mikroprojekt

# SmartFusion2 HMI-010 Kit

## USER'S GUIDE

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Rev. 1.0

# Table of contents

## Revision History

| Revision | Date | Author | Modification |
|---|---|---|---|
| **1.0** | 16.07.2015. | IP | Initial |

## Related Documents

| ID | Code | Description |
|---|---|---|
| | | |

# 1 Introduction

The SmartFusion2 HMI-010 Kit is an intelligent display module based on Microsemi's SmartFusion2 SoC which enables easy design and deployment of touch screen GUIs.

It is designed for use with Mikroprojekt's IQ Editor and already integrated Mikroprojekt's HMI solutions, guaranteeing a pre-validated and high reliability HMI module.

SF2 HMI is scalable and long-term available SoC that can easily be added to existing machines.

# 2 Board Features

| Category | Feature 1/2 |
|---|---|
| ***FPGA (65 nm Flash-FPGA)*** | Microsemi SmartFusion2 ***M2S010-FG(G)484***<br>• **12084** LUTs<br>• **233** I/O Pins<br>• **22** 18x18 Multipliers<br>• **21** LSRAM 18K Blocks<br>• **22** uSRAM1K Blocks<br>• **2x** PLLs, **2x** CCCs<br>**Microcontroller Subsystem**<br>• ARM ® CortexTM-M3 150 MHz with on-chip eSRAM and eNVM |
| ***Video Memory*** | • 256 MB DDR3, 16-bits @ 333MHz |
| ***Display*** | • 4.3" RGB TFT 480x272 resistive touch-screen |
| ***Communication Interfaces*** | • Micro USB2.0<br>• UART TTL<br>• RS232 (with hardware flow control)<br>• CAN<br>• SPI<br>• $I^2C$ Bus |
| ***Safety*** | • **1x** AES256, SHA256, RNG (each) |
| ***Nonvolatile storage*** | • **1x** Micro **S**ecure **D**igital Card slot<br>• **1x** SPI Flash |

| Category | Feature 2/2 |
|---|---|
| ***Expansion Ports*** | • **1x** External LED & Key<br>• **1x** GPIO (20 pins)<br>• ***1x** GPIO (Optional)* |
| ***Other Peripherals*** | • **1x** DIP Switch<br>• **4x** Push-buttons<br>• **4x** LEDs |
| ***Power Supply*** | • **5V** DC Input |
| ***Clocking*** | • **2x** Onboard 32 kHz Oscillator<br>• **1x** Onboard 50.000 MHz Oscillator |

## 2.1 Packaging and I/Os

| ***Type*** | | **M2S010-FG(G)484** |
|---|---|---|
| ***Pitch (mm)*** | | 1.0 |
| ***L x W (mm)*** | | 23x23 |
| ***Device*** | I/O | 233 |
| | Lanes | 4 |

There is no need to handle the GUI tasks, the client can immediately focus on critical design features.

Our SF2-HMI-010 can be used either as an Add-On solution to an existing main processor or a standalone, communicating easily with the embedded HMI through available interfaces.

When it comes to safety critical system, the HMI and safety critical application are separated and running on two different processors.

Alternatively the Cortex-M3 MCU can be used to run the application as well as the HMI, if the 150 MHz MCU offers sufficient resources to run both.

