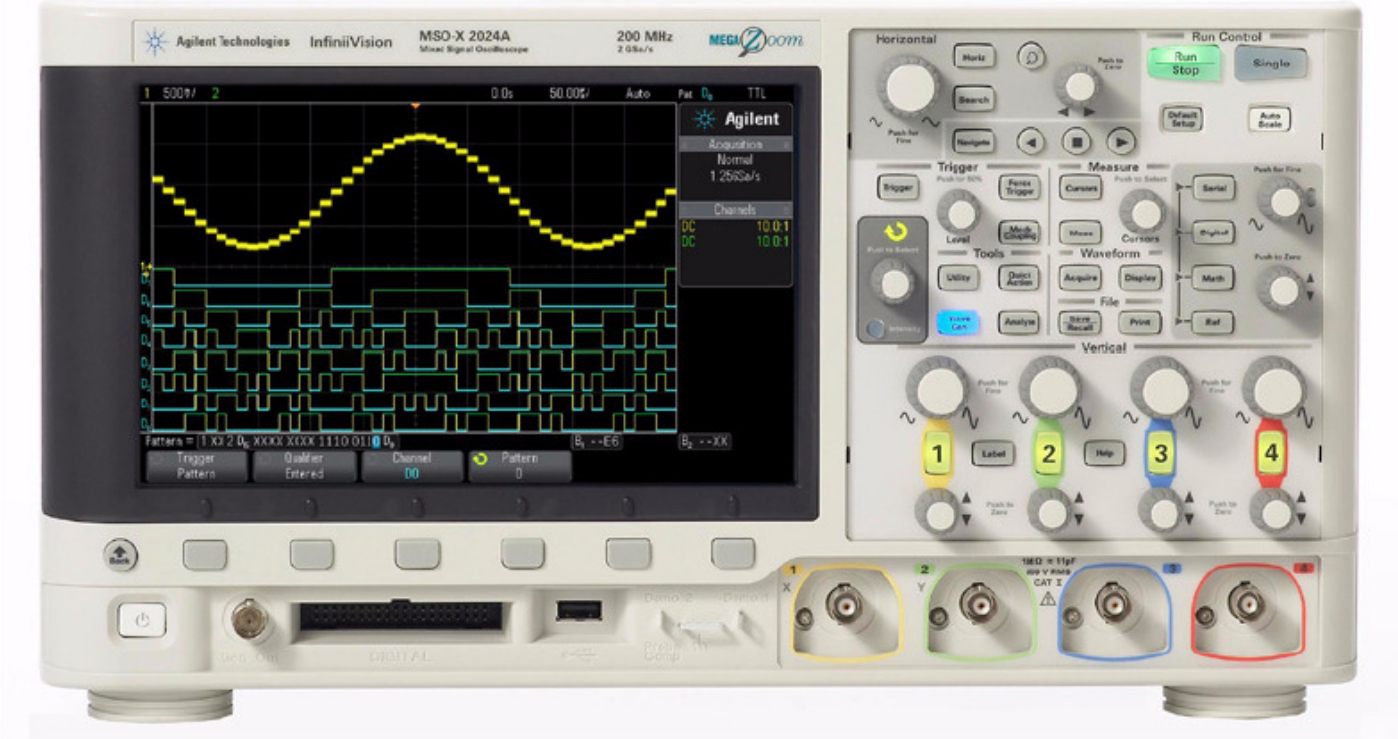
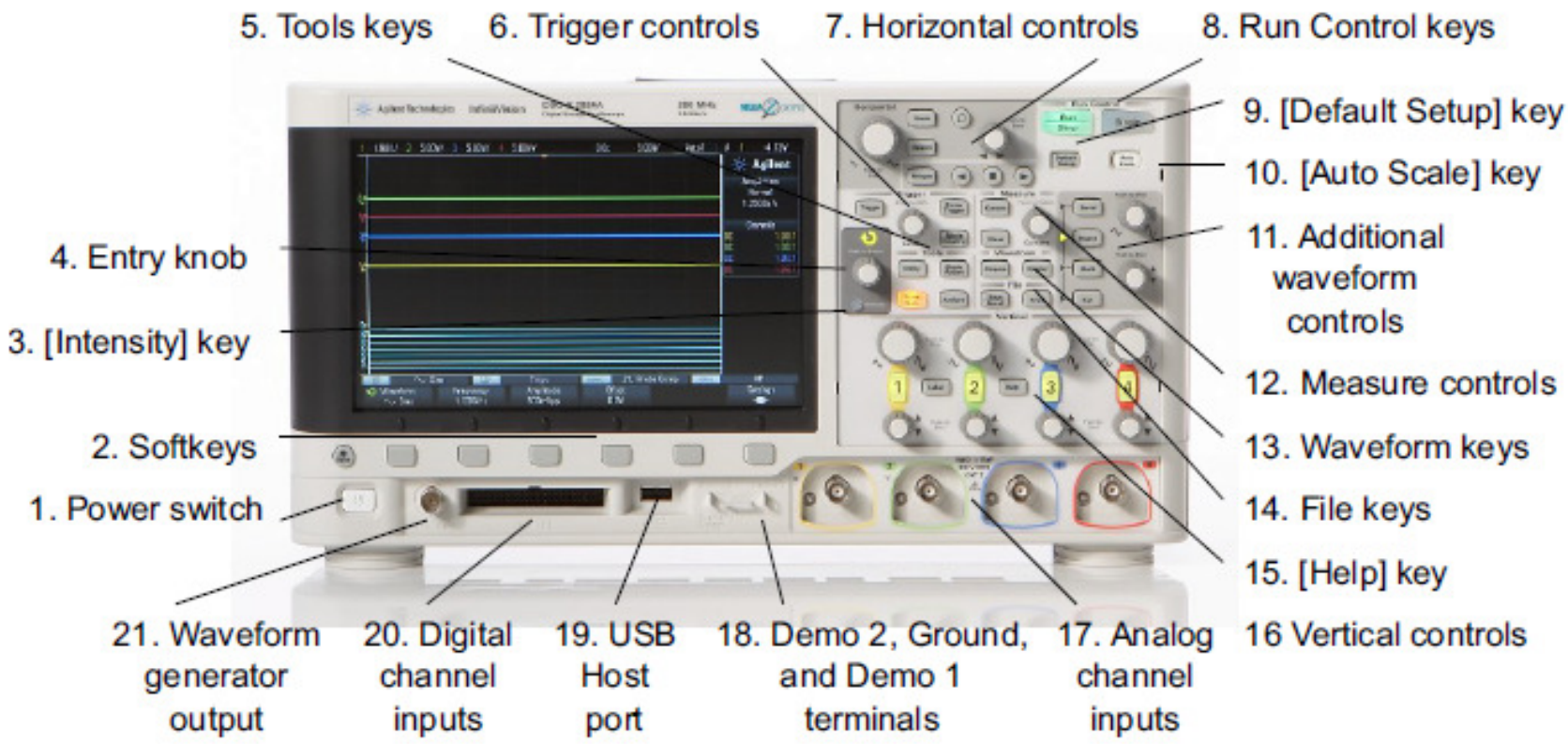
Osciloscope MSO-X 2002A

