

## SABT Programming Instructions

The setup being used to program the SABT is the JTAG ICE MkII debugger from ATMEL (<http://www.atmel.com/tools/AVRJTAGICEMKII.aspx>). At the time of creation of this document, the most recent version of AVR Studio did not work with this setup so AVR Studio 4 is being used (<http://www.atmel.com/tools/AVRSTUDIO4.aspx>).

The SABT includes four different boards:

1. Main control module
2. Primary user interface module
3. Intermediate user interface module
4. Advanced user interface module

The main control module uses an ATmega1284P microcontroller and all the user interface modules use an ATmega168PA microcontroller.

**IMPORTANT** - Before making or unmaking any connections to the boards, please make sure there everything is turned off or otherwise there is no power being supplied. The boards are easy to short circuit.

### Main control module connections

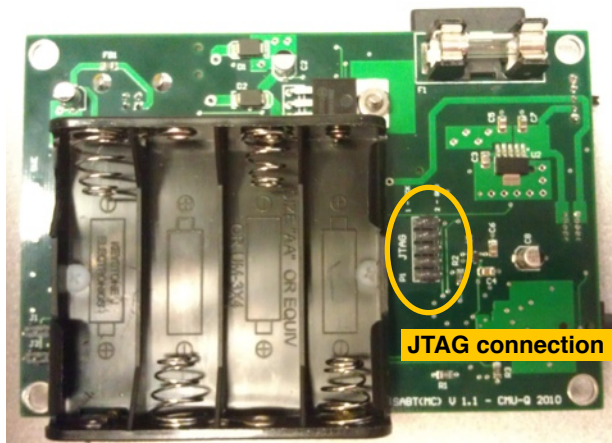


Figure 1 - Top of main control module.

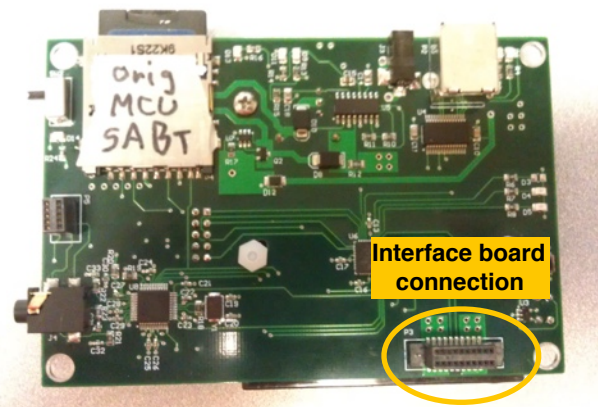


Figure 2 - Bottom of main control module.

The main control module powers itself and the connected user interface module through either 4 AA batteries or USB connection. If the batteries are used, the fuse does not need to be installed.

## User interface module connections

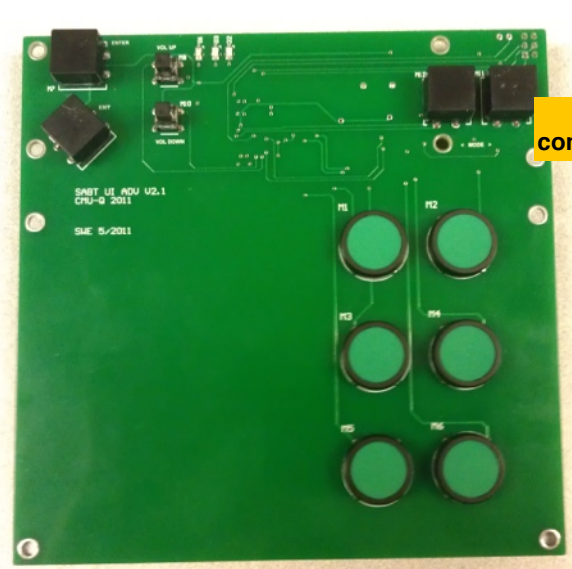


Figure 3 - Top of primary user interface module.

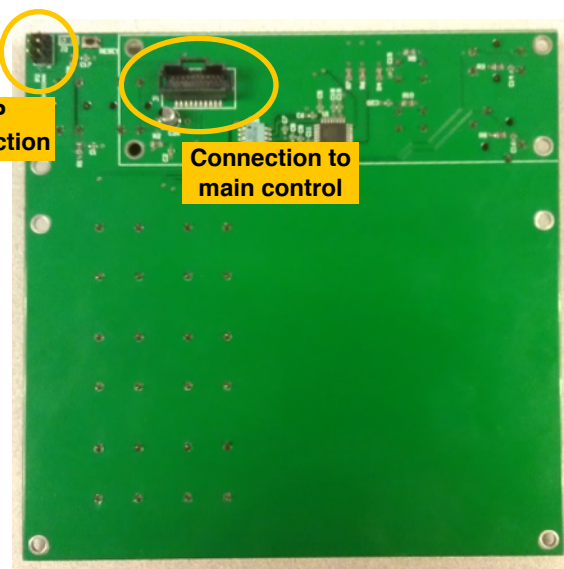


Figure 4 - Bottom of primary user interface module.

## Programming connections

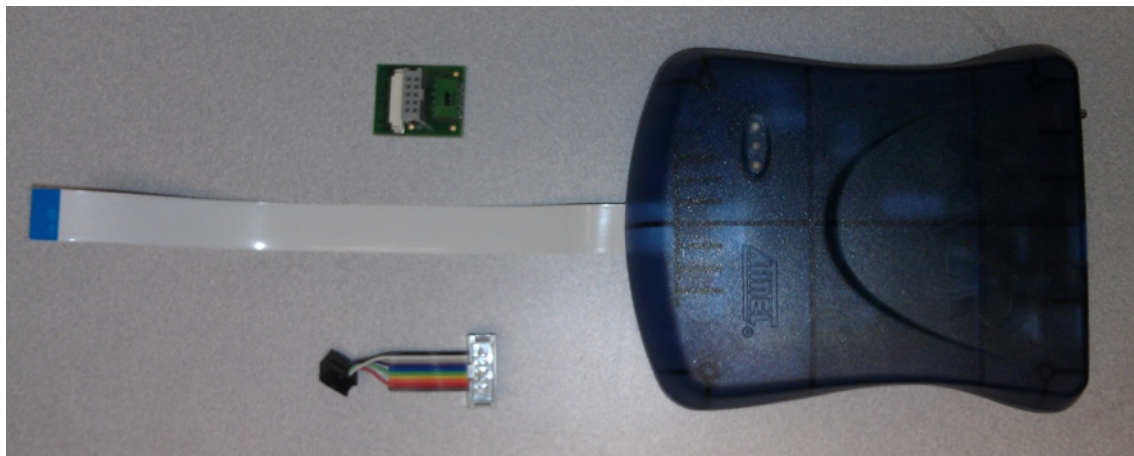


Figure 5 - JTAG ICE MkII debugger with JTAG connector(top) and ISP adapter(bottom)