## 2.2 Block Schematic

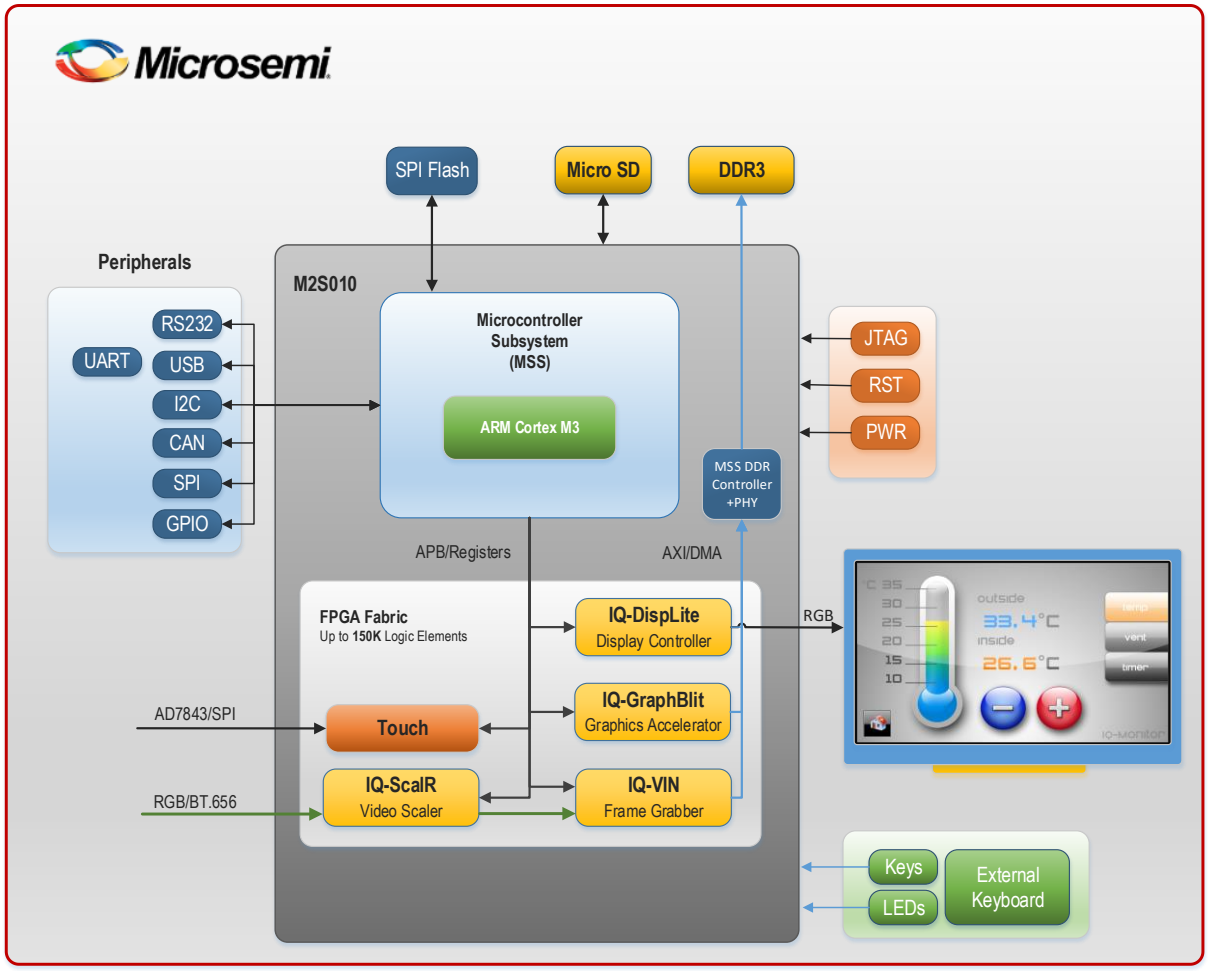



*Figure 1: SF2 HMI-010 Block Schema*

## 2.3 Board Layout

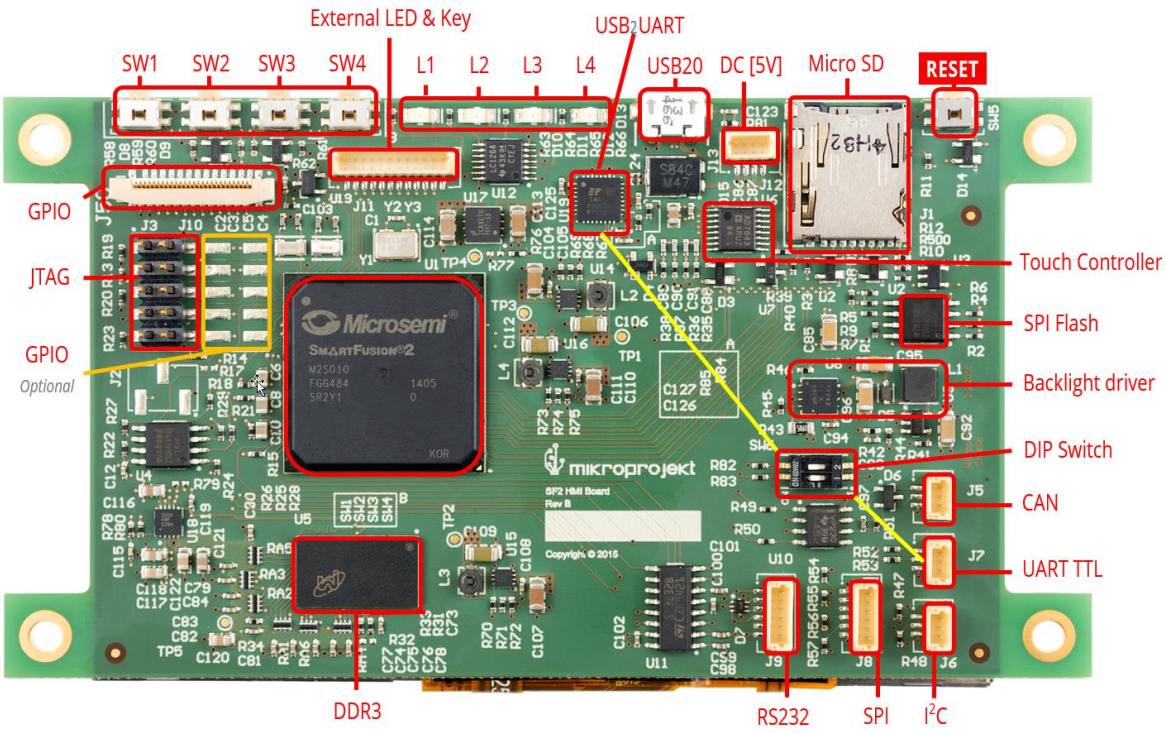



*Figure 2: SF2 HMI-010 Board Layout Annotated*

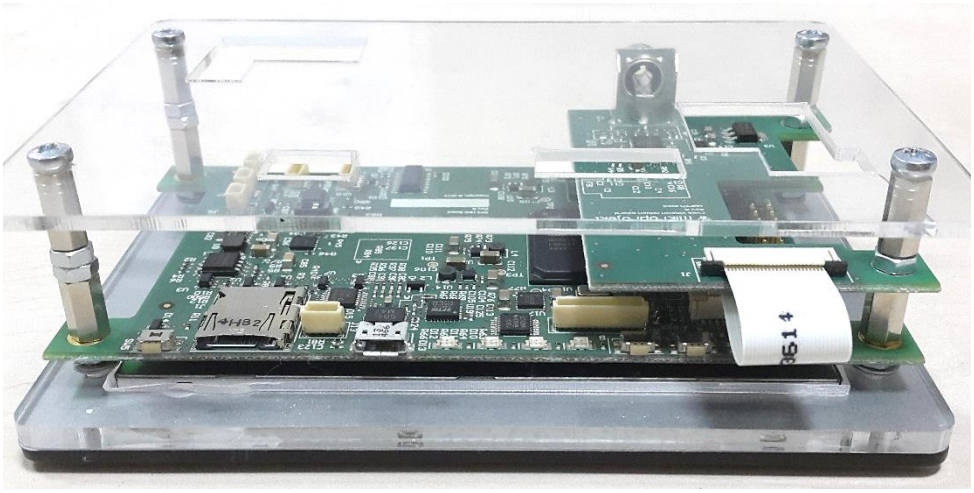


*Figure 3: SF2 HMI-010 Kit – Upper Side*

## 2.4 Powering Up the Board

The SmartFusion2 HMI-010 Kit is delivered with the HMI demo design in the SPI boot flash, and it will boot automatically after providing the power which can be any type of DC supply source, providing 5V DC.