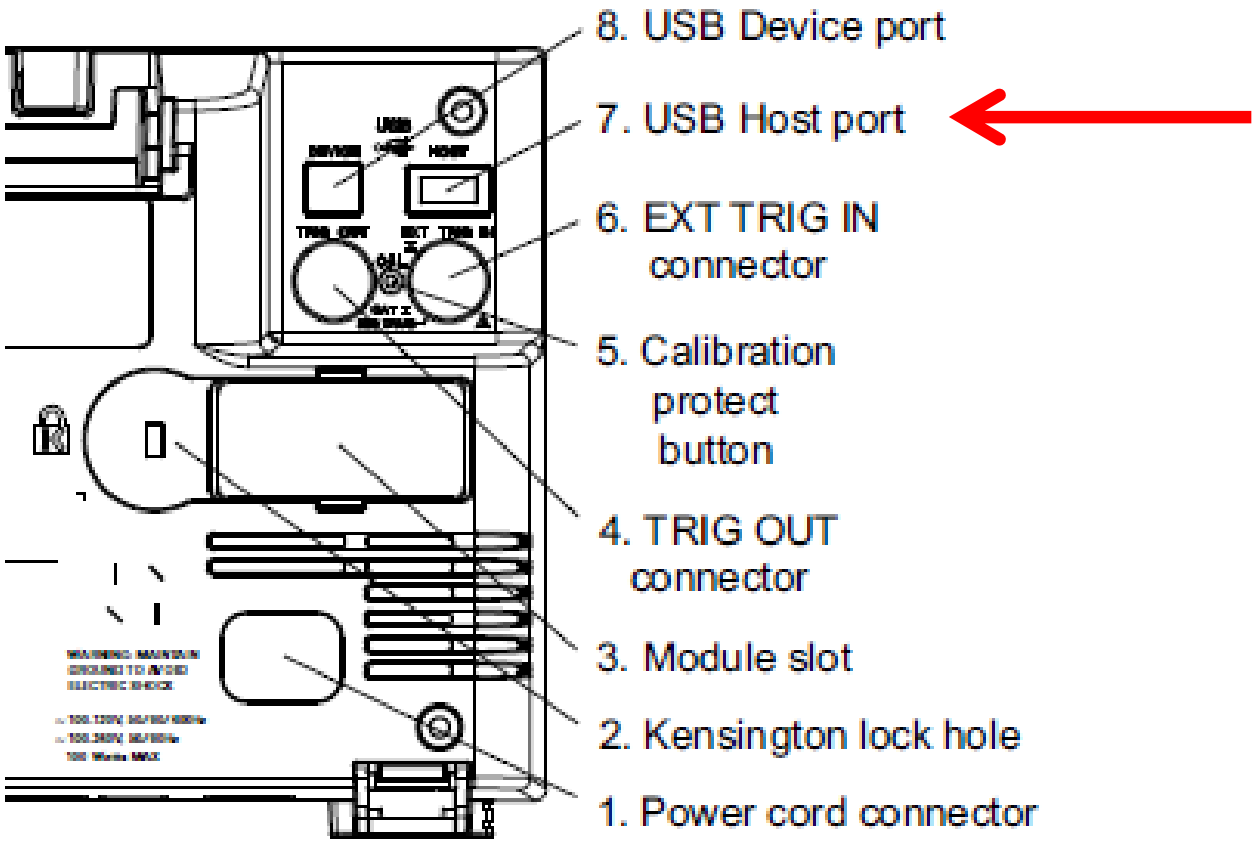
InfiniiVision 2000 X-Series Oscilloscopes—At a Glance



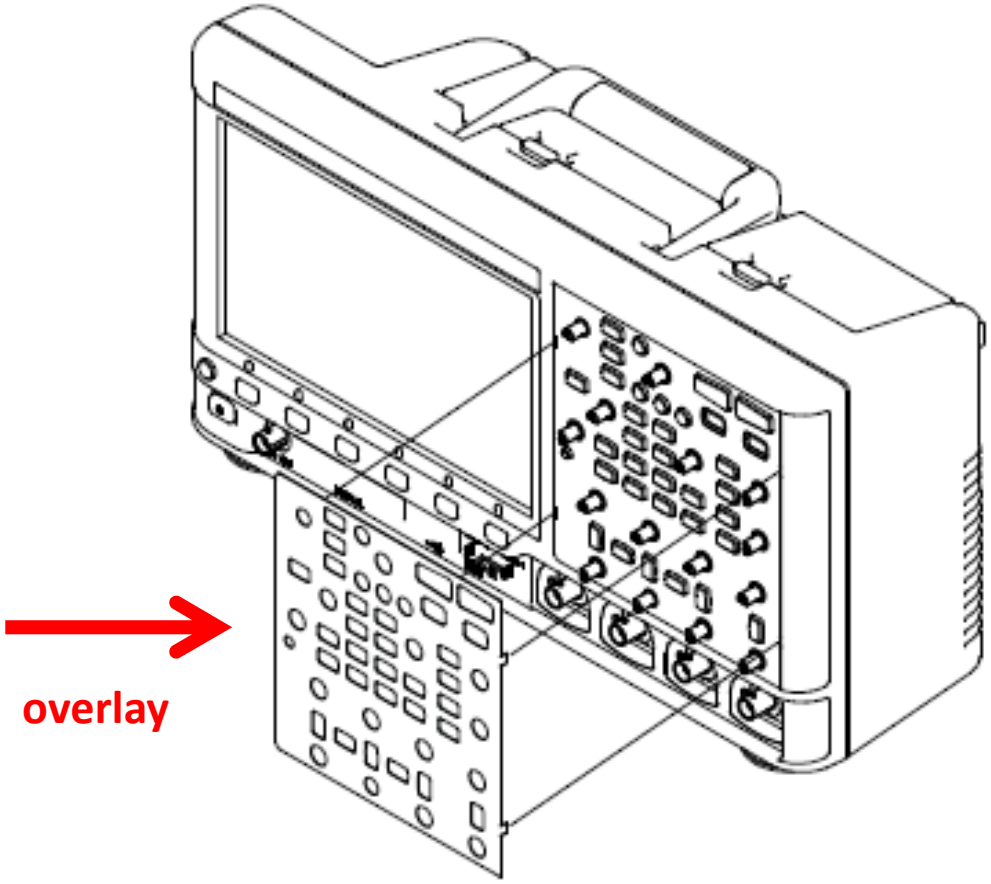
Osciloscope MSO-X 2002A



Osciloscope MSO-X 2002A



Osciloscope MSO-X 2002A



Osciloscope MSO-X 2002A (Models)

Table 1 2000 X-Series Model Numbers, Bandwidths

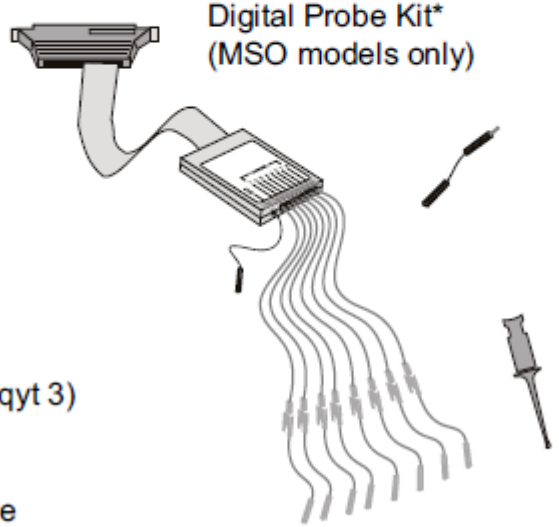
Bandwidth	70 MHz	100 MHz	200 MHz
2-Channel + 8 Logic Channels MSO	MSO-X 2002A	MSO-X 2012A	MSO-X 2022A
4-Channel + 8 Logic Channels MSO	MSO-X 2004A	MSO-X 2014A	MSO-X 2024A
2-Channel DSO	DSO-X 2002A	DSO-X 2012A	DSO-X 2022A
4-Channel DSO	DSO-X 2004A	DSO-X 2014A	DSO-X 2024A

Osciloscope MSO-X 2002A
Acessories

Documentation CD

N2862B probes
(Qty 2 or 4)

Power cord
(Based on country
of origin)



Digital Probe Kit*
(MSO models only)

*N6459-60001 Digital Probe Kit contains:

N6459-61601	8-channel cable (qyt 1)
01650-82103	2-inch probe ground leads (qyt 3)
5090-4832	Grabber (qty 10)

Digital probe replacement parts are listed in the
"Digital Channels" chapter.

