
# GCX LINEAR
# GEAR UP FOR SKIVING

**Gear power skiving is revolutionising the gear manufacturing process; it is 5~10 times more efficient than shaping, more flexible than broaching, can produce both internal gear and external gear.**

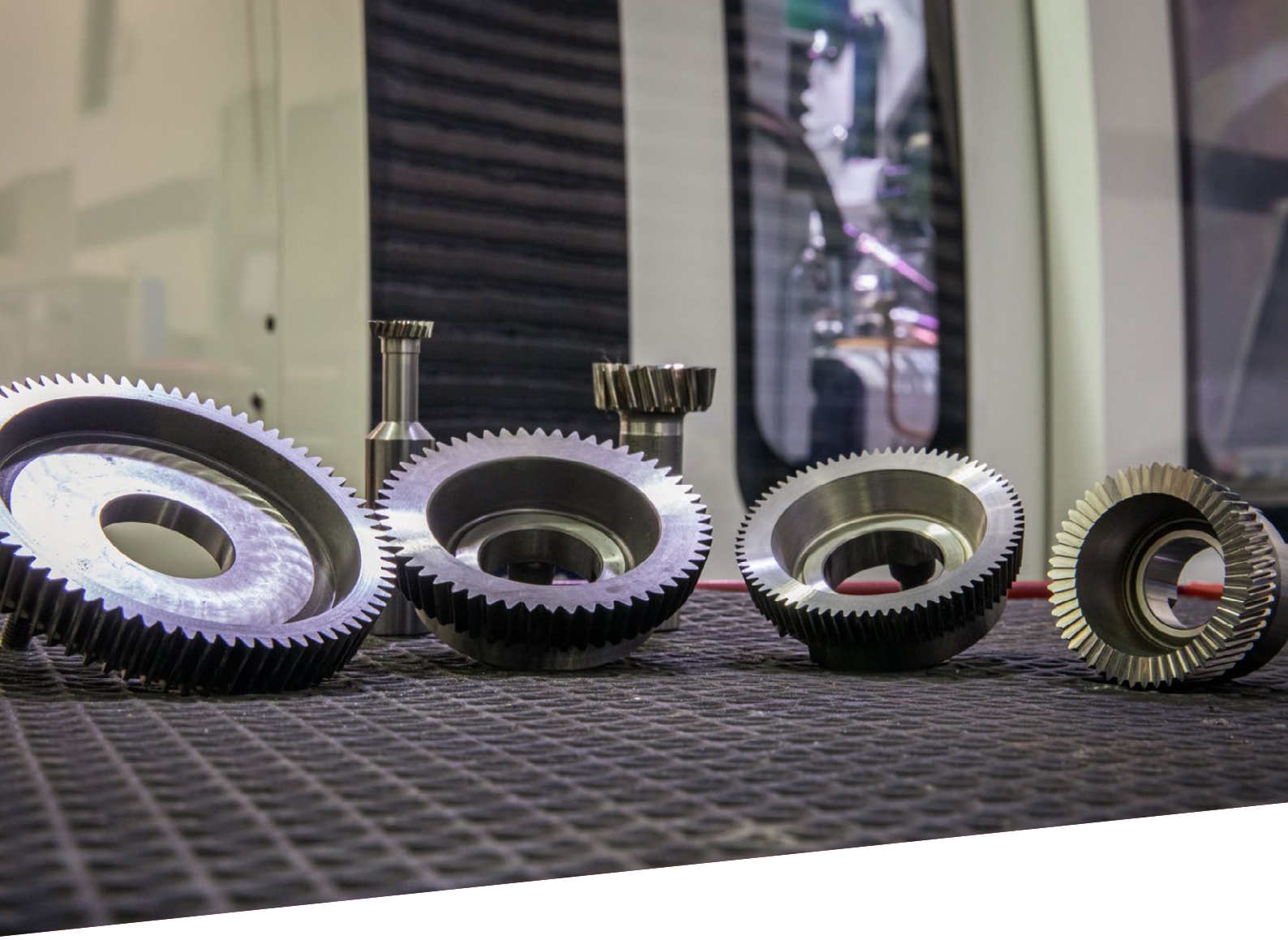
Driven by the automotive industry's electrification, the rising popularity of skiving has caused a surge in demand for skiving cutters. Responding to the market, ANCA brings a complete solution for manufacturing and sharpening skiving cutters as part of a comprehensive gear cutting tool package.