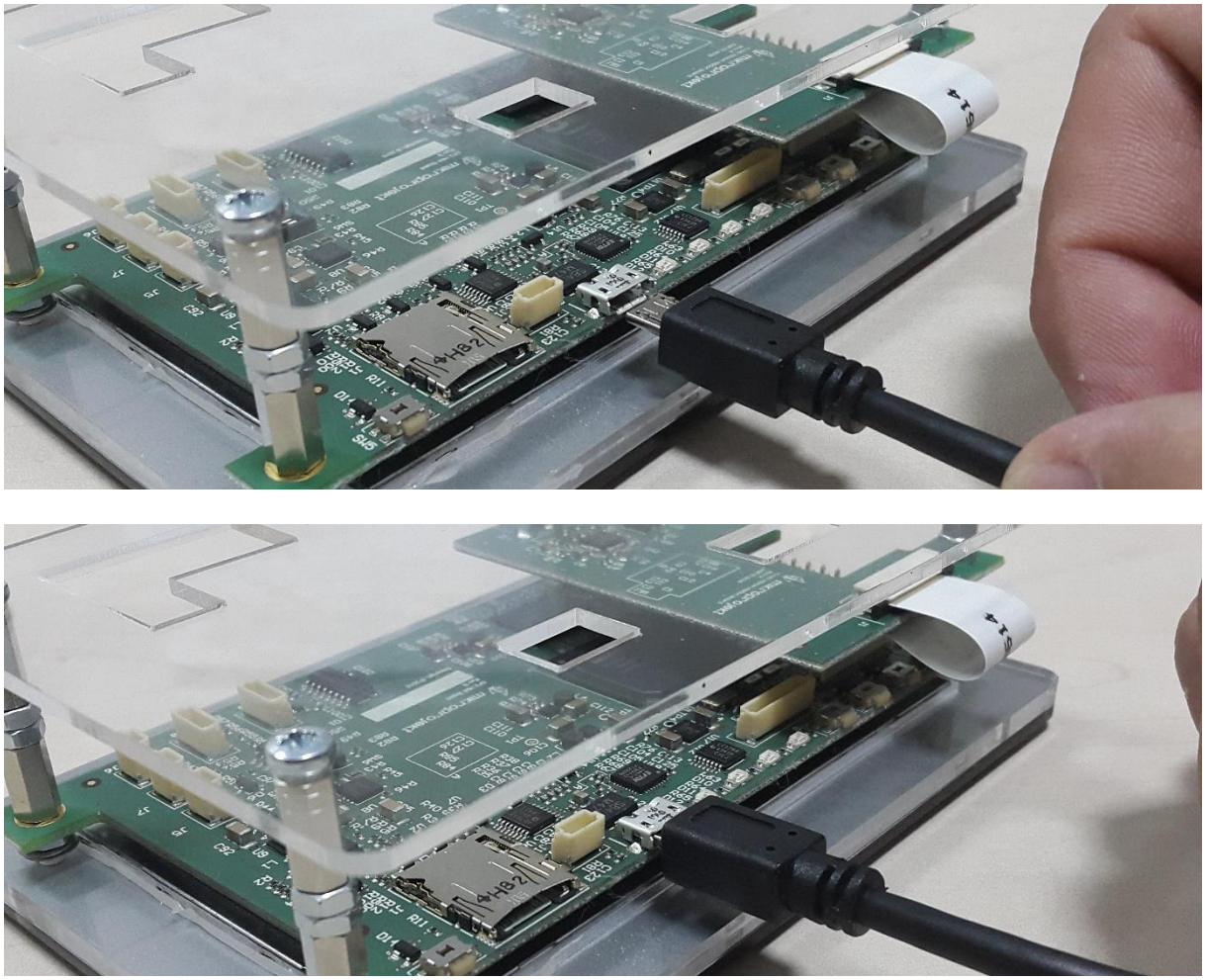


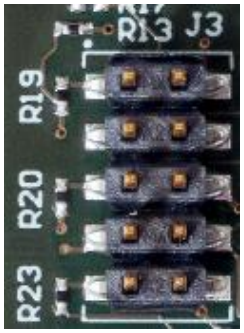
*Figure 4: Powering the Board*

# 2.5 Communications elements

## 2.5.1 JTAG

***SF2-M2S010-FG(G)484*** can be configured by ***ispVM*** download cable, connected to the JTAG header. FPGA is configured to boot from the SPI Flash after power-up.

| *JTAG header* | Conn pin | Function |
|---|---|---|
| *J3* | 1 | TCK |
| | 2 | GND |
| | 3 | TDO |
| | 4 | PROG_MODE |
| | 5 | TMS |
| | 6 | VJTAG |
| | 7 | $V_{PUMP}$ |
| | 8 | nTRST |
| | 9 | TDI |
| | 10 | GND |



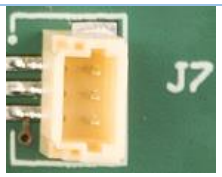

## 2.5.2 RS232

| *RS232* | Conn pin | Function |
|---|---|---|
| *J9* | 1 | TX |
| | 2 | CTS |
| | 3 | RX |
| | 4 | RTS |
| | 5 | |
| | 6 | GND |


## 2.5.3 SPI

| *SPI0* | Conn pin | Function |
|---|---|---|
| *J8* | 1 | GND |
| | 2 | SCLK |
| | 3 | SDI |
| | 4 | SDO |
| | 5 | CS0 |
| | 6 | GND |

## 2.5.4 UART

| *UART* | Conn pin | Function | |
|---|---|---|---|
| *J7* | 1 | RX |  |
| | 2 | TX | |
| | 3 | GND | |

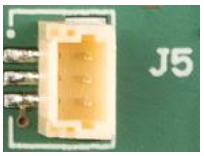


## 2.5.5 I²C

| *I²C* | Conn pin | Function | |
|---|---|---|---|
| *J6* | 1 | SCL |  |
| | 2 | SDA | |
| | 3 | GND | |

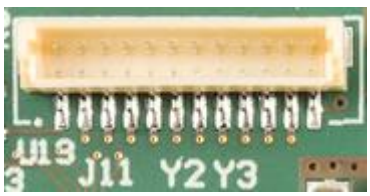


## 2.5.6 CAN

| *CAN* | Conn pin | Function | |
|---|---|---|---|
| *J5* | 1 | CANH |  |
| | 2 | CANL | |
| | 3 | GND | |



## 2.5.7 External Keys & LEDs

| *SPI0* | Conn pin | Function | |
|---|---|---|---|
| *J11* | 1 | RSTn |  |
| | 2 | KEY0 | |
| | 3 | KEY1 | |
| | 4 | KEY2 | |
| | 5 | KEY3 | |
| | 6 | GND | |
| | 7 | LED0 | |
| | 8 | LED1 | |
| | 9 | LED2 | |
| | 10 | LED3 | |
| | 11 | VCC_3V3 | |
| | 12 | GND | |

# 3 Configuring/Programming the Board

## 3.1 Prerequisites:

### 3.1.1 Hardware

- SmartFusion2 HMI-010 Kit
- Microsemi FlashPro4 - JTAG Programmator
- 2x USB 2.0 A to Mini B cable
- Computer with HDD: **500 MB**

### 3.1.2 Software

- **Windows 7** 64-bit and newer
- **FlashPro** Standalone from http://www.microsemi.com/products/fpga-soc/design-resources/programming/flashpro#software
- **Tera Term** (Terminal App**)** from http://logmett.com/index.php?/download/tera-term-487-freeware.html

## 3.2 FlashPro Tool

After installing and starting the FlashPro application, you should see the **FlashPro** Window like it is shown on the Figure 5. FlashPro is the tooll which enables programming of theFPGA fabric and the bootloader to the SPI Flash, and that is a mandatory prerequisite for transferring custom projects on kit

.

