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# Integrated Platform Management System

## Technical Specification HMI

**Volume -**

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# Preface

Since most ship processes and their interactions are rather complex they have been more and more controlled by computerized equipment. In the last twenty-five years these techniques have proved to be very useful. Nowadays, sensors and remote controllable equipment (the platform) are fully integrated with a ship. Monitoring and Control systems manage the platform by using programmable logic controllers and computers to serve just a few operators.

The Human Machine Interface (HMI) specification defines how the remote process values are to be visualized to a remote operator and what actions have to be done to control the equipment from remote. Its design is standardized and based on interface techniques and know-how gained by Imtech Marine & Offshore in projects that have been certified by class instances such as Lloyds Register and Bureau Veritas.

Since this document intends to describe all HMI aspects in general, not all of them might apply to the HMI of the TNI-AL Indonesia Corvette. Only the topics relevant for the project will be implemented as specified by this document.

# References


**[1]** **Title:** **Technical Specification**
Description: Technical Specification between Schelde Naval Shipbuilding and IMTECH Marine & Offshore
Ref.: I 1005
From: Schelde Naval Shipbuilding
Issue: D
Date: 23 September 2004

**[2]** **Title:** **Documentation Plan**
Description: TNI-AL Documentation Plan
Ref.: 190134-DCL-001
From: R. v. Treuren
Issue: 1.1
Date: 31 January 2005

**[3]** **Title:** **IAS System Specification**
Description: Overall System specification of the Integrated Automation System
Ref.: 190134-4000-IAS-SSC
From: E.J. Middeldorp
Issue: V1.0
Date: 9 May 2005

**[4]** **Title:** **IPMS Functional Specification**
Description: Functional specification of the Integrated Platform Management System.
Ref.: 190134-4380-FSC
From: R. Langeveld
Issue: V1.0
Date: 9 May 2005

**[5]** **Title:** **IPMS Technical Specification HMI**
Description: Technical Specification of the Human Machine Interface of the IPMS
Ref.: 190134-4380-HMI-TSC
From: R. Langeveld
Issue: V1.0
Date: 9 May 2005

**[6]** **Title:** **IPMS Technical Specification ELP**
Description: Technical Specification of the Element Processing of the IPMS
Ref.: 190134-4380-ELP-TSC
From: R. Langeveld
Issue: V1.0
Date: <>

**[7]** **Title:** **PMS Functional Specification**
Description: Functional Specification of the Power Management System.
Ref.: 190134-3900-FSC
From: C. Schouten
Issue: V1.0
Date: <>

**[8]** **Title:** **PCS Functional Specification**
Description: Functional specification of the Propulsion Control System.
Ref.: 190134-2520-FSC
From: R. Bipat
Issue: V1.0
Date: <>

**[9]** **Title:** **Network Architecture CSN and PDN**
Description: Network architecture of the IAS, Client Server Network (CSN) and Platform Data Network (PDN)
Ref.: 190134-4000-CFS-001
From: A.H. de Groot
Issue: V2.0
Date: 9 May 2005

**[10]** **Title:** **Navigation System Interface Specification**
Description: Interface Specification for all external interfaces of the navigation functions
Ref.: 190134-4200-ISC
From: H.J. Tigchelaar
Issue: 2.0
Date: 9 May 2005

**[11]** **Title:** **IO List**
Description: List with Input/Ouput signals of the IPMS
Ref.: 190134-4380-IOL
From: E.J. Middeldorp
Issue: V1.0
Date: <>

**[12]** **Title:** **Item Survey List**
Description: States the defined items and their characteristics, such as dimensions, weight, and allocation on board
Ref.: 190134-4000-ISL
From: E.J. Middeldorp
Issue: V1.0
Date: <>

**[13]** **Title:** **IPMS User Manual**
Description: An operator guide that describes the entire user scoped IPMS functions.
Ref.: 190134-4380-UM
From: R. Langeveld
Issue: V1.0
Date: <>

**[14]** **Title:** **GENSYS Technical documentation**
Description: All technical issues regarding the GENSYS modules.
Ref.: A40Z090004
From: DSF Technologies
Issue: h
Date: March 2003

**[15]** **Title:** **CCU2/C-MXMB**
Description: Installation and Configuration Manual
Ref.: CCU2/C-MXMB
From: Tyco Safety Product
Issue: Z
Date: 1 Feb 2004

**[16]** **Title:** **Local Control Panel Communication Modbus Definition**
Description: Modbus communication interface description with Pielstick main engines
Ref.: 17249S400372
From: SEMT Pielstick
Issue: A
Date: 31 Jan 2005

# Abbreviations

| | |
|---|---|
| AAE | Analogue Application Element |
| CAP | Component Assist Presentation |
| CBE | Circuit Breaker Element |
| CIP | Component Information Presentation |
| DAE | Digital Application Element |
| ELP | Element Processing |
| HAV | Alarm high threshold value |
| HMI | Human Machine Interface |
| HYHA | Hysteresis alarm high value |
| HYLA | Hysteresis alarm low value |
| IPMS | Integrated Platform Management and Control System |
| LAV | Alarm low threshold value |
| MCD | Motor Control Element, double speed |
| MCE | Motor Control Element |
| NBCD | Nuclear biological chemical/Damage |
| P&ID | Piping and Instrumentation Diagram |
| RRSS | Rapid Reaction Spray System |
| SCADA | Supervisory Control And Data Acquisition |
| SCC | Ship Control Centre |
| SF | Scale factor (multiplied) |
| SG | Specific gravity value |
| SSE | Sensor Element |
| SSL | Sensor Element, Level |
| SWE | Switch Element |
| SWN | Switch with NBCD functionality element |
| TAU | Filter constant |
| TCTRL | Control duration |
| TDLY | Delay time before activation |
| THA | Delay time alarm high active |
| TLA | Delay time alarm low active |
| TTRANS | Allowable transition duration |
| TTRO | Time needed for run-out |
| V20 | Scaled sensor value @ 20 mA |
| V4 | Scaled sensor value @ 4 mA |
| VCE | Valve Control Element |
| VCH | Valve Control Element, Hydraulic |
| VCP | Valve Control Element, Proportional |
| VDU | Video Display Unit |

# Terms and definitions

| | |
|---|---|
| Alarm | A state that indicates the occurrence of some undesirable event. |
| Platform | The underlying hardware architecture of the ship. |
| Typical | To be read as 'Example of'. I.e. the final implementation for this project may differ. |

# Updates

Underneath are the updates indicated of those parts, which have been changed related to the previous release.

| Issue: | Date: | Change: | Reason: |
|---|---|---|---|
| 1.0 | 9 May 2005 | - | First release for TNI-AL project |
| 1.1 | 4 Apr 2006 | Minor changes | Update |

# 1. Introduction

## 1.1 Purpose of this document

The purpose of this document is to specify the Human Machine Interface (HMI) that will be applied on IPMS workstations of the TNI-AL Indonesia Corvette. Issues like generic screen layout, screen animations and functions relevant for the IPMS will be described by this document.

## 1.2 Overview of this document

Chapter 1 (this section) gives the introduction of this document;
Chapter 2 describes the starting-points for building the graphical pages;
Chapter 3 covers all the symbol animations to be used to build the graphical pages;
Chapter 4 describes how detailed platform information can be obtained from the system;
Chapter 5 handles operator front-end functions regarding alarm presentation;
Chapter 6 depicts the function allocation mechanism.
Chapter 7 describes HMI logging and trending dialogs.

