LAPIS SEMICONDUCTOR

LCD Image Tool User's Manual

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Contents

1. Preface

LCD Image Tool is program development support software to do the LCD driver output of the micro controller who installs the embeded 8 bits CPU nX-U8/100 and installs the LCD driver function in emulation. It is possible to confirm it even at the stage without the LCD panel of applied product completion image with this tool with LCD by the LCD layout and the application program displayed.
Data necessary to display LCD when the bit map file input doing that images the LCD panel and display allocation information are set when LCD Image Tool is used can be generated automatically. Moreover, the quality of the design and the segment definition of the LCD panel can visually be confirmed in the LCD Image window. In addition, Real-Time LCD Monitor Mode can be achieved by the LCD output from Dr.U8 ICE into this tool via DTU8 Debugger. This manual describes operation of LCD Image Tool.

2. Overview

This chapter gives an overview of LCD Image Tool.

2.1. About this product

LCD Image Tool is composed by two tools of LCD Image Assignment Tool and LCD Image Check Tool.

2.2. Features of LCD Image Tool

LCD Image Tool consists of LCD Image Assignment Tool and LCD Image Check Tool. Their respective features follow
LCD Image Assignment tool supports mapping between the pins of microcontroller and the segment of LCD panel.And LCD Image Check Tool is a useful tool to conform the validity of mapping.
The features of LCD Image Assignemnt tool and LCD Image Check Tool is as follows.

[LCD Image Assignment Tool]
- Allows assignment between an LCD panel and COM pins/SEG pins visually.
- Programable assignment or Fixed assignment. are available.
- You can make the LCD Panel Image which is displayed on LCD Image Assignemnt Tool by the paint tool on the market.
- Auto-generates a data file (table information file) for controlling an LCD panel by program. This table information file can be used for C language or ASM language programming.
- Auto-generates a sample program to use this table file by C language or ASM language programming .
- The state of assignment between an LCD panel and COM pin/SEG pin can be saved and loaded into a CSV format file.

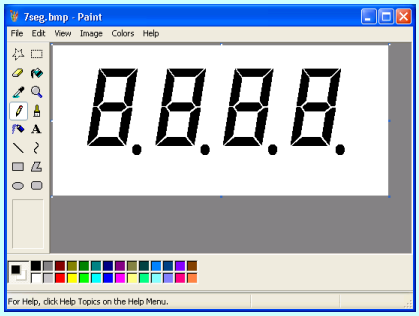
[LCD Image Check Tool]
- You can confirm On/Off of each segment on the LCD panel image by changing the contents of DSPR registers(*1).
- DTU8 Debugger has a feature which write the contents of DSPR registers to HEX file. LCD Image Check Tool loads this file, and turn On / Off each segment on the LCD panel image according to the content of the DSPR register. By this function, when there is not the LCD panel, you can confirm the behabior of program to operate the LCD panel.
- If Real-Time LCD Monitor Mode is set up, the LCD output from Dr.U8 ICE will be taken into this tool via DTU8 Debugger, and Real-Time LCD emulation (On/Off of each segment on the LCD panel image by real timing) will be performed.

*1: “DSPR registers” means the display registers (DSPRxx) in this document. Please refer to the user’s manual of the LSI used for the details of the display registers.

ATTENTION

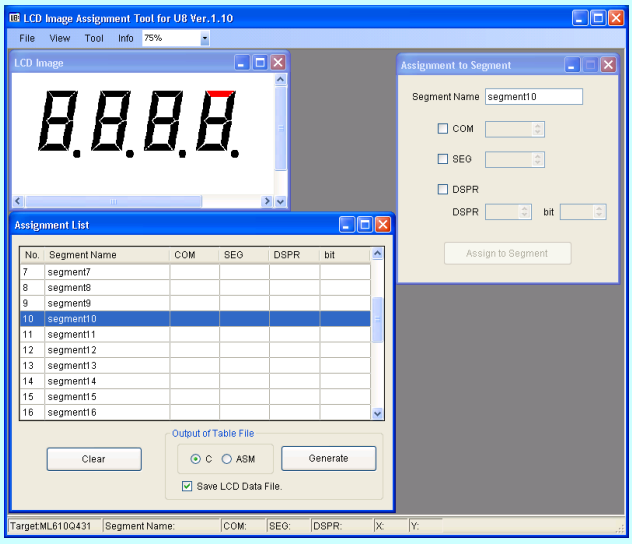
DTU8 Debugger is program development support software. The U8 Development Tools package include DTU8 Debugger. In order to write the contents of the DSPR registers to the file, please use DTU8 V2.51 or later with the U8 device information files corresponding to DSPR register writing. Please refer to Chapter 6.2.2. for the details which write the contents of the DSPR registers to the file using DTU8. The check on terminal COM/terminal SEG that cannot be used by combining the picture frequency and the duty with LCD Image Assignment Tool and LCD Image Check Tool is not executed. Please refer to the hardware manual of each device for details of the combination of the picture frequency and the duty.

① Create an image of an LCD panel.



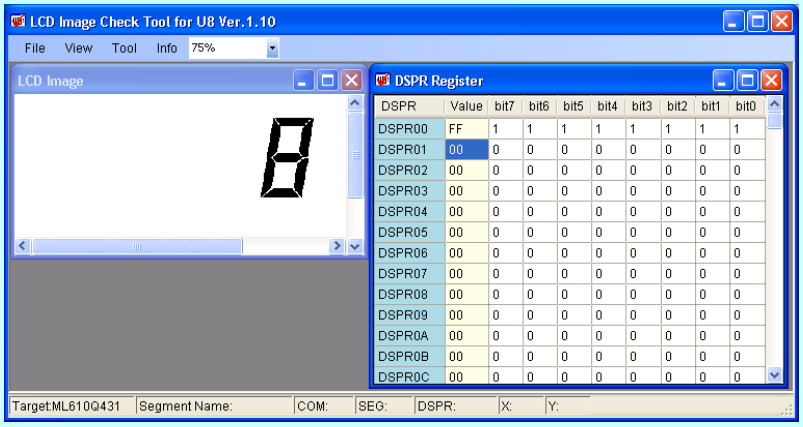
Chapter 4
Creating an LCD panel Image

② Do mapping segments and COM/SEG, DSPR.



Chapter 5
LCD Image assignment tool

③Confirm On/Off of segment



Chapter 6
LCD Image Check Tool

3. Operating Environment

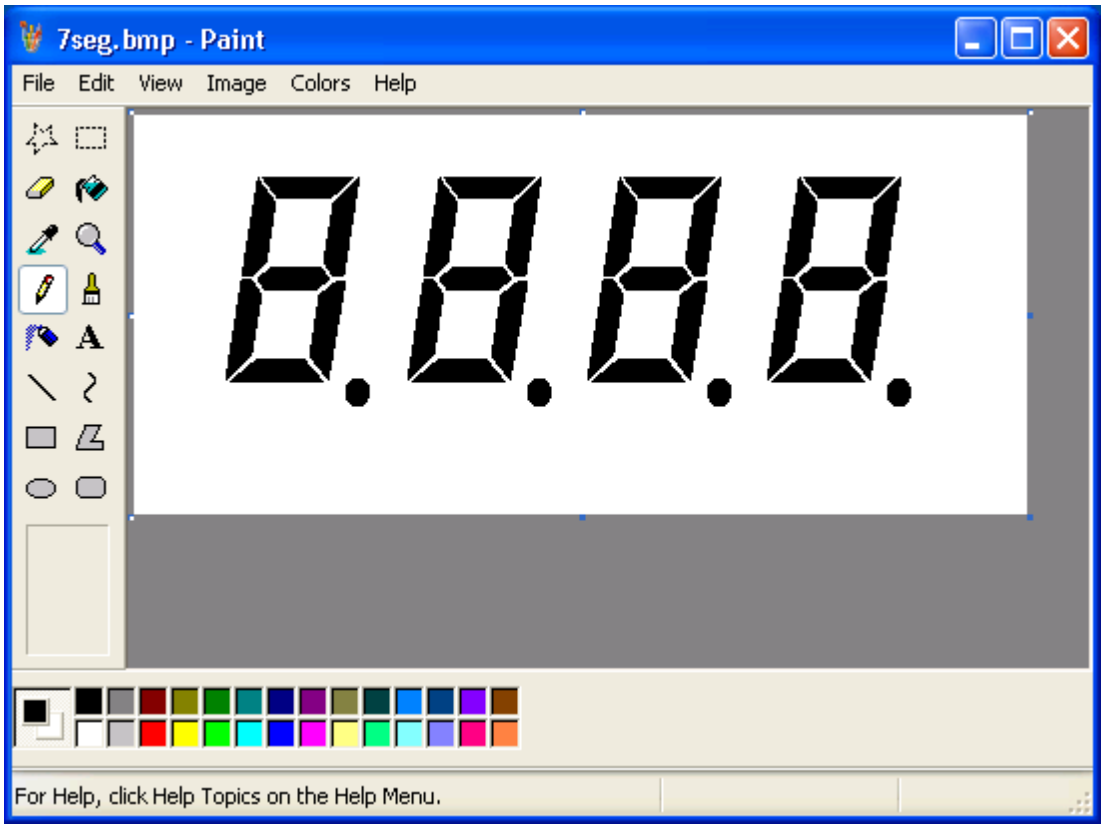
LCD Image Tool operates under the following environment.

Table 3　Operating Environment of LCD Image Tool

Item	Description
PC	IBM PC/AT-compatible machine
OS	Windows XP, Vista*, 7* (*:32-bit version / 64-bit version)
CPU	Recommendation: Intel Pentium/Celeron PC with a clock speed of 350 MHz or higher
Memory	Recommendation: 512 MB or more （LCD Image Assignment Tool and LCD Image Check Tool each require more than 100MB of memory space.）
Video card	Video adapter and color monitor supporting SVGA (800×600) or higher resolution
Hard disk	Free disk space of 10 MB or more required
Others	Pointing device such as a mouse Painting tool such as Paint

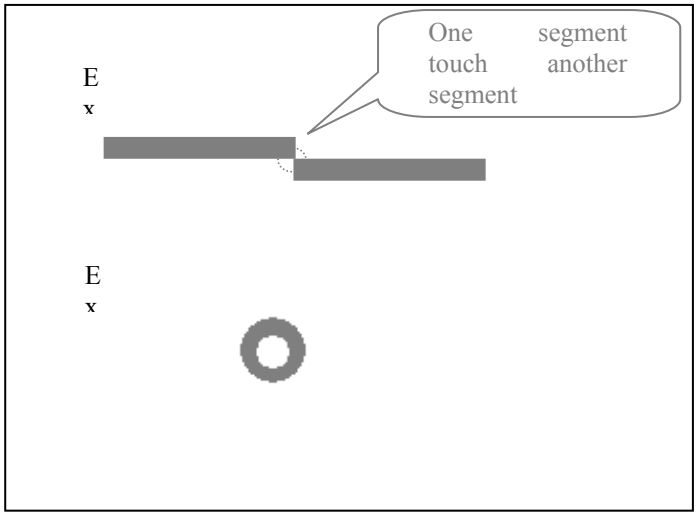
4. Creating LCD Panel Image

To create an LCD panel image, use a commercially-available painting tool that supports the BMP format..
And you can use an image data converted from an LCD panel layout to BMP format.
This document uses “Paint” that comes with Windows XP to create an LCD panel image.

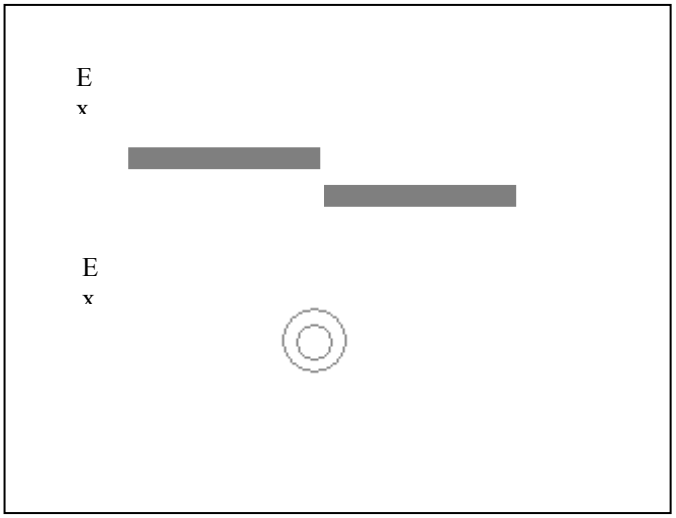


An LCD panel image is composed of segments. The segment means a unit which LCD Image Assignment Tool and LCD Image Check Tool recognize as a figure , and it is composed by sequence points.
The following pattern is an example which LCD Image Tool recognize as a figure.

