CubeSuite+ Simulator for 78K0R/Lx3 V3.00.03

Release Note

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Chapter 1. Target Devices

Below is a list of devices supported by the 78K0R/Lx3 simulator.

Nickname	Device name
78K0R/LF3	μPD78F1500(80pin), μPD78F1501(80pin), μPD78F1502(80pin), μPD78F1500A(80pin), μPD78F1501A(80pin), μPD78F1502A(80pin), μPD78F1510A(80pin), μPD78F1512A(80pin)
78K0R/LG3	μPD78F1503(100pin), μPD78F1504(100pin), μPD78F1505(100pin), μPD78F1503A(100pin), μPD78F1504A(100pin), μPD78F1505A(100pin), μPD78F1513A(100pin), μPD78F1515A(100pin)
78K0R/LH3	μPD78F1506(120pin), μPD78F1507(120pin), μPD78F1508(120pin), μPD78F1506A(120pin), μPD78F1507A(120pin), μPD78F1508A(120pin), μPD78F1516A(120pin), μPD78F1518A(120pin)

Chapter 2. User's Manuals

Please read the following user's manuals together with this document.

Manual Name	Document Number
CubeSuite+ V1.01.00 78K0R Debug	R20UT0732EJ0100
CubeSuite+ V2.00.00 Message	R20UT2448EJ0100

Chapter 3. Key Word for Uninstallation

To uninstall this product, use the integrated uninstaller (uninstalls CubeSuite+).

Chapter 4. Changes

This chapter describes changes from V3.00.02 to V3.00.03.

4.1 Specifications changed

4.1.1 Simulation on CubeSuite+ V2.00.00

Support simulation on CubeSuite+ V2.00.00. There is no functional change.

Chapter 5. Cautions

This section describes cautions for using 78K0R/Lx3 simulator. The following two types of caution are described:

•Differences between target devices and simulator : Differences from behavior of target devices due to simulator specifications

•Cautions for using simulator GUI : Cautions for using the simulator GUI window

5.1 Differences between target devices and simulator

5.1.1 Unsupported peripheral functions

The simulator does not support the following peripheral functions of the target device (the following functions cannot be debugged on the simulator).

* Operational amplifier
* Regulator
* Serial Interface IICA
* Simplified IIC (Serial array unit)

5.1.2 Flash self programming function

The following differences exist between the target device and simulator regarding the flash self programming function.

1. Operation when a pull-down resistor is connected to the FLMD0 pin

In the target device, whether the flash self programming mode can be set via software is determined based on its resistance when a pull-down resistor is externally connected to the FLMD0 pin.

FLMD0 Pin Handling	Setting via Software
Pulled down with a resistance of 100k ohm or more	Available
Pulled down with a resistance of less than 100k ohm	Not guaranteed

On the other hand, in the simulator, connection of a pull-down resistor to the FLMD0 pin can be specified in the I/O Panel window but this panel does not have the function to set the resistance value. As a result, if connection of a pull-down resistor to the FLMD0 pin is specified, it is regarded as an operation equivalent to that being pulled down with a resistance of 100k ohm or more.

2. Errors that are not generated

The simulator does not generate the following errors.

Function Name	Error Name	Return Value
FSL_Init	Processing abortion due to interrupt occurrence	0x1F
FSL_Init_cont	Processing abortion due to interrupt occurrence	0x1F
FSL_BlankCheck	Processing abortion due to interrupt occurrence	0x1F
FSL_Erase	Erase error	0x1A
	Processing abortion due to interrupt occurrence	0x1F
FSL_IVerify	Verification (internal verification) error	0x1B
	Processing abortion due to interrupt occurrence	0x1F
FSL_Write	Write error	0x1C
	Processing abortion due to interrupt occurrence	0x1F
FSL_EEPROMWrite	Write error	0x1C
	Processing abortion due to interrupt occurrence	0x1F
FSL_InvertBootFlag	Erase error	0x1A
	Verification (internal verification) error	0x1B
	Write error	0x1C
	Processing abortion due to interrupt occurrence	0x1F
FSL_SwapActiveBootCluster	Erase error	0x1A
	Verification (internal verification) error	0x1B
	Write error	0x1C
	Processing abortion due to interrupt occurrence	0x1F
FSL_SetChipEraseProtectFlag	Erase error	0x1A
	Verification (internal verification) error	0x1B
	Write error	0x1C
	Processing abortion due to interrupt occurrence	0x1F
FSL_SetBlockEraseProtectFlag	Erase error	0x1A
	Verification (internal verification) error	0x1B
	Write error	0x1C
	Processing abortion due to interrupt occurrence	0x1F
FSL_SetWriteProtectFlag	Erase error	0x1A
	Verification (internal verification) error	0x1B
	Write error	0x1C
	Processing abortion due to interrupt occurrence	0x1F
FSL_SetBootClusterProtectFlag	Erase error	0x1A
	Verification (internal verification) error	0x1B
	Write error	0x1C
	Processing abortion due to interrupt occurrence	0x1F
FSL_SetFlashShieldWindow	Erase error	0x1A
	Verification (internal verification) error	0x1B
	Write error	0x1C
	Processing abortion due to interrupt occurrence	0x1F

3. Voltage modes

Voltage modes (full-speed mode/wide voltage mode) are not simulated.

4. Operation of the FSL_SetInterruptMode function

The FSL_SetInterruptMode simulation is not complete.

Even if the FSL_SetInterruptMode function is called during interrupt processing, the function that had been suspended for the interrupt may continue executing, instead of returning to the user program.

5.1.3 Division processing by the multiplier/divider

There are the following differences between the target device and the simulator when the multiplier/divider performs division.

[Target device]

It takes 16 clock cycles from the start to the end of division.

[Simulator]

It takes 1 clock cycle from the start to the end of division.

