

## Control System Modernization

### Introduction

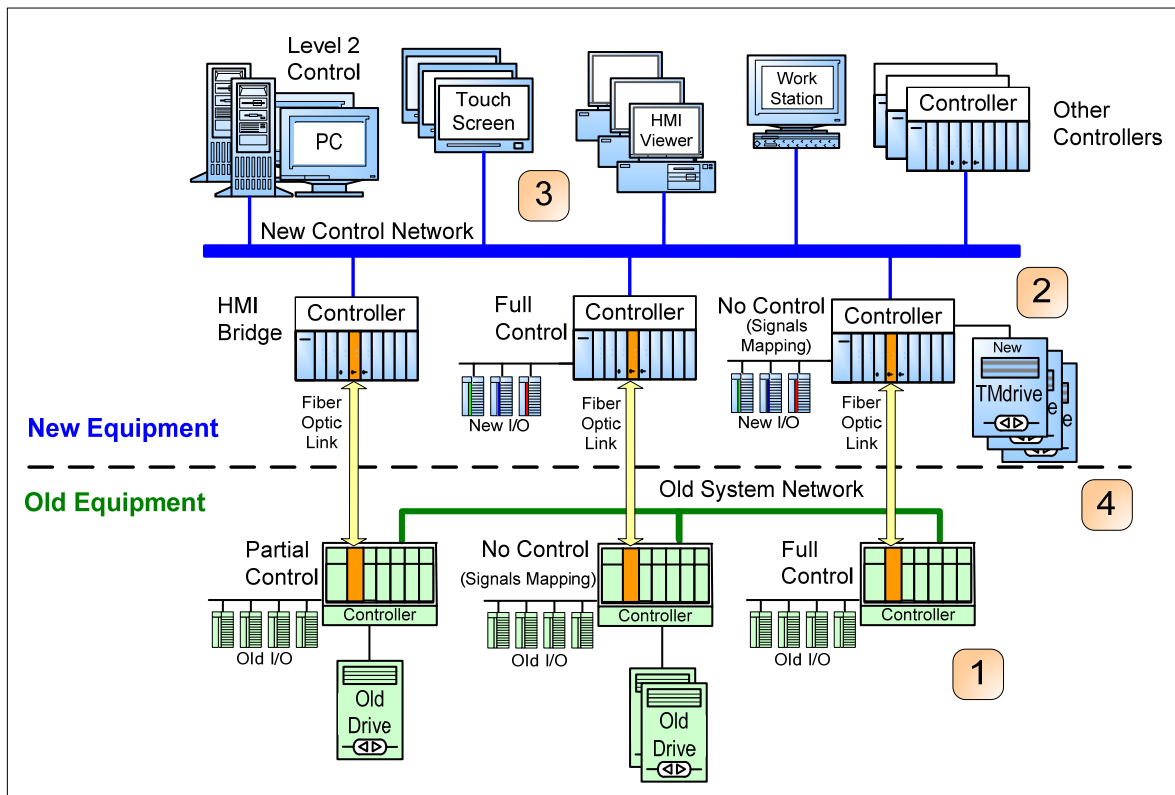
Replacement of an old control system is a challenge, especially when the existing system was supplied by another vendor. The customer always asks for the shortest possible shutdown period, and this calls for creative changeover engineering. This article outlines such a project carried out in a US steel mill.

### The Challenge

The customer needed to replace another vendor's Coiler control system, using new controllers, new Human Machine Interfaces (HMI), new PCs, new variable speed drives, and some new AC motors. Because the mill was in production, the replacement project had to minimize any additional shutdown periods, and any post-switchover production disturbances. In addition, installation complexity and expense had to be as low as possible.

This project presented an implementation challenge. Due to incompatibility with the other vendor's networks and components, the standard approach would have been to install a complete new system, remove the old one, and execute the switchover in one big step. This required an extended shutdown period and introduced significant risks because all system levels would have to be started and tuned up at the same time. A way of minimizing risk would have been to connect all the new Input / Output (I/O) in parallel with the existing I/O, but this is very costly due to the additional engineering, installation materials and labor.

TMEIC was the only vendor who could meet the requirements and cost target. Their approach to these problems used connectivity to the old system components, and a step by step control takeover. The figure shows an intermediate stage in the implementation.



Old Control System (in green) Running while in process of Replacement by New System (in blue)

## Approach to Replacement of the Old System

There were four main steps to replacing the control system; these are shown in the illustration above and are described below.

1. Establish Controller Connectivity
  - Install interface boards in the old controllers; (these were of two types, MultiBus I and II, shown in green in the illustration)
2. Install New Controllers
  - Install new VME controllers, shown in blue, and install matching interface boards in the new controllers. Then establish the data exchange using fast fiber optic links.
  - Map the data to and from the old system to and from the new global control network.
3. Add the New HMI System
  - The new HMIs and level 2 (supervisory) computers were easily implemented and initially tested in passive mode with no control output, then switched to bidirectional data flow.
4. Drive Modernization
  - The new variable speed drives were installed and connected to the new controller. In the initial stage, the new controller only acted as a drive bridge since the old controller was still in active operation controlling the drives.
  - The old controller just bi-directionally mapped all drive and I/O signals to the new controller.
  - By switching over small sections of I/O and associated functionality to the new controller during brief shutdowns, no production stoppages or interruptions were introduced.

Note that this project was performed some years ago; nowadays, using the latest TMEIC controllers and new interface modules, it would be much simplified.



TMdrive-10 Variable Frequency Drives Cabinet

## Benefits to the Customer

Using the phased upgrade approach, the customer obtained the latest control technology and equipment in this section of their mill. Some of the customer benefits were:

- Very few production disturbances
- No unplanned production stoppages
- Simple system installation
- A reasonable expense to the customer

In the customer's words:

"I would like to state how impressed I am at how smoothly this project was developed and executed. I have been involved in more projects of this nature than I care to count over the last 20 years, although this was a particularly difficult project of replacing an obsolete control system with a new TMEIC system in several phases of outages lasting seven days or less. Every phase of the project was prepared and planned to a level of detail that allowed little or no surprises, and the teams assigned to the project could not have been of a higher caliber. I have to acknowledge the personal and professional contributions of engineers from TMEIC for what they contributed to this project, ensuring a trouble-free startup of the system and drives that I have not seen before".

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