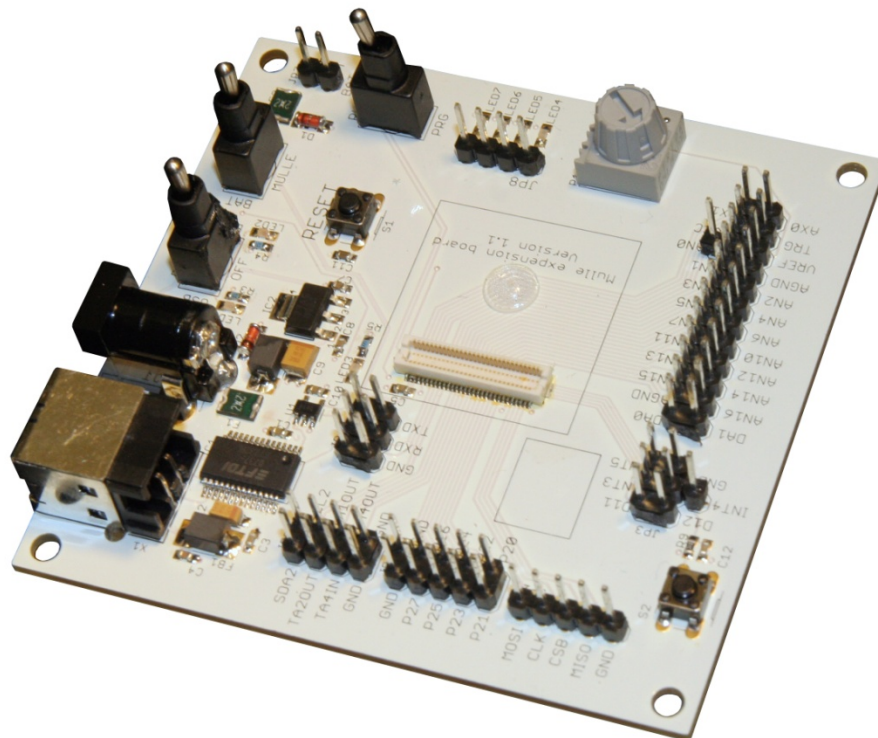


Mulle Expansion Board User Manual



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Valid for the Mulle Expansion Board version 1.1

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1 INTRODUCTION

1.1 SCOPE

The Mulle Expansion Board is used together with the Mulle platform during development in order to access all its features. This document describes the features of the expansion board. Please refer to the Mulle Platform User Manual for more information on the platform itself.

1.2 VERSION COMPATIBILITY

Table 1 below lists the released versions of the Expansion Board, and their compatibility with the different versions of the Mulle Platform.

Expansion Board Version	Mulle Platform Version
1.0	3.0
1.1	3.1, 3.2, 3.2B, 4.1, 5.2

Table 1: Version compatibility

1.3 PRECAUTIONS

When using the Mulle Platform together with the Expansion Board, make sure to always:

- Unplug the Expansion Board both from the computer and the power supply before inserting or removing a Mulle Platform.
- Switch off the extension board before connecting any peripherals.
- Have the Mulle switched off when connecting the USB cable.
- Switch off the power to the Mulle before switching modes (RUN / PRG)

1.4 REFERENCE DOCUMENTS

- [R1] Mulle_test_brd - rev 1 schematic, Eistec AB (see Annex A)
- [R2] M16C Group Datasheet rev 2.41, Renesas Technology Corp., ref: REJ03B0001-0241
- [R3] M16C Group Hardware Manual rev 2.41, Renesas Technology Corp., ref: REJ09B0185-0241

2 TECHNICAL DATA

2.1 PHYSICAL DESCRIPTION

Size: 78 x 75 x 22 mm.

Weight: 40 grams.

Layout: The layout of the Expansion Board can be seen in Figure 1 below. Please refer to this figure for all paragraphs throughout this chapter.