Furthermore the appendixes (A – C) comprise detailed information regarding the HMI.

## 1.3 Relationship to other documents

This document is part of the documentation for the Integrated Automation System. Figure 1-1 illustrates its relation to other documents.

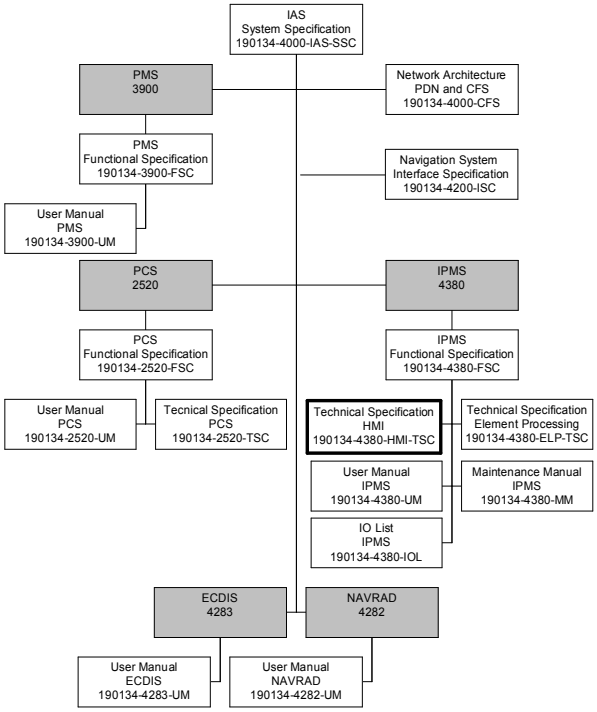



**Figure 1-1 Overview of the documentation**

# 2. Starting-points for building the graphical pages

## 2.1 General

This chapter describes the starting points, which will be used to develop the TNI-AL Indonesia Corvette graphical pages. The purpose of a graphical page is to show the surveying operator(s) clear 'up to date' information about the platform status by showing an animated schematic representation on his workstation VDU.

From now on, the term used for graphical page is 'mimic'. Mimics will be designed by using representative icons, texts and information blocks, all relevant to the applicable installation(s).

## 2.2 Starting points

1. A mimic is a functional graphical page that represents one or more installations. The geographical location of (physical) components represented by a mimic will be made second to the position of their symbol shown. If a geographical set-up can be realised still, the following will hold: Bow is right or above.

2. All mimics are to be shown on a width : height = 1280 : 1024 ratio VDU.

3. Cross lines are to be avoided as much as possible. However when lines cross, the horizontal lines will be interrupted.

4. Indicators and control facilities being displayed on the mimic will be shown in relation to the remainder of the system (e.g. pipeline-mounted sensors of some medium to be measured will be shown like pipeline-mounted sensors), unless it is deemed to be more apparent to show these components within integrated sections.

5. Symbols that represent the same physical component in several mimics shall have the same appearance.

6. The font being used is Arial. Font sizes and types are used according their function:
   - Explanatory text 8 points, upper case, regular
   - Control mode labels (§3.4) and section titles 10 points, upper case, bold
   - Static and dynamic status texts and mimic titles 12 points, upper case, bold
     (For practical reasons, CIP button texts F1 – F12 will still use upper and lower case alphanumeric characters)

7. The "all dark"-principle will be applied as much as possible. Colour animation (and if needed a change of shape) will be used to indicate a deviating state of the platform component involved.

8. Status information obtained from the platform is preferably to be shown by graphical symbols.

9. Actual values and object control mode indicators will be shown near the symbol in concern such that the relation between the two is unambiguous.

10. One or more mimics per ship system will display all the information, essential for remote monitoring and control. Where deemed necessary extra mimic overviews that comprise the most important information only will be included.

11. Mimics may include active hyperlinks to related sub-systems. Left-clicking on a hyperlink will show a mimic of that related sub-system. Hyperlinks will be two-sided: that is where a reference in mimic ‘A’ is made to mimic ‘B’, the latter will also show a reference to mimic ‘A’.

12. Besides calling mimics via hyperlinks they can be called by typing their reference-number also. Mimic reference numbers can be obtained from the ‘Table of Contents’ mimic. From this mimic it also possible to left-click on each mimic entry to call it.

13. The arrow-keys on the keyboard enable mimic navigation

- Key: ‘↑’ calls the mimic with the next lower reference number relative to the one currently shown;
- Key: ‘↓’ calls the mimic with the next higher reference number relative to the one currently shown;
- Key: ‘←’ follows your mimic navigation history track backwards (Max. 8 screens);
- Key: ‘→’ follows your mimic navigation history track forwards (Max. 8 screens).

## 2.3 Screen layout

Each mimic is split into frames for functional purposes as shown by Figure 2-1

- The alarm group bar provides an overview of alarm existence within all installation groups by colour animation and by showing alarm and unacknowledged count information (See section 5);
- The application window may present a mimic or any other program front-end, e.g. an Alarm presentation;
- The Component Information Presentation (CIP) displays dynamic platform information about the component currently selected by the operator. Function keys shown in this section display all operator commands applicable to the selected platform component. See section 4.1 for an overview of CIP functionality.

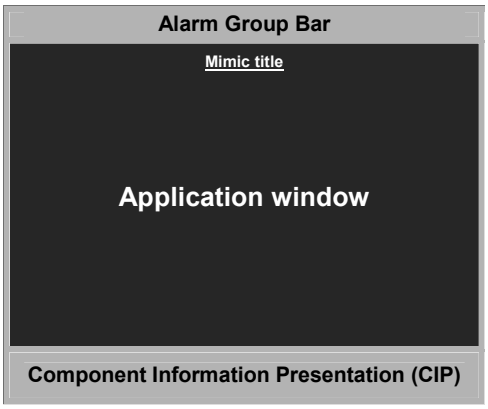



**Figure 2-1 Mimic frame lay-out**

Figure 2-2 shows a typical mimic that complies with this frame layout.

