

Updating Firmware on the CEENBoT 324

Version 0.1, September 21, 2011

Below are instructions for programming the factory firmware on your CEENBoT robot using Atmel's AVR Studio 4.

Background

What is Firmware?

Firmware is a program that is written and stored in non-volatile memory on the CEENBoT microcontrollers. It does not change nor need to be reprogrammed when the microcontroller starts up. Unless you take steps to change it, firmware does not change.

CEENBoTs, Microcontrollers and Firmware

The CEENBoT has 2 microcontrollers that have updateable firmware. New versions of firmware are released in pairs for the microcontrollers. We strongly recommend that if you update firmware for one of the microcontrollers, you update the other to the same version.

The main microcontroller on your CEENBoT is an Atmel ATmega324P or for newer models, the Atmel ATmega1284. We will refer to this as the "Mega".

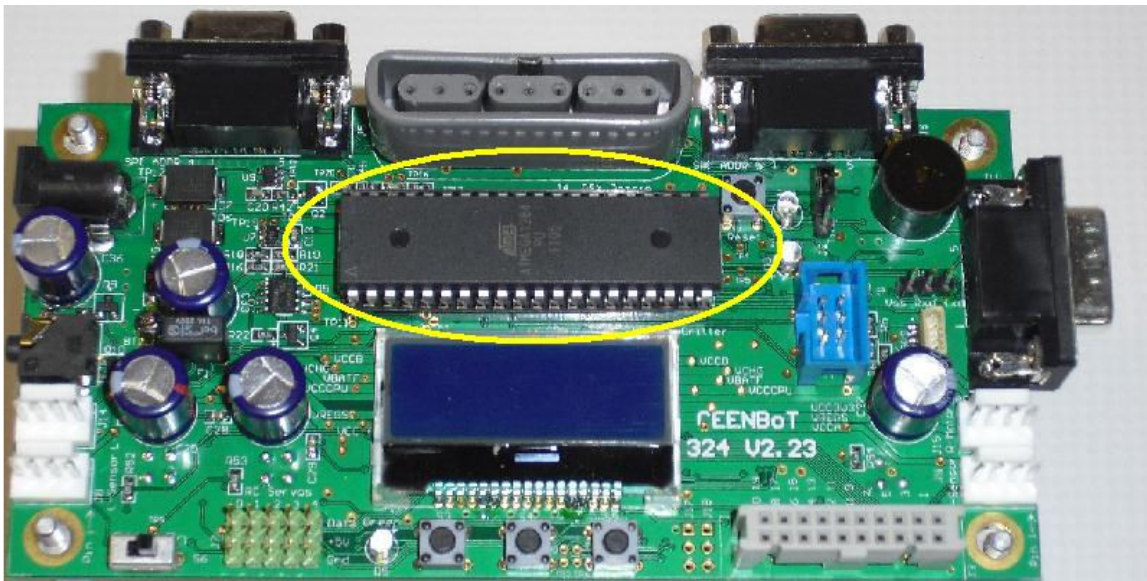


Figure 1 - CEENBoT ATmega324P (AKA "Mega")

The secondary microcontroller is an Atmel ATTiny48. We will refer to this as the "Tiny"

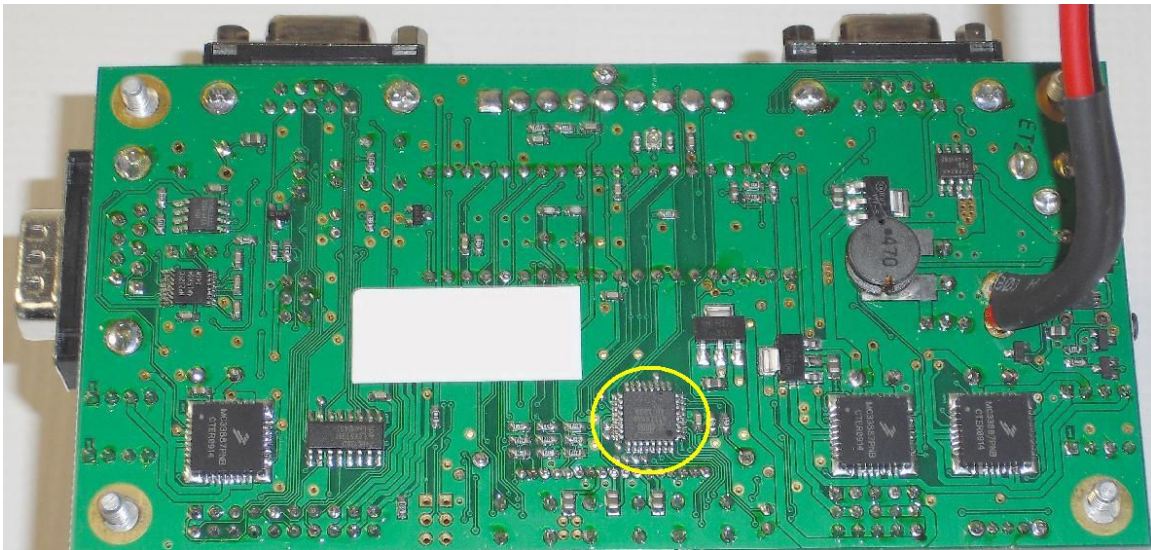


Figure 2 - CEENBoT ATTiny48 (AKA "Tiny")

Since these devices talk to each other, we recommend that they use the same firmware version to reduce the chances of odd behavior or problems due to communication problems.

Checking Firmware Versions

CEENBoTs report the installed version of software for both microcontrollers when the robot is running. Simply press the S3 button once to change to the firmware version screen.

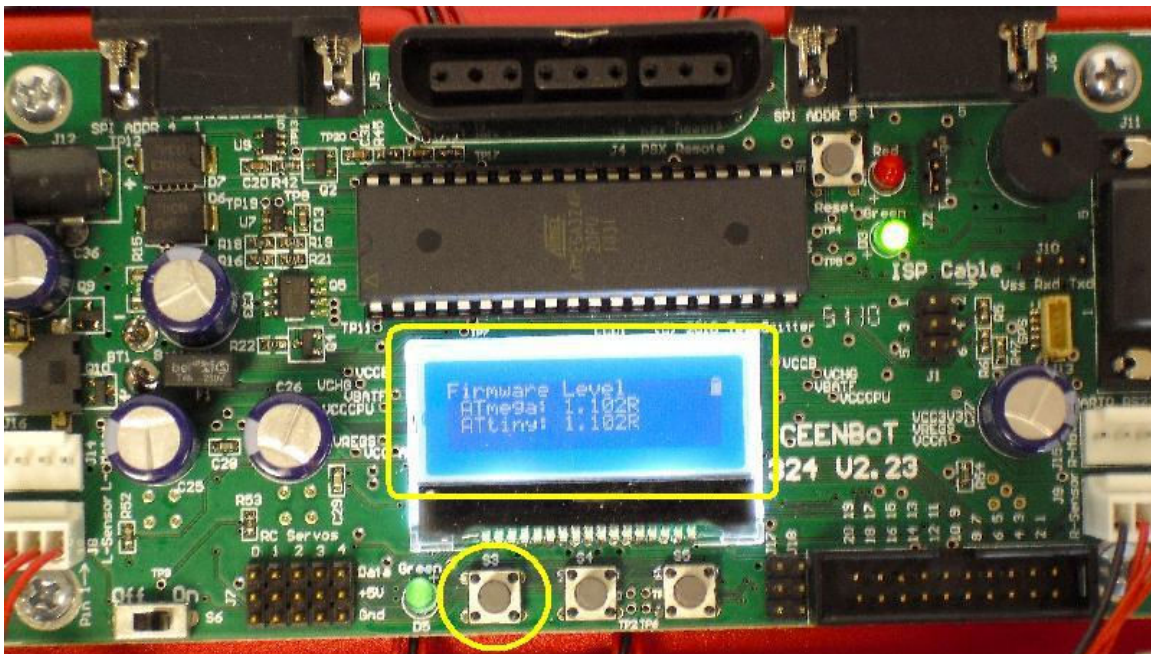


Figure 3 - Switch S3 to Display Firmware on LCD

CEENBoT publishes the most current firmware version on the www.ceenbotinc.com/tools web site. Compare the version you have installed with the published version to see if your CEENBoT is up to date.

New Firmware

In September, CEENBoT engineering released a new version of firmware that significantly improves battery charging and makes the CEENBoT compatible with the battery charger included with current CEENBoT robots. This version is 1.102R for both the Mega and Tiny. We recommend updating your robot to this version of firmware.

Upgrading Firmware

If you have already programmed your CEENBoT using AVR Studio 4, the upgrade process will be familiar to you. If you have not, read the following instructions and decide if you are comfortable performing the upgrade.

If you are not comfortable with performing the upgrade process, please contact us at support@ceenbotinc.com to discuss other options for the upgrade.