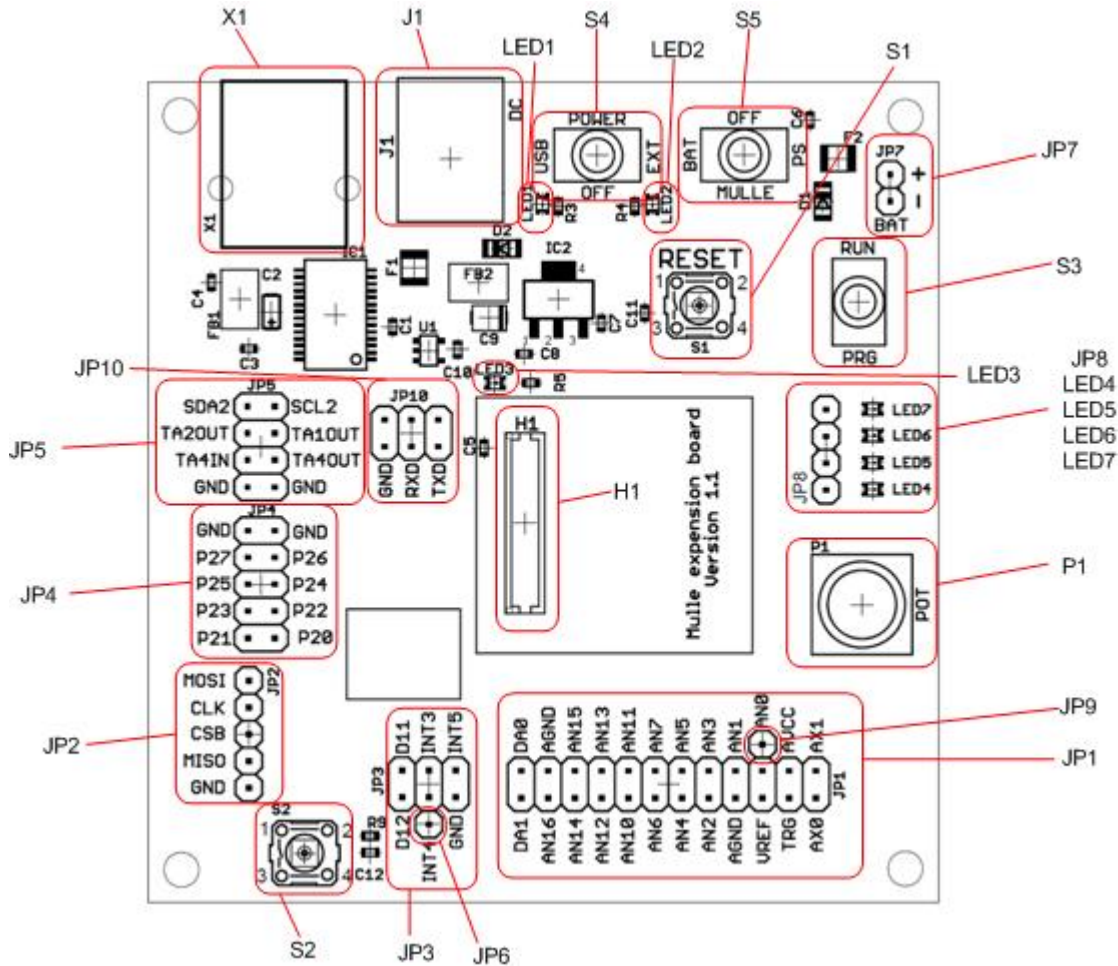


Figure 1: Expansion Board Layout

2.2 CONNECTIONS

Mulle Platform connector (H1). This is where the Mulle Platform should be plugged in.

USB Connector (X1). Controlled by a USB-to-UART converter chip, this connector allows both for power supply and for easy access to the Mulle platform. When a USB cable is connected LED1 is lit.

External Power (J1). This connector allows for an external power source, 7V-12V. Center pin is positive. Pin dimension 2.1 mm. When a power source is connected, LED2 is lit.

Battery connector (JP7). These two pins allow an external battery connection, 3.3V-5V. Positive and negative pins are indicated on the expansion board.

