Process Solutions

Honeywell

Experion PKS R431

HMIWeb Operator and Alarm Philosophy

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Symbol definitions

The following table lists the symbols used in this document to denote certain conditions.

Symbol	Definition
NOTICE	NOTICE is used to address practices not related to physical injury.
⚠CAUTION	CAUTION indicates a hazardous situation that, if not avoided, could result in minor or moderate injury. CAUTION symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.
⚠WARNING	WARNING indicates a hazardous situation that, if not avoided, could result in death or serious injury. WARNING symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.
⚠DANGER	DANGER indicates a hazardous situation that, if not avoided, will result in death or serious injury.

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About this guide

The purpose of this document is to provide guidance when designing displays using Honeywell's HMIWeb Display Builder, for Experion PKS R430 (and above) releases, making use of the HMIWeb Solution Pack R431.

This document provides a set of philosophy guidelines that should be followed when developing displays with the HMIWeb display builder. The contents of this document are based on experience developing the HMIWeb Solution Pack and other applications, such as GUS displays, conventional Experion PKS displays, and Visual Basic applications. This document includes modern HMI design techniques such as those published by the Abnormal Situation Management (ASM) consortium.

Revision history

Revision	Date	Description
A	February 2015	Initial release of document for Experion PKS R431.

Special terms

Abbreviation or acronym	Definition
ASM	Abnormal Situation Management
DSA	Distributed Server Architecture
ESV	Experion Server
ESVT	Experion Server TPS
ES-T	Experion Station TPS
ES-F	Experion Flex Station
FTE	Fault Tolerant Ethernet
GUS	Global User Station
HG	Hiway Gateway
HMI	Human Machine Interface
HPM	High Performance Process Manager
LCN	Local Control Network
NIM	Network Interface Module
PAS	Process Automation System
P&ID	Process &Instrument Diagram

Abbreviation or acronym	Definition
PIN	Plant Information Network
PCN	Process Control Network
PKS	Process Knowledge System
TPS	Total Plant Solution
UCN	Universal Control Network
VB	Visual Basic

Related documents

It is not the intent of this document to describe standard system features related to HMI. Reference documents that describe standard HMI related system features are identified below.

The following list identifies publications that may contain information relevant to the information in this document.

Document name	Document number
Experion PKS R431 HMIWeb Object Design Specification	EPDOC-X174-en-431
Experion PKS R431 HMIWeb Solution Pack Software Change Notice	EPDOC-X172-en-431
Experion PKS R431 Operator's Guide	EPDOC-XX80-en-431
Experion PKS R431 Integrated Experion-TPS User's Guide	EPDOC-XX66-en-431
Experion PKS R431 HMIWeb Display Building Guide	EPDOC-XX54-en-431
Experion PKS R431 SafeView User's Guide	EPDOC-X120-en-431
ASM Effective Console Operator HMI Design Practices	ISBN: 978-1492875635
ASM Effective Alarm Management Practices	ISBN: 978-1442184251

Chapter 1 Operating philosophy

1.1 Display hierarchy

1.1.1 General

ASM research in the area of human problem solving has found that people tend to use various levels of thinking when solving problems. The concept of displays level solves this 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. A concept of “levels” should be used when constructing the displays for HMIWeb. The purpose of these levels is to provide different levels of platform detail to aid the operator in different tasks.

These levels are referred to as Level-1, Level-2, Level-3 and Level-4 for the purpose of this specification. The primary purpose of these levels is to provide the operator different levels of operating detail to aid the operator in performing different tasks. A secondary purpose of these levels is to allow for navigation.

The three levels of display represent different levels of complexity. This is the result of a display hierarchy in which a single Level-1 is associated with several Level-2 graphics that are in turn associated with several Level-3 graphics. This hierarchical structure is illustrated in Figure 1.

Each Level-2 can only be associated with a single Level-1 and each Level-3 can only be associated with a single Level-2. Conversely, each Level-1 has several associated Level-2 displays and each Level-2 has several associated Level-3 displays.

Display hierarchy design specifics

Level 1: Overview display:

- Summarize key process variables and associated alarms
- Show any emergency and high-priority alarms in the operator’s span of control

Level 2: Process Unit Overview display:

- Have one primary display for each major process area or unit
- Show all emergency and high priority alarms for the process area
- Provide main control for the process area
- Provide enough information and control for most conditions

Level 3: Secondary Process unit Detail display:

- Provide detailed information not displayed on the Level2 displays
- Show low priority alarms, controllers, and indicators

Level 4: Selected details display:

- Provide necessary additional physical details
- Include online help

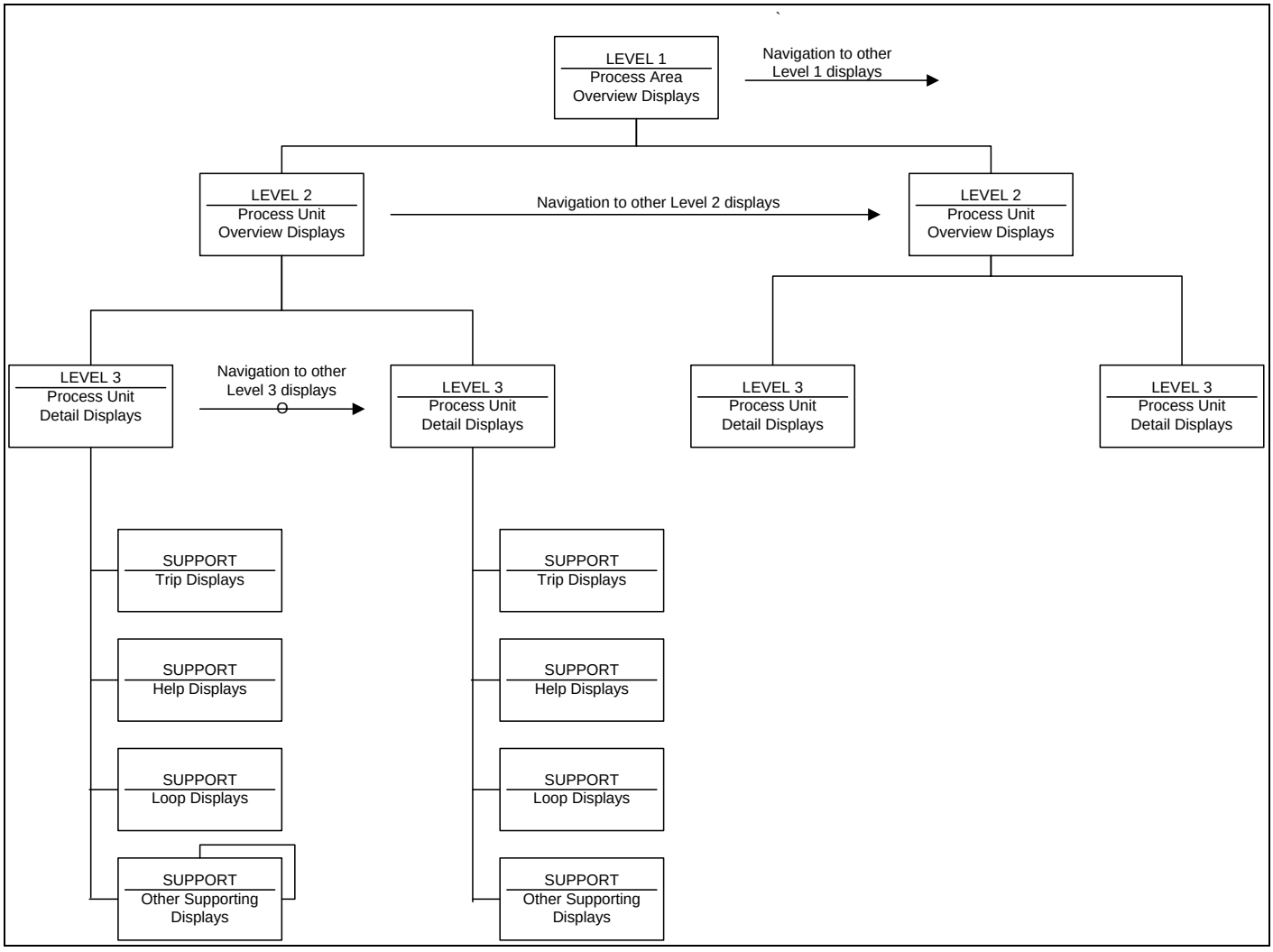


Figure 1: Display Hierarchy and links

1.1.2 Level-1 – Process Area Overview Displays

The process area overview (or Level-1) display's primary purpose is to provide a view of key elements of the plant, as summarized on a limited number of displays. Level-1 graphics show the broadest available view of the facilities under the operator's control. The variables displayed on the Level-1 graphic will have been selected and deemed most important by operations personnel. A Level-1 graphic contains multiple units showing critical variables across the operator span-of-control and directs the operator to areas of the plant for more details. The operator is not allowed to execute any control from this display.

The process area overview displays presents information in the form graphical objects. The Level 1 overview display shows:

- Alarms
  - General location
  - Acknowledged status
- Key process parameters

  - Measures of process health
  - Actual values
  - Abnormal status and process problems
  - Severity of deviation
  - Direction of change of key process parameters
  - Trends of key process parameters
- Equipment availability
  - Shutdown systems
  - Critical bypasses

The Level 1 overview display shows alarm summary information and can contain other information, if available, on related plant facilities. These include the downstream and upstream areas, as well as utilities that can affect the health of the process in the span of control of the operator.

Honeywell recommends that Level-1 displays be visible or readily accessible at all times. SafeView can be configured to ensure that critical Level-1 displays are always visible (that is, other windows or applications cannot obscure them) if Experion PKS is used in a multi-windowed/multi-screen environment.

Alignment, font size, separation, and color ensure visibility, and care should be taken to ensure visual noise on the display is not a distraction. Illustrations of Level-1 displays are shown in Figure 2 and Figure 3 below.

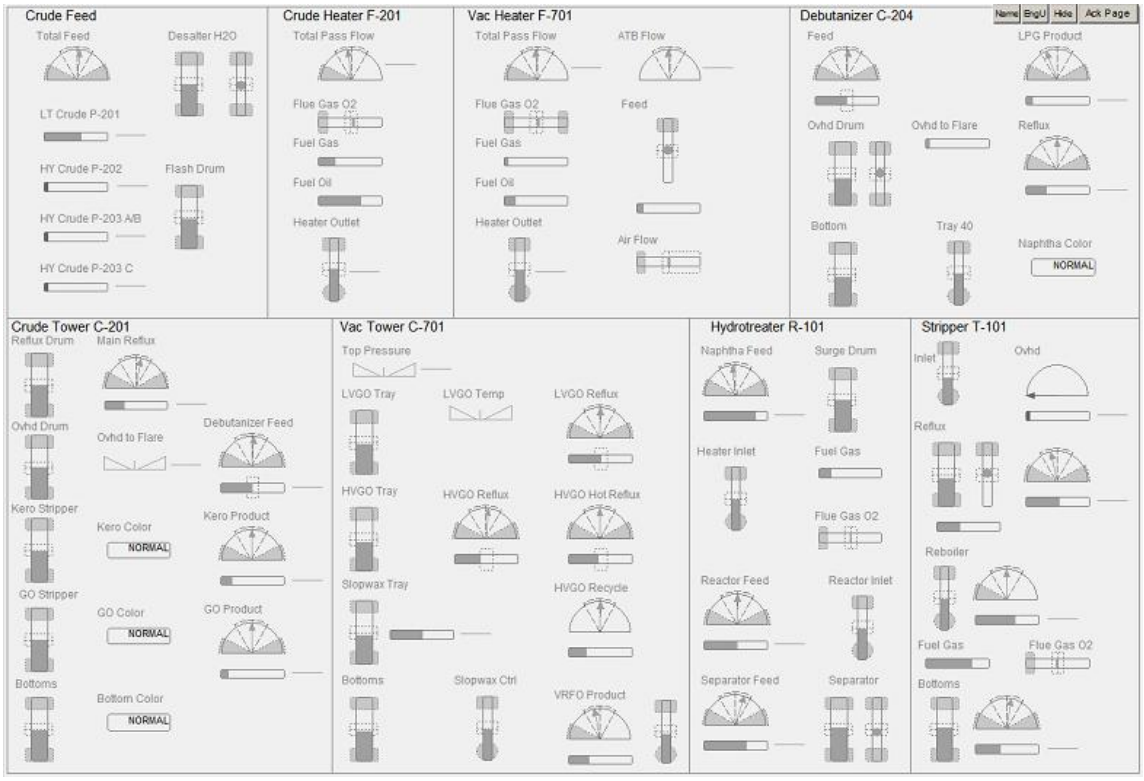


Figure 2: Example Level-1 Process Area Overview Display

In above example display equipment areas and overall process flow is represented by grouping these graphical objects within boxed areas.

This L1 overview display is not a schematic display type. The layout style of this display has been referred to as functional. In the functional layout, parameters are organized according to some functional dimension. This display is organized in eight major subsystems of equipment such as Crude Feed, Crude Feed Heater and Vacuum Heater. The major subsystems are organized on the display consistent with their functional relations in the plant, that is, the left-to-right, top-to-bottom organization is consistent with the main process flow through the major equipment subsystems. Within each major equipment subsystem, the same principle is applied to the extent that it is feasible.

The graphical objects design is based on a study conducted by the ASM Consortium in 2006, under the project name of Visual Thesaurus.

There are three types of shapes used:

- Analog Gauge
- Qualitative Object
- Controller Object

There are four analog gauges that represent specific parameter types: temperature, pressure, level, and flow. For analog gauge objects, the visual features can show the process value (PV) relative to a set point, normal range, and alarm limits.

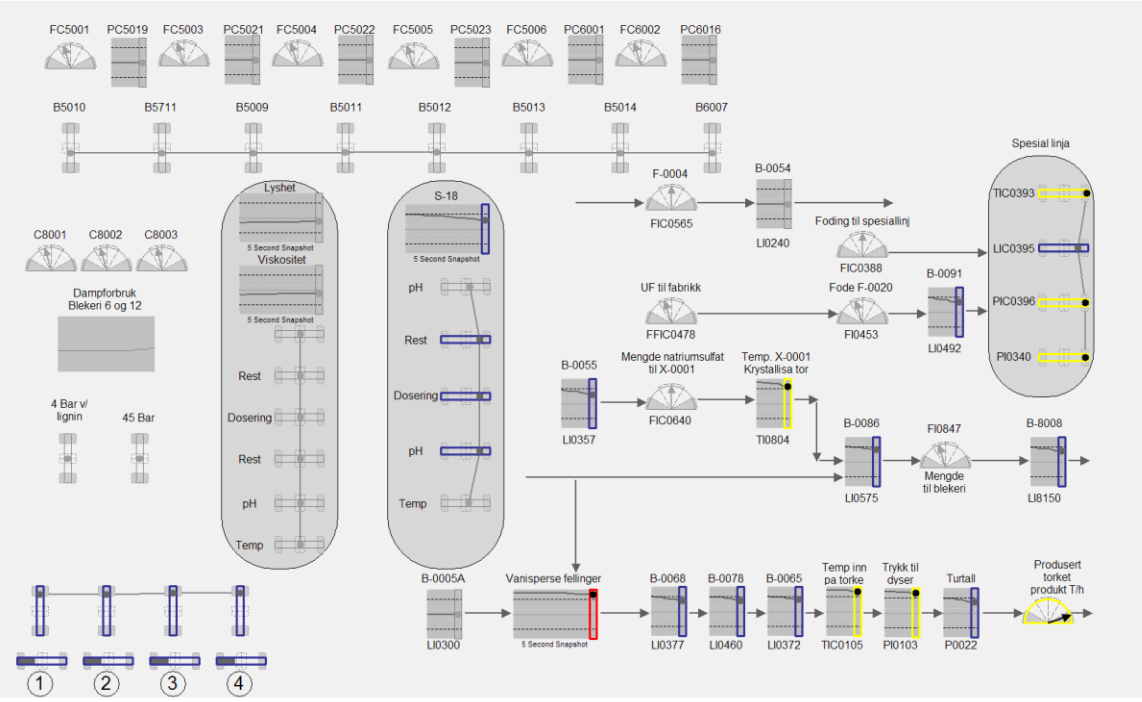


Figure 3: Example Level-1 Process Area Overview Display

The example display in Figure 3 shows the main process flow and main equipment organized on the display consistent with their functional relations in the plant, that is, the left-to-right, top-to-bottom. This L1 display uses the “Visual Thesaurus” analog gauges, trend objects and horizontal and vertical profile lines.

The profile line deviates from the center when a problem is developing. The profile reveals the overall pattern of values across numerous, related sensor readings. The dotted lines tell the operator what the intended range of operation for each parameter is. Developing problems are very easily seen using profile lines because human vision is highly sensitive to angular deviations in straight lines. Trend objects are used for variables when operators need to make decisions about the performance of a variable over time.

The visual coding of the objects change when a value exceeds its normal range and/or alarm limit. The process indication increases in salience and the outline of the objects shows the off-target and alarm states in different colors.

Notice! Please note that the graphical objects used in Example Overview display in Figure 2 and Figure 3 are part of the Advanced HMIWeb Solution Pack library which is a licensed option.

Other direction of change indicators which can be used in Level 1 displays are Radar objects or Polar stars.

In case SafeView is used for window management, in combination with multiple screens (dual or quad screen configuration), a small Level_1 navigation display may also be used, to aid the direct navigation to all Level 2 process and safety areas.

When multiple screens are used, the station Command Zone at the top of the screen and Status Bar zone at the bottom of the screen (and in some cases also windows taskbar) require some space on only one of the screens, leaving a reduced space for the main process display on that screen (about 85% of the height)

Normally the size of the displays on the other screen(s) is kept the same, meaning a small area of about 15% height and full width of the screen is available for other purposes. This small window can be used to present a small Level_1 navigation window, as shown below. This could be located in a window at the top of the bottom second monitor

The navigation display's primary purpose is to provide an overview of the Level-2 displays and a means to quickly navigate to these displays. Within the Navigation display, the navigation shapes are clearly separated from each other by spaces. An example of a Navigation display is shown in Figure 4 below.

Figure 4: Small Navigation Display

An alternative to provide an overview of the alarm status of the Level 2 and 3 displays and quickly navigate to these displays can be accomplished with Display tabs. There are different types of Display tabs, with and without Alarm information and or Yoking support. An example of the Display Tabs is shown in Figure 5.

Figure 5: Display Tabs

1.1.3 Level-2 – Process Unit Overview Displays

Level-2 graphic displays serve a dual purpose. They provide information about key elements of the plant unit, and they are also used to allow operators to intervene in common/critical abnormal situations. Often, variables from several locations in the process need to be accessed to allow the operator to properly intervene and then monitor the results of that intervention. Level-2 displays have this information gathered in one place. An example is shown in Figure 6.

Level-2 graphic displays allow operators to perform common tasks without changing graphics. Take, for example, the task of monitoring and controlling the separation trains during platform start-up. Seeing both 1st and 2nd stage separators on a single display together with critical signals from the production manifold will allow the operator to monitor the entire separation process on a single display. On traditional process graphic displays, each separator would likely be on a single page. To start-up the process, the operator would have to switch between the separator displays repeatedly.

Conceptually, the Level-2 graphic contains all the information and controls required to do most operator tasks from a single graphic and only contains information relevant to the task. When all relevant process information is on a single display in front of the operator, abnormal situations are more likely to be resolved quickly and efficiently.

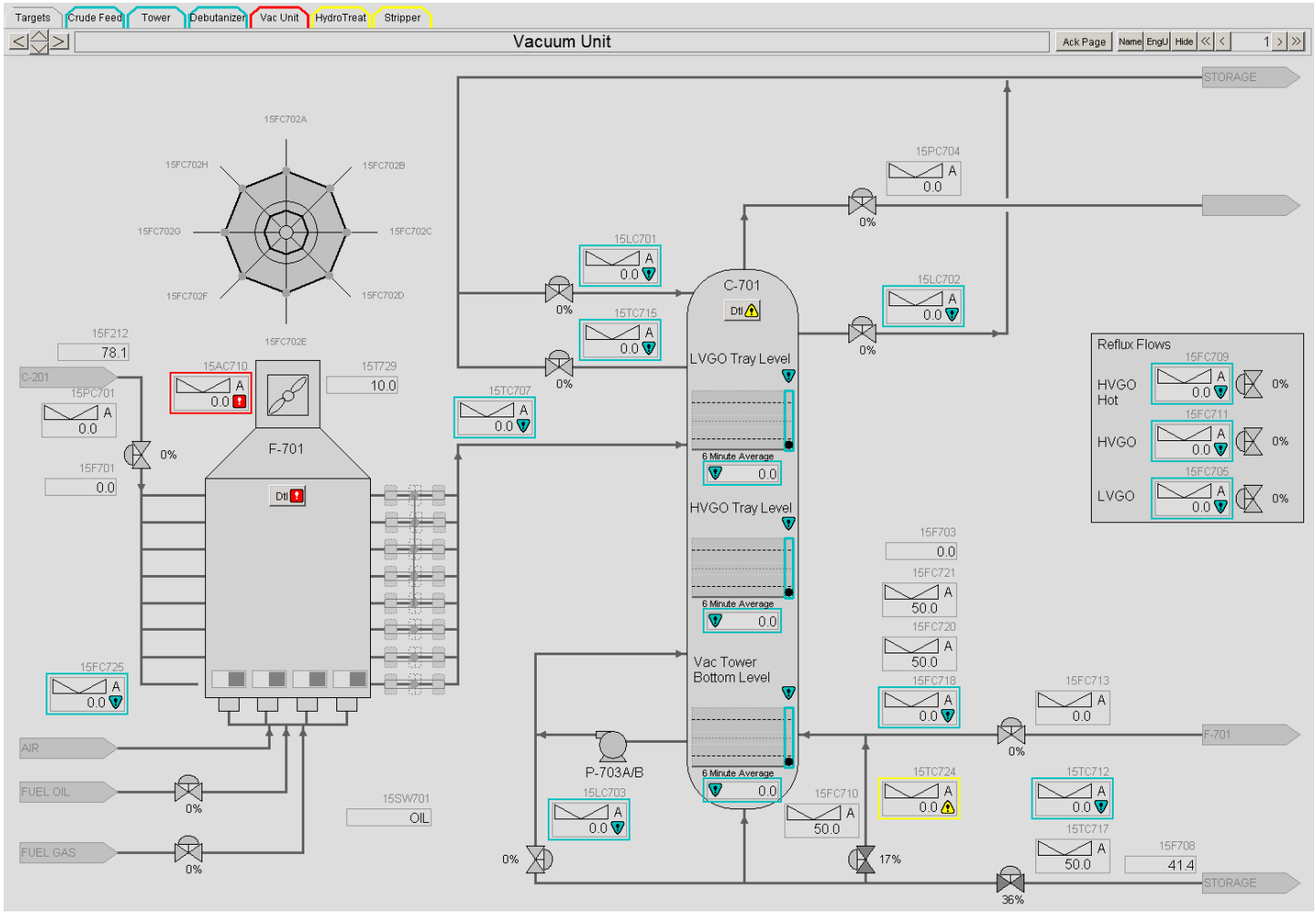


Figure 6: Level-2 Process Unit Overview Display

Notice! Please note that the some of the graphical objects used in Level2 display in Figure 6 like the Trends and Temperature profile lines are part of the Advanced HMIWeb Solution Pack library which is a licensed option.

In the above example, controller objects show the deviation of SP and PV using the symbols shown below. This makes it easy for an operator to trace controllers that need attention. The first symbol shows a small negative deviation of the PV, the second shows a large deviation of the PV and the third example shows a controller in optimal condition (very minor deviation).

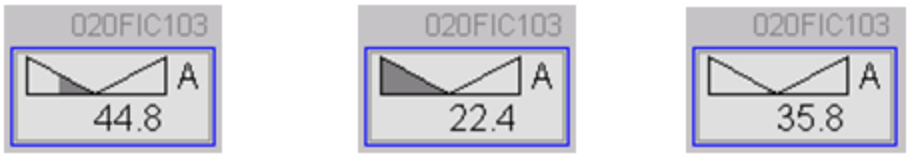


Figure 7: Deviation Indication Shapes

1.1.4 Level-3 – Process Unit Detail Displays

Level-3 graphic displays are exhaustive in their detail and contain all available information about smaller pieces of the process unit. While the objective of the Level-2 display is to provide only the handles and tools necessary to intervene in a particular section of the process, Level-3 displays provide the operator with a complete and detailed view of the entire facility.

All control loops are shown on the Level-3 displays. The displays are used for routine tasks such as operating pumps, starting blowers, opening valves, and so on They are also used for detailed investigations and interventions that are not time-critical.

An example of a Level-3 display is shown in Figure 8.