## 3.2.1 New Project

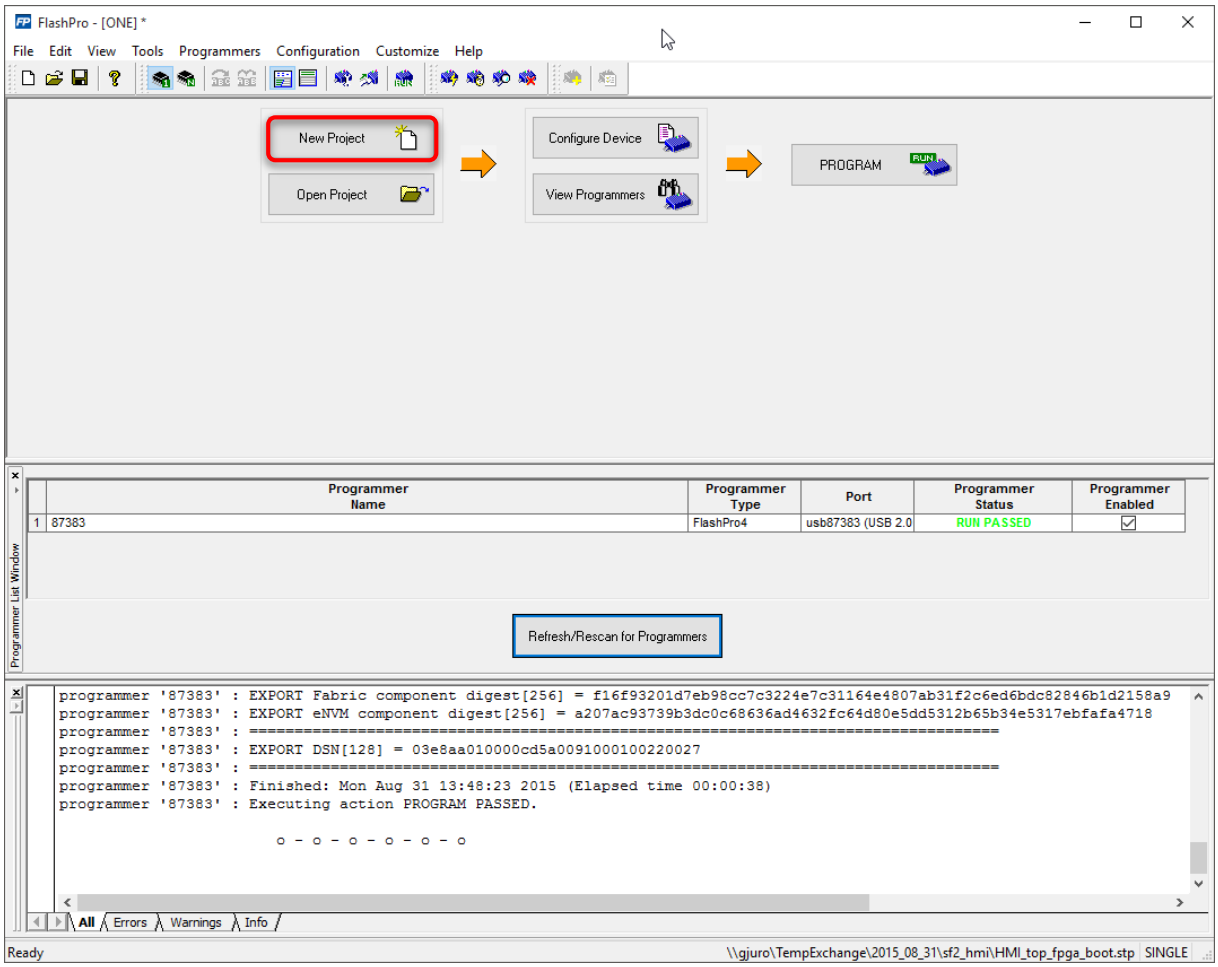



*Figure 5: FlashPro - Main Screen*

First, we need to create a new project, by clicking on the ***New Project*** button (Figure 5.). This will bring a new dialog window for our new project (Figure 6.).

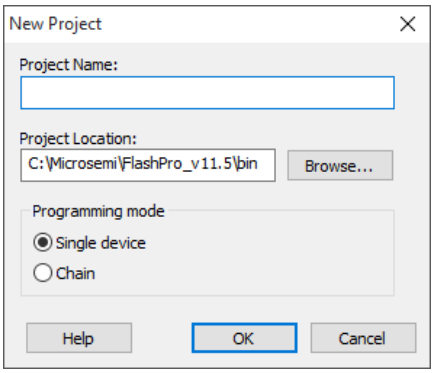



*Figure 6: Dialog box for "New Project"*

We need to write the name of our project, and we also have a possibility to change the project location here by clicking on "**Browse**" button, and also choose what programming mode we should use. At this time, we will just leave location and mode as they are already set.

