

OPEN VISION™ GRIND

Nearly 20 years ago, CNC Engineering, Inc. created Open Vision™ Grind; the most flexible grinding platform in the industry, designed to make grind programming faster and easier than with conventional controls.

Unlike an OEM control that is tailored for a specific application or machine type, Open Vision™ Grind is a feature-rich grinding package that can be adapted to most grinding machines powered by FANUC controls. All ID, OD, Step, Thread, Surface, and Creep Feed style grinders can be supported with one flexible package! Since Open Vision Grind supports a variety of grinding machine types, Operators can move from machine-to-machine without having to learn multiple OEM packages or machine specific software.

Absolute Position		Distance To Go		Wheel						
X *	0.00000	X *	0.00000	RPM	Diameter	Surface Speed				
Z *	0.00000	Z *	0.00000	Load	0	100 .0 %				
B *	0.00000	B *	0.00000							
Relative Position		Machine Position		Work RPM						
X *	0.00000	X *	0.00000	Dresser RPM	Mag					
Z *	0.00000	Z *	0.00000							
B *	0.00000	B *	0.00000	Feed in/sec	Ovrd%	Program				
				Actual	0	0 ▶				
				Size Correction	Capture Positions	Capture CS Offsets				
Program: Plunge Grind				Select...	Set Tools...					
Op. Seq. #	1	2	3	4	5	6	7	8	9	10
Surface		OSC								PLG
Dress					DIA					
Device			DEV				DEV			
Route	RTE			RTE		RTE		RTE	RTE	
Operation Key: <input type="checkbox"/> = Enabled <input type="checkbox"/> = Disabled <input type="checkbox"/> = Active <input type="checkbox"/> = Completed <input type="checkbox"/> = Skipped										
User	MDI	****	***	***		****	Inch	Cycles 0	Cycle 0:00:00	06:49:36
General	Maintain	Manual Settings			Ancillary Devices		Alarm	Docmnt		

Beyond just the basics of grinding and grind processes, Open Vision™ Grind can support a number of external hardware items including several different configurations of pre-process, in-process, and post-process gauging setups. There are also options for on-machine probing, offsetting, multiple wheels and wheel heads, as well as multiple dresser configurations.

In this overview of CNC Engineering's Open Vision™ Grind software we will briefly cover some of the programming possibilities. There are a nearly unlimited number of possible combinations, so please feel free to contact us to discuss your particular application needs.

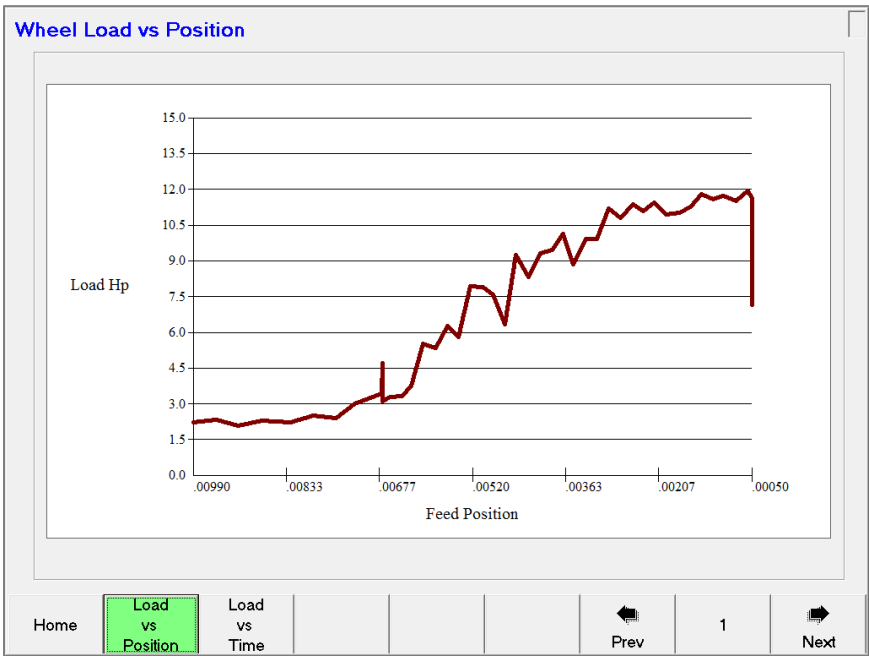
From the Front End

The main operators screen is designed to provide manual functionality as well as information and status of the program cycle currently selected. By making use of a touch screen interface and soft keys, the operator can change the display for easy setup or manual operation of the machine. Various soft keys within the display will link to information like cycle time, cycle logging, parts counters, current offsets, and wheel life data. For example, the load bar will open a bar graph display of wheel load for the last six cycles. This is a great tool for process development and diagnostics. At the bottom of the main operators screen, additional tools to support ancillary devices can also be accessed for set up and operation.

