Honeywell Process Solutions – Standard Builds

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HMIWeb Graphic Best Practices
Agenda

• Introduction HMI standards

• Effective Operator Display Design
  – Interaction Requirements Analysis
  – Display hierarchy
  – Qualitative Display Shapes and the impact on Operator Situation Awareness

• HMIWeb SP
  – Standard HMIWeb SP
  – Advanced HMIWeb SP
Why Standard Builds?

- Decrease Project Cost
- Reduction COPQ
- Standardize Project Engineering deliverables
- Global Customer requests for standardization
- For Mega projects multiple local standards is not working
- Open System Knowledge captures in Standards
- Utilization of global tools
Standard Builds content

- Standard Builds consists of:
  - Templates
  - Guidelines
  - Solution Libraries
  - Checklists
  - Productivity Tools
  - Methodology
- For the Disciplines:
  - Hardware
  - Control application
  - Operator Interface
  - Safety Engineering
  - System Architecture incl. L1/L2 networks
Standard Builds content

Standard Builds
- Libraries
- Checklists
- Guidelines
- Templates

Tools

Methodology

Project Deliverables
Operator Interface Concept

Objective

• Define ASM-based user interface concepts and features that improve usability and effectiveness of the human-machine interactions in the process control operations environment

Key Solution Concepts & Innovations

• Single, Integrated View of Multi-Level Hierarchy
• Mixed Initiative Approach
• Effective Window Management and Layout
• Effective Navigation Scheme
• Visual Coding Scheme
• Interaction Objects
• Contextual Menus & Information presentation
• Task View Organization

PROACTIVE versus REACTIVE
Operator Interface Concept

For Proactive Monitoring:
- Simultaneous, integrated view of increasing plant detail
- Integrated Trending
- Integrated alarm management into graphics and navigation tabs

For Fast Response:
- Multi-windowing with controlled window management
- “Yoked” navigation between display levels
- Tabbed navigation within a display level

- Graphics Design
  - e.g., Color-coding only for critical information – like alarms, No 3D graphical objects, etc.
- Right-mouse click access to online documentation
  - e.g., Alarm Objective Analysis documents, procedures, etc.
Process for developing operator interface design

- Phase 5: Usability Evaluation
- Phase 4: Interface Implementation
- Phase 3: Interface Design
- Phase 2: Requirements Generation
- Phase 1: Knowledge Acquisition

Interaction Requirement Methods

HMIWeb Solution Pack

Training Simulator OTS

Effective Operator Display Design
User interface design

Human Factored Design

- Defining a visual language for consistent and effective human machine interaction.
- Design maximizes human capabilities and integrates methodology to handle human limitations, i.e., memory, selective attentions, calculation skills, reading skills
- Impacts appearance of information presentation and input protocol
- UI features
  - Screen Layout, Content and Density
  - Use of visual characterization to convey information to the user
  - Styles Conventions and Object Representation

Human Centered Design

- Show right information in a display to optimized task performance effectively accurately and in a timely manner.
- Emphasis on operation tasks
- Design HMI structure to fit computer system limitations and boundaries by:
  - Creating functional groupings of information
  - Using proper Navigations schemes to allow for better data presentation (density)
  - Visualization techniques
  - Information content
Effective Operator Display Design

• **Sixteen Guideline Categories**
  – Display Types, Display Content, Display Style, Display Layout
  – Color, Symbols and Process Connections, Text and Numbers
  – Navigation, Interaction and Displays
  – Alarm Configuration Scheme, Audible Annunciation for Alarms, Visual Annunciation for Alarms
  – Training Program, Online Guidance, Design Methodology, Management of Change

• **81 guidelines** in total across these 16 categories
  Guidelines are prioritized
  – Priority “1” – rated as one of the minimum set of guidelines for achieving an ASM good quality practice.
  – Priority “2” – one of the comprehensive set of guidelines for achieving an ASM high quality practice.
  – Priority “3” – one of the advanced set of guidelines for achieving an ASM best practice
What is an *Interaction Requirement*?