Requirements for Upgrading

Upgrading your CEENBoT will require that you have a few resources handy to complete the process:

1) A computer with Windows XP, Vista or 7 installed.

2) Atmel AVR Studio 4. This is no-cost software available for download from the Atmel web site, http://www.atmel.com/dyn/products/tools_card.asp?tool_id=2725

Note that you will need to register to download the free software. Install AVR Studio 4 onto your computer following the instructions provided by Atmel, including support for the AVRISP mkII programmer.

Warning: AVR Studio 4 is NOT compatible with CEENBoT Commander. If you already have CEENBoT Commander on your computer, DO NOT install AVR Studio 4. Contact us at support.ceenbotinc.com for more information.

3) Atmel AVRISP mkII programmer. This is a small device that connects between your computer and the CEENBoT, and performs the programming. On-line vendors like Digikey sell these, or they are available for purchase from CEENBoT, Inc. One programmer can be used to upgrade all the CEENBoT robots you have.



Figure 4 - Atmel's AVRISP mkII Programmer

4) New firmware. The current firmware version is available at: www.ceenbotinc.com/tools. Two files are needed, one for the Mega and one for the Tiny.

5) A charged battery. The CEENBoT will need to be turned on and powered by battery for the programming process.

6) A CEENBoT with an old version of firmware.

Upgrade Process

In the following steps, we will describe the actions to upgrade your firmware.

Step 1) Start AVR Studio

Step 2) Plug in your AVRISP mkII programmer and follow the prompts to install the driver for it on your computer.

Once successful, the AVRISP mkII programmer should now have a green light illuminated at the USB connector end and a red light illuminated on the robot end.



Figure 5 - AVRISP mkII Programmer with Correct Drivers

Step 3) For your safety and protection for the robot, disconnect the two motor cables from the CEENBoT controller.

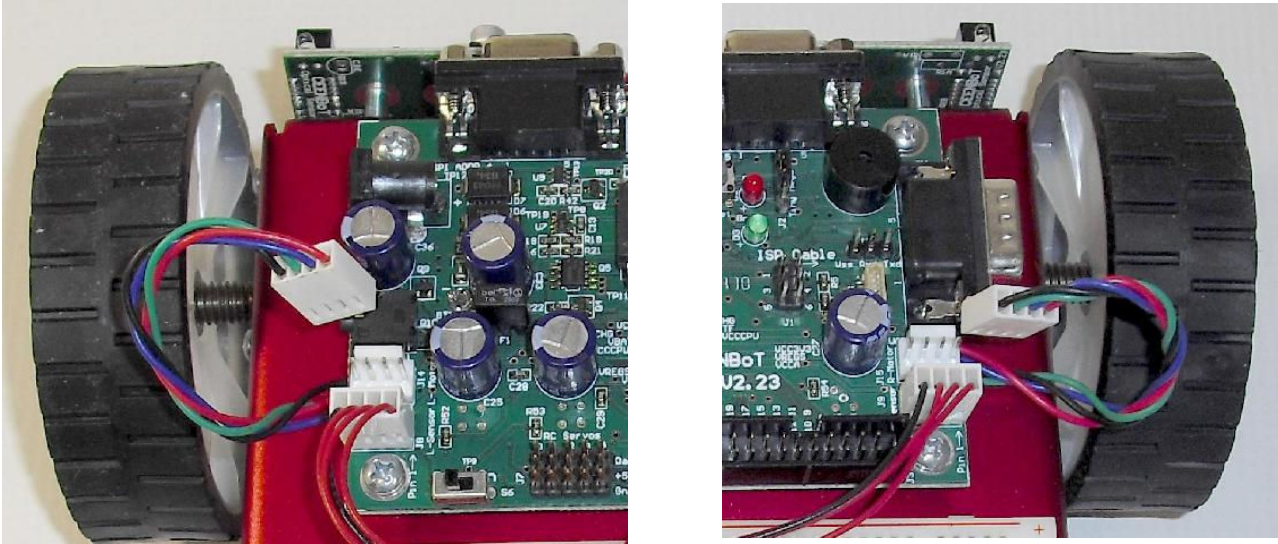


Figure 6 - Disconnect Both Motor Cables

Step 4) Connect the AVRISP mkII programmer to the CEENBoT ISP programmer connector. This connector is located to the right side of the board, and is 2 pins wide by 3 pins high. Newer robot controllers have a blue plastic shroud around this connector.

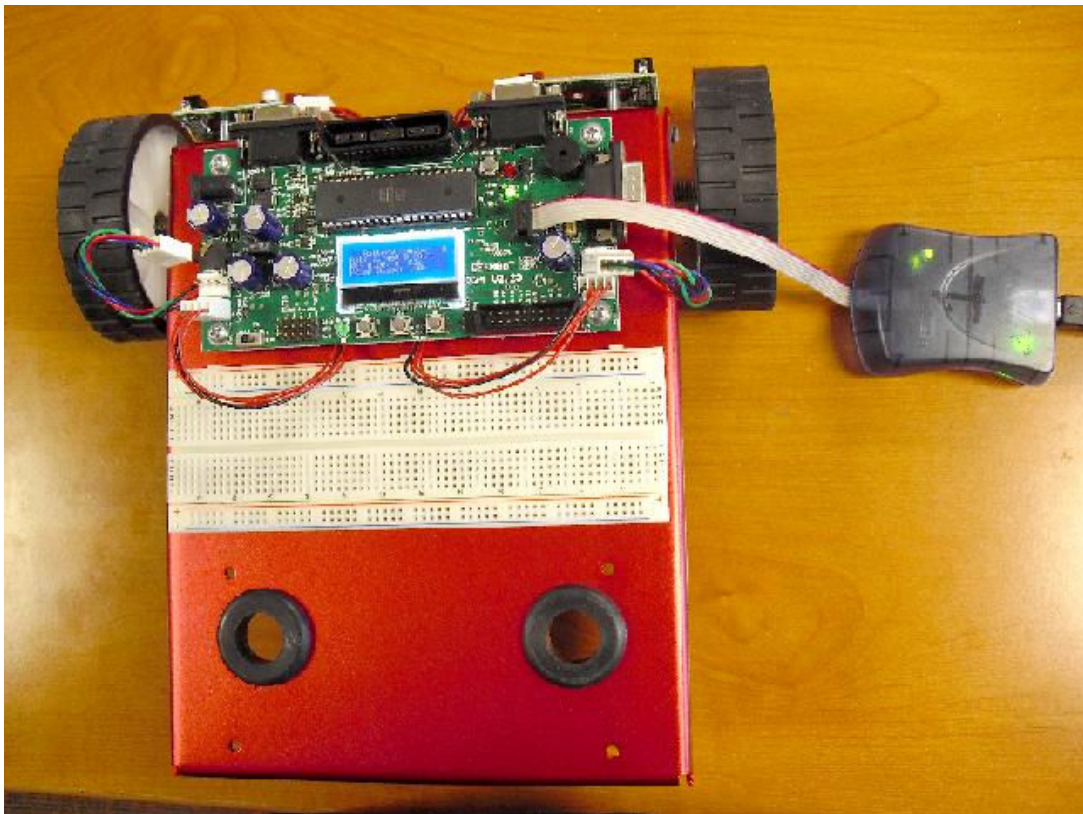


Figure 7 - Programmer Connected to Robot Controller

To correctly orient the programmer connector, the cable should go to the right, and all 6 pins should be connected. Double check this, as damage can be caused to the programmer if this is not correct.

Step 5) Confirm or move the microcontroller program select jumper is ready for the Tiny . The jumper is located immediately to the right of the CEENBoT controller's red LED, straight above the programmer connector. If the jumper is on the top two pins, it will select the Mega. If it is on the bottom two jumpers, it will select the Tiny. Make sure it is located on the bottom two pins for the Tiny.