2.3 SWITCHES

Expansion Board Power Switch (S4). Select power source for the Expansion Board: USB – Off – External Power Source. When the expansion board is powered on LED3 is lit.

Mulle Platform Power Switch (S5). Select power source for the Mulle Platform: Battery – Off – Expansion Board Power Source.

Mode Switch (S3). Run mode or Programming mode. PRG must be set when downloading new firmware to the Mulle platform. Otherwise RUN must be selected in order to communicate with the platform.

2.4 LEDS

LED1. This LED is green when the USB cable is connected.

LED2. This LED is green when the External Power Source is connected.

LED3. This LED is red when the Expansion Board is switched on¹.

LED4. This LED is red when a voltage of 3.3V is applied to the corresponding pin (JP8).

LED5. This LED is yellow when a voltage of 3.3V is applied to the corresponding pin (JP8).

LED6. This LED is green when a voltage of 3.3V is applied to the corresponding pin (JP8).

LED7. This LED is red when a voltage of 3.3V is applied to the corresponding pin (JP8).

2.5 BUTTONS

Reset button (S1). Push and release to reset the Mulle Platform.

Ground button (S2). Used together with pin JP6. Place the jumper over pin JP6 and INT4 in order to test the interrupts. JP6 is connected to ground when S2 is pushed, otherwise pulled high (+3.3V).

Potentiometer (P1). Used together with pin JP9 to set an analog reference voltage. The jumper should be set over JP9 and AN0 in order to use the potentiometer. The reference voltage will be seen on AN0. Range is [0, Vref] volt.

¹ LED3 may also be low intensity red when the Mulle Platform is switched on while the Expansion Board is off. This is due to a back feed of current from the Mulle platform via the RXD/TXD jumpers (JP10) to the USB-to-UART converter chip.

2.6 ANALOG CONNECTOR (JP1)

These pins are directly connected to the corresponding analog I/O pins on the Mulle platform. Please refer to the Renesas M16C Data Sheet [R2] or Hardware Manual [R3] for functions and reference voltages for these pins.

Note: *Difference is made between the Expansion Board ground and the Mulle Platform ground. In the schematic shown in annex A the former is referred to as “GND”, while the latter is called “GNDIO”. The latter is connected to the GNDIO pin of the Mulle Platform and should be used as ground reference for all measurements on the I/O pins.*

2.7 DIGITAL I/O PINS (JP4)

These pins are directly connected to the corresponding digital I/O pins on the Mulle platform. Please refer to the Renesas M16C Data Sheet [R2] or Hardware Manual [R3] for functions and reference voltages for these pins.

Note: *Difference is made between the Expansion Board ground and the Mulle Platform ground. In the schematic shown in annex A the former is referred to as “GND”, while the latter is called “GNDIO”. The latter is connected to the GNDIO pin of the Mulle Platform and should be used as ground reference for all measurements on the I/O pins.*

2.8 TIMERS AND I2C PINS (JP5)

SDA2 and SCL2 are connected to the I2C interface of the Mulle Platform when the microprocessor is in I2C mode. TA1OUT, TA2OUT, TA4IN and TA4OUT are related to timer operations of the Mulle Platform.

All these pins may also be used for digital I/O. Please refer to [R3]: Renesas M16C Hardware manual for more information on how to use these pins.

2.9 PROGRAMMING SELECT PINS (JP10)

The pins RXD and TXD provide direct access to the serial port (UART 1) of the Mulle Platform. RXD is connected to RXD1 (pin 30) on the M16C microcontroller, and TXD is connected to TXD1 (pin 29). However, for normal use, in order to allow access to the Mulle Platform serial port via the USB connection, two jumpers should be placed over the RXD and TXD pins and their opposite pins.

The pin marked GND is connected to GNDIO on the Mulle Platform, while the opposite pin is connected to ground on the Expansion Board.

2.10 BLUETOOTH PROGRAMMING PINS (JP2)

These pins connect to the Bluetooth Serial Programming Interface of the Mulle Platform Bluetooth chip.

Caution: The Bluetooth chip has been setup during production and it is strongly recommended to leave these settings unchanged.

