



## **QC YK73200**

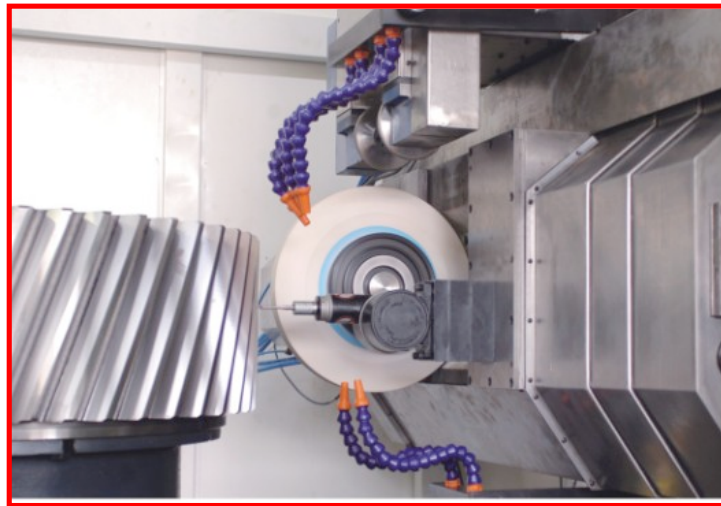
### **Vertical CNC Gear Profile Form Grinding**

#### **Machine**

The QC build philosophy is to design a machine using the best of what has been proven to work on previous (smaller) designs and then start with a design unencumbered by prior constraints. The #73200 is not the largest machine that QC has built, but it is the largest stock 'standard' commercially available machine to date for external form grinding. With features designed from the beginning to facilitate ease of loading and unloading large and varied workpieces, the #73200 uses similar grinding head designs from its smaller siblings, the #7380 and #73125, but houses these components in a more robust head and column assembly, along with a 40KW (54 HP) grinding spindle and a 1,250,0mm (49.21") tip diameter capacity. Heavier ways and a more modular enclosure are also used to make for a longer lasting machine capable of up to 1000,0mm face width (40") spur gears. Like its smaller brothers, #7380 and #73125, the #73200 utilizes a one-bed design, ribbed casting for ease of installation and overall stability.

The #73200 also utilizes the same software, on-board inspection capability and PC-Based NUM controls package as its smaller brothers and does come standard with inspection measurement and printing capability featuring Renishaw equipment. This design also utilizes Accoustic Emission (AE) monitoring equipment in conjunction with a dynamic wheel balancing system for enhanced grinding operations including grinding monitoring and anti-collision.

The working principle of this machine is form grinding. The profile of the grinding wheel is modified via on an on-board wheel dressing system and software package designed with a graphical interface to simplify complex profiling requirements.



## Main Characteristics

- Compact machine design featuring a ribbed, one-piece cast iron bed.
  - Column, carriage and workpiece table utilize a constant flow hydrostatic guideway system.
  - Ergonomic design with complete machine access from the ground floor and through a well designed and completely lit enclosure.
  - Flexible workholding area to accommodate all manner of customer workpieces up to 1750,0mm in height (68.89”).
  - The on-board automatic dressing cycle of the grinding wheel improves the uptime and efficiency of this machine tool. Using customized QC Software with a conversational format, profiles of the grinding wheel are easily modified.
  - NUM (Swiss Made – USA Serviced) 1050H PC Based CNC control with
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Eight (8) independent axes of control.

- Integrated Schmitt Industries (SBS – USA) dynamic grinding wheel balancing system for greater control of the grinding and dressing process.
- The special Human Machine Interface (HMI) was developed by QC according to the working characteristics of North American gear processing. Based on a conversational programming protocol, programming is simplified by entering work piece parameters and relevant technical parameters as called out by the operator.

