

**Chapter**

**5**



**5**

# **Binary, Octal, Decimal, and Hexadecimal Calculations**

This calculator is capable of performing the following operations involving different number systems.

- Number system conversion
- Arithmetic operations
- Negative values
- Bitwise operations

**5-1 Before Beginning a Binary, Octal, Decimal, or Hexadecimal Calculation with Integers**

**5-2 Selecting a Number System**

**5-3 Arithmetic Operations**

**5-4 Negative Values and Bitwise Operations**

## 5-1 Before Beginning a Binary, Octal, Decimal, or Hexadecimal Calculation with Integers

You can use the **RUN Mode** and binary, octal, decimal, and hexadecimal settings to perform calculations that involve binary, octal, decimal and hexadecimal values. You can also convert between number systems and perform bitwise operations.

- You cannot use scientific functions in binary, octal, decimal, and hexadecimal calculations.
- You can use only integers in binary, octal, decimal, and hexadecimal calculations, which means that fractional values are not allowed. If you input a value that includes a decimal part, the unit automatically cuts off the decimal part.
- If you attempt to enter a value that is invalid for the number system (binary, octal, decimal, hexadecimal) you are using, the calculator displays an error message. The following shows the numerals that can be used in each number system.

Binary: 0, 1

Octal: 0, 1, 2, 3, 4, 5, 6, 7

Decimal: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

Hexadecimal: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F

- The alphabetic characters used in the hexadecimal number appear differently on the display to distinguish them from text characters.

<b>Normal Text</b>	A	B	C	D	E	F
<b>Hexadecimal Values</b>	$\text{\AA}$	$\text{\textcircled{B}}$	$\text{\textcircled{C}}$	$\text{\textcircled{D}}$	$\text{\textcircled{E}}$	$\text{\textcircled{F}}$
<b>Keys</b>	$\overset{A}{\text{\textcircled{X,\theta,T}}}$	$\overset{10^x}{\text{\textcircled{B}}}$	$\overset{e^x}{\text{\textcircled{C}}}$	$\overset{\sin^{-1}}{\text{\textcircled{D}}}$	$\overset{\cos^{-1}}{\text{\textcircled{E}}}$	$\overset{\tan^{-1}}{\text{\textcircled{F}}}$

- Negative binary, octal, and hexadecimal values are produced using the two's complement of the original value.
- The following are the display capacities for each of the number systems.

Number System	Display Capacity
Binary	16 digits
Octal	11 digits
Decimal	10 digits
Hexadecimal	8 digits

- The following are the calculation ranges for each of the number systems.

#### Binary Values

Positive:  $0 \leq x \leq 1111111111111111$

Negative:  $1000000000000000 \leq x \leq 1111111111111111$

#### Octal Values

Positive:  $0 \leq x \leq 17777777777$

Negative:  $20000000000 \leq x \leq 37777777777$

#### Decimal Values

Positive:  $0 \leq x \leq 2147483647$

Negative:  $-2147483648 \leq x \leq -1$

#### Hexadecimal Values

Positive:  $0 \leq x \leq 7FFFFFFF$

Negative:  $80000000 \leq x \leq FFFFFFFF$

### •To perform a binary, octal, decimal, or hexadecimal calculation

1. In the main menu, select **RUN**.
2. Press **SHIFT** **SETUP** and then specify the default number system by pressing **F2** (Dec), **F3** (Hex), **F4** (Bin), or **F5** (Oct).
3. Press **EXIT** to change to the screen for calculation input. This causes a function menu with the following items to appear.
  - **{d-o}/{LOG}** ... {number system specification}/{bitwise operation} menu



P.5

## 5-2 Selecting a Number System

You can specify decimal, hexadecimal, binary, or octal as the default number system using the set up screen. After you press the function key that corresponds to the system you want to use, press **EXE**.