Links to other upstream or downstream displays are normally at the left and right sides of the display. An operator can invoke supporting displays related to the process unit detail display using the buttons at the top of the screen. Example supporting displays are safety/trip displays, help displays, interlocking displays, trend, and so on

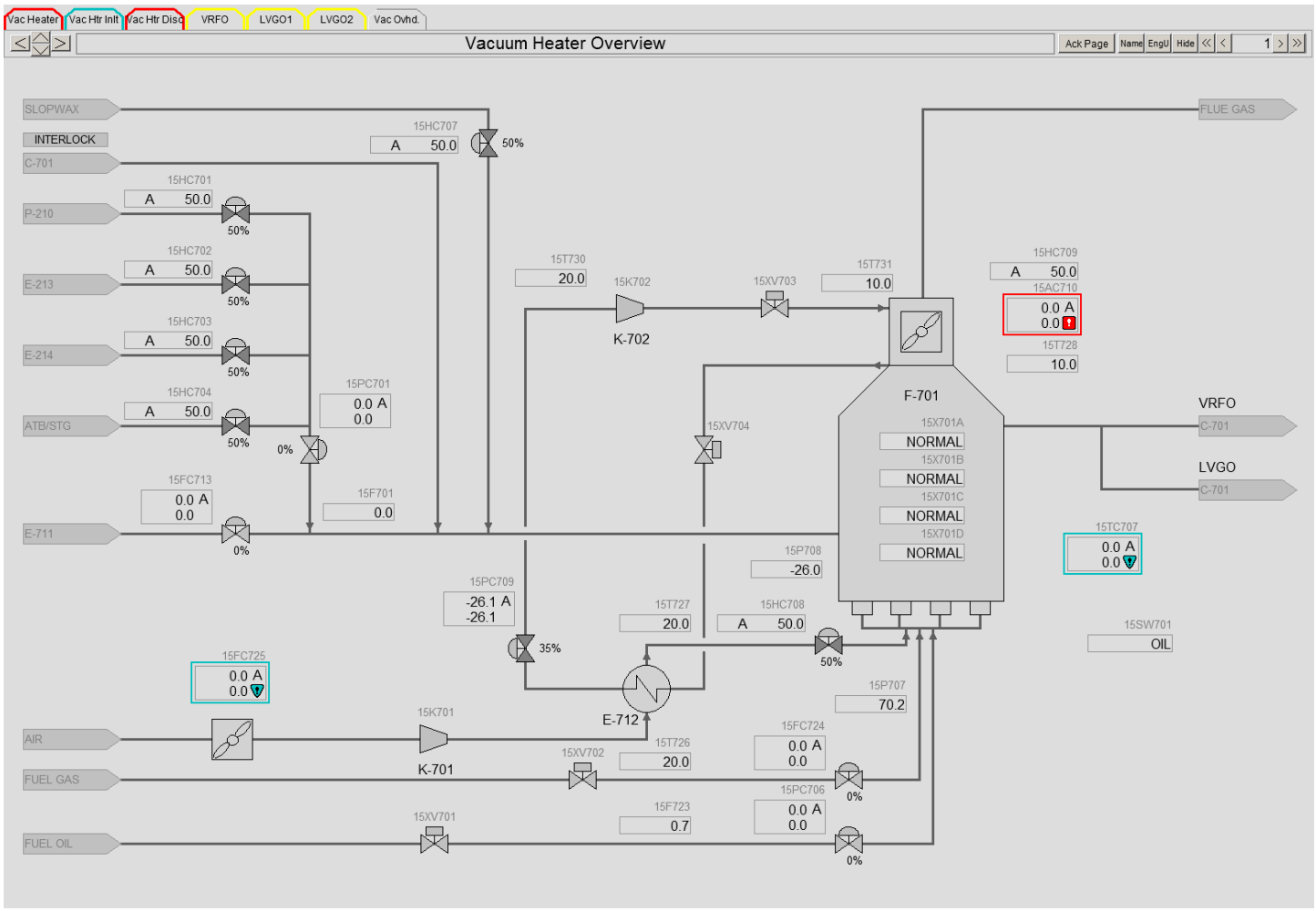


Figure 8: Level-3 Process Unit Detail Display

1.1.5 Safety Displays

ESD Displays

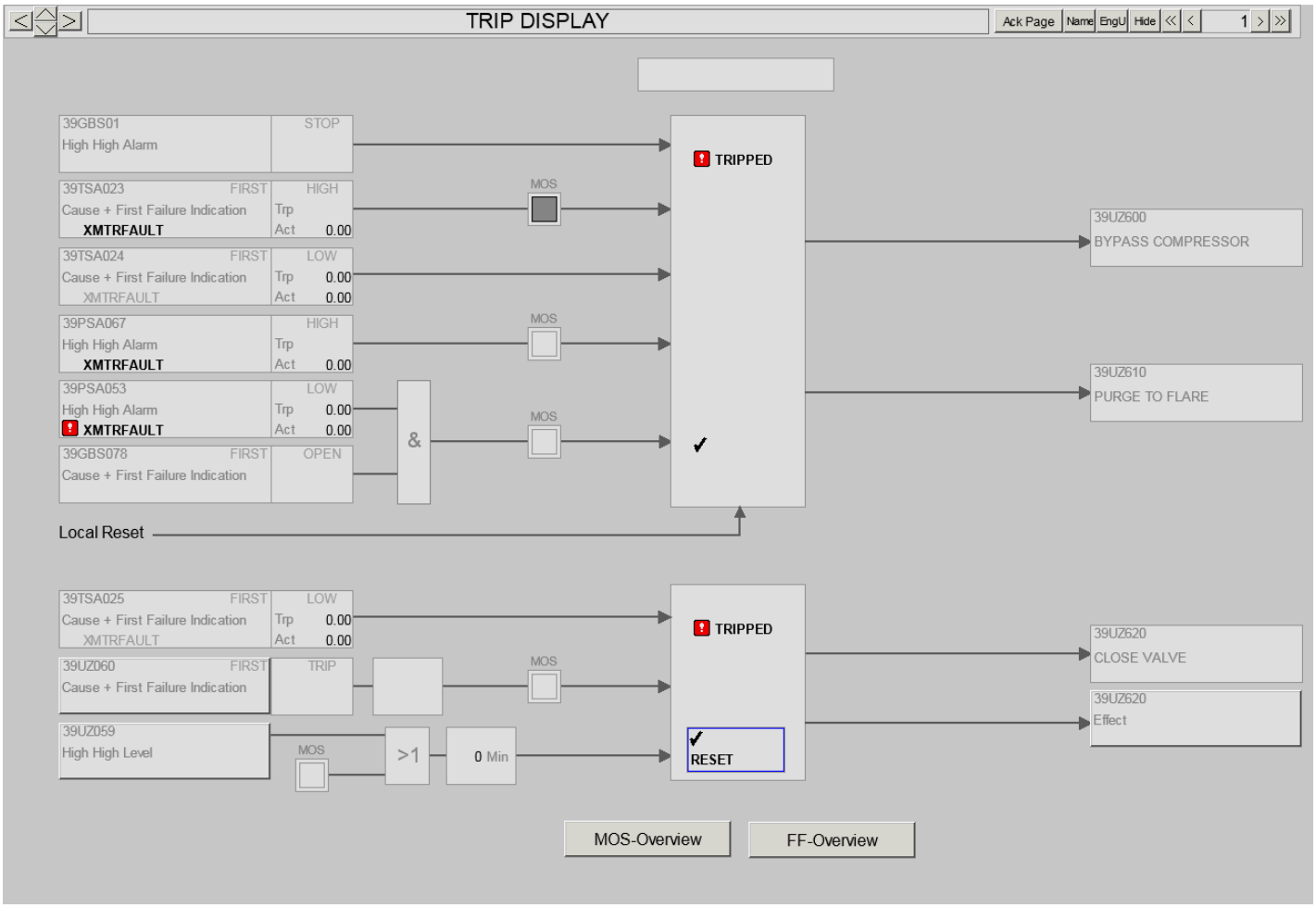


Figure 9 ESD Display Example

Fire/Gas Displays

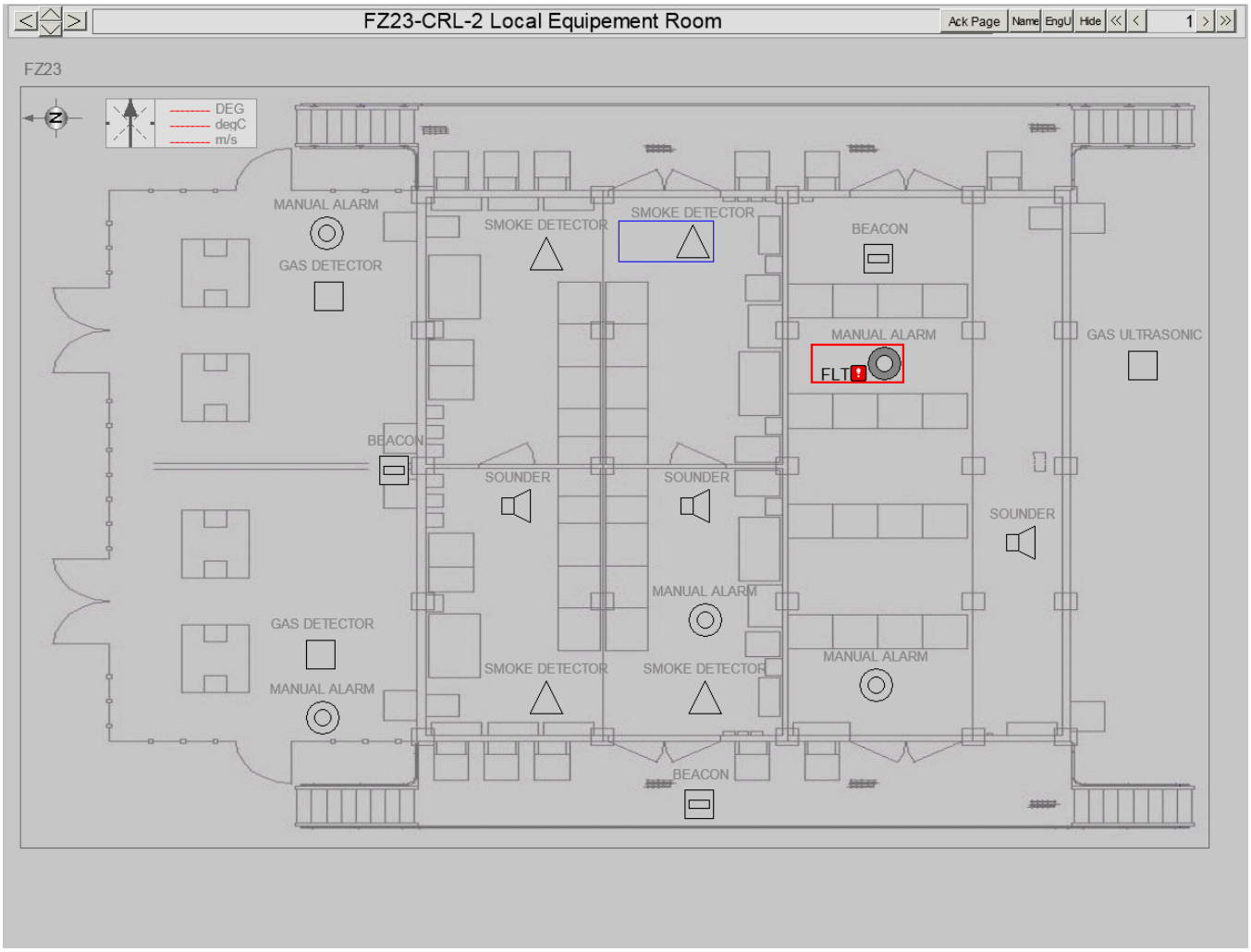


Figure 10 Fire/Gas Layout Example

1.1.6 Supporting Displays

Supporting displays are displays built in addition to normal operating displays to provide supplemental information. The following are examples:

Help Displays

Help displays provide auxiliary information to the operator which helps maximizing operator effectiveness. A few examples include:

- Process formula calculations;
- Process/Installation/Equipment specific notes, drawings etc.

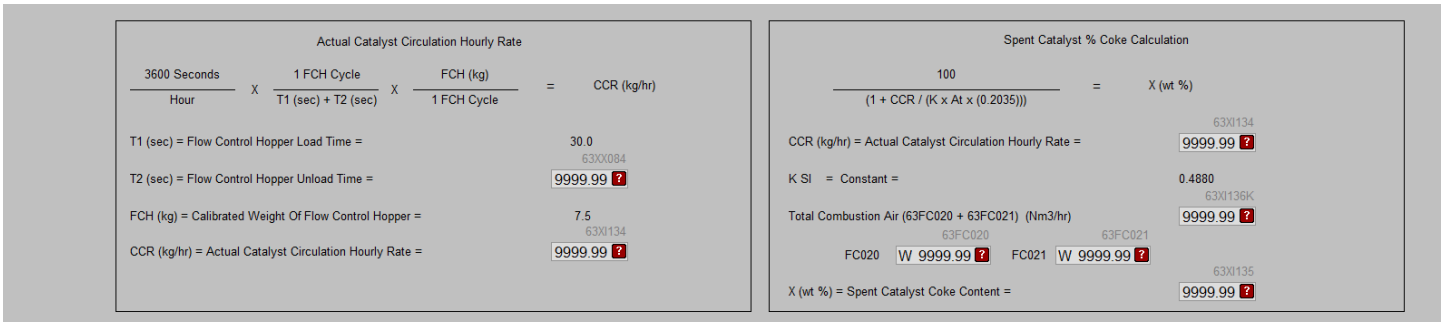


Figure 11 Help display example

Task Based Displays

These displays are used in specific situations for performing specific tasks such as unit start-up/shutdown. They combine different types of information on a single display such as:

- Startup conditions/interlocks;
- Process information;
- Trends;
- Procedure information;
- Notes for the operator etc.

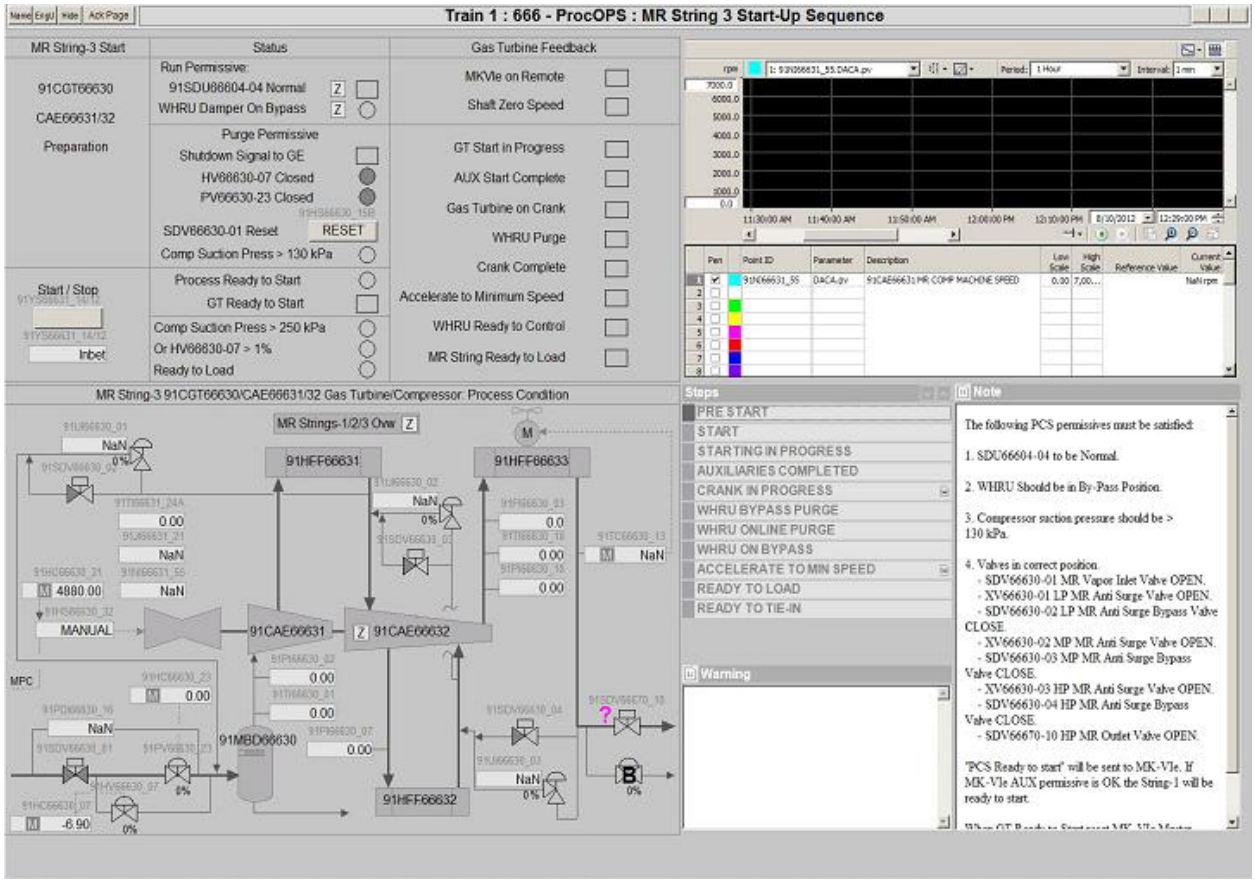


Figure 12 Task Based Display Example

Automated and Batch Displays

In accordance with the ASM Procedural Practices Guidelines, these displays enable the operator to effectively execute the mental and physical activities required by providing the operator with clear means to orient, evaluate, act, and assess.

The displays are project specific and developed per project specific needs.

A procedural specific display communicates the sequential progress of procedures and provides a bi-directional dialog between the procedure and the operator. There are 5 key properties to an effective procedural operations display:

1. Show the Operator what has happened; that is what has successfully been executed.
2. Tells the Operator what to do by showing the Operator, at a glance, where in the procedure the sequence is and showing the Operator the messages the ProcOps wants to communicate.
3. Tell the Operator of incipient problems.
4. Show the Operator what is going to happen (be done) next.
5. Provide the Operator with an area which contains clear and easy to use redirection actions and modification targets.

The key to achieving the above philosophy is a consistent display utilizing procedural specific shapes. Figure 10 is an example of a successful ProcOps display that allows the operator to execute the procedure from a single display. Conceptually, the display is divided into 4 quadrants:

Quadrant 1 (Upper left) – Key process data

Quadrant 2 (Bottom left) – Path re-direction

Quadrant 3 (Upper right) – Procedure specific progress information

Quadrant 4 (Bottom right) – Communication area

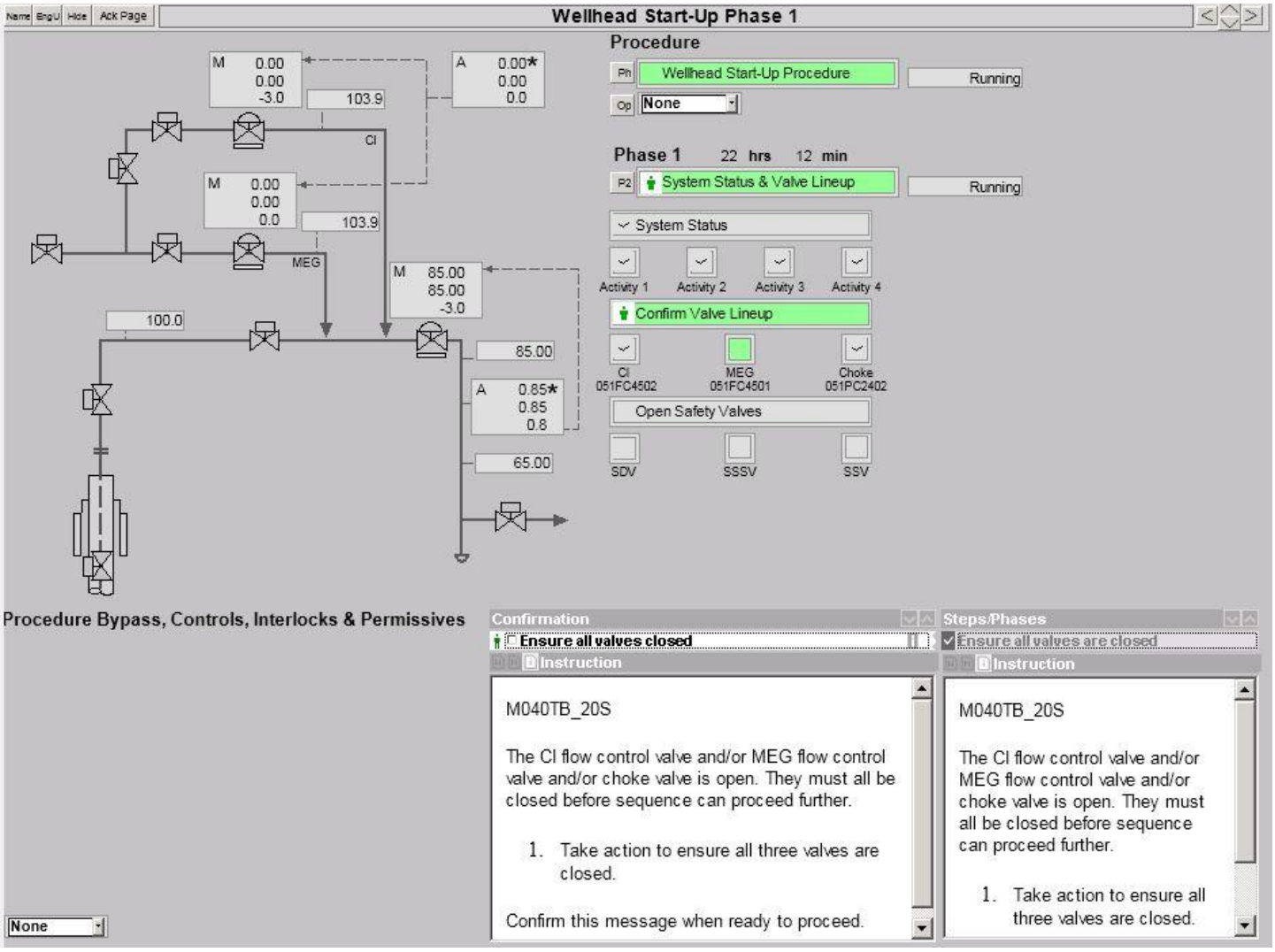


Figure 13: Typical ProcOps Display

A sequence display utilizes the sequence shape to graphically represent R/SCM points whose structure defines a sequence of events. When these points are running, the sequence shape follows their defined structure to illustrate to the operator the execution of specific tasks defined in the R/SCM. From this display, the operator can access the detail level of the sequence. These details are the actual step and transition blocks defined in the R/SCM points.

Visually, the sequence shape supports consolidated portions of the sequence, known as stages. These stages are user defined and are used to present to the operator a single logical activity or task that would typically encompass multiple R/SCM steps, transitions and/or sync blocks. Through the context menu, the operator has the ability to expand the stage block to see the direct representation of the R/SCM.

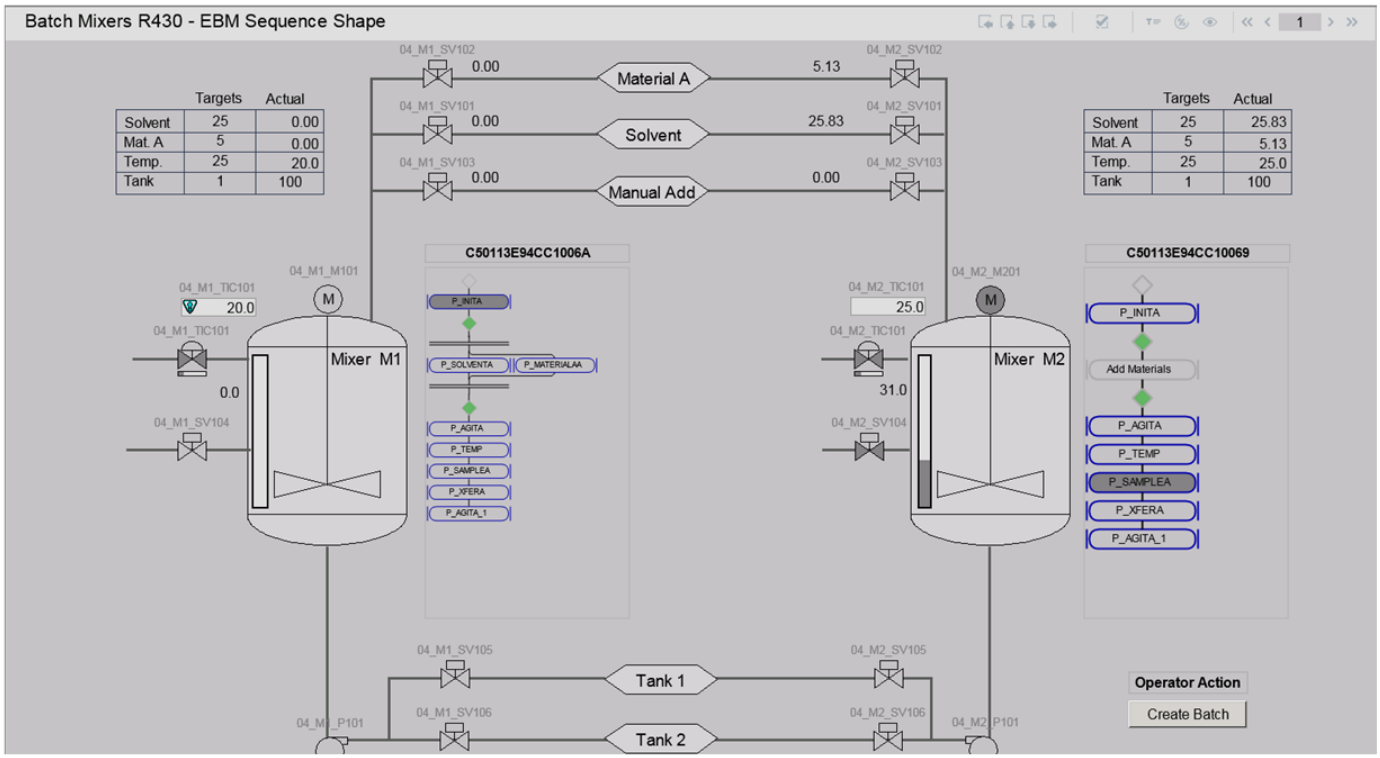


Figure 14: Typical Batch Display

Interlocking Displays

These are utility displays that provide detailed information about process interlocks. They are project specific and developed per project specific needs. Interlocking displays usually present the information in tabular/list form. They can be invoked as supporting popups or L4 auxiliary displays.

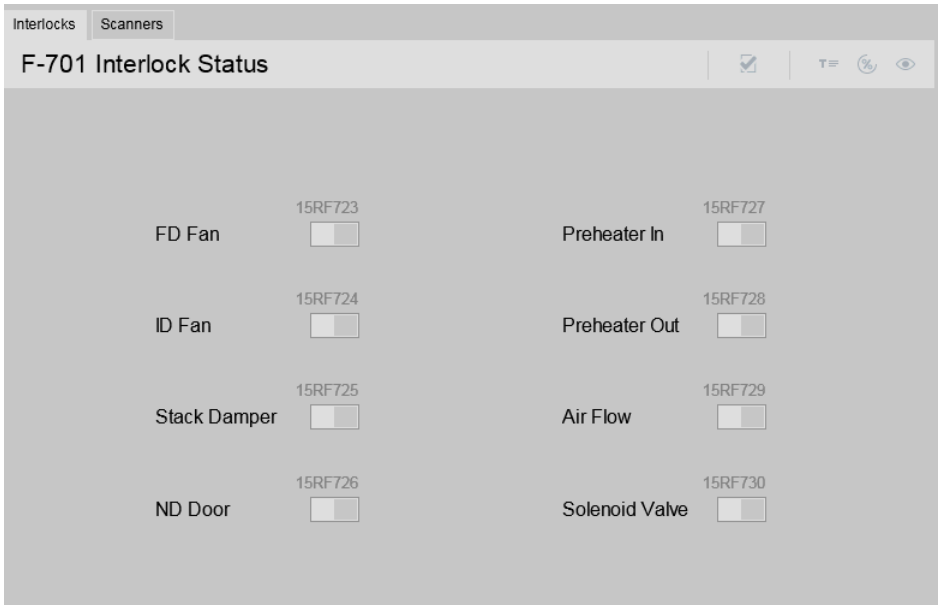


Figure 15 Interlock Popup example

Tabular Displays

Tabular displays are used to present key parameters in a tabular form.

