



## Quantum™ controller and Concept™ software improve steel mill productivity

### Introduction

This application is part of an overall control upgrade for a Steel Mill in Birmingham, AL. The mill takes steel scrap, melts it in an electric furnace, and pours it into a continuous caster to make billets. The billets are then rolled into structural shapes for sale. This portion of the job was the continuous caster. The job was a conversion from an old Reliance Automate system. The Automation system was based on an outdated PLC and the mill was converting to Modicon Quantum PLCs.

### Application

In this part of the application, liquid steel is poured from a ladle coming from the furnace into a vessel with openings in the bottom. The liquid steel flows from this vessel into a water-cooled mold the size of the desired billet. When the steel reaches the desired level in the mold, drives pull the steel bar out the bottom and turn it onto a bed where it is cut to length. Speeds of the drives are adjusted to regulate the level of the steel in the mold. Cooling water flow rates are coordinated with the speeds of the drives to control the rate at which the billet is cooled. All automatic and manual controls are included in the PLC for control of drives, water valves, pumps and other ancillary equipment.

### Objectives

The old control system was out of date, and parts as well as software were obsolete. The decision had been made to upgrade all controllers in the melt shop to Modicon Quantum controllers and to replace all existing IO as well. Additional considerations were the improvement of communications by going from serial communications to Ethernet.

Additionally, a prime objective of a conversion like this is to have a smooth transition. The system had to work properly the first time steel was poured. It goes without saying that spilling liquid steel either over the top of the mold or operating the drives too fast and spilling steel out of the bottom of the mold was to be avoided at all costs.

### INDUSTRY

Iron and steel

### OBJECTIVE

Upgrade all controllers in the melt shop and replace all existing IO

### SOLUTION

- Modicon® Quantum™ Controller
- Modicon Concept™ Software

### BENEFIT

The use of Quantum PLC and Concept software updated the system and allowed a critical control scheme to be installed, tested and tuned prior to pouring hot metal.

### *Solution*

The decision was made to not only upgrade to the Quantum™ PLC but to use Modicon Concept™ software as well. Since the old system was not Modicon, and everything had to be rewritten from scratch, changing to Concept made sense. Ladder logic in the old control system was replicated as closely as possible, while the old analog control sections were discarded and written from scratch. Concept software allowed this type of conversion. Analog control sections were written in function block with some structured text.

Another consideration in choosing Concept was the ability to do detailed simulations of the process. The mold level controls were not only written in function block, but simulation sections were written as well to mathematically calculate steel levels in the mold. This allowed preliminary tuning of the PID algorithm. This tuning was deemed necessary since there was no way of converting the tuning parameters from the old system to the new. Parameters such as drive ramp rates and lag times were included in the simulation. Once the system was installed another level of simulation allowed the actual drive feedback to control the math for the level control, leaving only the actual level feedback that could not be simulated.

Once the last simulation was complete, all possible billet sizes had been test run prior to actually pouring any steel.

### *Benefits*

- The use of Quantum and Concept allowed a critical control scheme to be installed, tested and tuned prior to pouring hot metal.
- The system started automatically the first time, controlled the level as it should and made product from the first pour.
- The customer has an up-to-date control system with capabilities to add Ethernet communications in the future.
- Training is reduced by the intuitive nature of Concept.