Replacement of a 220V DC spindle motor with an AC Servo motor for an OPTIMUM BF20L milling machine

When one decides NOT to go the traditional route of a 3-fase induction motor + VFD…..

SA CNC Club

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Problems with the original DC Spindle motor / DC controller:

Excessive arcing at speeds higher than 2000 rpm

Difficult to obtain low speeds (< 300 rpm) using the DC controller

Brushes needed replacement at short intervals

High voltage, high current diodes and SCRs needed replacement at short intervals

Removal of controller from enclosure was extremely difficult and time consuming

Wanted to learn how to use AC servo motors….

Original spindle:

220V DC motor with DC controller

800W

5 600 rpm

3.9 Kg

Simple 2-speed gearbox using plastic gears

Max spindle speed of the mill was 3000 rpm

Acquired an AC Servo motor and controller from AliExpress (without brake)

R 3000 + R 400 import duty

Model 90ST-M02430

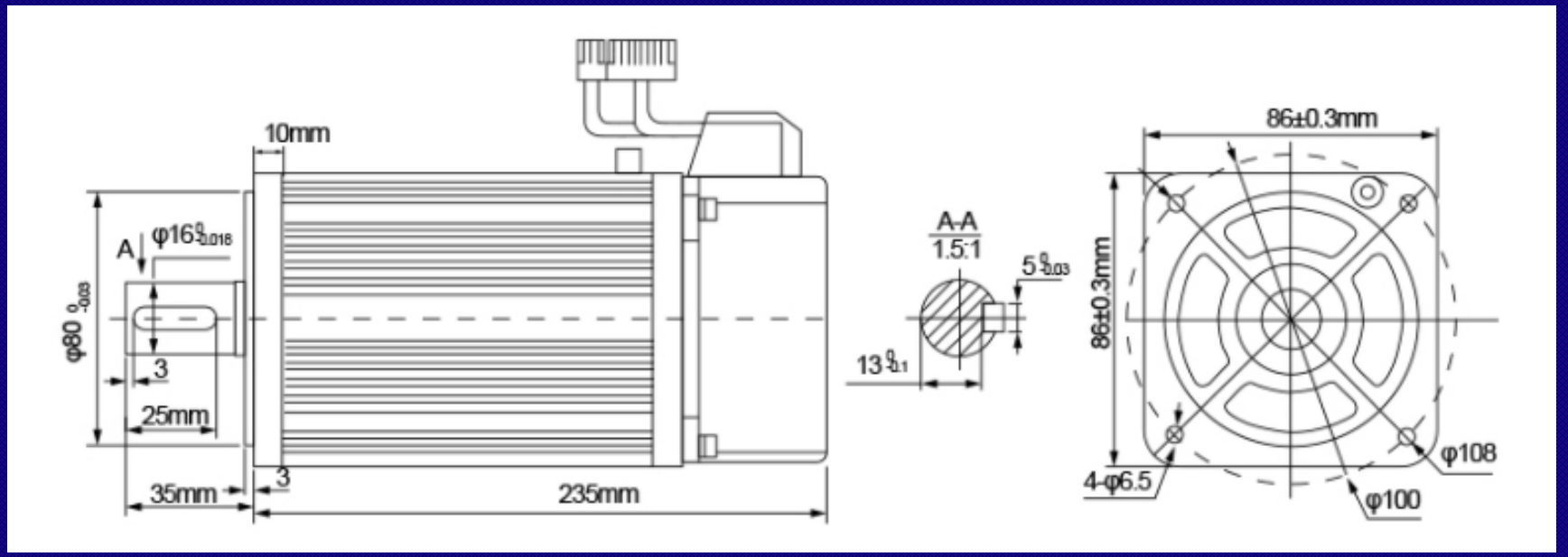
220V, 3A, 0.75 kW

3000 rpm

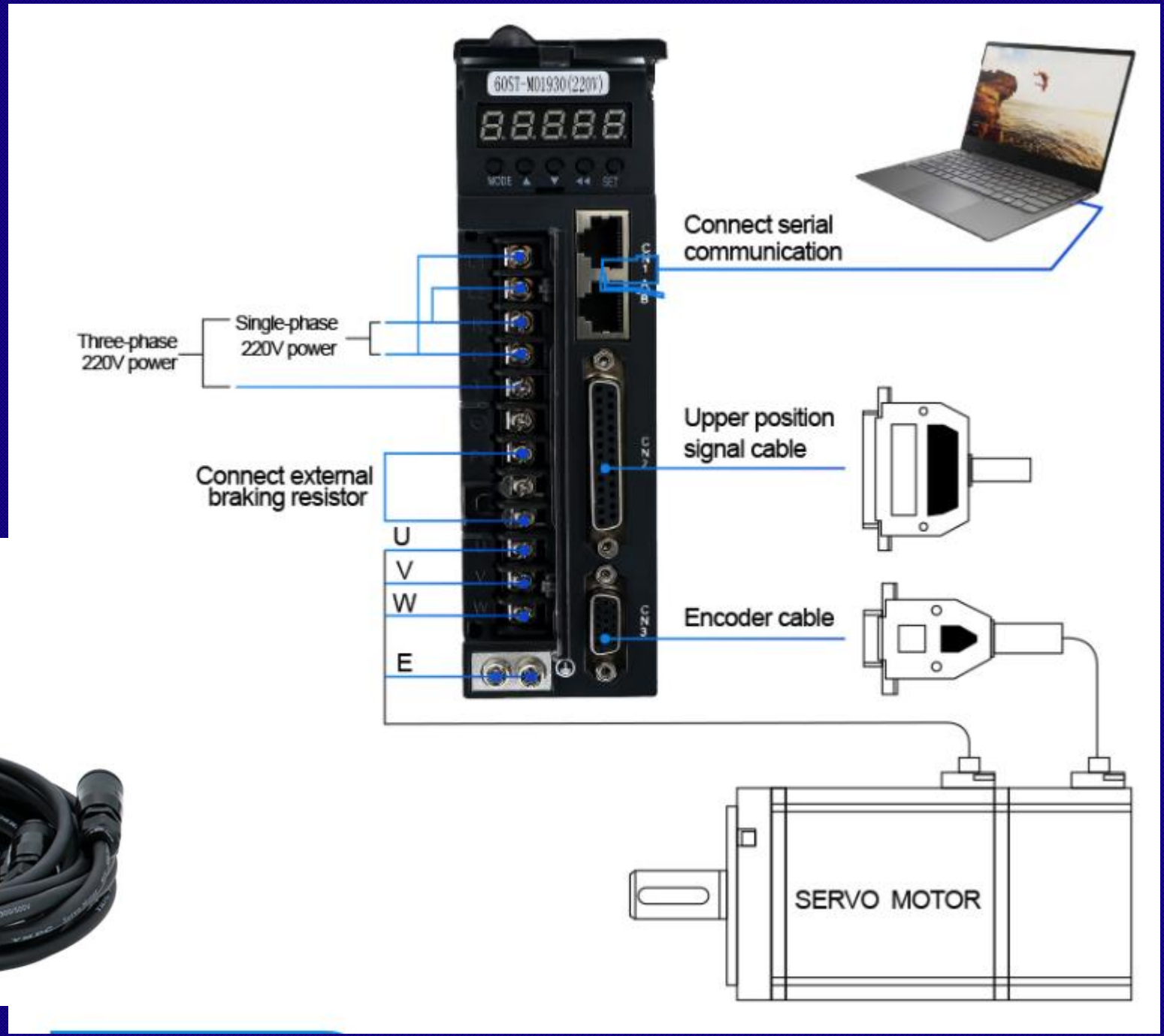
Rated torque: 2.4 N.m

Peak torque: 7.1 N.m