Osciloscope MSO-X 2002A

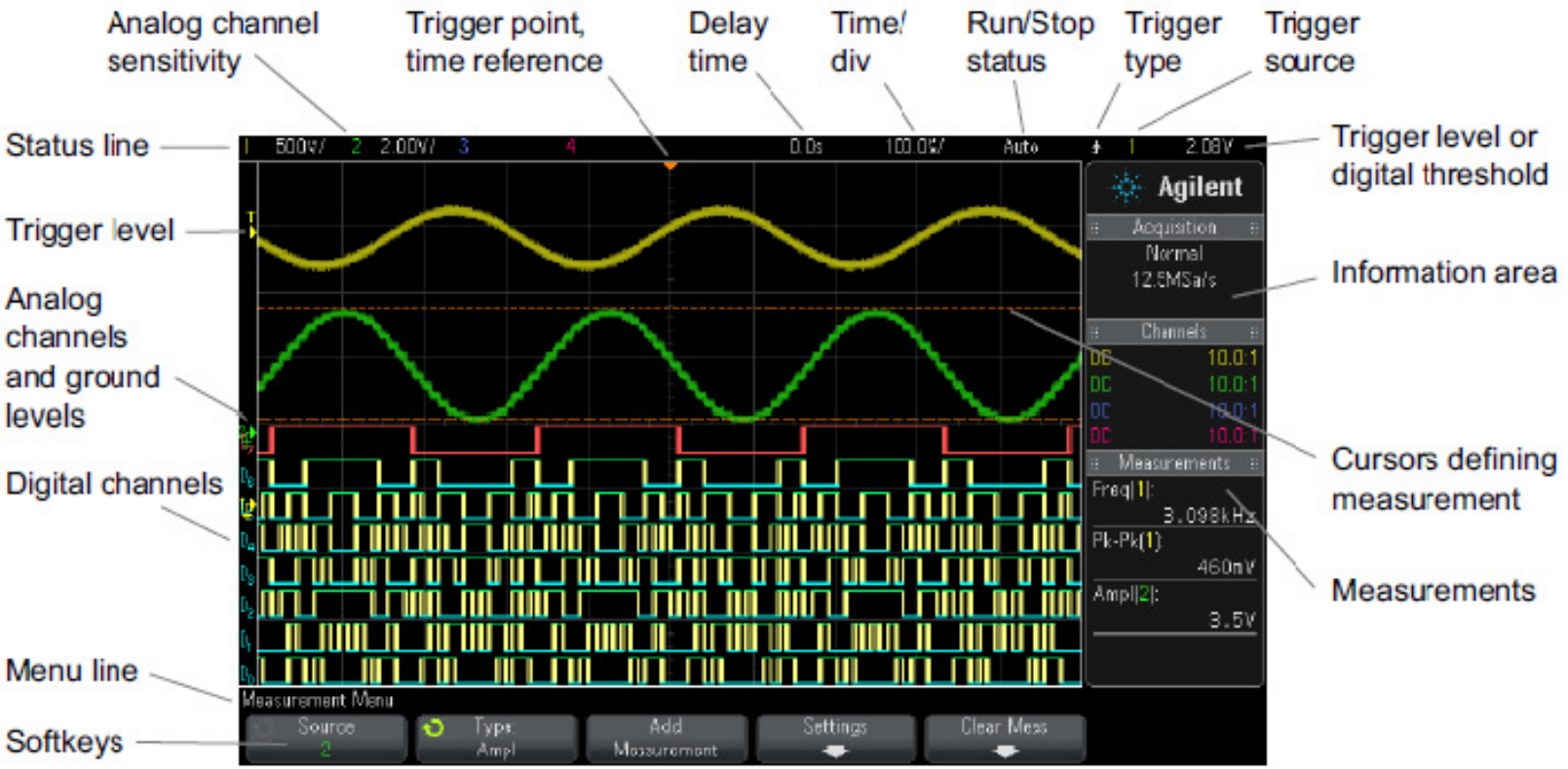


Figure 1 Interpreting the oscilloscope display

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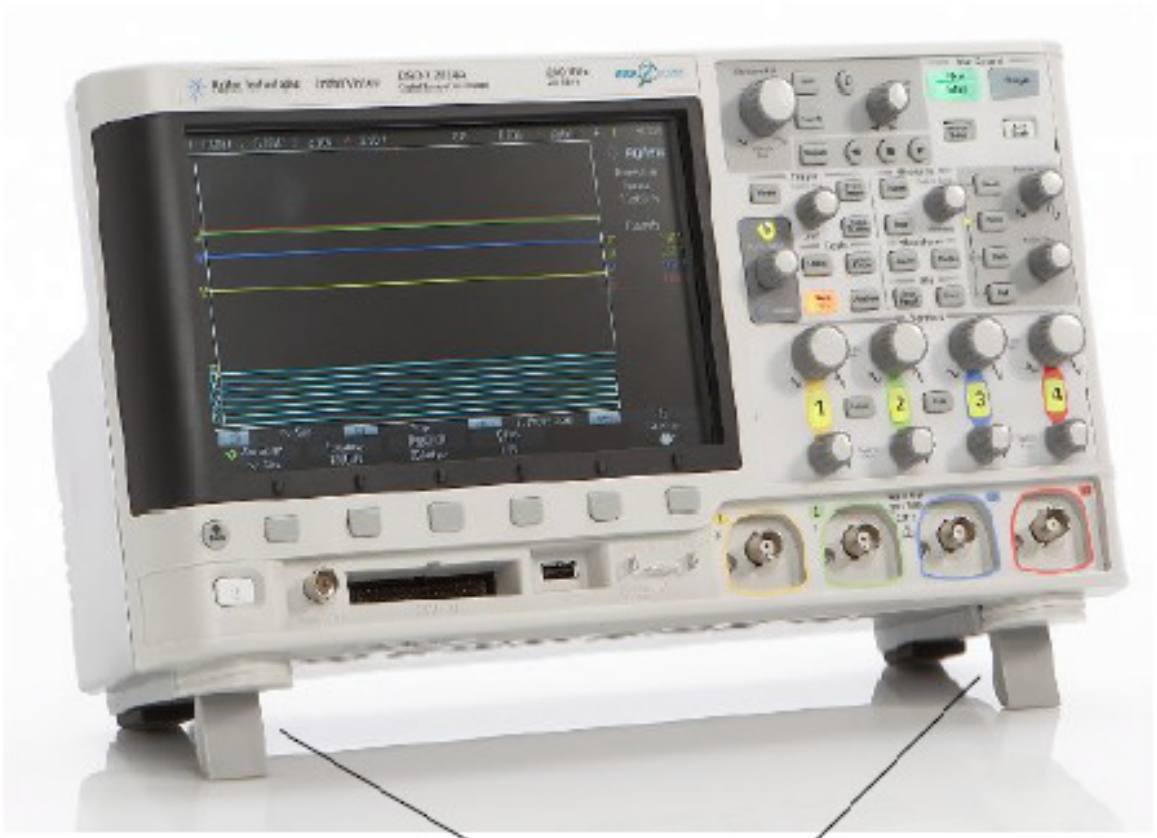
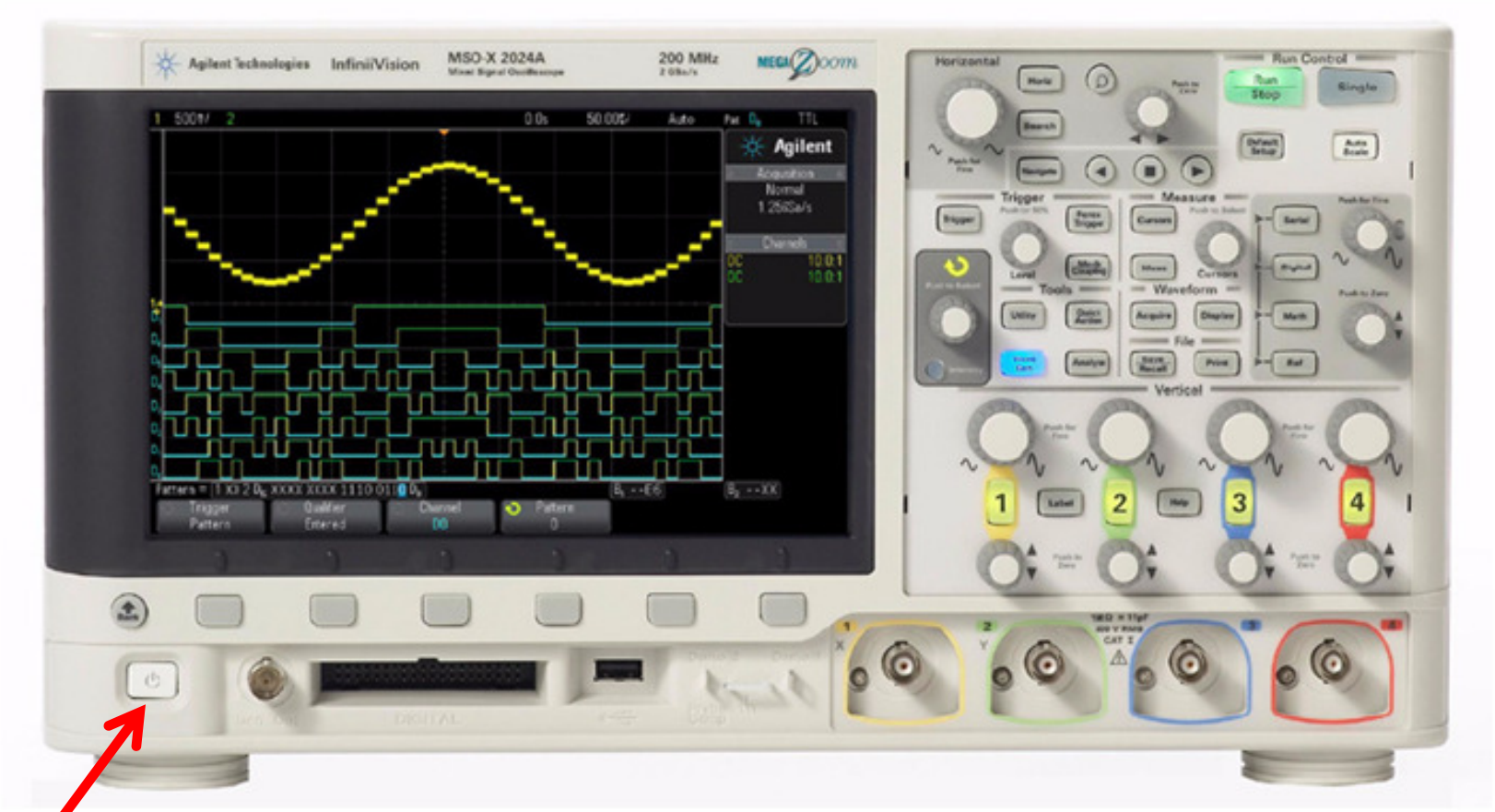