- **Interaction Requirements**
  - The *combination of* information, action, and collaboration requirements for the various work processes that we ask an operator to perform
  - Information Requirements = The *data and information* needs of an operator to make decisions or perform specific tasks
  - Action Requirements = The software applications, procedures, or *DCS “control handles”* needed to perform specific tasks
  - Collaboration Requirements = *Communications* (e.g., telephone, radio, and verbal) needed to complete the work
Sources of Interaction Requirements

- **Team**
  - Operations team structure
  - Team communication
  - Roles & Responsibilities
  - Coordination of work
- **Task**
  - Procedures (SOP / EOP)
  - Task structure & sequence
  - Work processes
- **Strategy**
  - Various ways of achieving job goals that are not explicitly documented
- **Process**
  - Process functions
  - Operating constraints / limits
  - Operating targets
  - Optimization objectives

Integration of Individual Requirements

Comprehensive Interaction Requirements
IRA Methods and the Display Hierarchy

• Purpose of the display hierarchy
  – Research in the area of human problem solving has found that people tend to use various levels of thinking when solving problems
    • From the “big picture” to the “details” and back and forth
  – Interaction Requirements Analysis supports this problem solving behavior by allowing an operator to move between the “big picture” of process plant status to the “details” around individual equipment areas, pieces of equipment and controllers as the task or situation requires

IRA Methods

“Big Picture”
- Process Status and Changes
  - LEVEL 1
    - Extraction Display
    - Conversion Display
    - Blending Display
  - Investigating and Troubleshooting
  - LEVEL 2
    - Furnaces
    - Coker
    - Fractionator
  - LEVEL 3
  - LEVEL 4

“Details”
- Adjustments and Control Moves
  - Furnaces
  - Coker
  - Fractionator
Display Hierarchy

- The **display hierarchy** is made up of four levels:
  - **Level (1) Overview**
    - Dedicated display
    - Shows critical variables across span-of-control
    - Used for summarizing the “Big Picture”
    - Directs operator to areas of the plant for more details
  - **Level (2) Summary**
    - Display for each major process area (e.g., PFD level)
  - **Level (3) Equipment**
    - Display for each equipment with more detail information (P&ID level)
  - **Level (4) Details**
    - Selected details, help, or faceplate displays
Proactive Monitoring

- Proactive monitoring is defined as actively maintaining awareness of the current situation and status of the process unit
  - Proactive monitoring is achieved by regularly reviewing major process functions and corresponding critical variables in the overview display
  - When critical variables begin to deviate from normal, operators typically respond before alarms activate
  - Proactive monitoring and responding gives operators more time to act before major consequences occur

- Proactive monitoring contrasts with reactive monitoring where operators react to process deviations only after alarms annunciate and then deal with problems
  - Maintaining awareness of process status by having a display hierarchy that supports operator interaction requirements is a key aspect of proactive monitoring
Effective Monitoring and Control
Effective Monitoring and Control

Operator scans the Level 1 overview and other displays in the display hierarchy.
Operator continues to glance back to dedicated Level 1 overview display to maintain awareness of “big picture” of process plant status.
Effective Monitoring and Control

Operator continues to glance back to dedicated Level 1 overview display to maintain awareness of “big picture” of process plant status.

Operator identifies a change in process plant status.
Level 1 example
Level 2 example
Level 3 example
## Qualitative Display Shapes and the impact on SA

**Is there a Problem?**

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### Qualitative Display Shapes and the impact on SA

**Watching a Fault Propagate for an individual Graphic**

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![Diagram showing the progression of fault propagation for individual graphics over time](image)
Qualitative Display Shapes and the impact on SA

- Information in the new display shapes is presented in such a way that operators can qualitatively perceive:
  - normal operating limits
  - alarm limits
  - how close the process is relative to the limits
  - how quickly the process is moving towards / away from the limits
Detecting deviations to variables can be supported in different ways in the Level 1 overview displays:

**Schematic Overview Display**

- Operators must assess process variation relative to their memory of operating ranges and alarm limits.

**Normal variation**

**Abnormal Process deviation**

**Functional Overview Display**

- Operators can perceive normal and abnormal variation relative to visual elements (operating range and/or alarm limits) in the shape.

- Operator attention is drawn to abnormal process deviations and alarms using visual cues.

