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Renesas Electronics Corporation

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H8/300H Tiny Series

8-Digit Decimal Subtraction (SUBD)

Introduction

Performs subtraction in this format:

minuend (8-digit 4-bit BCD) – subtrahend (8-digit 4-bit BCD) = difference (8-digit 4-bit BCD).

Target Device

H8/300H Tiny Series

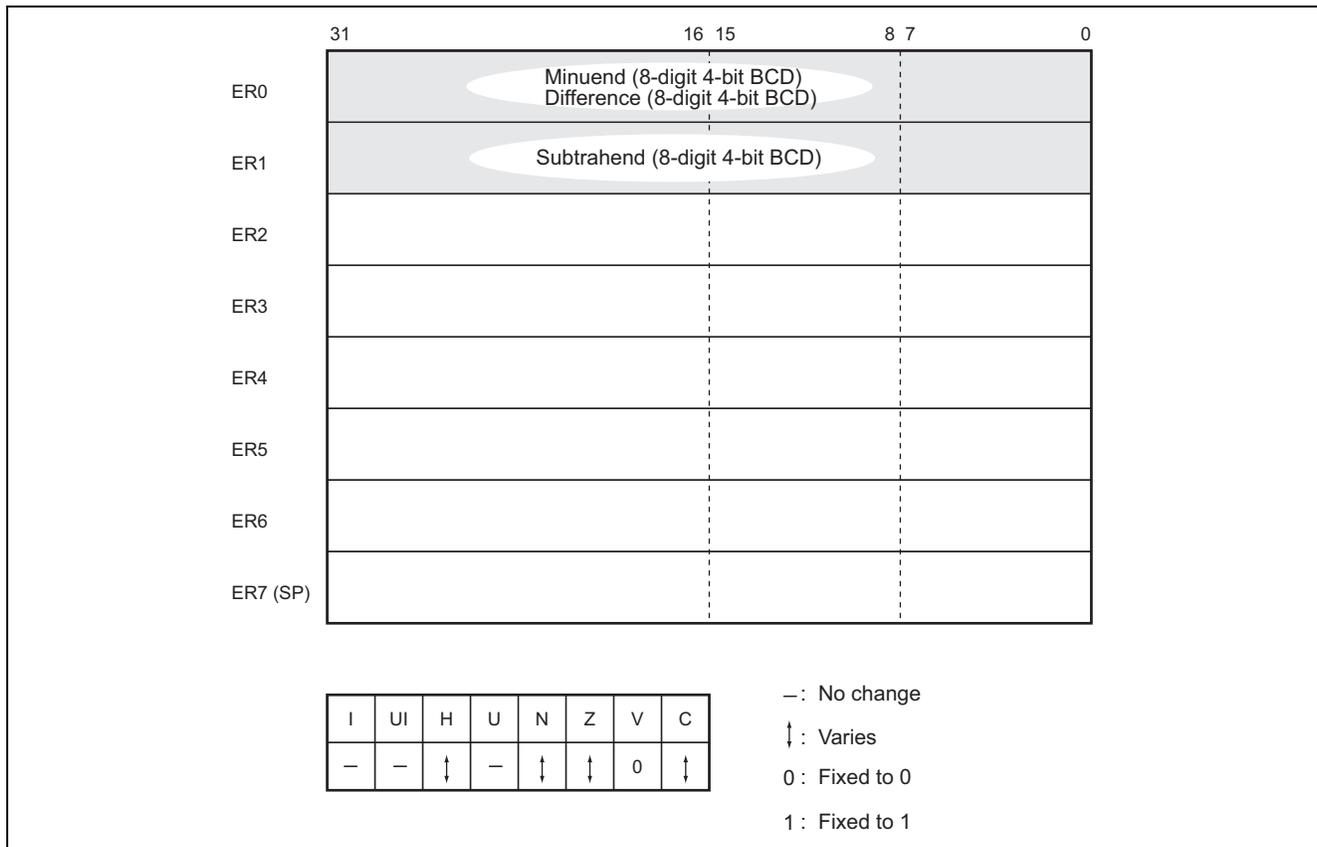
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1. Arguments

Description		Storage Location	Data Length (Bytes)
Input	Minuend (8-digit 4-bit BCD)	ER0	4
	Subtrahend (8-digit 4-bit BCD)	ER1	4
Output	Difference (8-digit 4-bit BCD)	ER0	4
	Occurrence of borrow (yes = 1, no = 0)	C flag (CCR)	—

2. Changes to Internal Registers and Flags



3. Programming Specifications

Program memory (bytes)
28
Data memory (bytes)
0
Stack (bytes)
0
Number of cycles
36
Re-entrant
Yes
Relocatable
Yes
Interrupts during execution
Yes

4. Description

4.1 Description of Functions

1. The arguments are as follows:

ER0: Set the minuend (8-digit 4-bit BCD) as an input argument. This register also holds the difference (8-digit 4-bit BCD) as an output argument.

