AMADA MACHINERY AMERICA, INC.

THE VISION OF PRECISION

Optical Profile Grinders

AMADA®


AMADA
DV1

›

CNC Rotary Table

Optional Full Automation Available

Operation Panel Screen

Productivity Made Easy

CNC Rotary Table Allows Four-Sided Grinding for Maximum Efficiency—With a CNC rotary table as standard equipment, the DVI is capable of full periphery processing with one chucking. Multiple wheel operations for roughing all sides of the workpiece can be completed—completely unattended—before changing the wheel for finishing.

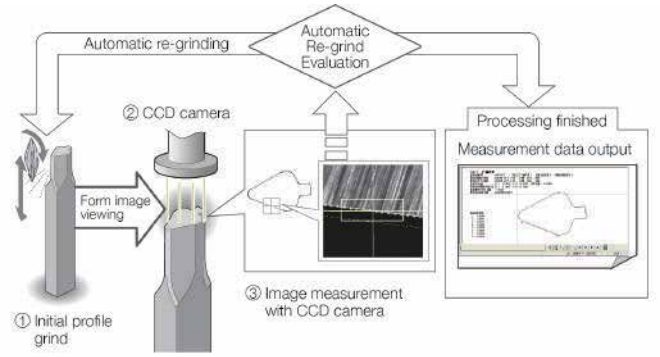
Easy-to-Use PC NC Interface—The PC NC operation software, accessed through a 12-inch color touch panel, significantly improves operability. The new layout of the operation panel organizes the function for both ease of use and clarity. Optimum usability makes this powerful grinder technology a pleasure to operate.

Optional Full Automation Available—With the addition of articulated robots for automated workpiece exchanges and wheel changes on the ATC spindle, the DV1 is capable of running completely unattended.

Automation that Drives Accuracy

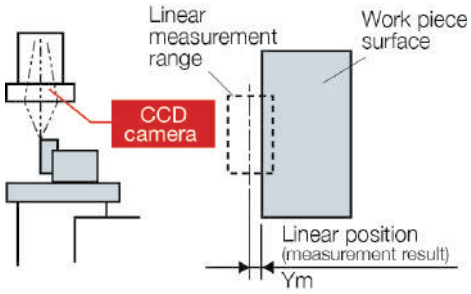
The implementation of CCD camera systems puts the DV1 in a new class of grinding technology.

1 Automatic measurement of workpiece form with automatic re-grinding ensures repeatable precision.

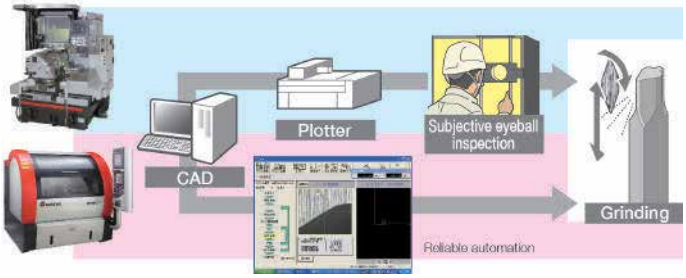


2 The DV1 can process ultra-small workpieces below an angle of 0.04" (1 mm), which is difficult to measure with a projector. In addition, the edge compensation function ensures consistency of inspection.

Horizontal edge (Y axis)
σ= 0.019 mm
Vertical edge (X axis)
σ= 0.013 mm

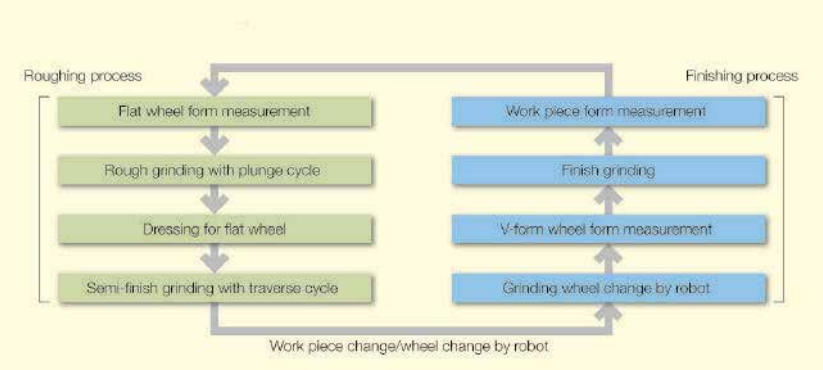


3 Automated CCD camera measurement eliminates subjective manual inspection, dramatically reducing variations in processing quality.



