

To our customers,

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Renesas Electronics website: <http://www.renesas.com>

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Renesas Electronics Corporation

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Note : Mitsubishi Electric will continue the business operations of high frequency & optical devices and power devices.

Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

M16C/80 Series

Subtracting BCD

1.0 Abstract

This program subtracts 8-digit BCD data using registers.

This program subtracts 8-digit BCD data between memory locations.

2.0 Introduction

This program subtracts 8-digit BCD data between registers by using a decimal subtract instruction(DSUB). Set the minuend in R2 and R0 and the subtrahend in R3 and R1 beginning with the upper half, respectively. The subtraction result is output to R2 and R0 beginning with the upper half. The borrow information is output to the C flag.

This program subtracts 8-digit BCD data between memory locations by using a decimal subtract instruction (DSUB). Set the least significant memory address of the minuend and that of the subtrahend in the address registers. The subtraction result is output to the minuend's memory location. The borrow information is output to the C flag.

C	Meaning
0	With borrow
1	Without borrow

(1) BCD subtraction (register)

Subroutine name : BCD_SUBTRACT8	ROM capacity : 15byte
Interrupt during execution:Accepted	Number of stacks used : None

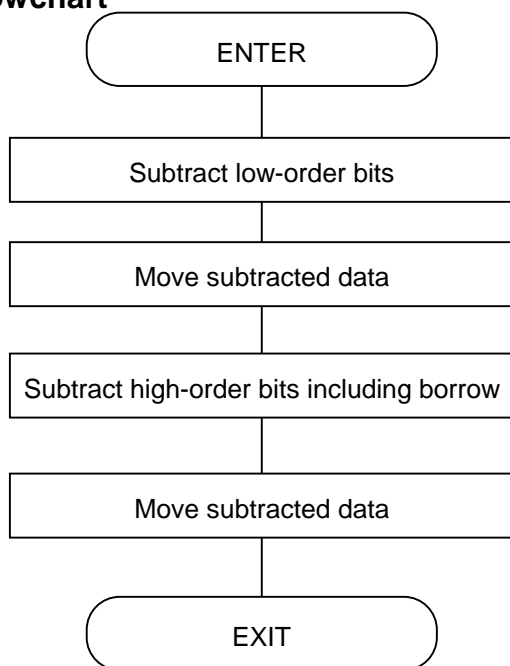
Register/memory	Input	Output	Usage condition
R0	Lower half of minuend	Lower half of subtraction result	←
R1	Lower half of subtrahend	Does not change	←
R2	Upper half of minuend	Upper half of subtraction result	←
R3	Upper half of subtrahend	Does not change	←
A0	-	-	Unused
A1	-	-	Unused
Z flag	-	Borrow information	←
Usage precautions	The minuend is destroyed as a result of program execution.		

(2) BCD subtraction (memory)

Subroutine name : BCD_SUBTRACTmemory8	ROM capacity : 22byte
Interrupt during execution:Accepted	Number of stacks used : None

Register/memory	Input	Output	Usage condition
R0	-	Indeterminate	Used for calculation
R1	-	Indeterminate	Used for calculation
R2	-	-	Unused
R3	-	-	Unused
A0	Minuend address	Does not change	←
A1	Subtrahend address	Does not change	←
Memory indicated by A0	Minuend data	Subtraction result	←
Memory indicated by A1	Subtrahend data	Does not change	←
C flag	-	Borrow information	←
Usage precautions	The minuend is destroyed as a result of program execution.		

3.0 Flowchart



4.0 Programming Code

```

*****
;
; *
;   M16C Program Collection
;   CPU : M16C/80 series
; *
;
*****
VromTOP      .EQU      0FE0000H          ; Declares start address of ROM
;=====
;   Title: Subtracting 8-digit BCD.
;   Outline: Subtracts 8-digit BCD using registers
;   Input:      ----->                Output:
;   R0(Lower half of minuend)          R0(Lower half of subtraction result)
;   R1(Lower half of subtrahend)       R1(Does not change)
;   R2(Upper half of minuend)          R2(Upper half of addition result)
;   R3(Upper half of subtrahend)       R3(Does not change)
;   A0()                                A0(Unused)
;   A1()                                A1(Unused)
;   Stack amount used: None
;   Notes: Result is returned by C flag
;=====
;
;   .SECTION      PROGRAM, CODE
;   .ORG          VromTOP                ; ROM area
BCD_SUBTRACT8:
;
;   DSUB.W        R1,R0                  ; Subtracts low-order bits
;   XCHG.W        R2,R0                  ; Moves subtracted data
;   XCHG.W        R3,R1
;
;   DSBB.W        R1,R0                  ; Subtracts high-order bits
;   XCHG.W        R2,R0                  ; Moves subtracted data
;   XCHG.W        R3,R1
;
;   RTS;
;=====
;
;   Title: Subtracting 8-digit BCD
;   Outline: Subtracts 8-digit BCD between memory locations
;   Input:      ----->                Output:
;   R0()          R0(Indeterminate)
;   R1()          R1(Indeterminate)
;   R2()          R2(Unused)
;   R3()          R3(Unused)
;   A0(Minuend address)  A0(Does not change)
;   A1(Subtrahend address) A1(Does not change)
;   Stack amount used: None
;   Notes: Result is returned by C flag
;=====
BCD_SUBTRACTmemory8:
;
;   MOV.W        [A0],R0
;   MOV.W        [A1],R1
;   DSUB.W        R1,R0                  ; Subtracts low-order bits
;   MOV.W        R0,[A0]
;   MOV.W        2[A0],R0
;   MOV.W        2[A1],R1
;   DSBB.W        R1,R0                  ; Subtracts high-order bits
;   MOV.W        R0,2[A0]
;   RTS
;
;
;   .END ;

```

5.0 Reference

MCU Technical Information Homepage

<http://www.infocom.maec.co.jp/indexe.htm>

(or <http://www.mdece.com/> , <http://www.mitsubishichips.com/products/mcu/index.html> or your local Web Site.)

Technical Support

E-mail: support@apl.maec.co.jp

(or your local support E-mail address. A private e-mail address should NOT be used.)

Data Sheet

M16C/80 group

(Use the latest version on the Homepage: <http://www.infocom.maec.co.jp/indexe.htm>)

User's Manual

M16C/80 group

(Use the latest version on the Homepage: <http://www.infocom.maec.co.jp/indexe.htm>)

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