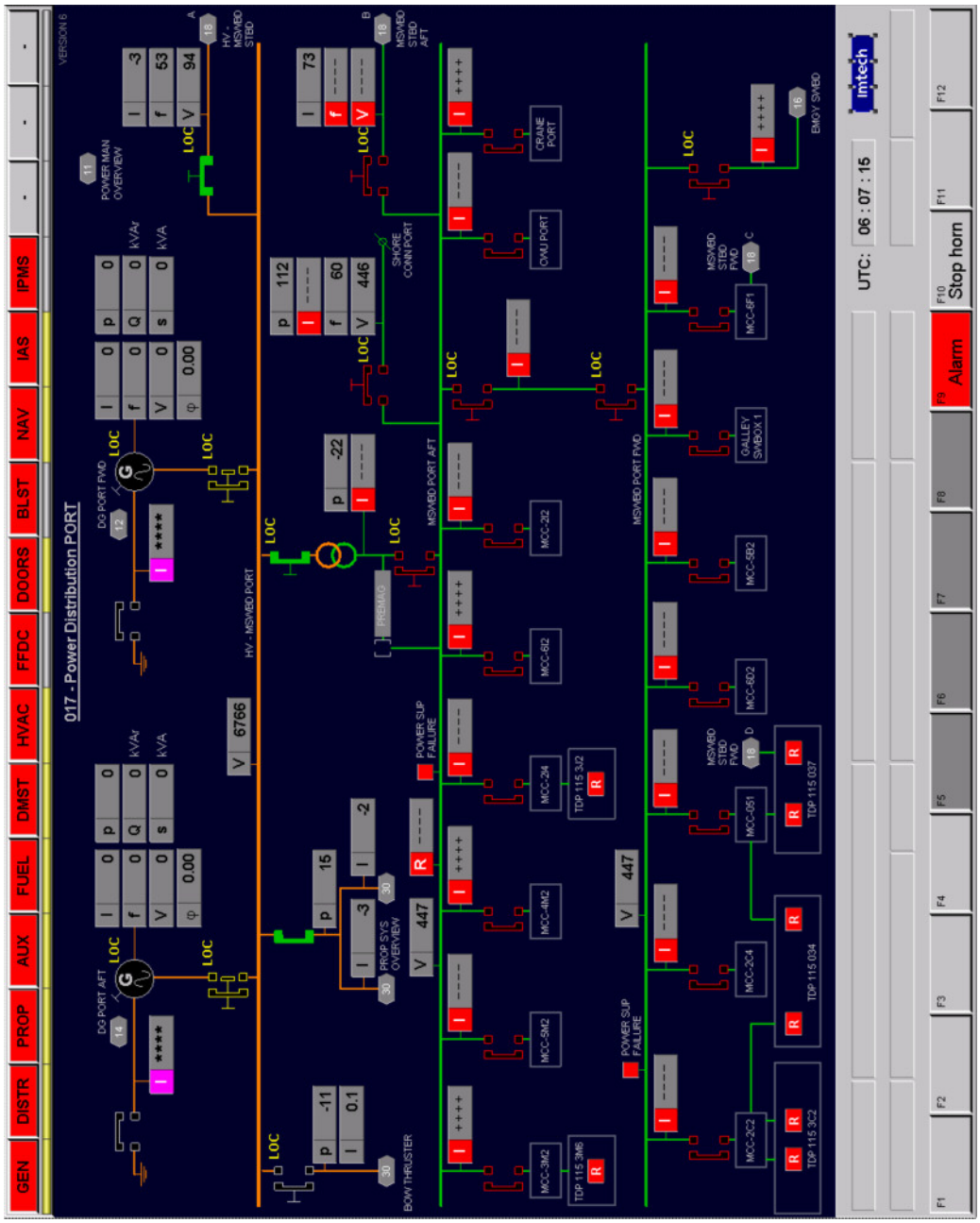



**Figure 2-2 Typical mimic layout**

# 3. Colour usage

## 3.1 Generic colour animation

The IPMS mimics will use the following generic colours for mimic animation:

| Colour | Colour codes | | | Description |
|---|---|---|---|---|
| | RED | GRN | BLU | |
| Black | 0 | 0 | 0 | Mimic background, numeric values, texts and comments. |
| Green | 0 | 195 | 0 | Active (e.g. pump running, valve open, breaker closed) states. |
| Pink | 255 | 0 | 255 | All animated objects if component status is unavailable. |
| Dark green | 0 | 128 | 0 | Alarm inhibited states (applicable to switch type elements only). |
| Yellow | 255 | 255 | 0 | Attention or deviating states that do not point at an alarm. |
| Red | 255 | 0 | 0 | Alarm states. |
| Silver grey | 192 | 192 | 192 | Inactive states; normal states, texts and comments. |
| Dark grey | 66 | 66 | 66 | Reserved for shading purposes and background sections. |
| Medium blue | 111 | 111 | 255 | Remote setpoint objects. |

**Table 3-1 Generic animation colour usage**

## 3.2 Medium dependant colour coding

The IPMS mimics use the following static colours for pipeline circuits and non-animated symbols:

| Colour | Colour codes | | | Medium description |
|---|---|---|---|---|
| | RED | GRN | BLU | |
| Brown | 195 | 65 | 0 | Fuel oil |
| Olive | 128 | 128 | 0 | Lubrication oil |
| Dark green | 0 | 128 | 0 | Sea water, ballast water, fire main system |
| Teal blue | 0 | 128 | 128 | Fresh water (cooling water and potable water) |
| Grey | 128 | 128 | 128 | Bilge water, hydraulics, grey/black water |
| Bright Green | 0 | 255 | 0 | Electric distribution - Medium Voltage |
| Orange | 255 | 102 | 0 | Electric distribution - High Voltage |
| White | 255 | 255 | 255 | Compressed air, ventilation air, exhaust gas |

**Table 3-2 Medium dependant colour coding**

## 3.3 Symbols and colour usage

Information regarding the platform has to be visualized to the remote operator by showing up to date graphical animations. Ship platform components, to be monitored or controlled by the IPMS, can be classified regarding their platform interface and functional behaviour into, so called, element types. Once classified into elements types it is easy to specify applicable symbol animations since the element type identifies the relevant monitoring and control abilities as well.

Mimics not only contain a number of animated objects. Static symbols might be used as well to improve the clarity of mimics (e.g. symbols for heat exchangers are used in cooling system diagrams although these objects themselves are not linked to the IPMS at all.). The set of symbols is based on nowadays widely accepted icons being used in system diagrams and P&ID drawings.

Static symbols are drawn in the colour of the medium flowing through. (See Appendix C for a summary of static symbols)

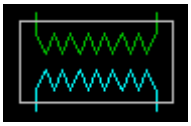


**Figure 3-1 A typical heat exchanger symbol between sea- and fresh water system.**

The next sections will specify the animated symbols applicable to components being classified for a certain element type. Since element types are called by their acronym it is useful to have a look at the currently defined element types first. See Technical Specification IPMS ELP, ref [6] for a summary of element types and their function.

### 3.3.1 Analogue sensor elements (SSE/AAE/SAE/SS1/SS2)

Analogue sensor elements are used to interface analogue values, either measured by analogue inputs or derived from an expression or serial interface. Analogue sensors are widely used for displaying pressures, temperatures, speeds, etc. Several parameters may apply to configure upper and lower alarm thresholds, hysteresis, time delays etc. All HMI symbols shown by Table 3-4 suit the analogue sensor type and its mutants defined by the Technical Specification IPMS ELP, ref [6].

The actual sensor value will be shown by black figures (12 points, Arial) on a grey coloured background. In case the analogue value is expressed by the default engineering unit (listed by Table 3-3) the unit sign will not be visualized explicitly unless it is deemed to improve clarity. Furthermore, engineering units that deviate from those shown in Table 3-3 will be shown by text (8 points, Arial) nearby the numeric sensor value.

The character displayed within the sensor symbol defines the nature of the physical sensor.

| Character | Meaning | Default engineering unit [] |
|---|---|---|
| T | Temperature | Degrees centigrade [ºC] |
| p | Pressure | Bars [bar] |
| P | Electrical power | Watt [W] |
| F | Flow | Cubic meters/second [$m^3/s$] |
| C | Contents | Cubic meters [$m^3$] |
| L | Level | Meters [m] |
| I | Electrical current | Amperes [A] |
| n | Speed | Revolutions / minute [rpm] |
| f | Frequency | Hertz [Hz] |
| R | Resistance | Ohm [Ohm] |
| S | Conductivity | Siemens [S] |
| V | Voltage | Volt [V] |
| H | Humidity | Percent [%] |

**Table 3-3 Engineering units used for analogue sensor elements.**

The sensor symbol shows the status of the sensor by its colour and value field. Although the animations shown by Table 3-4 apply for a temperature sensor they are valid for all analogue sensor types.