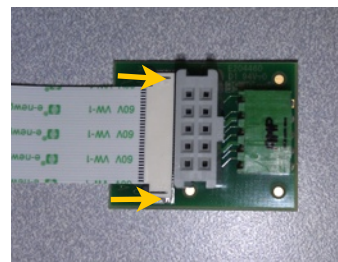
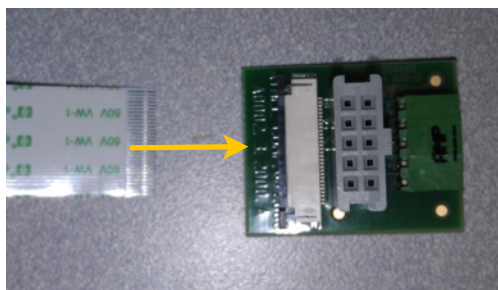


Figure 6 - Connecting the JTAG connector. Slide the ribbon cable in then push in the black clamps on both sides of the connection.



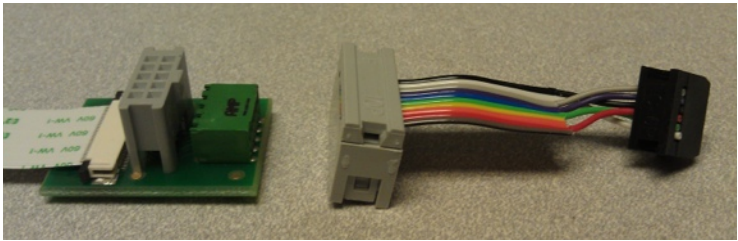
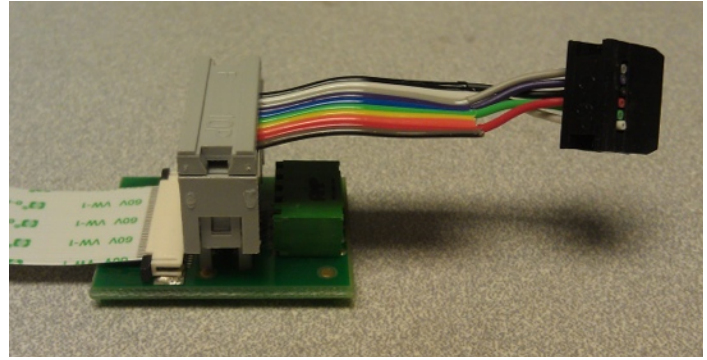


Figure 6 - Connecting the ISP adaptor.



## Programming the main control module

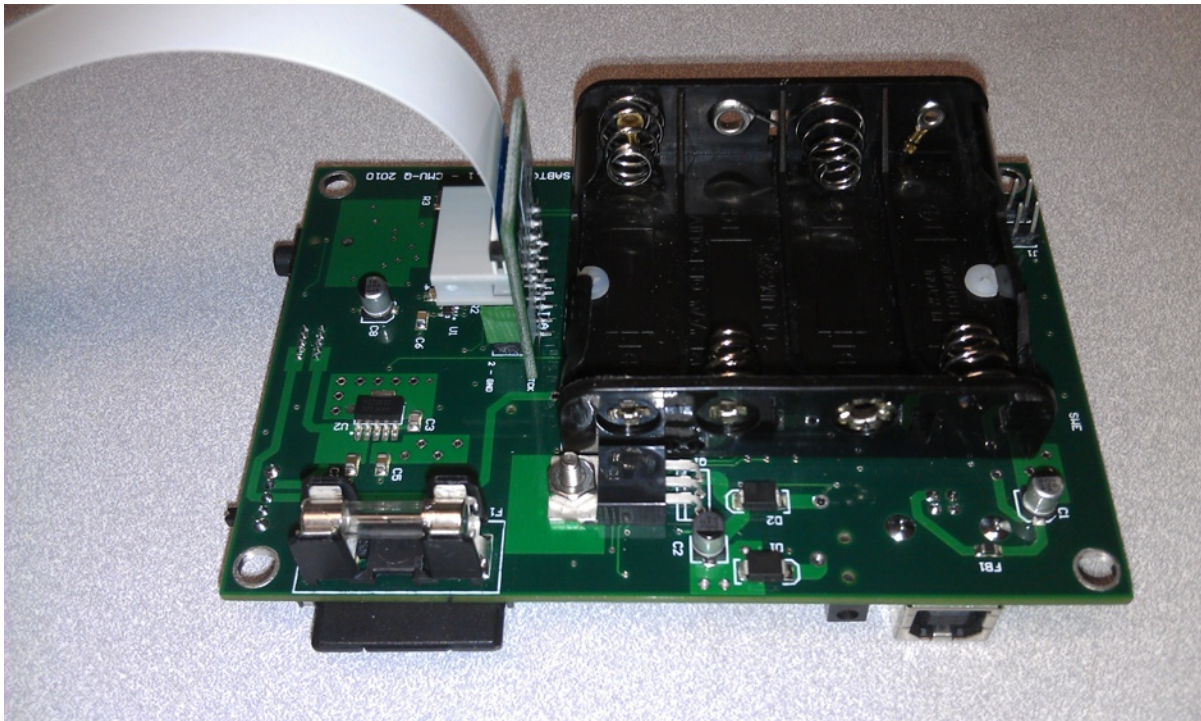


Figure 7 - Connecting the JTAG interface to program the main control module.

