

Coordinating Equipment Manufacturer Package Control Systems and Existing Plant Control Systems

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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

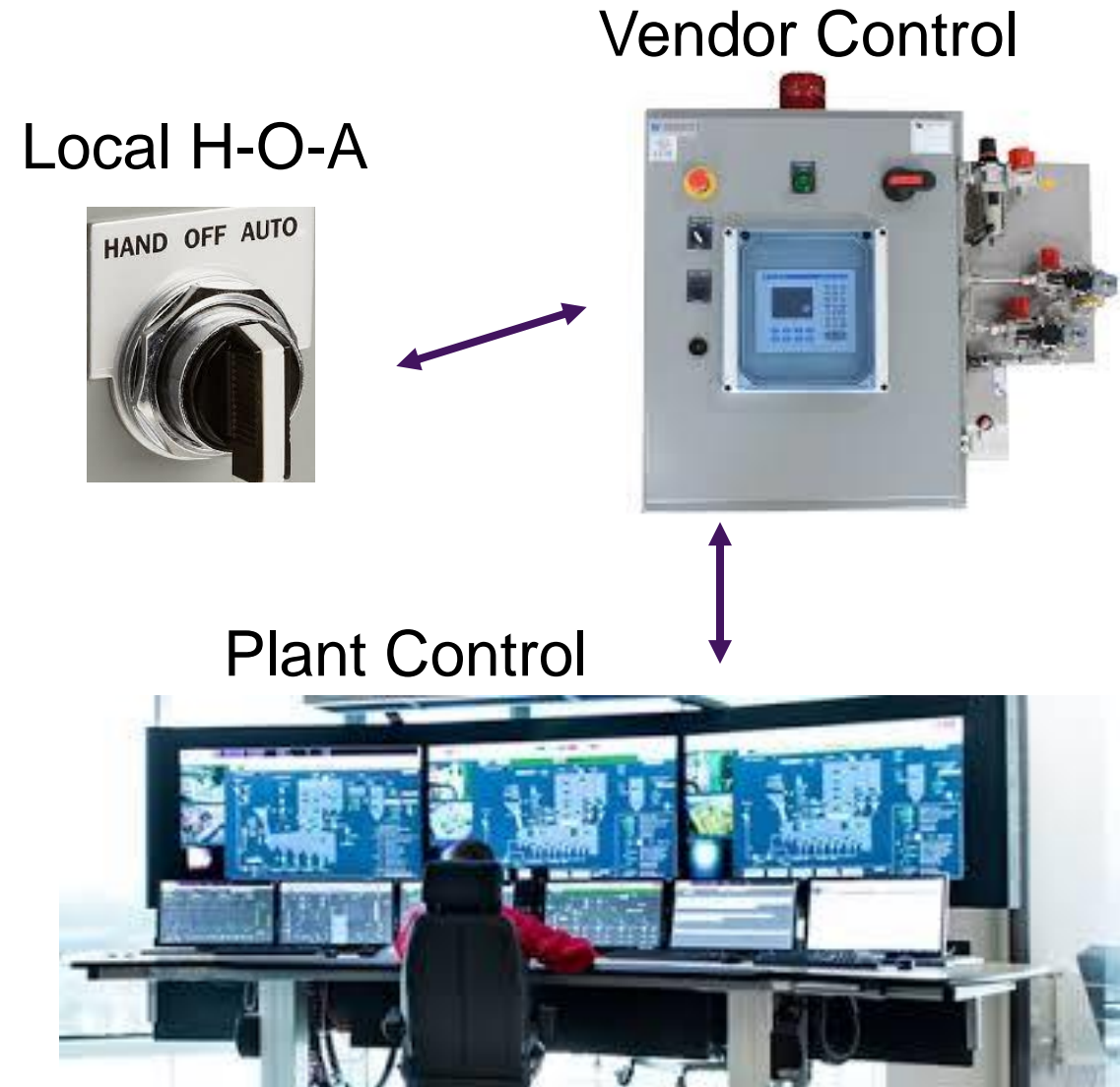
- Status Only

- 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.



