Modular Procedural Automation

Yokogawa Users Group

October 2012

Modular Procedural Automation (MPA)

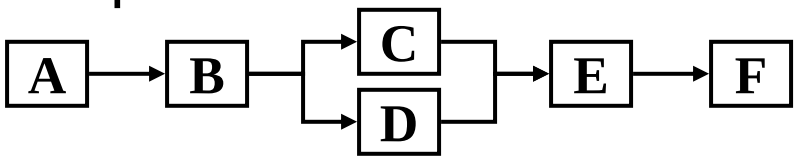
- What is MPA?
- Consulting Methodology
- How to select the right tool for the job
- ExaPilot examples
- Centum VP examples

What is MPA?

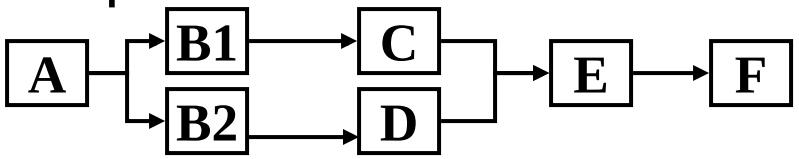
- "Modular Procedural Automation" (MPA) - Yokogawa's capability and expertise in providing automated procedures, in accordance with ISA106.
  - A consultative approach by process experts who understand process operations and provide recommendations to automate and improve procedures.
  - Proven methodology that captures, documents and implements procedural knowledge gathered from operational staff
  - It is modular- standardize implementation to increase flexibility, reduce implementation costs, and promote repeatability and reuse.
  - MPA integrates with any existing control system

Capturing Procedural Best Practices

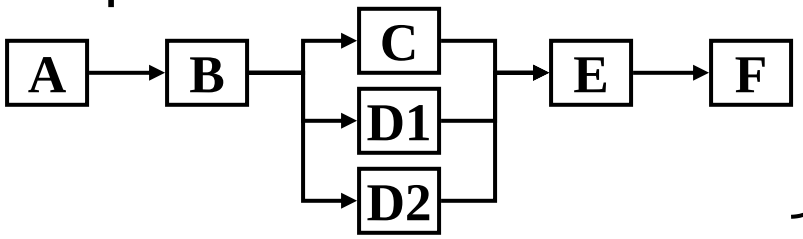
Operator A's Procedure



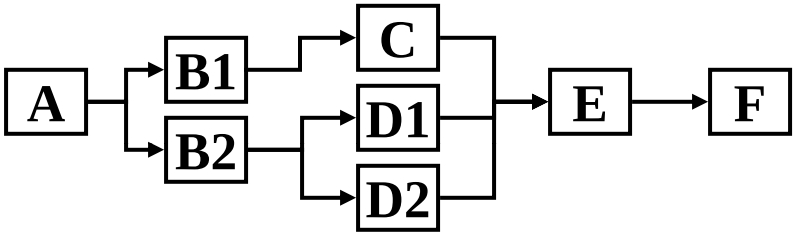
Operator B's Procedure



Operator C's Procedure



Best-Practices Procedure



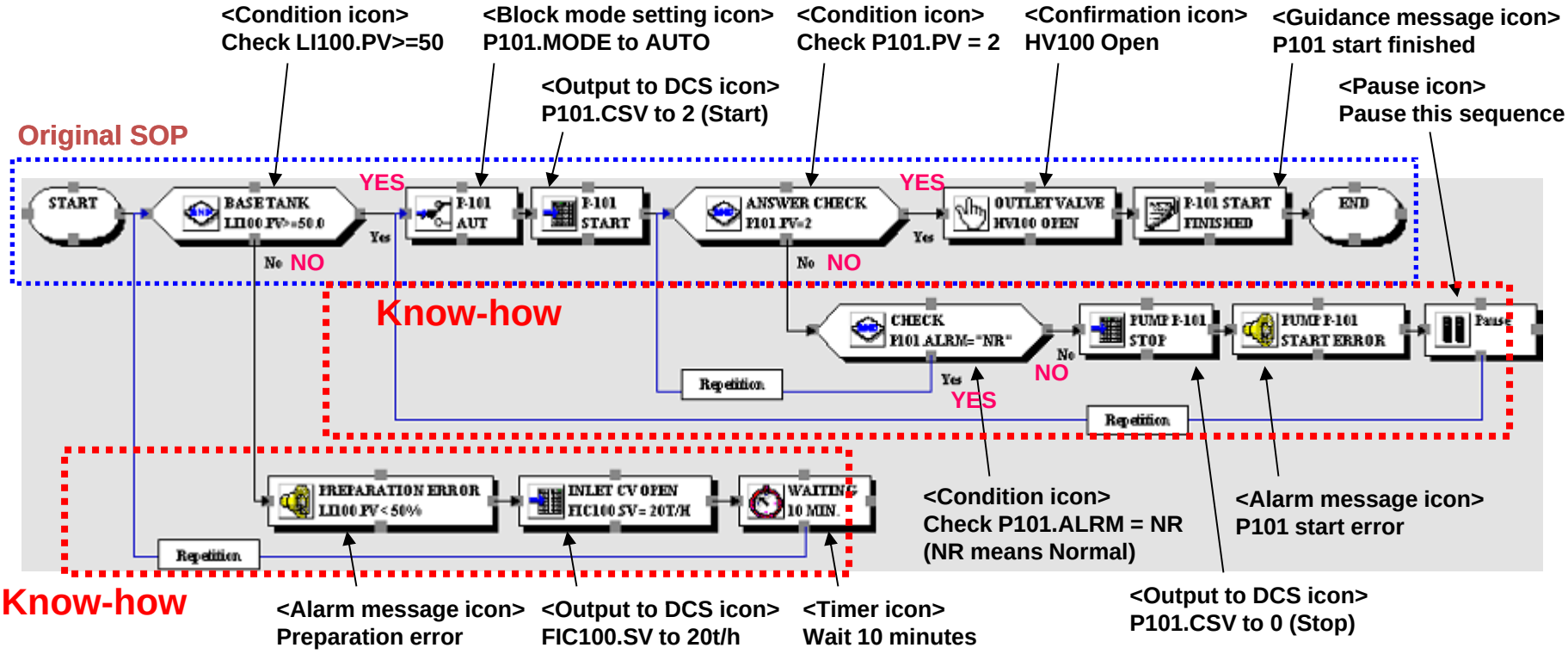
- Capture the Best Procedure from all operator inputs
- Combine into a Best Practice Procedure

Capturing Procedural Best Practices

Original SOP (Standard Operating Procedure)

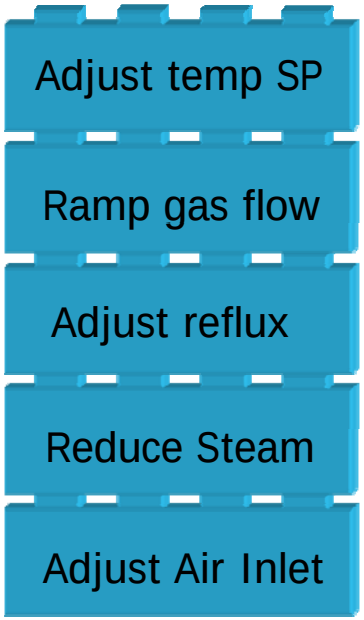
(1) Check base tank level LI100.PV >= 50%
(2) Start pump P-101
(3) Check pump status feedback
(4) Confirm field operator to open hand valve HV100

Capture Operator Knowledge!