Weight: 3.4 kg



Instructions from web-site regarding generic connections and installation



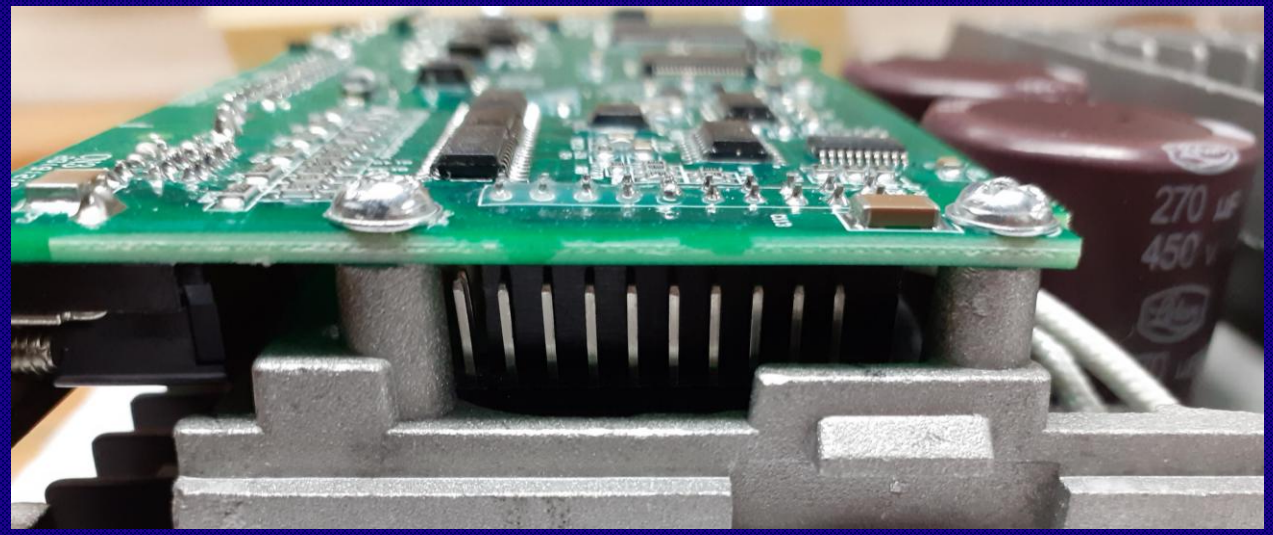
Arrived very well packed

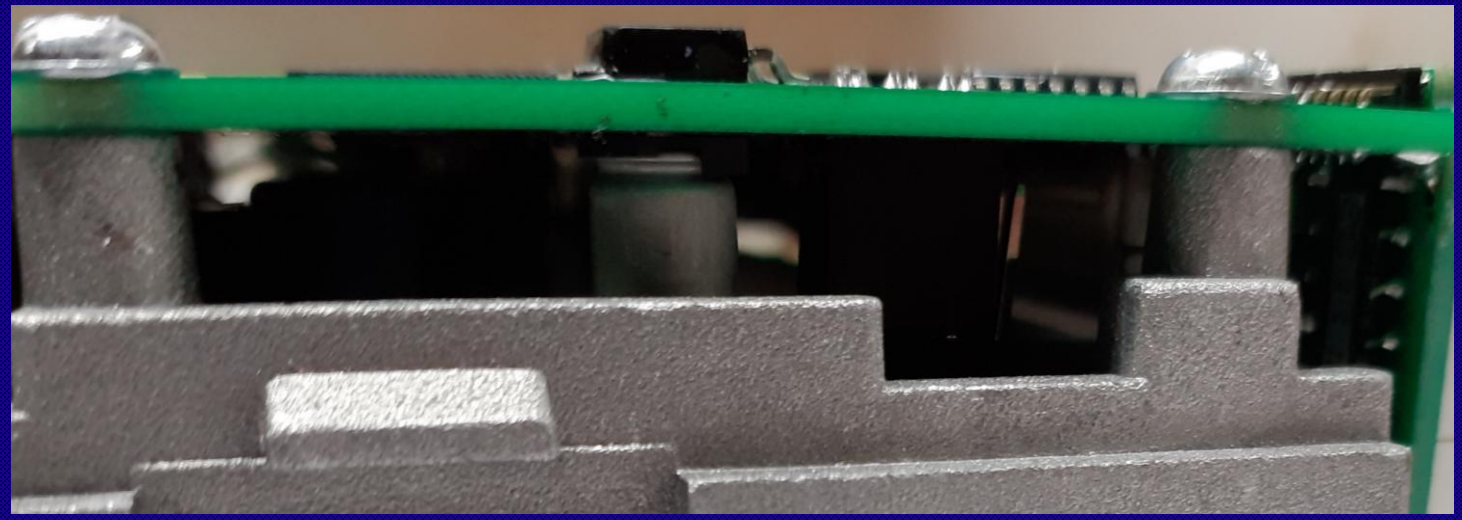
Major problems to get it working

220 V input was done different to what was explained in 200-page manual

Controller indicated an over-voltage alarm that could not be reset

Displayed input voltage on controller made no sense (638 V)……





After weeks of fruitless struggling, it was found that the pin headers inside 2-sides of the controller was misaligned **!**

