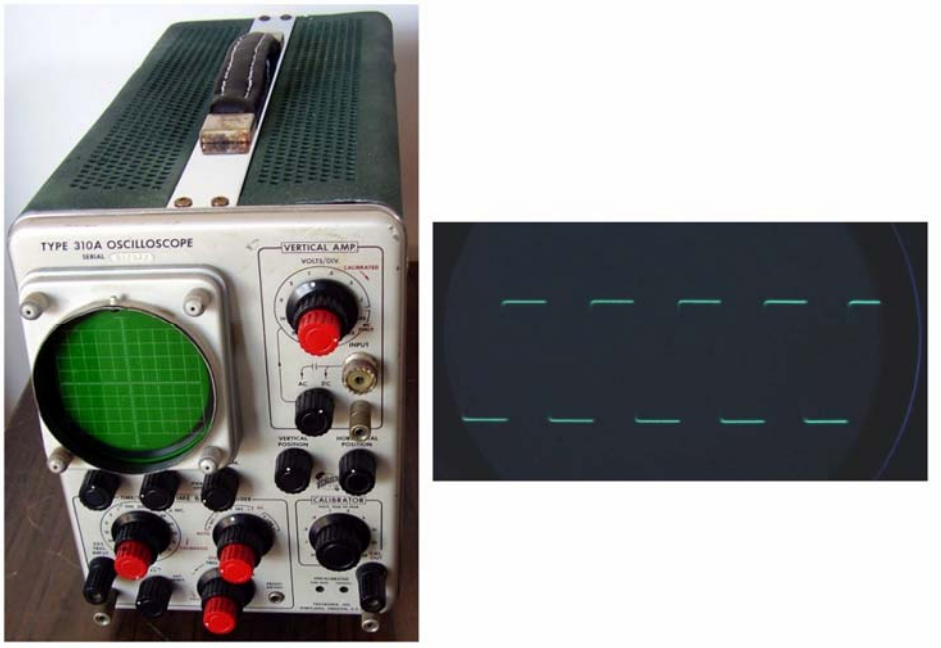
# Tektronix 310A - 3-inch Service Oscilloscope




The oscilloscope model 310A well illustrates the low end Tektronix production. The 310A can be dated around the late fifties as replacement for the model 310, introduced in 1955. At the time it was a compact portable instrument, measuring only 10 for 6 ¾ for 17 inches, intended for in field servicing of electronic equipment. The 310 in its first year was sold for 595 US dollars. To give an idea of how expensive this little oscilloscope could be, a 5 inch oscilloscope with the same bandwidth, like the Heatkit O-10 was listed at 69,50 US dollars.

Despite the compactness, about a shoe box, and the small 3-inch CRT, data are quite impressive for a service oscilloscope. The cabinet is full of parts, including thirty vacuum tubes, the CRT, twelve silicon diodes, that replaced three selenium bridge rectifiers of the early productions, one germanium diode and four neon bulbs. Frequency response of vertical amplifier goes from DC to 4 MHz, decreasing to 3.5 MHz at 10 mV/division. Vertical deflection sensitivity can be set from 10 mV to 50 V/ division in twelve calibrated steps. Built-in square wave calibrator in 12 steps from 50 mV to 100 volts peak-to-peak. Time base can be selected from 0.5 microsec/division to 5 sec/division in eighteen steps. The 5x magnifier increases sweep speed to 0.1 microsec/division. 3WP1 CRT with 1850 volts accelerating potential. This flexible instrument can be operated from 105 to 125 or from 210 to 250 volts AC, 50 to 800 Hz. Internal DC supplies are all electronically regulated to grant stable operation even under poor line-voltage regulation.

I found some units of this oscilloscope in a junkyard, in a rainy day over a large heap of scraps handled with a trash grapple head. I bought three units, the less warped

ones, with apparently intact CRT. According to the labels these units came from some SHAPE (NATO command) depots, the last calibration dating around 1994.

A lot of time was required to return two units, S/N 012561 and S/N 012572, to their original look, the third unit being used as source of hard to find spare parts. First of all it was necessary to remove all the side, the bottom and the back covers to straighten them. Then I had to paint the panels all around. The paint is not exactly like the original, but it is the best compromise I could find. A good cleaning was required to remove dust and dirt from inside. One unit even required the removal of some broken ceramic strips and some tube socket to straighten the warped power supply chassis. As usual in many old Tek oscilloscope, I had to rebuilt the handle of the scope S/N 012561. This job was the most complex for me and the result is anyway quite poor, as shown in the picture above. Next it was necessary to replace several embrittled cable clamps and many plastic bushings under the ceramic strips.

