

## Digital Oscilloscope Tektronix model TDS210

### Some Specifications

analog bandwidth	60 MHz (megaHz); risetime of 5.8 ns (for scales $\geq 10$ mV/div )
sampling rate	250 Samples/Div (S/Div), in the range 50S/s - 1 GS/s (1 S/ns)
record length	2500 samples for each of two channels
display	standard, i.e., 8 Divisions high by 10 Divisions wide
1 Division (on display)	slightly less than 1 cm (about 9 mm)
display	25 horizontal pixels/Div, or 250 total in 10 Div.
digitizers	8 bit resolution, each channel sampled simultaneously
Volts/Div ranges	2 mV/Div to 5V/Div at input BNC connector
2 mV/div & 5 mV/div	reduced bandwidth (20 MHz) and accuracy ( $\pm 4\%$ )
input impedance	$10^{+6}$ ohms, in parallel with 20 pico-Farads (without probe)
vertical scale accuracy	typically $\pm 3\%$
horizontal ranges	5 ns/div to 5 s/div, in a 1, 2.5, 5 sequence
MAX. input signal	<b>above 3 MHz, only 13 volts!!!</b>
sampling rate accuracy	$\pm 1$ part in $10^4$ , or 0.01% (applies also to time scales)

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### Basic Operations:

1. **Turn on the power** (depress the power switch on the top left of the case).
2. **Select the factory-default settings** (Press **Save/Recall**, select **Setups** in the top selection box on the screen, then select **Recall Factory**).
3. **Adjust the screen visibility** (Press **Display**, then select **Contrast Inc.** or **Contrast Dec.** on the screen)
4. **Connect the signal(s) to be observed to the Channel #1** (or #2) input connector directly, or via a scope probe.
5. Press **Autoset!** The signal should appear on the display.
6. **Set the vertical scale for the type of connection used.** (Press **CH 1 Menu**, then select **Probe** on the screen as needed; use 1X for a direct connection, 10X for a 10X probe, etc.)
7. **If desired, adjust the vertical scale** (turn the **VOLTS/DIV** control) and the **horizontal scale** (turn the **SEC/DIV** control)
8. **To halt data acquisition** and display the last data acquired, press **RUN/STOP**. **To restart data acquisition**, press **RUN/STOP** again.
9. **To print a copy of the screen display**, press **HARDCOPY** (once!)
10. **The display is calibrated**; it can provide numerical information! The cal. factor for the **vertical scale** (for each channel displayed) is shown at the lower left of the display (in V or mV per Div), while that for the **horizontal scale** is shown at the lower center (in nS,  $\mu$ S, mS, or S per Div). A Division corresponds to a major division on the screen, which is roughly 1 cm. **Ground** (i.e., 0 Volts) for each channel is indicated by the arrow along the left edge of the screen.
11. **To have various features of the waveform measured automatically** (such as frequency, period & RMS value of the first cycle, and mean and peak-to-peak value of the entire record), press **Measure** and use the upper selection box on the screen, and other selection boxes as needed.
12. **Self-calibration:** Optimizes accuracy. Remove cables from inputs, press **UTILITY**, then select **Do Self Cal.** Best after 20 min. warm-up; perform again if  $\Delta T > 5^\circ\text{C}$ .

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### **Facts and Definitions:**

**Digital Oscilloscope:** An oscilloscope that measures the input voltage at a set rate, stores the measurements as digital values in a memory, and uses those digital values to produce a visual display, most commonly a graph of voltage vs. time.

**Aliasing:** A false display of a signal that results if the sampling rate is too low, i.e., less than twice the highest frequency in the signal. If the properties of the waveform change when you change the time scale of the display, aliasing is present.

<b>Other Information</b>	
References	User Manual (116 pgs.); Instructions for Extension Modules (48 pgs.); Programmer Manual (200+ pgs.)
X-Y mode	Is of lower quality than on comparable analog scopes. Data is not collected continuously. Sampling rate fixed at 1 MS/s.
FFT, risetime, pulse width measurements	these options are available only with the optional TDS2MM measurement module; for details, see Inst. for Ext. Modules.
acquisition modes	sample mode, peak detect mode, and average mode
probe compensation	adjustment requires external tool
probe compensator output	0 to 5 volts, 1 kHz
Warning!	Do NOT leave this instrument in direct sunlight!!!
Display back-light	This light is replaceable.

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The TDS210 supports only certain printers. We use HP laser printers. We connect both a computer and a TDS210 to a single printer using an inexpensive (\$5 to \$15) autoswitch, such as the ASP model IA221 (2 PC to 1 printer) autoswitch available from 365USA.com

### **Costs:**

Model #	Description	List price (8/2000)	Quantity educational price (8/2000)
TDS210	<b>digital scope</b> (without any data output ports such as to a printer; no FFT, but with significant automatic measurement capability)	\$1195 (was \$995 in 1999!)	\$963
TDS2CM	<b>communication module</b> ; provides printer port, RS-232 port, & IEEE-488 port	\$265	\$214
TDS2MM	<b>"measurement" module</b> ; provides the ports of the TDS2CM, as well as a real-time FFT, pulse rise-time, fall-time & pulse-width measurement capability	\$495	\$399

Note: We equipped half of our scopes with a TDS2CM, and half with a TDS2MM. The scope accepts only one module. Note that the more expensive TDS2MM includes all the functions of the lower cost TDS2CM.