

Detailed Design of LCD Driver

Team X

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Introduction and functional overview:

This document specifies detailed design of the module LCD Driver. The LCD driver is targeting 4*20 LCD Hardware.

The LCD driver provides services for configuration, initializing the LCD, displaying character, string or integer either from the 1st row and column or starting from a certain row and column, it also can clear the LCD screen.

The behaviour of those services is synchronous.

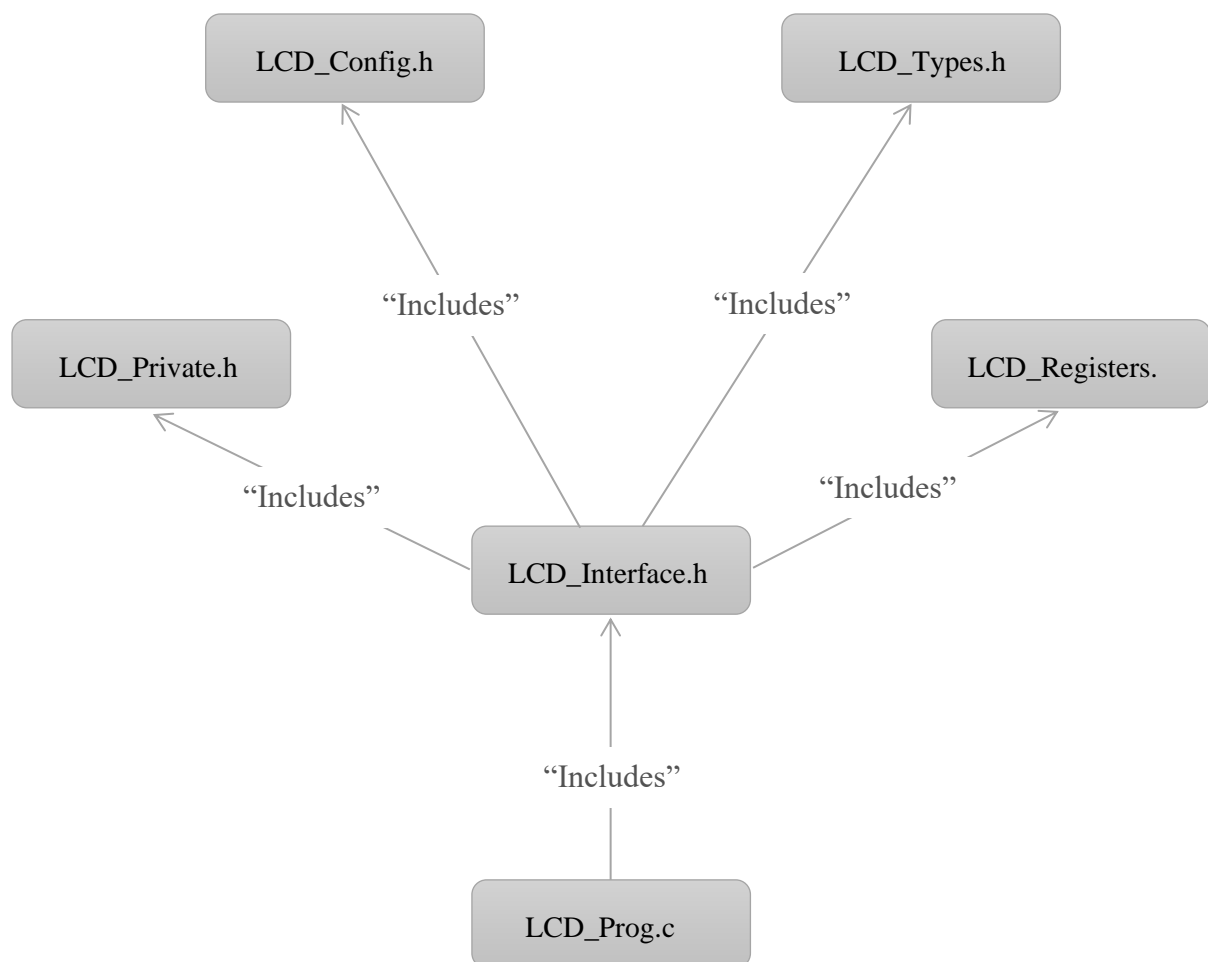
Dependencies to other modules:

DIO driver module

LCD ports and pins are initialized and written on using DIO driver module.

