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REFURBISHMENT OF PALINPINON-I CONTROL SYSTEMS

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ABSTRACT

With the advent of distributed control system and computer-based monitoring system in industrial plants such as geothermal plant operations, a reliable and high availability hybrid control system has been used in the Palinpinon-I Fluid Collection and Reinjection System (FCRS). With the new control system, the monitoring and control of various FCRS process and equipment parameters has become more efficient.

Compared with the conventional single and dual loop controllers, the new hybrid control systems used in Palinpinon-I FCRS provides powerful dual processors in implementing all logic and control functions of the FCRS. With the newly implemented hybrid control systems, Palinpinon-I FCRS control system availability is almost 100%.

1.0 INTRODUCTION

The Palinpinon-I Fluid Collection and Reinjection System (FCRS) has been in operation for more than a decade to provide steady steam supply to the 112.5 MW power plant. In the first ten years of its operation, the FCRS was automatically operated and monitored through the traditional panel-based single and dual loop controllers. These panel-based single and dual loop controllers were basically used to monitor and control the process variables of the FCRS, such as the separator brine level and the interface steam pressure.

With the passing of time, the operational capabilities of the single and dual loop controllers of the FCRS were beginning to decline due to component failures. The operational capabilities of the controllers were further reduced when the manufacturer stopped the production of the installed controllers, thereby zeroing the chances of procurement of replacement units.

To totally eliminate the risk involved in the operation of the FCRS with obsolete single and dual loop controllers, the control system was replaced with a state-of-the-art hybrid control system.

An RTP 2200 fully redundant hybrid control system is used to replace the aging and obsolete Turnbull Control Systems (TCS) single and dual loop controllers. The RTP 2200 control system is a hybrid control system that incorporates the features of the Programmable Logic Controller (PLC) and the Distributed Control System (DCS).

The RTP 2200 hybrid control system is interfaced with centralized computer-based operator workstation to provide centralized monitoring and control of the FCRS. The operator workstation computers are equipped with Citect 5.02 graphic operator interface software to provide the operator with visual interface with the FCRS.

2.0 CONTROL SYSTEM ARCHITECTURE

The new Palinpinon-I control systems were designed to provide the FCRS with a state-of-the-art reliable process control systems. Based on the design concept of high system availability and reliability, the control system is designed (Fig. 1) to provide fully redundant architecture as follows:

2.1 Multi-Function Controller Redundancy

The RTP2200 Hybrid Control System (HCS), which combines the best features of a PLC and DCS into a single system, is a fully redundant system. The RTP2200 control systems have dual controllers, power supplies, and backplanes to ensure virtually zero downtime for mission-critical applications in the geothermal processes.

