

# Addition, Subtraction, Multiplication and Division Functions for MCUs

HA0014E

## Introduction

This application program is aimed at 8-bit, 16-bit, 24-bit and 32-bit data calculations. The basic functions include signed and unsigned addition, signed and unsigned subtraction, signed and unsigned multiplication and signed and unsigned division. BCD addition and subtraction functions are also included as well as conversion functions.

## Driver Description

To implement basic 8-bit, 16-bit, 24-bit and 32-bit data calculations there are a total of 48 drivers supplied here. To use these driver an include file CALCULATE.INC and assembly file CALCULATE.ASM must be used. In the HT-IDE3000 development environment, before the interface function, the following steps as described below must be taken:

Step 1: Add the CALCULATE.ASM file into the project using the [Project/Edit] commands.

Step 2: According to the length of the data to be computed, modify the CALCULATE.INC file definitions. (Enable or mask out related define statements)

Step 3: Insert the statement "include calculate.inc" into the application program.

For detailed descriptions of each of the drivers please consult the appendix.

## Appendix

### 8-bit Fixed Point Data Calculation Driver

Driver Name : UNBIN\_ADD\_8  
Description : 8-bit binary unsigned addition calculation  
Parameter : summand --- data0  
            addend --- data4  
Return : to1, to0 (to1 is high 8-bits, to0 is low 8-bits)  
Stack used : none

Driver Name : BIN\_ADD\_8  
Description : 8-bit binary signed addition calculation  
Parameter : summand --- data0  
            addend --- data4  
Return : to1, to0 (to1 is high 8-bits, to0 is low 8-bits)  
Stack used : none

Driver Name : UNBIN\_SUB\_8  
Description : 8-bit binary unsigned subtraction calculation  
Parameter : summand --- data0  
            addend --- data4  
Return : to1, to0 (to1 is high 8-bits, to0 is low 8-bits)  
Stack used : none

Driver Name : BIN\_SUB\_8  
Description : 8-bit binary signed subtraction calculation  
Parameter : minuend --- data0  
            subrahend --- data4  
Return : to1, to0 (to1 is high 8-bits, to0 is low 8-bits)  
Stack used : 1

Driver Name : UNBIN\_MUL\_8  
Description : 8-bit binary unsigned multiplication calculation  
Parameter : multiplicand --- data0  
            multiplier --- data4  
Return : to1, to0 (to1 is high 8-bits, to0 is low 8-bits)  
Stack used : none

Driver Name : BIN\_MUL\_8  
Description : 8-bit binary signed multiplication calculation  
Parameter : multiplicand --- data0  
            multiplier --- data4  
Return : to1, to0 (to1 is high 8-bits, to0 is low 8-bits)  
Stack used : 1



Driver Name : UNBIN\_DIV\_8  
Description : 8-bit binary unsigned division calculation  
Parameter : dividend --- data0  
              divisor --- data4  
Return : to0  
Stack used : none

Driver Name : BIN\_DIV\_8  
Description : 8-bit binary signed division calculation  
Parameter : dividend --- data0  
              divisor --- data4  
Return : to0  
Stack used : 1

Driver Name : BCD\_ADD\_8  
Description : 8-bit BCD addition  
Parameter : summand --- data0  
              addend --- data4  
Return : to1, to0 (to1 is high 8-bits, to0 is low 8-bits)  
Stack used : none

Driver Name : BCD\_SUB\_8  
Description : 8-bit BCD subtraction calculation  
Parameter : minuend --- data0  
              subtrahend --- data4  
Return : to1, to0 (to1 is high 8-bits, to0 is low 8-bits)  
Stack used : none

Driver Name : BINTOBCD\_8  
Description : 8-bit binary to BCD conversion  
Parameter : binary data to be converted --- data0  
Return : to1, to0 (to1 is high 8-bits, to0 is low 8-bits)  
Stack used : none

