CAM-SXE to CAM.2 Upgrade

Control changes:
The CAM.2 incorporates a more robust motion controller giving the machine added functionality while also making it easier to operate and program. As opposed to a sequential controller on the CAM SXE, the CAM.2 uses a high speed 9.6 KHz servo loop providing better diameter control and smoother motion.

CAM.2 vs CAM-SXE Control system comparisons:

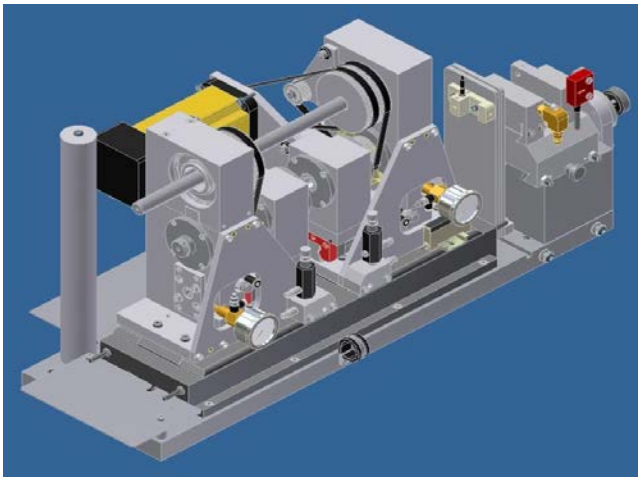
CAM SXE	CAM.2
	☐ Redesigned control screen access. Tab structure allows the operator to move from screen to screen faster. All machine functions are accessible from the main screen.
	☐ More detailed feeder troubleshooting screen
	☐ Setup information such as wheel type can be saved with part file to ease machine setup.
☐ 8 motion control related components including Parker 6K motion controller, Digital drives and daisy chained I/O modules mounted on drawer under base.	☐ Previous components were replaced with 1 High speed DSP intelligent controller which handles all axis and I/O. and is mounted in a self-contained electrical cabinet
	☐ Higher speed servo loop produces tighter positioning control for grinding wheel and dressing wheel axis. This results in better dressing and superior shape generation on the part.
	☐ High electrical noise immunity, eliminating "hang ups" previously attributed to the controller used.
☐ Stepper dresser motor	☐ Servo Dresser motor
	☐ Uses current programming methods such as the now familiar segment screens to program part geometry.
☐ Program using wheel path geometry. Program coordinates do not represent the part geometry.	☐ Part dimensions are entered per print in the program. Segment geometry represents the print dimensions.

☐ No G Code programming. Limited controller instruction set	☐ Full G code interpreter allowing more complex simpler programming steps such as looping, I/O control and many more features.
	☐ Future compatibility with 3rd party CAM packages such as Gibbs and Master Cam
	☐ Ability to pause in a cycle ☐ Ability to actuate external devices from the program
	☐ Cutter compensation built in allows the wheel width to be entered as a tool further simplifying program entry.
	☐ Wheel wear can be compensated for using cutter compensation eliminating the need to adjust the part geometry to compensate for wheel breakdown.
☐ 10" touch screen control	☐ 15" touch screen control
☐ Grinding flats, balls required additional axis moves.	☐ Better handling of arcs, flats, and balls using simpler programming methods.
	☐ Greater control over dressing (can now specify dress increments, before dress increments were fixed values determined by the wheel type).
	☐ Size adjustments can be made on the fly while the part is being ground. The dimensional change takes place on the next grind.
	☐ Far fewer pop-up screen messages
	☐ Can view segments screen while grinding.
	☐ Multiple manual jog speeds.
	☐ Redesigned Robust CNC dresser to dress wider variety of super abrasives such as, CBN, Vitrified diamond. (Some later CAM SXE machines had these dressers installed)

X-Axis modifications:

- Balanced collet pulleys and shaft assembly allows for collet speeds up to 100 revolutions per second with minimum vibration. Balanced high-speed rotation is crucial to improve surface finish on certain diameter parts.