4 Measurement data can be output, providing documented part qualification.

5 Grinding wheel form measurement can be performed.



Full Automation for Roughing and Finishing Operations

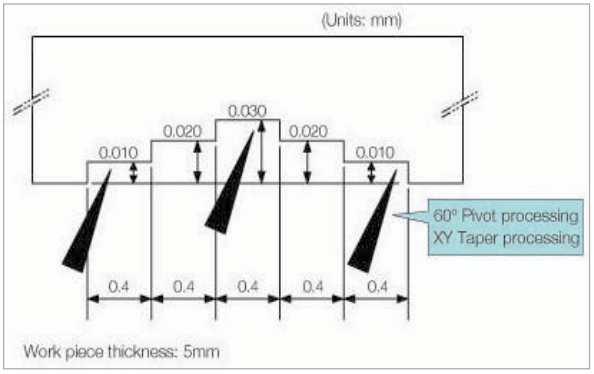
Fully Automated Part Production with Articulated Robot and Stocker

Through automatic wheel changing, rough and finish operations are seamless and can be conducted completely unattended. The ATC spindle automatically clamps the necessary wheels to fully process workpieces, unattended. Measurement software for flat (1A1) grinding wheels automatically qualifies the wheel width/position, and an integrated rotary dresser provides peripheral, side, and corner radius dressing in flat wheels for semi-finish operations. Rough plunge cycles speed throughput.

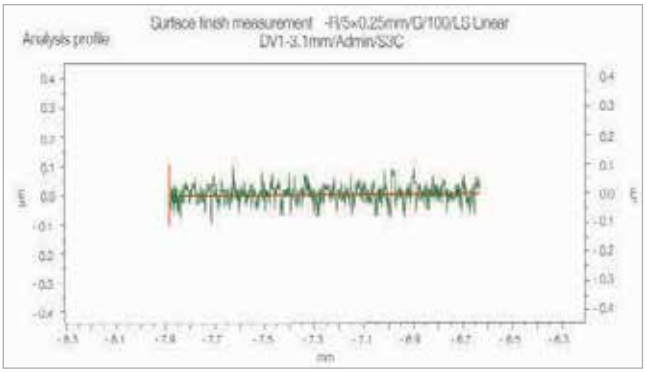
Five-Axis Controls For High-Quality Surface Finish

Uncompromising Machine Design for High-Precision Form Processing

Five-Axis Controls for High-Quality Surface Finish—The DV1 employs a crank-motion elevating stand to achieve superior surface finish. The TC-20 spindle (developed by Amada for 20,000 RPM performance) supports high precision and high speed when creating small and medium shoulders. Integrated front and side clearance ensures angles that satisfy die specifications.



Grinding Step Profile



Surface Finish Measurement Data

Precision in Part Processing

An ultra-hard workpiece 0.1" (2.5 mm) thick is precision-ground to within 1µm. Test piece is five steps of 10µm, as pictured, with grinding, measurement and compensated re-grind. A work surface finish of Rz0.16µm is achieved, showcasing the DV1's ability to produce "light" surface finishes.

10µm step grinding (5 steps) with automatic compensated re-grind

- Processing material: ultra-hard (G5 equivalent)
- Main spindle rotation speed: 12,000 RPM
- Reciprocation speed: 120 RPM
- Grinding wheel: TWD700R2
- Grindstone size: Ø3" x Ø0.87" (Ø75 x Ø22.23)
- Single V15º: R0.05

Straight processing (X-axis shift)

- Processing material: ultra-hard (G5 equivalent)
- Main spindle rotation speed: 12,000 RPM
- Reciprocation speed: 100 RPM
- Depth of cut: 0.0002" (0.005 mm)
- Feed speed: 0.04"/min. (1.0 mm/min.)
- Measuring machine: surface finish measuring instrument (Taylor Hobson)
- Grinding wheel: TWD700R2
- Grindstone size: Ø3" x Ø0.87" (Ø75 x Ø22.23)
- Single V15º: R0.05
- Wheel dressing device: MRD-180 dress after ~10 min. grinding time
- Dressing time: 5 min. (finish only)