Main Operator Screen

Absolute Position		Distance To Go		Wheel	
X *	0.00000	X *	0.00000	RPM	Diameter
Z *	0.00000	Z *	0.00000	Surface Speed	
B *	0.00000	B *	0.00000	Load 0	100 .0 %
Relative Position				Machine Position	
X *	0.00000	X *	0.00000	Work RPM	Mag
Z *	0.00000	Z *	0.00000	Dresser RPM	
B *	0.00000	B *	0.00000	Feed in/sec	Ovrd% Program
				Actual .00000	0 0 ▶
				Size Correction	Capture Positions Capture CS Offsets
Program: Plunge Grind Select... Set Tools...					
Op. Seq. #	1	2	3	4	5
Surface		OSC			
Dress				DIA	
Device			DEV		DEV
Route	RTE		RTE	RTE	RTE
Operation Key: <input type="checkbox"/> = Enabled <input type="checkbox"/> = Disabled <input type="checkbox"/> = Active <input type="checkbox"/> = Completed <input type="checkbox"/> = Skipped					
User	MDI	****	***	***	****
Inch		Cycles 0	Cycle 0:00:00	06:58:25	
General	Maintain	Manual Settings	Gage Setup	Ancillary Devices	Operator Console
		Alarm	Docmnt		

Wheel Load Screen



Machine Configurations

Axes

Standard machine axes such as X, Z, U, W, B, and Y are all supported and configurable per the application. Additional axes such as Z', X',C, A, E, as well as ancillary axes for loaders, probing, gauging, and other functionality can be integrated depending on the machine configuration and manufacturing requirements.

Many axes have different functions based on their orientation. For example, a swivel axis under the chuck has a much different function than the swivel under the wheel. Multiple designations are just part of the versatility of Open Vision™ Grind.

Dual path applications are also supported giving you the equivalent of 2 independent machines and capabilities running in the same environment.

Machine Setup

Machine Name

YOUR MACHINE

OpenVision HMI

File Handling, Etc.

More Axes

Gaging

Programming Wheel / Dress

Programming Grind

Devices

Units And Part CS

General

Axes

	CNC Axis	Non-CNC Axis	CNC Name	Non-CNC Port Address	Non-Prog.	Check Rest Position	Rest Position Tolerance	
X	<input checked="" type="checkbox"/>	<input type="checkbox"/>	X		<input type="checkbox"/>	<input checked="" type="checkbox"/>	.12500	
Z	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Z		<input type="checkbox"/>	<input checked="" type="checkbox"/>	.12500	
E	<input checked="" type="checkbox"/>	<input type="checkbox"/>	A		<input type="checkbox"/>	<input checked="" type="checkbox"/>	1.0	<input type="checkbox"/> E-axis Dress To Minus X
U	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>		U Clones X
UU	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>		UU Extends X
W	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>		W Clones Z
B	<input checked="" type="checkbox"/>	<input type="checkbox"/>	B		<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	Under Work
C	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>		

Save

Cancel

Machine Setup

Machine Name

YOUR MACHINE

General

Axes

Devices

Units And Part CS

OpenVision HMI

File Handling, Etc.

