

Softont 2025

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# Chapter 1

## Topic Index

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# Class Index

## 2.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

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### 3.1 File List

Here is a list of all documented files with brief descriptions:

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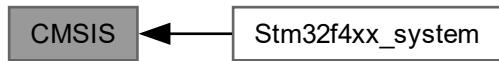


## Chapter 4

# Topic Documentation

### 4.1 CMSIS

Collaboration diagram for CMSIS:



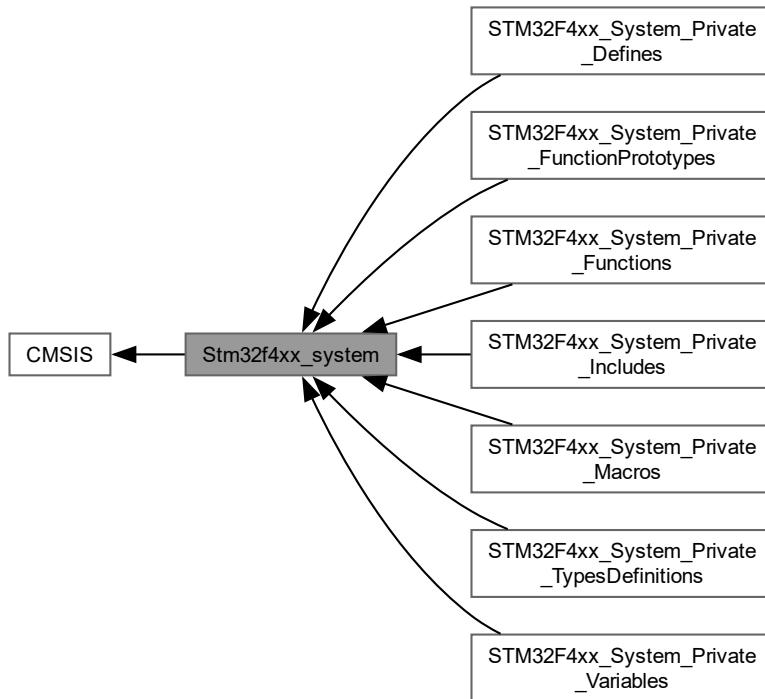
#### Topics

- [Stm32f4xx\\_system](#) . . . . . 8

#### 4.1.1 Detailed Description

#### 4.1.2 Stm32f4xx\_system

Collaboration diagram for Stm32f4xx\_system:



#### Topics

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#### 4.1.2.1 Detailed Description

#### 4.1.2.2 STM32F4xx\_System\_Private\_Includes

Collaboration diagram for STM32F4xx\_System\_Private\_Includes:



#### Macros

- `#define HSE_VALUE ((uint32_t)25000000)`
- `#define HSI_VALUE ((uint32_t)16000000)`

#### 4.1.2.2.1 Detailed Description

#### 4.1.2.2.2 Macro Definition Documentation

##### 4.1.2.2.2.1 HSE\_VALUE

```
#define HSE_VALUE ((uint32_t)25000000)
```

Default value of the External oscillator in Hz

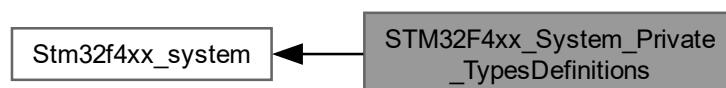
##### 4.1.2.2.2.2 HSI\_VALUE

```
#define HSI_VALUE ((uint32_t)16000000)
```

Value of the Internal oscillator in Hz

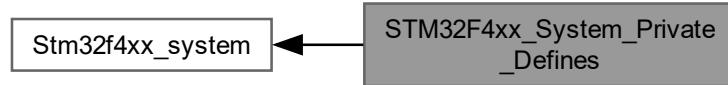
#### 4.1.2.3 STM32F4xx\_System\_Private\_TypesDefinitions

Collaboration diagram for STM32F4xx\_System\_Private\_TypesDefinitions:



#### 4.1.2.4 STM32F4xx\_System\_Private\_Defines

Collaboration diagram for STM32F4xx\_System\_Private\_Defines:



#### Macros

- `#define VECT_TAB_OFFSET 0x00`

##### 4.1.2.4.1 Detailed Description

##### 4.1.2.4.2 Macro Definition Documentation

###### 4.1.2.4.2.1 VECT\_TAB\_OFFSET

```
#define VECT_TAB_OFFSET 0x00
```

< Uncomment the following line if you need to use external SRAM or SDRAM as data memory

< Uncomment the following line if you need to relocate your vector Table in Internal SRAM. Vector Table base offset field. This value must be a multiple of 0x200.

#### 4.1.2.5 STM32F4xx\_System\_Private\_Macros

Collaboration diagram for STM32F4xx\_System\_Private\_Macros:



#### 4.1.2.6 STM32F4xx\_System\_Private\_Variables

Collaboration diagram for STM32F4xx\_System\_Private\_Variables:



#### Variables

- `uint32_t SystemCoreClock = 16000000`
- `const uint8_t AHBPrescTable [16] = {0, 0, 0, 0, 0, 0, 0, 0, 1, 2, 3, 4, 6, 7, 8, 9}`
- `const uint8_t APBPrescTable [8] = {0, 0, 0, 0, 1, 2, 3, 4}`

#### 4.1.2.6.1 Detailed Description

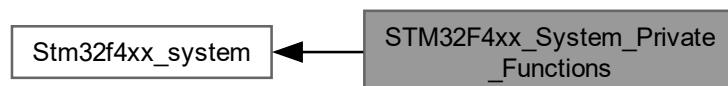
#### 4.1.2.7 STM32F4xx\_System\_Private\_FunctionPrototypes

Collaboration diagram for STM32F4xx\_System\_Private\_FunctionPrototypes:



#### 4.1.2.8 STM32F4xx\_System\_Private\_Functions

Collaboration diagram for STM32F4xx\_System\_Private\_Functions:



## Functions

- void [SystemInit](#) (void)  
*Setup the microcontroller system Initialize the FPU setting, vector table location and External memory configuration.*
- void [SystemCoreClockUpdate](#) (void)  
*Update SystemCoreClock variable according to Clock Register Values. The SystemCoreClock variable contains the core clock (HCLK), it can be used by the user application to setup the SysTick timer or configure other parameters.*

### 4.1.2.8.1 Detailed Description

### 4.1.2.8.2 Function Documentation

#### 4.1.2.8.2.1 [SystemCoreClockUpdate\(\)](#)

```
void SystemCoreClockUpdate (
    void )
```

Update SystemCoreClock variable according to Clock Register Values. The SystemCoreClock variable contains the core clock (HCLK), it can be used by the user application to setup the SysTick timer or configure other parameters.

#### Note

Each time the core clock (HCLK) changes, this function must be called to update SystemCoreClock variable value. Otherwise, any configuration based on this variable will be incorrect.

- The system frequency computed by this function is not the real frequency in the chip. It is calculated based on the predefined constant and the selected clock source:

- If SYSCLK source is HSI, SystemCoreClock will contain the [HSI\\_VALUE\(\\*\)](#)
- If SYSCLK source is HSE, SystemCoreClock will contain the [HSE\\_VALUE\(\\*\\*\)](#)
- If SYSCLK source is PLL, SystemCoreClock will contain the [HSE\\_VALUE\(\\*\\*\)](#) or [HSI\\_VALUE\(\\*\)](#) multiplied/divided by the PLL factors.

(\*) HSI\_VALUE is a constant defined in [stm32f4xx\\_hal\\_conf.h](#) file (default value 16 MHz) but the real value may vary depending on the variations in voltage and temperature.

(\*\*) HSE\_VALUE is a constant defined in [stm32f4xx\\_hal\\_conf.h](#) file (its value depends on the application requirements), user has to ensure that HSE\_VALUE is same as the real frequency of the crystal used. Otherwise, this function may have wrong result.

- The result of this function could be not correct when using fractional value for HSE crystal.

**Parameters**

None	
------	--

**Return values**

None	
------	--

**4.1.2.8.2.2 SystemInit()**

```
void SystemInit (
    void )
```

Setup the microcontroller system Initialize the FPU setting, vector table location and External memory configuration.

**Parameters**

None	
------	--

**Return values**

None	
------	--



# Chapter 5

## Class Documentation

### 5.1 ColorMap Struct Reference

#### Public Attributes

- const char \* **name**
- int **value**

The documentation for this struct was generated from the following file:

- C:/Git/EE-Y3-P2-SoftOnt/STM\_program/Core/Src/Logic.c

### 5.2 FontInfo Struct Reference

#### Public Attributes

- const char \* **name**
- uint16\_t **size**
- uint16\_t **num\_chars**
- const uint16\_t(\* **index** )[4]
- const uint8\_t \* **data**

The documentation for this struct was generated from the following file:

- C:/Git/EE-Y3-P2-SoftOnt/STM\_program/Core/Inc/combined\_charsets.h

### 5.3 input\_vars Struct Reference

#### Public Attributes

- uint8\_t **byte\_buffer\_rx** [BYTE\_BUflen]
- char **line\_rx\_buffer** [LINE\_BUflen]
- int **msglen**
- volatile int **char\_counter**
- char **command\_execute\_flag**

The documentation for this struct was generated from the following file:

- C:/Git/EE-Y3-P2-SoftOnt/STM\_program/Core/Inc/main.h

## 5.4 LogicInterface Struct Reference

```
#include <Logic_layer.h>
```

### Public Attributes

- char **function\_name** [15]
- int **argument\_len**
- char \* **arguments**

#### 5.4.1 Detailed Description

Struct voor het opslaan van een commando.

### Parameters

<i>char</i>	function_name[15] Naam van de functie/commando.
<i>int</i>	arguments_len Lengte van de argumenten string.
<i>char</i>	*arguments Pointer naar de argumenten string.

### Returns

Statuscode (0 = succes, anders fout).

The documentation for this struct was generated from the following file:

- C:/Git/EE-Y3-P2-SoftOnt/STM\_program/Core/Inc/Logic\_layer.h

## 5.5 ParsedArgs Struct Reference

### Public Attributes

- int **int\_args** [MAX\_ARGS]
- char **str\_args** [MAX\_ARGS][MAX\_TOKEN\_LEN]
- int **arg\_count**

The documentation for this struct was generated from the following file:

- C:/Git/EE-Y3-P2-SoftOnt/STM\_program/Core/Src/Logic.c

## 5.6 VGA\_t Struct Reference

### Public Attributes

- uint16\_t **hsync\_cnt**
- uint32\_t **start\_adr**
- uint32\_t **dma2\_cr\_reg**

The documentation for this struct was generated from the following file:

- C:/Git/EE-Y3-P2-SoftOnt/STM\_program/Core/ub\_lib/stm32\_ub\_vga\_screen.h

# Chapter 6

## File Documentation

### 6.1 API\_func.h

```
00001 /*
00002  * API_func.h
00003  *
00004  * Created on: 27 Nov 2025
00005  *      Author: jerem
00006 */
00007
00008 /*
00009
00010 TODO:
00011 Add error check to all functions
00012 completer functions
00013
00014 */
00015
00016 #ifndef API_API_FUNC_H_
00017 #define API_API_FUNC_H_
00018
00019 #include <stdint.h>
00020 #include <errno.h>
00021 #include <stm32_ub_vga_screen.h>
00022
00023
00024 int API_draw_text(int x_lup, int y_lup, int color, char *text, char *fontname, int fontsize, int
00025   fontstyle, int reserved);
00026
00027
00028 int API_draw_line(int x_1, int y_1, int x_2, int y_2, int color, int weight, int reserved);
00029
00030
00031 int API_draw_rectangle(int x, int y, int width, int height, int color, int filled, int reserved, int
00032   reserved_2);
00033
00034
00035 int API_draw_bitmap(int x_lup, int y_lup, int bm_nr);
00036
00037
00038 int API_clearscreen(int color);
00039
00040
00041 int API_wait(int msecs);
00042
00043
00044 int API_repeat_commands(int nr_previous_commands, int iterations, int reserved);
00045
00046
00047 int API_draw_circle(int x, int y, int radius, int color, int reserved);
00048
00049
00050 int API_draw_figure(int x_1, int y_1, int x_2, int y_2, int x_3, int y_3, int x_4, int y_4, int x_5,
00051   int y_5, int color, int reserved);
00052
00053
00054 #endif /* API_API_FUNC_H_ */
```

## 6.2 Bitmaps.h



























```

01216 0x60, 0x60, 0x60, 0x60, 0x40, 0x60, 0x64, 0x40, 0x20, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01217 0x00, 0x00,
01218 0x00, 0x00,
01219 0x00, 0x00,
01220 0x40, 0x40, 0x40, 0x60, 0x60, 0x60, 0x60, 0x60, 0x60, 0x40, 0x40, 0x40, 0x40, 0x40, 0x40, 0x40,
01221 0x20, 0x00, 0x00,
01222 0x00, 0x00,
01223 0xFF, 0x92, 0x91, 0x8D, 0x6D, 0x8D, 0xFF, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01224 0x20, 0x20, 0x40, 0x40,
01225 0x40, 0x40, 0x64, 0x64, 0x44, 0x20, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01226 0x00, 0x00,
01227 0x00, 0x00,
01228 0x00, 0x00,
01229 0x40, 0x40, 0x40, 0x40, 0x40, 0x40, 0x40, 0x40, 0x44, 0x44, 0x44, 0x44, 0x00, 0x00, 0x00, 0x00,
01230 0x00, 0x00,
01231 0x00, 0x00,
01232 0x00, 0x00,
01233 0x00, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20,
01234 0x00, 0x00,
01235 0x00, 0x00,
01236 0x00, 0x00
01237 };
01238
01239 // smile_meme (59x60)
01240 const uint8_t smile_meme_bitmap_data[3542] = {
01241 0x3B, 0x3C, 0xFF, 0xFF,
01242 0xFF, 0xFF,
01243 0xFF, 0x9F, 0x9F,
01244 0x9F, 0xFF, 0xFF,
01245 0xFF, 0xFF,
01246 0xFF, 0xFF, 0xFF, 0xD5, 0xD5,
01247 0xD5, 0xD5, 0xDA, 0xFF, 0xFF,
01248 0xFF, 0xFF,
01249 0xFF, 0xFF,
01250 0xF4, 0xF4, 0xF4, 0xF8, 0x9F, 0x9F,
01251 0x6F, 0xFF, 0xFF,
01252 0xFF, 0xFF,
01253 0xFF, 0xFB, 0xD2, 0x8C, 0x68, 0x68, 0xB0, 0xF5, 0xF4, 0xF4, 0xF8, 0xFC, 0xFD, 0xFD, 0xFD, 0xFD,
01254 0xFD, 0xFD, 0xFD, 0x9F, 0x8F, 0x8F,
01255 0xFF, 0xFF,
01256 0xFF, 0xFF,
01257 0xD4, 0xF4, 0xF8, 0xF8, 0xF8, 0xFC, 0xFD, 0xFD, 0x9E, 0x9E, 0x9E, 0x9E, 0x9E, 0x9E, 0x9E, 0x9E,
01258 0xFD, 0xFD, 0xF8, 0xF8, 0xF8, 0xF4, 0xF5, 0xB1, 0x44, 0x68, 0x68, 0x68, 0x68, 0x68, 0x68, 0x68,
01259 0xFF, 0xFF,
01260 0xFF, 0xFF,
01261 0xFD, 0xFD, 0xFD, 0x9F, 0x9F,
01262 0xF8, 0xF9, 0xF5, 0xD5, 0xD5, 0x6C, 0x8C, 0xFA, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01263 0xFF, 0xFF,
01264 0xB1, 0x88, 0x9F, 0x9F,
01265 0xFE, 0xFE, 0xFD, 0x9F, 0x9F,
01266 0xD5, 0x68, 0xB1, 0xFA, 0xFF, 0xFF,
01267 0xFF, 0xFF,
01268 0x8C, 0x8D, 0x91, 0x91,
01269 0xFD, 0xFE, 0xD9, 0x91, 0x91,
01270 0xFE, 0xFF, 0xFF,
01271 0xFF, 0xFF, 0xFF, 0xD5, 0xD5,
01272 0x91, 0xB5, 0xFD, 0x9E, 0xFD, 0x9D, 0x9D,
01273 0xFF, 0xFF, 0xFF, 0x8C, 0x9E, 0x9E,
01274 0xFF, 0xFF,
01275 0xF4, 0x9F, 0x6C, 0xFF, 0x9F, 0x97, 0x92, 0x92, 0x92, 0x92, 0x92, 0x92, 0x92, 0x92, 0x92, 0x92,
01276 0xFD, 0xFD, 0xFD, 0x9F, 0x9F,
01277 0xFB, 0x8C, 0x9F, 0x9F,
01278 0xFF, 0xFF,
01279 0x72, 0x4E, 0x2A, 0x4E, 0x4A, 0x6E, 0xDB, 0xFF, 0x91, 0x91, 0x91, 0x91, 0x91, 0x91, 0x91, 0x91,
01280 0xFD, 0xFE, 0x91, 0xDB, 0xDB, 0x4A, 0x2E, 0x2E, 0x2E, 0x2A, 0x93, 0xFF, 0xA, 0x8C, 0x9F, 0x9F,
01281 0xF8, 0xD4, 0xD5, 0x9F, 0x9F,
01282 0xFF, 0x9F, 0x9F,
01283 0x72, 0x4E, 0x2A, 0x4E, 0x4A, 0x6E, 0xDB, 0x91, 0x91, 0x91, 0x91, 0x91, 0x91, 0x91, 0x91,
01284 0x93, 0xBB, 0x29, 0x09, 0x2A, 0x2A, 0x97, 0xFF, 0x8D, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F,
01285 0xFF, 0xFF,
01286 0xF4, 0x8F, 0x8B, 0x6D, 0x6E, 0x29, 0x05, 0x00, 0x92, 0xFF, 0x4E, 0xB6, 0xDB, 0x91, 0x91,
01287 0xFD, 0xFD, 0xFD, 0x9F, 0x9F,
01288 0x49, 0x6E, 0x6D, 0x6B, 0x6B,
01289 0x93, 0xBB, 0x29, 0x09, 0x2A, 0x2A, 0x97, 0xFF, 0x8D, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F,
01290 0x48, 0x6D, 0x24, 0x00, 0x4D, 0x4D, 0x49, 0x9B, 0x9B, 0x9B, 0x9B, 0x9B, 0x9B, 0x9B, 0x9B,
01291 0xFD, 0xFD, 0x9F, 0x9F,
01292 0x8F, 0x4F, 0x4F,
01293 0x9F, 0xD4, 0x9F, 0x9F,
01294 0xD5, 0x90, 0x68, 0x6D, 0xDA, 0xB0, 0x9D, 0x9D, 0x9D, 0x9D, 0x9D, 0x9D, 0x9D, 0x9D, 0x9D,
01295 0x68, 0xB1, 0xB1, 0xD5, 0xB1, 0xB1,
01296 0x4F, 0x9F, 0x9F,
01297 0x4F, 0x4F,
01298 0x5D, 0x9D, 0x9D,
01299 0x9F, 0x9F,
01300 0xFF, 0xFF,
01301 0x4F, 0x4F, 0x5F, 0x9F, 0x9F,
01302 0xFD, 0xFD, 0x9F, 0x9F
01303

```



```

01390    0x60, 0x60, 0x60, 0x60, 0xA9, 0xC9, 0xC9, 0xC9, 0xA9, 0x60, 0x60, 0x60, 0x60, 0x64,
01391    0x40, 0x40, 0x40, 0x40, 0x60, 0x40, 0x40, 0x64, 0x88, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4,
01392    0xF8, 0xF4, 0xD5, 0xFF, 0xFF, 0xFF, 0xD9, 0xD4, 0xF4, 0xF8, 0xF4, 0xF4, 0xF4, 0xF4,
01393    0xF4, 0xD0, 0x64, 0x40, 0x60, 0x40, 0x64, 0x40, 0x60, 0x60, 0x60, 0x60, 0x60, 0x84,
01394    0xA9, 0xC9, 0xC9, 0xC9, 0x85, 0x60, 0x60, 0x40, 0x40, 0x60, 0x60, 0x64, 0x60, 0x40,
01395    0x64, 0x64, 0x64, 0xD0, 0xF4, 0xF8, 0xF4, 0xF4, 0xF4, 0xF4, 0xF8, 0xD4, 0x99, 0xFF, 0xFF,
01396    0xFF, 0xFE, 0xB5, 0xF8, 0xF8, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xAC, 0x64, 0x40,
01397    0x64, 0x60, 0x40, 0x60, 0x60, 0x60, 0x60, 0x40, 0x40, 0x64, 0x89, 0x89, 0x84, 0x84,
01398    0x40, 0x40, 0x40, 0x60, 0x60, 0x40, 0x40, 0x40, 0x40, 0x64, 0x40, 0x64, 0xAC, 0xF4, 0xF4,
01399    0xF8, 0xF8, 0xF4, 0xF4, 0xF8, 0xD4, 0xD5, 0xFE, 0xFF, 0xFF, 0xFF, 0xD5, 0xD5,
01400    0xF4, 0xF8, 0xF8, 0xF4, 0xF4, 0xF4, 0xF8, 0xF4, 0xAC, 0x64, 0x40, 0x60, 0x64, 0x64,
01401    0x60, 0x40, 0x40, 0x44, 0x44, 0x40, 0x64, 0x44, 0x40, 0x44, 0x44, 0x40, 0x64,
01402    0x64, 0x60, 0x64, 0x40, 0x60, 0x64, 0x40, 0xAC, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4,
01403    0xF4, 0xD5, 0xDA, 0xFF, 0xFF, 0xFF, 0xF5, 0xF4, 0xF8, 0xF4, 0xF4, 0xF4, 0xF4,
01404    0xF4, 0xF4, 0xF4, 0xF8, 0x40, 0x40, 0x64, 0x60, 0x60, 0x64, 0x40, 0x44, 0xB2, 0xD6,
01405    0xDB, 0xD6, 0xB6, 0xB2, 0xD6, 0xD6, 0xFB, 0xD6, 0x8D, 0x40, 0x40, 0x40, 0x60, 0x64, 0x64,
01406    0x40, 0x8C, 0xF4, 0xF4, 0xF8, 0xF4, 0xF4, 0xF4, 0xF8, 0xF8, 0xD4, 0xD9, 0xFF, 0xFF, 0xFF,
01407    0xFF, 0xFF, 0xFF, 0xFF, 0xFA, 0xD5, 0xF8, 0xF8, 0xF4, 0xF4, 0xF8, 0xF8, 0xF4, 0xF4, 0xF4,
01408    0xF4, 0xAC, 0x64, 0x40, 0x40, 0x64, 0x44, 0x8D, 0xFF, 0xFF, 0xFF, 0x4F, 0x4F, 0x4F, 0x4F,
01409    0xFF, 0xFF, 0xFF, 0xFB, 0x65, 0x40, 0x64, 0x64, 0x64, 0x60, 0x64, 0x40, 0x44, 0x44, 0x40,
01410    0xF4, 0xF4, 0xF4, 0xF8, 0xF8, 0xF4, 0xD5, 0xFA, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01411    0xFF, 0xF5, 0xF4, 0xF4, 0xF8, 0xF4, 0xF4, 0xF8, 0xF4, 0xF4, 0xF4, 0xF5, 0xAC, 0x64, 0x64,
01412    0x64, 0x40, 0x44, 0xB2, 0xFF, 0xFF, 0xFF, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F,
01413    0x40, 0x40, 0x60, 0x88, 0xAC, 0xF8, 0xF8, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4,
01414    0xF4, 0xF9, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F,
01415    0xF8, 0xF4, 0xF4, 0xF8, 0xF4, 0xF4, 0xF5, 0xDO, 0x88, 0x64, 0x44, 0x64, 0x40, 0x40, 0x40,
01416    0xFF, 0xFF, 0xFF, 0xFF, 0xDB, 0xF8, 0xFF, 0xFF, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F,
01417    0x9, 0xF4, 0xF4,
01418    0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4,
01419    0xF4, 0xF4, 0xF4, 0xF8, 0xF4, 0xF4, 0xDO, 0x68, 0x64, 0xB1, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01420    0xFF, 0xFF, 0xFF, 0xFF, 0x68, 0x64, 0x88, 0xDO, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4,
01421    0xF4, 0xF4, 0xF4, 0xF4, 0xF5, 0x5, 0xFA, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01422    0xFF, 0xFF, 0xFF, 0xFF, 0xFA, 0xD5, 0xF8, 0xF4, 0xF4, 0xF8, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4,
01423    0xF4, 0xF8, 0xD4, 0xDO, 0x5, 0xFA, 0xFA, 0xFA, 0xD6, 0xFA, 0xFA, 0xFA, 0xFA, 0xFA, 0xFA,
01424    0xB0, 0xDO, 0xF4, 0xF8, 0xF8, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4,
01425    0xFA, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F,
01426    0xFA, 0xD5, 0xD4, 0xF8, 0xF4, 0xF4, 0xF4, 0xF4, 0xF8, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4,
01427    0xD4, 0xD4, 0xD4, 0x5, 0x4, 0x4,
01428    0xF4, 0xF4,
01429    0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F,
01430    0xF4, 0xF4, 0xF8, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF8, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4,
01431    0xF4, 0xF8, 0xF8, 0xF8, 0xF8, 0xF8, 0xF8, 0xF8, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4, 0xF4,
01432    0xF4, 0xF4, 0xF4, 0xD5, 0xFA, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01433    0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x5, 0x4, 0x4,
01434    0xF4, 0xF4,
01435    0xF4, 0xF4,
01436    0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F,
01437    0xFF, 0xFF, 0xFF, 0xFF, 0x5, 0x4, 0x4,
01438    0xDO, 0xF4, 0xF4,
01439    0xF4, 0xF8, 0xF8, 0xF8, 0xF4, 0xD5, 0x9, 0xFA, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01440    0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F,
01441    0xFF, 0xFA, 0xD5, 0x5, 0x4, 0x4,
01442    0xDO, 0xDO, 0xDO, 0xDO, 0xF4, 0xF4, 0xF4, 0xF4, 0xF8, 0xF4, 0xF8, 0xF8, 0xF8, 0xF8, 0xF8, 0xF8,
01443    0x5, 0xFA, 0xFE, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F,
01444    0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F,
01445    0xD4, 0xD4, 0x4, 0x9, 0x8, 0x8,
01446    0x8, 0x8,
01447    0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F,
01448    0xFF, 0xFF, 0xFF, 0xFF, 0x5, 0x4, 0x4,
01449    0x9, 0x8, 0x8, 0x8, 0x9, 0x9,
01450    0x5, 0x5,
01451    0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F,
01452    0xFF, 0xFF, 0xFF, 0xFF, 0x5, 0x5,
01453    0x9, 0x9,
01454    0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F,
01455    0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F,
01456    0xD5, 0xD5, 0x5, 0x5,
01457    0x5, 0x5,
01458    0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F, 0x4F,
01459    0xFF, 0xFF, 0xFF, 0xFF, 0x5, 0x5,
01460    0xFF, 0xFF, 0xFF, 0xFF, 0x5, 0x5,
01461    0xFF, 0xFF, 0xFF, 0xFF, 0x5, 0x5,
01462    0xFF, 0xFF, 0xFF, 0xFF, 0x5, 0x5,
01463    };
01464
01465 // Klok (69x60)
01466 const uint8_t Klok_bitmap_data[4142] = {
01467 0x45, 0x3C, 0xFF, 0xFF,
01468 0xFF, 0xFF,
01469 0xDB, 0xB6, 0x71, 0x4D, 0x48, 0x4D, 0x6D, 0x92, 0xDA, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01470 0xFF, 0xFF,
01471 0xFF, 0xFF,
01472 0xFF, 0xFF,
01473 0xFF, 0xFF, 0xFF, 0xFF, 0x91, 0x4D, 0x28, 0x28,
01474 0xDA, 0xFF, 0xFF,
01475 0xFF, 0xFF,
01476 0xFF, 0xFF
}

