

# Coordinating Equipment Manufacturer Package Control Systems and Existing Plant Control Systems

May 3<sup>rd</sup> 2019

Richard Pearson, P.E.  
Senior Instrument & Control Engineer  
Jacobs



**JACOBS**<sup>®</sup>

[www.jacobs.com](http://www.jacobs.com) | worldwide

# Disclaimer

## Important

The material in this presentation has been prepared by Jacobs®.

Copyright and other intellectual property rights in this presentation vest exclusively with Jacobs. Apart from any use permitted under applicable copyright legislation, no part of this work may in any form or by any means (electronic, graphic, mechanical, photocopying, recording or otherwise) be reproduced, copied, stored in a retrieval system or transmitted without prior written permission.

Jacobs is a trademark of Jacobs Engineering Group Inc.

© Copyright

May 10, 2019

Jacobs Engineering Group Inc. All rights reserved.

# Safety Minute

- Design for Safety
  - Arc Flash & Energized Circuits
    - Separate Enclosures for Higher Voltage Components
    - Control System Panels power less than 50 Volts
    - Segregation of circuits that have separate Lockout points
    - Separate control system Lockout Source from motors to enable troubleshooting while motors and drives are locked out.



# Packaged Systems

- A packaged system can be visualized
  - Exists outside of the plant control system
  - It is a separate entity containing an embedded microprocessor, controller, or hardwired logic
  - Which performs specific tasks for a piece of equipment or a process operating within a facility.



## Provide a Clear Functional Specification

- Most packaged systems can be configured to send status and alarm information, or be controlled by the a basic process control system.
- This is the challenge. Pre-Design needs to answer:
  - Who
  - What
  - Where
  - When
  - How



Without clear definition in Pre-Design these questions can cause frustration, change orders and drive costs out of control.

# Controllability – WHAT level of control

- Type of Equipment

- Full Control

- Automated Filter Backwash
    - Belt Presses
    - Some Chemical Makeup Systems