ANCA
CNC MACHINES

# GCX Linear sets the new standard for producing the highest quality skiving tools in both carbide and HSS. Its onboard tool measurement realised an accurate closed-loop manufacturing process, an industry-first innovation.

## GCX Linear solves the challenges for producing high-quality skiving tools:

| Customer Challenges | GCX Linear Solution |
|---|---|
| **Complex geometry** | • GCX Linear comes with parameterised design software, calculate cutter geometry directly from gear parameter, provide collision analysis and grinding simulation.<br>• Support all types of pinion cutters: topping, semi-topping, non-topping and protuberance type skiving cutter and shaper cutter in both solid carbide and HSS. |
| **Tight tolerance** | • GCX Linear achieves the DIN AA quality with a suite of breakthrough technologies based on ANCA's flagship TX platform: MTC (Motor Temperature Control), AEMS (Acoustic Emission Monitoring System), high accuracy headstock, large working envelope support tool diameter up to 260mm, LinX linear motor on all linear axis and iBalance. |
| **Measurement** | • GCX Linear is the only CNC grinding machine with the industry-first onboard tool measurement, benchmark GMMs don't yet have the correct mathematical model for skiving cutter.<br>• Save customers substantial initial investment on a GMM |
| **Dressing complex wheel form** | • ANCA's advanced software derives simplified wheel form, enables direct path compensation<br>• AEMS monitor the dressing process with an intelligent machine-learning algorithm to minimise cost and improve efficiency. |
| **Quality control** | • Complete closed-loop production: Grind – Measure – Compensate all inside the machine without the need to unclamp the tool |
| **Knowledge gap** | • Comprehensive training programs to help the engineer/operator to step into the gear cutting tool world<br>• Offer complete process knowledge and help customers to adapt the standard process into their environment. |



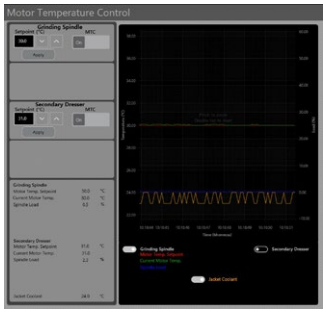
## POWERED BY LINX

**OFFERING RELIABILITY AND HIGH PERFORMANCE THROUGH ITS UNIQUE CYLINDRICAL DESIGN**

Our LinX linear motor technology for axis motion (X, Y and Z axes), in conjunction with linear scales, achieves superior precision and performance. Specially designed for a lifetime of operation in harsh grinding environments, the LinX motors have a cylindrical magnetic field which means there is no additional down force on the rails or machine base.

With no temperature variations (meaning no need for a separate chiller unit), and being sealed to IP67, there is minimal wear and tear so that the machine accuracy remains over the lifetime of the machine. The LinX linear motor has higher axis speed and acceleration, leading to reduced cycle times while maintaining a smooth axis motion.

## MOTOR TEMPERATURE CONTROL (MTC)




**MTC IS A PATENT-PENDING INNOVATION BUILT INTO THE MOTOR SPINDLE DRIVE FIRMWARE. INTELLIGENT CONTROL ALGORITHM ACTIVELY MANAGES AND MAINTAINS THE TEMPERATURE OF MOTORISED SPINDLES IN THE GCX LINEAR. BENEFITS DELIVERED BY THIS FEATURE INCLUDE:**

