

Using pic32prog and an Arduino NANO to Program PIC32 Devices

(c) Robert Rozée, 2016

(for full article see *Silicon Chip* magazine, November 2015)

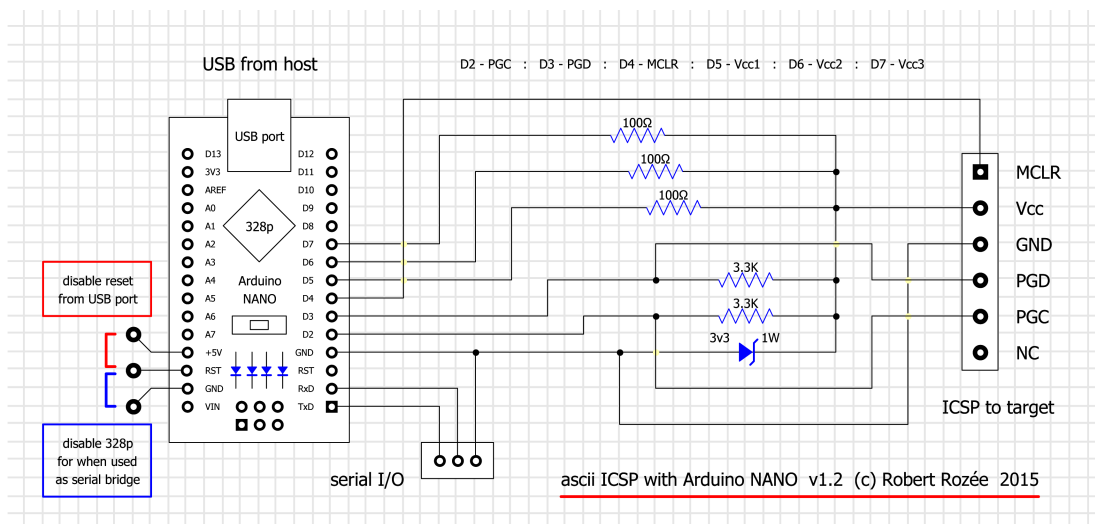
This constructor guide details the hardware and software needed to upload firmware to a PIC32 device, such as the PIC32MX170, through the device's ICSP port. An Arduino NANO (plus 5 resistors and a 3v3 zener diode) is used as the programming hardware, with the necessary Arduino firmware already embedded within the command line programming application - pic32prog. A copy of pic32prog can be downloaded from GitHub:

<https://github.com/sergev/pic32prog>

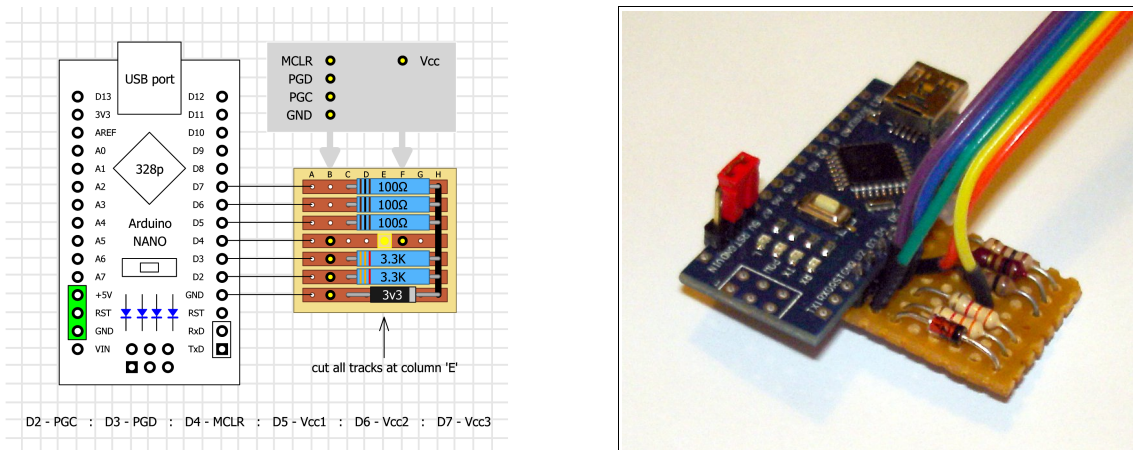
<https://github.com/sergev/pic32prog/blob/master/pic32prog.exe?raw=true>

(direct link to Win32 executable. Mac OS X and Linux versions are also available)

Below is the schematic of the required programming hardware:



and here is a suitable veroboard layout and photo of the original prototype construction as detailed in the *Silicon Chip* magazine article:



The three 100Ω resistors and 3v3 zener diode form a simple switchable power supply for the target processor that is capable of delivering about 50mA. This is sufficient for most PIC32 devices while being programmed. The two 3k3 resistors provide pullups on the programming pins, PGD and PGC, while MCLR should already have a 10k pullup at the device being programmed. The 5-way ribbon cable runs off to a suitable 0.1" 6-pin ICSP connector that matches the target PIC32 system. Note that the

jumper shown (red in photo) should not at this stage be installed.

