NetMedia

Basic Express
Application Note

Interfacing Keypads to BasicX Systems

Introduction

This application note describes both the hardware and software methods required to interface a 4 x 4 matrix keypad to a BasicX system.

Keypad

The size of a matrix keypad is defined by the number of keys it contains and how the keys are arranged. Typically the first number of a keypad description (such as 6 x 4) tells you the number of keys it has across, and the second number is the number of keys down. By multiplying these two numbers together you get the total number of individual keys. When the two numbers are added together you get the number of I/O lines needed to read the keypad.

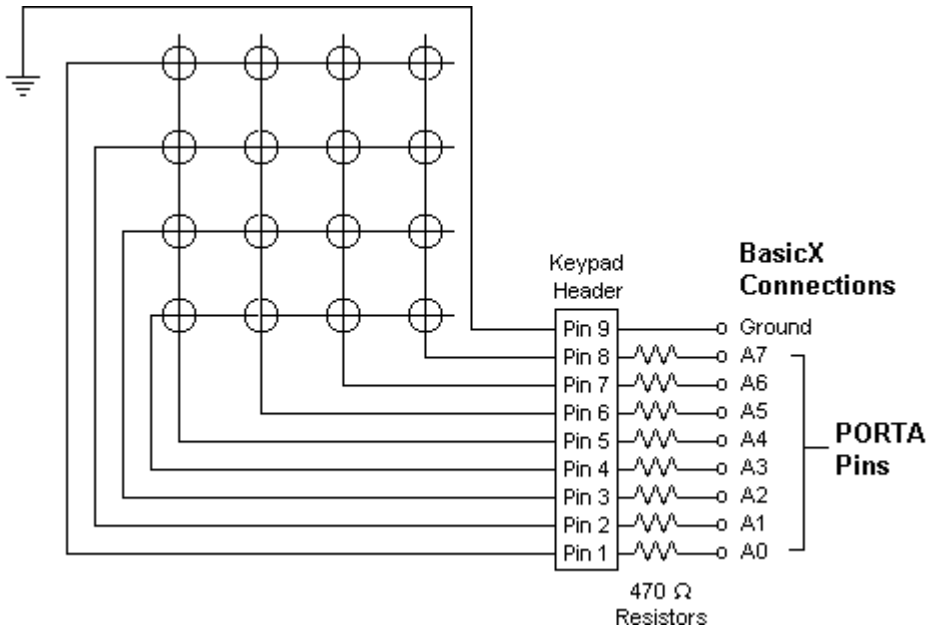

Figure 1

Hardware

Figure 1 shows how to interface a typical 4 x 4 keypad to the BasicX. The 470 Ω resistors on I/O lines A0 - A7 are not *required* to get the device to work, but are recommended to help to protect the lines from static discharge or accidental shorting.

In this example, the PORTA register is used to read the matrix keypad. As seen in Figure 1, the first 4 I/O lines from PORTA (A0 to A3) are used for the horizontal matrix connections. The remaining 4 lines (A4 to A7) are tied to the keypad's vertical matrix connections.

BX-01 PORTA pin numbers: 32 to 39 (32 is MSbit, 39 is LSbit -- note reversed ordering)

BX-24 PORTA pin numbers: 13 to 20 (13 is MSbit, 20 is LSbit -- note reversed ordering)

Software

The keypad is read in 3 steps -- first we read the horizontal pins, then the vertical pins, then combine the readings.

Step 1 -- the vertical pins (A4 to A7) are set to output-low, while the horizontal pins (A0 to A3) are set to input-pullup. Code:

```
Register.DDRA  = bx1111_0000
Register.PORTA = bx0000_1111
```

As you can see from Figure 1, any keypresses will bring low one or more of the input pins -- otherwise all 4 bits stay high. At this point the input pins are read from the lower 4 bits of register PINA:

```
Dim Horizontal As Byte
Horizontal = Register.PINA
```

Step 2 -- we reverse the pin configurations. The horizontal pins are set to output-low, while the vertical pins are set to input-pullup. Then the upper 4 bits of PINA are read:

```
Register.DDRA  = bx0000_1111
Register.PORTA = bx1111_0000

Dim Vertical As Byte
Vertical = Register.PINA
```

Step 3 -- take the both of the 4-bit readings of PINA and combine them into a single 8-bit value:

```
Dim KeypadValue As Byte
KeypadValue = Vertical Or Horizontal
```

Example program

An example program is provided in separate file Keypad.bas.