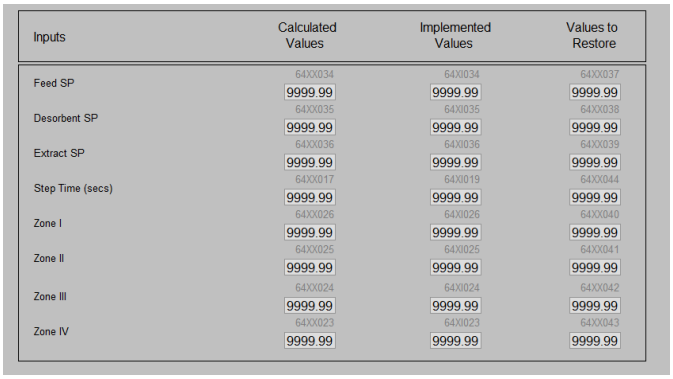


Figure 16 Tabular display example

Details regarding the supporting displays are described in the *HMIWeb Object Design Specification*. See this document for detailed information.

1.1.7 Level 4 – Point Manipulation

Faceplates

Within Experion PKS there are several places where operators can manipulate points (for example detail displays, group displays, faceplates or custom displays). The standard HMIWeb Solution Package object use faceplates as the primary interface for point manipulation. To provide a consistent operator interface, the HMIWeb Solution Pack does not provide objects that allow data entry directly from a display without invoking faceplate or detail displays.

Faceplates can behave in two different ways, depending on the use of SafeView. For multiple window configurations it is strongly recommended (in fact the only supported solution) that faceplates are controlled by SafeView, while for single window configurations, SafeView is not required.

Faceplates are delivered as part of the Experion PKS product. It is strongly recommended to use these standard faceplates as much as possible. Faceplates are an important means for operators and should always work without any problem. Although customized faceplates are supposed to be tested well, the risk and consequence of incorrect functioning is much higher.

Faceplates not managed by SafeView

Notice! It is Honeywell advice that this option only be used with single window stations. In all other cases (multiple window configurations), the use of unmanaged faceplates may result in incorrect keyboard and IKB support.

When SafeView is not applied to faceplates, the faceplates appear as child displays on top of the (process) display invoking the faceplate. Although these windows are initially placed near the object selected when they are invoked, they can be repositioned anywhere on the screen. By standard, up to 4 faceplates can be shown simultaneously per HMIWeb display. Upon invocation of the fifth faceplate, the faceplate with the first tag will be replaced with the 5th one, unless that faceplate has the “pinning” option set, in which case the next faceplate will be taken. If all faceplates are “pinned”, an error message will appear when the user tries to invoke a new faceplate. When the user tries to invoke two faceplates for the same tag, the second faceplate will not appear. Instead, the faceplate, which already shows that tag, will get highlighted by means of a blue title bar. The faceplates remain visible until its parent display is closed or until the operator closes the faceplate itself. If the “pin” option is selected, the faceplate remains visible when another display is invoked. Faceplates are modeless, which means that an operator can switch forward and backward to the main display, even though the faceplate is not closed.

Example faceplates are shown in Figure 17.

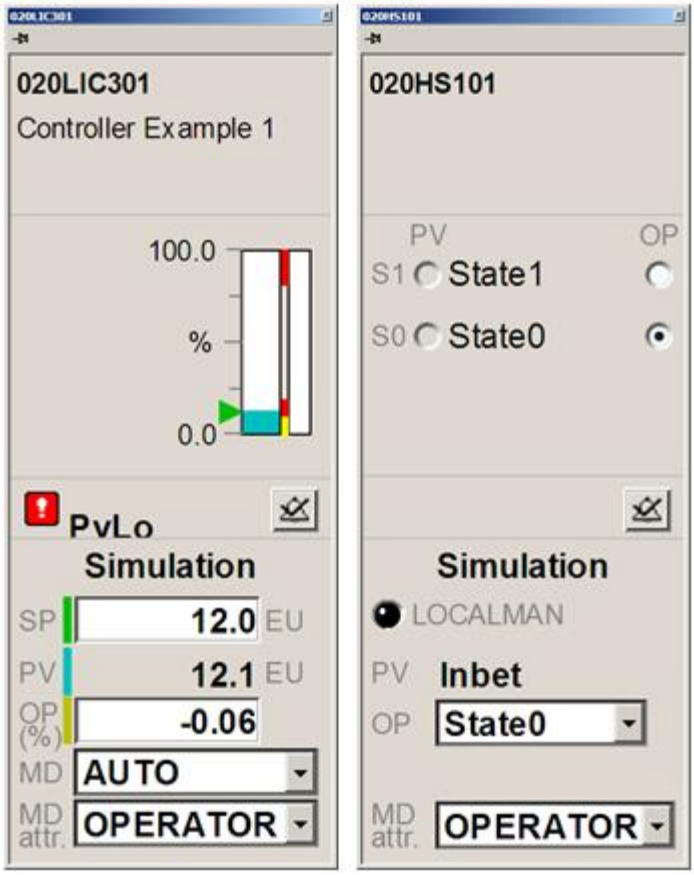


Figure 17: Example faceplates

If an operator needs more detailed information about a point, he can invoke a detail display, for example by double-clicking one of the parameters in the faceplate, or by requesting the detail display in the regular way, using the menu button bar. The detail display will, however, replace his process display and its pop-up display.

For TPS points on an ES-T, the Native Detail Display will be invoked by double-clicking one of the parameters in the faceplate, or by requesting the detail display in the regular way, using the menu button bar. The native window must be managed by SafeView in a separate window, normally floating on top of the process displays.

Faceplates managed by SafeView

When SafeView is applied to organize your HMIWeb displays, the faceplates do not appear as child displays on top of the process display, but instead are invoked as normal displays.

Their position will be defined by SafeView, making use of SafeView's display category feature. This means that the number of faceplates will be limited by SafeView, and that the faceplates do not have the pinning option (as described in the previous chapter), nor will they by default be closed when the display which invoked the faceplate is closed.

If an operator needs more detailed information about a point, he can invoke a detail display, for example by double-clicking one of the parameters in the faceplate, or by requesting the detail display in the regular way, using the menu button bar or the shortcut menu.

When faceplates are used on multiple screens, SafeView can be configured in such a way that faceplates invoked on screen 1 will be shown on screen 1, while faceplates invoked on screen 2 will be shown on screen 2. Normally faceplates are shown on top of the process displays, but of course it's also possible to reserve a dedicated space on the screen for faceplates. Resizing and moving of the faceplates can be prohibited by SafeView.

Optionally it is possible to automatically close the faceplates on one screen as soon as the process display on that screen is changed.

Shortcut menu

All HMIWeb shapes used for point/parameter presentation, such as pumps, valves, controllers and so on (excluding navigation objects), provide shortcut menu functionality. The shortcut menu appears upon right-clicking of a HMIWeb SP shape. The Shortcut menu will disappear after one of the options has been selected, when the operator clicks outside the shortcut menu, presses the escape button on the keyboard, or after the timeout period of 10 seconds (standard windows behavior).

The shortcut menu normally has the following layout:

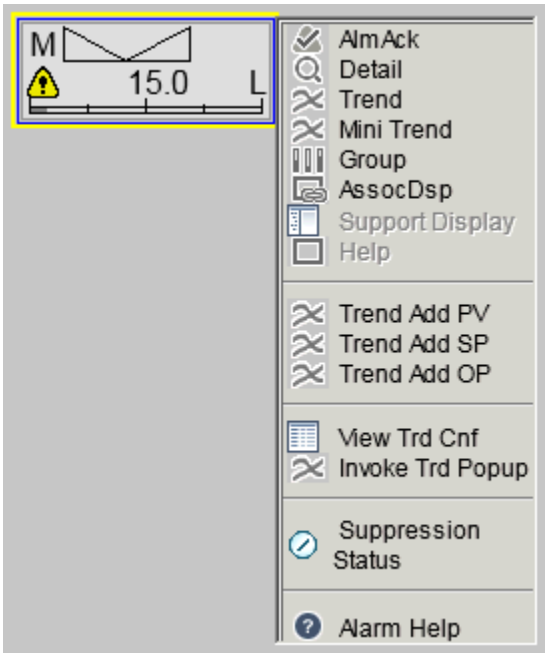


Figure 18: Shortcut menu

The Shortcut menu provides the following options:

- **AlmAck**: this option allows acknowledgment of the alarms of the current selected point. Please note that for shapes with multiple tags (like for example the F&G shapes), only the most important alarm will be acknowledged, after which the next important alarm can be acknowledged, until all alarms for that shape are acknowledged.
- **Detail**: this option will invoke the detail display for the current selected point
- **Trend**: normally invokes the first trend group in which the current selected point appears. If a point is not configured in a trend group, the system will ask the operator for a trend group number. If a custom trend group was defined for the shape (see shapes custom properties), this custom trend group will be invoked.
- **Mini Trend**: this will invoke a trend popup window showing up to 3 traces for PV, SP and OP of the current selected point (for analog points only). Availability of all 3 traces depends on the custom properties of the shape. If the shape has a custom property

for the PV named “cp_PV“ the PV trace will be shown. Similar for SP (cp_SP) and OP (cp_OP). If this custom property does not exist, the trace will not be shown in the popup trend.

- **Group**: normally invokes the first group in which the current selected point appears. If a point is not configured in a group, the system will ask the operator for a group number. If a custom group was defined for the shape (see shapes custom properties), this custom group will be invoked.
- **AssocDsp**: invokes the associated display for the current selected point. If no associated display has been configured, a warning will appear in the message zone “No associated display”.
- **Help**: this option allows an operator to open a document related to tagname presented by that shape. During display building the label to be shown in the shortcut menu, as well the link to the file to be opened can be defined. The shortcut menu will use windows explorer’s file type association to determine which application should be used to open the file (for example MS Word for *.doc documents, PDF reader for *.PDF files and so on). If no filename is specified, the label will still be shown but the choice in the shortcut menu will be disabled (grayed out).
- **Support display**: this option allows an operator to open a supporting display related to tagname presented by that shape. During display building the label to be shown in the shortcut menu, as well the link to the display to be opened can be defined. If no filename is specified, the label will still be shown but the choice in the shortcut menu will be disabled (grayed out).
- **Trend Add PV (SP/OP)**: these options allow an operator to quickly add the PV, SP and OP of the tagname presented by this shape to a trend group. If no trend group is defined, the operator will be asked for a group number. If a trend group is full or protected, he will get a warning. Dedicated shape are provided as part of the HMIWeb Solution Pack to show the current selected trend group as well to provide info about the number of pens still available in this trend group. These shapes also provide a shortcut menu which allows you to invoke the specific trend group, to view the trend group configuration as well to invoke a trend group as popup window.

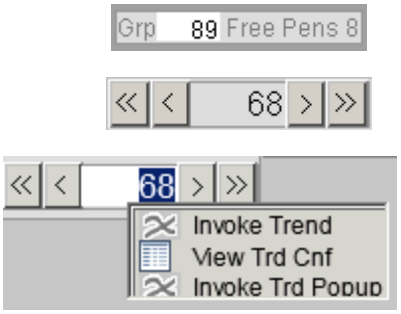


Figure 19: Trend Group Shapes

The “Trend Add PV” option is only enabled when the tagname represented by the shape has a custom property for the PV name “cp_PV“ (and cp_SP for SP, cp_OP for OP). If this custom property does not exist, the option to add the PV (SP/OP) to a trend will be disabled and the choice will be grayed out in the shortcut menu.

- **View Trd Conf**: this option will show the trend configuration for the current selected trend group as indicated by the above shapes. A table with this info will be shown on top of the process display. By clicking **Hide**, the HMIWeb Solution Pack trend configuration table will disappear.

PointName	Parameter	Hide
020LIC301	pida.PV	
020LIC301	pida.OP	
OVERRIDE_SC	PV	
HH_ALARM_SC	PV	
FAULT_SC	PV	

Figure 20: Trend Group Configuration Table

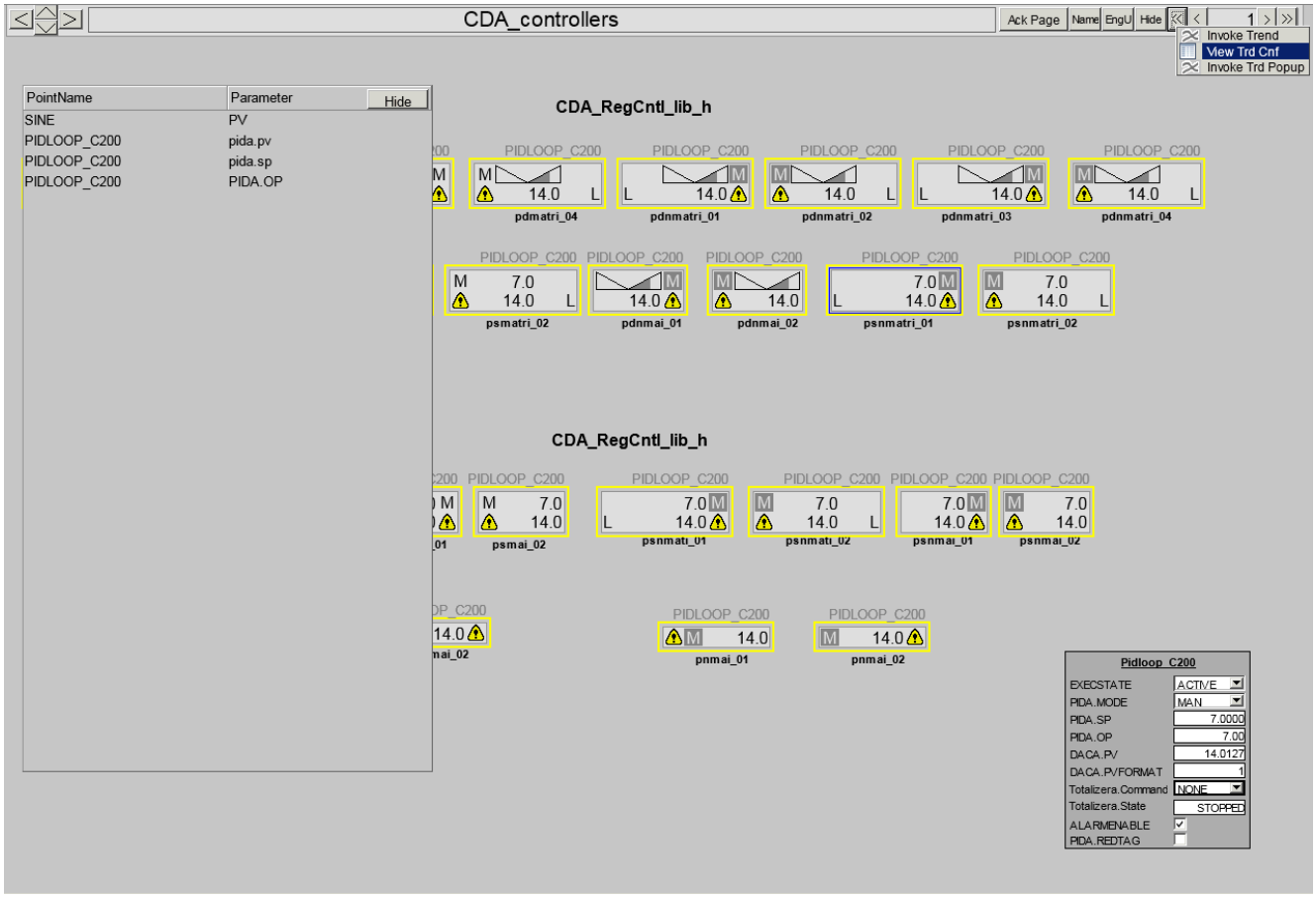


Figure 21: Trend Group Configuration Table in a display

- **Invoke Trd Popup**: this choice will invoke the current selected trend group (as indicated by the trend group selection shape) as a popup.
- **Suppression status**: this option will invoke the suppression status display filtered for the current selected point
- **Alarm help:** this option will invoke the Alarm help window for the current selected point

Standard Trend Group

The standard trend group can be invoked in several ways, for example via the menu bar or via the shortcut menu's.

When a trend is invoked via the menu bar and a point is selected it will invoke the first trend group in which that point appears. If a point is not configured in a trend group, the system will ask the operator for a trend group number.

When a trend is invoked via a shortcut menu of one of the shapes, it will invoke the first trend group in which that point appears. If a point is not configured in a trend group, the system will ask the operator for a trend group number. If a custom trend group was defined for the shape (see shapes custom properties), this custom trend group will be invoked.

Please refer to the standard Experion PKS documentation for detailed information about the trend display.

Mini Trend

The mini trend (or Point Trend) can be invoked via the shortcut menu of a shape. Availability of all 3 traces depends on the custom properties of the shape. If the shape has a custom property for the PV named “cp_PV“ the PV trace will be shown. Similar for SP (cp_SP) and OP (cp_OP). If this custom property does not exist, the trace will not be shown in the popup trend.

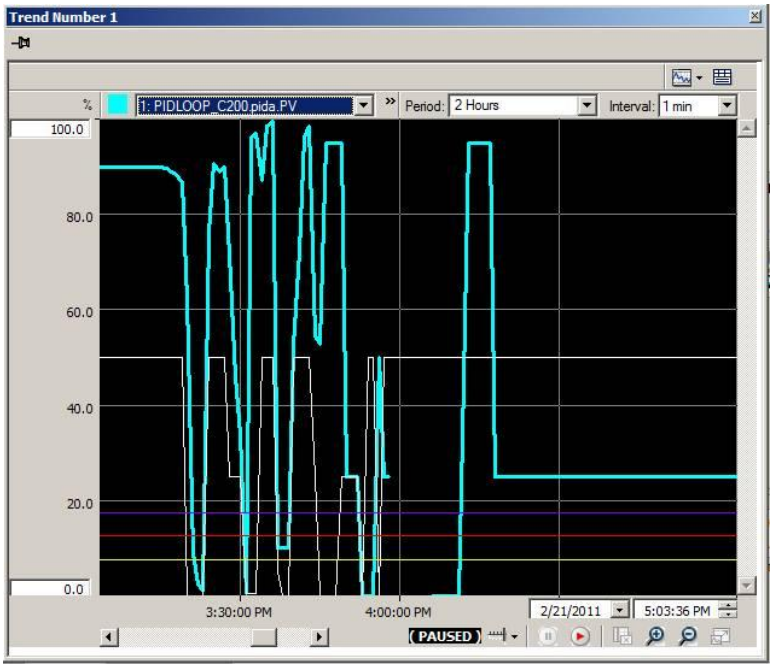


Figure 22: Mini Trend / Point Trend

Two variants of the Mini Trend popup are available – using Basic Trend or Standard Trend object.

Main features of the mini trend based on the Standard Trend object:

- 3 traces for SP, OP and PV
- Each trace can be highlighted using a combo box

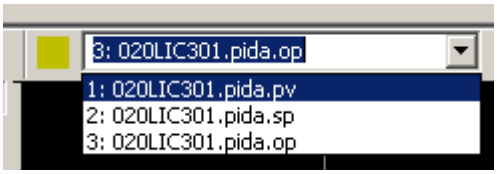


Figure 23: Trace Selector

- Scale can be switched between Engineering Units and Percentage

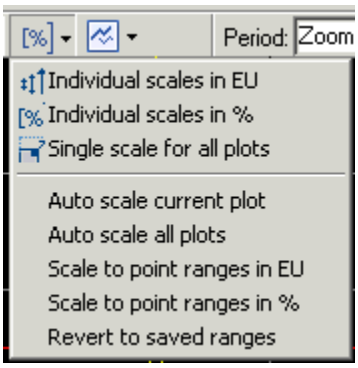


Figure 24: Scaling Selector

- Time Period & Interval as well Scaling can be modified
- Zoom-in and zoom-out using rubber-band
- Copy-Paste of trend data to other applications
- Scroll forward / backward
- Pause / Play
- Line / Bar chart selection
- Show / hide legend

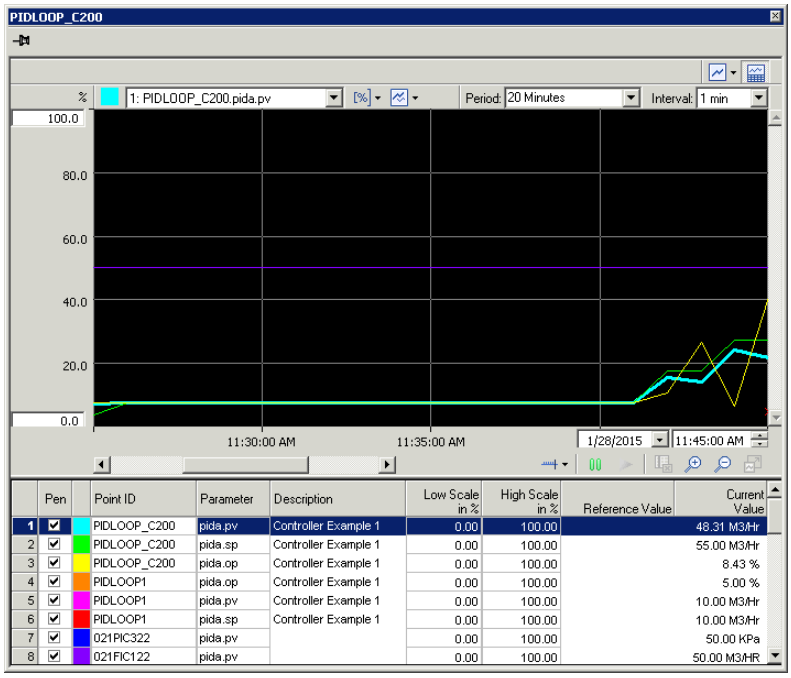


Figure 25: Mini Trend with legend

- Hairline values
- Trend Pen selection (on-off)
- Presentation of events (alarms + operator changes), with or without legend

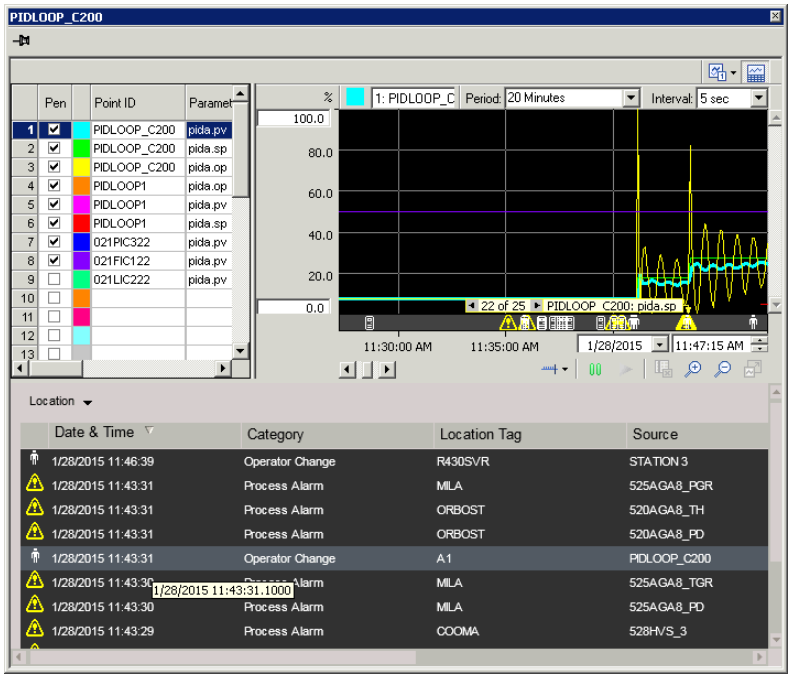


Figure 26: Mini Trend with Events

- Presentation of numeric history, with or without legend

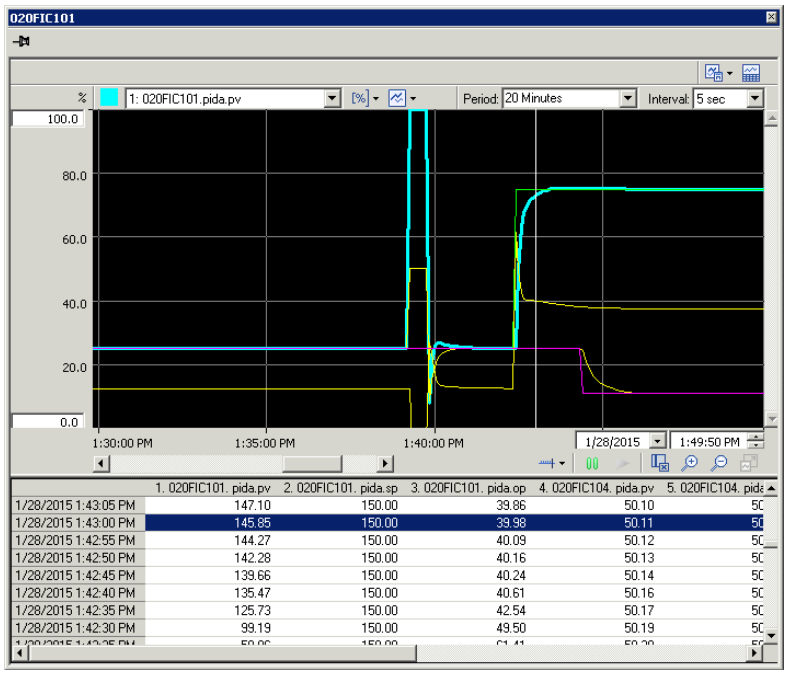


Figure 27 Mini Trend with numeric history

- The mini trend can be managed by SafeView (using category HW_SP_TrendPopUp) or just appear as a popup (child) window. When the mini trend is shown as a child window, its location is determined by the CSS file:

```
.Mini_Trend
{
    top_position:default;
```

```
    left_position:default;
    size_height:default;
    size_width:default;
    background_color: #000000;
    show_XY_axes: true; /* Applicable to both Trend objects: true/yes - show both chart axes (XY);
false/no - hide both axes (XY);*/
    show_legend: true; /*Applicable to Full Trend only:  true/yes - show legend; false/no - hide legend
*/
    view_type: 0; /*Applicable to Full Trend only:  0 - Full Legend (Default); 1 - Show Numeric History;
2 - Show Events*/
    plot_1_color: #00FFFF; /* Default - PV*/
    plot_2_color: #00FF00; /* Default - SP*/
    plot_3_color: #FFFF00; /* Default - OP*/
}
```

If all the values of the CSS attributes are left to “default”, the popup object will behave like standard system popups – round robin will be available. If top and left positions are specified the popups will appear at the specified position and only one popup at a time will be available. If height and width are specified the popups will not be sizeable. When changing the CSS attributes from specified values back to “default” Reset Faceplate Positions command might be necessary to be executed.

