

Keypad Scanning: C Version

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1

Agenda

- ❑ C version of AVR240 keypad scan

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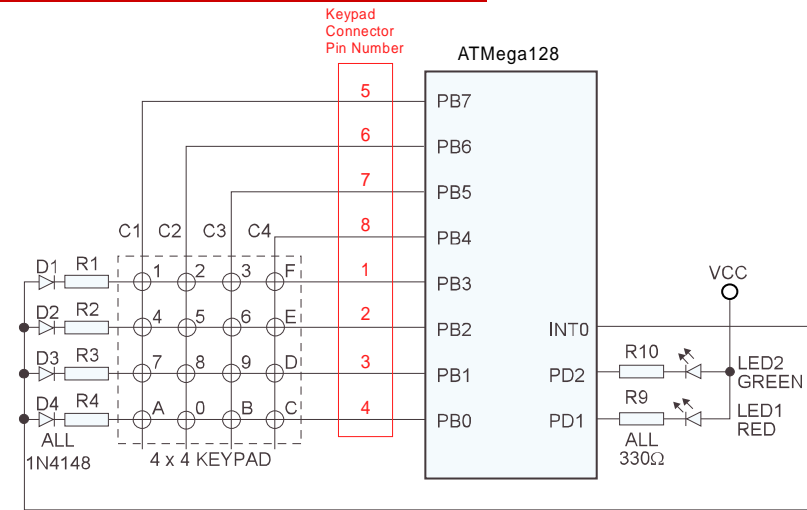
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2

C Version of AVR240 Keypad Scanning

- The keypad scanning algorithm implemented in assembler in AVR240 is implemented in C in the program keyscan_portb.c in the folder Keypad Project Code in the Module 01: Keypad and LCD Display on Blackboard.

Keypad to ATmega128 Interface



Variable Modifiers

- ❑ There are several variable modifiers that can be used to control the location and the use of different variables.
- ❑ For variables declared in the global section. (Not in a function or block), the location modifiers are:
 - `__flash` store in CODE ROM
 - `__eeprom` store in EEPROM
 - the default is store in DATA RAM
- ❑ The `type` directive can be preceded by:
 - `static` makes private to current module.
 - `const` declares as a constant.
- ❑ For variables declared in a function or block statement. no location modifiers can be used, all such variables are auto.
- ❑ The `type` directive can be preceded by:
 - `static` Makes the variable static within the function or block.
 - `const` Makes the variable a constant.

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5

Intrinsic Functions

- ❑ As stated previously, intrinsic functions allow you to control lower level processor functions and also provide you with some useful tools.
- ❑ The following intrinsics are used keypad.c
- ❑ `__delay_cycles(unsigned long num);`
This function produces asm code that delays for the total number of cycles.
- ❑ `__enable_interrupt();`
This function inserts an sei opcode.
- ❑ `__disable_interrupt();`
This function inserts an cli opcode.

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6

Table Lookups

- Table lookup is used to translate the scan code to the desired key code.

```
const char tbl[16] = {12, 11, 0, 10, 13, 9, 8, 7, 14, 6, 5, 4, 15, 3, 2, 1};
```

- This table will be located in DATA RAM and initialized at startup.
- It could be located in CODE ROM. To do this the following code would be used.

```
__flash const char tbl[16] = {...}
```

This would locate the variable tbl into CODE ROM. For more details see IAR AVR C/C++ Compiler Reference guide the chapter on Segment reference.

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7

Interrupt Service Routines in C

- All interrupt functions must be of type void and take no parameters.
- All interrupt functions definitions must be preceded by the `__interrupt` directive. This directive tells the compiler to save all used registers and to use a RETI instruction instead of a RET.
- The pragma directive used before the function declaration declares for which interrupt vectors this function will be called. For example...

```
#pragma vector=INT0_vect
```

is equivalent to

```
.org INT0_vect
jmp ISR_INT0
```
- Multiple vectors can use the same ISR function. For example.

```
#pragma vector=INT0_vect, INT1_vect
```

is equivalent to

```
.org INT0_vect
jmp ISR_INT0
.org INT1_vect
jmp ISR_INT0
```
- Interrupt vector names for the ATmega128 can be found in "iom128.h"

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8

Discussion of Program Listing keypad.c

- ❑ The listing to be discussed is in file keypad.pdf on Blackboard
- ❑ The code for use in the laboratory is provided in file keypad.c

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9

Next Class

- ❑ General discussion of displays
- ❑ Discussion of LCD display modules with parallel interface

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10

Reading Assignment

- ☐ Pondering Panels (article on BB)