

高速・高面品質・高精度研削対応砥石軸ユニット独自機構 Mechanism for high-speed, mirror surface, high-accuracy grinding with unique grinding wheel spindle unit

高速研削時の高面品質、高精度保持の為に徹底振動対策

- 独自ハイレシプロ機構（特許品）と独自上下スベリスライド機構採用により、Max400min⁻¹においても砥石軸ユニットの振動を限りなく0に近づけ、従来機の数倍の研削効率と面粗度を達成しています。
- 20余年の経験・実績による高精度モーター一体型砥石軸は高剛性構造と共に、0.1 μmNNRという高回転精度を保有しています。
- その他の振動対策
砥石台スライドには高剛性のガイドを使用し、外部振動を排除しております。砥石台の駆動用ボールネジとサーボモーターを直結し、加工面へのギャの影響を排除しております。高精度スピンドルと、波形を正弦波に近づけた高性能インバータとの組み合わせにより、スピンドル部の振動を抑えています。



ハイレシプロのスライド機構（特許品）
High-speed high reciprocating slide mechanism (patent granted)



大径スピンドル (3,000~10,000min⁻¹)
(φ150mm砥石用、標準)
Large size grinding wheel spindle (3,000~10,000min⁻¹)
(standard for φ150 mm grinding wheel)



小径スピンドル (10,000~30,000min⁻¹)
(φ150mm砥石用、標準)
Small size grinding wheel spindle (10,000~30,000min⁻¹)
(option for 30 mm/75 mm grinding wheel)

高精度保持の為に徹底した機械変位対策

- 砥石軸及び砥石台に対し徹底的に熱対策を施し、最小限の熱変位を抑えています。
- 砥石台のX,Yスライドは高精度なボールガイドを組み込み、走り精度を高めると共に砥石台の移動による変位を最小限に抑えた構造となっております。

人間工学性に富んだ高剛性ワークテーブル Highly-rigid worktable superior in terms of ergonomic engineering

高精度保持の為に高剛性機構

- オーバーハングのないU,W軸スライドにより長年の経年経年変化に対しても高精度を保証しております。
- スライド式ワークテーブル用手パンドルの採用により、オペレーター重視の構造となっております。又、電動テーブル（標準）では手動感覚の使い良さが特長です。
- NCテーブルU,W軸（オプション）により、多数個加工の無人化を計ることが出来ます。
- フットペダル採用によりテーブルの倍率送り (0.5 μm、50 μm) のワンタッチ切り替えが可能で、絶えず同じ姿勢での作業が出来、無駄時間を排除しています。
- 砥石軸ユニットX,Y軸スライドは高速ストロークに十分耐え得る、従来機より大幅に拡大したエリアをもつ為、オーバーハングがなく長年の経年変化に対しても、高精度を保証しています。
- 砥石軸ユニットやワークテーブルユニットを支えているベッド部構造は十分にリブを配した堅牢なボックス型となっております。



使いやすいスライド式ワークテーブル用手パンドル（標準）
Easy-to-operate manual pulse handle (standard) for slide worktable.



倍率送りフットペダル（標準）
Magnification feed foot pedal (standard)

Superb anti-vibration measures to maintain the surface quality and accuracy on the high level during high-speed grinding

- The high-speed, high-reciprocating mechanism (patent granted) and vertical slide mechanism, due to our unique technology, successfully limited vibration of the grinding wheel spindle unit to zero even at maximum 400 min⁻¹. The grinding efficiency and mirror surface thus achieved is several times higher than those of conventional grinders.
- The highly-accurate grinding wheel spindle and stable motor, the result of our 20-year experience and success, contributes, together with the highly-rigid construction, to the rotation accuracy as high as 0.1 μm NNR.
- Other anti-vibration measures
A highly-rigid guide is used to slide the grinding wheel table, eliminating external vibration. The grinding wheel table drive ball screw is directly coupled to the servo motor, thereby eliminating any effect of gears on the ground surface. The highly-accurate grinding wheel spindle is combined with the high-performance inverter whose waveform is approximated to the sine wave, thereby suppressing vibration of the grinding wheel spindle.

