I A M ELECTRONIC
Instrumentation And Measurement Electronics

FMC FRU EEPROM Programmer

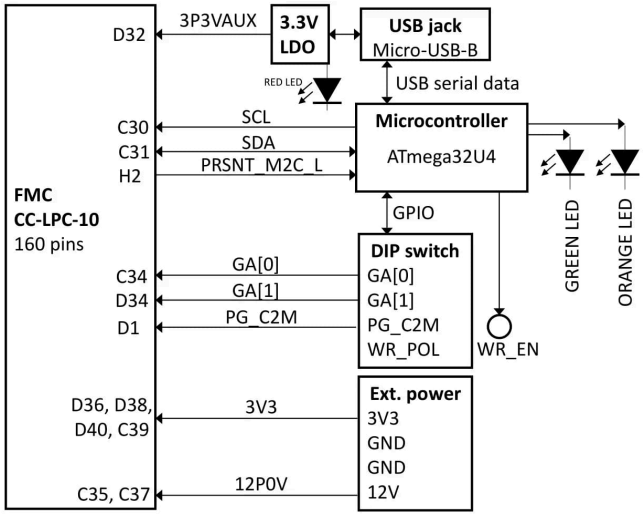
DS#T0009 REV 2020/03/20
PDF version | HTML version

FPGA Mezzanine Card (FMC) FRU EEPROM Programmer

Features

- Easy FMC FRU EEPROM programming and readout
- In-circuit configuration of FRU records
- Supports I2C EEPROMs with 1 byte and 2 byte addressing
- Fully open-source product
- USB serial port device
- USB powered 3P3VAUX voltage rail
- External power supply for 12 V and 3.3 V voltage rails
- Write enable/protection output
- Selectable GA[1:0] addressing pins
- Selectable PG_C2M flag
- AVR ISP programming header

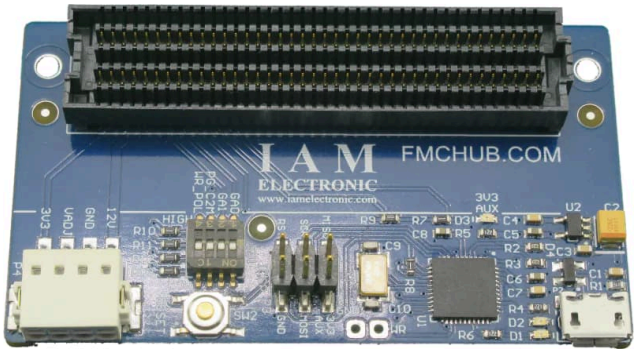
Block diagram



The photo below shows the top side of the FMC FRU EEPROM Programmer.

Applications

- Small batch FMC module programming
- Compliance and production tests
- Professional production of FMC boards
- Prototyping of FMC modules



FMC FRU EEPROM Programmer with FMC carrier card connector (CC-LPC-10) and peripherals for USB data interface and power supply.

1. Description

The **FMC FRU EEPROM Programmer** and the related toolchain is a powerful programming tool for FMC FRU (Field Replacable Unit) records. The programming adapter is designed for in-circuit configuration of ANSI/VITA 57.1 FPGA Mezzanine Cards (FMC) according to the IPMI Platform Management FRU Information Storage Definition. The board runs with open-source firmware and software for user-friendly configuration of I2C-compatible serial EEPROMs. Its microcontroller (Microchip ATmega32U4) translates a user command protocol

from the serial interface into corresponding I2C read/write accesses to any compatible EEPROM devices. A user application on the PC host simplifies file transfers to the EEPROM via a USB cable. By eliminating the need for customer-specific FPGA firmware to program an FMC module, the standalone programming adapter is suitable for reliable small-batch production and prototyping.

2. Application information

For easy programming of an FMC EEPROM, we recommend the use of our complete open-source toolchain consisting of FMC EEPROM programming hardware, User command protocol implemented in ATmega32U firmware, and command line tool for the PC. All parts of the FMC FRU programmer toolchain are freely available on GitHub.
By default, the microcontroller is programmed with the latest firmware revision on delivery!

