

## Unit : mm

Technical drawings of the R830 refrigerator, including front, side, and top views with dimensions.

**Front View Dimensions:**

- Overall width: 1630
- Internal width: 1230
- Overall height: 1717
- Bottom height: 565
- Top section height: 1805
- Top section width: 700

**Side View Dimensions:**

- Overall height: 1717
- Bottom height: 565
- Top section height: 1805
- Top section width: 700

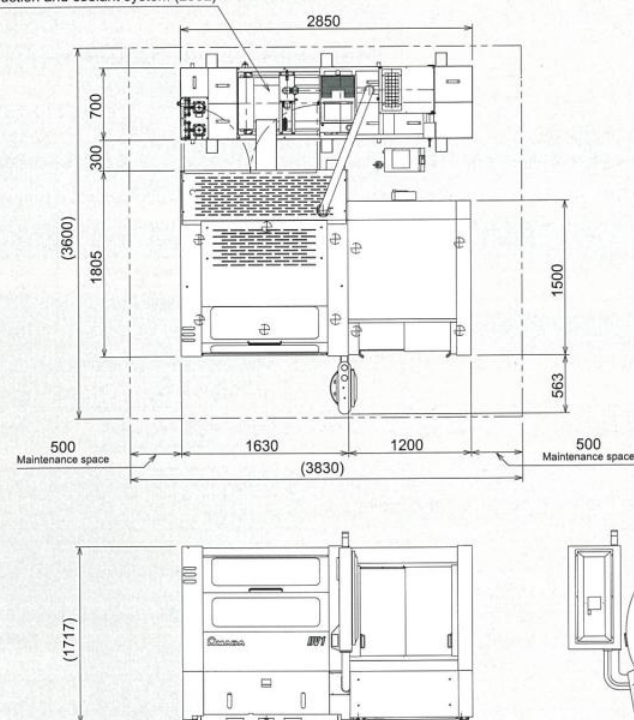
**Top View Dimensions:**

- Overall width: 1630
- Internal width: 1230
- Overall height: 1717
- Bottom height: 565
- Top section height: 1805
- Top section width: 700

**Technical Details:**

- The refrigerator features a top section with a glass door and a bottom section with a solid door.
- The top section is labeled "R830" and "R830" (likely indicating the model or series).
- The bottom section is labeled "FL" (likely indicating the freezer compartment).
- The refrigerator is shown with a side view and a top view, highlighting its compact design and dimensions.

Special dust suction and coolant system (250L)



