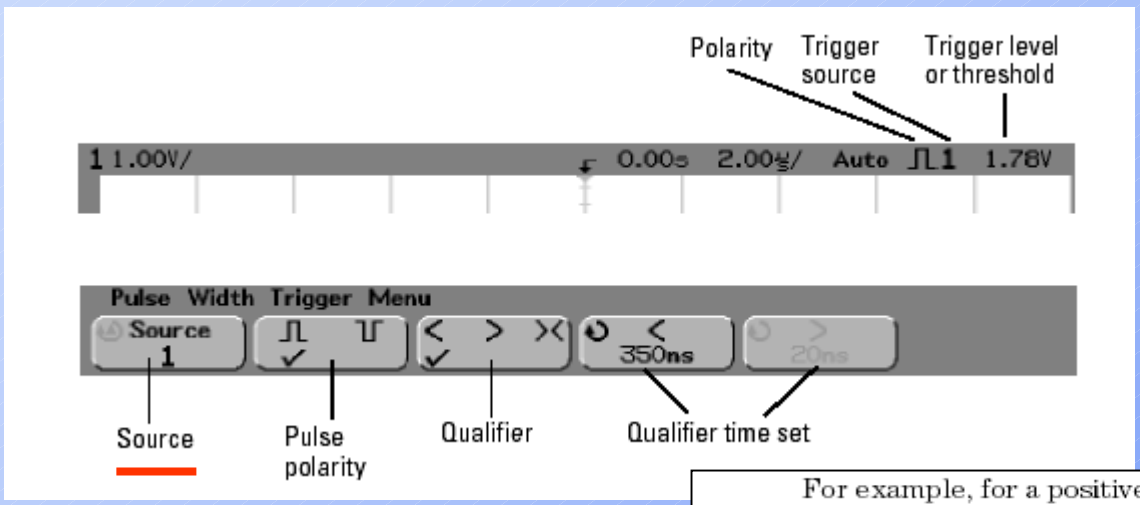


Note: with MegaZoom technology, you can press **Stop**, then **pan and zoom** through the data to find where it repeats. **Measure** this time using the cursors, then set **holdoff** to this number

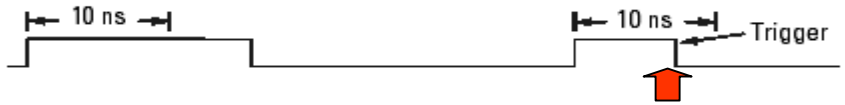
Trigger: press **Edge** hardkey



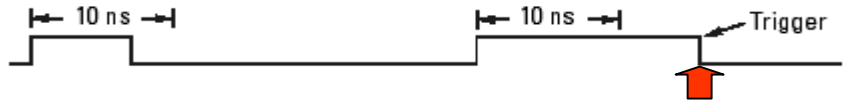
Trigger: press **Pulse Width** hardkey



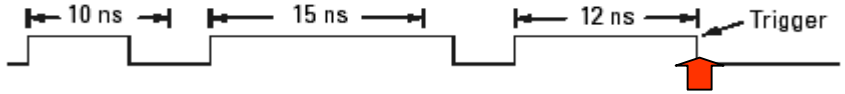
For example, for a positive pulse, if you set t<10 ns:



- greater than a time value (**>**).
  For example, for a positive pulse, if you set t>10 ns:

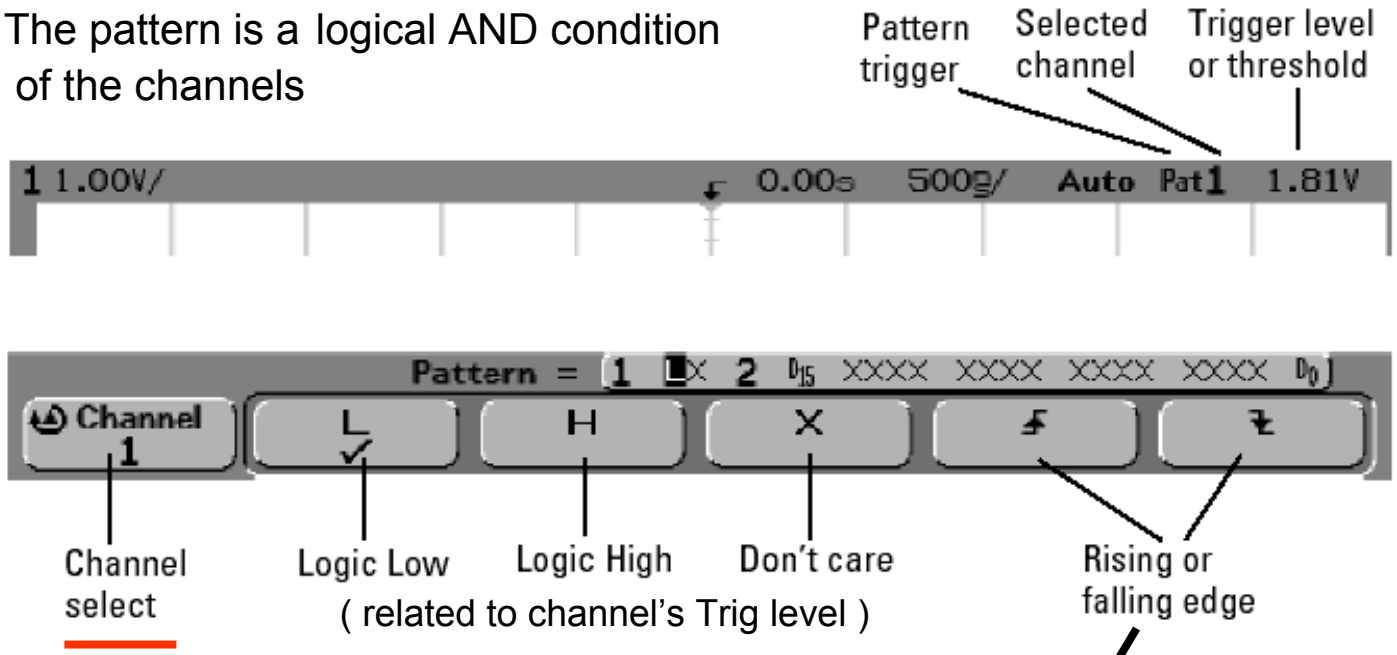


- within a range of time values (**><**).
  For example, for a positive pulse, if you set t>10 ns and t<15 ns:



Trigger: press **Pattern** hardkey

The pattern is a logical AND condition of the channels



Specifying an Edge in a Pattern

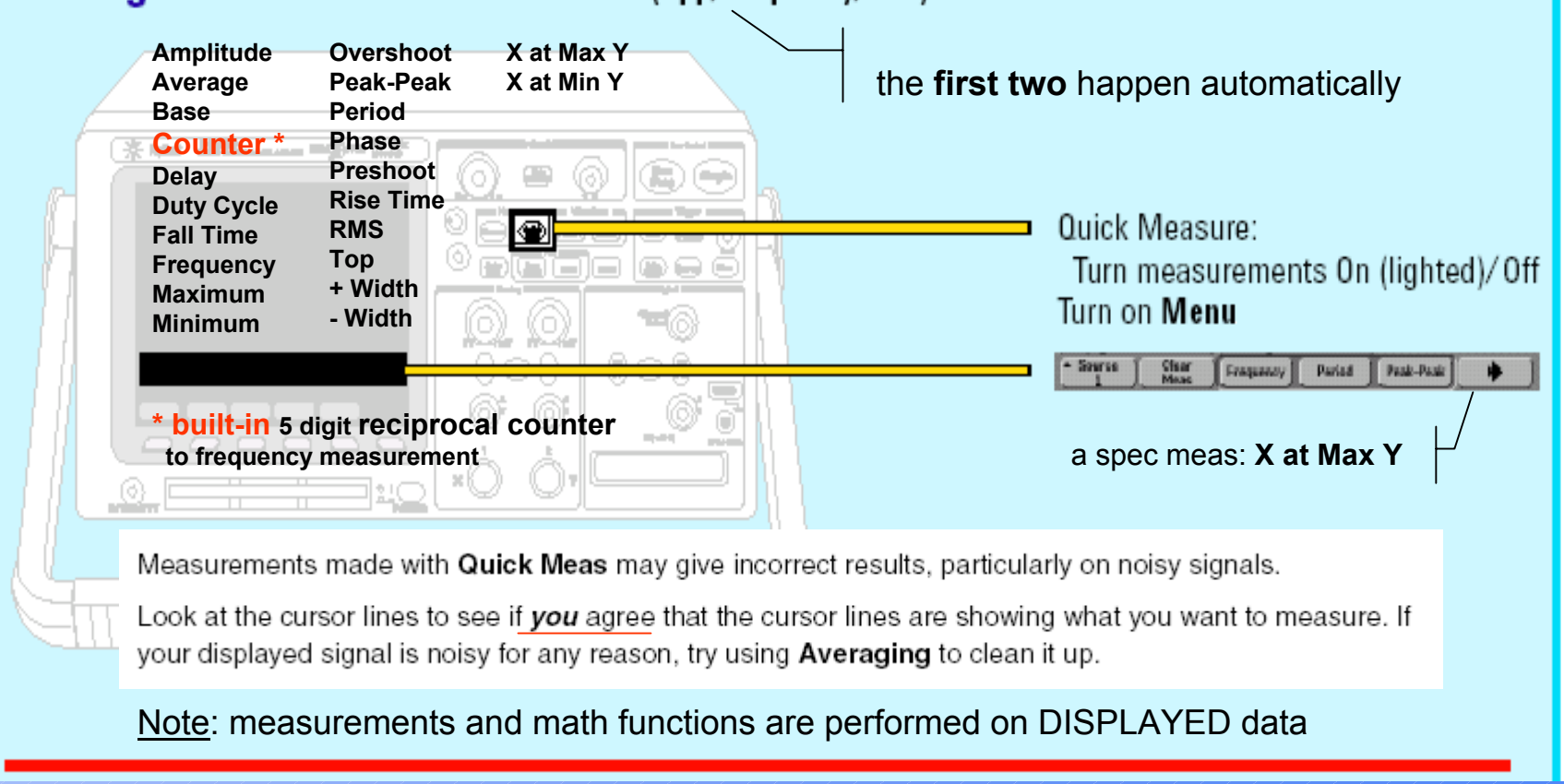
You are allowed to specify only one rising or falling edge term in the pattern. If you define an edge term, then select a different channel in the pattern and define another edge term, the previous edge definition is changed to a don't care.

(6) Measure (press **Quick Meas** hardkey)

Making Automatic Measurements (Vpp, frequency, etc.)

Amplitude	Overshoot	X at Max Y
Average	Peak-Peak	X at Min Y
Base	Period	
Counter *	Phase	
Delay	Preshoot	
Duty Cycle	Rise Time	
Fall Time	RMS	
Frequency	Top	
Maximum	+ Width	
Minimum	- Width	

the **first two** happen automatically



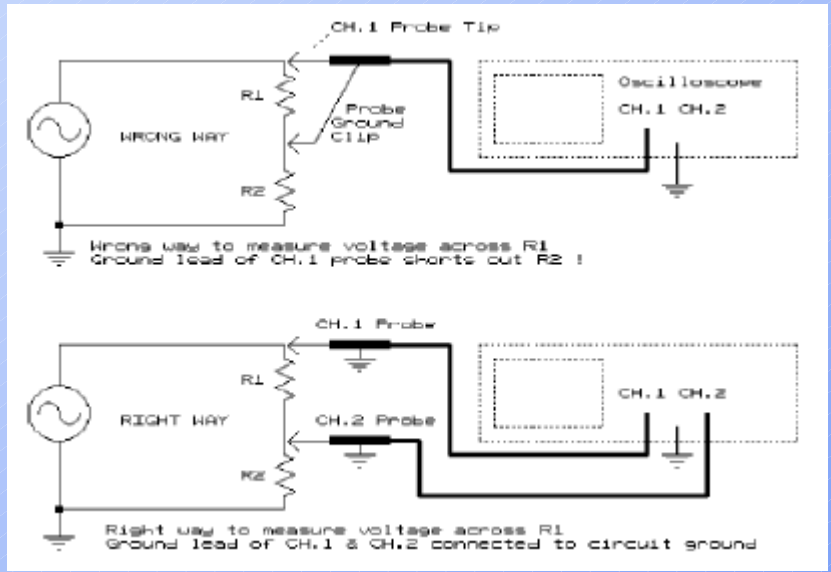
* **built-in** 5 digit **reciprocal counter** to frequency measurement