Driver Name : BCDTOBIN\_8  
Description : Convert BCD data to 8-bit Binary  
Parameter : BCD data to be converted --- data0  
Return : to0  
Stack used : none

**16-bit Fixed Point Data Calculation Driver**

Driver Name : UNBIN\_ADD\_16  
Description : 16-bit unsigned addition calculation  
Parameter : summand --- data1, data0 (data1 highest 8-bits,  
data0 is lowest 8-bits)  
addend --- data5, data4 (data5 highest 8-bits,  
data4 is lowest 8-bits)  
Return : to2, to1, to0 (to2 is bits 16~23, to1 is bits 8~15,  
to0 is bits 0~7)  
Stack used : none

Driver Name : BIN\_ADD\_16  
Description : 16-bit signed addition calculation  
Parameter : summand --- data1, data0 (data1 is highest 8-bits,  
data0 is lowest 8-bits)  
addend --- data5, data4 (data5 is highest 8-bits,  
data4 is lowest 8-bits)  
Return : to2, to1, to0 (to2 is bits 16~23, to1 is bits 8~15,  
to0 is bits 0~7)  
Stack used : none

Driver Name : UNBIN\_SUB\_16  
Description : 16-bit unsigned subtraction calculation  
Parameter : minuend --- data1, data0 (data1 is highest 8-bits,  
data0 is lowest 8-bits)  
subtrahend --- data5, data4 (data5 is highest 8-bits,  
data4 is lowest 8-bits)  
Return : to2, to1, to0 (to2 is bits 16~23, to1 is bits 8~15,  
to0 is bits 0~7)  
Stack used : none

Driver Name : BIN\_SUB\_16  
Description : 16-bit signed subtraction calculation  
Parameter : minuend --- data1, data0 (data1 is highest 8-bits,  
data0 is lowest 8-bits)  
subtrahend --- data5, data4 (data5 is highest 8-bits,  
data4 is lowest 8-bits)  
Return : to2, to1, to0 (to2 is bits 16~23, to1 is bits 8~15,  
to0 is bits 0~7)  
Stack used : 1

Driver Name : UNBIN\_MUL\_16  
Description : 16-bit unsigned multiplication calculation  
Parameter : multiplicand --- data1, data0 (data1 is highest 8-bits,  
data0 is lowest 8-bits)  
multiplier --- data5, data4 (data5 is highest 8-bits,  
data4 is lowest 8-bits)  
Return : to3, to2, to1, to0 (to3 is bits 24~31, to2 is bits 16~23,  
to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : BIN\_MUL\_16  
Description : 16-bit signed multiplication calculation  
Parameter : multiplicand --- data1, data0 (data1 is highest 8-bits,  
data0 is lowest 8-bits)  
multiplier --- data5, data4 (data5 is highest 8-bits,  
data4 is lowest 8-bits)  
Return : to3, to2, to1, to0 (to3 is bits 24~31, to2 is bits 16~23,  
to1 is bits 8~15, to0 is bits 0~7)  
Stack used : 1

Driver Name : UNBIN\_DIV\_16  
Description : 16-bit unsigned division calculation  
Parameter : dividend --- data1, data0 (data1 is highest 8-bits,  
data0 is lowest 8-bits)  
divisor --- data5, data4 (data5 is highest 8-bits,  
data4 is lowest 8-bits)  
Return : to1, to0 (to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : BIN\_DIV\_16  
Description : 16-bit division calculation  
Parameter : dividend --- data1, data0 (data1 is highest 8-bits,  
data0 is lowest 8-bits)  
divisor --- data5, data4 (data5 is highest 8-bits,  
data4 is lowest 8-bits)  
Return : to1, to0 (to1 is bits 8~15, to0 is bits 0~7)  
Stack used : 1

