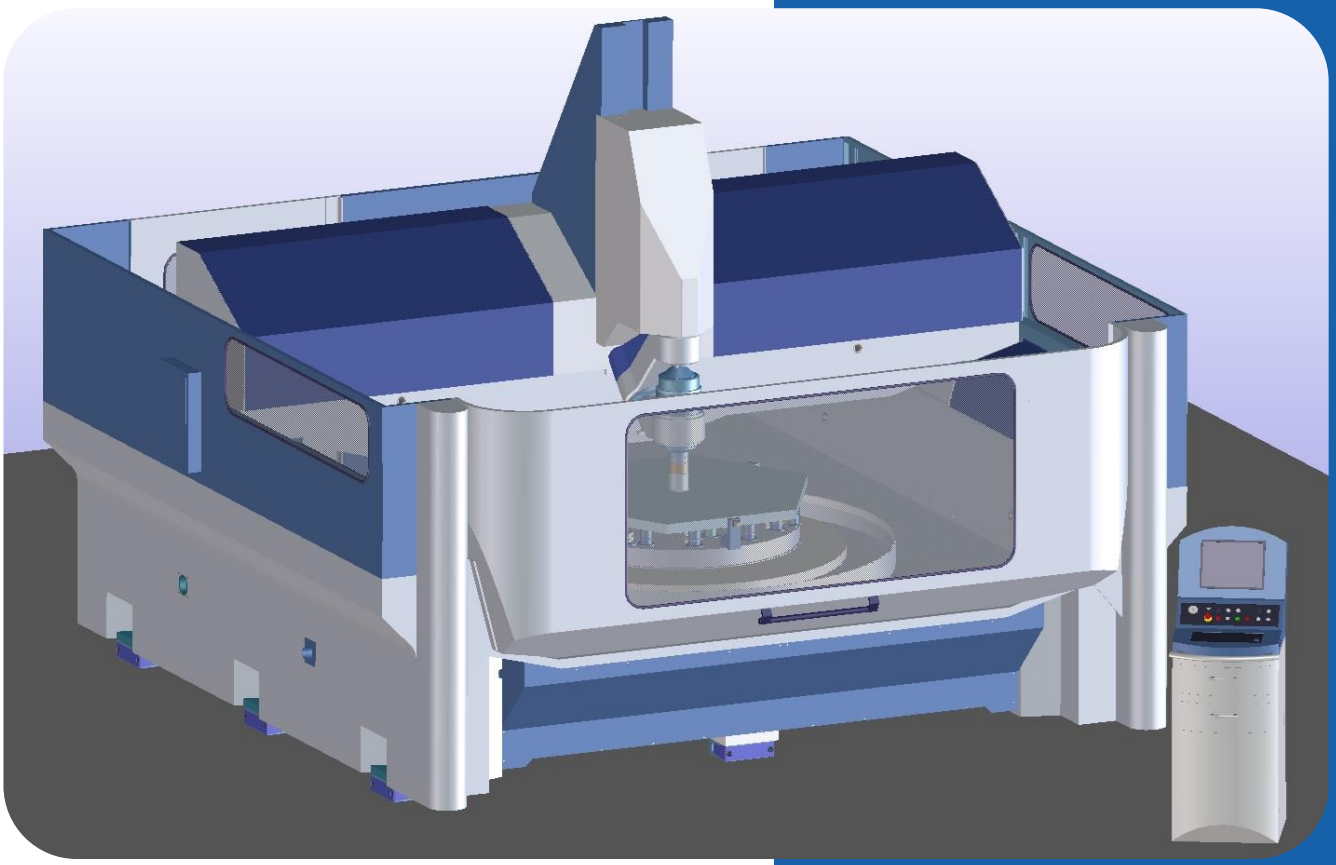
IRP3000 - 7Axis Ballscrew

Product Specification - Version 1, Release 1



Zeeko

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Contents

1 Machine Description

The IRP3000 is a 7-axis CNC corrective polishing machine capable of producing ultra-precision surfaces on a wide range of materials and surface forms.

Machine Dimensions: (without accessories)

- Size: 5500mm wide x 5000mm deep x 3500mm high.
- Mass: 50,000kg.