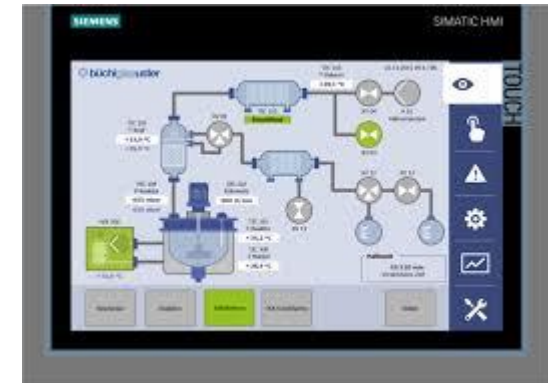
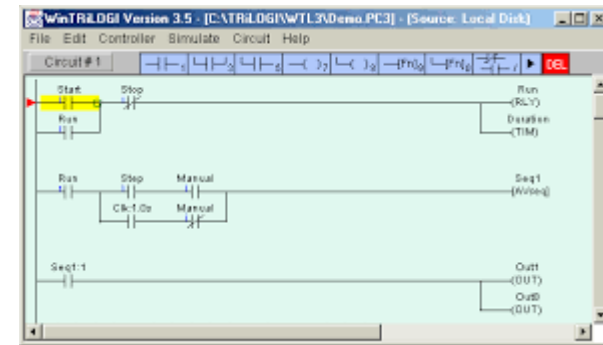
- Security from malicious attacks

- 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

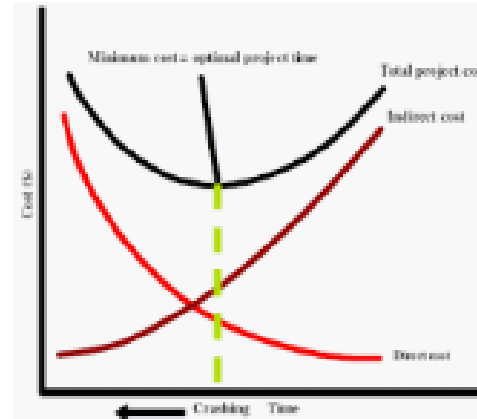
- The plant's standard VFD may not be well suited for the equipment service and fail early. - Owners Problem not the Vendors.

- 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

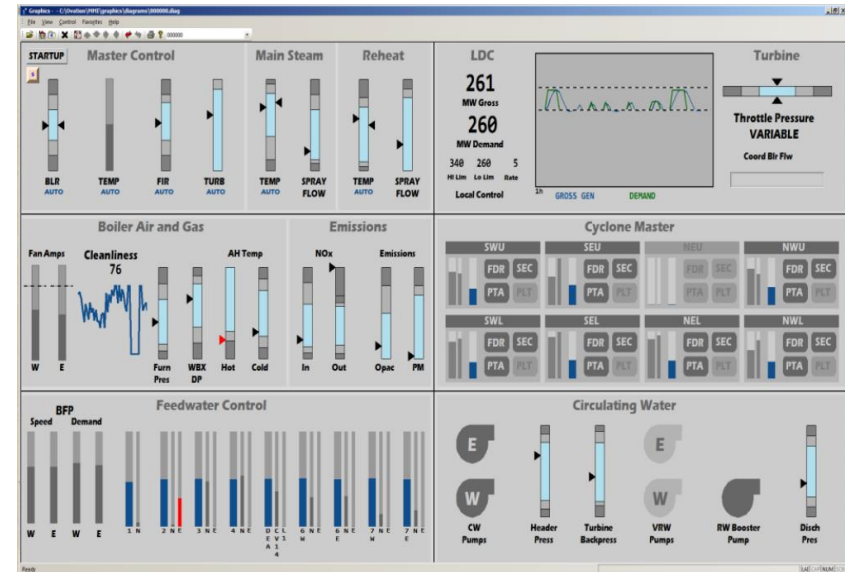
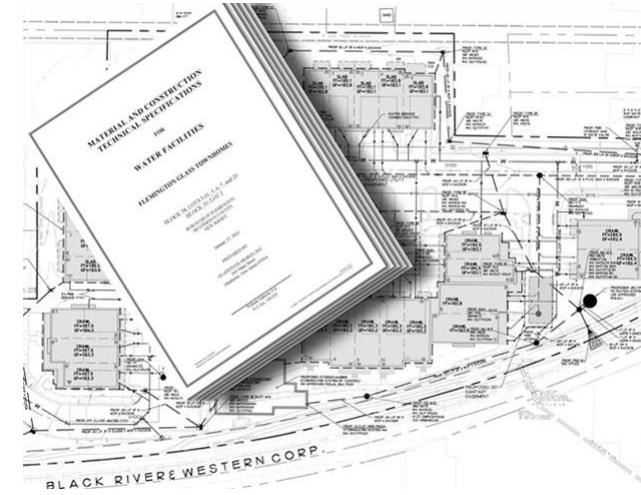


Keys to Successful Integration

- 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.



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