Fuxin Power Plant Application Story

DCS Revamp using RTP2200 Hybrid Control System at the Fuxin Power Plant

Summary

The control system for six 220-ton boilers and three 100MW turbines at the Fuxin power plant was using legacy analog instruments, which were reaching the end of their life expectancy and malfunctioning more frequently. The system upgrade was awarded to Citect (Ci Technologies Inc) in June 1999. The new control system uses RTP's 2200 HCS (Hybrid Control System), which combines the features and benefits of the PLC and DCS. Full redundancy is provided for I/O, busses, controllers, power supplies, network communications, Citect I/O servers, and Citect I/O operator stations. After the control system was updated, total automation of head main steam control of six boilers, DEH (Digital Electrical Hydrodynamic) control of the six turbines, network communications, and data sharing of whole system were successfully implemented.

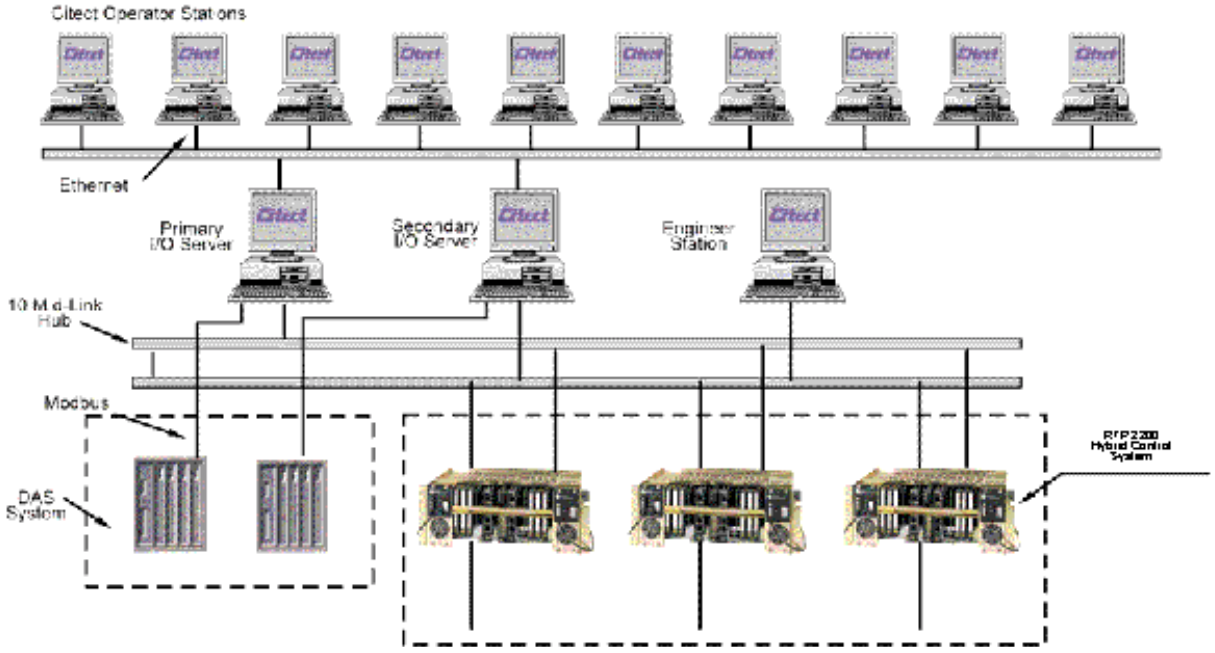

Figure 1 Fuxin Power Plant control system architecture

1. System architecture

The power plant control system is using three redundant RTP 2200 Hybrid Control Systems. Dual controllers are used for redundancy, and in case of failure; the standby controller will bumplessly take over, without affecting the normal system operation. To control two boilers and one turbine, each RTP 2200 controller has five racks of I/O. Citect software based on Client/Server architecture is used for operation. Two I/O servers are configured to provide redundancy for alarming, trending and reporting. A 10 MHz Ethernet network is used for communication between RTP 2200 controllers and Citect Operator stations. A DAS (Data Acquisition System) is used to retrieve temperature values and forward them to the I/O server via Modbus protocol over an RS-232 serial port. Twelve operator stations are configured in the system. By optimization of system resources, the update of system operator displays has reached 500 milliseconds. One engineering station is available to implement on-line configuration and system maintenance functions.