2.1 FMC EEPROM Programming Hardware

Putting the hardware into operation is quite simple. Just plug a USB cable into the Micro-USB socket. The red LED lights up as soon as the USB power supply is present. The green and orange LEDs should also (briefly) show some activity (fig. 1).

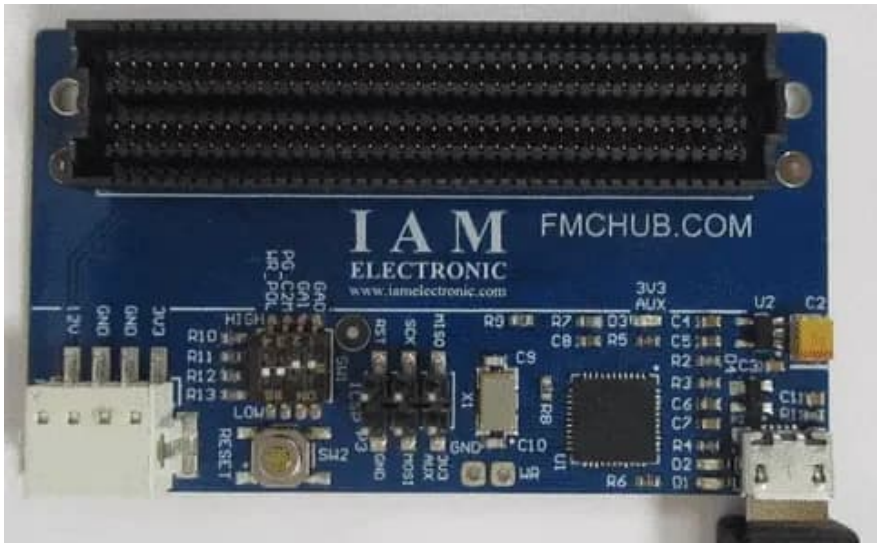


Fig. 1: Putting the FMC FRU EEPROM Programmer into operation. The red LED (D3) indicates the power-on state. The orange LED (D1) and green LED (D2) also show some activity.

An FMC module can be plugged into the programming adapter at any time. As long as a compatible module is plugged in (PRSNT_M2C_L is low), the green LED lights up permanently (fig. 2).



Fig. 2: The green LED (D2) lights up continuously when an ANSI/VITA 57.1 compliant FMC module is plugged in.

If there is the need to overwrite the firmware of the ATmega32U microcontroller, any AVR programmer with AVR ISP connector can be used. The connector must simply be plugged onto the 6-pin header (fig. 3). The signals are also marked on the carrier board.

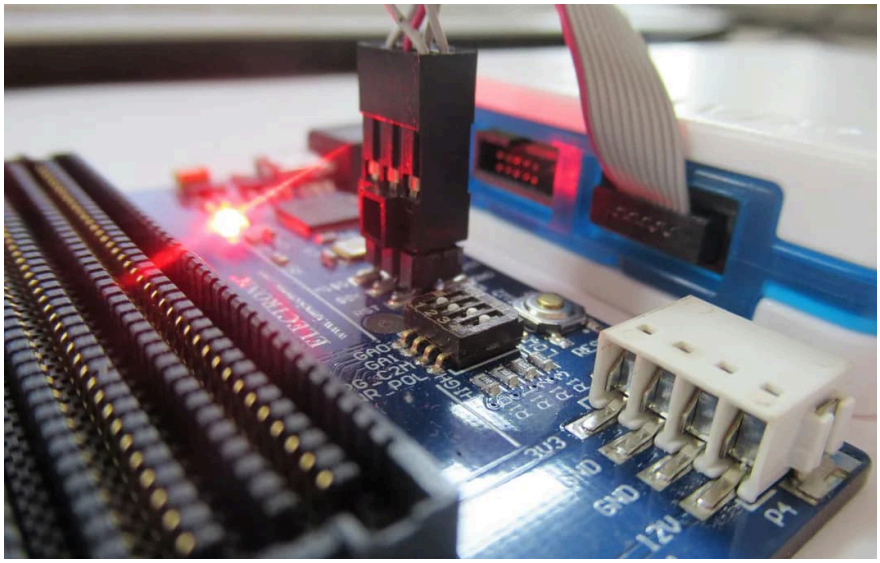


Fig. 3: The FMC programmer board is compatible with the AVR ISP header.