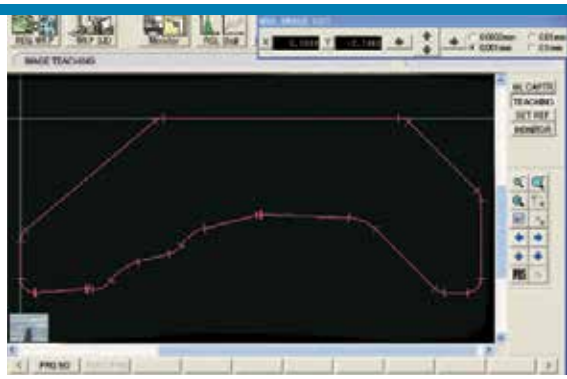


Image-Based Teach and Playback

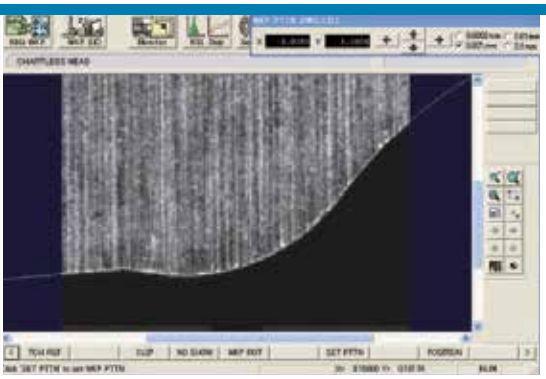
Custom Software and Craftsmanship in a Digital World

The new operation panel is designed for ease of use, and the control system allows intuitive navigation through all the powerful functions.

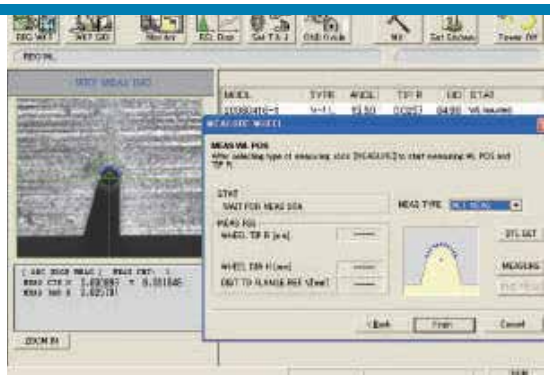
FANUC Series 32i-B—Five-axis control specification:

- Table X, Y
- Table up/down (Z)
- Headstock up/down (W)
- Workpiece pivot (B)

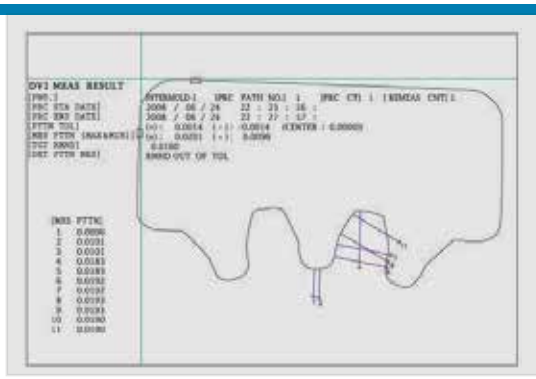
12-inch Color LCD Touch Panel (top)
USB Port (above)
Operation Panel (right)



Chartless Measurement



Automatic Workpiece Form Measurement/ Compensation Processing



Grinding Wheel Position and Shape Measurement

Software

The custom software on the DV1 is designed for maximum productivity.

Image-Based Teach and Playback—Image-based teach and playback software can create programs visually using monitor images of digital profiles, providing digital accuracy instead of projector-and-chart methods. Additionally, using digital profiles enables automatic measurement of the workpiece profile by measuring the CCD camera image of the workiece against the actual digital image.

Image teaching provides an actual, wheel-based profile by capturing digital images of the wheel profile. Then the wheel image is used to "teach" the wheel path against the digital workpiece profile. Actual teaching is done by manipulating the handle.

Chartless Measurement—CAD data (DXF) is loaded and, based on the processing data, the position of the workpiece image is set. When the manual handle is turned, the workpiece image moves. Similarly, by moving the cursor on the NC screen, the workpiece image moves, and the software can determine the difference.