More Axes

Gaging

Programming Wheel / Dress

Programming Grind

	CNC Axis	Non-CNC Axis	CNC Name	Non-CNC Port Address	Non-Prog.	Check Rest Position	Rest Position Tolerance	
X'	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>		
Z'	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/> Use Two Axis Dresser Only
V	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>		
A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	B		<input type="checkbox"/>	<input checked="" type="checkbox"/>	1.00000	
D	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>		
Y	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>		

Save

Cancel

Machine Setup

Machine Name
YOUR MACHINE

OpenVision HMI	File Handling, Etc.	More Axes	Gaging
Programming Wheel / Dress	Programming Grind		
General	Axes	Devices	Units And Part CS

Number of Wheelheads

☒ Stock Sensor Present

☒ Dresser Spindle Present

☐ Dress Tool Detection Present

☐ Radial Dresser Present

☐ Mag Chuck Hold Present

☐ NC Macro Programming of Devices

V-axis
Probe Touch Offset

Max Power InFeed

- ☒ Not Present
- ☐ Original PID Loop
- ☐ Enhanced PID Loop
- ☐ Adjust Once Per Piece

Max Power Read Filter

Max Power Calc Filter

Max Power InFeed Gain

Max Power Int Gain

Max Power Der Gain

MPI Override After Dress

MPI Override Increment

MPI Override Decrement

☐ Use Last MPI FRO

Save Cancel

Spindles

An unlimited number of Spindles can be programmed and called up at any time. Up to 4 programmable wheel heads and 2 programmable dresser spindles can be in use and running at any one time.

Work Holding

Open Vision™ Grind can be configured for a variety of work holding options. Magnetic chucks can be set for multi-step or programmable percent as well as variable between course, rough, and finish grinds as needed. Other work holding devices can be configured per your requirements and include feedback and part verification.

Stock sensor (Gap Eliminator)

Stock sensor can be used to reduce cycle time. The method is selectable, per the surface being ground. It may be based on wheel load or an input from an external source. Acoustic emission sensors such as Dittle or SBS are commonly used. These sensors can also be used for dress detection and verification.

Special NC Programming

Open Vision™ Grind allows for an NC program to be called from within the grind software to perform any extraordinary function you wish and then return to the grind software seamlessly. This can be used for hard turn operations or any function your application requires.

Gauging

Open Vision™ Grind can be configured to support pre, post, and in-process gauging. Digital, analog, and serial interfaces are all supported and selectable. Open Vision™ Grind also has its own built-in amplifier software that allows you more options for your choice of hardware. The options for placement and operation of your gauge are completely configurable per machine.

The image shows a 'Machine Setup' dialog box with a 'Machine Name' field containing 'YOUR MACHINE'. Below this are several tabs: 'General', 'Axes', 'Devices', 'Units And Part CS', 'OpenVision HMI', 'File Handling, Etc.', 'Programming Wheel / Dress', 'Programming Grind', 'More Axes', and 'Gaging'. The 'Gaging' tab is selected, showing two main sections: 'InProcess Gage' and 'Pre-Process Gage'. The 'InProcess Gage' section has radio buttons for 'Not Present' (selected), 'Analog Signal', 'Discrete Signals', 'Serial Interface - General Use', 'Serial Interface - Blade Tip A', 'PMC Interface - Blade Tip Grinding', and 'Offer Gage Point 4'. The 'Pre-Process Gage' section has radio buttons for 'Not Present' (selected), 'Serial - General Use', 'PMC - General Use', 'Serial - Blade Tip Grinding', 'PMC - Blade Tip Grinding', and 'Not Present - Manual Offset'. Below these is an 'InProcess Gage - Size Correction' section with radio buttons for 'Incrementally' (selected) and 'All At Once'. At the bottom are 'Save' and 'Cancel' buttons.

Dressing

The Dress Form Editor within Open Vision™ Grind is an incremental segment editor that allows you to program step-by-step contours without the need for G code. Built in tools can automatically assist with Trigonometry functions. If you program incremental endpoints, the programmer will automatically display the resulting angle. If you program an angle and a length, the software will display the resulting end points. The arcs and radius editor has additional functions to assist and there are no limits to the number of steps in your profile.

M and G code programming is available for those that prefer this method. Open Vision™ Grind also offers several specialized editors for more specific applications.