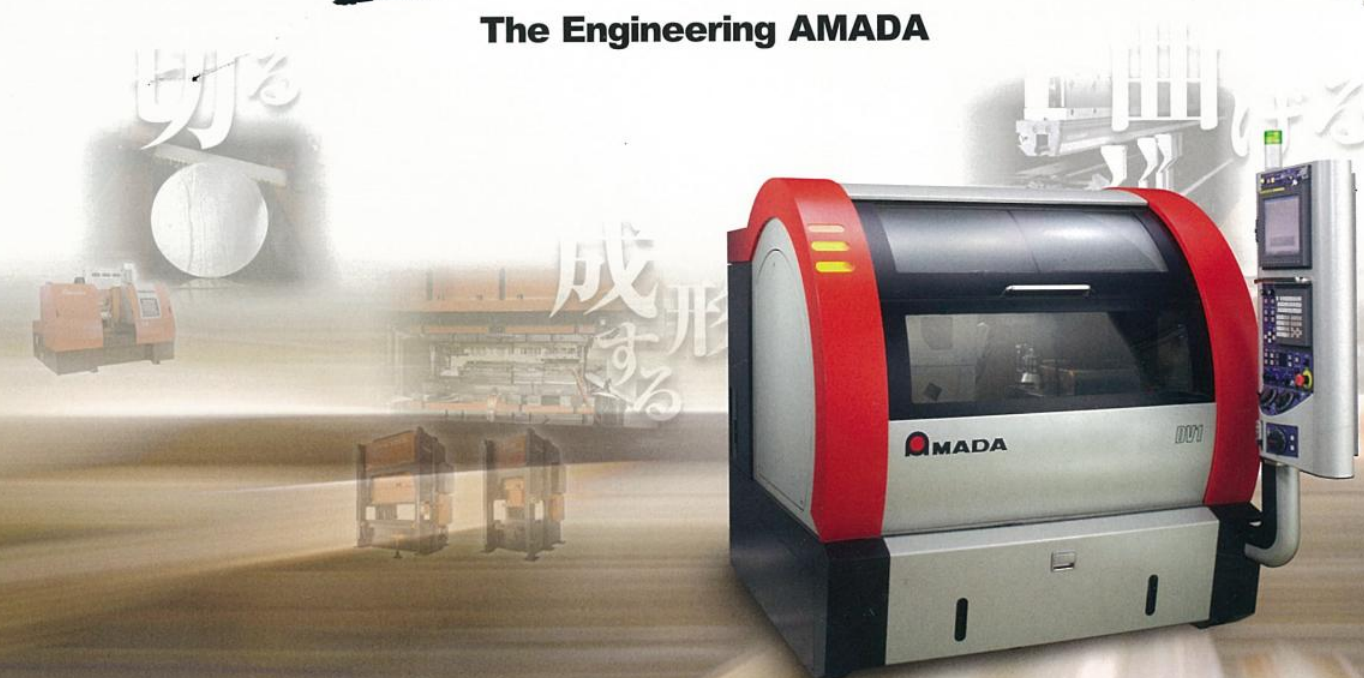
Oct. 2017

# SOLUTION

**Graphical profile grinder** *DV 1*



## The Engineering AMADA





From "Optical" to "Graphical". Evolution of profile is from AMADA.

# Compact, Chartless and Full-automatic third generation profile

Automatic image measurement with CCD camera has made it possible to perform fully automated high quality grinding. Furthermore, tolerance evaluation function has achieved automatic compensation. Problems conventionally difficult to deal with such as quality fluctuation, ultrafine workpiece grinding and efficiency have been improved.

Also, when the multijoint robot stoker (option) is attached, automation of grinding wheel replacement and workpiece replacement becomes possible, realizing further higher performance in productivity and operation rate.

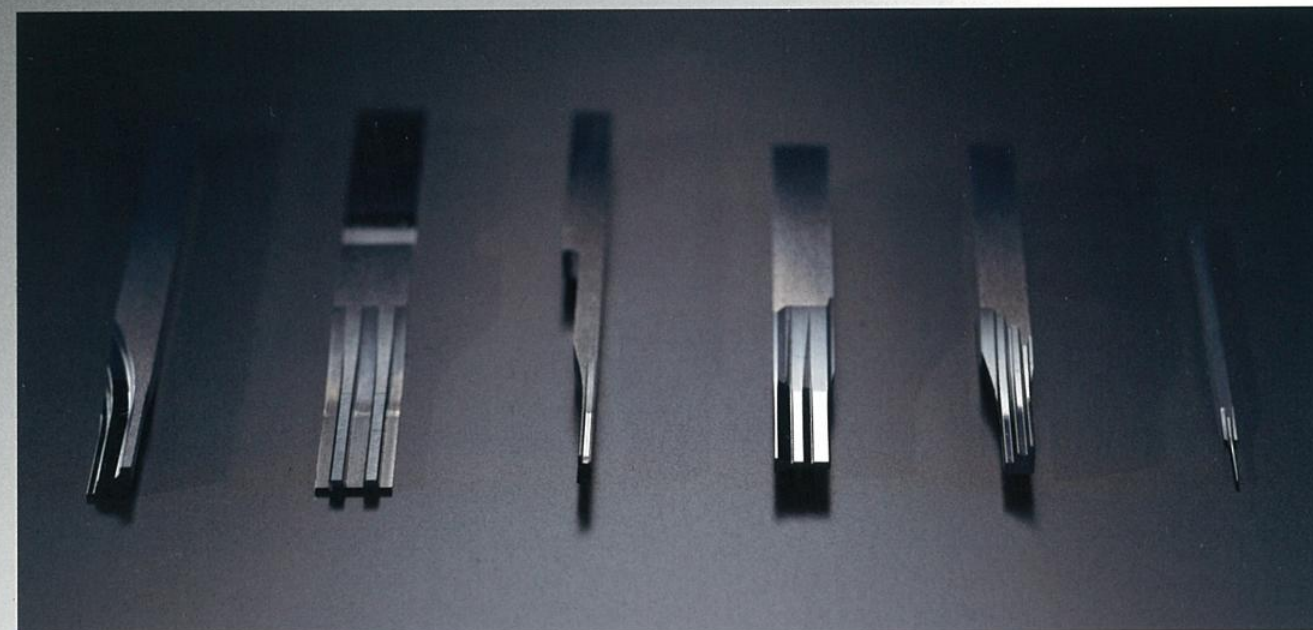


DV-1 (5-axis control specifications)