File structure:

The LCD module shall comply with the following file structure:



Requirements traceability:

Requirement	Description	Satisfied by
[SRS_LCD_111]	The LCD Driver shall support symbolic names for LCD pins.	[DD_LCD_111] [DD_LCD_112] [DD_LCD_113] [DD_LCD_114] [DD_LCD_115] [DD_LCD_116] [DD_LCD_117] [DD_LCD_118] [DD_LCD_119] [DD_LCD_1120] [DD_LCD_1121] [DD_LCD_1122] [DD_LCD_1123] [DD_LCD_1124] [DD_LCD_1125] [DD_LCD_1126] [DD_LCD_1127] [DD_LCD_1128] [DD_LCD_1129] [DD_LCD_1130] [DD_LCD_1131] [DD_LCD_1132] [DD_LCD_1133] [DD_LCD_1134]
[SRS_LCD_112]	The LCD driver shall provide a service that sends command to the LCD.	[DD_LCD_1136]
[SRS_LCD_113]	The LCD driver shall provide a service that initializes the LCD.	[DD_LCD_1135]
[SRS_LCD_114]	The LCD driver shall provide a service that displays a character on the LCD.	[DD_LCD_1137]
[SRS_LCD_115]	The LCD driver shall provide a service that displays a string on the LCD.	[DD_LCD_1138]
[SRS_LCD_116]	The LCD driver shall provide a service that moves the cursor to a certain row and column.	[DD_LCD_1141]
[SRS_LCD_117]	The LCD driver shall provide a service that displays a string in a certain row and column.	[DD_LCD_1140]
[SRS_LCD_118]	The LCD driver shall provide a service that clears the LCD screen	[DD_LCD_1139]
[SRS_LCD_119]	The LCD driver shall provide a service that converts the integer to string.	[DD_LCD_1142]
[SRS_LCD_1120]	The LCD driver shall provide a service that displays a string in a certain row and column.	[DD_LCD_1143]

API specification:**Imported types:**

1- [DD_LCD_111]

Module	Imported Type
DIO module: DIO_Types.h	E_DioPort E_dioPin

Type definitions:

1- [DD_LCD_112]

Name:	LCD_DATA_BITS_MODE
Type	Unsigned character
Range:	Either 4 or 8
Description:	Number of LCD data bits used.
Covered requirements:	[SRS_LCD_111]

2- [DD_LCD_113]

Name:	LCD_RS_PORT
Type	E_DioPort
Range:	0...<number of ports>
Description:	Port ID that contains Register select pin
Covered requirements:	[SRS_LCD_111]

3- [DD_LCD_114]

Name:	LCD_RS_PIN
Type	E_DioPin
Range:	0...<number of pins>
Description:	Register select pin number
Covered requirements:	[SRS_LCD_111]

4- [DD_LCD_115]

Name:	LCD_RW_PORT
Type	E_DioPort
Range:	0...<number of ports>
Description:	Port ID that contains Read/Write pin
Covered requirements:	[SRS_LCD_111]

5- [DD_LCD_116]

Name:	LCD_RW_PIN
Type	E_DioPin
Range:	0...<number of pins>
Description:	Read/Write pin number
Covered requirements:	[SRS_LCD_111]

6- [DD_LCD_117]

Name:	LCD_DATA_PORT
Type	E_DioPort
Range:	0...<number of ports>
Description:	Port ID that contains data pins
Covered requirements:	[SRS_LCD_111]

7- [DD_LCD_118]

Name:	LCD_D0_PIN
Type	E_DioPin
Range:	0...<number of pins>
Description:	D0 pin number
Covered requirements:	[SRS_LCD_111]