①A figure which is recognized as one segment



② A figure which is recognized as two segments



ATTENTION

LCD Image Tool can handle only monochrome image. If you use Paint, select ‘Monochrome Bitmap’ on saving. In case of scanning the layout of LCD panel, there are case in which LCD Image Assignment Tool can not recognize the segment for noise as you expected. Therefore remove noise from the layout of LCD panel. The size of the LCD panel image to which LCD Image Assignment Tool can be read becomes 2048×2048 pixels in the maximum.

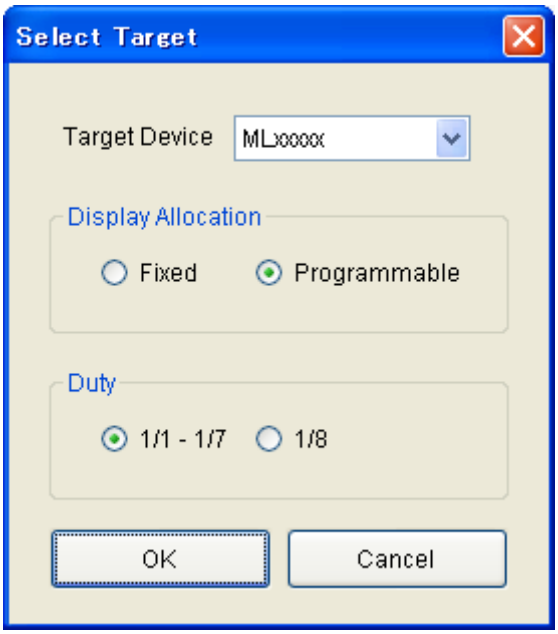
5. LCD Image Assignment Tool

5.1 Activation and Termination

This section describes the procedures for activating and terminating LCD Image Assignment Tool.

5.1.1. Activation Procedure

Go to [Start]>[All Programs]>[U8 Tools]>[LcdAtU8] and select [LCD Image Assignment Tool]. The "Select Target Device" dialog box will then appear.



Select target device from 'Target Device' field, and display allocation type either 'Fixed' or 'Programmable' The allocation type can be selected according to two kinds of the following.

Fixed …Fixed allocation
Programmable …Programmable allocation

When the programmable display allocation is selected, the Duty selection Radio-button becomes effective according to the device. The duty used in the application program is selected.
The duty can be selected according to two kinds of the following.

1/1 - 1/7 … 1/1, 1/2, 1/3, 1/4, 1/5, 1/6, 1/7Duty
1/8 … 1/8Duty

For the details of the display allocation type , refer to the user's manual of the LSI used.

5.1.2. Termination Procedure

To terminate LCD Image Assignment Tool, do one of the following:

(1)Click the 'Cancel' button in the " Select Target Device" dialog box.
(2)Select File->Exit form Menu.

If the user is in the middle of doing COM pin/SEG pin assignment work, the following message is displayed. Select the method of saving working data from among the three choices provided (their respective meanings below).

“Save Current symbol information?”

[YES]	Saves the working data to a file and quits the LCD assignment tool.
[No]	Discards the working data and quits the LCD assignment tool.
[Cancel]	Returns to the main dialog box.

5.2. Definition of LCD panel (Basic Operation)

To define the LCD panel, There are 2 way operation. One is the way to use programmable assignment; the other is the way not to use programmable assignment. In this document, the way not to use programmable assignment is called fixed assignment.
This section describes the procedure of programmable assignment and fixed assignment which are basic operation to define the LCD panel.

5.2.1. Operating Procedure (Fixed Assignment)

STEP1: Create the LCD panel image of Dot matrix using painting tool.
STEP2: Assign COM pins/SEG pins to each dot.
STEP3: Save difinition.

STEP1:Create the LCD panel image of Dot matrix using painting tool.

This section explain case study to make 8 x 8 LCD panel image like Fig 5.2.1_1.
Create this LCD panel image using painting tool.

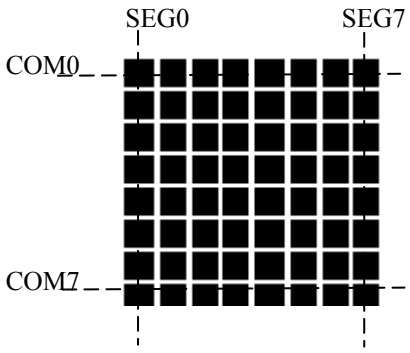


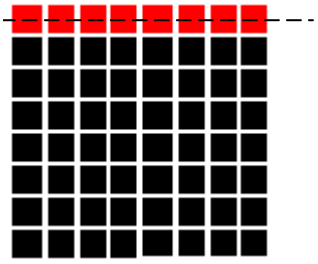
Figure 5.2.1_1 8 x 8 Dot matrix

STEP2:Assign COM pins/SEG pins to each dot.

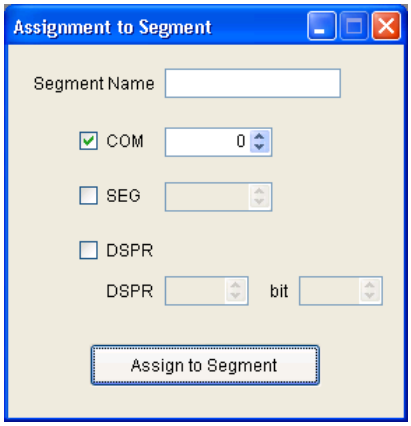
Select ‘File->Load’ and the LCD Dot matrix image which created on STEP1. Just then, this LCD Dot matrix image is displayed on ‘LCD Image’ window.

Assign COM pins/SEG pins to each segment.

COM

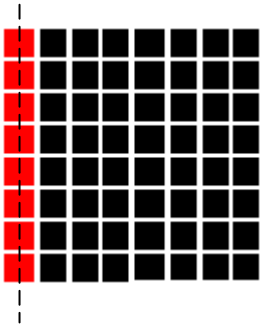


Do continuous selection for segments to connect to COM 0 pin.
(Regarding a continuous selection, refer Chapter 5.4)

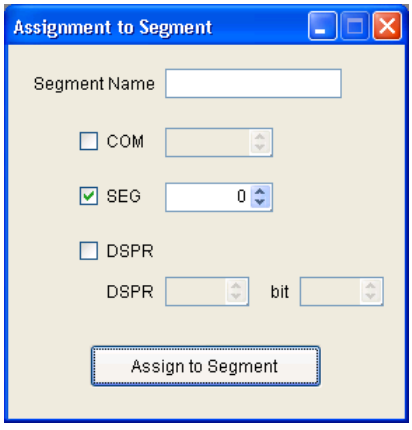


Check COM check box, select 0, and press ‘Assign to Segment’ button.
Likewise, assign from COM 1 to COM 7.

SEG0



Select segments to connect to SEG 0 pin.



Check SEG check box, select 0, and press ‘Assign to Segment’ button.
Likewise, assign from SEG 1 to SEG 7.

STEP3:Save definition

Save the contents of definition to file. This file needs for LCD Image Check Tool.
File -> Save as Specified file name in File dialog box.
File -> Save Overwrite on the file which you write first. In first writing, File dialog box will appear

5.2.2. Operating Procedure (Programmable Assignment)

This section describes the mapping operation the LCD panel, the COM pins/SEG pins and the corresponded to DSPR register.

The procedure for associating an LCD panel with COM pins/SEG pins is as follows:

STEP1: Give a segment name to each segment of the LCD panel.
STEP2: Assign the segment name of each segment of the LCD panel to a COM pin/SEG pin.
STEP3: Assign the segment name of each segment to a DSPR register.
STEP4: Generate table information.
STEP5: Create a program using the table information.

Detailed description of each step follows.

STEP1:Give a Segment name to Each Segment of the LCD Panel

The method of defining each segment is described below, taking an LCD panel as shown in the figure below as an example.

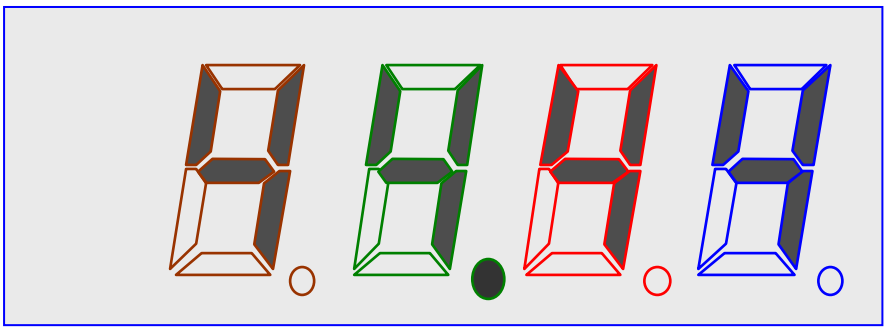


Figure 5.2.2_1 Example of LCD Panel

Give each segment a segment name (specific name) so that each segment can be identified. You do not always give a symbole name , but a segment name is useful to confim assignment condtion between COM pins/SEG pins and segments.
Characters from 0A to 4H in the figure below are the segment names assigned to the segments.

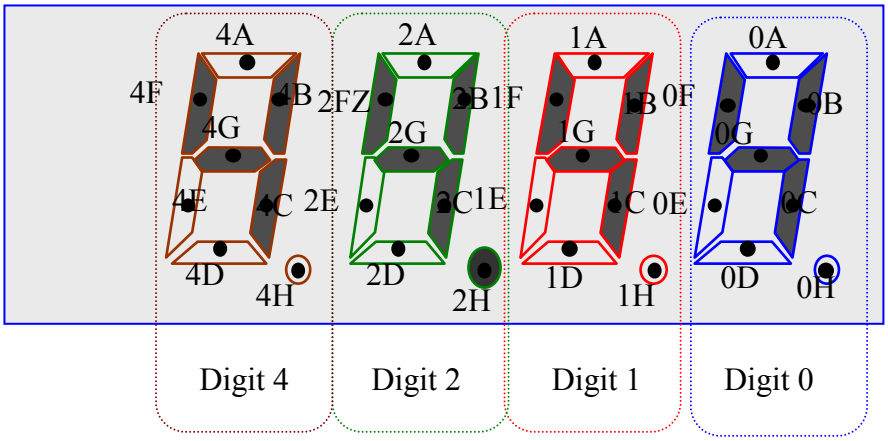


Figure 5.2.2_2 Definition of Segment Names

STEP2:Assign the Segment name of Each Segment of the LCD Panel to a COM Pin/SEG Pin

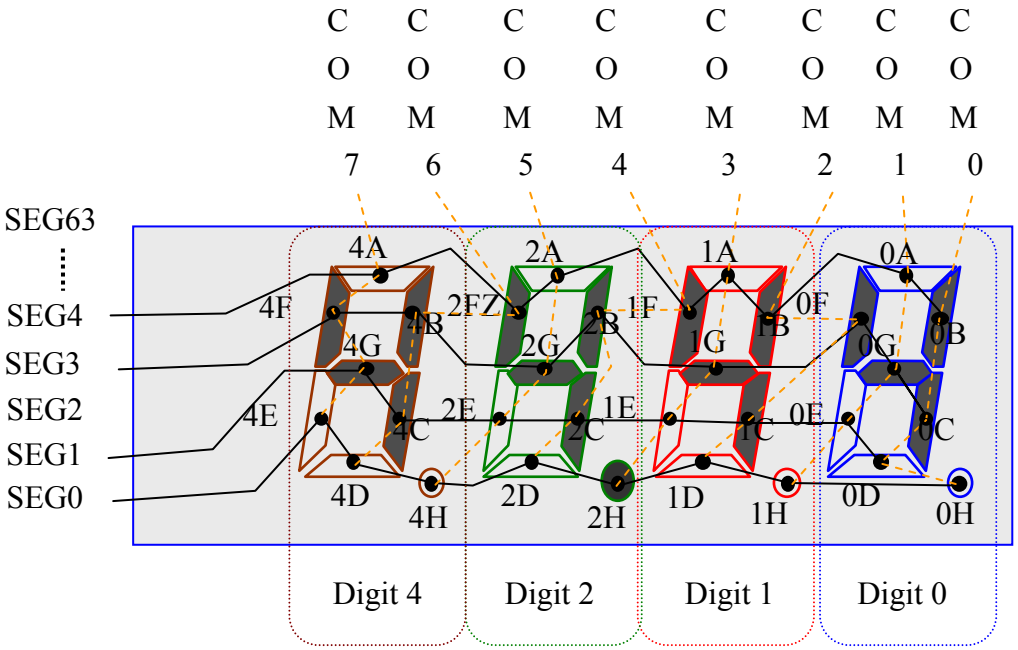


Figure 5.2.2_3 Assignment of COM Pins/SEG Pins

Each segment of LCD is to be connected to one COM pin and one SEG pin. Figure 5.2.2_3 shows an example of assigning the segments of LCD to the COM pins/SEG pins. In Figure 5.2.2_3, the segment defined as 0A is connected to COM1/SEG4. Likewise, 0B is connected to COM0/SEG4.

