RescueAVR

This sketch can be used to resurrect AVR chips with wrong fuse settings using **high-voltage programming**. It uses many of the ideas and code of MightyOhm's HV Rescue Shield 2.

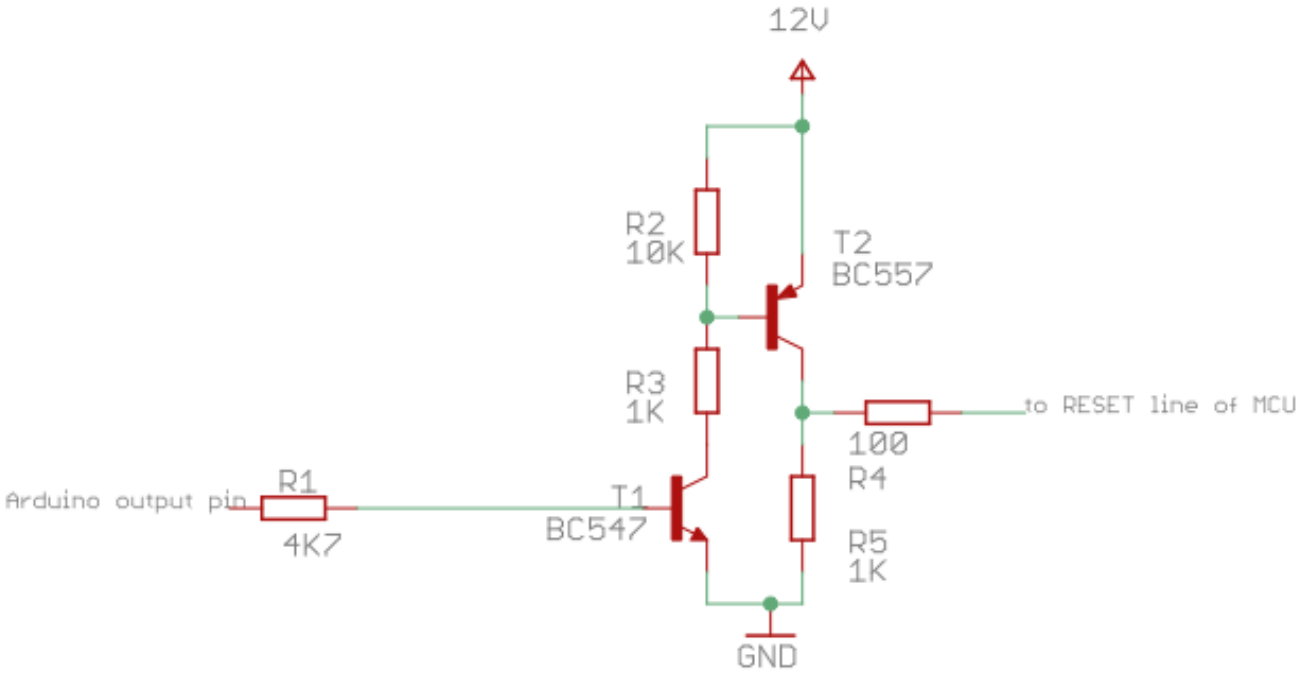
You need an Arduino Uno (or Nano), a breadboard, 2 transistors, a few resistors and an external regulated 12 volt supply. In addition, the sketch is also an alternative firmware for manekinen's Fusebit Doctor. The pin mapping is a bit different between these two usages. When the sketch is compiled for an Arduino Uno or Nano in the Arduino IDE (and the compile time constant `ARDUINO_AVR_UNO` or `ARDUINO_AVR_NANO` is defined), it will use the Arduino Uno pin mapping. Otherwise it uses the pin mapping for the Fusebit Doctor.

When you use the sketch, remember to set the baud rate to 19200 baud (no parity, 1 stop-bit).

Using RescueAVR on an Arduino

I have tried out the sketch with an ATtiny84, an ATtiny85, and an ATmega328 on the Arduino Uno. I have included Fritzing wiring scheme for these three chips (see below). For other chips, you have to consult the data sheet of the particular micro-controller. You find the pin mapping usually in the section on ***Memory Programming***.

