April 2021

Henne's Sites

AN111: AVR Programming

Content

Introduction

This application note describes the programming of AVRs with the ATMEL Studio. It is tailored to the DMX Transceiver, but should also be applicable in other designs.

Hardware

The AVRISPmkII from ATMEL (now Microchip) is a great USB programmer. There are also numerous other ISP programmers for AVR microcontrollers that are claimed to be compatible with the ATMEL Studio. Please refer to the installation instructions of the respective manufacturer.

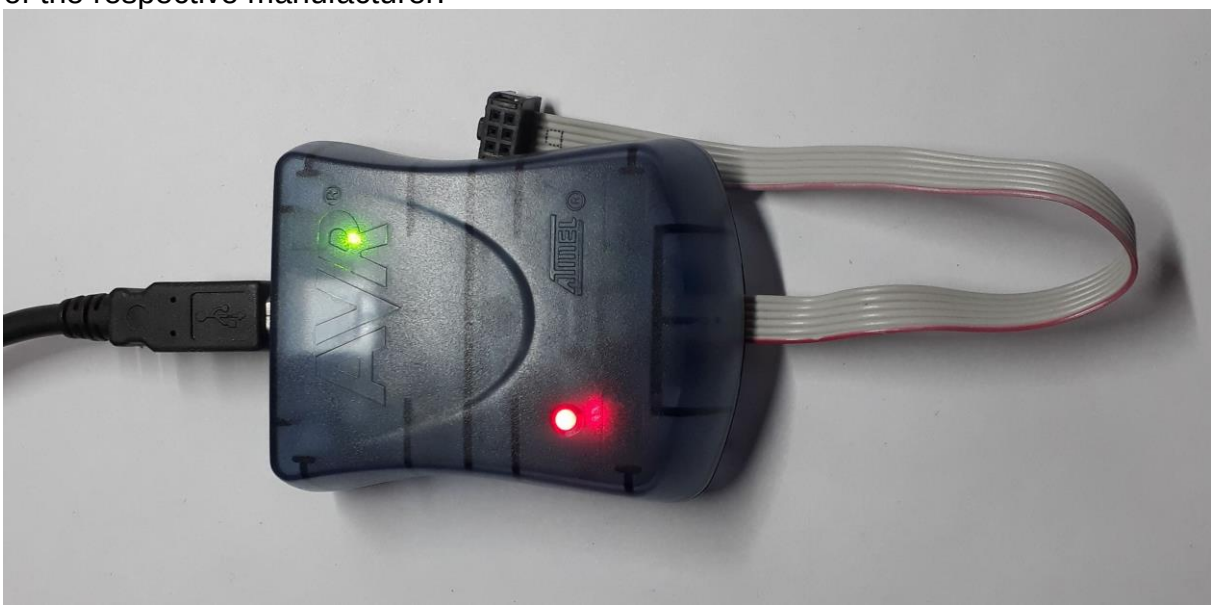

Figure 1: ISP-Programmer (AVRISPmkII)

A DMX Transceiver of Rev. 3.2 or above can be connected directly.

The connection to a DMX Transceiver of Rev. 3.01 and below is made via an adapter cable. The supply voltage VCC was not put out on the ISP connector and must be obtained separately from the PCB.