```

```

01477 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xB6, 0x4D, 0x28, 0x28, 0x4C, 0x71, 0x71, 0x71,
01478 0x71, 0x71, 0x50, 0x28, 0x28, 0x48, 0x92, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01479 0xFF, 0xFF,
01480 0xFF, 0xFF,
01481 0xFF, 0xFF,
01482 0x95, 0xAD, 0xAD, 0xA9, 0xA9, 0xA9, 0x8D, 0x91, 0x75, 0x30, 0x28, 0x91, 0x2C, 0x95,
01483 0xFF, 0xFF,
01484 0xFF, 0xFF,
01485 0xFF, 0xFF,
01486 0x28, 0x28, 0x50, 0x95, 0x91, 0xCD, 0xC9, 0xCD, 0xE9, 0xE9, 0xC9, 0xC9, 0x8D, 0x91, 0x50,
01487 0x28, 0x28, 0x48, 0x6D, 0x91, 0xB6, 0xDB, 0x8B, 0x91, 0x28, 0x28, 0x4D, 0x71, 0xB6, 0xDB,
01488 0xFF, 0xFF,
01489 0xFF, 0xFF,
01490 0x28, 0x28, 0x2C, 0x2C, 0x30, 0x75, 0x91, 0xC9, 0xC9, 0xCD, 0xCD, 0xCD, 0x5C, 0x5C,
01491 0xC5, 0xC9, 0xC9, 0x75, 0x30, 0x2C, 0x2C, 0x28, 0x28, 0x4D, 0x71, 0xB6, 0xDB, 0xF,
01492 0xFF, 0xFF,
01493 0xFF, 0xFF,
01494 0x91, 0x4D, 0x28, 0x28, 0x2C, 0x30, 0x50, 0x4C, 0x4C, 0x4C, 0x4C, 0x75, 0x8D, 0xC9, 0xC9,
01495 0xF2, 0xF6, 0xF6, 0xF2, 0xCE, 0xC9, 0xE9, 0xA9, 0x91, 0x50, 0x50, 0x50, 0x50, 0x30, 0x2C,
01496 0x2C, 0x28, 0x28, 0x48, 0x91, 0xB6, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01497 0xFF, 0xFF,
01498 0xFC, 0xFF, 0xB6, 0x6D, 0x48, 0x28, 0x28, 0x2C, 0x50, 0x50, 0x70, 0x70, 0x4C, 0x4C, 0x4C,
01499 0x4C, 0x91, 0x8D, 0xC9, 0xE9, 0xF6, 0xF6, 0xF2, 0xF2, 0xE9, 0xE9, 0xA9, 0x91, 0x70,
01500 0x50, 0x50, 0x50, 0x50, 0x70, 0x50, 0x50, 0x2C, 0x28, 0x28, 0x28, 0x6D, 0x6D, 0xB6, 0xFF, 0xFF,
01501 0xFF, 0xFF,
01502 0xFF, 0xFF,
01503 0x50, 0x50, 0x4C, 0x50, 0x71, 0x91, 0xB6, 0x91, 0xA9, 0xCD, 0xE9, 0xCD, 0xE9, 0x91, 0xED,
01504 0xCD, 0xC9, 0xAD, 0xB6, 0x91, 0x50, 0x50, 0x70, 0x50, 0x50, 0x4C, 0x4C, 0x30, 0x2C, 0x2C,
01505 0x28, 0x28, 0x6D, 0xB6, 0xFF, 0xFF,
01506 0xFF, 0xFF,
01507 0x4C, 0x50, 0x50, 0x4C, 0x50, 0x71, 0xB6, 0xBA, 0xDB, 0xDB, 0xDB, 0xBB, 0x91, 0xAD, 0xCD,
01508 0xED, 0xED, 0xED, 0xED, 0xCD, 0xAD, 0xB6, 0xDB, 0xDB, 0xBA, 0x95, 0x71, 0x4C, 0x50,
01509 0x4C, 0x4C, 0x4C, 0x50, 0x30, 0x2C, 0x28, 0x48, 0x71, 0xDA, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01510 0xFF, 0xFF,
01511 0x50, 0x50, 0x4C, 0x4C, 0x50, 0x50, 0x71, 0xB6, 0xDA, 0xDB, 0xDB, 0xDB, 0xDF, 0xFF, 0xFF,
01512 0xFF, 0xFF, 0xB6, 0x91, 0xB1, 0xB1, 0xB1, 0xB1, 0xB6, 0x95, 0x71, 0x4C, 0x50,
01513 0xDB, 0xDB, 0xBA, 0x95, 0x6D, 0x4C, 0x50, 0x70, 0x50, 0x50, 0x2C, 0x28, 0x4D,
01514 0xB6, 0xFF, 0xFF,
01515 0x91, 0x28, 0x28, 0x30, 0x50, 0x50, 0x4C, 0x4C, 0x91, 0xB6, 0xDB, 0xDB, 0xDB, 0xDB, 0xDF,
01516 0xFF, 0xFF,
01517 0xFF, 0xFF,
01518 0x50, 0x50, 0x50, 0x30, 0x28, 0x48, 0x6D, 0xDA, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01519 0xFF, 0xFF,
01520 0xDB, 0xDB, 0xFF, 0xFF,
01521 0xFF, 0xFF,
01522 0xFF, 0xFF, 0xDA, 0x91, 0x70, 0x50, 0x50, 0x54, 0x30, 0x2C, 0x28, 0x6D, 0x91, 0x4C, 0x6D,
01523 0xFF, 0xFF,
01524 0x91, 0xB6, 0xBA, 0xB6, 0xDB, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xB6, 0x96,
01525 0x96, 0x96, 0xB6, 0xB6, 0xFF, 0xBA, 0xB6, 0xB6, 0xB6, 0xB6, 0xB6, 0xB6, 0xB6, 0xB6, 0xB6,
01526 0xFF, 0xFF,
01527 0x28, 0x48, 0xDB, 0xFF, 0xFF,
01528 0x28, 0x30, 0x50, 0x70, 0x91, 0xDB, 0xB7, 0xDB, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01529 0xFF, 0xFF, 0xB6, 0x28, 0x28, 0x71, 0x71, 0x29, 0x4D, 0xBB, 0x96, 0x28, 0x71, 0x96,
01530 0x4D, 0x72, 0xFF, 0xFF,
01531 0xB6, 0x6C, 0x4C, 0x30, 0x30, 0x28, 0x28, 0x2B, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01532 0xFF, 0xFF,
01533 0xFF, 0xFF,
01534 0xDB, 0x4D, 0x28, 0xB6, 0xFF, 0xB6, 0x96, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01535 0xFF, 0xFF,
01536 0xFF, 0xFF,
01537 0xDB, 0xFF, 0xFF,
01538 0xBB, 0xFF, 0x28, 0x29, 0xB6, 0x49, 0x28, 0x92, 0x71, 0xB6, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01539 0xFF, 0xFF,
01540 0x4D, 0xFF, 0xFF,
01541 0x50, 0x54, 0x71, 0x91, 0xFF, 0x4D, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01542 0xFF, 0xFF, 0xFF, 0x29, 0x29, 0xBB, 0xFF, 0x2B, 0x28, 0x28, 0x96, 0x29, 0x08, 0x4D, 0x96,
01543 0xFF, 0xFF,
01544 0x91, 0x71, 0x50, 0x30, 0x28, 0x4D, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01545 0xFF, 0xFF,
01546 0xFF, 0xFF,
01547 0x29, 0x28, 0xB6, 0xB6, 0xBA, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01548 0xFF, 0xFF,
01549 0xFF, 0xFF,
01550 0xFF, 0xFF, 0x6D, 0x4D, 0x28, 0x54, 0x71, 0x91, 0xFF, 0x4D, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01551 0xFF, 0x71, 0x04, 0x71, 0xDB, 0x29, 0x28, 0x7B, 0xFF, 0xDB, 0x4D, 0xDB, 0xFF, 0xFF, 0xFF,
01552 0xFF, 0xDF, 0xDB, 0x6B, 0xBB, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01553 0xFF, 0xFF,
01554 0x54, 0x71, 0x91, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x29, 0x08, 0x4D, 0xB6, 0x29, 0x28, 0x4D,
01555 0x96, 0x71, 0x29, 0x29, 0x4D, 0x4D, 0x4D, 0x72, 0xDB, 0x92, 0x28, 0x28, 0x4D, 0x92, 0x4D, 0x4D,
01556 0x92, 0x4D, 0x4D, 0x4D, 0x4D, 0x4D, 0x71, 0x28, 0x28, 0x71, 0xDB, 0xFF, 0xFF, 0xFF, 0xFF, 0x91,
01557 0x71, 0x54, 0x50, 0x28, 0x6D, 0x2F, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
01558 0xFF, 0xFF,
01559 0xFF, 0xFF, 0x4D, 0x49, 0xB6, 0x75, 0xB5, 0xB6, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x4D, 0x08, 0x92,
01560 0x92, 0x96, 0xB6, 0xB6, 0xDB, 0xDB, 0x4D, 0x04, 0x28, 0x96, 0x29, 0x72, 0x72, 0xFF, 0xFF,
01561 0xFF, 0xFF,
01562 0xFF, 0xFF,
01563 0xFF, 0xFF, 0x4D, 0x04, 0x92, 0xFF, 0x4D, 0x4D, 0x54, 0x75, 0xB5, 0xA4, 0xFF, 0xFF, 0xFF,

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```

01564 0xFF, 0xFF, 0xDB, 0x72, 0x4D, 0x4D, 0x4D, 0xB6, 0xFF, 0x96, 0x04, 0x49, 0xDB, 0xFF,
01565 0x92, 0x4D, 0xDB, 0xFF, 0xFF, 0xFF, 0xFF, 0x95, 0x71, 0x50, 0x30, 0x28, 0x4D, 0xFF,
01566 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x95, 0x71, 0x50, 0x30, 0x28, 0x4D, 0xFF,
01567 0x95, 0xB6, 0xFF, 0xFF, 0xFF, 0xFF, 0x4D, 0x04, 0x92, 0xDB, 0x4D, 0x96, 0xFF, 0xFF,
01568 0x92, 0x04, 0x49, 0xB6, 0xFF, 0xFF, 0x4D, 0x28, 0x72, 0xDB, 0xDB, 0x49, 0x28, 0x96, 0xFF,
01569 0x96, 0x04, 0x4D, 0xDB, 0x86, 0x4D, 0x26, 0xFF, 0xFF, 0xFF, 0xFF, 0x99, 0x28, 0x96, 0xFF,
01570 0x50, 0x30, 0x28, 0x48, 0xFF, 0xFF, 0xFF, 0xFF, 0x99, 0x28, 0x96, 0x99, 0x28, 0x96, 0xFF,
01571 0xDA, 0x4D, 0x2C, 0x54, 0x50, 0x91, 0xB6, 0xFF, 0xFF, 0xFF, 0xFF, 0x99, 0x28, 0x96, 0x99,
01572 0x28, 0xB6, 0xFF, 0xFF, 0xFF, 0x96, 0x04, 0x4D, 0xDB, 0xFF, 0xFF, 0x72, 0x04, 0x4D, 0xDB, 0xFF,
01573 0xFF, 0x96, 0x04, 0x49, 0xBB, 0x96, 0x04, 0x4D, 0x96, 0x29, 0x71, 0xFF, 0xFF, 0xFF, 0xFF,
01574 0xFF, 0xFF, 0xDF, 0x91, 0x6D, 0x50, 0x30, 0x28, 0x48, 0xFF, 0xFF, 0xFF, 0xFF, 0x99, 0x28, 0x96, 0xFF,
01575 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xA4, 0x2C, 0x54, 0x50, 0x71, 0xB6, 0x4F, 0xFF, 0xFF, 0xFF, 0xFF,
01576 0xFF, 0x4D, 0x08, 0x29, 0x28, 0x08, 0x71, 0xDF, 0xFF, 0x96, 0x04, 0x4D, 0xDB, 0xFF, 0xFF, 0x96,
01577 0x29, 0x04, 0x71, 0xFF, 0xFF, 0xBB, 0x28, 0x08, 0x96, 0x92, 0x04, 0x29, 0x49, 0x04, 0x4D,
01578 0xDB, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x95, 0x91, 0x6C, 0x50, 0x50, 0x2C, 0x48, 0xDB, 0xFF,
01579 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x95, 0x91, 0x6C, 0x50, 0x50, 0x2C, 0x48, 0xDB, 0xFF,
01580 0xB6, 0xDF, 0xFF, 0xFF, 0xFF, 0x49, 0x04, 0x4D, 0x71, 0x08, 0x28, 0xB6, 0xFF, 0xFF, 0x92,
01581 0x04, 0x4D, 0xDB, 0xFF, 0x28, 0x04, 0x72, 0xFF, 0xFF, 0x28, 0x04, 0x72, 0x04, 0x71,
01582 0x04, 0x08, 0x29, 0x08, 0x29, 0x0B, 0xFF, 0x04, 0x08, 0x29, 0x0B, 0x91, 0x04, 0x48, 0x50,
01583 0x54, 0x2C, 0x48, 0xDA, 0xFF, 0xFF, 0x04, 0x08, 0x29, 0x0B, 0x91, 0x04, 0x48, 0x50,
01584 0x28, 0x2C, 0x50, 0x50, 0x6D, 0xDA, 0xFF, 0xFF, 0x04, 0x08, 0x29, 0x0B, 0x91, 0x04, 0x49,
01585 0x04, 0x71, 0xDF, 0xFF, 0x92, 0x04, 0x4D, 0xDB, 0xFF, 0x28, 0x08, 0x72, 0xFF, 0xFF, 0xF,
01586 0xDB, 0x28, 0x04, 0x72, 0x71, 0x04, 0x49, 0x96, 0x28, 0x28, 0x96, 0x04, 0x4F, 0xFF, 0x96,
01587 0xFF, 0xDB, 0x86, 0x50, 0x54, 0x2C, 0x48, 0xDA, 0xFF, 0xFF, 0x04, 0x4F, 0xFF, 0x96, 0x04,
01588 0xFF, 0xFF, 0xFF, 0x6D, 0x28, 0x30, 0x50, 0x71, 0x91, 0xDB, 0xFF, 0xFF, 0x04, 0x4F,
01589 0x29, 0x04, 0x96, 0xFF, 0x92, 0x04, 0x29, 0xB7, 0xFF, 0x92, 0x08, 0x4D, 0xDB, 0xFF, 0x29,
01590 0x08, 0x72, 0xFF, 0xFF, 0xBA, 0x28, 0x28, 0x96, 0x71, 0x04, 0x4D, 0xDB, 0x4D, 0x04, 0x71,
01591 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x71, 0x54, 0x30, 0x28, 0xB6, 0xFF, 0xFF, 0x96,
01592 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x71, 0x54, 0x30, 0x28, 0x30, 0x50, 0x71, 0x91, 0xDB,
01593 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x71, 0x54, 0x30, 0x28, 0x30, 0x50, 0x71, 0x91, 0x92,
01594 0x4D, 0xDB, 0x04, 0x4F, 0x4D, 0x04, 0x4D, 0xDB, 0xFF, 0x96, 0x08, 0x49, 0xDB, 0x92, 0x04,
01595 0x4D, 0xDB, 0x92, 0x04, 0x4D, 0xDB, 0xFF, 0x96, 0x08, 0x49, 0xDB, 0x92, 0x04, 0x4D,
01596 0x30, 0x28, 0x91, 0xFF, 0xFF, 0xFF, 0xFF, 0x9F, 0x04, 0x4D, 0xDB, 0xFF, 0x96, 0x04, 0x4D,
01597 0x50, 0x50, 0x6D, 0x91, 0xDB, 0xFF, 0xFF, 0xFF, 0xFF, 0x9F, 0x04, 0x29, 0x28, 0x96, 0xFF,
01598 0x04, 0x28, 0x72, 0x4D, 0x04, 0x29, 0xB6, 0xDB, 0x92, 0x28, 0x28, 0x96, 0x04, 0x4D,
01599 0x28, 0x96, 0xFF, 0x71, 0x08, 0x4D, 0xDF, 0xBB, 0x28, 0x29, 0xB6, 0xFF, 0xFF, 0x96, 0xFF,
01600 0xFF, 0xDB, 0xB5, 0x95, 0x54, 0x50, 0x28, 0x6D, 0xFF, 0xFF, 0x9F, 0x04, 0x4D, 0xFF, 0x9F,
01601 0xFF, 0x6D, 0x04, 0x2C, 0x30, 0x4C, 0x48, 0x91, 0xDB, 0xFF, 0xFF, 0x9F, 0x04, 0x29,
01602 0x08, 0x96, 0xFF, 0x92, 0x28, 0x28, 0x29, 0x49, 0x4D, 0x4D, 0x4D, 0x4D, 0x96,
01603 0x4D, 0x4D, 0x4D, 0x4D, 0x4D, 0x96, 0x92, 0x28, 0x28, 0x29, 0x96, 0x04, 0x4D,
01604 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x91, 0x54, 0x28, 0x4D, 0x4D, 0x4D, 0x4D, 0x96,
01605 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x91, 0x54, 0x28, 0x4D, 0x4D, 0x4D, 0x4D, 0x96,
01606 0xFF, 0xFF, 0xDB, 0x28, 0x08, 0x96, 0xFF, 0xDB, 0xDB, 0xDB, 0xDB, 0x96, 0x04, 0x4D,
01607 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x91, 0x54, 0x28, 0x4D, 0x4D, 0x4D, 0x4D, 0x96,
01608 0x96, 0xFF, 0x71, 0x08, 0x71, 0x0D, 0x9F, 0xFF, 0xFF, 0x9F, 0x04, 0x29, 0x91, 0x71,
01609 0x2C, 0x28, 0xDA, 0xFF, 0xFF, 0xFF, 0xFF, 0x9F, 0x04, 0x29, 0x91, 0x04, 0x28, 0x30,
01610 0x48, 0x48, 0xB6, 0xFF, 0xFF, 0xFF, 0xFF, 0x9F, 0x04, 0x29, 0x92, 0x04, 0x28, 0x30,
01611 0xB6, 0xDB, 0x86, 0x6B, 0x96, 0xBB, 0x96, 0x96, 0x6B, 0x96, 0x96, 0x04, 0x29, 0x92,
01612 0xBB, 0xDF, 0x86, 0x92, 0x96, 0x96, 0x96, 0x96, 0x04, 0x29, 0x92, 0x04, 0x29, 0x92,
01613 0xDB, 0xB6, 0x6D, 0x50, 0x50, 0x2C, 0x28, 0x92, 0xFF, 0xFF, 0xFF, 0xFF, 0x9F, 0x04,
01614 0x48, 0x04, 0x2C, 0x30, 0x4C, 0x48, 0x91, 0xDB, 0xFF, 0xFF, 0xFF, 0xFF, 0x9F, 0x04,
01615 0x28, 0x96, 0xDB, 0x86, 0xDB, 0x71, 0x09, 0x6D, 0x96, 0x72, 0x96, 0x6D, 0x92, 0x72,
01616 0xFF, 0x72, 0x72, 0x4D, 0x92, 0x04, 0x4D, 0x91, 0x71, 0x0D, 0x96, 0x04, 0x29, 0x92,
01617 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x71, 0x54, 0x30, 0x28, 0x96, 0x04, 0x6D, 0x91,
01618 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x71, 0x54, 0x30, 0x28, 0x96, 0x04, 0x6D, 0x91,
01619 0x96, 0xFF, 0x71, 0x08, 0x71, 0x0D, 0x9F, 0xFF, 0xFF, 0x9F, 0x04, 0x29, 0x91, 0x71,
01620 0xDB, 0xDB, 0x04, 0x4F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F,
01621 0x9B, 0x49, 0x28, 0x08, 0x28, 0x71, 0x0D, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F,
01622 0x28, 0x48, 0xDB, 0xFF, 0xFF, 0xFF, 0xFF, 0x9F, 0x04, 0x6D, 0x08, 0x2C, 0x50, 0x71,
01623 0xDB, 0xFF, 0xFF, 0xFF, 0xFF, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F,
01624 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x91, 0x54, 0x28, 0x4D, 0x4D, 0x4D, 0x4D, 0x96,
01625 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x91, 0x54, 0x28, 0x4D, 0x4D, 0x4D, 0x4D, 0x96,
01626 0xBB, 0x6D, 0x6C, 0x30, 0x30, 0x2C, 0x28, 0x6B, 0xFF, 0xFF, 0xFF, 0xFF, 0x9F, 0x04,
01627 0x50, 0x54, 0x71, 0x91, 0x6B, 0xFF, 0xFF, 0xFF, 0xFF, 0x9F, 0x04, 0x29, 0x91, 0x04,
01628 0xFF, 0x86, 0x92, 0x6B, 0x6B, 0x96, 0x96, 0x04, 0x29, 0x91, 0x0D, 0x96, 0x04, 0x29,
01629 0xDA, 0xDA, 0x04, 0xDA, 0xDA, 0x04, 0x29, 0x91, 0x0D, 0x96, 0x04, 0x29, 0x91, 0x04,
01630 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x91, 0x54, 0x28, 0x4D, 0x4D, 0x4D, 0x4D, 0x96,
01631 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x91, 0x54, 0x28, 0x4D, 0x4D, 0x4D, 0x4D, 0x96,
01632 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x91, 0x54, 0x28, 0x4D, 0x4D, 0x4D, 0x4D, 0x96,
01633 0x92, 0xDB, 0x91, 0x6D, 0x91, 0x6B, 0x92, 0x04, 0x29, 0x91, 0x0D, 0x96, 0x04, 0x29,
01634 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x91, 0x54, 0x28, 0x4D, 0x4D, 0x4D, 0x4D, 0x96,
01635 0x28, 0x28, 0x6B, 0xFF, 0xFF, 0xFF, 0xFF, 0x9F, 0x04, 0x29, 0x91, 0x04, 0x29, 0x91,
01636 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x91, 0x54, 0x28, 0x4D, 0x4D, 0x4D, 0x4D, 0x96,
01637 0x6D, 0x92, 0x04, 0x2C, 0x71, 0x09, 0x6D, 0x92, 0x04, 0x29, 0x91, 0x04, 0x29, 0x91,
01638 0x91, 0x6C, 0x71, 0x0D, 0x9F, 0xFF, 0xFF, 0xFF, 0xFF, 0x9F, 0x04, 0x29, 0x91, 0x04,
01639 0xDB, 0x91, 0x6D, 0x50, 0x50, 0x2C, 0x04, 0x6D, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F, 0x9F,
01640 0x71, 0x91, 0xDA, 0xFF, 0xFF, 0xFF, 0xFF, 0x9F, 0x04, 0x29, 0x91, 0x04, 0x29, 0x91,
01641 0xFF, 0x91, 0x6D, 0x71, 0x91, 0x6D, 0x96, 0x04, 0x29, 0x91, 0x04, 0x29, 0x91,
01642 0xB6, 0xFF, 0x91, 0x6D, 0x91, 0x6D, 0x96, 0x04, 0x29, 0x91, 0x04, 0x29, 0x91,
01643 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x91, 0x54, 0x28, 0x4D, 0x4D, 0x4D, 0x4D, 0x96,
01644 0x48, 0x28, 0x50, 0x50, 0x6D, 0x91, 0xFF, 0xFF, 0xFF, 0xFF, 0x9F, 0x04, 0x29, 0x91,
01645 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x91, 0x54, 0x28, 0x4D, 0x4D, 0x4D, 0x4D, 0x96,
01646 0xDF, 0x91, 0x6C, 0x92, 0xDA, 0x9F, 0x91, 0x6D, 0x9D, 0x04, 0x29, 0x91, 0x04, 0x29,
01647 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x91, 0x54, 0x28, 0x4D, 0x4D, 0x4D, 0x4D, 0x96,
01648 0x2C, 0x28, 0x6D, 0x91, 0x91, 0x28, 0x50, 0x50, 0x91, 0x91, 0x91, 0x91, 0x91, 0x91,
01649 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x9A, 0x91, 0x54, 0x28, 0x4D, 0x4D, 0x4D, 0x4D, 0x96,
01650 0x6D, 0xBA, 0x91, 0x6D, 0x92, 0x6D, 0x8D, 0x6D, 0x96, 0x04, 0x29, 0x91, 0x04, 0x29