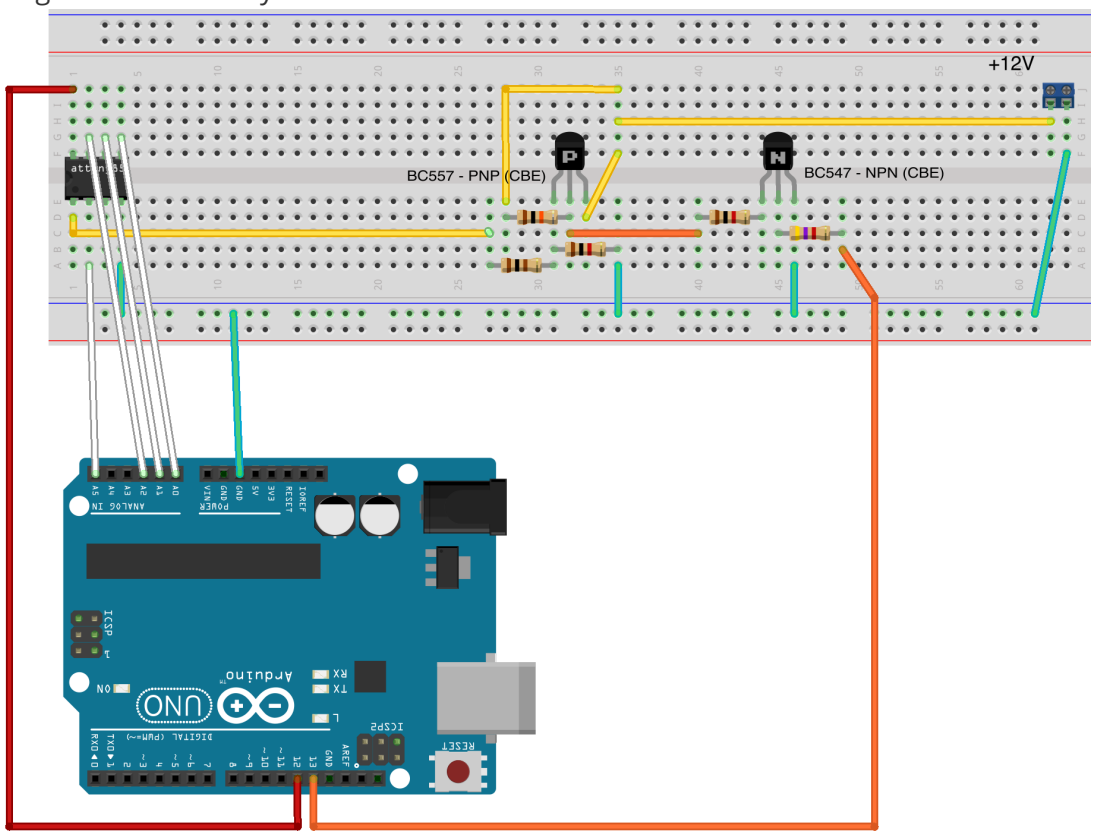
The most important part for high-voltage programming is the ability to put 12 volt to the RESET pin of the MCU. So, you need a regulated 12 volt supply and an electronic switch that applies this voltage to the RESET pin. Such a switch using two transistors is shown below. The transistors I have used are fairly standard ones. You can probably use any other reasonable type. But make sure that the pins are ordered as in the picture, i.e., CBE (otherwise the pins in the Fritzing diagram are not correct).



For small ATtinys, the wiring is straight forward because they use serial programming, where you need only few wires. The Fritzing diagram for an ATtinyX5 looks as follows.

