

# R8C/10, R8C/11, R8C/12, R8C/13 Group

## Commercial Frequency Determination

### 1. Abstract

This application note describes a program that determines the frequency (50/60 Hz) of a commercial power supply.

### 2. Introduction

The explanation of this issue is applied to the following condition:

Microcomputer	: R8C/10, R8C/11, R8C/12, R8C/13 Group
Main clock input oscillation frequency	: 16MHz

This program can also be used when operating other microcomputers within the R8C/Tiny, provided they have the same SFR (Special Function Registers) as the R8C/11 microcomputers. However, some functions may have been modified.

Refer to the Hardware Manual for details. Use functions covered in this Application Note only after careful evaluation.

### 3. Contents

Specifications for the determination of the frequency of a commercial power supply are described below.

- (1) The commercial power supply frequency after being converted to a square wave is fed into the circuit from the P17/CNTR0 pin and a period from a rise to the next rise of the input waveform is counted. To count it, the timer X in pulse period measurement mode is used, which is set up as follows: count source of timer X = f8, initial value of timer X = 0xFFh, and initial value of prescaler X = 200 - 1 (100  $\mu$ s).
- (2) The frequency is determined by comparing the count value and the threshold value. In the program, the count value is obtained from the timer X register (tx). If the results of five consecutive pulse period measurements are within the range 45 Hz to 55 Hz, then the frequency is determined to be 50 Hz and the flag flag.bit.b\_50Hz is set to "1". If the results are within the range 55 Hz to 65 Hz, then the frequency is determined to be 60 Hz and the flag flag.bit.b\_60Hz is set to "1".
- (3) If the pulse period measurement results are smaller than 45 Hz or larger than 65 Hz, the determination count is recycled, and determination processing is repeated over again.

Note that for reasons of SFR bit assignments, operation in this sample program may involve manipulating some bits whose functions are unused. Make sure the values of these bits are set according to the working condition in the user system.