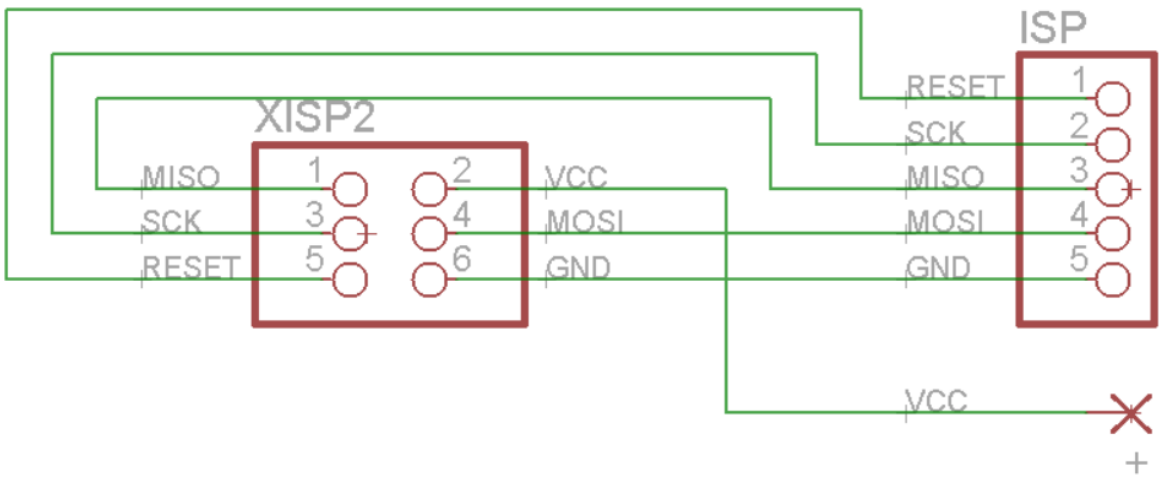

Figure 2: adapter cable for the DMX-Transceiver Rev. 3.01

Installation
First download the ATMEL Studio and follow the installation instructions:
https://www.microchip.com/mplab/avr-support/avr-and-sam-downloads-archive

Setup
First connect the ISP programmer to the computer. The LEDs of the AVRISPmkII should light up as shown in figure 1 - otherwise the installation of the driver was not successful.

Then connect the ISP programmer to the DMX transceiver using the adapter cable and connect the DMX transceiver to a supply voltage between 9V and 12V. Both LEDs of the AVRISPmkII should now light up green.

If one LED remains red, VCC was not detected: Please check whether 5V are present between + and GND (cf. fig. 3):

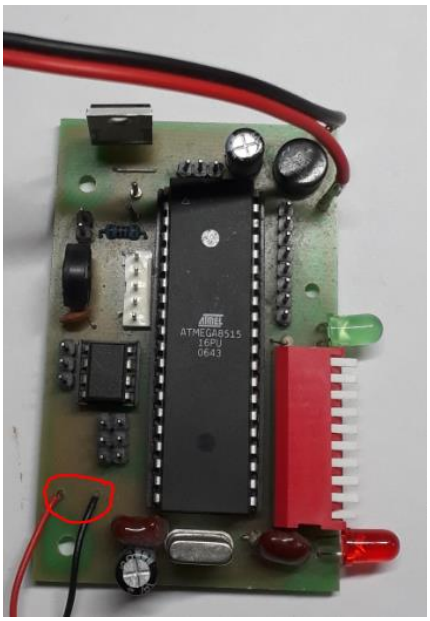

Figure 3: checking VCC

If a LED flashes orange, the AVRISPmkII has detected an error in the connection. Please check the adapter cable again carefully.

Alternatively the programmer might be connected in the wrong orientation.

Now open the ATMEL Studio:

If you want to transfer an existing firmware to the AVR, select "Device Programming" directly (cf. Fig. 4).

If you want to modify a firmware, select "Open Project...".

Figure 4: Device Programming

Select your ISP programmer as tool, the ATmega8515 as device and ISP as interface and confirm by clicking on Apply:

Figure 5: Settings

Since most AVRs have a default clock rate of 1 MHz, the ISP clock should initially operate at 125 kHz:

