Analog Sampling Program 2

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ANALOG SAMPLING PROGRAM 2

INTRODUCTION

ASP2 is a second generation PDP11 assembly language program that will sample up to 25,000 data points at a faster rate then ASP.[1] A sixteen channel, 12 bit A/D converter is triggered at specific intervals, and the DMA hardware moves the data into memory. Number of readings per channel, number of channels (starting with channel 0) to be read, and interval time, are all user selectable. This program was specifically written for quench studies but can be modified for other data collecting uses.

GENERAL

The data points are taken in bursts and stored sequentially in memory. Each burst is triggered by the interval time selected by the user. The number of channels read in each burst is also selected by the user. Minimum time between bursts is dependent on the number of channels read; i.e., if 10 or more channels are read, then minimum time is 0.6 milliseconds. If less than 10 channels, then minimum time is 0.5 milliseconds. If only 1 or 2 channels, this time could be 0.3 milliseconds. (See Table 1.) The channel number along with its digitized analog value (data point) is stored in memory. After the data acquisition period, the stored words are transferred as 16 bit words to a floppy disk file. The lower 12 bits (0-11) contain the digitized analog value. The upper 4 bits (12-15) contain the channel number. Up to four separate files can be stored on the floppy disk.

The retrieval of data from the floppy disk is the same routine that is used with ASP, and the routines generated for the Tektronix 4051 to read and plot specific channels is the same as for ASP.

ASP2 does not rely on any operating systems. All of the I/O handlers, algorithms, etc., are contained within the program.

PROGRAM OUTLINE

Run parameters are set up by user. The setup sequence follows:

SELECT INITIAL DELAY (MILLISEC)

Timing for the system is initiated by an external pulse which starts the clock. This instruction allows the user to delay the start of data-taking. The delay time has a range between 0.010 milliseconds and 999 milliseconds.

SELECT FIRST INTERVAL DELAY (MILLISEC)

This instruction allows the user to select the timing between bursts of data samples. When the initial delay period is over, the A/D is trig-gered and the first burst of channels are sampled. The clock is reset for timing future data intervals. Each time the clock overflows, the A/D is triggered and another burst of channels is taken (hardware interrupt). The program sits in a wait loop and allows the hardware and software interrupts to govern the data acquisition. This first interval delay range is between 0.5 milliseconds (10 channels or less) or 0.6 milliseconds (10 channels or more) and 999 millisec.

SELECT NUMBER OF FIRST INTERVAL READINGS PER CHANNEL

This instruction allows the user to select the number of times each channel will be sampled in the first time interval. Multiplying the in-terval delay by the number each channel is to be read gives total time required for first interval. Multiplying the number of times each channel is to be read by number of channels gives total number of data samples to be taken.

SELECT SECOND INTERVAL DELAY (MILLISEC)

This instruction allows the user to change the interval time between bursts. The interval time will automatically change to the new interval after the total number of readings per channel have been taken. This delay has the same range as the first interval delay.

SELECT NUMBER OF SECOND INTERVAL READING PER CHANNEL

This instruction serves the same purpose as the first interval reading. The first number of reads per channel times the number of channels added to the second number of reads per channel, times the number of channels should not exceed 25,000. (For 28K core)

SELECT # OF CHANNELS TO BE READ

This instruction allows the user to select the number of channels to be read in each burst. Each burst always starts with channel 00 and read up to channel 15 depending on the number the user has selected.

DUMP TO TAPE ? Y OR N

This instruction allows the user to select the option of sending the data to a tape file in the Tektronix 4051 or not. If the Tektronix 4051 is not in the system and a regular terminal is being used and the user selects "Y", the data points will be put up on the terminal. If "N" is selected, then the data points will be stored on a floppy disk file only.

ENTER DISK FILE # TO USE (0, 1, 2, OR 3)

This instruction allows the user to select a file on the floppy storage disk, disk 1, to store the data.

REQUIRED HARDWARE

PDP11	28 K Memory
Dual Floppy Disk	
A/D	Data Translation DT1762 with DMA
Clock	KWV 11-A
Line Printer	
CRT terminal or Tektronix 4051 (for plots)	

COMMENTS

The program has been tested and is free of hardware and software bugs. The lower interval time limits (0.5 & 0.6 milliseconds) is governed by the memory refresh system in the LSI-11. Modification can be made in the program to take advantage of all 32 channels on the A/D. This means a second memory location would be needed for channel address. Therefore, 1/2 the number of readings could be taken.

ASP has been modified and is presently being used to take magnet measurements.

TABLE 1	
# Channel	Interval Time
1 to 2	0.3 millisec
3 to 5	0.4 millisec
6 to 10	0.5 millisec
10 to 16	0.6 millisec

REFERENCE

1. Analog Sampling Program, EP&S Tech Note No. 85, V. Kovarik and R. Stoehr, 11/20/78.

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