The orientation of the JTAG connection matters so be sure to double check it. If the wrong orientation is used, it may be necessary to power cycle the programmer in order for the computer to recognize its presence. Plug in the JTAG connector, plug in the USB cable to the computer, turn on the main control module, then follow the procedure below to use AVR Studio 4 to upload code.

## Programming the user interface modules

Only the primary user interface module is pictured below, but all of the user interface modules use the same connection to program. First, make sure power is off to the main control module, then connect the boards as shown below (Figure 8). Then connect the ISP adaptor as shown above (Figure 6). Turn on power to the main control module and follow the AVR Studio procedure below to upload code.

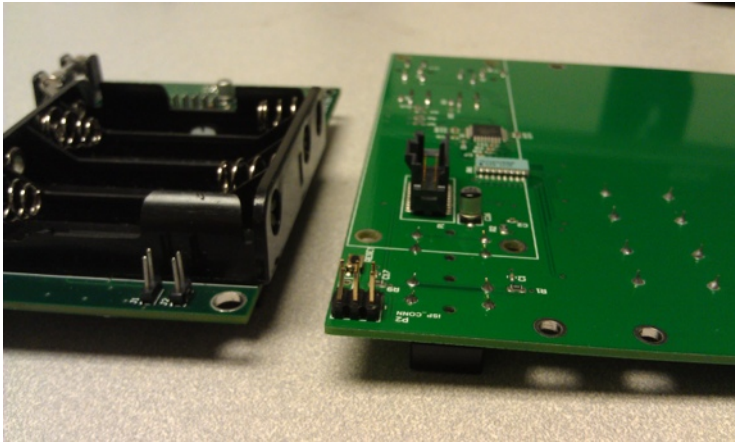


Figure 8 - Connecting the main control module to the primary user interface module.

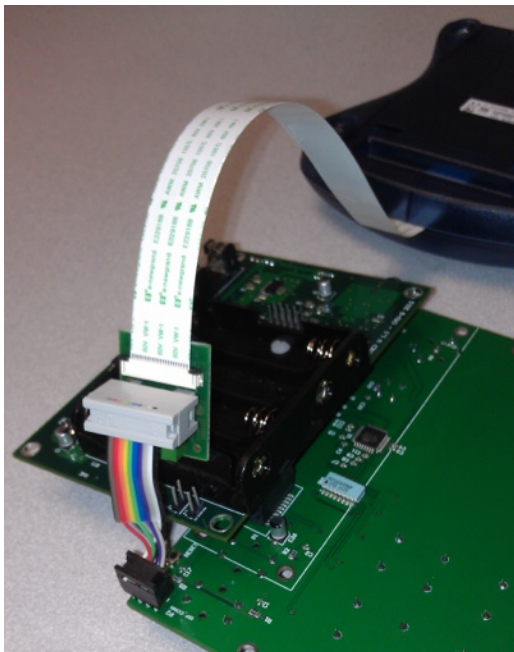
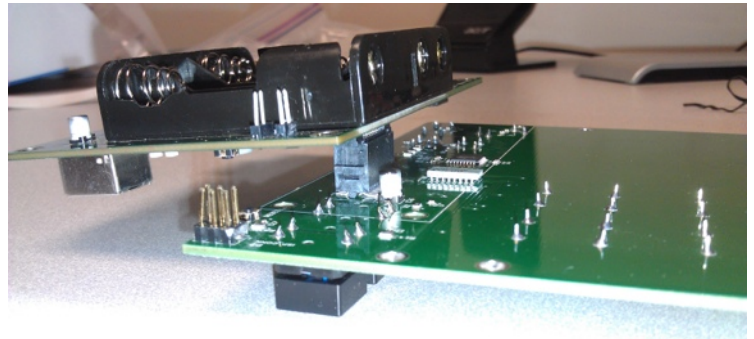


Figure 9 - Connecting the ISP adaptor to the primary board.

The orientation of the ISP adaptor does matter so be sure to double check it. If the wrong orientation is used, it may be required to power cycle the programmer in order for the computer to recognize its presence. Note the JTAG ICE MkII is upside down. This is done to reduce the strain on the ribbon cable connector as problems were had with them being fragile.

## Using AVR Studio 4

AVR Studio only works on windows platforms. Open AVR Studio and a prompt should open with recent projects (Figure 10). Select the project here or browse to the containing folder and open the .aps in order to open the project.

