

Chapter 7

Description of DSP-Based Signal Averager Software

Introduction

A programmable system has an advantages that the developing process is mainly concentrated in software. Many tools are provided to simplify the tasks. On developing process, a program is written in high-level language which is compiled later to give the instructions that understood by the target system. Simulators are used in verification process. The complete program is then saved in a non-volatile memory which resided in the system.

From chapter 6, two microprocessor-based parts are presented: the TMS320 part and the MCS32 part. An assembly-language program based on averaging algorithms has been developed for the TMS320 part which based on TMS32010 to perform averaging computation. A BASIC-language program and an assembly-language program have been developed for the MCS32 part to communicate with user via a liquid crystal display and a rotary encoder. As mentioned earlier, all of the control programs are resided in the MCS32 part. Two 32k x 8-bit memory chips of 27256 type are used. The first one which contains BASIC interpreter program and a command/statement extension program is in 0000h-7fffh area. The other one which reside in 8000h-f7fffh area contains BASIC control program and TMS320 program.

MCS32 Control Program

The MCS32 control program is a software unit that control the operations of other parts. User-interfacing is also controlled by this program via the encoder and LCD. However, controlling LCD and the encoder requires a fast execution program which cannot handle by a BASIC program. Thus, a program written in assembly language called command/statement extension program is required. These extension commands can be called within the BASIC program as reserved functions. The flowchart of the MCS32 control program is shown in Fig. 7-1.

After power-on reset, 8032 chip executes the initialization procedure. The program memory of TMS32010 is then transferred into the memory part, followed by setting the parameters as previously saved in the RAM. Menu-driven procedure is followed in which routine and configuration procedures are the selectable choices. In the routine procedure, three options are provided: averager, processor, and data transfer. Choosing the data transfer procedure activates the MCS32 to wait for the connection from a PC. If averager or processor procedure is chosen, MCS32 will activate TMS32010 to perform that procedure.

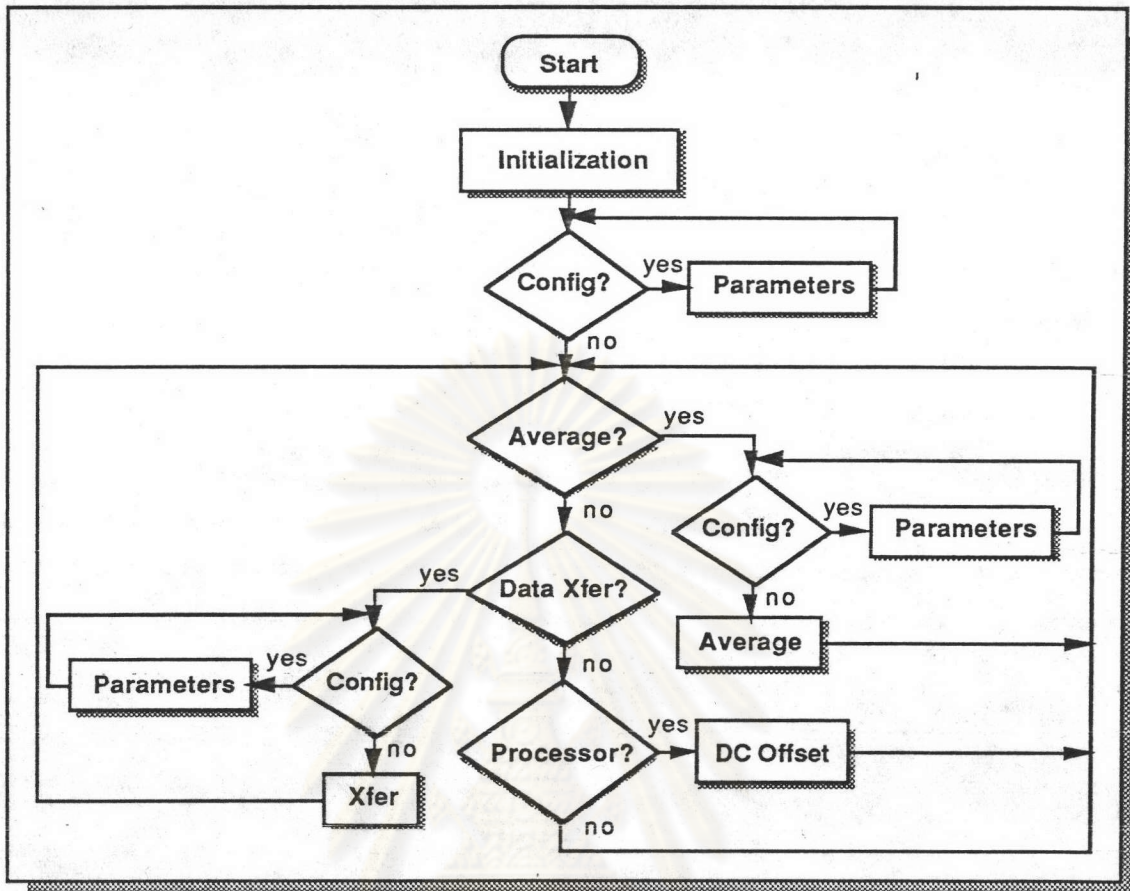


Fig. 7-1 Flowchart of the MCS32 control program.

MCS32 Command/Statement Extension Program

This is the part of program which written with an assembly language. The purpose of the program is to added some BASIC commands which is useful for specific task. In this design, the commands are added to perform the interfacing operations with LCD and the encoder.