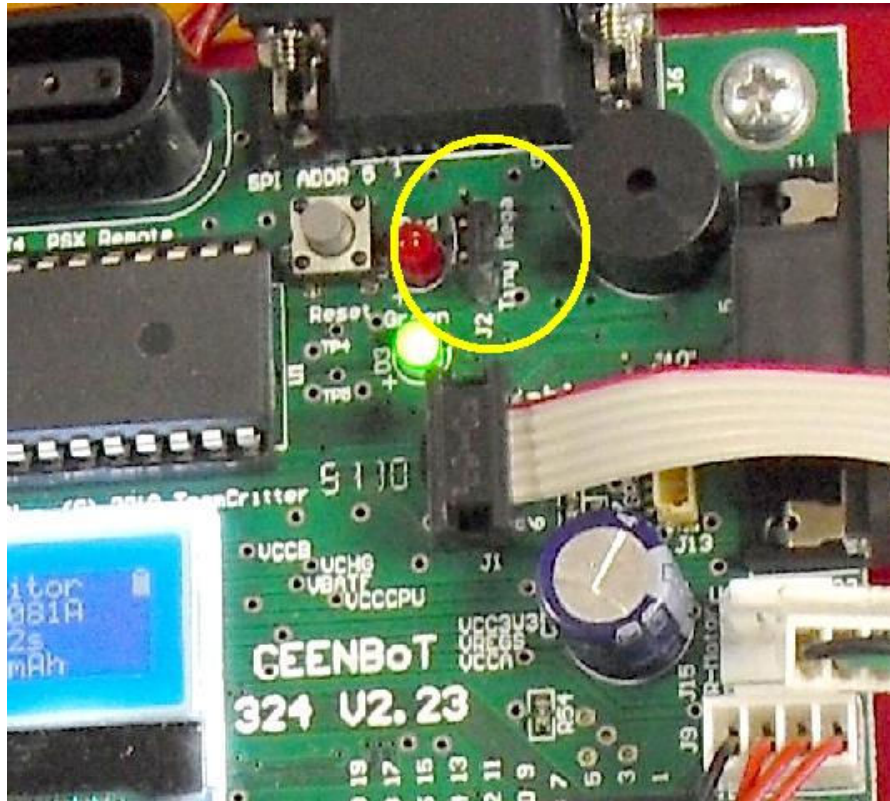


Figure 8 - Microcontroller Programming Select Jumper , Tiny At Bottom

Step 6) Turn on your CEENBoT. In a short time, the red light on the AVRISP mkII programmer will turn green so that both lights are now green.



Figure 9 - AVRISP mkII Programmer Correctly Connected to Controller

Step 7) Select the “Display Connect Dialog” icon on the AVR Studio 4 toolbar

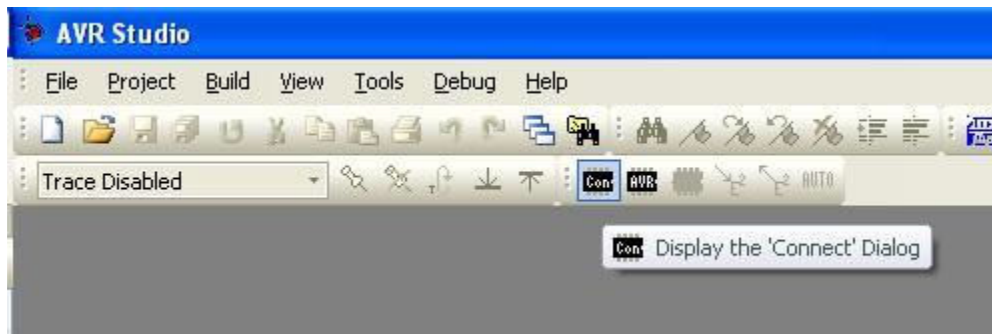


Figure 10 - AVR Studio 4 Programmer Connect Icon

Step 8) Identify your programmer as the AVRISP mkII, connected by USB.

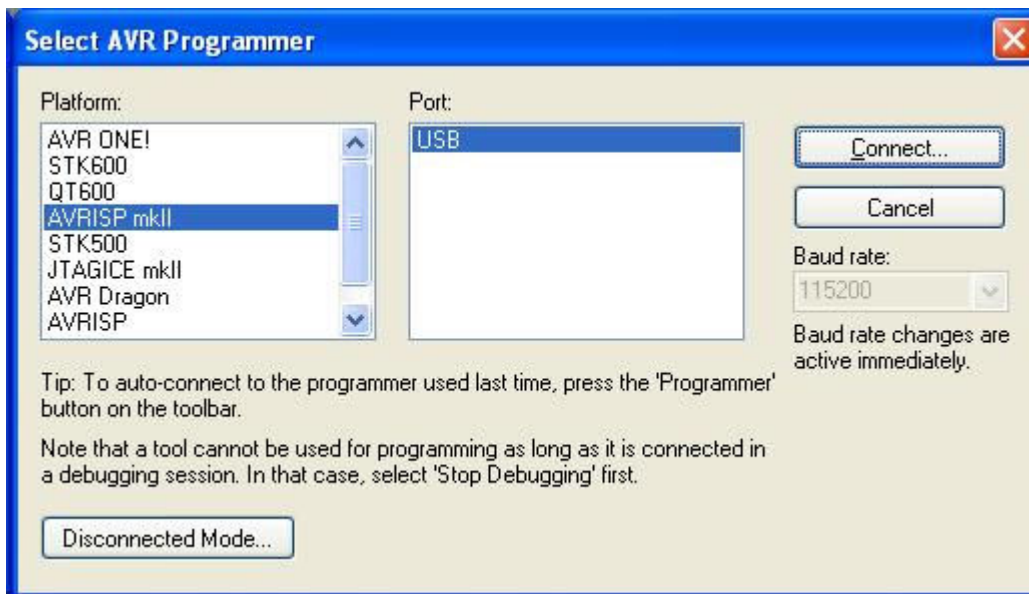


Figure 11 - Selection for the Correct Programmer

Step 9) In AVR Studio 4, on the Main screen, select 125KHZ as the programming speed, and click <write>

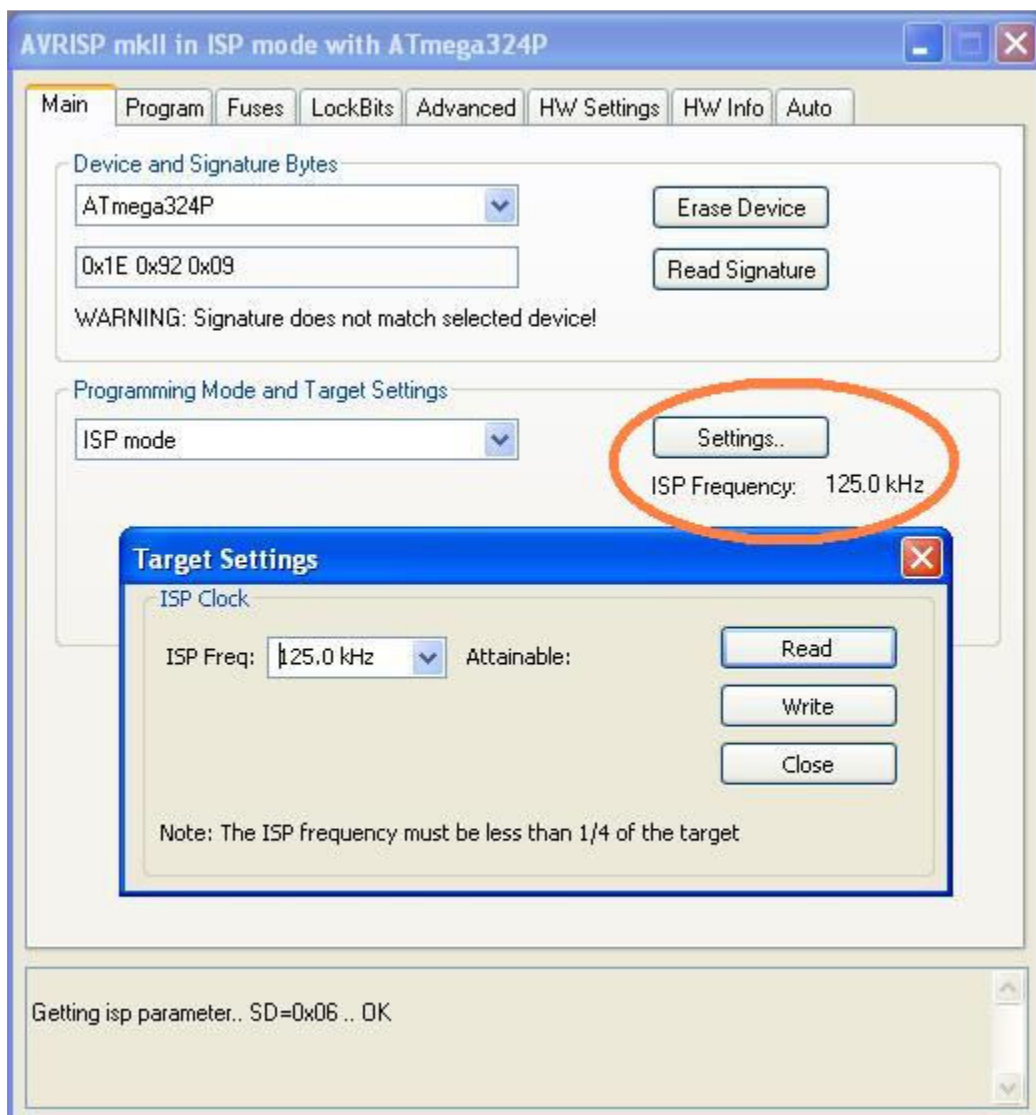


Figure 12 - In AVR Studio 4, Setting the Programmer Speed

Step 10) In AVR Studio 4, on the Main screen, select the ATtiny48 microcontroller from the drop-down menu. It will be near the bottom of the list.