```









```
01999 };
02000
02001 #endif // BITMAPS_H
```

## 6.3 combined\_charsets.h

```
00001 #ifndef COMBINED_CHARSETS_H
00002 #define COMBINED_CHARSETS_H
00003
00004 #include <stdint.h>
00005
00006 // Combined Character Sets - 8 fonts
00007
00008 // Font 1: arial
00009 // Characters: 95, Data size: 2282 bytes
00010
00011 const uint16_t arial_index[95][4] = {
00012     {32, 7, 14, 0}, // SPACE
00013     {33, 6, 14, 14}, // '!'
00014     {34, 8, 14, 28}, // '"'
00015     {35, 10, 14, 42}, // '#'
00016     {36, 10, 14, 70}, // '$'
00017     {37, 14, 14, 98}, // '%'
00018     {38, 11, 14, 126}, // '&'
00019     {39, 6, 14, 154}, // "'"
00020     {40, 8, 14, 168}, // '('
00021     {41, 8, 14, 182}, // ')'
00022     {42, 8, 14, 196}, // '*'
00023     {43, 10, 14, 210}, // '+'
00024     {44, 6, 14, 238}, // ','
00025     {45, 8, 14, 252}, // '-'
00026     {46, 6, 14, 266}, // '.'
00027     {47, 8, 14, 280}, // '/'
00028     {48, 10, 14, 294}, // '0'
00029     {49, 9, 14, 322}, // '1'
00030     {50, 10, 14, 350}, // '2'
00031     {51, 10, 14, 378}, // '3'
00032     {52, 10, 14, 406}, // '4'
00033     {53, 10, 14, 434}, // '5'
00034     {54, 10, 14, 462}, // '6'
00035     {55, 10, 14, 490}, // '7'
00036     {56, 10, 14, 518}, // '8'
00037     {57, 10, 14, 546}, // '9'
00038     {58, 6, 14, 574}, // ':'
00039     {59, 6, 14, 588}, // ';'
00040     {60, 10, 14, 602}, // '<'
00041     {61, 10, 14, 630}, // '='
00042     {62, 10, 14, 658}, // '>'
00043     {63, 10, 14, 686}, // '?'
00044     {64, 15, 14, 714}, // '@'
00045     {65, 12, 14, 742}, // 'A'
00046     {66, 11, 14, 770}, // 'B'
00047     {67, 11, 14, 798}, // 'C'
00048     {68, 11, 14, 826}, // 'D'
00049     {69, 10, 14, 854}, // 'E'
00050     {70, 10, 14, 882}, // 'F'
00051     {71, 12, 14, 910}, // 'G'
00052     {72, 11, 14, 938}, // 'H'
00053     {73, 6, 14, 966}, // 'I'
00054     {74, 9, 14, 980}, // 'J'
00055     {75, 11, 14, 1008}, // 'K'
00056     {76, 10, 14, 1036}, // 'L'
00057     {77, 12, 14, 1064}, // 'M'
00058     {78, 11, 14, 1092}, // 'N'
00059     {79, 12, 14, 1120}, // 'O'
00060     {80, 10, 14, 1148}, // 'P'
00061     {81, 12, 14, 1176}, // 'Q'
00062     {82, 11, 14, 1204}, // 'R'
00063     {83, 11, 14, 1232}, // 'S'
00064     {84, 10, 14, 1260}, // 'T'
00065     {85, 11, 14, 1288}, // 'U'
00066     {86, 12, 14, 1316}, // 'V'
00067     {87, 15, 14, 1344}, // 'W'
00068     {88, 11, 14, 1372}, // 'X'
00069     {89, 12, 14, 1400}, // 'Y'
00070     {90, 11, 14, 1428}, // 'Z'
00071     {91, 7, 14, 1456}, // '['
00072     {92, 8, 14, 1470}, // ']'
00073     {93, 7, 14, 1484}, // '^'
00074     {94, 10, 14, 1498}, // '^'
00075     {95, 11, 14, 1526}, // '_'
00076     {96, 8, 14, 1554}, // 'v'
00077     {97, 10, 14, 1568}, // 'a'
```

```

00078 {98, 10, 14, 1596}, // 'b'
00079 {99, 10, 14, 1624}, // 'c'
00080 {100, 10, 14, 1652}, // 'd'
00081 {101, 10, 14, 1680}, // 'e'
00082 {102, 8, 14, 1708}, // 'f'
00083 {103, 10, 14, 1722}, // 'g'
00084 {104, 10, 14, 1750}, // 'h'
00085 {105, 6, 14, 1778}, // 'i'
00086 {106, 7, 14, 1792}, // 'j'
00087 {107, 9, 14, 1806}, // 'k'
00088 {108, 6, 14, 1834}, // 'l'
00089 {109, 12, 14, 1848}, // 'm'
00090 {110, 10, 14, 1876}, // 'n'
00091 {111, 10, 14, 1904}, // 'o'
00092 {112, 10, 14, 1932}, // 'p'
00093 {113, 10, 14, 1960}, // 'q'
00094 {114, 8, 14, 1988}, // 'r'
00095 {115, 10, 14, 2002}, // 's'
00096 {116, 8, 14, 2030}, // 't'
00097 {117, 10, 14, 2044}, // 'u'
00098 {118, 10, 14, 2072}, // 'v'
00099 {119, 14, 14, 2100}, // 'w'
00100 {120, 10, 14, 2128}, // 'x'
00101 {121, 10, 14, 2156}, // 'y'
00102 {122, 10, 14, 2184}, // 'z'
00103 {123, 8, 14, 2212}, // '{'
00104 {124, 6, 14, 2226}, // '}'
00105 {125, 8, 14, 2240}, // '}'
00106 {126, 10, 14, 2254} // '~'
00107 };
00108
00109 const uint8_t aerial_data[2282] = {
00110 0x00, 0x00,
00111 0x00, 0x00, 0x00, 0x00, 0x20, 0x20, 0x20, 0x20, 0x20, 0x00, 0x20, 0x00, 0x00, 0x00, 0x00,
00112 0x00, 0x00, 0x28, 0x28, 0x28, 0x00, 0x00,
00113 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x0A, 0x00, 0x0A, 0x00, 0x00, 0x3E, 0x00, 0x14, 0x00, 0x14, 0x00,
00114 0x3E, 0x00, 0x28, 0x00, 0x28, 0x00, 0x00,
00115 0x1C, 0x00, 0x2A, 0x00, 0x28, 0x00, 0x1C, 0x00, 0x0A, 0x00, 0x00, 0x0A, 0x00, 0x2A, 0x00, 0x1C, 0x00,
00116 0x08, 0x00, 0x18, 0x80,
00117 0x25, 0x00, 0x25, 0x00, 0x1A, 0x00, 0x02, 0xC0, 0x05, 0x20, 0x05, 0x20, 0x08, 0xC0, 0x00, 0x00,
00118 0x00, 0x12, 0x00, 0x12, 0x00,
00119 0x0C, 0x00, 0x14, 0x00, 0x23, 0x00, 0x22, 0x00, 0x1D, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
00120 0x20, 0x20, 0x20, 0x00, 0x08, 0x10, 0x20, 0x20,
00121 0x20, 0x20, 0x20, 0x10, 0x08, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x08, 0x08, 0x08,
00122 0x08, 0x08, 0x10, 0x20, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x10, 0x38, 0x10, 0x28, 0x00, 0x00,
00123 0x00, 0x00,
00124 0x00, 0x00, 0x08, 0x00, 0x08, 0x00, 0x3E, 0x00, 0x08, 0x00, 0x08, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
00125 0x00, 0x20, 0x20, 0x00, 0x00, 0x00, 0x00, 0x00,
00126 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x38, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
00127 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x20, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x08, 0x08,
00128 0x10, 0x10, 0x10, 0x10, 0x20, 0x20, 0x00, 0x00,
00129 0x00, 0x00, 0x1C, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22,
00130 0x1C, 0x00, 0x04, 0x00, 0x00, 0x00,
00131 0x0C, 0x00, 0x14, 0x00, 0x04, 0x00, 0x04, 0x00, 0x04, 0x00, 0x04, 0x00, 0x04, 0x00, 0x04, 0x00, 0x00, 0x00,
00132 0x00, 0x1C, 0x00, 0x22, 0x00, 0x02, 0x00,
00133 0x02, 0x00, 0x04, 0x00, 0x08, 0x00, 0x10, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
00134 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x1C, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22,
00135 0x02, 0x00, 0x22, 0x00, 0x1C, 0x00, 0x00,
00136 0x00, 0x00, 0x04, 0x00, 0x0C, 0x00, 0x14, 0x00, 0x14, 0x00, 0x24, 0x00, 0x3E, 0x00, 0x04, 0x00,
00137 0x04, 0x00, 0x1E, 0x00,
00138 0x10, 0x00, 0x20, 0x00, 0x3C, 0x00, 0x02, 0x00, 0x02, 0x00, 0x22, 0x00, 0x1C, 0x00, 0x22, 0x00, 0x00,
00139 0x00, 0x1C, 0x00, 0x00, 0x22, 0x00, 0x00, 0x20, 0x00,
00140 0x3C, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00, 0x1C, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
00141 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x3E, 0x00, 0x04, 0x00, 0x04, 0x00, 0x08, 0x00, 0x08,
00142 0x10, 0x00, 0x10, 0x00, 0x10, 0x00, 0x00,
00143 0x00, 0x00, 0x1C, 0x00, 0x22, 0x00, 0x22, 0x00, 0x1C, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00,
00144 0x1C, 0x00, 0x1C, 0x00,
00145 0x22, 0x00, 0x22, 0x00, 0x22, 0x00, 0x1E, 0x00, 0x02, 0x00, 0x02, 0x00, 0x22, 0x00, 0x1C, 0x00, 0x00,
00146 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x20, 0x00, 0x00, 0x00, 0x00, 0x20, 0x00, 0x00, 0x00, 0x00, 0x00,
00147 0x00, 0x00, 0x20, 0x00, 0x00, 0x00, 0x00, 0x20, 0x00, 0x20, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
00148 0x00, 0x02, 0x00, 0x00, 0x1C, 0x00, 0x20, 0x00,
00149 0x1C, 0x00, 0x02, 0x00, 0x00,
00150 0x00, 0x3E, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
00151 0x00, 0x00,
00152 0x00, 0x00, 0x20, 0x00, 0x1C, 0x00, 0x02, 0x00, 0x00, 0x1C, 0x00, 0x20, 0x00, 0x00, 0x00, 0x00, 0x00,
00153 0x00, 0x1C, 0x00, 0x22, 0x00, 0x02, 0x00,
00154 0x04, 0x00, 0x08, 0x00, 0x08, 0x00, 0x00, 0x00, 0x08, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
00155 0x00, 0x00, 0x07, 0xC0, 0x18, 0x20, 0x13, 0x50, 0x24, 0xD0, 0x28, 0x90, 0x28, 0x90, 0x29, 0xA0,
00156 0x26, 0xC0, 0x10, 0x10, 0x0F, 0xE0, 0x00, 0x00,
00157 0x00, 0x00, 0x04, 0x00, 0x00, 0x0A, 0x00, 0x0A, 0x00, 0x0A, 0x00, 0x00, 0x11, 0x00, 0x00, 0x1F, 0x00, 0x20, 0x80,
00158 0x20, 0x80, 0x00, 0x3E, 0x00,
00159 0x21, 0x00, 0x21, 0x00, 0x3F, 0x00, 0x21, 0x00, 0x21, 0x00, 0x21, 0x00, 0x3E, 0x00, 0x00, 0x00, 0x00,
00160 0x00, 0x11, 0x00, 0x00, 0x20, 0x00,
00161 0x20, 0x00, 0x20, 0x00, 0x20, 0x00, 0x11, 0x00, 0x00, 0x0E, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
00162 0x00, 0x00,
00163 0x21, 0x00, 0x22, 0x00, 0x3C, 0x00, 0x00,
00164 0x00, 0x00, 0x3E, 0x00, 0x20, 0x00, 0x00,
```



```
00252     0x3A, 0x00, 0x2C, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00
00253 };
00254
00255 // Font 2: arial
00256 // Characters: 95, Data size: 4968 bytes
00257
00258 const uint16_t arial_2_index[95][4] = {
00259     {32, 10, 24, 0}, // SPACE
00260     {33, 8, 24, 48}, // '!'
00261     {34, 12, 24, 72}, // '"'
00262     {35, 16, 24, 120}, // '#'
00263     {36, 16, 24, 168}, // '$'
00264     {37, 24, 24, 216}, // '%'
00265     {38, 18, 24, 288}, // '&'
00266     {39, 8, 24, 360}, // "'"
00267     {40, 12, 24, 384}, // '('
00268     {41, 12, 24, 432}, // ')'
00269     {42, 12, 24, 480}, // '*'
00270     {43, 16, 24, 528}, // '+'
00271     {44, 8, 24, 576}, // ','
00272     {45, 12, 24, 600}, // '-'
00273     {46, 8, 24, 648}, // '.'
00274     {47, 12, 24, 672}, // '/'
00275     {48, 16, 24, 720}, // '0'
00276     {49, 14, 24, 768}, // '1'
00277     {50, 16, 24, 816}, // '2'
00278     {51, 16, 24, 864}, // '3'
00279     {52, 16, 24, 912}, // '4'
00280     {53, 16, 24, 960}, // '5'
00281     {54, 16, 24, 1008}, // '6'
00282     {55, 16, 24, 1056}, // '7'
00283     {56, 16, 24, 1104}, // '8'
00284     {57, 16, 24, 1152}, // '9'
00285     {58, 8, 24, 1200}, // ':'
00286     {59, 8, 24, 1224}, // ';'
00287     {60, 16, 24, 1248}, // '<'
00288     {61, 16, 24, 1296}, // '='
00289     {62, 16, 24, 1344}, // '>'
00290     {63, 16, 24, 1392}, // '?'
00291     {64, 26, 24, 1440}, // '@'
00292     {65, 20, 24, 1536}, // 'A'
00293     {66, 18, 24, 1608}, // 'B'
00294     {67, 18, 24, 1680}, // 'C'
00295     {68, 18, 24, 1752}, // 'D'
00296     {69, 16, 24, 1824}, // 'E'
00297     {70, 16, 24, 1872}, // 'F'
00298     {71, 20, 24, 1920}, // 'G'
00299     {72, 18, 24, 1992}, // 'H'
00300     {73, 8, 24, 2064}, // 'I'
00301     {74, 14, 24, 2088}, // 'J'
00302     {75, 18, 24, 2136}, // 'K'
00303     {76, 16, 24, 2208}, // 'L'
00304     {77, 20, 24, 2256}, // 'M'
00305     {78, 18, 24, 2328}, // 'N'
00306     {79, 20, 24, 2400}, // 'O'
00307     {80, 16, 24, 2472}, // 'P'
00308     {81, 20, 24, 2520}, // 'Q'
00309     {82, 18, 24, 2592}, // 'R'
00310     {83, 18, 24, 2664}, // 'S'
00311     {84, 16, 24, 2736}, // 'T'
00312     {85, 18, 24, 2784}, // 'U'
00313     {86, 20, 24, 2856}, // 'V'
00314     {87, 26, 24, 2928}, // 'W'
00315     {88, 18, 24, 3024}, // 'X'
00316     {89, 20, 24, 3096}, // 'Y'
00317     {90, 18, 24, 3168}, // 'Z'
00318     {91, 10, 24, 3240}, // '['
00319     {92, 12, 24, 3288}, // '\'
00320     {93, 10, 24, 3336}, // ']'
00321     {94, 16, 24, 3384}, // '^'
00322     {95, 18, 24, 3432}, // '_'
00323     {96, 12, 24, 3504}, // '\''
00324     {97, 16, 24, 3552}, // 'a'
00325     {98, 16, 24, 3600}, // 'b'
00326     {99, 16, 24, 3648}, // 'c'
00327     {100, 16, 24, 3696}, // 'd'
00328     {101, 16, 24, 3744}, // 'e'
00329     {102, 12, 24, 3792}, // 'f'
00330     {103, 16, 24, 3840}, // 'g'
00331     {104, 16, 24, 3888}, // 'h'
00332     {105, 8, 24, 3936}, // 'i'
00333     {106, 10, 24, 3960}, // 'j'
00334     {107, 14, 24, 4008}, // 'k'
00335     {108, 8, 24, 4056}, // 'l'
00336     {109, 20, 24, 4080}, // 'm'
00337     {110, 16, 24, 4152}, // 'n'
00338     {111, 16, 24, 4200}, // 'o'
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00687 {45, 5, 6, 165}, // '-'
00688 {46, 4, 4, 171}, // '.'
00689 {47, 7, 11, 175}, // '/'
00690 {48, 8, 10, 186}, // '0'
00691 {49, 8, 10, 196}, // '1'
00692 {50, 8, 10, 206}, // '2'
00693 {51, 8, 10, 216}, // '3'
00694 {52, 8, 10, 226}, // '4'
00695 {53, 8, 10, 236}, // '5'
00696 {54, 8, 10, 246}, // '6'
00697 {55, 8, 10, 256}, // '7'
00698 {56, 8, 10, 266}, // '8'
00699 {57, 8, 10, 276}, // '9'
00700 {58, 4, 8, 286}, // ':'
00701 {59, 5, 9, 294}, // ';'
00702 {60, 8, 8, 303}, // '<'
00703 {61, 8, 7, 311}, // '='
00704 {62, 8, 8, 318}, // '>'
00705 {63, 6, 10, 326}, // '?'
00706 {64, 12, 11, 336}, // '@'
00707 {65, 9, 10, 358}, // 'A'
00708 {66, 8, 10, 378}, // 'B'
00709 {67, 9, 10, 388}, // 'C'
00710 {68, 9, 10, 408}, // 'D'
00711 {69, 8, 10, 428}, // 'E'
00712 {70, 8, 10, 438}, // 'F'
00713 {71, 9, 10, 448}, // 'G'
00714 {72, 10, 10, 468}, // 'H'
00715 {73, 5, 10, 488}, // 'I'
00716 {74, 8, 10, 498}, // 'J'
00717 {75, 9, 10, 508}, // 'K'
00718 {76, 8, 10, 528}, // 'L'
00719 {77, 11, 10, 538}, // 'M'
00720 {78, 10, 10, 558}, // 'N'
00721 {79, 9, 10, 578}, // 'O'
00722 {80, 8, 10, 598}, // 'P'
00723 {81, 9, 11, 608}, // 'Q'
00724 {82, 9, 10, 630}, // 'R'
00725 {83, 8, 10, 650}, // 'S'
00726 {84, 9, 10, 660}, // 'T'
00727 {85, 9, 10, 680}, // 'U'
00728 {86, 9, 10, 700}, // 'V'
00729 {87, 12, 10, 720}, // 'W'
00730 {88, 9, 10, 740}, // 'X'
00731 {89, 9, 10, 760}, // 'Y'
00732 {90, 9, 10, 780}, // 'Z'
00733 {91, 6, 12, 800}, // '['
00734 {92, 7, 11, 812}, // '\'
00735 {93, 6, 12, 823}, // ']'
00736 {94, 8, 9, 835}, // '^'
00737 {95, 7, 3, 844}, // '_'
00738 {96, 5, 9, 847}, // ``
00739 {97, 7, 8, 856}, // 'a'
00740 {98, 8, 10, 864}, // 'b'
00741 {99, 7, 8, 874}, // 'c'
00742 {100, 8, 10, 882}, // 'd'
00743 {101, 8, 8, 892}, // 'e'
00744 {102, 6, 11, 900}, // 'f'
00745 {103, 8, 10, 911}, // 'g'
00746 {104, 9, 10, 921}, // 'h'
00747 {105, 5, 10, 941}, // 'i'
00748 {106, 5, 12, 951}, // 'j'
00749 {107, 8, 10, 963}, // 'k'
00750 {108, 5, 10, 973}, // 'l'
00751 {109, 11, 8, 983}, // 'm'
00752 {110, 9, 8, 999}, // 'n'
00753 {111, 7, 8, 1015}, // 'o'
00754 {112, 8, 10, 1023}, // 'p'
00755 {113, 8, 10, 1033}, // 'q'
00756 {114, 6, 8, 1043}, // 'r'
00757 {115, 7, 8, 1051}, // 's'
00758 {116, 5, 10, 1059}, // 't'
00759 {117, 9, 8, 1069}, // 'u'
00760 {118, 8, 8, 1085}, // 'v'
00761 {119, 10, 8, 1093}, // 'w'
00762 {120, 8, 8, 1109}, // 'x'
00763 {121, 8, 10, 1117}, // 'y'
00764 {122, 8, 8, 1127}, // 'z'
00765 {123, 5, 12, 1135}, // '{'
00766 {124, 5, 13, 1147}, // '|'
00767 {125, 5, 12, 1160}, // '}'
00768 {126, 8, 6, 1172} // '~'
00769 };
00770
00771 const uint8_t default_data[1178] = {
00772 0x00, 0x00, 0x00, 0x20, 0x20, 0x20, 0x20, 0x00, 0x00, 0x20, 0x00, 0x00, 0x30, 0x30,
00773 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x14, 0x18, 0x18, 0x3C, 0x28, 0x3C, 0x28, 0x30, 0x00,

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00774 0x00, 0x00, 0x08, 0x00, 0x1C, 0x00, 0x2A, 0x00, 0x2A, 0x00, 0x38, 0x00, 0x0C, 0x00, 0x0A, 0x00,
00775 0x2A, 0x00, 0x1C, 0x00, 0x08, 0x00, 0x00, 0x00, 0x00, 0x00, 0x39, 0x00, 0x2A, 0x00, 0x2A, 0x00,
00776 0x3C, 0x00, 0x07, 0x80, 0x0A, 0x80, 0x12, 0x80, 0x13, 0x80, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
00777 0x20, 0x00, 0x22, 0x00, 0x1F, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00, 0x1E, 0x00, 0x00, 0x00,
00778 0x00, 0x20, 0x20, 0x20, 0x00, 0x10, 0x20,
00779 0x20, 0x20, 0x20, 0x10, 0x00, 0x00, 0x00, 0x40, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20, 0x40,
00780 0x40, 0x00, 0x00, 0x00, 0x00, 0x00, 0x2A, 0x00, 0x1C, 0x00, 0x14, 0x00, 0x00, 0x00, 0x00, 0x00,
00781 0x00, 0x00, 0x08, 0x00, 0x08, 0x00, 0x3E, 0x00, 0x08, 0x00, 0x08, 0x00, 0x00, 0x00, 0x00, 0x00,
00782 0x00, 0x00, 0x20, 0x40, 0x00, 0x00, 0x60, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
00783 0x10, 0x10, 0x20, 0x20, 0x20, 0x40, 0x40, 0x40, 0x00, 0x00, 0x1C, 0x36, 0x22, 0x22, 0x22,
00784 0x22, 0x36, 0x1C, 0x00, 0x00, 0x18, 0x28, 0x08, 0x08, 0x08, 0x08, 0x08, 0x00, 0x00, 0x00, 0x00,
00785 0x24, 0x04, 0x04, 0x08, 0x10, 0x20, 0x7C, 0x00, 0x00, 0x38, 0x44, 0x04, 0x18, 0x04, 0x44, 0x44,
00786 0x38, 0x00, 0x00, 0x04, 0x0C, 0x14, 0x14, 0x24, 0x7E, 0x04, 0x04, 0x00, 0x00, 0x3C, 0x40, 0x40,
00787 0x58, 0x64, 0x04, 0x44, 0x38, 0x00, 0x00, 0x1C, 0x12, 0x22, 0x3C, 0x22, 0x22, 0x22, 0x1C, 0x00,
00788 0x00, 0x7C, 0x04, 0x08, 0x10, 0x10, 0x20, 0x20, 0x00, 0x00, 0x1C, 0x22, 0x22, 0x1C, 0x22,
00789 0x22, 0x22, 0x1C, 0x00, 0x00, 0x1C, 0x22, 0x22, 0x22, 0x1E, 0x22, 0x24, 0x1C, 0x00, 0x00, 0x20,
00790 0x00, 0x00, 0x00, 0x00, 0x20, 0x00, 0x00, 0x10, 0x00, 0x00, 0x00, 0x00, 0x00, 0x10, 0x20, 0x00,
00791 0x00, 0x0C, 0x30, 0x20, 0x18, 0x04, 0x00, 0x00, 0x3C, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
00792 0x30, 0x0C, 0x04, 0x18, 0x20, 0x00, 0x00, 0x18, 0x24, 0x24, 0x04, 0x08, 0x08, 0x00, 0x08, 0x00,
00793 0x00, 0x00, 0x07, 0x00, 0x18, 0x80, 0x17, 0x40, 0x40, 0x29, 0x40, 0x2A, 0x40, 0x2D, 0x80,
00794 0x10, 0x00, 0x0F, 0x00, 0x00, 0x00, 0x00, 0x00, 0x08, 0x00, 0x18, 0x00, 0x14, 0x00, 0x24, 0x00,
00795 0x3C, 0x00, 0x22, 0x00, 0x22, 0x00, 0x42, 0x00, 0x00, 0x00, 0x00, 0x3C, 0x22, 0x22, 0x24, 0x3E,
00796 0x22, 0x22, 0x3C, 0x00, 0x00, 0x00, 0x0E, 0x00, 0x11, 0x00, 0x21, 0x00, 0x20, 0x00, 0x20, 0x00,
00797 0x21, 0x00, 0x11, 0x00, 0x1E, 0x00, 0x00, 0x00, 0x00, 0x3C, 0x00, 0x00, 0x22, 0x00, 0x21, 0x00,
00798 0x21, 0x00, 0x21, 0x00, 0x21, 0x00, 0x22, 0x00, 0x3C, 0x00, 0x00, 0x00, 0x00, 0x3E, 0x20, 0x20,
00799 0x20, 0x3C, 0x20, 0x20, 0x3E, 0x00, 0x00, 0x3E, 0x20, 0x20, 0x20, 0x3C, 0x20, 0x20, 0x20, 0x00,
00800 0x00, 0x00, 0x0E, 0x00, 0x13, 0x00, 0x21, 0x00, 0x20, 0x00, 0x27, 0x00, 0x21, 0x00, 0x13, 0x00,
00801 0x1D, 0x00, 0x00, 0x00, 0x00, 0x21, 0x00, 0x21, 0x00, 0x21, 0x00, 0x00, 0x21, 0x00, 0x00, 0x3F, 0x00,
00802 0x21, 0x00, 0x21, 0x00, 0x21, 0x00, 0x00, 0x00, 0x00, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20,
00803 0x20, 0x00, 0x00, 0x04, 0x04, 0x04, 0x04, 0x04, 0x24, 0x24, 0x18, 0x00, 0x00, 0x00, 0x00, 0x22, 0x00,
00804 0x24, 0x00, 0x28, 0x00, 0x28, 0x00, 0x38, 0x00, 0x28, 0x00, 0x24, 0x00, 0x22, 0x00, 0x00, 0x00,
00805 0x00, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20, 0x3E, 0x00, 0x00, 0x00, 0x31, 0x80, 0x31, 0x80,
00806 0x31, 0x80, 0x2A, 0x80, 0x2A, 0x80, 0x2A, 0x80, 0x2C, 0x80, 0x24, 0x80, 0x00, 0x00, 0x00, 0x00,
00807 0x32, 0x00, 0x32, 0x00, 0x32, 0x00, 0x2A, 0x00, 0x2A, 0x00, 0x2A, 0x00, 0x00, 0x26, 0x00, 0x26, 0x00,
00808 0x00, 0x00, 0x00, 0x00, 0x0E, 0x00, 0x11, 0x00, 0x20, 0x80, 0x20, 0x80, 0x20, 0x80, 0x20, 0x80,
00809 0x11, 0x00, 0x0E, 0x00, 0x00, 0x00, 0x3C, 0x22, 0x22, 0x3C, 0x20, 0x20, 0x20, 0x20, 0x00,
00810 0x00, 0x00, 0x0E, 0x00, 0x11, 0x00, 0x20, 0x80, 0x20, 0x80, 0x20, 0x80, 0x20, 0x80, 0x11, 0x00,
00811 0x0F, 0x80, 0x00, 0x00, 0x00, 0x00, 0x00, 0x3C, 0x00, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00,
00812 0x3C, 0x00, 0x26, 0x00, 0x22, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x1C, 0x22, 0x20, 0x10, 0x0E,
00813 0x02, 0x22, 0x1C, 0x00, 0x00, 0x00, 0x3E, 0x00, 0x08, 0x00, 0x08, 0x00, 0x08, 0x00, 0x08, 0x00,
00814 0x08, 0x00, 0x08, 0x00, 0x08, 0x00, 0x00, 0x00, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00,
00815 0x22, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00, 0x1C, 0x00, 0x00, 0x00, 0x00, 0x00, 0x42, 0x00,
00816 0x22, 0x00, 0x22, 0x00, 0x24, 0x00, 0x14, 0x00, 0x14, 0x00, 0x18, 0x00, 0x08, 0x00, 0x00, 0x00,
00817 0x00, 0x00, 0x46, 0x40, 0x26, 0x40, 0x26, 0x40, 0x2A, 0x40, 0x2A, 0x80, 0x29, 0x80, 0x19, 0x80,
00818 0x11, 0x80, 0x00, 0x00, 0x00, 0x22, 0x00, 0x24, 0x00, 0x14, 0x00, 0x18, 0x00, 0x18, 0x00,
00819 0x14, 0x00, 0x24, 0x00, 0x22, 0x00, 0x00, 0x00, 0x00, 0x00, 0x22, 0x00, 0x22, 0x00, 0x14, 0x00,
00820 0x14, 0x00, 0x08, 0x00, 0x08, 0x00, 0x08, 0x00, 0x08, 0x00, 0x00, 0x00, 0x00, 0x00, 0x3E, 0x00,
00821 0x02, 0x00, 0x04, 0x00, 0x08, 0x00, 0x08, 0x00, 0x10, 0x00, 0x20, 0x00, 0x3E, 0x00, 0x00, 0x00,
00822 0x00, 0x30, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20, 0x30, 0x00, 0x00, 0x00, 0x40, 0x40, 0x40,
00823 0x20, 0x20, 0x20, 0x20, 0x10, 0x00, 0x00, 0x60, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20,
00824 0x20, 0x60, 0x00, 0x00, 0x00, 0x18, 0x28, 0x28, 0x24, 0x00, 0x00, 0x00, 0x7C, 0x00, 0x00,
00825 0x20, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x1C, 0x24, 0x0C, 0x34, 0x24, 0x3C, 0x00,
00826 0x00, 0x20, 0x20, 0x3C, 0x22, 0x22, 0x22, 0x3C, 0x00, 0x00, 0x1C, 0x22, 0x20, 0x20, 0x22,
00827 0x1C, 0x00, 0x00, 0x02, 0x02, 0x1E, 0x22, 0x22, 0x22, 0x1E, 0x00, 0x00, 0x00, 0x1C, 0x22, 0x3E,
00828 0x20, 0x22, 0x1C, 0x00, 0x00, 0x10, 0x20, 0x20, 0x70, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20, 0x00,
00829 0x1E, 0x22, 0x22, 0x22, 0x22, 0x1E, 0x22, 0x1C, 0x00, 0x00, 0x00, 0x00, 0x20, 0x00, 0x20, 0x00,
00830 0x00, 0x32, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00, 0x00, 0x00, 0x00, 0x00,
00831 0x20, 0x20, 0x20, 0x20, 0x20, 0x00, 0x00, 0x20, 0x00, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20,
00832 0x20, 0x60, 0x00, 0x00, 0x20, 0x20, 0x24, 0x28, 0x30, 0x28, 0x28, 0x24, 0x00, 0x00, 0x20, 0x20,
00833 0x20, 0x20, 0x20, 0x20, 0x30, 0x00, 0x00, 0x00, 0x3B, 0x80, 0x24, 0x80, 0x24, 0x80, 0x24,
00834 0x80, 0x24, 0x80, 0x24, 0x80, 0x00, 0x00, 0x00, 0x00, 0x3C, 0x00, 0x32, 0x00, 0x22, 0x00, 0x22,
00835 0x00, 0x22, 0x00, 0x22, 0x00, 0x00, 0x00, 0x00, 0x00, 0x22, 0x00, 0x22, 0x00, 0x00, 0x00,
00836 0x3C, 0x22, 0x22, 0x22, 0x3C, 0x20, 0x20, 0x00, 0x00, 0x1E, 0x22, 0x22, 0x22, 0x22, 0x1E,
