BaoSteel Corporation Application Story

RTP 2200 Hybrid Control System in the application of BaoSteel's boiler control system

Summary

The 135 Ton/Hour Boiler Computer-Control System at BaoSteel's Energy Department is using the new generation RTP 2200 HCS (Hybrid Control System), which combines the features and benefits of the PLC and DCS. This system includes full redundancy of I/O cards, I/O buses, CPUs, power supplies, network communications, Citect I/O servers, and Citect I/O operator stations.
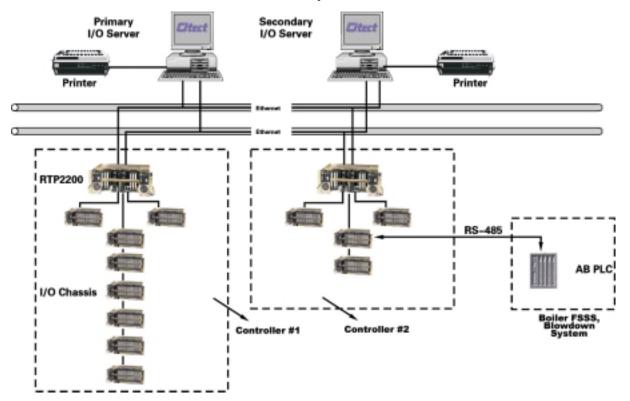
Figure 1 BaoSteel boiler control system architecture

System architecture

This 135 Ton/Hour Boiler Control System is using two redundant RTP 2200 hybrid control systems to monitor, display, record process data, and control the process automatically, which includes the Oil System, Boiler system, Turbine System, and Power Management System. The Operator Station is using Citect software in a Client/Server architecture. Two redundant I/O servers are configured with functions for alarming, trending, report generation, process control, operation guidance, job management, and data storage. After optimization of system resources, the update of system operator displays has reached 500 milliseconds. A 10 MHz Ethernet network is used for the communication between the RTP 2200 controller and Citect Operator stations. A multi-user networked SQL database server is configured in the system, by which the date logging system was developed. Functions such as logged date queries, and printer logging are implemented.

The I / O cards configured in the system include:

Analog input cards 30
Analog output cards 14
Digital input cards 55
Digital output cards 34
Pulse input cards 2
Modbus communications cards 1
Total I/O points .... >2000

To ensure the stability of the system, critical Analog Outputs and Digital Outputs are redundantly configured. The system includes 120 PID loops and 4500 floating point calculations. The system runs at 50 passes per second, which means that the CPU finishes all I/O scanning, Boolean logic algorithms, analog calculations, peer to peer communications, and communications with the operator stations in less than 20 milliseconds.
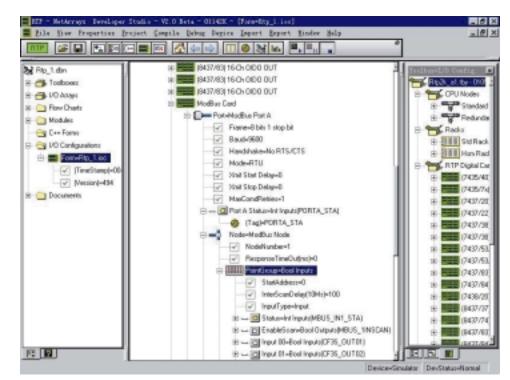

Figure 2 RTP 2200 configuration

RTP and AB PLC communications

The FSSS (Flame Supervisory Safety System) and Blowdown System are controlled by an AB SLC503. The RTP 2200 is configured with a model 8435/85 intelligent serial Modbus communication card for sharing data between the RTP 2200 control system and the AB PLC. Configuration of the RTP 2200 is show in figure 2 above.

Control function of the system

Control functions of the 135 T/H Boiler Control System (refer to figure 3) include:

- Oil control system
- Boiler system, includes:
  - boiler feed water chemical balance control
  - steam pressure control
  - drum level control
  - fuel control
  - furnace draft control
  - flue gas trimming control and boiler and unit interlocks.
- Turbine control, includes:
  - turbine speed control
  - temperature control
  - pressure control
  - oil pump and turbine interlocks.
- Accessories
- Power distribution system
- Turbine power management system

Figure 3 Boiler control system functions

Peer to Peer communication

Two RTP 2200 controllers are configured in the system. High speed Ethernet and peer-to-peer communications are used to exchange process data. In the mode of peer to peer communication, the peer variable values are only transmitted if a delta exists, (a change of state for digital values, or a change greater than the defined deadband for analog values). This optimization technique increases the overall communication efficiency of the entire system. Peer-to-peer communications does not rely on an additional software package. Configuring peer-to-peer communication is a simple matter of defining the data as a global peer variable. The BaoSteel system utilizes a total of 34 peer variables.

5. Realization of True DEH

The turbine is equipped with a DEH (Digital Electrical Hydrodynamic) system, which is an electrical regulator system. The RTP 2200 is configured with all of the automatic control functions, including:

Turbine Control

Remote reset or shutdown of turbine, opening or closing the main steam valve by commands to an electrical valve and motor.

Speed Control

A frequency signal of the turbine is sent to RTP 2200. It converts the frequency signal to a turbine speed value in the controller. Through one of three selectors, the speed is compared to the target speed setup, and an output control signal is generated by the controller to regulate the opening of the turbine throttle valve.

Power Control

The turbine is connected to a large electrical network with 3-5% startup loading. The operator can change the setup via keyboard and CRT, increasing the set point of turbine loading to the target value by a PID

close loop control. Anytime the main steam pressure deviates from normal, such as the pressure becomes lower than the allowed tolerance, the system will switch to Pressure Control to maintain main operational stream pressure. When the steam pressure returns to normal, the system switches to power loading control.

The DEH Operator Interface is shown in figure 4 below.

Figure 4 DEH operator interface