1) LCD Interfacing Program

Liquid crystal display is an electronics device which interface with microprocessor via a 8-bit data bus as a memory unit. The position of a display character occupies one location in the memory address. Displaying a character on the display is accomplished by writing the desired character ASCII code into the specified address. This interfacing program is written for performing this task. An extended command can be used like the reserved "PRINT" command in which the string of text can be used as an argument.

2) Optical Encoder Interfacing Program

An optical encoder is a device that gives 2 channels of output pulse denoted by 'A' & 'B'. When rotating the encoder in a clockwise direction, the output 'A' leads 'B' by 90°. For the signal averager, the encoder is used to give a relative value of the position. The interfacing program performs like a digital up/down counter in which the encoder is a clock generator. The up or down operation is selected by determining the direction of the rotation.

TMS32010 Signal Processing Program

The TMS32010 program can be executed by initiating command from the MCS32 part. The entire program is composed of averaging procedure, post-processing procedure and I/O control procedure. The flowchart of the MCS32 control program is shown in Fig. 7-2.

After activating by the MCS32, the program is in initialize process where as parameters are set as specified by user. When the TMS32010 is ready for acquiring the data, it gives the signal to make the trigger signal sensitive. Trigger signal puts TMS32010 in waiting state in which a pulse from dwell input starts the sample sequence. Averaging procedure is executed after the ADC data is read by the TMS32010. The result is recorded in the data memory and sent to the input of DACs. Finally, the position of sample is compared with setting length, sweep, and depth to determine the next sample.

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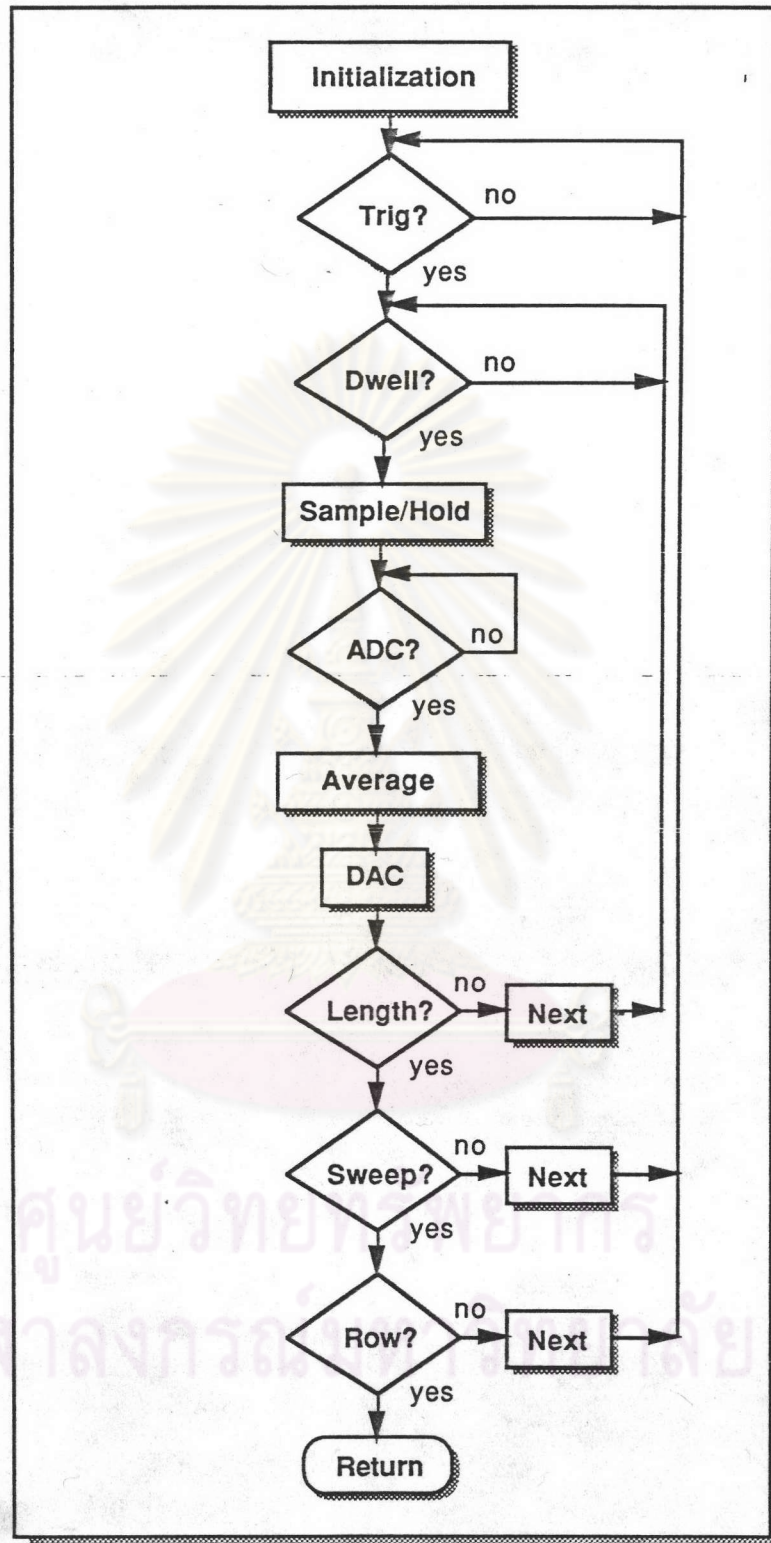


Fig. 7-2 Flowchart of the TMS32010 signal processing program.