Operational modes of AC Servo Motor:

Position control, Velocity control and Torque control

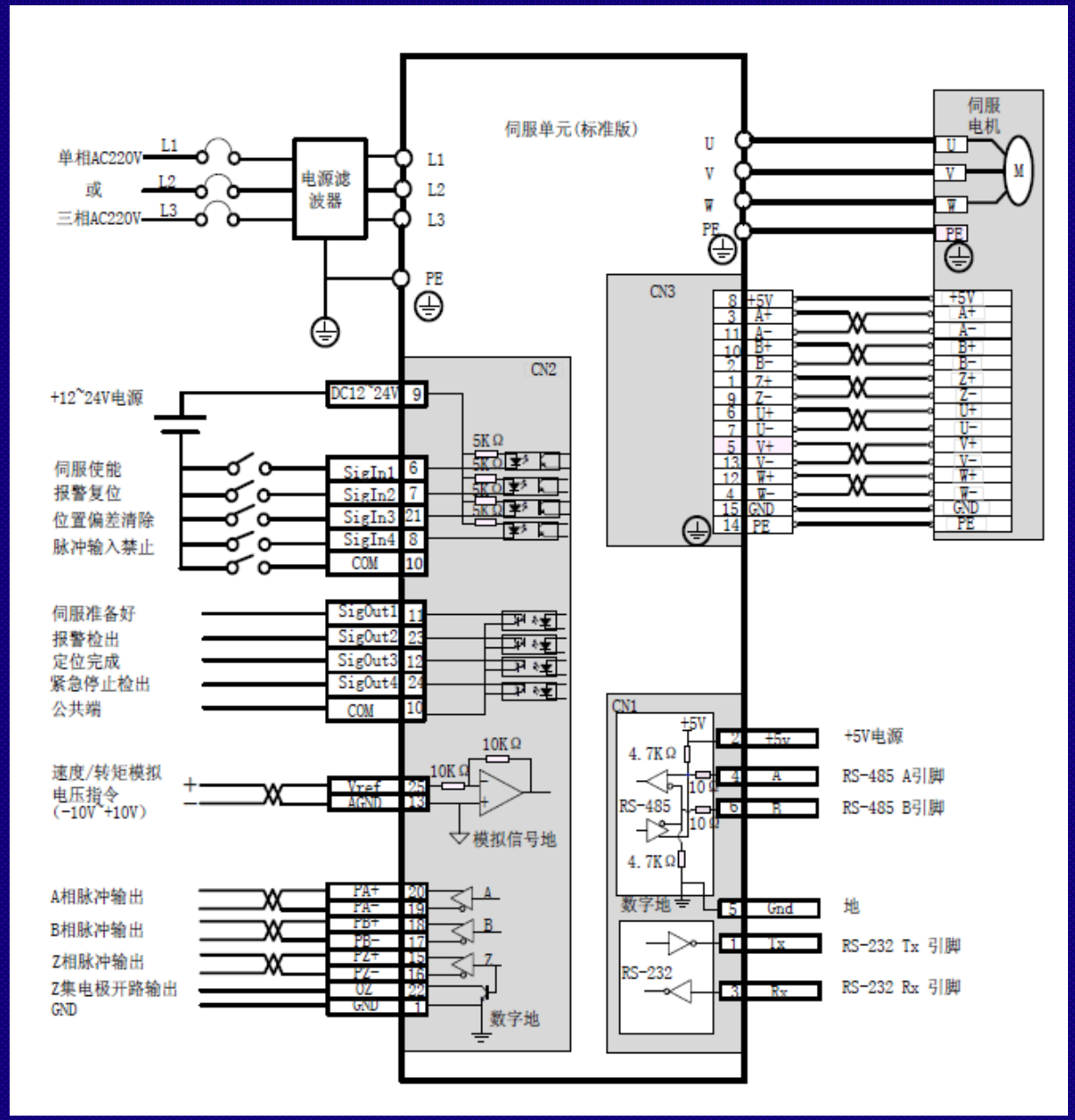
Velocity control was selected for the AC servo motor to be used as a spindle

