ATMEGA2560 Boot Loader for MINI-MAX/AVR

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1. Introduction.

BiPOM ATMEGA2560 bootloader is a piece of software that runs on the MINI-MAX/AVR to facilitate downloading to the FLASH/EEPROM memory of ATMEGA2560 microcontroller on the MINI-MAX/AVR board.

The boot loader communicates with ATMEL AVR Studio (<u>www.atmel.com</u>) running on a PC through the serial port.

Through the bootloader, the MINI-MAX/AVR appears AVR Studio as the ATMEL STK500 board. Most of STK500 functions is working:

FLASH/EEPROM programming/reading/verifying, Fuses/locks/signature/parameters reading, etc.

There are some restrictions:

Fuses and lock bits can not be changed;

"Erase Device" erases only the 1st FLASH page (256 bytes).

2. How to get started ?

To get started with ATMEGA2560 bootloader it is necessary to download the bootloader itself to BOOT section of the FLASH. Any AVR programmer can be used for that purpose.

Please download <u>http://www.bipom.com/support/mmavr/bootloader_atmega2560.zip</u> and unzip to c:\bootloader_atmega2560 folder.

Let's review how to do that using AVRISP (or AVRISP2):

2.1. Connect the 6-pin header of AVRISP to X2 connector of MINI-MAX/AVR board (AVRISP comes with both 6-pin and 10-pin headers so if yours is set to 10-pin, header, change this to 6-pin header).



2.2. Connect your AVRISP to your PC's COM port.

2.3. Power the MINI-MAX/AVR board. AVRISP will be powered from the MINI-MAX/AVR board.

- 2.4. Run the AVR Studio on your PC.
- 2.5. Select Tools->Program AVR->Connect menu option.

Select AVR Programmer	X
Platform: STK500 or AVRISP JTAG ICE JTAGICE mkII AVRISP mkII AVR Dragon	Port: Auto COM1 COM2 COM3 COM4 COM5 Connect Connect
button on the toolbar. Note that the JTAGICE cannot be us	mer used last time, press the 'Programmer' ed for programming as long as it is n that case, select 'Stop Debugging' first.

- 2.6. Select the COM port and press "Connect".
- 2.7. Select ATmega2560 as the "Device"

AVRISP	
Program Fuses LockBits	Advanced Board Auto
Device	
ATmega2560	Erase Device
Programming mode	 Erase Device Before Programming Verify Device After Programming
	r/Emulator FLASH Memory tmega2560.hex
Program	Verify Read
	r/Emulator EEPROM Memory Projects1\AVR\WinAVR_Tests\bootloade
Program	Verify Read
Detecting on 'COM2' AVRISP with V2 firmware foun Getting revisions HW: 0x0f, S	id on COM2 SW Major: 0x02, SW Minor: 0x0a OK

2.8. Go to "Advanced " TAB and check signature

VRISP	Signature bytes should be reported as 0x1E 0x98 0x01 and the message should indicate "Signature matches
Signature Bytes	selected device".
0x1E 0x98 0x01 Signature matches selected device	
Oscillator Calibration byte Calibrate for frequency:	
8.0 MHz	
Value: Write Address: Read Cal. Byte Flash Write to Memory	
Communication Settings	
Baud rate: 115200 Saud rate changes are active immediately.	
Setting mode and device parameters OK! Entering programming mode OK! Reading signature 0x1E, 0x98, 0x01 OK!	

2.9. Click on "Program" Tab and select bootloader_atmega2560.hex as the Input Hex File in Flash section.

AVRISP		
Program Fuses LockBits	Advanced Board A	uto
Device ATmega2560	•	Erase Device
Programming mode	T	vice Before Programming vice After Programming
	r/Emulator FLASH Memor tmega2560\bootloader_at	·
Program	Verify	Read
C Use Current Simulto	r/Emulator EEPROM Merr	nory
Program	Verify	Read
Setting mode and device para Entering programming mode I Reading signature 0x1E, 0x5 Leaving programming mode (0K! 98, 0x01 0K!	
		4

2.10. Press the "Program" button in the Flash section to download the ATMEGA2560 bootloader to BOOT Section of the FLASH.

2.11. Click on "Fuses" Tab and check all the boxes according to two screen shoots below.

Important Note. Be careful and don't block the Serial program downloading.