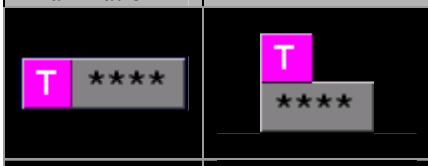
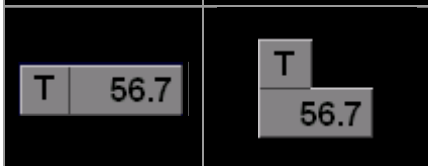
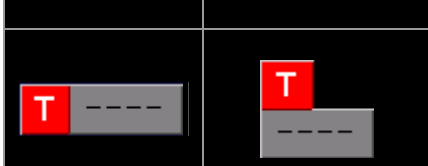
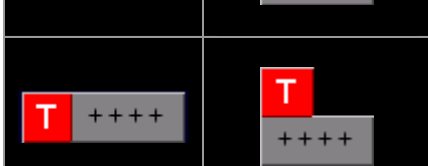
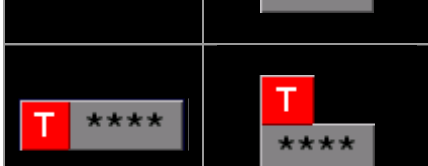
| Symbol animation | Symbol animation | Type indicator | Display | Status description |
|---|---|---|---|---|
|  | | White type ID on pink background | Black asterisks on a grey background | Sensor disabled OR Value unavailable |
|  | | Black type ID on a grey background | Black figures on a grey background | Sensor value OK |
|  | | White type ID on a red background | Black figures on a grey background | Sensor value high OR Sensor value low |
|  | | White type ID on a red background | Black minus signs on a grey background | Sensor value out of range low. (Not applicable to all analogue element types) |
|  | | White type ID on a red background | Black plus signs on a grey background | Sensor value out of range high. (Not applicable to all analogue element types) |
|  | | White type ID on a red background | Black asterisks on a grey background | Wire break detection (Not applicable to all analogue element types) |

**Table 3-4 Symbol animations applicable to analogue sensor elements**

The precision of the value display field will be determined for each sensor. Negative actual values will get a minus sign prefix; a plus sign will not be displayed. The position of the decimal point between significant figures is a fixed one and will be determined by the maximum size of the number to be displayed. Leading zeroes are to be suppressed.

If necessary a scale factor (k for kilo. m for milli, etc.) will be shown as an engineering unit prefix. In these cases the engineering unit will be shown near the sensor symbol for clarity purposes.

Sensor values can be displayed by bar graph symbols as well. The border and scale of a bar graph will be silver grey, the background of the bar will be black. Numeric sensor symbols (See Table 3-4) might be used along with the use of bar graphs if this is deemed to improve clearness.

Vertical bar graphs will fill from the bottom. Horizontal ones will be filled from the left.

Figure 3-2 shows some bar graph symbols (from left to right) for states: 'Disabled/Unavailable', 'Value OK', 'Value high/low', 'Out of Range High' and 'Out of Range Low'.

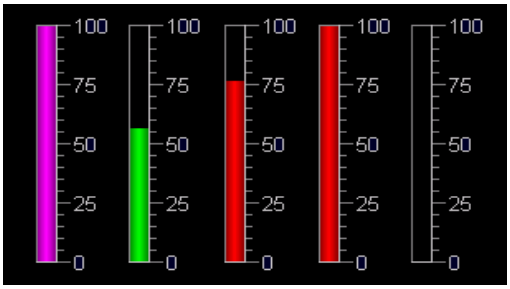
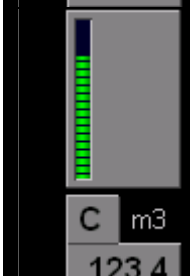
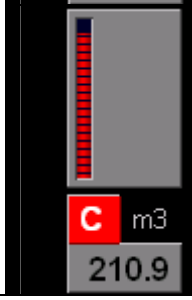



**Figure 3-2 Typical bar graph symbols**

### 3.3.2 Tank Sensor element (SSL)

This type of element is used to represent the contents of a tank. Usually, a tank content bar graph indicates a percentile tank value while the numeric sensor symbol near the bar graph expresses tank contents in cubic meters. Detailed information regarding tank contents can be obtained via the assist page (See section 4.2) by focussing this element type.

| Element | Symbol animation | Type indicator | Display | Status description |
|---|---|---|---|---|
| Tank Sensor Element |  | White type ID on pink background | Black asterisks on a grey background | Sensor disabled OR value unavailable |
| |  | Black type ID on a grey background | Black figures on a grey background | Sensor value OK |
| |  | White type ID on a red background | Black figures on a grey background | Sensor value high OR Sensor value low |

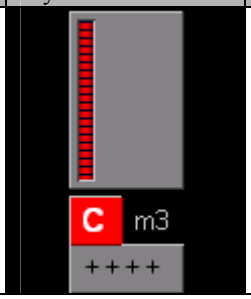
| Element | Symbol animation | Type indicator | Display | Status description |
|---|---|---|---|---|
| |  | White type ID on a red background | Black minus or plus signs on a grey background | Sensor value out of range low or high. |

**Figure 3-3 Typical tank symbol animations**

### 3.3.3 Motor Control Element (MCE)

MCE elements are used to interface pumps, fans, generators, etc. etc. via their relevant starter unit. Since this element type is suitable to process a wide range of components, several symbols are defined to represent each type. Colour animation is used to show the actual element status. Table 3-5 shows several symbols along with their state description.

In case the MCE element is in transition between states 'Running' and 'Stopped', colour animation will toggle between the symbols specified for those states at a 1 Hz rate.

Since more than one control mode may apply to this element type, an additional text label near the symbol will appear to indicate the control mode. (See section 3.4 for the animation aspects concerning this)

| Centrifugal pump | Piston pump | Fan (single speed) | Generator | Separator | Filter | Status description |
|---|---|---|---|---|---|---|
|  |  |  |  |  |  | Disabled OR Unavailable |
|  |  |  |  |  |  | Stopped |
|  |  |  |  |  |  | Running |
|  |  |  |  |  |  | Stopped, the device is not ready for use |
|  |  |  |  |  |  | Stopped, but device failed to start |
|  |  |  |  |  |  | The device is running but failed to stop OR Faulted OR State undetermined |

**Table 3-5 Single speed motor colour animation**

### 3.3.4 Motor control element, double speed (MCD)

Although initially classified as a MCE element, fans might be able to run in both directions (supply or exhaust mode). Other applications use motors that may run at low speed or high speed. Since this equipment has extra states that cannot be visualized using the standard MCE animations shown by Table 3-5 , these have to be extended for MCD type element.

Arrows, a single arrow for low - and a double arrow for high speed show the difference between a fan running at high speed and a fan running at low speed. (See Table 3-6) Moreover, when a fan runs in supply mode, an arrow pointing outwards will be highlighted. Similarly, an arrow pointing towards the fan symbol indicates that it is running in exhaust mode.