5.1.4 Simulating an LCD controller/driver

Simple simulation using the user open interface feature is used to simulate an LCD controller/driver. See below for a description of simple simulation, and functions for which simple simulation is not available.

[Overview of simple simulation]

Simulation is performed by reading the LCD display data memory, and displaying it on an LCD panel. The conditions for displaying the LCD display data memory on an LCD panel are as follows.

* PFALL register: Set to “Use as segment output”
* SEGEN register: Set to “Allow segment output”
* LCDON and SCOC bits of LCDM register: Set to “Display on”

The conditions for determining which portion of the LCD display data memory is used for the display on the LCD panel are as follows.

* BLON and LCDSEL bits of LCDM register: Sets display data area (pattern A/pattern B/alternating)
* LCDM0 to 3 bits of LCDM register: Selects display mode

[Content that cannot be confirmed with simulation]

* Waveform displays using timing chart window of COM0 to COM7 pins or SEG0 to SEG30 pins
* Operation of LCD driver voltage generation circuit (settings to the LCDMD register are ignored)
* Setting to enable/halt operation of voltage-increase circuit and capacitive divider circuit (settings of VLCON bit in LCDM register are ignored)
* Settings of LCD source clock (the LCDC0 register setting is ignored)
* Setting of standard voltage to generate upon voltage-increase circuit operation (the setting of the VLCD register is ignored)
* Schmitt trigger buffer control of segment output pin (if used as LCD pin, ISC register settings are ignored)

5.1.5 Reset

If a reset is generated by the Power-on-Clear circuit (POC) or low-voltage detector (LVI) circuit, the simulator will display "STANDBY" in the status bar. (The status is actually reset, not standby.)

And the behavior differs as follows if a reset is generated by the RESET pin.

[Target device]

Goes into reset status when the RESET pin goes to low level. Reset status is released when it goes to high level.

[Simulator]

Does not go into reset status when the RESET pin goes to low level. When it goes to high level, the simulator momentarily goes into reset status, and then the reset status is released immediately.

5.1.6 1-Hz pin output of real-time counter

If the waveform of the RTC1HZ pin is checked in the timing chart window using 1 Hz pin output of the real-time counter, the output waveform has a frequency of 32.768 Hz.

In this case, determine that 1 Hz output is being performed without problems.

5.1.7 Oscillation stabilization time of Clock Generator

The simulator does not simulate the clock oscillator oscillation stabilization time.

The oscillation stabilization time is always 0 seconds when a reset or standby is released, regardless of the OSTS register settings. The OSTS register is set to the following values.

- Initial value after reset, during STOP mode, when MSTOP of CSC register = 1: 0x00
- MSTOP of CSC register = 0 after STOP mode release: Values shown in the following table

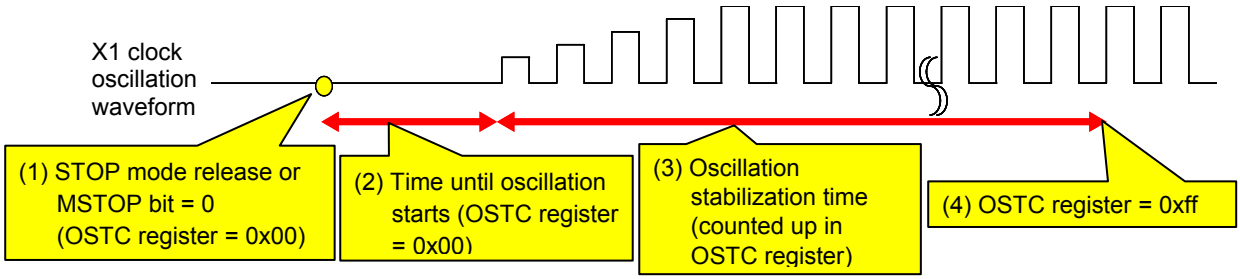
(Maximum value in the target device)

OSTS Setting Value	OSTC Value
0x0 (2^8/fx)	0x80
0x1 (2^9/fx)	0xc0
0x2 (2^{10}/fx)	0xe0
0x3 (2^{11}/fx)	0xf0
0x4 (2^{13}/fx)	0xf8
0x5 (2^{15}/fx)	0xfc
0x6 (2^{17}/fx)	0xfe
0x7 (2^{18}/fx)	0xff

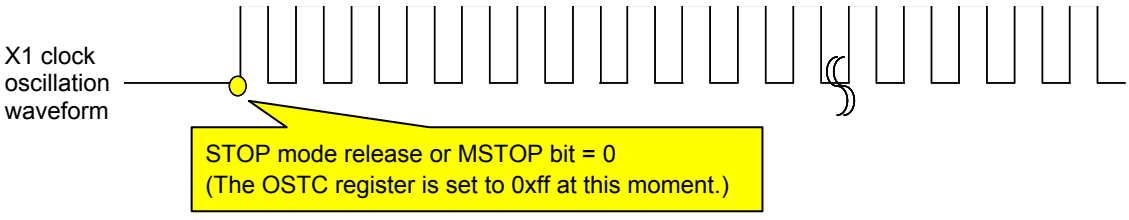
The following figure illustrates this operation.

In the target device, the X1 clock oscillation starts after the states (1) to (4) have passed. In the simulator, states (1) to (4) end instantly and the X1 clock oscillation starts.

[In target device (an example of when OSTS is set to 0x07)]



[In simulator (an example of when OSTS is set to 0x07)]



Therefore, pay attention to the code that waits for oscillation stabilization.

There is no problem if a program is created with the condition that the execution exits the oscillation stabilization wait period when the OSTC register value becomes the maximum value, or when the OSTC register value exceeds the specified value, but if a program is created with the condition that the execution exits the oscillation stabilization wait period when the OSTC register value becomes a value other than the maximum value, the execution enters an infinite loop.

The following shows examples of code that causes/does not cause problems.