Main features of the mini trend based on the Basic Trend object – similar to the Standard trend but without Legend/Numeric History/Events.

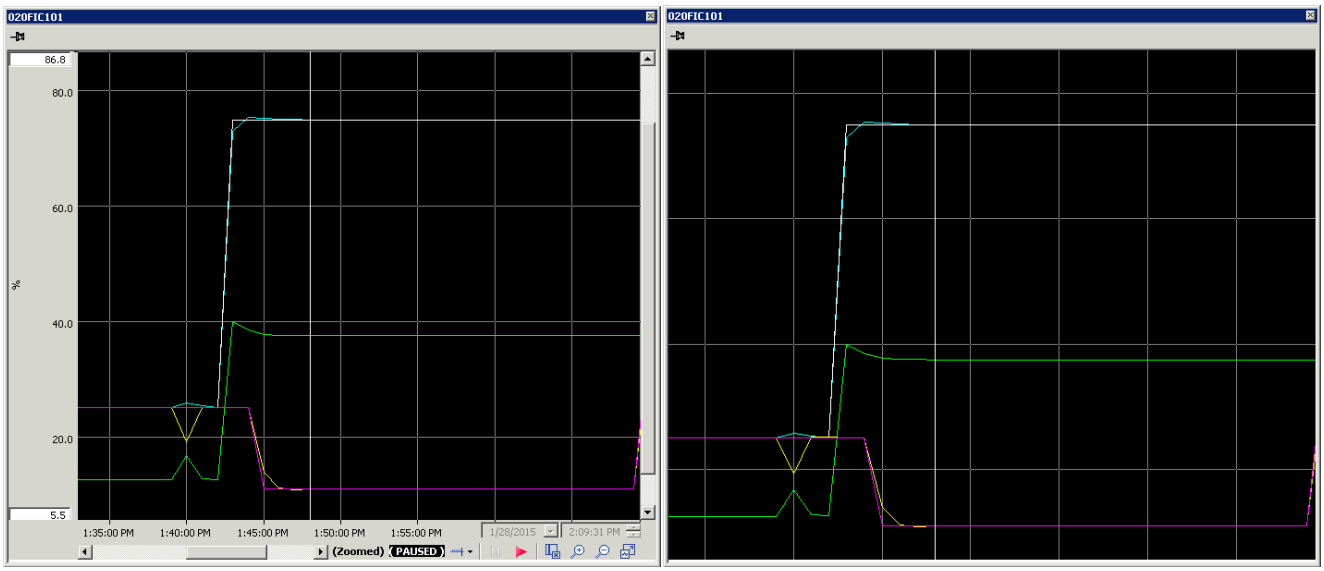


Figure 28 Mini Trend with Basic Trend Object - with or without axes shown

Trend Popup

The trend popup provides similar functionality as the “mini trend”. The only difference is the traces used by the trend which are determined by the current selected trend group (as indicated by the trend group selection shape).

The trend popup can be managed by SafeView (using category HW_SP_TrendPopUp) or just appear as a popup (child) window. When the trend popup is shown as a child window, its location is determined by the CSS file:

```
.Trend_PopUp
{
    top_position:default;
```

```
        left_position:default;
        size_height:default;
        size_width:default;
    }
```

If all the values of the CSS attributes are left to “default”, the popup object will behave like standard system popups – round robin will be available. If top and left positions are specified the popups will appear at the specified position and only one popup at a time will be available. If height and width are specified the popups will not be sizeable. When changing the CSS attributes from specified values back to “default” Reset Faceplate Positions command might be necessary to be executed.

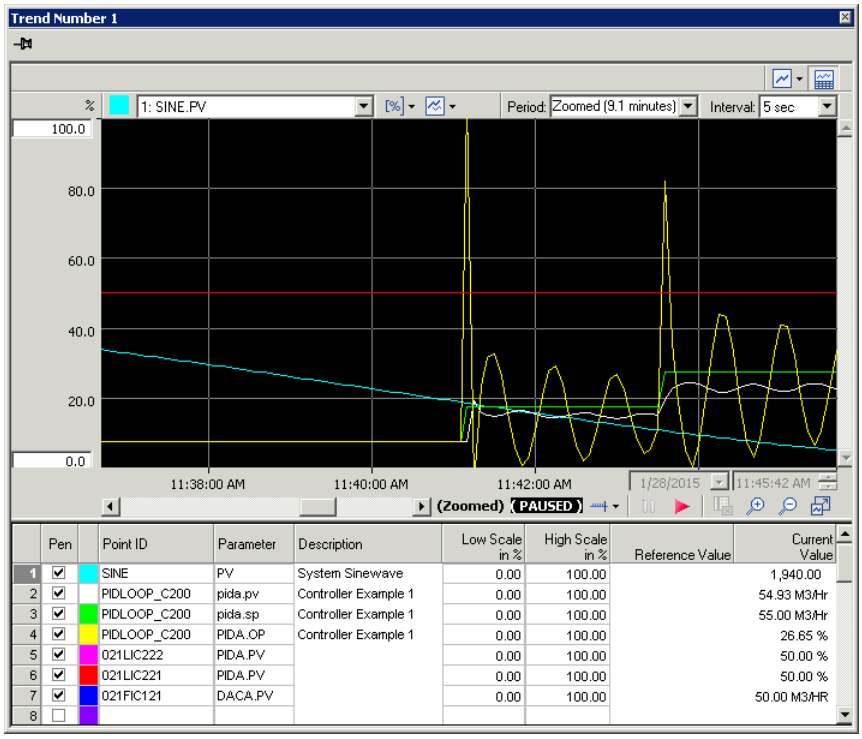


Figure 29: Popup trend with legend

Supporting displays

Supporting displays are displays which serve a special purpose and are often directly related to a Level-2 or Level-3 process display. The most commonly used supporting displays are:

- Safety Displays
- Help Displays
- Sequence Displays
- Typical Batch Tracking
- Interlocking Displays
- Tabular Displays
- Fire/Gas Displays
- Startup Permissive Displays
- QMI/Calibration Displays
- Other Applications

1.2 Display navigation

1.2.1 Experion PKS Station Tool Bar

The Experion PKS Station Tool Bar configuration is loaded when the Station window is started. It is used to supply quick access to commonly used Experion PKS functions and links that may be required from any graphic.

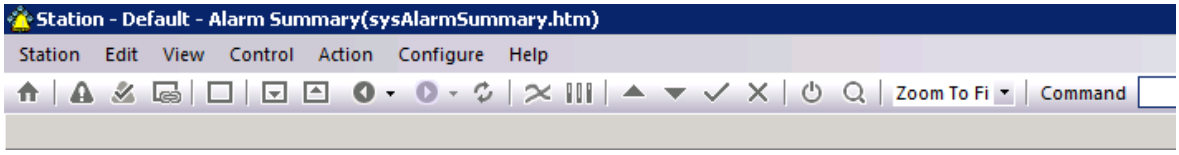
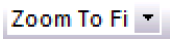


Figure 30: Station Toolbar

Button	Description and notes
	**System Menu.** Provides access to many standard displays, such as Alarm Summary, Event Summary, Display Summary, Group Summary, Trend Summary and many others. It shows how displays are organized –it is, in effect, the system's "table of contents".
	**Alarm Summary**. Calls up the Alarm Summary, which provides a one-line description of every alarm.
	**Ack Alarm**. Acknowledges the most recent alarm.
	**Associated Display**. Invokes the display associated with the current selected object. Associated displays can be invoked from many displays, such as for example alarm displays, in order to quickly jump to the display in which the selected point resides.
	**Call up Display**. Calls up the specified display. To call up a display: Click the button. Type the display number and press <Enter>.
 	When configuring a system, engineers normally link related displays in a "chain" so that you can quickly call up the next/previous display. **Page Down**. Calls up the next display in the current chain. **Page Up**. Calls up the previous display in the current chain. The PageDown/PageUp feature from custom displays can also be used by configuring the PageDown and PageUp as part of the display properties.
 	Navigate Back and Navigate Forward Allow you to move backwards and forwards between displays you have previously called. The arrow pointing down at the right of this button can be used to show a list with display history.

Button	Description and notes
	**Trend**. Calls up the specified trend display. To call up a trend: Click the button. Type the trend number and press <Enter>. Note: if you select this button while a point has been selected, the first trend group will appear in which this point resides.
	**Group**. Calls up the specified group display. To call up a group: Click the button. Type the group number and press <Enter>. Note: if you select this button while a point has been selected, the first trend group will appear in which this point resides.
 	**Raise**. Raises a parameter value. **Lower**. Lowers a parameter value.
 	**Enter**. Accepts the newly entered value. **Cancel**. Cancels the newly entered value, and returns it to its original value.
	**Enable/Disable**. Enables/disables for the associated point. Points are typically disabled when performing maintenance tasks to prevent misleading alarms being generated.
	**Detail**. Displays more details about the selected object.
	**Zoom to fit.** This button allows to zoom-in or zoom-out your display

Extra buttons can be added to the toolbar menu (see AO button example at the right side in the bitmap below) or the menu bar can be extended (see Overview example in the bitmap below) using the station connection properties. This feature can be used to add one or more top-level displays to the button toolbar.

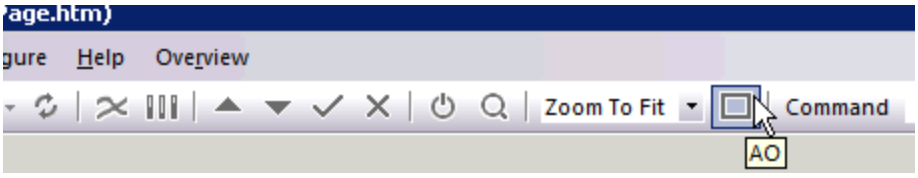


Figure 31: Customized toolbar menu

1.2.2 Level-1 Graphic Display Navigation

Navigation in Level-1 displays can be sideways (upstream and downstream) to other Level-1 (process area overview) displays or downward to Level-2 (process unit overview) displays.

Level-1 displays may also be invoked using the operator's configurable keypad, engineering keyboard shortcuts (for example, Ctrl+Alt+1) or toolbar buttons, which can be configured using the station connection properties feature.

Operators can navigate to associated Level-2 displays to get more detailed information about process areas within the plant typically using button-like objects inside the process scheme (see V603 button in example below). Alternatively, also other alarm navigation objects may be used to navigate to Level-2 displays (see UNIT 2 example below)

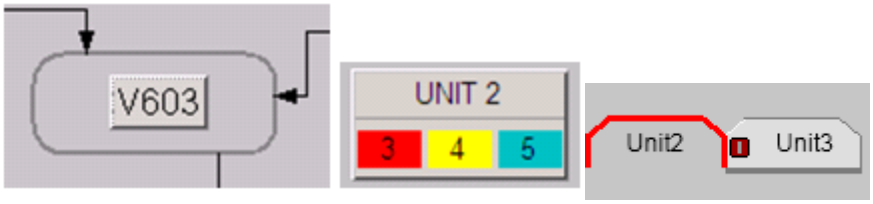


Figure 32: Alarm Navigation Shapes

Notice! The dynamic alarm behavior in the shapes in Figure 32 is based on the use of alarm groups. For more information, see chapter Chapter 3, "Alarm Management".

1.2.3 Level-2 and Level-3 Graphic Display Navigation

Navigation in Level-2 and Level-3 displays is similar to Level-1 displays, but is extended with upward navigation to parent displays (one level higher). Depending on the size of the process to be visualized, Level-3 displays may be omitted; in which case Level-2 displays will take over their functionality.

The displays are normally divided into 3 navigation zones (see Figure 33).

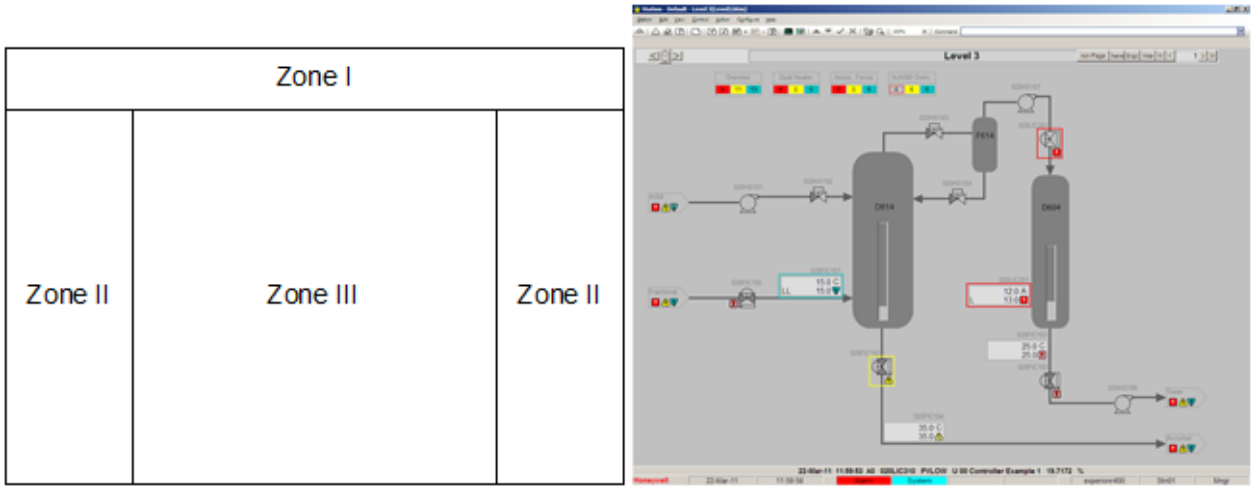


Figure 33: Navigation Zones

Zone I

Display navigation to higher level displays (from Level-3 to Level-1/2 or from Level-2 to Level-1) these are usually presented using navigation buttons with alarm indication, as shown below.

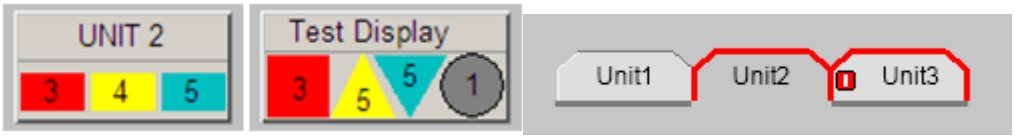


Figure 34: Alarm Navigation Shape

This zone may also contain navigation to supporting displays, (for example, help displays, loop displays, trip displays, and so on). These buttons are normally placed in the right upper corner of the display. The buttons referencing those displays normally do not contain alarm information. See example below.

Figure 35: Navigation Shape without alarming

Zone II

Sideways navigation to associated level displays (upstream or downstream on same level) is usually achieved by selecting buttons at the right and/or left side of the display. There are various navigation buttons. See examples below.

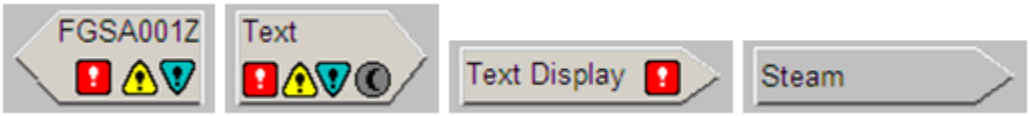


Figure 36: Navigation Shapes

These arrows will change the existing display to the upstream or downstream display. Sometimes, several arrows will be on each side of the display, each arrow leading to one of several upstream or downstream areas. Displays invoked in this manner will usually replace the display that invoked them

Zone III

The buttons for navigation to one level down (Level 2 to level 3) are usually placed in the near or in the related equipment. See example below.

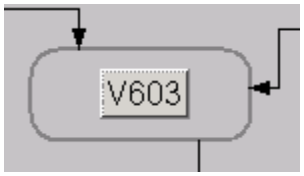


Figure 37: Navigation Shape

Notice! The dynamic alarm behavior in the shapes in, Figure 34, Figure 36 and Figure 37 is based on the use of alarm groups see for more details chapter Chapter 3, “Alarm Management”.

1.3 Display categories

1.3.1 Standard System Displays

Experion PKS is delivered with a number of standard displays, of which the most important have been listed below.

- Point Detail Displays
- Alarm Summaries
- Group Displays
- Trend Displays
- System Status Displays
- Communication Displays
- Event Displays

Please refer to the standard Experion PKS documentation set for a detailed description of the standard displays.

1.3.2 Non-Standard System Displays

Most system displays are available in HTM format and can be edited with the HMIWeb Display Builder. Honeywell recommends modifying or extending the standard displays as little as possible, the only exceptions being Point Detail displays and faceplates, which can be customized to cooperate with non-standard control modules. The use of standard control module conventions is recommended in order to limit the amount of standard display modification to a minimum. When modifications are made to standard displays, they should be saved with a new name and the modifications should be well documented, so that they can easily be re-applied when necessary in case the new updates of the standard displays become available.

Chapter 2 Display workspace

Experion application windows on dual, triple and quad screen configurations will be controlled by Honeywell's SafeView application. SafeView is a Window manager that allows the engineer to define where a window appears, the size of the window, how it can be modified or moved, and whether it can be closed, maximized, or minimized. SafeView can be configured to ensure that critical windows are never hidden.

SafeView is a runtime option that lets the operator work in a windowed environment. This allows to maintain a predictable, repeatable, and safe interface to the plant. With SafeView, engineers can divide each screen into regions, and designate what type of display or application goes into each region. They can also decide if displays in each region are movable and sizeable. SafeView can protect the plant window from being overlaid by other applications. Many SafeView configurations can be built, but only one can be active at any given time.

For single screen configurations it can be decided to implement Experion without SafeView.

2.1 Workspace without SafeView

When a workspace is applied without the use of SafeView, the workspace consists of one or more static stations (also referred to as multiple static stations). In this case multiple stations run independent from each other, normally resulting in two stations for a dual screen or 4 stations for a quad screen configuration. In this case each station has its own set of floating faceplates.

2.2 Multi-Window using SafeView

When a station is configured for Multi-Window, the station application will be divided into a Command Window, Status Window and a number of display windows, as shown in the example below. The number of display windows (and their contents) is determined by SafeView. Detailed information about SafeView can be found in "SafeView User's Guide".

When SafeView is used one of the most crucial things in the graphic development process is the definition of the viewing area sizes. This size is used in the graphic templates providing a one to one relationship to the viewing areas. Having the correct graphic size information eliminates costly rework and the use of "zoom to fit" which decreases graphic performance.

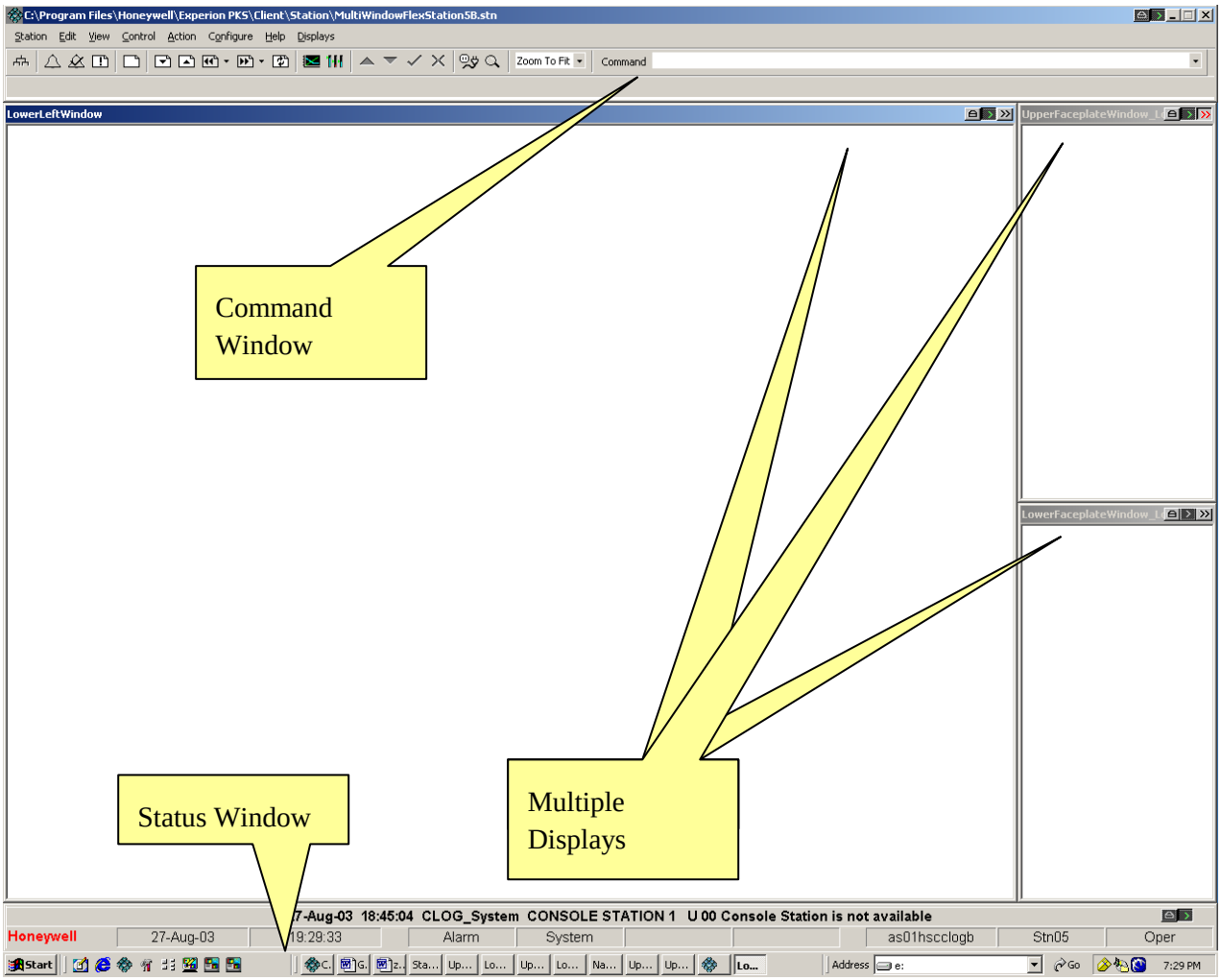


Figure 38: Example multi-window configuration

The above picture shows an example multi-window configuration, where 3 display-windows are used, one for a process display and two for faceplates. In the next sections, other configurations will be discussed, for example dual and quad screen configurations.

Command Window

The Command Zone Window will display the Menus, Toolbar, Status Bar, Alarm Bar, Command Zone and Message Zone.

Point Selection

Clicking on a point in any window (including faceplates) will cause the point description to be displayed in the command window.

Issuing commands

If the user initiates a command that requires input the prompt will be displayed in the command regardless of the window in which the command was performed. The screen shot below illustrates the command window after F5 has been pressed:

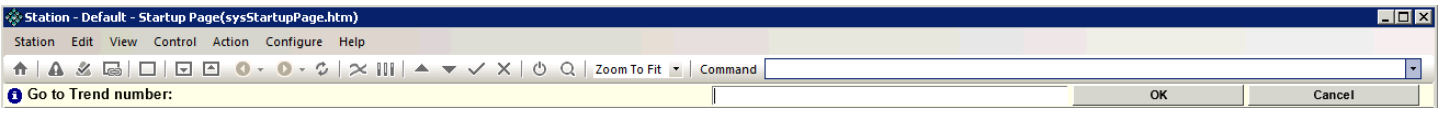


Figure 39: Station's Command Zone

Menus

The menus will only be displayed in the command window. They are not available in the display windows themselves.

Log On

When the system starts a logon dialog will be displayed in the screen containing the Command Window. If an operator has logged or timed out and someone clicks on a display the logon dialog will be displayed in the window that received the user interaction.

Launching a Faceplate

Faceplates will be top-level SafeView windows and can be controlled using the full SafeView functionality. A typical layout with faceplates is displayed in the main section of chapter 2.2. Any messages displayed while viewing a faceplate will only appear in the command window.

Exceeding the maximum number of displays open

An error message will be generated when the maximum number of displays, as specified in the *.STN file has been exceeded. Make sure that SafeView does not allow more displays than the number of displays in the pool. The maximum number of displays which can be opened is 16.

2.3 SafeView setup

This section describes the SafeView configurations, which are available for the stations in a multi-window environment. The example starts with the most complex situation, a two by two a quad monitor configuration. The other configurations are all derived from the 2x2 configuration.

2.3.1 Two by Two Monitor (Quad Screen) Configuration

The picture below shows the example SafeView configuration for a two-by-two monitor configuration.