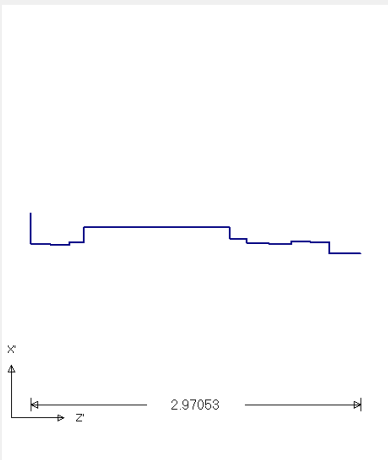
Dress Form Editor

for Dress Form: R30217 Whl 3 Undercut

Program Units

Inch

Radius



Sequence Editor

Seq. #	2	3	4	5	6	7	8	9	10
Line	PTP	PTP	ANG	PTP	ANG	PTP	ANG	PTP	PTP
Arc									
Dresser									

Edit...

Copy...

Delete

Add...

Paste

X-like Axis

Z-like Axis

X'

Z'

Save

Return

E-axis Dressing

The E-axis dress editor works like a CAD system to calculate the profile endpoints based on operator input of print data

E-Races Editor

for Dress Form: DEEP GROOVE

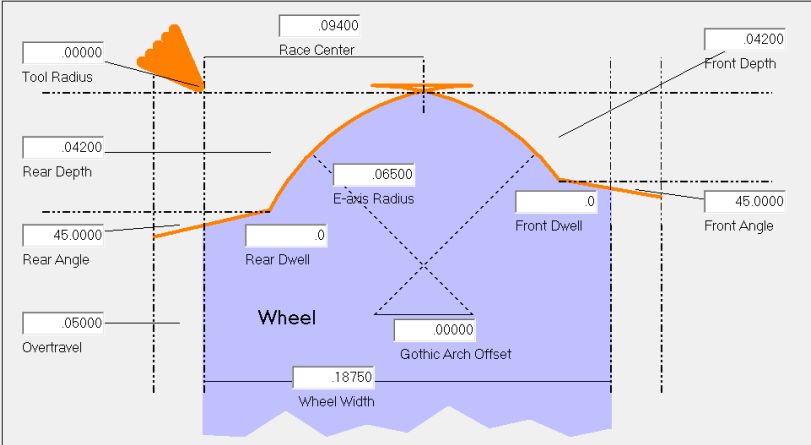
E-axis Race Type

Race Angle

Program Units

Inch

Diameter



Save

Return

Note

Crown Dress

The custom crown feature was created because the FANUC control will only allow a 9-digit radius input. If the wheel is long and your crown is only .0002 high, then the programmed radius may be in the thousands of millimeters or inches. Open Vision™ Grinds crown editor will break the radius into a programmable number of straight line segments to simulate the desired radius within the constraints of the FANUC control.

CrownDress for DressForm: 11.064rad

Program Units: Inch Diameter

The diagram shows a blue wheel profile with a red crown line. Key parameters are labeled:

- Taper Adjustment: .00000
- Wheel Angle: 15.0000
- Wheel Width: 6.00000
- Crown Height: .00020
- Overtravel: .10000
- X Adj.: .00000
- Dress Start Offset Adjustments: .00000
- Z Adj.: .00000

On the right side, there are dropdown menus for:

- Number Of Segments: 12
- Dresser Traverse Direction: +Z
- Dresser Feed Direction: +X

Note: Coordinates shown as if Dresser were moving.

Buttons: Save, Return

Spherical Editor

The double spherical editor is designed to allow the Operator to input the print data, dress the profile into the wheel, then offset for deviation based on first article inspection reports.

Sphericals for DressForm: 102884

Program Units: Inch Diameter

The diagram shows a blue wheel profile with a red crown line. Key parameters are labeled:

- Part Width: 2.04600
- Part: 1
- Light Correction: -.00050
- Race Location Correction: -.01430
- MB (rad offset): 1.05258
- Race Radius: 4.91
- Variance Correction: -.00160
- Gap Width: .19900
- Dress Path Overtravel: .09000
- Start Block: .04000
- Radius Correction: .00000
- Dresser Traverse Direction: +Z
- Dress Start Offset Corrections: -.00087, -.01803

Buttons: Save, Return

Excel Interface

The Custom Excel Interface allows the user to create their own Excel spread sheets, for complex profiles or proprietary calculations, and link them to Open Vision Grind. The Excel Interface provides ease of programming while maintaining flexibility and control over your process.

