

CEG-453/653 Laboratory Project 1

A Microcomputer System Using the SBC68K

This project is to familiarize students with the SBC68K and MC68000 programming. It also provides a test environment, which can be used to determine whether or not later projects are functioning correctly.

1. Familiarize yourself with the lab environment by following instructions in the handout entitled "453 Lab Help."
2. Construct a microcomputer system based on the SBC68K Educational Computer Board (ECB). The system uses a 16-key matrix-type keypad (see Figure 1) for input and two output devices, a personal computer (PC) monitor and a seven-segment LED. The 16-key keypad should be controlled and read through the eight-bit-I/O Port A, of the 68230 PI/T on the ECB. The seven-segment LED should be controlled through Port B of the PI/T. The PC should be connected to the serial port of the ECB through an RS232 link.
3. Write a C program for the ECB, which implements the following system.
 - a. The main function of the program sends a message to the PC monitor requesting the input of a positive integer (0 to 9) and displays the corresponding number with the seven-segment LED display. The same operation should be repeated until the program is terminated. Use `getc()` and `printf()` for PC terminal input and output. (You do not need to use the C directive: `#include <stdio.h>`.)
 - b. The 16-key keypad should be sampled at approximately 20 millisecond intervals. (Use the timer portion of the 68230 PI/T with an interrupt service routine to implement the sampling interval timing.) The entry of a key other than "." and "C" should cause the display of the corresponding character on the PC monitor. The entry of "." is considered as a carriage return and should start a new line on the display. Pressing the key "C" (clear) will return control to the TUTOR program via a TUTOR TRAP #14 call. Moreover, "debouncing" of the keys should be done in the software; that is, no key activation should be recognized until it has been stable for at least five sampling periods (.1 seconds). Assume no multiple keys get pressed at the same time and no auto repeat.
4. Replace `getc()` and `printf()` with TUTOR TRAP #14 routines. Note that these TRAP routines use various MC68000 data and/or address registers in addition to the ones documented in the ECB manual, and may not restore their original values. Therefore, your program must save any register values, which are important before issuing the TRAP #14 instruction, and restore the values when the I/O operation has been completed. Also, your interrupt service routine should save all the registers it will use, restoring their original values before the RTE (Return From Exception) instruction is executed.

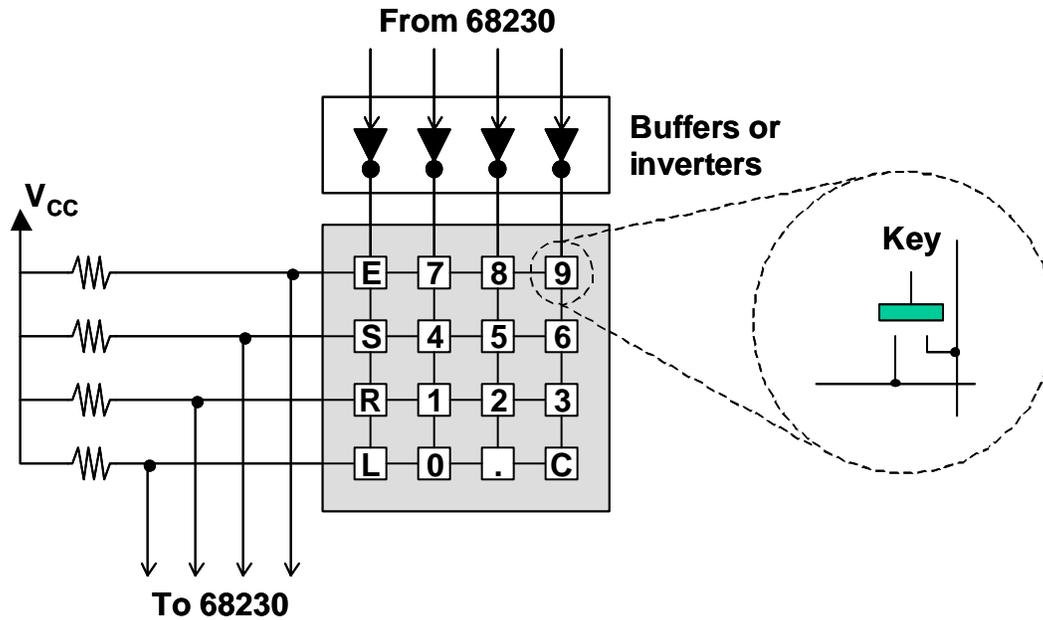


Figure 1. The 16-key keypad. Resistor values are not critical –any value between $1K\Omega$ and $5K\Omega$ will work

Lab Notebook

Each lab group is required to maintain a bound laboratory notebook, in which dated entries are made describing all work done in the laboratory during the quarter. All schematic circuit diagrams should be prepared on the notebook before the circuits are wired. This notebook will be checked by the lab TA during project checkout, and will be turned in at the end of the quarter with the final report.

Report

No report is required for this project. However, diagrams and listings of the hardware and software used in this project must be included in the final laboratory report.