Osciloscope MSO-X 2002A



On / Off

Osciloscope MSO-X 2002A

Connect Probes to the Oscilloscope

1 Connect the oscilloscope probe to an oscilloscope channel BNC connector.

2 Connect the probe's retractable hook tip to the point of interest on the circuit or device under test. Be sure to connect the probe ground lead to a ground point on the circuit.

Osciloscope MSO-X 2002A

Input a Waveform

The first signal to input to the oscilloscope is the Demo 2, Probe Comp signal. This signal is used for compensating probes.

1. Connect an oscilloscope probe from channel 1 to the **Demo 2** (Probe Comp) terminal on the front panel.
2. Connect the probe's ground lead to the ground terminal (next to the **Demo 2** terminal).

Osciloscope MSO-X 2002A

Recall the Default Oscilloscope Setup

To recall the default oscilloscope setup:

1 Press [**Default Setup**].

The default setup restores the oscilloscope's default settings. This places the oscilloscope in a known operating condition. The major default settings are:

Table 2 Default Configuration Settings

Horizontal	Normal mode, 100 µs/div scale, 0 s delay, center time reference.
Vertical (Analog)	Channel 1 on, 5 V/div scale, DC coupling, 0 V position.
Trigger	Edge trigger, Auto trigger mode, 0 V level, channel 1 source, DC coupling, rising edge slope, 40 ns holdoff time.
Display	Persistence off, 20% grid intensity.
Other	Acquire mode normal, [**Run/Stop**] to Run, cursors and measurements off.
Labels	All custom labels that you have created in the Label Library are preserved (not erased), but all channel labels will be set to their original names.