Next , by doing mapping between segment more than one and DSPR,you can control On/Off of LCD segment by your program. In this section, do mapping between bit 7 of DSPR0 and 0A segment.

Segment [0A] ⟺ COM pins/SEG pins [COM0/SEG4] ⟺ DSPR [DSPR0/bit 7]

Use ‘Assignment to Segment ‘Window to do mapping.
The detailed procedure is as follows.

①I nvoke LCD Image Assignment Tool , and select ‘Programablme’ check box
②Select ‘File->Load Image File’, and load the LCD panel image that prepared on Step1.
If download succedd, ‘LCD Image’ window will be appeaed, and display LCD panel Image on this window. At the same time, ‘Assignment List’ window and ‘Assignment to Segment’ window will be appeared.
③ Select target segment on ‘LCD Image’ window. The color of selected segment turns red. And you can cancel the selected segment by selecting a white backgroud.
④The name which LCD Image Assignment Tool assigned automatically will be appeared in ‘Segment name’ text box. In Fig5.2.2_4, change symbole name into 0A.
⑤Check COM check box, and select 1.
⑥Check SEG check box, and select 4.
⑦Check DSPR check box, and select 0 for DSPR, select 7 for bit.
⑧Press ‘Assign to Segment’ button, each contents are reflected into ‘Assignment List’ window.

It is possible for COM, SEG, and DSPR field to input directly.
After this, define segment name for the selected segment by operation from 3 to 8.

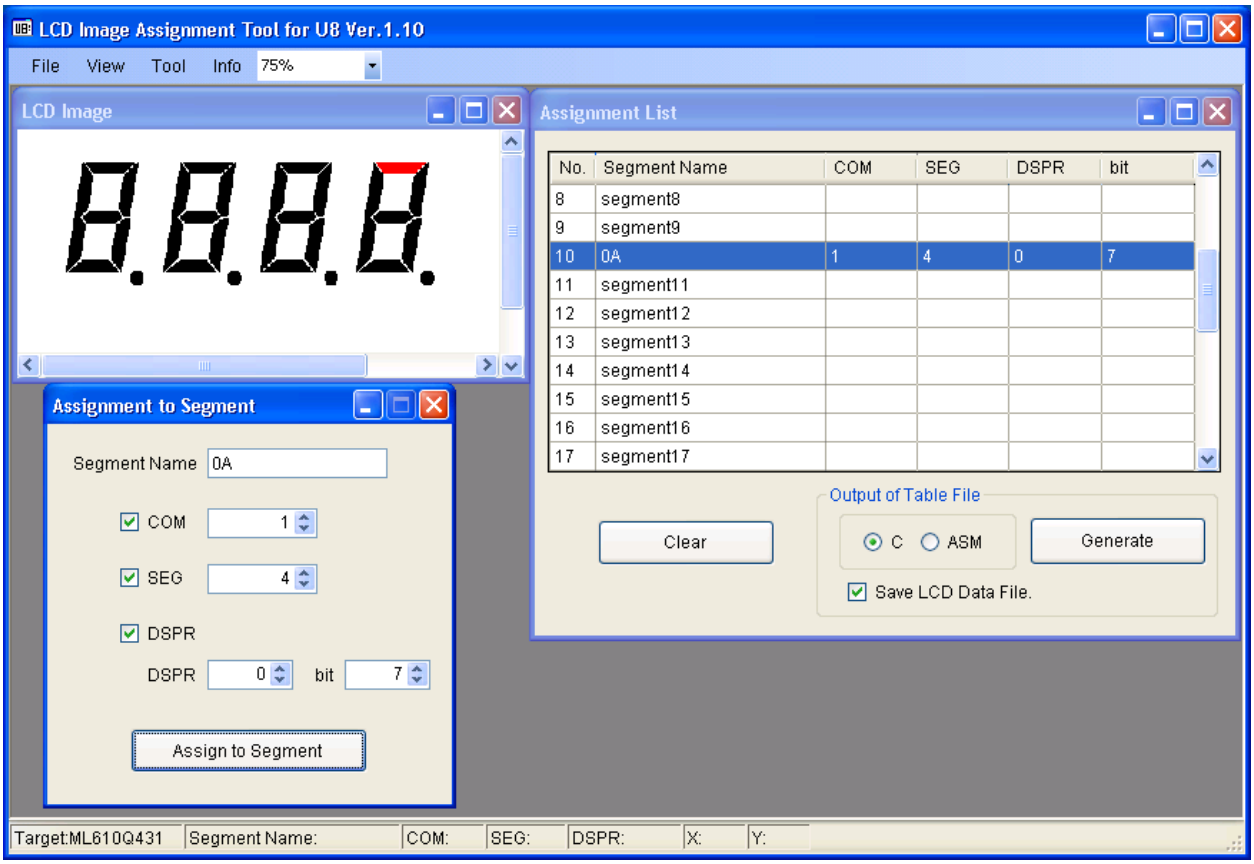
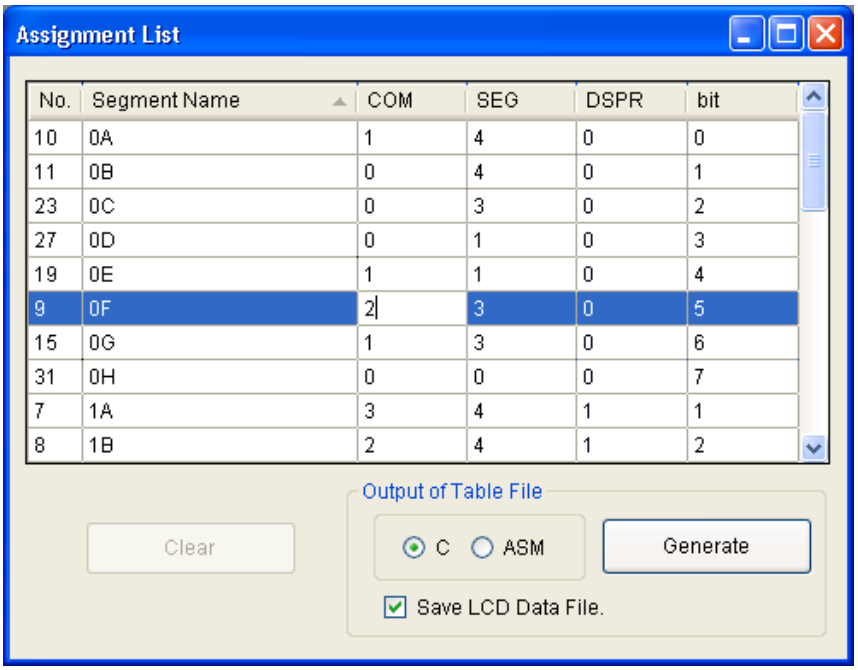


Figure 5.2.2_4 Screen Image

STEP3:Confirmation

You can confirm information about the assigned segment on Step2 on ‘Assignment List’ window.

Confirm assigned contents by the below procedure, and if you find a mistake, correct it.
・ Select a line which you want to confirm assignment, so corresponded segment turn red.
And a content of selected line is displayed on ‘Assignment to Segment’ window. If you find a mistake, you can correct a mistake on ‘Assignment to Segment’ window and press ‘Assign to Segment’.
・ In case of erasing the contents, select a line and press ‘Clear’ button. The plural selection of line is possible while pressing the Ctrl key.
・ Each item of The ‘Assignment List’ can sort. Regarding sort function, refer chapter 5.5.
・ Confirm that ‘Generate’ button is active. If ‘Generate’ button is not active, there are some pins which assignment does not complete. Check using the ‘Assignment List’ window.



STEP4:Generate Table Information

When all the segments have been assigned to the DSPR registers, generate table information to be used in program by taking the following procedure:
①Table information for C language or or ASM language can be created. Select the “C” or “ASM” radio button to determine the type of table information to generate.
②Pressing the [Generate] button displays the default file name in the “Save as” dialog box. If you want to use the default file name, press the [Save] button. If you want to change the file name, change the default file name and then press the [Save] button.
③A table information file and a sample program will be generated in the folder specified by the “Save as” dialog box.

STEP5:Create a Program Using the Table Information

If C language was selected in STEP4, LCD Image Assignment Tool generates two types of files, the extensions of which are .tac and .tbc.
If ASM language was selected, LCD Image Assignment Tool generates two types of files, the extensions of which are .taa and .tba. The extensions .tac and .taa denote the initialization table for display assignment register A and the extensions .tbc and .tba the initialization table for display assignment register B. For the display assignment registers A and B, refer to the user’s manual of the device used. Since these table information files are compliant with the C language and ASM language formats, they can be used as is.
Also, LCD Image Assignment Tool generates sample programs where the use of table information files and the basic control method of an LCD panel are described. The file names of the sample programs are as follows:

For C language: File name specified in STEP4 + .c
For ASM language: File name specified in STEP4 + .asm

ATTENTION

-The Fixed assignment does not need the table information file. Therefore the generate button does not become to active on selecting the Fixed assignemnt.
-The sample program selects type 3 for the display register segment map. This is restriction of LSI. Regardintg this matter, refer to the user's manual of the LSI used.

5.3. Definition of LCD panel (Applied Operation)

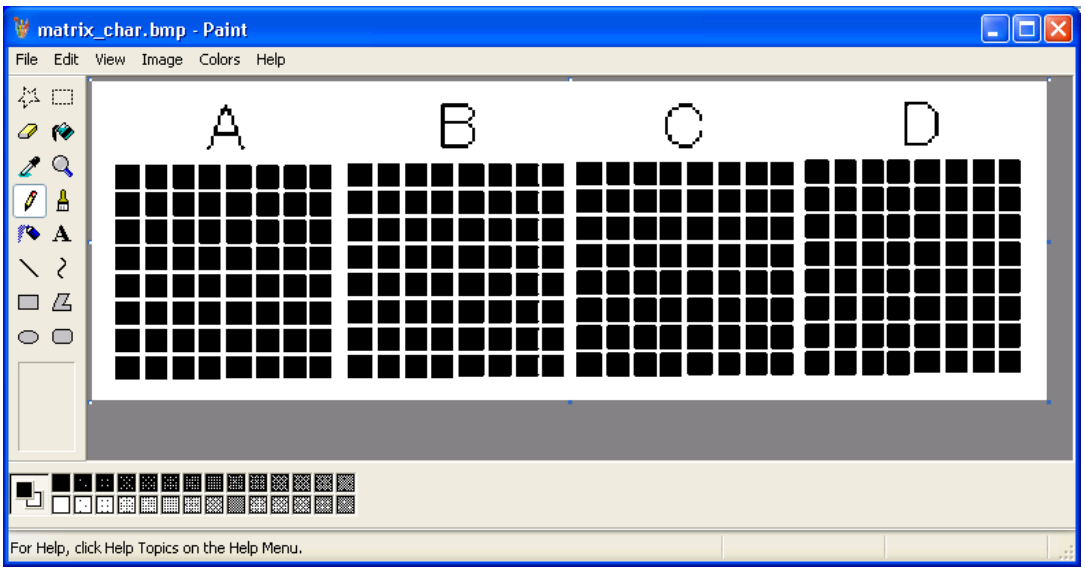
This section describes the procedure of programmable assignment and fixed assignment which are basic operation to define the LCD panel.

5.3.1. Dot Matrix Image LCD panel with Character

In the case of using the LCD bitmap image which the dot matrix image and character are mixed, do mapping to COM pins/ SEG pins by the below procedure.

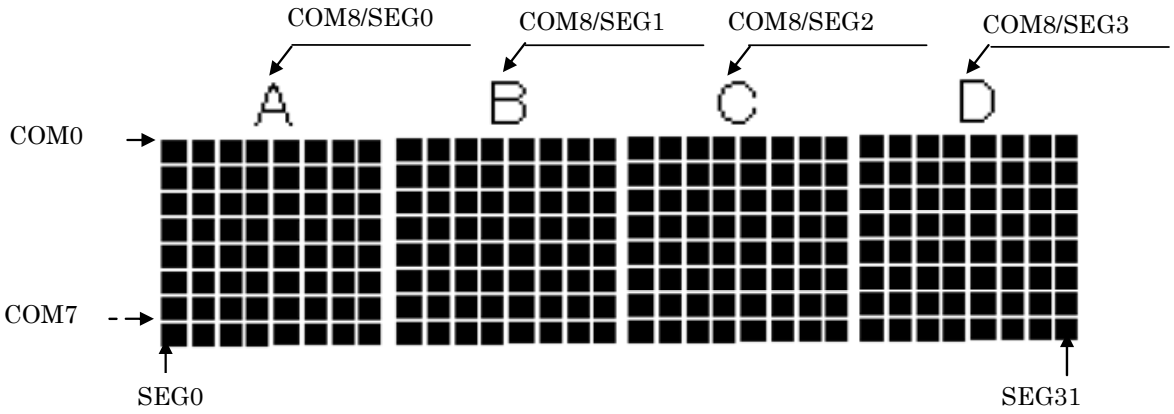
STEP1:Create the LCD bitmap image using painting tool

Design the image which 8 x 8 dot matrix and character(A,B,C,D) are mixed like the below figure.