## Technical Data

|   |           |             |               |
|---|-----------|-------------|---------------|
| Tip Diameter                              | Max.      | 2,000mm     | 78.74"        |
| Root Diameter                             | Min.      | 300mm       | 11.81"        |
| Number of Teeth                           |           | Any         |               |
| Profile depth                             | Max.      | 80mm        | 3.15"         |
| Module (Diametral Pitch)                  |           | 2-35mm      | 12.7 – .726DP |
| Helix Angle                               |           | ± 35°       |               |
| Maximum Face Width (Spur)                 | Max.      | 1000mm      | 39.37"        |
| Stroke Length @ 45 Degrees                | Max.      | 1000mm      | 39.37"        |
| Rotary Table Load                         | Max.      | 20,000KG    | 44,092 lbs    |
| Rotary Table Diameter                     |           | 1450mm      | 57.08"        |
| Rotary Table Speed                        | Max.      | 1.5RPM      |               |
| Height between Tailstock Center and Table | Min./Max. | 1000/1750mm | 39.37"/68.89" |

## Grinding Wheel

|                    |           |           |               |
|--------------------|-----------|-----------|---------------|
| Diameter           | Min./max. | 300/400mm | 11.81"/15.75" |
| Dressable Diameter | Min.      | 180mm     | 7.09"         |
| Width              | Max.      | 110mm     | 4.330"        |
| Speed              | Max.      | 50m/sec.  | 9840SFPM      |
| Drive Power        | Max.      | 240KW     | 54 hp         |

## Machine with Auxiliary Units

|                         |         |                   |                        |
|-------------------------|---------|-------------------|------------------------|
| Total connected load    |         | 75KVA             | 75KVA                  |
| Amp Draw                |         |                   | 100 Amps               |
| Net weight              | Approx. | 45,000KG          | 99,208 lbs             |
| Space requirement LxWxH | Approx. | 9000x6000x4800 mm | 354.33"X236.2"X188.97" |
| Voltage                 |         | 460/480           | 460/480                |

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## **1. Base Machine**

### **1.1 Assembly Groups**

- **Machine Base** of a ribbed cast iron design; carries the column, rotary table and outer column. Installation on leveling/vibration isolation pads.
- **Column** made of cast iron with constant flow hydrostatic guide ways. Radial infeed using precision ball screw, powered directly by an AC servo motor.
- **Rotary table** with constant flow hydrostatic bearing. Driven by AC servo motor through backlash free worm wheel.
- **Stroke slide** with constant flow hydrostatic guide ways. Stroke motion through precision ball screw, powered directly by an AC servo motor.
- **Grinding slide** with tangential movement using precision ball screw, powered directly by an AC servo motor.
- **Grinding spindle** is a direct drive high-speed spindle.
- **CNC dressing device** is a stationary unit for dressing grinding wheels with dressing spindle and diamond dressing wheels. The dressing paths are generated by the vertical and the tangential grinding slide movement.
- **Outer column** for clamping pinions between centers. Tailstock height adjusted through a screw and nut assembly.

### **1.2 Electrical Equipment**

#### **1.2.1 Power Supply**

Operating voltage is 460/480 Volt/3Phase/60Hz.

#### **1.2.2 Operator Interface Features: NUM Power 1050 Axium CNC Control**

- Operator station with TFT color flat screen and control panel in front of the control cabinet. Integrated keyboard with a team of horizontal and vertical soft keys.
- Hand-held operating panel for more convenient set-up of the machine.
- The machining program uses standard CNC conversational programming language fully developed by QC, and the interface program uses NUM standard MMI TOOL software.
- Swiss-owned NUM is serviced out of Naperville, IL. QC American provides front-line service regardless.

#### **Control Interface Features**

- Windows XP Professional Operating System
- 586MB Pentium processor
- 30GB hard drive
- 128M RAM
- 56K modem
- Two USB Ports for archiving user and machine data.
- 3.5" floppy drive.
- Parallel interface for connecting a printer.
- Serial interface for common use.
- Ethernet interface.

#### **Service Functions**

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- Integrated modem and ethernet ports for remote diagnostics connection between QC computers.
- Graphical display of processing data.

## 1.0 Software for PC Based NUM Axium Power 1050H Control

This QC Developed software package enables the user to generate, edit and optimize grinding programs and analyze processing data on the PC on the machine or a remote PC. The software interface is identical with the machine control menu and may even be used for rudimentary training purposes.