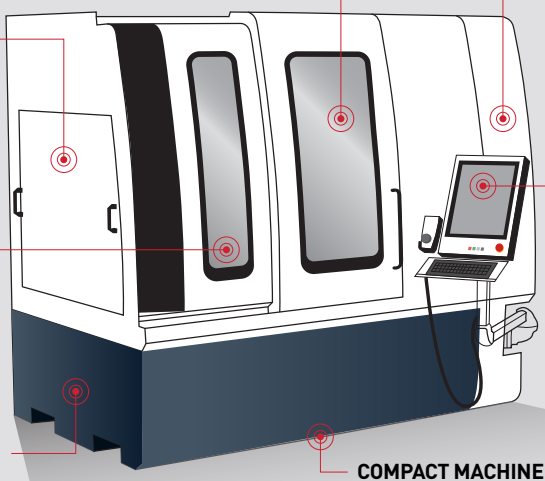
- Dramatically reduced machine warmup time, meaning you can start grinding tools sooner, knowing the machine has reached thermal stability - improves productivity and machine utilisation.
- Consistent thermal stability of the spindle over time, regardless of changes in spindle load or speed or spindle cooling coolant temperature - greatly improves the dimensional stability of grinding results.

**BI-SYMMETRICAL GANTRY**
A proven design for ultra-high precision grinding. It keeps the grinding spindle centre of rotation (C-axis) on the machine centreline which delivers superior rigidity and minimises effects of thermal growth.

**WHEEL PACK CHANGER**
The GCX Linear features a dual wheel pack changer to cover all grinding operations in one setup. Upgrade to GCXcell with 9 standard wheel packs, and options for up to 24. Coolant manifolds also change with the wheel packs.

**LARGE WORKING ENVELOPE**
For tool diameters up to 260mm (10.2"), the GCX Linear gives total flexibility to tackle any job.

**POLYMER BASE (ANCACRETE)**
Provides excellent thermal stability and vibration dampening properties delivering grinding process stability and outstanding tool surface finish.



**ANCA MOTION CONTROL**
ANCA Motion's latest AM5C CNC and AMD5X servo drives provide all the computing power needed for sub-micron motion control.

**CONTROL PANEL**
Including touch screen, USB ports and space for a standard keyboard. Ergonomic tilt adjust to suit different operators' heights. The handheld remote pendant includes ANCA's MPG Feed to make machine control and setup easier and safer.

**COMPACT MACHINE FOOTPRINT**
One machine for all grinding operations saves factory floor space compared to having multiple special purpose machines.

# AUTOMATION

## ROBOMATE LOADER

**ANCA's RoboMate robot loader is a versatile and flexible automation solution that is equally efficient on a range of ANCA CNC tool and cutter grinders. Using the accuracy and reliability of the Fanuc robot, RoboMate takes the tool directly from the pallet to the collet in a single grip.**

- ANCA's own LoaderMate software makes setup and programming simple
- Designed with high levels of safety and ergonomics
- Available with 2 pallets (standard) or 4 pallets (optional)
- Can load tool shank diameters from Ø3 mm (1/8") to Ø32 mm (1 1/4")
- Maximum standard tool length 350 mm (14")
- The size of the loader is L 2379 mm (94") x W 722 mm (28") x H 1865 mm (73")

## GCXcell LINEAR

**GCXcell Linear enjoys all the functions and features of the GCX Linear but has a standard robot loader. With the option of up to 24 wheel packs, multiple wheelsets for different tool sizes or types can be immediately available with zero change over time. Larger wheels also mean longer wheel life and reduced dressing requirements. The result is reduced machine setup and idle time and maximised productive tool grinding time.**

- Offered in two configurations
- Loads wheel packs up to 300mm (12") diameter, together with their coolant manifold
- Loads rotary cutting tools from 3mm (1/8") up to 32mm (1 1/4") diameter shank
- Maximum robot payload 35kg
- Can have custom engineered solutions to include pre and post grinding operations in the GCXcell Linear
- Offer customized solution for mixed batch gear tool (shaper cutter, skiving cutter, hobs) reconditioning/manufacturing solution