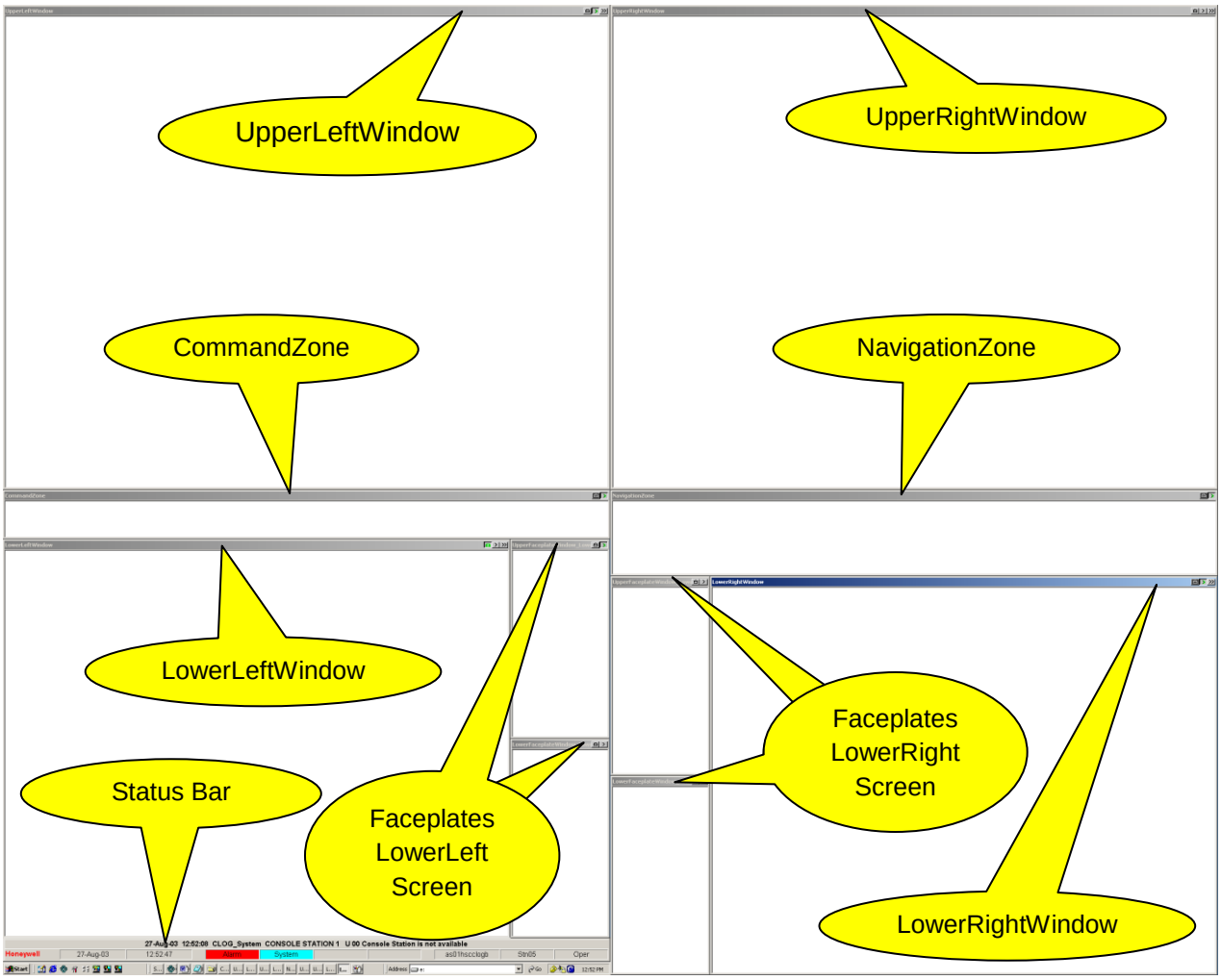


Figure 40: Example 2x2 SafeView Configuration

Lower Left Monitor

The lower left monitor contains 5 windows:

- Command Zone
- Status Bar
- Lower Left Window
- 2 Faceplates

The size of the Command Zone window and Status Bar window are determined by their configuration options (see figures below). They normally take up the full width, but their height depends on the option chosen in the configuration tool of station (see figure below).

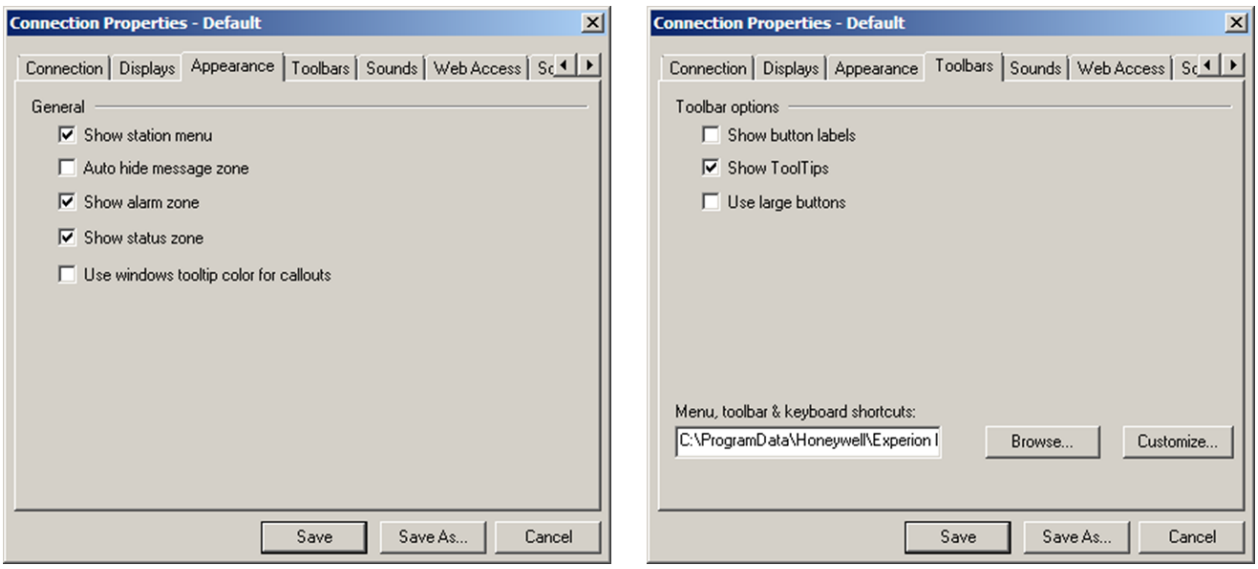


Figure 41: Station Connection Properties

The height remaining for the faceplates as well the LowerLeftWindow is determined by the monitor resolution minus the height of the Command Zone, Status Bar Zone and taskbar.

This configuration has the advantage of having a window size for process displays (window LowerLeftWindow), which has almost the same aspect ratio as the windows on the upper monitors (aspect ratio difference smaller than 2%). This means that zoomed displays shown at the lower monitors can be shown on the upper monitor without getting a grey area at the right or bottom of the monitor.

The disadvantage of this solution is the fact that standard displays will not be shown correctly, since they don't have an aspect ratio of 5:4 but approximately 3:2, which means that they will show up with about 20% white space at the bottom. To overcome this problem, an additional SafeView window could be configured which has the same height as the lower left window, but with the full screen resolution width. This window would then be positioned on top of the lower left window and the faceplates in the lower left monitor.

Finally, a space is reserved for all non-HMI related applications. These applications will appear between the Command Zone and Status Bar.

Lower Right Monitor

The lower right monitor contains 4 windows:

- Navigation Zone
- Lower Right Window
- 2 Faceplates

The design of SafeView for the lower right monitor was mainly based on the design of the lower left monitor, having a window for process displays with the exact same size as the process display window on the lower left monitor.

Since the lower right window is not a full height window, some space is left on the top and bottom. Instead of creating 2 small windows with the exact same size as the Command Zone and Status Bar Zone on the lower left monitor, it was decided that it was better to have one combined window and use it for navigation.

The four faceplate windows on the lower left and lower right monitor are shared by all displays. For that reason the faceplates are positioned at the right side of the lower left monitor and on the left side of the lower right monitor. This way, the four faceplates are always near to the graphic from where they have been invoked.

The navigation zone window is a window that can be used in different ways, for example a group of buttons referring to the most important displays. This could be implemented in a similar way as the buttons on an OEP or IKB.

Upper Monitors

The SafeView configuration as shown in Figure 40 has 2 upper monitors. The upper monitors are used in general to show overview displays, and will normally not be used for loop control. As such, the SafeView configuration does not show faceplates on the upper monitors, which results in a larger space being available for those windows.

The windows in those monitors have almost the same aspect ratio (+/- 2% difference) as the main windows on the lower monitors, and can therefore be easily used to show the same displays (but scaled) as on the lower monitors.

Please be aware that if you show standard system displays on the upper screens, such as for example the alarm summary and trend displays, that they will appear with a large white space at the bottom, since those displays have a 3:2 aspect ratio, while the windows on the upper monitors have a 5:4 aspect ratio.

2.3.2 Horizontal Dual Monitor Configuration

The picture below shows the example SafeView configuration for a horizontal dual monitor configuration. This configuration is exactly the same as the 2 x 2 configuration with exception of the 2 upper monitors, which are not part of this configuration.

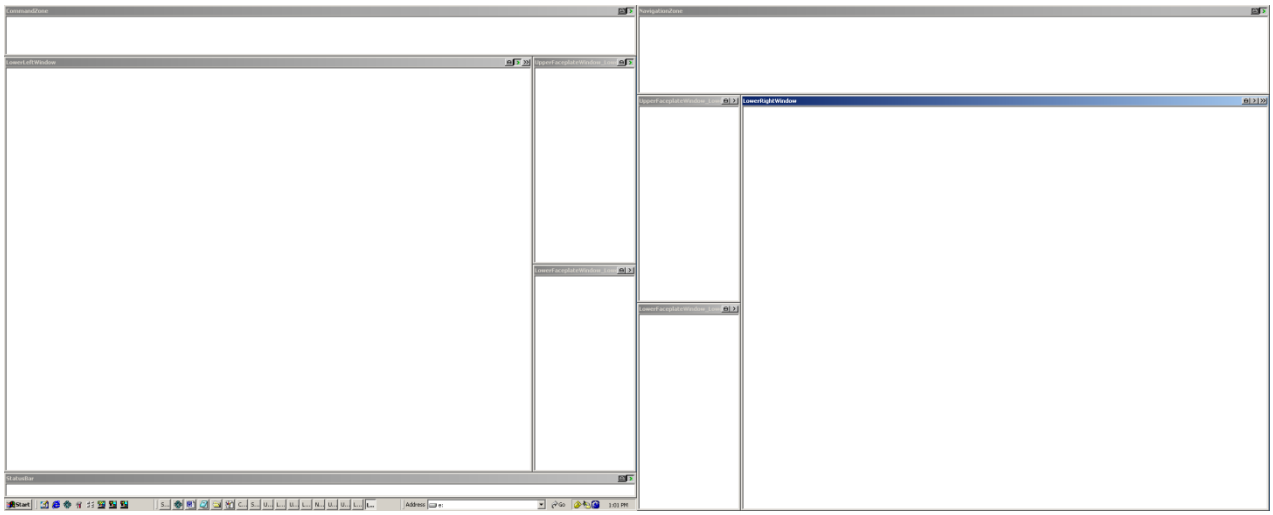


Figure 42: Example Horizontal Dual Screen SafeView Configuration

Vertical Dual Screen

The picture below shows the example SafeView configuration for a vertical dual monitor configuration. This configuration is exactly the same as the 2x2 configuration with exception of the 2 right monitors, which are not part of this configuration.

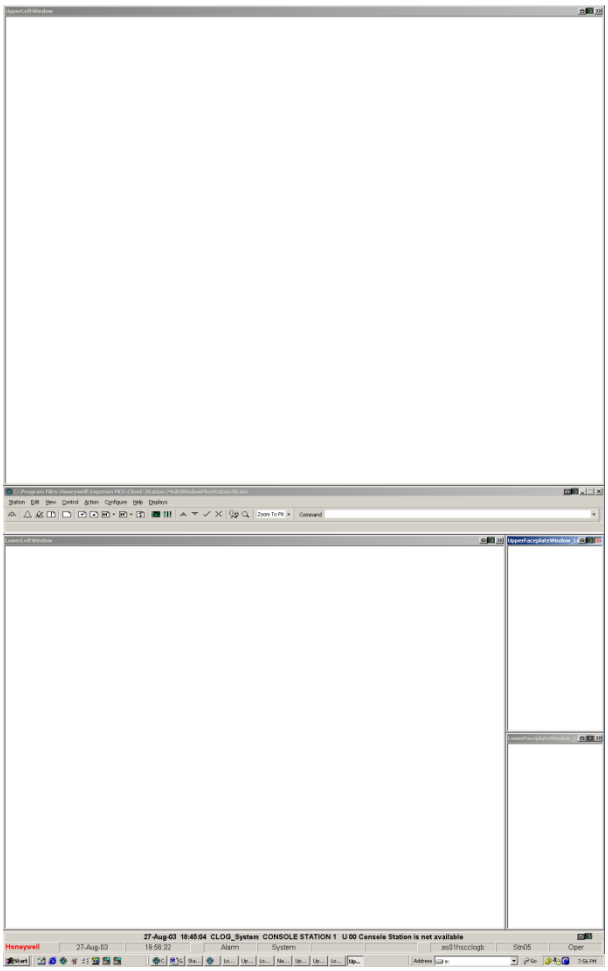


Figure 43: Example Vertical Dual Screen SafeView Configuration

Single Screen

The picture below shows the example SafeView configuration for a single monitor configuration. Again, this configuration is based on the 2x2 configuration with exception of the monitors at the right and at the top.

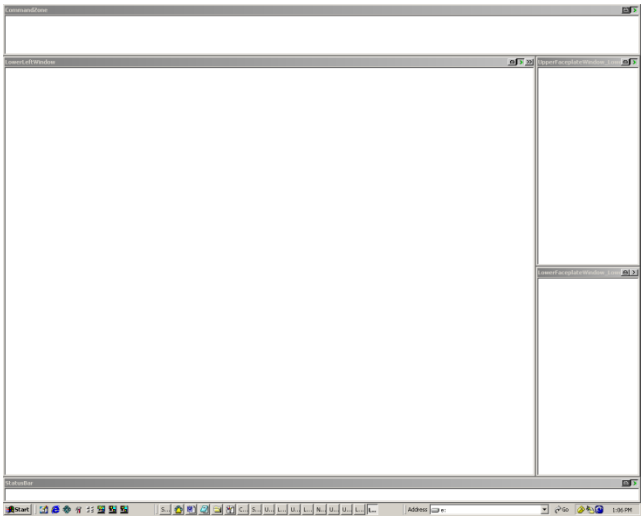


Figure 44: Example Single Screen SafeView Configuration

2.3.3 General SafeView Settings

Global Focus

When the global focus is activated (shown as a red “>>” sign in the right upper corner of the window), it means that each display that is opened afterwards will be displayed in this window, regardless of the category configuration. Global Focus can only be active on one window at a time.

Manual Select

Manual Select is applied for multiple windows with the same category. When the Manual select option (shown as a “>” sign) is pressed, the operator can select the window were the new display in that category will be invoked. This will be indicated with a green “>” sign. For example, when window 1 and 2 are both configured to show text displays, the operator can manual select the “>” sign were the next text display is shown.

Native Window

For LCN connected console Stations, the Native Window will normally be invoked in a separate window in the left upper corner. For multi-monitor setups, this means the top left corner in the upper monitor

Faceplates

Faceplates should be managed by SafeView. They can be positioned on top of the process displays as floating displays, or a dedicated area on the screen can be reserved (thus not obscuring the process display)

Other applications

When starting other applications during a SafeView session, these applications will normally be shown in dedicated window.

Window Taskbar

The window taskbar is normally shown on the lower left screen and can be configured to be auto hide (or not). Depending on this choice the SafeView configuration has to be modified. It is advised not to use auto hide for the taskbar when it may overlap the Station's Status Bar, since navigating to this status bar will often result in a status bar obscured by the windows taskbar.

Chapter 3 Alarm management

3.1 Introduction

It has been widely recognised that lack of a clear philosophy for alarm management on process plants controlled by a distributed control system (DCS) often results in there being too many alarms, leading to problems with:

- Standing alarms
- Nuisance alarms
- Frequently repeating alarms
- Alarm floods
- The operator's inability to prioritise remedial actions

In the worst cases, alarms can seriously impair the operator's ability to manage the process. Alarms floods during upset conditions can cause a minor event to escalate into a more serious incident. This is contrary to the design intent of an alarm system, which should seek to assist the operator to control the plant, avoid upsets and mitigate the consequences of undesirable events.

The assignment of alarm priorities and the implementation of alarm configuration reviews is one part of the overall process of managing alarms and alarm systems. The Engineering Equipment & Materials Users Association (EEMUA) published a guide to the design, management and procurement of alarm systems.

The guidelines on setting alarm priorities are based on the actions the operator needs to perform upon the alarm. Practical experience has shown that establishing the alarm priority based on an assessment of risk requires disproportional effort in relation to the results. The risk-based approach often does not offer acceptable or reliable results. Setting the priorities of alarms is meant to help the operator to prioritise his actions. However if the alarm rate is low, prioritisation is not required. If the alarm rate is high, the operational situation is already deteriorated to such an extent that the operator no longer uses the alarm system to assess the situation and to prioritise his actions.

Just setting different alarm priorities has little practical relevance. Instead of spending efforts on setting alarm priorities, attention should be focused on the ability of the alarm system to provide meaningful alarms under most or all operating conditions including upset and trip conditions. The priorities will be set only to distinguish between the kinds of activity to be executed.

The following measures will improve alarm management such that alarms become more 'meaningful':

- Setting Alarm priorities and Destination
- The setting of alarm priorities such that operator only gets alarms that he can actually action on. For existing installations, this includes the downgrading of the alarm priorities or removal of the alarm function.
- Optimising alarm parameters
- Alarm parameters such as filtering, and dead band allow the reduction of repeating alarms.
- Static alarm suppression
- Alarms that are always in alarm when a process unit or a large piece of equipment is shutdown, are suppressed.
- Dynamic alarm suppression
- Alarms that always follow after a process trip are suppressed.
- Dynamic mode dependant alarm settings

- Alarm settings are dynamically changed based on detected operational mode changes.
- Measuring alarm management performance
- By measuring the performance of the alarm management, attention and effort can be focused to aspects of existing alarm systems such that it can be optimised with the minimum of effort. Alarm management performance is measured using benchmarks.
- Optimise Alarm ergonomics
- By optimising the way alarms are presented to the operator; operator alarm handling may be greatly enhanced. This includes on-line alarm help

A formal Alarm management study is required to provide the operator with meaningful alarms, that is an adequate set of warning facilities during normal and upset operation whilst minimising, as far as is reasonably practicable:

- Standing alarms
- Nuisance alarms
- Repeating alarms
- Alarm floods

Summarising, Alarm management is intended to guide users to a safe, cost effective and consistent design and implementation for alarms in the Process Automation System (PAS).

3.2 Human factors

In any process, traditional process control elements and algorithms can maintain good control of the plant during normal operation. During normal operations, the operator's primary task is routine surveillance of the process and the required interface needs to reflect that task. This same interface must also, however, meet the different set of needs encountered during an abnormal situation.

If an abnormal situation occurs in the process, the operator must intervene. The goal of this intervention is to return the process to a safe condition and normal operations. During abnormal situations, operators must often act on widely divergent parts of the process, and they must be able to perform corrective action quickly and view key variables in order to identify the underlying faults. Hence, the interface used by operators reflects the specific tasks to be performed and the process conditions encountered during an abnormal situation, as well as those required during routine surveillance. An important part of this interface for normal and abnormal situations deals with the way alarms are dealt with by the operator.

When considering the design of an alarm system, it is reasonable to assume that operators and technicians are well trained and knowledgeable about the equipment they operate and maintain. The function of the alarm system is then to:

- Trigger a trained response to certain emergency conditions.
- Alert the operator to plant conditions that need consideration and possible action.
- Advise the operator of further developments that need action.

The aspect of 'acknowledge' and "consideration" - the analysis of the situation, the identification of the correct action and its execution or communication - is one that has been ignored in many past alarm system implementations. This results in cognitive overload for operators in upset situations and an increased potential for escalation. A good alarm system should assist the operator in evaluating the situation, which is fundamental to identifying the correct actions. Depending on the circumstances, these actions can be directed either at avoiding an event or mitigating its consequences.

The process of "acknowledge" and "consideration" takes typically 0.1 to 5 minutes each. Taking an average figure of say 5 minutes for a complete response, the maximum alarm (that is the meaningful alarms) load that one operator can handle effectively is limited to

around 1 alarm per 5 minutes. However considering that the operator has many additional tasks, the average number of alarms should be limited to the quantities as given in the table below.

	% of time spend on alarm handling	# of alarms that effectively can/should be handled
Normal (current)	40%	4 - 6 per hour
Good	10%	1 per 1 hour
Excellent	4%	1 per 2 hours

Numbers above this in for example an upset situation will probably be ignored so it is important not only to avoid unnecessary alarms during normal steady state conditions but also under upset conditions. It is also important for the operator to be able to access relevant plant information quickly and effectively, in order to speed up the process of responding to an alarm, and thus improve the effectiveness of his corrective actions. The design of the operator control interface and the rapid and comprehensive availability of current and trended information are important facets of alarm system design.

The configuration of an alarm system is therefore a balancing act between giving the operator an extensive set of warning facilities for normal operation and the need to avoid information overload under upset conditions.

3.3 Alarm functionality

3.3.1 Experion PKS Enterprise Model

Assets and the asset model form the core of the Experion PKS Enterprise Model, a framework that can be used by engineers, operators, and applications to model and view their plant or process. The Enterprise Model replaces the flat, area-based structure.

An Enterprise Model comprises:

- A system model
- An asset model
- An alarm group model

System Model

The system model represents the boundaries of the Experion PKS system. It comprises information about:

- The servers that are part of the Experion PKS system
- The Stations, channels, controllers, system interfaces, and printers that are associated with those servers.

In building the system model, it is possible to also define those servers that are connected to, but not part of the Experion PKS system (for example, servers on the business network), for diagnostic purposes.

Asset Model

The asset model, which forms the core of the Enterprise Model, is used to:

- Define scope of responsibility
- Navigate the Experion PKS system
- Resolve data references

- Manage alarms
- Organize points, displays and reports

An Experion PKS asset is a database entity that represents a particular physical item in the enterprise, for example, fixed plant equipment, facilities or buildings.

All entities in the Enterprise Model (systems, servers, assets and points) have a tag name which is a unique name used by the system to identify that entity. In addition to the tag name, entities also have an Item Name (no uniqueness required) and an Enterprise Model Name (also referred to as a Full Item Name), which provides a more structured way of identifying entities.

Assignable Assets

Within the asset model it is possible to define assignable assets in order to restrict access to parts of the system, processes, or individual pieces of equipment. By configuring assignable assets (and assign these to user profiles) access can be restricted to points, alarms, stations, operators, displays and reports.

The asset model should reflect the logical and physical design or structure of the plant. The design of the top-level structure should be based on Operations Area>Operations Sub Area>Panel Operator Position for scope assigning. Other sub levels could be added to cover Process Units associated to each Panel Operator Position.

Alarm Group Model

The alarm group model is used to:

- Define alarm groups
- View aggregated alarms for those alarm groups

Alarm groups provide a means to monitor a group of assets and or data points that are otherwise unrelated to one another in the asset model. Alarm groups are created and configured in the same way as assets. Assignable assets and data points then can be associated with the alarm group.

Alarm groups have the following characteristics or constraints:

- Alarm groups can be built in a hierarchy.
- An alarm group can contain points, area points and other alarm groups.
- There can be multiple, separate alarm group hierarchies.
- Recursive hierarchies are not allowed.
- Each point must belong to only one asset path.

The HMIWeb Solution Pack provides alarm-handling objects based on alarm group functionality. Operating displays are often organized hierarchically to support the required overview and task oriented displays for the operator. Alarm groups provide an infrastructure to greatly simplify the configuration and use of the aggregated alarm information required to support the navigation between these hierarchically organized displays.

Alarm groups are based on the following infrastructure:

- A new point type called the alarm group point, which allows arbitrary groupings of points to be created that are independent of the asset model. The asset model is used to segregate the plant, process or site to support different scopes of responsibility, whereas alarm groups are primarily used to support overview displays. The alarm group point has parameters that maintain aggregate alarm information for the contained points, such as alarm counts.

- Asset points that correspond to each configured asset. The Asset points are automatically created for each Asset and maintain similar aggregate alarm parameters to alarm group points. Asset points can be children of alarm groups and can also be used on displays and in other assets of the system, just like standard points.
- For consistency, standard points also include the same alarm parameters as alarm groups and asset points.

Alarm groups replace the following functionality:

- TPS “PRIMMOD”, which provides similar functionality in TPS systems.
- Provides an alternative to the Experion PKS Composite Alarm Initiation and Composite Alarm Processing algorithms (algo#11 and algo#12) with significantly enhanced functionality and simplified engineering. These algorithms provide similar functionality but have a number of limitations, such as having a limited group size, relatively complex engineering, and the lack of per group alarm counts and priority information. These algorithms will still exist in Experion PKS for legacy systems, but new systems should use the alarm group functionality.

Alarm Group Parameters

The following tables list the alarm group parameters that are now available for each point in the system, including alarm group points, area points and **standard points**.

Parameter (all)	Parameter (urgent)	Parameter (high)	Parameter (low)
TotalAckAlarms	TotalUrgentAckAlarms	TotalHighAckAlarms	TotalLowAckAlarms
TotalActiveAckAlarms	TotalUrgentActiveAckAlarms	TotalHighActiveAckAlarms	TotalLowActiveAckAlarms
TotalActiveAlarms	TotalUrgentActiveAlarms	TotalHighActiveAlarms	TotalLowActiveAlarms
TotalActiveUnackAlarms	TotalUrgentActiveUnackAlarms	TotalHighActiveUnackAlarms	TotalLowActiveUnackAlarms
TotalAlarms	TotalUrgentAlarms	TotalHighAlarms	TotalLowAlarms
TotalRTNAlarms	TotalUrgentRTNAckAlarms	TotalHighRTNAckAlarms	TotalLowRTNAckAlarms
TotalRTNUnackAlarms	TotalUrgentRTNAlarms	TotalHighRTNAlarms	TotalLowRTNAlarms
TotalRTNAckAlarms	TotalUrgentRTNUnackAlarms	TotalHighRTNUnackAlarms	TotalLowRTNUnackAlarms
TotalUnackAlarms	TotalUrgentUnackAlarms	TotalHighUnackAlarms	TotalLowUnackAlarms

Table 1: Alarm count parameters

Within the HMIWeb Solution Pack, three levels of display are distinguished:

- Level-1: Process Area Overview displays
- Level-2: Process Unit Overview displays
- Level-3: Process Unit Detail displays

The HMIWeb Solution Pack uses alarm group points for all levels of process displays. With that, the use of the area assignment table, as used in previous versions of HMIWeb Solution Pack is no longer required.

When navigation objects with alarm information are used, it is assumed that for each navigation target an aggregate alarm point will be built. In practice this means that for each (process) display one or more alarm group points are built. These points contain all points on the target display, with the exception of alarm group points on those displays which refer to sister displays (same level) or parent displays (one level up).

This way all alarms of a single display can be retrieved from one single alarm group point and presented in a symbol as shown below:

Figure 45: Alarm Navigation Shapes using Alarm Groups

All Level-3 displays show at the top of their display the alarm information of their parent display (Level-2 display) plus the alarm information of other Level-2 displays. This way, operators can monitor alarms in other process units without navigating to displays related to those units.