Measures to prevent displacement of the machine for higher accuracy

- Anti-heat generation measures have been taken for the grinding wheel spindle and grinding wheel table to minimize thermal displacement.
- The X-Y slide of grinding wheel table incorporates a highly accurate ball guide to enhance the running accuracy and to minimize displacement due to the traveling grinding wheel table.

High-rigidity of mechanism maintains high accuracy

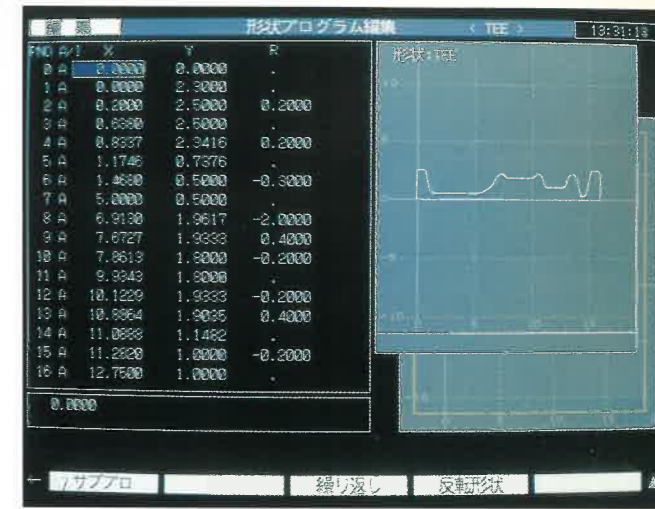
- U and W axes slides without overhang offers high accuracy against changes over a long period of time.
- The use of a handle for slide worktable offers an operator-friendly construction. The electric motor (standard) features easy manual operation.
- NC table U and W axes (optional) will help achieve unattended grinding of multiple workpieces.
- The foot pedal enables quick selection of the magnification feed (0.5 and 5 μm). This also enables the operator to work in one position to eliminate any dead time.
- The X & Y axis slides has the large area as compared with normal optical profile grinder. And it is strong enough to bear the high speed stroke and is free from overhang while ensuring high accuracy against changes over a long period of time.
- The bed, supporting the grinding wheel spindle and worktable units, is of a firm box construction with sufficient number of supporting ribs.

高精度投影装置 Highly-accurate Projector

- 500mm×500mm大型スクリーン
● Large 500×500 mm screen
- 基準投影機並の倍率精度 (0.03%以下) 解像力 (200本相当)
● Reference projector and magnification accuracy (0.03% or less) Resolution (equivalent to 200 pieces)
- シャープエッジが得られる鮮明画面
● Clear screen to display an image with sharp edges
- 透過ランプ、反射ランプ共500W仕様
● 500 W for transmission and reflection lamps
● 大口径透過照明レンズ採用
● Large-sized transmission lighting lens
- 倍率は×20、×50倍切替 (×25、×50はオプション)
● Selectable magnification from X20 and X50 (X25 and X50 available as option)



大口径透過照明装置
Large lens diameter transmitting illumination unit



形状表示画面（標準）
Shape display (standard)

PGX-2500N

高精度投影装置 High-accuracy projector



独自開発NC装置 Specifically developed NC system



モーター一体型スピンドル Grinding wheel spindle built in motor

高剛性ワークテーブル Highly-rigid worktable

独自砥石軸ユニット、スライドヘッド構造 Unique grinding wheel spindle unit, slide, and bed construction