Since more than one control mode may apply to this element type, an additional text label near the symbol will appear to indicate the control mode. (See section 3.4 for the animation aspects concerning this)

| Bi-directional fan | Double speed fan | Circle | Fan | Arrows | Status description |
|---|---|---|---|---|---|
|  |  | Pink border, filled black | Pink border, filled pink | Pink border, filled pink | Disabled OR Unavailable |
|  |  | Silver grey border, filled black | Silver grey border, filled black | Grey border, filled grey | Stopped |
|  |  | Green border, filled black | Green border, filled green | One arrow highlighted, other one greyed out | Remote controlled fan running in mode ‘supply’/’low’ |
|  |  | Green border, filled black | Green border, filled green | Both arrows highlighted | Remote controlled fan running in mode ‘exhaust’/’high’ |
|  |  | Yellow border, filled black | Yellow border, filled black | Yellow border, filled black | Stopped, but the fan is not ready for use) |
|  |  | Red border, filled black | Red border, filled black | ‘Supply’/’low’ arrow has a red border, filled black. Others grey out | Stopped, failed to start in mode ‘supply’/’low’ |
|  |  | Red border, filled black | Red border, filled black | ‘Exhaust’/’high & low’ mode arrows: red border, filled black. Others greyed out | Stopped, failed to start in mode ‘exhaust’/’high’ |
|  |  | Red border, filled black | Red border, filled red | ‘Supply’/’low’ arrow has a red border, filled red. Others greyed out | Running in mode ‘supply’/’low’ but failed to stop |
|  |  | Red border, filled black | Red border, filled red | ‘Supply’/’low’ arrow: red border, filled red. Other one red border, filled black | Running in mode ‘supply’/’low’ but failed to ‘start in mode ‘exhaust/high |
|  |  | Red border, filled black | Red border, filled red | ‘Exhaust’/’high’ arrow: red border, filled red. Other one red border, filled black | Running in mode ‘exhaust/high’ but failed to ‘start in mode ‘supply’/’low’ |
|  |  | Red border, filled black | Red border, filled red | ‘Exhaust’/’high & low’ mode arrows: red border, filled red. Others greyed out | Running in mode ‘exhaust/high’ but failed to ‘start in mode ‘supply’/’low’ |
|  |  | Red border, filled black | Red border, filled red | Red border, filled red | Current speed mode is undetermined or fan motor faulted |

**Table 3-6 Double speed motor colour animation**

### 3.3.5 Motor Control Element, standby (MCS)

MCS elements are used to interface motor starter units that support a ‘motor standby’ feature. That is, the starter unit starts the motors automatically if certain platform conditions are met but only whenever the starter unit state is in

mode ‘Standby’. When motor starters support standby functionality the IPMS will not be involved with this function. It interfaces the motor starter unit just to be able to monitor the state of the relevant motor and to set the starter unit mode.

Colour and shape animation is identical as specified for an MCE (section 3.3.3, Table 3-5). However, some extra animations have to be specified to indicate the ‘not in standby’ mode. Table 3-7 shows animations additional to those specified for an MCE element along with their state description gained by the symbols used for a centrifugal pump.

Since more than one control mode may apply to this element type, an additional text label near the symbol will appear to indicate the control mode. (See section 3.4 for the animation aspects concerning this)

| Centrifugal Standby Pump | Circle | Triangle | Status description |
|---|---|---|---|
|  | Silver grey border, filled black | Silver grey border, filled black | Stopped, not in standby |
|  | Red border, filled black | Red border, filled red | Running, failed to standby |
|  | Red border, filled black | Red border, filled black | Stopped, failed to standby |

**Table 3-7 MCS additional animations**

### 3.3.6 Switch element (SWE/SWB/DAE)

The switch element represents a digital input state either measured by a digital input or being derived from a logical expression or serial interface (e.g. pressure switch, temperature switch etc.). Moreover, the DAE is able to indicate 15 different states. All of them can be visualized by the text symbol whilst using a unique text for each state.

Several mutant switch element types are defined. All of them suit a number of mimic display symbols. Which one is used depends on its specific function.

If the switch element applies to an engineering value (e.g. pressure, temperature, level etc.) then its symbol includes a character (See Table 3-3) and an arrow - pointing upwards or downwards - to show that the engineering value is above or below a certain threshold. General statuses (running, engaged etc.) are often presented to the operator by the ‘TEXT’ symbol (available in several sizes) or by the rectangular indicator. In the latter case static text near the symbol is used to clarify its function to the operator.

Static text symbols (as displayed in Table 3-8) can only change their colour; the text itself cannot change. Dynamic text symbols however can change their text also. These symbols can be used to announce general messages, faults and to display warnings or states. Dynamic text symbols look exactly the same like the static TEXT symbol shown in Table 3-8.

All SWE symbols are animated according to the following table:

| Element | Symbol animation | Description | Status description |
|---|---|---|---|
| Switch element |  | White characters on a pink background | Disabled |
| |  | Black characters on a grey background | FALSE |
| |  | Black characters on a bright green background | TRUE, status OK |
| |  | White characters on a dark green background | TRUE, normally this would indicate an alarm but now it is inhibited. |
| |  | Black characters on a yellow background | TRUE but warning |
| |  | White characters on a red background | TRUE but alarm |

**Table 3-8 Switch type element colour animation**

### 3.3.7 Switch with NBCD function element (SWN)

The SWN element incorporates the same functionality as already defined for the SWE element (Section 3.3.6). Additionally the SWN is able to disable its alarm output as a function of a logical input being driven by an external command. This feature is often used to test the state of doors and hatches against a certain NBCD alert. Since activation without evaluation may cause a lot of alarms, a test facility provides door/hatch state evaluation by discolouring the relevant symbols without causing an alarm. This enables the operator to close hatches and doors first before the NBCD state is activated.

All SWN symbols are animated according to the following table:

| Element | Symbol animation | Description | Status description |
|---|---|---|---|
| Switch NBCD element |  | Pink | Disabled or unavailable |
| | | Grey | Closed or not activated |
| | | Dark green | Open but alarm inhibited |
| | | Yellow | State evaluation (attention) |
| | | Red | Alarm |

**Table 3-9 NBCD switch colour animation**

### 3.3.8 Valve Control Element (VCE/VCH)

Valve Control Elements interface valve objects that interface the IPMS. Although the VCE - and the VCH element types differ they both suit the same symbol. Colour animation is done according to Table 3-10.

Since more than one control mode may apply to this element type, an additional text label near the symbol will appear to indicate the actual control mode. (See section 3.4 for the animation aspects concerning this)

In case the VCE /VCH element is in transition between states ‘Open’ and ‘Closed’, colour animation will toggle between the symbols specified for those states at a 1 Hz rate.

| Element | Symbol animation Standard valve | Symbol animation Non-return valve (→) | Status description |
|---|---|---|---|
| Valve Control Element<br><br>Or<br><br>Valve Control Element Hydraulic |  |  | Disabled or unavailable |
| |  |  | Closed |
| |  |  | Open |
| |  | | Not ready for closing |
| |  |  | Not ready for opening |
| |  |  | Failed to close or undetermined |
| |  |  | Failed to open |

**Table 3-10 Valve colour animation**

### 3.3.9 Valve Control Element, proportionally controlled (VCP)

The VCP element applies to proportional controllable valves. That is, the valve state is not limited to state 'open' or 'closed' but can be anywhere in between those states depending its setpoint. The symbol and animations used for such an element are identical to those already shown for the VCE symbol (See Table 3-10). Additionally, a numeric value below the valve symbol indicates a percentile open value.