(This is an example of when OSTS is set to 0x07)

Correct program example (1)

```
while(OSTC != 0xff)
{
NOP();/* wait */
}
```

Correct program example (2)

```
while(OSTC <= 0xf0)
{
NOP();/* wait */
}
```

Example of program that may cause problems

```
while(OSTC != 0xf0)
{
NOP();/* wait */
}
```

5.1.8 SFR with clock generator (AMPH/FSEL)

The simulator does not simulate the following SFRs, which belong to the clock generator. Read/write for each register can be performed normally, but the operation does not change even if its value is changed.

- Bit 0 (AMPH) of clock operation mode control register (CMC)
- Bit 0 (FSEL) of operation speed mode control register (OSMC)

[Bit 0 (AMPH) of clock operation mode control register (CMC)]

This register is used to set the oscillator gain according to the frequency when oscillating the high-speed system clock. If a wrong setting is made, the high-speed system clock may not oscillate in the target device. In the simulator, however, wrong settings do not affect the oscillation of the high-speed system clock.

[Bit 0 (FSEL) of operation speed mode control register (OSMC)]

This register is used to control the step-up circuit for the high-speed flash memory operation.

If a wrong setting is made, read or instruction fetch from the flash memory may fail, or self programming may fail in the target device. In the simulator, however, wrong settings do not affect the operation.

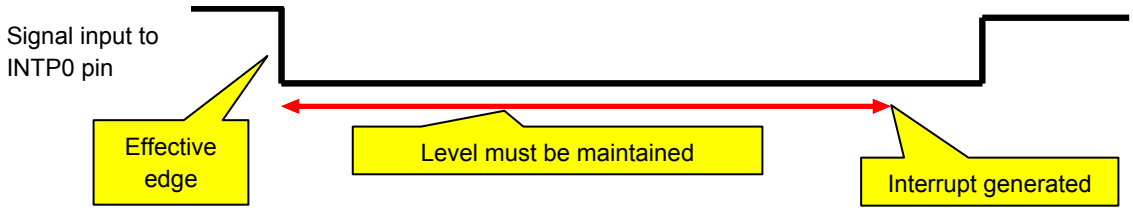
5.1.9 Noise reduction circuit for external-interrupt pin

The simulator does not simulate the noise reduction circuit. For example, if you input the active level to an external-interrupt pin with a noise reduction circuit, the interrupt will be received even if the active-level amplitude is too low.

The example below considers the case when there is input to the INTP0 pin.

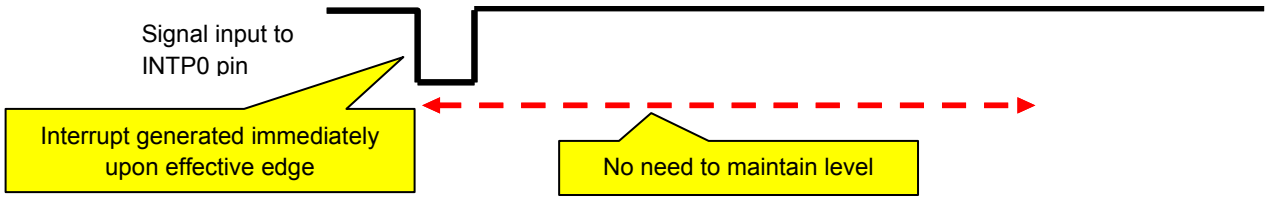
There is a noise reduction circuit on the INTP0 pin of the target device. For this reason, in order to generate an interrupt, it is necessary to input an effective edge to the target device, and subsequently maintain the signal level. (See the user's manual of the target device for the length of time it must be maintained.)

Target device behavior (falling effective edge)



In the case of the simulator, however, this noise reduction circuit is not simulated. For this reason, an interrupt will be generated any time a valid edge is generated. (No need to maintain signal level).

Simulator behavior (falling effective edge)



5.1.10 DMA controller

The transfer speeds of the target device and simulator differ as follows when simulating the DMA controller.

[Target device]

* It takes two clock cycles to complete one DMA transfer. The CPU waits during this period.
* If there is contention for transfer timing with another channel's DMA, then one of the DMA transfers will be placed on hold; after the other DMA transfer is completed, the one on hold will begin.

[Simulator]

* It takes zero clock cycles to complete one DMA transfer. For this reason, the CPU does not wait.
* If there is contention for transfer timing with another channel's DMA, then both of the DMA transfers are performed simultaneously.

5.1.11 Operation clock of timer array unit

Do not specify an operation clock that is 233 Hz or lower. If the operation clock (CKmk) of the timer array unit (m=0 or 1, k=0 or 1) is 233 Hz or lower, then the timer array unit will not operate correctly (it will behave as if operating via a clock that is faster than the one selected).

5.1.12 Input pulse interval measurement mode of timer array unit

When the input pulse interval measurement mode of the timer array unit is being used, the behavior when an effective edge is detected on the TImn (mn = 00-07 or 10-13) pin differs.

[Target device]

The TCRmn timer counter register (mn=00-07 or 10-13) is initialized to 0x0000.

[Simulator]

The TCRmn timer counter register (mn=00-07 or 10-13) is to 0xFFFF.

For this reason, the pulse width count will be one less than on the target device.

5.1.13 Noise filter of timer array unit

Although the target device's timer array unit has a function to turn the noise filter on and off in order to reduce noise on the timer input pin, the simulator does not simulate this. (There is no difference in behavior whether filtering is on or off.) Since there is no noise in the simulator's signal, it would be meaningless to simulate this function.

5.1.14 Operation clock of serial array unit

Do not use INTTM02 or INTTM03 as the operation clock for the serial array unit. (Doing so will prevent the serial array unit from operating at all.)

5.1.15 Noise filter of serial array unit

Although the target device's serial array unit has a function to turn the noise filter on and off in order to reduce noise on the input pin, the simulator does not simulate this. (There is no difference in behavior whether filtering is on or off.) Since there is no noise in the simulator's signal, it would be meaningless to simulate this function.