HVSP-pin mapping

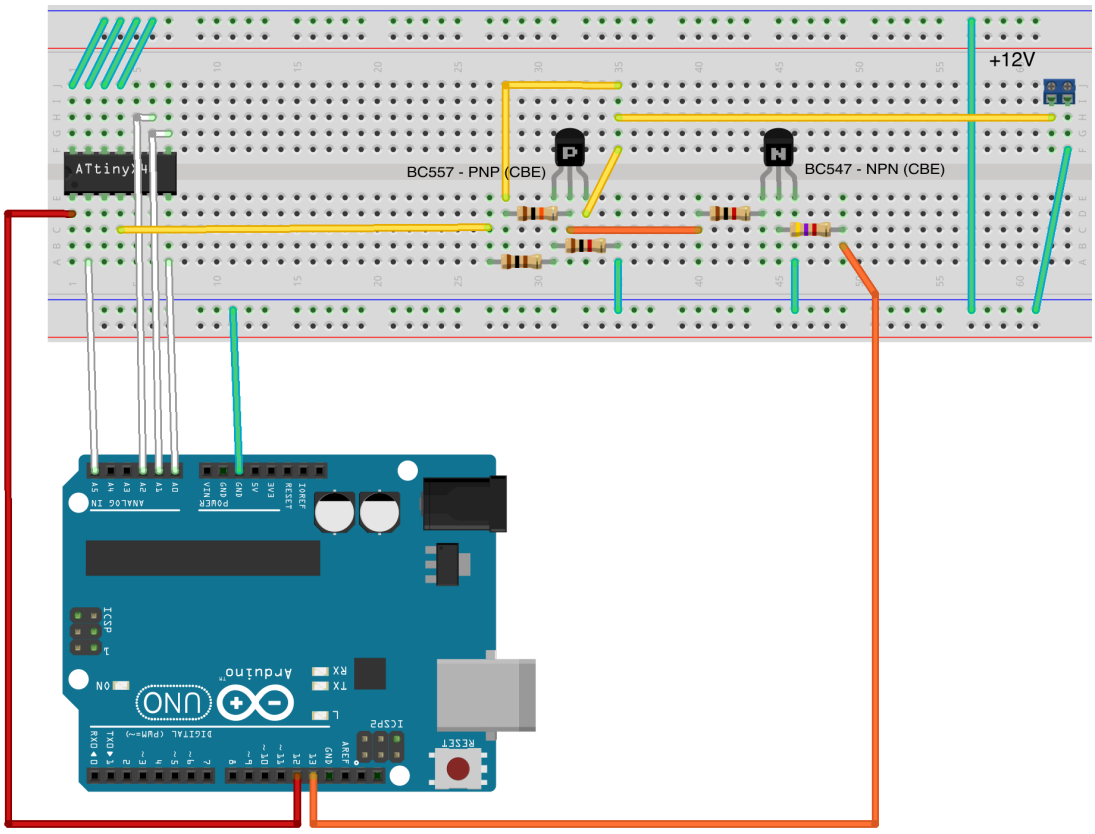
ATtinyX5 Pin	Function	Arduino
1	RESET 12V	
2	SCI	A5
3	N.C.	
4	N.C.	
5	SDI	A0
6	SII	A1
7	SDO	A2
8	Vcc	12



Similarly, the wiring for an ATtinyX4 is quite simple as well. As you can see, one needs just 2 data lines (SDI, SDO), one clock line (SCI), one control line (SII), and in addition one has to switch the RESET line and the Vcc line.

HVSP-pin mapping

ATtinyX4 Pin	Function	Arduino
1	Vcc	12
2	SCI	A5
3	N.C.	
4	RESET 12V	
5	N.C.	
6	N.C.	
7	SDI	A0
8	SII	A1
9	SDO	A2
10	N.C.	
11	GND	
12	GND	
13	GND	
14	GND	