25 pin signal port used for:

GND and 24V input voltage

Pin to enable servo

0-10V that determine the spindle speed



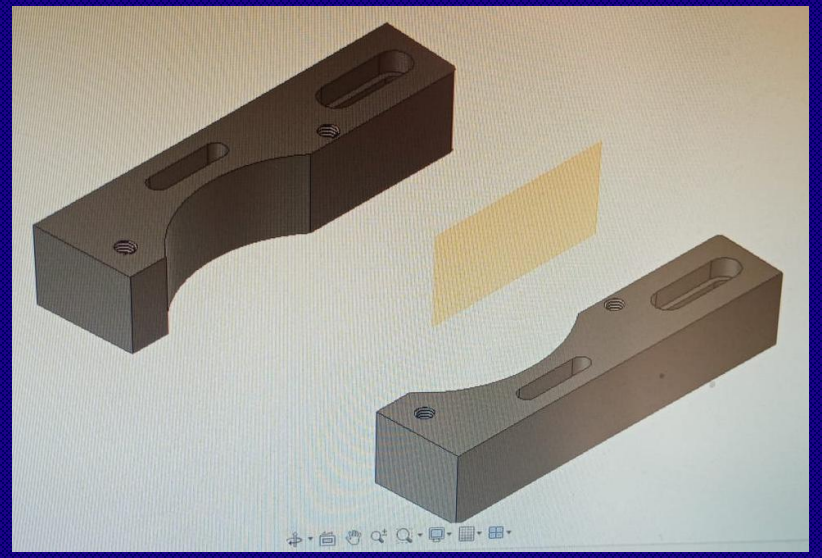
Mechanical interface:

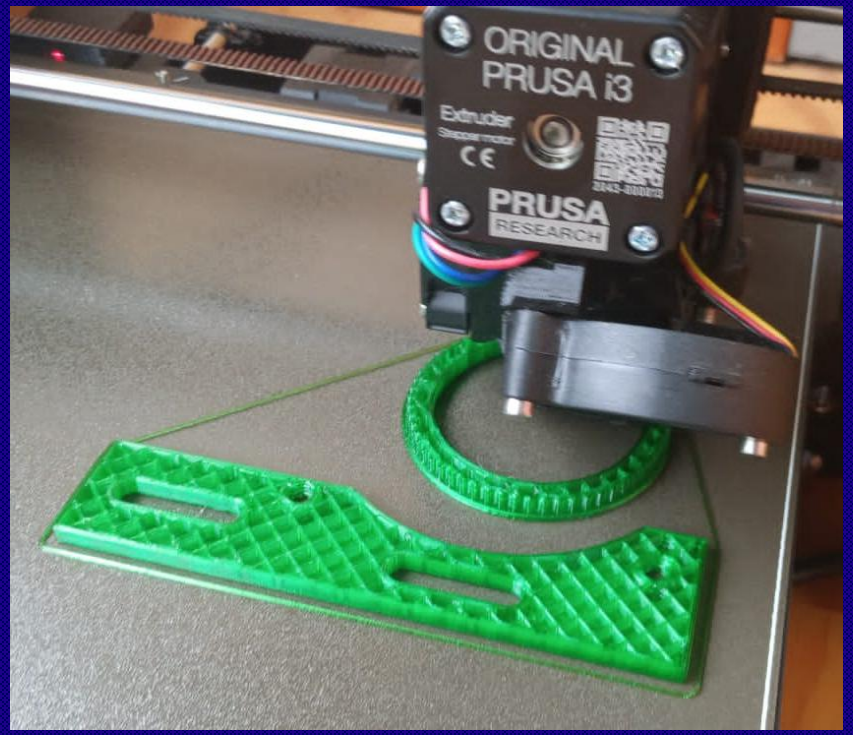
Wanted to use 3M pulley band with 1: 1 pulley ratio