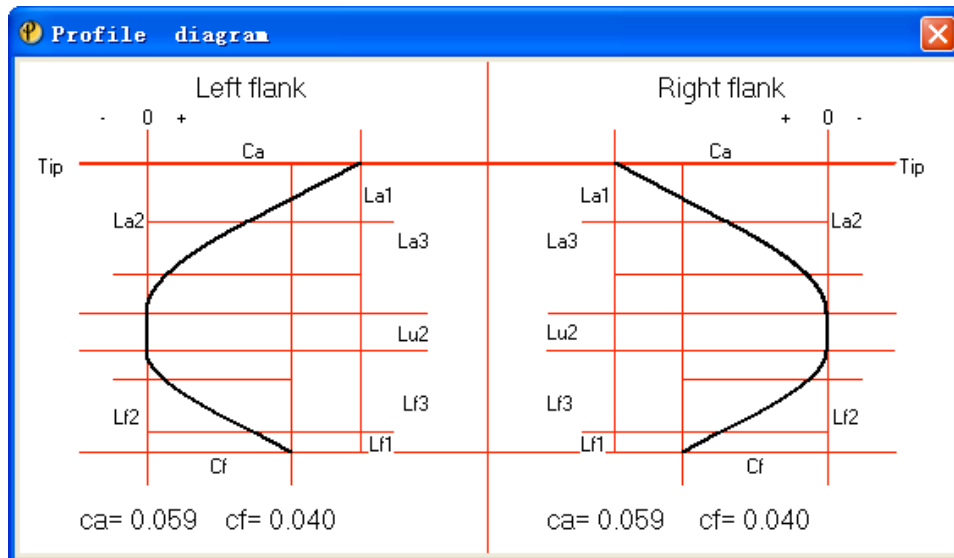
- **Gear parameters calculation module – Input and storage of workpiece data.** This module consists of a conversational interface for geometrical parameter data entry, technical parameters and measuring parameters to facilitate computing of standard gears, gears with addendum modification, modified spur (helical) cylindrical gears. Basic work piece data is recorded into a database for later editing or processing.

The screenshot shows the 'CAM system Gear form grinding machine [Part No.]' window. It features a menu bar with 'Data input', 'Data diagnosis', 'Other parameters', 'Data maintenance', and 'Operation Wizard'. The 'Gear parameters' section includes a 'Part No.' field with 'pn' and a 'Direction of helix angle' section with radio buttons for 'Spur', 'Left', and 'Right' (selected). The main area contains several input fields: 'Number of teeth' (28), 'Normal module' (8), 'Tooth width' (100), 'Pressure angle' (20), 'Helix angle' (25), 'Shaft angle' (65), 'Addendum factor' (1), 'Dedendum factor' (1.25), 'Addendum modification factor' (0.00), and 'Radius of grinding wheel' (100). A 'Calculate' button is located below these fields. At the bottom, there are fields for 'Radius of measuring circle' (123.57832692), 'Accuracy' (0.0005), and 'Tolerance degree' (3). A row of buttons at the very bottom includes 'Close', 'Base parameter', 'Tooth thickness', a hyphen, 'Edit', and 'Save'.

- **Profile computing module for grinding wheel – Profile and Lead modification.** This module serves to gather data in order to generate the correct wheel profile through an editable series of dressing cycles using the on-board dressing wheel system. Based on data entered about the workpiece and special requirements on gears to be machined; including profile, lead modification and fillet curve parameters, the profile of the grinding wheel can be automatically computed to meet the task at hand.

The screenshot shows the 'CAM system Gear form grinding machine [Part No.]' window in the 'Profile computing' section. The title bar reads 'Calculate the basic calibration error base on the profile measuring diagram'. The interface contains several input fields for evaluation ranges and errors: 'Start radius of evaluation range (R2)' (116.5), 'End radius of evaluation range (R1)' (129), 'Error of profile (left flank) [JL]' (0.021), 'Error of profile (Right flank) [JR]' (-0.01), 'Error of infeed [H]' (-0.01773), and 'Error of grinding wheel centre [A]' (-0.13645). Below these are 'Calculated results' for 'XDAT2 = XDAT2 -' (-0.0177) and '[TRIMZDAT] = [TRIMZDAT] -' (-0.1364). A diagram on the right shows a gear profile with 'Measuring end circle R1' and 'Measuring start circle R2' indicated, along with 'Left Flank' and 'Right Flank' labels. A 'QC A' watermark is visible on the left side of the image.