## 3.2.2 Configuring Device

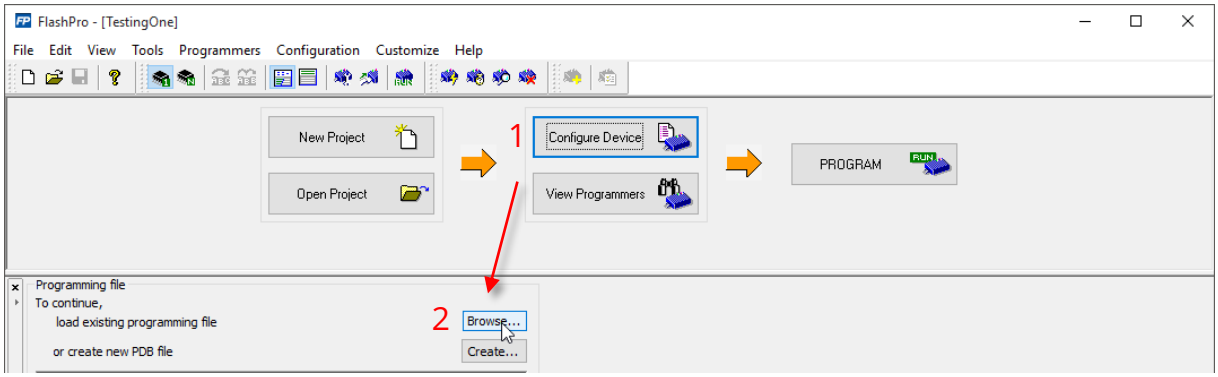



*Figure 7: Browse for programming file*

After creating a new project, we need to configure device. After pressing the button "**Configure Device**" (Figure 7. - 1) we should see the button "**Browse**" (Figure 7. - 2). After we clicked on it, we should see the "**Load Programming File**" dialog as is shown on Figure 8.. Now, we need to navigate and choose our ***.stp*** file. In our case, we have ***HMI_top_fpga_boot.stp*** which will load **FPGA Fabric** and the **Bootloader** for SF2 HMI-010 Kit.

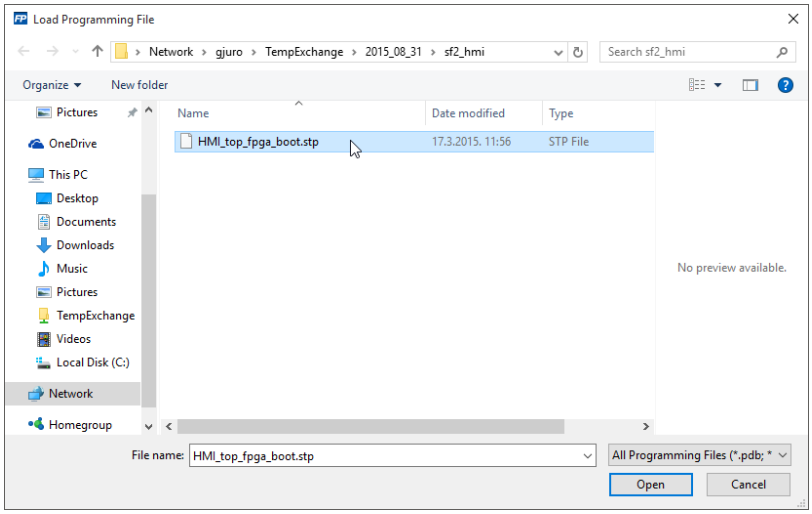



*Figure 8: Select & Open Programming File*

After picking the right ***.stp*** file, we should see a notification in the main screen, like is shown on Figure 9.

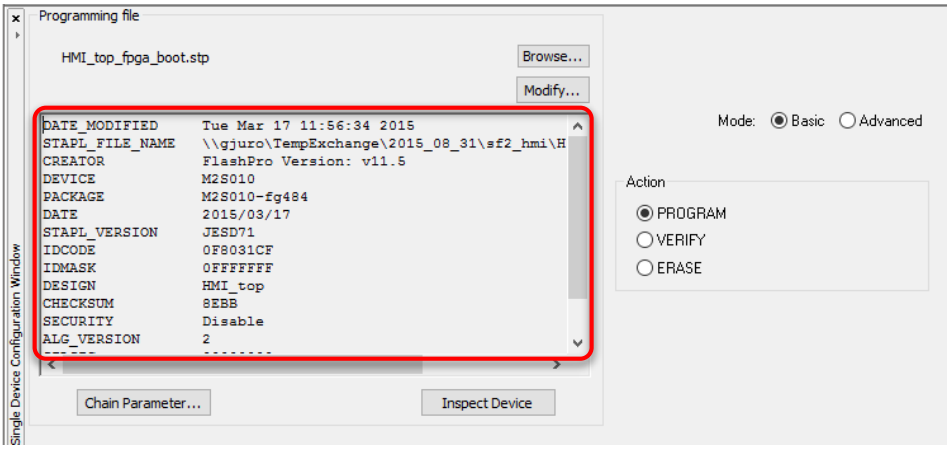



*Figure 9: The Programming File is loaded*

After the programming file is loaded we can proceed with programming, by clicking on the button **"PROGRAM"** (Figure 10.).

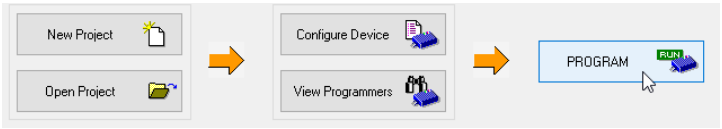



*Figure 10. Pressing the button "Program"*

When programming of device is done, we should see the report as is shown on Figure 11., which means it went well.

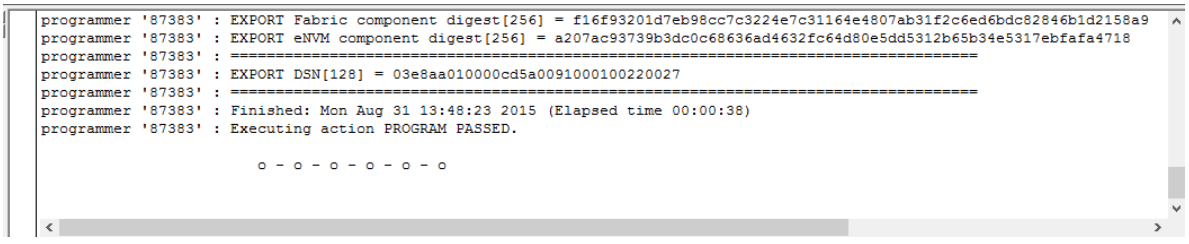



*Figure 11: Programming report*

It means that FPGA Fabric, as well as Bootloader both are set on the SF2 HMI-010.

## 3.3 Terminal Tool

After we install FPGA Fabric and Bootloader, we do not need ***FlashPro*** application for further actions. It is time to switch to terminal app and we suggest to use the ***Tera Term***, free software for this purpose.

When we start the application and plug in both USB cables into a PC, you should see a ***New Connection Screen***, as is shown in Figure 12.