Both left and right collet towers are line-bored in a fixture at the factory and assembled with balanced pulleys and linear bearing components. The assembly is then tested for speed and vibration stability.

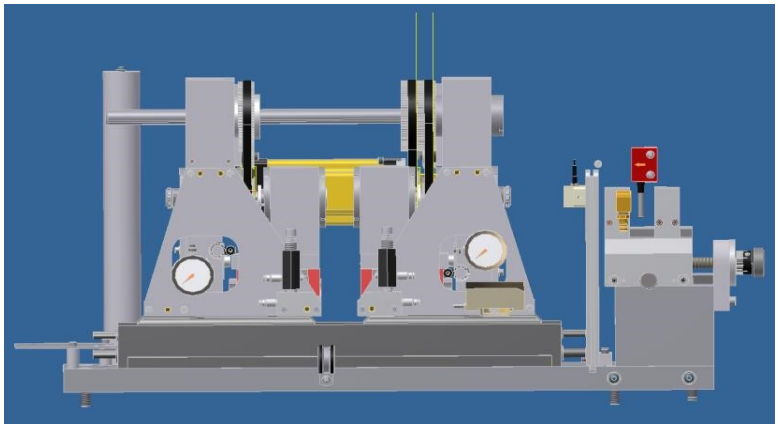


Linear motor replacement:

- New Linear motor design contains more robust linear scales less susceptible to contamination, stronger force spec to handle large diameter product and improved protection from coolant spills with better gasket protecting the motor.

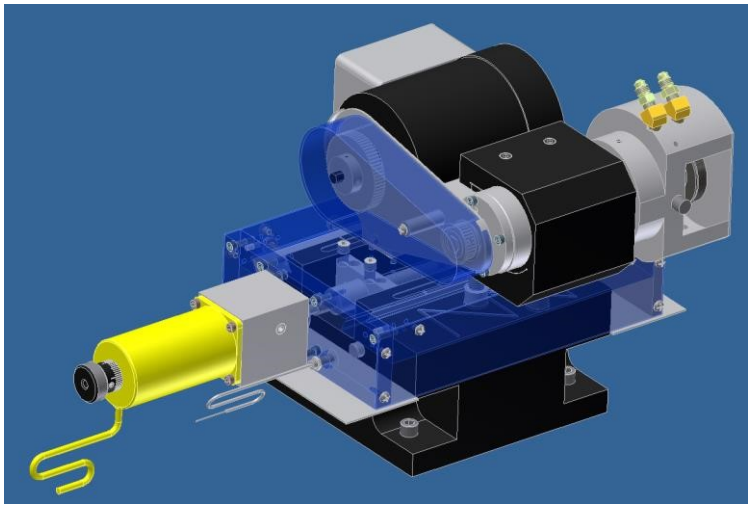
Air components:

- Independent collet Pressure gages and valves allow fine adjustment to the collet closing pressure.
- Magnetically coupled sensor mount makes cleaning the index sensor simpler.



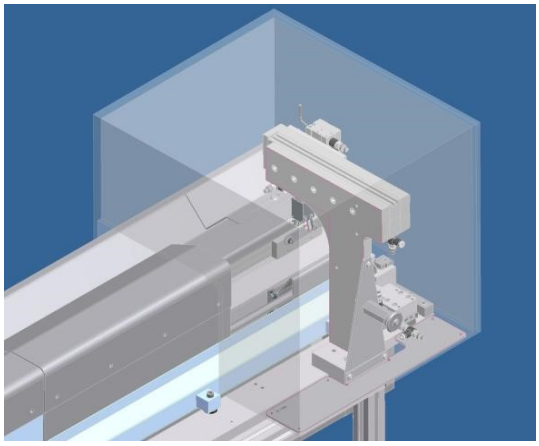
Dresser modifications:

- Due to the increased use of Vitrified diamond and CBN grinding wheels, the dresser has been redesigned to include a high precision, zero-backlash ball screw, servo drive and dovetail ground dresser bed assembly providing a stiffer setup and more consistent dressing of super abrasive compounds. - Modified cartridge spindle assembly with improved sealing



