

GENERIC 6-AXIS CNC MPG PENDANT MODIFICATION

After purchasing a cheap popular Chinese generic cnc mpg pendant from eBay, I decided to modify it to minimise the number of inputs both for efficiency and due to my setup's input availability.

I have a usb smoothstepper and regarding available free inputs, had its port 3 inputs free, (6 inputs, 3 differential & 3 single-ended). Also, optically buffered via a breakout board had 3 more port 2 inputs, (2 general purpose inputs and E-stop). Several free outputs where also available.

The original circuit I came up can be seen in the pdf "*initial_aborted_design*". The problem with that circuit was that the "between rotary positions" logical states where also the states for "off" state for rotary switch1 and "x100" state for rotary switch2. This could be ok for some cases, (in my original simplistic mach3 brains interface), but after wanting to do some more stuff like turning on and off my mill's light, enabling softlimits etc during jog, it became problematic. Also, did not like the various mpg indicator leds on mach3 screen "jumping around" during rotary switch state transitions.

Instead of trying to come up with another logical circuitry, since I had a few various microcontrollers sitting in their protective cases in suspended animation, decided to make good use of one that particularly fitted the application and most importantly without adding lots of extra components.

The circuit can be seen in "*final_design*" pdf. A pic18F1330 was utilised in an internal oscillator configuration, using all its pins. One pin that was left over, was utilised for making the project a bit tastier via outputting sounds during switch transitions.

The speaker was an 8Ω coil micro speaker from an an old mobile. It was decided to be used instead of a piezo speaker directly connected to pic's output due to the low frequency of the PWM A/D. This could easily pass through causing an irritating blending with the actual frequencies modulating the 7.8kHz carrier we want to hear. (PWM F=7.8kHz that can be heard by a piezo speaker but quite attenuated by the micro speaker's coil without the need for extra RC low pass filter). A push-pull amp with 2 complementary BJT's assured the desired sound intensity and stress relief on pic's output pin.

The received pendant:





The 2 external modifications where a volume knob and a speaker mesh.

NOTE: The pendant bezel is NOT of aluminium! It is a SS alloy and it will dull any HSS drill bits. The holes for the knob and speaker mesh were opened via diamond dentist bits on a Dremel tool. (Of course, you can try with your cnc machine with carbide tooling).

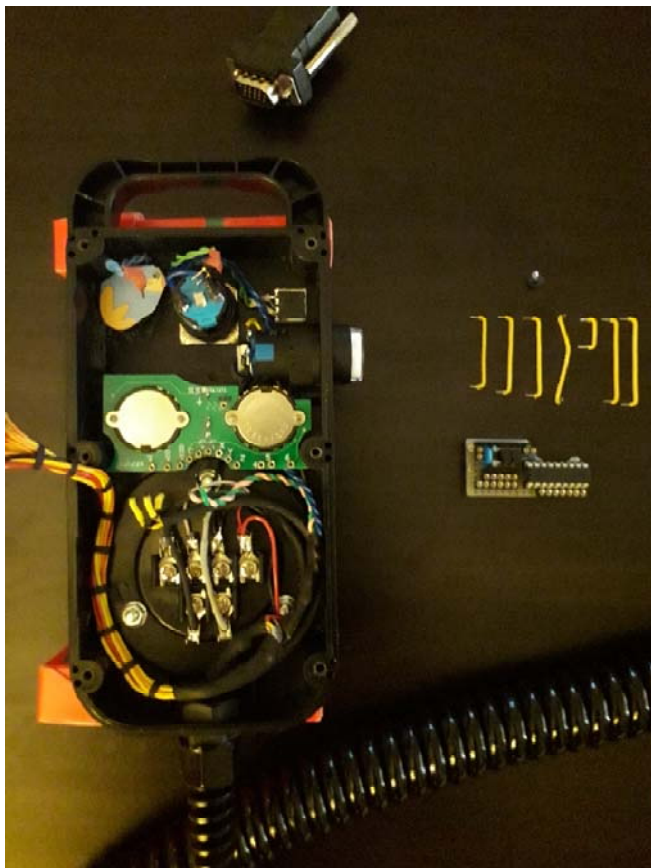
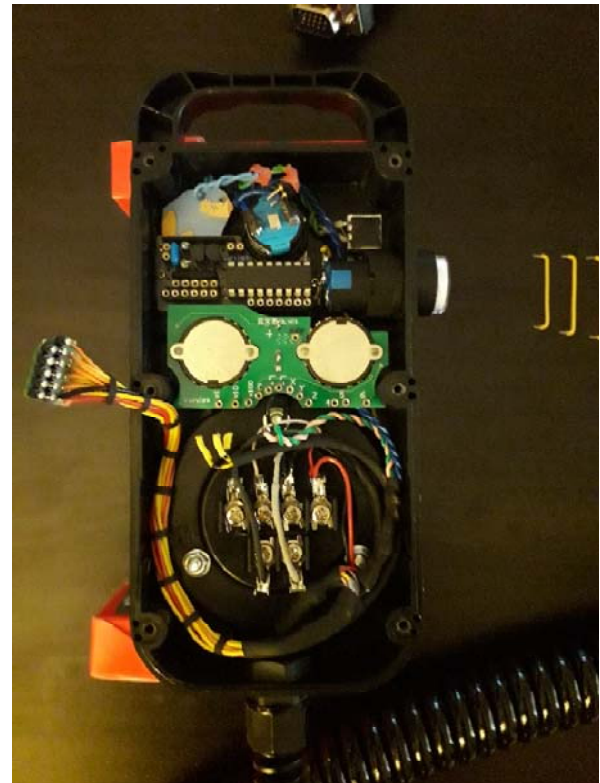
The speaker mesh “hat” was formed via a washer, aluminium tube and rod. It was cut from a strainer using a diamond disc on a Dremel tool.