5.1.16 SDRmn register of serial array unit

The following differences occur between the target device and simulator when the serial data register (SDRmn) is read during serial operation.

[Target device]

The value read from the upper 7 bits is 0.

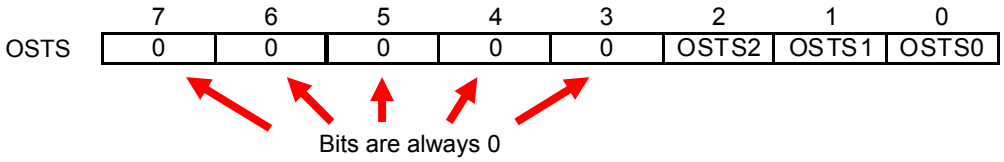
[Simulator]

The values read from the upper 7 bits are the values immediately before start of serial operation.

5.1.17 SFR 0/1 constant bit

The SFR has bits that are always 0 or 1.

For example, bits 3 to 7 are always 0 for the oscillation stabilization time selection register (OSTS).



Although the values of these bits cannot be changed in the case of the target device, the values can be changed in the case of the simulator. Note that changing these values has no effect on behavior.

5.1.18 Comparator stabilization time of A/D converter

The comparator stabilization times of the A/D converter are different for the target device and simulator.

[Target device]

It takes 1 microsecond from the start of operation of the comparator until it stabilizes. Any A/D conversion results obtained before stabilization will be invalid. For this reason, it is necessary to ignore the first A/D conversion results.

[Simulator]

Comparator operation stabilizes immediately upon startup. For this reason, A/D conversion results obtained within 1 microsecond of the start of operation will be correct, and there is thus no need to ignore the first A/D conversion results.

5.1.19 Default voltage of AV_{REFP} pin and AV_{REFM} pin

Default voltage of AV_{REFP} pin is 5.5V. And default voltage of AV_{REFM} pin is 0V.

Note : The meaning of "Default voltage " is the voltage when the pin have no connection.

5.1.20 Interrupt response time

The interrupt response times of the target device and simulator differ.

[Target device]

It takes 9 to 14 clock cycles from the generation of an interrupt until actual vector interrupt processing begins.

[Simulator]

Vector interrupt processing begins immediately upon the interrupt.

5.1.21 Execution of illegal instructions

If an illegal instruction (instruction code: 0xFF) is executed, the target device will be reset, but the simulator will go into an infinite loop (the illegal instruction will be executed repeatedly).

5.2 Cautions for using simulator GUI

5.2.1 Cautions for controlling each windows

The following keyboard operations are not available in the simulator windows (signal-data editor window, I/O panel window, and serial window).

* Navigation via tab or arrow keys (←, ↑, →, ↓)
* Deletion via the Del or Backspace keys
* Copy & paste and other operations via the Ctrl + C, V, X, A, or Z keys.

Perform the above operations as follows.

* Navigation: Navigate using the mouse.
* Deletion: Right click and perform the action via the context menu.
* Copy & paste, etc.: Right click and perform the action via the context menu.

5.2.2 Cautions for closing simulator GUI window

The simulator GUI window can only be closed by disconnecting from the debugging tool, or by closing CubeSuite+ proper. (The X button cannot be clicked.)
Additionally, although it appears that the X button can be pressed if Aero is enabled in Windows Vista, pressing this button will not close the GUI window.

5.2.3 Cautions for showing help for the simulator GUI window

Pressing the F1 key in the simulator GUI window will not display the help if none of the internal windows are visible (e.g. the I/O panel window).
To display the help for the simulator GUI window, from the GUI window's menu, select [Help] > [Main Window].

5.2.4 Cautions for disconnecting the debug tool

CubeSuite+ may exit if the debugging tool is disconnected while any of the following dialog boxes is open from the simulator GUI window. Make sure that the following dialog boxes are closed before disconnecting the debugging tool.

- Save As
- Open
- New
- Color
- Font
- Customize
- Loop
- Select Pin
- Search Data
- Format (UART)
- Format (CSI)
- Message (e.g. Error)
- Parts Button Properties
- Analog Button Properties
- Parts Key Properties
- Parts Level Gauge Properties
- Parts Led Properties
- Parts Segment LED Properties
- Parts Matrix Led Properties
- Parts Buzzer Properties
- Pull up / Pull down
- Entry Bitmap
- Object Properties

5.2.5 Cautions for setting the Host Machine's language and region

If a Japanese OS is installed on your Host Machine, then if the language or region is set to other than Japanese/Japan, the menus and dialog-box names of the simulator GUI window will be shown in English. Similarly, if a non-Japanese OS is installed on your Host Machine, then if the language or region is set to Japanese/Japan, the menus and dialog-box names of the simulator GUI window will be shown in Japanese.