Operators must judge whether an abnormal condition is occurring (cognitively demanding).
HMI Web Solution Packs

HMI Web Solution Pack Goals:

- Consistent HMI concept
- Integrated solution offering
- Effective plant operations
- Flexibility in use
- Low price for project implementation
- Low maintenance costs
- Effective support (TAC)
- Standardization
- Professional documentation
- High quality solutions

- Performant HMI Solution
- Library compatibility (easy to share)
- Roll-out of ASM (Abnormal Situation Management)
- Common look and feel for all shapes
- Quick project start
- Minimized project risk
- Clear sales, quotation, project baseline
Our thoughts what HMIWeb SP should be

**Thoughts behind the HMIWeb SP**

- Not just a library of objects
- Complete set of tools to develop your displays
- Consists of:
  - Operating Philosophy
  - Object Functional Design Specification (covering common object behaviour)
  - Library with over 2000 objects including professional documentation
  - Training material
- Continuous development:
  - Expanding functionality
  - Improving usability and performance
- Life cycle approach:
  - Project execution
  - Operator effectiveness
  - Site maintenance
HMIWeb Solution Pack Deployment Model

• There will be two HMIWeb Solution pack libraries
  – Experion Standard HMIWeb SP (EP-HMISPSTD)
  – Experion Advanced HMIWeb SP (EP-HMISPADV)

• Existing solution pack will be referred to as the Standard Solution Pack.

• New advanced objects (radar plots, objects from the ASM Visual Thesaurus project) will be added to a separate Advanced Solution Pack.

• Advanced HMIWeb SP will be a licensed option

• Advanced and new Standard HMI Web Solution pack will be available for R310.3 R311.2 and R400
Standard HMIWeb SP Features

• Delivers maximum functionality with high performance
• Consistent operation philosophy throughout the plant
• Easy display implementation
• Support of multi level display concept
• Easy cloning and adaptation of objects
• Pop-Up and faceplate support
• Shortcut menu support
• Flexible colour and text configuration (using CSS)
• Build to meet ASM guidelines
Main library features (cont’d)

Over 2000 objects for both C200/ C300, Scada, TPS HPM, TPS HG and Foundation Fieldbus (with control on the wire) with the following functionality:

- Alarm indications & navigation
- Analogue indicators (with & without SP)
- Counters & totalizers (with & without SP)
- Digital state symbols
- Switches
- Motors
- Pumps
- Valves (2-way & 3-way)
- Numerics & Flags
- Regulatory control indicator (PV, SP & OP)
- Regulatory control valves (with bar & value)
- Buttons
- Bars
- Fans
- Fire & Gas symbols
- ESD Symbols
- Motor Operated Valves
- Static symbols
- And much more
Standard HMIWeb SP Features

- CDA_controllers
- CDA_controllers_OP
- CDA_controllers_OPNM
- CDA_Totalizers

- MOTOR_C200
- Valve_C200
- MOTOR_C200
- Valve_C200
- MOTOR_C200
- Valve_C200
- MOTOR_C200
- Valve_C200

- CDA_Turbines
- CDA_Switches
- CDA_Pumps
- CDA_dataacqs

- CDA_Bars
- CDA_Bloppers
- CDA_digstates
- CDA_Fans

- CDA_OnOffValves
- CDA_OnOffValves_OP
- CDA_ControlValves
- CDA_3way
Common behaviour for all objects

- Mouse behaviour
- Color usage
- Mode indication
- Nmode indication
- Normal Mode Attribute
- Alarm type indication
- Alarm priority indication
- Inactive indication
- Error indication

- Redtag
- Winding
- Ramping
- Initialization
- Bad PV indication
- Alarm disable indication
- Tagname indication
- Engineering Unit Descriptor
- Selection box
- Shortcut menu functionality
Advanced HMIWeb SP Functionality

- Display yoking

A single click on the display Tab will change the Level 2, 3 and 4 displays simultaneously.