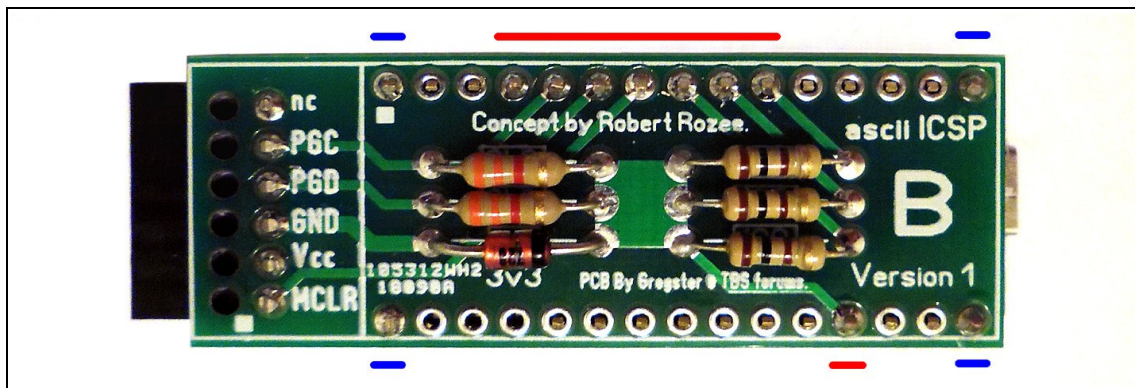
The cheapest source of parts is eBay China, where an Arduino NANO clone can be found for less than us\$2.50 (delivered) and the other parts bought for next to nothing. The Chinese NANOs generally use a CH340G USB to serial bridge chip instead of the more traditional FTDI device. It is important that the NANO selected has a 328p processor (not a 168p), 5v supply, and 16MHz clock. This is by far the most common variant.

PCB layout and full kit produced by Rictech Ltd:

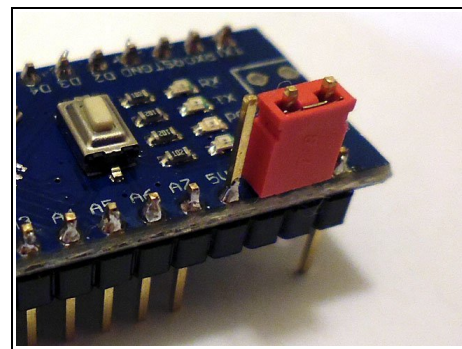
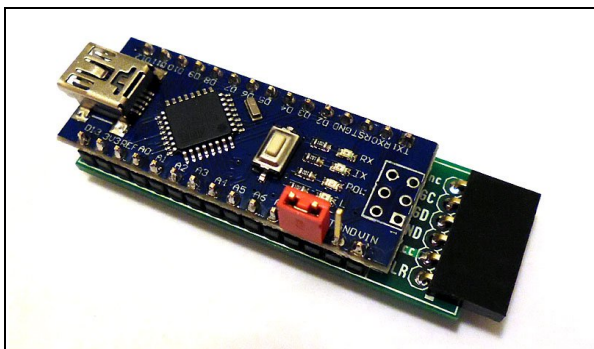
A professional PCB has been laid out and produced by Rictech Ltd and is available as part of a full kit of parts from their website: <http://www.rictech.nz/pages/5/Products>

It is suggested that the resistors and zener be assembled on side B of this PCB (with leads clipped as close to the PCB as possible), while the ICSP plug is fitted to side A. The Arduino NANO is then also assembled onto side A to provide a compact solution in a form-factor similar to a PicKit2/3.

The below pictures illustrated this suggested assembly, although exact details are up to the ingenuity of the constructor. For instance, all components could be assembled on side "A", but then the NANO would need to be lifted up higher to clear the components. Strain-relief holes are provided, allowing the ICSP plug to be replaced with five wires (as in the prototype) if desired.



Note (above) how only the 8 red and 4 blue (corner) pins need to be soldered. Also remember to push the 3 jumper pins through before soldering (below right). The PCB includes an extra connection between analog input A0 on the NANO and the 3v3 supply. This is to allow the 'ascii ICSP' firmware to monitor the supply to the target PIC32, a feature not currently used by pic32prog.



Configuration and Usage:

First thing, once assembled, is to plug the Arduino NANO into your PC and install drivers. If running Windows 7 or later the drivers for the NANO should be found automatically by Windows. For Windows XP the drivers can be found here:

http://www.wch.cn/download/CH341SER_ZIP.html

If necessary, you can test the operation of drivers + serial bridge chip alone using the following steps:

- place a jumper between RST and GND to disable the 328p processor,
- jumper (or short) between TxD and RxD to loop back data, then,
- use Teraterm or HyperTerminal to verify characters typed at the keyboard are echoed back.

Once correct operation has been verified, remove both jumpers.

Next, run pic32prog and upload the 'ascii ICSP' firmware to the NANO using the following command:

```
pic32prog -d ascii:com5 -b3
```

where `com5` is the serial port assigned to the NANO and `-b3` indicates the NANO's bootloader baud rate. If `-b3` does not work try the less common baud rates using `-b1`, `-b2`, or `-b4`. In some cases it may be necessary to press the reset button on the NANO while `pic32prog` is trying to detect the bootloader.

Successful upload of the 'ascii ICSP' firmware to the NANO looks something like:

```
C>pic32prog -d ascii:com5 -b3
Programmer for Microchip PIC32 microcontrollers, Version 2.0.174
  Copyright: (C) 2011-2015 Serge Vakulenko
    (ascii ICSP coded by Robert Rozee)

57600 baud ... synchronized
Signature = 1e950f   Device = ATmega328P
#####
Firmware uploaded to 'ascii ICSP' adapter OK
```

With the 'ascii ICSP' firmware now in place, install a jumper between Vcc and RST on the NANO to prevent the bootloader from being triggered during normal use. After this jumper is installed, do not press the reset button on the NANO as it will short Vusb to ground.

Finally, to program your PIC32 device attach the ICSP connector to the target device and use the following command:

```
pic32prog -d ascii:com5 filename.hex
```

where `filename.hex` is the PIC32 firmware you wish to upload.