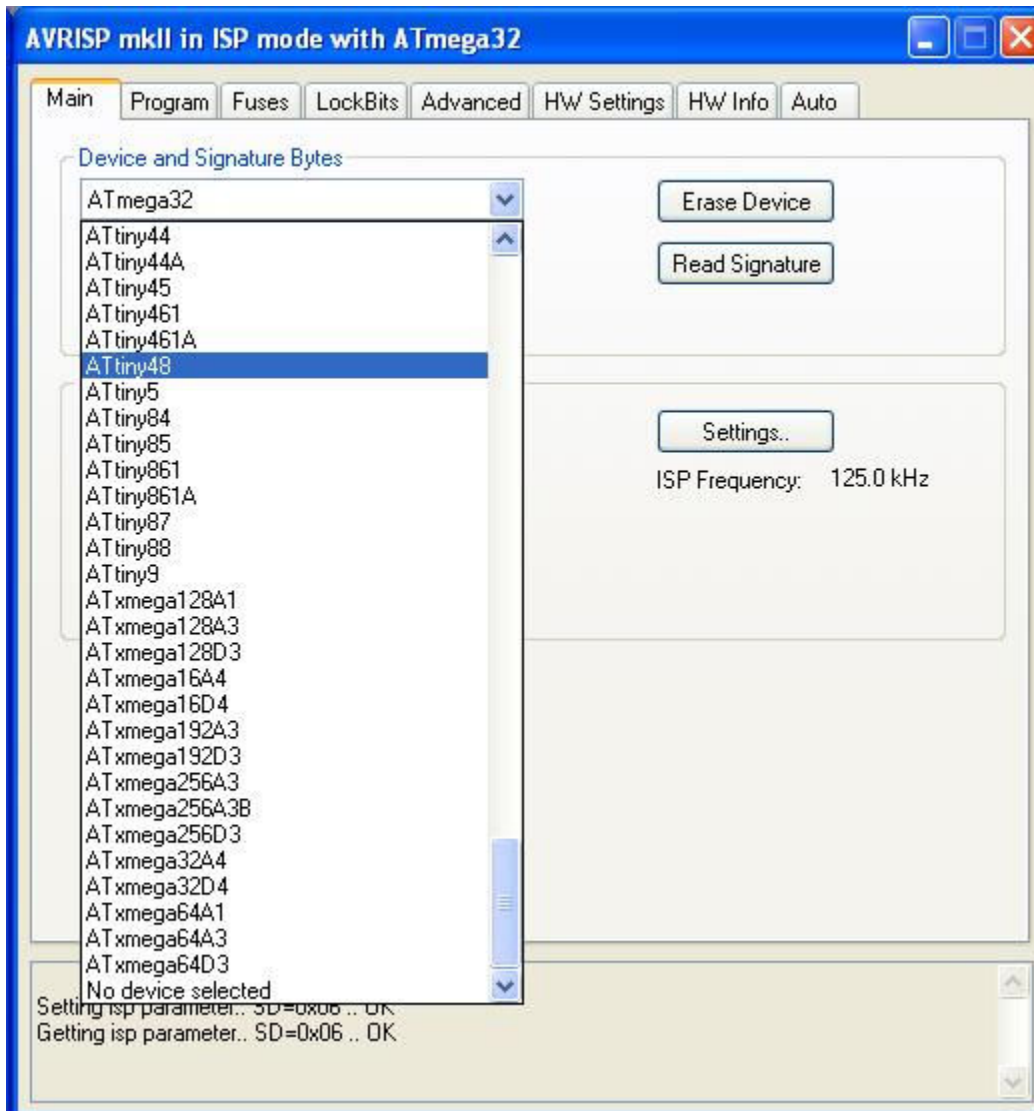


Figure 13 - Selecting the ATtiny48 Microcontroller in AVR Studio 4

Step 11) Check the processor ID by clicking the button. You should see the message” processor matches.

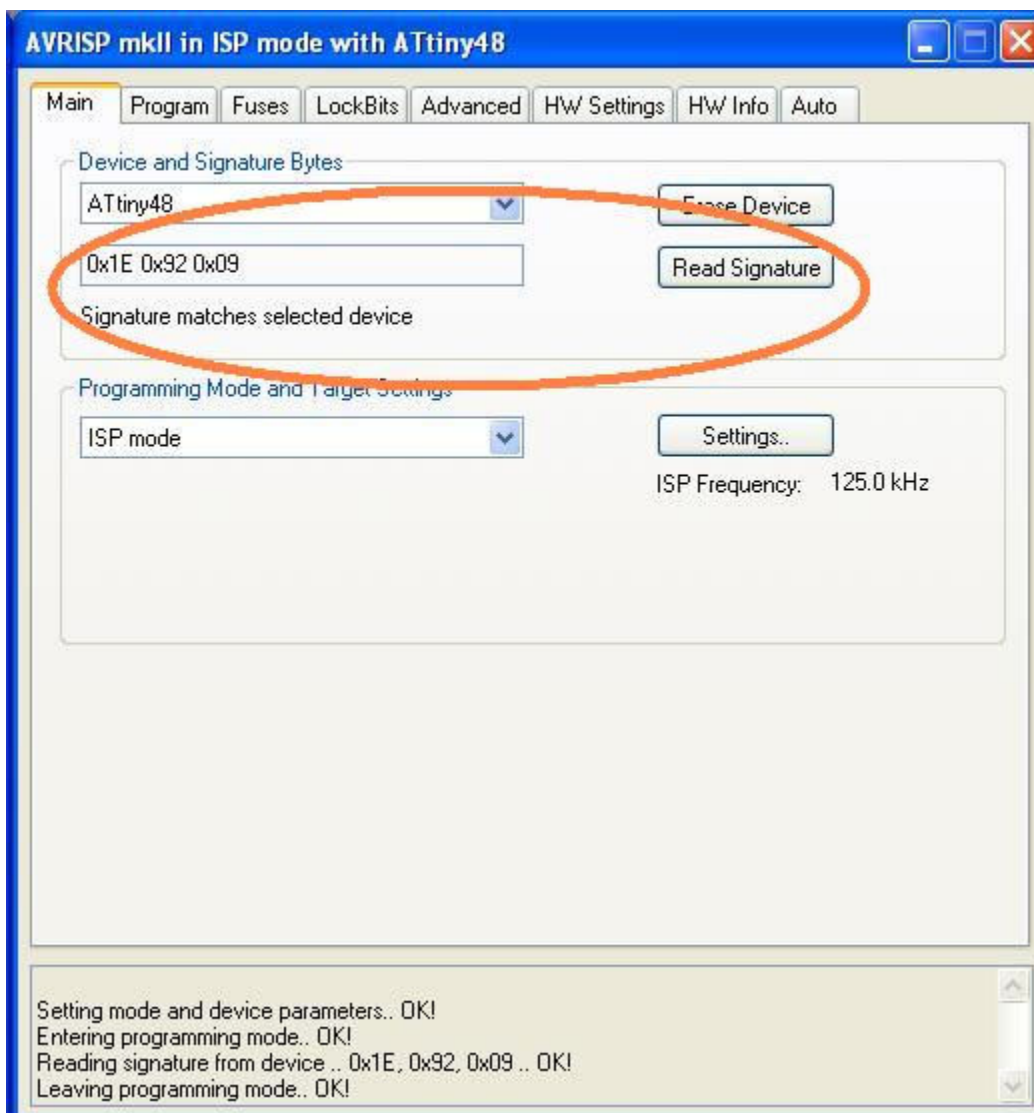


Figure 14 - Confirming the Correct Microcontroller is Selected in Software and With Jumper

If you get the message that the processor does not match, troubleshoot the problem by checking the microcontroller program select jumper and the microcontroller type on the programmer screen.