8- [DD_LCD_119]

Name:	LCD_D1_PIN
Type	E_DioPin
Range:	0...<number of pins>
Description:	D1 pin number
Covered requirements:	[SRS_LCD_111]

9- [DD_LCD_1120]

Name:	LCD_D2_PIN
Type	E_DioPin
Range:	0...<number of pins>
Description:	D2 pin number
Covered requirements:	[SRS_LCD_111]

10- [DD_LCD_1121]

Name:	LCD_D3_PIN
Type	E_DioPin
Range:	0...<number of pins>
Description:	D3 pin number
Covered requirements:	[SRS_LCD_111]

11- [DD_LCD_1122]

Name:	LCD_D4_PIN
Type	E_DioPin
Range:	0...<number of pins>
Description:	D4 pin number
Covered requirements:	[SRS_LCD_111]

12- [DD_LCD_1123]

Name:	LCD_D5_PIN
Type	E_DioPin
Range:	0...<number of pins>
Description:	D5 pin number
Covered requirements:	[SRS_LCD_111]

13- [DD_LCD_1124]

Name:	LCD_D6_PIN
Type	E_DioPin
Range:	0...<number of pins>
Description:	D6 pin number
Covered requirements:	[SRS_LCD_111]

14- [DD_LCD_1125]

Name:	LCD_D7_PIN
Type	E_DioPin
Range:	0...<number of pins>
Description:	D7 pin number
Covered requirements:	[SRS_LCD_111]

15- [DD_LCD_1126]

Name:	LCD_E_PIN
Type	E_DioPin
Range:	0...<number of pins>
Description:	Enable pin number
Covered requirements:	[SRS_LCD_111]

16- [DD_LCD_1127]

Name:	LCD_E_PORT
Type	E_DioPort
Range:	0...<number of ports>
Description:	Port ID that contains the Enable pin
Covered requirements:	[SRS_LCD_111]

17- [DD_LCD_1128]

Name:	E_ErrorType
Type	Enum
Range:	0 .. E_OK 1.. E_NOT OK
Description:	Error type
Covered requirements:	[SRS_LCD_111]

18- [DD_LCD_1129]

Name:	LCD_commandType
Type	Unsigned character
Range:	0x00..0xFF
Description:	Command written on the LCD data pins
Covered requirements:	[SRS_LCD_111]

19- [DD_LCD_1130]

Name:	LCD_string
Type	Constant pointer to unsigned character
Range:	0x00..0xFF
Description:	String to display on the LCD screen
Covered requirements:	[SRS_LCD_111]

20- [DD_LCD_1131]

Name:	LCD_dataType
Type	Unsigned character
Range:	'A' to 'z'
Description:	character to display on the LCD screen
Covered requirements:	[SRS_LCD_111]

21- [DD_LCD_1132]

Name:	LCD_row
Type	Unsigned character
Range:	0 ... 4
Description:	LCD row number
Covered requirements:	[SRS_LCD_111]

22- [DD_LCD_1133]

Name:	LCD_column
Type	Unsigned character
Range:	0 ... 20
Description:	LCD column number
Covered requirements:	[SRS_LCD_111]

23- [DD_LCD_1134]

Name:	LCD_integer
Type	Unsigned long int
Range:	0 ... 2^{32}
Description:	Integer to display on the LCD screen
Covered requirements:	[SRS_LCD_111]

Function definitions:**1- [DD_LCD_1135]**

Service name:	LCD initialization
Syntax:	E_ErrorType HAL_LCD_init()
Sync/Async:	Synchronous
Re-entrancy:	Re-entrant
Parameters (in):	none
Parameters (out):	none
Parameters (inout):	none
Return type:	E_ErrorType
Description:	Function that initializes the LCD
Covered requirements:	[SRS_LCD_113]

2- [DD_LCD_1136]

