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# H8SX Family

## RTS/L Return from Subroutine with Data Restoration

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### Introduction

Shows an example of C compiler use of the RTS/L instruction.

### Target Device

H8SX/1688 EVA    Maximum mode

### Contents

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## 1. Specifications

- The H8SX family microcomputer RTS/L instruction performs the following processing.
  - Restores the saved data from the stack to the registers specified by the register list.
  - Restores the PC from the stack, and performs processing from the address indicated by the restored PC.
- In this sample task, a subroutine is called from the main routine, and the assembly language code generated by the C compiler is shown.

## 2. Functions Used

This sample task shows an example of use of the RTS/L instruction by the C compiler.

## 3. Principles of Operation

Table 1 shows an example of the assembly language code generated by the C compiler when a subroutine is called.

**Table 1 RTS/L Code**

Sample C Program	Sample Assembly Language Code Generated by the C compiler
void main(void)	<code>_main:</code>
{	<code>.</code>
<code>.</code>	<code>.</code>
<code>.</code>	<code>.</code>
<code>sub_pgm() /* Subroutine call */</code>	<code>BSR _sub_pgm:8 ; Subroutine call</code>
<code>.</code>	<code>.</code>
}	<code>RTS</code>
void sub_pgm(void)	<code>_sub_pgm:</code>
{	<code>PUSH.L ER3 ; Save ER3 to stack</code>
<code>.</code>	<code>.</code>
<code>.</code>	<code>.</code>
<code>.</code>	<code>RTS/L ER3 ; End of subroutine</code>
}	<code>/* End of subroutine */ ; Restore ER3</code>
	<code>.END</code>

## 4. Development Environment

### 4.1 Development Support Tool Versions

The development support tools of this sample task is shown in table 2.

**Table 2 Development Support Tool Versions**

Software Name	Version Used
CH38.EXE	C compiler (H8S, H8/300 series C/C++ compiler) Ver. 6.0.00.005
ASM38.EXE	Assembler (H8S, H8/300 series cross assembler) Ver. 6.0.01.005
OPTLNK.EXE	Linkage editor (optimizing linkage editor) Ver. 8.0.00.020
LBG38.EXE	Library configuration tool (H8S, H8/300 series C/C++ standard library generator) Ver. 2.0.00.000

### 4.2 C compiler Option Settings

C compiler option settings for this sample task are shown in table 3.

**Table 3 C compiler Option Settings**

Option	Set Value
CPu	H8SXA:24:MD
Code	Machinecode
OPTimize	1
REGParam	3
SPEED	Register, SHift, STruct, Expression

## 5. Description of Software

### 5.1 Modules

Modules used by this sample task are shown in table 4.

**Table 4 Modules**

Module Name	Function
main	Main routine Calls rtslstst function.
rtslstst	RTS/L test program Writes data to RAM as dummy processing.

### 5.2 Arguments

No arguments are used by this sample task.

### 5.3 Internal Registers Used

No internal registers are used by this sample task.

### 5.4 RAM Usage

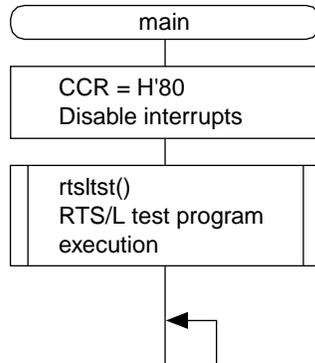
Table 5 describes RAM usage in this sample task.

**Table 5 RAM Usage**

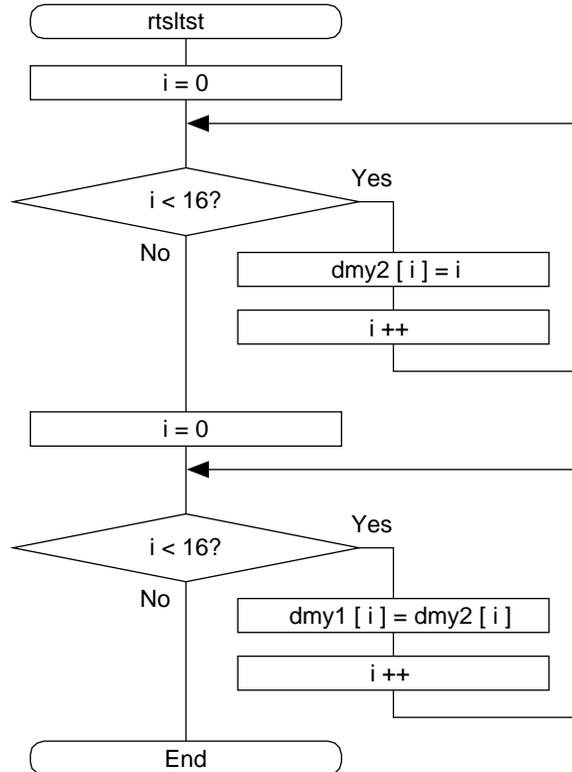
Label	Size	Function
dmy1[16]	16 bytes	For dummy processing