Driver Name : BCD\_ADD\_16  
Description : 16-bit BCD addition calculation  
Parameter : summand --- data1, data0 (data1 is highest 8-bits,  
data0 is lowest 8-bits)  
addend --- data5, data4 (data5 is highest 8-bits,  
data4 is lowest 8-bits)  
Return : to2, to1, to0 (to2 is bits 16~23, to1 is bits 8~15,  
to0 is bits 0~7)  
Stack used : none

Driver Name : BCD\_SUB\_16  
Description : 16-bitBCD subtraction calculation  
Parameter : minuend --- data1, data0 (data1 is highest 8-bits,  
data0 is lowest 8-bits)  
subtrahend --- data5, data4 (data5 is highest 8-bits,  
data4 is lowest 8-bits)  
Return : to2, to1, to0 (to2 is bits 16~23, to1 is bits 8~15,  
to0 is bits 0~7)  
Stack used : none

Driver Name : BINTOBCD\_16  
Description : 16-bit binary conversion to BCD  
Parameter : Binary data to be converted --- data1, data0  
(data1 highest 8-bits, data0 is lowest 8-bits)  
Return : to2, to1, to0 (to2 is bits 16~23, to1 is bits 8~15,  
to0 is bits 0~7)  
Stack used : none

Driver Name : BCDTOBIN\_16  
Description : BCD to 16-bit binary conversion  
Parameter : BCD data to be converted --- data1, data0  
(data1 highest 8-bits, data0 is lowest 8-bits)  
Return : to1, to0 (to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

**24-bit Fixed Point Data Calculation Driver**

Driver Name : UNBIN\_ADD\_24  
Description : 24-bit unsigned addition calculation  
Parameter : summand --- data2, data1, data0 (data2 is bits 16~23,  
data1 is bits 8~15, data0 is bits 0~7)  
addend --- data6, data5, data4 (data6 is bits 16~23,  
data5 is bits 8~15, data4 is bits 0~7)  
Return : to3, to2, to1, to0 (to3 is bits 24~31, to2 is bits 16~23,  
to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : BIN\_ADD\_24  
Description : 24-bit signed addition calculation  
Parameter : summand --- data2, data1, data0 (data2 is bits 16~23,  
data1 is bits 8~15, data0 is bits 0~7)  
addend --- data6, data5, data4 (data6 is bits 16~23,  
data5 is bits 8~15, data4 is bits 0~7)  
Return : to3, to2, to1, to0 (to3 is bits 24~31, to2 is bits 16~23,  
to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : UNBIN\_SUB\_24  
Description : 24-bit unsigned subtraction calculation  
Parameter : minuend --- data2, data1, data0 (data2 is bits 16~23,  
data1 is bits 8~15, data0 is bits 0~7)  
subtrahend --- data6, data5, data4 (data6 is bits  
16~23, data5 is bits 8~15, data4 is bits 0~7)  
Return : to3, to2, to1, to0 (to3 is bits 24~31, to2 is bits 16~23,  
to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : BIN\_SUB\_24  
Description : 24-bit signed subtraction calculation  
Parameter : minuend --- data2, data1, data0 (data2 is bits 16~23,  
data1 is bits 8~15, data0 is bits 0~7)  
subtrahend --- data6, data5, data4 (data6 is bits  
16~23, data5 is bits 8~15, data4 is bits 0~7)  
Return : to3, to2, to1, to0 (to3 is bits 24~31, to2 is bits 16~23,  
to1 is bits 8~15, to0 is bits 0~7)  
Stack used : 1