2.2 Microchip ATmega32U4 microcontroller firmware

The microcontroller will be identified via the USB interface as serial port / terminal. The following parameters must be set for communication with a host PC.

```
Baudrate:       115200
Data:           8 data bits
Start/Stop:     1 start bit, 1 stop bit
Parity bit:     none
Flow control:   none
```

The complete implementation of the firmware for the microcontroller is available on the FMC FRU EEPROM Programmer GitHub repository. It can be compiled by using Atmel Studio 7. The source code implements the user command protocol, which interprets the following commands:

Tab. 1: Serial port commands from host PC to FMC programmer

Command	Description	Example (hex)	Response (hex)
'b' (0x62)	set number of bytes to read in a burst Argument 1: n bytes to read (1 byte) Response 1: ACK (0x06) Response 2: Argument 1 value	0x62 0x08	*0x06 0x08*
'f' (0x66)	returns always 0xFF Argument 1: - Response 1: 0xFF	0x66	*0xFF*
'g' (0x67)	get global address (GA) pins of dip switch SW1 Argument 1: - Response 1: GA[1:0] in hex (0x00 .. 0x03)	0x67	*0x03*
'p' (0x70)	get plugged-in state (inverted PRSNT_M2C_L pin) Argument 1: - Response 1: 0x00=not plugged, 0x01=plugged	0x70	*0x01*
'P' (0x50)	get protection polarity Argument 1: - Response 1: 0x00 or 0x01	0x50	*0x01*
'r' (0x72)	read with 1 byte addressing Argument 1: I2C Addr (1 byte) Argument 2: Mem Addr (1 byte) Response 1: ACK (0x06) Response 2: Mem data (up to n byte)	0x72 0x50 0x01	*0x06 0xFF*

'R' (0x52)	Read with 2 byte addressing Argument 1: I2C Addr (1 byte) Argument 2: Mem Addr MSB (1 byte) Argument 3: Mem Addr LSB (1 byte) Response 1: ACK (0x06) or NACK (0x3F) Response 2: Mem data (up to n byted)	0x72 0x50 0x00 0x01	*0x06 0xFF*
's' (0x73)	scan for EEPROM addresses Argument 1: - Response 1: I2C Addr (7 bit format) Response n: 0xFF (end of list)	0x73	*0x50 0xFF*
'v' (0x76)	version of firmware Argument 1: - Response 1: Major version Response 2: Minor version Response 3: Build no. Response 4: 0xFF	0x73	*0x01 0x01 0x01 0xFF*
'w' (0x77)	write with 1 byte addressing Argument 1: I2C Addr (1 byte) Argument 2: Mem Addr (1 byte) Argument 3: Mem Data 1 (1 byte) Argument n: Mem Data n-2 (1 byte) Response 1: ACK (0x06) or NACK (0x3F)	0x77 0x50 0x00 0xFF	*0x06*
'W' (0x57)	Write with 2 byte addressing Argument 1: I2C Addr (1 byte) Argument 2: Mem Addr MSB (1 byte) Argument 3: Mem Addr LSB (1 byte) Argument 4: Mem Data 1 (1 byte) Argument n: Mem Data n-3 (1 byte) Response 1: ACK (0x06) or NACK (0x3F)	0x77 0x50 0x00 0x01 0xFF	*0x06*

2.3 Command line tool

For easy use and out-of-the-box functionality, there is a simple console application for Microsoft Windows. The executable binaries and the source code are available on FMC FRU EEPROM Programmer GitHub repository.



Fig. 4: Example usage of the command line tool with parameters -p -s -i and -m. The application reports all necessary status information of the FMC module's EEPROM.