独自開発NC装置 Unique NC system

特長 Features

- オリジナルNCシステム (標準)
 - (1)PG加工専用開発されたNCシステムの為独自の豊富な加工ソフトを用意しています。
 - (2)対話型入力方法
 - Gコードを一切使わず、複雑なプログラムは不要です。
 - 仕上げ形状のみの入力ですぐ荒取りから仕上げまでのプログラムを加工ソフトにより自動的に作る事が出来ます。
 - カラーグラフィックを使用した仕上げ形状の任意の箇所に複数の加工設定が出来る自由度の高い簡易入力NCです。
 - (3)外部入出力インターフェースを装備している為、他社NC、CAD/CAMによるNCプログラムも容易に入力出来ます。
 - (4)下記独自加工ソフトにより、ワーク1チャックにて高速研削との併用で従来機とくらべ1/3~1/2の研削時間が可能です。
 - 荒取サイクル (RCR)
 - 荒取往復サイクル (RCRB)
 - 仕上げサイクル (FCR)
 - 仕上げ往復サイクル (FCRB)
- Original NC system(standard)
 - (1)This NC system has been developed for grinding and many grinding software programs are available.
 - (2)Interactive input method
 - Neither G code nor complicated program mind is required.
 - The grinding software can generate a program covering roughing to finishing simply by entering the finish shape.
 - This is a simple input NC with high degree of freedom, which allows the setting of multiple points in any locations of a finish shape by using a color graphic.
 - (3)The external input/output interface is provided, which facilitates easy input of NC programs generated by other companies or NC programs created by CAD/CAM.
 - (4)Our unique grinding software listed below can reduce the grinding time from 1/3 to 1/2 with one chucking of workpiece during high-speed grinding when compared with conventional machines.
 - Roughing cycle (RCR)
 - Roughing reciprocal cycle (RCRB)
 - Finish cycle (FCR)
 - Finish reciprocal cycle (FCRB)

豊富な加工ソフト(オプション) Abundant grinding software programs (optional)

- プレイバック機能
投影機上のチャート図に倣いながら工具位置を教示するだけで形状プログラムの作成ができます。また、作成した形状がグラフィック上でリアルタイムに表示されます。
- タイバー加工
当社の加工ノウハウを基に作成した専用画面により、不等ピッチやファインピッチの加工にも容易に対応できます。
- シュミレーション表示
実加工を行う前にグラフィック表示でシュミレーションを実行することにより加工確認と加工時間を把握できます。
- 原点補正
投影機チャート上に砥石を合わせることで自動的に砥石先端R、砥石先端R中心位置を測定します。
- 形状回転
手でワークを割出して加工する場合に、全形状を入力しておけばその都度の座標値を計算入力する必要がありません。
- Playback function
Simply teaching the tool position while copying the chart diagram on the projector can generate the shape program. The generated shape can be displayed in real time on the graphic display.
- Tie-bar(comb) grinding
A dedicated screen, based on our grinding know-how, ensures easy compatibility while grinding with unequal and fine pitches.
- Simulation display
Simulation can be made on a graphic display before practical grinding. This enables confirmation of the grinding operation and understanding of the grinding condition.
- Zero compensation
Matching the grinding wheel on the projector chart enables automatic measurement of the grinding wheel end R and grinding wheel end R center position.
- Shape rotation
When grinding is made through manual indexing of workpiece, it is enough to enter the entire shape and neither calculation nor entry of coordinates each time is necessary.

多彩な特別付属品 Diversified special accessories

- 機上R成形ドレッサー (MRドレス)
- 機上R成形ドレッサー (DR-7)
- ワーク微調ベース (200×300mm)
- 複数個取付バイス
- 静圧円筒研削装置 (OG-1S)
- NC横型割出装置 (IH-4NT)
- NCテーブル型割出装置 (CT-5NA)
- R-profile dresser (MR dresser) mounted on the machine
Corrects the shape of grinding wheel end R automatically (with a dedicated MR dresser software)
- R-profile dresser (DR-7) mounted on the machine
Corrects the shape of grinding wheel end R manually.
- Workpiece fine adjustment base(200×300mm)
Facilitates adjustment of the level and squareness of the jig and workpiece. The base makes change of grinding wheel zero point unnecessary during grinding of multiple similar workpieces, ensuring high efficiency.
- Multiple workpiece mounting vice
Enables mounting of multiple workpieces.
- Air static cylindrical grinding device (OG-1S)
●No. of revolutions: Max. 20,000/min
- NC horizontal indexing device (IH-4NT)
●Minimum indexing unit: 0.0001°
- NC table indexing device (C-5NA)
●Table diameter: 120 mm φ
●Minimum indexing unit: 0.0001°



ワーク Workpieces Sample

PGX-2500N

CNC成形研削盤 (高速型)

高速研削と鏡面、高精度の高次元な両立を実現。 High-speed and mirror grindings; both achieved with high accuracy at a higher level.