Workpiece Size Constraints

The optics that can be manufactured on the IRP3000 machine are as follows:

- Freeform parts of up to: 3000mm x 3000mm x 700mm
- Rotationally Symmetrical parts of up to: Ø4000mm using hypotenuse or synchro-spiral polishing (raster mode is not an acceptable method for parts larger than 3000mm in diameter)

2 Arrangement of the Axes

The arrangement and definition of the 7 CNC axes is as follows:

- X is a linear axis which mounts horizontally to the epoxy-granite bridge.
- Y is a linear axis which mounts horizontally to the base and is aligned perpendicular to the X axis.
- Z is a linear axis which mounts vertically from the X axis and is aligned perpendicular to both the X and Y axes.
- C is a rotational axis that holds the work-piece. It is mounted vertically to the base.
- A, B and H are rotational axes configured such that the spherical polishing tool, mounted on the H axis, rotates about a point in space called the virtual pivot point. This three axes assembly mounts to the Z axis.

3 Polymer Granite Machine Base and Bridge

The machine base and bridge are precision cast and machined epoxy-granite composite structures that provide excellent thermal stability and vibration damping characteristics. These two key machine elements incorporate the following features:

- The machine base is a precision cast and machined epoxy granite composite structure with a hybrid RHS/epoxy-granite span.
- Moulded-in stainless steel inserts for mounting and alignment of the X and Y axes, machine lifting, handling, and transportation.
- Threaded stainless steel inserts for mounting the polishing and electrical enclosures.
- Moulded-in feeds for electrical supply and control cables, compressed air, and slurry supply and return.

4 Linear Axes

Each axis is mounted on a pair of precision THK linear motion rails and driven via an AC servo motor and precision ground ballscrew. Home positions measured via absolute rotary encoders or optional linear encoders

- Slide type: THK caged ball, linear motion rails
- Travel (X Axis): ±1650mm
- Travel (Y Axis) ±1650mm
- Travel (Z Axis) 750mm
- Drive system: AC servo driven, caged ball, precision ground ballscrew
- Max velocity: 3000mm/min

5 Rotary Axes & Spindles

The A, B & H axes provide the primary tool motions and are often referred to as the Virtual Pivot (VP). The VP is mounted directly to the Z-Axis.

5.1 A-AXIS

The A-axis is mounted to the Z-Axis via an AC servo drive Harmonic Drive unit with enhanced radial stiffness. Referencing of the position is via a non-contact referencing element. Referencing is only required following power up of the machine.

- Rotational Range: ±270°
- Max Rotational Velocity: 10 rpm
- Positional accuracy : ±0.5arcmin

5.2 B-AXIS

The B axis is mounted to the A axis via AC servo driven Harmonic Drive unit. Referencing of the position is via a non-contact referencing element. Referencing is only required following power up of the machine.

- Rotational Range: ±180°
- Max Rotational Velocity: 10 rpm
- Positional accuracy : ±0.5arcmin

5.3 H-AXIS

The H axis forms the tool holding spindle and is mounted to the A/B axes and completes the virtual pivot assembly.

Drive is provided via a DC frameless motor with position feedback from a rotary encoder. The spindle is cooled by an external chiller system.

Tooling mounts via a Ø40mm chuck.

- Speed Range: 10 to 2000
- Polishing Head radius: R20, R40, R80, R160, R320

5.4 C-AXIS

The C-Axis forms the work piece mounting spindle and is mounted to the Y-Axis. The C-Axis consists of rolling element bearings driven by a Brushless DC servo motor, with positional feedback provided by a precision absolute encoder.

Spindle is cooled by external SMC chiller system.

The Spindle is supplied with an Ø3000mm turntable and Ø40mm hydraulic chuck for work piece mounting. The chuck may be used via an adapter to the table.

- Speed Range: 0 to 100 rpm
- Max Load Capacity: 7000kg[1]
- Vacuum (Optional): -0.8bar maximum

[1] As the workpiece load approaches the maximum capacity, all velocities and accelerations will be reduced to meet safe working conditions.

6 Machine Enclosures

The Machine enclosures are provided as follows:

- Uncoated stainless steel polishing enclosure (internal surfaces)
- Slurry return drain passing through the base.
- Slide protection for the X, Y, and Z axes.
- Isolated machine electrical and pneumatic systems.
- Maintenance access to X, Y, and Z axes.

7 Control System

Zeeko Fanuc (30i-B) System

- Fanuc Multi-Axis Controller, 30i Series CNC
- 30i-B Basic unit, Stand-Alone Type
- Designation of Number of Axes – 7 Axes
- Designation of Control Path – 1 Path
- 1µm Minimum Axis Increment System
- Multi-axis Spline Capability – AI Contour Control II – Nurbs Interpolation
- Compensation – Straightness, Pitch Error
- Panel-i – Windows Embedded Standard 7 OS
- Zeeko Dedicated Graphical User Interface
- 15.0” Colour LCD, with Softkeys, with Touch Panel
- Ethernet Port for Data I/O and/or Remote Diagnostics / Maintenance
- USB Socket
- Data Server with Compact Flash Card, 4GB
- Program Transfer Tool Software

8 Guards, Covers & Safety Features

The equipment specified herein shall conform to requirements of EC and international safety regulations as required by current legislation.

