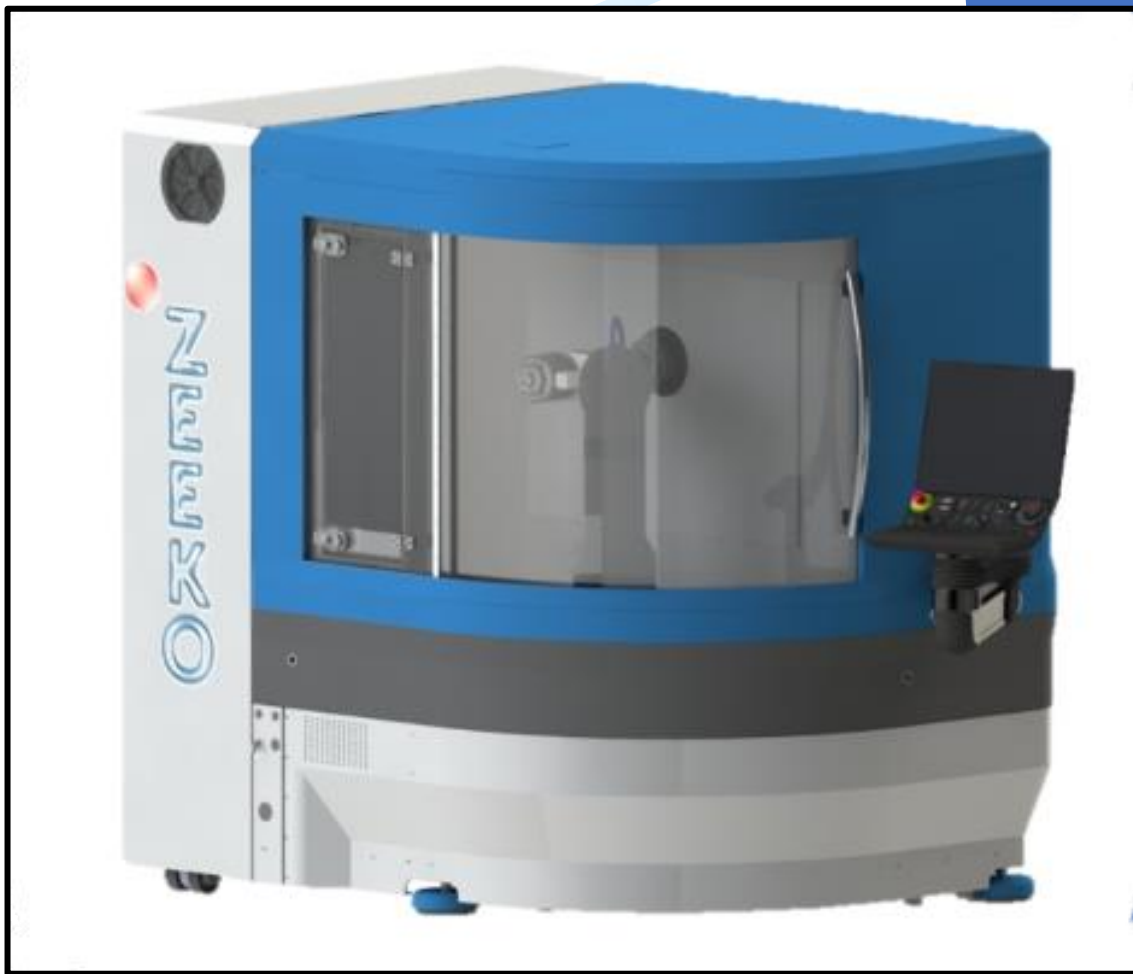


Specification Manual



IRP200 MkII Fanuc
Linear 7 Axis

Version 7, Rev a

June 2024

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Liability Statement

Zeeko (hereinafter referred to as “the Manufacturer”) warrants that the CNC machines are free from defects in materials and workmanship for a period of one year from the date of delivery. The Manufacturer will repair or replace, at its option, any defective CNC machine or part thereof, provided that the CNC machine is returned to the Manufacturer, or an authorized service engineer site visit is arranged, within the warranty period.

This warranty does not cover normal wear and tear, damage caused by improper installation, operation, maintenance, or modification, or any damage resulting from misuse, abuse, negligence, accident, or natural causes.

The Manufacturer’s liability under this warranty is limited to the repair or replacement of the defective CNC machine or part thereof, and does not include any incidental or consequential damages, such as loss of profits, loss of production, loss of data, or injury to persons or property. The Manufacturer disclaims any implied warranties of merchantability or fitness for a particular purpose, and any other warranties not expressly stated herein.