2. System size

The system's I/O card configuration includes the following cards:

Analog input cards 78
Analog output cards 6
Thermocouple cards 3
Digital input cards 36
Digital output cards 45
Pulse input cards 2
RTP 2200 I/O points 1678
DAS system I/O points 360
Total I/O points 2038

3. Control Function of the System

RTP 2200 HCS controller is based on the Intel 586 microprocessor, which provides four to ten times faster scan rates than a normal DCS and PLC solution can provide. Configured with sixty PID loops and three thousand floating point calculations the system runs at 50 passes per second. The HCS controller completes all I/O scans, Boolean logic algorithms, analog calculations, peer to peer, and operator station communications in less than 20 milliseconds.

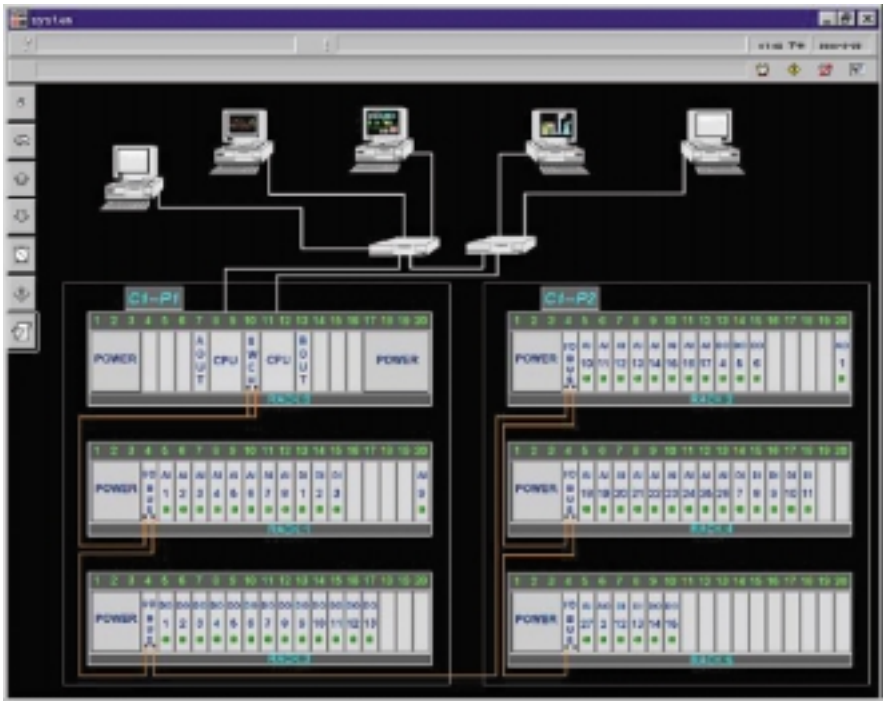

Figure 2 RTP 2200 configuration

Main control functions of this system include:

- combustion air system
- feed water control system
- boiler water circulation system
- furnace draft system
- main steam and reheat steam temperature control
- combustion fuels control
- total head main steam pressure control of six boilers
- DEH control of three turbines

4. Peer to Peer Communication

Three 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. Configuration is simple, requiring only a global data peer variable definition. It is peer-to-peer communications that makes it possible to control the total header main steam pressure of the six boilers.