CAUTION: Be careful and wear eye-protection, mask and gloves during the above operations!

Take your time and plan carefully your hole dimensioning otherwise you will regret an irreversible condition. Also, use some tape and/or hole guide over the pendant’s bezel because any involuntary tool contacts will leave their marks permanently:



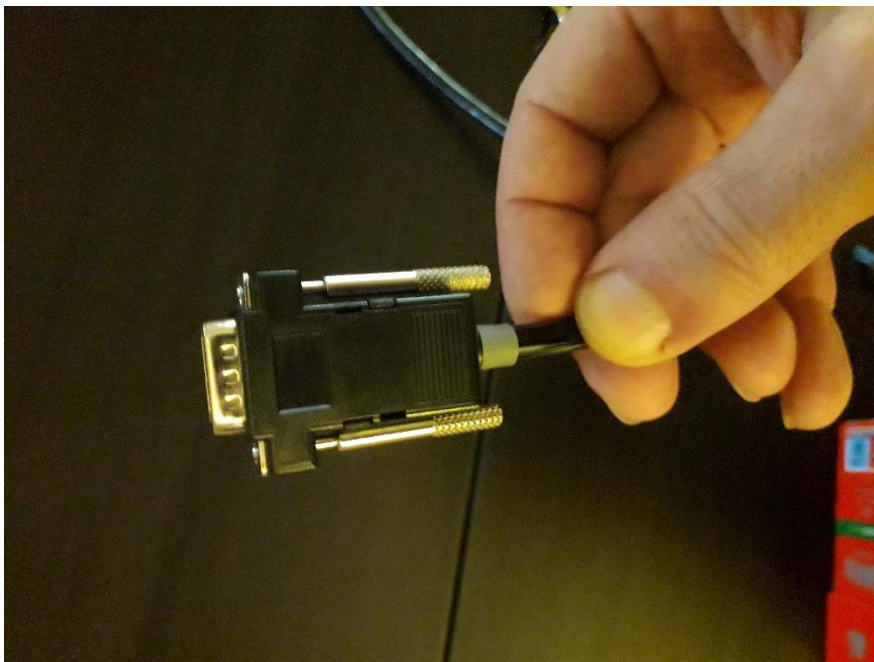
The circuit was built using prototyping board and point-to-point connections. DIP sockets were used for the PIC, into creating pcb plugs/sockets and dip socket pins were soldered on the existing pendant pcb after desoldering and cleaning/removing the factory applied hot glue, enlarging the existing holes and locating the rotary switch1 “off” tab and drilling/soldering an extra socket pin. The led’s original 4.7k Ω resistor was replaced with 1.5k Ω :



The speaker mesh hat's brim was cemented with superglue and baking soda/cigarette ash. A black L-shaped plastic tab on the left and a white stepped abs plastic on the right were glued in place for the board mounting. Another white abs plastic support was glued on top left for the speaker holder by a piece of an old phonecard.



The connector used was a 15-pin D-sub:



Now, a few words about the required brain functions:

I already had added a button in my mach screen that toggles a led light under the spindle illuminating the xy table. I wanted this light to turn on when the rotary switch 1 was not in off position, to stay on unaffected by the screen button -persistent- and to also be able to toggle its state when I turn the rotary switch 1 at position 5 and press the control button.

I also wanted my spindle to go to G53 Z-1 and after that to G54X0Y0 when I press the control button and the rotary switch 1 is at position 6.

The 2 above functions were implemented by utilising the M-macro to OEM code 301 association.

A macro M1000.m1s was written with only this line SetTriggerMacro(1001) , saved in macros folder and its name included in initialisation string definition in general configuration (e.g M80M1000).

Then, a second macro M1001.m1s was written with the following script, also saved in macros folder:

```
VarMacroTable = GetOemDRO(1499)           ' get macro id

If VarMacroTable=1 Then                    ' if macro id =1, toggle proxxon
    If IsOutputActive(output4) Then        ' mill led light
        DeActivateSignal(output4)
    Else
        ActivateSignal(output4)
    End If
Else
End If
If VarMacroTable=2 Then
    Code "G90 G53 G0 Z-1"                  ' go @ rapid feed @ machine Z-1
    While IsMoving()                       ' wait until move is complete
    Wend
    Code "G90 G54 G0 X0 Y0"                ' go @ rapid feed @ g54 X0Y0
    While IsMoving()                       ' wait until move is complete
    Wend
Else
End If
```

Details on the brains are found on the pdf “mpg brains and macros”

Another important function was to be able to toggle between velocity and multiple exact steps mode. This was accomplished via the 1st flipflop in brain 4. (Second flipflop is in brain 5 for toggling the mill's light).

Other functions include enabling the soft limits during jog, persistency in all controlled states and blinking the led for multiple exact step mode indication.

I hope this project will inspire variations tailored to each individual's specs.