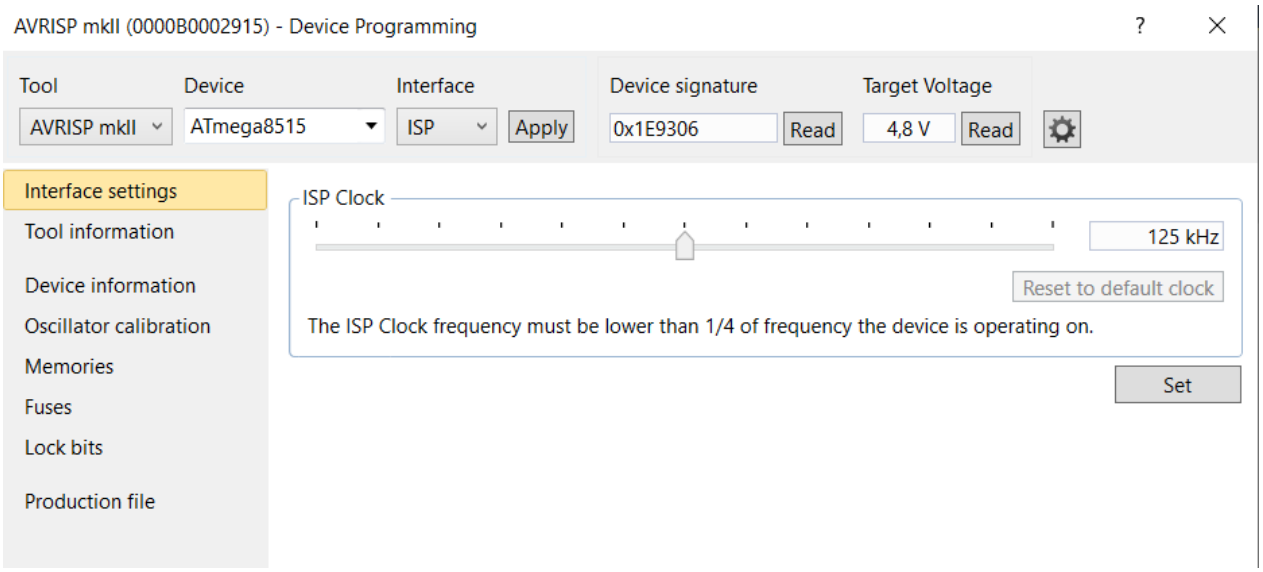

Figure 6: ISP Clock

Finally, check the settings by reading the device signature. The target voltage of the DMX Transceiver should be approx. 5.0V.

Programming AVRs

1. Download a project from Henne's Sites and unzip the archive.
2. Select "Memories" on the left side.
3. Open the *.hex-file for the flash memory from the debug folder of the project.
4. Flash the AVR by clicking on "Program".

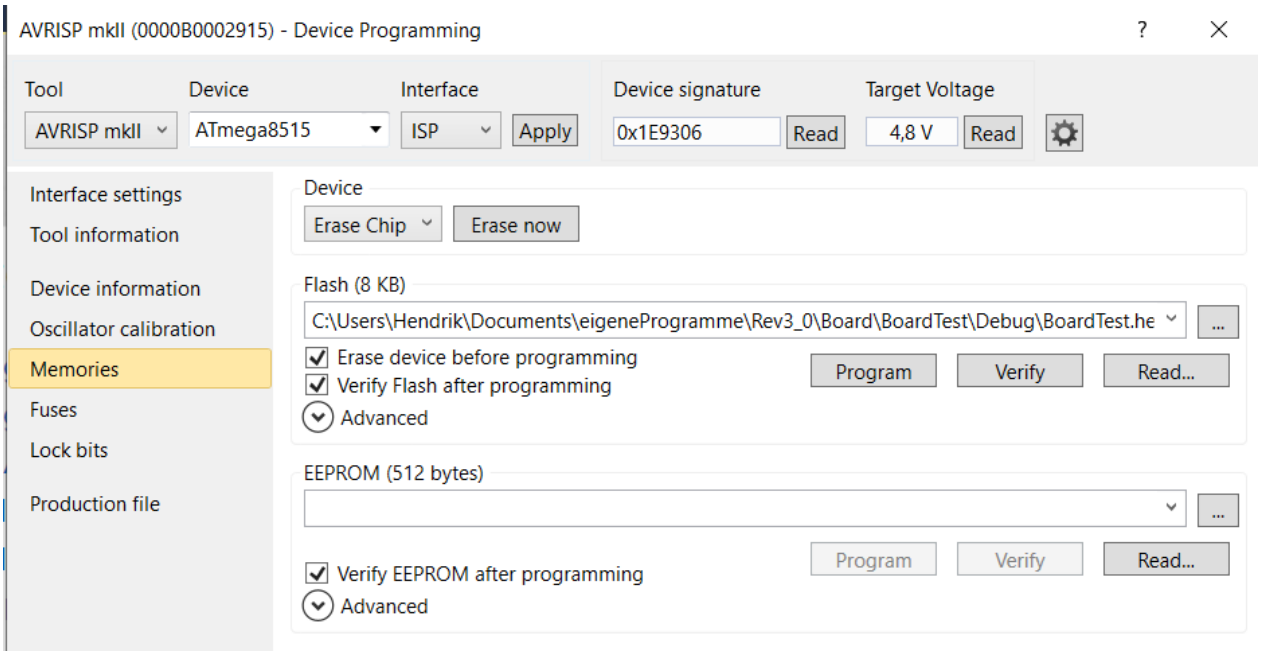

Figure 7: Flashing the Firmware

Changing the fuse bits (without bootloader)

The internal RC oscillator (1MHz) is selected as the default clock source. Since this is too slow for DMX, the crystal (8MHz) has to be selected. This is done by adjusting the fuse bits as follows:

1. Select "Fuses" on the left side.
2. Read the current settings.
3. Change the bits according to figure 8 (0x9D; 0x3F).
4. Write back the fuse bits.