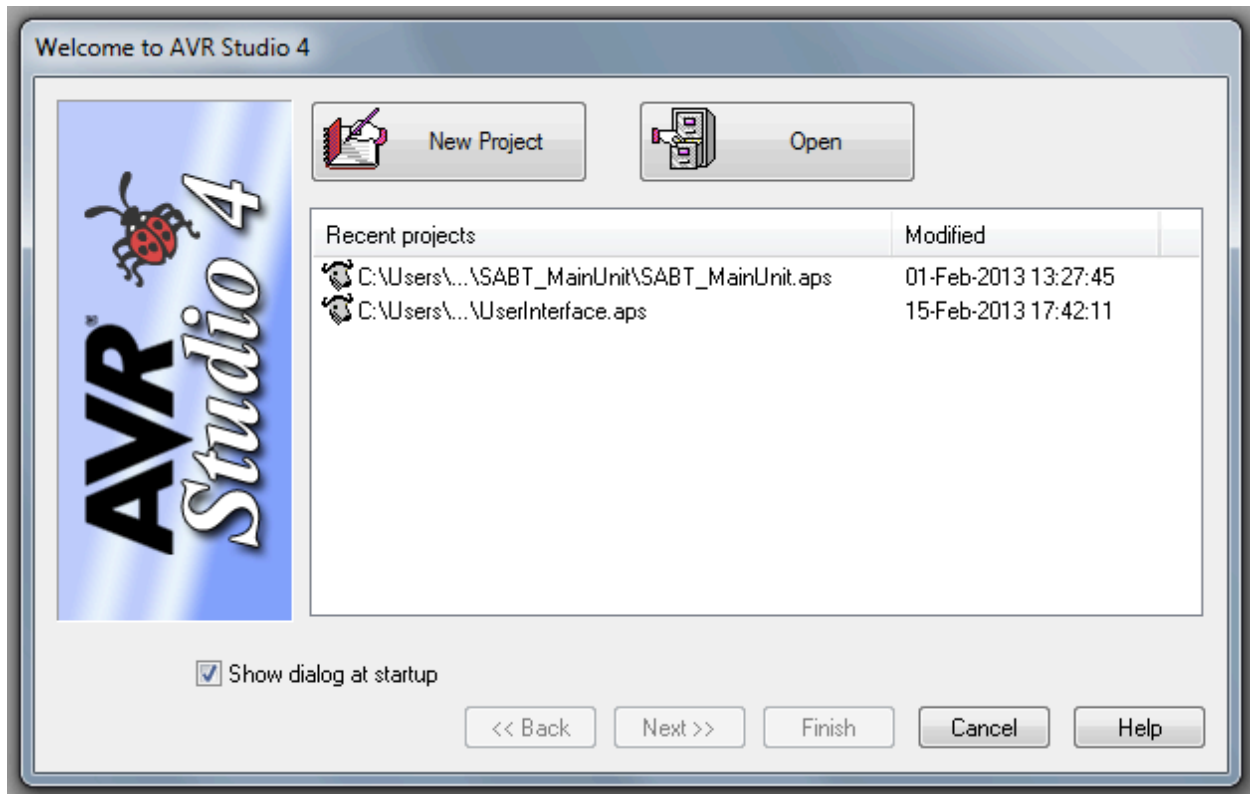


Figure 10 - Welcome screen, choose project.

First double check all of the configuration options (Figure 11). The settings shown below are known to be important, but if a particularly nasty, unexplainable bug occurs, it may be prudent to double check ALL of the other configuration options as well if the cause cannot be determined in the software. Do (Figure 12) for both the main control module and the user interface modules. Do (Figure 13) only for the user interface modules.

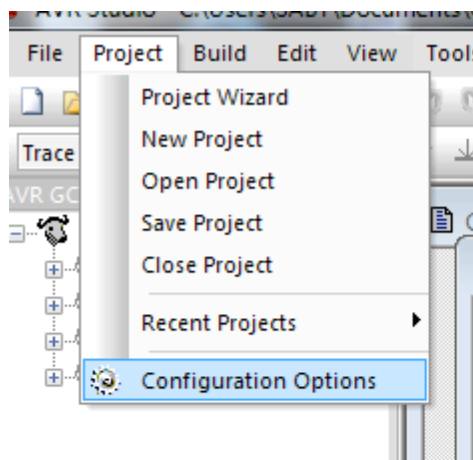


Figure 11 - Configuration options



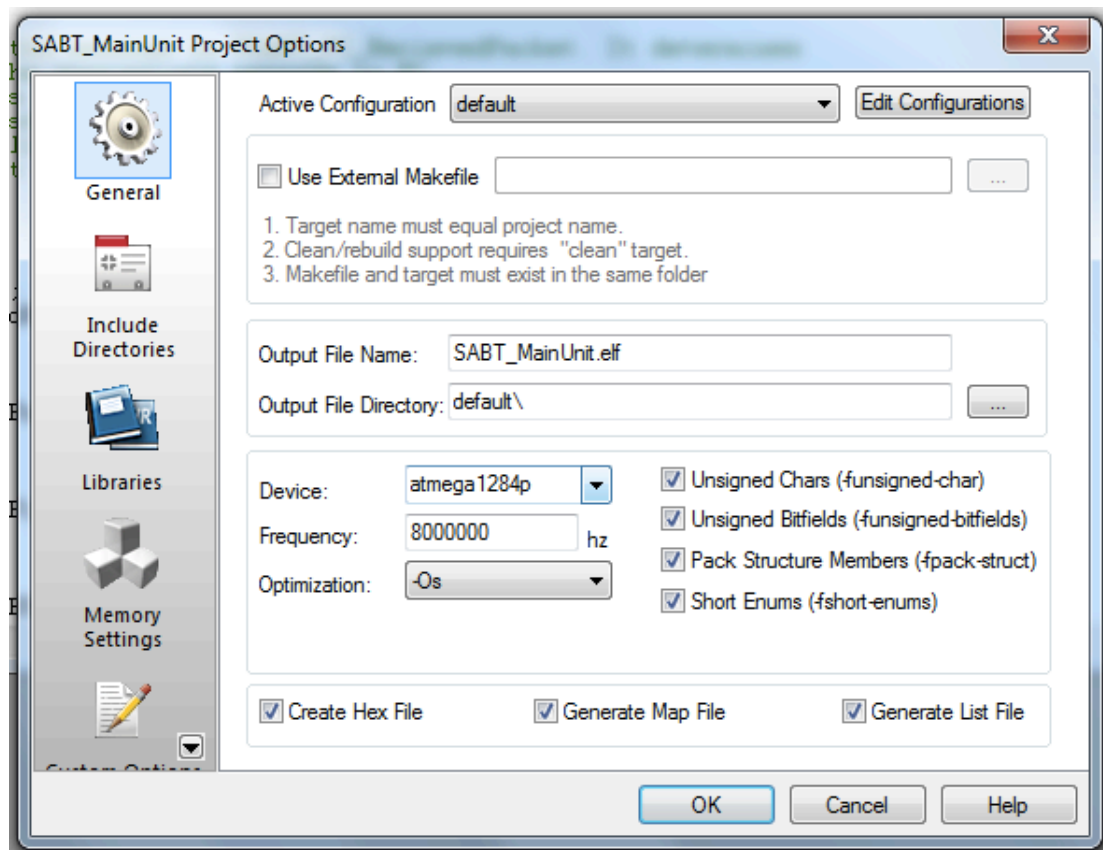


Figure 12 - Choose the proper device.