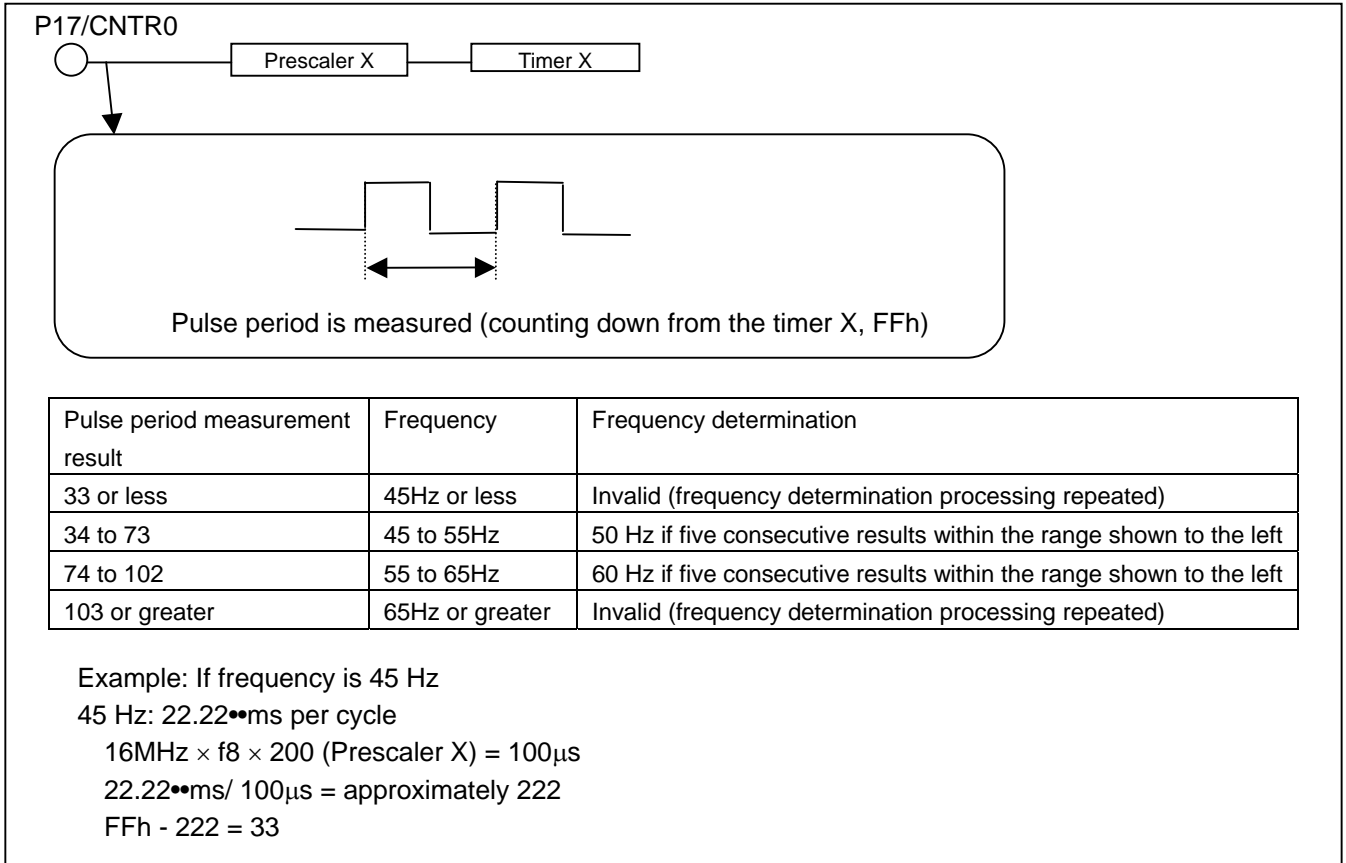


Figure 1. Frequency Determination

3.1 Pins Used

Table 1. List of Pins Used and Their Functions

Pin name	I/O	Function
P17/CNTR0	Input	Commercial frequency (square wave) input

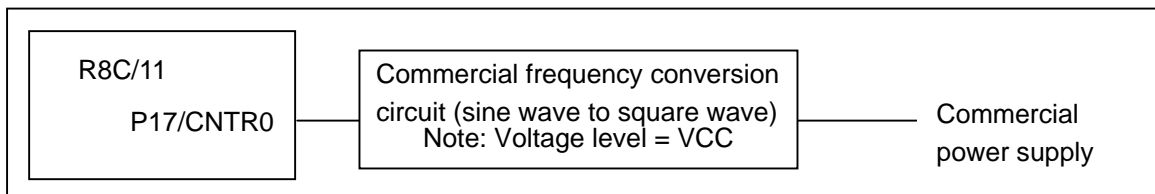


Figure 2. Commercial Frequency Input

### 3.2 Memory Usage

**Table 2. Memory Usage**

Memory Usage	Size	Remarks
ROM	162 bytes	In only the main.c module
RAM	1 byte	In only the main.c module
Maximum user stack used	6 bytes	sfr_init function: 3 bytes Hz_judge function: 3 bytes
Maximum interrupt stack used	0 byte	Unused

The size of the used memory differs with the C compiler version and compile options. The above applies to the conditions given below.

- C compiler: M3T-NC30WA V.5.20 Release 1
- Compile option: -g -O -finfo<sup>Note</sup> - R8C