本機の特長 Principle features

①高速研削

従来機比2~3倍の研削能力が実現できます。
●砥石軸ユニット上下ストロークスピードMax.400min⁻¹となっています。
●標準スピンドルで3,000~10,000min⁻¹、小径スピンドルで10,000~30,000min⁻¹の幅広い回転数を持ち、各種加工物材質に対する最適研削条件が得られます。

②鏡面研削

高速研削時において金型部品、丸物の鏡面研削が出来ます。又刃物の刃先のチップングも小さく出来ます。
●①当社独自のハイレシプロ機構 (パテント品)
●②当社独自の高速用上下スライド機構
●③高回転精度 (0.1 μmNRR) のモーター—体型高剛性砥石軸による徹底振動対策を取っております。
●砥石軸ユニットは高精度X、Yスライドの為、確実な0.1 μm移動を保証しています。

③高精度を保証する構造

長期間安定した高精度を保証します。
●砥石軸ユニット及びワークテーブルはガイドのスパンを大きく取っている為、スライド剛性が高く、長期間による経年変化に強い構造となっています。
●小径スピンドルは軸受部にセラミックスボールを使用している為、長寿命高速回転が可能です。
●投影器照明装置 (透過、反射共) このクラス最大の500Wのハロゲンランプを使用している為、明るく鮮明な像を得ることが出来、高い倍率精度と解像力を有している為、オペレーターのレベルによらず、高精度な形状画像を保証しています。

④高剛性構造

特にセラミックス研削において威力を発揮します。
●難研削材 (超硬・サーメット・セラミックス等) や重研削対応の機械剛性・構造となっており、特に砥石軸ユニット、砥石軸、ベッド、ワークテーブルユニットは、この点を充分考慮した設計となっています。
●機械本体重量: 4,500kg
●大型ワークテーブル (470×210mm) を有している為、大型機器の取り付け、大型加工物の加工が可能です。

⑤段取時間の短縮

総合加工時間を大幅に短縮できます。
●各ハンドルは全てオペレーターが立つ位置 (機械正面) に配置されており、同一場所にて段取りができる人間工学的にも優れた配置である為、最小の時間にて段取りが出来ます。
●ワークテーブル用ハンドルの位置はオペレーターに合わせて移動出来 (スライド式)、また操作ペンダントもオペレーターが立つ位置にて集中操作出来る為、段取り作業において無駄な時間がありません。
●微調ベース (オプション) 上にて加工物や加工物取付治具の水平、直角調整が全て出来る為、段取りが大変簡単です。又、同一形状加工物を複数個段取替しながら研削する場合、砥石位置調整がまったく不要で最小の段取時間で済みます。

①High-speed grinding

Grinding efficiency improved 2~3 times as compared with the normal CNC Optical profile grinder.
●Vertical stroke speed of grinding wheel spindle unit-Max.400min⁻¹.
●Wide range of grinding wheel spindle speeds 3,000~10,000rpm(Standard Spindle) & 10,000~30,000rpm(Small dia spindle), offering the optimum grinding conditions with various workpieces.

②Mirror grinding

High-speed grinding can mirror-grind the dil part and edge while minimizing chipping of the cutter edge.
●①Our unique high-speed reciprocal mechanism. (patent granted)
●②Our unique high-speed vertical slide mechanism.
●③The grinding wheel spindle due to highly stable motor with high rotation accuracy(0.1 μmNRR). With these features, vibration is extremely small.
●The grinding wheel spindle unit can slide with high accuracy in X and Y directions, ensuring reliable 0.1 μm travel.