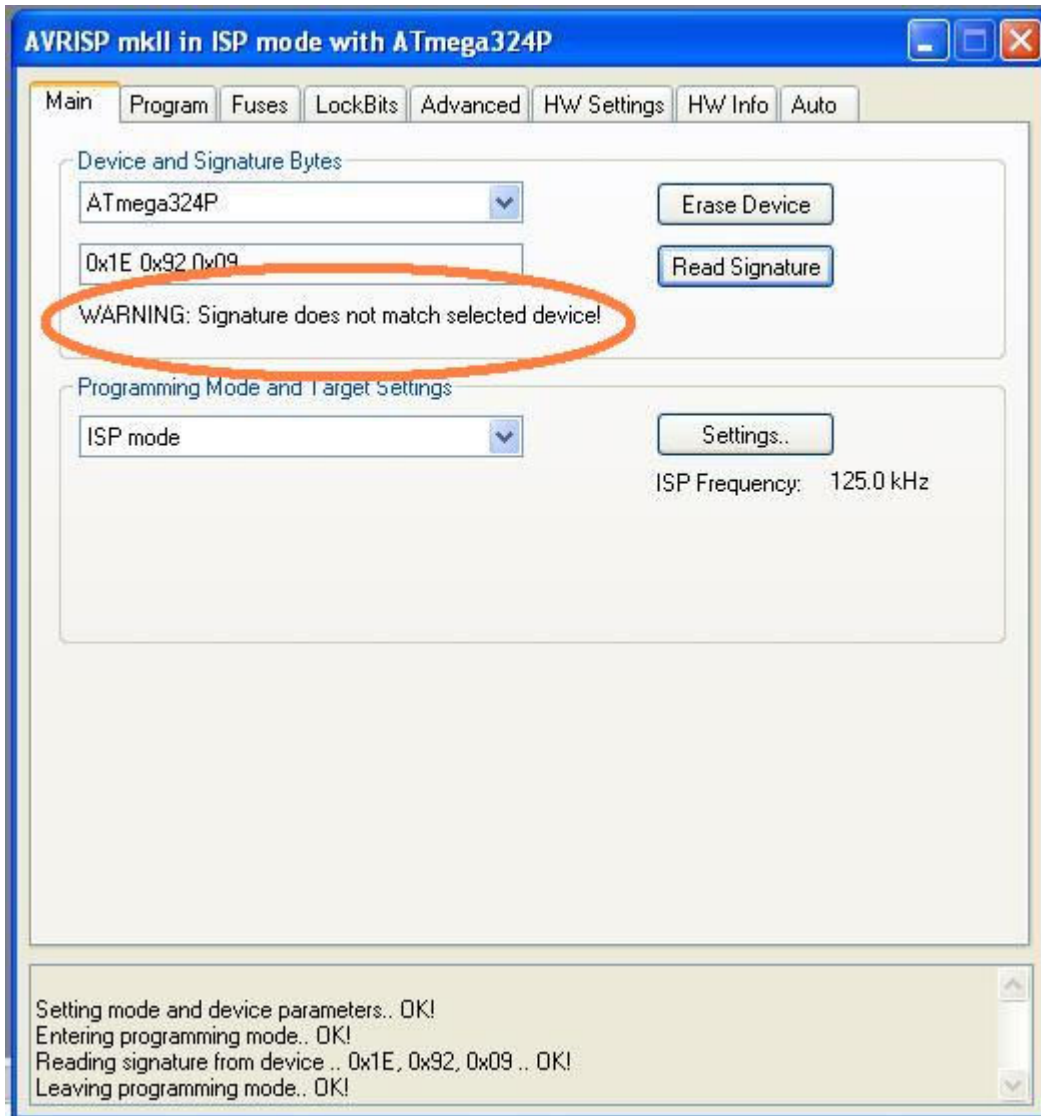


Figure 15 - Error if Incorrect Microcontroller Settings are Selected

If you get the message no power, make sure the robot is turned on, that both programmer lights are green, that the connector is on right and that the program select jumper is on right.

Step 12) In AVR Studio 4, on the programmer screen, select the firmware for the ATTiny48 microcontroller from the location where you put it when downloaded.

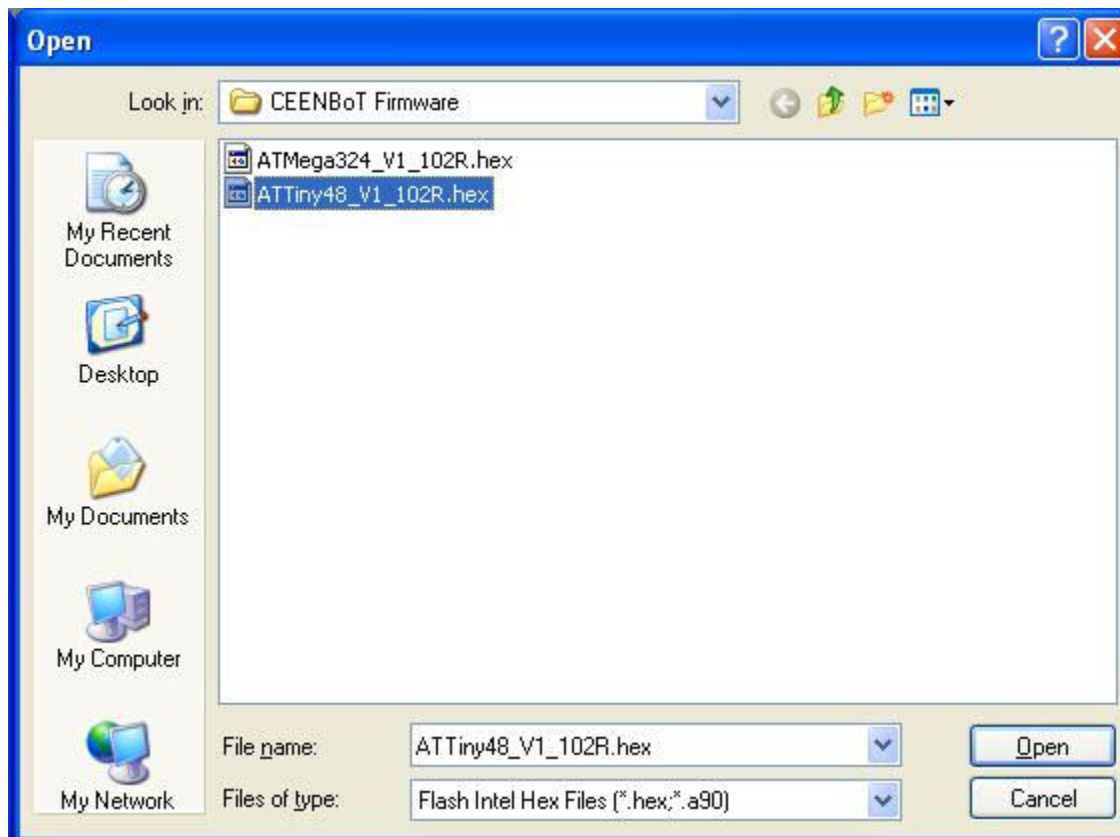


Figure 16 - Selecting the Right Firmware File for Tiny Upgrade

Step 13) Make sure the erase before programming check box is selected (checked).

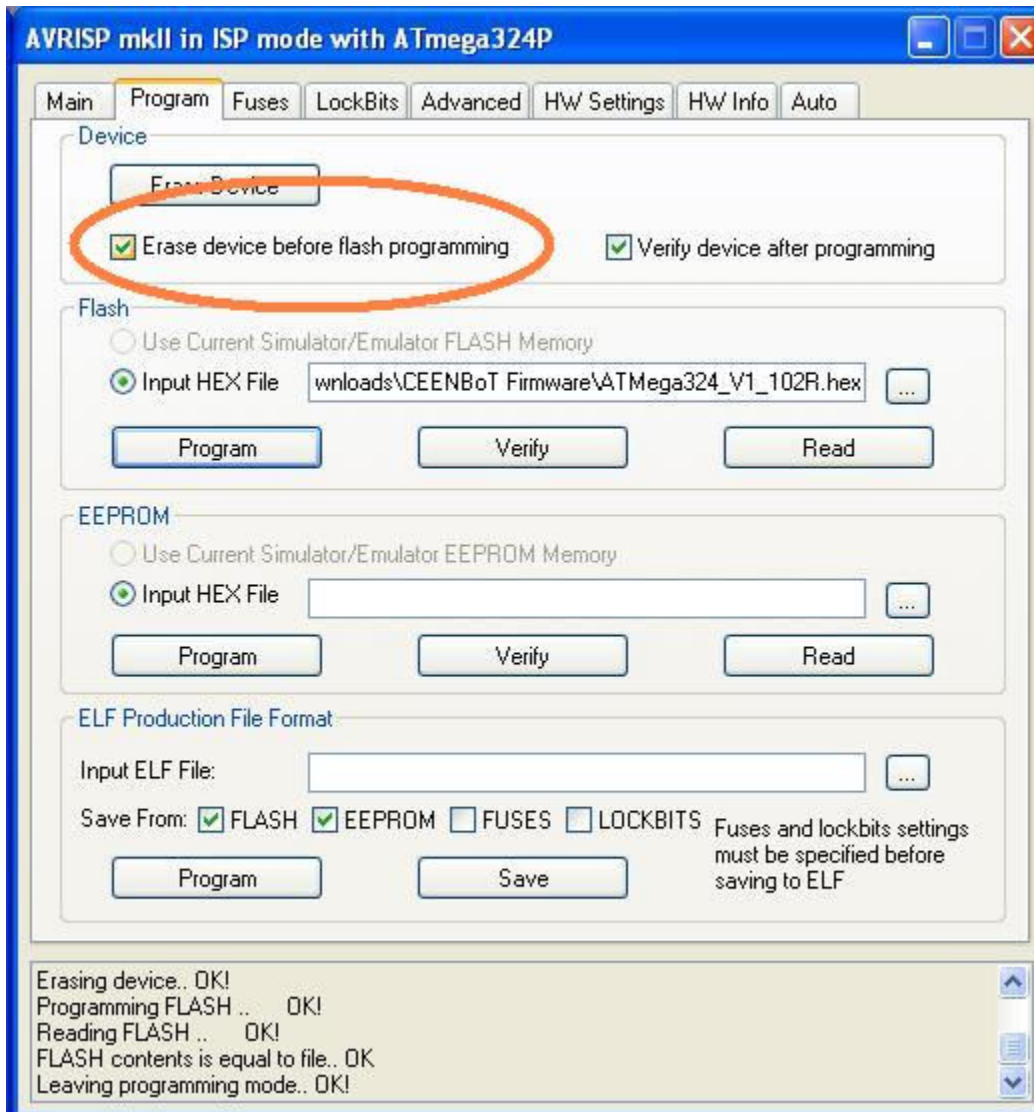


Figure 17 - Setting AVR Studio 4 to Erase the Microcontroller Before Reprogramming