Graphical profile grinder

# DV1

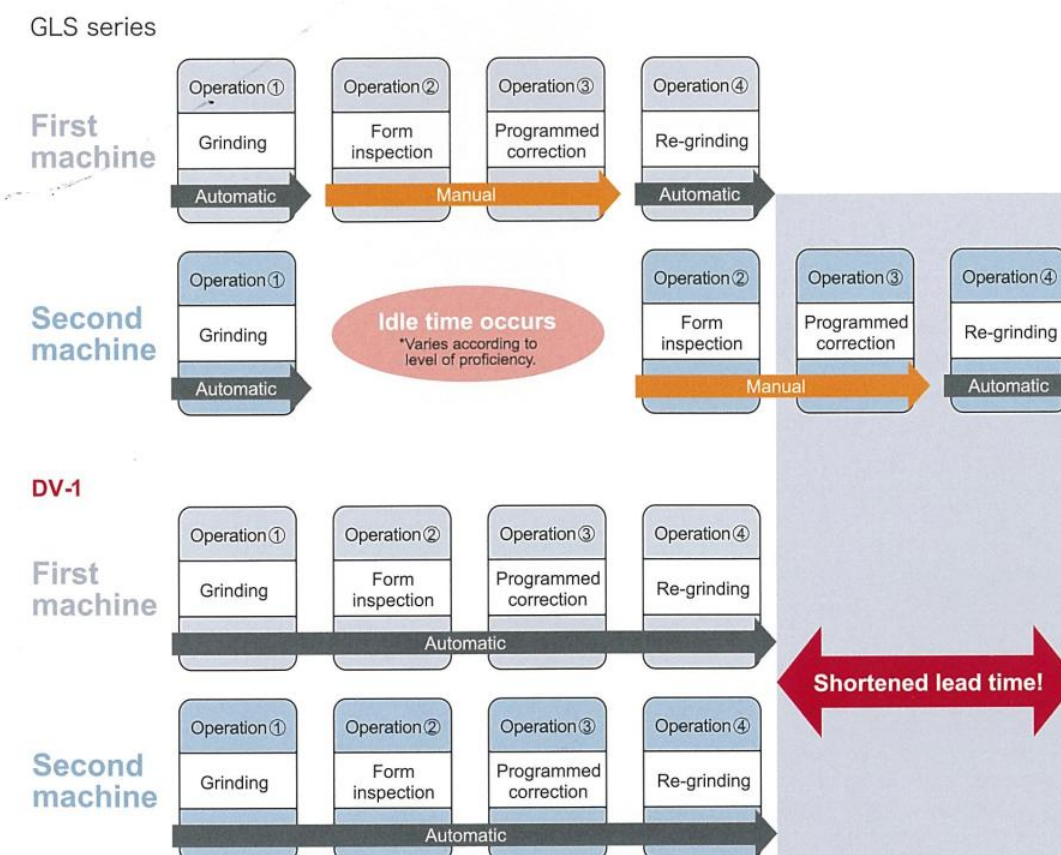
## Multi-Processing Capability



Ultra precision metal press punch

## Comparing Optical Grinding to Graphical Grinding

If you use two machines for one worker, our optical profile grinder GLS series requires manual form measurement and program correction causing machine idle time. In contrast, DV-1 can perform this task automatically, resulting in shorter lead times. This achieves improved productivity.





# AMADA's progress sets the standard in grinding technology.

## Digital machine that brings an innovation to production site

Structural analysis, including 3D design, provide rigidity and compact design. Already LCD has supplanted CCD cameras as the replacement of the traditional projector charts. Mylar charts are replaced by the efficiency of a CAD based digital profile. Program creation can now be based on actual digital data. Also because it is chartless the plotter is eliminated.

Also the original image teaching-program function uses the CCD camera without a projector, as standard equipment and has increased versatility such as chart-less instrumentation, enabling full closure guard specifications for high performance design characteristics without any compromise in basic work efficiency.



DV-1 (7-axis control specifications) + articulated robot stocker

### CCD camera automatic instrumentation Automatic compensation grinding system

Optical resolution x 10, monitor resolution x 350 is standard equipment. With the long-cultivated CCD camera image processing technology, automation is implemented from post-processing work piece form measurement to re-grinding.



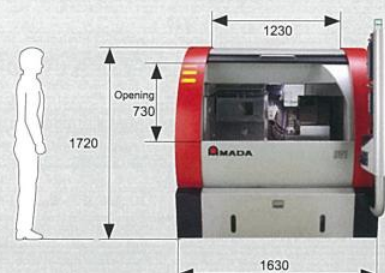
### 5-axis or 7-axis type available

Two models have been developed, the 5-axis control produces unmatched surface finishes, and the 7-axis control provides automated multi-function operation with superior grinding performance. Select model according to application.



### New full enclosure, ergonomic & beautiful

Through newly designed full enclosure, the human factor is addressed. Operator work load is greatly reduced. The full enclosure also protects the environment for worker health and safety, enclosing and evacuating mist and grinding dust. Additionally, the full enclosure fully stabilizes the machine working envelope for maximum repeatability and performance.



### CNC rotary table allows four sided grinding for maximum efficiency

The standard equipped CNC Rotary Table is capable of full periphery processing with one chucking. Multiple wheel operation for roughing and finishing is more efficient through unattended completion of all roughing operations on all sides before executing wheel change for finishing.