3 USAGE

3.1 PREPARATION

In order to use the Mulle Expansion Board in the development process, the following steps has to be taken:

1. Download and install drivers for the USB-to-serial converter from FTDI chip². Choose the appropriate driver that is compatible with your operating system for the device FT232R.
2. Connect the Mulle Expansion Board with the USB cable to a free USB port on your computer.
 - Under Windows, it should appear as a USB Serial Port (COMx) in the computers device manager, under Ports, where x can be any number. In Figure 2 below, it is located as COM7. The corresponding port in Cygwin is /dev/ttyS6.
 - Under Linux, it is located under /dev/ttyUSBx, where x is a number.
 - In Mac OS X, it is located under /dev/tty.usbserial-A4R2MOK7 (or similar)
3. You can now connect to the device, download software to it, and communicate with the installed software.
 - If your CPU is the M16C-62P, use for example M16C Flasher³ on windows, or sm16cf⁴ under Linux.
 - You may also use sflash⁵ on any operating system. sflash is necessary when you have the M16C-65 CPU (Mulle 3.2B)

² Available at <http://ftdichip.com/Drivers/VCP.htm>

³ Available at <http://www.m16c-flasher.de/> (in German)

⁴ Available at <http://sourceforge.net/projects/sm16cf>

⁵ Available at <http://people.redhat.com/dj/m32c/flash-tool.tar.gz>

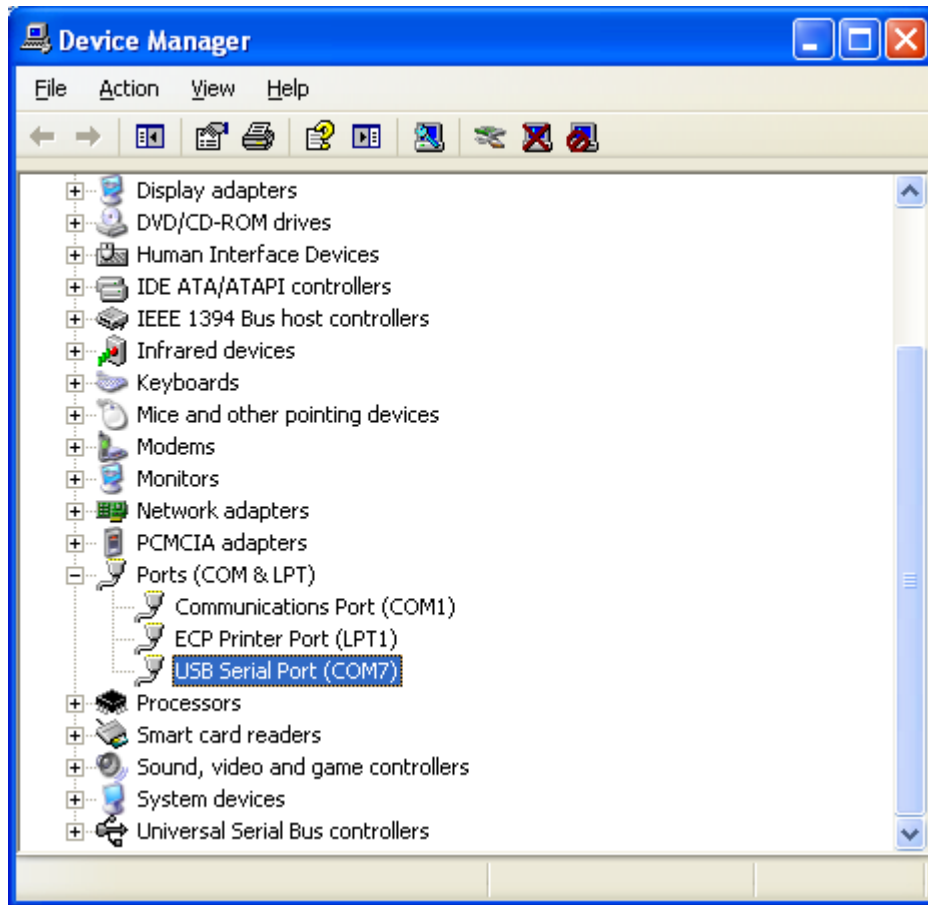


Figure 2: Windows XP Device Manager

3.2 DOWNLOADING A NEW FIRMWARE TO THE MULLE PLATFORM

3.2.1 Using M16C flasher (on Windows, with the M16C-62 CPU)

1. Prepare your computer and the expansion board as described in paragraph 3.1. Remember which COM port the Expansion Board resides on. (COM7 in this case, as shown by Figure 2)
2. Start the M16C-flasher tool. The main window is displayed. See Figure 3 below