Automatic Workpiece Form Measurement/ Compensation Processing—After the grind operation is finished, the standard position is confirmed and measurements are made to determine the deviation from the standard. This is done automatically—no operator intervention or programming is required.

At the time of measurement, multiple points are simultaneously inspected and large deviations from the standard are disregarded. The measured image area is as small as 0.019" (0.5 mm). In order to measure areas less than 1µm, the number of pixels and dots is set.

Grinding Wheel Position and Shape Measurement—The on-board dresser unit re-trues the leading edge radius of the grinding wheel. The shape of the grinding wheel is plunged into the dummy workpiece fixtured to the table. Through the dummy, the profile of the grindstone radius is measured at multiple points, and determined by CCM calculations. Taking measurements at multiple points minimizes errors. This procedure automatically qualifies both the wheel radius and wheel position, greatly facilitating the setup process.

Machine Specifications

PROJECTOR	Screen size			12" LCD (CCD view range 0.5 x 0.4 mm)
	Magnification			Optical magnification x10/monitor magnification x350
	Lighting			Tapering lighting 150 W
TABLE	Working surface			4.5" (Ø115 mm) (round table)
	Distance from the table top to focus point			7.8" (200 mm)
	Maximum loading weight			44 lb. (20 kg) (workpiece + fixture + chuck)
	Linear axis	Travel	Traverse feed (X axis)	11.8" (300 mm)
			Cross feed (Y axis)	9.8" (250 mm)
			Vertical feed (Z axis)	3.1" (80 mm)
		Feedrate	Rapid traverse (G00)	XY: 78"/min, Z: 19.6"/min (XY: 2000 mm/min, Z: 500 mm/min)
			Linear interpolation (G01)	XY: 0.0004~39"/min (XY: 0.1~1000 mm/min, Z: 500 mm/min)
		Jog feed		XY: 78"/min (2000 mm/min), Z: 19.6"/min (500 mm/min)
		Minimun input increment		0.000010" (0.0001 mm)
		Position detection/ scale resolution	X and Y axes	Full-closed/0.05 µm
			Z axis	Semi-closed
	Rotary axis B	Travel		360°
		Feedrate	Rapid traverse (G00)	1000°/min
			Linear interpolation (G01)	0.1~1000°/min
		Jog feed		1000°/min
		Minimun input increment		(0.0001°)
		Position detection/scale resolution		Full-closed/±5°
WHEEL SPINDLE	Wheel size (outer diameter x width x hole diameter)			Ø2.5"~3.9" x 0.15"~0.25" x 0.875" (Ø65~100 x 4~6 x Ø22.23 mm)
	Spindle nose			Ø1.0" (Ø25.4 mm) 1/4 taper
	Spindle speed			2000~20000 min^{-1} (TC-20)
WHEEL HEAD	Reciprocating axis	Reciprocating slide stroke (W axis)		0 – 3.14" (0~80*1 mm)
		Drive system		Crank
		Reciprocation speed		1.18"~15.7" (30~400 mm) (in case of 10st)*2
	Relief angle	Travel	Radial relief angle (V axis)	-1~2° (manual operation)
			Axial relief angle (A axis)	±3° (manual operation)

MOTOR	Wheel spindle	2 HP~4P (1.5~4 kW-P) (TC-20)
	X/Y axes	1 HP (0.75 kW)
	Z axis	.67 HP (0.5 kW)
	B axis	.06 HP (0.05 kW)
	Reciprocating axis (W axis)	2.5 HP (1.8 kW)
	Automatic lubrication	4 W
POWER CAPACITY		13 kVA
MACHINE SIZE (WIDTH X DEPTH X HEIGHT)		64" x 93" x 67" (1630 x 2370 x 1717 mm)
MACHINE WEIGHT		8800 lb (4000 kg)

[1] Length that can be processed will vary depending on the setting of relief angle.
[2] There is limitation depending on the reciprocation stroke.

