

Appendix I.

Digital Oscilloscope Tektronix model TDS210

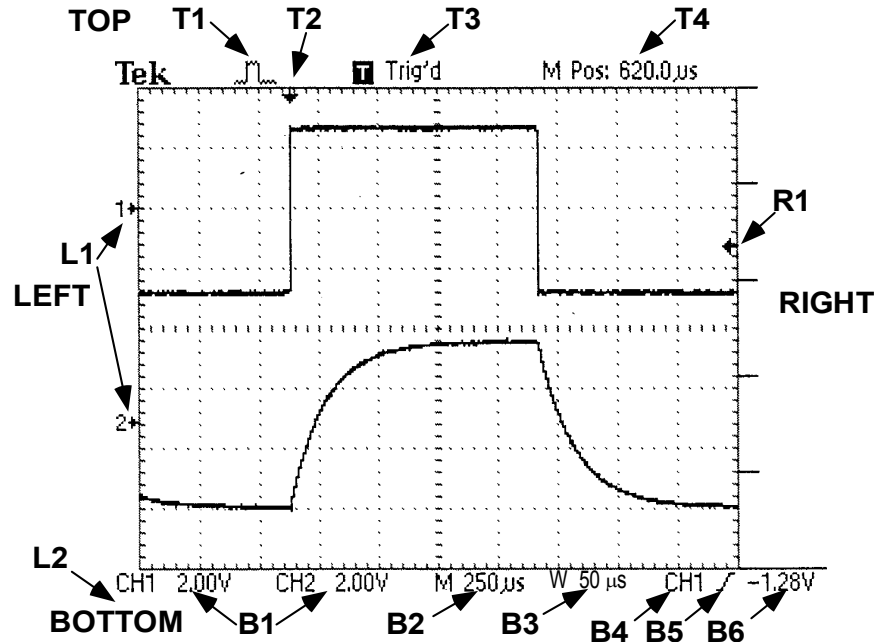
Basic Operations:

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. **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.)
6. Press **Autoset!** The signal should appear on the display.
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, μ 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 $\Delta T > 5^\circ\text{C}$.

**Do NOT leave this instrument
in Direct Sunlight!!!!
(or the LCD screen may be damaged!)**

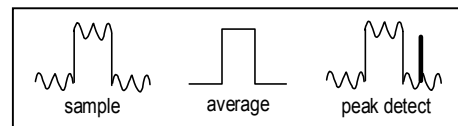
Appendix II.

The display of the Tektronix model TDS210 digital oscilloscope



Most important indicators:

- L1. **Channel number** and **zero voltage level** for displayed signals.
- B1. **Vertical scale(s)** of displayed channel(s), in mV or V per Div. (screen height = 8 Div.)
- B2. **(Main) Horizontal time scale** in nS, μ S, mS, or S per Div. (screen width = 10 Div.)
- R1. **Trigger level** is indicated by the horizontal arrow.
- T2. **Trigger time**: Downward arrow indicates when the trigger occurred.
- T3. **Operational status**, with common conditions being:
 - * **Trig'd**: scope has triggered and is acquiring data.
 - * **Stop**: scope has stopped acquiring data.
 (See below for less common conditions.)
- B4. **Trigger source** (i.e., the signal used to trigger the scope).
- B5. Icon indicating **Trigger slope**, rising or falling (when scope is in its normal "edge" operating mode).
- T1. Icon indicating **acquisition mode**, namely, sample (the usual choice), average, or peak detect. See below for other details.



Other indicators are:

- B6. Numerical value of **Trigger level**.
- T3. **Operational status** - the less common conditions are:
 - * **Auto**: scope is automatically acquiring data in the absence of triggers.
 - * **Scan**: scope is acquiring data in a very slow, repeating mode that does not require a trigger.
 - * **Ready**: scope is ready to accept a trigger.
 - * **Armed**: a temporary condition in which the scope cannot accept a new trigger.
- T4. Time at center of screen with respect to the trigger time. (This reads zero when the display is positioned so that the trigger at the center.)
- B3. **Time scale** of the **Window** option (an advanced feature used to magnify a portion of the display).
- L2. Message display area.
- T1. **Acquisition modes**:
 - * **sample mode**: a single "sample" (or value) is saved during each acquisition interval.
 - * **average mode**: an average of the most recently acquired waveforms is displayed.
 - * **peak detect mode**: both the min. and max. value detected during the interval are stored.

Appendix III.

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Some Specifications	
analog bandwidth	60 MHz (megaHz); risetime of 5.8 ns (for scales ≥ 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	above 3 MHz, only 13 volts!!!
sampling rate accuracy	± 1 part in 10^4 , or 0.01% (applies also to time scales)

Facts and Definitions:

Digital Oscilloscope: An instrument 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.

Other Information	
References	User Manual (116 pg.); Instructions for Extension Modules (48 pg.); Programmer Manual (200+ pg.)
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!!! (The LCD display is subject to damage from sunlight!!!)
Display backlight	This light is replaceable.