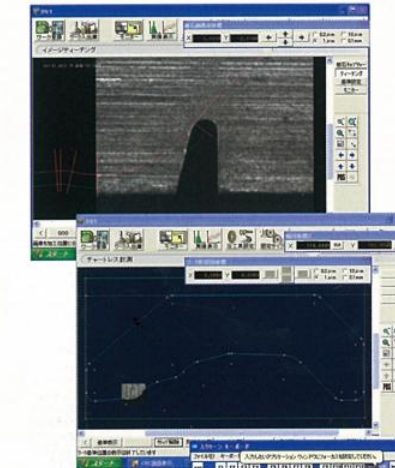
### The operation panel screen is an easy to use PC NC interface

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 functions for both ease of use and clarity. Optimum usability makes this powerful grinder technology a pleasure to operate.



### Universal operations software provides the familiarity of a projector

The "Teach & Playback" function of AMADA profile grinders can be used with simple operations. And due to the CCD camera, chart creation and utilization is a thing of the past. The ultimate goal of labor reduction and environmental conservation are achieved.



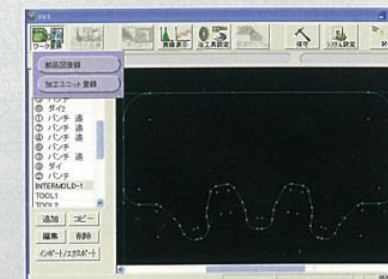
### AMADA custom software facilitates processing

Creative, software solutions resolve process limitations and operation bottlenecks. Complex and highly skilled operations have become simpler. Grinders take on manually intensive processing functions.



### Internal automatic programming system

On-board programming system accepts CAD based files for efficient processing. CNC program is created directly at the machine.



### Optional full automation available

Unattended operation is achieved through automated work piece exchange utilizing articulated robots with work piece and wheel stockers. The robot also changes various grinding wheels on the ATC spindle enabling complete unattended processing. Manual wheel changing is eliminated.



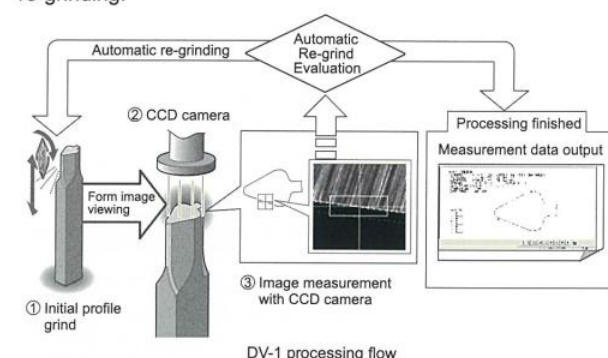


# DV-1 New technologies

## 1 CCD camera automatic measurement compensation system

1

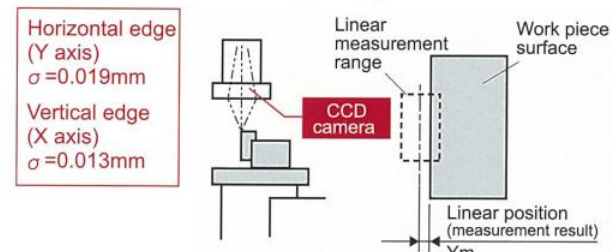
Automatic measurement of work piece form, with automatic re-grinding.



2

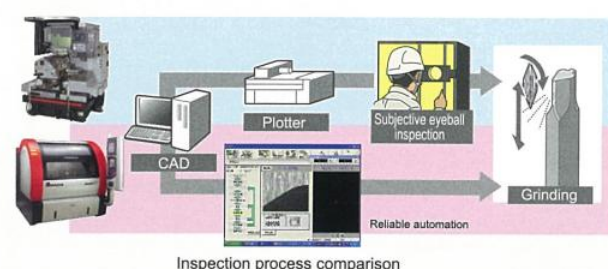
Support is possible for ultra small shape work piece below an angle of 1mm, which is difficult to measure with a projector. Also, consistency of inspection is possible by means of the edge compensation function.

CCD camera measurement repeatability



3

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



4

Measurement data output is possible, providing documented part qualification.