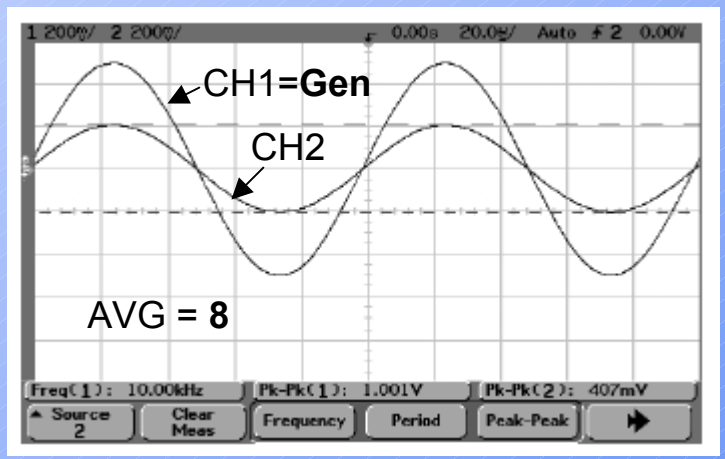
Measurements made with **Quick Meas** may give incorrect results, particularly on noisy signals.

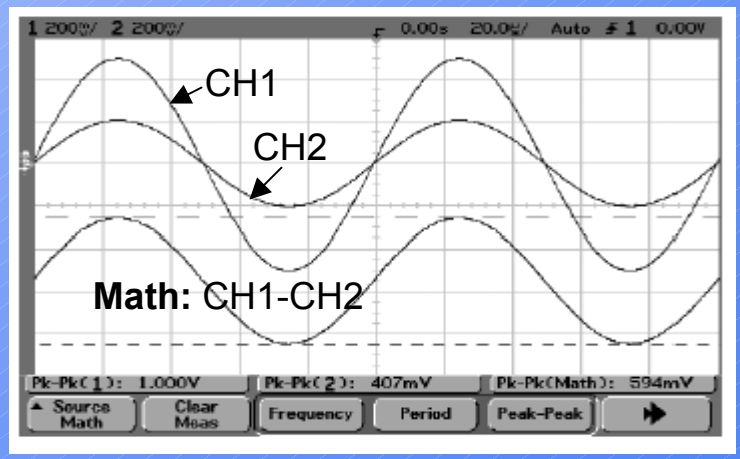
Look at the cursor lines to see if ***you*** agree that the cursor lines are showing what you want to measure. If your displayed signal is noisy for any reason, try using **Averaging** to clean it up.

Note: measurements and math functions are performed on DISPLAYED data

To measure voltage across R1 (R1 = 3K, R2 = 2K)

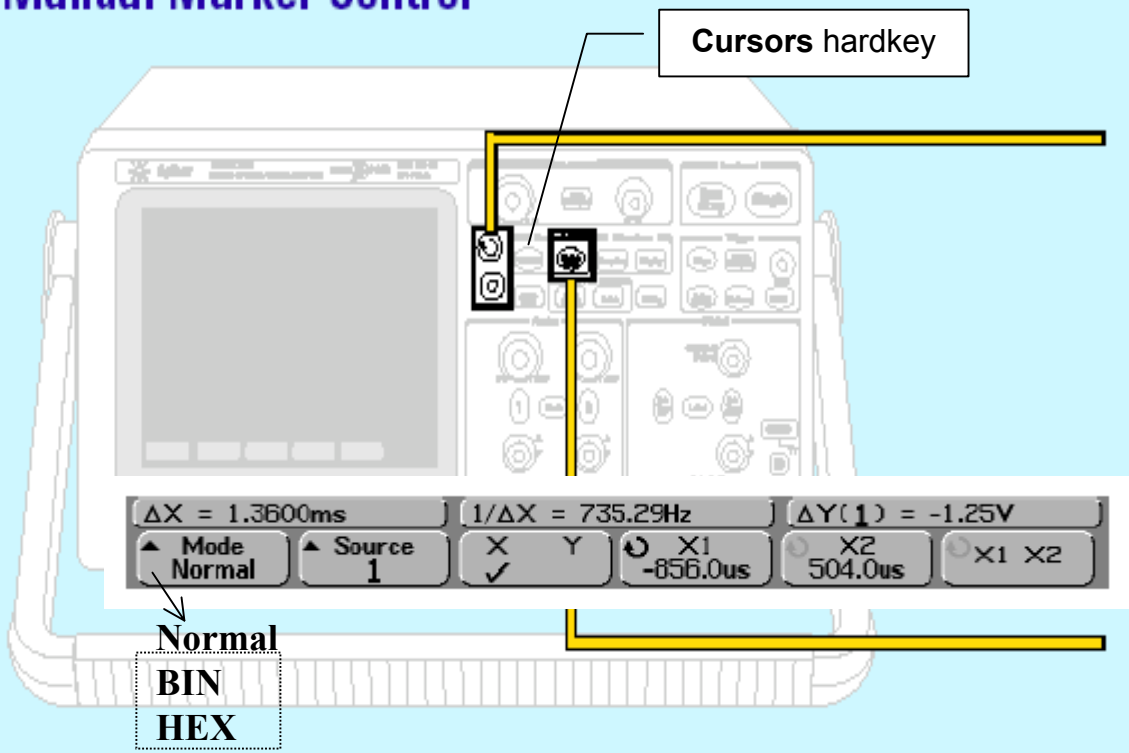






Measure (press **Cursors** hardkey)

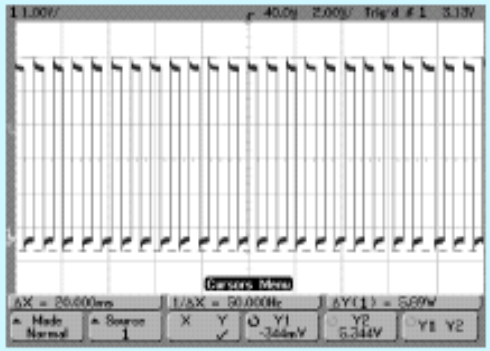
Manual Marker Control



Markers:

Turn markers On (lighted)/Off

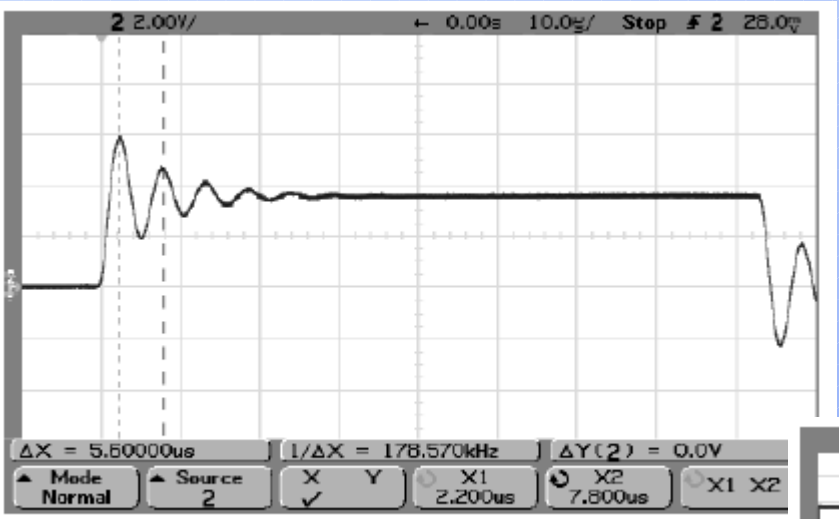
Turn on **Menu**



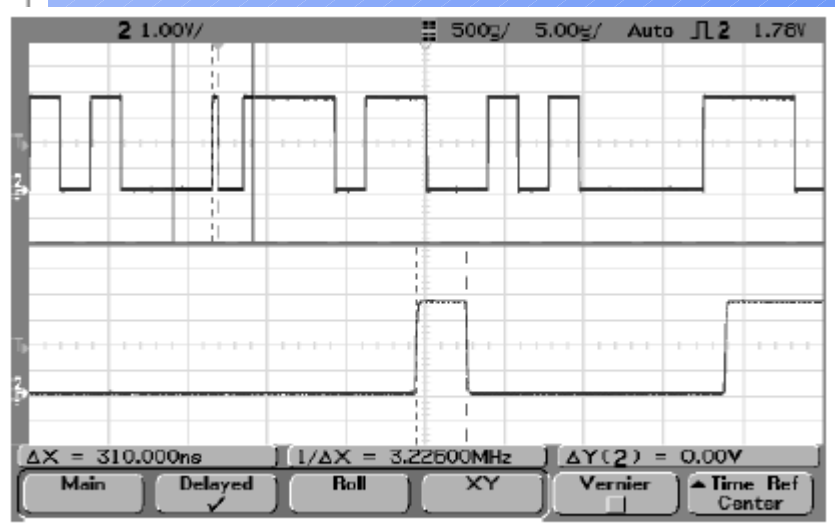
...or do it the easy way

(Press **Quick Measure**)

Cursor measurements



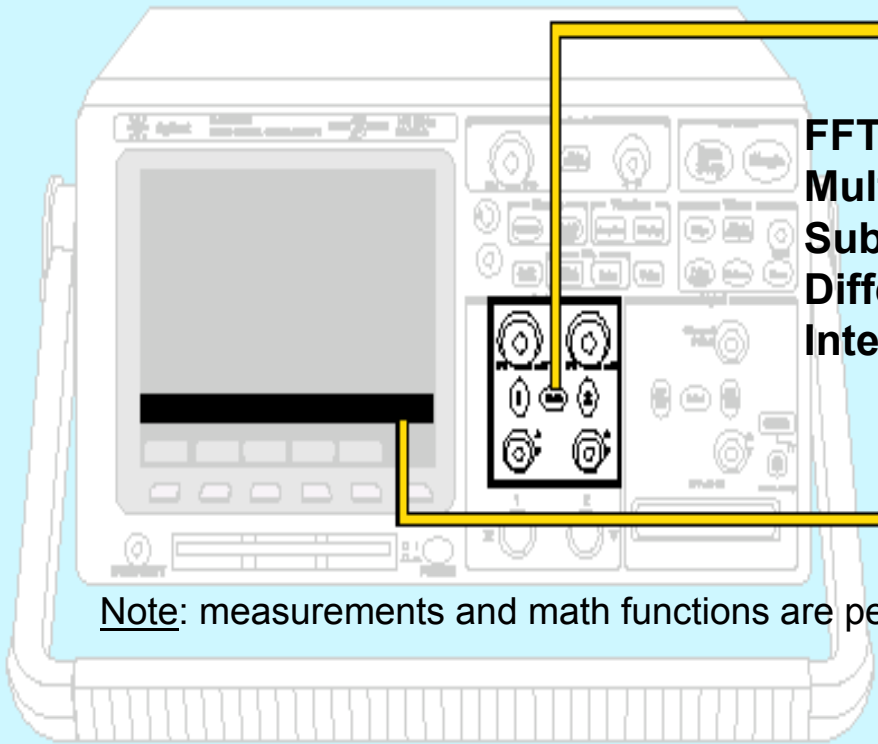
Cursors measure frequency of pulse ringing



Cursors track delayed sweep

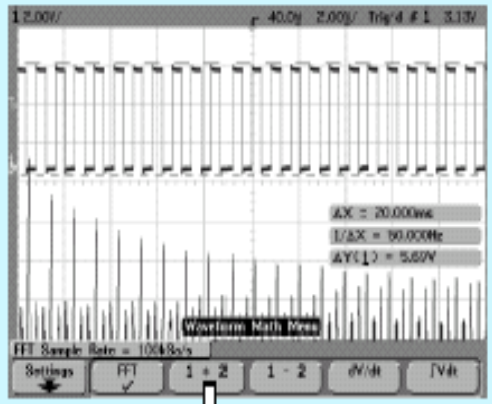
(7) Math functions (press **Math** hardkey)

Math Functions (*, –, FFT, etc.)



FFT,
Multiplying,
Subtracting,
Differentiation,
Integration

Turn **Math** on (Lighted = on)



Menu Setup

Note: measurements and math functions are performed on DISPLAYED data

2K FFT (dBV vs. frequency)

Press the **Math** key, press the **FFT** softkey, then press the **Settings** softkey to display the FFT menu.