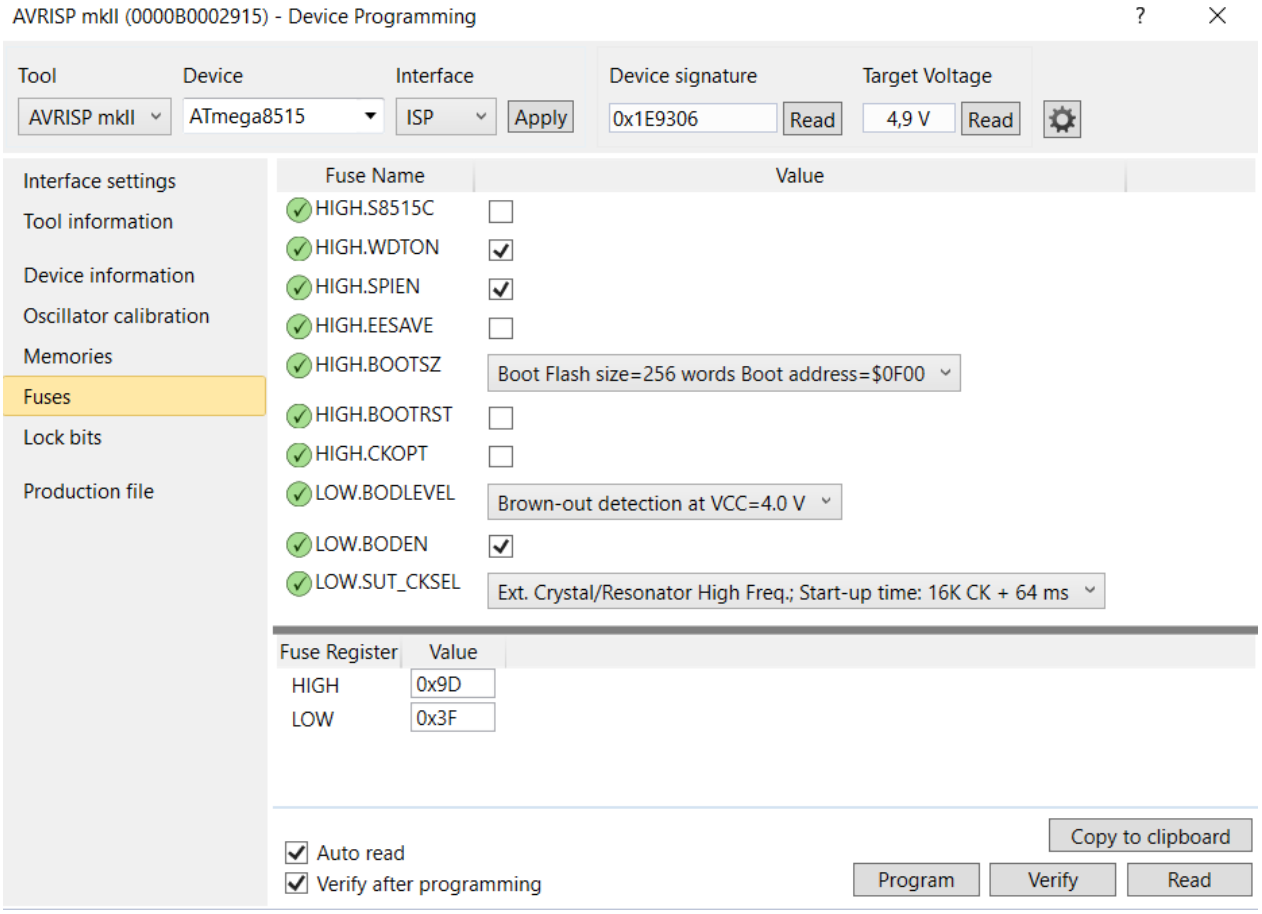

Figure 8: fuse bits (Settings for crystal, Brown-Out detection and Watchdog)

Changing the fuse bits (with bootloader)

The internal RC oscillator (1MHz) is selected as the default clock source. Since this is too slow for DMX, the crystal (8MHz) has to be selected. This is done by adjusting the fuse bits as follows:

1. Select "Fuses" on the left side.
2. Read the current settings.
3. Change the bits according to figure 9 (0x9C; 0x3F).
4. Write back the fuse bits.