5

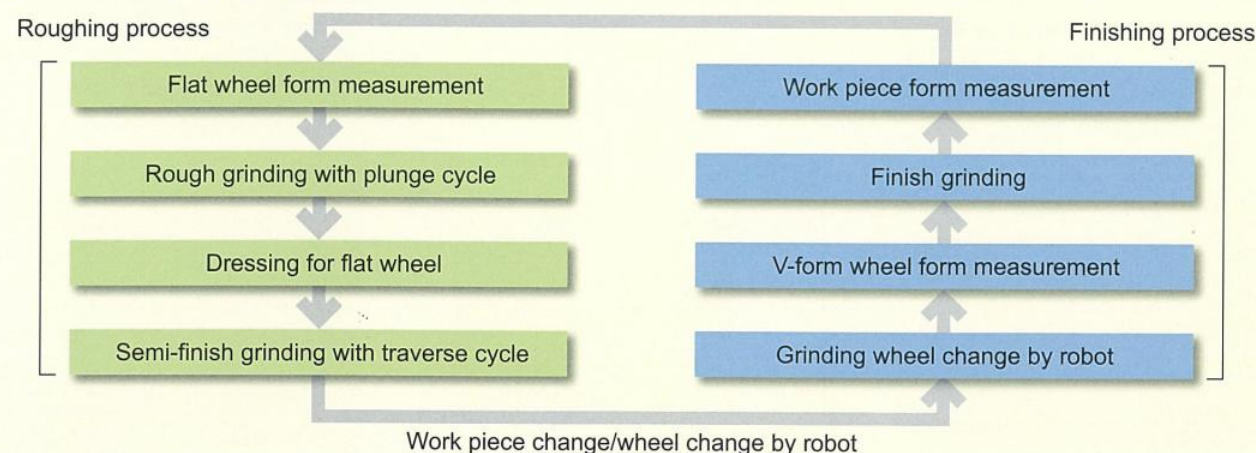
Grinding wheel form measurement is possible.



## 2 Fully automated part production with articulated robot & stocker

Through automatic wheel changing rough and finish operations are seamless and unattended. The ATC spindle automatically clamps the range of wheels necessary to fully process work pieces unattended. Measurement software for flat (1A1) grinding wheels, automatically qualifies the wheel width/position. An integrated rotary dresser provides peripheral, side and corner radius dressing in flat wheels for semi-finish operations. Rough plunge cycles speed through-put.

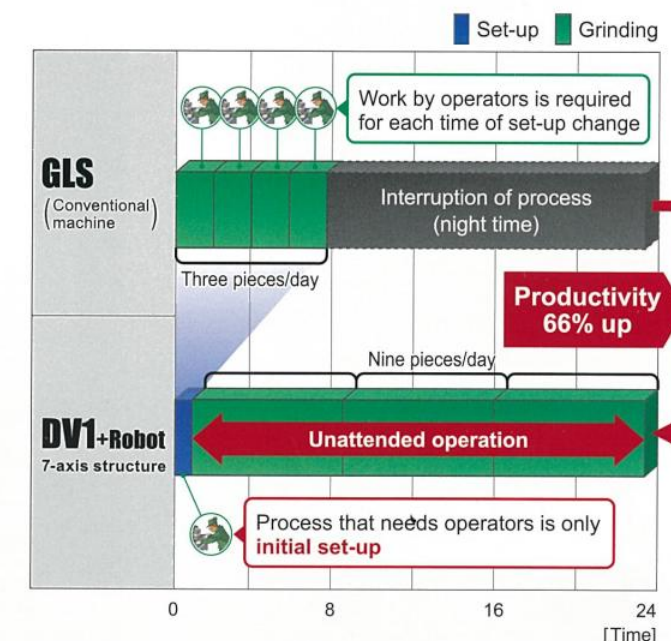
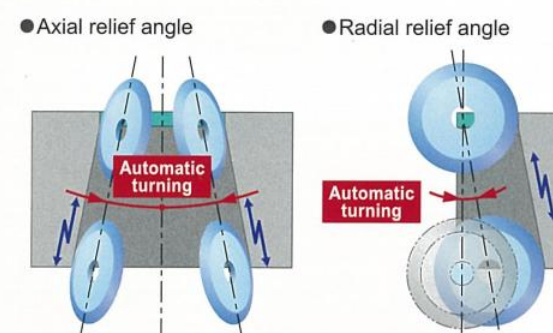
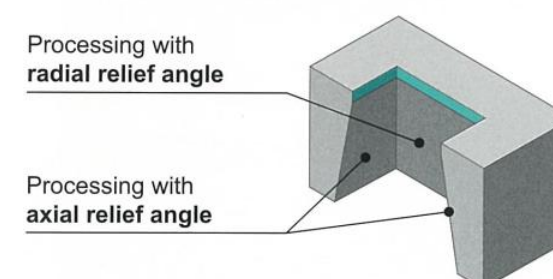
Full automation for roughing and finishing operations



## 3 Radial/axial relief angle automatic turning (7-axis structure)

The direct driving reciprocating slide with newly developed ball screws has realized automatic reciprocating stroke by NC control. Since NC control structure is also adopted for radial/axial relief angle, program operation of large relief angle is now possible. It contributes to reduction of processes and improvement of productivity.

