

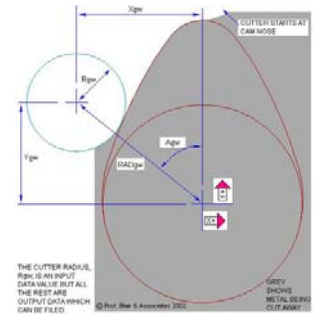
Case Study of FORTUNA CAM GRINDING MACHINE CNC and Servo Retrofit

Background : A tier one Automotive components manufacturer wanted to upgrade the control of its CNC controlled CAM grinding machine. The original motors & servo drives were from Indramat and the CNC control was from Fortuna.

The electronics of drives and controls were not in a good shape. However the mechanical condition of the machine was good enough to produce high precision CAM shafts for automobiles.

The customer approached Logical Solutions and Siemens Ltd. to find out the feasibility of the CNC retrofit. The machine was jointly inspected by Logical Engineers and Siemens personnel. The customer had a large installed base of Siemens controls and was very happy with the performance of the controls and service support from Siemens.

The Fortuna make *CAM grinder* was taken up for retrofit to change the electrical control system. The change in control meant change in the way the operator interfaces with the machine. This was explained to the customer personnel in advance.



The customer was informed that the installation, maintenance and operation manuals provided by the Original Equipment Manufacturer (OEM) will be required to operate the machine as per the specifications. The scope of work for the retrofit activities involved change of controls only and hence the guidelines given by original manufacturer must be adhered to. Logical studied all the documents from the OEM and provided a complete Mechatronics support to the customer personnel working on the Mechanical aspects of interfacing.

The mechanical specifications of the machine remained unaltered and hence it was advised that the grade / quality / specification of consumable items such as Lubrication Oil, Coolant, Industrial Diamond, Grinding Wheel, Compressed Air and any other items remained unchanged.

The machine now has six axes with servodrives of SIEMENS make for work head (C-Axis), Wheel axis (X-axis) and table traverse (Z-axis), Dresser depth axis (B-axis), dresser traverse axis (A-axis). The 840D CNC control included OP12 as an operator interface with PCU50, MCP and Handweel.

The change of controls was in no way supposed to affect the Preventive Maintenance schedule of the machine and hence the schedule was to be adhered to as per the standard.

There are several utilities associated with the machine such as

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| 1) Spindle lubrication system | 2) Hydraulic power pack |
| 3) Pneumatic system | 4) Oil Chilling System |
| 5) Oilmist filter system | 6) Coolant filtering system, |
| 7) Wheel Balancer, | 8) Marposh Measuring Device |
| 9) Gap Control System | 10) Refu Wheel Spindle Drive |

The new control system was required to interface with these units through properly identified signal levels. However the working of all these utilities remained as earlier and the operation and maintenance of these units was carried out as per the procedures given by the Original Equipment Manufactures.

An electrical circuit diagram of the new control system was developed by Logical Solutions. However the pneumatic & Hydraulic circuit diagrams provided by the OEM were referred to while carrying out maintenance of the machine

Modifications Carried out During retrofit

The CAM Grinding Machine Operation Manual indicates Metric System of measurement, the same system of conversion was followed while developing part programs. All linear dimensions are in millimeters unless and otherwise specified. All feed rates are in mm / min unless and otherwise specified. All dimensions are in mm and diametric unless explicitly mentioned as radial. All revolutions are in revolutions / minute unless specified otherwise.

Six Servo Motors for wheel axis, workhead axis, Dresser depth axis, dresser traverse axis, and for job rotation were changed with Siemens servo motors. As the motors were changed the couplings

and adapter plates for these motors respectively were designed and changed in order to interface with the machine to transmit the power from the Servo Motor to the ball screw. All the motors are flange mounted to the machine. An inbuilt incremental encoder with 2048 pulses per revolution gives the feedback to the CNC system.

The original servo drives used potentiometers for set-up purposes. Upgrading to digital drives made for robust functionality; "set it once, and it's set until you want it changed." Machine set-up was made even easier with set-up software from Siemens and the onboard axes tuning utility of the 840D.



Work Carried Out

- Initial documentation and application Study
- Electrical design
- Interfacing of Panel with Field elements
- PLC Software development
- Part Program & Cycles development
- Support during Laser calibration for all axes
- Commissioning and prove out
- As built documentation
- Training and Hand over to the customer personnel

Challenges Faced

- Optimization of 840D controller to suit application
- Selection of new motors that were similar to the original ones.
- X and C axis synchronization.
- Generating velocity & position profile for CAM

Operation The new system was completely programmed, tested and run-off for approval prior to handing over the machine to the customer. Logical field checked the machine for adapter plate accuracy as well as verifying the mechanical interface for existing motors. Program codes were documented while the machine was running. Traces of velocity and amperage for each axis were also recorded after to the retrofit.

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