ER1: Set the subtrahend (8-digit 4-bit BCD) as an input argument.

C flag (CCR): Indicates whether or not a borrow has occurred in the execution of SUBD.

C flag = 1: indicates a borrow.

C flag = 0: indicates no borrow.

2. The following figure illustrates the execution of the SUBD subroutine. When the input arguments are set as shown below, SUBD places the difference in ER0.

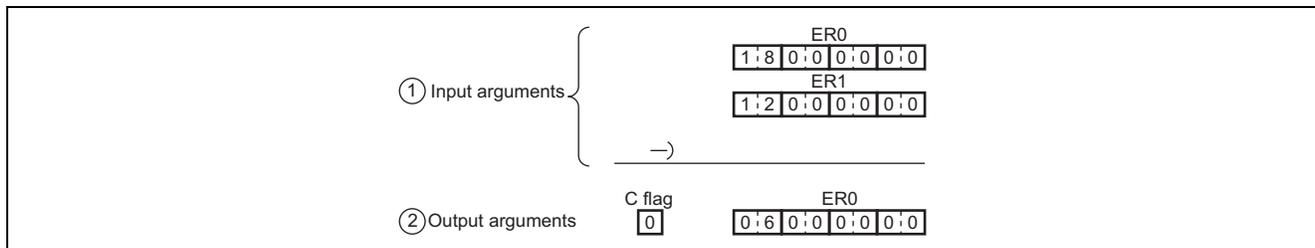


Figure 1 Example of SUBD Execution

4.2 Usage Notes

Since the results of subtraction are placed in the register used to set the minuend, the minuend is lost through the execution of SUBD. When you will still require the minuend, save it elsewhere in memory beforehand.

4.3 Description of Data Memory

No data memory is used by SUBD.

4.4 Example of Usage

After setting the minuend and subtrahend, call the SUBD subroutine.

```

WORK1 . RES. L 1      ..... Reservation of the data memory are a for setting of the minuend (8-digit 4-bit BCD) by the user
                                program.
WORK2 . RES. L 1      ..... Reservation of the data memory are a for setting of the subtrahend (8-digit 4-bit BCD) by the user
                                program.

MOV. L @WORK1, ER0   ..... Sets, as an input argument, the minuend specified by the user program.

MOV. L @WORK2, ER1   ..... Sets, as an input argument, the subtrahend specified by the user program.

JSR @SUBD            ..... Subroutine call of SUBD.

BCS OVER            ..... If the result of subtraction produces a borrow, the nprogram branches to the routine for processing
.                    of borrowing.
.
.

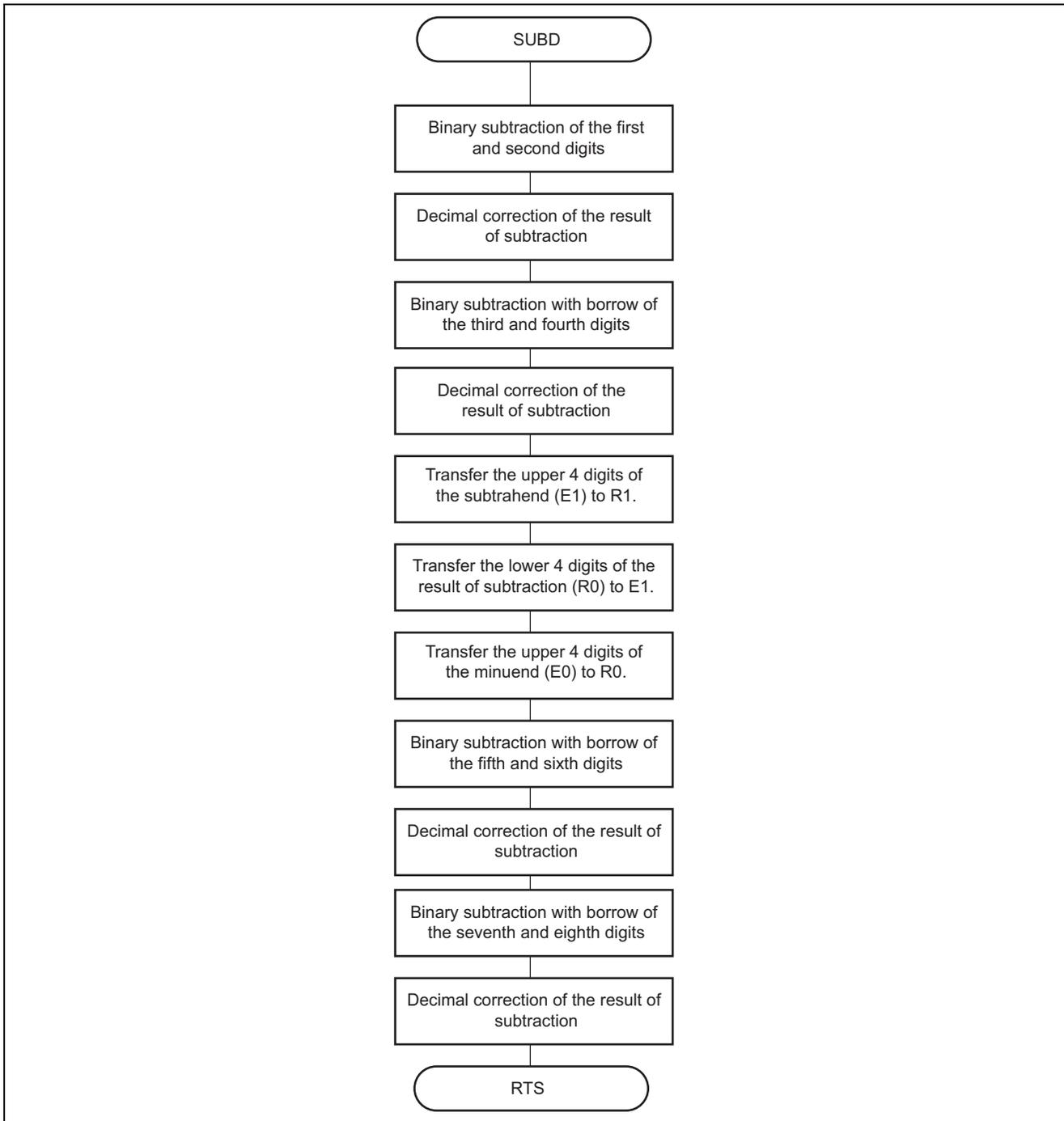
OVER Processing routine for borrowing
.
.
.

