TESTING FOR HEADER RULES COMPLIANCE (Kieras, 2012)

CVAVR 3 / CL2 – Rev. 4-11-2017 / R.Oliva

Updated with tests 5-11-2017

1ˢᵗ ASSESMENT, 4-11-2017 - LCD Driver 4x20(2010) - (Files lcd_cl2_3.c; .h)
This document in C:\cvavr328\Work3\CL2\CL2_Drivers\LCD\LCD4x20(2010)\DOC
Directory structure proposed:

Name	Size ▾	Allocated	Files	Folders	% of Paren...	Last Modified
204,3 KB C:\cvavr328\Work3\CL2\CL2_Drivers\LCD\LCD4x20(2010)\	204,3 KB	220,0 KB	8	4	100,0 %	04/11/2017
184,0 KB DOC	184,0 KB	188,0 KB	2	0	90,1 %	04/11/2017
183,8 KB LCD_4x20(2010)_TESTING FOR HEADER RULES COMPLIA...	183,8 KB	184,0 KB	1	0	99,9 %	04/11/2017
0,2 KB ~$D_4x20(2010)_TESTING FOR HEADER RULES COMPLIANCE_...	0,2 KB	4,0 KB	1	0	0,1 %	04/11/2017
14,3 KB src	14,3 KB	20,0 KB	3	0	7,0 %	04/11/2017
7,1 KB lcd_cl2_3.c	7,1 KB	8,0 KB	1	0	49,8 %	28/01/2017
6,3 KB lcd_cl2_3.c~	6,3 KB	8,0 KB	1	0	44,2 %	28/01/2017
0,9 KB lcd_cl2_3.cci	0,9 KB	4,0 KB	1	0	6,0 %	04/11/2017
6,0 KB inc	6,0 KB	12,0 KB	3	0	2,9 %	04/11/2017
2,6 KB lcd_cl2_3.h	2,6 KB	4,0 KB	1	0	43,9 %	28/01/2017
2,6 KB lcd_cl2_3.h~	2,6 KB	4,0 KB	1	0	43,4 %	28/01/2017
0,8 KB lcd_cl2_3.hci	0,8 KB	4,0 KB	1	0	12,6 %	04/11/2017
0,0 KB TEST_PRJ	0,0 KB	0,0 KB	0	0	0,0 %	04/11/2017

Rule #1 OK – Separate functionality for this module.

Rule #2 OK – "Include guards", used here in lcd_cl2_3.h files:

```
#ifndef LCD_DRIVER_H
#define LCD_DRIVER_H
…
#endif
```
Rule #3 All required declarations to use the module should appear in the lcd_cl2_3.h file

Rule #4 OK – Required moving some stuff from the .h file to the .c file, this was done on 28.01.207 to comply with this rule. Subsequent tests showed it worked ok.

```
// ********************************************************
// Add extern in LCD_CL2_3.h, define here in
// LCD_CL2_3.c  to comply rules #4,#5 28-01-2017
// Also if not, gives Linker errors L59,60,62,66
// ********************************************************
unsigned char *pvdata;
unsigned char vdata = 0;

// Give values of 0 28-01-2017
unsigned char LCD_ADDR = 0;
unsigned char LCD_LINE = 0;

// this Look-Up-Table translates LCD line/cursor positions
// into the displays' internal memory addresses 22.3.2006
const unsigned char flash addLUT[4] = {0x80,0xC0,0x94,0xD4};
//
// Changed place 28-01-2017
#define LCD_VAR (*(bits *) pvdata)
```

Also, at beginning includes its header: #include "../inc/lcd_CL2_3.h" (OK)

PROBLEM: these variables should be declared static, because they are only used within the internal functions of lcd_cl2_3.c (we checked to find any references to them in main1284.c,

and none were found). Furthermore, three of the functions in lcd_CL2_3.h are internal functions of lcd_CL2_3.c, and should be redefined as static and local to lcd_CL2_3.c, therefore hidden from external access:

```
// **************************************************************
// LCD Function Definitions - same as lcd1.c/.h in Mega128DEV2a
void wr_half(unsigned char data);
void wr_disp(unsigned char data);
void line(char which_line);
```