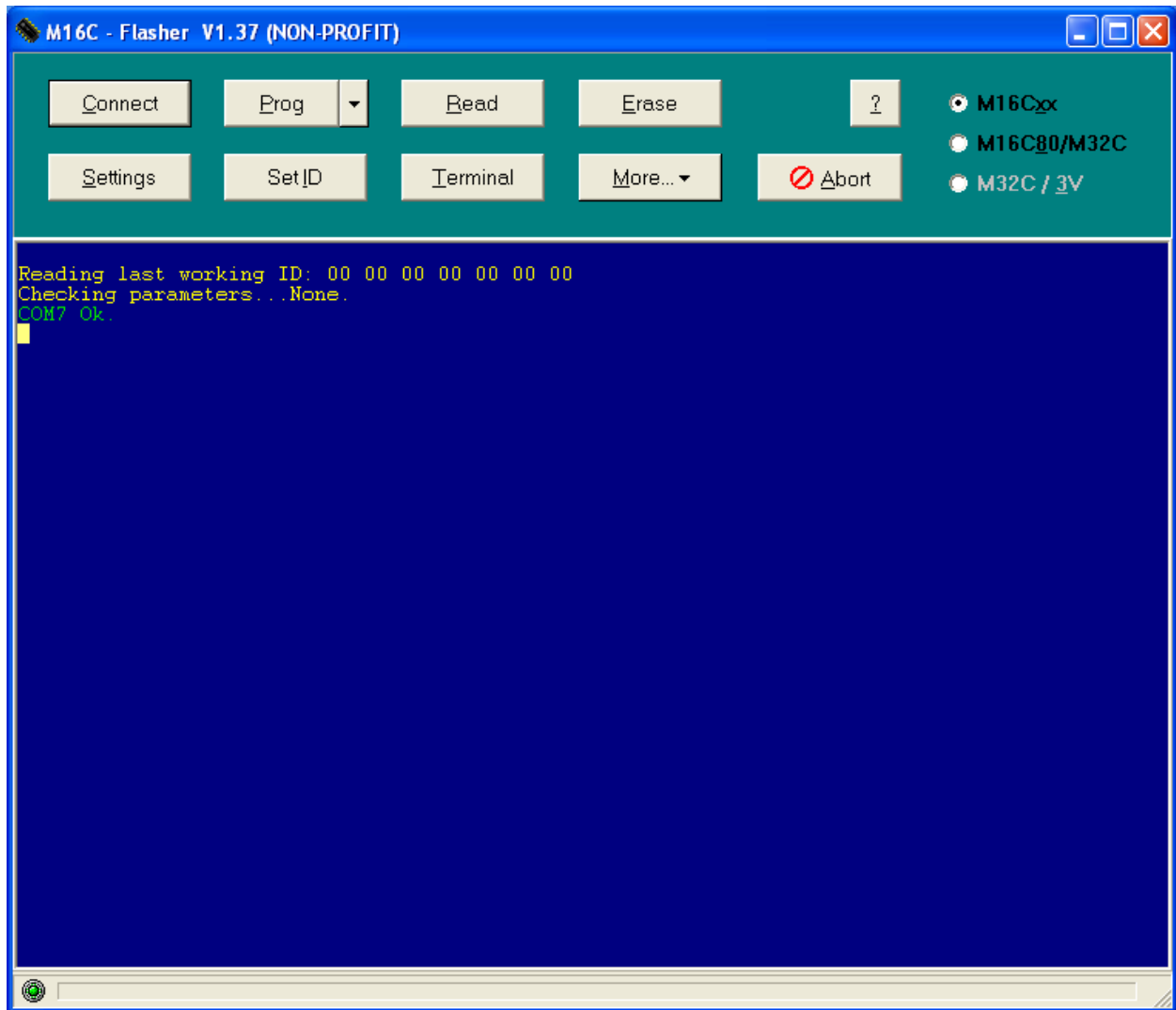


Figure 3: M16C Flasher main window

3. Click the "Settings" button in the main window.
4. Change the COM port to the number reserved for the Expansion Board. Also increase the baud-rate from 9600 to 57600. Then click "Close".
5. Switch on the Expansion Board. Set the Mulle Platform in PRG-mode and power it on.
6. In the M16C Flasher main window, click "Connect" followed by "Prog". The window should now look like Figure 4.