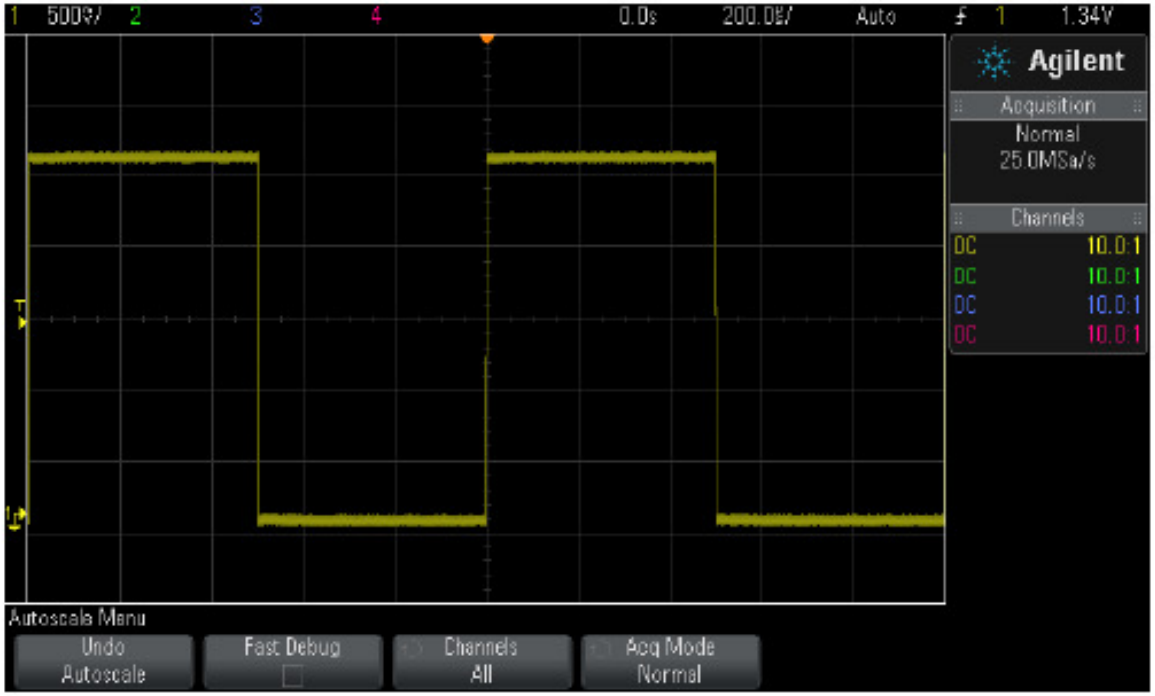
Osciloscope MSO-X 2002A

Use Auto Scale

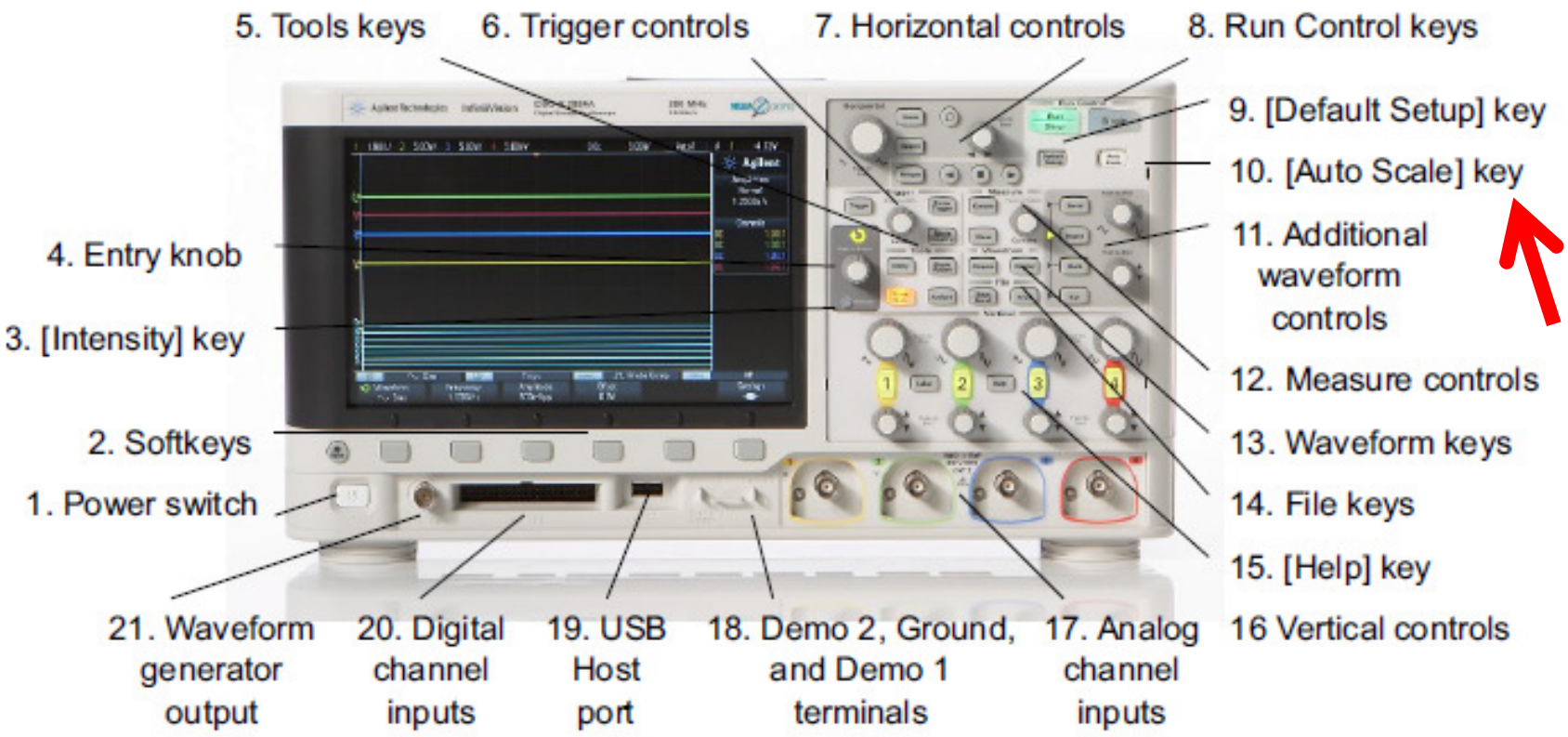
Use **[Auto Scale]** to automatically configure the oscilloscope to best display the input signals.

1 Press **[Auto Scale]**.

You should see a waveform on the oscilloscope's display similar to this:



Osciloscope MSO-X 2002A



Osciloscope MSO-X 2002A

Compensate Passive Probes

Each oscilloscope passive probe must be compensated to match the input characteristics of the oscilloscope channel to which it is connected. A poorly compensated probe can introduce significant measurement errors.

1 Input the Probe Comp signal (see "Input a Waveform" on page 25).

2 Press [**Default Setup**] to recall the default oscilloscope setup (see "Recall the Default Oscilloscope Setup" on page 25).

3 Press [**Auto Scale**] to automatically configure the oscilloscope for the Probe Comp signal (see "Use Auto Scale" on page 26).

4 Press the channel key to which the probe is connected ([**1**], [**2**], etc.).

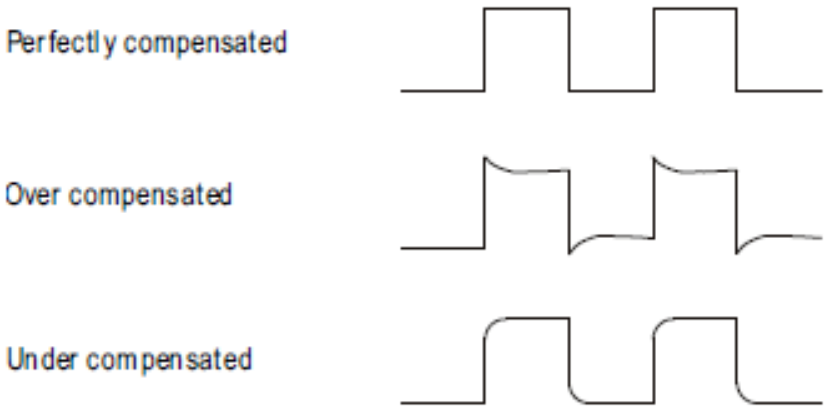
5 In the Channel Menu, press **Probe**.

6 In the Channel Probe Menu, press **Probe Check**; then, follow the instructions on-screen.

Osciloscope MSO-X 2002A

If necessary, use a nonmetallic tool (supplied with the probe) to adjust the trimmer capacitor on the probe for the flattest pulse possible.

On the N2862/63/90 probes, the trimmer capacitor is the yellow adjustment on the probe tip. On other probes, the trimmer capacitor is located on the probe BNC connector.



7 Connect probes to all other oscilloscope channels (channel 2 of a 2-channel oscilloscope, or channels 2, 3, and 4 of a 4-channel oscilloscope).

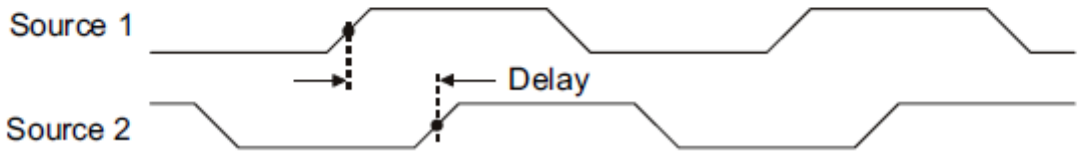
8 Repeat the procedure for each channel.