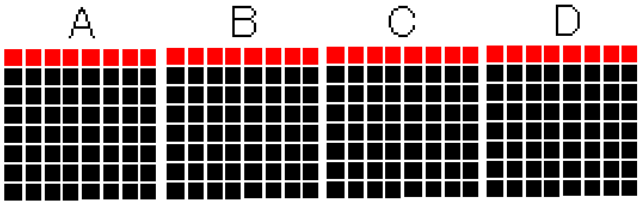


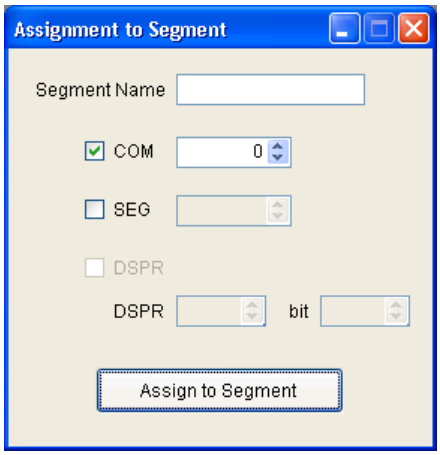
STEP2:Invoke LCD Image Assignment Tool by fixed mode

This section gives procedure to assign COM pins/SEG pins to the LCD image which character and dot matrix are mixed.



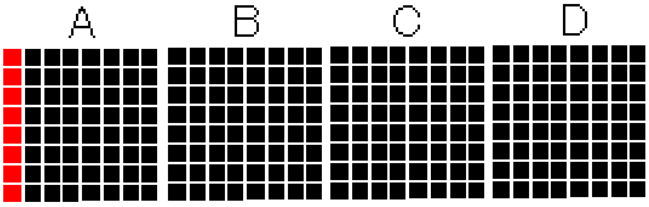
Assign selected segments to connect COM 0 pin.

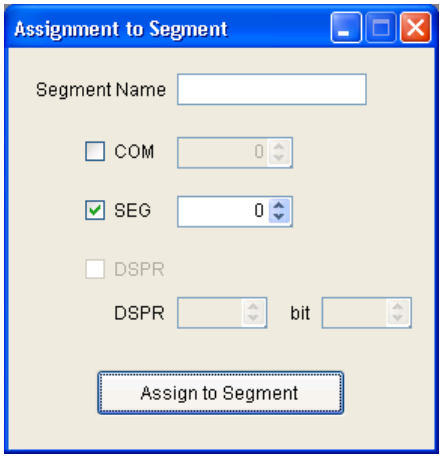




Likewise, assign segments to other pin from COM1 to COM7

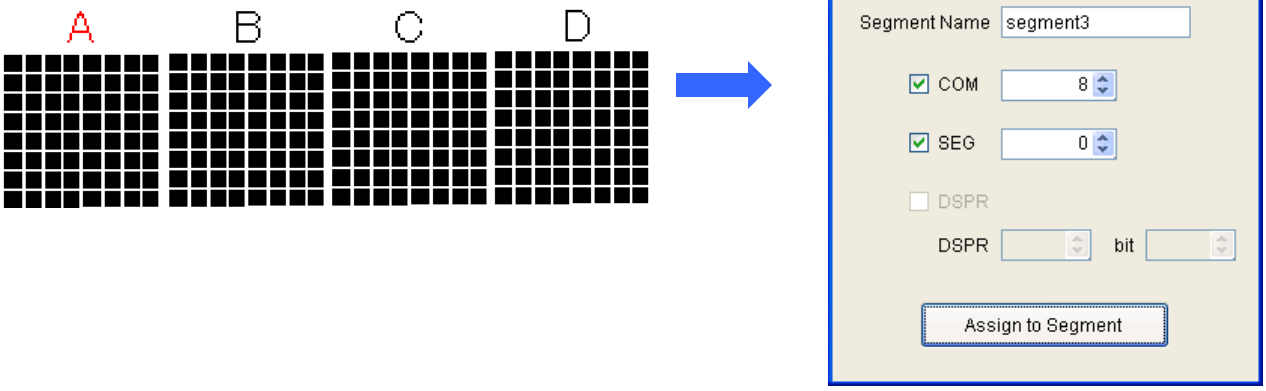
Assign selected segments to connect SEG 0 pin.





Likewise, assign segments to other pin from SEG1 to SEG31

Assign character to any COM pin/SEG pin.



When you select fixed display allocation function, the DSPR which correspond to each COM pins/SEG pins is decided by each LSI. Regrading the relationship between COM pins /SEG pins and DSPR, refer to the user's manual of the LSI used.

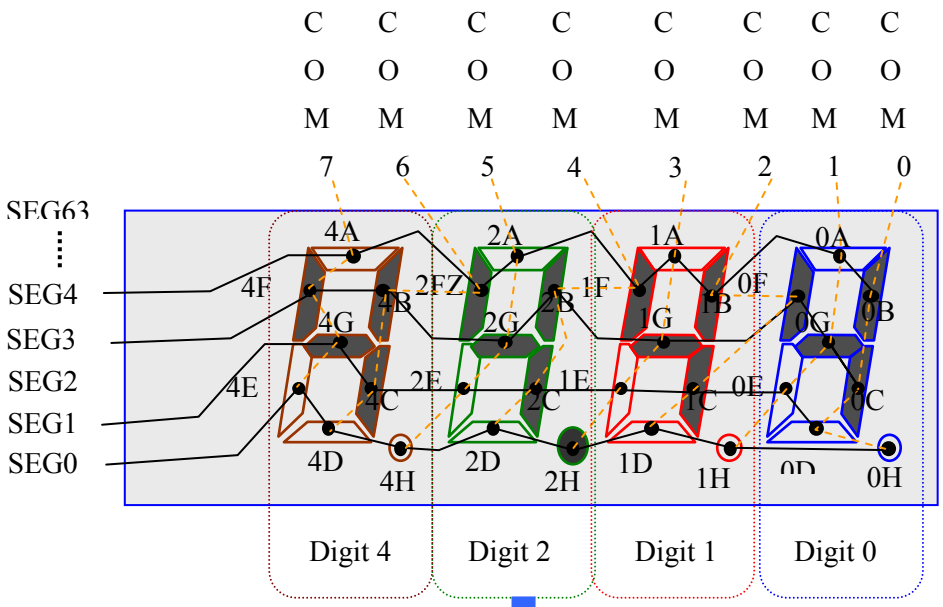
5.3.2. Definition of LCD panel by CSV file

In the case of using the CSV file, do mapping to COM pins/ SEG pins by the below procedure.

STEP1: Create the list which assigned segment name and COM pin/SEG pin to each segment.
STEP2: Assign the segment name of each segment.
STEP3: Save the CSV file.
STEP4: Edit the CSV file.
STEP5: Load the CSV file.

STEP1:Create the list which assigned segment name and COM pin/SEG pin to each segment.

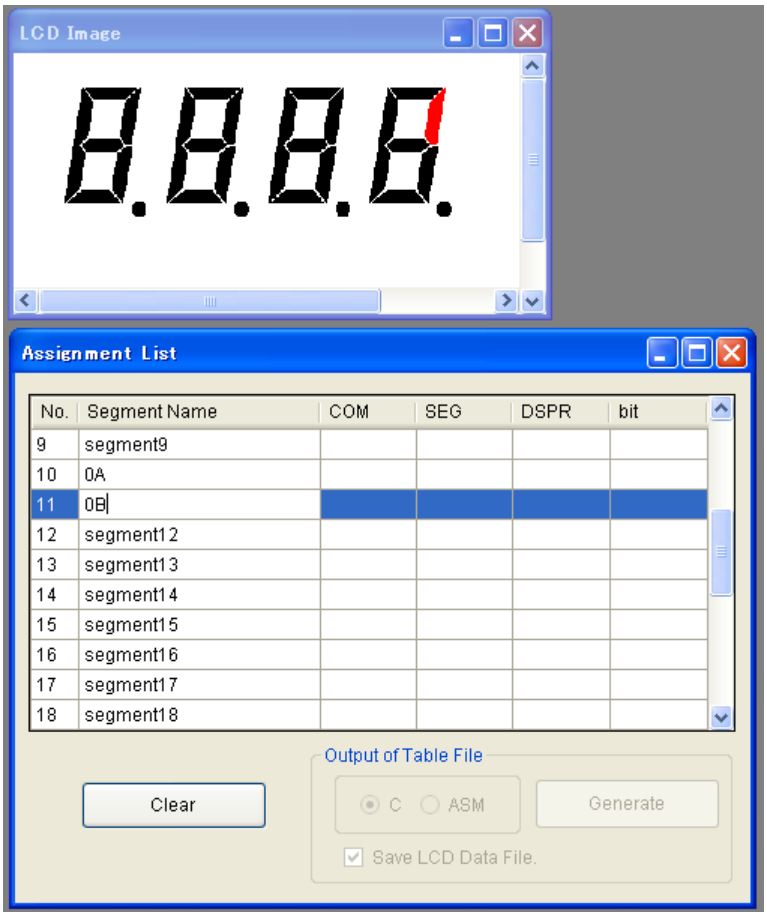
Create the list which assigned a name and COM/SEG to each segment by Excel etc.



Segment	COM	SEG	DSPR	bit
0A	1	4	0	0
0B	0	4	0	1
0C	0	3	0	2
0D	0	1	0	3
0E	1	1	0	4
0F	2	3	0	5
0G	1	3	0	6
0H	0	0	0	7
1A	3	4	1	1
1B	2	4	1	2
1C	2	1	1	3
1D	2	0	1	4
1E	3	1	1	5
1F	4	4	1	6
1G	3	3	1	7
1H	1	0	1	0
2A	5	4	2	0
2B	4	3	2	1
2C	4	1	2	2
2D	4	0	2	3
2E	5	1	2	4
2F	6	4	2	5
2G	5	3	2	6
2H	3	0	2	7
4A	7	4	3	0
4B	6	3	3	1
4C	6	1	3	2
4D	6	0	3	3
4E	7	0	3	4
4F	7	3	3	5
4G	7	1	3	6
4H	5	0	3	7

STEP2:Assign the segment name of each segment.

① Select ‘File->Load Image File’, and load the LCD panel image.If download succedd, ‘LCD Image’ window will be appeaed, and display LCD panel Image on this window. At the same time, The segment name which LCD Image Assignment Tool assigned automatically to each segment is displayed on ‘Assignment List’ window.
② Select target segment on ‘LCD Image’ window. Change the segment name into the name assigned on STEP1 in ‘ Assignment List’ window.
③ Repeat ② to all the segments.



STEP3:Save the CSV file.

Select ‘File->Save CSV File’, and save current settings to the CSV file.

ATTENTION

Regardless of the turn currently displayed on ‘Assignment List’ window, each line is outputted to order with a small value of “No.” column to the CSV file.
Each column is outputted as well as ‘Assignment List’ window in order of “No.”, “Segment Name”, “COM”, “SEG”, “DSPR”, and “bit”.
When fixed assignment is selected, “DSPR” and “bit” are outputted as a blank.

STEP4:Edit the CSV file.

Open the CSV file outputted on STEP3 by Excel. Each line is sorted by ascending order with the value of “No.” column. Sort in ascending order with the value of “Segment Name”. Copy the setting of each segment from the list created on STEP1, and paste on the CSV file.