### ●To convert a displayed value from one number system to another

**Example** To convert 22<sub>10</sub> (default number system) to its binary or octal value

<b>AC</b> <b>SHIFT</b> <b>SETUP</b> <b>F2</b> (Dec) <b>EXIT</b> <b>F1</b> (d~o) <b>F1</b> (d)	d22	22
<b>2</b> <b>2</b> <b>EXE</b>		
<b>SHIFT</b> <b>SETUP</b> <b>F4</b> (Bin) <b>EXIT</b> <b>EXE</b>		0000000000010110
<b>SHIFT</b> <b>SETUP</b> <b>F5</b> (Oct) <b>EXIT</b> <b>EXE</b>		00000000026

### ●To specify a number system for an input value

You can specify a number system for each individual value you input. While binary, octal, decimal, or hexadecimal is set as the default number system, press **F1** (d~o) to display a menu of number system symbols. Press the function key that corresponds to the symbol you want to select and then input the value you want.

- {d}/{h}/{b}/{o} ... {decimal}/{hexadecimal}/{binary}/{octal}

### ●To input values of mixed number systems

**Example** To input 123<sub>10</sub> or 1010<sub>2</sub>, when the default number system is hexadecimal

<b>SHIFT</b> <b>SETUP</b> <b>F3</b> (Hex) <b>EXIT</b>	d123	0000007B
<b>AC</b> <b>F1</b> (d~o) <b>F1</b> (d) <b>1</b> <b>2</b> <b>3</b> <b>EXE</b>		
<b>F3</b> (b) <b>1</b> <b>0</b> <b>1</b> <b>0</b> <b>EXE</b>	b1010	0000000A

## 5-3 Arithmetic Operations

**Example 1** To calculate  $10111_2 + 11010_2$

SHIFT SETUP F4 (Bin) EXIT  
 AC 1 0 1 1 1 +  
 1 1 0 1 0 EXE

10111+11010
0000000000110001

**Example 2** To input and execute  $123_8 \times ABC_{16}$ , when the default number system is decimal or hexadecimal

SHIFT SETUP F2 (Dec) EXIT  
 AC F1 (d~o) F4 (o) 1 2 3 X  
 F2 (h) A B C EXE

o123xhABC	228084
-----------	--------

SHIFT SETUP F3 (Hex) EXIT EXE

00037AF4
----------



P.74

# 5-4 Negative Values and Bitwise Operations

While binary, octal, decimal, or hexadecimal is set as the default number system, press **F2** (LOG) to display a menu of negation and bitwise operators.

- **{Neg}** ... {negation}<sup>\*1</sup>
- **{Not}/{and}/{or}/{xor}/{xnor}** ... {NOT}<sup>\*2</sup>/**AND**/**OR**/**XOR**/**XNOR**<sup>\*3</sup>

## ■ Negative Values

**Example** To determine the negative of 110010<sub>2</sub>

SHIFT	SETUP	F4	(Bin)	EXIT	Neg 110010 1111111111001110		
AC	F2	(LOG)	F1	(Neg)			
1	1	0	0	1		0	EXE

## ■ Bitwise Operations

**Example 1** To input and execute “120<sub>16</sub> and AD<sub>16</sub>”

SHIFT	SETUP	F3	(Hex)	EXIT	120andAD 00000020	
AC	1	2	0	F2		(LOG)
F3	(and)	A	D	EXE		

**Example 2** To display the result of “36<sub>8</sub> or 1110<sub>2</sub>” as an octal value

SHIFT	SETUP	F5	(Oct)	EXIT	EXIT	36orb1110 0000000036	
AC	3	6	F2	(LOG)			
F4	(or)	EXIT	F1	(d~o)	F3		(b)
1	1	1	0	EXE			

**Example 3** To negate 2FFFD<sub>16</sub>

SHIFT	SETUP	F3	(Hex)	EXIT	EXIT	Not 2FFFD FFD00012	
AC	F2	(LOG)	F2	(Not)			
2	F	F	F	E	D		EXE



P.74



P.74



\*1 two's complement

\*2 one's complement (bitwise complement)

\*3 bitwise AND, bitwise OR, bitwise XOR, bitwise XNOR