Osciloscope MSO-X 2002A

Time Measurements

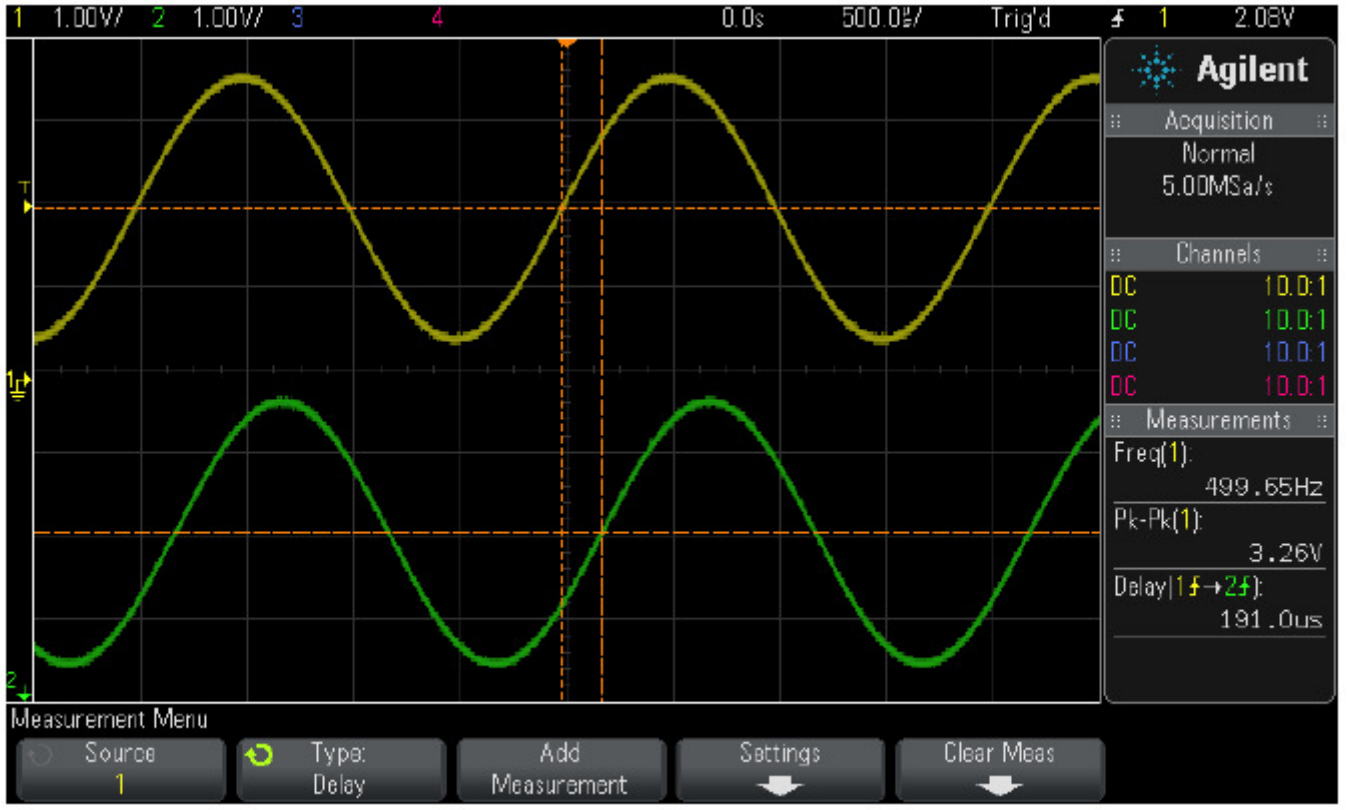
Delay

Delay measures the time difference from the selected edge on source 1 and the selected edge on source 2 closest to the trigger reference point at the middle threshold points on the waveforms. Negative delay values indicate that the selected edge of source 1 occurred after the selected edge of source 2.



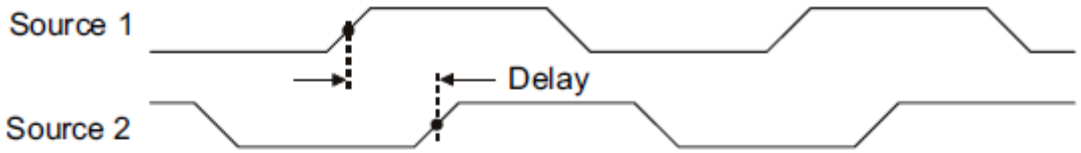
Osciloscope MSO-X 2002A

Time Measurements



Osciloscope MSO-X 2002A

Time Measurements



1 Press the **[Meas]** key to display the Measurement Menu.

2 Press the **Source** softkey; then turn the Entry knob to select the first analog channel source.

3 Press the **Type**: softkey; then, turn the Entry knob to select **Delay**.

4 Press the **Settings** softkey to select the second analog channel source and slope for the delay measurement.

The default Delay settings measure from the rising edge of channel 1 to the rising edge of channel 2.

5 Press the Back/Up key to return to the Measurement Menu.

6 Press the **Add Measurement** softkey to make the measurement.

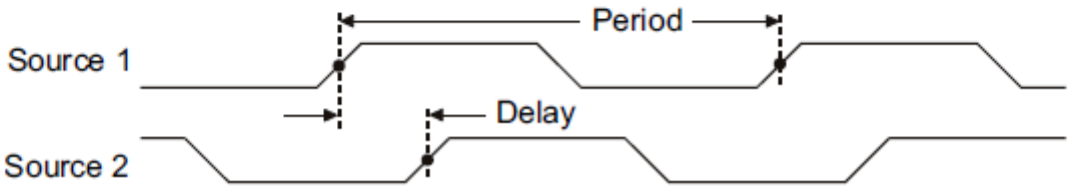
Osciloscope MSO-X 2002A

Phase Measurements

Phase

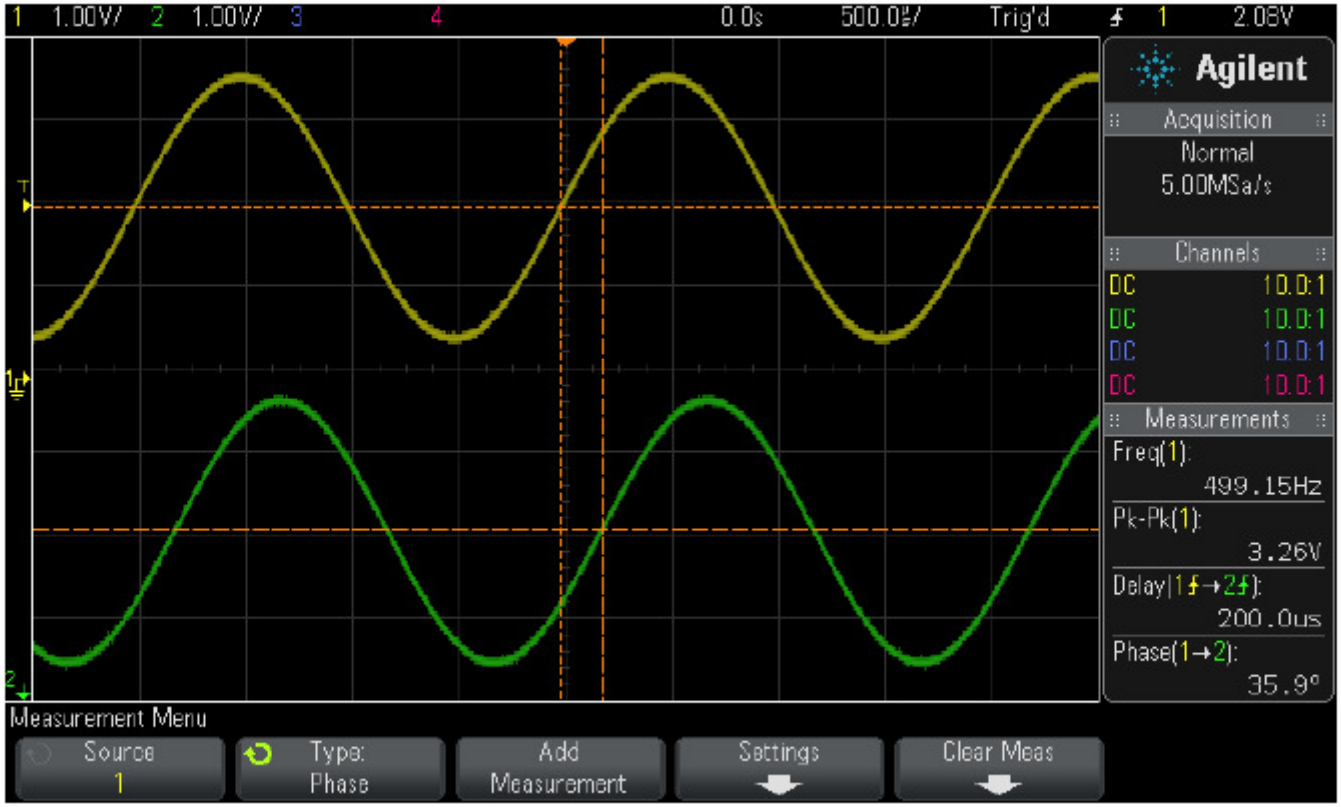
Phase is the calculated phase shift from source 1 to source 2, expressed in degrees. Negative phase shift values indicate that the rising edge of source 1 occurred after the rising edge of source 2.

$$\text{Phase} = \frac{\text{Delay}}{\text{Source 1 Period}} \times 360$$



Osciloscope MSO-X 2002A

Phase Measurements



Osciloscope MSO-X 2002A

Phase Measurements

1 Press the [**Meas**] key to display the Measurement Menu.

2 Press the **Source** softkey; then turn the Entry knob to select the first analog channel source.

3 Press the **Type:** softkey; then, turn the Entry knob to select **Delay**.

4 Press the **Settings** softkey to select the second analog channel source for the phase measurement.

The default Phase settings measure from channel 1 to channel 2.

5 Press the Back/Up key to return to the Measurement Menu.

6 Press the **Add Measurement** softkey to make the measurement.

The example below shows a phase measurement between the channel 1 and the math d/dt function on channel 1.