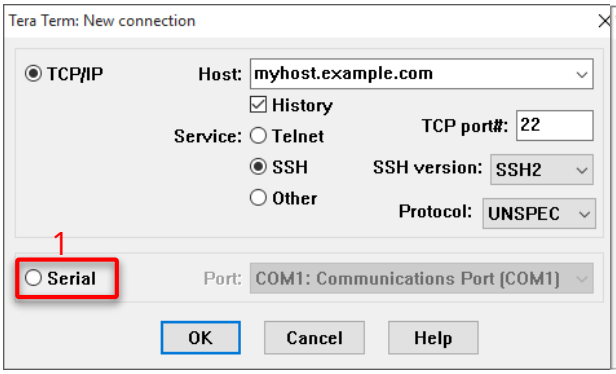



*Figure 12: Tera Term | Default Connection Dialog*

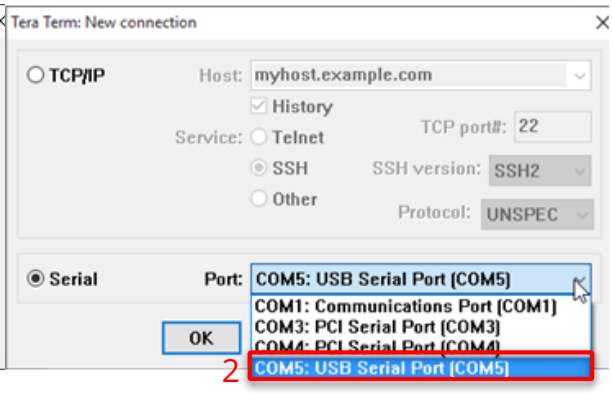



*Figure 13: Choose Serial Port to Connect*

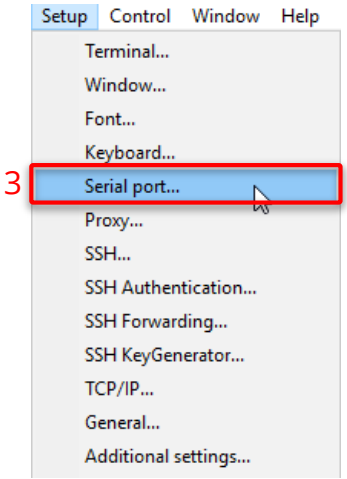



*Figure 14: Serial Port Setup*

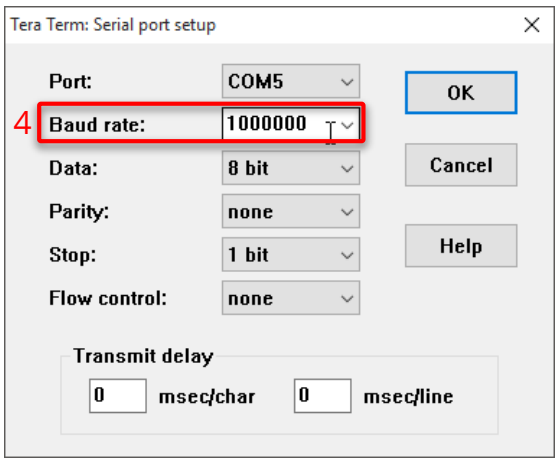



*Figure 15: I need a specific baud rate of 1000000 (million)*

If we use the USB 2.0 A to Mini B cable for connecting SF2 HMI-010 Kit to the PC, then we should connect our kit through the USB Serial Port (Figure 13). Also, we need to change the serial port's baud rate to **1000000** (1M).

***Setup > Serial Port... > Baud Rate*** (type 1000000), and confirm on "**OK**" button.

After pressing a reset button on **SF2 HMI-010 Kit**, we have about 3 seconds to initialize the bootloader with pressing some (any) key. If we did these steps right, we should see the IQ-Engine bootloader menu on the screen, like on Figure 16.

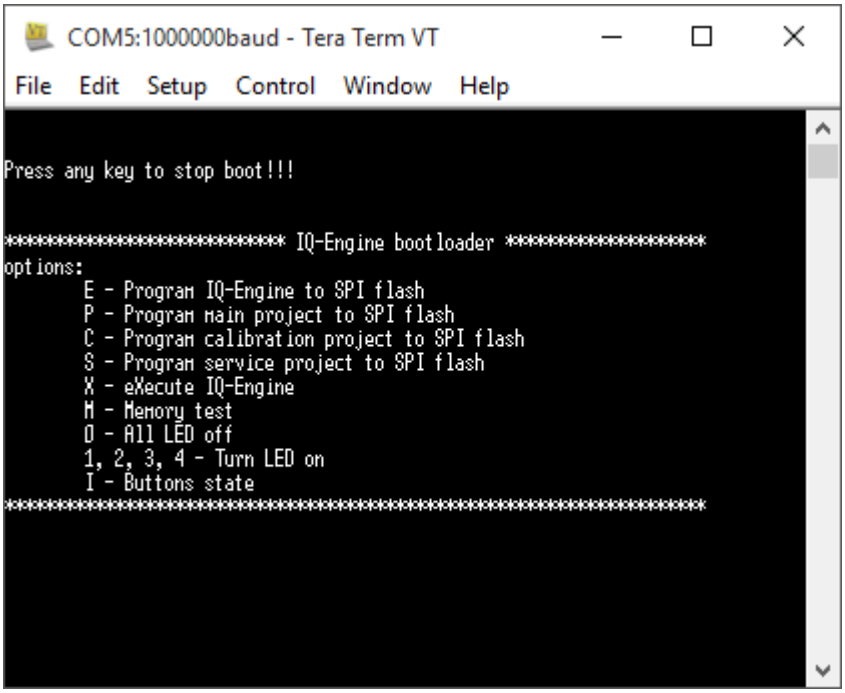



*Figure 16: IQ-Engine Bootloader*

IQ-Engine Bootloader menu

| | | | |
|---|---|---|---|
| **E** | Program | *IQ-Engine* | To SPI Flash |
| **P** | | *Main project* | |
| **C** | | *Calibration project* | |
| **S** | | *Service project* | |
| **X** | Execute IQ-Engine | | |
| **M** | Memory test | | |
| **0** | All **LED** Off | | |
| **1,2,3,4** | Turn **LED** On | | |
| **I** | Button state | | |

Now we are able to upload IQ-Engine to the SPI Flash, and then other projects as well.

### 3.3.1 IQ-Engine

In order to program the IQ-Engine to the SPI Flash, need to press "**E**" from the main bootloader menu, and then ***File > Transfer > XMODEM > Send...*** from the Tera Term menu (Figure 17).