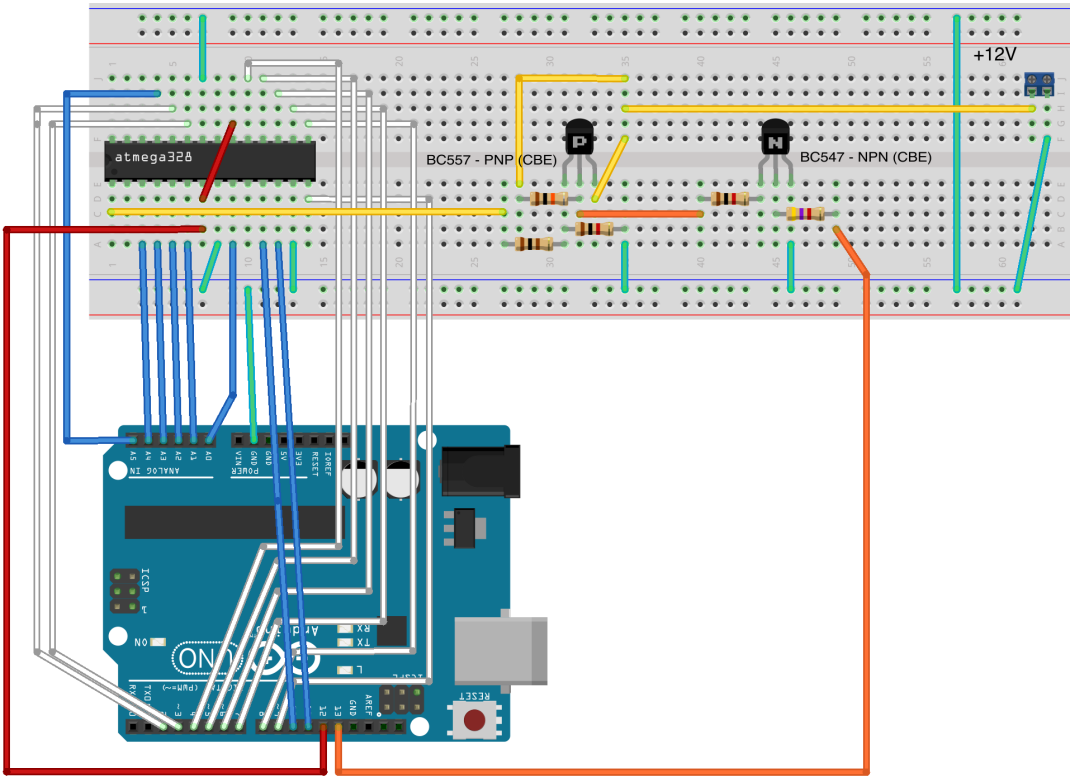


Made with Fritzing.org

For an ATmegaX8 MCU, the wiring is much more involved. Instead of 2 data lines, one clock line as well as three control lines (SII, RESET and Vcc), one has to deal with 8 data lines, one clock line, and 9 control lines! This may look like as in the following Fritzing diagram.