00837 0x02, 0x02, 0x00, 0x00, 0x00, 0x38, 0x20, 0x20, 0x20, 0x20, 0x20, 0x00, 0x00, 0x1C, 0x12, 0x18, 0x06,
00838 0x12, 0x1E, 0x00, 0x00, 0x20, 0x20, 0x70, 0x20, 0x20, 0x20, 0x20, 0x20, 0x30, 0x00, 0x00, 0x00,
00839 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00, 0x26, 0x00, 0x1E, 0x00, 0x00, 0x00, 0x00, 0x44, 0x44,
00840 0x28, 0x28, 0x28, 0x10, 0x00, 0x00, 0x00, 0x4C, 0x80, 0x4D, 0x00, 0x2D, 0x00, 0x35, 0x00, 0x33,
00841 0x00, 0x12, 0x00, 0x00, 0x00, 0x00, 0x48, 0x28, 0x10, 0x30, 0x28, 0x48, 0x00, 0x00, 0x44, 0x44,
00842 0x28, 0x28, 0x10, 0x10, 0x20, 0x00, 0x00, 0x3C, 0x04, 0x08, 0x10, 0x20, 0x3C, 0x00, 0x00,
00843 0x30, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20, 0x30, 0x00, 0x00, 0x20, 0x20, 0x20, 0x20,
00844 0x20, 0x20,
00845 0x20, 0x20, 0x60, 0x00, 0x00, 0x34, 0x2C, 0x00, 0x00, 0x00
00846 };
00847
00848 // Font 4: consolas
00849 // Characters: 95, Data size: 1512 bytes
00850
00851 const uint16_t consolas_index[95][4] = {
00852 {32, 8, 12, 0}, // SPACE
00853 {33, 8, 12, 12}, // '!'
00854 {34, 8, 12, 24}, // '"'
00855 {35, 9, 12, 36}, // '#'
00856 {36, 8, 12, 60}, // '$'
00857 {37, 9, 12, 72}, // '%'
00858 {38, 9, 12, 96}, // '&'
00859 {39, 8, 12, 120}, // "'"
00860 {40, 8, 12, 132}, // '('

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00861 {41, 8, 12, 144}, // ')'
00862 {42, 8, 12, 156}, // '*'
00863 {43, 9, 12, 168}, // '+'
00864 {44, 8, 12, 192}, // '/'
00865 {45, 8, 12, 204}, // '-'
00866 {46, 8, 12, 216}, // '.'
00867 {47, 8, 12, 228}, // '//'
00868 {48, 9, 12, 240}, // '0'
00869 {49, 8, 12, 264}, // '1'
00870 {50, 8, 12, 276}, // '2'
00871 {51, 8, 12, 288}, // '3'
00872 {52, 9, 12, 300}, // '4'
00873 {53, 8, 12, 324}, // '5'
00874 {54, 8, 12, 336}, // '6'
00875 {55, 8, 12, 348}, // '7'
00876 {56, 8, 12, 360}, // '8'
00877 {57, 8, 12, 372}, // '9'
00878 {58, 8, 12, 384}, // ':'
00879 {59, 8, 12, 396}, // ';'
00880 {60, 8, 12, 408}, // '<'
00881 {61, 8, 12, 420}, // '='
00882 {62, 8, 12, 432}, // '>'
00883 {63, 8, 12, 444}, // '?'
00884 {64, 9, 12, 456}, // '@'
00885 {65, 9, 12, 480}, // 'A'
00886 {66, 8, 12, 504}, // 'B'
00887 {67, 8, 12, 516}, // 'C'
00888 {68, 9, 12, 528}, // 'D'
00889 {69, 8, 12, 552}, // 'E'
00890 {70, 8, 12, 564}, // 'F'
00891 {71, 8, 12, 576}, // 'G'
00892 {72, 8, 12, 588}, // 'H'
00893 {73, 8, 12, 600}, // 'I'
00894 {74, 8, 12, 612}, // 'J'
00895 {75, 9, 12, 624}, // 'K'
00896 {76, 8, 12, 648}, // 'L'
00897 {77, 9, 12, 660}, // 'M'
00898 {78, 8, 12, 684}, // 'N'
00899 {79, 9, 12, 696}, // 'O'
00900 {80, 8, 12, 720}, // 'P'
00901 {81, 9, 12, 732}, // 'Q'
00902 {82, 9, 12, 756}, // 'R'
00903 {83, 8, 12, 780}, // 'S'
00904 {84, 9, 12, 792}, // 'T'
00905 {85, 8, 12, 816}, // 'U'
00906 {86, 9, 12, 828}, // 'V'
00907 {87, 9, 12, 852}, // 'W'
00908 {88, 9, 12, 876}, // 'X'
00909 {89, 9, 12, 900}, // 'Y'
00910 {90, 8, 12, 924}, // 'Z'
00911 {91, 8, 12, 936}, // '['
00912 {92, 8, 12, 948}, // '\\'
00913 {93, 8, 12, 960}, // ']'
00914 {94, 8, 12, 972}, // '^'
00915 {95, 9, 12, 984}, // '_'
00916 {96, 8, 12, 1008}, // '``'
00917 {97, 8, 12, 1020}, // 'a'
00918 {98, 8, 12, 1032}, // 'b'
00919 {99, 8, 12, 1044}, // 'c'
00920 {100, 8, 12, 1056}, // 'd'
00921 {101, 8, 12, 1068}, // 'e'
00922 {102, 9, 12, 1080}, // 'f'
00923 {103, 9, 12, 1104}, // 'g'
00924 {104, 8, 12, 1128}, // 'h'
00925 {105, 8, 12, 1140}, // 'i'
00926 {106, 8, 12, 1152}, // 'j'
00927 {107, 9, 12, 1164}, // 'k'
00928 {108, 8, 12, 1188}, // 'l'
00929 {109, 9, 12, 1200}, // 'm'
00930 {110, 8, 12, 1224}, // 'n'
00931 {111, 9, 12, 1236}, // 'o'
00932 {112, 8, 12, 1260}, // 'p'
00933 {113, 8, 12, 1272}, // 'q'
00934 {114, 9, 12, 1284}, // 'r'
00935 {115, 8, 12, 1308}, // 's'
00936 {116, 8, 12, 1320}, // 't'
00937 {117, 8, 12, 1332}, // 'u'
00938 {118, 9, 12, 1344}, // 'v'
00939 {119, 9, 12, 1368}, // 'w'
00940 {120, 9, 12, 1392}, // 'x'
00941 {121, 9, 12, 1416}, // 'y'
00942 {122, 8, 12, 1440}, // 'z'
00943 {123, 8, 12, 1452}, // '{'
00944 {124, 8, 12, 1464}, // '}'
00945 {125, 8, 12, 1476}, // '}'
00946 {126, 9, 12, 1488} // '~'
00947 },
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01383     0x01, 0x80, 0x02, 0x00, 0x02, 0x00, 0x02, 0x00, 0x02, 0x00, 0x06, 0x00, 0x1C, 0x00,
01384     0x00, 0x00,
01385     0x00, 0x0E, 0x20, 0x13, 0x20,
01386     0x11, 0xC0, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00
01387 };
01388
01389 // Font 6: minecraft
01390 // Characters: 95, Data size: 2268 bytes
01391
01392 const uint16_t minecraft_index[95][4] = {
01393     {32, 7, 14, 0}, // SPACE
01394     {33, 6, 14, 14}, // '!'
01395     {34, 9, 14, 28}, // '"'
01396     {35, 10, 14, 56}, // '#'
01397     {36, 9, 14, 84}, // '$'
01398     {37, 11, 14, 112}, // '%'
01399     {38, 10, 14, 140}, // '&'
01400     {39, 6, 14, 168}, // "'"
01401     {40, 8, 14, 182}, // '('
01402     {41, 8, 14, 196}, // ')'
01403     {42, 8, 14, 210}, // '*'
01404     {43, 9, 14, 224}, // '+'
01405     {44, 6, 14, 252}, // ','
01406     {45, 7, 14, 266}, // '-'
01407     {46, 6, 14, 280}, // '.'
01408     {47, 9, 14, 294}, // '/'
01409     {48, 9, 14, 322}, // '0'
01410     {49, 8, 14, 350}, // '1'
01411     {50, 9, 14, 364}, // '2'
01412     {51, 9, 14, 392}, // '3'
01413     {52, 9, 14, 420}, // '4'
01414     {53, 10, 14, 448}, // '5'
01415     {54, 9, 14, 476}, // '6'
01416     {55, 9, 14, 504}, // '7'
01417     {56, 9, 14, 532}, // '8'
01418     {57, 9, 14, 560}, // '9'
01419     {58, 6, 14, 588}, // ':'
01420     {59, 6, 14, 602}, // ';'
01421     {60, 8, 14, 616}, // '<'
01422     {61, 9, 14, 630}, // '='
01423     {62, 8, 14, 658}, // '>'
01424     {63, 9, 14, 672}, // '?'
01425     {64, 12, 14, 700}, // '@'
01426     {65, 9, 14, 728}, // 'A'
01427     {66, 10, 14, 756}, // 'B'
01428     {67, 10, 14, 784}, // 'C'
01429     {68, 10, 14, 812}, // 'D'
01430     {69, 10, 14, 840}, // 'E'
01431     {70, 9, 14, 868}, // 'F'
01432     {71, 10, 14, 896}, // 'G'
01433     {72, 10, 14, 924}, // 'H'
01434     {73, 7, 14, 952}, // 'I'
01435     {74, 8, 14, 966}, // 'J'
01436     {75, 9, 14, 980}, // 'K'
01437     {76, 9, 14, 1008}, // 'L'
01438     {77, 10, 14, 1036}, // 'M'
01439     {78, 10, 14, 1064}, // 'N'
01440     {79, 11, 14, 1092}, // 'O'
01441     {80, 10, 14, 1120}, // 'P'
01442     {81, 11, 14, 1148}, // 'Q'
01443     {82, 11, 14, 1176}, // 'R'
01444     {83, 9, 14, 1204}, // 'S'
01445     {84, 10, 14, 1232}, // 'T'
01446     {85, 10, 14, 1260}, // 'U'
01447     {86, 10, 14, 1288}, // 'V'
01448     {87, 10, 14, 1316}, // 'W'
01449     {88, 10, 14, 1344}, // 'X'
01450     {89, 10, 14, 1372}, // 'Y'
01451     {90, 10, 14, 1400}, // 'Z'
01452     {91, 7, 14, 1428}, // '['
01453     {92, 9, 14, 1442}, // '\\'
01454     {93, 7, 14, 1470}, // ']'
01455     {94, 9, 14, 1484}, // '^'
01456     {95, 9, 14, 1512}, // '_'
01457     {96, 7, 14, 1540}, // '``'
01458     {97, 9, 14, 1554}, // 'a'
01459     {98, 10, 14, 1582}, // 'b'
01460     {99, 9, 14, 1610}, // 'c'
01461     {100, 9, 14, 1638}, // 'd'
01462     {101, 9, 14, 1666}, // 'e'
01463     {102, 9, 14, 1694}, // 'f'
01464     {103, 9, 14, 1722}, // 'g'
01465     {104, 9, 14, 1750}, // 'h'
01466     {105, 6, 14, 1778}, // 'i'
01467     {106, 8, 14, 1792}, // 'j'
01468     {107, 9, 14, 1806}, // 'k'
01469     {108, 6, 14, 1834}, // 'l'
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01470 {109, 12, 14, 1848}, // 'm'
01471 {110, 9, 14, 1876}, // 'n'
01472 {111, 9, 14, 1904}, // 'o'
01473 {112, 9, 14, 1932}, // 'p'
01474 {113, 9, 14, 1960}, // 'q'
01475 {114, 8, 14, 1988}, // 'r'
01476 {115, 8, 14, 2002}, // 's'
01477 {116, 7, 14, 2016}, // 't'
01478 {117, 9, 14, 2030}, // 'u'
01479 {118, 10, 14, 2058}, // 'v'
01480 {119, 10, 14, 2086}, // 'w'
01481 {120, 10, 14, 2114}, // 'x'
01482 {121, 9, 14, 2142}, // 'y'
01483 {122, 9, 14, 2170}, // 'z'
01484 {123, 7, 14, 2198}, // '{'
01485 {124, 6, 14, 2212}, // '|'
01486 {125, 7, 14, 2226}, // '}'
01487 {126, 10, 14, 2240} // '~'
01488 };
01489
01490 const uint8_t minecraft_data[2268] = {
01491     0x00, 0x00,
01492     0x00, 0x00, 0x00, 0x00, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20, 0x00, 0x20, 0x00, 0x00, 0x00, 0x00, 0x00,
01493     0x00, 0x14, 0x00, 0x14, 0x00, 0x28, 0x00,
01494     0x00, 0x00,
01495     0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x14, 0x00, 0x14, 0x00, 0x3E, 0x00, 0x14, 0x00, 0x3E, 0x00,
01496     0x14, 0x00, 0x14, 0x00, 0x00,
01497     0x08, 0x00, 0x1C, 0x00, 0x00, 0x00, 0x20, 0x00, 0x10, 0x00, 0x08, 0x00, 0x3C, 0x00, 0x08, 0x00,
01498     0x00, 0x01, 0x00,
01499     0x19, 0x00, 0x1A, 0x00, 0x00, 0x00, 0x05, 0x80, 0x09, 0x80, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01500     0x00, 0x08, 0x00, 0x14, 0x00, 0x10, 0x00,
01501     0x1A, 0x00, 0x24, 0x00, 0x24, 0x00, 0x1A, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x20,
01502     0x20, 0x00, 0x18, 0x00,
01503     0x20, 0x20, 0x20, 0x18, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x30, 0x00, 0x08, 0x08, 0x08,
01504     0x08, 0x30, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x28, 0x18, 0x28, 0x00, 0x00, 0x00, 0x00,
01505     0x00, 0x00,
01506     0x00, 0x00, 0x04, 0x00, 0x1E, 0x00, 0x04, 0x00, 0x04, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01507     0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x20, 0x20, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01508     0x00, 0x00, 0x00, 0x00, 0x30, 0x00, 0x00,
01509     0x00, 0x00, 0x00, 0x00, 0x00, 0x20, 0x00, 0x00,
01510     0x00, 0x00, 0x00, 0x00, 0x02, 0x00, 0x00, 0x00, 0x04, 0x00, 0x00, 0x00, 0x08, 0x00, 0x10, 0x00,
01511     0x20, 0x00, 0x00,
01512     0x18, 0x00, 0x00, 0x00, 0x24, 0x00, 0x2C, 0x00, 0x34, 0x00, 0x24, 0x00, 0x18, 0x00, 0x00, 0x00,
01513     0x00, 0x00, 0x00, 0x00, 0x00, 0x10, 0x30, 0x10, 0x10, 0x10, 0x10, 0x38, 0x00, 0x00, 0x00, 0x00,
01514     0x00, 0x18, 0x00, 0x24, 0x00, 0x00, 0x00, 0x00,
01515     0x08, 0x00, 0x10, 0x00, 0x20, 0x00, 0x3C, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01516     0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x18, 0x00, 0x00, 0x00, 0x00, 0x24, 0x00, 0x08, 0x00, 0x00, 0x00,
01517     0x24, 0x00, 0x18, 0x00, 0x00,
01518     0x00, 0x00, 0x04, 0x00, 0x0C, 0x00, 0x14, 0x00, 0x14, 0x00, 0x24, 0x00, 0x24, 0x00, 0x3E, 0x00, 0x04, 0x00,
01519     0x00, 0x00,
01520     0x20, 0x00, 0x20, 0x00, 0x20, 0x00, 0x1C, 0x00, 0x22, 0x00, 0x1C, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01521     0x00, 0x0C, 0x00, 0x10, 0x00, 0x00, 0x00,
01522     0x20, 0x00, 0x3C, 0x00, 0x22, 0x00, 0x18, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01523     0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x3C, 0x00, 0x24, 0x00, 0x00, 0x00, 0x08, 0x00, 0x10, 0x00,
01524     0x10, 0x00, 0x10, 0x00, 0x00,
01525     0x00, 0x00, 0x18, 0x00, 0x00, 0x00, 0x24, 0x00, 0x18, 0x00, 0x00, 0x00, 0x24, 0x00, 0x18, 0x00,
01526     0x00, 0x00,
01527     0x00, 0x00, 0x24, 0x00, 0x24, 0x00, 0x1C, 0x00, 0x04, 0x00, 0x18, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01528     0x00, 0x00, 0x00, 0x00, 0x00, 0x10, 0x00, 0x00, 0x00, 0x10, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01529     0x00, 0x10, 0x00, 0x00, 0x10, 0x10, 0x00, 0x00,
01530     0x00, 0x18, 0x20, 0x10, 0x08, 0x00, 0x00,
01531     0x00, 0x3C, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01532     0x00, 0x30, 0x08, 0x10, 0x20, 0x00,
01533     0x00, 0x00,
01534     0x00, 0x00, 0x24, 0x00, 0x08, 0x00, 0x10, 0x00, 0x00, 0x00, 0x10, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01535     0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x1F, 0x00, 0x20, 0x80, 0x20, 0x80, 0x27, 0x80, 0x29, 0x80,
01536     0x29, 0x80, 0x2F, 0x80, 0x20, 0x80, 0x1F, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01537     0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x18, 0x00, 0x00, 0x00, 0x26, 0x00, 0x3E, 0x00, 0x22, 0x00,
01538     0x22, 0x00, 0x22, 0x00, 0x00,
01539     0x00, 0x00, 0x3C, 0x00, 0x24, 0x00, 0x22, 0x00, 0x3C, 0x00, 0x24, 0x00, 0x22, 0x00, 0x3C, 0x00,
01540     0x00, 0x00,
01541     0x21, 0x00, 0x20, 0x00, 0x20, 0x00, 0x21, 0x00, 0x1E, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01542     0x00, 0x3C, 0x00, 0x24, 0x00, 0x22, 0x00,
01543     0x22, 0x00, 0x22, 0x00, 0x00,
01544     0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x3E, 0x00, 0x20, 0x00, 0x20, 0x00, 0x38, 0x00, 0x20, 0x00,
01545     0x20, 0x00, 0x3B, 0x00, 0x00,
01546     0x00, 0x00, 0x3E, 0x00, 0x20, 0x00, 0x00, 0x38, 0x00, 0x20, 0x00, 0x20, 0x00, 0x20, 0x00, 0x00,
01547     0x00, 0x00,
01548     0x00, 0x00, 0x20, 0x00, 0x23, 0x00, 0x00, 0x21, 0x00, 0x21, 0x00, 0x1E, 0x00, 0x00, 0x00, 0x00, 0x00,
01549     0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00,
01550     0x3E, 0x00, 0x22, 0x00, 0x22, 0x00, 0x00,
01551     0x08, 0x08, 0x08, 0x08, 0x18, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x04, 0x04, 0x04, 0x04,
01552     0x04, 0x24, 0x00, 0x10, 0x00, 0x00,
01553     0x00, 0x00, 0x20, 0x00, 0x22, 0x00, 0x24, 0x00, 0x38, 0x00, 0x24, 0x00, 0x20, 0x00, 0x22, 0x00,
01554     0x00, 0x00,
01555     0x20, 0x00, 0x20, 0x00, 0x20, 0x00, 0x20, 0x00, 0x20, 0x00, 0x3E, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01556     0x00, 0x22, 0x00, 0x36, 0x00, 0x2A, 0x00,

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01557 0x2A, 0x00, 0x22, 0x00, 0x22, 0x00, 0x00,
01558 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x22, 0x00, 0x32, 0x00, 0x2A, 0x00, 0x26, 0x00, 0x22, 0x00,
01559 0x22, 0x00, 0x22, 0x00, 0x00,
01560 0x00, 0x00, 0x1E, 0x00, 0x00, 0x00, 0x21, 0x00, 0x21, 0x00, 0x21, 0x00, 0x21, 0x00, 0x1E, 0x00,
01561 0x00, 0x00,
01562 0x22, 0x00, 0x20, 0x00, 0x3C, 0x00, 0x20, 0x00, 0x20, 0x00, 0x20, 0x00, 0x00, 0x00, 0x00, 0x00,
01563 0x00, 0x00,
01564 0x21, 0x00, 0x21, 0x00, 0x3F, 0x00, 0x1F, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
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01566 0x22, 0x00, 0x21, 0x00, 0x00,
01567 0x00, 0x00, 0x1E, 0x00, 0x20, 0x00, 0x00, 0x00, 0x18, 0x00, 0x02, 0x00, 0x02, 0x00, 0x00, 0x38, 0x00,
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01569 0x08, 0x00, 0x08, 0x00, 0x08, 0x00, 0x08, 0x00, 0x08, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
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01571 0x11, 0x00, 0x11, 0x00, 0x00, 0x00, 0x0C, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
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01573 0x08, 0x00, 0x08, 0x00, 0x00,
01574 0x00, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00, 0x22, 0x00, 0x2A, 0x00, 0x36, 0x00, 0x22, 0x00,
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01576 0x14, 0x00, 0x00, 0x00, 0x08, 0x00, 0x14, 0x00, 0x22, 0x00, 0x22, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01577 0x00, 0x22, 0x00, 0x14, 0x00, 0x00, 0x00,
01578 0x08, 0x00, 0x08, 0x00, 0x08, 0x00, 0x08, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
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01580 0x10, 0x00, 0x3E, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x30, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20,
01581 0x20, 0x30, 0x00, 0x00,
01582 0x20, 0x00, 0x00, 0x00, 0x10, 0x00, 0x00, 0x00, 0x08, 0x00, 0x04, 0x00, 0x02, 0x00, 0x00, 0x00,
01583 0x00, 0x00, 0x00, 0x10, 0x10, 0x10, 0x10, 0x10, 0x10, 0x30, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01584 0x00, 0x00,
01585 0x24, 0x00, 0x00,
01586 0x00, 0x00,
01587 0x3E, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x20, 0x10, 0x00, 0x00, 0x00, 0x00, 0x00,
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01591 0x20, 0x00, 0x2C, 0x00, 0x32, 0x00, 0x22, 0x00, 0x3C, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
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01593 0x20, 0x00, 0x22, 0x00, 0x18, 0x00, 0x00,
01594 0x00, 0x00, 0x00, 0x04, 0x00, 0x04, 0x00, 0x1C, 0x00, 0x24, 0x00, 0x24, 0x00, 0x24, 0x00, 0x24, 0x00,
01595 0x3C, 0x00, 0x00,
01596 0x00, 0x00, 0x00, 0x00, 0x1C, 0x00, 0x24, 0x00, 0x38, 0x00, 0x24, 0x00, 0x1C, 0x00, 0x00, 0x00, 0x00,
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01598 0x3C, 0x00, 0x10, 0x00, 0x10, 0x00, 0x10, 0x00, 0x10, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
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01610 0x00, 0x00,
01611 0x00, 0x00, 0x18, 0x00, 0x24, 0x00, 0x24, 0x00, 0x18, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
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01614 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x1C, 0x00, 0x2C, 0x00, 0x24, 0x00, 0x24, 0x00, 0x1C, 0x00,
01615 0x04, 0x00, 0x04, 0x00, 0x38, 0x00, 0x00, 0x00,
01616 0x20, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x1C, 0x00, 0x20, 0x10, 0x04, 0x30,
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01618 0x00, 0x00,
01619 0x24, 0x00, 0x24, 0x00, 0x24, 0x00, 0x1C, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
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01622 0x00, 0x21, 0x00, 0x25, 0x00, 0x25, 0x00,
01623 0x1F, 0x00, 0x00,
01624 0x00, 0x00, 0x22, 0x00, 0x00, 0x14, 0x00, 0x08, 0x00, 0x14, 0x00, 0x22, 0x00, 0x00, 0x00, 0x00, 0x00,
01625 0x00, 0x24, 0x00, 0x24, 0x00,
01626 0x24, 0x00, 0x1C, 0x00, 0x04, 0x00, 0x38, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01627 0x00, 0x3C, 0x00, 0x04, 0x00, 0x00, 0x00, 0x00,
01628 0x08, 0x00, 0x10, 0x00, 0x3C, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x08, 0x10, 0x10, 0x10, 0x30, 0x10,
01629 0x10, 0x10, 0x08, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x20, 0x20, 0x20, 0x20, 0x20, 0x20,
01630 0x20, 0x20, 0x00, 0x00, 0x00, 0x00, 0x00, 0x20, 0x10, 0x10, 0x18, 0x10, 0x10, 0x10, 0x10, 0x20, 0x00,
01631 0x00, 0x00,
01632 0x00, 0x00, 0x00, 0x00, 0x3E, 0x00, 0x00,
01633 };
01634
01635 // Font 7: minecraft
01636 // Characters: 95, Data size: 3740 bytes
01637
01638 const uint16_t minecraft_2_index[95][4] = {
01639 {32, 9, 20, 0}, // SPACE
01640 {33, 7, 20, 40}, // '!'
01641 {34, 13, 20, 60}, // '"'
01642 {35, 15, 20, 100}, // '#'
01643 {36, 13, 20, 140}, // '$'

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01644 {37, 18, 20, 180}, // '%'
01645 {38, 15, 20, 240}, // '&'
01646 {39, 7, 20, 280}, // ''
01647 {40, 11, 20, 300}, // '('
01648 {41, 11, 20, 340}, // ')'
01649 {42, 11, 20, 380}, // '*'
01650 {43, 14, 20, 420}, // '+'
01651 {44, 7, 20, 460}, // ','
01652 {45, 10, 20, 480}, // '-'
01653 {46, 7, 20, 520}, // '.'
01654 {47, 13, 20, 540}, // '/'
01655 {48, 13, 20, 580}, // '0'
01656 {49, 11, 20, 620}, // '1'
01657 {50, 13, 20, 660}, // '2'
01658 {51, 13, 20, 700}, // '3'
01659 {52, 14, 20, 740}, // '4'
01660 {53, 15, 20, 780}, // '5'
01661 {54, 14, 20, 820}, // '6'
01662 {55, 13, 20, 860}, // '7'
01663 {56, 13, 20, 900}, // '8'
01664 {57, 13, 20, 940}, // '9'
01665 {58, 8, 20, 980}, // ':'
01666 {59, 8, 20, 1000}, // ';'
01667 {60, 11, 20, 1020}, // '<'
01668 {61, 13, 20, 1060}, // '='
01669 {62, 11, 20, 1100}, // '>'
01670 {63, 13, 20, 1140}, // '?'
01671 {64, 19, 20, 1180}, // '@'
01672 {65, 14, 20, 1240}, // 'A'
01673 {66, 15, 20, 1280}, // 'B'
01674 {67, 16, 20, 1320}, // 'C'
01675 {68, 15, 20, 1360}, // 'D'
01676 {69, 15, 20, 1400}, // 'E'
01677 {70, 14, 20, 1440}, // 'F'
01678 {71, 16, 20, 1480}, // 'G'
01679 {72, 15, 20, 1520}, // 'H'
01680 {73, 10, 20, 1560}, // 'I'
01681 {74, 12, 20, 1600}, // 'J'
01682 {75, 14, 20, 1640}, // 'K'
01683 {76, 14, 20, 1680}, // 'L'
01684 {77, 15, 20, 1720}, // 'M'
01685 {78, 15, 20, 1760}, // 'N'
01686 {79, 17, 20, 1800}, // 'O'
01687 {80, 15, 20, 1860}, // 'P'
01688 {81, 17, 20, 1900}, // 'Q'
01689 {82, 17, 20, 1960}, // 'R'
01690 {83, 14, 20, 2020}, // 'S'
01691 {84, 15, 20, 2060}, // 'T'
01692 {85, 15, 20, 2100}, // 'U'
01693 {86, 15, 20, 2140}, // 'V'
01694 {87, 15, 20, 2180}, // 'W'
01695 {88, 15, 20, 2220}, // 'X'
01696 {89, 15, 20, 2260}, // 'Y'
01697 {90, 15, 20, 2300}, // 'Z'
01698 {91, 9, 20, 2340}, // '['
01699 {92, 13, 20, 2380}, // '\'
01700 {93, 9, 20, 2420}, // ']'
01701 {94, 13, 20, 2460}, // '^'
01702 {95, 14, 20, 2500}, // '_'
01703 {96, 9, 20, 2540}, // 'r'
01704 {97, 14, 20, 2580}, // 'a'
01705 {98, 15, 20, 2620}, // 'b'
01706 {99, 14, 20, 2660}, // 'c'
01707 {100, 13, 20, 2700}, // 'd'
01708 {101, 13, 20, 2740}, // 'e'
01709 {102, 13, 20, 2780}, // 'f'
01710 {103, 13, 20, 2820}, // 'g'
01711 {104, 13, 20, 2860}, // 'h'
01712 {105, 7, 20, 2900}, // 'i'
01713 {106, 12, 20, 2920}, // 'j'
01714 {107, 13, 20, 2960}, // 'k'
01715 {108, 7, 20, 3000}, // 'l'
01716 {109, 19, 20, 3020}, // 'm'
01717 {110, 14, 20, 3080}, // 'n'
01718 {111, 13, 20, 3120}, // 'o'
01719 {112, 14, 20, 3160}, // 'p'
01720 {113, 13, 20, 3200}, // 'q'
01721 {114, 12, 20, 3240}, // 'r'
01722 {115, 12, 20, 3280}, // 's'
01723 {116, 10, 20, 3320}, // 't'
01724 {117, 13, 20, 3360}, // 'u'
01725 {118, 15, 20, 3400}, // 'v'
01726 {119, 16, 20, 3440}, // 'w'
01727 {120, 15, 20, 3480}, // 'x'
01728 {121, 13, 20, 3520}, // 'y'
01729 {122, 13, 20, 3560}, // 'z'
01730 {123, 10, 20, 3600}, // '{'
```





