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M16C/62

Writing M16C/62 Interrupt Handlers in C

1.0 Abstract

Because interrupt mechanisms are processor (hardware) specific, the ANSI C specification for writing interrupt functions is at best vague. The following article describes how to write hardware and software interrupt handlers in C using Renesas' NC30 C compiler (version 4.XX and earlier) for the M16C series 16-bit microcontrollers.

2.0 Introduction

This application note describes how to write interrupt handlers using Renesas' NC30 C compiler for M16C microcontrollers.

In order to process interrupts, your program must do two things:

1. Properly declare the function handling the interrupt.
2. Set the appropriate interrupt vector to point to the function.

3.0 Hardware Interrupts

By declaring the function as an interrupt handler, the compiled output ends in an "reit" (return from interrupt) instruction rather than the standard "rts" (return from subroutine). For hardware interrupts, use the declaration

```
#pragma INTERRUPT function name
```

Note: "INTERRUPT" must be uppercase.

and the prototype

```
void  function name  (void);
```

Obviously, a hardware interrupt can neither be passed a value nor return a value.

The following is an example hardware interrupt processing program. Note the /B (capital "B") in the pragma statement. This option speeds up interrupt response by switching to CPU register Bank 1. Without this switch, the compiler generates code to stack all registers used by the interrupt functions. Take care in using this option if using an RTOS or nested interrupts (note that this option is compatible with the M30624 starter kit as the ROM Monitor saves both banks of registers as required).

```
/* Prototype declarations *********************************/
  void countplse(void);
#pragma INTERRUPT /B countplse
//note: no leading spaces before #pragma
  void main(void);
/**********************************************************/

int count = 0;

void main(void)
{
 int0ic = 1;      // set interrupt level = 1
 ta0 = 10000;    // 16meg xtal, divide by 8, times 10,000 counts-> 5msec interrrupts.
 ta0mr = 0x40;
 ta0s = 1;        //start counting
 _asm( "fset  i ");    // enable interrupts
 while(1);               // wait for interrupt loop
}



void countplse(void)
{
  _asm( "fset  i ");    // enable interrupts for the ROM Monitor
/* To avoid nesting user interrupts, set all interrupt priority levels to the same
value */

  count++;                        // count pulses on INT0 pin
}
```

Now the second part of the process is to set up the interrupt vector. Included with the compiler is the startup file ‘sect30.inc’. Open this file and near the end, the interrupt vectors are declared. The assembler function label is the C function name preceded by an underscore (_). First define the label as global using the ‘.glb’ pseudo-instruction; then replace the ‘dummy’ label at the appropriate table entry (see sample code below).

```
;-----------------------------------------------------------------
; variable vector section
;-----------------------------------------------------------------
       .section      vector        ;variable vector table
       .org   VECTOR_ADR
```

```
.lword dummy_int            ;BRK    (vector 0)
.org    (VECTOR_ADR+16)
        .
        .
        .
        .lword dummy_int             ;timer A3 (vector 24)
        .lword dummy_int             ;timer A4 (vector 25)
        .lword dummy_int             ;timer B0 (vector 26)
        .lword dummy_int             ;timer B1 (vector 27)
        .lword dummy_int             ;timer B2 (vector 28)
        .glb   _countplse           ;countplse address inserted into table
        .lword _countplse           ;int0
.lword dummy_int            ;int1   (vector 30)
        .lword dummy_int             ;int2   (vector 31)
        .
        .
        .
        .lword dummy_int     ;vector 46 (software interrupt vector)
        .lword dummy_int     ;vector 47 (software interrupt vector)
;=================================================================
```

4.0 Reference

Renesas Technology Corporation Semiconductor Home Page

http://www.renesas.com

E-mail Support

support_apl@renesas.com

Data Sheets

- M16C/62 datasheets, 62aeds.pdf

User's Manual

- NC30 Ver. 4.0 User's Manual NC30UE.pdf
- M16C/60 and M16C/20 C Language Programming Manual 6020EC.pdf

5.0 Software Code

Following is a simple program written for the NC30 compiler to illustrate how to set up Pulse Output Mode on timer A0. This program runs on the MSV1632/62 Starter Kit Board and generates a 200Hz square wave on P7.0. A scope can be connected to pin 4 of JP3 to view the waveform. Be sure to remove IC4 (if installed) or the jumper across pins 3 and 4 at JP3 before running the program.

Note that when you stop the program (under KD30), the square wave output does not stop until the system is reset.

To become familiar with the timer, try changing the output frequency, the clock source, or even switch to a different timer (e.g. TA1, etc.).

```
/***********************************************************************
*
*       File Name: pulsout.c
*
*       Content: Example program for the "TIMER PULSE OUTPUT MODE ON THE
*             M16C/62" application note. Generates a 200 Hz square wave
*             on the P7.0 pin. For the MSV1632/62 starter kit board.
*
*        Compiled with NC30 ver. 3.20.00.
*
*        All timing based on 16 Mhz Xtal
*
*       Copyright, 2003 Renesas Technology Corporation, Inc.
*=======================================================================
*       $Log:$
*=======================================================================*/
#include "sfr62.h"
```

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