Dress Forms

Dress Form Name

R30217 Whl 3 Undercut

Program Units

Inch

Radius

Dress Forms:

R30217 Whl 1 Finish OD

R30217 Whl 1 Rough OD

R30217 Whl 2 Rough Race

R30217 Whl 3 Undercut

R30217 Whl 4 Bead Face

R30217 Whl 5 Finish Race

R30217 Whl 6 Chamfer

Custom Excel Editor

New

Copy...

Excel Export

Delete

X

Z

2.97053

Sequence Editor

NC Editor

Save

Return

Roll Crown

for Grind Form: R30217 Whl 3 Undercut

Program Units

Inch

Radius

Profile

Dimensions and Offsets

LEAD	.96875	K	23000
ALPHA	2.55000	L (FRONT)	500
DELTA	2.55000	N	.03300
A	.82500	P	.09300
B	.70000	Y	.06500
C	.07500	Z	.00000
D	.08100		
E	.10100		
F	.07000		
H	.00000		
J	.05000		
L (REAR)	501		

Save

Return

Additional Machine Configuration Options

Because every operator seems to have their own preference for how a machine should be set up and programmed, CNC Engineering has tried to provide as many options as possible. Inch-to-metric and radius-to-diameter are switchable at any time, but the default unit when using a given screen is selectable. Rates, like per-minute and per-second, are also selectable according to an Operators preference.

Operators can also switch between Part Coordinate programming and Machine Coordinate programming, on a per-program basis.

By selecting the features you need and leaving out the options you don't, manufacturers have the power to truly customize the software for each machine tool.

Machine Setup

Machine Name

OpenVision HMI	File Handling, Etc.	More Axes	Gaging
Programming Wheel / Dress	Programming Grind	Devices	Units And Part CS
General	Axes		

Default Programming Units:

Default Radius/Diameter:

Wheelhead Power Units:

Rates:
☐ Per Minute ☐ Per Min. & Per Rev.
☒ Per Second ☐ Per Sec. & Per Rev.

G Code Programming:

Contour Dimensions:

Part Coordinate System:
☐ Do Not Offer
☐ Offer Using Local Offsets (per Program)
☒ Offer Using Global Offsets

Part CS: How To Align Centerlines:
For ID machines align workhead and wheelhead centerlines by:
☒ Reference Wheel To Known Diameter
☐ Indicate In Manually
Note: OD machines always reference wheel to known diameter.
☐ Data Entry Only

Machine Setup

Machine Name

Programming Wheel / Dress	Programming Grind	More Axes	Gaging
General	Axes	Devices	Units And Part CS
OpenVision HMI	File Handling, Etc.		

☒ Capture End Of Grind Envelope
☒ Allow Disabling of Routes
☒ Allow Disabling of Devices
☐ Disallow Disabling of Dress Op
☐ Disallow Disabling of Surface Op
☐ Exclude Whl Wear From Rte Moves
☐ Force Program Test
☐ Enable Capture Warning
☐ Delay Wheel Start
☐ Stop Wheel At End Of Cycle

Crash Detect:
☒ Emergency Stop
☐ X-axis Zero Return
☐ Return To Rest
☐ Return To Rest On Interrupt
☐ Abort On Cycle Interrupt
☐ Use NC Program for Oscillation
☐ Use PMC Axes For Rapid
☐ Display Actual Spindle Speeds
☐ Display Ancillary Analog Data

Machine Setup

Machine Name

YOUR MACHINE

- | General | Axes | Devices | Units And Part CS |
|----------------------------------|--------------------------|------------------|-------------------|
| OpenVision HMI | File Handling, Etc. | | |
| Programming Wheel / Dress | Programming Grind | More Axes | Gaging |