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01905    0x30, 0x60, 0x30, 0x00, 0x30, 0x60, 0x30, 0x0F, 0x80, 0x0F, 0x80, 0x00, 0x00, 0x00,
01906    0x00, 0xC0, 0x00, 0xC0,
01907    0x00, 0xC0, 0x0F, 0xC0, 0x0F, 0xC0, 0x30, 0xC0, 0x30, 0xC0, 0x30, 0xC0, 0x30, 0xC0,
01908    0x3F, 0xC0, 0x3F, 0xC0, 0x00, 0x00,
01909    0x00, 0x00,
01910    0x00, 0x00,
01911    0x00, 0x00,
01912    0x0C, 0x00, 0x3F, 0xC0, 0x3F, 0xC0, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01913    0x0C, 0x00, 0x0C, 0x00, 0x00,
01914    0x00, 0x00, 0x0F, 0xC0, 0x0F, 0xC0, 0x30, 0xC0, 0x30, 0xC0, 0x0F, 0xC0, 0x0F, 0xC0, 0x00,
01915    0x00, 0xC0, 0x00, 0xC0, 0x30, 0xC0, 0x30, 0xC0, 0x0F, 0x00, 0x0F, 0x00, 0x00, 0x00, 0x00,
01916    0x00, 0x00,
01917    0x30, 0x00, 0x30, 0x00, 0x33, 0x00, 0x33, 0x00, 0x3C, 0xC0, 0x3C, 0xC0, 0x30, 0xC0, 0x30,
01918    0x30, 0xC0, 0x30, 0xC0, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x30, 0x30,
01919    0x30, 0x30,
01920    0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x01, 0x80, 0x01, 0x80, 0x00, 0x00, 0x01, 0x80,
01921    0x01, 0x80, 0x01, 0x80, 0x01, 0x80, 0x31, 0x80, 0x31, 0x80, 0x0E, 0x00, 0x00, 0x0E, 0x00,
01922    0x00, 0x00,
01923    0x30, 0x00, 0x30, 0x00, 0x30, 0xC0, 0x30, 0xC0, 0x33, 0x00, 0x33, 0x00, 0x3C, 0x00, 0x3C,
01924    0x33, 0x00, 0x33, 0x00, 0x30, 0xC0, 0x30, 0xC0, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
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01926    0x00, 0x00,
01927    0x00, 0x3F, 0x3C,
01928    0x3F, 0x3C, 0x00, 0x30, 0xC3, 0x00, 0x30, 0xC3, 0x00, 0x30, 0xC3, 0x00, 0x30, 0xC3, 0x00,
01929    0xC3, 0x00, 0x30, 0xC3, 0x00, 0x30, 0xC3, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
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01931    0x3F, 0x80, 0x30, 0x60, 0x30, 0x60, 0x30, 0x60, 0x30, 0x60, 0x30, 0x60, 0x30, 0x60, 0x30,
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01933    0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x0F, 0x00, 0x0F, 0x00, 0x30, 0xC0, 0x30, 0xC0,
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01936    0x30, 0x60, 0x30, 0x60, 0x3F, 0x80, 0x30, 0x60, 0x30, 0x60, 0x30, 0x60, 0x30, 0x60, 0x30,
01937    0x00, 0x00,
01938    0x0E, 0xC0, 0x0F, 0xC0, 0x31, 0xC0, 0x30, 0xC0, 0x30, 0xC0, 0x30, 0xC0, 0x30, 0xC0,
01939    0x0F, 0xC0, 0x00, 0xC0, 0x00, 0xC0, 0x00, 0xC0, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01940    0x00, 0x37, 0x00,
01941    0x3F, 0x80, 0x38, 0x80, 0x30, 0x00, 0x30, 0x00, 0x30, 0x00, 0x30, 0x00, 0x30, 0x00,
01942    0x00, 0x00,
01943    0x00, 0x00, 0x00, 0x00, 0x0F, 0x80, 0x0F, 0x80, 0x30, 0x00, 0x30, 0x00, 0x00, 0x00, 0x00,
01944    0x01, 0x80, 0x01, 0x80, 0x3E, 0x00, 0x3E, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01945    0x00, 0x18, 0x00, 0x18, 0x00, 0x3C,
01946    0x3C, 0x00, 0x18, 0x00, 0x18, 0x00, 0x18, 0x00, 0x18, 0x00, 0x18, 0x00, 0x06, 0x00, 0x06,
01947    0x00, 0x00,
01948    0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x30, 0xC0, 0x30, 0xC0, 0x30, 0xC0, 0x30, 0xC0,
01949    0x30, 0xC0, 0x30, 0xC0, 0x0F, 0xC0, 0x0F, 0xC0, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01950    0x00, 0x00,
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01952    0x00, 0x00,
01953    0x00, 0x18, 0x30, 0x18, 0x30, 0x18,
01954    0x31, 0x98, 0x31, 0x98, 0x0F, 0xF8, 0x0F, 0xF8, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01955    0x00, 0x00,
01956    0x0C, 0xC0, 0x0C, 0xC0, 0x03, 0x03, 0x03, 0x03, 0x0C, 0xC0, 0xC0, 0xC0, 0xC0, 0x30,
01957    0x00, 0x03,
01958    0x00, 0x00, 0x30, 0xC0, 0x30, 0xC0, 0x30, 0xC0, 0x30, 0xC0, 0x30, 0xC0, 0x0F, 0xC0, 0x0F,
01959    0x00, 0xC0, 0x00, 0xC0, 0x3F, 0x00, 0x3F, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01960    0x00, 0x3F, 0xC0, 0x3F,
01961    0x01, 0x80, 0x01, 0x80, 0x06, 0x00, 0x06, 0x00, 0x18, 0x00, 0x18, 0x00, 0x3F, 0xC0, 0x3F,
01962    0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x06, 0x00, 0x06, 0x00, 0x18, 0x00,
01963    0x18, 0x00, 0x18, 0x00, 0x18, 0x00, 0x30, 0x00, 0x18, 0x00, 0x18, 0x00, 0x18, 0x00, 0x18,
01964    0x18, 0x00, 0x18, 0x00, 0x06, 0x00, 0x06, 0x00, 0x00, 0x00, 0x00, 0x00, 0x30, 0x30,
01965    0x30, 0x30,
01966    0x00, 0x00, 0x00, 0x00, 0x30, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
01967    0x0C, 0x00, 0x06, 0x00, 0x0C, 0x00, 0x0C, 0x00, 0x0C, 0x00, 0x0C, 0x00, 0x0C, 0x00, 0x0C,
01968    0x30, 0x00, 0x30, 0x00, 0x00,
01969    0x00, 0x00,
01970    0x31, 0xC0, 0x00, 0x00,
01971    };
01972
01973 // Font 8: sga
01974 // Characters: 95, Data size: 6300 bytes
01975
01976 const uint16_t sga_index[95][4] = {
01977    {32, 8, 25, 0}, // SPACE
01978    {33, 21, 25, 25}, // '!'
01979    {34, 15, 25, 100}, // '"'
01980    {35, 21, 25, 150}, // '#'
01981    {36, 17, 25, 225}, // '$'
01982    {37, 21, 25, 300}, // '%'
01983    {38, 21, 25, 375}, // '&'
01984    {39, 15, 25, 450}, // '/'
01985    {40, 15, 25, 500}, // '('
01986    {41, 15, 25, 550}, // ')'
01987    {42, 24, 25, 600}, // '*'
01988    {43, 15, 25, 675}, // '+'
01989    {44, 19, 25, 725}, // ','
01990    {45, 17, 25, 800}, // '-'
01991    {46, 24, 25, 875}, // '.'
}

```

```

01992 {47, 17, 25, 950}, // '/'
01993 {48, 17, 25, 1025}, // '0'
01994 {49, 19, 25, 1100}, // '1'
01995 {50, 15, 25, 1175}, // '2'
01996 {51, 17, 25, 1225}, // '3'
01997 {52, 17, 25, 1300}, // '4'
01998 {53, 19, 25, 1375}, // '5'
01999 {54, 17, 25, 1450}, // '6'
02000 {55, 15, 25, 1525}, // '7'
02001 {56, 17, 25, 1575}, // '8'
02002 {57, 17, 25, 1650}, // '9'
02003 {58, 24, 25, 1725}, // ':'
02004 {59, 24, 25, 1800}, // ';'
02005 {60, 19, 25, 1875}, // '<'
02006 {61, 17, 25, 1950}, // '='
02007 {62, 19, 25, 2025}, // '>'
02008 {63, 21, 25, 2100}, // '?'
02009 {64, 21, 25, 2175}, // '@'
02010 {65, 21, 25, 2250}, // 'A'
02011 {66, 17, 25, 2325}, // 'B'
02012 {67, 12, 25, 2400}, // 'C'
02013 {68, 17, 25, 2450}, // 'D'
02014 {69, 17, 25, 2525}, // 'E'
02015 {70, 19, 25, 2600}, // 'F'
02016 {71, 17, 25, 2675}, // 'G'
02017 {72, 19, 25, 2750}, // 'H'
02018 {73, 10, 25, 2825}, // 'I'
02019 {74, 10, 25, 2875}, // 'J'
02020 {75, 19, 25, 2925}, // 'K'
02021 {76, 15, 25, 3000}, // 'L'
02022 {77, 17, 25, 3050}, // 'M'
02023 {78, 15, 25, 3125}, // 'N'
02024 {79, 17, 25, 3175}, // 'O'
02025 {80, 15, 25, 3250}, // 'P'
02026 {81, 19, 25, 3300}, // 'Q'
02027 {82, 17, 25, 3375}, // 'R'
02028 {83, 12, 25, 3450}, // 'S'
02029 {84, 17, 25, 3500}, // 'T'
02030 {85, 19, 25, 3575}, // 'U'
02031 {86, 19, 25, 3650}, // 'V'
02032 {87, 15, 25, 3725}, // 'W'
02033 {88, 19, 25, 3775}, // 'X'
02034 {89, 15, 25, 3850}, // 'Y'
02035 {90, 17, 25, 3900}, // 'Z'
02036 {91, 15, 25, 3975}, // '['
02037 {92, 17, 25, 4025}, // '\\'
02038 {93, 15, 25, 4100}, // ']'
02039 {94, 19, 25, 4150}, // '^'
02040 {95, 19, 25, 4225}, // '_'
02041 {96, 15, 25, 4300}, // 'v'
02042 {97, 21, 25, 4350}, // 'a'
02043 {98, 17, 25, 4425}, // 'b'
02044 {99, 12, 25, 4500}, // 'c'
02045 {100, 17, 25, 4550}, // 'd'
02046 {101, 17, 25, 4625}, // 'e'
02047 {102, 19, 25, 4700}, // 'f'
02048 {103, 17, 25, 4775}, // 'g'
02049 {104, 19, 25, 4850}, // 'h'
02050 {105, 10, 25, 4925}, // 'i'
02051 {106, 10, 25, 4975}, // 'j'
02052 {107, 19, 25, 5025}, // 'k'
02053 {108, 15, 25, 5100}, // 'l'
02054 {109, 17, 25, 5150}, // 'm'
02055 {110, 15, 25, 5225}, // 'n'
02056 {111, 17, 25, 5275}, // 'o'
02057 {112, 15, 25, 5350}, // 'p'
02058 {113, 19, 25, 5400}, // 'q'
02059 {114, 17, 25, 5475}, // 'r'
02060 {115, 12, 25, 5550}, // 's'
02061 {116, 17, 25, 5600}, // 't'
02062 {117, 19, 25, 5675}, // 'u'
02063 {118, 19, 25, 5750}, // 'v'
02064 {119, 15, 25, 5825}, // 'w'
02065 {120, 19, 25, 5875}, // 'x'
02066 {121, 15, 25, 5950}, // 'y'
02067 {122, 17, 25, 6000}, // 'z'
02068 {123, 15, 25, 6075}, // '{'
02069 {124, 10, 25, 6125}, // '|'
02070 {125, 15, 25, 6175}, // '}'
02071 {126, 19, 25, 6225} // '~'
02072 };
02073
02074 const uint8_t sga_data[6300] = {
02075     0x00, 0x00,
02076     0x00, 0x00,
02077     0x00, 0x00,
02078     0x00, 0x00,
02079

```









```

02427     0x00, 0x00, 0x60, 0x00, 0x60, 0x00, 0x00, 0x60, 0x00, 0x00, 0x60, 0x00, 0x00, 0x60, 0x00,
02428     0x00, 0x60, 0x00, 0x00, 0x60, 0x00, 0x00, 0x60, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
02429     0x60, 0x00, 0x00, 0x60, 0x00, 0x00,
02430     0x00, 0x00,
02431     0x00, 0x00,
02432     0x00, 0x0C, 0x0C, 0x00,
02433     0x00, 0x0C, 0x00, 0xC0,
02434     0x00, 0x3F, 0xF8, 0x00, 0x3F,
02435     0x00, 0x00,
02436     0x00, 0x01, 0x80, 0x00, 0x01, 0x80, 0x00, 0x01, 0x80, 0x00, 0x01, 0x80, 0x00, 0x01, 0x80,
02437     0x01, 0x80, 0x00, 0x01, 0x80, 0x00, 0x3F, 0xF8, 0x00, 0x3F, 0xF8, 0x00, 0x00, 0x00, 0x00,
02438     0x00, 0x00, 0x00, 0x00, 0x00, 0x3F, 0xF8, 0x00, 0x3F, 0xF8, 0x00, 0x00, 0x00, 0x00, 0x00,
02439     0x00, 0x00,
02440     0x00, 0x00,
02441     0x00, 0x0C, 0x00, 0x0C, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x33, 0x00, 0x33, 0x00,
02442     0x00, 0x00,
02443     0x00, 0x00,
02444     0x00, 0x00, 0x00, 0x00, 0x30, 0x18, 0x00, 0x30, 0x18, 0x00, 0x00, 0x00, 0x00, 0x00, 0x60,
02445     0x00, 0x60, 0x00, 0x01, 0x80, 0x00, 0x01, 0x80, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
02446     0x00, 0x00, 0x30, 0x00, 0x00, 0x30, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
02447     0x00, 0x00,
02448     0x31, 0x80, 0x31, 0x80, 0x31, 0x80, 0x31, 0x80, 0x31, 0x80, 0x31, 0x80, 0x31, 0x80,
02449     0x31, 0x80, 0x31, 0x80, 0x31, 0x80, 0x31, 0x80, 0x31, 0x80, 0x31, 0x80, 0x31, 0x80,
02450     0x00, 0x00,
02451     0x00, 0x00,
02452     0x00, 0x0F, 0x80, 0x00, 0x0F, 0x80, 0x00, 0x00, 0x00, 0x00, 0x00, 0x30, 0x60, 0x00, 0x30,
02453     0x30, 0x60, 0x00, 0x30, 0x60, 0x00, 0x30, 0x60, 0x00, 0x30, 0x60, 0x00, 0x30, 0x60,
02454     0x60, 0x00, 0x30, 0x60, 0x00, 0x00,
02455     0x00, 0x30,
02456     0x00, 0x31, 0x80, 0x31, 0x80, 0x30, 0x00, 0x3E, 0x00, 0x3E, 0x00, 0x3E, 0x00, 0x3E,
02457     0x00, 0x31, 0x80, 0x31, 0x80, 0x30, 0x00, 0x30, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
02458     0x00, 0x00,
02459     0x00, 0x00, 0x00, 0x30, 0x00, 0x30, 0x00, 0x30, 0x00, 0x30, 0x00, 0x30, 0x00, 0x30, 0x00,
02460     0x00, 0x30, 0x00, 0x30, 0x00, 0x30, 0x00, 0x30, 0x00, 0x30, 0x00, 0x00, 0x00, 0x00, 0x00,
02461     0x00, 0x00,
02462     0x00, 0x01, 0x80, 0x01, 0x80, 0x31, 0x80, 0x31, 0x80, 0x01, 0x80, 0x0F, 0x80, 0x0F, 0x80,
02463     0x80, 0x0F, 0x80, 0x01, 0x80, 0x31, 0x80, 0x31, 0x80, 0x01, 0x80, 0x01, 0x80, 0x00, 0x00,
02464     0x00, 0x00,
02465     0x00, 0x00,
02466     0x00, 0x00,
02467     0x00, 0x01, 0x80, 0x00, 0x01, 0x80, 0x00, 0x01, 0x80, 0x00, 0x01, 0x80, 0x00, 0x00, 0x00,
02468     0x00, 0x7C, 0x00, 0x00, 0x7C, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00
02469   };
02470
02471 // Font lookup structure
02472 typedef struct {
02473   const char* name;
02474   uint16_t size;
02475   uint16_t num_chars;
02476   const uint16_t (*index)[4];
02477   const uint8_t* data;
02478 } FontInfo;
02479
02480 const FontInfo available_fonts[8] = {
02481   {"arial", 1, 95, arial_index, arial_data},
02482   {"arial", 2, 95, arial_2_index, arial_2_data},
02483   {"default", 1, 95, default_index, default_data},
02484   {"consolas", 1, 95, consolas_index, consolas_data},
02485   {"consolas", 2, 95, consolas_2_index, consolas_2_data},
02486   {"minecraft", 1, 95, minecraft_index, minecraft_data},
02487   {"minecraft", 2, 95, minecraft_2_index, minecraft_2_data},
02488   {"sga", 1, 95, sga_index, sga_data}
02489 };
02490
02491 #define NUM_FONTS 8
02492
02493 #endif // COMBINED_CHARSETS_H

```

## 6.4 dma.h