The Manufacturer is not liable for any direct, indirect, incidental, or consequential damages arising from the use or inability to use the CNC machines, whether based on contract, tort, or any other legal theory, even if the Manufacturer has been advised of the possibility of such damages. The Manufacturer’s maximum liability under any circumstances shall not exceed the purchase price of the CNC machine.

Some jurisdictions do not allow the exclusion or limitation of certain warranties or damages, so some of the above exclusions or limitations may not apply to you. This liability statement gives you specific legal rights, and you may also have other rights that vary from jurisdiction to jurisdiction.

By purchasing, installing, operating, or using the CNC machines, you agree to be bound by the terms and conditions of this liability statement. If you do not agree with this liability statement, do not purchase, install, operate, or use the CNC machines.

Machine description

The IRP200 is a 7 axis CNC optical polishing / form generating machine capable of producing ultra-precise surfaces on a wide range of materials and surface forms. The machine axes can be used for traditional spiral, raster, and free-form polishing.

- Mass = 3000 kg
- Dimensions = 1520 x 2800* x 2000 (W x D x H mm)

* Maximum machine depth including operator console (Depth of machine without console = 2040 mm)

The machine frame is a welded steel structure incorporating the following features:

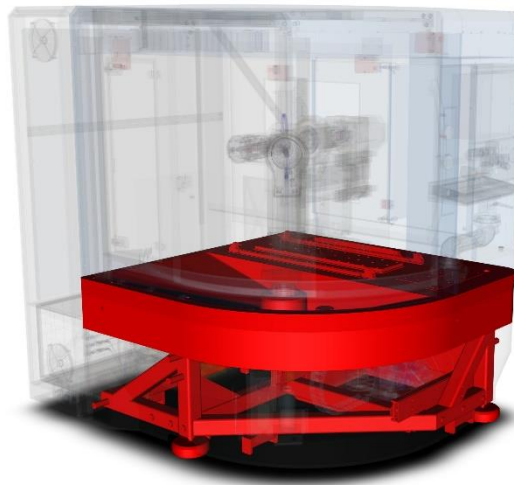
- 3 point floor mounting
- Integrated electrical and pneumatics enclosures
- 3-point mounting for polymer-granite base

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 polymer-granite base. The X axis carriage is a precision machined structure
- Y is a linear axis, precision machined structure, mounted vertically to the X axis carriage and aligned perpendicular to the X axis
- Z is a linear axis, precision machined structure, mounted horizontally to the Y 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 in line with the Z axis
- A, B and H are rotational axes configured such that the polishing head (H axis) rotates through a point in space call the Virtual Pivot (VP). This three-axes assembly mounts to the Polymer-granite base

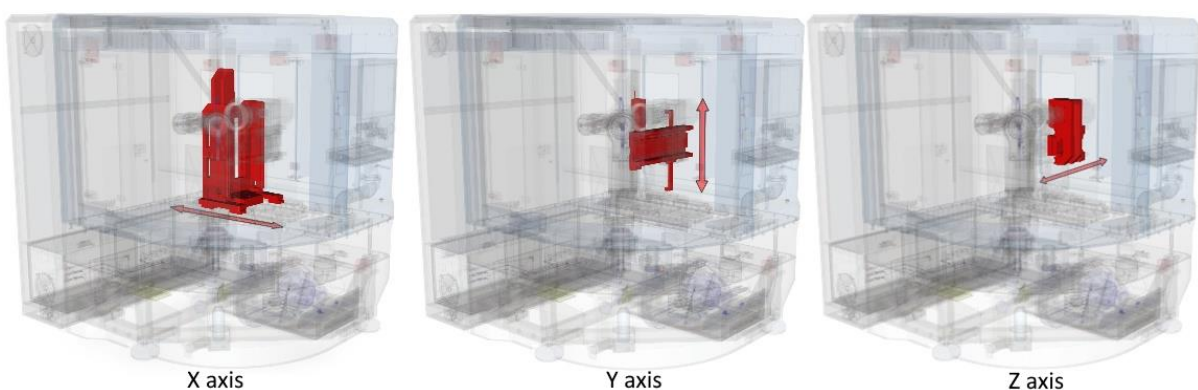
Polymer granite machine base



The machine base is a precision cast and machined polymer-granite composite structure that provides excellent thermal stability and vibration damping characteristics. This key machine element incorporates the following features:

- Moulded-in stainless steel inserts for mounting and alignment of the X and A axes and for machine handling and transportation
- Threaded stainless steel inserts for mounting the polishing enclosure
- Moulded-in feeds for electrical supply and control cables, compressed air, and slurry supply and return
- Moulded steel insert for mounting of peripheral hardware (e.g. Measuring Equipment)

