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AEC-NASA TECH BRIEF

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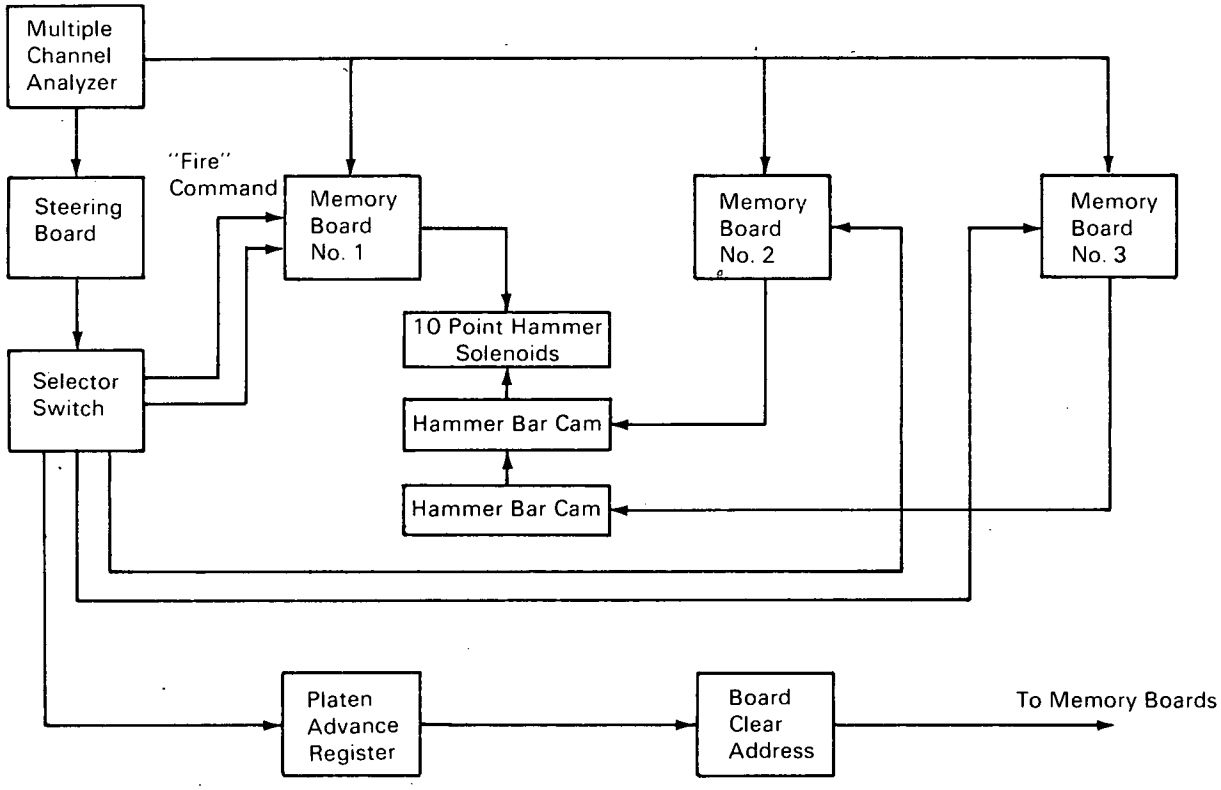
High-Speed Digital Plotter



Block Diagram of Digital Plotter

The problem:

To provide a digital plot of the output from a multichannel analyzer. The techniques and equipment used to perform this function should be capable of high-speed and flexible operation in producing irregular as well as smooth curves. Prior methods require the use of complex and expensive equipment, and are generally capable of plotting only 2 to 7 channels/sec. Typical commercial plotters are controlled by analog voltages from the analyzer, and are subject to amplifier drift. Log diodes in the analyzer cannot decode more than two significant digits.

The solution:

A modified typewriter mechanism controlled in both axes by digital signals. Standard logic components, e.g., shift registers, memory elements, and adders, are used to provide a high-speed, flexible, and inexpensive means of controlling the plotter. The unit can plot irregular curves at approximately 14 channels/sec, and smooth curves at over 25 channels/sec, and is not sub-

(continued overleaf)

ject to analog error or drift. It is capable of decoding three significant digits.

How it's done:

The mechanical components consist of a basic typewriter frame and platen mechanism, with the keys and type removed. Ten equally spaced, solenoid-operated hammers mounted on a movable hammer bar (translation carriages) are positioned horizontally along the longitudinal axis of the platen. The translation carriage, operated by two cam assemblies, may select any one of 100 discrete positions between the solenoid hammers. Thus point-plot information is "typed" using ordinary paper and typewriter ribbon in an operation similar to the action of a standard typewriter. The electronic components consist of three memory boards and associated logic circuitry to provide the analyzer/plotter interface.

The analyzer output for a given channel is represented in five decades, with the first decade being unused, i.e., having no stored information. The digits of each decade are transmitted to the plotter over ten output wires connected in parallel with memory boards 1, 2, and 3. As the analyzer sweeps through its decades, a pulse is produced for each decade and transmitted to the steering board. The selector switch is preset to extract the first four consecutive pulses from the steering board, with the remaining pulses being discarded. The first extracted pulse transmitted to memory board 1 is a "fire command" which instructs the memory board to fire, or energize, the "0" hammer solenoid, since the first analyzer decade contains no stored information. This step provides a reference base for the subsequent digits, or intervals of interest. Assume now that 521 is the number to be plotted. The second extracted pulse is stored for future use in memory board 1, and represents the first analyzer decade containing the desired information, in this case the digit 5. The third pulse, representing the digit 2, is transmitted to memory board 2 which actuates the first set of cams, and moves the hammer bar two-tenths of the distance between the hammer solenoids. The fourth pulse, representing the digit 1, is transmitted to memory board 3 which actuates the second set of cams, and moves the hammer bar one-hundredth of the distance between the hammer solenoids. Thus the hammer bar is now displaced from its normal zero position by 0.21 of the distance between two hammer solenoids. On the next sweep of the analyzer through its decades, the first pulse will command memory board 1 to "fire." However, the memory board now contains stored information, and the sixth solenoid, corresponding to the digit 5, energizes. Since the 5 digit is displaced 0.21 from its normal zero position, the point plotted is 521. The first pulse also actuates the platen advance and clears the memory boards so that the next channel may be read out.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Division of Technical Information
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Reference: B71-10049

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to:

Technology Utilization Officer
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