Since more than one control mode may apply to this element type, an additional text label near the symbol will appear to indicate the control mode. (See section 3.4 for the animation aspects concerning this)

In case the VCP element is outside its setpoint range colour animation will toggle between the animations specified for states 'Not closed' and '(Almost) closed' at a 1 Hz rate.

Colour animation is done according to Table 3-11.

| Element | Symbol animation | Description | Status description |
|---|---|---|---|
| Valve Control Element Proportional |  | Pink border, filled pink | Disabled or unavailable |
| |  | Grey border, filled black | (Almost) closed |
| |  | Green border, filled green | Not closed |
| |  | Yellow border, filled | Not ready for use |
| |  | Red border, filled red | Sensor value out of range low. |
| |  | Red border, filled red | Sensor value out of range high. |
| |  | Red border, filled black | Failed. |

**Table 3-11 Proportionally controlled valve colour animation**

### 3.3.10 Setpoint element (SPE)

The SPE element enables the operator to control a platform process by altering its setpoint from remote. The actual setpoint will be shown by black figures (12 points, Arial) on a grey coloured background. In case the setpoint value is expressed by the default engineering unit (As listed in Table 3-3) the unit sign will not be visualized explicitly. Setpoint engineering units that deviate from those shown in Table 3-3 will be shown as text (8 points, Arial) near the field of the actual setpoint.

The character displayed in the setpoint symbol defines the nature of the setpoint.
Table 3-11 shows colour animation applicable to a motor speed setpoint element.

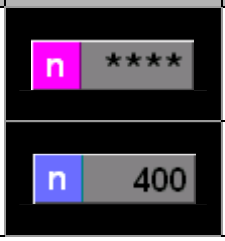
| Element | Symbol animation | Type indicator | Display | Status description |
|---|---|---|---|---|
| Setpoint element |  | White type ID on pink background | Black asterisks on a grey background | Disabled or unavailable |
| |  | Black type ID on a blue background | Black figures on a grey background | Normal mode |

**Table 3-12 Setpoint element colour animation**

The operator can change the setpoint by a left-click at the SPE symbol. Once focussed by the CIP he can alter the setpoint value provided that the element is classified for an installation group that has been assigned to the operator station.

### 3.3.11 Running hour element (RHE)

To be able to plan preventive repairs and to be able to test defects of the component against the terms of the guarantee, this function counts and records the time that selected, predefined platform components are in operation. The predefined platform components are in most cases components with rotating parts, like compressors, pumps and engines.

Table 3-11 shows the applicable colour animation.

| Element | Symbol animation | Type indicator | Display | Status description |
|---|---|---|---|---|
| Running Hours Element |  | White type ID on pink background | Black asterisks on a grey background | Disabled or unavailable |
| |  | Black type ID on a grey background | Black figures on a grey background | Not counting |
| |  | Blinking type ID on a green background | Black figures on a grey background | Counting |

**Table 3-13 Running hour element colour animation**

### 3.3.12 Switch event element (SEE)

To be able to plan preventive repairs and to be able to test defects of the component against the terms of the guarantee, this function counts and records the time that selected, predefined platform components are in operation. The predefined platform components are in most cases components with switching elements, like circuit breakers. Table 3-11 shows the applicable colour animation.

| Element | Symbol animation | Type indicator | Display | Status description |
|---|---|---|---|---|
| Switch Event Element |  | White hatch on pink background | Black asterisks on a grey background | Disabled or unavailable |
| |  | Black hatch on a grey background | Black figures on a grey background | Normal |

**Table 3-14 Switch event element colour animation**

### 3.3.13 Circuit Breaker Element (CBE/CBA)

Both CBE and CBA elements suit the circuit breaker symbol currently used for visualization.
Although these elements are used to interface circuit breakers mostly, they can be used to interface other components (e.g. clutches) as well.

CBA-elements just forward the commands and states in between HMI and the PMS. I.e. the circuit breaker processing is actually done by the PMS whilst the CBE processes the circuit breaker element itself.

Since more than one control mode may apply to this element type, an additional text label near the symbol will appear indicating the actual control mode. (See section 3.4 for the animation aspects concerning this)

In case the CBE/CBA element is in transition between states ‘Open’ and ‘Closed’, colour animation will toggle between the colours specified for those states at a 1 Hz rate. Its shape however will not change as long as the breaker is in transition. So, when the breaker transits from ‘Open’ to ‘Closed’, its symbol shows the ‘Open’ shape whilst in transition. Likewise when the breaker transits from ‘Closed’ to ‘Open’, its symbol shows the ‘Closed’ shape whilst in transition.

Symbol animation is done according to Table 3-15.

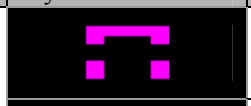
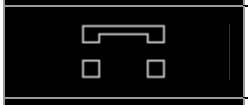
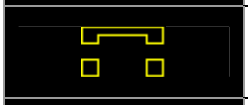
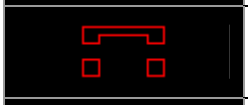
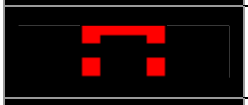
| Element | Symbol animation | Description | Status description |
|---|---|---|---|
| Circuit Breaker Element |  | Not connected, Pink border, filled pink | Disabled or unavailable |
| |  | Not connected, Silver grey border, filled black | Open |
| |  | Connected, Green border, filled green | Closed |
| |  | Not connected, Yellow border, filled black | Not ready for closing |
| |  | Connected, Yellow border, filled yellow | Not ready for opening |
| |  | Not connected, Red border, filled black | Failed to close OR Tripped |
| |  | Not connected, Red border, filled red | Undetermined |
| |  | Connected, Red border, filled red | Failed to open |

**Table 3-15 CBE colour animation**

### 3.3.14 Control Element (CTR)

The control element is mostly used to start/stop a control sequence from remote. Several symbols such as buttons and checkboxes suit this element type. The actual control state is visualized by button face colour animation. Besides this, the button symbol supports different user defined button texts to indicate each mode.

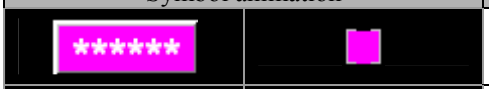
| Symbol animation | Description | Status description |
|---|---|---|
|  | Pink button face or Pink checkbox | Disabled or unavailable |
|  | Silver grey button face or Unticked checkbox | OFF |
|  | Bright green button face or Green ticked checkbox | ON |
|  | Greyed out button or unticked checkbox | Not ready for use |
|  | Red button face or Red ticked checkbox | Alarm |

**Table 3-16 CTR colour animation**

In case the control sequence is in transition between states ‘OFF’ and ‘ON’, colour animation will toggle between the colours specified for those states at a 1 Hz rate. While in this state, a special button text (<TEXT 3>) can be used to indicate the transition.

Symbol animation is done according to Table 3-16

### 3.4 Modes of control

Several control modes may apply to a number of element types such as VCE, MCE, MCD etc. The control mode determines which control source is selected. The control mode mechanism is based on a selector switch between states: REMOTE/AUTO, REMOTE/MANUAL and LOCAL. This is illustrated by Figure 3-4.