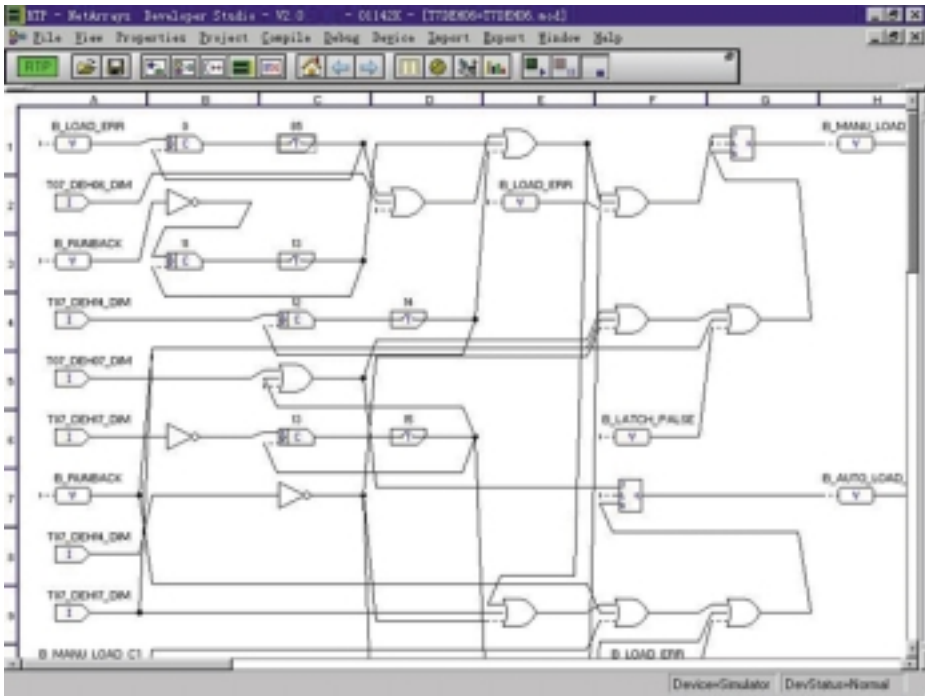

Figure 3 NetArrays digital logic

5. SOE Function

The Fuxin Power Plant control system is configured with interlocks to safely control start-up and shutdown of the six 220 ton boilers and the three 100 MW turbines. To trace and analyze failures, the RTP 2200 Hybrid Control Systems are configured with SOE (Sequence of Events) capability, providing one millisecond resolution. When status of an SOE digital input changes, an interrupt is sent to the RTP 2200 controller.

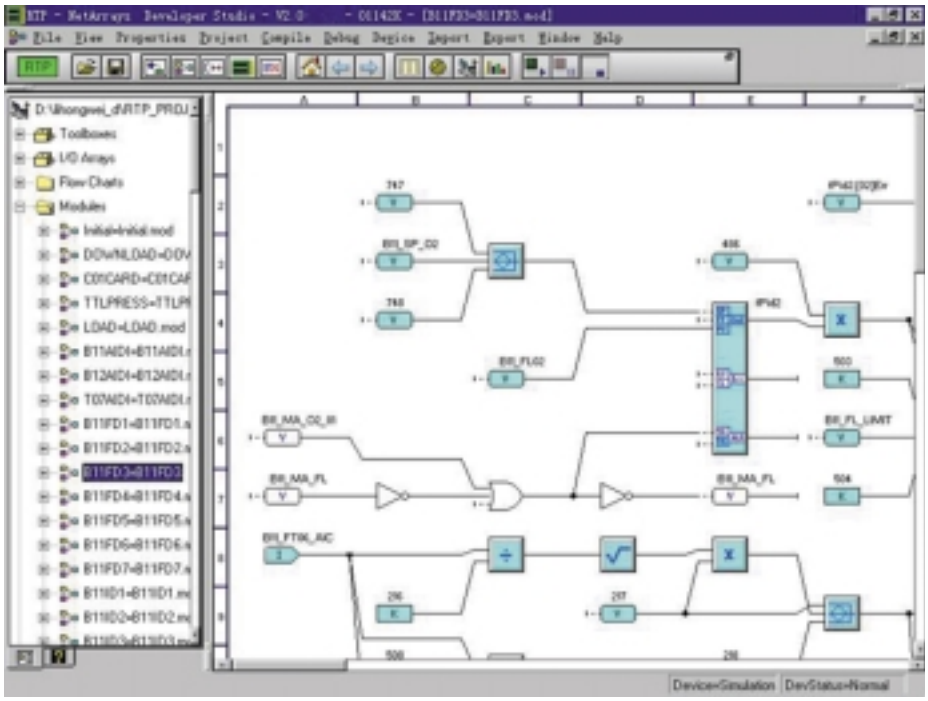

Figure 4 NetArrays PID control loop

The input and its time-stamp are recorded in a buffer by the controller. Citect SCADA (Supervisory Control And Data Acquisition) software retrieves and records all SOE information for analysis. The main I/O server controls time synchronization. When the difference of any controller time is greater than a predefined limit, the main I/O server will send a clock signal to three RTP 2200 controllers to synchronize their clocks. This synchronization technique guarantees high resolution of time for the three controllers and increases the resolution of time stamping for SOE processing.