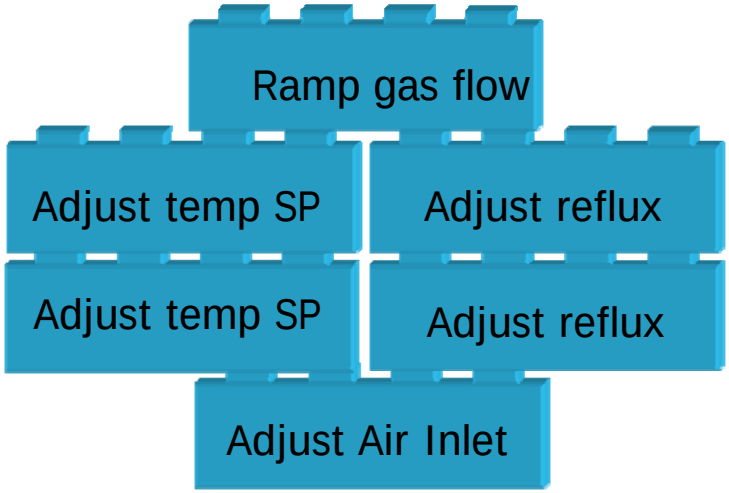


Procedural control- Modularization of code

- Transition from Product mix A to Product mix B



- Transition from Product mix B to Product mix C

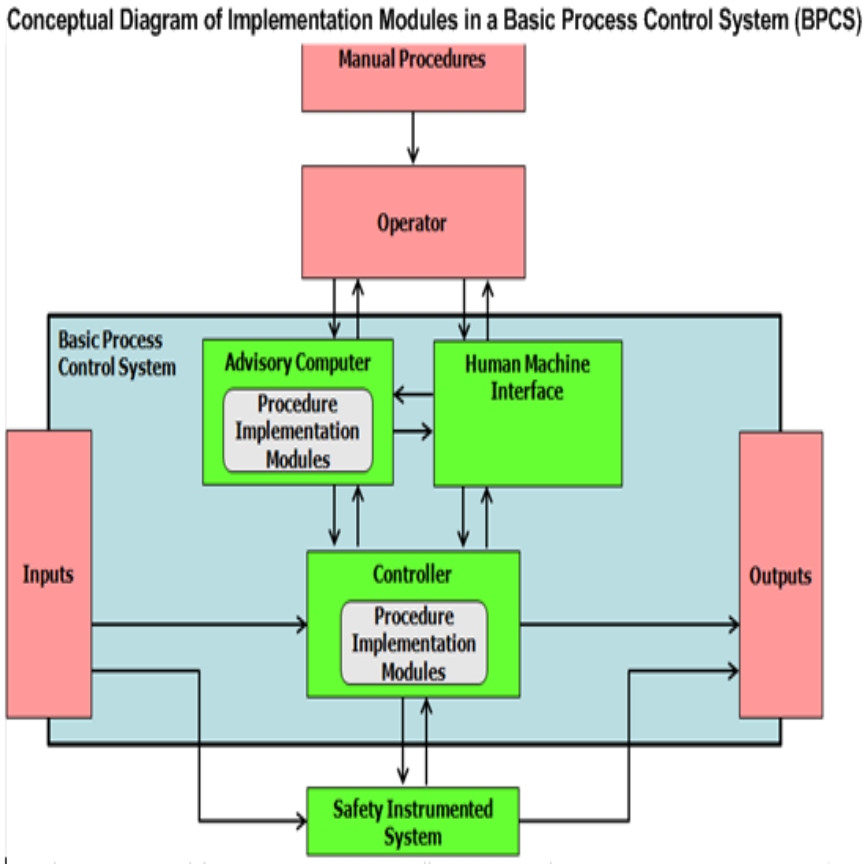


Consulting Site Visit

- Look for opportunities for improvement (major “pain” points)
- Methodologies and templates for:
  - Site visit pre-work
  - Plant walkthrough
  - Interview checklists with
    - Management
    - Operations
    - Other functions
  - Initial review meeting/ on-site report
- Assist in ROI calculations
- Prioritize and recommend best solutions

Tool Selection

- What determines if the MPA application should be implemented in the controller?
  - Fault tolerance (high reliability required?)
  - Safety/environmental risks
  - Execution speed requirements
  - Level of automation available
  - Procedure implementation and lifecycle cost
  - Operating philosophy
  - Incremental implementation/modification of procedures