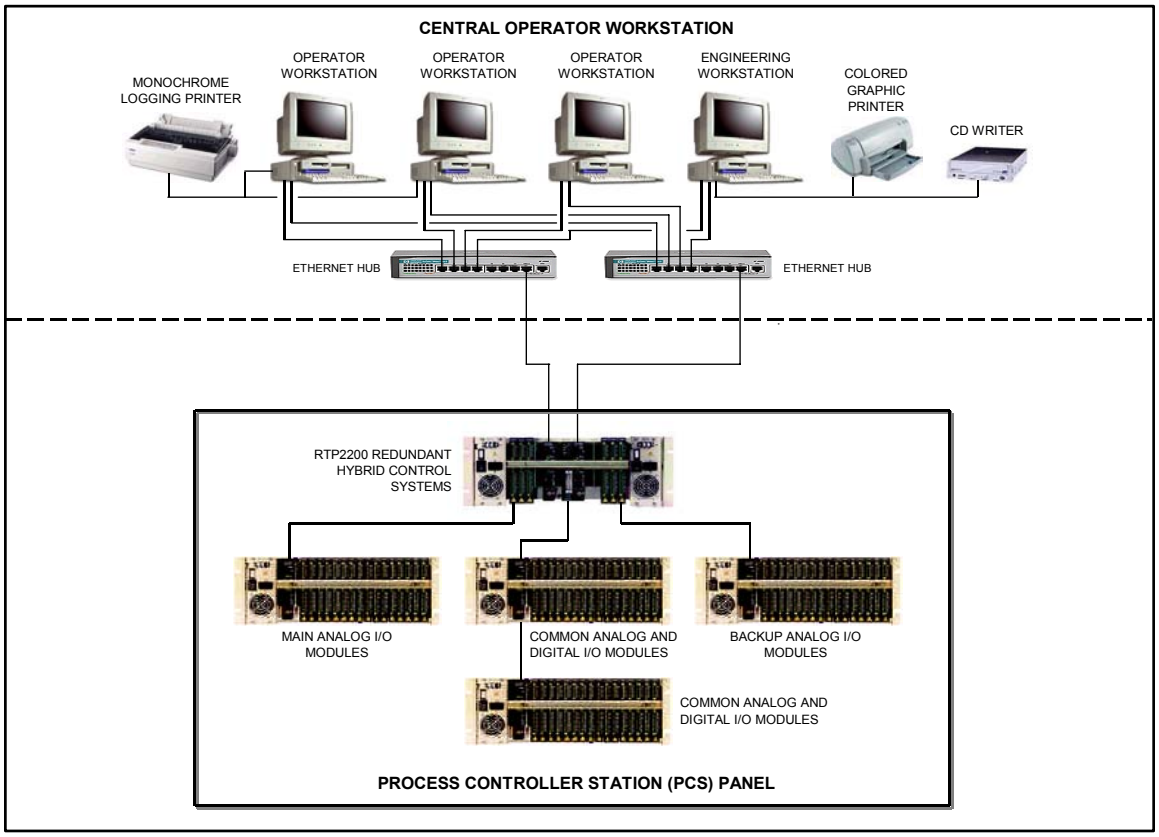

Figure 1. Palinpinon-1 control system architecture.

The dual controllers, power supplies and backplanes of the RTP2200 hybrid control systems ensures that any failure in one of the redundant components will not affect the normal operation of the whole control system. In this way, the geothermal process controls will continue to run while the failed component is under repair or replacement.

The RTP2200 redundant hybrid control system operates in bumpless fail-over in case the primary controller fails. This means that the control functions of the failed primary controller will automatically – without operator intervention – be handled by the secondary controller to provide continuous and uninterrupted process controls.

Futhermore, as hybrid control system, the RTP2200 modules – controller and power supply – can be removed from the chassis while on power. In this way, any failed component can be taken out for repair or replacement.

2.2 Analog Input and Output Module Redundancy

For critical application of the process control such as separator level and interface pressures, redundant analog input and output modules are provided.

The RTP2200 hybrid control system's analog input and output (I/O) modules have true 16-bit A/D precision converters. To protect from voltage surges, the I/O modules have built-in over-voltage isolation protection.

The RTP2200 I/O modules can be taken out from the chassis while on power. Thus, any failed I/O module can be taken out for repair or replacement.

2.3 Central Operator Workstation

The Palinpinon-I Central Operator Workstation provides a graphical operator interface with the process. The Central Operator Workstation is equipped with three Operator Workstation

Computers and one Engineering Workstation Computer that doubled as Operator Workstation.

Four (4) workstation computers are in Ethernet network configuration through redundant Ethernet hubs that use the TCP/IP communication protocol. Two of the Central Operator Workstation computers are configured to function as redundant data, communication and alarm servers. As redundant data servers, the two Operator Workstation computers facilitate the processing of data. As communication servers, the two Operator Workstation computers facilitate the communication to the RTP2200 hybrid control system. As alarm servers, the two Operator Workstation computers facilitate the alarm management of the control systems.

The Engineering Workstation computer that doubled as Operator Workstation also serves as the graphic operator display for alarm annunciation. As alarm annunciator graphic display unit, the operator can view all alarm windows thereby providing a vivid view of all process and hardware alarms of the control systems.

The Central Operator Workstation is also equipped with monochrome and colored printers. The monochrome printer functions as the logging and event printer. As event printer, it automatically prints any alarm on the process and control system abnormalities that occur. As logging printer, it automatically print any action made by the operator on the control system during his shift. The colored printer on the other hand, served as the graphic printer. Any graphic page that need to be printed can be printed on this printer.

To facilitate storage of large data, the Central Operator Workstation is provided with external CD-Writer. The CD-Writer is basically used to store the data from the workstation computers for historical analysis of data and to free the computer CPU from accumulation of large data.