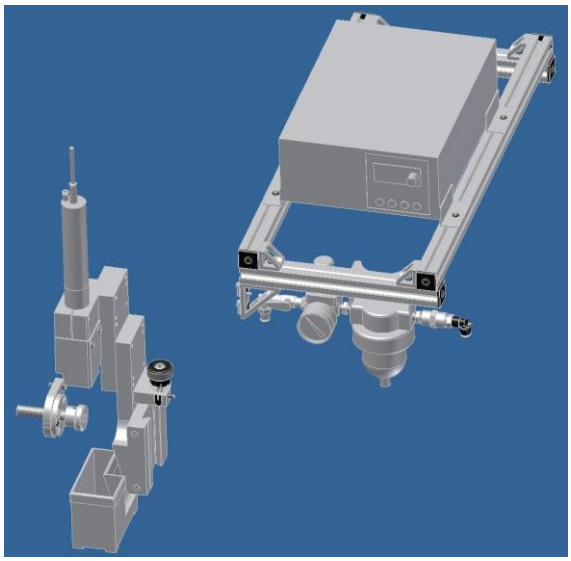
Feeder modifications:

- The feeder pick/place assembly has been redesigned to pick a larger volume of parts. Instead of picking parts from a 45-degree angle, the vacuum unit picks the wire from a vertical position allowing more wires to be staged into the trays.
- A wire hold down air assembly enables wires as small as 0.009” to be stripped from a bundle more effectively increasing the reliability of the feeding system for small diameter wires.
- Replacement of the retracting air cylinder with a sealed more robust unit.



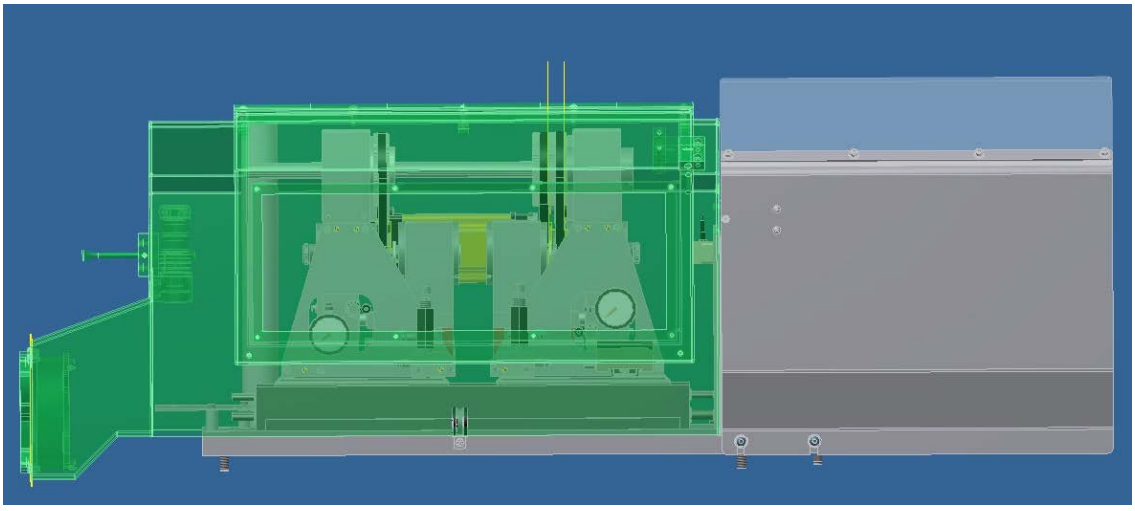
Slot cutting Assembly SA-578:

- Machine attachment provides the ability to slot parts on the exit side of the machine. High-speed precision spindle mounted on the dovetail fixture mount can be controlled from the CAM.2 machine.



Covers:

- Sheet metal redesign (green shadowed items below) has built in fan assembly.
- Removal of X-axis (Inchworm) box does not disrupt the alignment of the exit tube leaving the feed mechanism area.
- Safety interlocks and spray shields contain coolant spray and interrupt the cycle when guards are removed from the machine.