```

00001
00019 /* Define to prevent recursive inclusion -----*/
00020 #ifndef __dma_H
00021 #define __dma_H
00022
00023 #ifdef __cplusplus
00024   extern "C" {
00025   #endif
00026
00027 /* Includes -----*/
00028 #include "main.h"
00029
00030 /* DMA memory to memory transfer handles -----*/

```

```

00031
00032 /* USER CODE BEGIN Includes */
00033
00034 /* USER CODE END Includes */
00035
00036 /* USER CODE BEGIN Private defines */
00037
00038 /* USER CODE END Private defines */
00039
00040 void MX_DMA_Init(void);
00041
00042 /* USER CODE BEGIN Prototypes */
00043
00044 /* USER CODE END Prototypes */
00045
00046 #ifdef __cplusplus
00047 }
00048 #endif
00049
00050 #endif /* __dma_H */
00051
00055
00056 /***** (C) COPYRIGHT STMicroelectronics *****END OF FILE****/

```

## 6.5 gpio.h

```

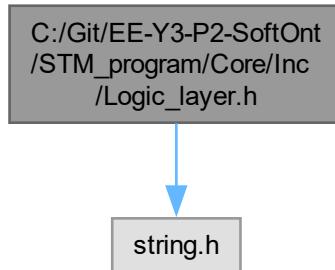
00001
00019
00020 /* Define to prevent recursive inclusion -----*/
00021 #ifndef __gpio_H
00022 #define __gpio_H
00023 #ifdef __cplusplus
00024 extern "C" {
00025 #endif
00026
00027 /* Includes -----*/
00028 #include "main.h"
00029
00030 /* USER CODE BEGIN Includes */
00031
00032 /* USER CODE END Includes */
00033
00034 /* USER CODE BEGIN Private defines */
00035
00036 /* USER CODE END Private defines */
00037
00038 void MX_GPIO_Init(void);
00039
00040 /* USER CODE BEGIN Prototypes */
00041
00042 /* USER CODE END Prototypes */
00043
00044 #ifdef __cplusplus
00045 }
00046 #endif
00047 #endif /*__ pinoutConfig_H */
00048
00052
00056
00057 /***** (C) COPYRIGHT STMicroelectronics *****END OF FILE*****/

```

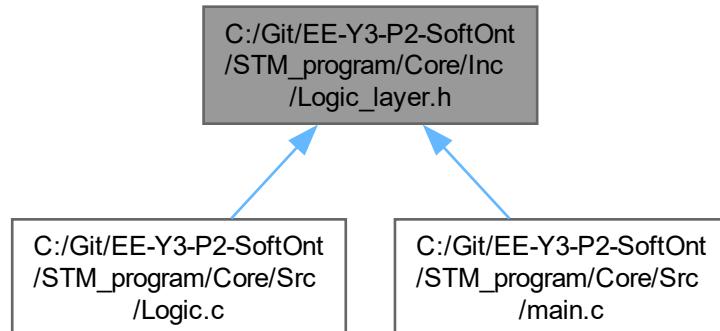
## 6.6 C:/Git/EE-Y3-P2-SoftOnt/STM\_program/Core/Inc/Logic\_layer.h File Reference

: Header voor Logic\_layer.c file. In dit bestand word de logic functie en struct gedefinieerd.

```
#include <string.h>
Include dependency graph for Logic_layer.h:
```



This graph shows which files directly or indirectly include this file:



## Classes

- struct [LogicInterface](#)

## Functions

- int [execute\\_command](#) (struct [LogicInterface](#) \*cmd)

### 6.6.1 Detailed Description

: Header voor Logic\_layer.c file. In dit bestand word de logic functie en struct gedefinieerd.

## 6.6.2 Function Documentation

### 6.6.2.1 execute\_command()

```
int execute_command (
    struct LogicInterface * cmd)

//configuratie doorsturen naar de parser en hieruit de juiste api's uitvoeren.
```

#### Parameters

<i>struct</i>	LogicInterface* cmd Pointer naar de <a href="#">LogicInterface</a> struct met commando informatie.
---------------	----------------------------------------------------------------------------------------------------

#### Returns

int Statuscode (0 = succes, anders fout).

Executeer een commando

#### Parameters

<i>cmd</i>	In parameter: het commando dat uitgevoerd moet worden
<i>parsed</i>	Geparste argumenten
<i>result</i>	Uit parameter: de return waarde van de API functie

#### Returns

0 bij succes, errno waarde bij fout

## 6.7 Logic\_layer.h

[Go to the documentation of this file.](#)

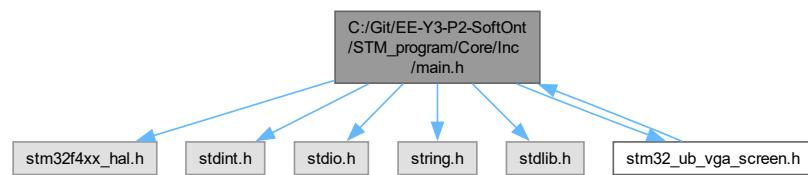
```
00001
00008
00009 #ifndef LOGIC_LAYER_H_
00010 #define LOGIC_LAYER_H_
00011
00012 #include <string.h>
00013
00023
00024 struct LogicInterface
00025 {
00026     char function_name[15];
00027     int argument_len;
00028     char *arguments;
00029 };
00030
00037
00038 int execute_command(struct LogicInterface* cmd);
00039 #endif /* LOGIC_LAYER_H_ */
```

## 6.8 C:/Git/EE-Y3-P2-SoftOnt/STM\_program/Core/Inc/main.h File Reference

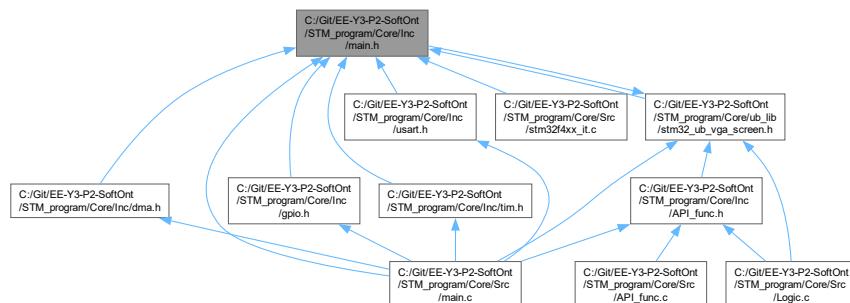
: Header for [main.c](#) file. This file contains the common defines of the application.

```
#include "stm32f4xx_hal.h"
#include "stdint.h"
#include "stdio.h"
#include "string.h"
#include <stdlib.h>
#include "stm32_ub_vga_screen.h"
```

Include dependency graph for main.h:



This graph shows which files directly or indirectly include this file:



### Classes

- struct [input\\_vars](#)

### Macros

- #define **VGA\_BLUE0\_Pin** GPIO\_PIN\_8
- #define **VGA\_BLUE0\_GPIO\_Port** GPIOE
- #define **VGA\_BLUE1\_Pin** GPIO\_PIN\_9
- #define **VGA\_BLUE1\_GPIO\_Port** GPIOE
- #define **VGA\_GREEN0\_Pin** GPIO\_PIN\_10
- #define **VGA\_GREEN0\_GPIO\_Port** GPIOE
- #define **VGA\_GREEN1\_Pin** GPIO\_PIN\_11

- #define **VGA\_GREEN1\_GPIO\_Port** GPIOE
- #define **VGA\_GREEN2\_Pin** GPIO\_PIN\_12
- #define **VGA\_GREEN2\_GPIO\_Port** GPIOE
- #define **VGA\_RED0\_Pin** GPIO\_PIN\_13
- #define **VGA\_RED0\_GPIO\_Port** GPIOE
- #define **VGA\_RED1\_Pin** GPIO\_PIN\_14
- #define **VGA\_RED1\_GPIO\_Port** GPIOE
- #define **VGA\_RED2\_Pin** GPIO\_PIN\_15
- #define **VGA\_RED2\_GPIO\_Port** GPIOE
- #define **VGA\_HSYNC\_Pin** GPIO\_PIN\_11
- #define **VGA\_HSYNC\_GPIO\_Port** GPIOB
- #define **VGA\_VSYNC\_Pin** GPIO\_PIN\_12
- #define **VGA\_VSYNC\_GPIO\_Port** GPIOB
- #define **BYTE\_BUflen** 1
- #define **LINE\_BUflen** 1024
- #define **CARRIAGE\_RETURN** 13 /\* carriage return char \r \*/
- #define **LINE\_FEED** 10 /\* linefeed char \n \*/
- #define **FALSE** 0x00
- #define **TRUE** 0xFF

## Functions

- void [Error\\_Handler](#) (void)  
*This function is executed in case of error occurrence.*

## Variables

- [input\\_vars input](#)
- volatile char **container** [1024]
- volatile int **temp**
- volatile int **key**

### 6.8.1 Detailed Description

: Header for [main.c](#) file. This file contains the common defines of the application.

#### Attention

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## 6.8.2 Function Documentation

### 6.8.2.1 Error\_Handler()

```
void Error_Handler (
    void )
```

This function is executed in case of error occurrence.

#### Return values

None	
------	--

## 6.9 main.h

[Go to the documentation of this file.](#)

```
00001 /* USER CODE BEGIN Header */
00020 /* USER CODE END Header */
00021
00022 /* Define to prevent recursive inclusion -----*/
00023 #ifndef __MAIN_H
00024 #define __MAIN_H
00025
00026 #ifdef __cplusplus
00027 extern "C" {
00028 #endif
00029
00030 /* Includes -----*/
00031 #include "stm32f4xx_hal.h"
00032
00033 /* Private includes -----*/
00034 /* USER CODE BEGIN Includes */
00035 #include "stdint.h"
00036
00037 #include "stdio.h"
00038 #include "string.h"
00039 #include <stdlib.h>
00040
00041 #include "stm32_ub_vga_screen.h"
00042
00043 /* USER CODE END Includes */
00044
00045 /* Exported types -----*/
00046 /* USER CODE BEGIN ET */
00047
00048 /* USER CODE END ET */
00049
00050 /* Exported constants -----*/
00051 /* USER CODE BEGIN EC */
00052
00053 /* USER CODE END EC */
00054
00055 /* Exported macro -----*/
00056 /* USER CODE BEGIN EM */
00057
00058 /* USER CODE END EM */
00059
00060 /* Exported functions prototypes -----*/
00061 void Error_Handler(void);
00062
00063 /* USER CODE BEGIN EFP */
00064
00065 /* USER CODE END EFP */
00066
00067 /* Private defines -----*/
00068 #define VGA_BLUE0_Pin GPIO_PIN_8
00069 #define VGA_BLUE0_GPIO_Port GPIOE
00070 #define VGA_BLUE1_Pin GPIO_PIN_9
00071 #define VGA_BLUE1_GPIO_Port GPIOE
00072 #define VGA_GREEN0_Pin GPIO_PIN_10
00073 #define VGA_GREEN0_GPIO_Port GPIOE
00074 #define VGA_GREEN1_Pin GPIO_PIN_11
00075 #define VGA_GREEN1_GPIO_Port GPIOE
00076 #define VGA_GREEN2_Pin GPIO_PIN_12
00077 #define VGA_GREEN2_GPIO_Port GPIOE
```

```

00078 #define VGA_RED0_Pin GPIO_PIN_13
00079 #define VGA_RED0_GPIO_Port GPIOE
00080 #define VGA_RED1_Pin GPIO_PIN_14
00081 #define VGA_RED1_GPIO_Port GPIOE
00082 #define VGA_RED2_Pin GPIO_PIN_15
00083 #define VGA_RED2_GPIO_Port GPIOE
00084 #define VGA_HSYNC_Pin GPIO_PIN_11
00085 #define VGA_HSYNC_GPIO_Port GPIOB
00086 #define VGA_VSYNC_Pin GPIO_PIN_12
00087 #define VGA_VSYNC_GPIO_Port GPIOB
00088 /* USER CODE BEGIN Private defines */
00089
00090 #define BYTE_BUFLen      1
00091 #define LINE_BUFLen     1024
00092 #define CARRIAGE_RETURN 13 /* carriage return char \r */
00093 #define LINE_FEED       10 /* linefeed char \n */
00094
00095 #define FALSE    0x00
00096 #define TRUE     0xFF
00097
00098 /* Struct's -----*/
00099 typedef struct
00100 {
00101     uint8_t byte_buffer_rx[BYTE_BUFLen]; // Store the rx byte from the USART2
00102     char line_rx_buffer[LINE_BUFLen]; // Buffer to hold all the bytes from rx USART2
00103     int msglen;
00104     volatile int char_counter; // Counter for line_rx_buffer
00105     char command_execute_flag; /* Set = whole transmission is received, ready for
00106     processing \
00107     Reset = still receiving*/
00108 }input_vars;
00109 extern input_vars input;
00110
00111 /* Globals -----*/
00112 extern volatile char container[1024];
00113 extern volatile int temp;
00114 extern volatile int key;
00115
00116 /* USER CODE END Private defines */
00117 #ifdef __cplusplus
00118 }
00119 #endif
00120
00121 #endif /* __MAIN_H */
00122
00123 **** (C) COPYRIGHT STMicroelectronics *****END OF FILE****/

```

## 6.10 stm32f4xx\_hal\_conf.h

```

00001
00021
00022 /* Define to prevent recursive inclusion -----*/
00023 #ifndef __STM32F4xx_HAL_CONF_H
00024 #define __STM32F4xx_HAL_CONF_H
00025
00026 #ifdef __cplusplus
00027 extern "C" {
00028 #endif
00029
00030 /* Exported types -----*/
00031 /* Exported constants -----*/
00032
00033 /* ##### Module Selection ##### */
00034 #define HAL_MODULE_ENABLED
00035
00036 /* #define HAL_ADC_MODULE_ENABLED */
00037 /* #define HAL_CRYP_MODULE_ENABLED */
00038 /* #define HAL_CAN_MODULE_ENABLED */
00039 /* #define HAL_CRC_MODULE_ENABLED */
00040 /* #define HAL_CAN_LEGACY_MODULE_ENABLED */
00041 /* #define HAL_CRYP_MODULE_ENABLED */
00042 /* #define HAL_DAC_MODULE_ENABLED */
00043 /* #define HAL_DCMI_MODULE_ENABLED */
00044 /* #define HAL_DMA2D_MODULE_ENABLED */
00045 /* #define HAL_ETH_MODULE_ENABLED */
00046 /* #define HAL_NAND_MODULE_ENABLED */
00047 /* #define HAL_NOR_MODULE_ENABLED */
00048 /* #define HAL_PCCARD_MODULE_ENABLED */
00049 /* #define HAL_SRAM_MODULE_ENABLED */
00050 /* #define HAL_SDRAM_MODULE_ENABLED */
00051 /* #define HAL_HASH_MODULE_ENABLED */
00052 /* #define HAL_I2C_MODULE_ENABLED */

```

```

00056 /* #define HAL_I2S_MODULE_ENABLED */  

00057 /* #define HAL_IWDG_MODULE_ENABLED */  

00058 /* #define HAL_LTDC_MODULE_ENABLED */  

00059 /* #define HAL RNG_MODULE_ENABLED */  

00060 /* #define HAL RTC_MODULE_ENABLED */  

00061 /* #define HAL_SAI_MODULE_ENABLED */  

00062 /* #define HAL_SD_MODULE_ENABLED */  

00063 /* #define HAL MMC_MODULE_ENABLED */  

00064 /* #define HAL SPI_MODULE_ENABLED */  

00065 #define HAL_TIM_MODULE_ENABLED  

00066 #define HAL_UART_MODULE_ENABLED  

00067 /* #define HAL_USART_MODULE_ENABLED */  

00068 /* #define HAL_IRDA_MODULE_ENABLED */  

00069 /* #define HAL_SMARTCARD_MODULE_ENABLED */  

00070 /* #define HAL_SMBUS_MODULE_ENABLED */  

00071 /* #define HAL_WWDG_MODULE_ENABLED */  

00072 /* #define HAL_PCD_MODULE_ENABLED */  

00073 /* #define HAL_HCD_MODULE_ENABLED */  

00074 /* #define HAL_DSI_MODULE_ENABLED */  

00075 /* #define HAL_QSPI_MODULE_ENABLED */  

00076 /* #define HAL_QSPI_MODULE_ENABLED */  

00077 /* #define HAL_CEC_MODULE_ENABLED */  

00078 /* #define HAL_FMPI2C_MODULE_ENABLED */  

00079 /* #define HAL_SPDIFRX_MODULE_ENABLED */  

00080 /* #define HAL_DFSDM_MODULE_ENABLED */  

00081 /* #define HAL_LPTIM_MODULE_ENABLED */  

00082 #define HAL_GPIO_MODULE_ENABLED  

00083 #define HAL_EXTI_MODULE_ENABLED  

00084 #define HAL_DMA_MODULE_ENABLED  

00085 #define HAL_RCC_MODULE_ENABLED  

00086 #define HAL_FLASH_MODULE_ENABLED  

00087 #define HAL_PWR_MODULE_ENABLED  

00088 #define HAL_CORTEX_MODULE_ENABLED  

00089  

00090 /* ##### HSE/HSI Values adaptation ##### */  

00096 #if !defined (HSE_VALUE)  

00097 #define HSE_VALUE ((uint32_t)8000000U)  

00098 #endif /* HSE_VALUE */  

00099  

00100 #if !defined (HSE_STARTUP_TIMEOUT)  

00101 #define HSE_STARTUP_TIMEOUT ((uint32_t)100U)  

00102 #endif /* HSE_STARTUP_TIMEOUT */  

00103  

00109 #if !defined (HSI_VALUE)  

00110 #define HSI_VALUE ((uint32_t)16000000U)  

00111 #endif /* HSI_VALUE */  

00112  

00116 #if !defined (LSI_VALUE)  

00117 #define LSI_VALUE ((uint32_t)32000U)  

00118 #endif /* LSI_VALUE */  

00124 #if !defined (LSE_VALUE)  

00125 #define LSE_VALUE ((uint32_t)32768U)  

00126 #endif /* LSE_VALUE */  

00127  

00128 #if !defined (LSE_STARTUP_TIMEOUT)  

00129 #define LSE_STARTUP_TIMEOUT ((uint32_t)5000U)  

00130 #endif /* LSE_STARTUP_TIMEOUT */  

00131  

00137 #if !defined (EXTERNAL_CLOCK_VALUE)  

00138 #define EXTERNAL_CLOCK_VALUE ((uint32_t)12288000U)  

00139 #endif /* EXTERNAL_CLOCK_VALUE */  

00140  

00141 /* Tip: To avoid modifying this file each time you need to use different HSE,  

00142 === you can define the HSE value in your toolchain compiler preprocessor. */  

00143  

00144 /* ##### System Configuration ##### */  

00148 #define VDD_VALUE ((uint32_t)3300U)  

00149 #define TICK_INT_PRIORITY ((uint32_t)0U)  

00150 #define USERTOS 0U  

00151 #define PREFETCH_ENABLE 1U  

00152 #define INSTRUCTION_CACHE_ENABLE 1U  

00153 #define DATA_CACHE_ENABLE 1U  

00154  

00155 #define USE_HAL_ADC_REGISTER_CALLBACKS 0U /* ADC register callback disabled */  

00156 #define USE_HAL_CAN_REGISTER_CALLBACKS 0U /* CAN register callback disabled */  

00157 #define USE_HAL_CEC_REGISTER_CALLBACKS 0U /* CEC register callback disabled */  

00158 #define USE_HAL_CRYP_REGISTER_CALLBACKS 0U /* CRYP register callback disabled */  

00159 #define USE_HAL_DAC_REGISTER_CALLBACKS 0U /* DAC register callback disabled */  

00160 #define USE_HAL_DCMI_REGISTER_CALLBACKS 0U /* DCMI register callback disabled */  

00161 #define USE_HAL_DFSDM_REGISTER_CALLBACKS 0U /* DFSDM register callback disabled */  

00162 #define USE_HAL_DMA2D_REGISTER_CALLBACKS 0U /* DMA2D register callback disabled */  

00163 #define USE_HAL_DSI_REGISTER_CALLBACKS 0U /* DSI register callback disabled */  

00164 #define USE_HAL_ETH_REGISTER_CALLBACKS 0U /* ETH register callback disabled */  

00165 #define USE_HAL_HASH_REGISTER_CALLBACKS 0U /* HASH register callback disabled */  

00166 #define USE_HAL_HCD_REGISTER_CALLBACKS 0U /* HCD register callback disabled */  

00167 #define USE_HAL_I2C_REGISTER_CALLBACKS 0U /* I2C register callback disabled */  

00168 #define USE_HAL_FMPI2C_REGISTER_CALLBACKS 0U /* FMPPI2C register callback disabled */

```

```

00169 #define USE_HAL_I2S_REGISTER_CALLBACKS          OU /* I2S register callback disabled */  

00170 #define USE_HAL_IRDA_REGISTER_CALLBACKS        OU /* IRDA register callback disabled */  

00171 #define USE_HAL_LPTIM_REGISTER_CALLBACKS       OU /* LPTIM register callback disabled */  

00172 #define USE_HAL_LTDC_REGISTER_CALLBACKS        OU /* LTDC register callback disabled */  

00173 #define USE_HAL_MMIC_REGISTER_CALLBACKS        OU /* MMC register callback disabled */  

00174 #define USE_HAL_NAND_REGISTER_CALLBACKS        OU /* NAND register callback disabled */  

00175 #define USE_HAL_NOR_REGISTER_CALLBACKS         OU /* NOR register callback disabled */  

00176 #define USE_HAL_PCCARD_REGISTER_CALLBACKS      OU /* PCCARD register callback disabled */  

00177 #define USE_HAL_PCD_REGISTER_CALLBACKS         OU /* PCD register callback disabled */  

00178 #define USE_HAL_QSPI_REGISTER_CALLBACKS       OU /* QSPI register callback disabled */  

00179 #define USE_HAL_RNG_REGISTER_CALLBACKS        OU /* RNG register callback disabled */  

00180 #define USE_HAL_RTC_REGISTER_CALLBACKS         OU /* RTC register callback disabled */  

00181 #define USE_HAL_SAI_REGISTER_CALLBACKS        OU /* SAI register callback disabled */  

00182 #define USE_HAL_SD_REGISTER_CALLBACKS         OU /* SD register callback disabled */  

00183 #define USE_HAL_SMARTCARD_REGISTER_CALLBACKS   OU /* SMARTCARD register callback disabled */  

00184 #define USE_HAL_SDRAM_REGISTER_CALLBACKS      OU /* SDRAM register callback disabled */  

00185 #define USE_HAL_SRAM_REGISTER_CALLBACKS       OU /* SRAM register callback disabled */  

00186 #define USE_HAL_SPDIFRX_REGISTER_CALLBACKS    OU /* SPDIFRX register callback disabled */  

00187 #define USE_HAL_SMBUS_REGISTER_CALLBACKS      OU /* SMBUS register callback disabled */  

00188 #define USE_HAL_SPI_REGISTER_CALLBACKS        OU /* SPI register callback disabled */  

00189 #define USE_HAL_TIM_REGISTER_CALLBACKS       OU /* TIM register callback disabled */  

00190 #define USE_HAL_UART_REGISTER_CALLBACKS      OU /* UART register callback disabled */  

00191 #define USE_HAL_USART_REGISTER_CALLBACKS     OU /* USART register callback disabled */  

00192 #define USE_HAL_WWDG_REGISTER_CALLBACKS      OU /* WWDG register callback disabled */  

