Parallel port interface
control the Profiler with G-code
towards full 3D

A nice project also suited for less experienced electronic-builders

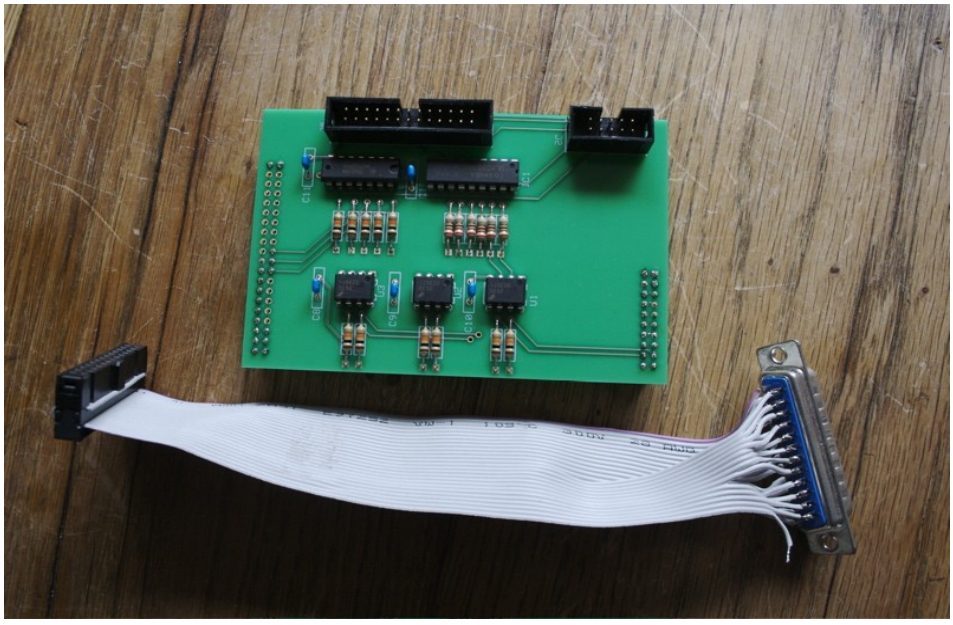
Benny Croonen has made an interface that comes in place of the processorboard of the Profiler. Now the Profiler is able to interact with programs like Mach3 and run full 3D toolpaths. The processor of the computer does all the computing and only step and direction information is send through the parallel port to the XY and Z axes.
This adaptation is relatively easy!

This card is also able to control the spindle and a vacuumtable or cleaner and should also be able to listen to pulses of the XYZ axes so that you can create a feedback of the position of the lead-screws.

All can be controlled by Mach3 which has a demo of 500 lines of code.
BOCNC Deskproto, Rams etc can create the G-code toolpaths.

I have briefly documented the proces. Build all at your own risk. Mine worked instantly. I have only little experience with electronics so if you have extra explanations on this part let me know.

This is how the hardware looks like when assembled:
It fits exactly in place of the processorboard.



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Instructions: Pieter Verhees bornot4b@planet.nl

Electronic Parts

Electronic parts you need:

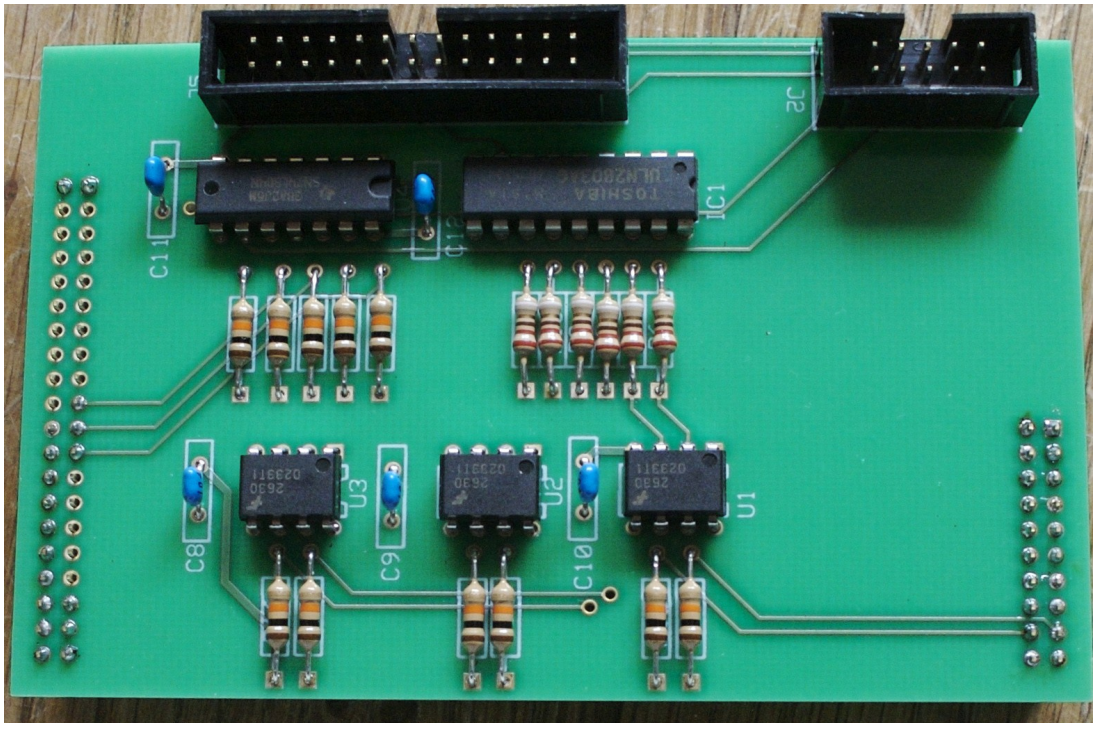
-The PCB of the interface card
-1 ULM2803a or ULN2803a
-1 74LS04
-3 HPCL-2630 (optocoupler)
-11 10 k resistors
-6 220 ohm resistors
-5 100nf capacitor
-DB 25 connector parallel port male (solder)
-serial port connector female
-Header Female 2X36 straight (2,54 mm) resize them
 20 pins
 40 pins
-box header
 26 pins
 10 pins
-Female flatcable connector
 10 pins
 26 pins
-parallel cable: female-male to connect to the computer
-switch voor an Estop (emergency stop button)

optional
-2 solid state relais voor spindle and vacuumtable/pump.

All the parts you can buy at a regular electronics shop. I ordered the ULN2803a at [www.voti.nl.](http://www.voti.nl)

Building of the electronics

Build the card.
This is rather straight forward. Beware of the right orientation of the parts.
The box headers need to be placed on top, the female header on the downside.



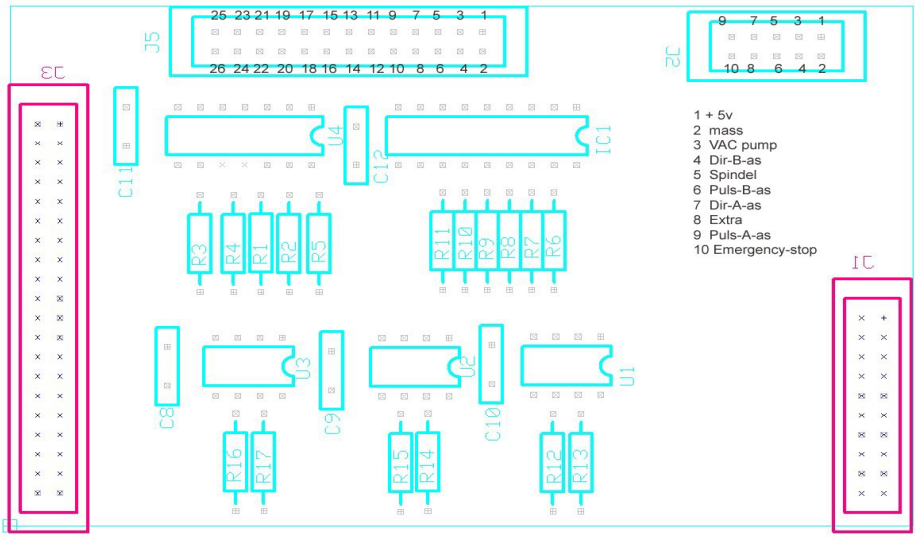
Internal connection cables:

Prepare the two internal connection-cables between the board and the housing.
One, with 25 wires, for the parallel port to connect with the computer. Connect pin one of the board boxheader(26pins) to pin one of the male chassisconnector, pin two to pin two etc. ...until pin 25 to 25 and pin 26 will stay unconnected. All the wires need to be connected.

Prepare another cable with the 9 pins serial connector, to control Estop, spindels etc.
I should connect pin 1,2,4,5,6,7,8,9 and 10 to the serial connector, not the 3.(9 wires also).
The reason is that pin 3 is connected to pin 14 of the parallel port connector, and Mach3 can't control this pin 14 as an output.
Write down how you connected the pins of J2 to the pins of the serial connector!
In fact you can use the inputs 4,6,7,9 to your own wish. By example detection of lenght, or a 4th axis.

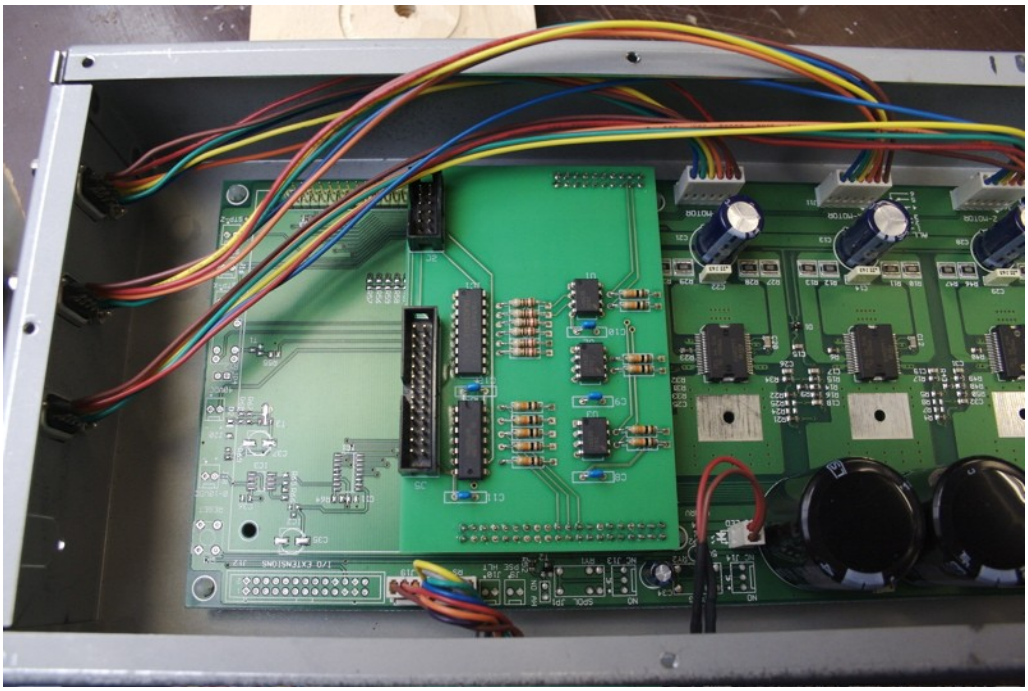
The external cabling:

Prepare an external cable with a male serial connector and 9 wires.
Note down the colors of the wires and the related numbers on the connector.
Connect the E-stop button to the pins of J2: the pos+(1) and the (8).
Connect (if you want) the 2 solid state relais; one of their pins to the pos+(1) and their other side to resp. 3 and 5 of J2. Take care that you use the right pins!
These solid state relais will enable you to control the spindle and vacuumpump.



