

4x4 matrix keypad



This is how the HEX keypad is connected, each square with a number or letter in it is a push to make switch, which connects the horizontal wires (rows) with the vertical wires (columns). So if you press button 'A' it will connect COL1 with ROW4, or pressing button '6' will connect COL3 with ROW2. For a numeric (4x3) keypad COL4 will be missing, and 'A' and 'B' replaced with '*' and '#' but is otherwise the same. The sample programs use a lookup table for the keys; this would need to be changed to insert the correct values for the non-numeric characters.

As the switches are all interconnected, we need a way to differentiate between the different ones - the four resistors on the interface board pull lines COL1 to COL4 high, these four lines are the ones which are read in the program. So in the absence of any switch being pressed these lines will all read high. The four ROW connections are connected to output pins, and if these are set high the switches will effectively do nothing - connecting a high level to a high level, results in a high level.

In order to detect a switch we need to take the ROW lines low, so if we take all the ROW lines low - what happens? Assuming we press button 1, this joins COL1 with ROW1, as ROW1 is now at a low level, this will pull COL1 down resulting in a low reading on COL1. Unfortunately if we press button 4, this joins COL1 with ROW2, as ROW2 is at a low level this also results in a low reading at COL1. This would only give us four possible choices, where each four buttons in a COL do exactly the same (e.g. 1, 4, 7, and A are the same).

The way round this is to only switch one ROW at a time low, so assuming we set ROW1 low we can then read just the top row of buttons, button 1 will take COL1 low, button 2 will take COL2 low, and the same for buttons '3' and 'F' in COL3 and COL4. The twelve lower buttons won't have any effect as their respective ROW lines are still high. So to read the other buttons we need to take their respective ROW lines low, taking ROW2 low will allow us to read the second row of buttons (4, 5, 6, and E), again as the other three ROW lines are now high the other 12 buttons have no effect. We can then repeat this for the last two ROW's using ROW3 and ROW4, so we read four buttons at a time, taking a total of four readings to read the entire keypad - this is a common technique for reading keyboards, and is called 'Keyboard Scanning'.