③Construction guarantees high accuracy

Long-term stable high-accuracy.
●Due to large guide span, the grinding wheel spindle unit and worktable have high slide rigidity, proving highly resistive against changes over a long period of time.
●The use of ceramic balls in the bearings of the small-size grinding wheel spindle enables high-speed rotation while assuring longer service life.
●A projector lighting system (both transmission and reflection types) uses a 500 W halogen lamp, the largest in this class, producing a bright sharp image and ensuring high magnification accuracy and resolution. Accordingly, the highly-accurate profile image is guaranteed irrespective of the operator's skill level.

④Highly rigid construction

These properties will prove particularly advantageous for the grinding of ceramics.
●The machine has a construction and rigidity compatible with difficult-to-grind material (carbide,thermet,ceramics,etc.) or heavy grinding. In particular, the grinding wheel spindle unit, grinding wheel spindle, bed, and worktable unit are designed to achieve such properties.
●Machine main body weight: 4,500kg
●A large (470×210mm) worktable is provided to enable setting of large equipment & grinding of large workpieces.

⑤Reduction of the setup time

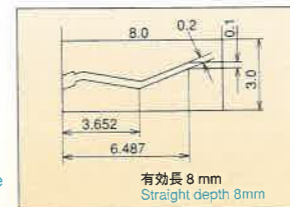
Overall grinding time can thus be reduced substantially.
●All handles are located in the position where the operator stands (namely, in front of the machine). This arrangement, superior in terms of ergonomic engineering, allows all setups to be completed in the same position while minimizing the time required for setup.
●The position of the handle for the slide type worktable can be moved as required by the operator. The operation pendant can also be used for extended operation from the operator position. In this way, there is not any dead time.
●All of level and square adjustments can be completed for workpieces and workpiece jigs on a fine adjustment base (optional), making setup extremely simple. As grinding of multiple workpieces of the same shape is made while changing the setup, it can be completed within the minimum setup time and no grinding wheel position adjustment is necessary.

高速研削時の鏡面研削事例 Example of mirror grinding during high-speed grinding.

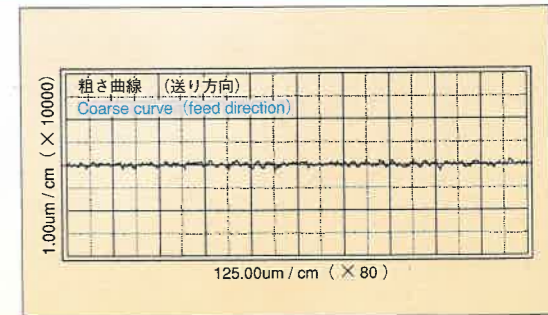


- 研削時間: 1時間30分 (角ブロックからの合計研削時間)
- 加工精度: ±0.0015mm
- Grinding time: 90 minutes (total grinding time starting from a square block)
- Grinding accuracy: ±0.0015mm

材質: 超微粒子超硬
形状▶
Material: Micro fine carbide
Shape▶



面精度送り方向
Ra: 0.0032 μm
Ry: 0.224 μm
Rz: 0.166 μm
Accuracy in feed directions
Ra: 0.032 μm
Ry: 0.224 μm
Rz: 0.166 μm



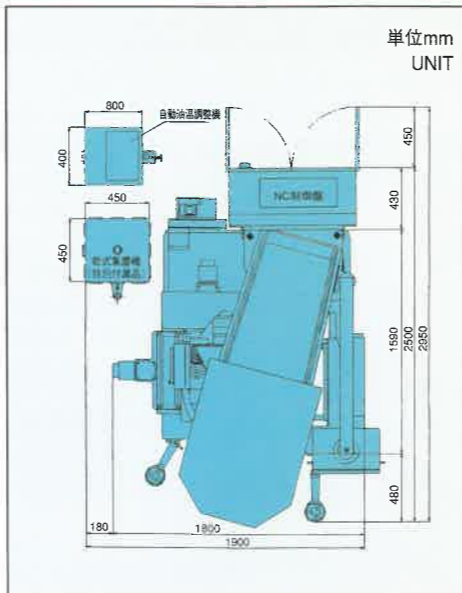
※その他多数の加工ソフトが用意されています。 ※Apart from above, various grinding software programs are available.