Install the hardware

Remove the electronics-box of the Profiler. (Take care you mark the XYZ connectors).
Open the box. Carefully remove the processor-card which is on top of the larger PCB. You can pull it up with slight levering. (store it on a safe place, perhaps Colinbus will have full 3D support in future).
The housing has the two connector holes already precut. Remove their inner parts. Now carefully put the new card in place. If you look well it is obvious in which orientation it has to be installed.
Attach the parallel-connector to the frame and connect it to the board. Do the same with the smaller serial connector.



In fact this was it. If you have build your electronics carefully, you can now close the electronic-box and attach it back to the Profiler. Don't forget to connect the 4th serial cable to its connection before putting the Profiler back on its feet.

Connect the parallel cable between the Profiler and the computer.

Software

Now I suggest you use the Mach3 demo to test your setup.
They have nice instructions on how to configure the software to run with the Profiler. It is called “Basic SETUP of Mach3 Mill Document”. You can find it on their website.
It is not difficult. Just go carefully throught the document, it will help you to understand Mach3.

Configuration Mach3 for Profiler

These are the configuration settings I used for the Profiler.

Config > Engine configuration... ports and pins:

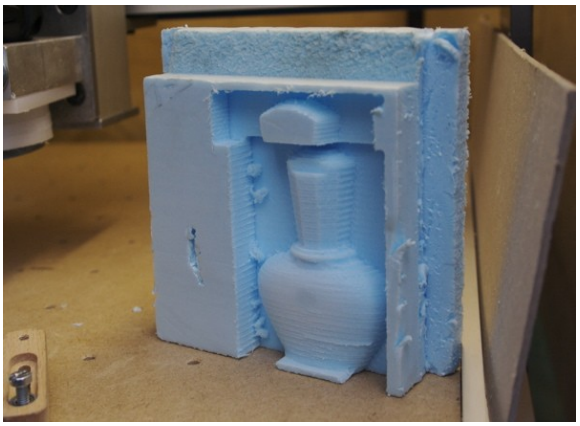
-----Port setup and Axis selection
----------port#1 enabled 0x378
---------- Kernelspeed: 25000 Hz
----------all other unchecked
-----Motor outputs
---------- X - enabled - stepPin 2 - DirPin 3 - Dir LowActive off - Step LowActive on
---------- Y - enabled - stepPin 4 - DirPin 5 - Dir LowActive off - Step LowActive on
---------- Z - enabled - stepPin 6 - DirPin 7 - Dir LowActive on - Step LowActive on

-----Input Signals
---------- X home – enabled - port#1- pin 10 – ActiveLow on
---------- Y home – enabled - port#1- pin 11 – ActiveLow on
---------- Z home – enabled - port#1- pin 12 – ActiveLow on
---------- Estop enabled port 1 - pin number 15 - active low on

-----Output Signals for spindel on/of (I didn't connect this jet)
----------output# 1- enabled -port# 1- pin 1 - active low

Config > Motor tuning and setup: these settings the same for all three axes
----------steps per unit 133.3
----------step puls setting (niks doen?)----------Dir puls setting (niks doen?)
----------Velocity MM/min 1507.8
----------Acceleration MM/SEC/SEC 312.26
----------Step puls 1
----------Div pulse 1

Config > Homing/SoftLimits (depends on you machine)
---------X – ReverseN- softMax 314 - softMin 0 - slowZone 2 - HomeNegY – AutoZ-Y -speed 20%,
---------Y – ReverseN - softMax 400 - softMin 0 - slowZone 2 - HomeNegY - AutoZ-Y -speed 20%
---------Z - ReverseN - softMax 0 - softmin -65 -slowZone 2 - HomeNegN - AutoZ-Y -speed 20%



In Deskproto you can use the postprocessor called something like “mach2/3 mm” and adapt it a little to your desire...

Coming next: Benny will add the charge-pump safety function: this protects during startup or missing connection with the PC against unknown state of parallel port.

Let us know if you have any comments.

Good job Benny...
Towards 3D and beyond! Pieter Verhees - April 2008