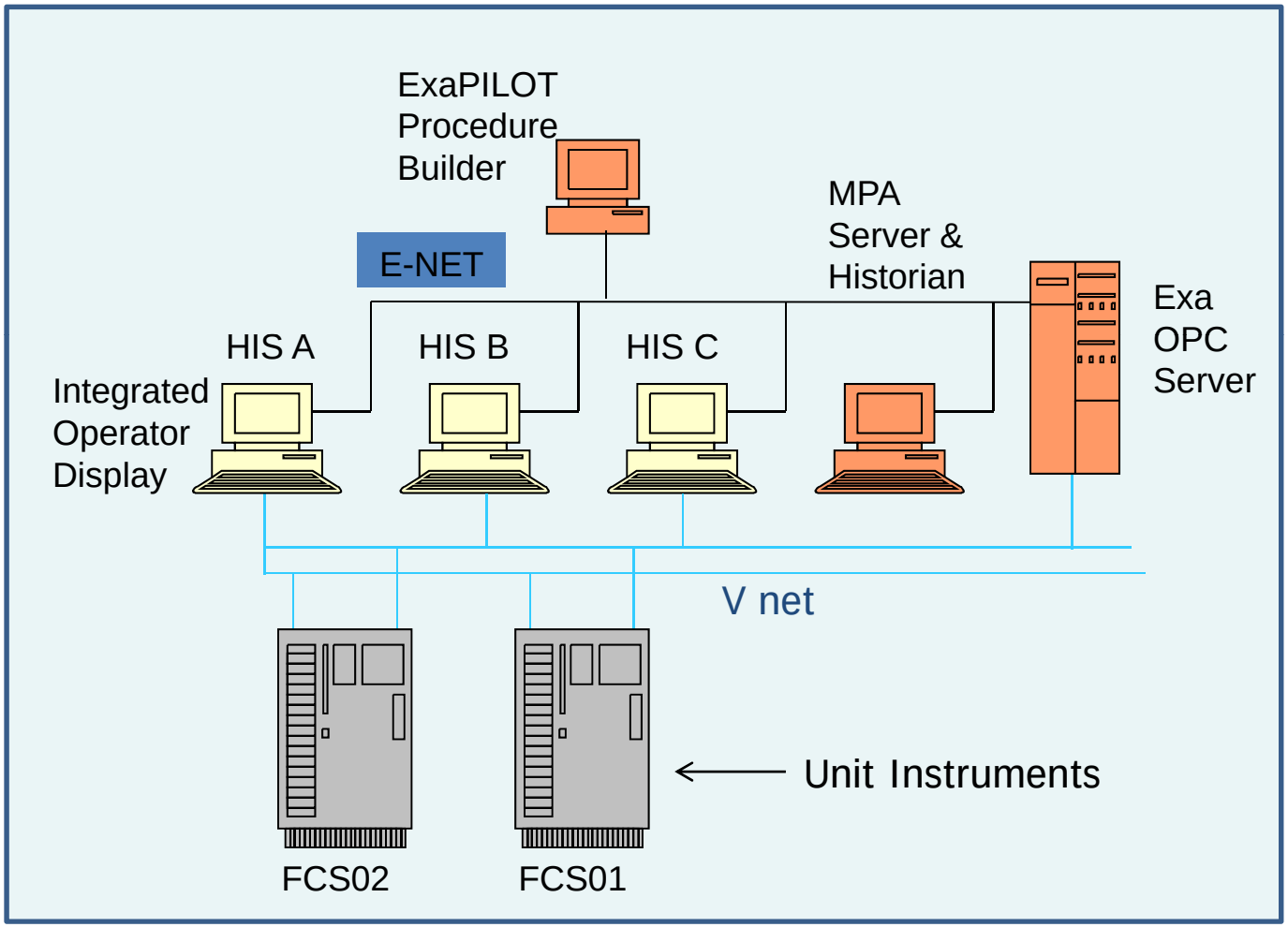


Yokogawa MPA Tools

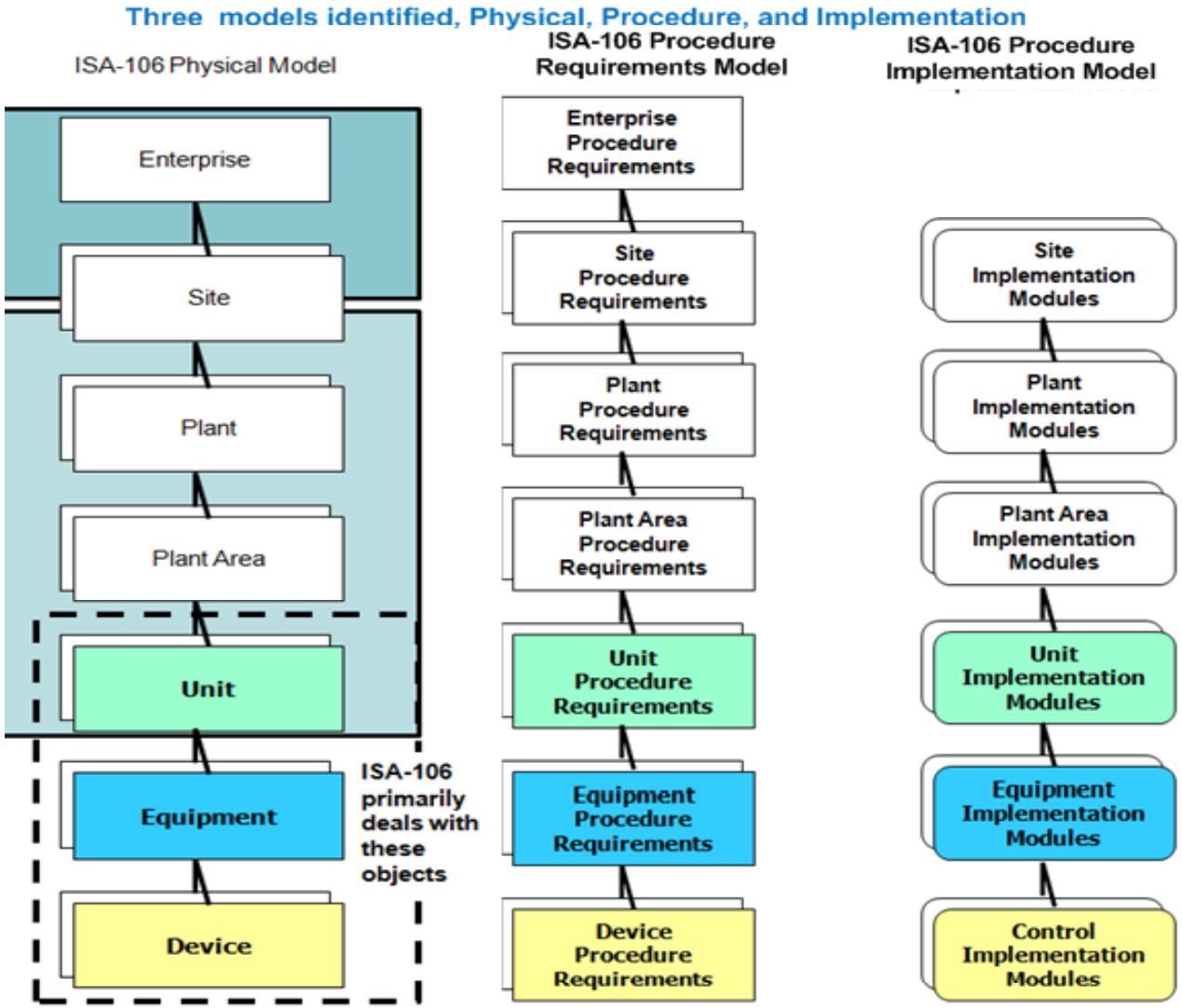
- Unit Instrument Function Block
  - Within the redundant FCS Controller
  - Based on ISA88 structure (SFC)
  - Supports state-based control
  - Allows the use of modular generic sequences/tags/code
  - Generates operator messages/confirmations/data entry

- Exapilot
  - Within the Advisory Computer
  - User-friendly flowcharting
  - Allows for modular sub-procedures
  - Capable of manipulating instruments
  - Generates operator messages/confirmations/data entry
  - Works with any control system (OPC)