3.0 MAN-MACHINE INTERFACE SOFTWARE

To provide the operator with graphical interface of the process being monitored and controlled, the Central Operator Workstation computers are equipped with licensed Citect 5.02 man-machine interface software (MMI).

The Citect 5.02 software features a high-speed DLL interface with the RTP2200 hybrid control system. As DLL interface, Citect 5.02 software is responsible as the communication interface and handles all data gathering of process variables, setpoints, alarms, trends, etc. from the RTP2200 hybrid control system. The data gathered from RTP2200 hybrid control system are then displayed through Citect's engineered graphic display pages.

The graphic display pages include graphical presentation of the separator vessels (Fig. 2), FCRS pipelines, manual valves, motorized valves, pneumatic control valves, and field instrumentations (Fig. 3).

Numerical displays of process variables, set-points, controller outputs, and other parameters are provided to give a real-time display of the FCRS monitored and controlled parameters (Fig. 4).

Graphical trends of selected process parameters are also provided to give historical trends for reference purposes.

Real-time alarms of selected process parameters provide the operator of any impending abnormalities in the operation of the FCRS (Fig. 5). Thus the operator will have ample time to react and make the necessary corrective measures to avert FCRS shutdown.

Furthermore, diagnostics of the control system hardware enables the maintenance personnel to have a clear understanding of the status of control system components, thus averting FCRS shutdown due to control system hardware failures.

4.0 RTP2200 NETARRAYS GRAPHICAL CONFIGURATION SOFTWARE

The RTP2200 hybrid control system utilizes a graphical configuration software, which is an object-oriented, portable control language with a graphical user interface (GUI). As configuration software, it uses the ISA (Instrument Society of America) symbol set to illustrate processes with objects. Each symbol can be used in an object-oriented fashion and can be used repeatedly in different programs wherever the same or similar function is needed.