- Supervisory Control

- Centrifuges
    - On-Site Sodium Hypochlorite Generator
    - Metering Pumps

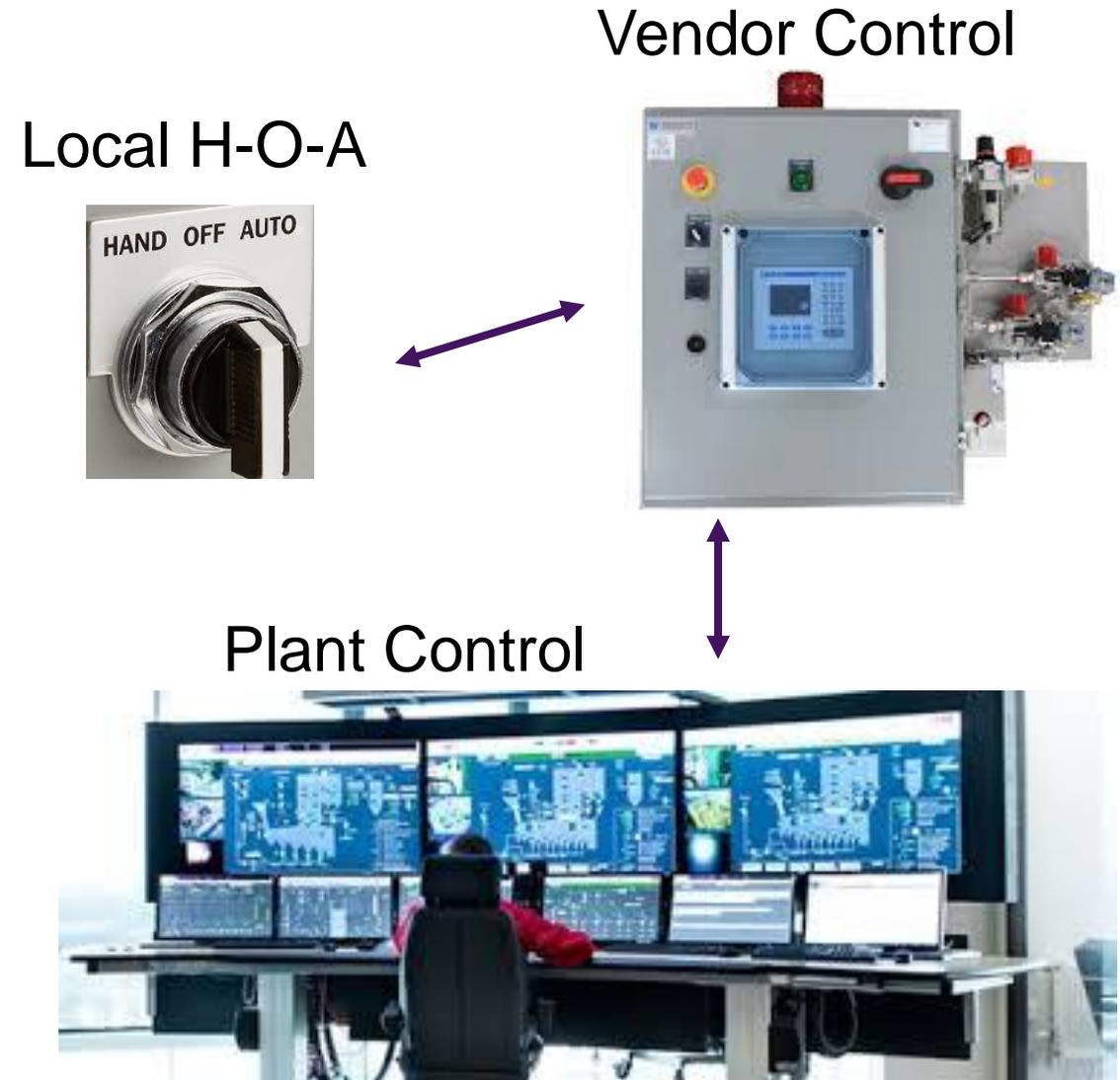
- Status Only

- HVAC
    - Air Compressors



# The Interface – WHERE & WHEN

- At the Equipment
- Vendor Provided Panel
  - Local Display Screen
  - Panel Devices (Buttons, Switches, Indicators)
- Plant Control System
  - Operator Stations
- What do Auto, Remote & Local Mean?
  - Does the equipment respond to commands from multiple sources?



## Integration - HOW

Pass values for monitoring and control between the vendor package and the plant control system.

- Plant's Control System Capability
  - Stable & Reliable Networks – All control and monitoring over a network
  - Hardwire for Control and Network for Information

### Networked Connection

Large volumes of data  
Create a clear view of Operation Status  
Advanced Maintenance Status  
Can be Complex to Implement

### Hardwired Connection

Limited number of values available to pass  
May not be able to create a clear vision of the equipment status

# Hardwired Connections

- Generally straight forward to design
  - Can be designed to connect any two vendors equipment together
  - Clearly define what the voltage is and where the voltage for a circuit is generated from.
  - Should include relay isolation for discrete signals
    - I/O cards leak small amounts of current and can create false signals to the other side.
  - Should include signal isolators on analog signals.
    - Minor differences in the potential of the common circuit can create inaccuracies in the transmitted value.
- Adds Hardware Costs for I/O cards and enclosure size

## Networked Connection Use

A networked connection will be able to provide a large amount of data quickly and securely.

Used for both Control and Monitoring.

Improved Information for: IIoT (Industrial Internet of Things)

Operations – Control and Monitoring

Process Data Analytics

Maintenance

Business Analysis



# Connectivity using Networks

- Types of Networks

- Serial Communication – RS232 & RS485 - Modbus, ProfiBusDP

- 9.6 kBits/sec



- Proprietary Networks – DeviceNet, ModbusPlus, ProfiBusPA, ControlNet

- 30 to 500 to 1,000 kBits/s (1MBit/s)



- Ethernet TCP/IP – Transports data information packets between devices

- 100,000 kBits/sec to 1,000,000 kBits/sec (100MBits/s to 1GBit/s)



# Ethernet Connections are Complex

- Not All Ethernet Devices can share data

- What protocol or language do they use:

- Modbus TCP, Ethernet/IP, ProfiNet, BACNet

- Different Control System Vendors have different protocols natively.

- A data bridge may be necessary – requires extra management

- A memory device that connects to multiple protocols where multiple devices can write to and read from the shared memory points.

- Security from malicious attacks

- Isolation of control systems from outside networks

- Firewalls, Intrusion Monitoring & Detection

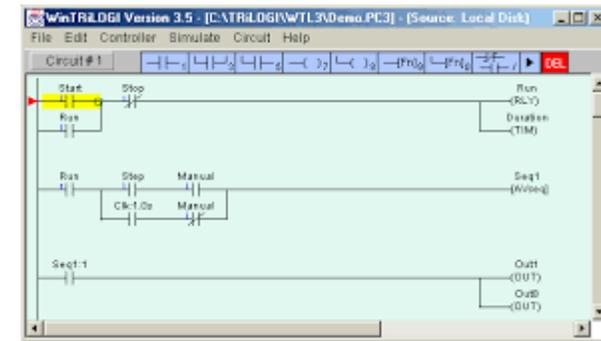
- Vendor Remote Access – Activated as necessary

- Segregation at I/O Device Level



# Specifying Control Components

- Standardization
  - Hardware & Software
    - Match the Plant's Standard Control Hardware
      - Training
      - Spare Parts
    - Match the Plant's Programming Techniques
      - Naming
      - Structure of Programs
      - Look & Feel of Operator Displays
      - Alarming and Abnormal Situation Information and Design
      - Share Standard Elements & Graphics with the Vendor



# Specifying Control Components

- Critical Considerations

- Who will maintain the equipment.

- If the vendor will do all of the maintenance you do not want to specify a component on their equipment that they are not use to supporting.