- **Conversational Control Design.** The G code will be automatically created based on the gear processing and grinding parameters entered by the user. In addition, the customers can even directly use and upload straight G code if desired.
- **Customer can add specific modifications to suit their applications.**

## 1.5 Axis Information

### Eight (8) CNC Controlled-Axes

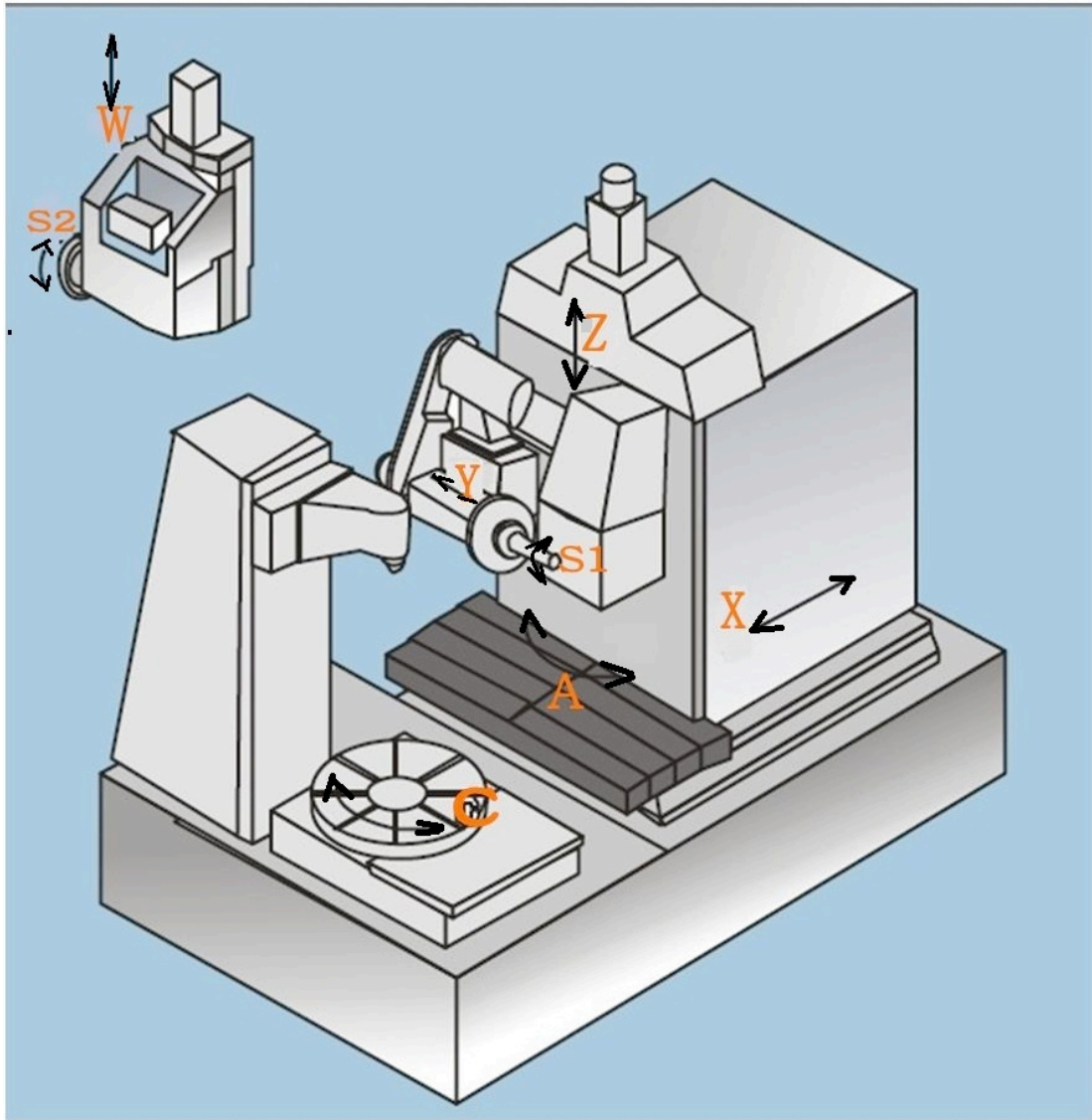
- 'X'-Axis. Radial movement of the column. Constant Flow Hydrostatic Guideway. AC Servo motor with precision ball screw.
- 'Z'-Axis. Axial vertical movement of the grinding stroke slide. Constant Flow Hydrostatic Guideway. AC Servo motor with precision ball screw.
- 'Y'-Axis. Tangential movement of the grinding slide. Schneberger Needle Type Linear guideway. AC Servo motor with precision ball screw.
- 'A'-Axis. Rotary movement of grinding wheel head for grinding helix angles. Rotary positioning encoder – Heidenhain.
- 'C'-Axis. Indexing and rotary movement of the rotary table. Constant Flow Hydrostatic Guideway. Heidenhain +/-0,001mm Resolution.
- 'W'-Axis. Dressing axis of grinding wheel. Schneberger Needle-Type Linear guideway.
- 'S1'-Axis. Rotation of the grinding wheel.
- 'S2'-Axis. Rotation of the diamond dressing wheel.

