NASA TECH BRIEF

NASA Pasadena Office

Numerical Interactive Controller

The problem:

To enlarge the picture displayed on a digital video display system so that any portion can be viewed in enlarged form for observation of specific details and features, and to generate a light-dot cursor to identify data cells on the enlarged display.

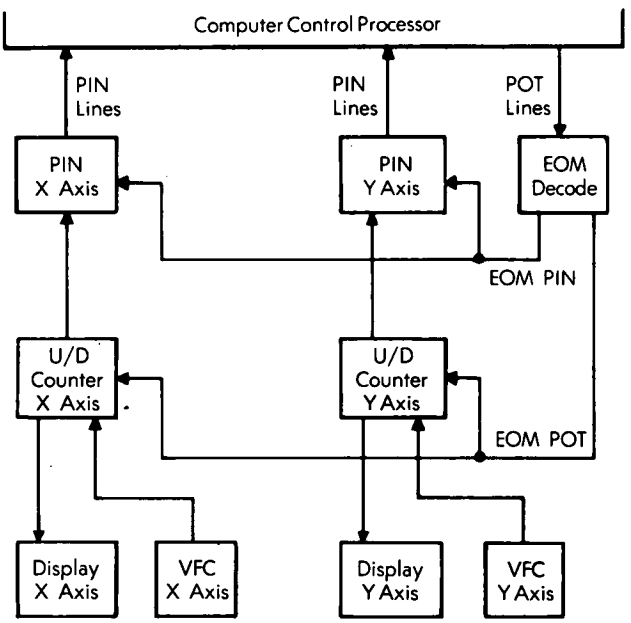
The solution:

A small, peripheral device, compatible with specific digital computers, which allows interaction of an operator with the data in the computer central processor in order to shift the frame of the data in Cartesian coordinates and slew the desired data into view. A "cursor generator program" is used in conjunction with the device to provide a light pen with sufficient resolving power to identify any particular set of coordinates with single-cell accuracy.

How it's done:

The numerical interactive controller (NIC), which generates pulses of variable repetition rates, clocks the X and Y axes. The variable clocking in the X and Y data registers, which are transferred to the computer, allows an image displayed on a digital video display system or an X-Y plotter to be displaced a corresponding amount in the X and Y directions. The amount of shift in each axis is conveniently monitored by a 3-decimal digit plus sign display, using positive and negative number cyclic counting. A lever on the device is used for coordinate control, which controls the frequency of pulses used for shifting the data. The greater the displacement from center, the higher the pulse rate; the direction of the displacement determines whether the numbers are increasing or decreasing in the X and Y registers.

The functional flow diagram illustrates the interface with the computer. The NIC is composed of two duplicate channels (X and Y), each comprising a variable frequency clock (VFC) oscillator and controller capable of generating pulses from 1 Hz to 1000



Hz in two ranges. The pulses from the VFC oscillator and controller are counted in an up/down (U/D) counter having a count display which shows the decimal count and the direction of counting. Counts cycle to 999 in the positive direction, change sign and then count from —998 to zero; the counting and display is cyclic. It is necessary only to keep track of the number of cycles in a large displacement; the three decimal digits in the positive and negative directions

(continued overleaf)

give high resolution with minimal hardware. The count in the up/down counter is strobed into a specific computer register (via parallel input PIN) and then into memory where data can be used to displace or otherwise enter into a computation. The NIC can be preset by the computer via parallel output (POT) so that the data is stored in the up/down counter and displayed on the 3-digit display.

The energize output medium (EOM), PIN, and POT commands are timed signals. Parallel input/output operations, where a data transfer of up to 24 bits is involved, consists of two instructions. Before the transfer of data can occur, an EOM signal must be given to alert the NIC that an exchange is imminent. The instruction following the EOM will be either a POT for data leaving the computer, or a PIN, if the transfer is to be *into* the computer.

Notes:

1. A digital video display system, with which the NIC can be used, is described in NASA Tech Brief B73-10132.
2. Requests for further information may be directed to:

   Technology Utilization Officer
   NASA Pasadena Office
   4800 Oak Grove Drive
   Pasadena, California 91103
   Reference: TSP 73-10294

Patent status:

This invention has been patented by NASA (U.S. Patent No. 3,729,129). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

NASA Patent Counsel
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