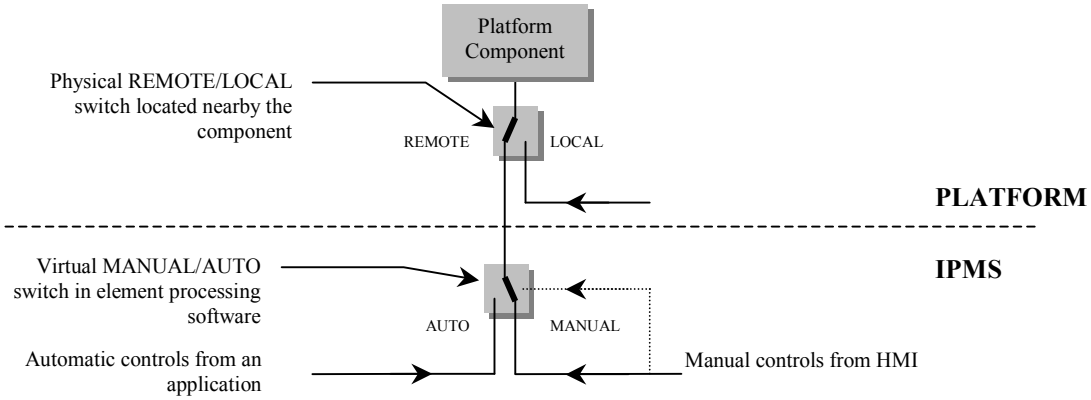



**Figure 3-4 Control mode switch mechanism**

When the control mode is REMOTE/AUTO, an automatic process controls the component. An operator is able to control the component from remote provided that its control mode is REMOTE/MANUAL. When the control mode is LOCAL, the component can be controlled by manual interaction (e.g. pushbuttons, switches etc. on (or nearby) the component itself) only.

A physical REMOTE/LOCAL switch nearby the component does the REMOTE/LOCAL toggling. If the control mode is REMOTE then the remote operator does the MANUAL/AUTO toggling using a virtual switch in the element-processing software. Figure 3-4 shows that a local operator will be able to override all commands given from remote. This can be achieved by toggling the ‘REMOTE/LOCAL’ switch to state ‘LOCAL’

A control mode label near the symbol shows the control mode currently active. However, this label is to appear only when the control mode deviates from the most hierarchical control mode that applies to the element.

Not all control modes may apply to all controllable elements although control mode ‘LOCAL’ mostly applies to all of them. Potential control mode(s) ‘REMOTE/AUTO’ and ‘REMOTE/MANUAL’ may apply. This will be visualized by showing specific ‘T-shaped’ handles as a symbol extension regardless the control mode currently active. A ‘REMOTE/MANUAL’ handle is identified by a ‘T’ whilst the REMOTE/AUTO handle is identified by an open ‘T’. (See Table 3-17) If both control modes are applicable then hence both handles will be displayed. Table 3-17 shows some examples regarding the appearance of control mode labels and handles.

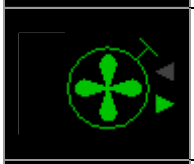
| Symbol shown | Description |
|---|---|
|  | A centrifugal pump that is currently running in control mode REMOTE/AUTO. Control mode REMOTE/MANUAL applies to this component also. |
|  | A centrifugal pump that is currently running in control mode REMOTE/MANUAL. Since this control mode deviates from the default mode, 'MAN' is shown along with the pump symbol. |
|  | A bidirectional fan that is currently running in supply mode. Control mode REMOTE/MANUAL is applicable but since this is the default control mode the control mode label is invisible. |
|  | A bidirectional fan that is currently running in supply mode. Control mode REMOTE/MANUAL is the default control mode but since the actual mode is 'LOCAL' 'LOC' is shown along with the fan symbol. |
|  | An open circuit breaker. Control mode REMOTE/AUTO is the default control mode but since the actual mode is 'LOCAL' 'LOC' is shown along with its symbol. |

**Table 3-17 Control mode label examples**

## 3.5 Element identification

As already described before, the state of ship components will be visualized by colour/shape animation of symbols. Each of them matches a certain element type that provides monitoring and control functions by calling a software subroutine whilst referencing the element id-code.

The element id-code is attached to the symbol that represents the component to link it with the ELP process that is running within the LPU's. To obtain an overview of all element id's that exist on a certain mimic the operator may press the <ALT> + S key combination. Labels that show the applicable element id will appear near or on top of each symbol (except for those used for doors, hatches and fire detectors) for about 10 seconds aiming to improve the search for a certain element id.

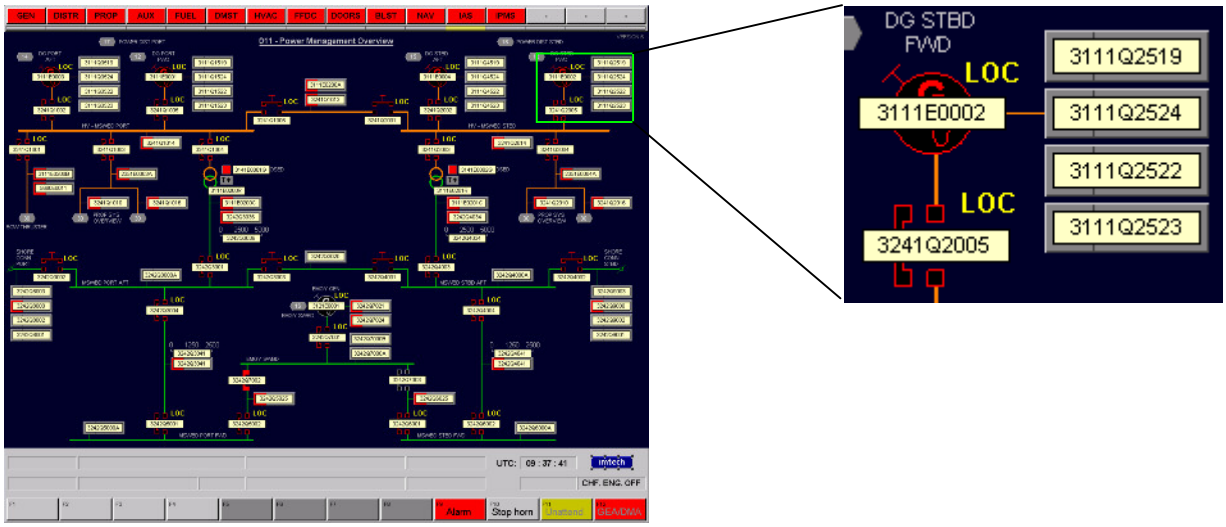



**Figure 3-5 Element id's visualized by their labels**

# 4. Component Information

The following component information tools are available within the HMI:

- Component Information Presentation (CIP)
- Component Assist Page (CAP)

The following sections will describe these tools:

## 4.1 Component Information Presentation (CIP)

An operator may explore and control a platform element by means of the CIP, which is displayed at the bottom of each mimic. By a single left-click of his pointing device on the symbol of his choice relevant information regarding the applicable symbol will be displayed by the CIP. Moreover, the controls applicable to the selected element are displayed into the function key fields. The CIP window front-end will be similar to the one shown by Figure 4-1.