The same applies for Level-2 displays, which show the alarm information of their parent display (Level-1 display) plus the alarm information of other Level-1 displays. This way, operators can monitor alarms in other process units without navigating to displays related to those units.

3.4 Alarm navigation

There are three methods of tracing new alarms:

- Through the display hierarchy and the alarm indicator flashing in the appropriate priority colour. Progressively selecting the alarm indicator will invoke more detailed displays and locate the display with the cause of the alarm.
- Through Alarm Summary displays, then directly to the associated custom display.
- Through custom LED-enhanced keyboard buttons on the IKB; pressing the button will invoke either a Level-2 or a Level-3 display.

The operator should choose the appropriate method, the choice being situation-dependent.

3.5 Alarm information

3.5.1 Level-1 Display Alarm Information

As described in Section 1.1.2, Level-1 displays can be in many different formats. If Level-1 displays are alarm-driven, then they contain alarm group information, using objects such as those shown below, or similar.

Figure 46: Alarm Navigation Objects (Level-1)

Selecting one of these objects will open one of the underlying displays, which contain detailed alarm information. The button colour will be the colour associated with the alarm priority and will remain blinking until the new alarm is acknowledged.

3.5.2 Level-2 Graphic Display Alarm Information

Level-2 alarm notification is similar to Level-1 notification. Selecting any of the symbols showing aggregated alarms will invoke an associated Level-3 display. Where specific dynamic details are shown, the alarm will be accompanied by the appropriate colour-coding on the display. Alarm acknowledgement is only possible for tags in alarms shown in this display. Aggregated alarms using the objects as shown above can only be acknowledged in Level-3 displays.

3.5.3 Level-3 Graphic Display Alarm Information

At this level, all point-parameter alarms will be visible. Each alarm will be accompanied by the appropriate colour-coding on the display and can be acknowledged.

3.6 Alarm color setting

Standard alarm behaviour, such as colour presentation, (un)acknowledged state presentation, and alarm disabling is described in detail in the *HMIWeb Object Design Specification*. See this document for detailed information.

3.7 Responding to alarms from custom displays

3.7.1 Acknowledging alarms

The HMIWeb Solution Pack allows various ways of alarm acknowledgment:

- Most shapes have a shortcut menu, which allows the acknowledgement of the alarms in that shape. Please note that for shapes with multiple tags (like for example the F&G shapes), only the most important alarm will be acknowledged, after which the next important alarm can be acknowledged, until all alarms for that shape are acknowledged.
- When a shape is selected, normally a faceplate appears. The alarms can be acknowledged from the faceplate.
- Select the alarm line at the bottom and press ACK, on the operator's keypad, to acknowledge the last alarm.
- Using the page acknowledge shape. This shape will acknowledge all alarms on a page (as in the alarm summary)

3.8 Responding to alarms using the Alarm Summary

3.8.1 Alarm Summary

Alarms are listed on the alarm summary, which provides a one-line description of an alarm.

If a repeat alarm occurs, the repeat is not added as another entry in the summary. Instead, the alarm details of the original alarm are updated to show the details of the latest occurrence of the alarm. The number of occurrences of the alarm and the time of the original alarm are shown in the Details pane of the alarm. An alarm is considered to be a repeat alarm if the source, condition, parameter, are the same.

To call up the alarm summary, click the  (**Alarm Summary**) toolbar button. (Alternatively, choose **View > Alarms** from the menu).

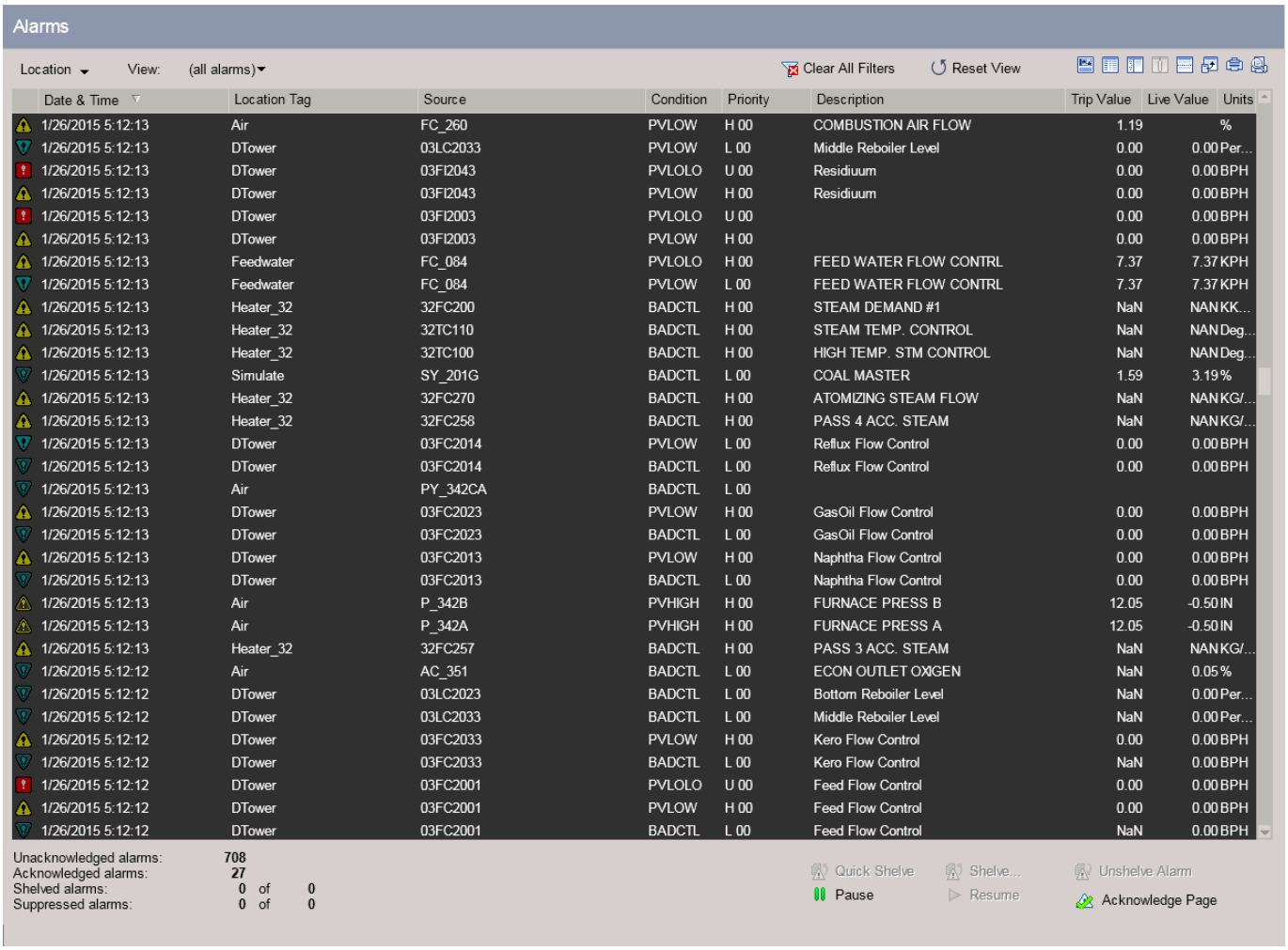


Figure 47: Alarm Summary

The following table describes the default alarm line items, starting from the left. When a function is disabled, the original icon shape is retained, but the symbol changes to a minus sign and its colour changes to grey.

Alarm Item	Description	Disabled
	Red and flashing: the alarm is urgent priority, unacknowledged and the cause of the alarm still exists. Red and not flashing: the alarm is urgent priority, acknowledged and the cause of the alarm still exists. Inverse color and flashing: the alarm is urgent priority, unacknowledged and the cause that generated the alarm no longer exists.	
	Yellow and flashing: the alarm is high priority, unacknowledged and the cause of the alarm still exists. Yellow and not flashing: the alarm is high priority, acknowledged and the cause of the alarm still exists. Inverse color and flashing: the alarm is high priority, unacknowledged and the cause that generated the alarm no longer exists.	

Alarm Item	Description	Disabled
	Cyan and flashing: the alarm is low priority, unacknowledged and the cause of the alarm still exists. Cyan and not flashing: the alarm is low priority, acknowledged and the cause of the alarm still exists. Inverse color and flashing: the alarm is low priority, unacknowledged and the cause that generated the alarm no longer exists.	
	Questionable alarm. The state of an existing alarm is unknown because communications with the source of the alarm have been lost.	
	Shelved active urgent alarm. Inverse color indicates that the alarm has returned to normal.	
	Shelved active high alarm. Inverse color indicates that the alarm has returned to normal.	
	Shelved active low alarm. Inverse color indicates that the alarm has returned to normal.	
	Shelved active alert. Inverse color indicates that the alert has returned to normal.	
	Shelved point (all alarms on the point have been shelved).	
	Dynamic suppressed alarm	
Time	The time and date at which the alarm was received.	
Area	The area to which the point or device belongs.	
Source	The point or device that caused the alarm. If the point ID is too long to be fully displayed in the alarm summary, it is truncated. To see the full name place the mouse pointer over the partial point ID to display the full point ID.	
Condition	The alarm condition.	
Priority	The priority of the alarm. The prefix letter indicates the general priority: • Urgent • High • Low If a number follows the letter, it represents the relative priority within the general priority. For example, Urgent alarms can vary from U15 (most urgent) to U00 (least urgent).	
Description	A description of the alarm. If the description is too long to be fully displayed in the alarm summary, it is truncated. To see the full description place the mouse pointer over the partial description to display the full description.	
Trip Value	The value that triggered the alarm.	
Live Value	The current value. This value is continually updated.	

Alarm Item	Description	Disabled
Units	The unit that the value represents, for example ml/s.	

Table 2: Alarm Summary Line Contents

3.8.2 Changing what is shown in the Alarm Summary

By default, the alarm summary shows all alarms, with the newest alarm at the top. You can change the alarm summary by applying filters and sorting the summary.

Filtering the alarm summary allows you to show alarms that match the filter criteria and hide alarms that do not match the filter criteria. For example, you can filter the alarm summary to show alarms of a particular priority only, or you can filter the alarm summary to show alarms for a particular area only. You can filter the alarm summary by most columns in the summary.

An easy way to filter the summary is to perform a "like currently selected" filter. For example, if you want to see all alarms for a particular point. You can select an alarm for the particular point, click the Source column and select (like currently selected). The alarm summary is filtered to show all alarms in the summary that match the source of the currently selected alarm.

Sorting allows you to set the order in which alarms appear in the summary. The sort order can be ascending or descending. For example, you can sort alarms by date and time, in ascending order. This means that alarms are listed in order of ascending date and time, that is, the oldest alarm is listed at the top of the summary.

You can apply more than one filter at a time and you can also filter and sort at the same time. When the alarm summary is filtered or sorted, the column by which you are filtering or sorting is highlighted.

To filter the alarm summary:

- Call up the alarm summary display
- Click the column heading you want to filter by.
- Select the filter you want to apply.

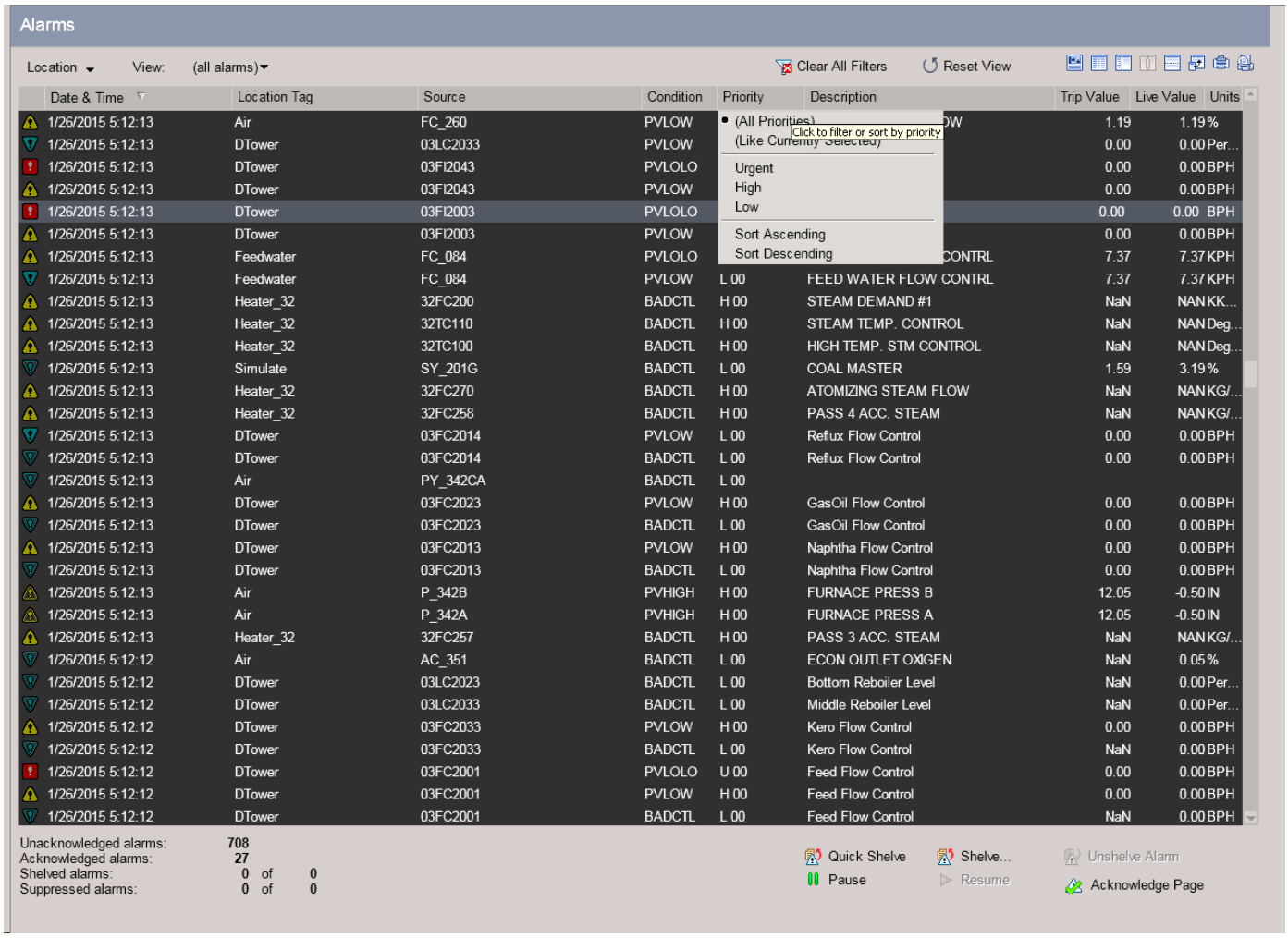


Figure 48: Alarm Summary Sorting & Filtering

To sort the alarm summary

1. Call up the alarm summary display
2. Click the column heading you want to sort by.
3. Select the sort order.

To **remove filtering**, Click **Clear all Filters**.

3.8.3 Using Alarm Summary Views

You can change how information is displayed in the alarm summary by applying a different "view". A view contains the information about filtering and sorting, which alarm line items are shown, the order they are shown in and the space provided for each item.

There are several predefined views. These are:

- Unacknowledged alarms; shows only unacknowledged alarms
- Urgent alarms; shows only urgent alarms

- Urgent and high alarms; shows only urgent and high alarms

There may be other views that have been configured for your system.

To apply a view

4. Click the view list

5. Select the view from the list

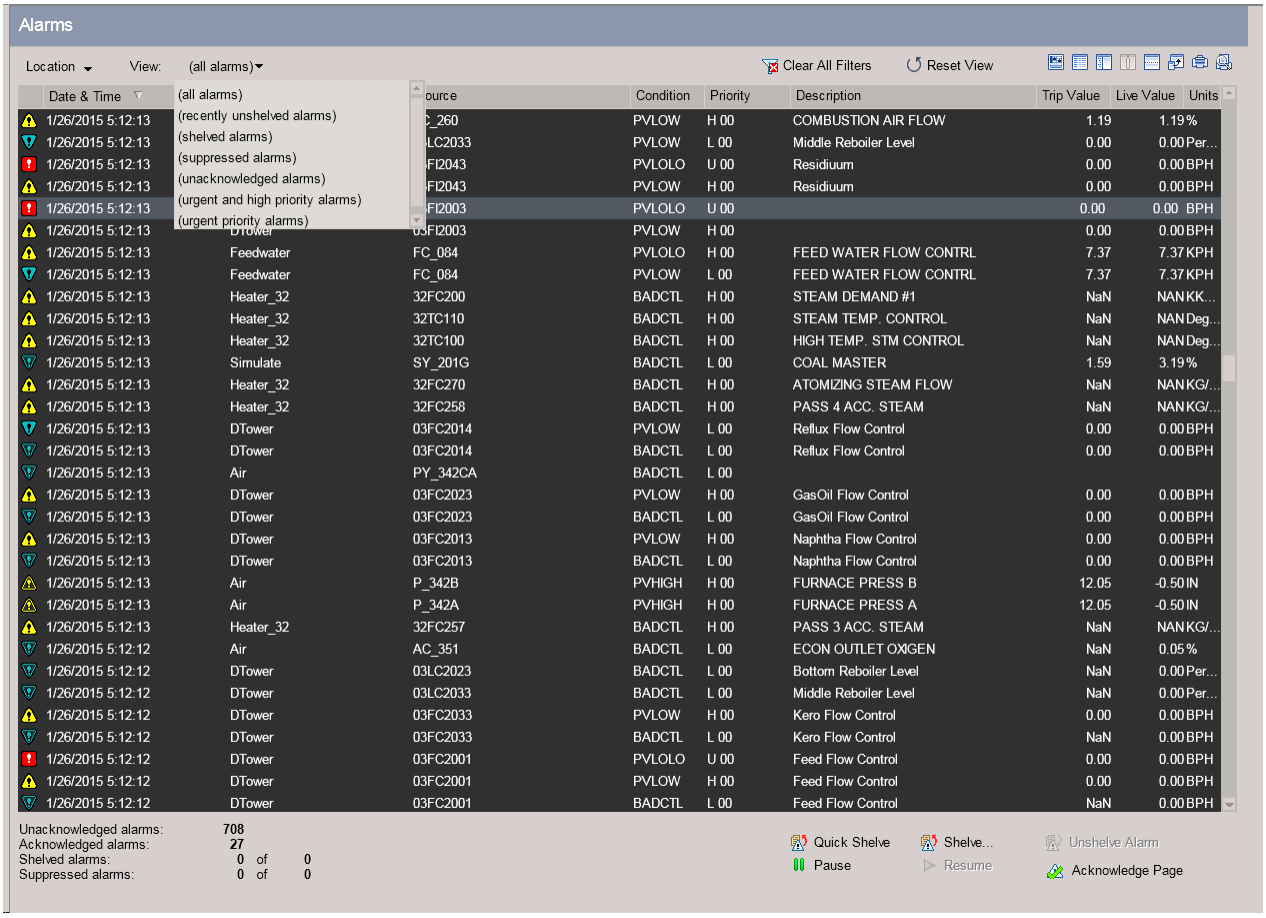


Figure 49: Alarm Summary Views

3.8.4 Using the Location Pane

The location pane provides a list of assets and alarm groups to which you have access. You can use the area pane to filter the alarm summary to show alarms for a particular asset or alarm group only. The location pane also provides a summary of the number of alarms in each asset or alarm group. If alarm groups are used to calculate the aggregate alarms per display and when this done in a structured way using the display hierarchy, the alarm group can be selected to quickly get an impression of the alarms in these displays.

To display the area pane use either method

- Click the Show Area Pane icon 
- Click the Area list and click the Push Pin to dock the area pane 

To hide the area pane use either method

- Click the Hide Area Pane icon 
- Click the Close icon in the Area Pane 

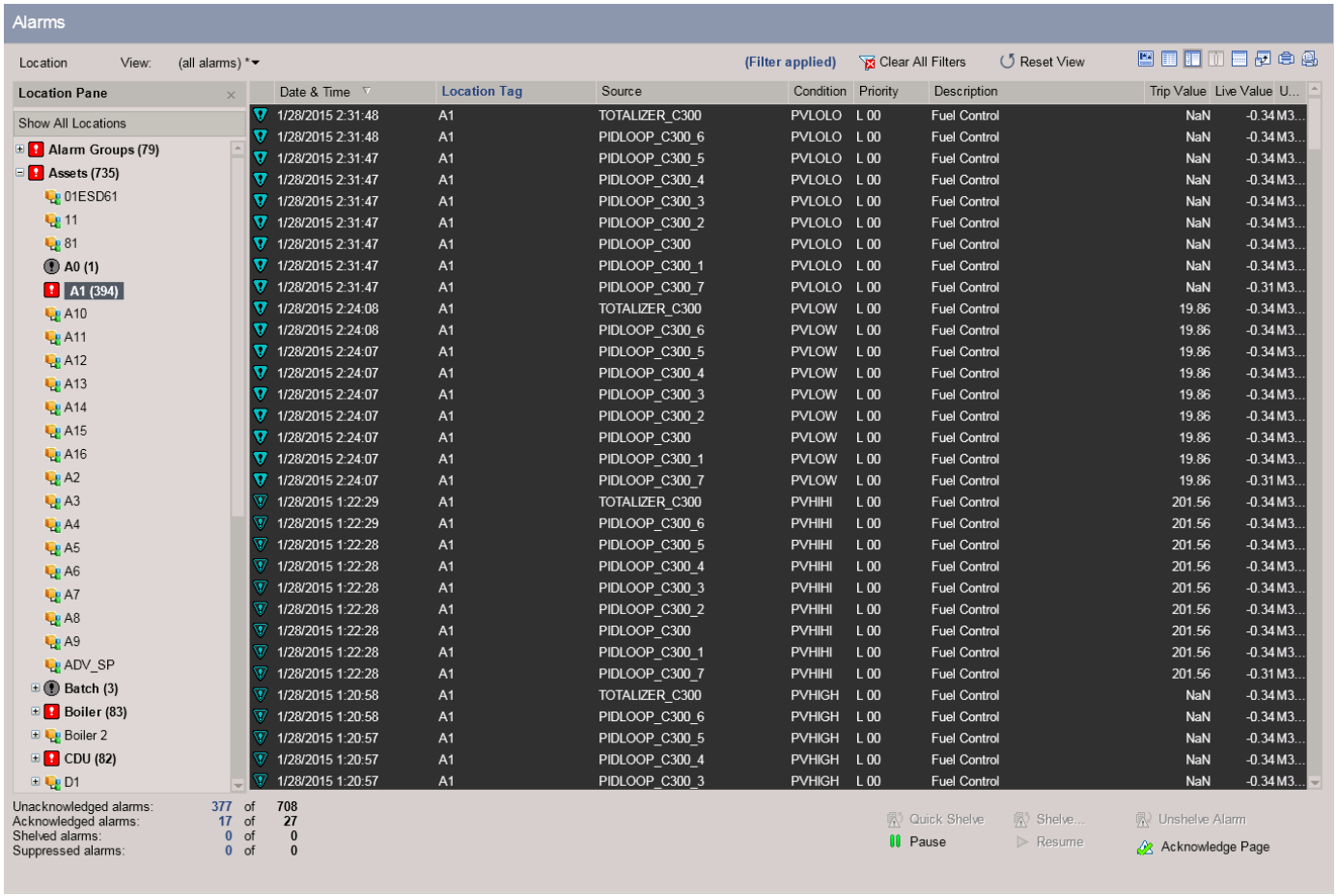


Figure 50: Alarm Summary Location Pane

3.8.5 Using the Details Pane

The Details pane shows the details of the currently selected alarm. If no alarm is selected, the details pane is empty. If the selected alarm is for a point, the details pane also provides links to the point detail display and associated display.

To show or hide the Details pane, click the Details pane icon  .

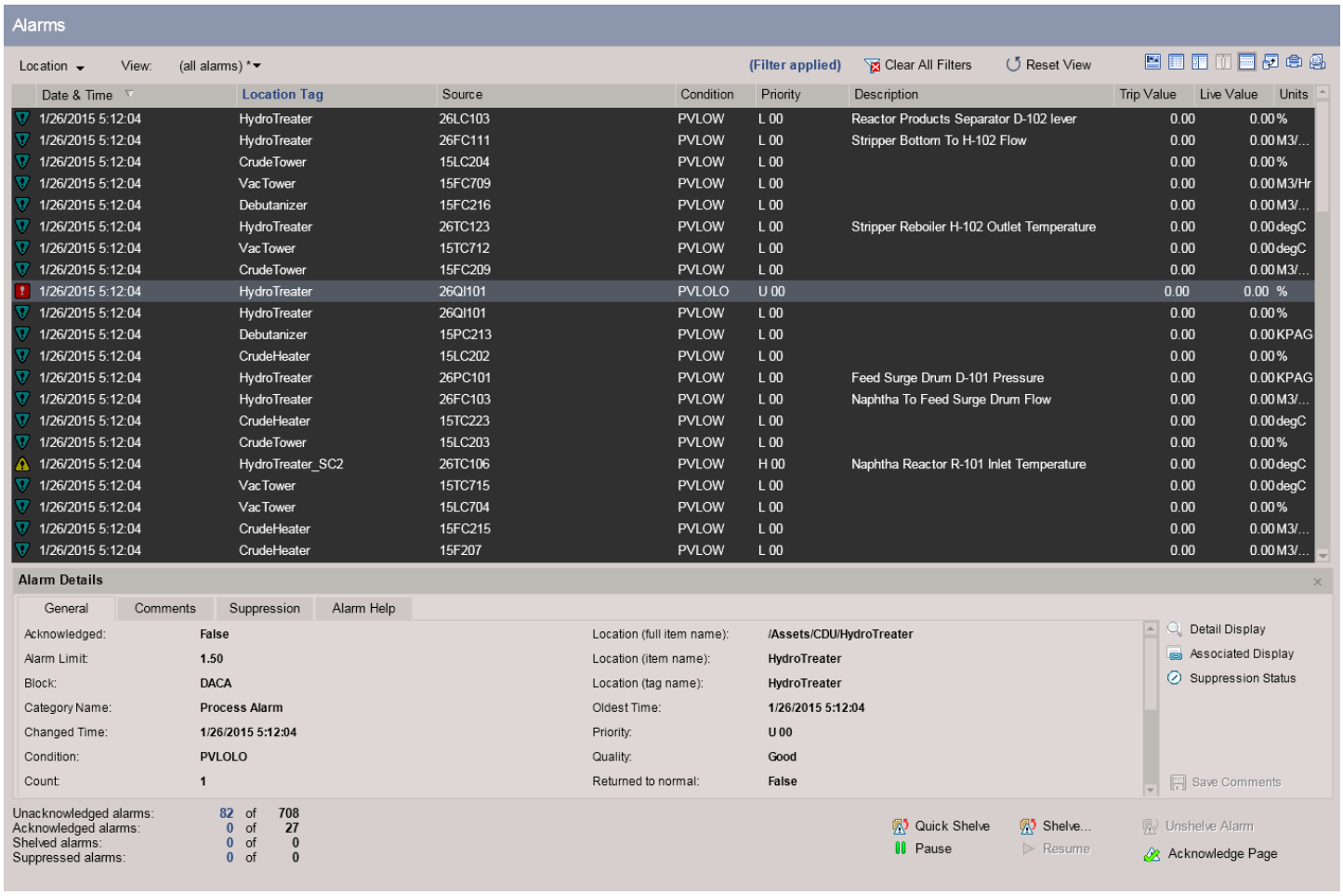


Figure 51: Alarm Summary Details Pane

3.8.6 Navigating the Alarm Summary

There are several ways to scroll the list of alarms on the alarm summary. You can:

- Use your mouse and click on the scroll bar
- Use your mouse wheel (if your mouse has one)
- Use the Up and Down arrow keys on your keyboard
- Press the <Page Up> and <Page Down> keys to scroll a page at a time
- Press the <Home> key to go to the first alarm in the summary
- Press the <End> key to go to the last alarm in the summary

If you want to use your keyboard keys or mouse wheel to scroll the alarm summary, you need click your mouse in the summary grid to give it focus.