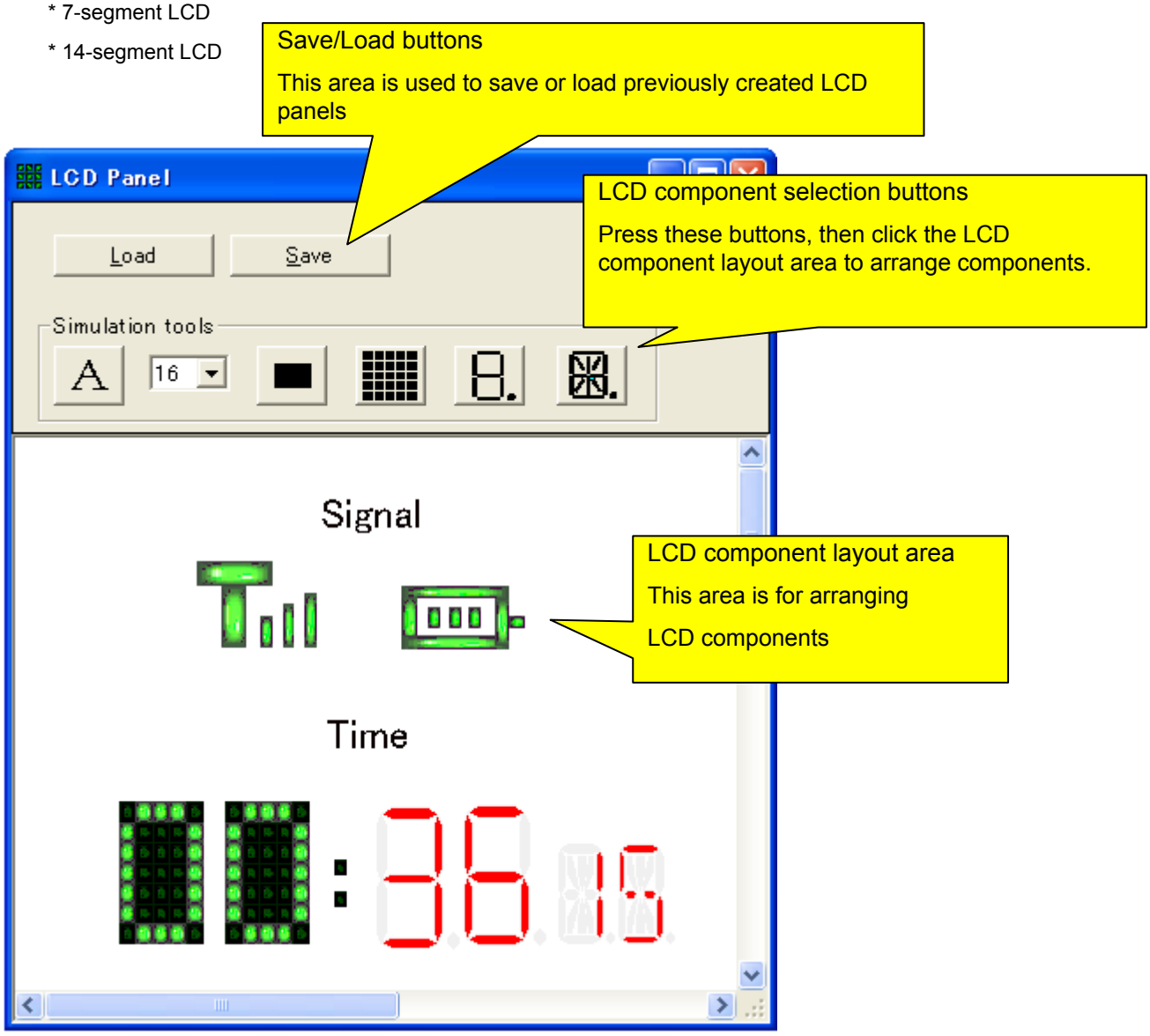
Chapter 6. Using LCD panel

This chapter includes overview and instructions for using CubeSuite+'s LCD panel window.

6.1 Overview

CubeSuite+'s LCD panel window allows you to simulate the following types of LCD panel displays, using CubeSuite+'s user open interface feature.

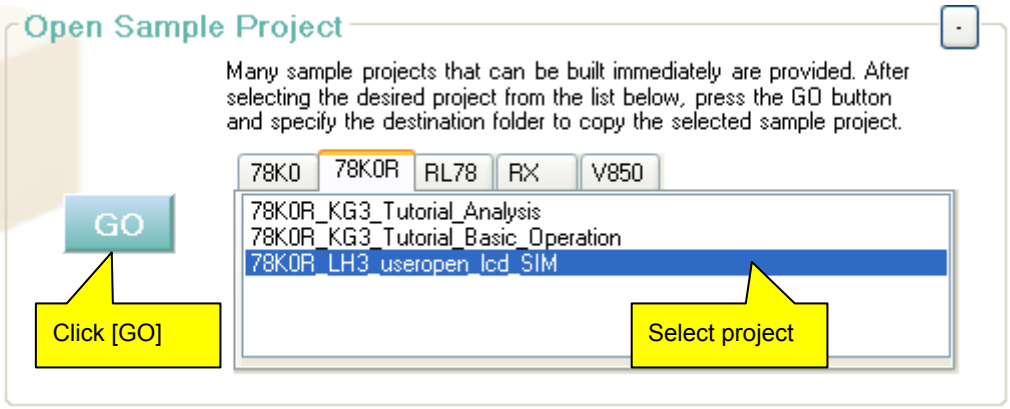
* Dot LCD
* Dot matrix LCD
* 7-segment LCD
* 14-segment LCD



6.2 Getting Ready to Use the LCD Panel Window

Please carry out the preparations below before using the LCD panel.

(1) Under CubeSuite+'s start panel, from the [Open Sample Project] area, select [78K0R_LH3_useropen_lcd_SIM], and then click [GO].



(2) Copy the project to an arbitrary folder.

(3) After copying, the project is loaded automatically.