AVRISP			
Program Fuses LockBits	Advanced Bo	ard Auto	
Program Tesses EdekBits Advanced Board Aduat Brown-out detection disabled; [BODLEVEL=111] Brown-out detection level at VCC=1.8 V; [BODLEVEL=110] Brown-out detection level at VCC=2.7 V; [BODLEVEL=101] Brown-out detection level at VCC=4.3 V; [BODLEVEL=100] On-Chip Debug Enabled; [OCDEN=0] JTAG Interface Enabled; [JTAGEN=0] Serial program downloading (SPI) enabled; [SPIEN=0] Watchdog timer always on; [WDTON=0] Preserve EEPROM memory through the Chip Erase cycle; [EESAVE=0] Boot Flash section size=512 words Boot start address=\$1FE00; [B001] Boot Flash section size=2408 words Boot start address=\$1FE00; [B001] Boot Flash section size=4096 words Boot start address=\$1FE00; [B001] Boot Reset vector Enabled (default address=\$0000); [B00TRST=0] Divide clock by 8 internally; [CKDIV8=0] Clock output on PORTE7; ICKOUT=01			
 Auto Verify Smart Warnings 	Program	Verify	Read
Entering programming mode OK! Writing fuses 0xFC, 0x98, 0xFF OK! Reading fuses 0xFC, 0x98, 0xFF OK! Fuse bits verification OK Leaving programming mode OK!			
AVDICD			
AVRISP Program Fuses LockBits	Advanced Bo	ard Auto	
Program Fuses LockBits □ Ext. Crystal Osc.; Frequ □ Ext. Crystal Osc.; Frequ	Jency 3.0-8.0 MH Jency 8.0- MHz Jency 8.0- MHz	z; Start-up time: 25 z; Start-up time: 11 z; Start-up time: 11 z; Start-up time: 11 z; Start-up time: 16 z; Start-up time: 16	<pre>< CK + 0 ms; < CK + 4.1 m; < CK + 65 ms 6K CK + 0 ms 6K CK + 4.1 r 6K CK + 65 m 3 CK + 65 ms CK + 65 ms; CK + 0 ms; [(CK + 4.1 ms; CK + 65 ms; < CK + 0 ms;</pre>
Program Fuses LockBits Ext. Crystal Osc.; Frequ Ext. Crystal Osc.; Frequ	Jency 3.0-8.0 MH Jency 8.0- MHz Jency 8.0- MHz Jency 8.0- MHz Jency 8.0- MHz Jency 8.0- MHz Jency 8.0- MHz Jency 8.0- MHz	2; Start-up time: 25 2; Start-up time: 11 2; Start-up time: 11 2; Start-up time: 16 2; Start-up time: 16 2; Start-up time: 256 35tart-up time: 256 35tart-up time: 256 35tart-up time: 17 35tart-up time: 18 35tart-up time: 18 35tart-up time: 161 35tart-up time: 161 35tart-up time: 161	<pre>< CK + 0 ms; < CK + 4.1 m; < CK + 65 ms 6K CK + 0 ms 6K CK + 65 m 3 CK + 65 m 3 CK + 65 ms CK + 0 ms; [(CK + 4.1 ms; CK + 65 ms; < CK + 65 ms; < CK + 65 ms;</pre>
Program Fuses LockBits Ext. Crystal Osc.; Frequ Ext. Crystal Osc.; Frequ	Jency 3.0-8.0 MH Jency 8.0- MHz Jency 8.0- MHz	2; Start-up time: 25 2; Start-up time: 11 2; Start-up time: 11 2; Start-up time: 16 2; Start-up time: 16 2; Start-up time: 256 3tart-up time: 256 3tart-up time: 256 3tart-up time: 1K 3tart-up time: 1K 3tart-up time: 1K 3tart-up time: 161 3tart-up time: 161 3tart-up time: 161	<pre>< CK + 0 ms; < CK + 4.1 m; < CK + 65 ms 6K CK + 0 ms 6K CK + 4.1 r 6K CK + 65 m 3 CK + 65 ms CK + 65 ms; CK + 0 ms; [(CK + 4.1 ms; CK + 65 ms; < CK + 0 ms;</pre>

2.12. Press the "Program" button.

2.13. Click on "LockBits" Tab and check all the boxes according to the picture below. *Important Note. Be careful and do NOT check "Further programming disabled" options.*

AVRISP
Program Fuses LockBits Advanced Board Auto
 Mode 1: No memory lock features enabled Mode 2: Further programming disabled Mode 3: Further programming and verification disabled Application Protection Mode 1: No lock on SPM and LPM in Application Se Application Protection Mode 2: SPM prohibited in Application Section Application Protection Mode 3: LPM and SPM prohibited in Application Section Application Protection Mode 4: LPM prohibited in Application Section Boot Loader Protection Mode 1: No lock on SPM and LPM in Boot Loader Boot Loader Protection Mode 2: SPM prohibited in Boot Loader Section Boot Loader Protection Mode 3: LPM and SPM prohibited in Boot Loader Section Boot Loader Protection Mode 3: LPM and SPM prohibited in Boot Loader Section
✓ Auto Verify Program Verify Read ✓ Smart Warnings Program Verify Read
Entering programming mode OK! Writing lockbits 0xEF OK! Reading lockbits 0xEF OK! Lock bits verification OK Leaving programming mode OK!