A left click on the object will change the Level 3 and 4 displays simultaneously.
Advanced HMIWeb SP Functionality

- Display yoking
- Principal and Associated Focus
Advanced HMIWeb SP Functionality

- Display yoking
- Principal and Associated Focus
Advanced HMIWeb SP Functionality

- Display yoking
- Principal and Associated Focus
Advanced HMIWeb SP Functionality

- Display yoking
- Principal and Associated Focus
- Tabbed Display
Advanced HMIWeb SP Functionality

- Display yoking
- Principal and Associated Focus
- Tabbed Display
- Level1 shapes
  - Polar Star
Advanced HMIWeb SP Functionality

- Display yoking
- Principal and Associated Focus
- Tabbed Display
- Level1 shapes
  - Polar Star
  - Temperature Profile
Advanced HMIWeb SP Functionality

- Display yoking
- Principal and Associated Focus
- Tabbed Display
- Level1 shapes
  - Polar Star
  - Temperature Profile
  - Historical Data Object
Advanced HMIWeb SP Functionality

- Display yoking
- Principal and Associated Focus
- Tabbed Display
- Level1 shapes
  - Polar Star
  - Temperature Profile
  - Historical Data Object
  - Horizontal & Vertical Profile Object
Advanced HMIWeb SP Functionality

- Display yoking
- Principal and Associated Focus
- Tabbed Display
- Level1 shapes
  - Polar Star
  - Temperature Profile
  - Historical Data Object
  - Horizontal & Vertical Profile Object
  - Performance Curve Monitoring
Advanced HMIWeb SP Functionality

- Display yoking
- Principal and Associated Focus
- Tabbed Display
- Level1 shapes
  - Polar Star
  - Temperature Profile
  - Historical Data Object
  - Horizontal & Vertical Profile Object
  - Performance Curve Monitoring
- Gauges
  - Flow
  - Pressure Gauges
  - Temperature Gauges
  - Level Gauges

Analog Gauges

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Diagram showing various types of analog gauges.
Advanced HMIWeb SP Functionality

- Display yoking
- Principal and Associated Focus
- Tabbed Display
- Level1 shapes
  - Polar Star
  - Temperature Profile
  - Historical Data Object
  - Horizontal & Vertical Profile Object
  - Performance Curve Monitoring
- Gauges
  - Flow
  - Pressure Gauges
  - Temperature Gauges
  - Level Gauges
  - Valve Outputs
  - Change indicator
  - Deviation Indicator

**Qualitative Objects**

- Quality Indicator
- Change Indicator
- Deviation Indicator
HMIWeb SP - why use?

- It’s a worldwide supported library
- Consistent HMI concept
- Rich functionality
- Designed to meet ASM guidelines
- Flexibility in use
- Optimized for performance
- Low price for project implementation
- Low maintenance costs
- Effective support
- Standardization
- It offers effective plant operations
- Professional documentation
- Common look and feel for all shapes
- Quick project start
- Minimized project risk
- For sales persons it offers a clear sales, quotation & project baseline
HMIWeb SP - when to use?

- For all Experion HMI projects
- - CDA, Scada, FF, HPM, HG

- It’s more than just a bunch of objects
- It’s a methodology of how to do your job
- It provides a default Operating Philosophy, which can be extended to meet customer specific needs
- It provides an FDS and DDS, which can also be used as a basis to specify your customer specific needs
- It provides good engineering guidelines
- Rich functionality, of which a lot may be re-usable for your project (e.g. the context menu)
- It contains a display editing tool named “HMIWeb PowerTool” which should be used for more effective display engineering (this tool is only meant for internal use and can not be sold to customers or other third parties)
HMIWeb SP .V. HMI SP Advanced - what's so Different?

- Existing solution pack will be referred to as the Standard Solution Pack.
- New advanced objects will be added to a separate Advanced Solution Pack.
  - Principal and Associated Focus
  - Display yoking
  - Tabbed Display objects
  - Polar Star (Radar plots)
  - Temperature / deviation Profile
  - Horizontal Profile Objects
  - Historical Data Objects
  - Performance Curve Monitoring
  - Shapes for Level 1 displays based on the ASM Visual Thesaurus study
HMIWeb SP or HMI SP Advanced for use with ASM - or both?

• Both,
  – Standard SP for ASM compliant “Normal” process, ESD, F&G, permissive, displays.
  – Advanced for the advanced ASM best practices,

• HMIWeb SP helps you to create a PROACTIVE rather than REACTIVE environment
Contact details & HMI Core Team Members

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