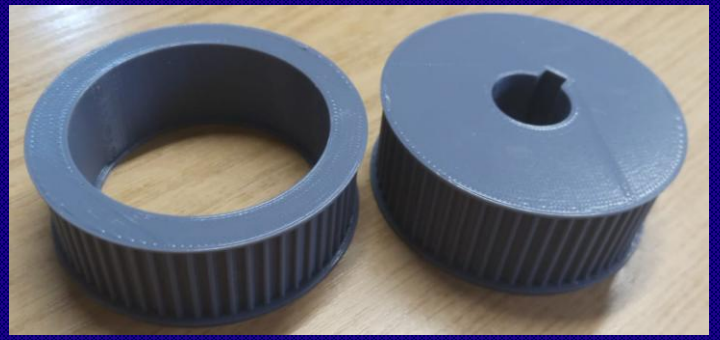
Interface blocks and pulleys were designed in Fusion360

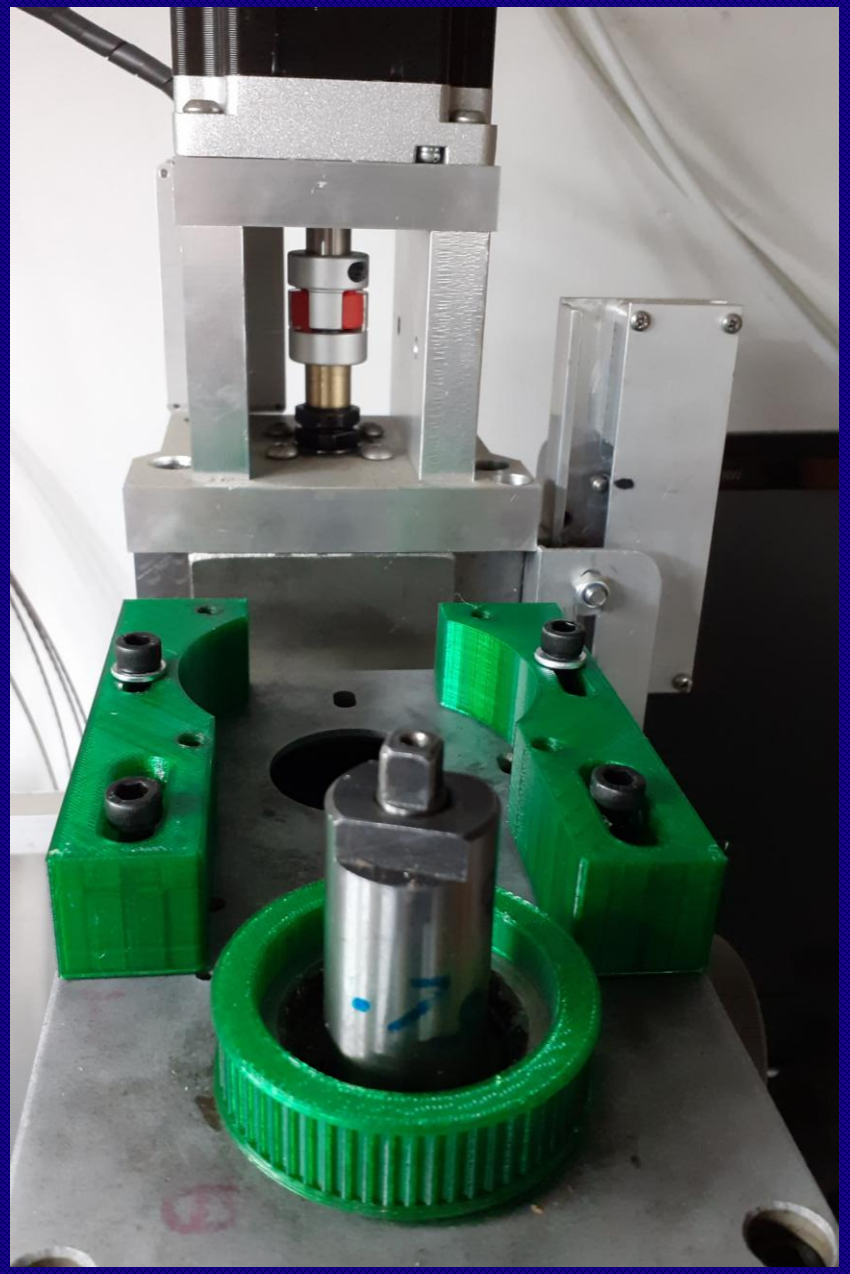
Interface blocks and pulleys were 3D printed in PLA+ to verify the design