Rule #5 <mark>This rule is violated,</mark> because of the modifications made to comply with Rule#4, on 28-01-2017- See following transcription of code on lcd_CL2_3.h:

```
// **************************************************************
// Add extern to comply rules #4,#5 28-01-2017
// Only declare, do not define (this is done in lcd_xx .c)
// Variables for LCD bit access - idea is not to
// disturb I2C bits PC0,1
extern unsigned char *pvdata;
extern unsigned char vdata;

extern unsigned char LCD_ADDR,LCD_LINE;

// this Look-Up-Table translates LCD line/cursor positions
// into the displays' interal memory addresses 22.3.2006
extern const unsigned char flash addLUT[4];
// **************************************************************
```

The problem with the code above is that it makes public variables which should be private, and only accessible to lcd_CL2_3.c functions. Same applies to the local functions:

```
// **************************************************************
// LCD Function Definitions - same as lcd1.c/.h in Mega128DEV2a
void wr_half(unsigned char data);
void wr_disp(unsigned char data);
void line(char which_line);
```
This will be corrected in the next iteration of the functions, original files will be saved in:
C:\cvavr328\Work3\CL2\CL2_Drivers\LCD\LCD4x20(2010)\DOC\Old_(not-complying)_versions

Rule #6 <mark>This rule is violated,</mark> because internal items of the module are present in the .h file.

As bef: This will be corrected in the next iteration of the functions, original files will be saved in:
C:\cvavr328\Work3\CL2\CL2_Drivers\LCD\LCD4x20(2010)\DOC\Old_(not-complying)_versions

Rule #7,8 Not Applicable, since no external .h functions are required for this module.

Rule #9 Self compilation OK:

In CVAVR 3 we need to make a Test_Dr.prj, including only the file lcd_cl2_3.c, which at the start executes: #include "../inc/lcd_CL2_3.h" – It compiles correctly by itself.