NC Control Specifications

CONTROL UNIT MODEL		**FANUC SERIES 180i-MB**
NUMBER OF CONTROL AXES	5-axis control specification	Table X, Y; table vertical Z; reciprocation W; workpiece rotary B
STANDARD FUNCTIONS	12" color LCD (touch panel)	Manual reference return
	PC NC (O/S Windows XP)	Memory-type pitch error compensation
	CNC screen display function	Feedrate override 0 to 200%
	Wheel spindle infinitely variable-speed drive (inverter control)	Tape memory 40m (16kB)
	Simple S command (7-speed)	Registerable programs 63
	Reciprocation 20-speed (servo control)	Total tool offset pairs 32
	Circuit breaker (30mA)	Tool length compensation
	Auto power off	Rapid speed override
	AC100V outlet (2P-1 outlet)	Warm-up timer (daily timer)
	3 manual handles (5-spindle control specification: common to X axis, Y axis, Z/B axis)	Memory card I/O
	Handle magnification ratio Off, x1, x10, x100	Table setup function
OPTIONAL FUNCTIONS	Additional memory (80, 160, 320, 640, 1280m)	Run hour and parts count display
	Additional registerable programs (125, 200, 400)	Cycle time stamp function
	Additional tool offset pairs (64, 99, 200, 400)	Automatic corner override
	Weekly timer	
	I/O interface	
	LAN connection (additional Ethernet function/connector for the PC part) *[3]	

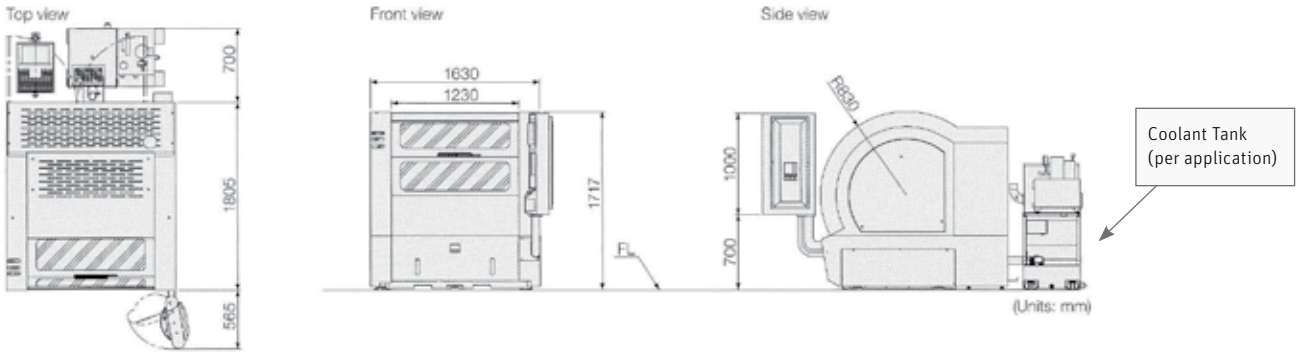
[3] Device for LAN connection is added. The network connection for the PC part should be set by customer.

Software

DV1 SOFTWARE (APPLICATION FOR PC)		CONVERSATIONAL MICROSOFTWARE, ETC.
STANDARD FUNCTIONS	Image teaching playback	Wheel data recording function
	Chartless measurement	Fixture recording function
	Processing simulation display	Simple S command (7-speed)
	Workpiece standard measurement	Warm-up setting
	Processing actual performance display	
	Wheel position measurement (wheel transcription form measurement)	
	Automatic workpiece form measurement/correction processing software	
OPTIONAL FUNCTIONS	Rough grinding cycle	Taper interpolation
	R-forming dress software	Simple circular interpolation
	Outside auto programing software ASSIST DV*4	Repeat cycle
		Run hour display function

*4 *Not compatible with WAPS WIN.*

Floor Layout DV1 Stand-Alone Specification



Multi-Axis Robot Stocker Specification

ROBOT	Robot	Manufacturer: FANUC	
	Number of controlled axes	6 axes	
	Maximum travel	35" (892 mm)	
	Maximum delivery weight	11 lb (5 kg)	Including robot hand
	Machine weight	63 lb (29 kg)	
STOCKER	Maximum number of stocked pallets	12 pieces	4 pallet x 3
	Maximum number of stocked wheel flanges	4 pieces	4 tools x 1
	Maximum workpiece size	4.5" x 3.5" (Ø115 mm x 90 mm) from pallet top surface	Pallet diameter 3.14" (Ø80 mm) is available
	Maximum wheel size	Ø2.9"~3.3" x 0.15"~0.23" (Ø75 mm~85 mm x 4 mm to 6 mm)	