2.14. Press the "Program" Button.

2.15.Remove power from MINI-MAX/AVR and disconnect AVRISP.

3. How to use the boot loader ?

3.1. Connect the 10-pin header of serial cable to X8 connector of MINI-MAX/AVR board. ATMEGA2560 uses UART1 as BOOT serial port.

3.2. Connect the other end of the serial cable to your PC's COM port.

3.3. Install JP1 jumper.

3.4. Power the MINI-MAX/AVR board.

3.5. Start AVR Studio on your PC.

3.6. Press Tools->Program AVR->Connect menu option

Select AVR Programmer		
Platform: STK500 or AVRISP JTAG ICE JTAGICE mkll AVRISP mkll AVR Dragon	Port:	Cancel
button on the toolbar. Note that the JTAGICE cannot be us	mer used last time, press the 'Programm sed for programming as long as it is n that case, select 'Stop Debugging' fir	

3.7. Select COM port and press "Connect". You will see that the MINI-MAX/AVR board is detected as STK500. Select ATmega2560 as "Device"

STK500	
Program Fuses LockBits Advanced Board Auto	ase Device
Programming mode ISP mode Verify Device After	
Flash C Use Current Simulator/Emulator FLASH Memory Input HEX File C:\bipom\bootloader_atmega2560\boo	otloader
Program Verify	Read
EEPROM © Use Current Simulator/Emulator EEPROM Memory © Input HEX File D:\Projects1\AVR\WinAVR_Tests\bo	otloade
Program Verify	Read
Detecting on 'COM1' STK500 with V2 firmware found on COM1 Getting revisions HW: 0x02, SW Major: 0x02, SW Minor: 0x0a	OK

3.8. Click on "Advanced " Tab and check signature

STK500 Program Fuses LockBits Advanced Board Auto	Signature by 0x1E 0x98
Signature Bytes Ox1E 0x98 0x01 Read Signature matches selected device Oscillator Calibration byte Calibrate for frequency: 8.0 MHz Value: Write Address: Read Cal. Byte Calibrate for frequency: Bead Cal. Byte Calibrate for Memory	should indi selected devi
Communication Settings Baud rate: 115200 Baud rate changes are active immediately.	
Setting mode and device parameters OK! Entering programming mode OK! Reading signature 0x1E, 0x98, 0x01 OK! Leaving programming mode OK!	

Signature bytes should be reported as 0x1E 0x98 0x01 and the message should indicate "Signature matches selected device".

3.9. Click on "Program" Tab and select the hex file that you want to download (that is, your application code) as Input Hex File in the Flash section.

STK500	
Program Fuses LockBits Adv	anced Board Auto
Device ATmega2560	Erase Device
Programming mode	Erase Device Before Programming
Flash C Use Current Simulator/Emu C Input HEX File cts1\AVR\	lator FLASH Memory WinAVR\tb1led\default\tb1led.hex
Program	Verify Read
EEPROM © Use Current Simulator/Emu © Input HEX File D\Project	lator EEPROM Memory s1\AVR\WinAVR_Tests\bootloade
Program	Verify Read
Erasing device OK! Programming FLASH OK! Reading FLASH OK! FLASH contents is equal to file OK Leaving programming mode OK!	

- 3.10. Press the "Program" button to download your program to the FLASH memory of ATMEGA2560.
- 3.11. Remove power from the MINI-MAX/AVR board.
- 3.12. Remove JP1 jumper.
- 3.13. Connect power to the MINI-MAX/AVR board. This resets the board and your application will start.

To provide a more efficient download environment and not have to cycle power each time, a switch can be connected to JP1 jumper pins.

To reset the board, a push button can be connected to JP2 jumper pins.

This is shown in the diagram below:



To enter BOOT mode: JP1 (switch) is closed, JP2 (button) is closed momentarily;

To enter RUN mode: JP1 (switch) is open, JP2 (button) is closed momentarily.