| | GCX Linear | GCXcell Linear |
|---|---|---|
| Wheel packs (one pack can hold up to 4 wheels) | 2 | **Small cell:** 9 standard, 14 optional.<br>**Large cell:** 9 standard, 14/19/24 optional |
| Grinding wheel diameter | Max. 203mm (8") | Max. 305mm (12") (on selected wheel packs) |
| Tool Loader | RoboMate (option) | Included |
| *Loader Tool Capacity | Shank Diameter 2 Pallet 4 Pallet<br>12mm 120 360<br>20mm 40 120 | Shank Diameter Small cell 2 Pallet Large cell 4 Pallet<br>12mm 120 360<br>20mm 40 120 |
| Tool Load Time | 15 sec | 20 sec |
| Machine Power Requirement | 25kVA | **Machine:** 25kVA +. **Cell :** 3kVA |
| Machine Weight | 8500kg (16,500 lbs) | **Machine:** 8500kg (16,500 lbs) +. **Cell:** 2500kg (5500lbs) max |

*Depends on the head size, the capacity will vary

# STANDARD ACCESSORIES

## WHEEL DRESSERS

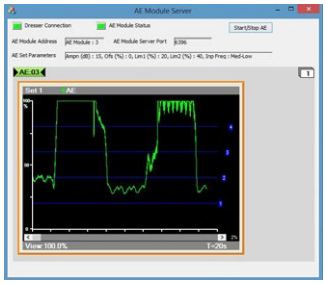
**Two wheel dressing options are included. Able to run at 3000RPM, the machine headstock can run a 200mm dresser roll. Additional secondary motorised dresser is suitable for profile wheel dressing. Secondary dresser uses quick change HSK arbor for fast change over times.**

- Integrated dressing software for complete flexibility of in-process dressing
- Automatically update grinding wheel size after dressing
- Mount plated diamond or aluminium oxide dresser rolls
- On machine dressing ensures zero runout on grinding wheels
- Maintain wheel form and grinding performance to maximise machine productivity

## HIGH ACCURACY HEADSTOCK

Large disk type skiving cutters and shaper cutters require higher headstock accuracy, as the impact of A-axis positional error will linearly increase with diameter. This option improves the A-axis accuracy by a factor of 10. The positional accuracy is now ±0.00034 degrees.

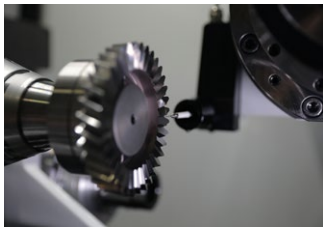
## ACOUSTIC EMISSION MONITORING SYSTEM (AEMS)

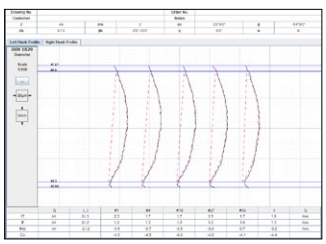


Dressing the complex wheel profile is critical; ANCA developed the latest acoustic emission monitoring system (AEMS). AEMS can be taught to pick up the right sound of perfect dressing in a noisy production environment.  Built upon a supervised machine learning algorithm, AEMS ensures the wheel profile is dressed within micron accuracy with the least possible time while minimising the size reduction.

# OPTIONAL ACCESSORIES

## ONBOARD TOOL MEASUREMENT





Due to the novelty of the skiving cutter, many industry benchmark GMMs (gear measurement machine) have yet to develop inbuilt mathematical models for evaluating the skiving cutter profile.

ANCA's onboard tool measurement evaluate directly against the cutting edge's correct mathematical form is an industry-first innovation.

- Measure the tooth profile against the correct curve
- Measure the tooth spacing
- Generate instant reports without the need to take the tool out of the grinding machine
- Improve process controllability
- Practical closed-loop production process

## AUTO ADJUSTING COOLANT MANIFOLDS

As wheels are regularly dressed, their diameter will reduce. Auto-adjusting coolant manifolds will move with the reducing wheel diameter to ensure consistent coolant delivery to the grind point. This is essential to avoid tool burn and maintain optimal grinding wheel performance.

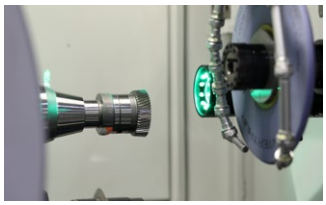
## CNC TAILSTOCK

The Travelling Steady (P-axis) is fitted with a tailstock for between centre grinding, ensuring rigid support. Tailstock position and engagement force is fully programmable. A range of replaceable male and female centres are easily changed for fast setup time.

