

Customer Information from Tektronix, Inc.,  
P.O. Box 500, Beaverton, Oregon 97005

Editor: Gordon Allison,  
Graphic Designer: Tom Jones

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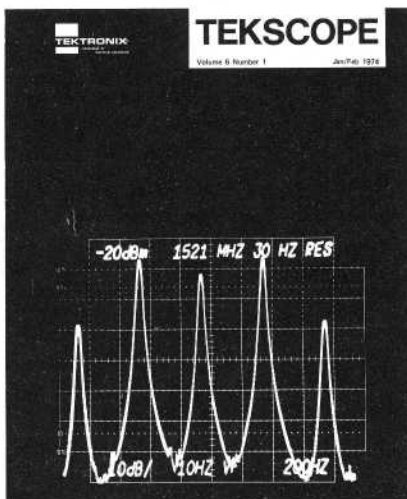
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**Cover:** A close-up view of the display of the 7L13 Spectrum Analyzer. The CRT Readout displays the Spectrum Analyzer control settings. Center frequency is 1521 MHz, frequency span is 200 Hz/div, resolution is 30 Hz and the video filter is set at 10 Hz. The reference level at the top of the screen is -20 dBm and the vertical deflection factor is 10 dB/div.



# CRT READOUT— nicety or necessity?

When the 7000-Series Oscilloscopes were being conceived much discussion centered around a scheme to present alphanumeric information on the CRT along with the waveform. Would the benefits derived justify the engineering effort required? What about the added cost to the customer who didn't need or want readout? These and related questions consumed hours of discussion.

The question of added cost for those not needing readout was neatly resolved by placing the bulk of the readout circuitry on a single printed circuit board. Easily installed or removed, readout could be included at the time the instrument was ordered, or added later at the customer's preference. Only time could adequately answer the question of whether the benefits would justify the effort required.

## How It Works

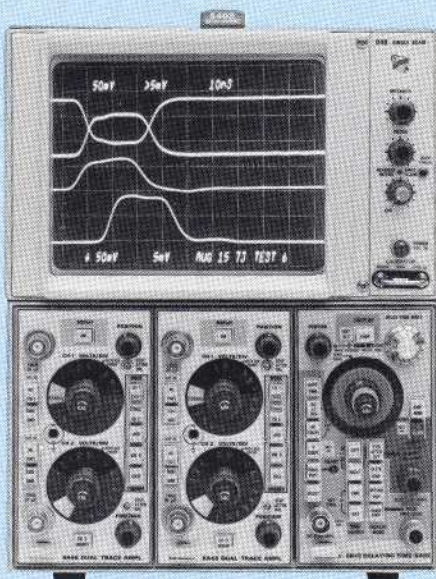
Here, briefly, is how the readout system works. The system uses an electronic character generating circuit which time shares the CRT with the normal scope functions. The characters are formed by a series of X and Y analog currents developed by Character Generating

I.C.'s. A set of 50 different characters are provided, with the capability to add others as the need arises. Included are all of the numerals, most of the alphabet in upper case, the symbols,  $p$ ,  $n$ ,  $\mu$ ,  $m$  and other special symbols.

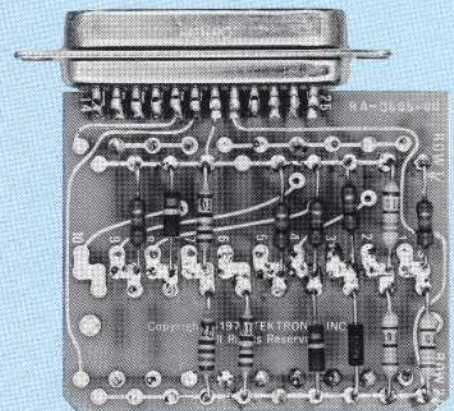
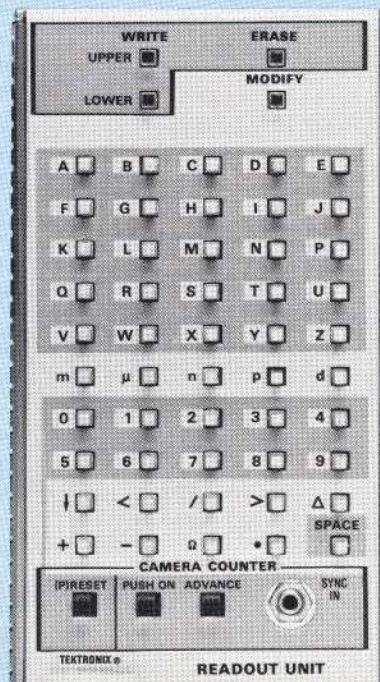
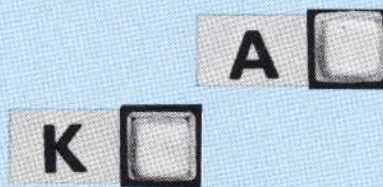
To minimize coding complexity an analog coding scheme was developed in which data is encoded by means of resistors and switch closures. This data is generated in the plug-in by connecting these resistors between time-slot pulses and data output lines via the appropriate switch. The coding scheme includes two channels for each plug-in so that dual trace amplifiers and delaying/delayed time bases can be accommodated. A maximum of eight words can be displayed, corresponding to two channels for each of four plug-ins. The position of each word on the CRT is fixed and related to the plug-in from which it comes. Each channel will display one word having up to ten characters. The characters are normally written without redundant spaces, but spaces can be called for in the code if desired. Only those channels in use have their readout displayed.

## Some Benefits of Readout

Now, what are some of the benefits afforded by CRT READOUT? To those whose work entailed photographing the waveform a major benefit was immediately apparent. The vertical deflection factors and sweep rates could be recorded right on the film with the



The 5403 Oscilloscope features 60-MHz bandwidth, plug-ins and CRT READ-OUT.



Optional readout programming board for the 5403.



7M13 Readout Unit for the 7000-Series.