Step 14) Press the program button and wait for the process to complete. AVR Studio 4 shows a progress bar at the bottom left of the screen. Note that programming is a two-step process that first writes the firmware and then reads it back to make sure no errors occurred.

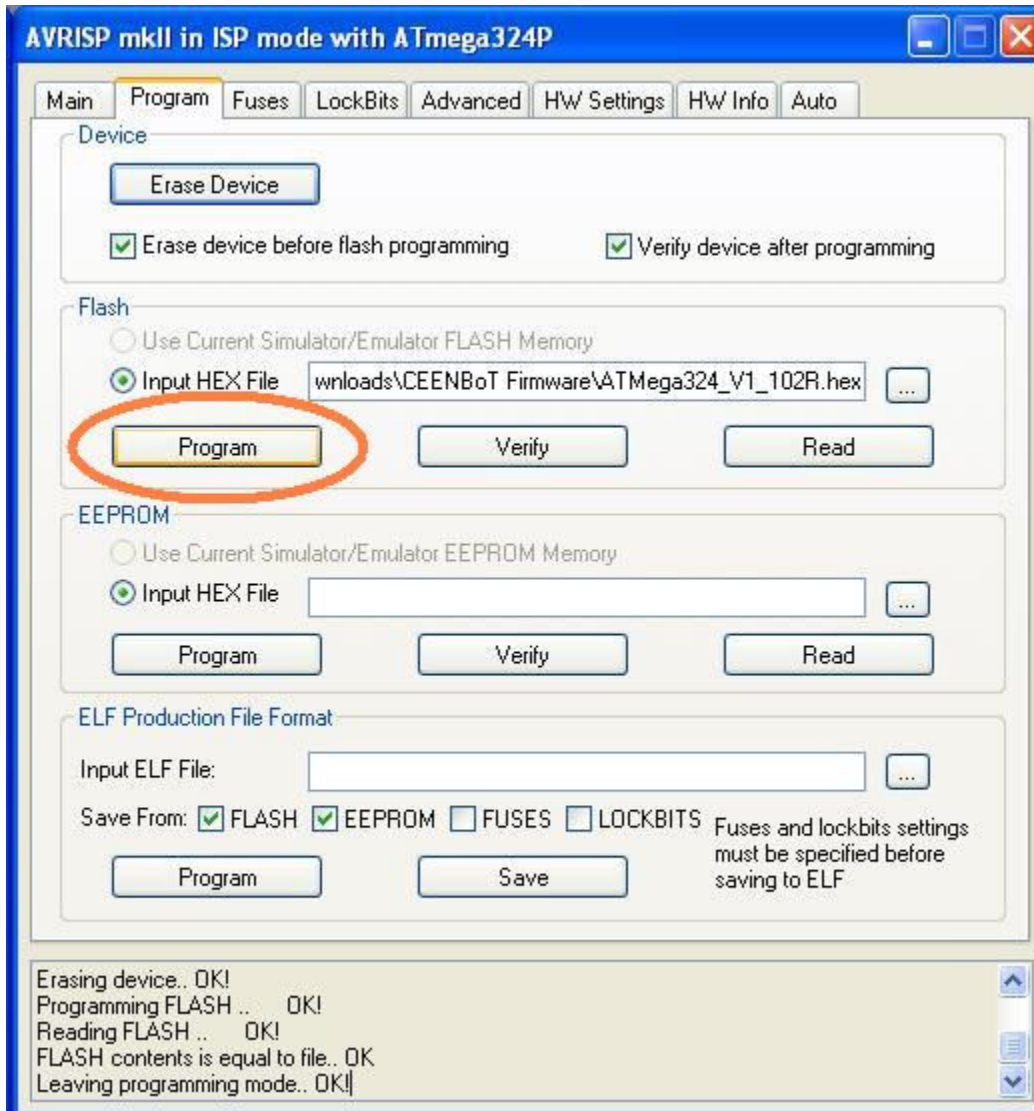


Figure 18 - The "Program" Button in AVR Studio 4 Starts Programming Process

Note the results of the programming process in the window at the bottom. You are looking for "OK!" for erasing, programming, reading and contents are equal.

Step 15) Prepare to program the Mega microcontroller. Move the microcontroller program select jumper to the top two pins to select the Mega

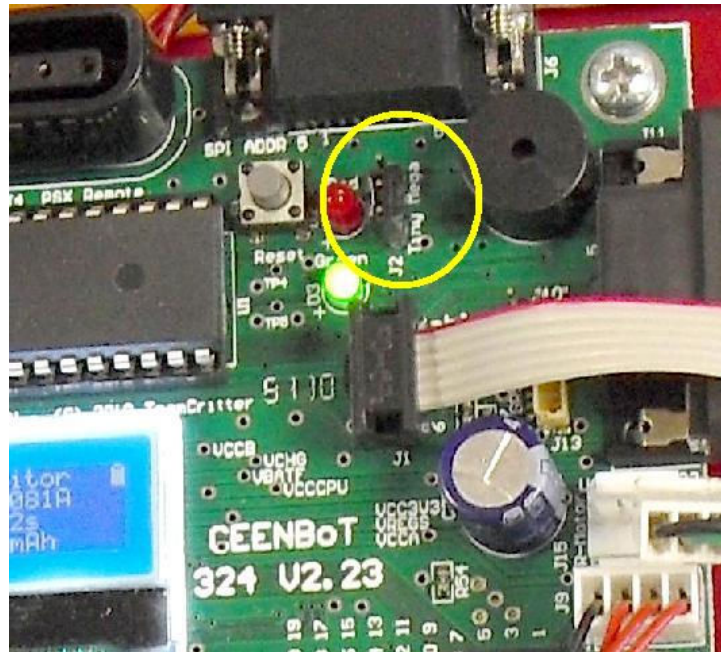


Figure 19 - Microcontroller Programming Select Jumper, Mega at Top

Step 16) In AVR Studio 4, on the programmer screen, select the ATmega324P microcontroller from the drop-down menu. It will be near the middle of the list. There are several microcontrollers listed that start with the name ATmega324. Be sure to use the ATmega324P setting.