## AUTOSTICK

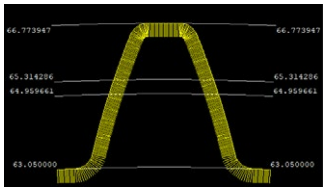
The AutoStick is the automatic wheel-conditioning system for ANCA's tool grinders. Automatic wheel conditioning improves the life and grinding performance of resin bond grinding wheels. When continually grinding, wheels become glazed or loaded. The sticking process exposes the wheel grit and removes chips (swarf) embedded in the wheel so the wheel cuts better.

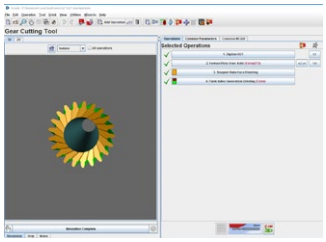
## iVIEW

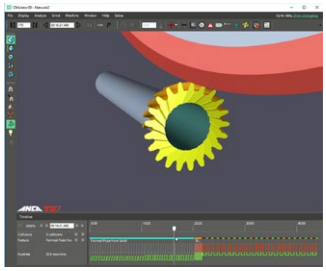


iView is a measuring system that is able to measure the ground tool while it is still in the workholding in the grinding machine. The image of the ground tool taken by the iView camera is compared with an ideal overlay profile which is generated by the iView software.

# DEDICATED SOFTWARE





The GCX Linear software package includes multiple software components for manufacturing and resharpening pinion type gear cutters. It includes design, simulation, grinding sequence programming, wheel editing and wheel dressing, tool profile and spacing measurement, direct grinding path compensation supporting full virtualisation of the manufacturing process.

Gear cutting tools, such as skiving and shaper cutters have complex geometries. The design process relies mainly on iterative optimisation. The cutter can be designed from basic gear workpiece data or the transverse section of the enveloping gear on the design station. The skiving kinematics can also be simulated to verify the cutter design and potential collision rectified.

Virtualisation of the entire manufacturing process reduces setup time and scrap, allowing streamlined manufacturing. Software modules include:

**Integrated import wizard –** guides the user through creating the wheel packs and setup grinding points.

**iGrind –** provides dedicated flank index generation grinding operation, supports both stepped and conical rake face, fluting, cylindrical grinding, step geometry editing operations, and more.

**CIMulator3D -** simulate the grinding process and analyse the parameters of each operation.

**Dresser software –** supports standard and formed dresser roll, visualise the dressing process with errors over 1µm highlighted.

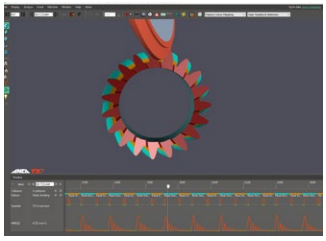
**Tool file management –** take your saved tool file straight to the machine or upload it to the tool library.

**Tool measurement -** evaluate tooth profile and spacing according to DIN standard, comparing to correct mathematical model.

**Direct path compensation -** correct tooth profile error by directly compensate the grinding path.

# SOFTWARE OPTIONS

## CIMULATOR3D



The ability to fully simulate the grinding process using ANCA's patented CIMulator3D software means the entire grinding operation, as well as the final geometry, can be set up and visually verified in 3D. CIMulator3D also provides the benefit of performing process optimisation, maximising machine utilisation and further reducing set-up times.

- The parts can also be accurately sliced and inspected in any orientation providing fine control of the measurement process.
- The ability to import DXF overlays allows comparisons to be made between the simulation and the nominal design.
- All machine models, work holding and accessories are available in CIMulator3D for the entire grinding sequence to be animated and collisions detected automatically.