00193  

00194 /* ##### Assert Selection ##### */  

00195 /* #define USE_FULL_ASSERT 1U */  

00200  

00201 /* ##### Ethernet peripheral configuration ##### */  

00202  

00203 /* Section 1 : Ethernet peripheral configuration */  

00204  

00205 /* MAC ADDRESS: MAC_ADDR0:MAC_ADDR1:MAC_ADDR2:MAC_ADDR3:MAC_ADDR4:MAC_ADDR5 */  

00206 #define MAC_ADDR0 2U  

00207 #define MAC_ADDR1 0U  

00208 #define MAC_ADDR2 0U  

00209 #define MAC_ADDR3 0U  

00210 #define MAC_ADDR4 0U  

00211 #define MAC_ADDR5 0U  

00212  

00213 /* Definition of the Ethernet driver buffers size and count */  

00214 #define ETH_RX_BUF_SIZE           ETH_MAX_PACKET_SIZE /* buffer size for receive */  

00215 #define ETH_TX_BUF_SIZE           ETH_MAX_PACKET_SIZE /* buffer size for transmit */  

00216 #define ETH_RXBUFNBN ((uint32_t)4U) /* 4 Rx buffers of size ETH_RX_BUF_SIZE */  

/*/  

00217 #define ETH_TXBUFNBN ((uint32_t)4U) /* 4 Tx buffers of size ETH_TX_BUF_SIZE */  

/*/  

00218  

00219 /* Section 2: PHY configuration section */  

00220  

00221 /* DP83848_PHY_ADDRESS Address*/  

00222 #define DP83848_PHY_ADDRESS 0x01U  

00223 /* PHY Reset delay these values are based on a 1 ms SysTick interrupt*/  

00224 #define PHY_RESET_DELAY ((uint32_t)0x000000FFU)  

00225 /* PHY Configuration delay */  

00226 #define PHY_CONFIG_DELAY ((uint32_t)0x000000FFU)  

00227  

00228 #define PHY_READ_TO ((uint32_t)0x00000FFFU)  

00229 #define PHY_WRITE_TO ((uint32_t)0x00000FFFU)  

00230  

00231 /* Section 3: Common PHY Registers */  

00232  

00233 #define PHY_BCR ((uint16_t)0x0000U)  

00234 #define PHY_BSR ((uint16_t)0x0001U)  

00235  

00236 #define PHY_RESET ((uint16_t)0x8000U)  

00237 #define PHY_LOOPBACK ((uint16_t)0x4000U)  

00238 #define PHY_FULLDUPLEX_100M ((uint16_t)0x2100U)  

00239 #define PHY_HALFDUPLEX_100M ((uint16_t)0x2000U)  

00240 #define PHY_FULLDUPLEX_10M ((uint16_t)0x0100U)  

00241 #define PHY_HALFDUPLEX_10M ((uint16_t)0x0000U)  

00242 #define PHY_AUTONEGOTIATION ((uint16_t)0x1000U)  

00243 #define PHY_RESTART_AUTONEGOTIATION ((uint16_t)0x0200U)  

00244 #define PHY_POWERDOWN ((uint16_t)0x0800U)  

00245 #define PHY_ISOLATE ((uint16_t)0x0400U)  

00246  

00247 #define PHY_AUTONEGO_COMPLETE ((uint16_t)0x0020U)  

00248 #define PHY_LINKED_STATUS ((uint16_t)0x0004U)  

00249 #define PHY_JABBER_DETECTION ((uint16_t)0x0002U)  

00250  

00251 /* Section 4: Extended PHY Registers */  

00252 #define PHY_SR ((uint16_t)0x10U)  

00253  

00254 #define PHY_SPEED_STATUS ((uint16_t)0x0002U)  

00255 #define PHY_DUPLEX_STATUS ((uint16_t)0x0004U)  

00256  

00257 /* ##### SPI peripheral configuration ##### */  


```

```
00258 /* CRC FEATURE: Use to activate CRC feature inside HAL SPI Driver
00259 * Activated: CRC code is present inside driver
00260 * Deactivated: CRC code cleaned from driver
00261 */
00262 */
00263
00264 #define USE_SPI_CRC          OU
00265
00266 /* Includes -----*/
00267
00268 #ifndef HAL_RCC_MODULE_ENABLED
00269     #include "stm32f4xx_hal_rcc.h"
00270 #endif /* HAL_RCC_MODULE_ENABLED */
00271
00272 #ifndef HAL_GPIO_MODULE_ENABLED
00273     #include "stm32f4xx_hal_gpio.h"
00274 #endif /* HAL_GPIO_MODULE_ENABLED */
00275
00276 #ifndef HAL_EXTI_MODULE_ENABLED
00277     #include "stm32f4xx_hal_exti.h"
00278 #endif /* HAL_EXTI_MODULE_ENABLED */
00279
00280 #ifndef HAL_DMA_MODULE_ENABLED
00281     #include "stm32f4xx_hal_dma.h"
00282 #endif /* HAL_DMA_MODULE_ENABLED */
00283
00284 #ifndef HAL_CORTEX_MODULE_ENABLED
00285     #include "stm32f4xx_hal_cortex.h"
00286 #endif /* HAL_CORTEX_MODULE_ENABLED */
00287
00288 #ifndef HAL_ADC_MODULE_ENABLED
00289     #include "stm32f4xx_hal_adc.h"
00290 #endif /* HAL_ADC_MODULE_ENABLED */
00291
00292 #ifndef HAL_CAN_MODULE_ENABLED
00293     #include "stm32f4xx_hal_can.h"
00294 #endif /* HAL_CAN_MODULE_ENABLED */
00295
00296 #ifndef HAL_CAN_LEGACY_MODULE_ENABLED
00297     #include "stm32f4xx_hal_can_legacy.h"
00298 #endif /* HAL_CAN_LEGACY_MODULE_ENABLED */
00299
00300 #ifndef HAL_CRC_MODULE_ENABLED
00301     #include "stm32f4xx_hal_crc.h"
00302 #endif /* HAL_CRC_MODULE_ENABLED */
00303
00304 #ifndef HAL_CRYPT_MODULE_ENABLED
00305     #include "stm32f4xx_hal_crypt.h"
00306 #endif /* HAL_CRYPT_MODULE_ENABLED */
00307
00308 #ifndef HAL_DMA2D_MODULE_ENABLED
00309     #include "stm32f4xx_hal_dma2d.h"
00310 #endif /* HAL_DMA2D_MODULE_ENABLED */
00311
00312 #ifndef HAL_DAC_MODULE_ENABLED
00313     #include "stm32f4xx_hal_dac.h"
00314 #endif /* HAL_DAC_MODULE_ENABLED */
00315
00316 #ifndef HAL_DCMI_MODULE_ENABLED
00317     #include "stm32f4xx_hal_dcmi.h"
00318 #endif /* HAL_DCMI_MODULE_ENABLED */
00319
00320 #ifndef HAL_ETH_MODULE_ENABLED
00321     #include "stm32f4xx_hal_eth.h"
00322 #endif /* HAL_ETH_MODULE_ENABLED */
00323
00324 #ifndef HAL_FLASH_MODULE_ENABLED
00325     #include "stm32f4xx_hal_flash.h"
00326 #endif /* HAL_FLASH_MODULE_ENABLED */
00327
00328 #ifndef HAL_SRAM_MODULE_ENABLED
00329     #include "stm32f4xx_hal_sram.h"
00330 #endif /* HAL_SRAM_MODULE_ENABLED */
00331
00332 #ifndef HAL_NOR_MODULE_ENABLED
00333     #include "stm32f4xx_hal_nor.h"
00334 #endif /* HAL_NOR_MODULE_ENABLED */
00335
00336 #ifndef HAL_NAND_MODULE_ENABLED
00337     #include "stm32f4xx_hal_nand.h"
00338 #endif /* HAL_NAND_MODULE_ENABLED */
00339
00340 #ifndef HAL_PCCARD_MODULE_ENABLED
00341     #include "stm32f4xx_hal_pccard.h"
00342 #endif /* HAL_PCCARD_MODULE_ENABLED */
00343
00344 #ifndef HAL_SDRAM_MODULE_ENABLED
00345 #endif /* HAL_SDRAM_MODULE_ENABLED */
```

```
00348 #include "stm32f4xx_hal_sdram.h"
00349 #endif /* HAL_SDRAM_MODULE_ENABLED */
00350
00351 #ifdef HAL_HASH_MODULE_ENABLED
00352 #include "stm32f4xx_hal_hash.h"
00353 #endif /* HAL_HASH_MODULE_ENABLED */
00354
00355 #ifdef HAL_I2C_MODULE_ENABLED
00356 #include "stm32f4xx_hal_i2c.h"
00357 #endif /* HAL_I2C_MODULE_ENABLED */
00358
00359 #ifdef HAL_SMBUS_MODULE_ENABLED
00360 #include "stm32f4xx_hal_smbus.h"
00361 #endif /* HAL_SMBUS_MODULE_ENABLED */
00362
00363 #ifdef HAL_I2S_MODULE_ENABLED
00364 #include "stm32f4xx_hal_i2s.h"
00365 #endif /* HAL_I2S_MODULE_ENABLED */
00366
00367 #ifdef HAL_IWDG_MODULE_ENABLED
00368 #include "stm32f4xx_hal_iwdg.h"
00369 #endif /* HAL_IWDG_MODULE_ENABLED */
00370
00371 #ifdef HAL_LTDC_MODULE_ENABLED
00372 #include "stm32f4xx_hal_ltdc.h"
00373 #endif /* HAL_LTDC_MODULE_ENABLED */
00374
00375 #ifdef HAL_PWR_MODULE_ENABLED
00376 #include "stm32f4xx_hal_pwr.h"
00377 #endif /* HAL_PWR_MODULE_ENABLED */
00378
00379 #ifdef HAL_RNG_MODULE_ENABLED
00380 #include "stm32f4xx_hal_rng.h"
00381 #endif /* HAL_RNG_MODULE_ENABLED */
00382
00383 #ifdef HAL_RTC_MODULE_ENABLED
00384 #include "stm32f4xx_hal_rtc.h"
00385 #endif /* HAL_RTC_MODULE_ENABLED */
00386
00387 #ifdef HAL_SAI_MODULE_ENABLED
00388 #include "stm32f4xx_hal_sai.h"
00389 #endif /* HAL_SAI_MODULE_ENABLED */
00390
00391 #ifdef HAL_SD_MODULE_ENABLED
00392 #include "stm32f4xx_hal_sd.h"
00393 #endif /* HAL_SD_MODULE_ENABLED */
00394
00395 #ifdef HAL_SPI_MODULE_ENABLED
00396 #include "stm32f4xx_hal_spi.h"
00397 #endif /* HAL_SPI_MODULE_ENABLED */
00398
00399 #ifdef HAL_TIM_MODULE_ENABLED
00400 #include "stm32f4xx_hal_tim.h"
00401 #endif /* HAL_TIM_MODULE_ENABLED */
00402
00403 #ifdef HAL_UART_MODULE_ENABLED
00404 #include "stm32f4xx_hal_uart.h"
00405 #endif /* HAL_UART_MODULE_ENABLED */
00406
00407 #ifdef HAL_USART_MODULE_ENABLED
00408 #include "stm32f4xx_hal_usart.h"
00409 #endif /* HAL_USART_MODULE_ENABLED */
00410
00411 #ifdef HAL_IRDA_MODULE_ENABLED
00412 #include "stm32f4xx_hal_irda.h"
00413 #endif /* HAL_IRDA_MODULE_ENABLED */
00414
00415 #ifdef HAL_SMARTCARD_MODULE_ENABLED
00416 #include "stm32f4xx_hal_smartcard.h"
00417 #endif /* HAL_SMARTCARD_MODULE_ENABLED */
00418
00419 #ifdef HAL_WWDG_MODULE_ENABLED
00420 #include "stm32f4xx_hal_wwdg.h"
00421 #endif /* HAL_WWDG_MODULE_ENABLED */
00422
00423 #ifdef HAL_PCD_MODULE_ENABLED
00424 #include "stm32f4xx_hal_pcd.h"
00425 #endif /* HAL_PCD_MODULE_ENABLED */
00426
00427 #ifdef HAL_HCD_MODULE_ENABLED
00428 #include "stm32f4xx_hal_hcd.h"
00429 #endif /* HAL_HCD_MODULE_ENABLED */
00430
00431 #ifdef HAL_DSI_MODULE_ENABLED
00432 #include "stm32f4xx_hal_dsi.h"
00433 #endif /* HAL_DSI_MODULE_ENABLED */
00434
```

```

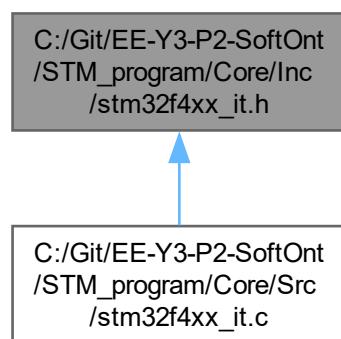
00435 #ifdef HAL_QSPI_MODULE_ENABLED
00436   #include "stm32f4xx_hal_qspi.h"
00437 #endif /* HAL_QSPI_MODULE_ENABLED */
00438
00439 #ifdef HAL_CEC_MODULE_ENABLED
00440   #include "stm32f4xx_hal_cec.h"
00441 #endif /* HAL_CEC_MODULE_ENABLED */
00442
00443 #ifdef HAL_FMPI2C_MODULE_ENABLED
00444   #include "stm32f4xx_hal_fmpi2c.h"
00445 #endif /* HAL_FMPI2C_MODULE_ENABLED */
00446
00447 #ifdef HAL_SPDIFRX_MODULE_ENABLED
00448   #include "stm32f4xx_hal_spdifrx.h"
00449 #endif /* HAL_SPDIFRX_MODULE_ENABLED */
00450
00451 #ifdef HAL_DFSDM_MODULE_ENABLED
00452   #include "stm32f4xx_hal_dfsm.h"
00453 #endif /* HAL_DFSDM_MODULE_ENABLED */
00454
00455 #ifdef HAL_LPTIM_MODULE_ENABLED
00456   #include "stm32f4xx_hal_lptim.h"
00457 #endif /* HAL_LPTIM_MODULE_ENABLED */
00458
00459 #ifdef HAL_MMC_MODULE_ENABLED
00460   #include "stm32f4xx_hal_mmc.h"
00461 #endif /* HAL_MMC_MODULE_ENABLED */
00462
00463 /* Exported macro -----*/
00464 #ifdef USE_FULL_ASSERT
00465   #define assert_param(expr) ((void)0U : assert_failed((uint8_t *)__FILE__, __LINE__))
00466 /* Exported functions -----*/
00467   void assert_failed(uint8_t* file, uint32_t line);
00468 #else
00469   #define assert_param(expr) ((void)0U)
00470 #endif /* USE_FULL_ASSERT */
00471
00472 #ifdef __cplusplus
00473 }
00474 #endif
00475
00476 #endif /* __STM32F4xx_HAL_CONF_H */
00477
00478 /***** (C) COPYRIGHT STMicroelectronics *****END OF FILE****/

```

## 6.11 C:/Git/EE-Y3-P2-SoftOnt/STM\_program/Core/Inc/stm32f4xx\_it.h File Reference

This file contains the headers of the interrupt handlers.

This graph shows which files directly or indirectly include this file:



## Functions

- void **NMI\_Handler** (void)  
*This function handles Non maskable interrupt.*
- void **HardFault\_Handler** (void)  
*This function handles Hard fault interrupt.*
- void **MemManage\_Handler** (void)  
*This function handles Memory management fault.*
- void **BusFault\_Handler** (void)  
*This function handles Pre-fetch fault, memory access fault.*
- void **UsageFault\_Handler** (void)  
*This function handles Undefined instruction or illegal state.*
- void **SVC\_Handler** (void)  
*This function handles System service call via SWI instruction.*
- void **DebugMon\_Handler** (void)  
*This function handles Debug monitor.*
- void **PendSV\_Handler** (void)  
*This function handles Pendable request for system service.*
- void **SysTick\_Handler** (void)  
*This function handles System tick timer.*
- void **TIM2\_IRQHandler** (void)  
*This function handles TIM2 global interrupt.*
- void **USART2\_IRQHandler** (void)  
*This function handles USART2 global interrupt.*
- void **DMA2\_Stream5\_IRQHandler** (void)  
*This function handles DMA2 stream5 global interrupt.*

### 6.11.1 Detailed Description

This file contains the headers of the interrupt handlers.

#### Attention

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## 6.12 stm32f4xx\_it.h

[Go to the documentation of this file.](#)

```

00001 /* USER CODE BEGIN Header */
00019 /* USER CODE END Header */
00020
00021 /* Define to prevent recursive inclusion -----*/
00022 #ifndef __STM32F4XX_IT_H
00023 #define __STM32F4XX_IT_H
00024
00025 #ifdef __cplusplus
00026 extern "C" {
00027 #endif
00028
00029 /* Private includes -----*/
00030 /* USER CODE BEGIN Includes */
00031
00032 /* USER CODE END Includes */
00033
00034 /* Exported types -----*/
00035 /* USER CODE BEGIN ET */
00036
00037 /* USER CODE END ET */
00038
00039 /* Exported constants -----*/
00040 /* USER CODE BEGIN EC */
00041
00042 /* USER CODE END EC */
00043
00044 /* Exported macro -----*/
00045 /* USER CODE BEGIN EM */
00046
00047 /* USER CODE END EM */
00048
00049 /* Exported functions prototypes -----*/
00050 void NMI_Handler(void);
00051 void HardFault_Handler(void);
00052 void MemManage_Handler(void);
00053 void BusFault_Handler(void);
00054 void UsageFault_Handler(void);
00055 void SVC_Handler(void);
00056 void DebugMon_Handler(void);
00057 void PendSV_Handler(void);
00058 void SysTick_Handler(void);
00059 void TIM2_IRQHandler(void);
00060 void USART2_IRQHandler(void);
00061 void DMA2_Stream5_IRQHandler(void);
00062 /* USER CODE BEGIN EFP */
00063
00064 /* USER CODE END EFP */
00065
00066 #ifdef __cplusplus
00067 }
00068 #endif
00069
00070 #endif /* __STM32F4XX_IT_H */
00071
00072 **** (C) COPYRIGHT STMicroelectronics *****END OF FILE****/

```

## 6.13 tim.h

```

00001
00019 /* Define to prevent recursive inclusion -----*/
00020 #ifndef __tim_H
00021 #define __tim_H
00022 #ifdef __cplusplus
00023 extern "C" {
00024 #endif
00025
00026 /* Includes -----*/
00027 #include "main.h"
00028
00029 /* USER CODE BEGIN Includes */
00030
00031 /* USER CODE END Includes */
00032
00033 extern TIM_HandleTypeDef htim1;
00034 extern TIM_HandleTypeDef htim2;
00035
00036 /* USER CODE BEGIN Private defines */

```

```

00037
00038 /* USER CODE END Private defines */
00039
00040 void MX_TIM1_Init(void);
00041 void MX_TIM2_Init(void);
00042
00043 void HAL_TIM_MspPostInit(TIM_HandleTypeDef *htim);
00044
00045 /* USER CODE BEGIN Prototypes */
00046
00047 /* USER CODE END Prototypes */
00048
00049 #ifdef __cplusplus
00050 }
00051 #endif
00052 #endif /*__ tim_H */
00053
00054
00055
00056
00057
00058
00059
00060
00061
00062 /***** (C) COPYRIGHT STMicroelectronics *****END OF FILE****/

```

## 6.14 usart.h

```

00001
00019 /* Define to prevent recursive inclusion -----*/
00020 #ifndef __uart_H
00021 #define __uart_H
00022 #ifdef __cplusplus
00023 extern "C" {
00024 #endif
00025
00026 /* Includes -----*/
00027 #include "main.h"
00028
00029 /* USER CODE BEGIN Includes */
00030
00031 /* USER CODE END Includes */
00032
00033 extern UART_HandleTypeDef huart2;
00034
00035 /* USER CODE BEGIN Private defines */
00036
00037 /* USER CODE END Private defines */
00038
00039 void MX_USART2_UART_Init(void);
00040
00041 /* USER CODE BEGIN Prototypes */
00042
00043 /* USER CODE END Prototypes */
00044
00045 #ifdef __cplusplus
00046 }
00047 #endif
00048 #endif /*__ usart_H */
00049
00050
00051
00052
00053
00054
00055
00056
00057
00058 /***** (C) COPYRIGHT STMicroelectronics *****END OF FILE****/

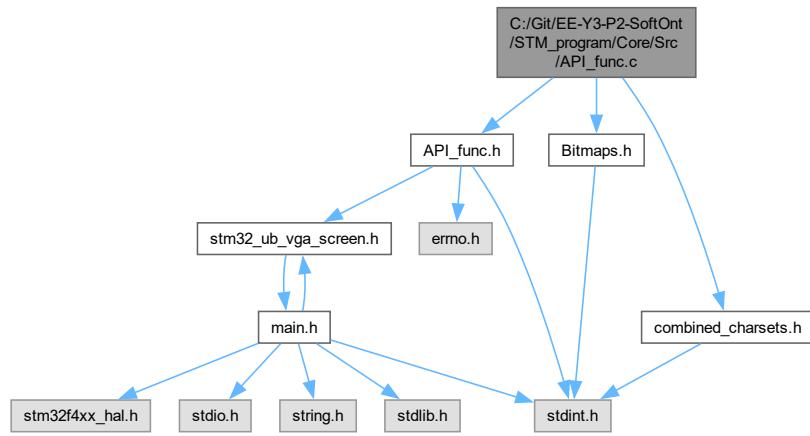
```

## 6.15 C:/Git/EE-Y3-P2-SoftOnt/STM\_program/Core/Src/API\_func.c File Reference

: API functies om scherm aan te sturen via ub\_lib.

```
#include <API_func.h>
#include <Bitmaps.h>
```

```
#include <combined_Charsets.h>
Include dependency graph for API_func.c:
```



## Functions

- int [API\\_draw\\_text](#) (int x\_lup, int y\_lup, int color, char \*text, char \*fontname, int fontsize, int fontstyle, int text\_length)
- int [API\\_draw\\_line](#) (int x\_1, int y\_1, int x\_2, int y\_2, int color, int weight, int reserved)
- int [API\\_draw\\_rectangle](#) (int x, int y, int width, int height, int color, int filled, int reserved, int reserved\_2)
- int [API\\_draw\\_bitmap](#) (int x\_lup, int y\_lup, int bm\_nr)
- int [API\\_clearscreen](#) (int color)
- int [API\\_wait](#) (int msecs)
- int [API\\_repeat\\_commands](#) (int nr\_previous\_commands, int iterations, int reserved)
- int [API\\_draw\\_circle](#) (int x, int y, int radius, int color, int reserved)
- int [API\\_draw\\_figure](#) (int x\_1, int y\_1, int x\_2, int y\_2, int x\_3, int y\_3, int x\_4, int y\_4, int x\_5, int y\_5, int color, int reserved)

### 6.15.1 Detailed Description

: API functies om scherm aan te sturen via ub.lib.

### 6.15.2 Function Documentation

#### 6.15.2.1 API\_clearscreen()

```
int API_clearscreen (
    int color)
```

Maakt het scherm vrij en vult het met de opgegeven kleur.

**Parameters**

<i>color</i>	Kleurcode die gebruikt wordt om het volledige scherm mee te vullen.
--------------	---------------------------------------------------------------------

**Returns**

Statuscode (0 = succes, anders fout).

**6.15.2.2 API\_draw\_bitmap()**

```
int API_draw_bitmap (
    int x_lup,
    int y_lup,
    int bm_nr)
```

Tekent een eerder geladen bitmap (resource) met gegeven nummer op de opgegeven linkerbovenhoek-coördinaten.

**Parameters**

<i>x_lup</i>	X-coordinaat van de linkerbovenhoek waar de bitmap geplaatst wordt.
<i>y_lup</i>	Y-coordinaat van de linkerbovenhoek waar de bitmap geplaatst wordt.
<i>bm_nr</i>	Bitmapnummer/ID dat verwijst naar een geladen bitmapresource.

**Returns**

Statuscode (0 = succes, anders fout).

**6.15.2.3 API\_draw\_circle()**

```
int API_draw_circle (
    int x,
    int y,
    int radius,
    int color,
    int reserved)
```

Tekent een cirkel met middelpunt en straal in de opgegeven kleur.

**Parameters**

<i>x</i>	X-coordinaat van het middelpunt.
<i>y</i>	Y-coordinaat van het middelpunt.
<i>radius</i>	Straal van de cirkel in pixels.
<i>color</i>	Kleurcode voor de cirkel (rand of vulling afhankelijk van implementatie).

<i>reserved</i>	Gereserveerd voor toekomstig gebruik; momenteel genegeerd.
-----------------	------------------------------------------------------------

**Returns**

Statuscode (0 = succes, anders fout).

**6.15.2.4 API\_draw\_figure()**

```
int API_draw_figure (
    int x_1,
    int y_1,
    int x_2,
    int y_2,
    int x_3,
    int y_3,
    int x_4,
    int y_4,
    int x_5,
    int y_5,
    int color,
    int reserved)
```

Tekent een figuur gedefinieerd door maximaal vijf punten (veelhoek/figuur) met de opgegeven kleur.

**Parameters**

<i>x_1</i>	X-coordinaat van het eerste punt.
<i>y_1</i>	Y-coordinaat van het eerste punt.
<i>x_2</i>	X-coordinaat van het tweede punt.
<i>y_2</i>	Y-coordinaat van het tweede punt.
<i>x_3</i>	X-coordinaat van het derde punt.
<i>y_3</i>	Y-coordinaat van het derde punt.
<i>x_4</i>	X-coordinaat van het vierde punt.
<i>y_4</i>	Y-coordinaat van het vierde punt.
<i>x_5</i>	X-coordinaat van het vijfde punt.
<i>y_5</i>	Y-coordinaat van het vijfde punt.
<i>color</i>	Kleurcode voor de figuur (rand of vulling afhankelijk van implementatie).
<i>reserved</i>	Gereserveerd voor toekomstig gebruik; momenteel genegeerd.

Opmerking: punten kunnen in volgorde worden verbonden; implementatie kan bepalen of de figuur automatisch gesloten en/of gevuld wordt.

**Returns**

Statuscode (0 = succes, anders fout).

**6.15.2.5 API\_draw\_line()**