### Introduction effect in die processing



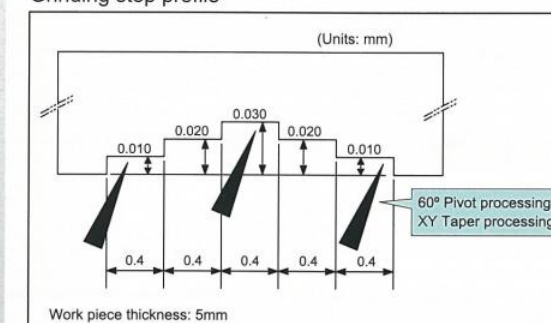
## 4 Excellent grinding accuracy

An ultra-hard work piece 2.5mm thick is precision ground to within  $1\mu\text{m}$ . Test piece is 5 steps of  $10\mu\text{m}$  as pictured with grinding, measurement, and compensated re-grind. A work surface finish of  $Rz0.16\mu\text{m}$  (5-axis specification) is achieved. AMADA proudly displays "light" surface finish.

■ 10 $\mu\text{m}$  step grinding (5 step) with automatic compensated re-grind

Processing material: ultra-hard (G5 equivalent)  
Main spindle rotation speed: 12,000min<sup>-1</sup>  
Reciprocation speed: 100min<sup>-1</sup>  
Depth of cut: 0.005mm  
Feed speed: 1.0mm/min  
Grinding wheel: TWD700R2  
Grindstone size:  $\phi 75 \times \phi 22.23$   
Single V15°: R0.05

Grinding step profile



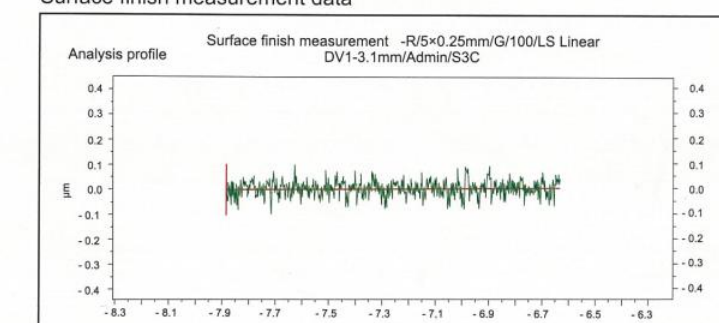
Grinding precision (mechanical measurement with DV-1)  
-0.3 to +0.4 $\mu\text{m}$

■ Straight processing (X axis shift)

Processing material: ultra-hard (G5 equivalent)  
Main spindle rotation speed: 12,000min<sup>-1</sup>  
Reciprocation speed: 100min<sup>-1</sup>  
Depth of cut: 0.005mm  
Feed speed: 1.0mm/min  
Measuring machine: Surface finish measuring instrument (Taylor Hobson)

Grinding wheel: TWD700R2  
Grindstone size:  $\phi 75 \times \phi 22.23$   
Single V15°: R0.05  
Wheel dressing device: MRD-180 Dress after about 10 minutes grinding time  
Dressing time: 5min (finish only)

Surface finish measurement data



Processing surface finish  
 $Rz=0.1588\mu\text{m}$



Custom software,craftsmanship in a digital world.

1 Control system

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



12 inch color LCD (touch panel)



USB interface

FANUC series 32i-MB

5-axis control specification	Table X, Y Table up/down Z Headstock Up/down W Work piece pivot B
7-axis control specification	Table X, Y Table up/down Z Headstock Up/down W Work piece pivot B Frontal relief V Side relief A

2 Functions

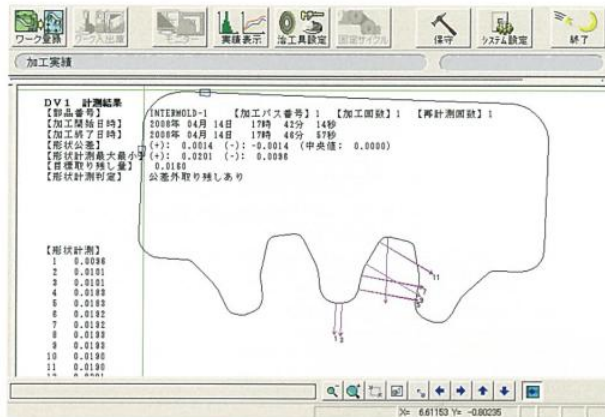
- dCNC screen display function dGrinding wheel spindle variable speed drive (inverter control)
- dEasy S C Commands (7 stage) dWheelhead stroking has 20 speed selection with variable speed inverter
- dAutomatic power-off dAC100V outlet (2P-1 outlet)
- dManual handles 3 (5-axis control: X axis, Y axis, Z/B axis shared) (7-axis control: X axis, Y axis, Z/W/B/A/V axis shared)
- dHandle resolution, ×1, ×10, ×100 dManual reference point recovery dComputer NC (O/S Windows XP)
- dMemory type pitch error compensation dFeed speed override 0 – 200% dMemory editing capacity 40m (16kB)
- dTotal recorded programs 63 dTool offset number total 32 dRapid feed override F0, 25, 50, 100% dMemory card I/O
- dTable set up function dRunning operation (weekly timer)