Source select

Frequency Span

Center frequency

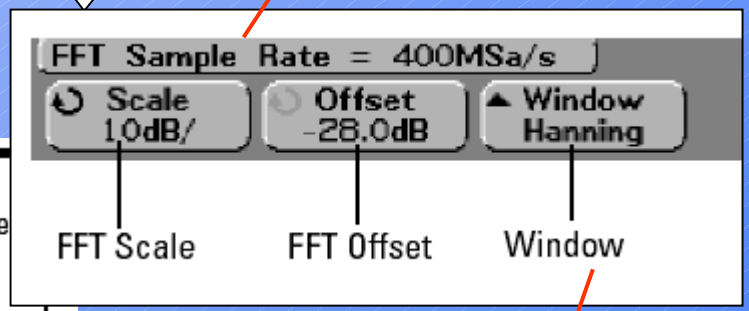
Preset Span and Center frequencies

Vertical and Window FFT controls

Return to previous menu

1, 2, 1+2, 1- 2, 1*2

set by **Time/DIV**



FFT Scale

FFT Offset

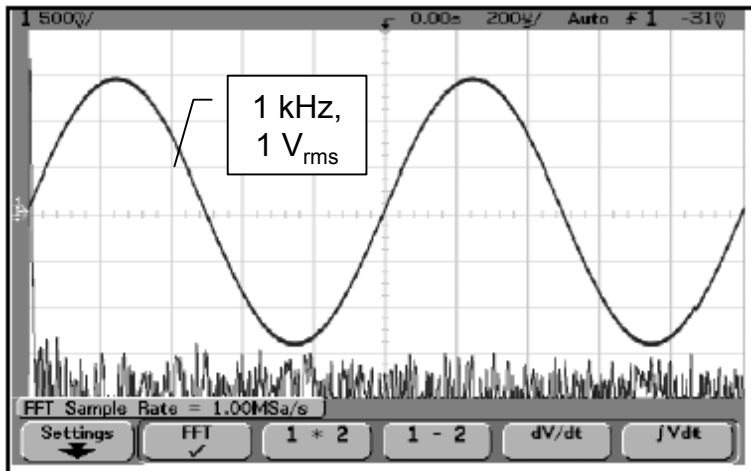
Window

Hanning (freq)
Flat Top (ampl)
Rectangular

Scale and offset considerations

If you do not manually change the FFT scale or offset settings, when you turn the horizontal sweep speed knob, the span and center frequency settings will automatically change to allow optimum viewing of the full spectrum. If you do manually set scale or offset, turning the sweep speed knob will not change the span or center frequency settings, allowing you see better detail around a specific frequency. Pressing the FFT **Preset** softkey will automatically rescale the waveform and span and center will again automatically track the horizontal sweep speed setting.

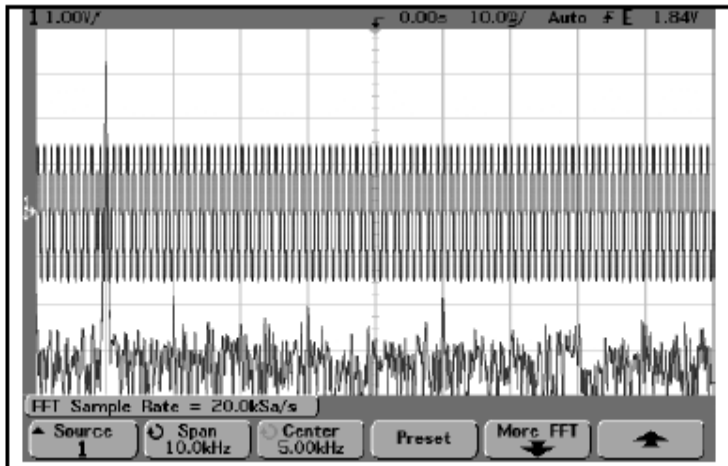
Time domain vs. frequency domain (Δt. $\Delta f = 1/N$; **N = 2K**)



time/div = 200 µs
FFT sample rate = 1.00 MSa/s
Span = 500 kHz
Center = 250 kHz

Δt **= 1 / sample_rate**

change
the **time/DIV**
(i.e. sample_rate)