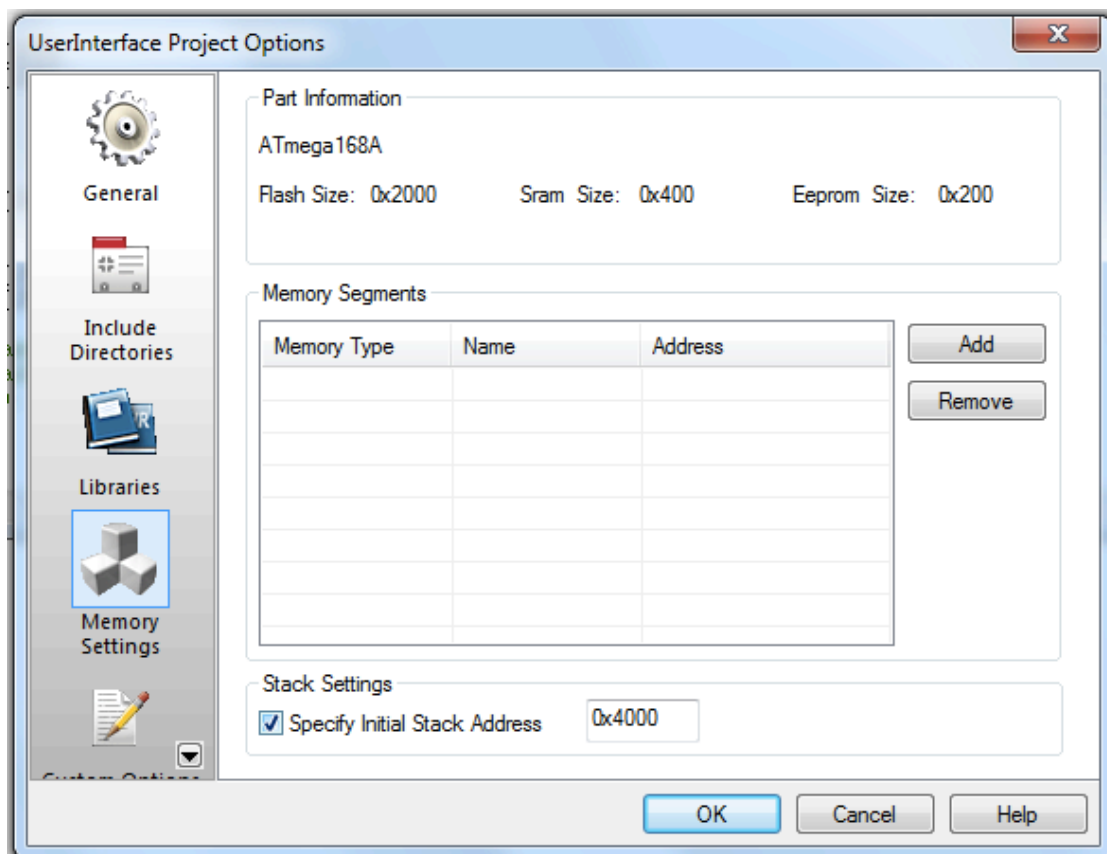


Figure 13 - Check 'Specify Initial Stack'

After making changes to the code - rebuild the project and connect to the microcontroller as shown below.

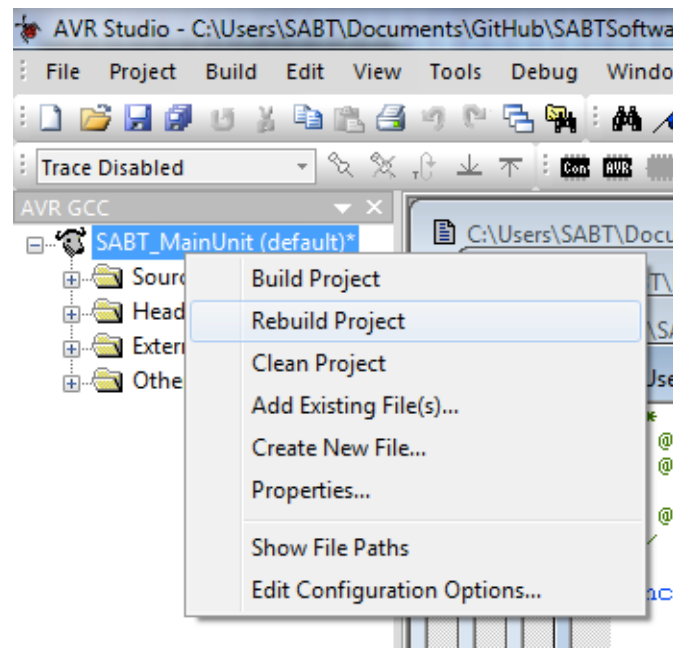


Figure 14 - Right click on the top level directory.