Linear axes



X axis

Y axis

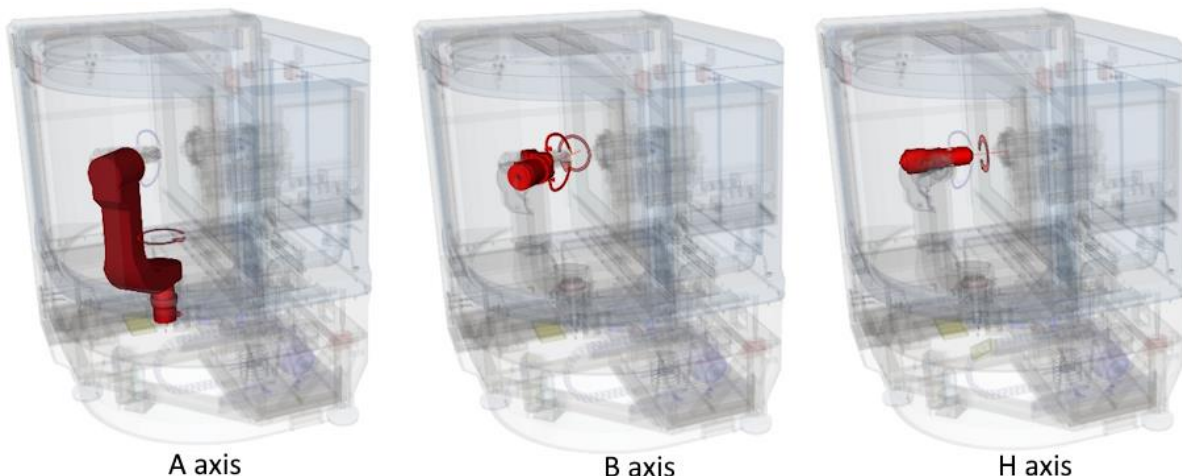
Z axis

Each axis is mounted on a pair of precision linear motion rails and driven via linear motors. The Y-Axis linear motor system utilizes a servo driven precision ballscrew and spring combination as a counterbalance. Position feedback is provided by the use of absolute linear encoders.

■ Slide type:	Precision linear motion rail
■ Travel (X Axis):	±160 mm
■ Travel (Y Axis)	±160 mm
■ Travel (Z Axis)	140 mm
■ Drive system:	Fanuc Linear Motor
■ Positioning feed-back:	Absolute linear encoder
■ Max velocity:	3000 mm/min

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 polymer-granite base.



The A-Axis is mounted to the base 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.

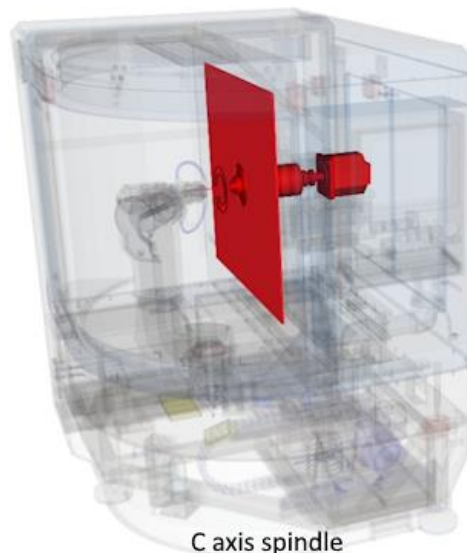
■ Rotational Range:	-50° to +115°
■ Max Rotational Velocity:	25 rpm

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: $\pm 180^\circ$
- Max Rotational Velocity: 25 rpm

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 a chiller system. Tooling mounts via a 25 mm precision hydraulic chuck. The H-Axis also integrates a load cell arrangement to facilitate part probing essential for process stability and part/machine referencing.

- Speed Range: 10 to 2000 rpm



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

The spindle is supplied with a $\varnothing 25$ mm hydraulic chuck for work piece mounting.