- Unsuitable for the duty

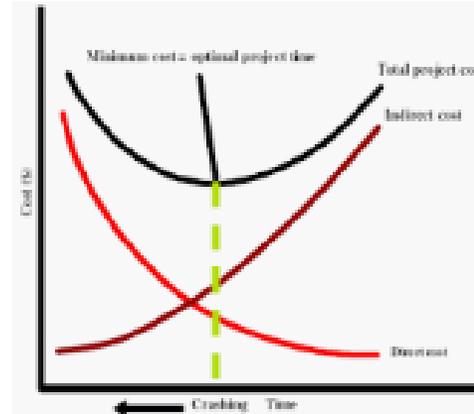
- The plant's standard VFD may not be well suited for the equipment service and fail early. - Owners Problem not the Vendors.

- Components are replaced as a unit from the Vendor

- Component is just replaced when bad, no troubleshooting or advanced knowledge needed.

# Specifying Control Components

- Vendor Pushback / Bid Exceptions
  - Adds Cost to the Package
- COSTS of Not Standardizing
- Operational Issues
  - Non-Standard Operator displays and non-standard alarms
    - cause delays and improper response to abnormal conditions
    - Injuries, Spills, Equipment Failures
- Cost you money
  - Extra ongoing training for both operators and mechanics
  - Increased spare parts inventory
  - Extended troubleshooting downtime

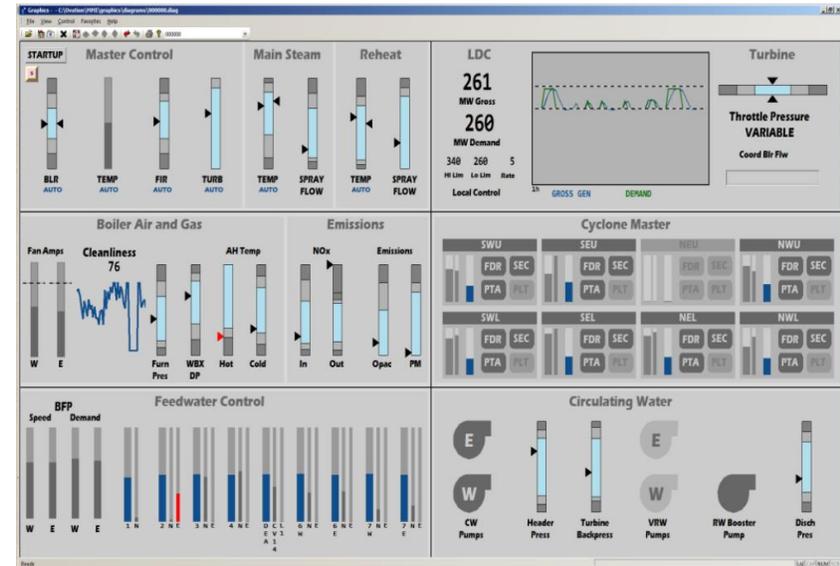
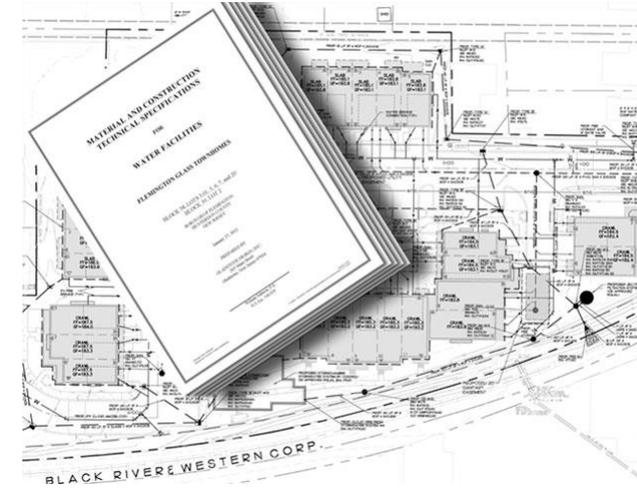


## Keys to Successful Integration

- Clear specifications that include all of your expectations
- Query vendors during Pre-Design to verify their capabilities.
- Specify workshops, prior to Design Submittal, to determine:
  - How the control systems will work together
  - Data to share and tag naming
  - Format of data
- Detailed review of submittals and accountability to standards
- Remove Vendor Control from the Package
  - Vendor could provide an enclosure with terminals or Remote I/O to connect to the plant control system.

# Summary

- Pre-Design to create clear specifications
  - Who, What, When, Where & How
- Take advantage of the available information. Use Networked Connections to create advanced Operations and Maintenance Informational Displays
- Standardize! When it makes sense.



# Coordinating Equipment Manufacturer Package Control Systems and Existing Plant Control Systems

Richard Pearson, P.E.

Senior Instrument & Control Engineer

Jacobs Engineering Inc.

Buildings, Infrastructure & Advanced Facilities

1100 112<sup>th</sup> Ave. NE

Suite 500

Bellevue, WA. 98004

425-233-3401