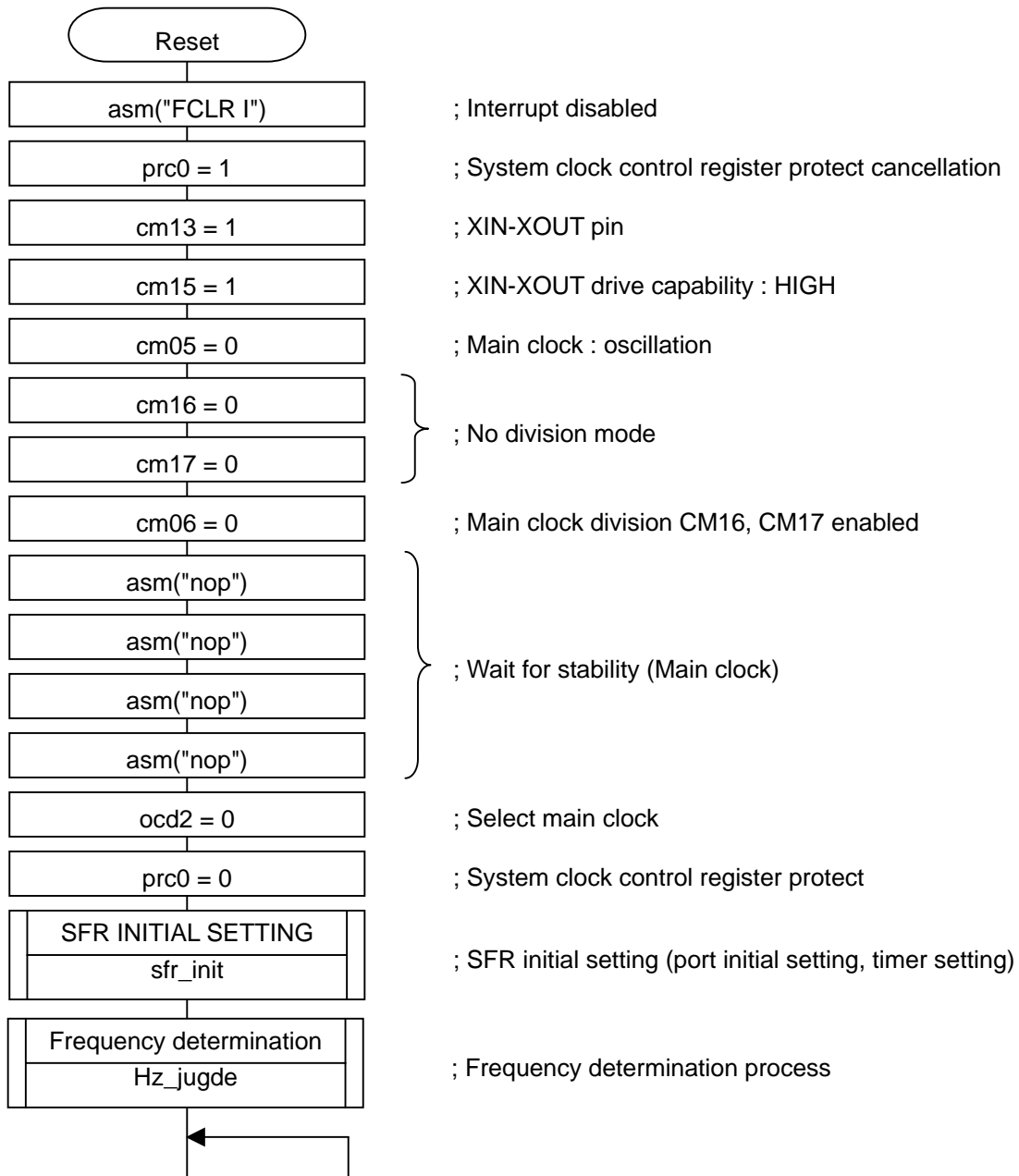
Note: Unusable in the R8C/Tiny-only free version.

**Table 3. RAM Usage and Definition**

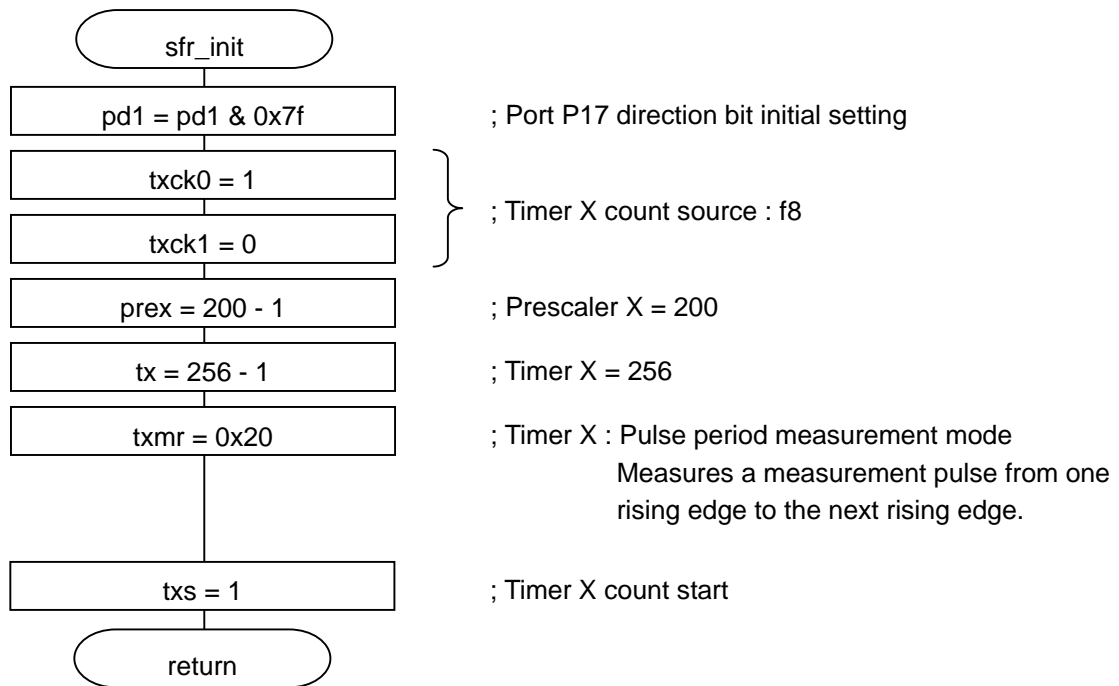
Symbol	Type	Size	Content
flag.bit.b_50Hz	unsigned char :1	1 bit	50 Hz determination flag
flag.bit.b_60Hz	unsigned char :1	1 bit	60 Hz determination flag