- Speed Range: 0 to 1000 rpm
- Max Load Capacity: 15 Kg

Machine enclosures

The Machine enclosures are provided as follows:

- Uncoated stainless steel polishing enclosure (with internal surfaces covered in self-adhesive low friction film)
- Drain pipe passing through the granite base
- Slide protection for the X, Y, and Z axes
- Isolated machine electrical and pneumatic systems
- Maintenance access to X, Y, and Z axes
- Transit constraints

Control system



Zeeko Fanuc (30i-B Plus) System

- Industrialised internal PC
- 19" Touch Colour LCD Screen and Industrialised Keyboard with Trackball
- 5-axes interpolation (export controlled) with cubic, polynomial, and B-spline (NURBS) capability
- Designation of control paths: 1 path
- Least Command Increment: 1µm
- Processor: Intel i5 - Windows embedded Standard 10 IOT
- Data Server option for up to 4GB NC programs

Guards, covers and 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 door when the machine is in cycle.
- Electrical cabinet when the machine is energised

An emergency stop button readily accessible to the machine operator

Summary specifications

General

General	Description
System configuration	A 7 Axis CNC Optical Polishing Machine constructed on a Polymer Granite Machine Base and Bridge, capable of producing ultra-precise surfaces on a variety of optical materials and surface forms.
Work piece capacity (1)	Nominal polishing envelope of 300 x 300 x 120 mm
Base structure	Polymer granite
Control system	Fanuc 30i-B
Dimensions (no accessories) W x D x H	1520 x 2800* x 2000 (mm – Width x Depth x Height) *Maximum machine depth including operator console
Minimum Install Dimensions	3750 x 3400 x 2200 (mm – Width x Depth x Height)
Suggested Install Dimensions	3900 x 3700 x 3000 (mm – Width x Depth x Height)
Weight	3,000 kg
Floor load requirements	Minimum loading 105,000 Kg/m ² Floor must be even to <3 mm/m ²
Environmental requirements	
Min/max operating temperature	20 °C +/- 1 °C (<2 °C/hour Temperature Gradient)
Max operating humidity	75 % RH Non-condensing
Min/max storage temperature	-15 °C – 50 °C
Max storage humidity	80 % RH Non-condensing
Power supply requirements	3Phase+E, 220 VAC +/-5 % - 50/60 Hz 7.6 kW
Services requirements	Clean dry air at 250 L/min with minimum pressure of 6 bar
Noise level	<50 dB(A) continuous
Safety	In accordance with EC directives 2006/42/EC, 2004/108/EC (EMC) and 2006/95/CE (low voltage)

Linear axes

Description	X	Y	Z
Slide Type	Precision Linear Motion Rails	Precision Linear Motion Rails	Precision Linear Motion Rails
Drive Type	Fanuc Linear Motor	Fanuc Linear Motor	Fanuc Linear Motor
Feedback Type	Absolute Linear Encoder	Absolute Linear Encoder	Absolute Linear Encoder
Travel	±160 mm	±160 mm	+5 mm , -135 mm, Max VP–Chuck Face Distance=150 mm, Min VP–Chuck Face Distance=10 mm
Max Velocity	3000 mm/min	3000 mm/min	3000 mm/min
Max Acceleration	250 mm/sec ²	250 mm/sec ²	250 mm/sec ²
Positioning Accuracy	<10 µm over full travel	<10 µm over full travel	<10 µm over full travel
Bi-direction Repeatability	<5 µm	<5 µm	<5 µm
Straightness: Horizontal: Vertical:	<10 µm over full travel <5 µm over 100 mm	<10 µm over full travel <5 µm over 100 mm	<10 µm over full travel <5 µm over 100 mm
Squareness	<50 µ/m	<50 µ/m	<50 µ/m
Circularity	<50 µm	<50 µm	<50 µm

Rotary axes

Rotary Axes	A	B	H (Tool)	C (Workpiece)
Mounting	Epoxy-Granite Base	A-Axis Arm	Virtual Pivot Assembly	Z-Axis Carriage
Spindle/Axis	Axis	Axis	Spindle	Spindle & Axis
Cooled	N/A	N/A	Yes	Yes
Integral Services	N/A	N/A	Purge	Purge (Optional Vacuum)
Probing	N/A	N/A	125N Load Cell	N/A
Drive	Servo drive via Harmonic Drive with enhanced radial stiffness	Servo drive via Harmonic Drive with enhanced radial stiffness	DC Frameless	Brushless DC Servo Motor
Feedback Type	Motor Encoder	Motor Encoder	Rotary Encoder, 5000 lines/min	Absolute Encoder
Speed Range	0-25 rpm	0-25 rpm	0-2000 rpm	0-1000 rpm
Load Capacity	N/A	N/A	N/A	15 Kg
Maximum Inertial Load ¹				2.0 Kg*m ² @239 rad/s ²
Positional Repeatability @ Motor	±1 arcmin	±1 arcmin	-	±1 arcmin
Working Range	+115°, -50°	±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 < 40 µm			<5 µm
Axial Run-out				<10 µm

Contact information

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