

Lab #11

Interface to a Hexadecimal Keypad

PURPOSE

This lab introduces interfacing a keypad to a 68000 microprocessor through a 6821 peripheral interface adapter (PIA). Upon completion of this lab, students will be able to do the following:

- Write program to perform input/output operations using a 6821 PIA.
- Write programs that scan rows and columns of a keypad to determine if a key is pressed.
- Write programs to perform software debouncing.

PREPARATION

Prior to the scheduled lab session, read the following sections from your textbook:

- Section 9.11 (6821 Peripheral Interface Adapter)
- Section 9.12 (Hexadecimal Keypad Interface)

MATERIALS

Hardware:

- 68KMB 68000-based computer
- I/O Board #5 for the 68KMB
- I/O Board #2 for the 68KMB
- PC host computer
- RS232C serial interface cable
- 20-conductor ribbon cable

MS-DOS Software:

- A68K 68000 cross assembler
- XLINK 68000 linker, locator, conversion utility
- PC-VT VT100 terminal emulator
- EDIT MS-DOS text editor (or equivalent)

68000 Programs:

- KEYPAD provided in 68KMB directory
- KEYPAD2 to be written

INTRODUCTION

This is the fifth in a series of labs to explore interfacing with the 68KMB. I/O Board #5 is quite different from the boards used in the preceding labs. Instead of interfacing to the 68681 on the 68KMB, I/O Board #5 contains its own peripheral interface IC – a 6821 peripheral interface adapter (PIA). The connection to the 68KMB is through J2. J2 includes the required address decoding and control signals to interface to any 8-bit peripheral interface device from the 6800-family. The signals on J2 of the 68KMB are illustrated in Figure 8-16 in *The 68000 Microprocessor*.

The connection between I/O Board #5 and connector J2 of the 68KMB is illustrated in Figure 11-1.

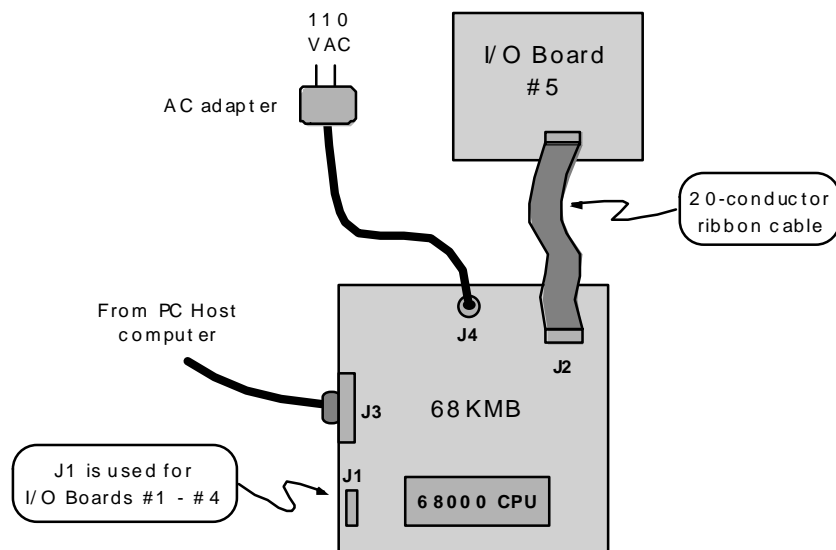


Figure 11-1. Connecting I/O Board #5 to J2 on the 68KMB

The hexadecimal keypad has 16 pressure-sensitive switches arranged in four rows and four columns. These connect to Port A on the 6821 PIA. The complete interface is shown in Figure 11-2.