Problem found: Test_Dr.prj if defined within C:\cvavr328\Work3\CL2\CL2_Drivers\LCD, creates /release, /debug, and other directories. We now confine it to:
C:\cvavr328\Work3\CL2\CL2_Drivers\LCD\LCD4x20(2010)\TEST_PRJ. It creates a test_dr.c empty file, which is not used at this stage..
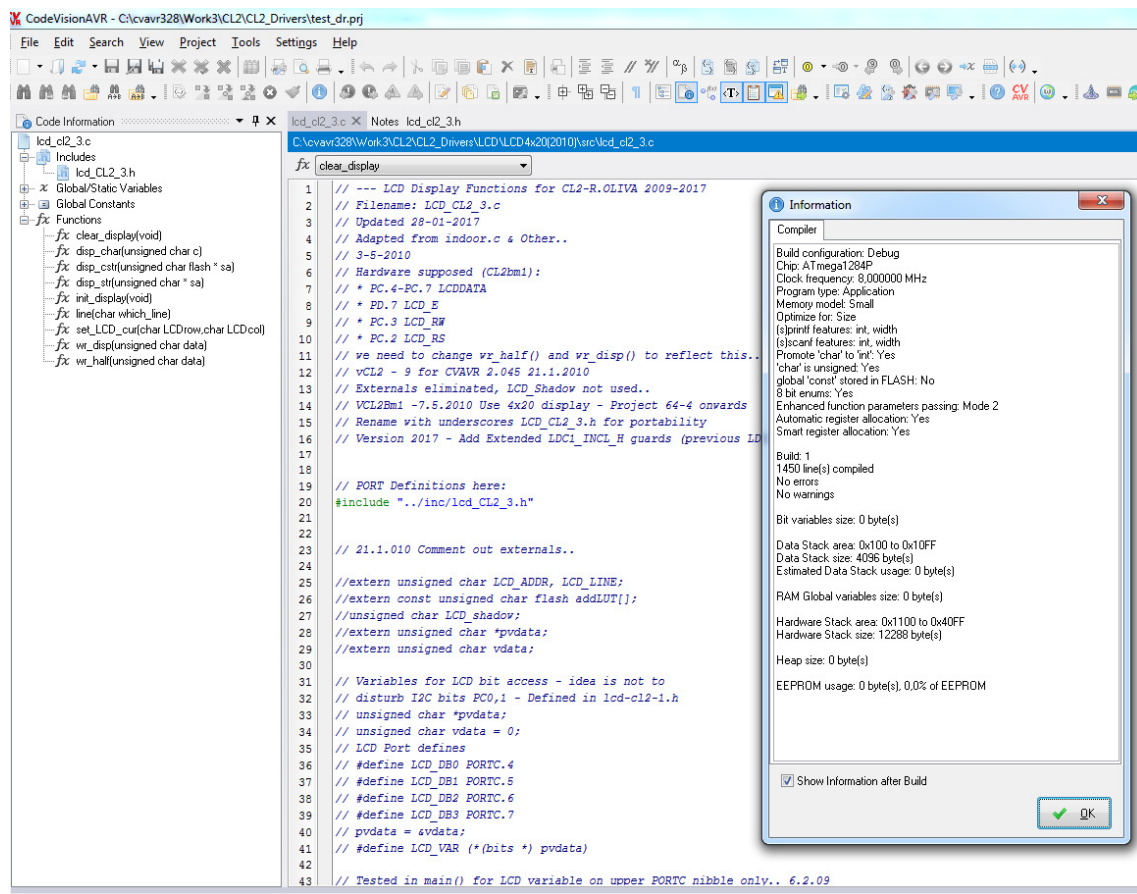
Rule #10 OK: lcd_cl2_3.c includes at beginning the file lcd_cl2_3.h, other files not applicable, since no external .h functions are required for this module.

Rule #11 OK no .c files #included.

CORRECTIONS TO 4-11-2017 - LCD Driver 4x20(2010) - (Files lcd_cl2_3.c; .h)