0	4F				
1	4A				
2	4B				
3	2F				
4	2A				
5	2B				
6	1F				
7	1A				
8	1B				
9	0F				
10	0A				
11	0B				
12	4G				
13	2G				
14	1G				
15	0G				
16	4E				
17	2E				
18	1E				
19	0E				
20	4C				
21	2C				
22	1C				
23	0C				
24	4D				
25	2D				
26	1D				
27	0D				
28	4H				
29	2H				
30	1H				
31	0H				

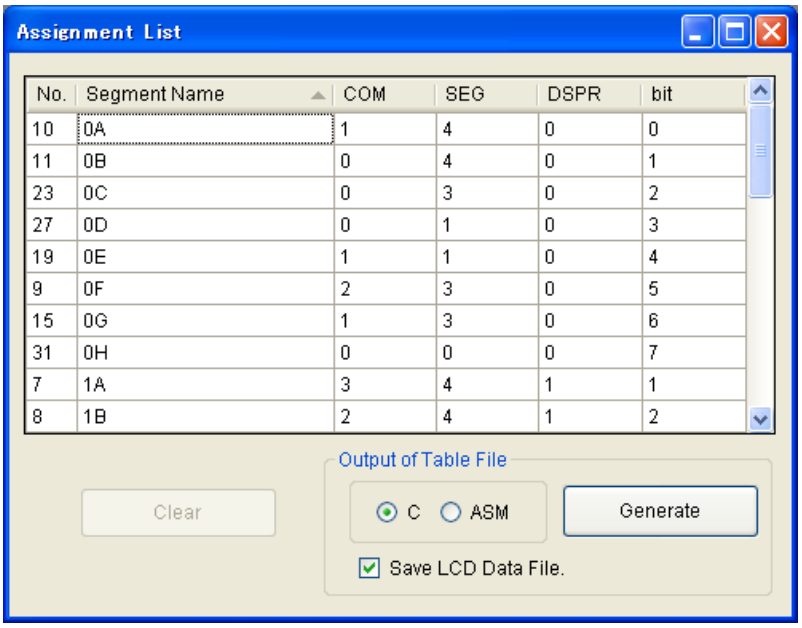
10	0A	1	4	0	0
11	0B	0	4	0	1
23	0C	0	3	0	2
27	0D	0	1	0	3
19	0E	1	1	0	4
9	0F	2	3	0	5
15	0G	1	3	0	6
31	0H	0	0	0	7
7	1A	3	4	1	1
8	1B	2	4	1	2
22	1C	2	1	1	3
26	1D	2	0	1	4
18	1E	3	1	1	5
6	1F	4	4	1	6
14	1G	3	3	1	7
30	1H	1	0	1	0
4	2A	5	4	2	0
5	2B	4	3	2	1
21	2C	4	1	2	2
25	2D	4	0	2	3
17	2E	5	1	2	4
3	2F	6	4	2	5
13	2G	5	3	2	6
29	2H	3	0	2	7
1	4A	7	4	3	0
2	4B	6	3	3	1
20	4C	6	1	3	2
24	4D	6	0	3	3
16	4E	7	0	3	4
0	4F	7	3	3	5
12	4G	7	1	3	6
28	4H	5	0	3	7

ATTENTION

Don't change the value of “No.” column.
Each column should not have a blank. Set 0 as all cells of the “DSPR” column and “bit” column when fixed assignment is selected..

STEP5:Load the CSV file.

Select ‘File->Load CSV File’, and load the CSV file edited on STEP4.



5.4. Selecting Segment

In the LCD Image window, the method of selecting the segment is as follows.

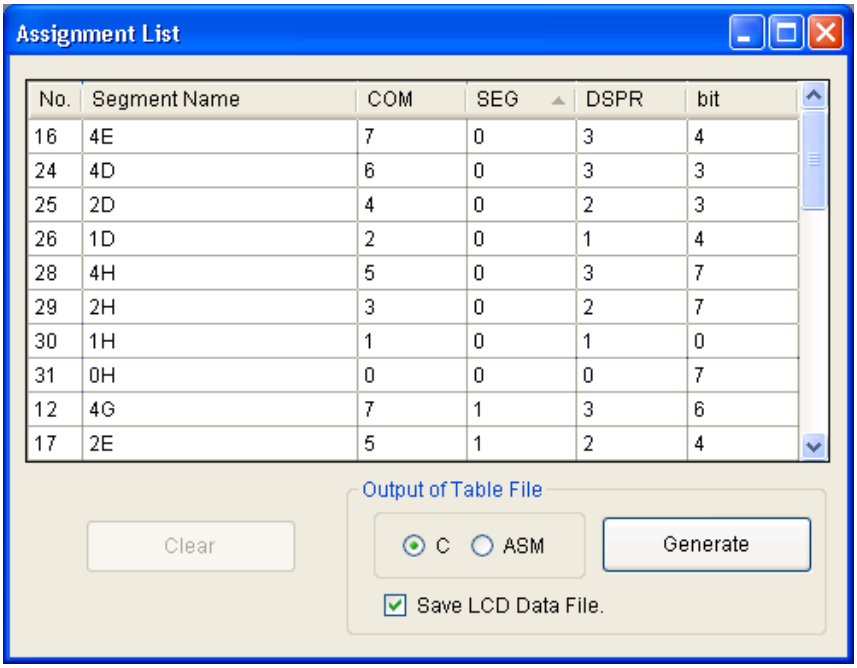
① Left-click the target segment. Doing it while holding down the Ctrl key allows segments to be selected continuously.

② Drag the cursor while holding down the left button of the mouse to select a group of segments.

③ Select ‘Clear’ from context menu, to cancel definition of segment.

5.5. Sorting Assignment List

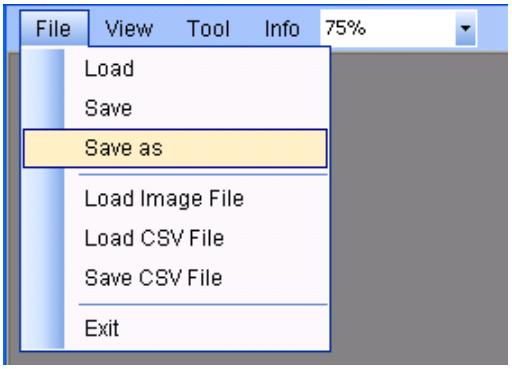
Assignment List’ window can sort each line. At this time you can use each item as sort key. If you click an item which you want to be sort key, each line will be sorted by descending order. And click the item again; it will be sorted by ascending order.



5.6. Saving and Restoring Working Status

By selecting ‘File->Save’ command or ‘File->Save as’ command, the working status can be saved to a file called an LCD data file (.ld8).
Also, the saved working status can be restored (loaded) by ‘File->Load’ command.

5.6.1. Saving Working Status



To overwrite the LCD data file currently loaded, select ‘File->Save’. To create a new LCD data file, select ‘File->Save as’.

When ‘File->Save’ is selected:
The following message is displayed. Confirm the message content and then select “Yes”.
Message example: “file name” already exists.¥n Do you overwrite?

When ‘File->Save as’ is selected:
The “Save as” dialog box is displayed.
A file name is displayed in the file name field according to the following naming rules:

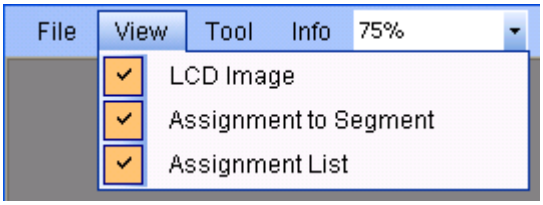
- If there is an LCD data file currently loaded, the file name of the LCD data file is displayed.
- If there is no LCD data file currently loaded, a file name is displayed according to the following naming rules:
  File name: “lcdImgAtU8”+”_yymmdd”+”_hhmmss”+“.ld8”
  For example, if the save date and time is March 24, 2008, 15:15:00, the file name “lcdImgAtU8_080324_151500.ld8” is displayed.

5.6.2. Restoring Working Status

To restore working status, select ‘File->Load’. The “Open File” dialog box will then appear. Select the desired LCD data file and load it.

5.7. Re-Displaying Window

If the LCD Image window, Assignment List window, or to Segment window is currently closed, the window currently closed can be redisplayed by selecting that window from Assignment the Window menu.



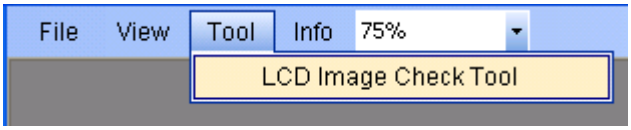
The bit map image displayed in the LCD Image window can be scaled using the Zoom combo box in the menu bar. The bit map image screen can be scaled either by selecting a zoom rate from the drop-down list or by directly entering a desired zoom rate. When entering a zoom rate directly, a value of 10% to 800% can be entered.

6. LCD Image Check Tool

6.1. Activation and Termination

6.1.1. Activation Procedure

LCD Image Check Tool is activated from LCD Image Assignment Tool.
From the menu bar of LCD Image Assignment Tool, select 'Tool->LCD Image Check Tool'.



At this time, if fixed assignment was selected in the Select Target dialog box of LCD Image Assignment Tool in Section 5.1.1, "Activation Procedure," the dialog box shown in Figure 6.1.1 will then appear. The fixed assignment type is a type of address mapping for DSPR registers in fixed assignment. For the details of the fixed display assignment type, refer to the user's manual of the LSI used.
The dialog box shown in Figure 6.1.1 will not appear if programmable assignment was selected in the Select Target dialog box of LCD Image Assignment Tool.

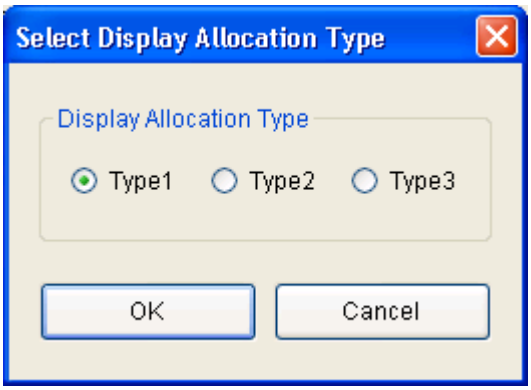


Figure 6.1.1 Select Display Allocation Type Dialog Box

6.1.2. Termination Procedure

To terminate LCD Image Assignment Tool, do one of the following:

(1)Click the 'Cancel' button in the " Select Target Device" dialog box.
(2)Select File->Exit form Menu.

6.2. Checking LCD Segments ON

LCD Image Check Tool allows the user to check that each segment of the LCD panel is turned on or off on PC.
The tool is provided with the following three modes for checking the status of each segment of the LCD panel:

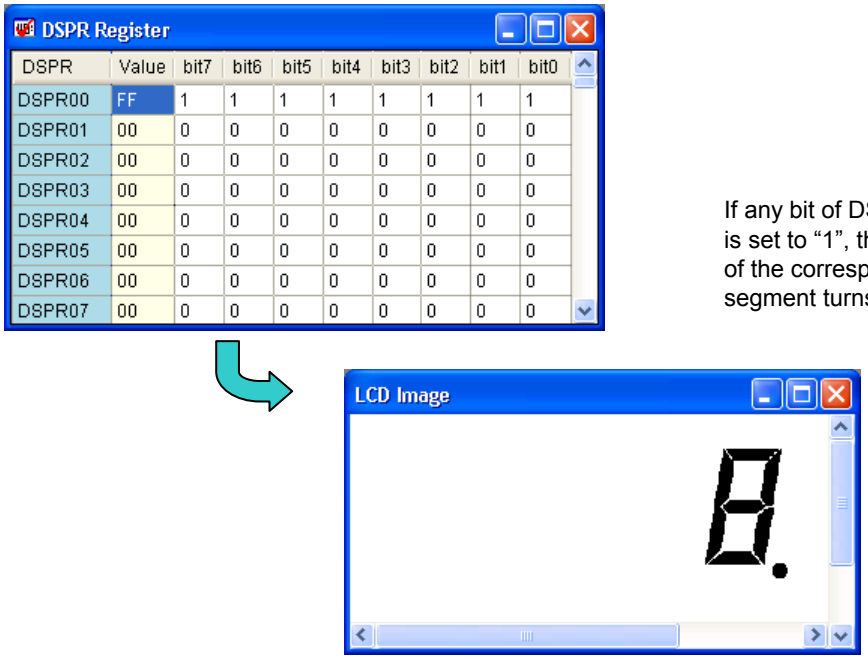
•Manual mode
This mode is used to check the contents of the LCD panel segment definitions defined by LCD Image Assignment Tool.
If any change is made to the contents of a DSPR register by LCD Image Check Tool, the color of the LCD segment corresponding to the DSPR register changes.

•Auto-Update Mode

In this mode, the color of each segment of the LCD panel of LCD Image Check Tool is automatically updated as the value of a DSPR register in DTU8 Debugger changes in conjunction with DTU8 Debugger.