Vector drive:

- New compact improved performance vector drive for the work wheel motor

Wire detection Sensors

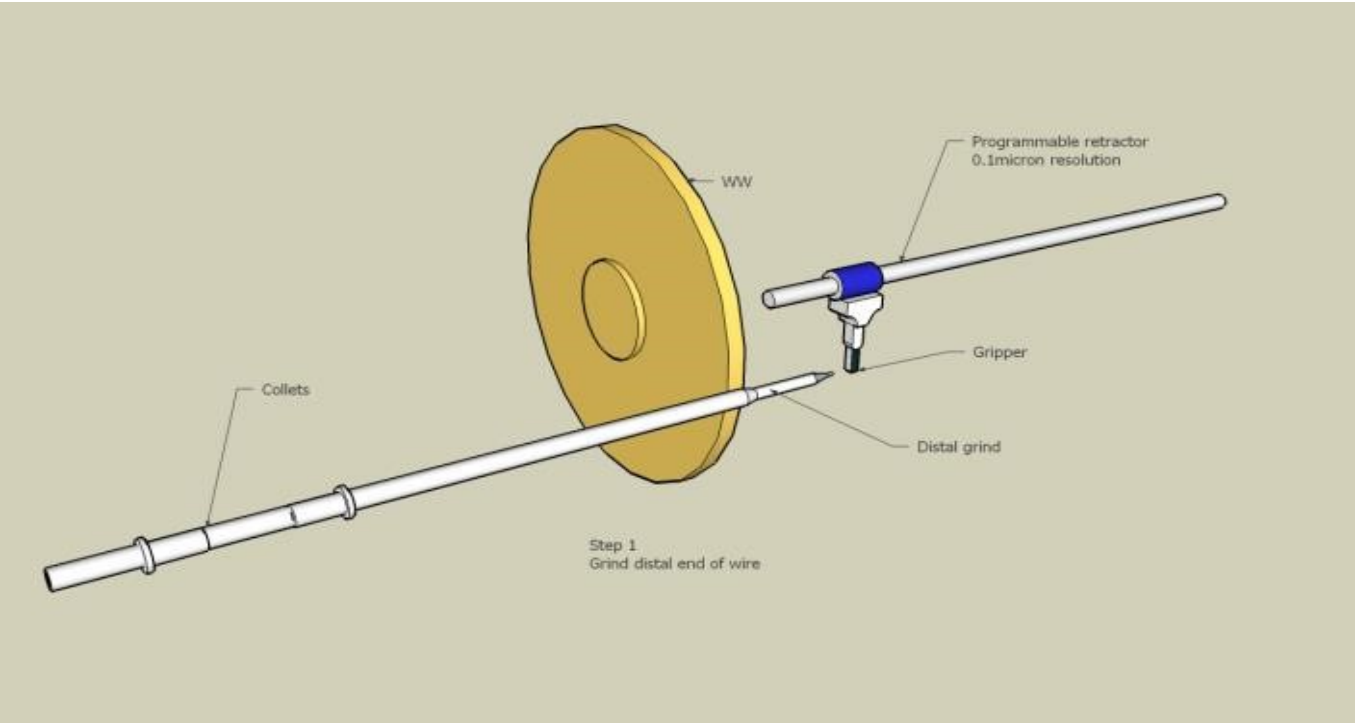
- Three options to control product placement in the grind zone o Photoelectric sensor o Laser thru beam sensor
    - o Vision system – for applications where pre-process features vary from part to part