Optional NC functions

Playback (P25N OP-PB)	Two types of playback inputs: change point and intersection point. Arc specification with shape changed is made by specifying the arc radius (Center may be specified instead.)
Manual linear interpolation (OP-LITP/CITP)	For five types of manual linear interpolation, the angle Manual arc interpolation is set when a part of the shape is to be specified manually. Linear or arc may be performed manually for one process.
Shape symmetry (OP symmetry)	Symmetry of shape program. For profile symmetrical in terms of Y axis, the use of this command allows omission of input.
Shape rotation (OP shape rotation)	Rotation of the shape program. When the rotation angle is specified for the existing shape program, data converted in coordinates by the specified angle around the program coordinates (0,0) is generated and may be registered as a different file.
Shape parallel movement (OP-shape shift)	Parallel movement of a shape program. By specifying the travel distance and direction to the existing shape program, this shape program is moved for the specified distance in a specified direction and may be registered as a different file.
Shape sub-program (OP-shape sub-program)	This function facilitated generation of the shape program by registering the fixed shape as a sub-program.
Shape repetition (OP-shape repetition)	When the same shape is repeated within the shape program, the use of the repetition function facilitates generation of the program.
Dowel (OP-dowel)	Function to interrupt NC grinding for the specified time.
Point correction (OP-point correction)	This function allows insertion/deletion of the points specified in grinding setting to increase/decrease specified SP/EP points automatically.
Graphic tool locus display (OP-graphic display)	This junction displays grinding wheel movement with workpiece. Actual grinding position for the shape is displayed in real time.
Simulation (OP-simulation display)	This function graphically displays simulation before actual grinding to confirm grinding settings. This also allows grasping the approximate grinding time.
Dedicated R grinding (OP-grinding)	Simple circular arc grinding. Separate grinding is made for right and left corners. This function enables grinding of a 1/4 circular arc. As a dedicated screen is available, the operation similar to NC can be made with the minimum data input.
Tie-bar grinding (OP tie-bar grinding)	Simple tie-bar grinding (10 programs can be registered). A screen dedicated to tie-bar grinding is available. By entering data dedicated to tie-bar grinding, tie-bar grinding can be made with ease.
Zero compensation (OP zero compensation)	With the grinding wheel matched to the chart, the tool radius and position are measured automatically. When the grinding wheel is matched to the finish shape chart, the tool radius and grinding wheel center position can be measured. This function allows measurement of tool radius and grinding wheel center position at one time.
Optional stop (OP-optional stop)	This function stops grinding at the specified position.
Block skip (OP skip)	This Block skips the grinding of a specified position.
Plunge cutting roughing cycle	Plunge cutting with straight grinding wheel.
Memory capacity (OP 5000/200 programs)	Shape points can be stored up to 5000 points (equivalent to 450 m) in 200 programs.
Floppy (1) (OP-FD 1.22M)	1.22 MB floppy drive may be installed.
Floppy (1) (OP-FD 1.44M)	1.44 MB floppy drive may be installed.
DVF compatible (OP-FD DVF)	1.22 or 1.44 MB floppy drive may be selected.
NC table compatible (OP-U/W axes)	This function allows automatic operation of U and W axes during NC operation, causing the table to automatically move to U and W positions of offset conditions. (With pitch error compensation)
Additional axis (1) (OP-C axis)	C axis added. Addition of this C axis allows indexing and grinding along the normal line. The command for grinding along the normal line is available in three types: finishing along the normal line, roughing, and finishing reciprocation.
Additional axis (2) (OP-V axis)	V axis added. Addition of this V axis allows traverse grinding. The traverse grinding command is for traverse grinding with the tool radius offset and traverse grinding with the tool length offset.