Driver Name : UNBIN\_MUL\_24  
Description : 24-bit unsigned multiplication calculation  
Parameter : multiplicand --- data2, data1, data0 (data2 is bits  
16~23, data1 is bits 8~15, data0 is bits 0~7)  
multiplier --- data6, data5, data4 (data6 is bits  
16~23, data5 is bits 8~15, data4 is bits 0~7)  
Return : to5, to4, to3, to2, to1, to0 (to5 is bits 40~47,  
to4 is bits 32~39, to3 is bits 24~31, to2 is bits 16~23,  
to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : BIN\_MUL\_24  
Description : 24-bit signed multiplication calculation  
Parameter : multiplicand --- data2, data1, data0 (data2 is bits  
16~23, data1 is bits 8~15, data0 is bits 0~7)  
multiplier --- data6, data5, data4 (data6 is bits  
16~23, data5 is bits 8~15, data4 is bits 0~7)  
Return : to5, to4, to3, to2, to1, to0 (to5 is bits 40~47,  
to4 is bits 32~39, to3 is bits 24~31, to2 is bits 16~23,  
to1 is bits 8~15, to0 is bits 0~7)  
Stack used : 1

Driver Name : UNBIN\_DIV\_24  
Description : 24-bit unsigned division calculation  
Parameter : dividend --- data2, data1, data0 (data2 is bits 16~23,  
data1 is bits 8~15, data0 is bits 0~7)  
divisor --- data6, data5, data4 (data6 is bits 16~23,  
data5 is bits 8~15, data4 is bits 0~7)  
Return : to2, to1, to0 (to2 is bits 16~23, to1 is bits 8~15,  
to0 is bits 0~7)  
Stack used : none

Driver Name : BIN\_DIV\_24  
Description : 24-bit signed division calculation  
Parameter : dividend --- data2, data1, data0 (data2 is bits 16~23,  
data1 is bits 8~15, data0 is bits 0~7)  
divisor --- data6, data5, data4 (data6 is bits 16~23,  
data5 is bits 8~15, data4 is bits 0~7)  
Return : to2, to1, to0 (to2 is bits 16~23, to1 is bits 8~15,  
to0 is bits 0~7)  
Stack used : 1

Driver Name : BCD\_ADD\_24  
Description : 24-bit BCD addition calculation  
Parameter : summand --- data2, data1, data0 (data2 is bits 16~23,  
data1 is bits 8~15, data0 is bits 0~7)  
addend --- data6, data5, data4 (data6 is bits 16~23,  
data5 is bits 8~15, data4 is bits 0~7)  
Return : to3, to2, to1, to0 (to3 is bits 24~31, to2 is bits 16~23,  
to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : BCD\_SUB\_24  
Description : 24-bit BCD subtraction calculation  
Parameter : minuend --- data2, data1, data0 (data2 is bits 16~23,  
data1 is bits 8~15, data0 is bits 0~7)  
subtrahend --- data6, data5, data4 (data6 is bits  
16~23, data5 is bits 8~15, data4 is bits 0~7)  
Return : to3, to2, to1, to0 (to3 is bits 24~31, to2 is bits 16~23,  
to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : BINTOBCD\_24  
Description : 24-bit binary to BCD conversion  
Parameter : Binary data to be converted --- data2, data1, data0  
(data2 is bits 16~23, data1 is bits 8~15, data0 is bits  
0~7)  
Return : to3, to2, to1, to0 (to3 is bits 24~31, to2 is bits 16~23,  
to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : BCDTOBIN\_24  
Description : BCD to 24-bit binary conversion  
Parameter : BCD data to be converted ---data2, data1, data0 (data2 is bits 16~23, data1 is bits 8~15, data0 is bits 0~7)  
Return : to2, to1, to0 (to2 is bits 16~23, to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