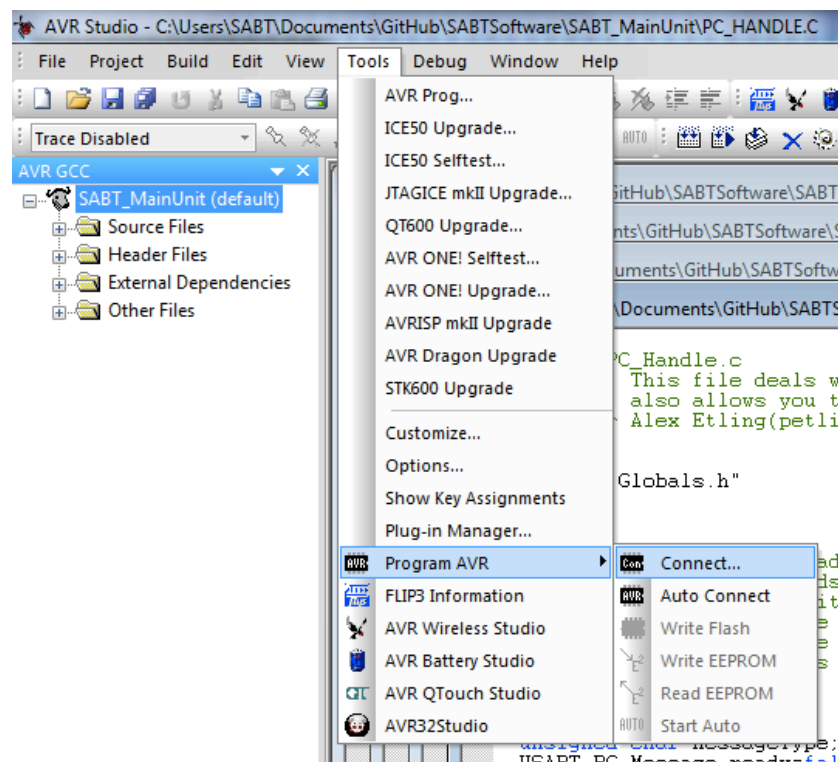


Figure 16 - Connect to the microcontroller

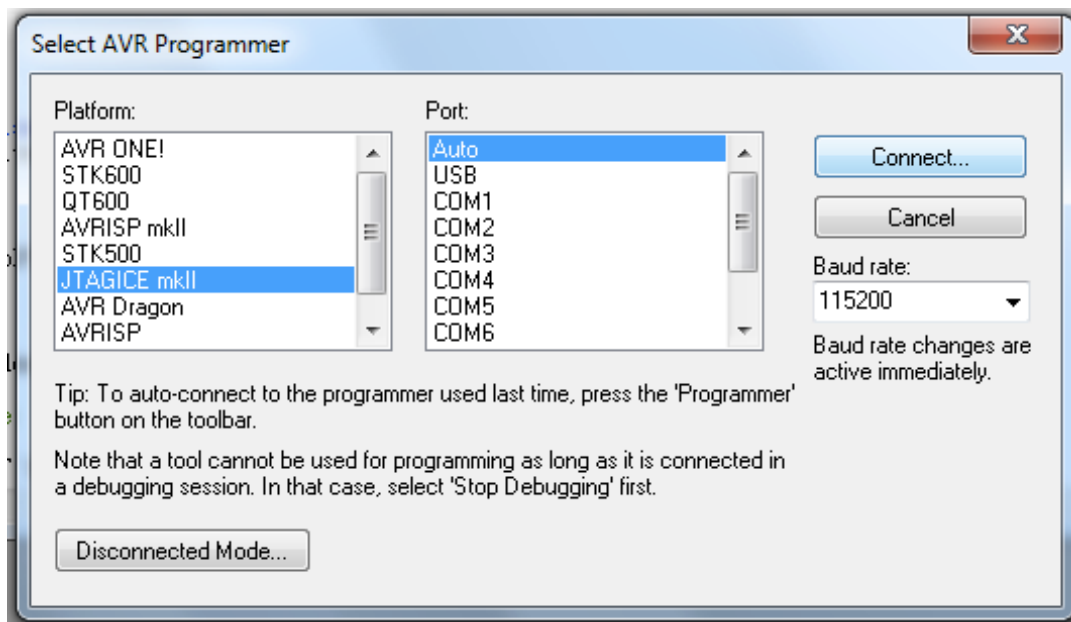


Figure 17 - Select programmer

**NOTE:** If/when connection problems arise, the most effective way to fix it is to turn off the main control module and programmer, unplug their USB cables and replug them. If this does not work, double check the orientation of the programming cable.