Osciloscope MSO-X 2002A

Cursor Measurments

1 Connect a signal to the oscilloscope and obtain a stable display.

2 Press the **[Cursors]** key.

The Cursors box in the right-side information area appears, indicating that cursors are "on". (Press the **[Cursors]** key again when you want to turn cursors off.)

3 In the Cursors Menu, press **Mode**; then, select the desired mode:

- **Manual** – ΔX, 1/ΔX, and ΔY values are displayed. ΔX is the difference between the X1 and X2 cursors and ΔY is the difference between the Y1 and Y2 cursors.

Medidas Elétricas em Circuito AC
Filtros Passivos

Filtros são circuitos elétricos contendo elementos passivos (R, L ou C) ou circuitos eletrônicos contendo elementos ativos (transistores, amplificadores operacionais) projetados para preservar sinais senoidais pertencentes a uma determinada faixa de freqüência e rejeitar os sionais restantes. São, por exemplo, utilizados em sistemas de comunicações para preservar sinais elétricos de interesse e em sistemas de áudio para separar sinais utilizados por amplicadores e alto falantes (woofer, tweeter, ...).

Filtro Passivos

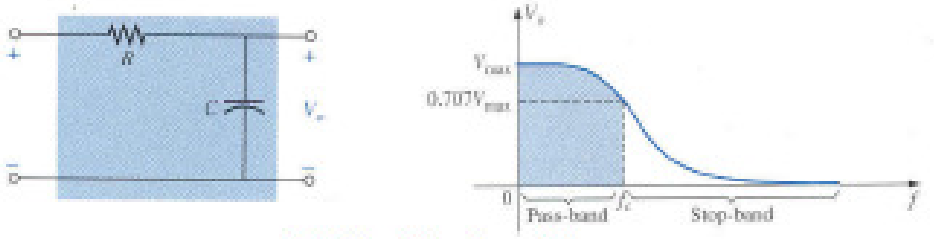


Fig. 3.1 - Filtro Passa-Baixa

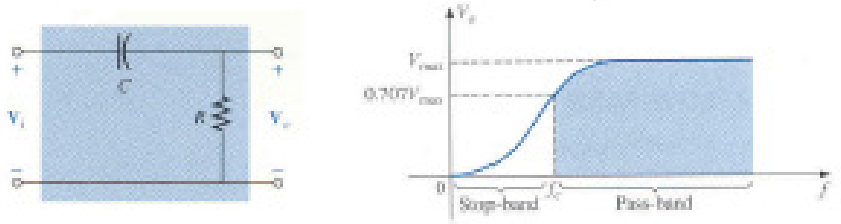


Fig. 3.2 – Filtro Passa-Alta

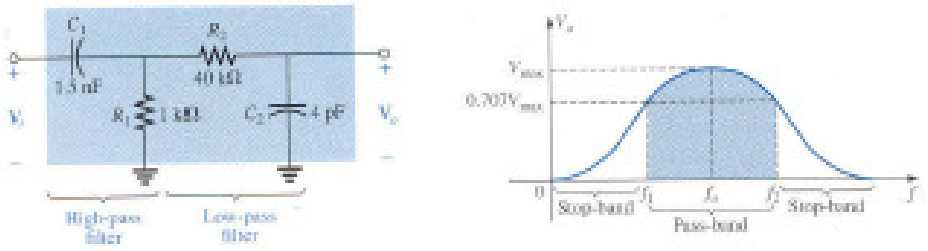


Fig. 3.3 – Filtro Passa-Banda

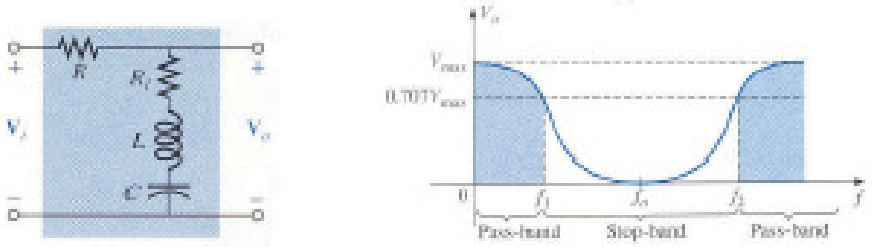


Fig. 3.4 – Filtro Rejeita-Banda

Filtro Passivos

Woofer (filtro passa baixa)

Filtro Passa Faixa

Tweeter (filtro passa alta)

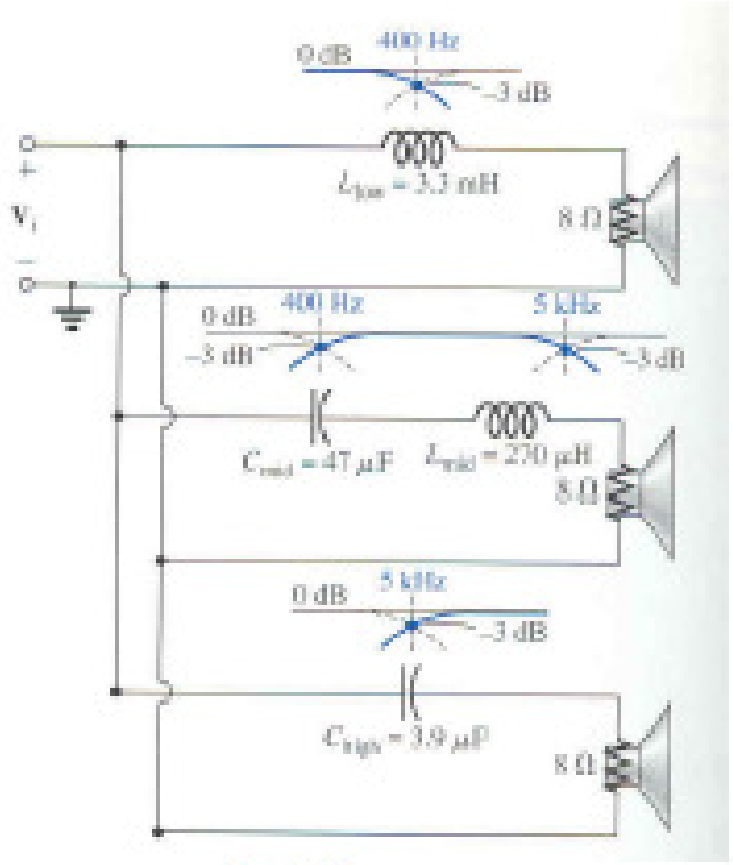
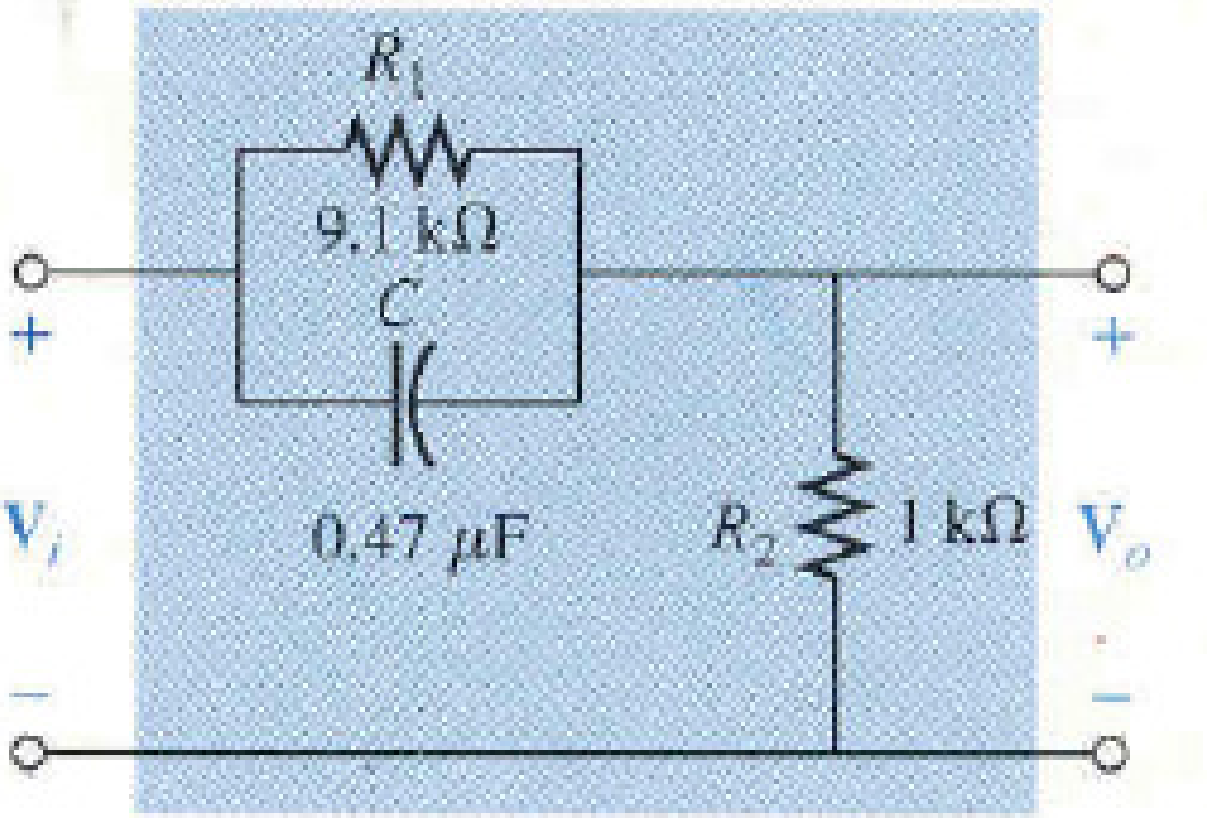