**32-bit Fixed Point Data Calculation Driver**

Driver Name : UNBIN\_ADD\_32  
Description : 32-bit unsigned addition calculation  
Parameter :  
summand --- data3, data2, data1, data0 (data3 is bits 24~31, data2 is bits 16~23, data1 is bits 8~15, data0 is bits 0~7)  
addend --- data7, data6, data5, data4 (data7 is bits 24~31, data6 is bits 16~23, data5 is bits 8~15, data4 is bits 0~7)  
Return : to4, to3, to2, to1, to0 to4 is bits 32~39, to3 is bits 24~31, to2 is bits 16~23, to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : BIN\_ADD\_32  
Description : 32-bit signed addition calculation  
Parameter :  
summand --- data3, data2, data1, data0 (data3 is bits 24~31, data2 is bits 16~23, data1 is bits 8~15, data0 is bits 0~7)  
addend --- data7, data6, data5, data4 (data7 is bits 24~31, data6 is bits 16~23, data5 is bits 8~15, data4 is bits 0~7)  
Return : to4, to3, to2, to1, to0 (to4 is bits 32~39, to3 is bits 24~31, to2 is bits 16~23, to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : UNBIN\_SUB\_32  
Description : 32-bit unsigned subtraction calculation  
Parameter :  
minuend --- data3, data2, data1, data0 (data3 is bits 24~31, data2 is bits 16~23, data1 is bits 8~15, data0 is bits 0~7)  
subtrahend --- data7, data6, data5, data4 (data7 is bits 24~31, data6 is bits 16~23, data5 is bits 8~15, data4 is bits 0~7)  
Return : to4, to3, to2, to1, to0 (to4 is bits 32~39, to3 is bits 24~31, to2 is bits 16~23, to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : BIN\_SUB\_32  
Description : 32-bit signed subtraction calculation  
Parameter : minuend --- data3, data2, data1, data0 (data3 is bits 24~31, data2 is bits 16~23, data1 is bits 8~15, data0 is bits 0~7)  
                  subtrahend --- data7, data6, data5, data4 (data7 is bits 24~31, data6 is bits 16~23, data5 is bits 8~15, data4 is bits 0~7)  
Return : to4, to3, to2, to1, to0 (to4 is bits 32~39, to3 is bits 24~31, to2 is bits 16~23, to1 is bits 8~15, to0 is bits 0~7)  
Stack used : 1

Driver Name : UNBIN\_MUL\_32  
Description : 32-bit unsigned multiplication calculation  
Parameter : multiplicand --- data3, data2, data1, data0 (data3 is bits 24~31, data2 is bits 16~23, data1 is bits 8~15, data0 is bits 0~7)  
                  multiplier --- data7, data6, data5, data4 (data7 is bits 24~31, data6 is bits 16~23, data5 is bits 8~15, data4 is bits 0~7)  
Return : to7, to6, to5, to4, to3, to2, to1, to0 (to7 is bits 56~63, to6 is bits 48~55, to5 is bits 40~47, to4 is bits 32~39, to3 is bits 24~31, to2 is bits 16~23, to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : BIN\_MUL\_32  
Description : 32-bit signed multiplication calculation  
Parameter : multiplicand --- data3, data2, data1, data0 (data3 is bits 24~31, data2 is bits 16~23, data1 is bits 8~15, data0 is bits 0~7)  
                  multiplier --- data7, data6, data5, data4 (data7 is bits 24~31, data6 is bits 16~23, data5 is bits 8~15, data4 is bits 0~7)  
Return : to7, to6, to5, to4, to3, to2, to1, to0 (to7 is bits 56~63, to6 is bits 48~55, to5 is bits 40~47, to4 is bits 32~39, to3 is bits 24~31, to2 is bits 16~23, to1 is bits 8~15, to0 is bits 0~7)  
Stack used : 1

Driver Name : UNBIN\_DIV\_32  
Description : 32-bit unsigned division calculation  
Parameter : dividend --- data3, data2, data1, data0 (data3 is bits 24~31, data2 is bits 16~23, data1 is bits 8~15, data0 is bits 0~7)  
divisor --- data7, data6, data5, data4 (data7 is bits 24~31, data6 is bits 16~23, data5 is bits 8~15, data4 is bits 0~7)  
Return : to3, to2, to1, to0 (to3 is bits 24~31, to2 is bits 16~23, to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : BIN\_DIV\_32  
Description : 32-bit signed division calculation  
Parameter : dividend --- data3, data2, data1, data0 (data3 is bits 24~31, data2 is bits 16~23, data1 is bits 8~15, data0 is bits 0~7)  
divisor --- data7, data6, data5, data4 (data7 is bits 24~31, data6 is bits 16~23, data5 is bits 8~15, data4 is bits 0~7)  
Return : to3, to2, to1, to0 (to3 is bits 24~31, to2 is bits 16~23, to1 is bits 8~15, to0 is bits 0~7)  
Stack used : 1