Pitch error compensation C (OP-pitch error C)	
MR dressing software (OP MR dressing)	Addition of the MR dressing device allows dressing of the grinding wheel on the machine. Such dressing allows control of the edge R and toothing.
Operation counter (OP-IC)	Hardware integrating counter may be installed.
Calendar timer (OP-CLT)	The grinding wheel spindle, stroke, and projector warm-up may be made with a hardware timer.
Three color-lamp (OP-3-lamp Patite)	Three-lamp signal tower indicate a machine working condition by 3 color-lamp.
Grinding wheel peripheral speed change gear (OP-grinding wheel peripheral speed control)	This function changes the grinding wheel rotation in a given cycle. The grinding wheel rotation speed can be changed on the basis of set value.
Projector lighting voltage variable (OP-voltage variable)	Transmission and reflection lighting brightness can be changed by a dial, to get the best life of halogen lamp.
Specifications in English (OP-English and millimeters)	Description on the pendant and screen is indicated in English and millimeters.
Specifications in Chinese (OP-Chinese and millimeters)	Description on the pendant and screen is indicated in Chinese and millimeters.
Air-static grinding wheel spindle specifications (OP-static pressure)	Air-static grinding wheel spindle compatible.
100V receptacle (OP 100V socket)	100V socket added in the panel.

機械配置図 Machine layout plan



機械仕様

投影機	
スクリーン有効面積	500×500mm
倍率 (切換式)	×20 ×50
投影可能寸法	25×25mm (×20) 10×10mm (×50)
照明装置 (透過)	100V, 500W
(反射)	100V, 500W
工作物テーブル	
面積	470×210mm
移動量 (U軸)	250mm (電動)
移動量 (W軸)	150mm (電動)
移動量 (上下)	100mm (電動)
砥石軸ユニット	
砥石軸	モータ直結型
砥石軸回転数	3,000~10,000min ⁻¹ (インバータ変速)
ストローク回数	0~400min ⁻¹ (インバータ変速) (ストローク量に対する制限有り)
ストローク量	5~110mm
砥石外径	φ120~φ150mm
移動量 (X軸)	200mm (NC制御軸)
移動量 (Y軸)	150mm (NC制御軸)
前変角設定範囲	-2° ~+20°
横変角設定範囲	±8°
水平旋回角設定範囲	±15°
電動機	
砥石軸回転用	1.0kW 4P
砥石軸ストローク用	0.75kW 4P
X軸・Y軸送り用	1.5kW ACサーボモータ×2
U軸・W軸送り用	0.4kW ACサーボモータ×2
テーブル上下用	0.4kW 4P
機械の大きさ	
幅×奥行×高さ	1,850×2,460×2,125mm
重量	4,500kgf

Standard accessories list

Projector	
Screen effective area	500×500mm
Magnification (selectable)	×20 ×50
Projection size	25×25mm (×20) 10×10mm (×50)
Lighting system (transmission)	100V, 500W
Lighting system (reflection)	100V, 500W
Worktable	
Area	470×210mm
Travel (U axis)	250mm (electrical)
Travel (W axis)	150mm (electrical)
Travel (up-down)	100mm (electrical)
Grinding wheel spindle unit	
Grinding wheel spindle	Directly coupled to the motor
Grinding wheel spindle speed	3,000~10,000 min ⁻¹ (inverter speed change)
Strokes	0~400min ⁻¹ (inverter speed change) (Stroke amount limited)
Stroke amount	5~110mm
Grinding wheel outside diameter	φ120~φ150mm
Travel (X axis)	200mm (NC control axis)
Travel (Y axis)	150mm (NC control axis)
Front angle change setting range	-2° ~+20°
Lateral angle change setting range	±8°
Horizontal swing angle setting range	±15°
Motor	
For grinding wheel spindle rotation	1.0kW 4P
For grinding wheel spindle stroke	0.75kW 4P
For X and Y axes feed	1.5kW AC servo motor×2
For U and W axes feed	0.4kW AC servo motor×2
For table up/down	0.4kW 4P
Machine size	
Width×depth×height	1,850×2,460×2,125mm
Weight	4,500kgf

WAIDA

PGX-2500N

CNC成形研削盤 (高速型)

CNC Profile Grinder (High-speed Type)