Cleaning of the front panels required the removal of the knobs. This operation was very difficult, since knobs were fitted with a single tiny Allen screw. Quite strange for two sets with so close serial numbers, the size of screws was different on the two units. Broken feet and knobs were replaced with parts taken from the third unit.

Service started cleaning the contacts of the power-on switch on both units. A small hole was drilled in the wall of the switches, to inject some contact cleaner inside, while rotating the knob back and forth. Then electrolytic capacitors were preformed at reduced voltage for about half an hour. At the power up both units appeared to be inoperative, with lamps and neon bulbs lighted but with dark screens.

**Electrical service of the 310A, S/N 012561.**

Voltages were quite close to their nominal values, with the exception of the unregulated 400V. I replaced the dried filter capacitor C660, adjusting the –150 volt to the exact value. All the voltages went within their specified values. A regular flickering of the neon diode B163 in the time base circuits indicated that this section was operating correctly. Using the right cautions and my old AVOmeter 8 MKIV, the one with 2500V f.s. range, I started to check the high voltage supply section. Here I found that the brightness and the focus controls were both faulty. A short between the cursor and one of the side connections could be measured. Some oxide grown between the base metal plate and the rivets connecting the resistive element to the terminal lugs was at the origin of the problem. The problem was cleared replacing the two potentiometers with the good ones taken from the third unit.

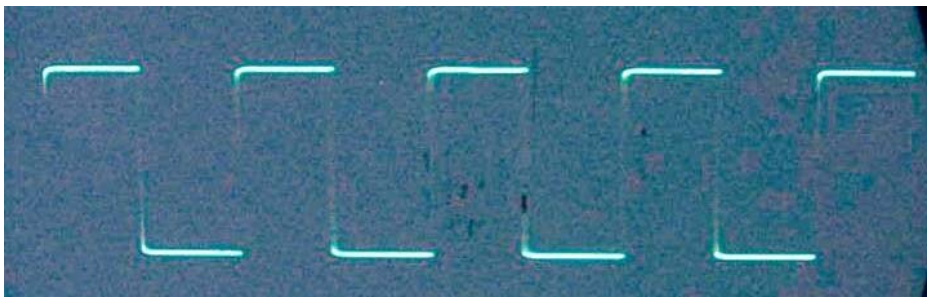
The trace appeared, but after few minutes focus and brightness became to drift considerably, while the absolute value of high voltage was rapidly decreasing under 1600 volts. The voltage on the screen grid of the oscillator V704, a 6AQ5, was at its maximum value, indicating that the control loop was operating fine. The new

problem was fixed in a faulty C705 resonating capacitor across the primary winding of the HV transformer. The capacitor was leaky, probably punctured, and the leakage increased when warm, after few minutes of operation.

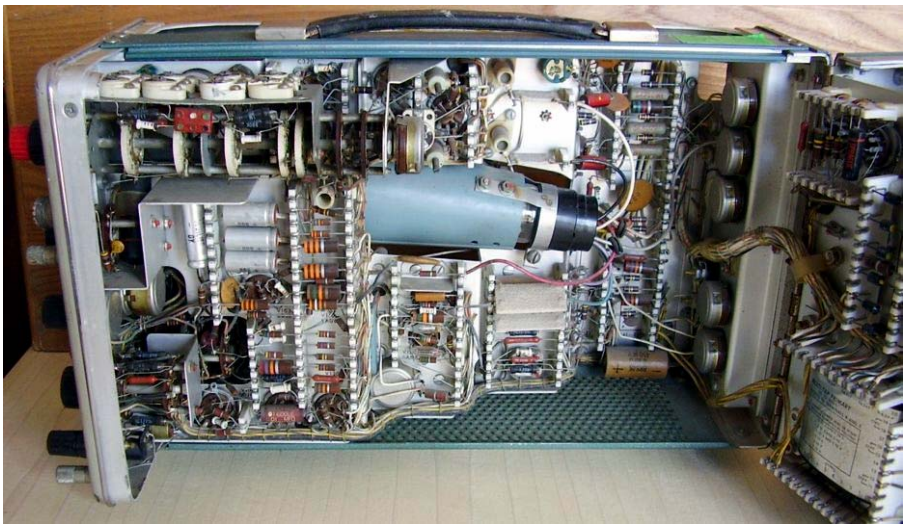
The oscilloscope is now fully operating, with a sharp and brilliant trace. I took the picture below, removing the plexiglass graticule to better focus the camera.