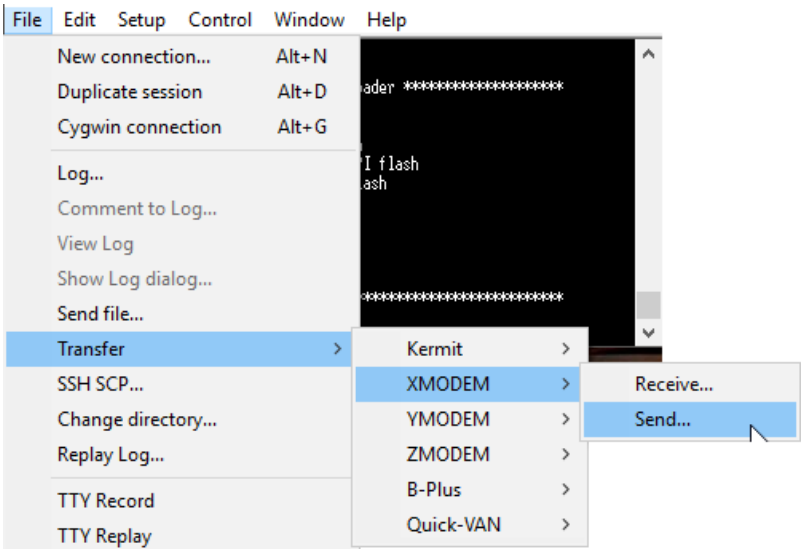



*Figure 17: Transferring to SPI Flash*

It will open a new dialog box, for choosing the **IQ-Engine** file

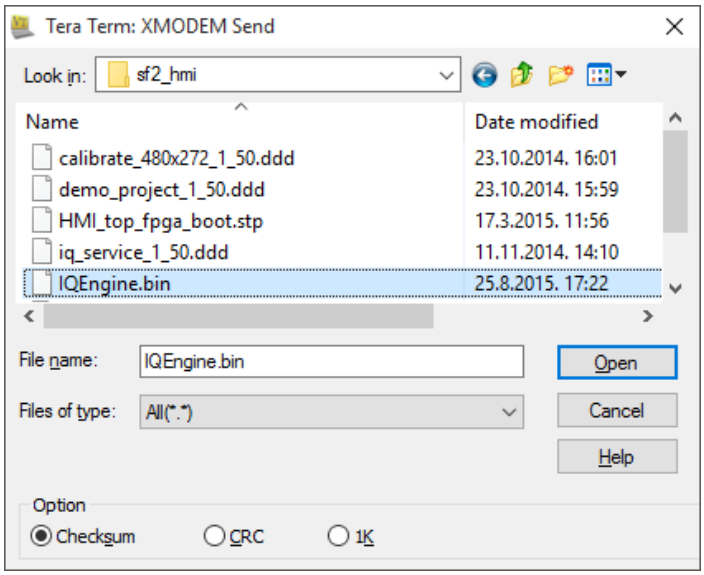



*Figure 18: IQ-Engine.bin file*

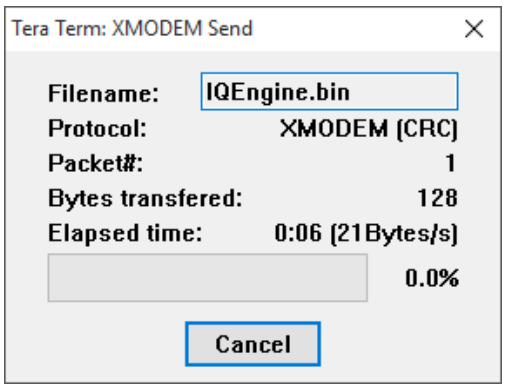



*Figure 19: Transferring the IQ-Engine*

After we installed the IQ-Engine, we could transfer the other projects as well.

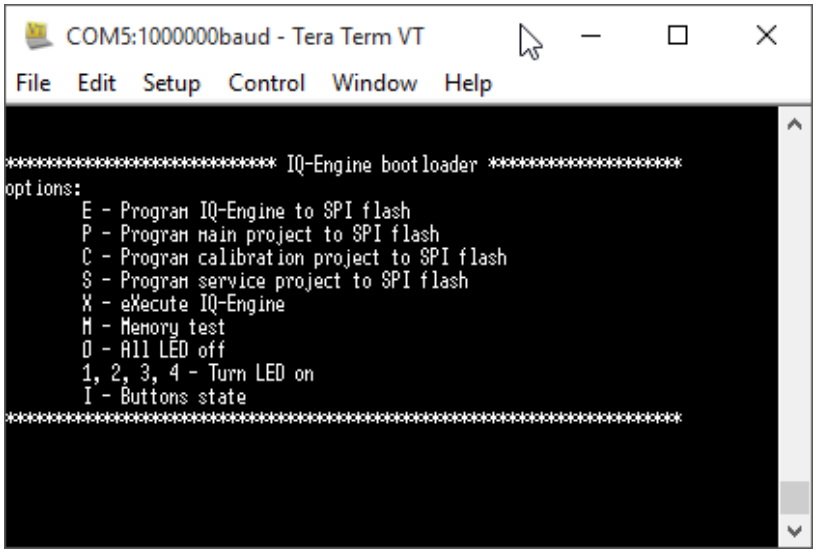



*Figure 20: Tera Term - Main Menu*

| **P – Program main project to SPI Flash** |
|---|
| *This option allow us to transfer one project file (.ddd) which will be the main one. It means, when we turn the **SF2 HMI-010 Kit** on, this project will be the first thing we will see.* |
| **C – Program calibration project to SPI Flash** |
| *This option is for transferring the calibration project, which will be initialized when we turn on the kit, along with pressing the touch screen. It allows us to calibrate the screen of the **SF2 HMI-010 Kit**.* |
| **S – Program service project to SPI Flash** |
| *The service project will server us as a system menu (usually). After we transfer it to the SPI Flash, we need to turn the kit on, together with pressing RST & SW1 keys on SF2 HMI-010 Kit.* |

