



INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
MATERIALS MANAGEMENT DIVISION
Powai, Mumbai 400076

Ref. PR No.1000017087 (RFx No.6100000517)

Technical Specifications :

Tabletop CNC milling machine with open controller enabled for Industry 4.0

Requirement is for two tabletop 3 axis CNC milling machines with PC based (Windows 10 compatible) controller.

Broad specifications:

Each machine should have an open controller that can be programmed and interfaced with external applications written in Java, Python, C, C# etc. and with features that offer a possibility to expand the machine's capabilities through interfacing with various digital technologies and data acquisition systems. The PC based controller should also provide a GUI based programming software.

It should be possible to integrate digital technologies like RFID read/write devices, Vision systems, sensors etc.

An example use case to elaborate the kind of operations to be demonstrated by the machine, its controller and external applications is as follows:

Use case: A job placed on a pallet with a RFID tag is received at the machine. The job ID is read through the RFID reader and the relevant NC code is downloaded from a server or an internet location. The program for executing these actions will be residing on the PC connected to the controller and will pass on the downloaded NC code to the controller, which will execute the code.

Detailed specifications:

The specifications for the machine are as follows. Vendor should submit a sheet showing conformance against each of the following specifications. The deviations should also be specified.

1. XY axis, 300 x 300 mm travel
2. Z axis, 75 mm travel
3. Use of Ball screws and LM guides

Note: Model no. and type should be specified, and the catalogs should be attached.

4. Resolution: 5 microns or lower on all linear axis

5. It should be possible to disassemble the spindle from the frame, and conduct other experiments like EDM, ECM etc.
6. Closed loop stepper or servo-motor based control for X/Y axes.
7. Servo controlled Z axis based on feedback from the RC power supply circuit for EDM operation.
8. Linear scale feedback of 1 micron resolution should be offered as an option and accompanied with a datasheet.
9. A 1.5 kW spindle that can work up to 24000 rpm. Ability to machine MS components is to be ensured.
10. Additional 400 watt, 6000 rpm spindle to be offered as an option.
Note: datasheets, drawings, technical details to be attached and vendor must agree to train an IITB representative to disassemble and assemble the spindles.
11. C axis to be provided as an option.
12. Turning attachment to be provided as an option.
13. A sturdy T-slot table with precision machined slots to be provided in an assembled state (should also be easily removable) for workpiece mounting.
14. Controller should be standalone and connected with a Windows 10 PC/Laptop through an Ethernet port.
15. DLL Libraries, APIs etc. to connect to the controller and acquire data to enable custom software development with Python, C/C++/C# should be provided.
16. Controller should be closed loop for all axes. Feedback to be provided as input through a rotary or linear encoder.
17. Operation of the machine should be through a Graphical User Interface (GUI) software that is Windows 10 compatible and runs ISO standard G/M codes. It should be possible to run the machine from a PC/laptop.
18. The GUI software should support both G/M code based operation and Drawing Input based operation simultaneously.
19. Programming tool (Windows 10 compatible) should be provided for the PLC.
20. Machine should have 16 Digital Inputs (DI) and 16 Digital Outputs (DO), expandable to 64 DI and 48 DO.
21. Simulation with actual graphic movement should be shown on the computer screen.
22. Machine should be tested/calibrated
Note : This testing should be for flatness, alignment, accuracy, spindle runout, etc. as per standards and test certificates should be provided
23. Suitable documentation for the machine, hardware, operation, motion programming, PLC etc. should be provided.

24. Training (for 3 days at IIT Bombay campus) should be provided to facilitate the development of application software that interfaces with the machine controller.
25. A MS Fabricated, height adjustable sturdy frame should be provided for machine. The frame should also look good aesthetically.
The frame should host the controls in a way that they are easily accessible and meet the safety and recommended operating conditions for the controls. The dimensions of the frame should be mentioned.
The frame should safely host the PC and a small additional data acquisition system (DAQ).
The arrangement should allow the PC to be connected internally to the controller and the DAQ and externally to a monitor.
26. Space/provision to keep a 15 inch monitor on the machine is desirable.
27. It is expected that the arrangement will be as compact as practically possible and a footprint of 3ft x 3ft or smaller is desirable.
Note: Pictures of the frame and the hosting arrangements should be attached.
28. Safety features to be incorporated and clearly mentioned
29. Tool holder and a set of 10 milling tools (8mm dia, 4 flute square carbide end mills)
30. Set of sturdy work-holding clamps, vice with swivel base, spanner, etc.
31. A detailed 3D CAD model of the entire system assembly to the smallest component should be provided.
32. Warranty policy on components should be individually and clearly specified and 1-year warranty should be accepted.
33. Nature and duration of post-sale support in case of breakdown, spares supply, troubleshooting etc. should be specified.
34. Nature and duration of technical support related to operation, programming, interfacing etc. should be specified.

Other requirements:

1. The technical bid should include a specification conformance check sheet for each of the above mentioned points. The check sheet should also mention the page number of the documentation where the specification is mentioned.
2. Confirm that, if required, you can bring your controller to IIT Bombay for a presentation and demonstration of the points of concern to IIT Bombay.
3. Vendor must have the capability to train our personnel on using the controller, and its expansion ports, integration options and programming options.
4. The delivery should be made within 3 to 4 months after the order is placed.