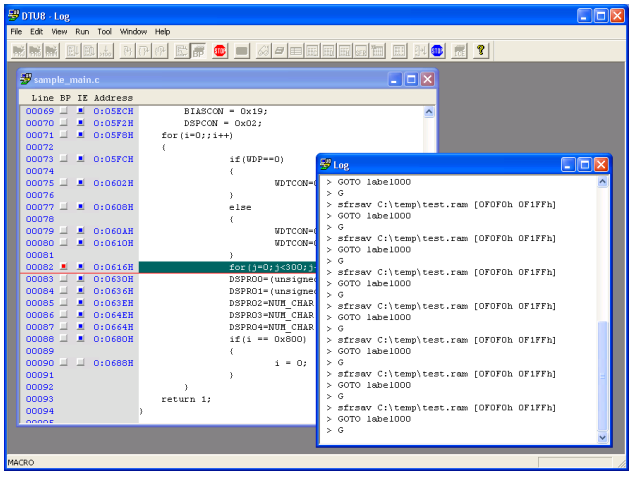
•Real-Time LCD Monitor Mode
In this mode, the LCD output from Dr.U8 ICE will be taken into this tool via DTU8 Debugger, and Real-Time LCD display emulation (On/Off of each segment on the LCD panel image by real timing) will be performed.

Manual mode



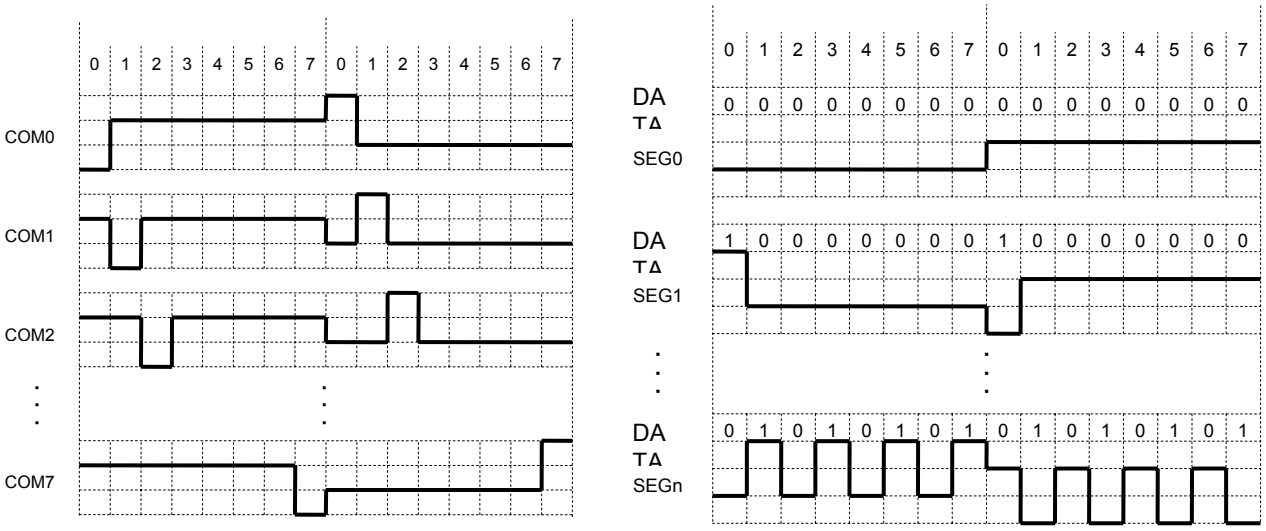
If any bit of DSPRxx is set to “1”, the color of the corresponding segment turns black.

Auto-update mode

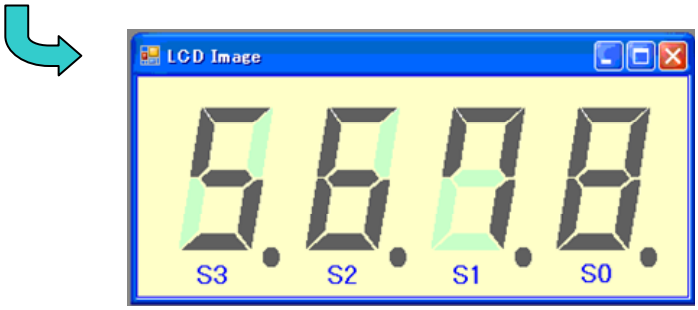


The color of each segment changes in conjunction with the program running on the DTU8 debugger.

Real-time LCD monitor mode



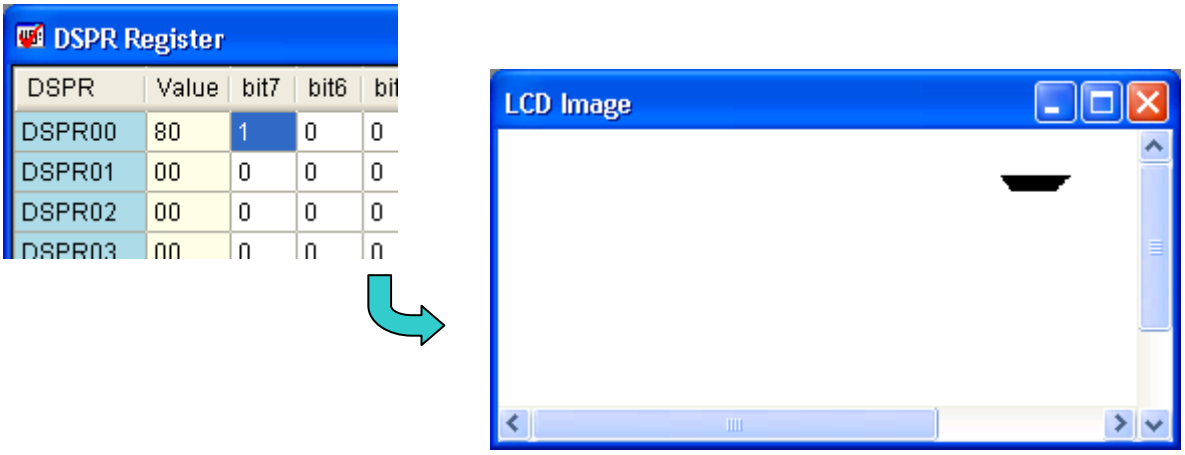
It synchronizes with the signal of terminal COM/terminal SEG, and the color of each segment changes



6.2.1. Confirming Segment Definitions of LCD Panel (Manual Mode)

Normally, LCD Image Check Tool is in manual mode after activation. Nothing is displayed on LCD Image window.

In STEP2 in Section 5.2.2, “Operating Procedure (Programmable Assignment),” segment “0A” has been assigned to DSPR00/bit7 by LCD Image Assignment Tool.
If in this state, you move the mouse cursor to the DSPR00/bit7 cell in the DSPR Register window and then left-click on the cell, the cell goes into a “selected” state. Moving the mouse cursor to the destination cell and then making it “selected” is called “move the focus.”
After moving the focus to the DSPR00/bit7 cell, if a 1 is input to the cell, the color of segment 1 in the LCD Image window turns black. Inputting a 1 to a cell indicates outputting an ON waveform to COM/SEG pins. Also, a “black” segment indicates that the segment is ON.



By first mapping segment “0A” to DSPR00/bit7 in LCD Image Assignment Tool and then by changing the value of DSPR00/bit7 to 1 in LCD Image Check Tool, segment “0A” turns black.

By manipulating DSPR registers as described above, it is possible to verify the mapping between each segment of the LCD panel and the DSPR registers.

6.2.2. Auto-Update Mode (Connecting with DTU8 Debugger)

LCD Image Check Tool allows displaying an LCD panel image on the LCD Image window in synchronization with the contents of the DSPR registers being managed inside DTU8 Debugger. With this function, it is possible to check the operation of an LCD panel in a pseudo manner even at a stage where the actual machine is equipped with no LCD panel.

ATTENTION

This function enables an LCD panel to be operated in a pseudo manner on PC. Please note that there are the following restrictions on LCD panel operations:

•Notes related to bias setting and display contrast

The register that LCD Image Check Tool targets is as follows.
Bias circuit control register 0 (BIASCON:Bias Circuit Control Register)
Display mode register 1 (DSPMOD1:Display Mode register 1)
Display contrast register (DSPCNT:Display Contrast register)
LCD allocation register A and B (DSmCnA/DSmCnB or DSCxxxA/DSCxxxB:Display Allocation register A and B)
Indicator register (DSPRxx:Display register)
When the value of the display contrast register is never included from the automatic update mode beginning in the file, it is displayed in the minimum density.

The DASN bit of display mode register 1(DSPMOD1) cannot read it from LCD allocation register A and B in the state of one. The DASN bit of display mode register 1 must execute it in the state of 0 when you output the value of LCD allocation register A and B to the file.

•Notes related to renewal of output file of DTU8 Debugger and file concerned reading timing of LCD Image Check Tool

LCD Image Check Tool periodically reads the file to which the value of the DSPR register that DTU8 Debugger outputs is output, and renews the LCD Image window. If timing depends when the update and reading the file come in succession, it is not likely to be able to read. Please change timing in which the file is output by DTU8 Debugger when the LCD Image window is not normally renewed or select Tool→Setting for Auto-Update Mode of LCD Image Check Tool and adjust the reading cycle of the file.

SETTING METHOD:

Use the following procedure to set up auto-update:

STEP1: Create a macro for DTU8 Debugger.
STEP2: Put LCD Image Check Tool into auto-execution mode.
STEP3: Run the macro for DTU8 Debugger.
STEP4: Confirm the display status of the LCD panel.
STEP5: Stop LCD Image Check Tool auto-execution mode.
STEP6: Stop the macro for DTU8 Debugger.

STEP1:Create a macro for DTU8 Debugger

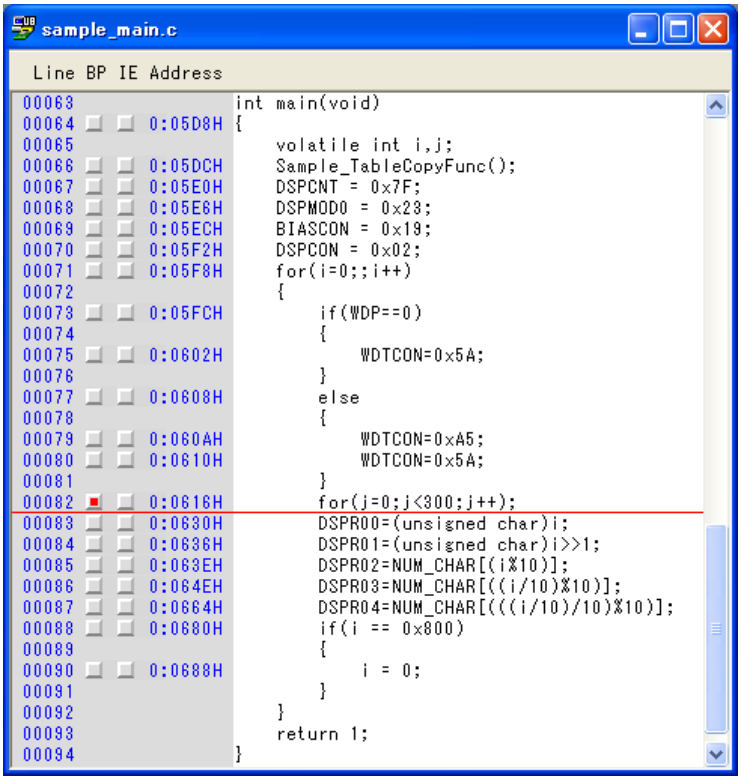


Figure 6.2.2_1

Figure 6.2.2_1 shows an example of a C program that controls an LCD panel. This program repeats the processing which changes the value of DSPR registers.
In STEP1, create a macro that outputs the contents of the DSPR registers to a new file.
Shown below is a desription example of a macro that operates DTU8 Debugger automatically.

<Macro description example>
SBP 0616H ①
G ②
SFRSAV C:¥LcdData¥CheckLCD.ram ③

①Set a breakpoint at the cursor line position. 0616H is an address of the cursor line position. Addresses can be checked on the source window of DTU8 Debugger.
②Command that executes the program.
③After the program stops at breakpont, the SFRSAV command saves the SFR area including the DSPR registers to a file called CheckLCD.ram.
Please refer to Chapter 6.4 for the format of the SFRSAV command.