“Final components” 3D printed in PETG

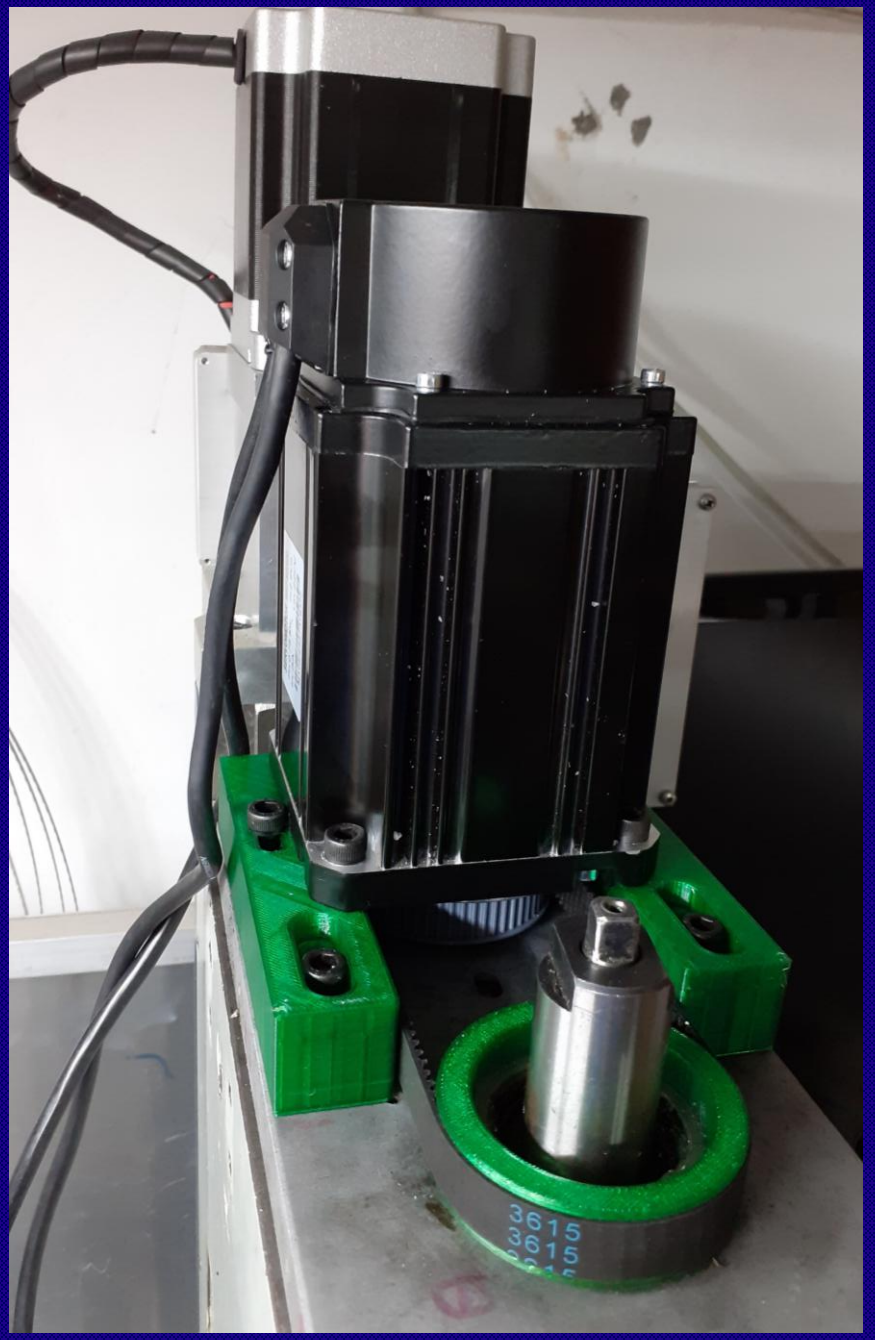








Installation of 3D printed interface blocks and pulleys, as well as the AC servo motor on the OPTIMUM mill



Conclusions

- After hours of machining aluminium the PETG 3D printed pats seems to be doing fine
- AC servo motor extremely quiet
- Very easy to interface with motion control card
- Precise control of the spindle speed
- Under normal circumstances it should be easy to “get going”
- High torque at low rpm
- Relatively low cost

Baie dankie

Thank you

Suggestions would be very much appreciated