Deploying more intuitive HMI graphics in accordance with the ISA standards
Introduction

• Are you / your operators able to understand the information displayed on your HMI?

• Have you ever found yourself searching for information on an HMI?

• Can you quickly and effectively recognize deviances in your process through your HMI?

- “provide guidance to design build, operate and maintain HMIs to achieve a safer, more effective process control system under all operating conditions.”
- “improve the user’s abilities to detect, diagnose, and properly respond to abnormal situations.”

- Standardized approach to HMI Design – not restricted by brand of HMI, type of process, PLC, DCS, etc.
- Industry standard but not widely implemented – due to release date.
- Not restricted to new systems. Older systems can be converted to some of the standards outlined with a quick turn over.

By implementing ISA 101 philosophies we have found that the goals set fourth are satisfied, allowing users to focus on information desired, better than the previous generation HMIs.
Overview of Topics

1. **Informational Guidelines** - Grouping, Coloring, Types of displays.
   - How it will immediately affect Operations.

2. **Separation of Screens** - Based on diversity of needs within the end user’s organization.
   - To allow users to obtain the information they want

3. **Density of Information** - How it affects the end user’s understanding / operation / maintenance.
Informational Guidelines
Types of Displays

One display does not fit all scenarios...

Transmitter

### psi

**Process Information**

Transmitter

### psi

**Process with Tolerances**

Transmitter / PID

### psi

Present

**Process Dependent e.g. PID Loop**

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Types of Displays - Example
**Grouping of Information**

When deployed correctly:

1. Allows users to quickly focus in on the information they need.
2. Can show a large amount of information in a simplified format.

Grouping is not present / not intuitive:

1. Users will spend more time searching for information.
2. Information will become cluttered and possibly distracting.
## Grouping – Example

### PLANT EFFICIENCY

<table>
<thead>
<tr>
<th></th>
<th>Live</th>
<th>Daily</th>
<th>Monthly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Power</td>
<td>1796.4 kW</td>
<td>12360.5 KWH</td>
<td>371200.4 KWH</td>
</tr>
<tr>
<td>Total Cooling</td>
<td>2309.0 TONS</td>
<td>15660.1 TONH</td>
<td>509881.9 TONH</td>
</tr>
<tr>
<td>KW/Ton</td>
<td>0.778</td>
<td>0.789</td>
<td>0.728</td>
</tr>
<tr>
<td>COP</td>
<td>4.520</td>
<td>4.456</td>
<td>4.831</td>
</tr>
</tbody>
</table>

### CHILLER 1

- **Power:** 0.0 kW
- **Cooling:** 0.0 TONS
- **KW/Ton:** 0.000
- **Delta T:** 5.0 DEGF
- **Flow:** 0.0 GPM

### CHILLER 2

- **Power:** 599.0 kW
- **Cooling:** 1213.3 TONS
- **KW/Ton:** 0.494
- **Delta T:** 8.9 DEGF
- **Flow:** 3289.0 GPM

### CHILLER 3

- **Power:** 537.0 kW
- **Cooling:** 1095.7 TONS
- **KW/Ton:** 0.490
- **Delta T:** 8.1 DEGF
- **Flow:** 3242.0 GPM

### CHILLER 4

- **Power:** 1.0 kW
- **Cooling:** 0.0 TONS
- **KW/Ton:** 0.000
- **Delta T:** 5.7 DEGF
- **Flow:** 0.0 GPM

### CONDENSER WATER PUMPS

- **CWP-1, CWP-3, CWP-5:** 120.0 kW
- **CWP-2, CWP-4:** 115.0 kW
- **Total:** 235.0 kW

### CHILLED WATER PUMPS

- **CHP-1:** 0.0 %FS, 121.5 kW
- **CHP-2:** 57.3 %FS, 123.9 kW
- **CHP-3:** 0.0 %FS, 123.9 kW
- **CHP-4:** 0.0 %FS, 0.0 kW
- **CHP-5:** 57.5 %FS, 0.0 kW
- **Total:** 369.3 kW

### COOLING TOWERS

- **CT-2:** 0.0 %FS, 0.0 kW
- **CT-3:** 0.0 %FS, 0.0 kW
- **CT-4:** 68.1 %FS, 27.1 kW
- **CT-5:** 67.6 %FS, 27.0 kW
- **Total:** 54.1 kW
Why is Coloring Important?