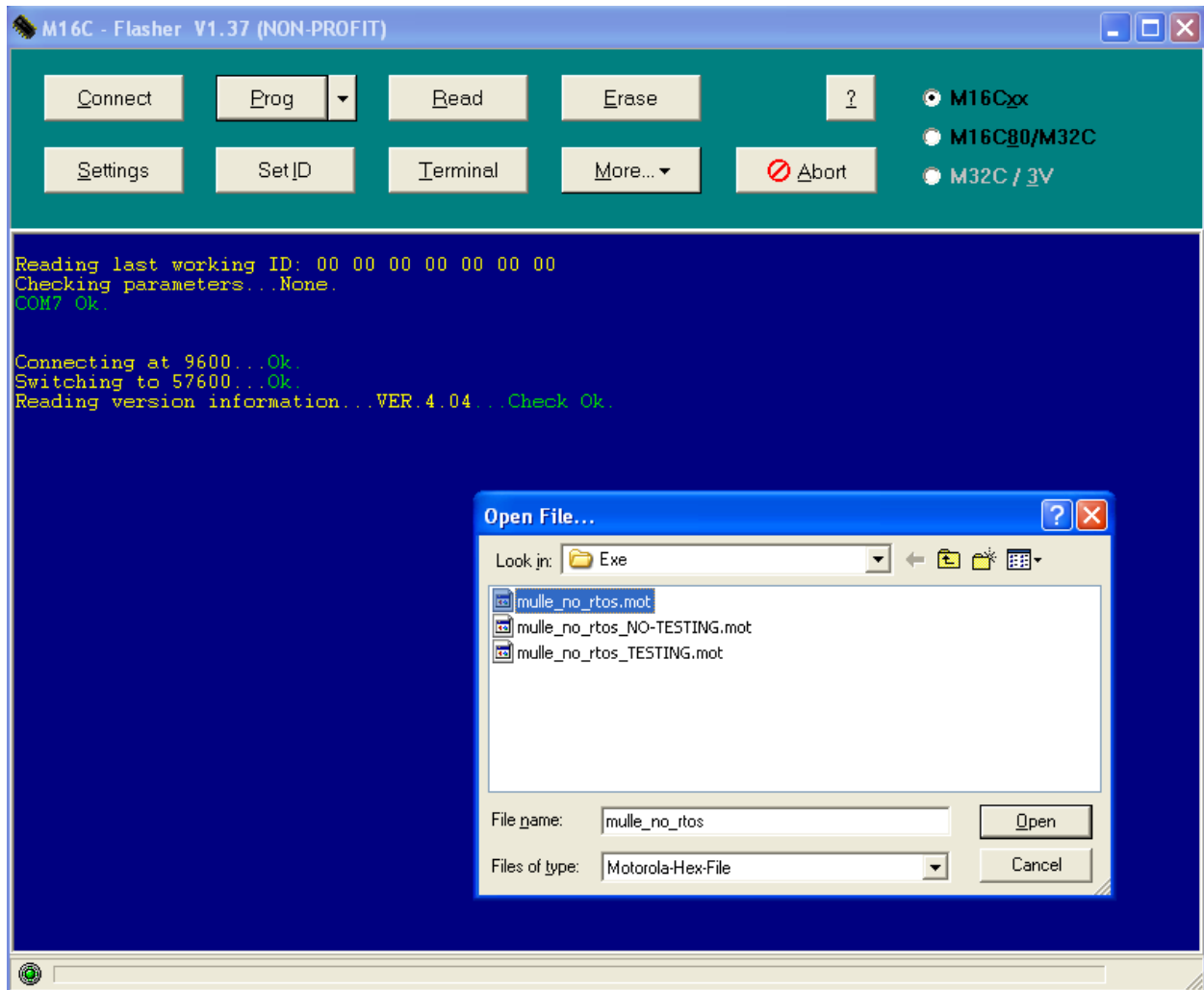


Figure 4: M16C Flasher. Choose firmware to download

7. Choose the new firmware to download by browsing to it and click “Open”. See Figure 4.
8. When the download is complete, the M16C Flasher main window should look like Figure 5.

