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.

<table>
<thead>
<tr>
<th>Normal Text</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexadecimal Values</td>
<td>À</td>
<td>Ì</td>
<td>Ç</td>
<td>ü</td>
<td>Æ</td>
<td>í</td>
</tr>
<tr>
<td>Keys</td>
<td>X, ë</td>
<td>Í</td>
<td>Î</td>
<td>Í</td>
<td>Í</td>
<td>Í</td>
</tr>
</tbody>
</table>

- 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.

<table>
<thead>
<tr>
<th>Number System</th>
<th>Display Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binary</td>
<td>16 digits</td>
</tr>
<tr>
<td>Octal</td>
<td>11 digits</td>
</tr>
<tr>
<td>Decimal</td>
<td>10 digits</td>
</tr>
<tr>
<td>Hexadecimal</td>
<td>8 digits</td>
</tr>
</tbody>
</table>
The following are the calculation ranges for each of the number systems.

**Binary Values**
- Positive: $0 \leq x \leq 111111111111111$
- 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
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 \text{EX}.

\textbf{To convert a displayed value from one number system to another}

\textbf{Example} To convert \(22_{10}\) (default number system) to its binary or octal value

\[
\begin{array}{c}
\text{AC} \quad \text{SHIFT} \quad \text{SETUP} \quad \text{F2} (\text{Dec}) \quad \text{EXIT} \quad \text{F1} (\text{d–o}) \quad \text{F1} (\text{d}) \quad \boxed{d22} \\
2 \quad 2 \quad \text{EX}
\end{array}
\]

\[
\begin{array}{c}
\text{SHIFT} \quad \text{SETUP} \quad \text{F4} (\text{Bin}) \quad \text{EXIT} \quad \text{EX} \\
\end{array}
\]

\[
\begin{array}{c}
\text{SHIFT} \quad \text{SETUP} \quad \text{F5} (\text{Oct}) \quad \text{EXIT} \quad \text{EX} \\
\end{array}
\]

\textbf{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 \text{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\} \ldots \{\text{decimal}\}/\{\text{hexadecimal}\}/\{\text{binary}\}/\{\text{octal}\}

\textbf{To input values of mixed number systems}

\textbf{Example} To input \(123_{10}\) or \(1010_{2}\), when the default number system is hexadecimal

\[
\begin{array}{c}
\text{SHIFT} \quad \text{SETUP} \quad \text{F3} (\text{Hex}) \quad \text{EXIT} \\
\end{array}
\]

\[
\begin{array}{c}
\text{AC} \quad \text{F1} (\text{d–o}) \quad \text{F1} (\text{d}) \quad 1 \quad 2 \quad 3 \quad \text{EX} \\
\end{array}
\]

\[
\begin{array}{c}
\text{F3} (\text{b}) \quad 1 \quad 0 \quad 1 \quad 0 \quad \text{EX} \\
\end{array}
\]

\[
\begin{array}{c}
\end{array}
\]

\[
\begin{array}{c}
\end{array}
\]

\[
\begin{array}{c}
\end{array}
\]

\[
\begin{array}{c}
\end{array}
\]

\[
\begin{array}{c}
\end{array}
\]

\[
\begin{array}{c}
\end{array}
\]

\[
\begin{array}{c}
\end{array}
\]

\[
\begin{array}{c}
\end{array}
\]
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
```

Example 2  To input and execute $123_{10} \times ABC_{16}$, 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

SHIFT  SetUp  F3 (Hex)  EXIT  EXE
```

P.74
5-4 Negative Values and Bitwise Operations

While binary, octal, decimal, or hexadecimal is set as the default number system, press \( F_2 \) (LOG) to display a menu of negation and bitwise operators.

- \{Neg\} ... \{negation\}*1
- \{Not\}/(and)/(or)/(xor)/(xnor) ... \{NOT\}/(AND)/(OR)/(XOR)/(XNOR)*3

**Negative Values**

**Example** To determine the negative of 1100102

```
SHIFT SETUP FA (Bin) EXIT
AC F2 (LOG) F1 (Neg)
0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
```

**Bitwise Operations**

**Example 1** To input and execute “12016 and AD16”

```
SHIFT SETUP F3 (Hex) EXIT
AC 1 2 0 F2 (LOG)
F3 (and) A D EXIT
```

**Example 2** To display the result of “368 or 11102” as an octal value

```
SHIFT SETUP F5 (Oct) EXIT EXIT
AC 3 6 F2 (LOG)
F4 (or) EXIT F1 (d-o) F3 (b)
1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0
```

**Example 3** To negate 2FFFED16

```
SHIFT SETUP F3 (Hex) EXIT EXIT
AC F2 (LOG) F2 (Not)
2 F F F E D EXIT
```

*1 two’s complement
*2 one’s complement (bitwise complement)
*3 bitwise AND, bitwise OR, bitwise XOR, bitwise XNOR