Programming the Controller PCB

Preparation

Requirements

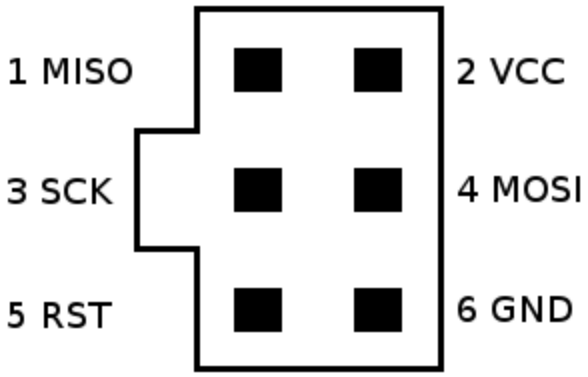
To prepare the board, you will need the following:

- A computer running Windows (Furhat NUC known as Sylvanas)
- Atmel Studio installed
- Arduino IDE (or avrdude) installed for testing the microcontroller
- An AVR programmer with ISP support (this guide will use the JTAGICE mkII)
- An ICSP-6 connector adapter
- A 4-position picoblade to USB adapter cable
- The Furhat modified Caterina bootloader
- The Furhat firmware Arduino code

Connecting the microcontroller

Connect the AVR programmer to your computer with the USB cable and to the board using the ICSP-6 connector and either power up the whole board with a 19V power supply or use the picoblade to USB cable to connect the board to your computer.

The PCB should have a shrouded socket that stops you from connecting the cable backwards, but if it doesn't, make sure that the ICSP-6 connector is turned the right way.



Flashing the Bootloader

Start Atmel Studio. Press Ctrl+Shift+P to open the Device Programming window. In the "Tool" dropdown menu, select your programmer. Select **ATMEGA32U4** as your Device, and ISP as the interface. Click Apply. The microcontroller should show up and the message "Reading device ID...OK" should show up at the bottom. Target voltage should show 3.3V.

On the left side of the window, select the “Memories” tab, under "Flash (32 KB)" it should have the Caterina-furhat.hex. If not, click the "..." box to find and load it.
Then press "Program" to upload it to the microcontroller.

Once complete you should get a “programmed OK” message at the bottom of the window.

Setting Fuses and Lock bits

- Go to the Lock bits tab on the left. Set the following lock bits:

LB	=	NO_LOCK
BLB0	=	NO_LOCK
BLB1	=	LPM_SPM_DISABLE

LOCKBIT	=	0xCF (valid)

- Go to the fuses tab on the left. Set the following fuses:

BODLEVEL	=	2V6
HWBE	=	[ ]
OCDEN	=	[ ]
JTAGEN	=	[ ]
SPIEN	=	[X]
WDTON	=	[ ]
EESAVE	=	[ ]
BOOTSZ	=	2048W_3800

BOOTRST	=	[X]
CKDIV8	=	[ ]
CKOUT	=	[ ]
SUT_CKSEL	=	EXTXOSC_8MHZ_XX_258CK_65MS

EXTENDED	=	0xFB (valid)
HIGH	=	0xD8 (valid)
LOW	=	0xDE (valid)

When you've set everything, click “program”. Click continue when you get a warning about disabling JTAG.

On both the Lockbits and Fuses page you can press "Copy to clipboard" and paste to a text document to ensure your changes match the settings above.

The PCB should now have a working arduino-compatible microcontroller.

Uploading the software for the first time

Start the Arduino IDE, connect the board to your computer using the picoblade to USB cable. **Disconnect the AVR Programmer.** Keeping it turned on will increase confusion by one COM-port.

Open the furhat firmware source file (this will automatically be opened if opened before).
In the “Tools” menu, go to “board” and select “Sparkfun Pro Micro”.
Under “Processor”, make sure that “Atmega32U4, 3.3V, 8MHz” is selected.

Select the correct COM-port and press “upload” to compile and upload the program.

If there are no problems, you will see “Done!” in the window at the bottom and you will have successfully programmed the microcontroller. After testing, the board should now be ready to be used in the assembly.

Testing

Connect an LED strip and a rotary encoder to the PCB to test that the microcontroller was programmed correctly. In the Arduino IDE, open the “serial monitor” (Shortcut Ctrl+Shift+M) and type in commands accepted by the firmware to test that it's working.

The rotary encoder, connected to the PCB via a 5 pin picoblade cable (same as in the assembly), should give the following readings in the serial monitor:

- Button press - a single “**bd**” should appear in the monitor.
- Button release - a single “**bu**” should appear in the monitor.
- Clockwise rotation - “**ruru**“ should appear in the monitor.
- Anti-clockwise rotation - “**rdrd**“ should appear in the monitor.

Variations to the above such as double, multiple or no readings could imply a production fault in the soldering or a faulty component on the rotary encoder.

An LED strip, connected it to the PCB via the appropriate Molex 3 pin connector on the PCB, should have 88 of the LEDs light up if the following command is typed In the serial monitor:

l101010

If the LEDs do not light up, check the connectors and wires, or try testing a second strip. Also ensure you are connected to the correct connector on the PCB.