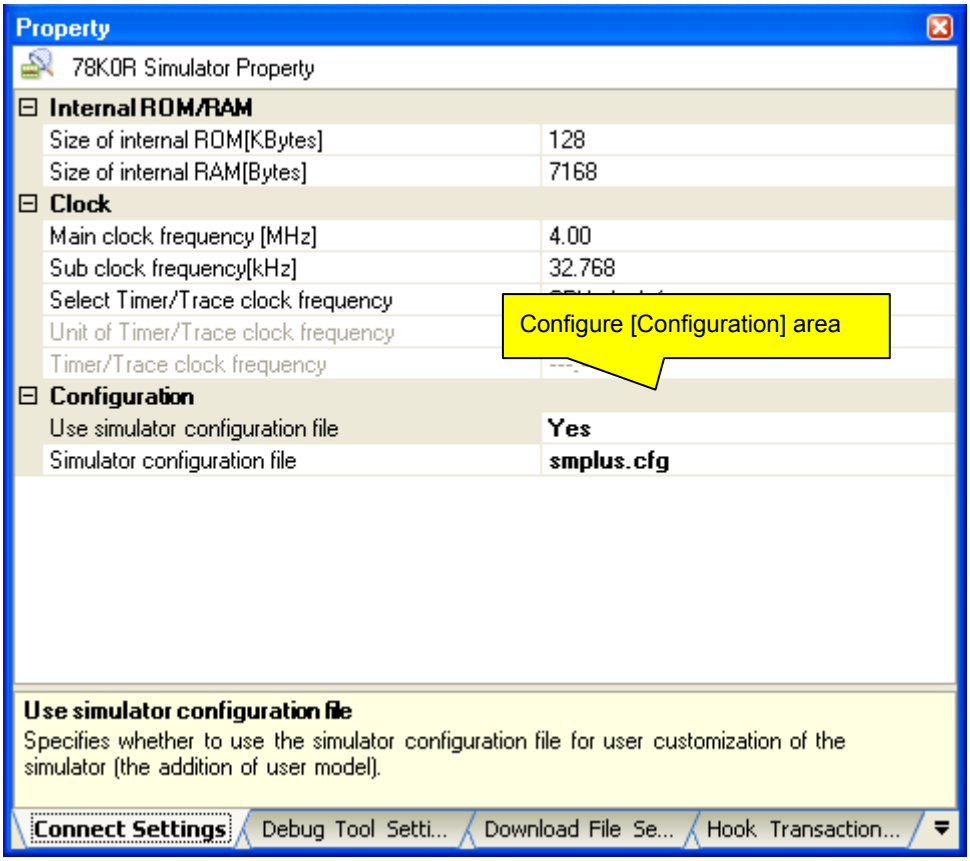
If you will be using the LCD panel window with an open project, go on to step (6).

If you will be using the LCD panel window with other project, close the project for now, and go on to step (4).

(4) Copy the following two items from the folder copied in step (3) into the project folder.

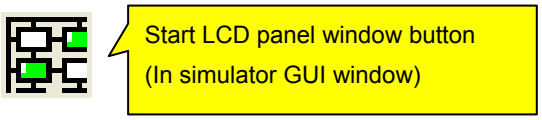
* smplus.cfg file
* uo_lcd folder

(5) Open the project, and before connecting the CubeSuite+'s simulator, make the following configurations in the [Configuration] area of the Property panel.



(6) Download or connect to debugging tool.

Once the following button appears in the Simulator GUI window, setup is complete. Press the button to start the LCD panel window.



6.3 Using a Dot LCD

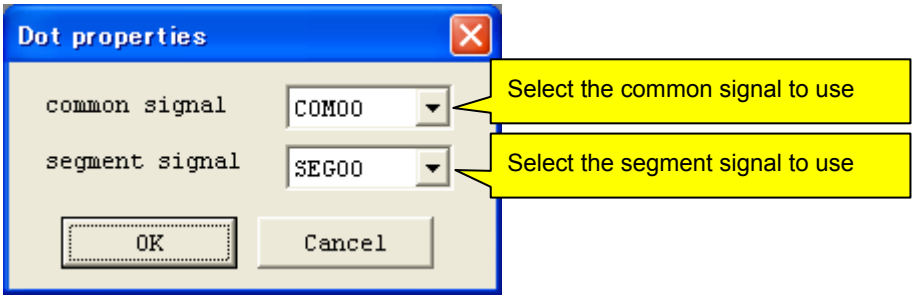
Follow the steps below to make a dot LCD available.

(1) Click the button.

(2) Click on the location where you wish to position the dot LCD.

(3) Double click on the dot LCD you just placed.

(4) In the [Dot Properties] dialog box, select the common signal and segment signal to connect.



(5) Click [OK] to close the [Dot Properties] dialog. The dot LCD can now be used.

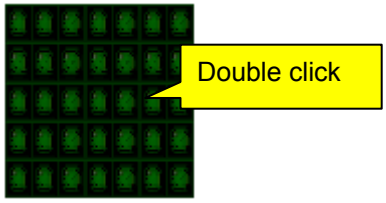
6.4 Using Dot Matrix LCD

Follow the steps below to make a dot matrix LCD available.

(1) Click the button.

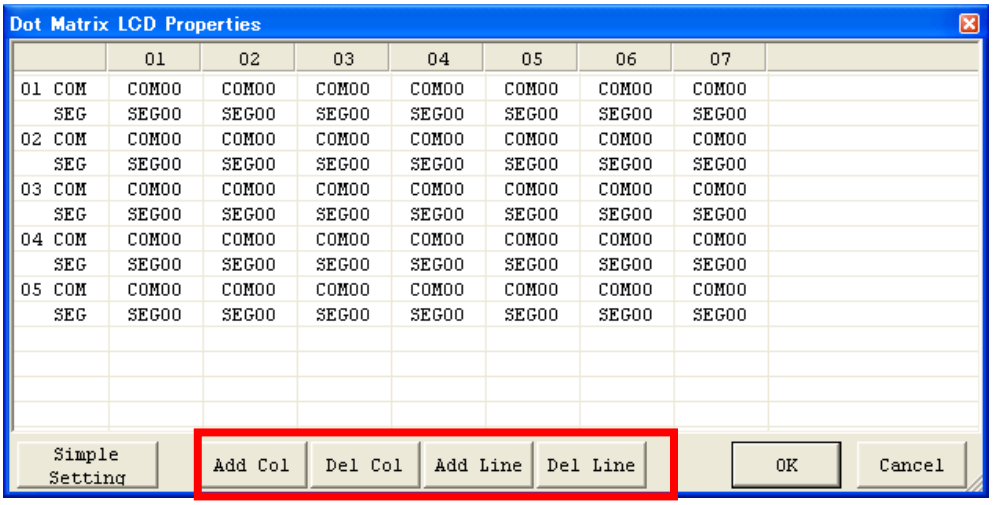
(2) Click on the location where you wish to position the dot matrix LCD.