## iBALANCE

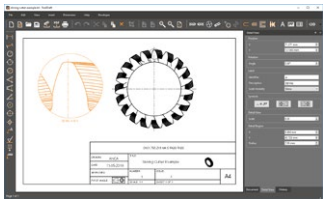

iBalance is an ANCA designed wheel balancing system to achieve perfectly balanced wheels. It is a cost-effective system as the iBalance software uses hardware already on the machine.

iBalance enables the balancing of wheel packs in the machine through a semi-automatic process. Wheel packs are balanced by adding weight to the wheel nut at locations indicated by the iBalance software. The software is also able to monitor the wheel balance while the machine is in operation. Some of the benefits of iBalance are:

- Provides improved tool surface finish due to the removal of wheel vibration
- Extends wheel life
- Cost-effective and practical
- User-friendly graphical interface

iBalance has been extended to balance the headstock to support the accuracy requirement for skiving cutters.

## TOOLDRAFT



ToolDraft is used for creating 2D cutting tool drawings from a simulated tool or direct from ToolRoom. This is built on the foundation of CIM3D engine projecting a 3D model into accurate 2D projection views. This will help customers to create drawings of cutting tools manufactured on ANCA machines without relying on third party software.

- Dimension all tool features with tolerances and surface finish requirements.
- Annotate drawing with text, images, and drafting symbols from the drafting symbols library.
- Load and save customer defined drawing templates with defined text, line and colour styles.
- Export drawing as PDF or DXF with ability to print drawings

## MANAGEMENT SUITE


Management Suite provides customers with the ability to manage their tool production, tool files and wheel files. This standalone software comes with three main features:

- REDAX monitors machine production 24/7 in real-time and delivers up-to-date information, greatly enhancing the visibility and control of the tool manufacturing operation. This system will enable customers to improve the productivity of their machines by reducing machine downtime, analysing tool production, and past production history.
- Wheel management is a server-based wheel library which provides means to easily share wheel packs and qualification data between machines.
- Tool management is a server-based application which makes it easy to transfer between simulators and machines. This also maintains version control and history of all tool files. This has user permissions for read/write for better control of tool files.

# TECHNICAL SPECIFICATIONS

## CNC DATA

• ANCA AMC5 G2 High Performance CNC, High Speed SSD, Ethercat, Intel processor, Windows 10.

## MECHANICAL AXES

| | X-axis | Y-axis | Z-axis | C-axis | A-axis |
|---|---|---|---|---|---|
| Position Feedback Resolution | 0.0001 mm<br>0.0000039" | 0.0001 mm<br>0.0000039" | 0.0001 mm<br>0.0000039" | 0.0001 deg | 0.0001 deg |
| Programming Resolution | 0.001 mm<br>0.000039" | 0.001 mm<br>0.000039" | 0.001 mm<br>0.000039" | 0.001 deg | 0.001 deg |
| Travel | 586mm<br>23.1" | 408mm<br>16.1" | 242 mm<br>9.5" | 264 deg | 360 deg |

## SOFTWARE AXES (PATENTED)

• B, V, U, W

## WORKPIECE*

• Max Tool Diameter: 260mm (10.2")
• Blank form: shank type, hub type and disk type
• Material: Solid carbide and HSS

## DRIVE SYSTEM

• ANCA Digital AMD5X (EtherCat Standard)
• Machine Axes:
  - ANCA LinX Linear Motors (X, Y & Z Axis)
  - Direct drive rotary axis (A & C axis)

## MACHINE DATA

• Grinding Spindle
  - 37kW (49hp) (peak power)
  - ANCA Bi-directional, with spindle orientation
  - 8000RPM (optional 10,000RPM and 15,000RPM)
  - Direct drive induction motor
  - BigPlus BT40 wheel arbors
• Wheel bore: 20mm, 31.75mm (1.25"), 32mm, 50.4mm (2"), 76.2mm (3")

## OTHER DATA

• Probe System: Renishaw
• Coolant System: External
• Machine Base: ANCAcrete (polymer concrete)
• Colour: RAL 7035 / RAL 5008
• Control Panel: 19" touch screen
• Machine Structure: Bi-symmetrical column

* Dependent of on tool geometry and weight, program and tooling layout