3.8.7 Pausing the Alarm Summary

You can pause the alarm summary to make it easier to read if alarms are occurring in rapid succession. When the alarm summary is paused no new alarms are added to the summary, however you can still acknowledge alarms and filter and sort the summary. Alarms that are acknowledged or returned to normal while the summary is paused are shown with a strikethrough.

3.8.8 Acknowledging alarms

In most systems, Station produces an "alarm tone" when a new alarm occurs. There are several ways of silencing or acknowledging alarms:

To	Do this
Silence the tone	Either: Click the  (Alarm Acknowledge) toolbar button. Press the appropriate key (ACK or F4)
Acknowledge a particular alarm on the alarm summary	Either: Select the alarm and click the  (Alarm Acknowledge) toolbar button. Right-click then select Acknowledge.
Acknowledge all alarms currently visible on the alarm summary	Click the Acknowledge Page button on the display. Note that if there are any more unacknowledged alarms in the list, you first have to display them before clicking the Acknowledge Page button again.

Table 3: Acknowledging Alarms

3.8.9 Shelving an alarm

Shelving an alarm allows you to temporarily hide a distracting/nuisance alarm.

When you shelve an alarm it is silenced, acknowledged, and removed from normal view. Also, further instances of the same alarm are combined with the existing shelved alarm, which continues to remain shelved.

A shelved alarm is automatically unshelved at the end of the shelving period, which depends on a number of factors, such as the reason the alarm is shelved.

Alternatively, you can manually unshelve it before the shelving period has expired.

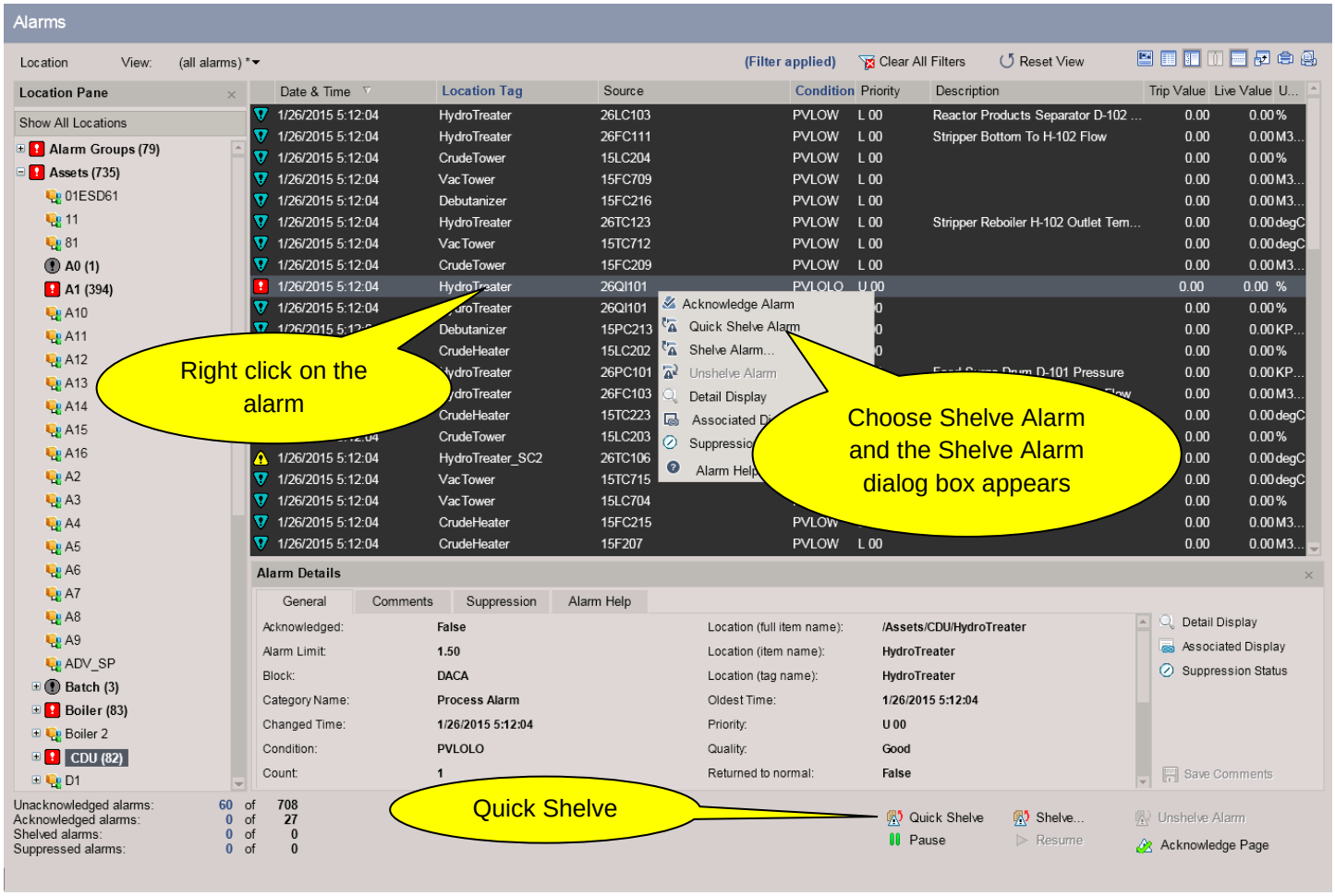


Figure 52: Alarm Shelving

To shelve an alarm for the default time and reason

1. Call up the Alarm Summary.
2. Select the alarm you want to shelve.
3. If the Shelve Alarm button is available, you can click this button to perform a quick shelve.

The selected alarm is shelved for the default time and reason that is configured on the alarm shelving configuration page.

If the Shelve Alarm button is not available, there may be several reasons, which can include quick shelving has been disabled, the default shelve time is greater than the remaining shift duration, or you don't have adequate permissions. If the Shelve Alarm button is not available, try using the procedure below.

To shelve an alarm for a specified time and/or reason

1. Call up the Alarm Summary.
2. Right-click on the alarm you want to shelve, and choose the Shelve Alarm command.

   The Shelve Alarm dialog box appears.

3. In the Reason for shelving list, select the reason for shelving the alarm.
4. If you do not want to use the default shelving period, in the Shelving period list, select a shelving period.
5. If appropriate for the alarm, in the Comments box, type your detailed reason for shelving the alarm.
6. Click OK.

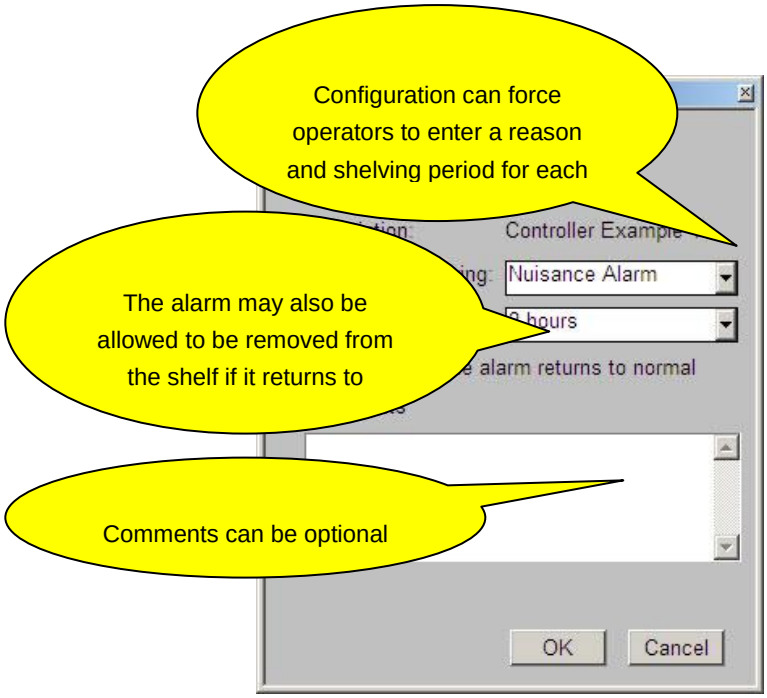


Figure 53: Alarm Shelving Dialog

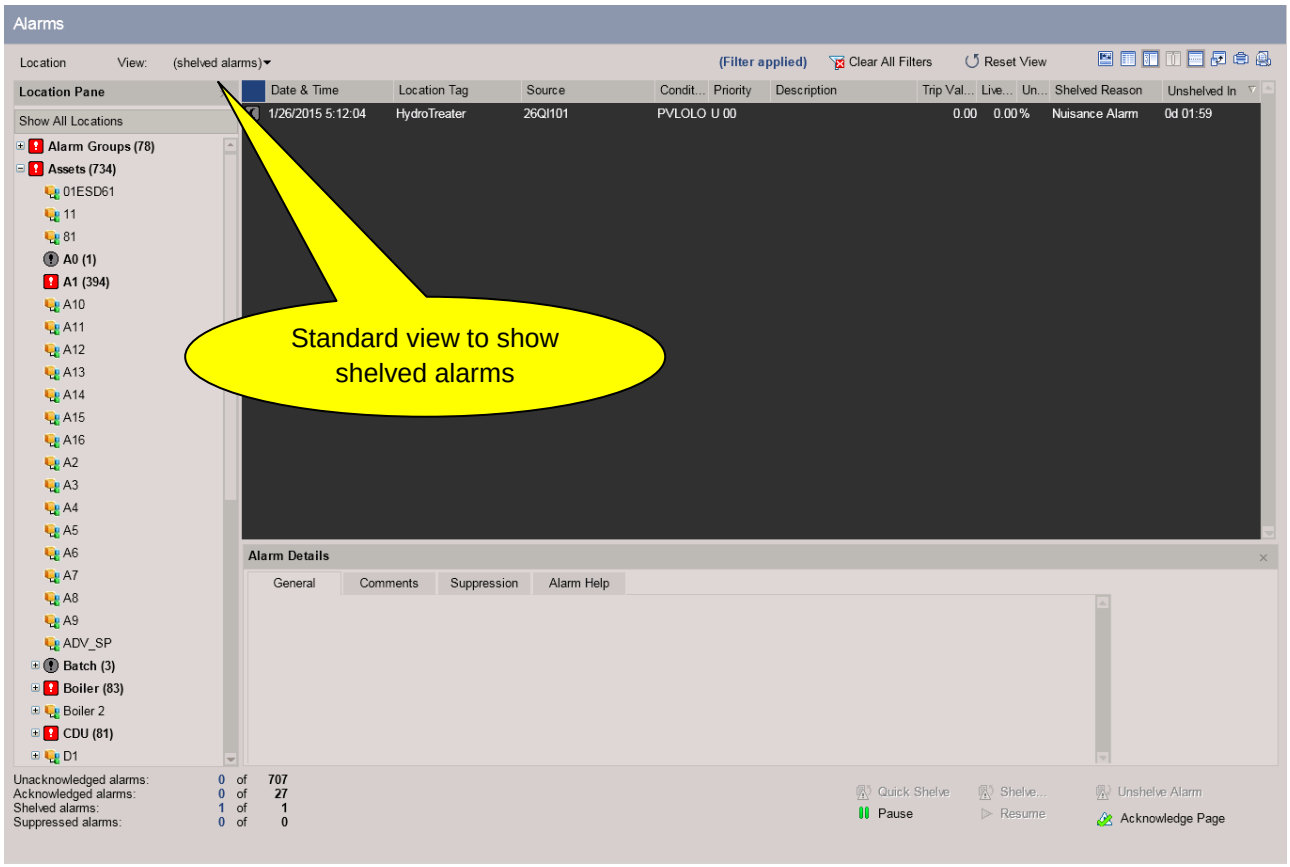


Figure 54: Standard view to show shelved alarms

To view the shelved alarms, the operator clicks on the drop down “View” list to select the “shelved alarms” view

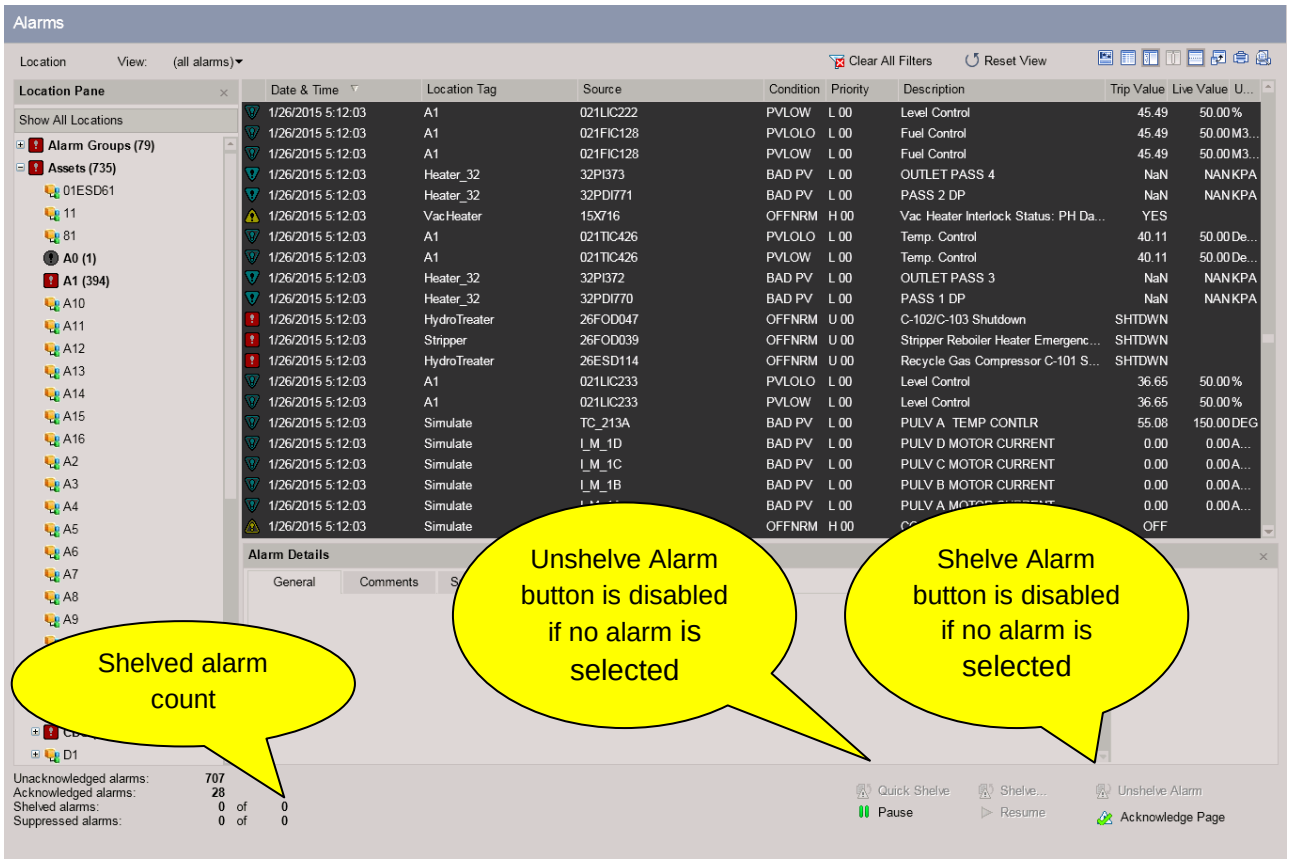


Figure 55: Alarm Shelving User Interface

All Alarm Shelving actions are accomplished from the standard Alarm Summary display

To unshelve an alarm

1. Call up the Alarm Summary.
2. Select the (shelved alarms) view.
3. Select the alarm you want to unshelve.
4. Click the Unshelve Alarm button.

3.8.10 Adding comments to an alarm

If required, you can add comments to alarms in the Alarm Summary. For example, you might need to keep a record of your actions in response to an alarm.

To add a comment to an alarm, select the alarm to which you want to add a comment.

If the Details Pane is not visible, click the Show Details Pane button and then select the Comments tab.

Any existing comments that are added to the alarm are displayed.

Type in your comment and click **Save Comments**. In the example below, you will also see that for the selected alarm a small icon is shown in the summary to indicate that comments exists for this alarm.

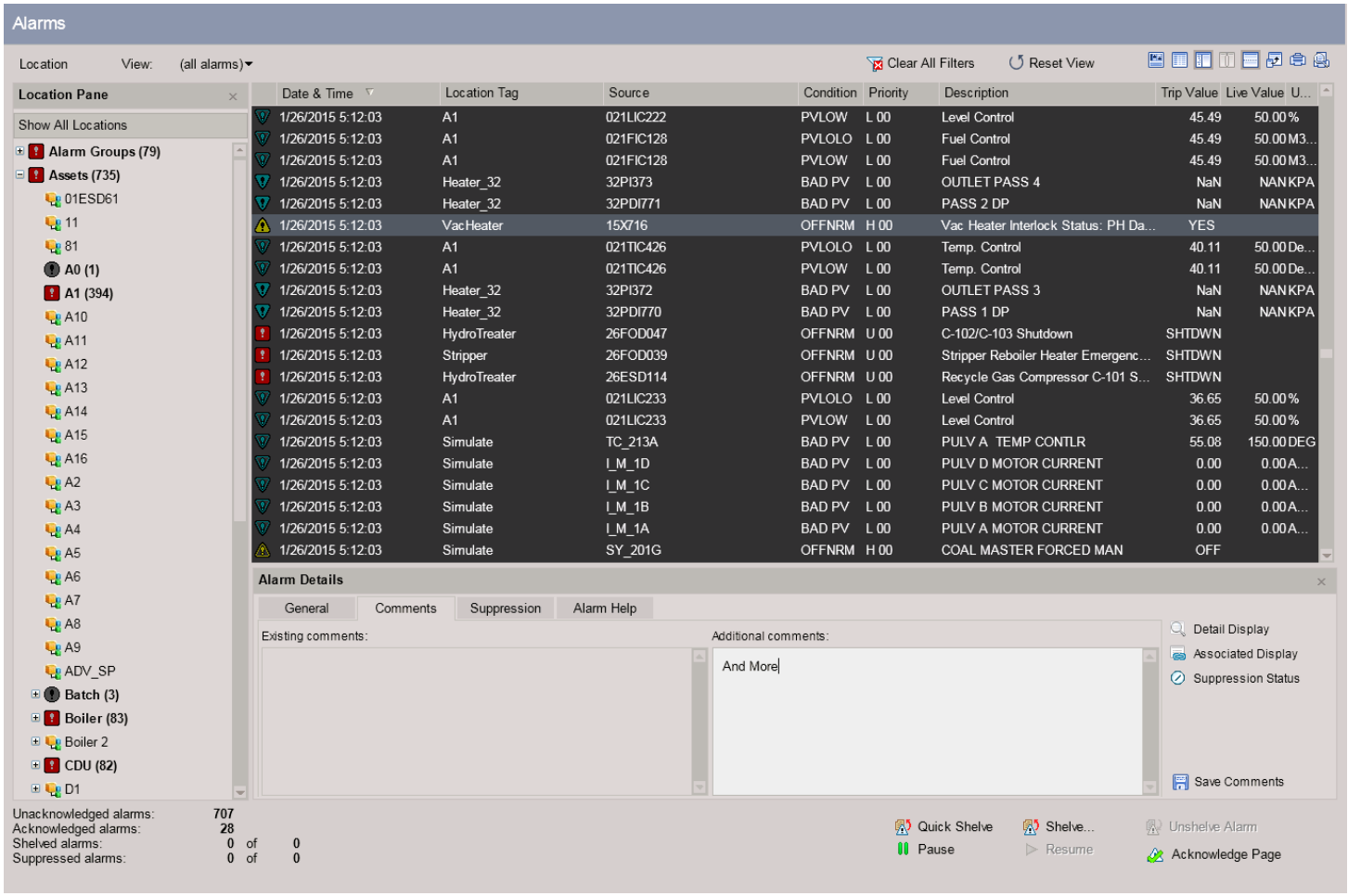


Figure 56: Adding comments to an Alarm

Alarm and message acknowledgement in Consoles

In general when an alarm is acknowledged or silenced on one Station, the alarm is acknowledged or silenced on all stations in that system. By contrast, the default setting for a system with a Console is for alarms to have to be acknowledged on every console in the system. You can, however, change this default setting within a server system so that when an alarm is acknowledged on one Station it is acknowledged on all Stations, including Console Stations within a Console.

3.9 Other alarm displays

3.9.1 System Status Display

The default Alarm Summary contains all alarms, including system alarms, which are also included on the System Status display. The default is often changed such that system alarms are not included for operators in the Alarm Summary.

The System Status Display lists all system alarms. Similarly to the Alarm Summary, the System Status Display can be used with different views and can be filtered and sorted.

It is possible to configure the priority for the following system alarms in Experion PKS:

- Communications marginal.
- Communications failure.
- Redundancy failure.
- Operator lockout.
- Printer failure.
- and so on

3.9.2 Event Summary

The Event Summary lists events that occur in the system, including:

- Alarms
- Alarm acknowledgements
- Return to Normal
- Operator control actions
- Login actions & security level changes
- On-line database modifications
- Communication alarms
- System Restart Messages

Events are initially collected into a circular event file called the online event file. This file forms part of the real-time server database and is independent of the SQL Server event database. Every 30 seconds, events are copied from the online event file to the SQL event database, where events are stored up to 50,000 events. Data can be viewed from the online data file and from the SQL event database. Events in SQL Server can be archived on tape and used for playback at a later stage.

If required, it is possible to add comments to events in the Event Summary, for example to keep a record of actions in response to an event.

3.9.3 Third Party Packages Alarm and Events

Alarm and Event data from third party packages such as Gas Turbines, Compressor Controls, ENMC, and so on can be integrated in the Alarm and Event database of Experion PKS. This functionality is provided by the Experion PKS OPC Alarm and Event client and requires OPC Alarm and Event server functions to be available from the required third party packages.

3.9.4 System Event Server

The System Event Server (SES) is an Experion PKS system component that issues Windows events as OPC alarms or events to subscribing OPC clients. This allows Windows system or application events to be viewed in the Event Summary or as alarms in the System Status Display. A filter will allow exposing only a subset of the windows events as OPC alarm and events. The configuration of the SES will be reviewed with Contractor before implementation.

3.9.5 Sequence of Events Summary

Experion PKS also provides for a dedicated list of high-resolution time stamped events named Sequence of Events (SOE). This functionality is used for sequence of events coming from Honeywell's Safety Managers.

Signals configured for SOE are transferred to the Experion Server upon read request. The request frequency is configurable. The features of the Sequence of Events Summary display are essentially identical to the Event Summary Display.

3.9.6 Alert Summary

Alerts are defined in Experion PKS as notifications whose urgency are not high enough to be alarms. There are two types of alerts. User-generated alerts can be used for example as a reminder to an operator to schedule maintenance for a piece of equipment. System-generated alerts are notifications of an abnormal condition in the system that could cause problems if the condition is not fixed.

Alerts are incorporated into Experion PKS from third-party user alert applications. Honeywell's User Alert application can be used to configure alert conditions and can be used to generate alerts in the Alert Summary of Experion PKS.

The Alert Summary can be filtered, sorted and use different views similarly to the Alarm Summary. The Alert Summary allows for viewing of private alerts, that is alerts defined by an individual user.

3.9.7 Diagnostic Alarms

Diagnostic alarms are defined as signals that indicate the otherwise dormant or hidden failures of instruments, instrument systems or electrical systems. Examples are:

- DCS system alarms
- IPS system alarms
- MVC alarms
- Fieldbus device diagnostic alarms
- BadPV alarms
- Open loop / short circuit alarms
- Variable Speed drive error messages
- Valve watchdog alarms (valve speed slower than expected)
- And so on

Diagnostic alarms are prioritized in different levels of urgency in the same way as process alarms. When prioritizing IPF diagnostic alarms it may be assumed that the device failure is not certain and that a demand may not be imminent. Repairs will be required within 2-3 days. However operations will need to be notified within a few hours of the situation. Typical priority is 'L'. When prioritizing diagnostic alarms, one should assume that most diagnostic alarms are intended to generate scheduled – condition based maintenance rather than reactive breakdown maintenance.

HART and Foundation Fieldbus connected devices are part of the system architecture and contribute with their diagnostics to the load of the alarming system. In Foundation Fieldbus and HART a device has its own Tag name, in addition to the function blocks AI/AO and PID (for example TT101 for a temperature transmitter, whereas the process value has a tag TI101). In order to prevent diagnostic alarms with a priority higher than journal to be seen in the Alarm Summary, diagnostic alarms will be assigned to the System asset or any other Asset like Device1 (D1) and therefore be available in the System Status Display or the Alarm Summary for users with particular scope of responsibilities.

This means that a device tag is assigned in the asset model to a device asset and the normal scope of responsibility for process operators excludes assignment to this asset. However these diagnostic alarms are configured to be captured by the Asset Management System. Asset Management captures the alarms and events that occurred per diagnostic asset.