(3) Double click on the dot matrix LCD you just placed.

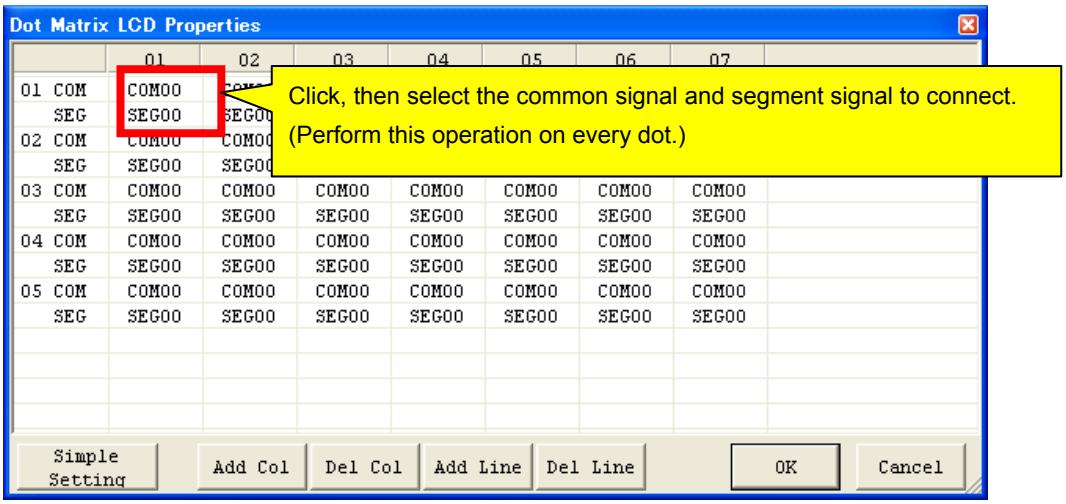


(4) Set the number of lines and columns of the dot matrix LCD.

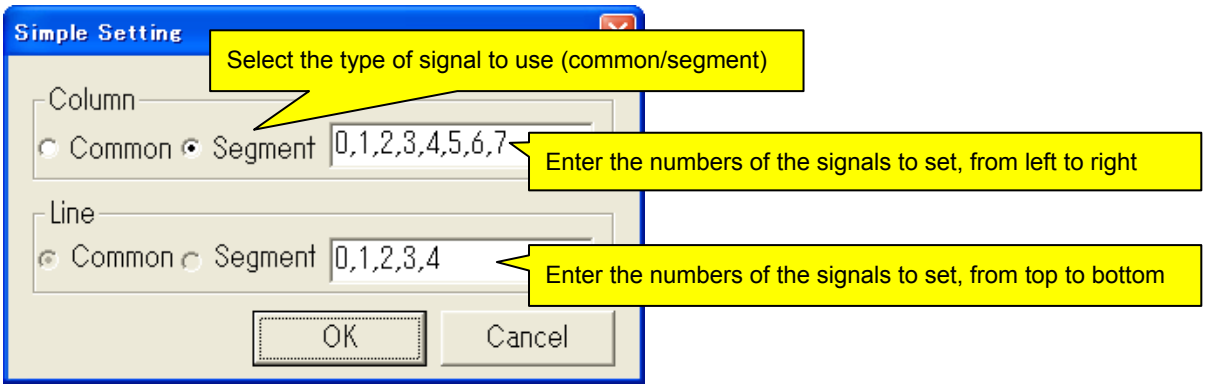
* [Add Col] button: Add one column.
* [Del Col] button: Delete one column.
* [Add Line] button: Add one line.
* [Del Line] button: Delete one line.



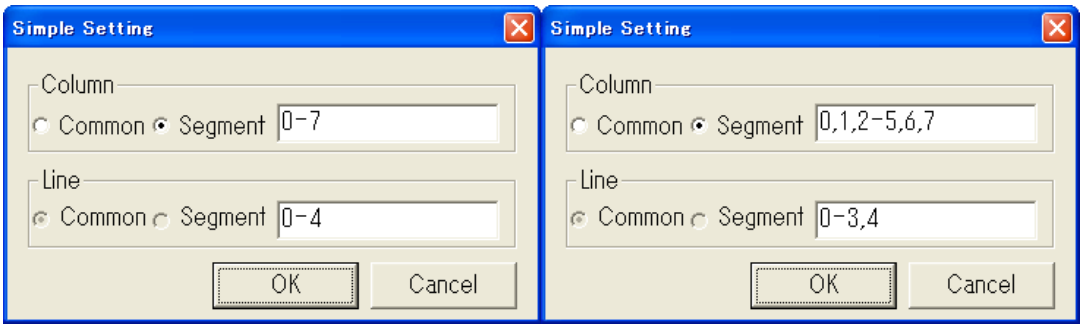
(5) Click on the locations corresponding to each dot, and select the common signal and segment signal to connect.



Note that if there are too many dots to set easily, you can use the [Simple Setting] button.
You can select the common and segment signals for individual dots, as well as each line and column.
The example below shows segment signals 0 through 7 selected for a column, and common signals 0 through 4 selected for a line.



It is also possible to specify a range, as shown below. (This signifies giving all the same setting.)



(6) Click [OK] to close the [Simple Setting] dialog box and the [Dot Matrix] dialog box. The dot matrix LCD can now be used.

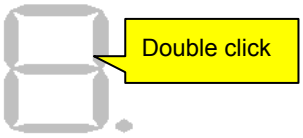
6.5 Using a 7-segment LCD

Follow the steps below to make a 7-segment LCD available.

(1) Click the button.