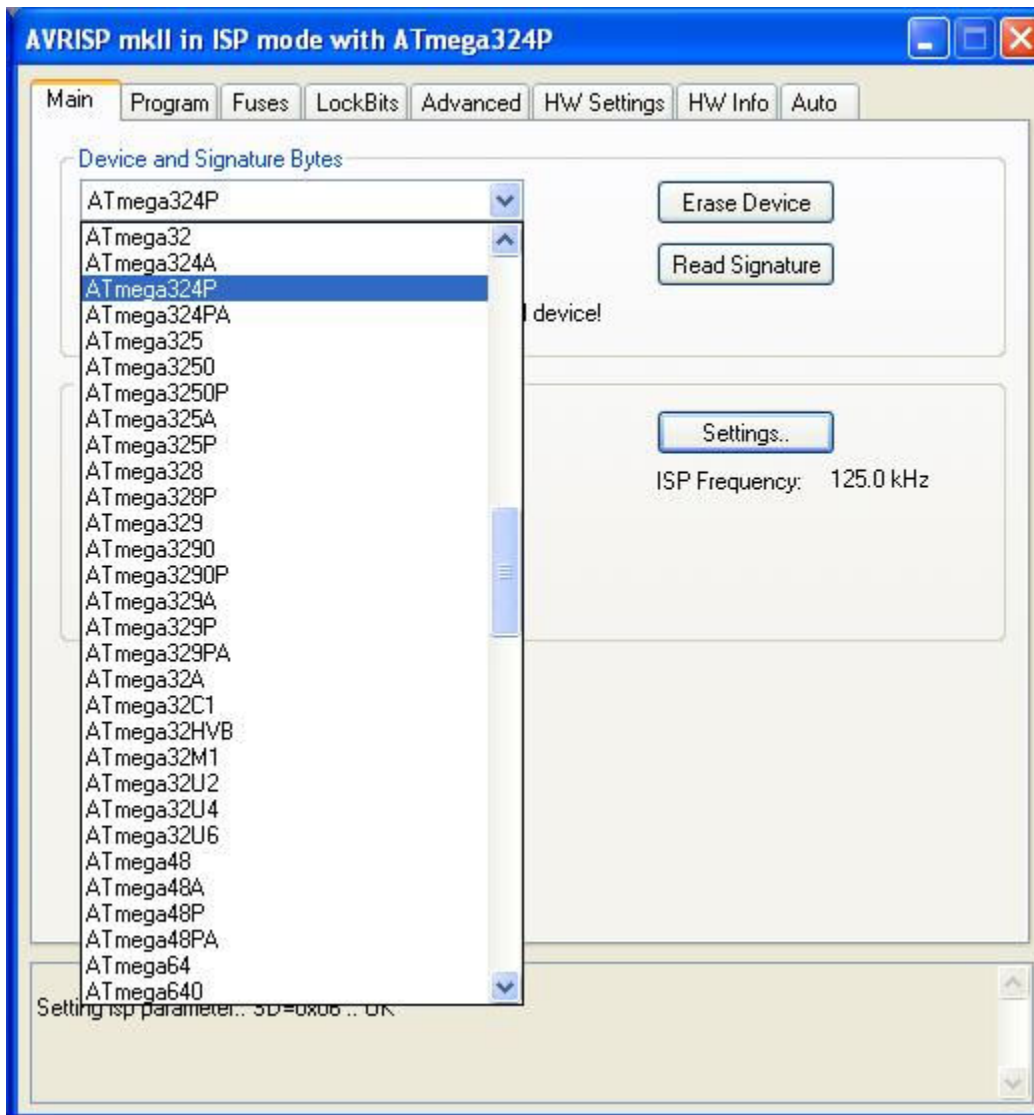


Figure 20 - Selecting the ATmega324P Microcontroller in AVR Studio 4

Step 17) Check the processor ID by clicking the button. You should see the message "processor matches".

If you get the message that the processor does not match, troubleshoot the problem by checking the microcontroller program select jumper and the microcontroller type on the programmer screen.

If you get the message no power, make sure the robot is turned on, that both programmer lights are green, that the connector is on right and that the program select jumper is on right.

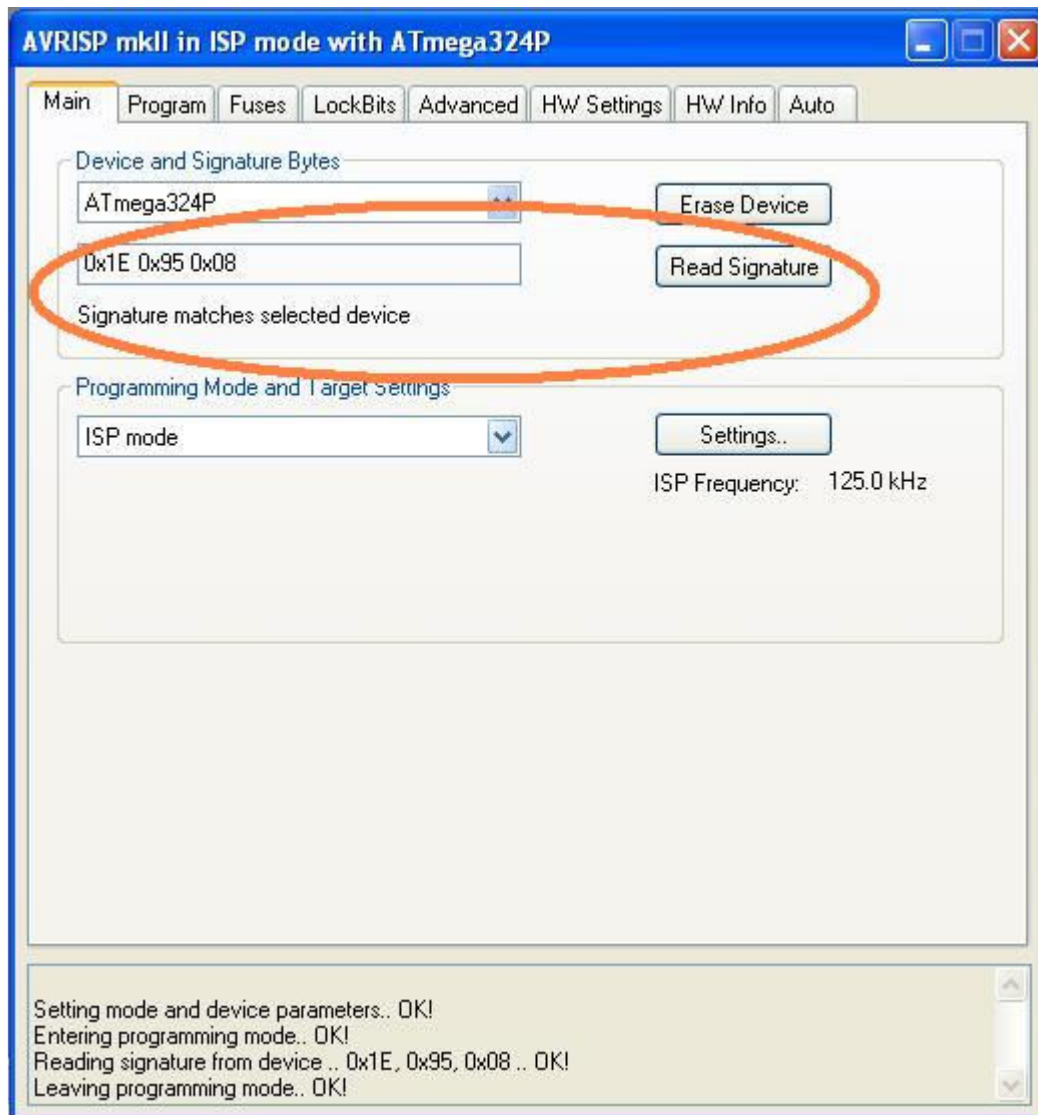


Figure 21 - Checking That the Correct Microcontroller is Selected on Controller and in Software

Note: a small number of robots built for University and College Engineering departments have the ATmega1284 processor installed instead of the ATmega324P. If your robot has the ATmega1284 installed, AVR Studio 4 will report a mismatch. This is acceptable and you may continue without changes to settings.

Step 18) In AVR Studio 4, on the programmer screen, select the firmware for the ATmega324 microcontroller from the location where you put it when downloaded.

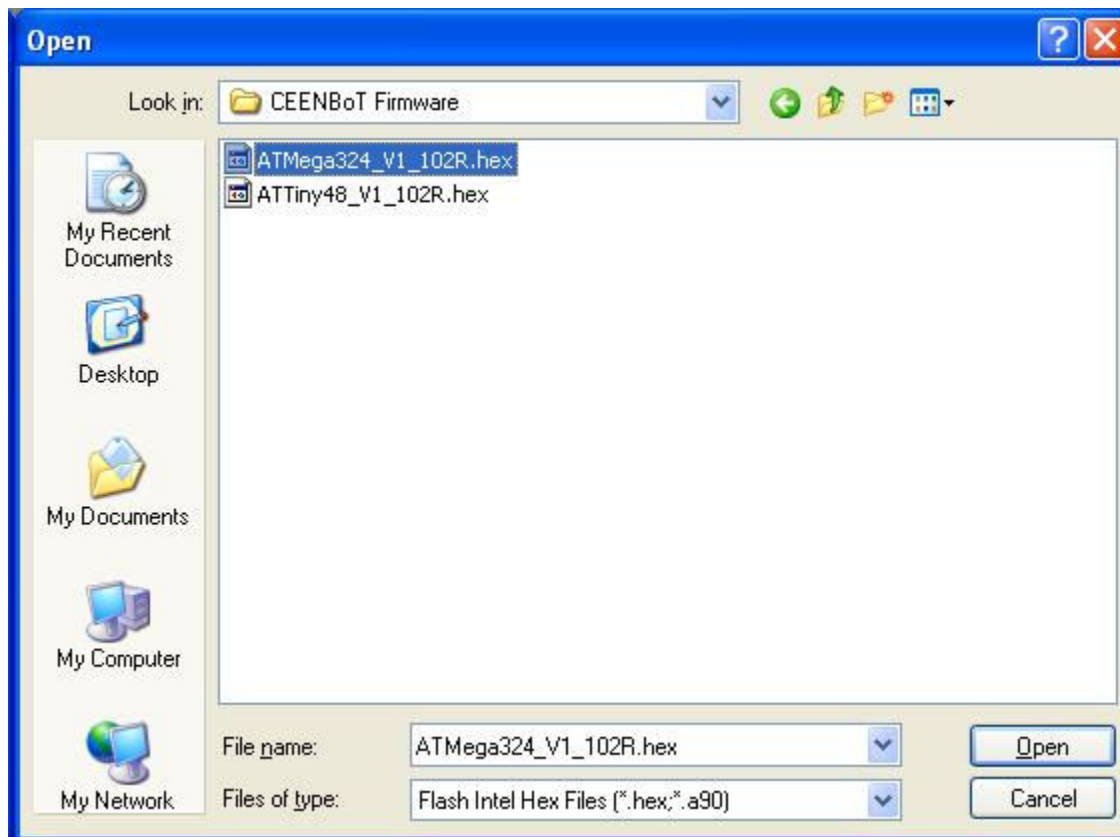


Figure 22 - Selecting the Correct Firmware File for the Mega

Step 19) Press the program button and wait for the process to complete. AVR Studio 4 shows a progress bar at the bottom left of the screen. Note that programming is a two-step process that first writes the firmware and the reads it back to make sure no errors occurred.