```

4.5 Principles of Operation

1. Binary subtraction is performed on two BCD digits at a time, from the lowest-order two digits, and the results of each subtraction are corrected to obtain two digits of 4-bit BCD by the DAS.B instruction. This process is repeated four times.
2. Since borrowing may have to be included in any of the 2-digit subtractions except for that of the lowest-order two digits, the SUBX.B (subtraction-with-borrow instruction) is used for these subtractions.
3. The DAS.B and SUBX.B instructions are inapplicable to the extended registers which hold the higher-order four digits of the minuend and subtrahend, so this subtraction is carried out after these digits have been transferred to general registers.

5. Flowchart



6. Program Listing

```

1          1          ;*****
2          2          ;*
3          3          ;*      NAME      :      8 FIGURE DECIMAL SUBTRACTION   (SUBD)      *
4          4          ;*
5          5          ;*****
6          6          ;*
7          7          ;*      ENTRY      :      ERO      (MINUEND)      *
8          8          ;*
9          9          ;*      RETURNS    :      ERO      (DIFFERENCE)      *
10         10         ;*
11        11         ;*
12        12         ;*****
13        13         ;
14        14         .CPU      300HA
15        15         .SECTION A, CODE, LOCATE=H'001000
16        16         SUBD     .EQU      $      ;Entry point
17        17         SUB.B    R1L,R0L   ;
18        18         DAS      R0L      ;
19        19         SUBX.B   R1H,R0H   ;
20        20         DAS      R0H      ;
21        21         MOV.W    E1,R1    ;
22        22         MOV.W    R0,E1    ;
23        23         MOV.W    E0,R0    ;
24        24         SUBX.B   R1L,R0L   ;
25        25         DAS      R0L      ;
26        26         SUB.B    R1H,R0H   ;
27        27         DAS      R0H      ;
28        28         MOV.W    R0,E0    ;
29        29         MOV.W    E1,R0    ;
30        30         RTS
31        31         .END
32        32
***** TOTAL  ERRORS      0
***** TOTAL  WARNINGS   0

```

Note: The program listing included in this application note assumes compilation under the option for the advanced mode of H8/300H CPU. If you use this sample program with an H8/300H Tiny Series product, make the following change to the program code:

.CPU 300HA → .CPU 300HN

Revision Record

Rev.	Date	Description	
		Page	Summary
2.00	Feb.28.06	—	Format has been changed from Hitachi version to Renesas version.

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