All CNC axes utilize closed-loop controls. The positioning feedback devices of each axis utilize HEIDENHAIN high precision encoders and scales.

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### 1.6 On-Board, Integrated Measuring System (*Option*)

The machine can be equipped with a Renishaw measuring system on-board the machine. Including the #LP-2 measuring probe, cables, adapter card and a QC software integration module. It is very easy to connect with your printer through one of the USB ports on the control. You can store or print measurement reports at any time. Based on the measuring data, the on-board inspection system can draw out a diagram of profile, lead, pitch, cumulative pitch of gear tooth and print and/or store the measuring data to allow for analysis of the previous grind cycle's effect on the workpiece. The program can automatically analyze and judge the measuring results, correct the machine parameters and the profile data of the grinding wheel.

This system has long been perfected on the #YK7380 & #YK73125 machines. There is an electrically operated moveable arm carrying the measuring probe. The arm automatically rotates as the machine moves to the measuring position, which is located close to the grinding wheel. See picture, on page 2.

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## 2.0 Peripherals

### 2.1 Hydraulics/Lubrication

Complete hydraulic system for lubrication, clamping, and tailstock stroke.

### 2.2 Hydrostatic System

Complete constant flow hydrostatic system for 'X', 'Z' and 'C' Axes.

### 2.2 Coolant Filtration System

The coolant filtration system cleans used coolant using paper filtration media and includes the following:

- Temperature controlled for grinding fluid utilizing a chiller-type oil cooler.
- Filter capacity=120L/min.
- Multiple circuit coolant chilling equipment: With automatic temperature regulation for cooling oil.
- Oil mist recovery and electrostatic air filter system.

## 3.0 Standard Machine Accessories

|    |   |       |  |
|----|---|-------|--|
| 01 | Leveling & Vibration Isolation Pads for Machine Foundation. | 1set  |  |
| 02 | Special tools; wrenches & tools specific to the machine.    | 1set  |  |
| 03 | Balance Blocks, Set   | 40pcs |  |
| 04 | Grinding Wheels – To Suit Application                       | 2pcs  |  |
| 05 | Diamond Dressing Wheel (2pc)                                | 1set  |  |
| 06 | Grinding Wheel Flanges, 150,0mm                             | 6sets |  |
| 07 | Operation Manual, Set                                       | 1set  |  |

### 4.1 Machine Color

Machine and peripheral units: Blue

Doors: White

### 4.2 Power-off Protection System

For controlled retreat of the machine into a safety parking position in case of a power outage to protect workpiece and tools. Included.

### 4.3 Operator Training at Customer Facility

Our program is designed to prepare your operators to begin operating the machine directly before or after final acceptance at your facility, or a QC American LLC in Ypsilanti, MI.

## 5.0 Special Accessories (Options)

|          |                                       |      |  |
|----------|---------------------------------------|------|--|
| Option A | Balance core shaft for grinding wheel | 1set |  |
| Option B | Balance frame for grinding            | 1set |  |

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|          |   |   |        |  |
|----------|---|---|--------|--|
|          | wheel balance   |   |        |  |
| Option C | Measure bar   |   | 1set   |  |
| Option D | Standard gear   |   | 1set   |  |
| Option E | Oil mist recovery and electrostatic air filter                              |   | 1set   |  |
| Option F | On-Board Measuring System and Machine Integration.                          | Renishaw #LP-2                          | 1set   |  |
| Option G | Printer   | Print Measuring Reports                 | 1set   |  |
| Option H | Ebbco Metalworking Filtration System – 80psi @ 100GPM Cartridge-Type System | #PMF-MWF5-623-T-FP<br>BFH-FP-24K J-8705 | 1 Each |  |

## 6.0 Warranty

A warranty period of 12 months on entire machine and accessories from time of final acceptance or 5,000 hours of use – whichever occurs first. An extended warranty is available per further negotiation(s).

## 7.0 Spare Parts Warranty

Spare Parts availability is guaranteed for 10 years from the date of machine commissioning with deliveries under current market conditions.



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