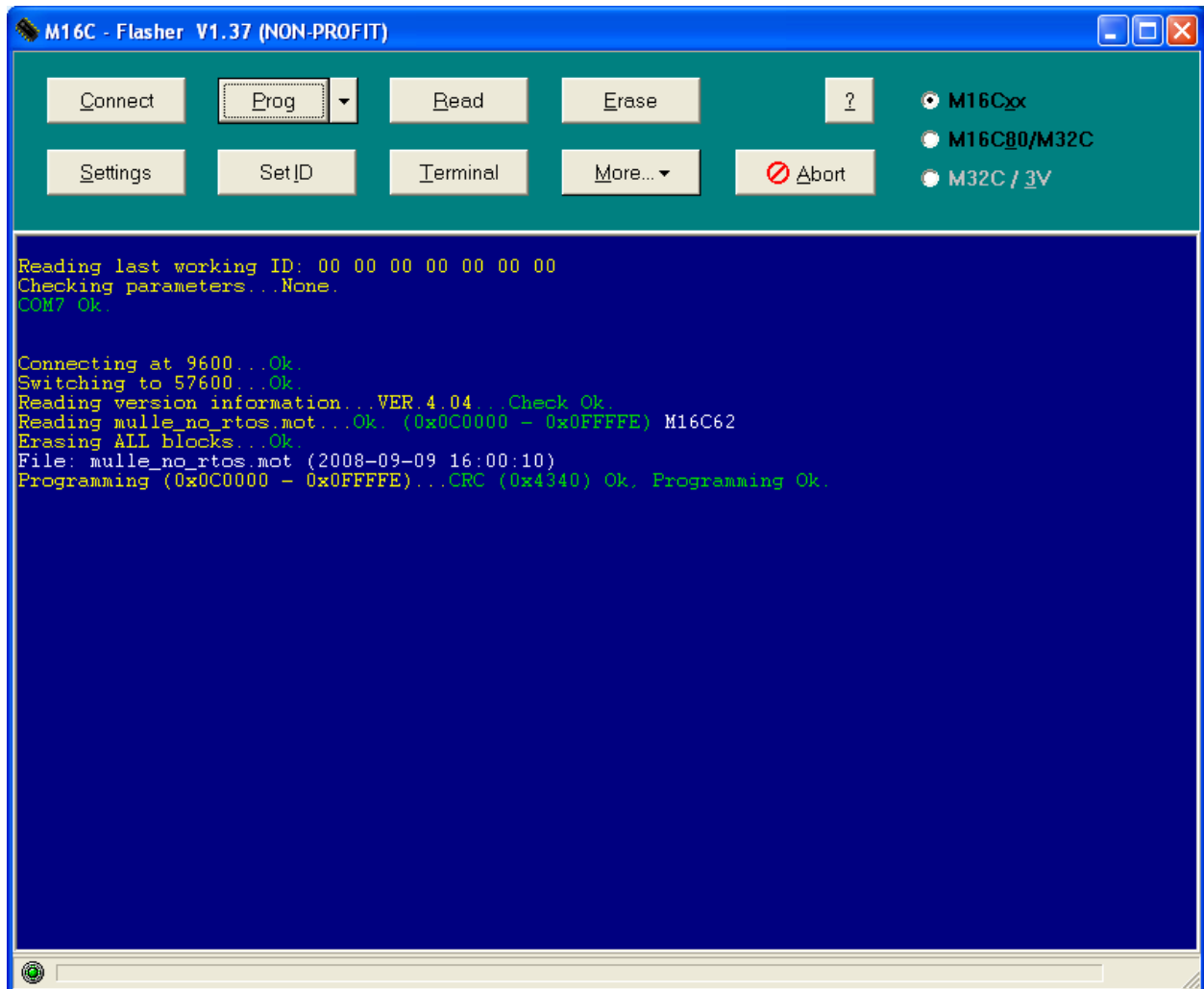


Figure 5: M16C Flasher. Download complete

9. Now switch off the power to the Mulle Platform and click “Terminal”. Set the Mulle Platform in RUN mode and power it back on. Via the terminal you should now be able to communicate with the newly flashed software on the Mulle Platform.
10. Download and run setup.exe from <http://cygwin.com/install.html>. Install Cygwin with default settings, and in the “devel” package, include “gcc-core” and “make”. Include any necessary packages on the next screen during installation.

3.2.2 Using sflash with the M16C-65 CPU (Windows, Linux, or OS X)

1. Download⁶ and unpack the flash-tool archive.
2. Open the file `serial.c` in the flash-tool directory, and comment out every line that uses or references any of the variables `lockf` and `lockn`.

⁶ <http://people.redhat.com/dj/m32c/flash-tool.tar.gz>

3. Open a terminal window on Linux or Mac OS X, or a Cygwin⁷ window on windows. Navigate to the flash-tool folder [`cd flash-tool`].
4. Type [`make clean`], followed by [`make sflash`]. The sflash tool is now created. Move this to your /bin directory on Linux, or Cygwin/bin on windows. In Mac OSX, it is a good idea to put it in the same directory as the m32c compiler. If you have followed the guidelines in the document "Using the GCC toolchain for Mulle SW development", the directory is /Library/opt/m32c-elf/bin, and you have already added this directory to the PATH variable.
5. Switch on the Expansion Board. Set the Mulle Platform in PRG-mode and power it on.