Service name:	LCD send command
Syntax:	E_ErrorType HAL_LCD_sendCommand(LCD_commandType)
Sync/Async:	Synchronous
Re-entrancy:	Re-entrant
Parameters (in):	LCD_commandType .. Command to write on LCD data pins
Parameters (out):	none
Parameters (inout):	none
Return type:	E_ErrorType
Description:	Function that writes a command on LCD data pins
Covered requirements:	[SRS_LCD_112]

3- [DD_LCD_1137]

Service name:	LCD send character
Syntax:	E_ErrorType HAL_LCD_sendCharacter(LCD_dataType)
Sync/Async:	Synchronous
Re-entrancy:	Re-entrant
Parameters (in):	LCD_dataType ... data to write on LCD data pins
Parameters (out):	none
Parameters (inout):	none
Return type:	E_ErrorType
Description:	Function that displays a character on LCD screen
Covered requirements:	[SRS_LCD_114]

4- [DD_LCD_1138]

Service name:	LCD send string
Syntax:	E_ErrorType HAL_LCD_sendString(LCD_string)
Sync/Async:	Synchronous
Re-entrancy:	Re-entrant
Parameters (in):	LCD_string ... String to display on LCD screen
Parameters (out):	none
Parameters (inout):	none
Return type:	E_ErrorType
Description:	Function that displays a string on LCD screen
Covered requirements:	[SRS_LCD_115]

5- [DD_LCD_1139]

Service name:	LCD clear screen
Syntax:	E_ErrorType HAL_LCD_clearScreen()
Sync/Async:	Synchronous
Re-entrancy:	Re-entrant
Parameters (in):	none
Parameters (out):	none
Parameters (inout):	none
Return type:	E_ErrorType
Description:	Function that clears the LCD screen
Covered requirements:	[SRS_LCD_118]

6- [DD_LCD_1140]

Service name:	LCD display string row column
Syntax:	E_ErrorType HAL_LCD_displaystringRowColumn(LCD_string, LCD_row, LCD_column)
Sync/Async:	Synchronous
Re-entrancy:	Re-entrant
Parameters (in):	LCD_string ... String to display on LCD screen LCD_row ... Row to move the cursor to LCD_column ... Column to move the cursor to
Parameters (out):	none
Parameters (inout):	none
Return type:	E_ErrorType
Description:	Function that displays a string on LCD screen starting from a certain row and column
Covered requirements:	[SRS_LCD_117]

7- [DD_LCD_1141]

Service name:	LCD go to row column
Syntax:	E_ErrorType HAL_LCD_gotoRowColumn(LCD_row, LCD_column)
Sync/Async:	Synchronous
Re-entrancy:	Re-entrant
Parameters (in):	LCD_row ... Row to move the cursor to LCD_column ... Column to move the cursor to
Parameters (out):	none
Parameters (inout):	none
Return type:	E_ErrorType
Description:	Function that moves the cursor to a certain row and column on LCD screen
Covered requirements:	[SRS_LCD_116]

8- [DD_LCD_1142]

Service name:	LCD integer to string
Syntax:	E_ErrorType HAL_LCD_integerToString(LCD_integer, LCD_string)
Sync/Async:	Synchronous
Re-entrancy:	Re-entrant
Parameters (in):	LCD_integer ... Integer to convert to string
Parameters (out):	none
Parameters (inout):	LCD_string
Return type:	E_ErrorType
Description:	Function that converts an integer to string
Covered requirements:	[SRS_LCD_119]

9- [DD_LCD_1143]

Service name:	LCD display integer row column
Syntax:	E_ErrorType HAL_LCD_displayIntegerRowColumn(LCD_integer, LCD_row, LCD_column)
Sync/Async:	Synchronous
Re-entrancy:	Re-entrant
Parameters (in):	LCD_integer ... Integer to display on LCD screen LCD_row ... Row to move the cursor to LCD_column ... Column to move the cursor to
Parameters (out):	none
Parameters (inout):	none
Return type:	E_ErrorType
Description:	Function that displays an integer on LCD screen starting from a certain row and column
Covered requirements:	[SRS_LCD_1120]