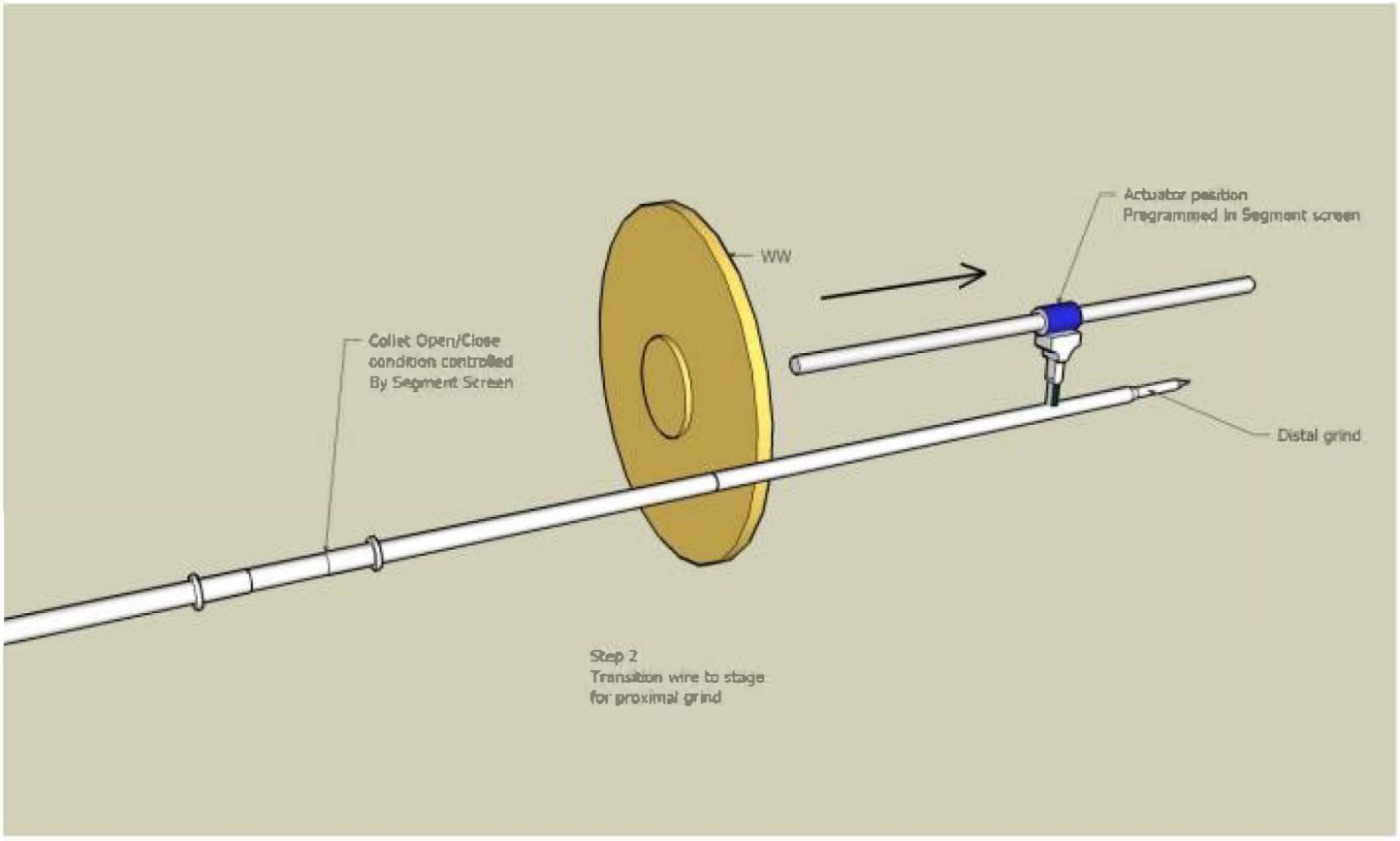
Grit blasting attachment:

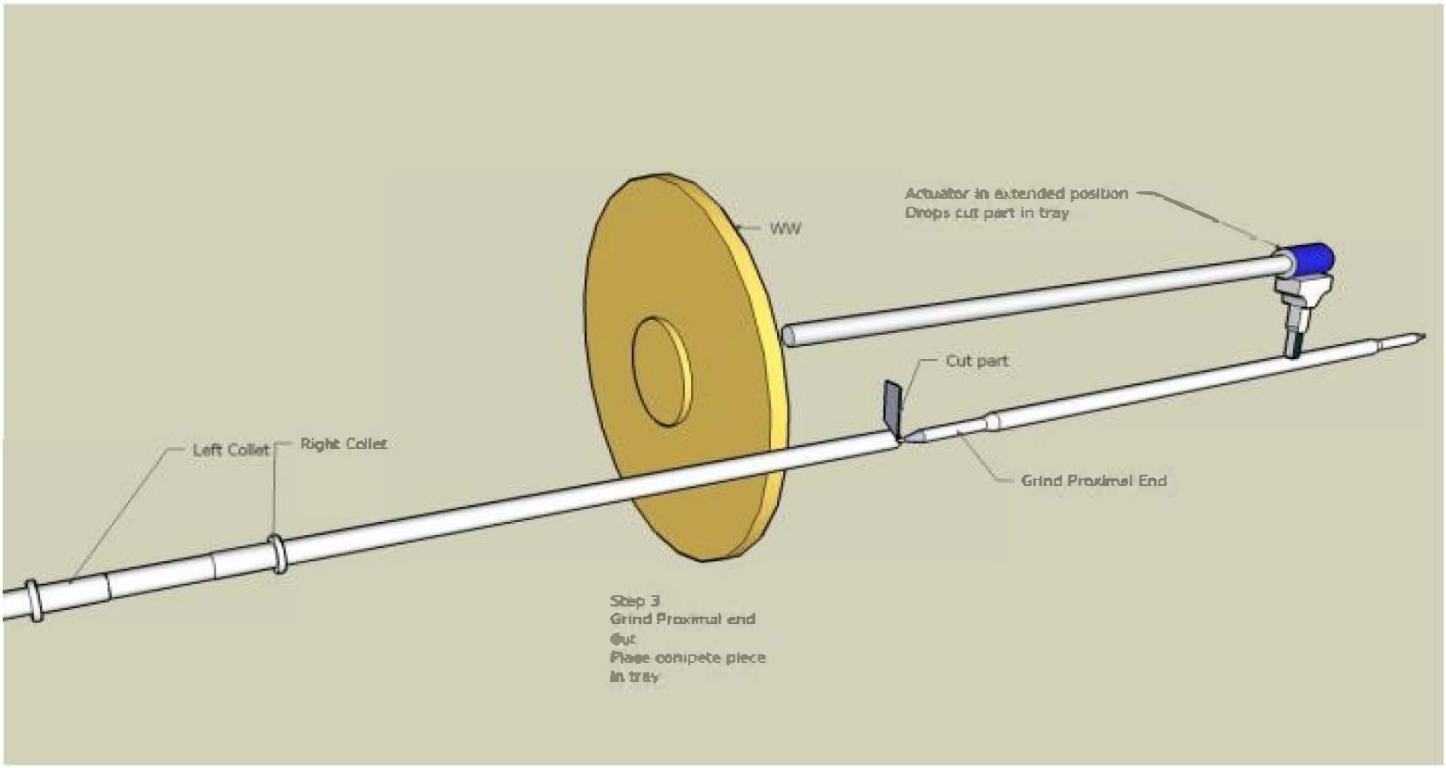
- Control grit blasting process on the machine

High speed wire retractor:

- In addition to air operated basic retractor on the CAM-SXE a programmable high speed gripper and wire retractor for the CAM.2 utilizes a precision linear motor. This option allows the CAM.2 to rapidly traverse from the distal end of the wire to the proximal end without losing length accuracy where part length accuracy is critical or where proximal shapes are ground into the wire







Contact gage option

- Ability to integrate in-process contact diameter gage for feedback

Spool cutter

- Integration of spool cutter to all feeders to payout and cut to length both Nitinol wire and SLT wire for automatic feeding to the machine.

OPC / OEE

- All CAM.2 machines control software includes a multitude of OPC tags for Overall Equipment Effectiveness data gathering software which allows a supervisory control system to monitor all aspects of production.

P4K interface:

- Up to seven CAM.2 machines can be networked to each P4K gage using unique machine IP addressing. Diameter feedback by lot can be sent back to the machine for diameter adjustment without stopping the process.