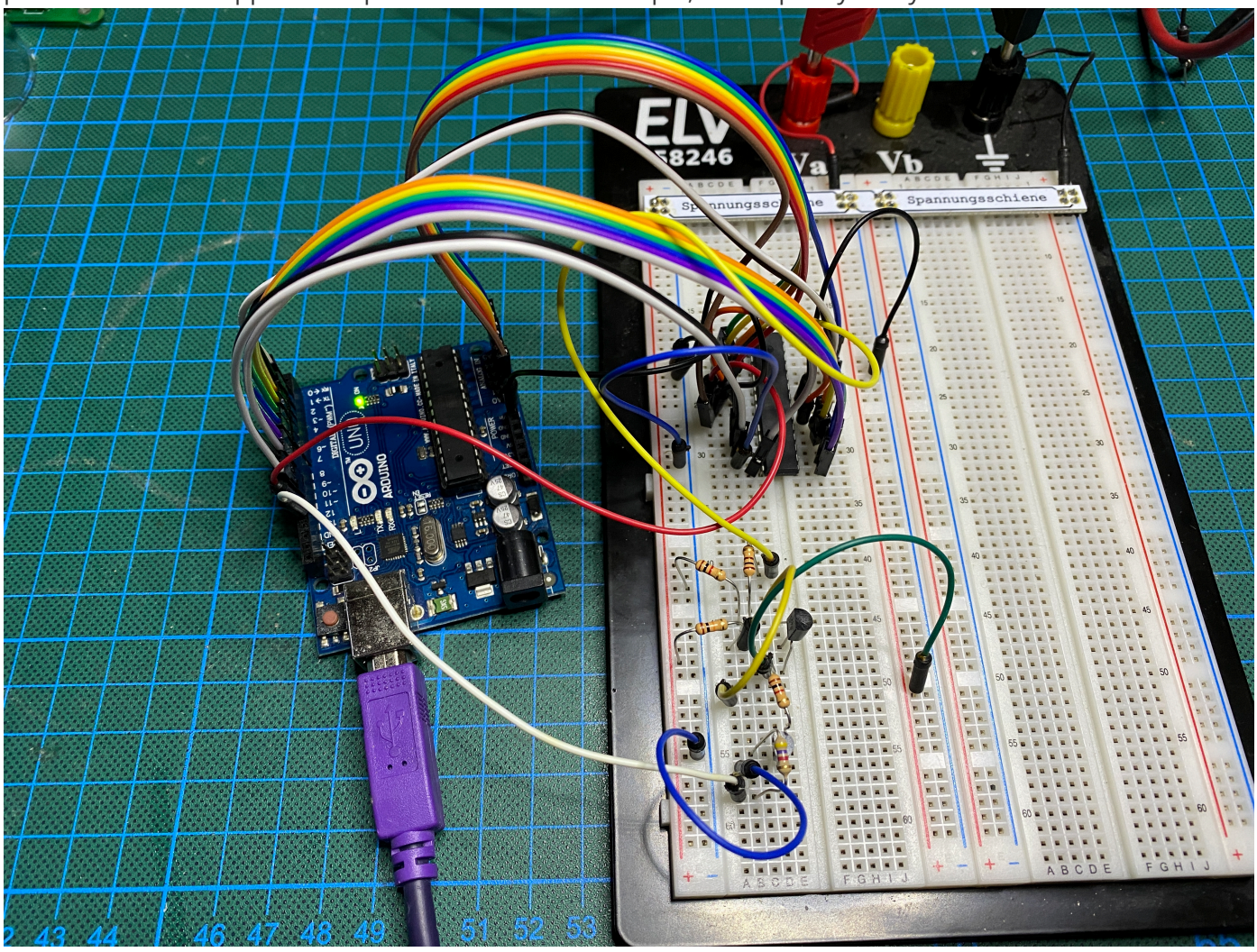
HVPP-pin mapping

ATmegaX8 Pin	Function	Arduino
1	RESET 12V	
2	N.C.	
3	RDY	A4
4	OEi	A3
5	WRi	A2
6	BS1	A1
7	Vcc	12
8	GND	
9	XTAL1	A0
10	N.C.	
11	XA0	10
12	XA1	11
13	PAGEL->GND	
14	DATA0	9
15	DATA1	8
16	DATA2	7
17	DATA3	6
18	DATA4	5
19	DATA5	4
20	Vcc	12
21	N.C.	
22	GND	
23	DATA6	3
24	DATA7	2
25	BS2	A5
26	N.C.	
27	N.C.	
28	N.C.	



Made with Fritzing.org

When this is put to work in reality, it can look as follows. Check the wiring twice before applying the external power. If 12 volt is applied to a pin that is not the RESET pin, the chip may easily die.



After you made all the connections (and double checked them!), open the Arduino monitor window, switch to 19200 baud, switch the external power supply on, and press reset on the Arduino. You are now in ***interactive rescue mode*** and can do a lot of things (see below).

Using RescueAVR on the Fusebit Doctor

The Fusebit Doctor can be run stand-alone or connected to a computer. In the stand-alone mode, after power-up, all LEDs are off and you can insert a chip. After pressing the button, the board will first try to recognize the chip:

- green LED on for three seconds: chip has been successfully recognized,
- green LED on for one second, then red LED on for three seconds: chip has been rcognized, but there is not enough information in the firmware to resurrect it,
- red LED is on for three seconds: no chip recognized.

After having recognized the MCU, the board tries to reset all lock bits and then tries to set the fuses to a safe default setting. If successful, the green LED flashes for 5 seconds, otherwise the red LED flashes for 5 seconds. If unsuccessful, you can try to set the erase jumper, which allows for erasing the entire chip in order to recover it.

If the serial line on the board is connected to a computer using 19200 baud (no parity, 1 stop-bit) then you can use the ***interactive rescue mode***, which gives you more control than the stand-alone mode.

Interactive Rescue Mode

When switched on or after a reset, the sketch will try to determine what kind of programming mode the MCU uses and which MCU is connected. If unsuccessful, the following is displayed:

```
No chip found!
Insert chip and reset or give details.

Choose from:
  P - HVPP
  T - HVPP for Tiny
  S - HVSP
  R - Start again
Choice:
```

When this message is shown, you either forgot to insert the MCU, the wiring is wrong, the external power supply is not switched on, or the chip is badly damaged. In the latter case, you might try then to select the programming mode, where *HVPP* is the high-voltage parallel programming mode for ATmegas, *HVPP for Tiny* is the same mode for ATtinys (but PAGEL and BS1 are both controlled by BS1, and BS2 and XA1 are both controlled by BS2), *HVSP* is the high-voltage serial programming mode for ATtinys. You have to look up in the data sheet which mode is used for your MCU. After having selected a programming mode, you can try to set fuses and lock bits. However, I have never been successful when the MCU could not be identified anymore. In any case, it is more likely that there is a wiring error or you forgot to plug the MCU into the socket (or breadboard).

Usually, the chip is detected and something along the following line is printed.

```
Signature: 1E910A
MCU name:  ATtiny2313
Current L/H/E-Fuses: 63 DF FF
Default L/H/E-Fuses: 62 DF FF
Current lock byte:   FF
Oscillator calibr.:  61
```

You can then choose from the following menu.

```
Choose:
  T - Try to resurrect chip by all means
  E - Erase chip
  D - Burn default fuse values
  L - Change low fuse
  H - Change high fuse
  X - Change extended fuse
  K - Change lock byte
  R - Restart
Action:
```

If you are only interested unbricking your chip, press 'T'. This tries to unlock the chip. If this is not possible, it will try to erase the chip (if the 'chip erase' jumper on the Fuse-Doctor board is set). After it, it will try to reset the fuses to their default value. If 'T' does not help, you can probably say 'good bye' to the chip.