- | | |
|---|--|
| <input type="checkbox"/> Multiple Wheels Per Wheel Type | <input type="checkbox"/> Offer Per Dress Operation Skip |
| <input type="checkbox"/> Offer Prog Group Wheel Offsets | <input type="checkbox"/> Offer Side Dress Direction |
| <input checked="" type="checkbox"/> Programmable Wheel Speeds | <input type="checkbox"/> Offer Attached Dress |
| <input type="checkbox"/> Offer Wheel Direction | <input type="checkbox"/> Offer InProcess Compensation |
| <input type="checkbox"/> Offer Quill/Blotter Data | <input type="checkbox"/> Offer Adjust Size After Dress |
| <input type="checkbox"/> Offer Wheel Types Face Data | <input type="checkbox"/> Clear Handle Interrupt Offset |
| <input type="checkbox"/> Offer Wheel Types Backface Data | <input checked="" type="checkbox"/> Disable Worn Wheel Display |
| <input type="checkbox"/> Offer Dress Tool Radius | <input type="checkbox"/> Offer Sphericals Dress Editor |
| <input type="checkbox"/> Offer CBN Adaptive Dress | <input type="checkbox"/> Offer E-axis Races Dress Editor |
| <input type="checkbox"/> Offer CBN Wheel Conditioning | <input type="checkbox"/> Offer Crown Dress Editor |
| <input type="checkbox"/> Offer Skip Dress Decay | <input type="checkbox"/> Offer Tangential Dressing |
| <input type="checkbox"/> Offer Dress On Wheel Load | <input type="checkbox"/> Offer E Rad. Dress Pos. Adjust |

Save

Return

Machine Setup

Machine Name

YOUR MACHINE

- | General | Axes | Devices | Units And Part CS |
|----------------------------------|--------------------------|------------------|-------------------|
| OpenVision HMI | File Handling, Etc. | | |
| Programming Wheel / Dress | Programming Grind | More Axes | Gaging |

- | | |
|---|---|
| <input checked="" type="checkbox"/> Offer Sep Surf Op Spindle Data | <input type="checkbox"/> Aux. Grind Contour Slide Present |
| <input checked="" type="checkbox"/> Offer Separate Oscillation Data | <input type="checkbox"/> Offer Do Not Backoff After Grind |
| <input checked="" type="checkbox"/> Offer Work Direction | <input type="checkbox"/> Offer Dont Backoff Before Macro |
| <input checked="" type="checkbox"/> Offer Prog Approach Rates | <input type="checkbox"/> Offer Discard Size Correction |
| <input type="checkbox"/> Offer FeedPoint Sparkout | <input type="checkbox"/> Offer Rotary Contour |
| <input type="checkbox"/> Offer Pick Feed and Cont. Osc | <input type="checkbox"/> Offer Roll Crown Editor |
| <input type="checkbox"/> Offer Uni-Directional Pick Feed | <input type="checkbox"/> Offer Feed Rotation |
| <input type="checkbox"/> Offer Thread Grinding | <input type="checkbox"/> Offer Prog. Surface Boundaries |
| <input type="checkbox"/> Offer Per Surface Part CS | <input type="checkbox"/> Offer Prog. Surf. Bound. - addl |
| <input type="checkbox"/> Use Last Flag Offset | <input type="checkbox"/> Offer NC Plunge |
| <input type="checkbox"/> Only Offer Finish Grind | <input type="checkbox"/> Offer Grind Tool Radius |
| <input type="checkbox"/> Offer Reverse Feed | |

Save

Return

Custom Open Vision™ Grind Add-Ons

Beyond the standard grinding software itself, there are many add-ons available. Custom pages for Auto loaders, probe cycles, robot integration, and other ancillary devices can be configured. Custom plant automation and integration systems can also be supported.

Device Operation for Program: A.T.S. 3-9513 Op.3

Device Operation Name: Program Units:

General | Skip Option | Lookahead Option

Device:

☒ Activate Device ☒ Wait for Device Confirmation

Activate Condition: Confirm Condition:

☒ X Axis Operation Position:
☒ Z Axis Operation Position:

Flag Direction:

Flag Detect Rate:
Max Detect Travel:
Flag Wheel Reference Offset:
Last Flag Offset:

Dwell:

Solutions for Manufacturers & OEMs

Open Vision™ Grind is already used on hundreds of grinding machines throughout the world. Some manufacturers, like a leading bearing manufacturer in New York, have installed Open Vision™ Grind on all of their grinders, thereby ensuring Operators and Programmers can easily support all of their machines. While most of the existing Open Vision™ Grind systems have also been retrofitted with new FANUC controls by CNC Engineering, Inc., almost any grinder supported by a FANUC CNC can be improved with Open Vision™ Grind.

A number of grinding machine OEMs, including Campbell, MRSE, CNC North, and EDAC also offer Open Vision™ Grind on their new grinding machines.