# 4 System Menu


*Figure 21: Front side view*

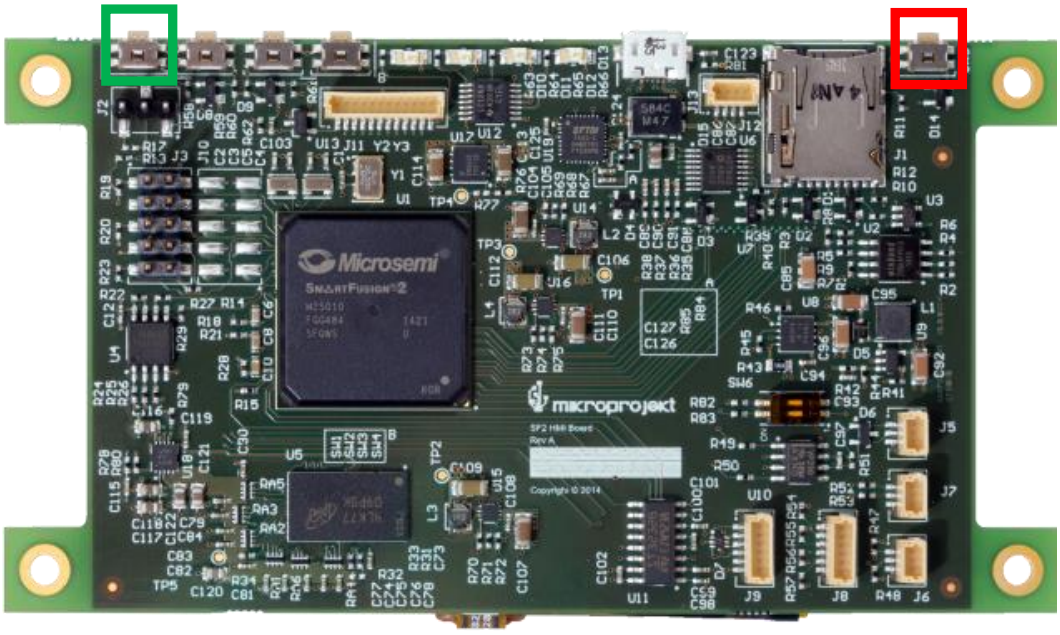


*Figure 22: Rear side view*

## 4.1 Step by step procedure

*Table 1: Step-by-step procedure*

| | | |
|---|---|---|
| | ▼ | 1. Press & hold the Reset microswitch **RST** (**red**) |
| ▼ | ▼ | 2. While you're holding the **RST** microswitch, press & hold **SW1** microswitch too (**green**) |
| ▼ | △ | 3. Release **RST** microswitch, while you're still holding **SW1** until the display is on. |
| △ | | 4. When the display is on and you can see the menu, relase **SW1** microswitch as well. |

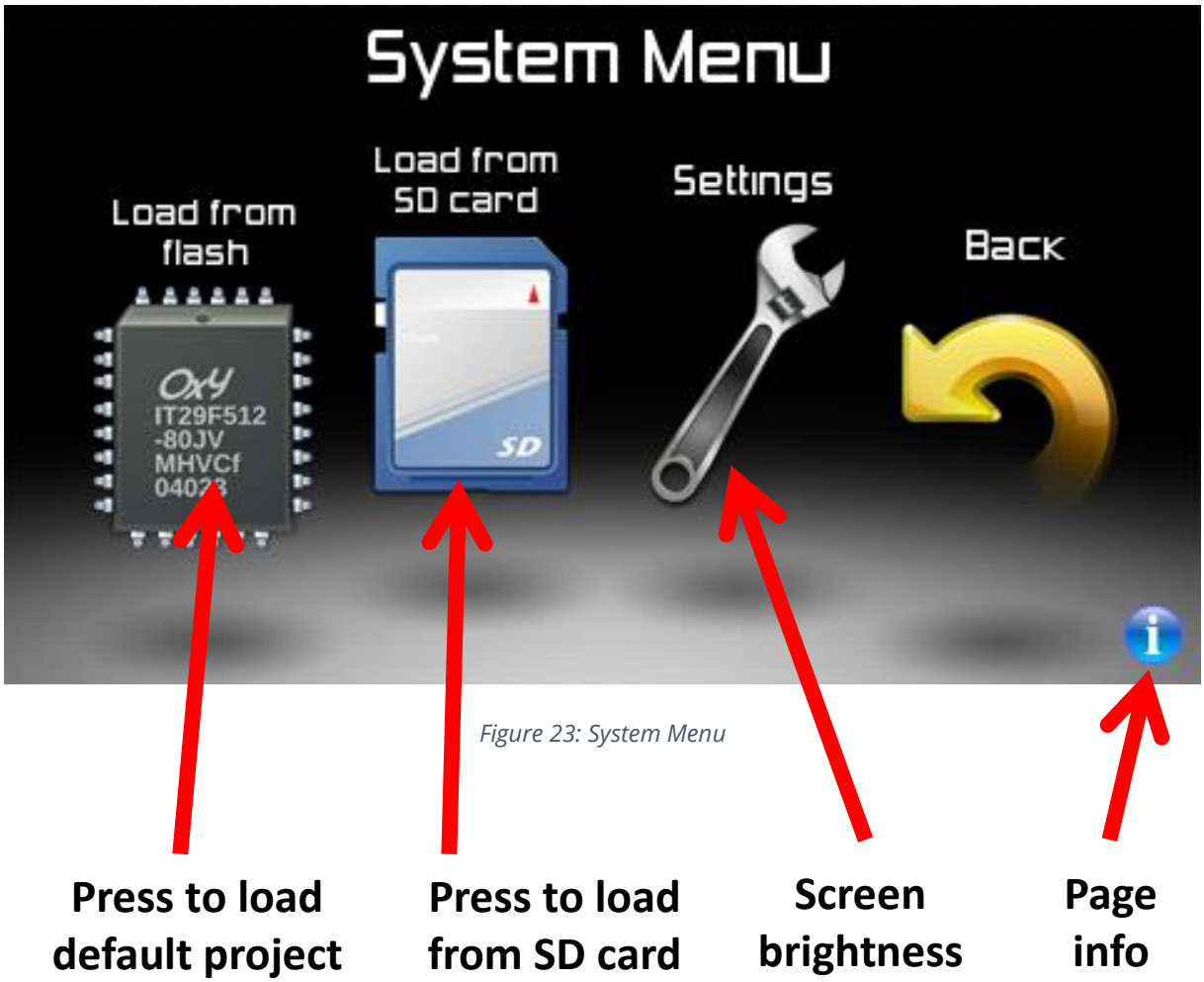



*Figure 23: System Menu*

# 5 References

[1.] http://www.microsemi.com/products/fpga-soc/soc-fpga/smartfusion2

# 6 Ordering Information

Please contact us via email **contact@mikroprojekt.hr** about item availability and ordering details.

# 7 Technical Support Assistance

Basic technical product support is free of charge and available via e-mail to all Mikroprojekt customers, whether they are evaluating or have purchased a Mikroprojekt product.

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- Instant Messaging Support
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