6. Navigate to your /Applications/{project name} folder in the terminal, where you have your Mulle project software.
7. Type [`make clean`] and [`make all`] to compile the software and then [`sflash -b19200 -p /dev/tty{yourdevice} {project name}.out`] to download the compiled software to the Mulle platform. For example, if you have seen in chapter 3.1 point 2 that your USB to serial converter uses USB0 (in Linux), and your project name is "Mulle_Demo", then type [`sflash -b19200 -p /dev/ttyUSB0 Mulle_Demo.out`].
 - a. In Mac OSX the command will be [`sflash -b19200 -p /dev/tty.usbserial-A4R2M0K7 Mulle_Demo.out`].
 - b. In Cygwin it will be [`sflash -b19200 -p /dev/ttyS6 Mulle_Demo.out`] for COM7. Notice that ttySn is the corresponding port for COM(n+1).
8. When the command returns after successful flashing of the device, switch off the power to the Mulle platform, and put it in RUN mode. Then open a window where you can communicate with the Mulle device over the serial port, e.g the [`screen`] command. Switch on the Mulle.

Note: Type e.g [`screen /dev/tty{yourdevice} 57600`] to open a screen window connected to the Mulle Platform at 57600 baud. Useful commands are [CTRL-a k] to quit, or [CTRL-a :] to enter command line mode. See e.g. http://www.math.utah.edu/docs/info/screen_5.html for more useful commands.

⁷ Download and run setup.exe from <http://cygwin.com/install.html>. Install Cygwin with default settings, and in the "devel" package, include "gcc-core" and "make". Open the "util" package and include "screen". Include any necessary packages on the next screen during installation.

ANNEX A: SCHEMATICS

