PlantPAx™ for Power Plant Control:
A New Approach to Distributed Control

Lee J Ward
Region Business Manager
Heavy Industry Consulting
A **distributed control system** (DCS) refers to a **control system** usually of a manufacturing system, **process** or any kind of **dynamic system**, in which the **controller elements** are not central in location (like the brain) but are **distributed** throughout the system with each component sub-system controlled by one or more controllers.
Recognize this?
Key Power Plant Elements

Visualization
- Fuel
- Turbine Control

Engineering
- Comb
- HRSG
- SCR

Historian
- Gen 1 Control
  - Excitation Synch
- Gen 2 Control
  - Excitation Synch
- Gen Prot

Plant Control
- Feed Water
  - Drum
- Steam Turbine
- Cooling
- Condensate

CEM
- APC
Does this fit the definition?
It starts here – The Control Room

- Safety Systems
- Alarming
- Steam Generation
- Turbine Control
- Fuel Management
- Waste Management
- Balance of Plant
- Pollution Control
- Power Quality
Informative Visualization

Combustion Turbine Control

- Turbine Exhaust Temperature
- Turbine RPM
- Generator Voltage
- Generator Amperage

Fuel Oil Tank Level
Fuel Oil Flow
Fuel Oil Temp
Fuel Oil Pressure

PlantPax
Process Automation System
Plant Control Focus Points

- High Availability – Uptime is Prime
- Scalable Architecture – One size does not fit all. One platform can!
- Robust Communication – Open, but secure.
- Grand Master of Time – One version of the truth
- Sequence of Events – When did it happen?
- Alarming – Event and Priority Management
- Historical Data – What happened?
- Condition Monitoring – Stop it before it happens
- Easy Integration – Native and Foreign Device Interface
- Integrated BOP – Drives and MCC’s
- Instrumentation
- Asset Management
- Advanced Process Control - Optimization
PlantPAx Centralized Engineering

- **Simplified Configuration Effort**
  - Single Starting Point
  - Synchronization w/ Running System

- **Modularity & Reuse**
  - Library for Managing Reusable Logic
  - Copy/Paste; Drag/Drop; XML-based Import/Export

- **Complete Toolset**
  - System View, Logic Editor, HMI Designer, Batch Configuration, Process Networks, etc...
PlantPAx System Development Environment

- Create & Manage System Displays
- Develop & Maintain Application Code
- Launch Support Applications
- Store & Access Documentation
Grand Master of Time - GPS

- Resilient / Redundant
- 1756-Time GPS module: Grand Master of time, not just a Time Source.
- CIP Synch using EtherNet/IP

HI PROM GPS Module is the Real Time Source and Grand Master (GM) of time to Synch Redundant Controller Wall Clocks and SOE (Event) Time Stamping.
Easy Configuration

Module Properties: RemRack2_CN2R4 (1756HP-TIME 2.1)

Version: 2.0.1

Simulation Mode

Status: Running

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Sequence of Events (SOE)

- High Speed Event Capture – 10 - 20 μS
- When did the event occur?
- What happened first?
- What action to take?
- Linked to A&E
- Linked to Plant Historian
Comprehensive Process Control Library

- Suite of ready to use Device Level Control Modules

- Content:
  - Control Instructions (AOI) - RSLogix™ 5000 V19+ Add-On Instructions
  - PlantPAx Ver 2.0 Library
  - Graphics Objects – for FactoryTalk® View
  - Operations and Configuration Faceplates – FactoryTalk View
  - Fully documented - PDF Manuals for all Instructions

- Premier Integration
PlantPAx Process Library

Application Code

Motor FBD

Interlock FBD

Graphic Objects

Motor Objects

Interlock Object

Operator Faceplates

Interlock Object

Interlock and Permissive Help

Indicators

- One or more conditions not OK
- Non-Bypassed conditions OK
- All conditions OK
- Condition OK
- Condition Not OK
- Bypassed, but OK
- Not OK but bypassed
- First Interlock not OK

Interlock Command

Reset safety interlocks that have been configured as "Must Reset"
System Alarm Management

- The Alarm Summary provides extensive information to assist the operator in determining an appropriate response to an alarm.

- Configurable Views of the system alarms allow the operator to customize the display enabling the operator to focus on events from a specific area of control or interest.