## Programmer settings

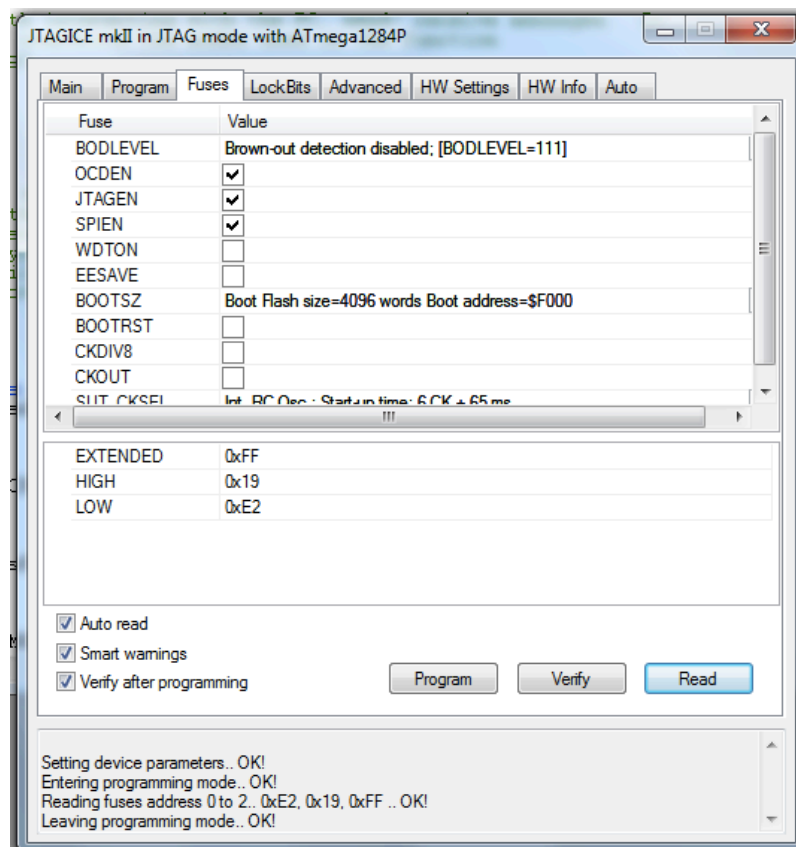


Figure 18 - Fuse settings



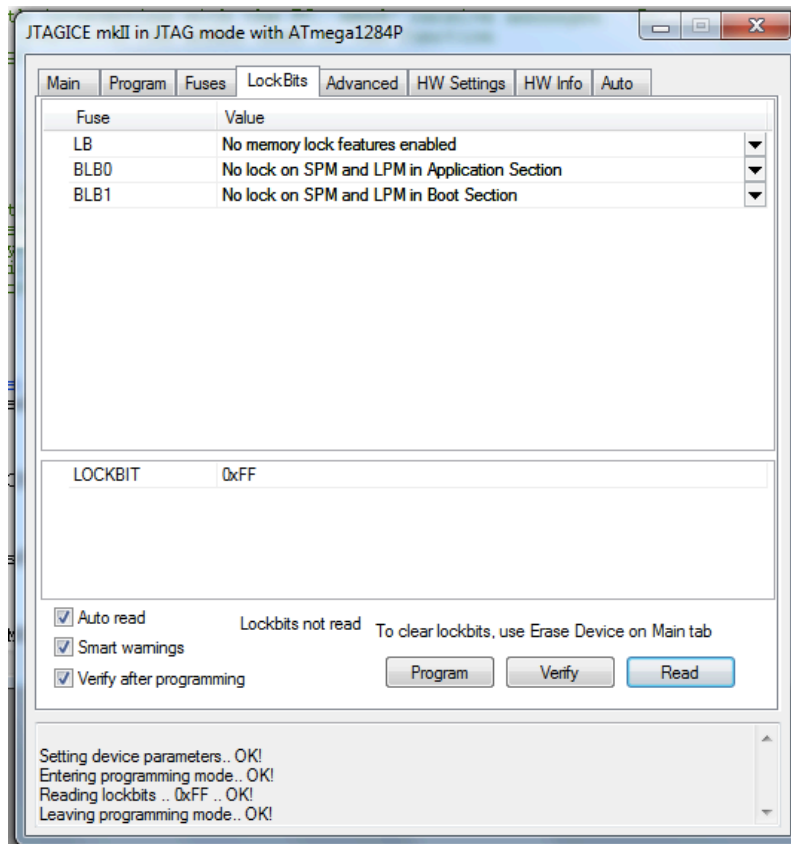


Figure 19 - Advanced settings

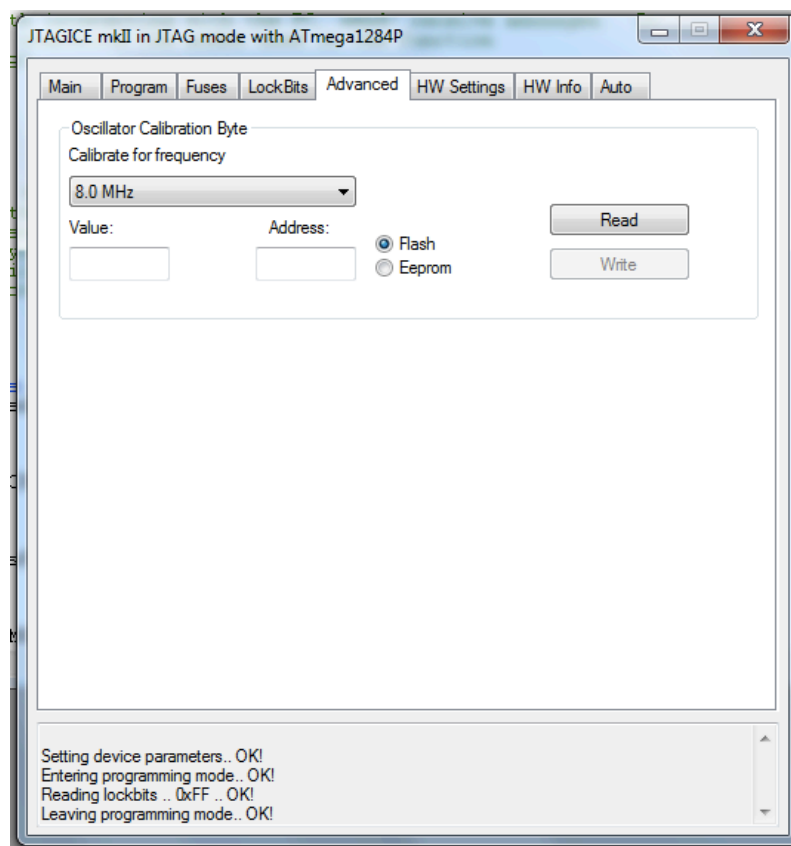


Figure 20 - LockBit settings

## Programming the microcontroller

In the 'Main' tab, select the proper device (ATmega 1284P for main control module, ATmega 168PA for user interface modules). If programming the main control module, use JTAG mode. If programming a user interface module, use ISP mode (Figure 21). Next, go to the 'Program' tab, select the proper .hex file and click 'Program' (Figure 22).