Cover and guards will be provided to protect the operator from:

- Moving machine parts
- Slurry and spray

Covers will also protect machine elements from:

- Slurry and fluids
- Airborne dust and debris

Electrical interlocks will prevent opening of:

- The polishing enclosure doors when the machine is in cycle.
- Electrical cabinet when the machine is energised

An emergency stop button readily accessible to the machine operator

9 Summary Specification

9.1 General

General	Description
System Configuration	7 Axis CNC Optical Polishing Machine constructed on Epoxy-Granite Machine Base, capable of producing ultra-precise surfaces on a variety of optical materials and surface forms
Work piece Capacity (1)	Freeform Parts of up to: 3000mm x 3000mm x 700mm Rotationally Symmetrical part of up to: 4000mm in diameter
Base Structure	Hybrid RHS/Epoxy-Granite
Control System	Fanuc 30i - B
Dimensions (No Accessories)	5500mm wide x 5000mm deep x 3500mm high
Suggested Install Dimensions	7500mm x 7000mm x 4500mm
Weight	50,000Kg (max. with part)
Floor Load Requirements	Minimum loading 250,000Kg/m2 Floor must be even to <3mm/m2
Environmental Requirements Min/Max Operating Temp. Max Operating Humidity Min/Max Storage Temp. Max Storage Humidity	15°C - 35°C (<2°C/hour Temperature Gradient) 75% RH Non Condensing -15°C - 50°C 80% RH Non Condensing
Power Supply Requirements	3Phase+N+E, 200/220/240/420/480VAC 50/60H
Services Requirements	Clean dry air at 1200L/min with minimum pressure of 6bar
Noise Level	<50bB(A) Continuous
CE Marking	In accordance with EC Directives 2006/42/EC, 2004/108/EC (EMC) and 2006/95/CE (Low Voltage)

9.2 Linear Axes

Description	X	Y	Z
Slide Type	THK Linear Motion Rails	THK Linear Motion Rails	THK Linear Motion Rails
Drive Type	Servo Driven precision ground ballscrew	Servo Driven precision ground ballscrew	Servo Driven precision ground ballscrew
Feedback Type	Absolute Rotary Encoder (std)	Absolute Rotary Encoder (std)	Absolute Rotary Encoder (std)
Travel	1650mm	1650mm	750mm
Max Velocity	3000mm/min	3000mm/min	3000mm/min
Max Acceleration	250mm/sec2	250mm/sec2	250mm/sec2
Positioning Accuracy	<50µm over full travel	<50µm over full travel	<50µm over full travel
Bi-direction Repeatability	<5µm	<5µm	<5µm
Straightness: Horizontal: Vertical:	<100µm over full travel <5µm over 100mm	<100µm over full travel <5µm over 100mm	<100µm over full travel <5µm over 100mm
Squareness	<50µm/m		
Circularity	<50µm		

9.3 Rotary Axes

Rotary Axes	A	B	H (Tool)	C (Workpiece)
Mounting	Z Axis Carriage	Virtual Pivot Arm	Virtual Pivot Assembly	Base (option of Tumtable or ∅40 Schunk Chuck)
Spindle/Axis	Axis	Axis	Spindle	Spindle & Axis
Cooled	Not Required	Not Required	Yes	Yes
Drive	AC Servo Drive Harmonic Drive Unit with Enhanced Radial Stiffness	AC Servo Drive Harmonic Drive Unit with Enhanced Radial Stiffness	DC Frameless Direct Drive	DC Frameless Direct Drive
Feedback Type	Motor Encoder	Motor Encoder	Rotary Encoder, 5000lines min	Heidenhain Absolute Angle Encoder
Speed Range	0-25rpm	0-25rpm	10-2000rpm	0-100rpm (Tumtable) 0-900rpm (Schunk chuck)
Load Capacity	N/A	N/A	N/A	7000Kg
Positional Accuracy	±1arcmin	±1arcmin	-	±5arcsecs
Working Range	±270°	±180°	Continuous- bi directional	Continuous- bi directional
Radial Run-Out	Rotation of VP Setting ball mounted in H Axis Chuck and rotated about the Virtual Pivot < 5µm			<10µm
Axial Run-out				<25µm (@R=800)

10 Contact

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