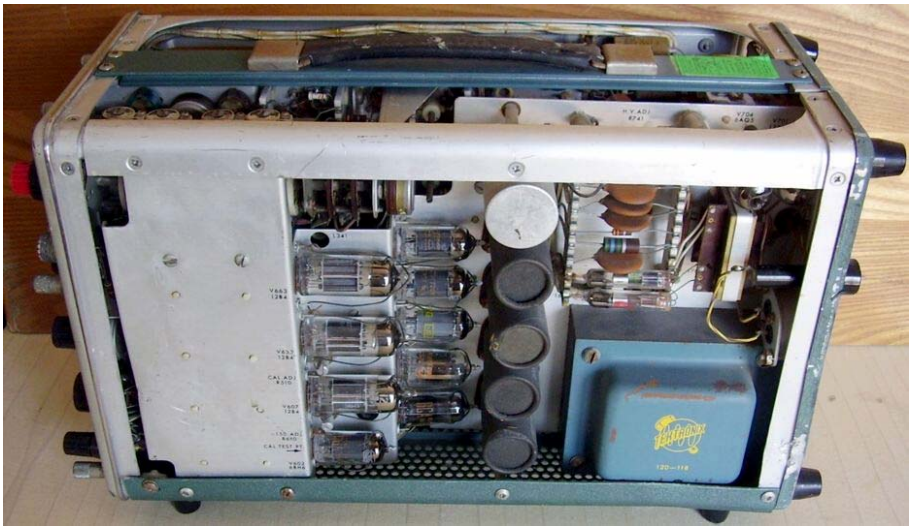
**Electrical service of the 310A, S/N 012572.**

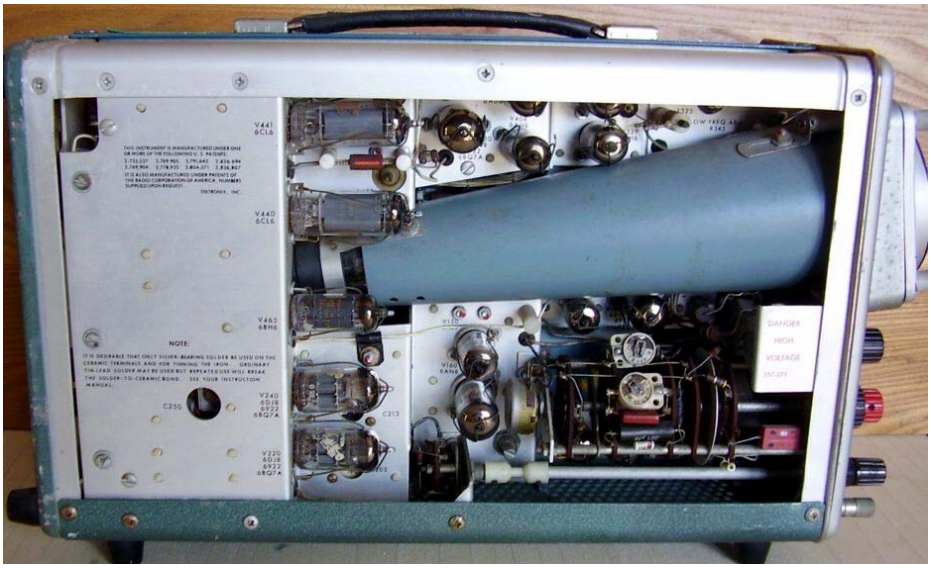
Moving the trace position controls, a sort of unfocused spot was visible on the screen, but horizontal deflection was inoperative. A check of the supply voltages returned a quite low value, around 85 volts, on the regulated +100 V supply line. The filter aluminum capacitor C630 was found dried and was then replaced. Even the +300V was someway low, around 285 volts. The problem was cleared replacing the 12B4 series pass regulator tube, V663. Once fixed the problems in the power supply section, the time base returned to its operation, even if the trace appeared considerably out of focus. The value of the accelerating voltage was found around -1550 volts and a small adjustment of the trimmer R741, H.V. Adj, was required to return this voltage to its nominal value, -1675 volts. The trace is now sharp and brilliant as in the picture below.



Click here for photo gallery.






V441
6CL6
V442
6CL6
V443
6BH6
NOTE:
V240
6DJ8
6922
6EQ7A
V220
6DJ8
6922
6EQ7A
DANGER
HIGH
VOLTAGE