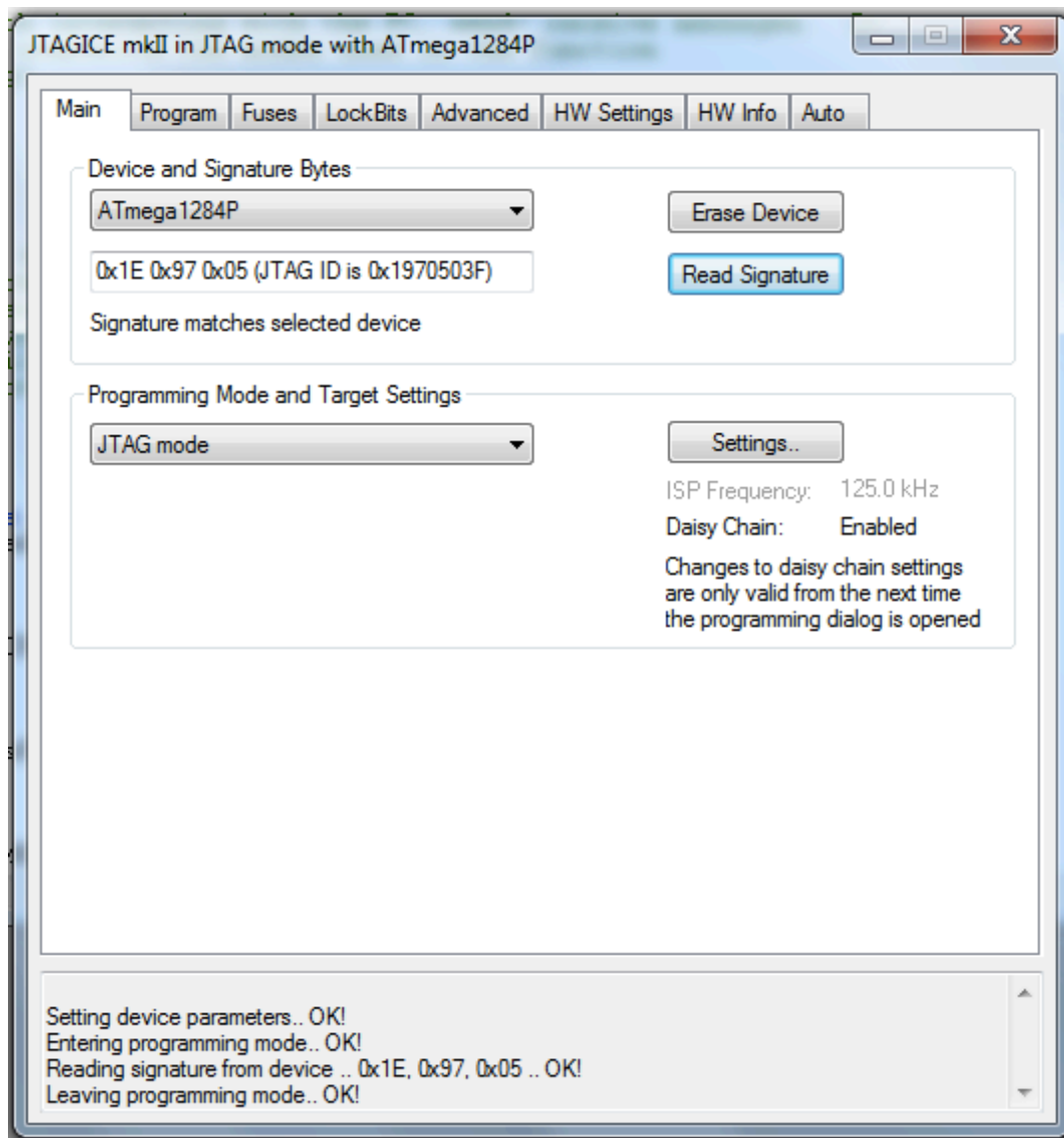


Figure 21 - Main tab settings

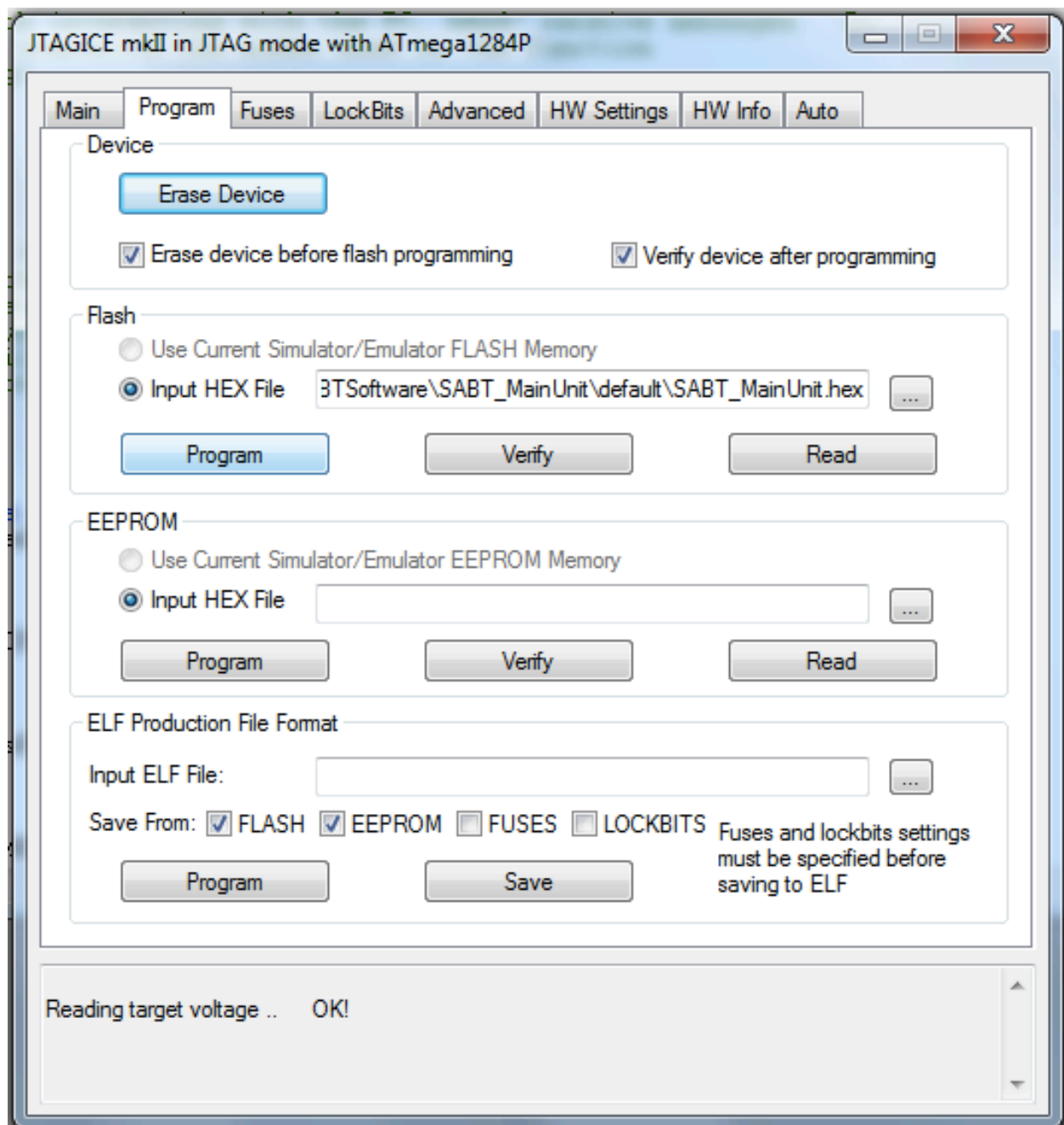


Figure 22 - Program the microcontroller

Check the printouts at the bottom of the display to make sure the device was programmed successfully. Enjoy!