1. Users may be colorblind / vision deficient.
   - Certain color combinations may not be clear / visible to users.

2. Coloring will influence the amount of eyestrain user experience over extended time.
   - High contrast should be limited.

3. Will affect users situational awareness.
   - When a consistent clear format is used, users can identify problems / alarms quicker because the problem will stand out.
## Coloring - Examples

<table>
<thead>
<tr>
<th>Normal</th>
<th>Alarm</th>
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</thead>
<tbody>
<tr>
<td><strong>Transmitter</strong></td>
<td><strong>Transmitter</strong></td>
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<tr>
<td><code>##.# psi</code></td>
<td><code>##.# psi</code></td>
</tr>
<tr>
<td><strong>Eyestrain</strong></td>
<td><strong>Colorblind</strong></td>
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## Coloring - Example

<table>
<thead>
<tr>
<th>PRI CHWS TEMP</th>
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<th>PRI CHW DELTA T</th>
<th>PRI CHWS FLOW</th>
<th>PCHWS/PCHWR DIFF PRESS</th>
<th>SEC CHW DELTA T</th>
<th>ETS #</th>
</tr>
</thead>
<tbody>
<tr>
<td>42.9 DEGf</td>
<td>52.9 DEGf</td>
<td>9.9 DegF</td>
<td>1222 GPM</td>
<td>54.4 IN WC</td>
<td>8.4 DegF</td>
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</tr>
<tr>
<td>42.1 DEGf</td>
<td>54.1 DEGf</td>
<td>12.6 Degf</td>
<td>1777 GPM</td>
<td>100.0 IN WC</td>
<td>11.8 DegF</td>
<td>2</td>
</tr>
<tr>
<td>42.0 DEGf</td>
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<td>12.4 Degf</td>
<td>1777 GPM</td>
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<td>1900 GPM</td>
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<tr>
<td>42.0 DegF</td>
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<td>305.0 GPM</td>
<td>91.6 IN WC</td>
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<td>12</td>
</tr>
</tbody>
</table>

[www.thermosystems.com](http://www.thermosystems.com)
Separation of Screens
When should Screens be Separated?

1. Information is not related to the process shown.

2. Too much information on the screen.

3. Information is does not pertain to primary users.
Example - Chilled Water Plant – Leg Piping overview

• Operators want to know differential pressures to adjust pump speed setpoints. (Primary users)

• Managers / Admin want to know totalized tonnage for billing purposes / efficiency calculations. (Secondary users)

• Engineers want to know pipe diameters and use screen as a reference. (Tertiary users)
Density of Information
Density of Information

Showing related process information

- Increases users understanding of the process.
- Makes troubleshooting easier.
- Can usually be accomplished by simple techniques.
1. Too Much information on the screen:
   - Can cause confusion in operations.
   - Information is misinterpreted.
   - User has to focus on the information desired.

2. Less is more approach:
   - Information shown is important to the running process.
   - Detailed information is shown in popups / secondary screens.
   - Allows operations to focus on the process and still allows for additional information to be shown (in secondary screens / popups).
## Electric System Data

### Breaker Statuses
- **Breaker Position**: Closed
- **Trouble Status**: No Trouble
- **Breaker Available**: Available
- **Modbus Comm Alarm**: Normal

### Current Values
- **Phase A Current**: 734.1 Amps
- **Phase B Current**: 747.9 Amps
- **Phase C Current**: 753.4 Amps
- **Voltage A-B**: 480.0 V
- **Voltage B-C**: 480.7 V
- **Voltage C-A**: 491.4 V
- **Kilowatt**: 558.2 kW
- **Kilowatt Hour**: 756,417.7 kWh
- **kVAR**: 243.0 kVAR
- **Power Factor Phase**: -0.9

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[Image: www.thermosystems.com]
1. Planning is Key

- Removes secondary information from screens to increase performance.
- Working with Operations in development is critical to success – Operations will take ownership of the screens.
- Customer is aware of the design / knows the philosophy of showing / removing certain information from the primary screens.

2. Operations Will Adapt Quickly

- Operators typically struggle with changes to the system, however because the ISA Standard is focused around them (primary users), Operators adapt much quicker, and benefit faster.