Foundation Fieldbus devices will report malfunction of the device as a Block Alarm. These alarms are generated as a result of the internal diagnostics, mainly in the transducer blocks of the device and grouped together as Block Alarms. This means that all the automatically generated device alarms will go to the Alarm Summary like all the other system alarms.

Foundation Fieldbus alert priorities are mapped to alarm priorities using the following mapping table.

Alarm	FF Alert priority	Host Alarm Priority
15	Critical	Urgent
14	Critical	Urgent
13	Critical	Urgent
12	Critical	Urgent
11	Critical	High
10	Critical	High
9	Critical	High
8	Critical	High
7	Advisory	Low
6	Advisory	Low
5	Advisory	Low
4	Advisory	Journal
3	Advisory	Journal
2	Low-fixed	Journal
1	No notification	No Action
15	Critical	Urgent

Table 4: Fieldbus Alarm Priority Table

Integration with AMS

Alarm and event data from each Experion PKS Server can be accessed with the Asset Management System. See the Asset Management System Specification for more detail.

The core of AMS is Alert Manager that uses Data Scouts to collect data from various systems. Data Scout allows for retrieving, testing and creation of Alert Manager symptoms based on OPC data. In other words, for Experion PKS the Data Scout application enables for configuration of symptoms based on data that comes from Experion PKS OPC servers, perform data checks, and report associated symptoms to Alert Manager.

- Instrument generated alarms and events are transferred to Experion PKS

- Alert Manager subscribes to Alarm and Event data from Experion PKS using Data Scouts. Also selected process data is collected using the Data Scouts.
- Alarm and Events become symptoms in Alert Manager and can lead to Faults based on symptom/fault models and fault trees.

As part of the notification process in Alert Manager it is possible to pass events back to Experion PKS OPC server where they can trigger alarms to notify the operator of asset management events. This functionality will be used to report certain highly critical diagnostic alarms to the Alarm Summary.

3.10 Alarm Suppression

An alarm is suppressed when an operator initiated application or an automated system determines that the alarm is not necessary under certain process conditions. Alarm suppression is an effective tool to prevent alarm floods in abnormal situations and lets operators focus on surveillance and monitoring activities by removing alarms that are not meaningful under certain process conditions.

3.10.1 Individual Alarm Suppression

Alarms can be disabled server-wide during building of the system, this function is restricted to the MNGR role. Alarms for individual points can be disabled using the Point Detail Display. Security to operators is controlled with control levels and asset assignments or alternatively for individual Stations.

3.10.2 Static Alarm Suppression

Operators often find alarm systems difficult to manage when larger quantities of alarms are (semi) permanent in alarm. There is the risk of any new alarm to stay unnoticed and the standing alarms cannot be ‘meaningful’ to the operator. In order to minimise the number of standing alarms, static alarm suppression can be required. The static alarm suppression does not differentiate between H or L or LL alarms, Bad PV and so on All alarms associated to the listed tag number will be suppressed.

When the static alarm suppression is suspended, alarms that are still active will re-generate an alarm. This is standard functionality of the current release of Experion PKS.

3.10.3 Visual Suppression Indication

Disabled alarms are indicated as such on custom displays, to make the operator aware of the suppression conditions. For most point-types, the position of the alarm priority can be shared with the alarm disable indication, because they mutually exclude each other. Disabled alarms will typically be shown as a black letter D on a grey background.

3.10.4 Mode Dependent Alarms

Dynamic mode dependant alarm setting may be required to further reduce the meaningless alarm rate. Mode dependant alarm setting may be required where systems have distinct operational modes that require distinct alarm settings. This is for instance the case for furnaces having a normal mode and a decoke mode. Also the burner management system may have Oil firing mode, a Gas firing mode and a dual firing mode. A dryer will have an operating and a regeneration mode. A crude distiller may have different alarm settings depending on the crude being processed.

With dynamic mode dependant alarm settings, the alarm settings of analog or digital points are changed based on the detected mode of operation. The mode switching is detected from a set of process parameters and may also involve logic that includes the condition of a manual switch.

Upon a detected mode change, the new set of alarm settings is automatically downloaded into the DCS point. This is done for all alarms associated to specific equipment that have mode dependent settings. For example for a furnace, one mode dependent alarm settings group is made. For such a group a number of operating modes are defined that require different settings.

These new settings will be applicable until the next mode change is detected or the dynamic mode dependant alarm setting enable switch is disabled. When disabled the default set of settings is downloaded into the DCS point automatically. When none of the defined modes are detected, the default mode shall be selected automatically.

Dynamic mode dependant alarm setting shall not be applied to IPF's since these settings are based on the excursion of safe operating envelopes that should not be mode dependant.

Where pre-alarms are also used to alarm excursion from the normal operating envelop, they may have dynamic mode dependant alarm settings.

The Alarm Configuration Manager (optional package) can be configured to enforce automatically when an operating mode is changed for mode dependant alarms where applicable. All tags affected by the operating mode are enforced.

Chapter 4 Display policies

4.1 Display Implementation

4.1.1 Display build conventions

The conventions as described in the following sections should be followed when designing custom displays. But before implementing the displays, the display hierarchy should be defined (level1, level2, and so on) together with the names of the displays in this hierarchy (including definition of parent and child displays), to allow the engineers to easily implement the navigation objects in displays.

General

- Graphic displays are not intended to duplicate PEFS, P&IDs, Fire & Gas Layouts, ESD Cause & Effects, and so on, but should be simplistic representations, designed to reduce visual noise and enhance the operator's ability to control and monitor the process.
- Because our eyes are trained to read from left to right, an effort should be made to lay out the process flow from left to right whenever possible.
- The operator should be able to reach a control point with a minimum number of mouse clicks or keystrokes.
- The HMI system should be designed to minimize operator mistakes and provide validation and security measures.
- An effort should be made to lay out the process flow from left to right whenever possible. Gas should flow up and liquids flow down.
- An effort should be made to minimize the number of bends in lines.
- Crossing lines should be avoided whenever possible.
- Operator actions should elicit immediate feedback. An audible 'tick' sound should accompany every selection made on the screen. A selected item should indicate that it has been selected.
- Leading zeroes should be omitted, except on fractions.
- All numbers and text should be displayed upright.
- A standardized color pallet (using CSS styles) for pipeline colors and services should be developed and cleared with the customer prior to implementation. By default, pipeline colors will be grey.

Labeling

- Upper and lower case lettering should be used for labels, codes, and abbreviations. Whenever possible, labels should be lined up horizontally and vertically. End of the line text should be lined up with the respective edge of the graphic. For example, a line entering from the left should be left justified; a line that exits to the right side of the screen should be right justified.
- All graphic displays should have a title.
- All major vessels should be labeled.
- Groups of identical or very similar equipment should be clearly labeled in the middle of the group.
- Periods should not be used in abbreviations.
- Abbreviations should only be used if they make the text appreciably shorter or more meaningful.
- A consistent standard list of labels and abbreviations should be developed by Honeywell and its customer and used for all custom displays (and database development).
- Whenever possible, 1-l, O-0, B-8, and so on, should be avoided.

Static (Non-acting) Elements

- Vessels should have solid two-dimensional representations. Three-dimensional representations are allowed to increase the "image" of displays, but unnecessarily attract the attention of operators. Other unnecessary details should not be included in the vessels (distributors, packing, weirs, and so on).
- Static elements should only be included if discussions with the operations staff have determined that they are absolutely necessary for understanding of the process.
- The following should be avoided:
  - Large or colour-filled solid objects
  - Flashing or large objects
  - Flashing or changing colour of process lines, unless useful for abnormal situation (for example, flare lines when the flare valves are open)
- The following should not be shown unless needed for clarity:
  - Start-up lines, unless they include instrumentation to be displayed
  - Bypass lines having manual valves
  - Block valves, manual valves, check valves, relief valves, and so on
  - Interiors of columns and vessels, unless this information directly relates positional information to data objects and or control information outside the vessel
- The following design criteria should be followed for equipment:
  - The shape of the equipment to be displayed on the graphics should be shown to represent the actual equipment as much as possible without excessive detail. All major equipment (for example, vessels, columns, pumps, compressors, and blowers) should be displayed.
  - All major vessels should be labelled.

Process Lines

The following design criteria for process lines should be followed:

- The source and destination of main incoming and outgoing lines should be shown with arrows. Lines that vector to and/or from other process display end-points should be in the form of buttons (targets) within boxes. If the lines do not continue to and/or from another process display, the end-points should be arrows with no buttons.
- Main process lines should be shown as a thick line. An example is wellhead flow to a separator.
- Utility lines and other non-main process lines should be shown as thin lines. Examples of these include cooling water supply/return, and hot oil supply/return lines.
- Instrument signal lines for outputs from controllers to valves, or software links to other points (as with master-slave controllers) should be depicted by short-dashed lines. These will only be shown where necessary and restricted to Level-3 displays.
- Crossing of process lines or the use of line jumpers for process lines should be avoided to the extent practical. If crossing is unavoidable, process utility lines will break before main process lines. For equal weight lines, the vertical line will break.
- Process inlet lines should enter on the left-hand side of the display and process outlet lines shall exit on the right-hand side of the display to the extent practical.
- As a general rule, the direction of flow should be from left to right, except for recycle lines, which shall be right to left.
- The direction of flows should be shown using small arrows on the flow lines.
- Wherever possible, the process lines exiting one display and continuing on another display should be at relatively the same corresponding location.
- The positioning of tabular or embedded trends should be restricted to the bottom left or upper right of the displays.

Instrument symbology

The design criteria for instrument symbology including values and text should be as follows:

- Instrument tag names should be shown on displays only after the Operator selects the "Name" button. Equipment tags should be shown on the displays at all times.
- Instrument lines should only be displayed when required for operator understanding of where the measurement is coming from.

4.1.2 Level-1 Graphic Display Construction

The most difficult part of building a Level-1 display is determining which information should be included. Level-1 graphic displays will be either tabular or primitive schematic representations of the underlying process (similar to Process Flow Diagrams). Depending on the amount of information deemed critical for the operator, overview graphic displays may permit process flow information and primitive schematic representations because of the high resolution of the Experion PKS displays.

Because of the critical nature of the information to be displayed, the Level-1 graphics may be the last to be developed. Included below is an example of the process required to design Level-1 graphics.

The process of building these displays starts with consultations with operations personnel, as follows:

- Determine the operator span of control.
- Determine those variables for each major piece of operating equipment that indicate the overall health of that piece of equipment.
- Determine those variables that may not be associated with a major piece of equipment but which could somehow indicate a problem with process health.
- Determine those variables upstream (pressures, temperatures), out of the span of control of the operator, which may foretell a problem.
- Determine those variables in the utilities (for example, instrument air pressure, cooling medium flow rates), out of the span of control of the operator, that may foretell a problem.
- Of all identified variables, determine the ones that may require dynamic information in order to see changes. These variables will be trended.

In the consultation process, it is critical to get to the crux of the situation. By using a dynamic process simulator or by printing hard copies of the displays, the following may be investigated. Operators typically have a few favourite variables that they monitor on existing Level-2/3 graphic displays. The operator may flip through several display screens very quickly, monitoring the process. These variables may be required in the overview.

Once the variables have been successfully identified, the Level-1 display may be built. The completed graphic displays must then be put before the operators, in an operational mode (for example using a dynamic process simulator), for evaluation. The operators would be asked if they could perform their routine surveillance without the other process displays.

At this point, further modifications to the Level-1 display may be required. Iteration will lead to a display the operator considers he needs for routine surveillance (not intervention or mundane operation).

The use of these displays is normally for "monitoring" and "fast navigation" to areas of abnormality. The navigation techniques are based on the Alarm Group Model see for more details chapter 0. The operator is not allowed to execute any control from this display.

4.1.3 Level-2 Graphic Display Construction

Level-2 graphic displays are generally identified before Level-3 displays, but are often built after them. Using the process used to design the Level-1 displays, Level-2 construction is a matter of examining the history of abnormal situations and what actions were taken, then designing a graphic with these things in mind.

The key to creating effective Level-2 graphic displays is consulting with the operations staff, in a structured way, to extract information about the tasks they must accomplish during an abnormal situation. All the relevant points and controls to accomplish this intervention should be on the appropriate Level-2 display. This, of course, is more complex when designing for a totally new plant, although finding similarities in existing plants may be possible.

By asking the operators what they do given a wide variety of plant problems, it quickly becomes obvious what information and controls they need to accomplish their tasks:

- What abnormal situations have been seen in the past?
- What actions were taken?
- What abnormal situations can be predicted, for example, low flow, pump failure?
- What actions should be taken?

In the consultation process, it is critical to get the minimum number of control valves and process measurements the operator needs to intervene in the process. Excess information and control may distract the operator from the task at hand. Inadequate information or control may prevent the operator from completing the task. Corrective actions may sometimes be trial-and-error due to the novelty of the abnormal situation being handled. Several iterations may be required before a balance between excess and inadequacy can be achieved.

As with the Level-1 display, several versions may have to be made with the help of the operators. As the idea of three-level graphic displays matures with operations staff, other graphic displays may be suggested. Implementing this methodology will dramatically reduce operator response times and potential loss of production.

4.1.4 Level-3 Graphic Display Construction

The Level-3 graphic displays are usually the first to be built. In assembling these displays, the criteria, based on the design guidelines, will have to be examined carefully. Whenever possible, excessive artistic detail must be avoided. As well, the colour convention, naming conventions, fonts, and so on must be addressed carefully. The graphic display designer must work with the operations staff to determine what details add to the operator's understanding of the process, keeping in mind that simpler graphic displays promote better operation.

4.2 Cascading Style Sheets

HMIWeb Display Builder supports the use of Cascading Style Sheets (CSS), which allows the definitions of colour settings, as well many other object property settings to be defined centrally. Per display one CSS file can be linked, which can define many style classes. These style classes can be attached to objects in your display, such as for example process lines. This way, the presentation of for example process lines can easily be implemented, maintained and modified. All shapes in the HMIWeb Solution Pack make use of the Cascading Style Sheet feature.

Example CSS content

```
.Background
{
    hw-fill-color:#C0C0C0;
}
.A_ProcessLinesWidth2
{
    hw-line-color:#5F5F5F;
    hw-fill-color:#5F5F5F;
    hw-line-width:2;
}
```

The example below shows the same graphic, but with different style sheets. As can be seen, it's very easy to change the whole graphics style, by just modifying the cascading style sheet.

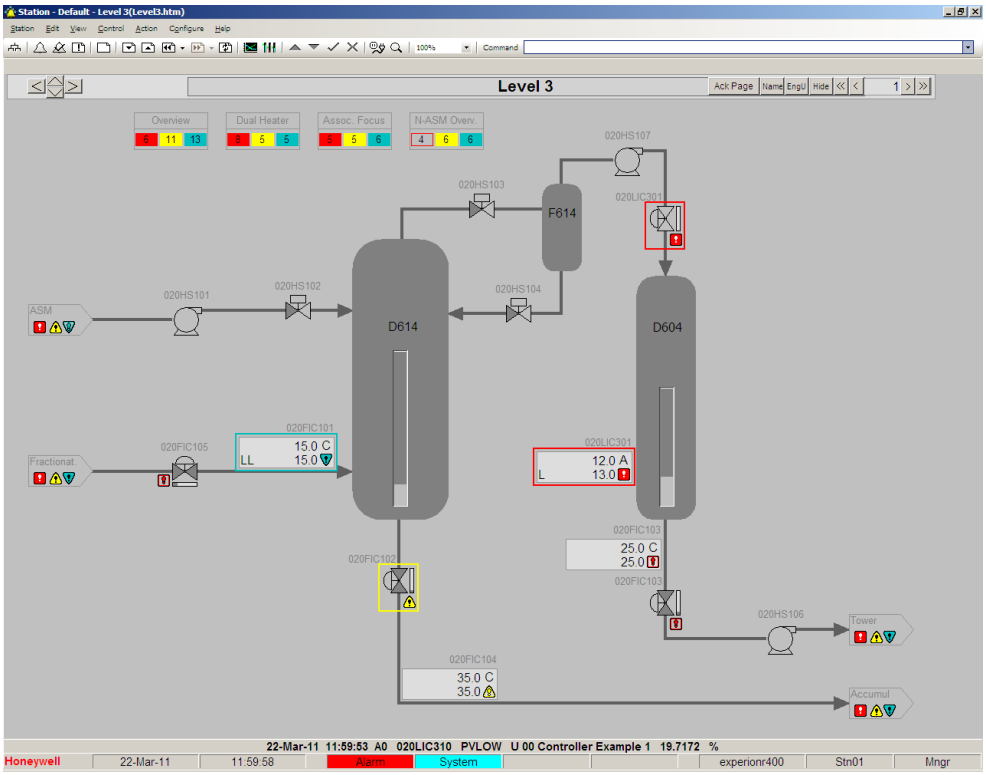


Figure 57: Level-3 display with standard Cascading Style Sheet

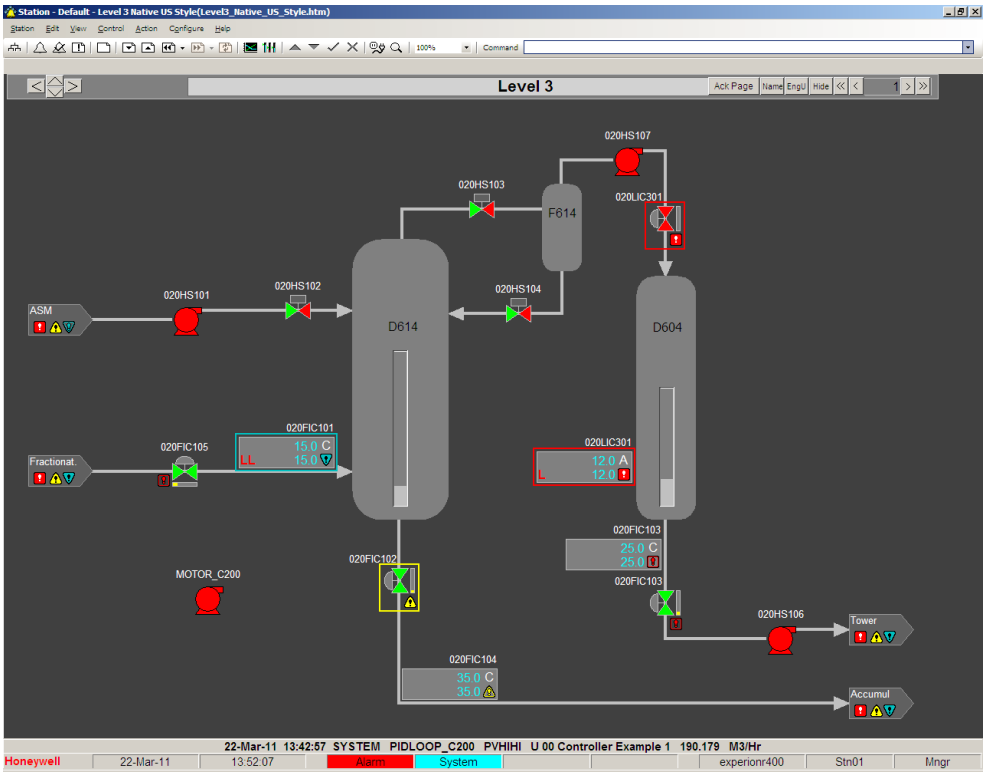


Figure 58: Same Level-3 display with modified Cascading Style Sheet

4.3 Miscellaneous Display Settings

See the *HMIWeb Object Specification* document for a detailed description of miscellaneous display settings and common behaviour of HMIWeb components such as pumps, valves, and controllers.

Notices

Documentation feedback

You can find the most up-to-date documents on the Honeywell Process Solutions support website at:

http://www.honeywellprocess.com/support

If you have comments about Honeywell Process Solutions documentation, send your feedback to:

hpsdocs@honeywell.com

Use this email address to provide feedback, or to report errors and omissions in the documentation. For immediate help with a technical problem, contact your local Honeywell Process Solutions Customer Contact Center (CCC) or Honeywell Technical Assistance Center (TAC) listed in the “Support and other contacts” section of this document.

How to report a security vulnerability

For the purpose of submission, a security vulnerability is defined as a software defect or weakness that can be exploited to reduce the operational or security capabilities of the software.

Honeywell investigates all reports of security vulnerabilities affecting Honeywell products and services.

To report a potential security vulnerability against any Honeywell product, please follow the instructions at:

https://honeywell.com/pages/vulnerabilityreporting.aspx

Submit the requested information to Honeywell using one of the following methods:

- Send an email to security@honeywell.com.

  or

- Contact your local Honeywell Process Solutions Customer Contact Center (CCC) or Honeywell Technical Assistance Center (TAC) listed in the “Support and other contacts” section of this document.

Support and other contacts

For support, contact your local Honeywell Process Solutions Customer Contact Center (CCC).

North America

Country	Phone	Facsimile	Email
Canada and United States	800-822-7673	973-455-5000	asksc@honeywell.com

Northern Europe

Country	Local Time Business Hours	Phone	Facsimile	Email
Denmark	07:00 – 18:00	80–252165	+45 6980 2349	hpscustomersupport@honeywell.com
Finland	08:00 – 19:00	0800–9–15938	+358 (0)9 2319 4396	hpscustomersupport@honeywell.com
Ireland	06:00 – 17:00	1800939488	+353 (0)1 686 4905	hpscustomersupport@honeywell.com
Netherlands	07:00 – 18:00	0800 020 3498	+31 (0)20 524 1609	hpscustomersupport@honeywell.com
Norway	07:00 – 18:00	800–11478	47–852–287–16	hpscustomersupport@honeywell.com
Sweden	07:00 – 18:00	0200883167	+46 (0)8 509 097 84	hpscustomersupport@honeywell.com
United Kingdom	06:00 – 17:00	08002797226	+44 (0)20 3031 1064	hpscustomersupport@honeywell.com

Southern Europe

Country	Local Time Business Hours	Phone	Facsimile	Email
Belgium	07:00 – 18:00	080048580	+32 (0)2 791 96 02	hpscustomersupport@honeywell.com
France	07:00 – 18:00	0805100041	+33 (0)1 72 74 33 44	hpscustomersupport@honeywell.com
Luxembourg	07:00 – 18:00	8002–8524	+352 24611292	hpscustomersupport@honeywell.com
Spain	07:00 – 18:00	800099804	+34 91 791 56 25	hpscustomersupport@honeywell.com
Portugal	06:00 – 17:00	800–8–55994	+34 91 791 56 25	hpscustomersupport@honeywell.com

Eastern Europe

Country	Local Time Business Hours	Phone	Facsimile	Email
Bulgaria	08:00 – 19:00	700 20771	+359 (0)2 489 7384	hpscustomersupport@honeywell.com
Croatia	07:00 – 18:00	0800 80 6392	+420 227 204 957	hpscustomersupport@honeywell.com
Czech Republic	07:00 – 18:00	800 142 784	+420 227 204 957	hpscustomersupport@honeywell.com
Hungary	07:00 – 18:00	06 800 20 699	+36 (06) 1 577 7371	hpscustomersupport@honeywell.com
Poland	07:00 – 18:00	00 800 121 50 46	+48 22 485 35 10	hpscustomersupport@honeywell.com
Romania	08:00 – 19:00	0 800 800 178	+40 (0)31 710 7590	hpscustomersupport@honeywell.com
Russia Federation	09:00 – 20:00	8.10.80 02-412 50 11	+7 495 796 98 94	hpscustomersupport@honeywell.com
Slovakia	07:00 – 18:00	0800 002 340	+421 (0)2 3301 0376	hpscustomersupport@honeywell.com

Central Europe

Country	Local Time Business Hours	Phone	Facsimile	Email
Austria	07:00 – 18:00	0800 006438	+43 (0)1 253 6722 4904	hpscustomersupport@honeywell.com
Germany	07:00 – 18:00	0800 7239098	+49 (0)30 6908 8463	hpscustomersupport@honeywell.com
Greece	08:00 – 19:00	00800 12 9493	+30 21 1 268 6973	hpscustomersupport@honeywell.com
Israel	08:00 – 19:00	1 809 407 309	+972 (0)2 591 6148	hpscustomersupport@honeywell.com
Italy	07:00 – 18:00	8000 35205	+39 06 96681356	hpscustomersupport@honeywell.com
Switzerland	07:00 – 18:00	00 080 035	+41 (0)31 560 41 60	hpscustomersupport@honeywell.com

Middle East and South Africa

Country	Local Time Business Hours	Phone	Email
Bahrain	08:00 – 19:00	8008 1343	hpscustomersupport@honeywell.com
Oman	08:00 – 19:00	8007 7595	hpscustomersupport@honeywell.com
Qatar	08:00 – 19:00	800 5460	hpscustomersupport@honeywell.com
Saudi Arabia	08:00 – 19:00	800 844 5309	hpscustomersupport@honeywell.com
South Africa	07:00 – 18:00	0800 983 634	hpscustomersupport@honeywell.com
Turkey	08:00 – 19:00	00800 448823587	hpscustomersupport@honeywell.com
United Arab Emirates	09:00 – 20:00	8000 444 0300	hpscustomersupport@honeywell.com

Other regions

In other regions, contact your local Honeywell Technical Assistance Center (TAC) for support.

Region	Phone	Facsimile	Email
Pacific	1300-364-822 (toll free within Australia) +61-8-9362-9559 (outside Australia)	+61-8-9362-9564	GTAC@honeywell.com
India	+91-20-6603-2718 / 19 1800-233-5051	+91-20-6603-9800	Global-TAC-India@honeywell.com
Korea	+82-80-782-2255 (toll free within Korea)	+82-2-792-9015	Global-TAC-Korea@honeywell.com

Region	Phone	Facsimile	Email
People’s Republic of China	+86-21-2219-6888 800-820-0237 400-820-0386		Global-TAC-China@honeywell.com
Singapore	+65-6823-2215	+65-6445-3033	GTAC-SEA@honeywell.com
Japan		+81-3-6730-7228	Global-TACJapanJA25@honeywell.com

World Wide Web

Honeywell Process Solutions website:

http://www.honeywellprocess.com/support

Elsewhere

Contact your nearest Honeywell office.

For more information

To learn more about Honeywell's products or solutions visit www.honeywellprocess.com or contact your Honeywell account manager.

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Honeywell

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Houston, TX 77042

Honeywell House, Skimped Hill Lane
Bracknell, RG12 1EB

Shanghai City Centre, 100 Junyi Road
Shanghai, China 20051

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