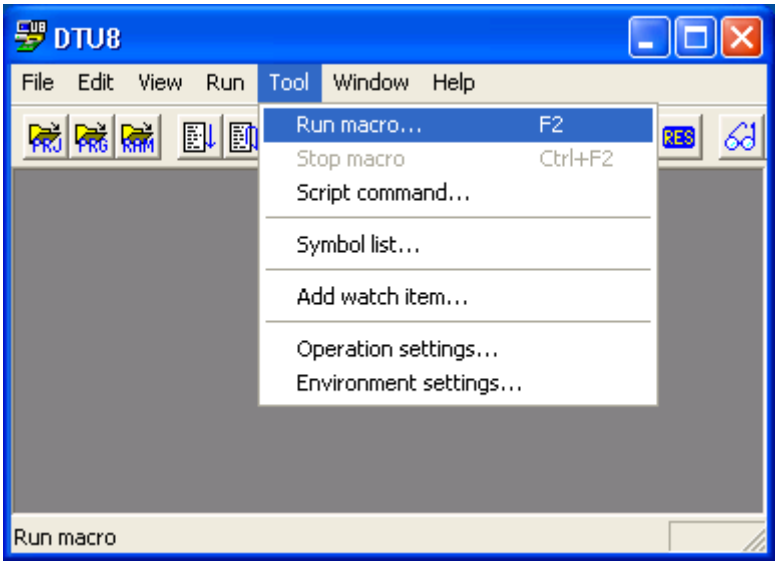
For the details of macros, refer to the “DTU8 User’s Manual,” Section 12.2, “Macro Functions.”

STEP2:Put LCD Image Check Tool into auto-execution mode

From the menu bar of LCD Image Check Tool, select ‘Tool->Start Auto-Update Mode ’. The Save As dialog box will then appear. In the dialog box, specify the file created in STEP1 (CheckLCD.ram).

STEP3:Run the macro for DTU8 Debugger

Run the macro created in STEP1 using DTU8 Debugger.
From the menu bar of DTU8 Debugger, select ‘Tool->Run Macro’. A dialog box for selecting a macro will then appear. Specify the macro created in STEP1.



STEP4:Confirm the display status of the LCD panel

The display status of the LCD panel is displayed in the LCD Image window in conjunction with the program running on DTU8 Debugger. Confirm the status change in the LCD panel.

STEP5:Stop LCD Image Check Tool auto-execution mode

From the menu bar of LCD Image Check Tool, select ‘Tool->Stop Auto-Update Mode ’.

STEP6:Stop the macro for DTU8 Debugger

From the menu bar of DTU8 Debugger, select ‘Tool->Stop Macro’.

6.2.3. Real-Time LCD Monitor Mode (Synchronizing with Dr.U8 ICE)

LCD Image Check Tool can emulate Real-Time display by the LCD output (signal of terminal COM and terminal SEG) from Dr.U8 ICE via DTU8 Debugger. The confirmation of the display action of the LCD panel at the stage without the LCD panel of applied product completion image is possible according to this function.
LCD Image Check Tool can confirm the following setting in addition to the display to the LCD Image window about the above-mentioned.

•Bias circuit control register (BIASCON) 1/3 bias or 1/4 bias are displayed by the value of BSEL.
•Display Mode Register 0 (DSPMOD0)
The picture frequency (The reference frequency: value for LSCLK=32.768kHz) is displayed from the value of DUTY0-DUTY4 by the value of the duty, FRM0, and FRM1.
•Display Mode Register 1 (DSPMOD1)
The warning is displayed when different from the type of the composition of the segment map of the indicator register set with LCD Image Check Tool unlike the allocation type of the LCD panel set with LCD Image Assignment Tool.


ATTENTION

Only when the signal is output from terminal COM/terminal SEG, the value of each register is read. When the signal is not output, the setting of each register is not displayed.

SETTING METHOD:

Real-Time LCD Monitor Mode is set according to the following procedures.

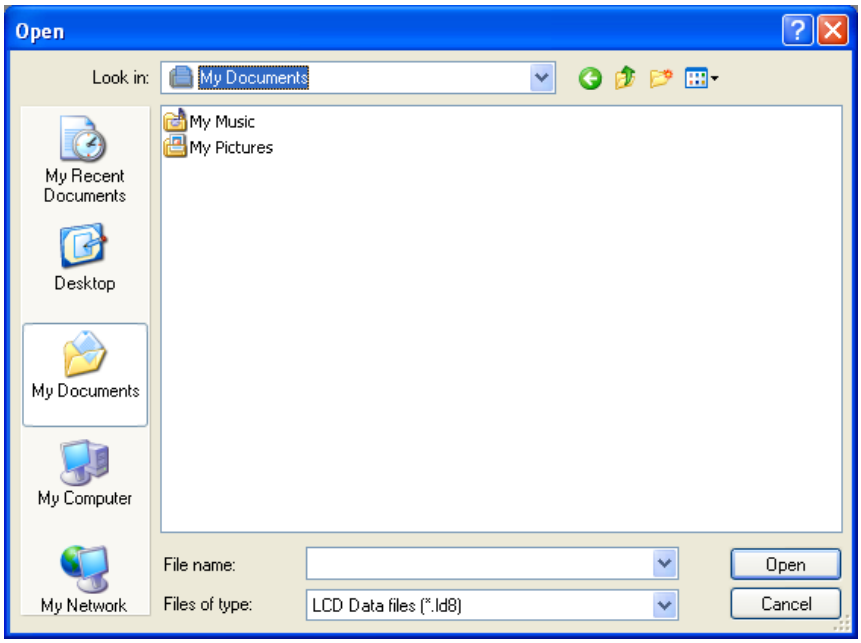
STEP1: Connect Dr.U8 ICE with PC and start up DTU8 Debugger.
STEP2: Start up LCD Image Check Tool on DTU8 Debugger.
STEP3: Begin Real-Time LCD Monitor Mode.
STEP4: Execute the program on the target chip.
STEP5: Stop Real-Time LCD Monitor Mode.

STEP1: Connect Dr.U8 ICE with PC and start up DTU8 Debugger

Connect Dr.U8 ICE with PC which performs LCD Image Check Tool by USB. Please refer to each user's manual for details and the connection method of Dr.U8 ICE.
Then, start up DTU8 Debugger.

STEP2: Start up LCD Image Check Tool on DTU8 Debugger

Select [LCD Monitor] on [tool] menu on DTU8 Debugger. The dialog box which chooses LCD data file will open.



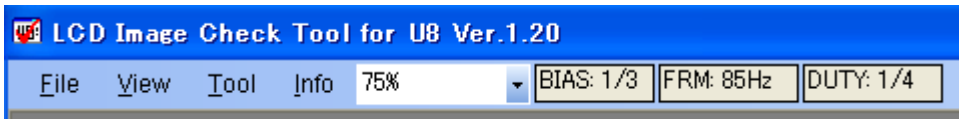
Choose a LCD data file and push the OK button. Then, LCD Image Check Tool will start.

ATTENTION

When you use Real-Time LCD Monitor Mode, please be sure to start LCD Image Check Tool from DTU8 Debugger.

STEP3: Bigin Real-Time LCD Monitor Mode
Select [Start Real-Time LCD Monitor Mode] on [tool] menu on LCD Image Check Tool. When the DSPR Register window is open at this time, it will close automatically.

STEP4: Execute the program on the target chip
The program is downloaded by DTU8 Debugger, and it executes it continuously. When Real-Time LCD Monitor Mode is executed, the reference frequency of the clock for the pressure of the bias generation circuit and the picture frequency and duties are displayed in the toolbar.



STEP5: Stop Real-Time LCD Monitor Mode

Select [Stop Real-Time LCD Monitor Mode] on [tool] menu on LCD Image Check Tool. The display of the LCD Image window will keep to the time of stop Real-Time LCD Monitor Mode. The DSPR Register window that close in Real-Time LCD Monitor Mode opens again when the DSPR Register window is opened when Real-Time LCD Monitor Mode begins.

ATTENTION

When Real-Time LCD Monitor Mode ends, the DSPR Register window is automatically opened when the DSPR Register window is automatically close when Real-Time LCD Monitor Mode begins. At this time, the content of the DSPR Register window before Real-Time LCD Monitor Mode begins is displayed in the DSPR Register window. Therefore, the content and the LCD Image window display of the DSPR Register window enter the state of the disagreement. Afterwards, if the content of the DSPR Register window is updated in Manual mode or Auto-Update Mode , the content of the DSPR Register window is displayed in the LCD Image window according to the timing.

6.2.4. Silk Background Image

LCD Image Check Tool reads the silk background image and the function to display is provided. Dash sign (´) always displayed with the silk screen and the stopwatch etc. of the segment made with the LCD assignment tool can be displayed, and the silk background image be used for the segment name display to help debugging and the display of COM number SEG number in the dot matrix, etc. The silk background image can be made by the color, and the number of colors is not limited.
The display method selects File→Load Background Image File of LCD Image Check Tool, and reads the silk background image made beforehand. The read silk background image can switch non-display/display by selecting View→Display Background Image.

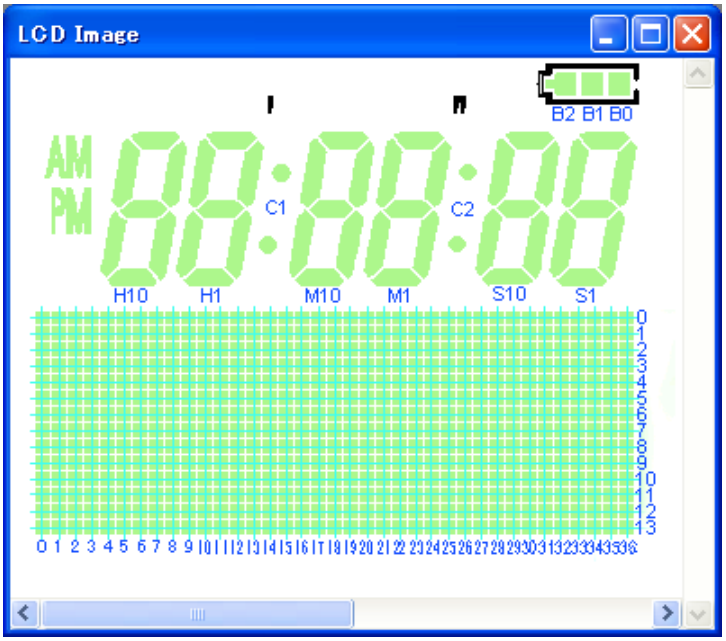


Figure 6.2.4 The silk background image

6.3. Modifying Segment Definitions

After checking the ON status for each LCD segment, if any mistake or error in mapping is found, correct it using the following procedure:

•When LCD Image Assignment Tool has already been activated

①Correct the error or mistake using LCD Image Assignment Tool and then save the LCD data file by the operation described in Section 5.6.1, “Saving Working Status.”
②If any update to the LCD data file is detected, LCD Image Check Tool displays a dialog box with the following message:
The LCD data file xxxx.ld8 was updated. Do you want to reload it ?

Clicking the “Yes” button re-loads the LCD data file. Check the contents of the file again.

•When LCD Image Assignment Tool has not been activated

From the menu bar of LCD Image Check Tool, select ‘Tool->LCD Image Assignment Tool’.
LCD Image Assignment Tool will then be activated. At this time, the LCD data file that has been loaded into LCD Image Check Tool will now be loaded into LCD Image Assignment Tool.

6.4. Loading/Saving the Contents of the DSPR Registers

6.4.1. Loading the Contents of the DSPR Registers and Checking the LCD Panel Status

DTU8 Debugger has a function to write the contents of the DSPR registers into a file in the Motorola S28 format.
In addition, LCD Image Check Tool has a function to load Motorola S28 format files.
By using these functions, it is possible to display snapshots of the LCD panel while DTU8 Debugger is debugging the program that controls the LCD panel.

Use the following procedure for loading the contents of the DSPR registers and checking the LCD panel status:
①From the menu bar of DTU8 Debugger, select Tool ⇒ Run Script Command.
②Execute the SFRSAV command to write the data in the DSPR register area into a file. For the addresses where the DSPR registers are assigned, refer to the user's manual of the LSI used. The example shown in Figure 6.4.1 assumes that the DSPR registers are assigned to addresses F100H to F1FEH. It is assumed that a file named sample.ram will be output. In this case, the format of the SFRSAV command is as follows (see Figure 6.4.1):
SFRSAV Sample.ram
③In the same way as in step 2, write the data in the Display Allocation register AB area into a file.
④To load the data of the DSPR register area, select File ⇒ Load DSPR Data File from the menu bar of LCD Image Check Tool. To load the data of the Display Allocation register AB area, select File ⇒ Load Display Allocation Data File. When loading is completed, the LCD Image window and DSPR Register window are updated.

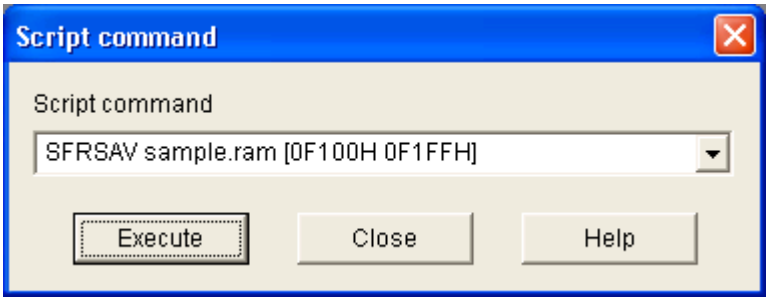


Figure 6.4.1 Run a Script Command

It is even possible to load a user-created file so long as its file format is compliant with Motorola S28. However, an error occurs if a file is loaded that contains no valid data in the DSPR register area or Display Allocation register area (when programmable assignment is selected).