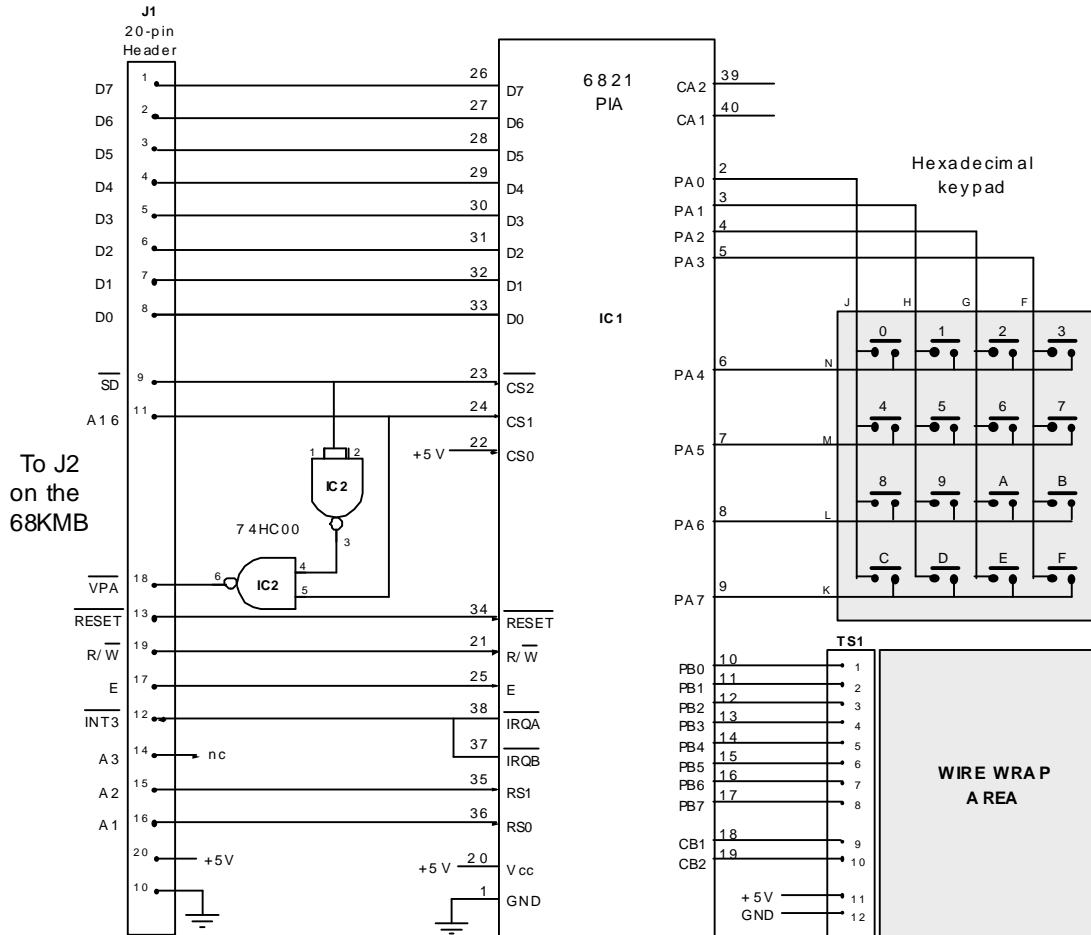


Figure 11-2. I/O Board #5

The 6821 PIA and the keypad interface are discussed in Section 9.11 and Section 9.12 of your textbook. Review this material before proceeding.

PROCEDURE

1. With the 68KMB powered-off, connect I/O Board #5 to J2.

2. Power-on the 68KMB and the PC host computer. Execute PC-VT and obtain the MON68K prompt from the 68KMB.
3. An example program called KEYPAD is presented in Example 9-12 in your textbook. KEYPAD scans the rows and columns of the keypad to determine if a key is pressed. The program includes software debouncing to ensure the mechanical contacts in the keypad have stabilized. When a clean key closure is detected, the ASCII code for the key is sent to the console. Review the software listing and the description of the program to gain an understanding of its operation.

The program is in the directory 68KMB on the PC host computer. Run the program and demonstrate it to your lab instructor. Be prepared to answer questions on the operation of this program.

11.1



4. Power-off the 68KMB. For the next part of this lab, we will use two I/O Boards – I/O Board #5 and I/O Board #2. Connect I/O Board #2 to J1 on the 68KMB. Power-on the 68KMB. Execute PC-VT and obtain the MON68K prompt from the 68KMB.
5. Make a copy of KEYPAD.SRC and save it in a file called KEYPAD2.SRC. Put your name and the date in comment lines at the top. Modify the program such that the output is sent to the 7-segment display on I/O Board #2 (rather than to the console).

Run the new program and demonstrate it to your lab instructor.

11.2



CONCLUSION

This lab has introduced interfacing to a hexadecimal keypad, including scanning the rows and columns of the keypad and debouncing mechanical switches through software.