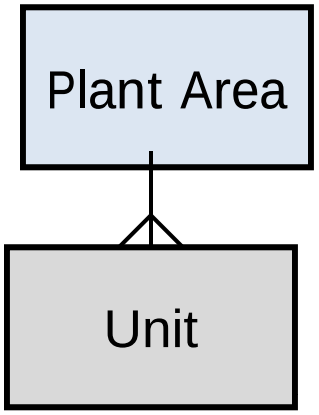
Basic MPA Architecture

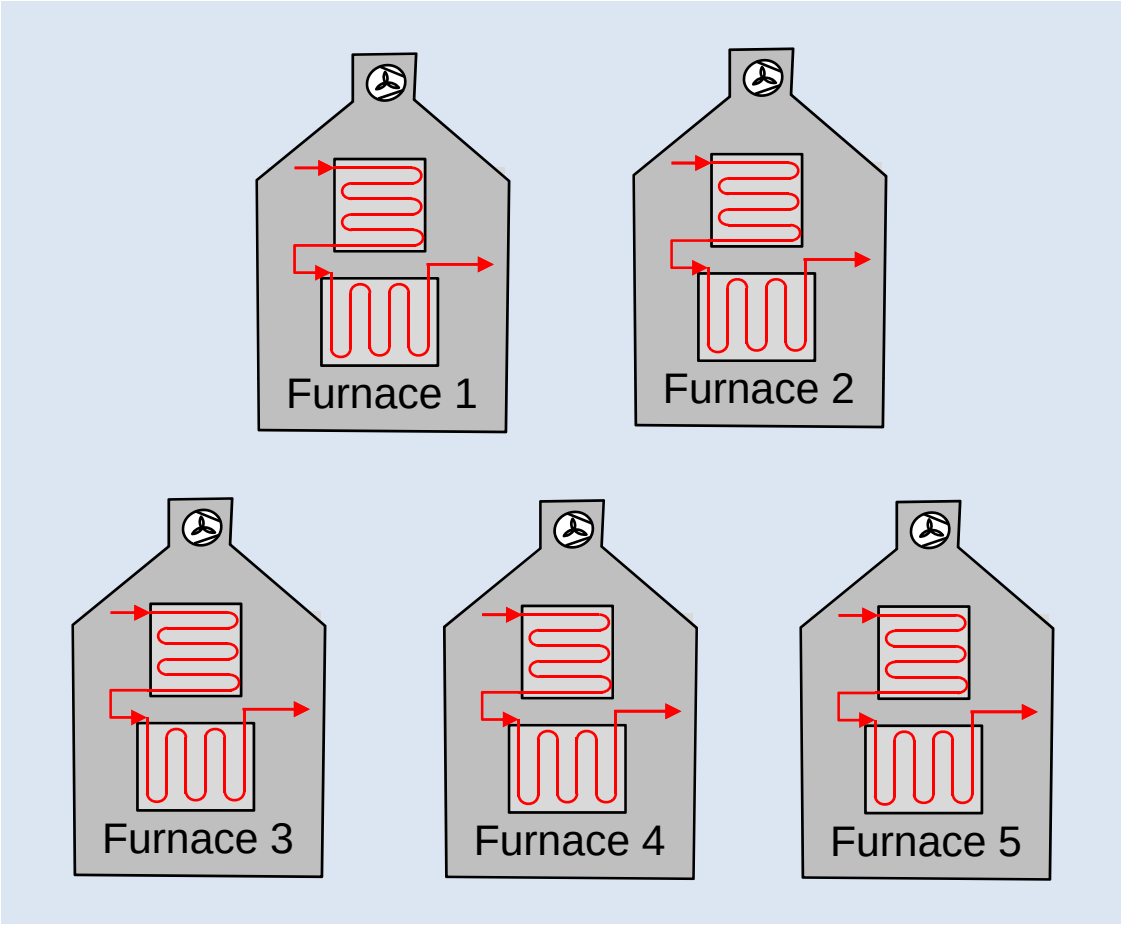


Design Components

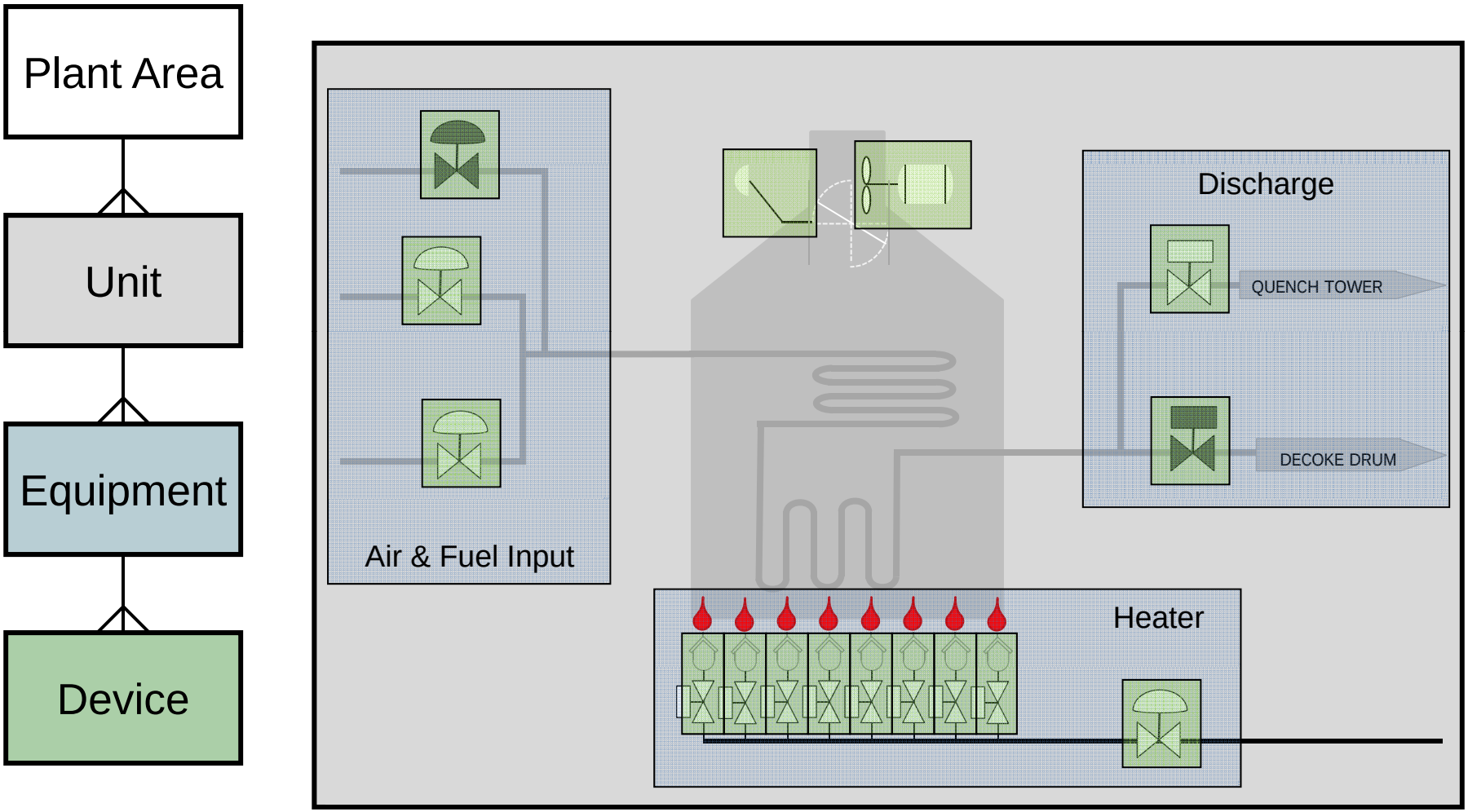


Ethylene Furnace Example

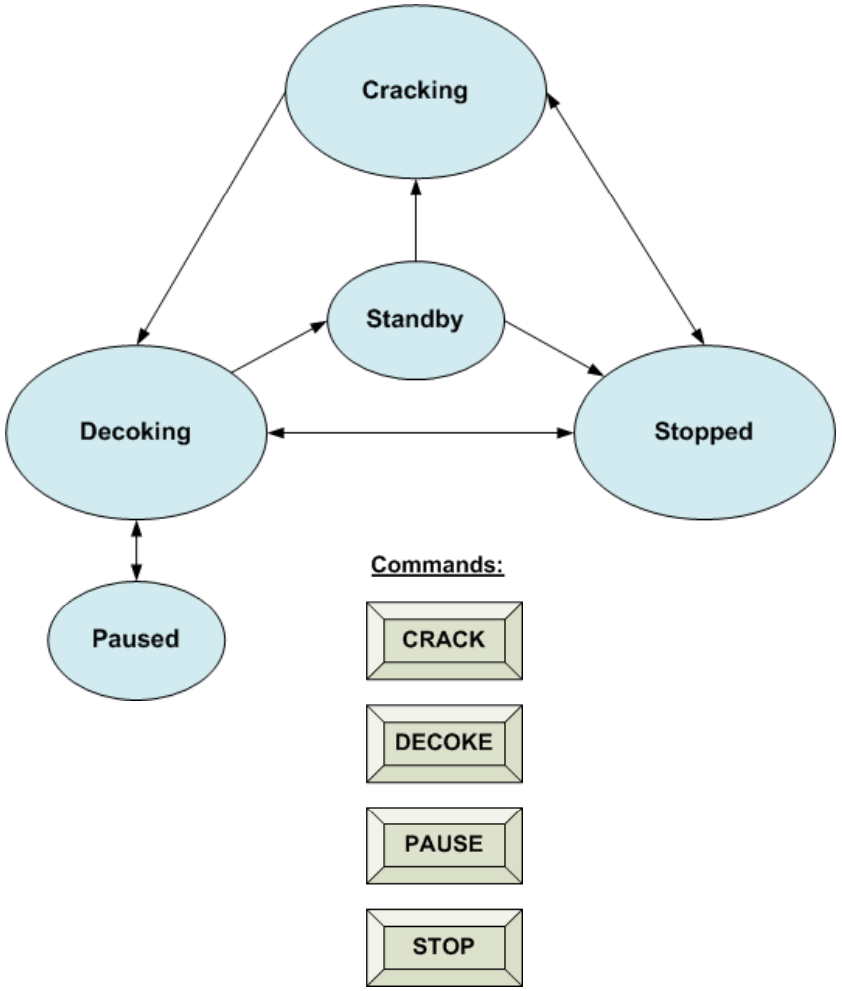




Ethylene Furnace Example

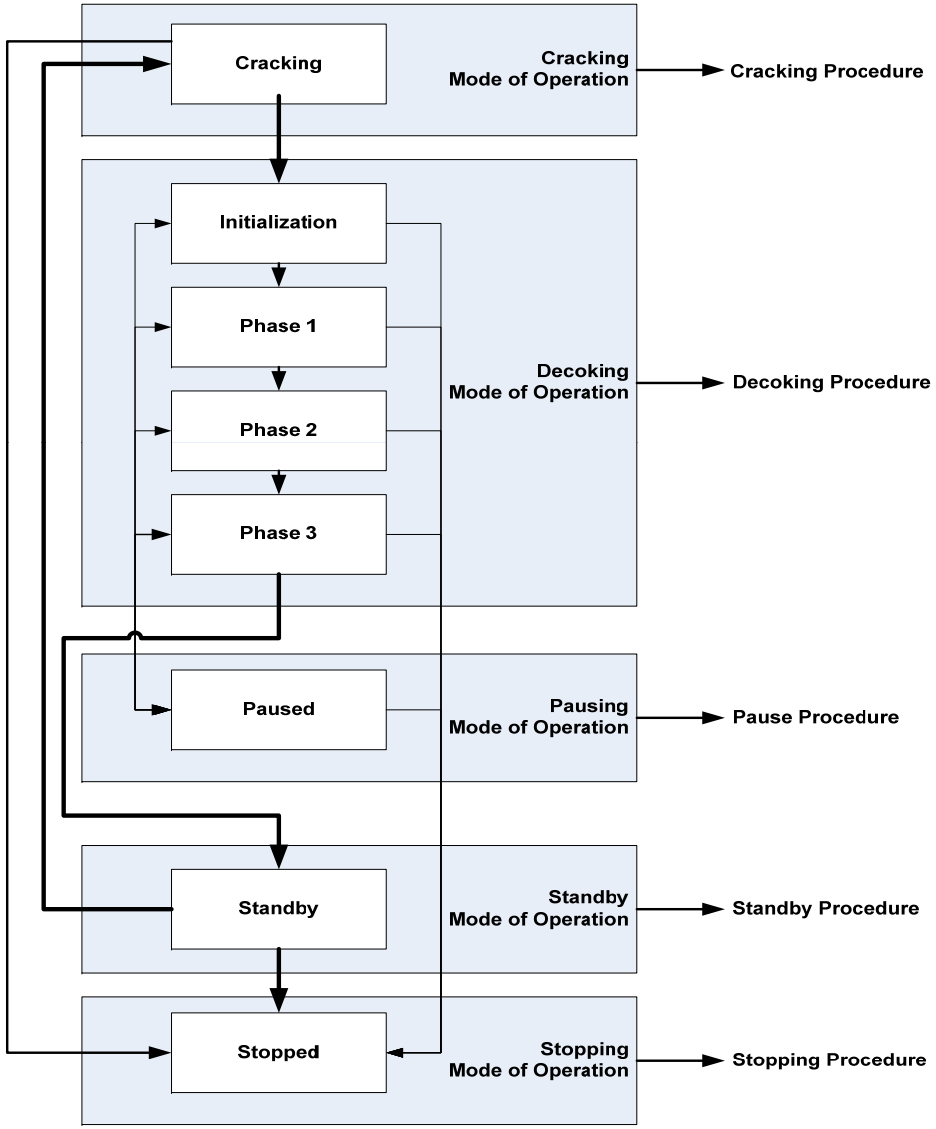


State Transition Diagram

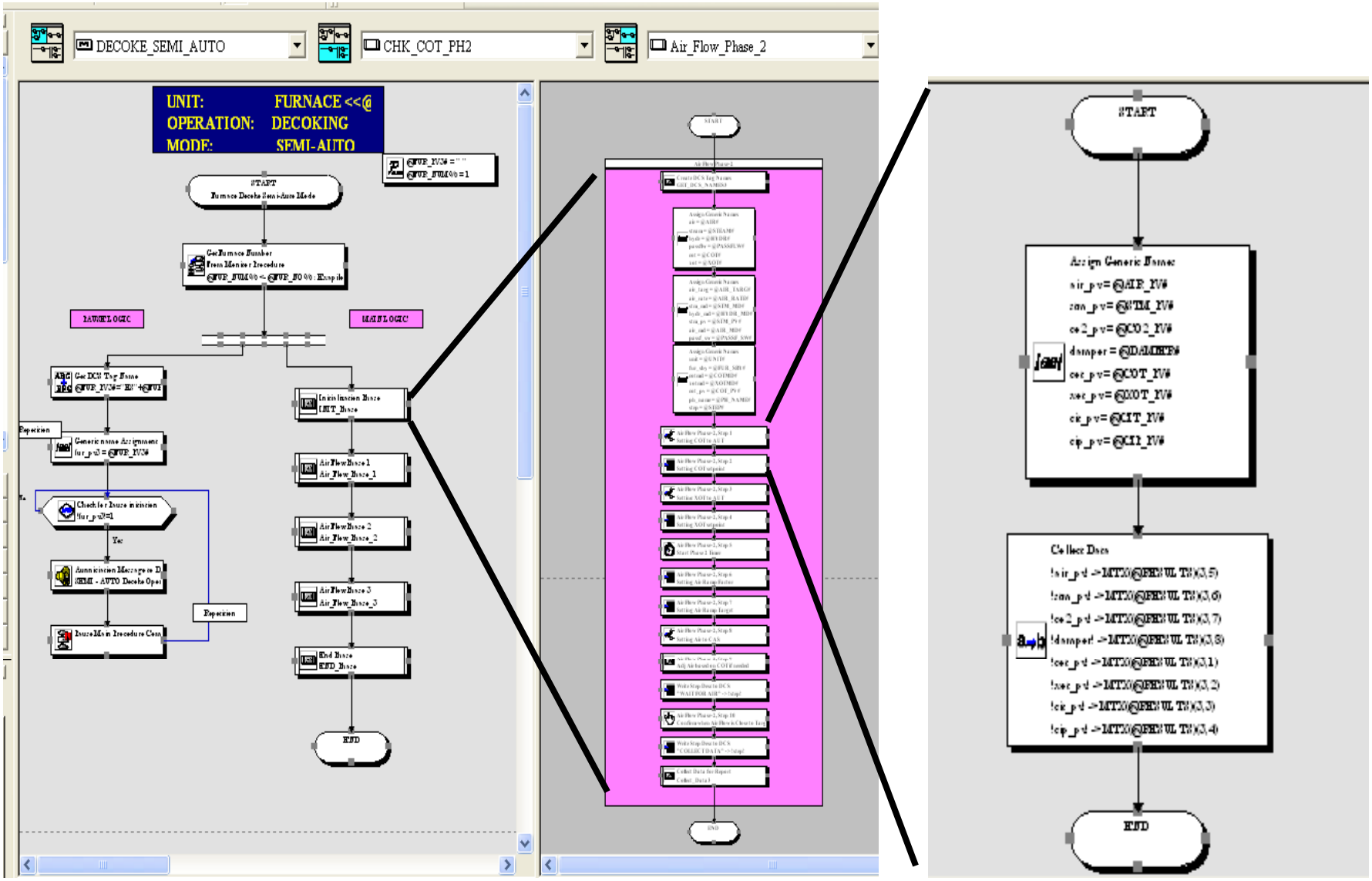


State	Available Commands	Operator-Initiated?	Description
Cracking	Decoke Stop	Yes Yes	The furnace is in full production. Coking deposits are being monitored.
Decoking	Standby Pause Stop	No No/Yes Yes	Coking deposits are being removed from the coils. At the end of process, the status is automatically changed to Standby. If an abnormal condition occurs, the status is automatically changed to Pause.
Stopped	Crack Decoke	Yes Yes	Furnace is taken out of service for maintenance. Cracking or Decoking can be selected by the operator.
Standby	Crack Stop	Yes Yes	Furnace is ready to be transitioned into Cracking from Decoking.
Paused	Decoke	Yes	Operator can pause the Decoking at any time and resume it.