6.4.2. Saving the Contents of the DSPR Registers

To save the contents of the DSPR register area located in LCD Image Check Tool, select File ⇒ Save DSPR Data File from the menu bar of LCD Image Check Tool.

6.5. Efficient Keys for the DSPR Registers Window

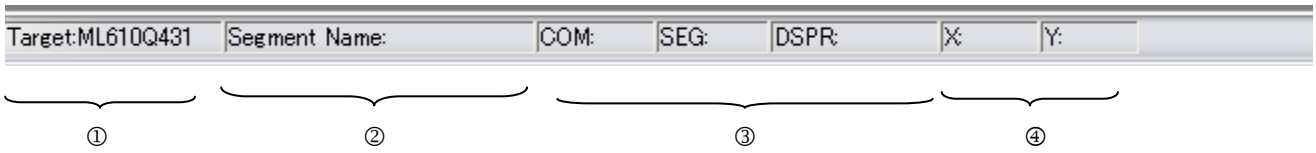
Direction key	move Focus to up/down/right/left
Home	move Focus to end of left
End	move Focus to end of cell on the present line
PageDown	scroll one page to downward
PageUp	scroll one page to upward
Tab	move Focus to next left cell
Shift+Tab	move Focus to next right cell
Ctrl+Direction key	move Focus to end cell
Ctrl+Home	move Focus to start of cell on the present line
Ctrl+End	move Focus to end of cell on the present line
Ctrl+PageUp	scroll one page to upward(=PageUp)
Ctrl+PageDown	scroll one page to downward(=PageDown)
Enter	fix input-data and move Focus to downward cell
Ctrl+Enter	fix input-data and not move Focus

Note:

Moving Focus	fix input-data when Focus move to another calls

7. Status Bar

The status bar, which is shown at the bottom of the main window of LCD Image Tool, displays various pieces of information.



① Target:
Displays the name of the currently set target.

② Segment Name:
Displayed when the LCD Image window is active.
If the cursor is positioned on an LCD segment, this field displays the Target Name.

③ COM/SEG/DSPR:
Displayed when the LCD Image window is active.
If the cursor is positioned on an LCD segment that has already been assigned a segment name in the “LCD Image” window, this field displays the COM No., SEG No., DSPR No., and bit position alreay defined.

④ X/Y:
Displayed when the LCD Image window is active.
This field displays the coordinates of the mouse pointer.

8. Displaying Information about Target Device

Selecting ‘Help->System Information’ displays System Information dialog box.
System Information dialog box displays the information about the target device currently selected.

The following information is displayed:
- Target device name
- The number of COM and SEG pins with which the target device is provided.
- The number of DSPR registers and bits with which the target device is provided
- The display allocation type
- Duty selected when starting (It is not displayed according to the target device).

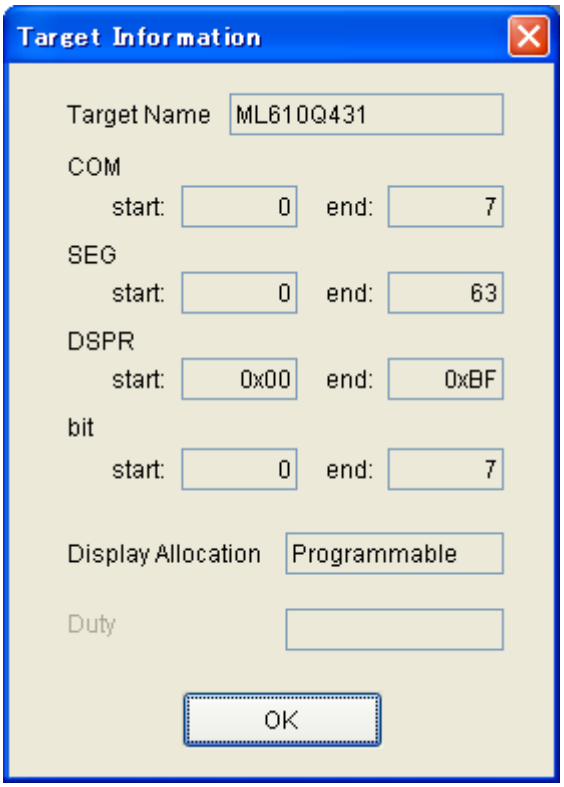
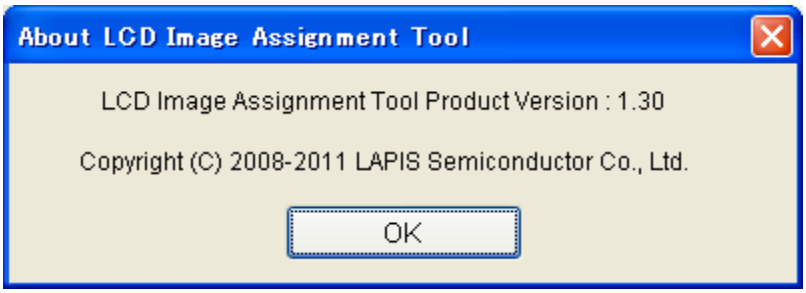


Figure 8 Target Information dialog

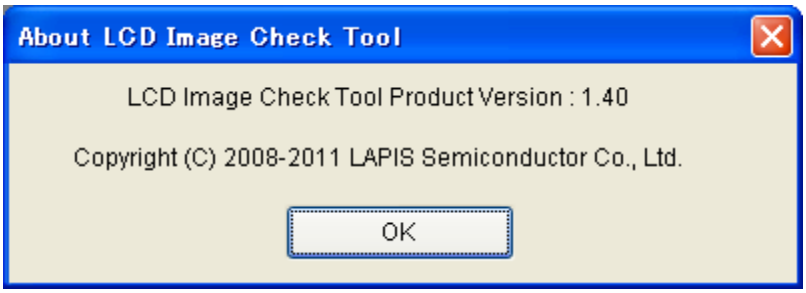
9. Displaying Version Number of LCD Image Tool

Selecting ‘Info->About LCD Image Assignment Tool’ or ‘About LCD Image Check Tool’ display the “About LCD Image Assignment Tool” dialog box or the “About LCD Image Check Tool” dialog box. These dialog box can be used to check the version number of LCD Image Tool.

<for LCD Image Assignment Tool >



<for LCD Image Check Tool >



10. Error Messages

Error code	Explanation and measures
Cannot open file ‘filename’	‘filename’ cannot be opened. Check ’filename’. [Common to LCD assignment tool and LCD Image Tool]
Cannot close file ‘filename’	‘filename’ cannot be closed.
Cannot read to file ‘filename’	Cannot read to ‘filename’. [Common to LCD assignment tool and LCD Image Tool]
Cannot write to file ‘filename’	Cannot write to ‘filename’. Check the attribute of ’filename’. [Common to LCD assignment tool and LCD Image Tool]
Incorrect file format ‘filename’	The file format of ‘filename’ is invalid. If the opened file is an .lt8, file, reinstall the LCD Tool. If the opened file is an .ad8 file, re-create the settings file. [LCD assignment tool only]
Old version of ‘filename’ was loaded	[Assignment tool] ’filename’, is a file created by an old version of LCD Image Assignment Tool. Continued operation may cause a problem; however, no problem unless the [Generate] button is grayed out. To continue operation, click [continue], and to cancel operation, [terminate].
Incorrect segment name	The segment name includes invalid character(s). The characters that can be used as a segment name are alphabetic characters, numerals, underscores (_), question marks (?), and dollar signs ($).
Length of segment name is too long.	The number of characters of the segment name exceeds 32. Make it 32 or less.
The symbol can not be changed which is already used in DSPR TabPage.	The segment name cannot be changed, because it has already been defined in the DSPR tab. To change the segment name, clear the assignment in the DSPR tab.
“'xxxx.ad8' has some symbols which are not assigned.”	There are some symbols that have not been assigned yet.
LcdImgAtU8.exe is already active.	You can not start either of LCD Image Assignment Tool can not start at the same them.
LcdImgChkU8.exe is already active.	You can not start either of LCD Image Assignment Tool can not start at the same them.
The value of Zoom is incorrect	The specified zoom rate has invalid character. Specify within the range from 10% to 800%.
The value must be in the range from 10 to 800.	The specified zoom rate is outside the valid range. Specify within the range from 10% to 800%.
Exception error happened ‘cause’	An exception caused by ’cause’ occurred in Windows. It may become impossible to continue operation.
Internal Error	An internal error occurred. Contact your nearest LAPIS Semiconductor sales office and report how the error occurred.
Speechified value out of range	Specified value is not within valid range.
Another DSPR/bit is already assigned to specified COM/SEG.	When different DSPR is allocated to the combination of same COM/SEG, it is displayed. Confirm the combination of COM/SEG/DSPR.
The specified file did not include effective DSPR register data.	The loaded RAM data file does not include effective data. This file must include whole or a part of DSPR range.

Error code	Explanation and measures
The specified file did not include effective display allocation data.	The loaded RAM data file does not include effective data. This file must include whole or a part of DSPR display allocation data range.
The value of DSPMOD1 register differs from the present setting. Do you continue?	The value of DSPMOD1 in specified file differs from current settings on LCD Image Check Tool.
Checksum error	Detect check sum error in RAM data file.
Incorrect file format 'file name'	The loaded RAM data file is not based on Motorola S28 format.
The executable file of 'LCD Image Assignment Tool' is not found.	There is no executable file 'LcdImgAtU8.exe'. Install again.
The value of specified DSPR and bit is incorrect.	The combination of COM and SEG can be assigned to one or more segments. In this case, the combination of assignable COM/SEG/DSPR is only one. This message is displayed when different DSPR is assigned to the same combination of COM and SEG.
Not enough memory.	The memory for starting LCD Image Assignment Tool and LCD Image Check Tool is insufficient. In order to start LCD Image Assignment Tool and LCD Image Check Tool, 100 M bytes of availability is required respectively.
Incorrect file format. (Line: %1)	The file format of the CSV file is invalid. The CSV file which can be loaded with LCD Image Check Tool has some restrictions. Please refer to Chapter 5.3.2 for details.
Number of Segment is over the maximum number. (Line: xxxx)	The number of segments in the CSV file exceeded limiting value. Limiting value is 16384.
Incorrect Segment name. (Line: xxxx)	The segment name in the CSV file includes invalid character(s). The characters that can be used as a segment name are alphabetic characters, numerals, underscores (_), question marks (?), and dollar signs ($).
Length of Segment Name is too long. (Line: xxxx)	The number of characters of the segment name in the CSV file exceeds 32. Make it 32 or less.
Specified value out of range. (Line: xxxx)	Specified value in the CSV file is not within valid range.
The value of specified DSPR and bit is incorrect. (Line: xxxx)	The combination of COM and SEG can be assigned to one or more segments. In this case, the combination of assignable COM/SEG/DSPR is only one. This message is displayed when different DSPR is assigned to the same combination of COM and SEG in the CSV file.
Segment Number is duplicated. (Line: xxxx)	The segment number of the record in the CSV file overlaps.
Timeout error. Check the connection and the LCD Transmitter.	Abnormality is found in the communication between LCD Image Check Tool and the LCD transmitter. Confirm the connection, and reactivate LCD Image Check Tool and the LCD transmitter.
Different firmware version. Use latest version Firmware. Firmware version : (x.xx)	When the version of the LCD transmitter is the one that cannot correspond to LCD Image Check Tool, this message is displayed. Use the tool of the check on the LCD image of the latest version so that there is a possibility that LCD Image

	Check Tool is old.
Failed to communicate with the LCD Transmitter. Check the connection. (Error code:6100)	Abnormality is found in the communication between LCD Image Check Tool and the LCD transmitter. Confirm the connection, and reactivate LCD Image Check Tool and the LCD transmitter.
The LCD Transmitter may be malfunctioning. Check the connection, and then restart LcdImgChkU8.exe and the LCD Transmitter. (Error code:6101)	Abnormality is found in the communication between LCD Image Check Tool and the LCD transmitter. Confirm the connection, and reactivate LCD Image Check Tool and the LCD transmitter.
The LCD Transmitter is not connected. Check the connection. (Error code: 6102)	Abnormality is found in the communication between LCD Image Check Tool and the LCD transmitter. Confirm the connection, and reactivate LCD Image Check Tool and the LCD transmitter.

LCD Image Tool User's Manual
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