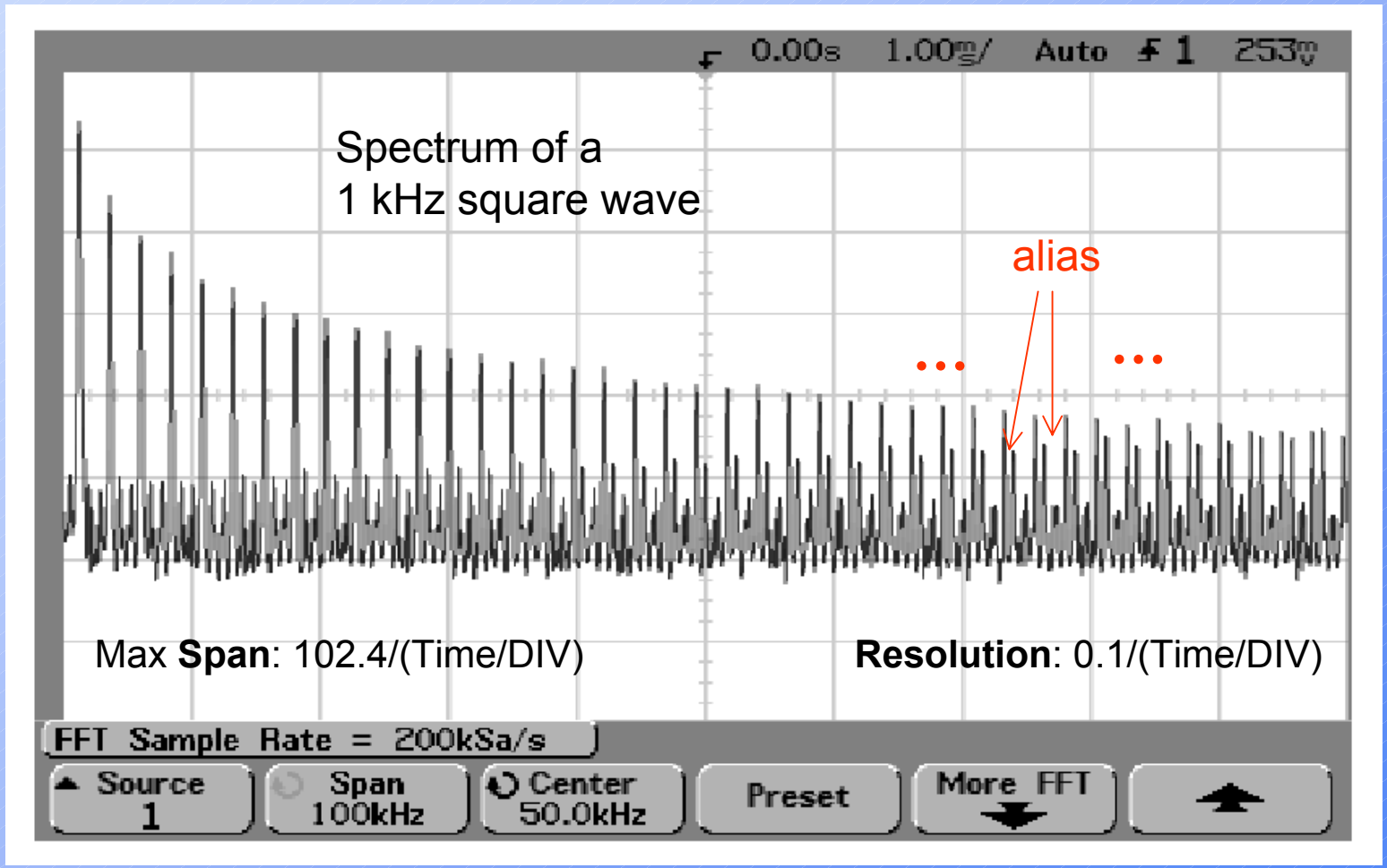


time/div = 10 ms
FFT sample rate = 20 kSa/s
Span = 10.0 kHz
Center = 5.00 kHz

There are two (2) graphs shown here: voltage vs. time (over a 100 ms interval) and voltage vs. ***frequency*** (in a "window" 10 kHz wide).

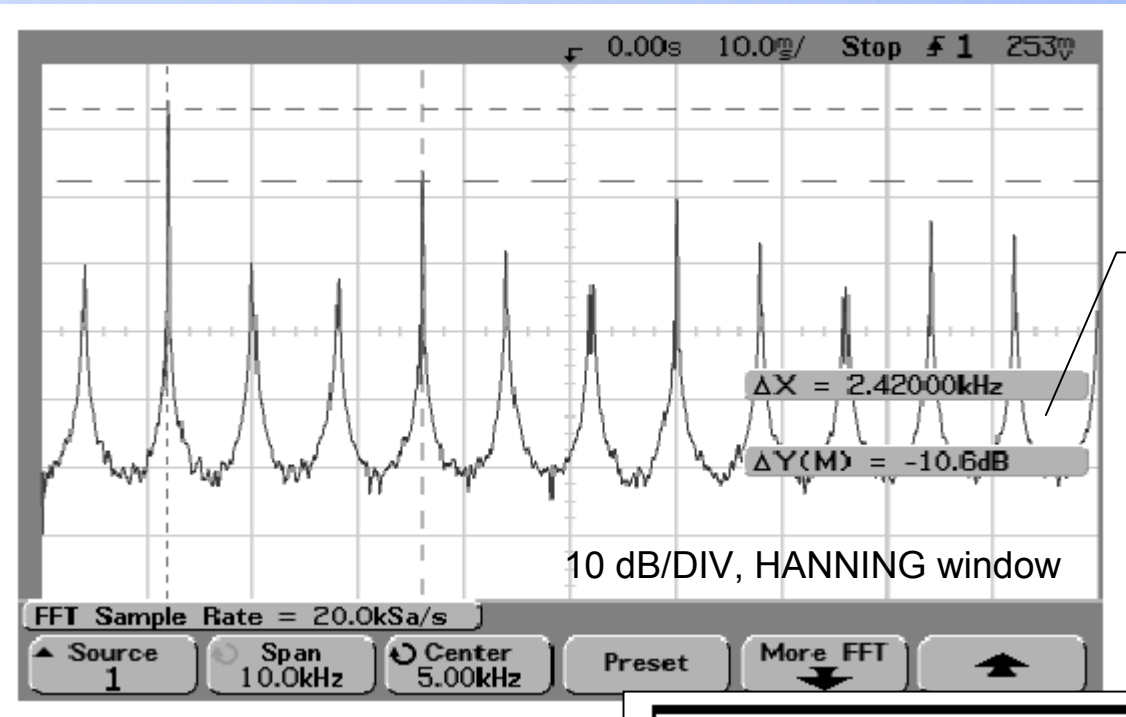
Δf **= sample_rate / N**

Aliasing



Note: turn OFF the time-domain display by pressing "**1**" hardkey **twice**

Spectrum of Probe Comp signal (1.2 kHz square wave)



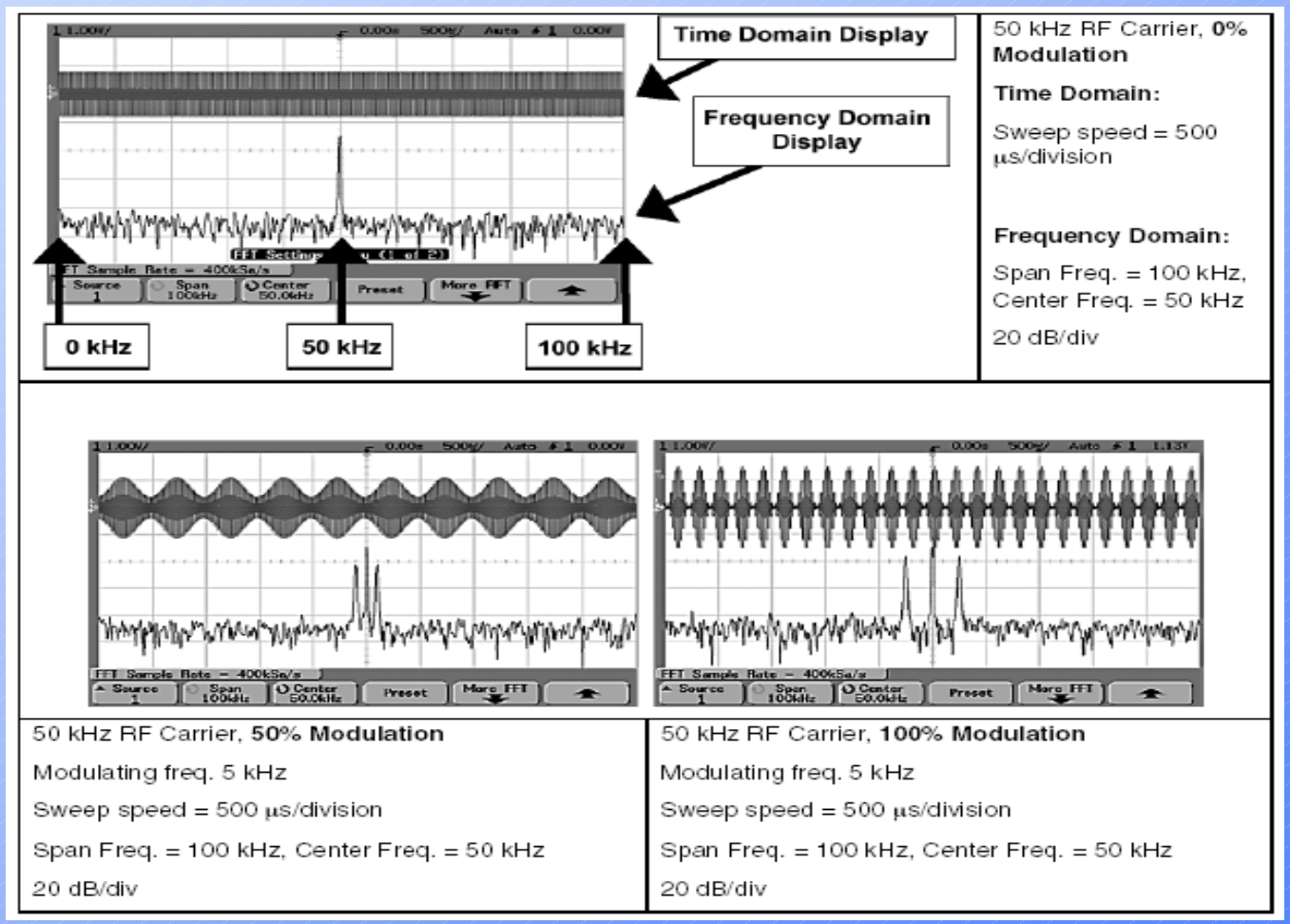
Quick Meas hardkey, **Source** softkey to **Math**