## 4. Flow Chart

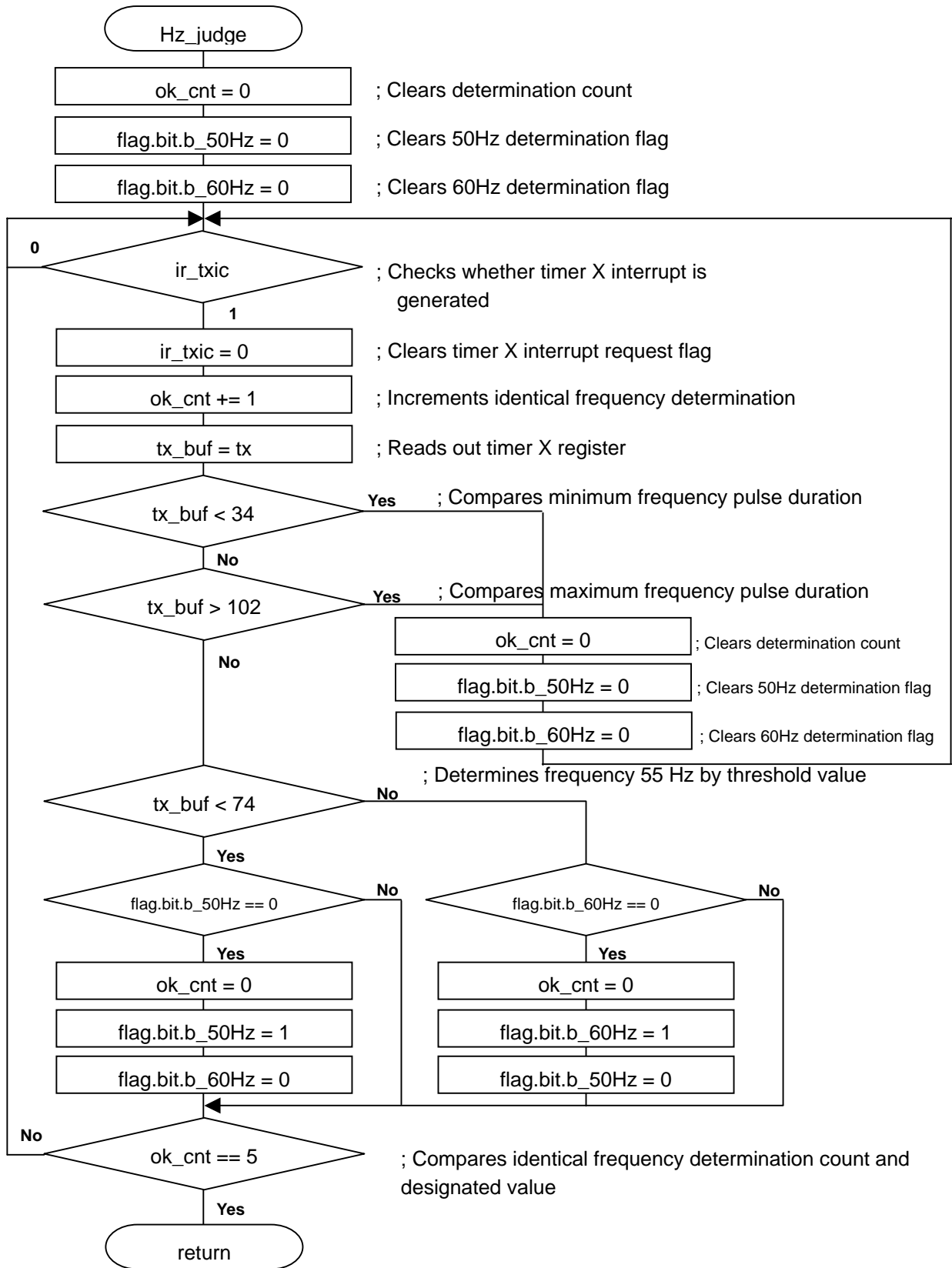
### 4.1 Initial Operation and Main Loop



## 4.2 SFR Initial Setting



4.3 Frequency Determination Process



## 5. Programming Code

```

/*****
*
* File Name      : main.c
* Contents      : Main program of the sample program No.7 R8C/11 Group
* Copyright(C)2003, Renesas Technology Corp.
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* All rights reserved.
* Version       : 1.10
* note          : 0.01 : First version
*                : 1.10(2004.08.02): Comment is revised
*****/
#include "sfr_r811.h"      /* Definition of the R8C/11 SFR */

/* Definition of RAM area */
typedef union{
    unsigned char all;
    struct BFIELD{
        unsigned char b_50Hz      :1;      /* Frequency 50Hz flag */
        unsigned char b_60Hz      :1;      /* Frequency 60Hz flag */
        unsigned char undefined   :6;
    }bit;
}flag_union;
flag_union      flag;

/* Declaration of function prototype */
void sfr_init(void);      /* Initial setting of SFR registers */
void Hz_judge(void);

main() {

    asm("FCLR I");      /* Interrupt disable */
    /*-----
    -Change on-chip oscillator clock to Main clock -
    -----*/
    prc0 = 1;      /* Protect off */
    cm13 = 1;      /* Xin Xout */
    cm15 = 1;      /* XCIN-XCOUT drive capacity select bit : HIGH */
    cm05 = 0;      /* Xin on */
    cm16 = 0;      /* Main clock = No division mode */
    cm17 = 0;
    cm06 = 0;      /* CM16 and CM17 enable */
    asm("nop");      /* Waiting for stable of oscillation */
    asm("nop");
    asm("nop");
    asm("nop");
    ocd2 = 0;      /* Main clock change */
    prc0 = 0;      /* Protect on */

    /*-----
    - Initialize SFR -
    -----*/
    sfr_init();      /* Initial setting of SFR registers */

```

```

/*-----
-           Judge Frequency           -
-----*/
Hz_judge();                               /* Judgment of Frequency */

/*-----
-           Loop of main              -
-----*/
while(1){                                  /* Main processing */
}
}
/*****
Name:      sfr_init
Parameters: None
Returns:   None
Description: Initial setting of SFR registers
*****/
void sfr_init(void){
    /* Setting port direction registers */
    pd1 = pd1 & 0x7f;                    /* CNTR0 port direction = input */

    txck0 = 1;                            /* Timer X count source = f8 */
    txck1 = 0;

    /* 16MHz * 1/8 * 200 = 100us */
    prex = 200 - 1;                       /* Setting Prescaler X register */
    tx = 256 - 1;                          /* Setting timer X register */