3 Software

AMADA MACHINE TOOLS' custom software is designed for high productivity

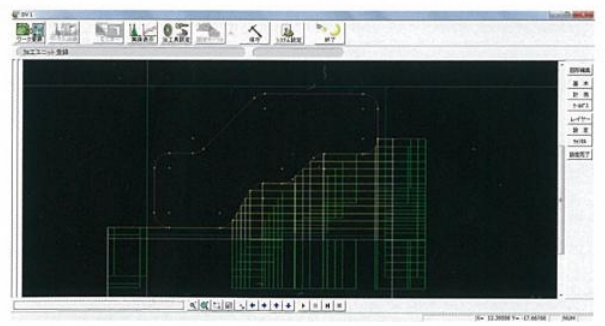
Automatic work piece form measurement/compensation processing software

After grind operation is finished, the standard position is confirmed, and measurement is made with 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 0.5mm. In order to measure less than 1μm, the number of pixels and dots is set.



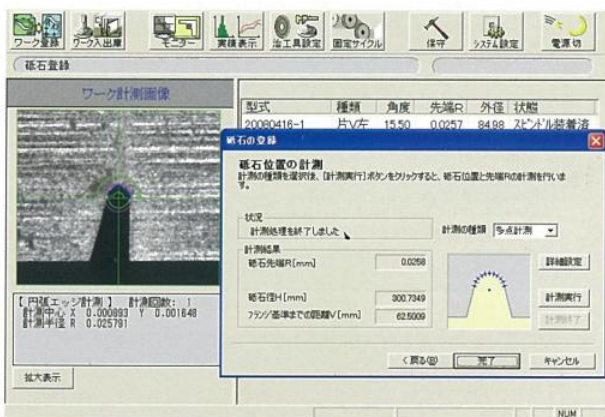
Rough traverse cycle

In rough grinding cycle of plunge cutting, there are cases where processing speed cannot be increased due to load given to workpieces and uneven wear may arise to grinding wheels. This is software to solve these problems by preparing an optimum tool path with Traverse (horizontal feeding) for providing high speed and high efficient grinding.



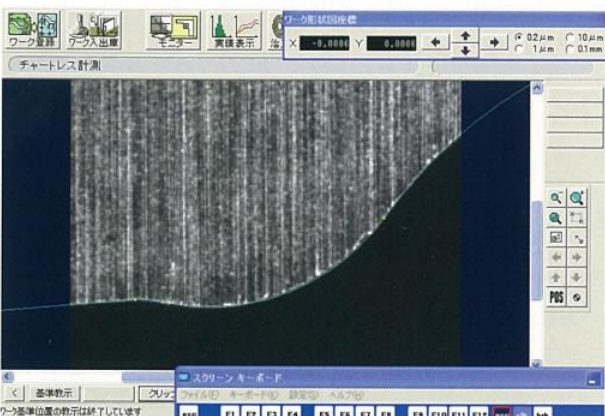
Grinding wheel position and shape measurement

The on board dresser unit re-trues leading edge radius of the grinding wheel. The shape of the grinding wheel is plunged into the dummy work piece fixtured to the table. Through the dummy, the profile of grindstone radius is measured at multiple points, and determined by CCM calculations. Measuring at points minimizes error. The procedure automatically qualifies both the wheel radius and wheel position greatly facilitating the set up process.



Chartless measurement

CAD data (DXF) is loaded, and based on the processing datums, the position of the work piece image is set. When the manual handle is turned, the work piece image moves. Similarly, by moving the cursor on the NC screen the work piece image moves, and the software can determine the error.