FFT Measurement Hints

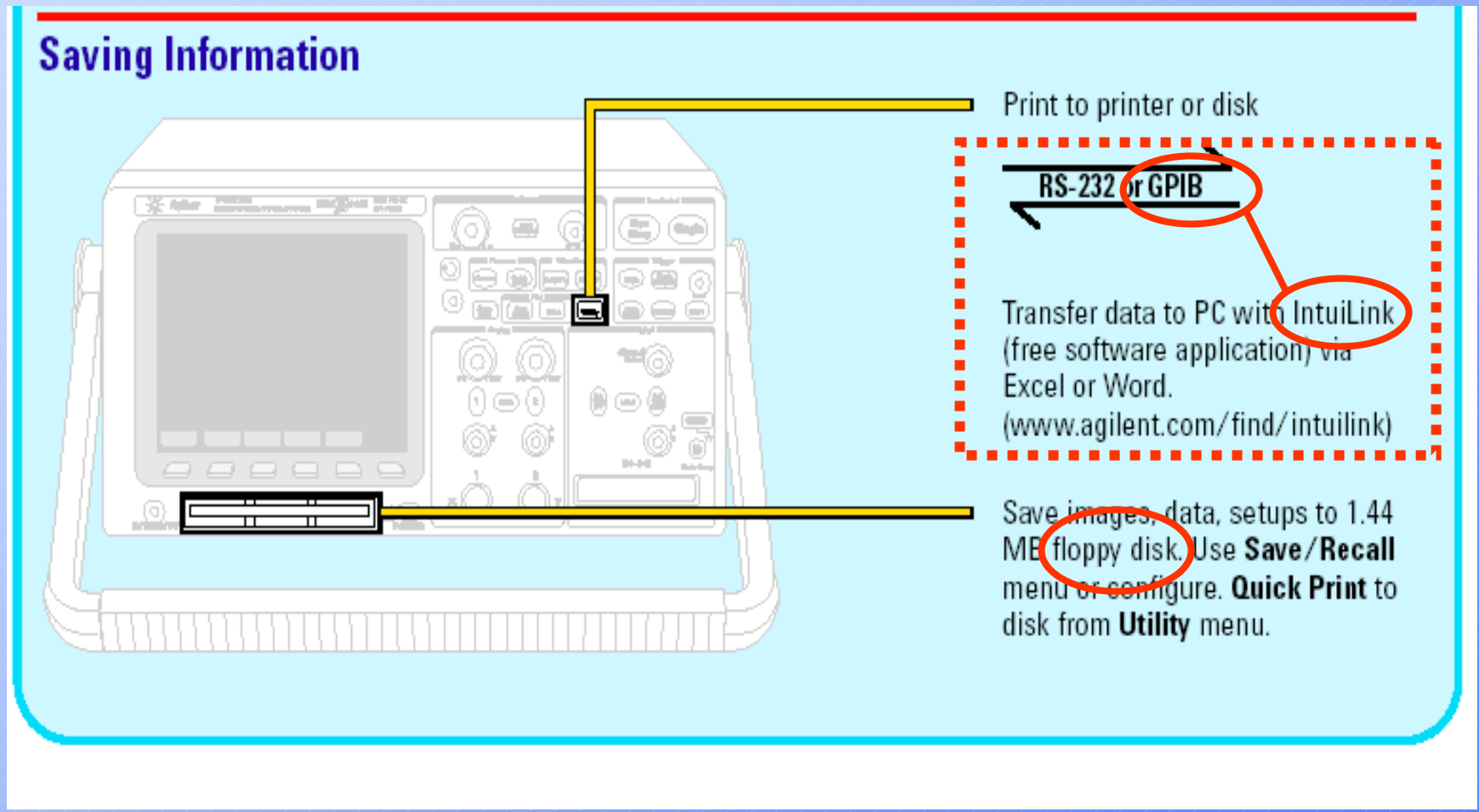
It is easiest to view FFTs with Vectors set to On. The Vector display mode is set in the Display menu.

The number of points acquired for the FFT record 2048 and when frequency span is at maximum, all points are displayed. Once the FFT spectrum is displayed, the frequency span and center frequency controls are used much like the controls of a spectrum analyzer to examine the frequency of interest in greater detail. Place the desired part of the waveform at the center of the screen and decrease frequency span to increase the display resolution. As frequency span is decreased, the number of points shown is reduced, and the display is magnified.