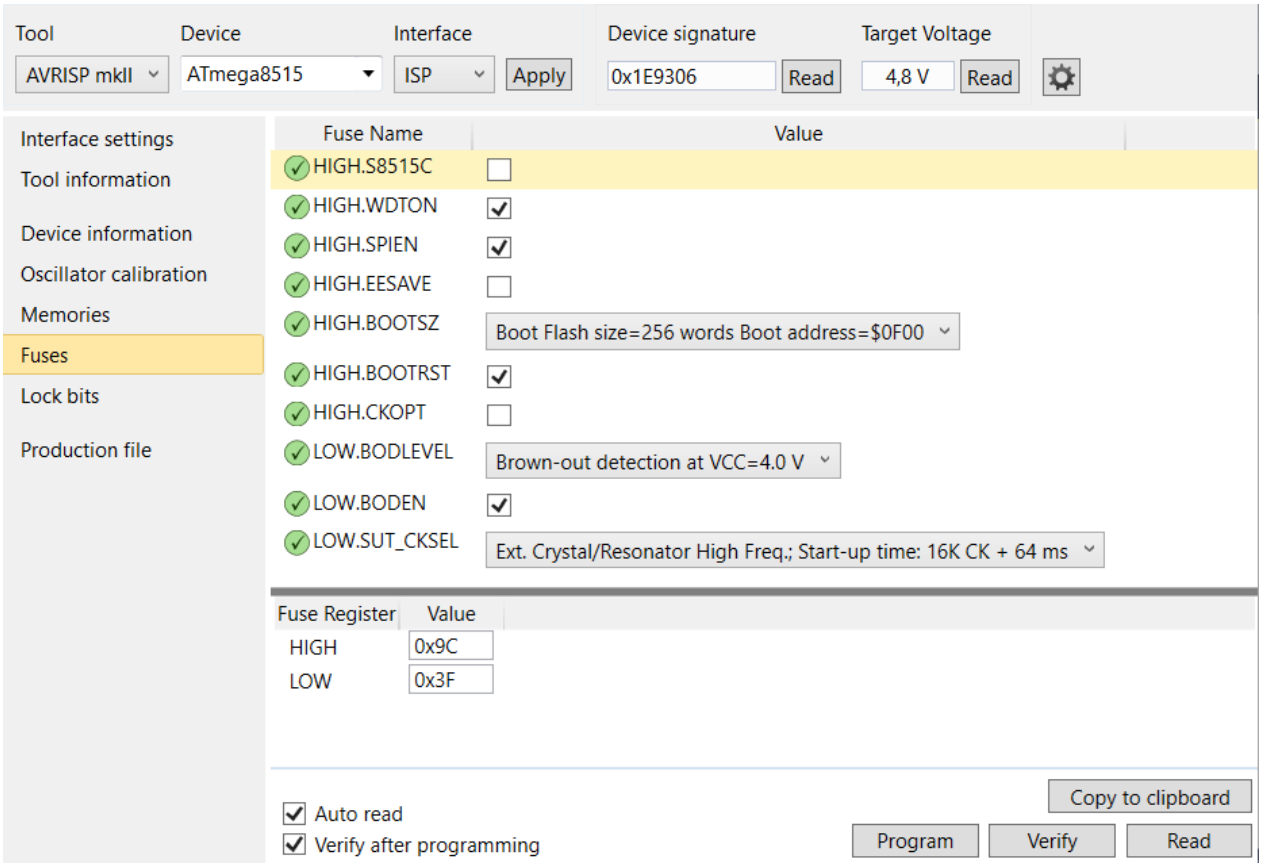

Figure 9: fuse bits (Settings for crystal, bootloader, Brown-Out detection and Watchdog)

The bootloader can be accessed when starting the DMX Transceiver with all DIP switches off. Firmware updates are done with the OpenRDM software.

board.hex
This is a test file for the DMX Transceiver.

1. Download the project.
2. Transfer the hex file to the flash memory of your AVR.
3. Select the crystal by adjusting the fuse bits.

Test functions:

Flashing of the red LED indicates that the test file has been loaded into the flash memory.

All DIPs off:

A glow of the green LED indicates that it has been soldered correctly.

All DIPs on:

A glow of the green LED indicates that all DIP switches are soldered correctly.

Only DIP1 on:

The green LED lights up to indicate that the fuse bits have been adjusted.

Only DIP2 on:

If the green LED lights up, there is a signal at the DMX input.

It may be that D+ and D- are swapped.

Only DIP3 on:

If the green LED lights up, a correct DMX signal has been detected.

Only DIP4 on:

If the green LED is lit, a connected zero crossing detection is OK.