- Alarms are individually color-coded for easy determination of active alarms and their priority.

- Links between alarms and associated controls or displays provide direct access for rapid resolution of abnormal situations.
System Alarm Management

![System Alarm Management](image)

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<th>Severity</th>
<th>Acknowledge Time</th>
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Scalable Historian Solution

Right Information, Right Time, Right Fidelity and Applications…
Historical Data

The Operator Workstation and Application Server-Historian provide the ability to visualize specific process operations over a period of time:

- The Local Datalog provides operators with configurable short term / “real time” data capture and trend displays for quick analysis of the process’s operation.

- The Historian collects data across the plant over periods of time for long term system analysis and optimization.

  - Collect information from native Integrated Architecture control and production management components.
  - Collect data from third-party systems which are interfaced or otherwise integrated with the IA for process system.
Why the Power Industry Needs Integrated Condition Monitoring
Why the Power Industry Needs Integrated Condition Monitoring
Preconfigured Faceplates for the Operator - Maintenance - Engineering
Native and Foreign Device Interface

- EtherNet/IP
- ControlNet
- DeviceNet
- Profinet DP, PA
- HART
- Foundation Fieldbus
- DH+
- DH485
- DH1
- GE Genius
- TI 500/505
- DNP3
- IEC61850
- ModBus
- ModBus TCP
- ModBus Plus
- S908 RIO
- LonWorks
- BACNet
- FipIO
- CANOpen
- ASI
Integrated Balance of Plant (BOP)

Third Party OEM’s

- Electronic Overload Relays
- Soft Starters
- Variable Frequency AC Drives
- DeviceNet I/O
- Power Monitoring Equipment
- Programmable Controllers
Endress+Hauser Integration

Add-On Instructions (AOI) and Faceplates

- **Pre-designed AOIs** provide a two-way exchange of data between the faceplates and the ControlLogix controller.

- **FactoryTalk View SE faceplates** provide visualization of instruments connected to a 1756-IF8H HART module.
Endress+Hauser Integration

• Faceplates provide directly from the instrument:
  – Tag name, Description, Message/Label, Engineering Units, Zero and Span, Analog fault status
  – HART PV (first, second, third), HART PV fault status
  – **Diagnostic Information**
    • Device specific error codes, warnings, information, etc.

• Configure the faceplates to provide:
  – Mode (such as operator or program), High-high, high, low, and low-low alarms, Over-range and under-range alarms, Alarm delay, Alarm hysteresis
Advanced Process Control

- Scalable to meet a wide range of advanced process control requirements
- Improve yield, increase throughput, reduce costs, and improve quality

Real-time Optimization

Model Predictive Control
- Nonlinear Multivariable Control
- Linear Multivariable Control

Inferential Sensors

Advanced Regulatory Control

Regulatory Control

Pavilion8 Dynamic MPC

- PlantPAx Model Builder
- PlantPAx Fuzzy Designer
- Logix IMC, CC, MMC
- Logix PID, PIDE, AOI

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What does Pavilion do?

- Minimize operational variance
- Transition effectively
- Follow operational plan

**Diagram:**

Before Model Predictive Control:
- Key Target
- Time

With Model Predictive Control and Optimization:
- Specification or Limit
- Time
What is Pavilion8® Control?

Classical MPC algorithms:
- dynamic identification
- multivariate
- parametric dynamic models

Linear and nonlinear gain/dynamics:
- models handling industries
- broadest application space

Fully functional economic nonlinear optimization available in same application or product

Interacts directly with over ten different DCS/SCADA systems
- interface is Pavilion GUI or
- standard operator DCS interface

Dynamic cascade visibility, trajectories
Traditional CEMS Cabinet...
The Pavilion Software CEM® Solution

Consists of an emission model that reflects the relationship between process operations and ambient conditions to emissions.

A patented, sensor validation system to ensure the accuracy of the predicted emissions data.
Integrating the Switch Yard
Network Setup

- Substation Automation
- Load Shedding
- SCADA Data Collection
- Generator Control & Protection
- PlantPAx access to all information and control from a single interface
Now….To The Demo
Questions

Contact Information:

Lee Ward
Regional Business Manager
Engineering Consultants
774 249 3592
ljward@ra.rockwell.com