## 6. Flowcharts

### 6.1 Main Routine



### 6.2 RTS/L Test Program



### 6.3 Link Address Specifications

Section Name	Address
CV1	H'000000
P	H'001000
B	H'FEC000

## 7. Program Listing

### 7.1 C Program

```

/*****/
/*
/* H8SX Family
/* Application Note
/*
/* 'RTS/L Test Program'
/*
/* Function
/* : RTS/L
/*
/*
/*
/*
/*
/*****/

#include <machine.h>

/*****/
/* Function define
/*****/
void main ( void );
void rtsltst ( void );

/*****/
/* RAM define
/*****/
long dmyl[16];

/*****/
/* Vector Address
/*****/
#pragma section V1 /* VECTOR SECTOIN SET */
void (*const VEC_TBL1[])(void) = {
    main /* 00 Reset */
};

#pragma entry main(sp=0xFFC000)
#pragma section /* P */
/*****/
/* Main Routine
/*****/
void main ( void )
{
    set_ccr(0x80); /* Initialize CCR/Interrupt Disable */

    rtsltst(); /* RTS/L Test Program */

    while(1);
}

```

```
/* ***** */
/* RTS/L Test Program */
/* ***** */
void rtsltst ( void )
{
    unsigned char i;
    unsigned long dmy2[16];

    for ( i=0; i<16; i++)
        dmy2[i] = i;

    for ( i=0; i<16; i++)
        dmy1[i] = dmy2[i];
}
```

## 7.2 Assembly Language Code Generated by the C compiler

```

P
;*** File main.c      , Line 42
; section
00000000      _main:      ; function: main
00000000 7A0700FFC000      MOV.L      #16760832,SP
00000006 F880      MOV.B      #128:8,R0L
00000008 0308      LDC.B      R0L,CCR
0000000A 5500      BSR      _rtsltst:8
0000000C      L33:
0000000C 4000      BRA      L33:8

;*** File main.c      , Line 54
; function: rtsltst
0000000E      _rtsltst:
0000000E 01006DF3      PUSH.L     ER3
00000012 7A3F0040      SUB.L     #64:16,SP
00000016 18AA      SUB.B     R2L,R2L
00000018      L36:
00000018 0CAB      MOV.B     R2L,R3L
0000001A 1763      EXTU.L   #2,ER3
0000001C 0CA9      MOV.B     R2L,R1L
0000001E 01CC5041      MULXU.B  #4:4,R1
00000022 0D10      MOV.W     R1,R0
00000024 1770      EXTU.L   ER0
00000026 0AF0      ADD.L     SP,ER0
00000028 01006983      MOV.L     ER3,@ER0
0000002C 0A0A      INC.B     R2L
0000002E AA10      CMP.B     #16:8,R2L
00000030 4500      BLO      L36:8
00000032 18AA      SUB.B     R2L,R2L
00000034      L38:
00000034 0CA9      MOV.B     R2L,R1L
00000036 01CC5041      MULXU.B  #4:4,R1
0000003A 0D10      MOV.W     R1,R0
0000003C 1770      EXTU.L   ER0
0000003E 0AF0      ADD.L     SP,ER0
00000040 010800DA00000000      MOV.L     @ER0, @(_dmy1:32,R2L.B)
00000048 0A0A      INC.B     R2L
0000004A AA10      CMP.B     #16:8,R2L
0000004C 4500      BLO      L38:8
0000004E 7A1F0040      ADD.L     #64:16,SP
00000052 5403      RTS/L     ER3

B
; section
00000000      _dmy1:      ; static: dmy1
00000000 00000040      .RES.L     16

CV1
; section
00000000      _VEC_TBL1:  ; static: VEC_TBL1
00000000 00000000      .DATA.L     _main

```

### Revision Record

Rev.	Date	Description	
		Page	Summary
1.00	Sep.15.04	—	First edition issued

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