    txmr = 0x20;                          /* Pulse period measurement mode */
                                        /* Interrupt at rising edge */
                                        /* Measure a measurement pulse */
                                        /* from one rising edge to the next rising edge */
    txs = 1;                              /* Timer X count start flag = start */
}

```

```

/*****
Name:      Hz_judge
Parameters: None
Returns:   None
Description: Judgment of Frequency
*****/
void Hz_judge(void){

    unsigned int ok_cnt = 0;
    unsigned char tx_buf;

    flag.bit.b_50Hz = 0;          /* Frequency bit clear */
    flag.bit.b_60Hz = 0;          /* Frequency bit clear */

    while(1){                    /* Main processing */
        if (ir_txic == 1){       /* Timer X int check */
            tx_buf = tx;
            ir_txic = 0;         /* Timer X int request clear */

            ok_cnt += 1;         /* O.K. counter +1 */
            if ((tx_buf < 34)    /* Frequency in this time < 45Hz */
                || (tx_buf > 102)){ /* Frequency in this time > 65Hz */
                ok_cnt = 0;      /* O.K. counter clear */
                flag.bit.b_50Hz = 0; /* Frequency bit clear */
                flag.bit.b_60Hz = 0; /* Frequency bit clear */
            }else{              /* 45Hz <= Frequency in this time <= 65Hz */
                if (tx_buf < 74){ /* Frequency in this time < 55Hz */
                    if (flag.bit.b_50Hz == 0){
                        ok_cnt = 0; /* O.K. counter clear */
                        flag.bit.b_50Hz = 1; /* New Frequency set */
                        flag.bit.b_60Hz = 0;
                    }
                }else{          /* Frequency in this time >= 55Hz */
                    if (flag.bit.b_60Hz == 0){
                        ok_cnt = 0; /* O.K. counter clear */
                        flag.bit.b_60Hz = 1; /* New Frequency set */
                        flag.bit.b_50Hz = 0;
                    }
                }
            }
            if (ok_cnt == 5){
                break;
            }
        }
    }
}

```

## 6. Reference

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Hardware Manual

**R8C/10 Group Hardware Manual**

**R8C/11 Group Hardware Manual**

**R8C/12 Group Hardware Manual**

**R8C/13 Group Hardware Manual**

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REVISION HISTORY

Rev.	Date		Description
		Page	Summary
1.10	2004.08.02	-	First edition issued

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