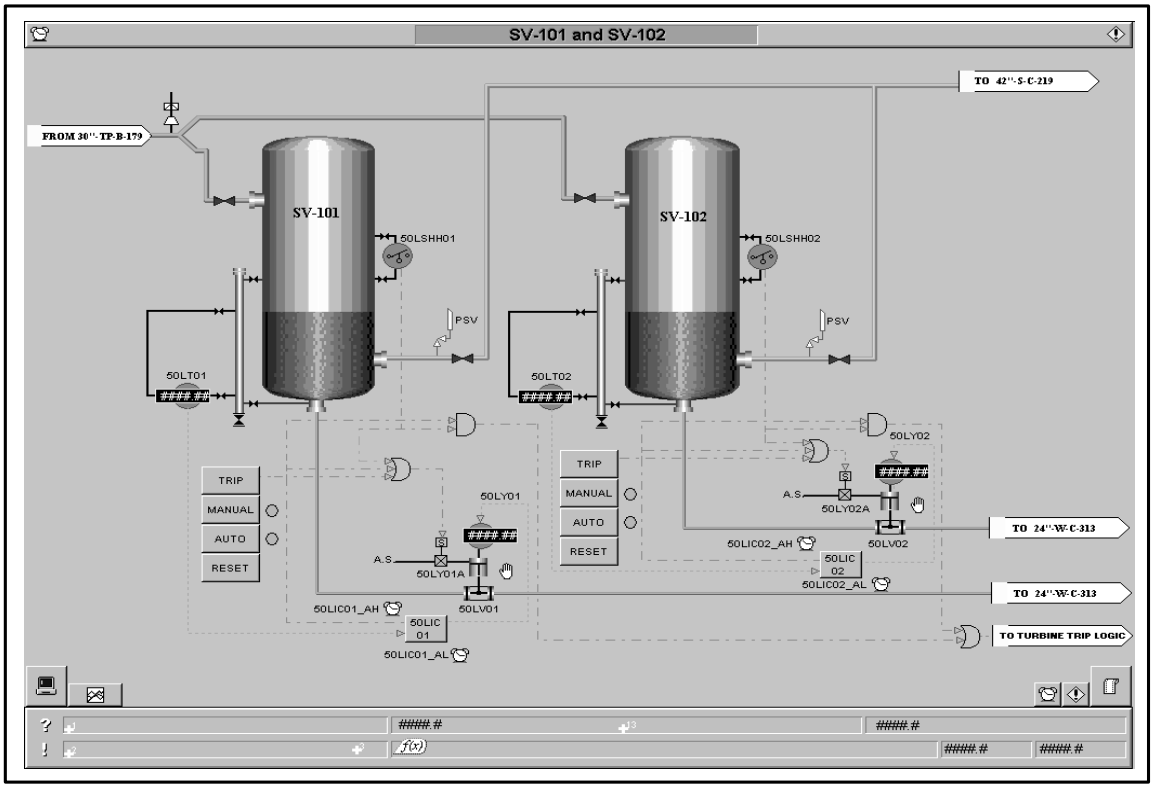

Figure 2. Palinpinon-1 operator workstation separator vessel graphic page.

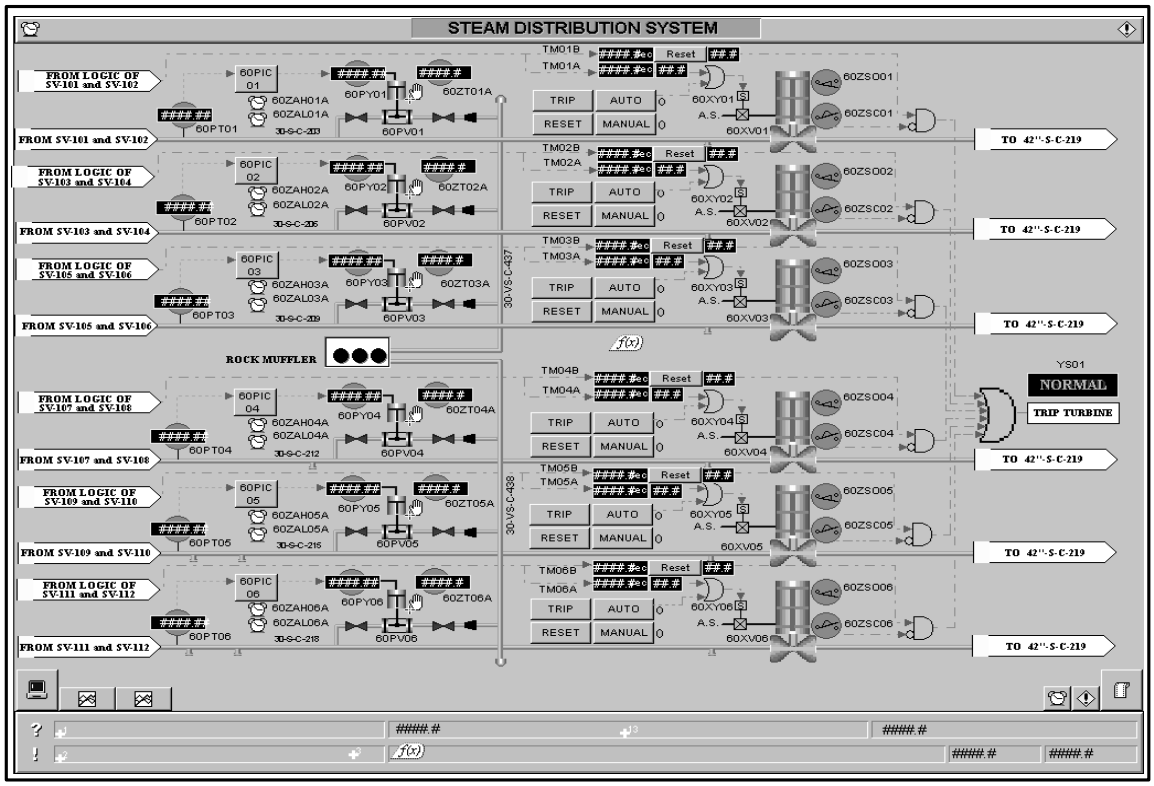

Figure 3. Palinpinon-1 operator workstation steam distribution system graphic page.

Figure 4. Palinpinon-1 operator workstation trending graphic page.