AM signals
(the ability of the FFT to resolve two closely spaced frequencies)



(8) Saving and Recalling info



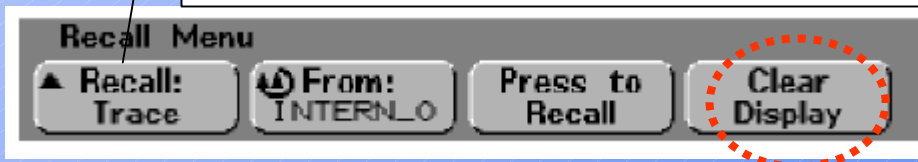
File (press **Save/Recall** hardkey)

Current oscilloscope **setup** and waveform **trace**
to internal memory (**3** non-volatile) or floppy disk

…a link to **Utility** / Print Config

Floppy disk (**QFILE_nn**)
.TRC trace file
.SPC setup file

Trace, Setup or
Trace and Setup (to meas recalled trace with cursors)



Recalling overwrites current settings

Because recalling a setup will overwrite the oscilloscope's current settings, you may want to save the existing setup first.

Internal memory (**INTERN_n**, n is **0,1,2**)
Floppy disk (**QFILE_nn**)

File (press **Quick Print** hardkey)

The first step: **Print Config** (i.e. Disk) and file **Format** (i.e. TIF)
With a floppy disk in the 3.5-inch disk drive under the display, press the **Quick Print** hardkey. The displayed waveform, including the measured values, will be written to a file on the floppy disk.

If it's the first waveform saved, the file will be called **PRINT_00.TIF**.

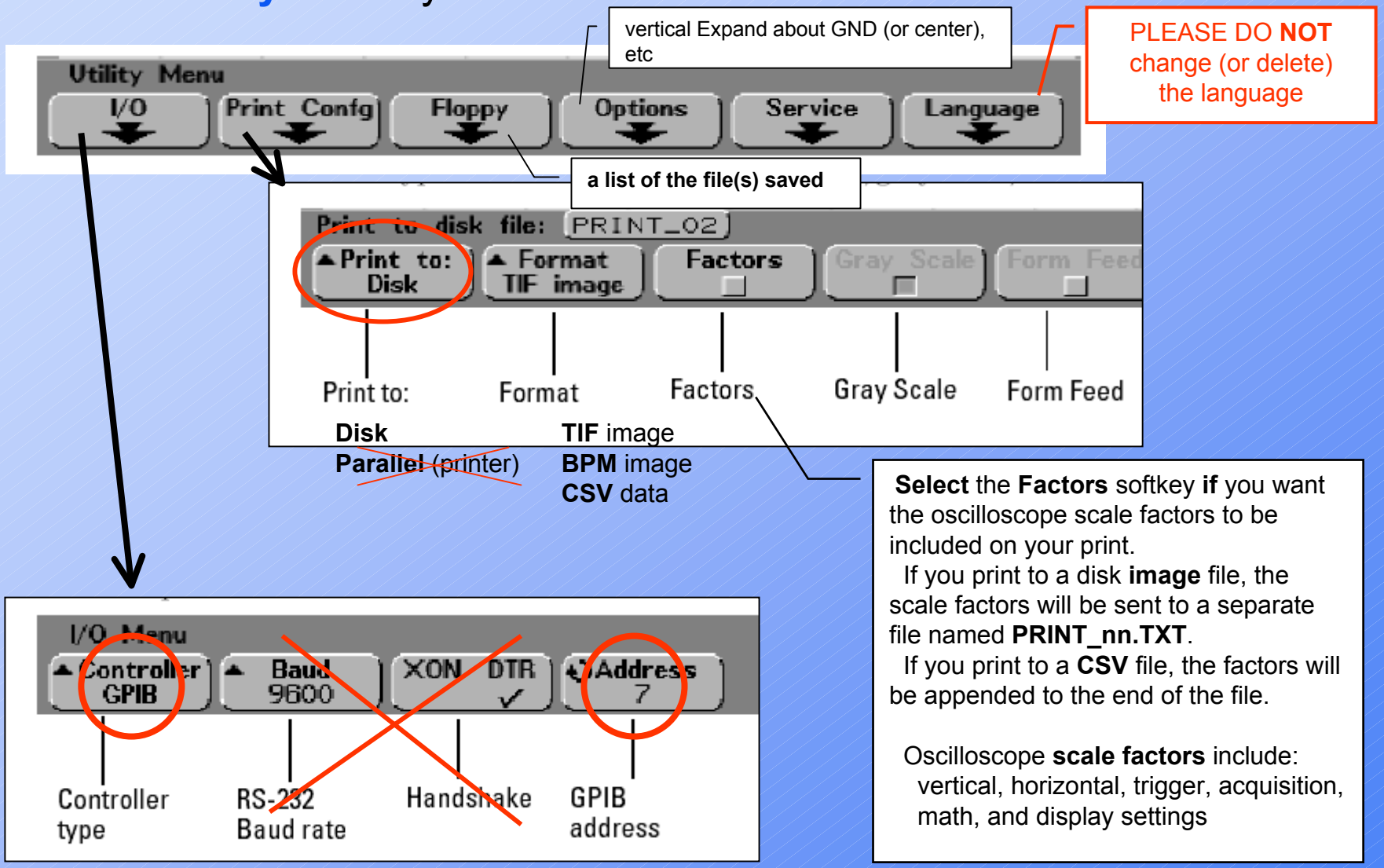
You can see that the file was saved successfully by pressing the **Utility** hardkey, then the **Floppy** softkey, and then the **File:** softkey. A list of the file(s) saved will appear on the display, with the date and time they were written.

Note:

The Default Setup does **NOT** change the how waveforms are saved to a floppy disk. You should be sure to check that your oscilloscope file format for saving waveforms is **TIF**. This can be selected by using the **Utility** hardkey, then the **Print Confg** softkey followed by the **Format** softkey where **TIF** is selected.

Another graphic file **Format** choice is **BMP** (bitmap). While this is also easily imported into Word, it takes twice as long to write the file (e.g. **PRINT_01.BMP**) to the diskette, and the file is much bigger (about 6 times bigger!). The last choice for file format is **CSV**; this is Comma-Separated Variable format. It is not a graphic file, but is suitable for importing into a spreadsheet program.

Press **Utility** hardkey



Select the **Factors** softkey **if** you want the oscilloscope scale factors to be included on your print.

If you print to a disk **image** file, the scale factors will be sent to a separate file named **PRINT_nn.TXT**.

If you print to a **CSV** file, the factors will be appended to the end of the file.

Oscilloscope **scale factors** include:
vertical, horizontal, trigger, acquisition, math, and display settings