Controlling Temperature by Microcomputer

Shahrokh Khanizadeh¹

Agriculture Canada, 430 Boul. Gouin, St-Jean-sur-Richelieu, Que., J3B 3E6, Canada

Additional index words. data transfer, computer software

In most biological studies, temperature control is of great importance, especially in studies where the temperatures are not static and reproduction of precise temperature fluctuations over time is necessary. Changing temperature by hand is laborious and time-consuming. For example, in cold-hardiness studies, 21/2 days are required if temperature is decreased from 0 to -30C at a rate of 0.5C/h. Microcomputer technology and interface controller cards permit adjustments of temperature automatically. This communication describes an application of a computer software program for simplifying temperature regulation in controlled environment applications.

An FST MC-4-80 Multi-Cool mechanically refrigerated chamber, equipped with an FST TC-40 controller (FST System, Stone Ridge, N.Y.), was employed as a cooling device. A 12 MHz IBM-PC AT 286 (Micro A/L, Nepean, Ontario) was equipped with a Metrabyte MBC-488 interface card (Omega Engineering, Stamford, Conn.). The MBC-488 is a half-length card that can be used in any slot, including short half slots in any compatible IBM-PC/XT/AT. It is capable of performing data transfers directly to/from the General Purpose Interface Bus (GPB), from/to memory using direct memory access (DMA). The back of the card includes a standard

IEEE-488 connector for direct interface to the IEEE-488 bus. An IEEE-488 24-pin connector cable was used to connect the MBC-488 card to the FST TC-40 controller. The MBC-488 card uses the special software driver GPIBDVR.COM (Omega Engineering). This driver is not part of the ROM (read only memory) operating system, and has to be loaded after booting. The program "Temperature Controller" (Khanizadeh, 1988) was developed on an IBM/AT using MS-DOS version 4.0 and GW-BASIC version 3.23. It was compiled with the Microsoft Basic compiler. This software is capable of controlling or recording the temperature of an environment for a selected time interval. After loading and executing, the program searches for an MBC-488 IEEE-488/GPIB interface card, and then prompts the user to select one of the following options: 1) send temperature data to a device, or 2) receive temperature data from a device. Brief instructions regarding each step are included.

The first option allows the user to control the temperatures. When this option is selected, the operator receives a prompt to enter the following information: a) a range of temperatures, e.g., 0 to 25C by 0.1, or user-defined decrements, e.g., 20C, 10C, -5C, and -10C, or increments, e.g., -20C, -10C, 0C, 1C, 5C, 10C, and 20C; b) a constant time interval in minutes for changing the temperatures. During execution, the screen will display the following information: a) number of different temperatures sent to the device, b) number of different temperatures yet to be sent, c) present temperature of the device, and d) accumulated time since the operator started the program run.

The second option permits the user to monitor the temperature of the environment. The operator receives a prompt to enter the following information: a) a file name to store temperature data, and b) a time interval, in minutes, for reading the temperature. An example of a saved file is given in Fig. 1.

The software described above is available at a nominal cost upon request to the author on 3.5- or 5.25-inch micro flexible disk. It can be run on an IBM-PC/XT/AT and other bus compatible machines equipped with a MBC-488 IEEE/GPIB and a 3.5- or a 5.25-inch disk drive.

Literature Cited

Khanizadeh, S. 1988. Temperature Controller, Version 1.0, Copyright 1988, registration no. 367247, Consumer and Corporate Affairs Canada, Copyright Office, Ottawa.

Date,Time,Count,Temperature

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"03-01-1989","21:13:01",1,"-0100"
"03-01-1989","21:18:01",2,"-0200"
"03-01-1989","21:23:01",3,"-0400"
"03-01-1989","21:28:01",4,"-0600"
"03-01-1989","21:33:01",5,"-0800"
"03-01-1989","21:38:01",6,"-0900"
"03-01-1989","21:43:01",7,"-0950"
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Fig. 1. An example of a saved file using Temperature Controller.

Received for publication 2 Apr. 1990. Agriculture Canada, Contribution no. 335/90.03.04R. I wish to thank Ian Wallace, librarian with Agriculture Canada, for viewing and testing the program. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

¹Research Scientist.