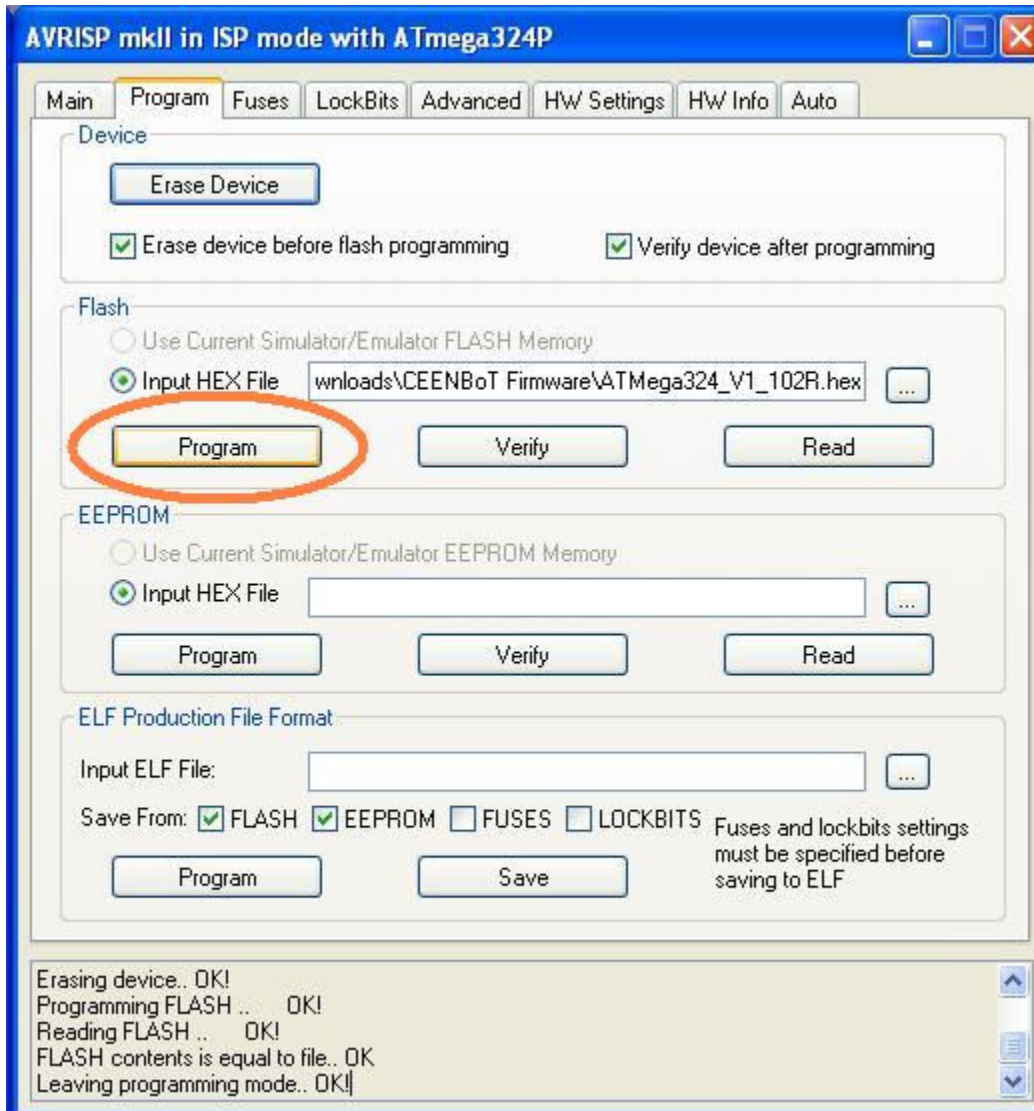


Figure 23 - The "Program" Button in AVR Studio 4 Starts Programming Process

Note the results of the programming process in the window at the bottom. You are looking for "OK!" for erasing, programming, reading and contents are equal.

Step 20) Disconnect the AVRISP mkII programmer from your CEENBoT, and turn off the CEENBoT for a few seconds.

Step 21) Turn your CEENBoT on and once it has fully started, check the firmware version it reports by pressing S3 until the correct screen is displayed. If the firmware version is the one you installed, your upgrade is successful. If it is not the expected version, check the steps and firmware file names and try again. If you are unable to get the expected version to display, contact us at support@ceenbotinc.com.

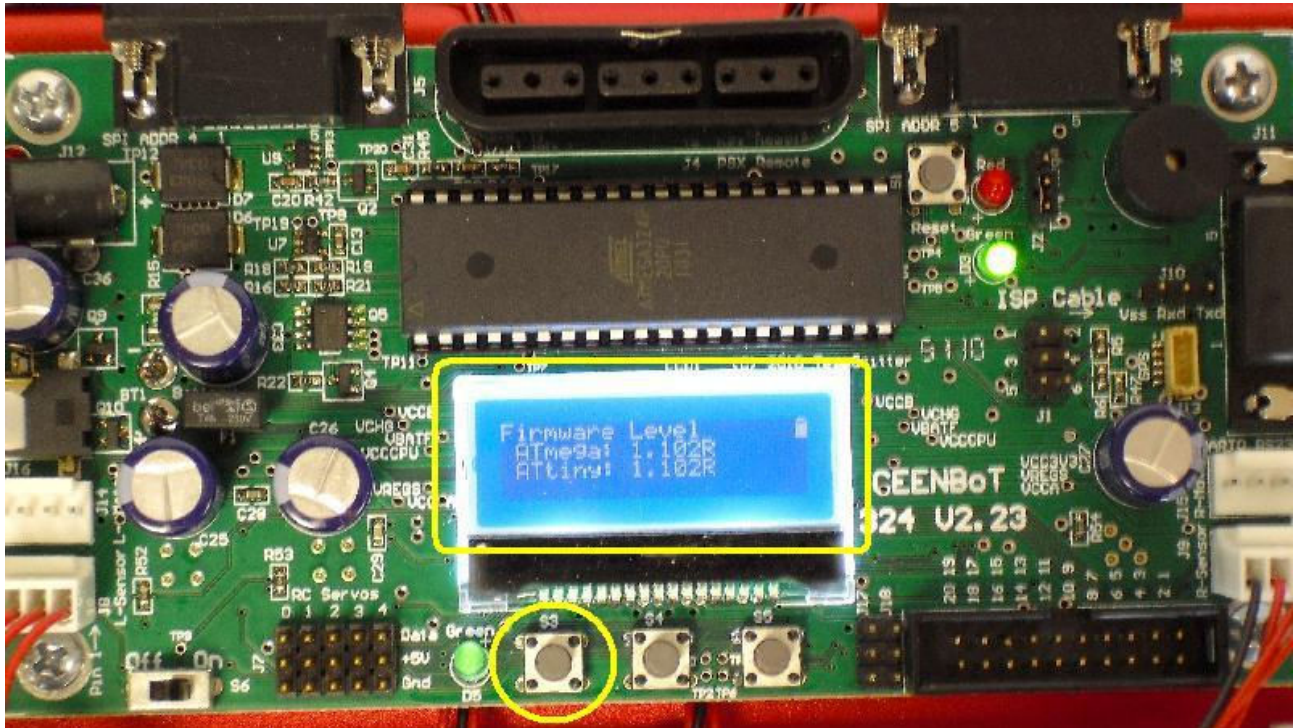


Figure 24 - Using Switch S3 to Check New Firmware on LCD

Step 22) Turn off the CEENBoT, reconnect the motor cables, close AVR Studio 4.

Congratulations, you are done!