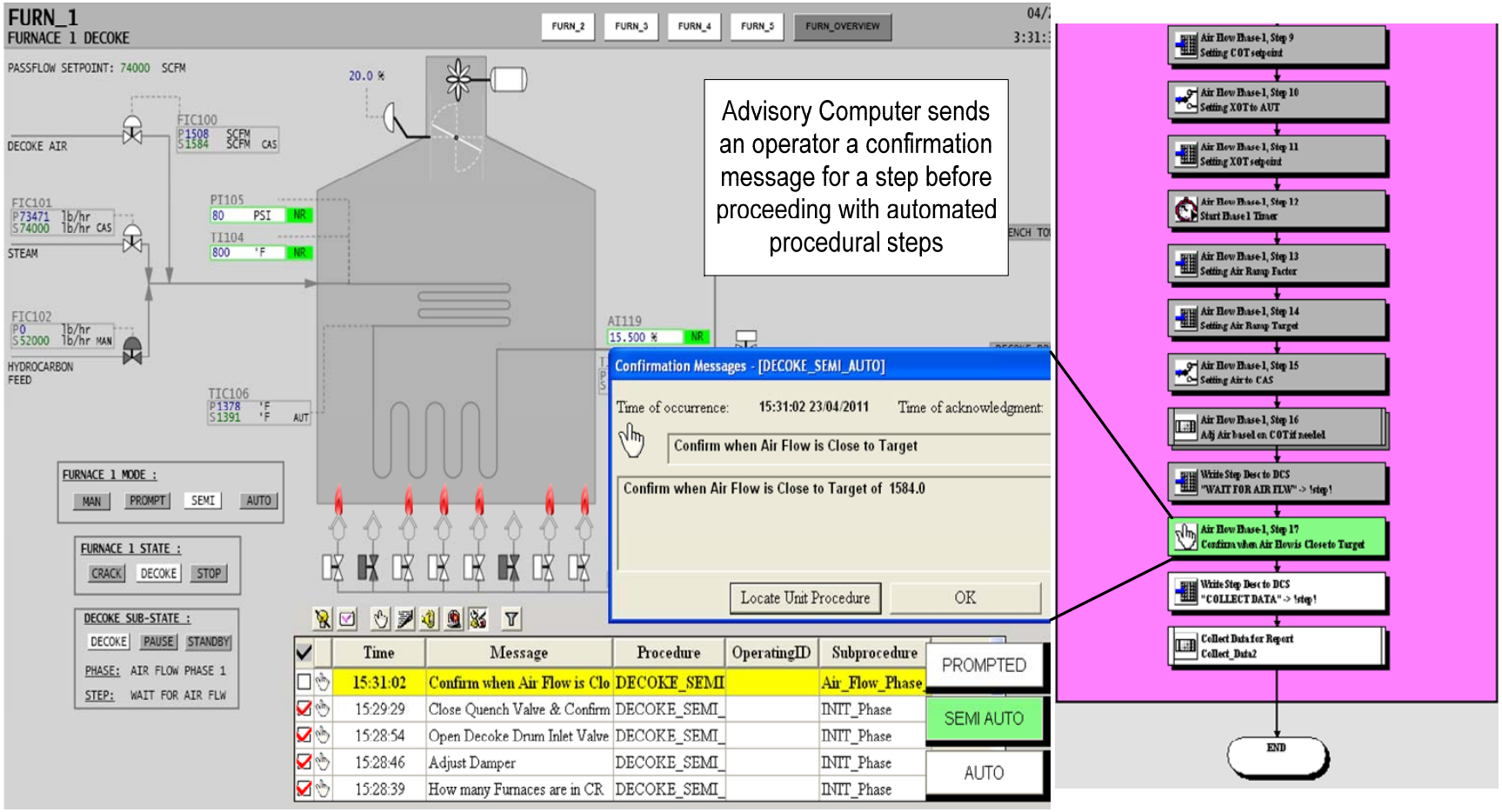
Map Procedures to States



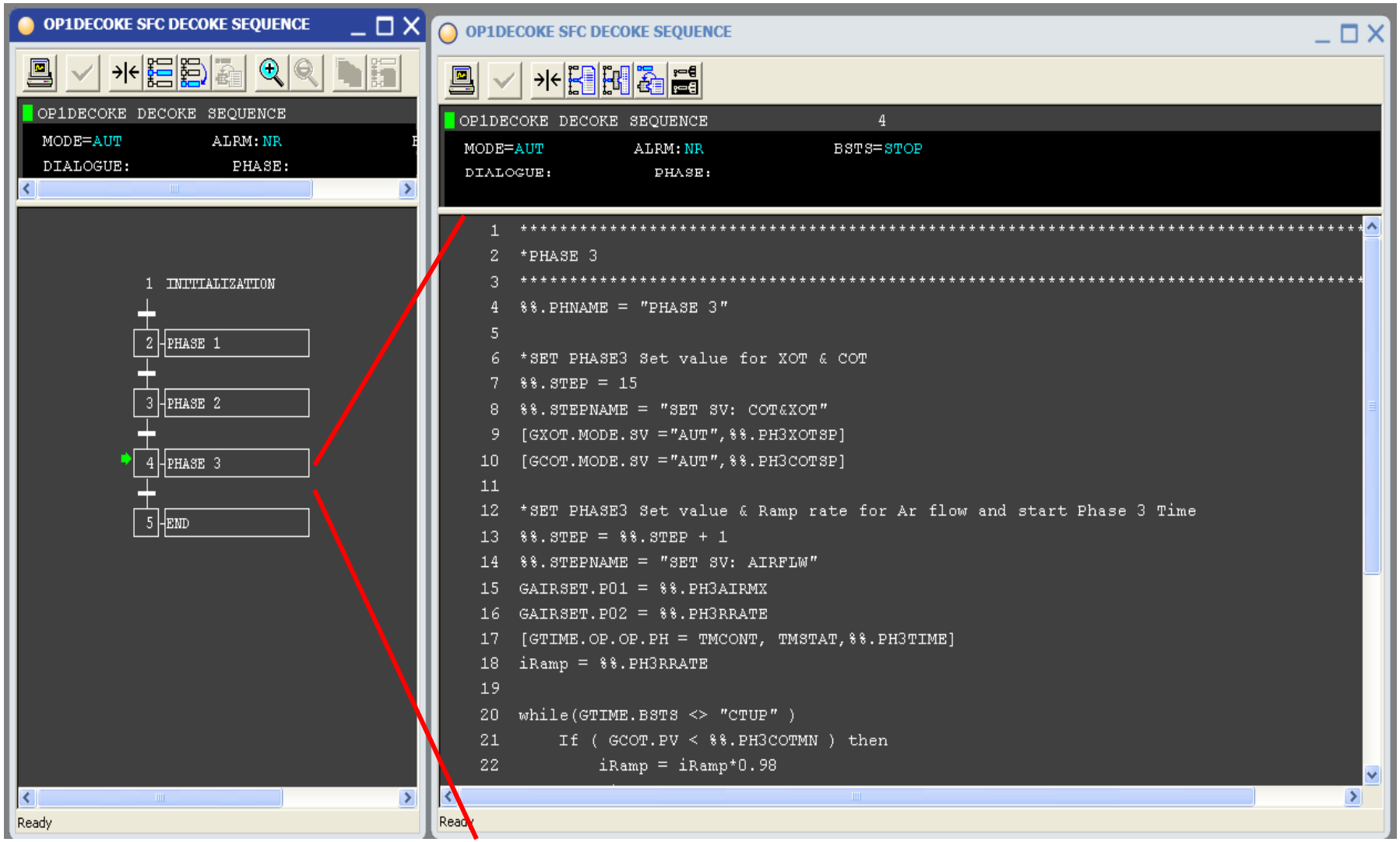
Exapilot MPA Example



Exapilot – Interface with Graphics

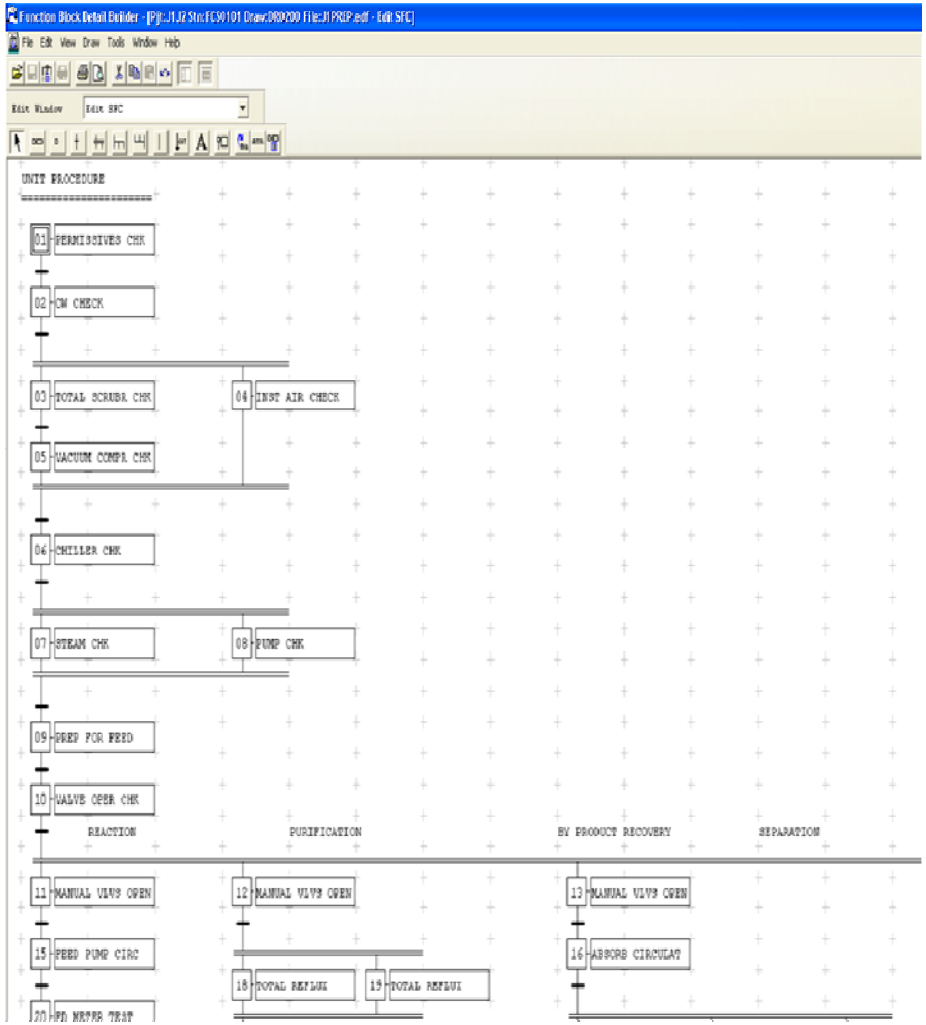


Centum Unit Instrument Example

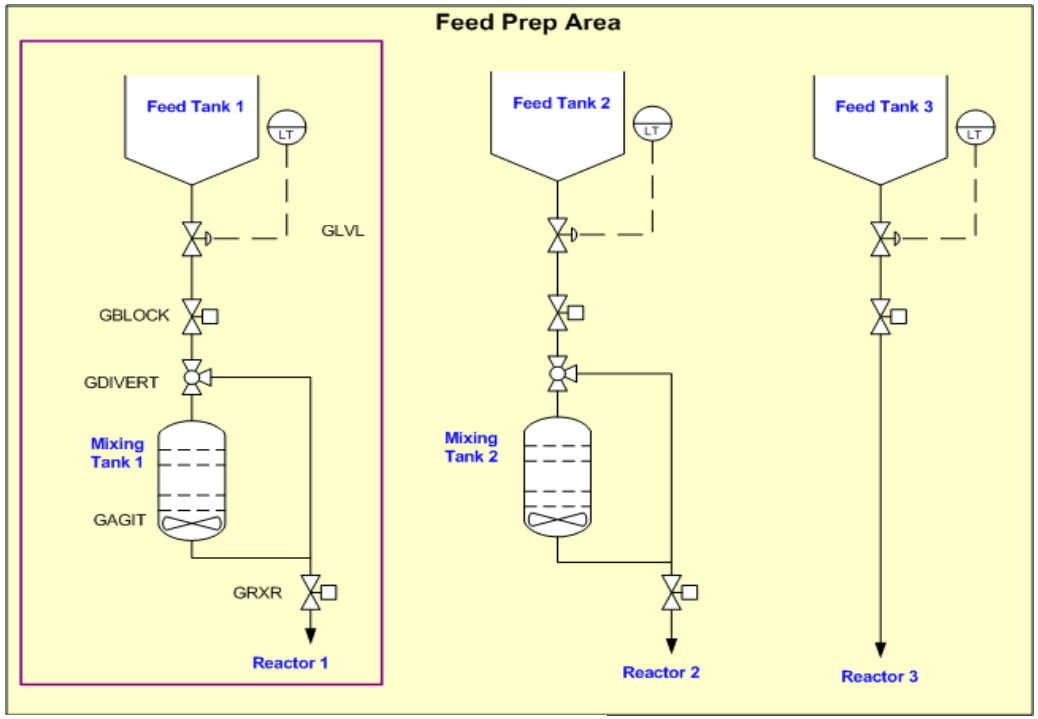


Example of Unit-based Procedure:

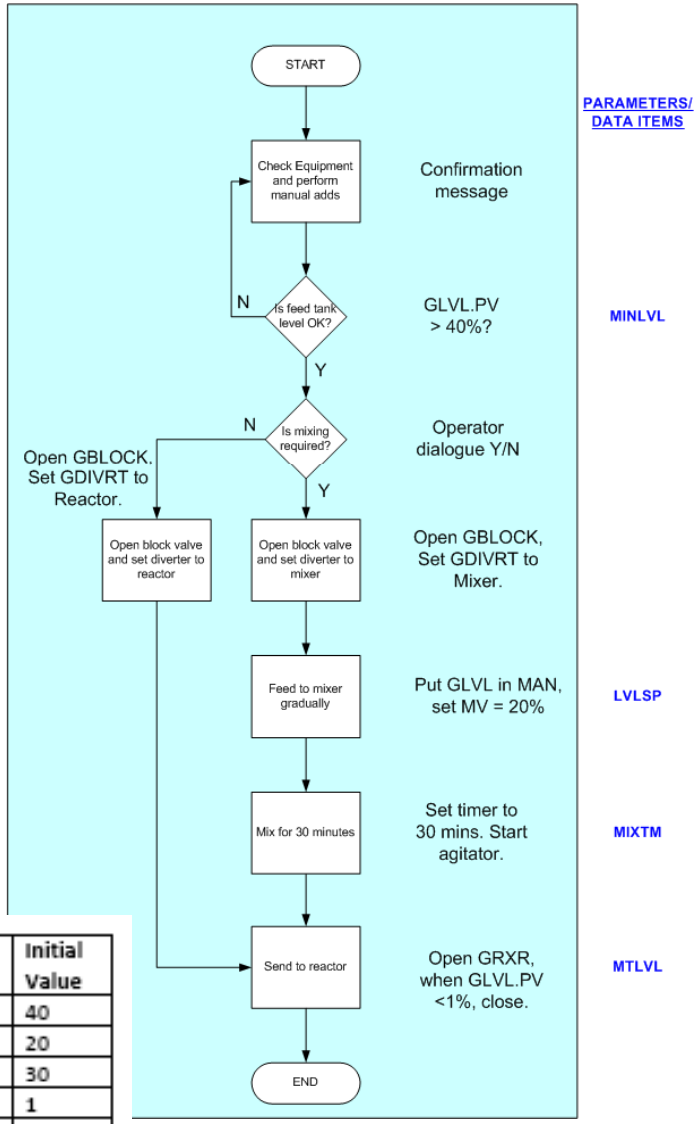
- Preparation for Startup of Train XYZ
  - Utilities Check (check of utilities valves, instrumentation, etc.)
  - Reaction Process (start of circulation, heating, flow check, etc.)
  - Purification Process (manual valves open check, etc.)
  - By-product Recovery Process (temperature checks, etc.)
  - Separation Process (scrubber circulation, pH check, etc.)
- Possible States of the Train XYZ
  - WAIT
  - READY FOR START
  - START-UP
  - RUNNING
  - STOP



Unit Instruments – Generic Functions



Generic Tag	Feed1	Feed2	Feed3
GLVL	LC-101	LC-201	LC-301
GBLOCK	SV-102	SV-202	SV-302
GDIVERT	SV-103	SV-203	SV-303
GAGIT	HC-104	HC-204	*
GRXR	SV-105	SV-205	*



ta Item	Type	Format	Low Limit	Hi Limit	Eng Units	Initial Value
MINLVL	Float	4.1	10	90	%	40
LVLSP	Float	4.1	20	50	%	20
MIXTM	Integer	3	10	60	MIN	30
MTLVL	Float	4.1	0	5	%	1

MPA - Where to Start?

- Look for opportunities – Any time one needs to move from one state to another that requires a discrete set of activities
  - Startups / Shutdowns
  - Crude Switches
  - Grade Changes
  - Cleaning / Regeneration

- Find Justifications based on:
  - Safety & Exposure
  - Productivity
  - Cost Efficiency
  - Knowledge Capture

- Start Small
  - Use the best tool for the job
  - Get users involved (buy-in and better results)
  - Create Templates

Modular Procedural Automation - Applications

- **Wednesday 10-31-2012, Technology Session Track 2**

  - Wayne Hawkins, Chevron

    "Modular Procedural Automation in Gulf of Mexico Deepwater Operations"

  - Zahra Kerkan, Shell

    "Modular Design Approach to Subsea MCS"

  - Exhibit Area – Exapilot Demo

Modular Procedural Automation - Summary

- Consulting Methodology
  - Capture best practices
  - Modular
- Available Today
- ISA-106 Upcoming Standard
  - Systematic, model-based approach
- Tool Selection
  - Exapilot
  - Unit Instrument Function Block