Driver Name : BCD\_ADD\_32  
Description : 32-bit BCD addition calculation  
Parameter : summand --- data3, data2, data1, data0 (data3 is bits 24~31, data2 is bits 16~23, data1 is bits 8~15, data0 is bits 0~7)  
addend --- data7, data6, data5, data4 (data7 is bits 24~31, data6 is bits 16~23, data5 is bits 8~15, data4 is bits 0~7)  
Return : to4, to3, to2, to1, to0 (to4 is bits 32~39, to3 is bits 24~31, to2 is bits 16~23, to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : BCD\_SUB\_32  
Description : 32-bit BCD subtraction calculation  
Parameter : minuend --- data3, data2, data1, data0 (data3 is bits 24~31, data2 is bits 16~23, data1 is bits 8~15, data0 is bits 0~7)  
subtrahend --- data7, data6, data5, data4 (data7 is bits 24~31, data6 is bits 16~23, data5 is bits 8~15, data4 is bits 0~7)  
Return : to4, to3, to2, to1, to0 (to4 is bits 32~39, to3 is bits 24~31, to2 is bits 16~23, to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : BINTOBCD\_32  
Description : 32-bit binary to BCD conversion  
Parameter : binary data to be converted --- data3, data2, data1, data0 (data3 is bits 24~31, data2 is bits 16~23, data1 is bits 8~15, data0 is bits 0~7)  
Return : to4, to3, to2, to1, to0 (to4 is bits 32~39, to3 is bits 24~31, to2 is bits 16~23, to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

Driver Name : BCDTOBIN\_32  
Description : BCD to 32-bit binary conversion  
Parameter : BCD data to be converted --- data3, data2, data1, data0 (data3 is bits 24~31, data2 is bits 16~23, data1 is bits 8~15, data0 is bits 0~7)  
Return : to3, to2, to1, to0 (to3 is bits 24~31, to2 is bits 16~23, to1 is bits 8~15, to0 is bits 0~7)  
Stack used : none

**Driver Reserved Names**

data0, data1, data2, data3, data4, data5, data6, data7  
to0, to1, to2, to3, to4, to5, to6, to7  
com0, com1, com2, com3, com4, com5  
count0, count1, count2, count3  
unbin\_add\_8, unbin\_sub\_8, unbin\_mul\_8, unbin\_div\_8,  
bin\_add\_8, bin\_sub\_8, bin\_mul\_8, bin\_div\_8  
bcd\_add\_8, bcd\_sub\_8, bintobcd\_8, bcdtobin\_8  
unbin\_add\_16, unbin\_sub\_16, unbin\_mul\_16, unbin\_div\_16,  
bin\_add\_16, bin\_sub\_16, bin\_mul\_16, bin\_div\_16  
bcd\_add\_16, bcd\_sub\_16, bintobcd\_16, bcdtobin\_16  
unbin\_add\_24, unbin\_sub\_24, unbin\_mul\_24, unbin\_div\_24,  
bin\_add\_24, bin\_sub\_24, bin\_mul\_24, bin\_div\_24  
bcd\_add\_24, bcd\_sub\_24, bintobcd\_24, bcdtobin\_24  
unbin\_add\_32, unbin\_sub\_32, unbin\_mul\_32, unbin\_div\_32,  
bin\_add\_32, bin\_sub\_32, bin\_mul\_32, bin\_div\_32  
bcd\_add\_32, bcd\_sub\_32, bintobcd\_32, bcdtobin\_32