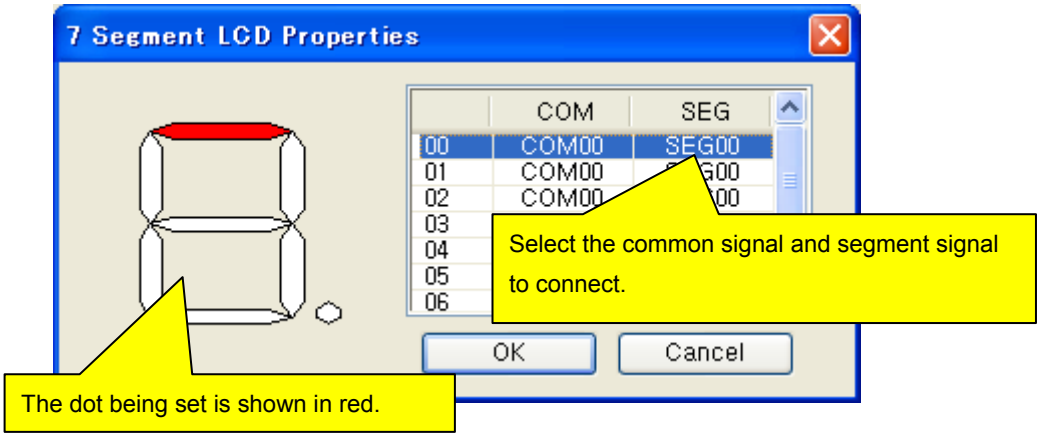
(2) Click on the location where you wish to position the 7-segment LCD.

(3) Double click on the 7-segment LCD you just placed.



(4) Select the common signal and segment signal to connect for each dot in the 7-segment LCD.

Note: The dot being set is displayed in red, so you can tell which dot is being set.



(5) Click [OK] to close the [Dot Properties] dialog. The 7-segment LCD can now be used.

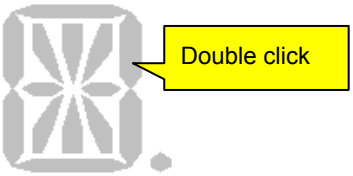
6.6 Using a 14-segment LCD

Follow the steps below to make a 14-segment LCD available.

(1) Click the button.

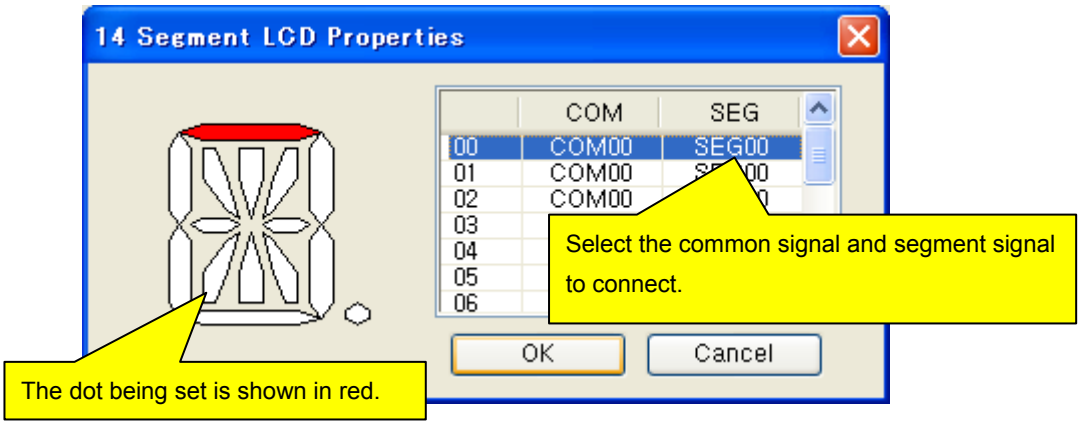
(2) Click on the location where you wish to position the 14-segment LCD.

(3) Double click on the 14-segment LCD you just placed.



(4) Select the common signal and segment signal to connect for each dot in the 14-segment LCD.

Note: The dot being set is displayed in red, so you can tell which dot is being set.



(5) Click [OK] to close the [Dot Properties] dialog. The 14-segment LCD can now be used.

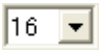
6.7 Naming LCD Components (Adding Text)

You can arrange arbitrary text on the LCD panel window. This is convenient, because it makes it easier to understand by naming LCD components.

(1) Click the button.

(2) Click on the location where you wish to position text.

(3) A text box appears. Enter the text.

(4) If you would like to change the font size, you can select a size from the  pull-down menu.

6.8 Saving a Panel You Have Created

You can save LCD components and text you have created in the LCD panel window.

Note that unlike other windows, you cannot save this in a project file.

(1) Click the button.

(2) Enter a file name, and save it in an arbitrary folder.

6.9 Opening a Panel You Have Created

You can open LCD components and text that you have saved in “Saving a Panel You Have Created” in the LCD panel window.

Note that unlike other windows, the contents of the LCD panel window are not saved in a project file. For this reason, the panel contents will not be restored when a project file is opened.

(1) Click the button.

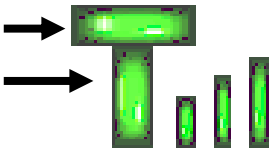
(2) Select the LCD file (file with extension “LCD”).

6.10 Creating LCD Components with Multiple Shapes (Advanced Usage)

If you create LCD components with multiple shapes, you can create ingenious dot LCD combinations.

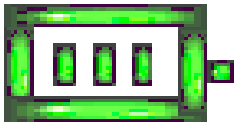
* Example 1: Antenna mark (for displaying signal strength, etc.)

[Key points for creating]
If you assign the same common and segment signals to these two dots, you can treat them as a single dot.



* Example 2: Battery mark (for displaying battery level, etc.)

[Key points for creating]
If you assign the same common and segment signals to all dots in the battery frame, you can treat them as a single dot.



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