```
int API_draw_line (
    int x_1,
    int y_1,
    int x_2,
    int y_2,
    int color,
    int weight,
    int reserved)
```

Tekent een rechte lijn tussen twee punten met aangegeven kleur en lijngewicht.

**Parameters**

<i>x_1</i>	X-coordinaat van het eerste eindpunt.
<i>y_1</i>	Y-coordinaat van het eerste eindpunt.
<i>x_2</i>	X-coordinaat van het tweede eindpunt.
<i>y_2</i>	Y-coordinaat van het tweede eindpunt.
<i>color</i>	Kleurcode voor de lijn.
<i>weight</i>	Dikte van de lijn (in pixels of units afhankelijk van implementatie).
<i>reserved</i>	Gereserveerd voor toekomstig gebruik; momenteel genegeerd.

**Returns**

Statuscode (0 = succes, anders fout).

**6.15.2.6 API\_draw\_rectangle()**

```
int API_draw_rectangle (
    int x,
    int y,
    int width,
    int height,
    int color,
    int filled,
    int reserved,
    int reserved_2)
```

Tekent een rechthoek op de gegeven positie met breedte, hoogte en kleur. Kan gevuld of slechts omtrek zijn.

**Parameters**

<i>x</i>	X-coordinaat van de linkerbovenhoek van de rechthoek.
<i>y</i>	Y-coordinaat van de linkerbovenhoek van de rechthoek.
<i>width</i>	Breedte van de rechthoek in pixels.
<i>height</i>	Hoogte van de rechthoek in pixels.
<i>color</i>	Kleurcode voor de rechthoek (vulling of rand afhankelijk van 'filled').
<i>filled</i>	Indien niet-nul: teken een gevulde rechthoek; indien nul: teken alleen de rand.
<i>reserved</i>	Gereserveerd voor toekomstig gebruik; momenteel genegeerd.
<i>reserved</i> <sub>2</sub>	Extra gereserveerd parameter voor toekomstig gebruik; momenteel genegeerd.

**Returns**

Statuscode (0 = succes, anders fout).

**6.15.2.7 API\_draw\_text()**

```
int API_draw_text (
    int x_lup,
    int y_lup,
    int color,
    char * text,
    char * fontname,
    int fontsize,
    int fontstyle,
    int reserved)
```

Tekent input string op opgegeven linkerbovenhoek-coordinaten met een gegeven kleur, font en stijl.

**Parameters**

<i>x_lup</i>	X-coordinaat van de linkerbovenhoek waar de tekst begint.
<i>y_lup</i>	Y-coordinaat van de linkerbovenhoek waar de tekst begint.
<i>color</i>	Kleurcode die gebruikt wordt om de tekst te tekenen.
<i>text</i>	Pointer naar de NUL-terminerende tekenreeks die getekend moet worden.
<i>fontname</i>	Naam van het lettertype dat gebruikt moet worden (bijv. "Arial").
<i>fontsize</i>	Grootte van het lettertype in punten of pixels (implementatieafhankelijk).
<i>fontstyle</i>	Stijlflags voor het lettertype (bijv. vet, cursief; implementatieafhankelijk).
<i>reserved</i>	Gereserveerd voor toekomstig gebruik; momenteel genegeerd.

**Returns**

Statuscode (0 = succes, anders fout).

### 6.15.2.8 API\_repeat\_commands()

```
int API_repeat_commands (
    int nr_previous_commands,
    int iterations,
    int reserved)
```

Herhaalt een reeks eerder uitgevoerde tekencommando's een aantal keren.

#### Parameters

<i>nr_previous_commands</i>	Aantal voorgaande commando's die herhaald moeten worden.
<i>iterations</i>	Hoe vaak de reeks herhaald moet worden.
<i>reserved</i>	Gereserveerd voor toekomstig gebruik; momenteel genegeerd.

#### Returns

Statuscode (0 = succes, anders fout).

### 6.15.2.9 API\_wait()

```
int API_wait (
    int msecs)
```

Pauzeert de uitvoering gedurende het opgegeven aantal milliseconden.

#### Parameters

<i>msecs</i>	Aantal milliseconden om te wachten/sleepen.
--------------	---------------------------------------------

#### Returns

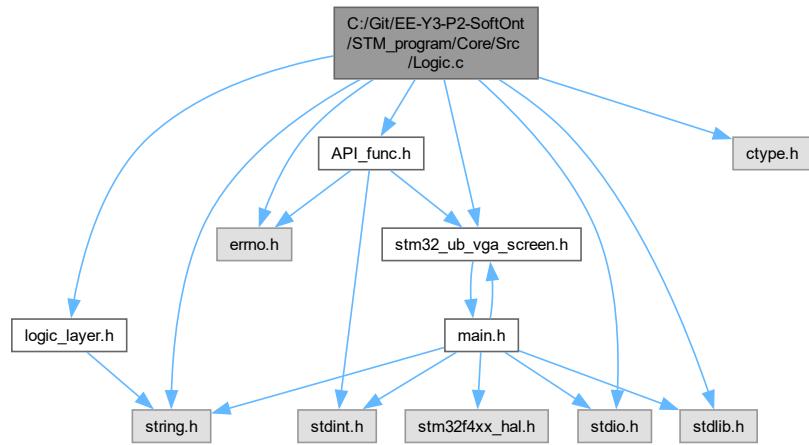
Statuscode (0 = succes, anders fout).

## 6.16 C:/Git/EE-Y3-P2-SoftOnt/STM\_program/Core/Src/Logic.c File Reference

: Logic layer implementatie om uart commando's te parsen en uit te voeren via API\_func.

```
#include "logic_layer.h"
#include "API_func.h"
#include "stm32_ub_vga_screen.h"
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <ctype.h>
```

```
#include <errno.h>
Include dependency graph for Logic.c:
```



## Classes

- struct [ColorMap](#)
- struct [ParsedArgs](#)

## Macros

- #define **MAX\_ARGS** 12
- #define **MAX\_TOKEN\_LEN** 50
- #define **MAX\_LINE\_LEN** 256
- #define **FONT\_NORMAAL** 0
- #define **FONT\_VET** 1
- #define **FONT\_CURSIEF** 2
- #define **COLOR\_TABLE\_SIZE** (sizeof(COLOR\_TABLE) / sizeof([ColorMap](#)))

## Functions

- int [parse\\_color](#) (char \*color\_str)
- int [parse\\_font\\_style](#) (char \*style\_str)
- int [parse\\_script\\_line](#) (char \*line, struct [LogicInterface](#) \*cmd)
- int [execute\\_command](#) (struct [LogicInterface](#) \*cmd)

### 6.16.1 Detailed Description

: Logic layer implementatie om uart commando's te parsen en uit te voeren via API\_func.

## 6.16.2 Function Documentation

### 6.16.2.1 execute\_command()

```
int execute_command (
    struct LogicInterface * cmd)
```

Executeer een commando

#### Parameters

<i>cmd</i>	In parameter: het commando dat uitgevoerd moet worden
<i>parsed</i>	Geparste argumenten
<i>result</i>	Uit parameter: de return waarde van de API functie

#### Returns

0 bij succes, errno waarde bij fout

### 6.16.2.2 parse\_color()

```
int parse_color (
    char * color_str)
```

Converteer kleurnaam naar kleurcode

#### Parameters

<i>color_str</i>	Kleurnaam als string
------------------	----------------------

#### Returns

Kleurcode of VGA\_COL\_BLACK als niet gevonden

### 6.16.2.3 parse\_font\_style()

```
int parse_font_style (
    char * style_str)
```

Converteer font style naam naar code

#### Parameters

<i>style_str</i>	Font style naam als string
------------------	----------------------------

#### Returns

Font style code of FONT\_NORMAAL als niet gevonden

#### 6.16.2.4 parse\_script\_line()

```
int parse_script_line (
    char * line,
    struct LogicInterface * cmd)
```

Parse een script regel naar [LogicInterface](#) struct

##### Parameters

<i>line</i>	In parameter: de regel die geanalyseerd wordt
<i>cmd</i>	Out parameter: de struct met de geanalyseerde commando's

##### Returns

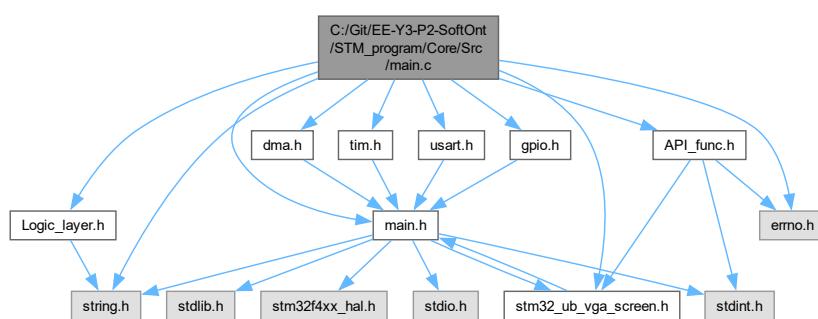
0 bij succes, errno waarde bij fout

## 6.17 C:/Git/EE-Y3-P2-SoftOnt/STM\_program/Core/Src/main.c File Reference

: Main program body

```
#include "main.h"
#include "dma.h"
#include "tim.h"
#include "uart.h"
#include "gpio.h"
#include "Logic_layer.h"
#include "API_func.h"
#include "stm32_ub_vga_screen.h"
#include <string.h>
#include <errno.h>
```

Include dependency graph for main.c:



##### Macros

- #define **USART\_PRINTF** int fputc(int ch, FILE \*f)

## Functions

- void **SystemClock\_Config** (void)  
*System Clock Configuration.*
- int **main** (void)  
*The application entry point.*
- uint16\_t **UART\_ReadStringEcho** (UART\_HandleTypeDefDef \*huart, char \*buffer, uint16\_t maxLen)  
*Reads a string from UART and sends it back.*
- void **Error\_Handler** (void)  
*This function is executed in case of error occurrence.*

## Variables

- uint8\_t **rx**
- UART\_HandleTypeDefDef **huart2**
- **input\_vars** **input**
- volatile char **container** [1024]
- volatile int **temp**
- volatile int **key**
- uint8\_t **rxChar**
- char **uartBuffer** [128]
- uint16\_t **uartIndex** = 0
- **USART\_PRINTF**
- return **ch**

### 6.17.1 Detailed Description

: Main program body

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## 6.17.2 Function Documentation

### 6.17.2.1 Error\_Handler()

```
void Error_Handler (
    void )
```

This function is executed in case of error occurrence.

#### Return values

None	
------	--

### 6.17.2.2 main()

```
int main (
    void )
```

The application entry point.

#### Return values

int	
-----	--

### 6.17.2.3 SystemClock\_Config()

```
void SystemClock_Config (
    void )
```

System Clock Configuration.

#### Return values

None	
------	--

Configure the main internal regulator output voltage

Initializes the RCC Oscillators according to the specified parameters in the RCC\_OscInitTypeDef structure.

Initializes the CPU, AHB and APB buses clocks

#### 6.17.2.4 **UART\_ReadStringEcho()**

```
uint16_t UART_ReadStringEcho (
    UART_HandleTypeDef * huart,
    char * buffer,
    uint16_t maxLen)
```

Reads a string from UART and sends it back.

##### Parameters

<i>huart</i>	UART handle
<i>buffer</i>	Pointer to buffer to store received string
<i>maxLen</i>	Maximum length of string to receive

##### Return values

<i>Number</i>	of characters received
---------------	------------------------

### 6.17.3 Variable Documentation

#### 6.17.3.1 **huart2**

```
UART_HandleTypeDef huart2 [extern]
```

File Name : USART.c Description : This file provides code for the configuration of the USART instances.

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#### 6.17.3.2 **USART\_PRINTF**

```
USART_PRINTF
```

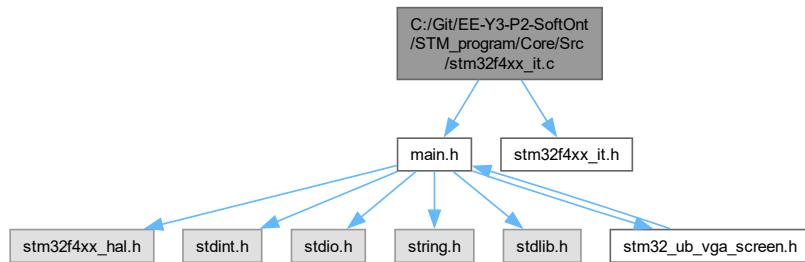
##### Initial value:

```
{
    HAL_UART_Transmit(&huart2, (uint8_t *)&ch, 1, 0xFFFF)
```

## 6.18 C:/Git/EE-Y3-P2-SoftOnt/STM\_program/Core/Src/stm32f4xx\_it.c File Reference

Interrupt Service Routines.

```
#include "main.h"
#include "stm32f4xx_it.h"
Include dependency graph for stm32f4xx_it.c:
```



### Functions

- void **NMI\_Handler** (void)
 

*This function handles Non maskable interrupt.*
- void **HardFault\_Handler** (void)
 

*This function handles Hard fault interrupt.*
- void **MemManage\_Handler** (void)
 

*This function handles Memory management fault.*
- void **BusFault\_Handler** (void)
 

*This function handles Pre-fetch fault, memory access fault.*
- void **UsageFault\_Handler** (void)
 

*This function handles Undefined instruction or illegal state.*
- void **SVC\_Handler** (void)
 

*This function handles System service call via SWI instruction.*
- void **DebugMon\_Handler** (void)
 

*This function handles Debug monitor.*
- void **PendSV\_Handler** (void)
 

*This function handles Pendable request for system service.*
- void **SysTick\_Handler** (void)
 

*This function handles System tick timer.*
- void **TIM2\_IRQHandler** (void)
 

*This function handles TIM2 global interrupt.*
- void **USART2\_IRQHandler** (void)
 

*This function handles USART2 global interrupt.*
- void **DMA2\_Stream5\_IRQHandler** (void)
 

*This function handles DMA2 stream5 global interrupt.*

## Variables

- DMA\_HandleTypeDef **hdma\_tim1\_up**
- TIM\_HandleTypeDef **htim2**
- UART\_HandleTypeDef **huart2**
- TIM\_HandleTypeDef **htim1**

### 6.18.1 Detailed Description

Interrupt Service Routines.

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### 6.18.2 Variable Documentation

#### 6.18.2.1 htim1

TIM\_HandleTypeDef htim1 [extern]

File Name : TIM.c Description : This file provides code for the configuration of the TIM instances.

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### 6.18.2.2 huart2

```
UART_HandleTypeDef huart2 [extern]
```

File Name : USART.c Description : This file provides code for the configuration of the USART instances.

#### Attention

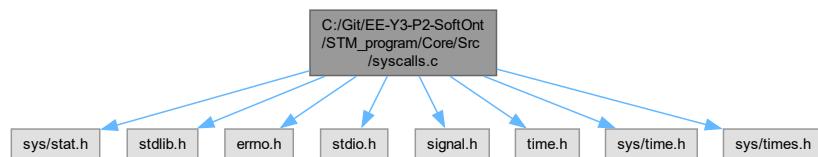
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## 6.19 C:/Git/EE-Y3-P2-SoftOnt/STM\_program/Core/Src/syscalls.c File Reference

STM32CubeIDE Minimal System calls file.

```
#include <sys/stat.h>
#include <stdlib.h>
#include <errno.h>
#include <stdio.h>
#include <signal.h>
#include <time.h>
#include <sys/time.h>
#include <sys/times.h>
Include dependency graph for syscalls.c:
```



## Functions

- int **\_io\_putchar** (int ch) \_\_attribute\_\_((weak))
- int **\_io\_getchar** (void)
- void **initialise\_monitor\_handles** ()
- int **\_getpid** (void)
- int **\_kill** (int pid, int sig)
- void **\_exit** (int status)
- \_\_attribute\_\_ ((weak))
- int **\_close** (int file)
- int **\_fstat** (int file, struct stat \*st)
- int **\_isatty** (int file)
- int **\_lseek** (int file, int ptr, int dir)
- int **\_open** (char \*path, int flags,...)
- int **\_wait** (int \*status)
- int **\_unlink** (char \*name)
- int **\_times** (struct tms \*buf)
- int **\_stat** (char \*file, struct stat \*st)
- int **\_link** (char \*old, char \*new)
- int **\_fork** (void)
- int **\_execve** (char \*name, char \*\*argv, char \*\*env)

## Variables

- int **errno**
- char \*\* **environ** = \_\_env

### 6.19.1 Detailed Description

STM32CubeIDE Minimal System calls file.

#### Author

Auto-generated by STM32CubeIDE

For more information about which c-functions  
need which of these lowlevel functions  
please consult the Newlib libc-manual

#### Attention

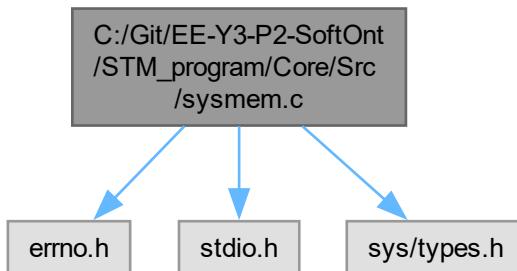
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## 6.20 C:/Git/EE-Y3-P2-SoftOnt/STM\_program/Core/Src/sysmem.c File Reference

STM32CubeIDE Minimal System Memory calls file.

```
#include <errno.h>
#include <stdio.h>
#include <sys/types.h>
Include dependency graph for sysmem.c:
```



### Functions

- register char \*stack\_ptr **asm** ("sp")
- caddr\_t **\_sbrk** (int incr)

### Variables

- int **errno**

#### 6.20.1 Detailed Description

STM32CubeIDE Minimal System Memory calls file.

### Author

Auto-generated by STM32CubeIDE

For more information about which c-functions  
need which of these lowlevel functions  
please consult the Newlib libc-manual

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## 6.20.2 Function Documentation

### 6.20.2.1 \_sbrk()

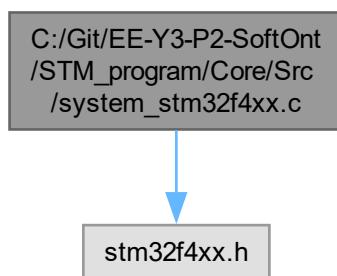
```
caddr_t _sbrk (
    int incr)
```

\_sbrk Increase program data space. Malloc and related functions depend on this

## 6.21 C:/Git/EE-Y3-P2-SoftOnt/STM\_program/Core/Src/system\_ $\leftarrow$ stm32f4xx.c File Reference

CMSIS Cortex-M4 Device Peripheral Access Layer System Source File.

```
#include "stm32f4xx.h"
Include dependency graph for system_stm32f4xx.c:
```



### Macros

- #define HSE\_VALUE ((uint32\_t)25000000)
- #define HSI\_VALUE ((uint32\_t)16000000)
- #define VECT\_TAB\_OFFSET 0x00

## Functions

- void **SystemInit** (void)  
*Setup the microcontroller system Initialize the FPU setting, vector table location and External memory configuration.*
- void **SystemCoreClockUpdate** (void)  
*Update SystemCoreClock variable according to Clock Register Values. The SystemCoreClock variable contains the core clock (HCLK), it can be used by the user application to setup the SysTick timer or configure other parameters.*

## Variables

- uint32\_t **SystemCoreClock** = 16000000
- const uint8\_t **AHBPrescTable** [16] = {0, 0, 0, 0, 0, 0, 0, 0, 1, 2, 3, 4, 6, 7, 8, 9}
- const uint8\_t **APBPrescTable** [8] = {0, 0, 0, 0, 1, 2, 3, 4}

### 6.21.1 Detailed Description

CMSIS Cortex-M4 Device Peripheral Access Layer System Source File.

#### Author

MCD Application Team

This file provides two functions and one global variable to be called from user application:

- **SystemInit()**: This function is called at startup just after reset and before branch to main program. This call is made inside the "startup\_stm32f4xx.s" file.
- SystemCoreClock variable: Contains the core clock (HCLK), it can be used by the user application to setup the SysTick timer or configure other parameters.
- **SystemCoreClockUpdate()**: Updates the variable SystemCoreClock and must be called whenever the core clock is changed during program execution.

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## 6.22 stm32\_ub\_vga\_screen.h

```

00001 //-----
00002 // File      : stm32_ub_vga_screen.h
00003 //-----
00004
00005 //-----
00006 #ifndef __STM32F4_UB_VGA_SCREEN_H
00007 #define __STM32F4_UB_VGA_SCREEN_H
00008
00009
00010 //-----
00011 // Includes
00012 //-----
00013 #include "main.h"
00014
00015
00016
00017 //-----
00018 // color designation
00019 // 8bit color (R3G3B2)
00020 // Red   (3bit) -> Bit7-Bit5
00021 // Green (3bit) -> Bit4-Bit2
00022 // Blue   (2bit) -> Bit1-Bit0
00023 //-----
00024 #define VGA_COL_BLACK      0b00000000
00025 #define VGA_COL_BLUE       0b00000011
00026 #define VGA_COL_LIGHTBLUE  0b00011111
00027 #define VGA_COL_GREEN      0b00011100
00028 #define VGA_COL_LIGHTGREEN 0b01111100
00029 #define VGA_COL_CYAN       0b00011011
00030 #define VGA_COL_LIGHTCYAN  0b00011111
00031 #define VGA_COL_RED        0b11100000
00032 #define VGA_COL_LIGHTRED   0b11101010
00033 #define VGA_COL_MAGENTA    0b11101110
00034 #define VGA_COL_LIGHTMAGENTA 0b11100011
00035 #define VGA_COL_BROWN      0b01101000
00036 #define VGA_COL_YELLOW    0b11111100
00037 #define VGA_COL_GRAY       0b10010010
00038 #define VGA_COL_WHITE     0b11111111
00039
00040
00041
00042 //-----
00043 // define the VGA_display
00044 //-----
00045 #define VGA_DISPLAY_X    320
00046 #define VGA_DISPLAY_Y    240
00047
00048
00049
00050 //-----
00051 // VGA Structure
00052 //-----
00053 typedef struct {
00054     uint16_t hsync_cnt;    // counter
00055     uint32_t start_addr;  // start_adres
00056     uint32_t dma2_cr_reg; // Register constant CR-Register
00057 }VGA_t;
00058 extern VGA_t VGA;
00059
00060
00061
00062 //-----
00063 // Display RAM
00064 //-----
00065 extern uint8_t VGA_RAM1[(VGA_DISPLAY_X+1)*VGA_DISPLAY_Y];
00066
00067
00068
00069 //-----
00070 // Timer-1
00071 // Function = Pixelclock (Speed for DMA Transfer)
00072 //
00073 // basefreq = 2*APB2 (APB2=84MHz) => TIM_CLK=168MHz
00074 // Frq      = 168MHz/1/12 = 14MHz
00075 //
00076 //-----
00077 #define VGA_TIM1_PERIODE    11
00078 #define VGA_TIM1_PRESCALE   0
00079
00080
00081
00082 //-----
00083 // Timer-2
00084 // Function = CH4 : HSync-Signal on PB11

```

```
00085 //          CH3 : Trigger point for DMA start
00086 //
00087 //  basefreq = 2*APB1 (APB1=48MHz) => TIM_CLK=84MHz
00088 //  Frq      = 84MHz/1/2668 = 31,48kHz => T = 31,76us
00089 //  1TIC     = 11,90ns
00090 //
00091 //-----
00092 #define  VGA_TIM2_HSYNC_PERIODE    2667
00093 #define  VGA_TIM2_HSYNC_PRESCALE    0
00094
00095 #define  VGA_TIM2_HSYNC_IMP        320 // HSync-length (3,81us)
00096 #define  VGA_TIM2_HTRIGGER_START   480 // HSync+BackPorch (5,71us)
00097 #define  VGA_TIM2_DMA_DELAY       37  // ease the delay when DMA START (Optimization = none)
00098 // #define  VGA_TIM2_DMA_DELAY      30  // ease the delay when DMA START (Optimization = -O1)
00099
00100
00101 //-----
00102 // VSync-Signal
00103 //  Trigger   = Timer2 Update (f=31,48kHz => T = 31,76us)
00104 //  1TIC     = 31,76us
00105 //-----
00106 #define  VGA_VSYNC_PERIODE       525
00107 #define  VGA_VSYNC_IMP           2
00108 #define  VGA_VSYNC_BILD_START    36
00109 #define  VGA_VSYNC_BILD_STOP     514 // (16,38ms)
00110
00111
00112 //-----
00113 // Adress from PORTE (Reg ODR) callback DMA
00114 // (see Page 53+204 of the Manual)
00115 //
00116 // Data-Bit0 => PE8
00117 // Data-Bit7 => PE15
00118 //-----
00119 #define VGA_GPIOE_BASE_ADR    ((uint32_t)0x40021000) // ADR from Port-E
00120 #define VGA_GPIO_ODR_OFFSET   ((uint32_t)0x00000014) // ADR from Register ODR
00121 #define VGA_GPIO_BYTE_OFFSET  ((uint32_t)0x00000001) // Data for 8bit
00122 #define VGA_GPIOE_ODR_ADDRESS (VGA_GPIOE_BASE_ADR | VGA_GPIO_ODR_OFFSET | VGA_GPIO_BYTE_OFFSET)
00123
00124 //-----
00125 // Define for black on PE8 - PE15
00126 //
00127 #define VGA_GPIO_HINIBBLE   ((uint16_t)0xFF00) // GPIO_Pin_8 to GPIO_Pin_15
00128
00129 //-----
00130 // Global Function call
00131 //-----
00132 void UB_VGA_Screen_Init(void);
00133 void UB_VGA_FillScreen(uint8_t color);
00134 void UB_VGA_SetPixel(uint16_t xp, uint16_t yp, uint8_t color);
00135
00136 //-----
00137 #endif // __STM32F4_UB_VGA_SCREEN_H
```



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