Embedded Software
CS 145/145L

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If you’re not using Microchip Studio or MPLAB X (and you don’t know anyone that is, and can set fuse bits for you), you’ll need to use a program called avrdude to do that.
Warnings

If you set the wrong fuse bits in your microcontroller, you might get locked out! (i.e., it won’t work or connect to your computer)
So double/triple check everything before running any commands!

If you *do* get locked out, **DO NOT** try doing the same thing with your 2nd chip!! Instead, use that one to fix your locked chip:

- [https://www.avrfreaks.net/forum/tutsoft-recovering-locked-out-avr](https://www.avrfreaks.net/forum/tutsoft-recovering-locked-out-avr)
Install avrdude

- https://github.com/avrdudes/avrdude
- https://formulae.brew.sh/formula/avrdude
avrdude

-p (platform):
   m32 (ATmega32)
-c (programmer):
   atmelice_isp (ATATMEL-ICE-BASIC)
-P (port):
   usb
Fuse Bits Calculators

- [https://www.engbedded.com/fusecalc/](https://www.engbedded.com/fusecalc/)
Example (Ext. Crystal) - Calculator

1: choose settings

2: copy command parameter
Example (Ext. Crystal) - Resulting Command

avrdude -p m32 -c atmelice_isp -P usb -U lfuse:w:0xFF:m

from template
from calculator

Note that since we only modified the Low Bits in the calculator, we only set those!
Example (JTAG) - Calculator

Select Chip: Atmega32 (current)  Go

LOW Fuse Presets:
- Brown-out detection enabled; [BOOLEV=0]
- Brown-out detection level at VCC=2.7 V; [BOOLEV=1]
- Ext. Crystal/Resonator High Freq.; Start-up time: 16x CK * 64 ms; [CKSEL=1111 SUT=111]

HIGH Fuse Presets:
- Boot Flash section size=2048 words Boot start address=$3800; [BOOTSZ=0] default value
- Boot Reset vector Enabled (default address=$0000); [BOOTRST=0]
- CKOPT fuse (operation dependent of CKSEL fuses); [CKOPT=0]
- JTAG interface Enabled; [JTAGEN=0]
- On-Chip Debug Enabled; [DCDEN=0]
- Preserve EEPROM memory through the Chip Erase cycle; [EESAVE=0]
- SPI program downloading (SPI) enabled; [SPIEN=0]

LOCKBIT Fuse Presets:
- Application Protection Mode 1: No lock on SPM and LPM in Application Section
- Boot Loader Protection Mode 1: No lock on SPM and LPM in Boot Loader Section
- Mode 1: No memory lock features enabled

Manual Fuse Bit Manipulation
Remember: ✓ = programmed = 0; ✓ = unprogrammed = 1

<table>
<thead>
<tr>
<th>Bit</th>
<th>LOW</th>
<th>HIGH</th>
<th>LOCKBIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>BOOLEV</td>
<td>OCDEN</td>
<td>Bit 7</td>
</tr>
<tr>
<td>6</td>
<td>BOODEN</td>
<td>JTAGEN</td>
<td>Bit 6</td>
</tr>
<tr>
<td>5</td>
<td>Bit 5</td>
<td>SPIEN</td>
<td>Bit 5</td>
</tr>
<tr>
<td>4</td>
<td>Bit 4</td>
<td>Bit 4</td>
<td>Bit 4</td>
</tr>
<tr>
<td>3</td>
<td>CKSEL3</td>
<td>EESAVE</td>
<td>Bit 3</td>
</tr>
<tr>
<td>2</td>
<td>CKSEL2</td>
<td>BOOTSZ1</td>
<td>Bit 2</td>
</tr>
<tr>
<td>1</td>
<td>CKSEL1</td>
<td>BOOTSZ0</td>
<td>Bit 1</td>
</tr>
<tr>
<td>0</td>
<td>CKSEL0</td>
<td>BOOTRST</td>
<td>Bit 0</td>
</tr>
</tbody>
</table>

Default: 0x0F
Apply: 0x0F
AVRDUDE: -O ifuse:w:0x0F:i


1: choose settings
2: copy parameter
Example (JTAG) - Resulting Command

```bash
avrdude -p m32 -c atmelice_isp -P usb -U hfuse:w:0xD9:m
```

Note that since we only modified the **High Bits** in the calculator, we only set those!
Example (Defaults) - Calculator

1: click to restore default values

2: copy command parameters

AVRDIGE

Example (Defaults) - Resulting Command

```
avrdude -p m32 -c atmelice_isp -P usb -U lfuse:w:0xF1:m -U hfuse:w:0x99:m
```

Note that in this case we can set both high and low fuse bits with a single command.
See you next time :) Q & A