

EIGHT CHANNEL SCANNER AND TIMING CONTROLLER FOR PHYSIOLOGICAL DATA ACQUISITION

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Abstract. A system is described which enables the sequential conversion into digital form, and printing or punching on paper tape of up to eight channels of physiological data. A control unit allows the selection of acquisition-window time for each successive channel of data, programs the measurement parameters, and switches in the appropriate signal line. The system will accept mixed analog data, i.e. continuous slowly-varying signals (ECG, EEG, temperature, etc.) as well as pulse data (action potentials, etc.), and is capable of direct analog-to-digital conversion, or of the counting functions: totalizing, time interval between pulses, period, etc. The basic DAS components are standard Hewlett-Packard instruments. The controller is assembled from Digital Equipment Corporation M-series digital modules.

Introduction. Data acquisition systems have become universally available for single channel automatic operation, and for multi-channel operation in applications where acquisition parameters are the same for all channels. In the collection of physiological data, it is often necessary to have sequential measurements of different kinds of data, i.e. requiring a different set of acquisition parameters for each channel. Commercial systems provide this capability by inclusion of a small general-purpose computer within the structure. The controller described here is capable of sequential scanning of two to eight channels of data, with intermixed data windows of 5 milliseconds to greater than 50 seconds, and with full remote programming facilities when attached to a suitable channel data acquisition system.

Description of controller. Timing originates at an internal adjustable clock, or is provided externally. Basic clock rate is 1 KHz, and from it are derived secondary clock rates of 200 Hz and 500 Hz. (See block diagram). By appropriately programming one column of the first section of the matrix programming board, the pulse rate at the output of the Countdown can take on one value in the range 1000, 500, 200

through 0.1, 0.05, 0.02 Hz in decade steps. This establishes the "scan position duration" (or data window) for the corresponding "scan position", that is, the time spent in acquiring a data point from one signal channel. The output pulse from the Countdown advances the Scan Driver by one position. The Scan Driver is a Binary-to-Octal decoder, and it gates on the appropriate acquisition parameters (in this case the FUNCTION and RANGE controls of the remotely-programmable Counter) and the desired signal channel for that scan position according to the placement of programming pins in each section of the matrix board. The Scan Driver also gates on the appropriate scan position duration column in the matrix.

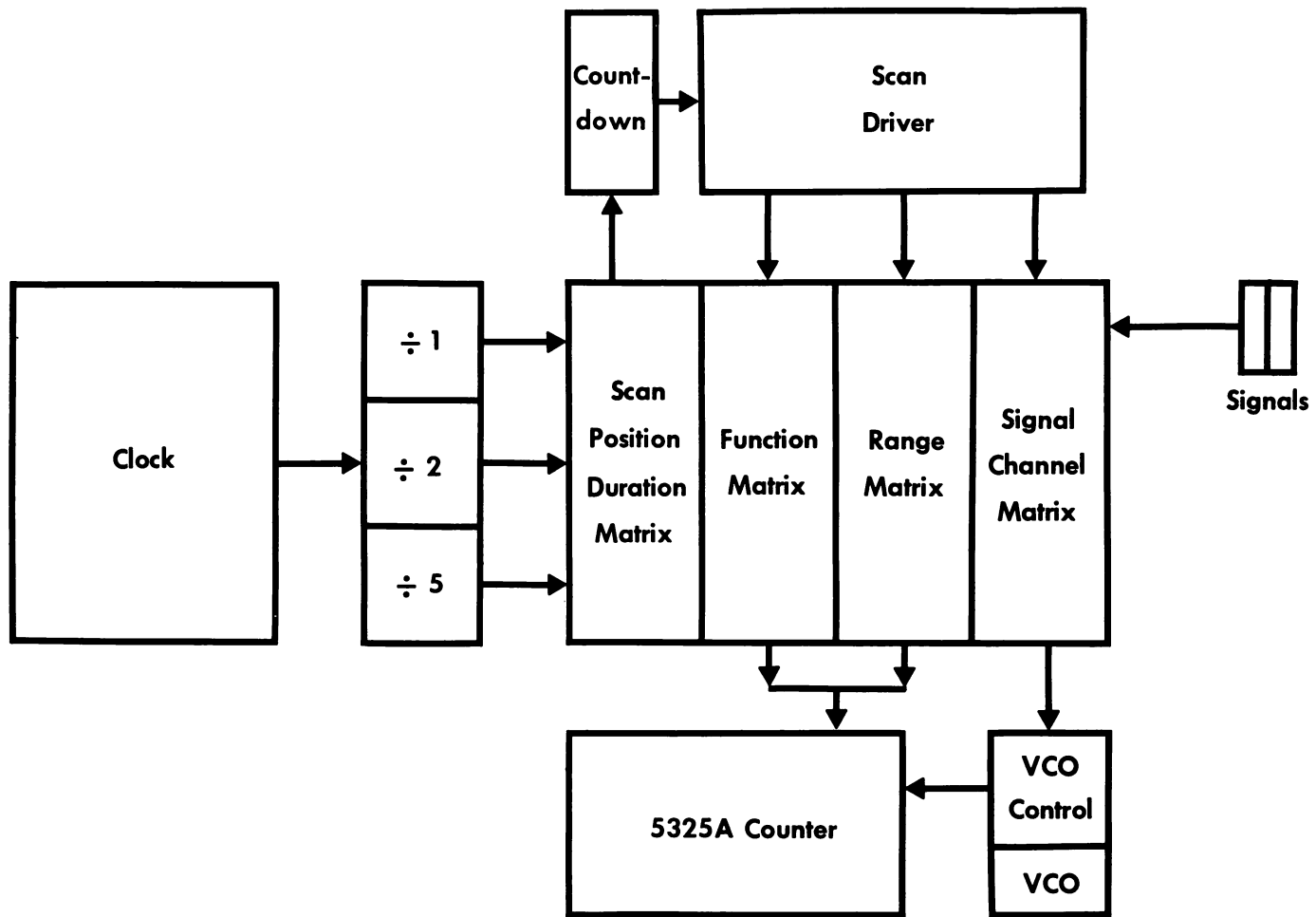
Seven Counter functions and nine ranges are available. Any one of eight signal channels can be utilized in any of the eight scan positions. Depending on whether the incoming data is pulse or analog, a voltage-controlled oscillator (VCO) can be programmed to precede the counter in any scan position. For pulse data, the signal bypasses the VCO. Signal switching is achieved with field-effect transistor switches.

In the case where less than eight signal channels are active a Return-to-Zero can be programmed for the terminal scan position, and the controller then recycles.

Transfer pulses (scan advance) signal the data acquisition system at the end of each scan position, and cause transfer of the Counter register contents to a preselected output device (print or punch).

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BLOCK DIAGRAM OF CONTROLLER