## Machine specification

Model				5-axis control specification		7-axis control specification			
Projector	Screen size			mm		12 inch LCD (CCD view range 0.5 × 0.4)			
	Magnification					Optical magnification x10/Monitor magnification ×350			
	Lighting			W		Tapering lighting 150			
Table	Working surface			mm		ø115 (Round table)			
	Distance from the table top to focus point			mm		200			
	Maximum loading weight			kg		20 (Work piece+ Fixture+ Chuck)			
	Linear axis	Travel	Traverse feed (X axis)	mm	300				
			Cross feed (Y axis)	mm	250				
			Vertical feed (Z axis)	mm	80				
		Feedrate	Rapid traverse (G00)	mm/min	XY: 2000, Z: 500				
			Linear Interpolation (G01)	mm/min	XY: 0.1 – 1000, Z: 500				
		Jog feed			mm/min	XY: 2000, Z: 500			
	Minimum input increment			mm	0.0001				
	Positiondetection/	XY axes		μm	Full-closed/0.05				
		Scale resolution		Z axis	Semi-closed				
	Rotary axis B	Travel			deg	360			
		Feedrate	Rapid traverse (G00)	deg/min	1000				
			Linear Interpolation (G01)	deg/min	0.1 – 1000				
		Jog feed			deg/min	1000			
		Minimum input increment			deg	0.0001			
Position detection/Scale resolution			sec	Full-closed/±5					
Wheel spindle	Wheel size (outer diameter × width × hole diameter)			mm	ø65 – 100 × 4 – 6 × ø22.23		ø120 – 180 × 3 – 10 × ø31.75		
	Spindle nose			mm	ø25.4 1/4 Taper				
	Spindle speed			min <sup>-1</sup>	2000 – 20000 (TC-20)		2000 - 20000 (TC-20) or 600 - 6000 (TS-60)		
Wheel head	Reciprocating axis	Reciprocating slide stroke (W axis)			mm	0 – 80*1			
		Drive system				Crank		Ball screw	
		Reciprocation speed			min <sup>-1</sup>	30 – 400 (In case of 10st)*2		30 – 200 (In case of 15st)*2	
		Jog feed			mm/min	2000			
		Minimum input increment			mm	0.0001			
		Position detection				Semi-closed			
	Relief angle	Travel	Radial relief angle (V axis)	deg	-1 – 2 (Manual operation)		-1 – 15 (NC control)		
			Axial relief angle (A axis)	deg	±3 (Manual operation)		±8 (NC control)		
			Rapid traverse (G00)	deg/min	72				
		Jog feed			deg/min	72			
		Minimum input increment			deg	0.0001			
Position detection				Semi-closed					
Motor	Wheel spindle			kW-P	1.5-4				
	X/Y axes			kW	0.75				
	Z axis			kW	0.5				
	B axis			kW	0.05				
	Reciprocating axis (W axis)			kW	1.8		1.0		
	A axis			kW	0.05				
	V axis			kW	0.05				
	Automatic lubrication			W	4				
	Power requirement			kVA	13				
Machine size (width × depth × height)			mm	1630 × 2370 × 1717					
Mass of machine			kg	4000					

\*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 specification

Control unit model		FANUC series 32i-MB	
Number of control axis	5-axis control specification	Table X, Y, Table vertical Z, reciprocation W Work piece rotary B	
	7-axis control specification	Table X, Y, Table vertical Z, reciprocation W Work piece rotary B, radial relief V, axial relief A	
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 Tool length compensation	
	Circuit breaker (30mA)		
	Auto power off	Rapid speed override	
	AC100V outlet (2P-1 outlet)	Warm up timer (weekly timer)	
	3 manual handles (5-spindle control specification: Common to X axis, Y axis, Z/B axis)	Memory card I/O	
	(7-spindle control specification: X axis, Y axis, Z/W/B/A/V axis)		
	Handle magnification ratio Off, x1, x10, x100	Table setup function	
	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	
Optional functions	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

DV-1 software (PC application)	Interactive macro software, others
Image teaching playback	Grinding wheel registration function
Chartless measurement	Tool registration function
Grinding simulation display	Simplified S instruction (7 stages)
Workpiece datum measurement	Running operation setting
Grinding results display	
Grinding wheel position measurement (grinding wheel transcript shape measurement)	
Automatic workpiece shape measurement, compensation	
Auto focusing error check function	
Upper face datum measurement error check function	
Rough finishing cycle	Taper interpolation
On board R-forming dress	Simplified circular arc interpolation
External automatic programming ASSIST DV**4	Repeat cycle
Protector for ASSIST DV	Operation time indication function
Semi-finishing repeat function	
On board flat R-forming dress	
AWC schedule operation	
ATC spindle handling	
Extension to whole perimeter measurement	
Rough plunge cutting cycle	
Center dividing workpiece upper face datum measurement	
Four faces installation handling (standard machine only)	
Workpiece upper face step handling	
Multiple paths simultaneous finishing	
Finishing cycle measurement window change function	
Same pallet number warehousing handling	
Gear punch grinding	
Workpiece turning angle alignment (automatic correcting of parallelism)	
AV axis relief angle turning (only 7-axis)	
Rough traverse cycle	

\*4 There is no compatibility with WAPS-WIN.

## Multi-axis robot stocker specification

Item	Specification		Note
Robot	Robot	Manufacturer: FANUC	
	Number of controlled axis	axis	6
	Maximum travel	mm	892
	Maximum delivery weight	kg	6
	Machine weight	kg	29
Stocker	Maximum number of stocked pallets	pcs	12
	Maximum number of stocked wheel flange	pcs	4
	Maximum work piece size	mm	ø115 × 90 from pallet top surface
	Maximum wheel size	mm	ø75 – 85 × 4 to 6