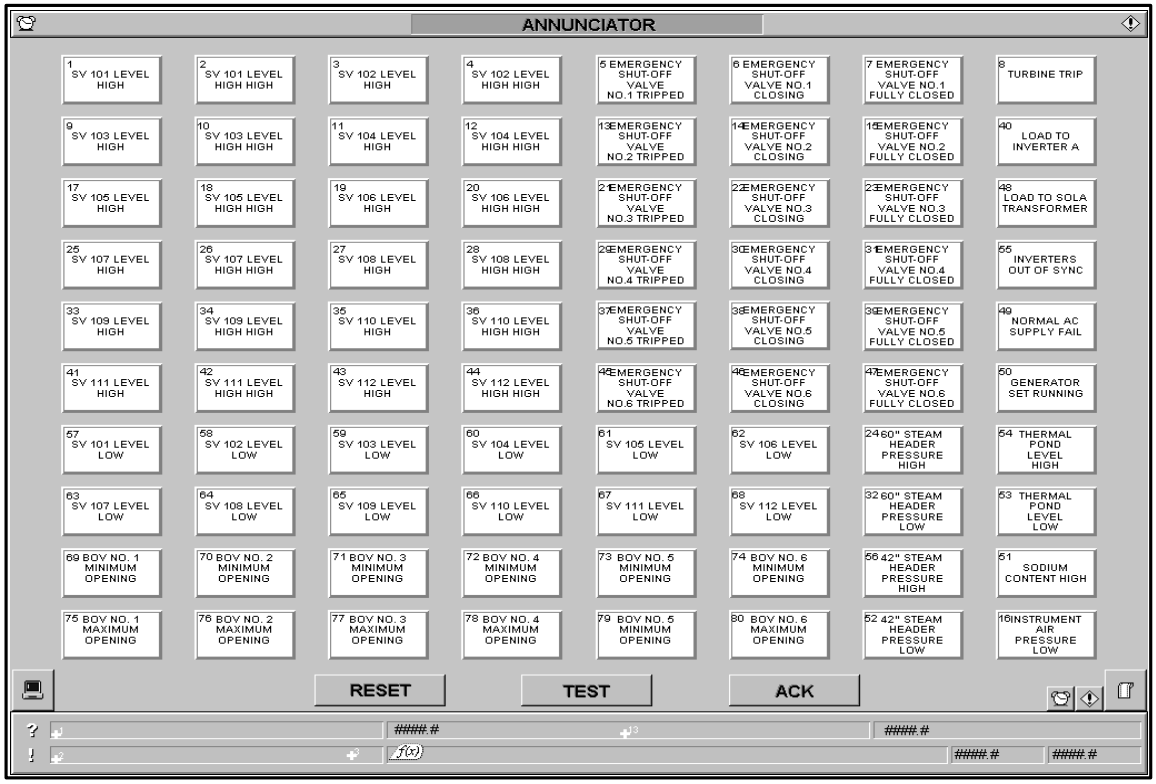

Figure 5. Palinpinon-1 operator workstation annuciator graphic page.

Object-oriented programming of the control system is much like drawing a flow chart. When all of the objects are in place and connected, the design task is completed and documented. All downloaded and uploaded target node programs contain full program documentation. In this way user documentation is always completed, “as-running”, and up-to-date.

The RTP2200 NetArrays software consists of the GUI programming language, editor, and flow language. The GUI flow language, which is the directional part of the program, allows control execution of pages in a particular sequence.

5.0 BENEFITS OF THE NEW CONTROL SYSTEM

As a new full function hybrid control system of Palinpinon-I FCRS (Fluid Collection & Reinjection Systems), the RTP2200 combines DCS features such as rapid processing of analog signals, the ability to handle PID (Proportional-Integral-Derivative) control loops, and floating point conversions, with the performance, speed, and ease-of-use of PLCs in a single system.

The RTP2200 hybrid control system provides a high degree of network functionality, with transparent connections to platforms from other vendors, without any programming. A peer-to-peer communications over the Ethernet link and full-capability remote dial-up connections are what make RTP2200 an open system architecture.

During common Windows task of the new control system, data collection and alarming will continue uninterrupted. Thus, 100% data integrity is achieved.

The new control system has built-in error detection and recovery for I/O or network communication disruptions. On line programming modification enable the new control system to continue its normal functions.

With the new RTP2200 hybrid control system, real-time FCRS process monitoring, control and error detection of communication disruptions make the operation of the Palinpinon-I FCRS efficient. Thus, downtime in the operation of the FCRS due to control system failure is reduced to zero.