This document in C:\cvavr328\Work3\CL2\CL2_Drivers\LCD\LCD4x20(2010)\DOC

I)   Rules #5,6 <mark>Both rules apply correctly with following corrections</mark>

```
a)  In .h file
// ***********************************************************
// No Externaly accessible variables here..
// ***********************************************************


// ***********************************************************
// LCD Function Definitions - same as lcd1.c/.h in Mega128DEV2a
// 4.11.2017 - Local functions wr_half, wr_disp, line() declaration
// moved to start of .c file:

void init_display(void);
void clear_display(void);
void set_LCD_cur(char LCDrow, char LCDcol);
void disp_char(unsigned char c);
void disp_str(unsigned char *sa);                        // display string from RAM
void disp_cstr(unsigned char flash *sa);       // display string from ROM


#endif

b)  In .c file
// ***********************************************************
// LOCAL VARIABLES
// These are local variables, defined as static
// within LCD_CL2_3.c  to comply rules #5, #6 04-11-2017
// Not exposed in LCD_CL2_3.h
// ***********************************************************
static unsigned char *pvdata;
static unsigned char vdata = 0;

// Give values of 0 28-01-2017
static unsigned char LCD_ADDR = 0;
static unsigned char LCD_LINE = 0;

// this Look-Up-Table translates LCD line/cursor positions
// into the displays' interal memory addresses 22.3.2006
const unsigned char flash addLUT[4] = {0x80,0xC0,0x94,0xD4};

// Changed place 04-11-2017, local to .c function
#define LCD_VAR (*(bits *) pvdata)

// ***********************************************************


// ***********************************************************
// LOCAL FUNCTIONS
// These are local functions, defined as static
// within LCD_CL2_3.c  to comply rules #5, #6 04-11-2017
// Not exposed in LCD_CL2_3.h
// ***********************************************************
static void wr_half(unsigned char data);
static void wr_disp(unsigned char data);
static void line(char which_line);
```
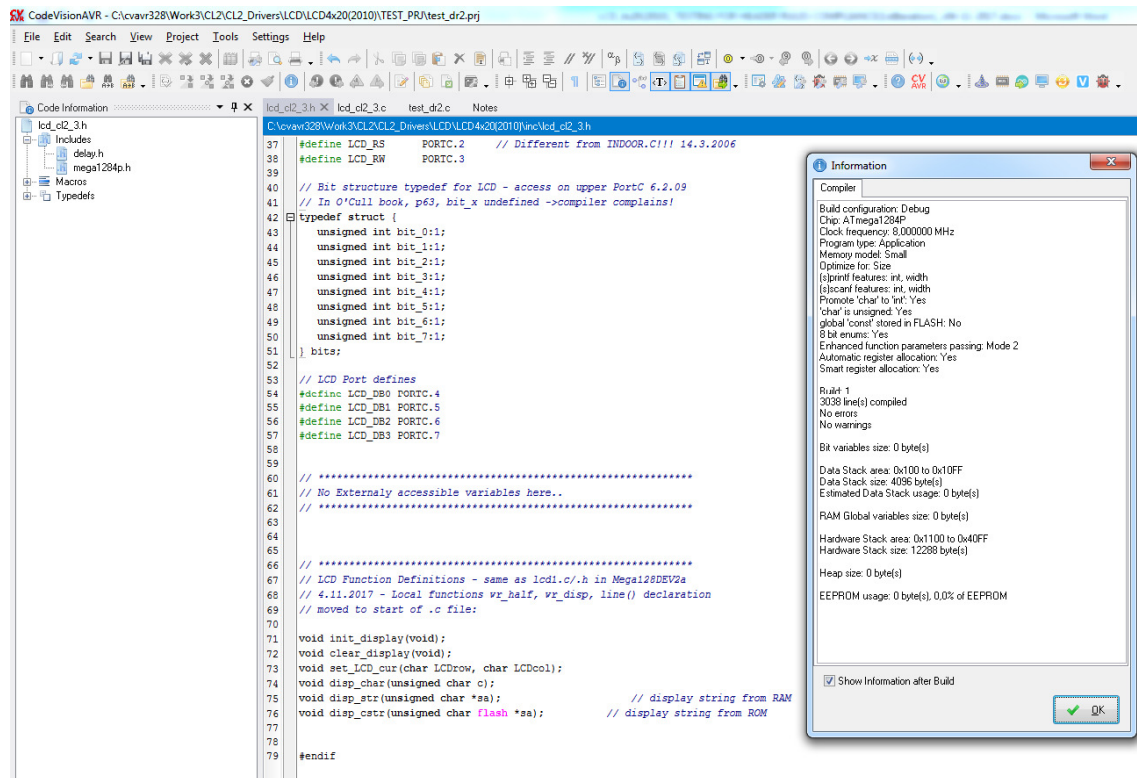
II)   Rule #9 Self compilation OK, verified:

        Test_Dr.prj, including only the file lcd_cl2_3.c, and is confined to:
        C:\cvavr328\Work3\CL2\CL2_Drivers\LCD\LCD4x20(2010)\TEST_PRJ. It creates a test_dr.c
        empty file, which is not used at this stage..
 It compiles correctly by itself, as shown here:

III) Hardware Testing (verify correct operation)
Take: c:\cvavr328\Work3\CL2\CL2_Basis_3\src\main.c
Copy the complete directory to CL2_Basis_4 and recompile the same main, this time with CL2_Basis_4.prj

OK! See Report from:
C:\cvavr328\Work3\CL2\CL2_Basis_4\DOCsInternal\2017\
    Construction_CL2Basis4.docx