The most important calls for uploading and downloading files are shown in the examples below:

2.3.1 File download

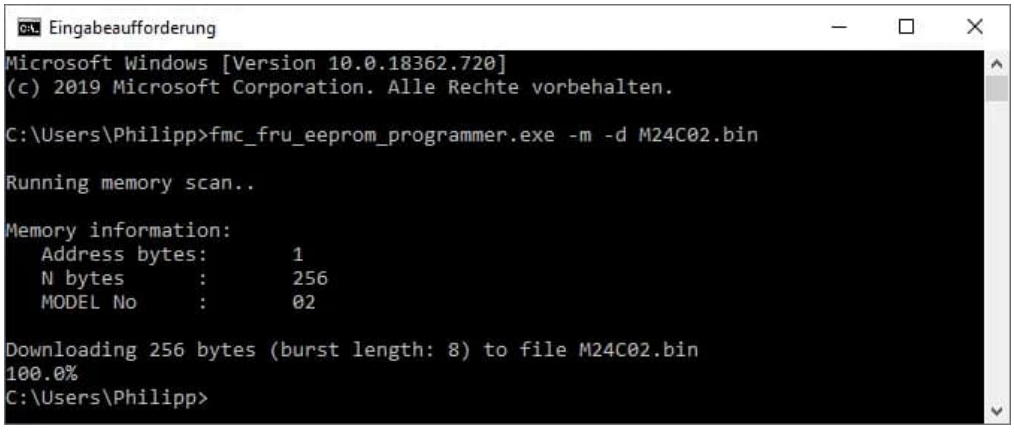


Fig. 5: Example usage of the command line tool with parameters -m and -d. Firstly, the application sets the EEPROM parameters by memory autodetect function. Secondly, the application transfers the content from the FMC EEPROM to a file on the host PC (download).

2.3.2 File upload

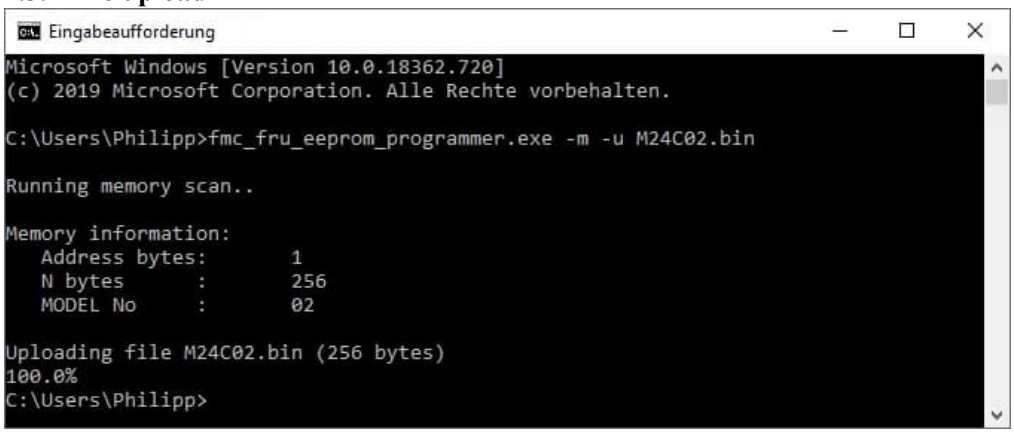


Fig. 6: Example usage of the command line tool with parameters -m and -u. Firstly, the application sets the EEPROM parameters by memory autodetect function. Secondly, the application transfers a file from the host PC to the FMC EEPROM (upload).

2.3.3 Driver installation

In case you are using Microsoft Windows 7, the FMC FRU EEPROM Programmer needs an addiotional driver file. It is located in the GitHub repository DRIVER directory. On Windows 10, the driver files for the hardware will be automatically installed.

3. Electrical data

The schematics can be downloaded from GitHub:
https://github.com/FMCHUB/FMC_FRU_EEPROM_PROGRAMMER/.../Schematic_FRU_Programmer.pdf

T.B.D.

