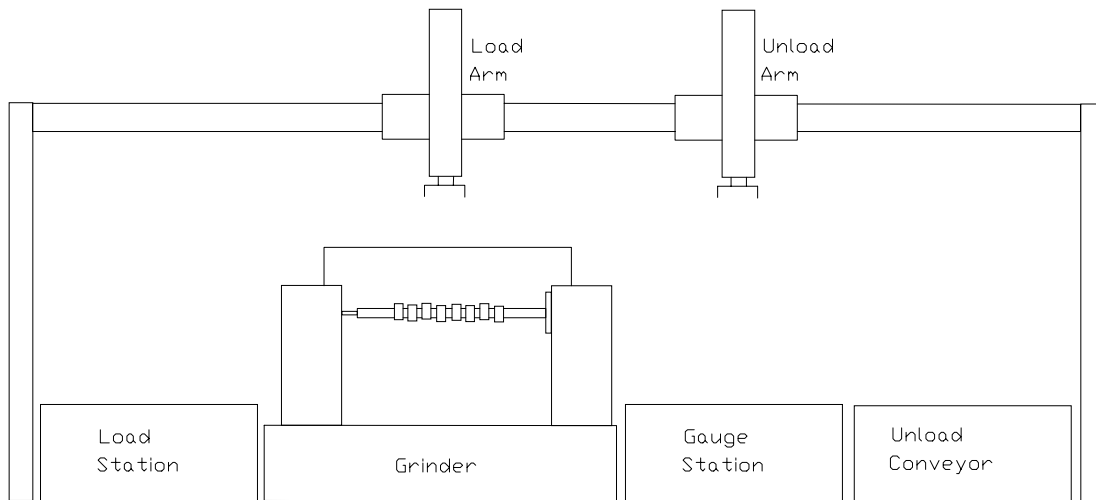
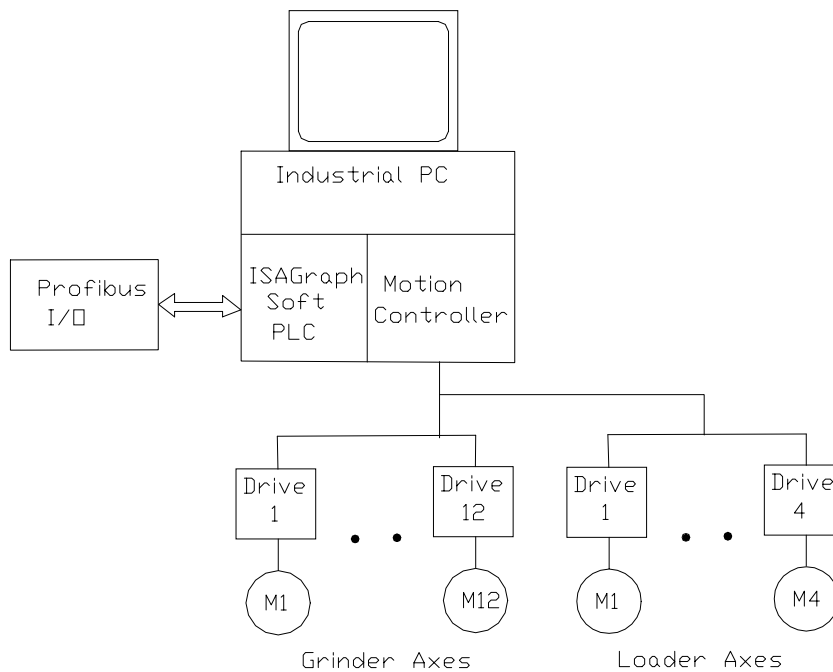


Camshaft Grinder with Loader

I²T designed the control system and wrote the application software for a sixteen axis profiling camshaft grinder.



The following shows a block diagram of the control hardware used.



All of the control hardware for this project is housed in a Pentiumbased industrial PC. The motion control, PLC, and user interface applications all run concurrently on the PC. Both the grinder and loader are controlled using a single U600 PC-based motion control board. The grinder and loader logic is performed by ISAGraph (a software PLC) driving Profibus I/O modules, with the grinder having twelve axes of motion and the loader having four axes of motion. The grinder and the loader were designed as separate machines that run independently as separate tasks under Windows NT. The user interface for the application was done using Visual C++.

The grinder axes include a work rotation axis, a work feed axis, left and right taper compensation axes, and eight grinding head axes. The work axis rotates the camshaft at a precise speed while it is being ground. The feed axis does rapid feeds of the camshaft into the grinding belts. The left and right compensation axes ensure that the camshaft is perpendicular to the grinding belts. The eight grinding head axes are each profiled to the work rotation axis to grind the proper shape on each lobe of the camshaft. As the camshaft rotates, the head axes move in and out independently to provide the final shape of the lobes. Each camshaft is gauged after it is ground, and the resulting information is feed back into the software so that the profiles can be adjusted on the next part.

The loader consists of two arms, with each arm having an X-axis and a Z-axis. The function of the loader is to pickup parts from a conveyor, put parts into the grinder, remove parts from the grinder, put ground parts into a gauge for testing, and then put the finished parts into a pallet. For optimal cycle time, one arm is used to load the grinder with a rough part, while the other arm unloads the finished part from the grinder. Each finished part is gauged, with any rejected parts being discarded.