Fig. 3. 6

Filtro Passivo Passa Alta



Filtro Passivo Passa Alta

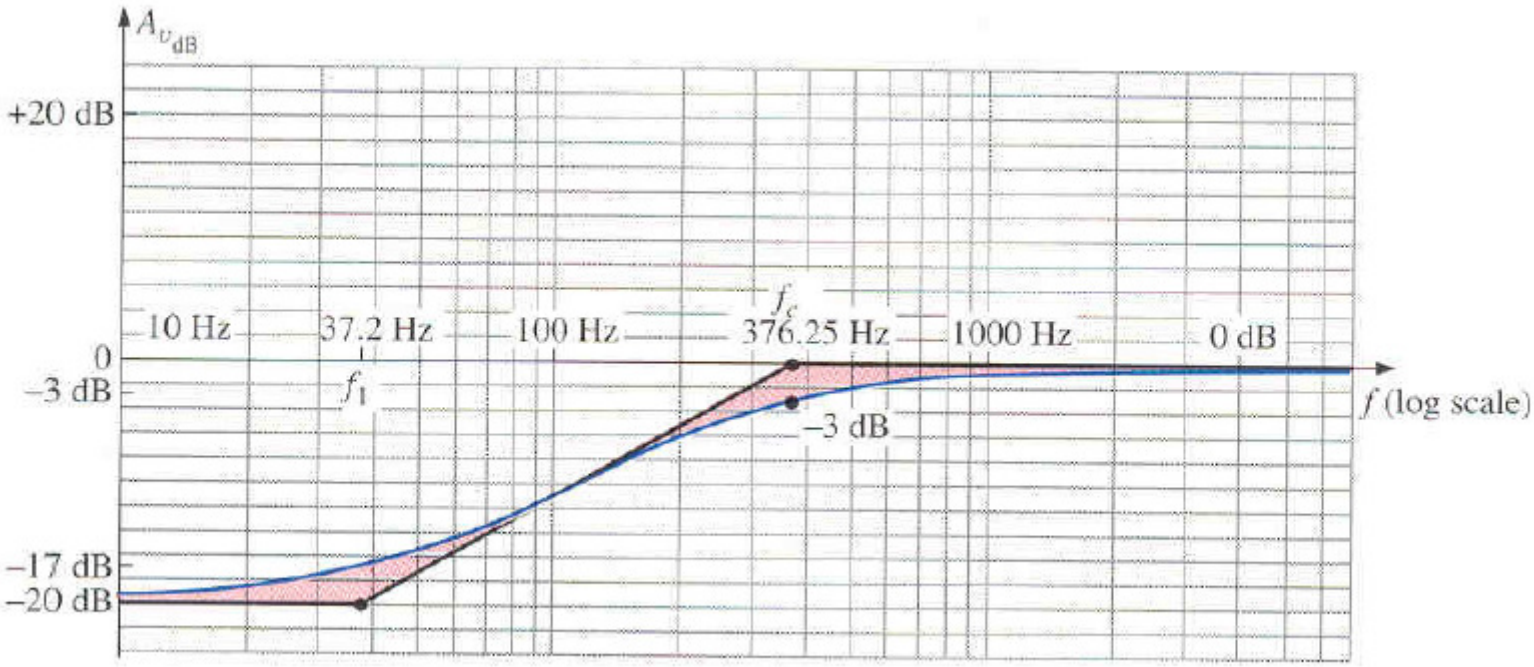


Diagrama de Bode - Amplitude

Filtro Passivo Passa Alta

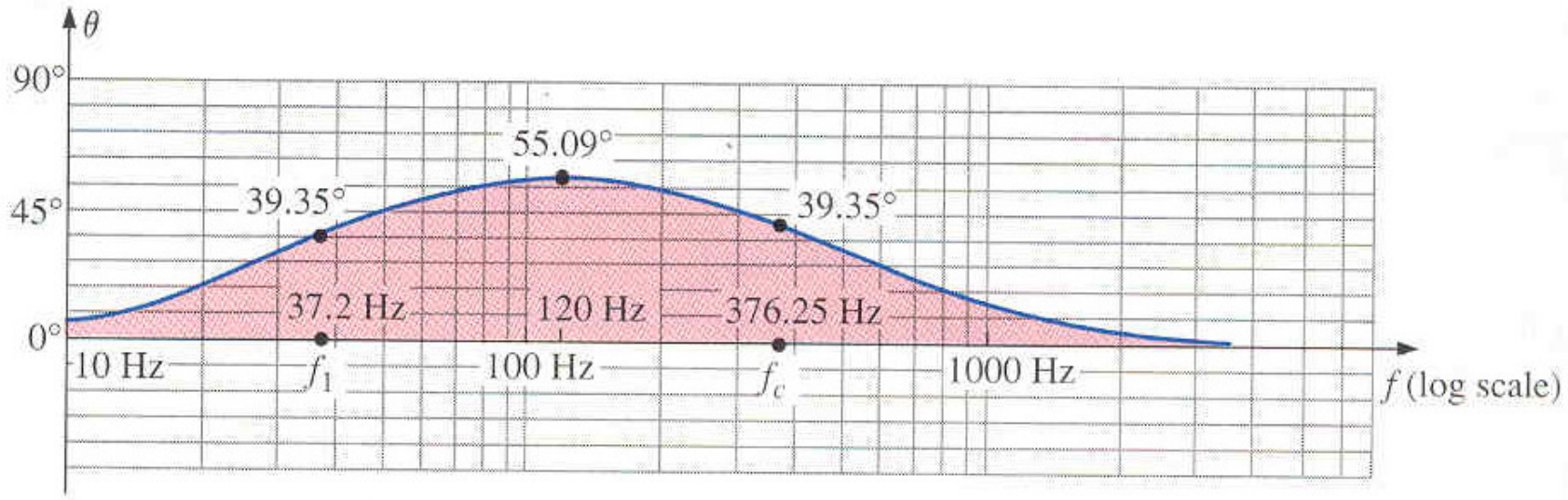


Diagrama de Bode - Fase

Filtro Passivo Passa Alta
Atividade Experimental

Tabela - Ganho e Defasagem em função da freqüência (Hz)

Frequência (Hz)	V_{in}^{max} (V)	V_{out}^{max} (V)	G (dB)	Δt (s)	θ (graus)
20					
40					
60					
80					
100					
120					
200					
400					
600					
800					
1000					
1200					
1600					
1850					
2000					