4. Mechanical data

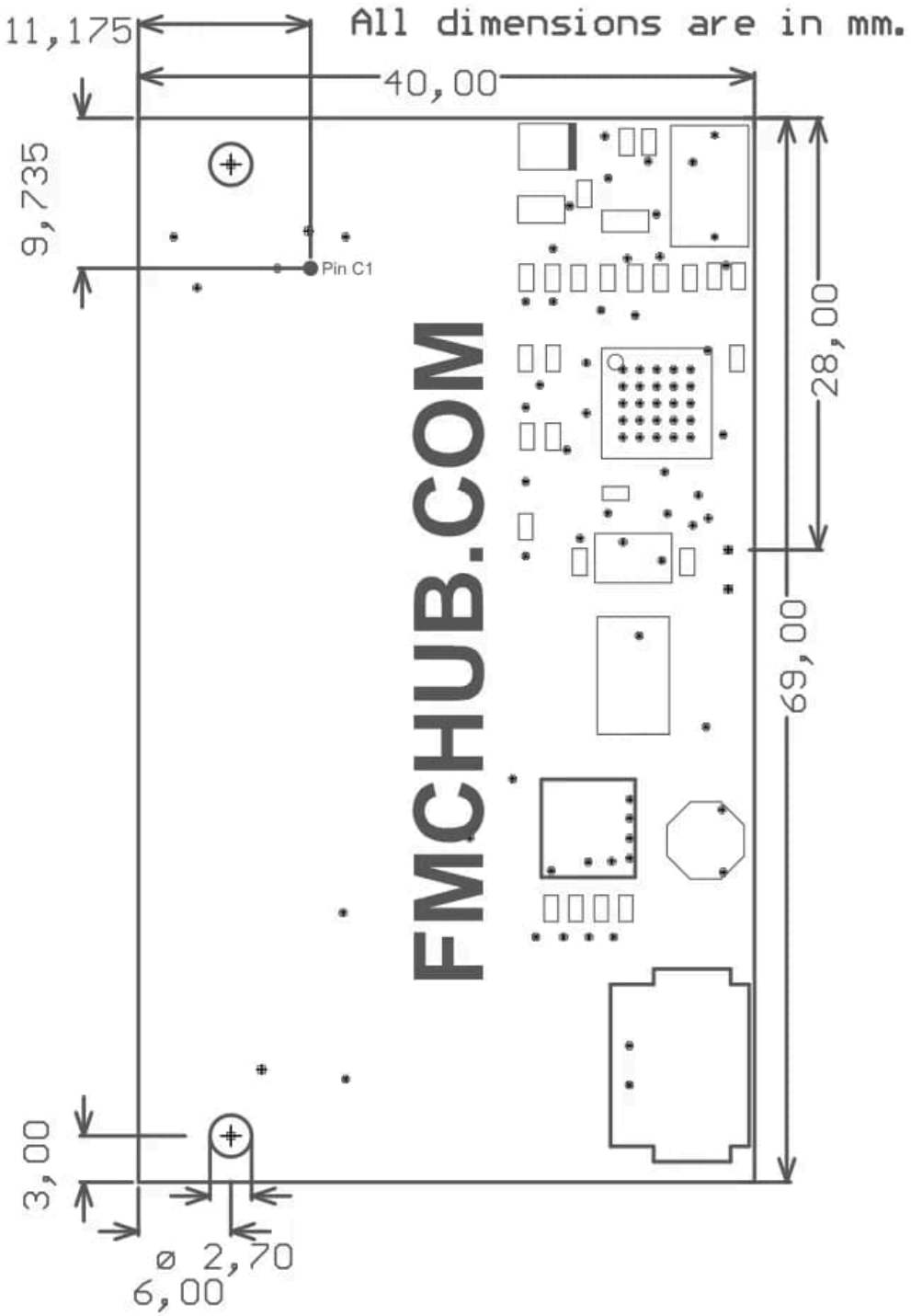


Fig. 7: Mechanical dimensions of the FMC FRU EEPROM Programmer.

5. Ordering information

The FMC FRU EEPROM Programmer can be ordered at various online market places, or you can request a quotation by sending an e-mail to info@iamelectronic.com.

Tab. 3: Assembly variants of FMC FRU EEPROM Programmer with product numbers and market places.

Product no.	Description	Market place	Request quote	Standard lead time

T0009	FMC FRU EEPROM Programmer with CC-LPC-10 connector and ATmega32U4.	IAM Electronic Shop Ebay #185422171646 Tindie #19594 DigiKey 6068-T0009-ND	info@iamelectronic.com	Normally in stock, otherwise 4 weeks

6. Document history

Document number:
DS#T0009

Version history:
2020/03/21: Minor changes in features list and ordering information
2020/03/20: Initial release