**Figure 4-1 Impression of a CIP window**

The CIP fields marked in Figure 4-1 have functions as described in Table 4-1 to Table 4-2.

| Field code | Display function: |
|---|---|
| Cip1Txt | Element ID code |
| Cip2Txt | Element description |
| Cip3Txt [1] | Current element status |
| Cip4Txt [1] | Shows status: 'Enabled' / 'Disabled' or 'Alarm inhibited' |
| Cip5Txt | Installation group the element belongs to. |
| Cip6Txt | NBCD code (if applicable) |
| Cip7Txt | Element setpoint input field (if applicable) |
| Cip8Txt **** [] | If current element is of analogue sensor type then: Actual sensor value<br>Else if element is a proportional element then: Current setpoint<br>Else if element is remote controllable then: Last command accepted by IPMS<br>Else this field is cleared. |
| Cip9Txt [1] | If applicable to the element then: Current control mode<br>Else: Cleared |
| F1Txt - F8Txt (F1 - F8) | Reserved for element control. All button faces grey. Texts black or grey. |

**Table 4-1 CIP field element functionality**

Since all statuses derived from the element may change whilst the element is in CIP focus, some CIP fields must be updated automatically as soon as the element status changes. This is applicable to the CIP fields marked with a number 1 ([1]).

The operator may left-click a function key button displayed by the CIP to send a command regarding the focussed element. Alternatively, function keys on the workstation keyboard can be used as well. Function keys (the ones

drawn on the screen as well as the physical ones on the keyboard) might be blocked if:

- The function attached to the button is currently is not applicable. For example, if the element control mode is 'LOCAL' then the remote operator won't be able to control the element by means of the HMI.
- The focussed element is classified for an installation group currently not attached to the workstation. Installation group access must be granted to your workstation to be able to control the elements classified for that group;
- The element control time has expired. To prevent accidental controls a 10 seconds time gate 'opens' right after left-clicking an element symbol. An operator may press (or left-click) a function key within that time. The timer will restart each time the operator presses (or left-clicks) a function key within the time gate. If the time gate closes then function keys F1-F8 will be blocked. The operator has to click on the element symbol again to regain controllability.

Disabled function key texts are greyed-out (dark grey button text on a grey button face) to indicate they are currently not available.

CIP texts and texts displayed into function key fields are based on the type of element being focussed on by the operator. Deviating texts may appear in the CIP among elements of the same type since several text sets are provided for each element type. (See **Appendix A**)

The element symbol that complies with the element information displayed by the CIP will be highlighted by a yellow box to clarify the link between them. Figure 4-2 shows an example of an element identified '3242Q3000A' that is in focus.


**Figure 4-2 Element focussed by CIP**

Furthermore the following functions are integrated with the CIP:

| Field code | Function: |
|---|---|
| UTC: HH:MM:SS | Displays UTC Time. Date will be displayed if the cursor hovers over it by a tool tip |
| Alarm (F9) | If no alarm is active applicable to installation groups currently attached then:<br>Button face is grey.<br><br>If all active alarms are acknowledged then: Button face is steady red.<br><br>If any alarm applicable to the station is not acknowledged then: Button face is blinking red/grey.<br><br>When Alarm (F9) is pressed: the alarm presentation (Section 5.1) will be shown. |
| Stop horn (F10) | Button face is grey.<br>When pressed, the local horn is stopped until a new alarm is being activated. |

**Table 4-2 CIP generic functions**

The CIP field generic functions mentioned in Table 4-2 are always visible/enabled for the operator. Function keys F11-F12 are reserved for future functions.

## 4.2 Component Assist Page (CAP)

Detailed element information can be obtained by calling the Component Assist Page (CAP). The CAP can be entered from the CIP (See section 4.1) Figure 4-3 shows a typical CAP screen. The CAP provides the operator with the following element information.

- Generic element info such as:
  - Element ID;
  - Element description;
  - Installation group;
- Element IO information:
  - Which PLC input(s) is (are) involved. (Location, IO board, Channel, IO reference number);
  - Which PLC output(s) is (are) involved (Location, IO board, Channel, IO reference number);
  - Reference IDs that might apply if logical expressions are involved with any element input.
  - Remarks, mostly used to indicate external addresses ( e.g. Modbus address)
  - Cfg field shows switch element configuration settings, like:
    - NO The element is configured as Normally Open (No input current is the normal state)
    - NC The element is configured as Normally Closed (Input current is the normal state)
    - NOA The element is configured as Normally Open and will generate an alarm if closed.
    - NOC The element is configured as Normally Closed and will generate an alarm if opened.
  - State: this column shows the actual state of the discrete digital input/output channels when they apply.

    No electrical current flows through the digital input/output;

    An electrical current flows through the digital input/output;

    The actual state of the digital input/output can not be determined.

- Element parameters:
  - Element type specific. Only the user configurable parameters are shown (See **Appendix B**); Parameter changes are password protected.
- Involved equations:
  - Logical expressions may be involved with some of the element inputs shown in the IO map information section. Example: Alarm inhibit equations will be shown in here;
- Tank tables
  - Applicable to the Tank sensor element type only. This section provides information about the tank content curve being implemented for the tank sensor element.


**Figure 4-3 Typical Component Assist Page (CAP)**

Furthermore the CAP also has an alarm group bar and a CIP as described by section 2.3. However functionality of CAP Function keys F1 – F8 differs from those displayed by the CIP.

The following key functions have been defined for the CAP:

F1 Disable element. This function key is disabled by default. Authorize first (F7) to enable this key;

F2 Enable element. This function key is disabled by default. Authorize first (F7) to enable this key;

F3 Reset running hour / event counter element. This function key is disabled by default. Authorize first (F7) to enable this key;

F4 Reserved for future use

F5 Reserved for future use

F6 Select another element. As described, calling the CAP whilst focussing a certain element displays all the information concerning that element. A dialog box, which makes it possible to change focus to another element will pop-up by pressing the 'Select' button.

F7 Authorize. When parameter values should be modified or if there is any need to enable/disable an element the operator must authorize first. Pressing the F7 key causes a dialog box to pop-up. The operator can authorize by typing in the password, which is needed to gain access to these CAP functions. Once authorized, the operator may change the password by pressing the 'C'-key on his keyboard. Whilst leaving the CAP, the 'authorized' status will be reset automatically.

F8 Return to the former mimic.

Note: The CAP is a child screen of its mimic parent screen. It is shown on top of the mimic from whom it is called. As a consequence the operator can't call another mimic, apart from the alarm presentation, whilst the CAP is shown. To call another mimic the operator must close the CAP first by pressing the 'Return' button (F8).

# 5. Alarm Information

The following alarm information is featured by the HMI:

- Alarm Presentation;
- Alarm Group bar
- Alarm History;

## 5.1 Alarm presentation

Alarms are displayed by the alarm presentation, but only those applicable to installation groups being attached to the workstation will appear. Alarms will be sorted first by their acknowledged state and then by their timestamp in a descending order. Unacknowledged alarms will be displayed at the top of the list. The operator can acknowledge alarms shown on the alarm presentation by clicking at the alarm row. The applicable alarm message will be highlighted. Once the alarm message is highlighted the alarm can be acknowledged by pressing the 'ACK' (F1) button. (See Figure 5-1)

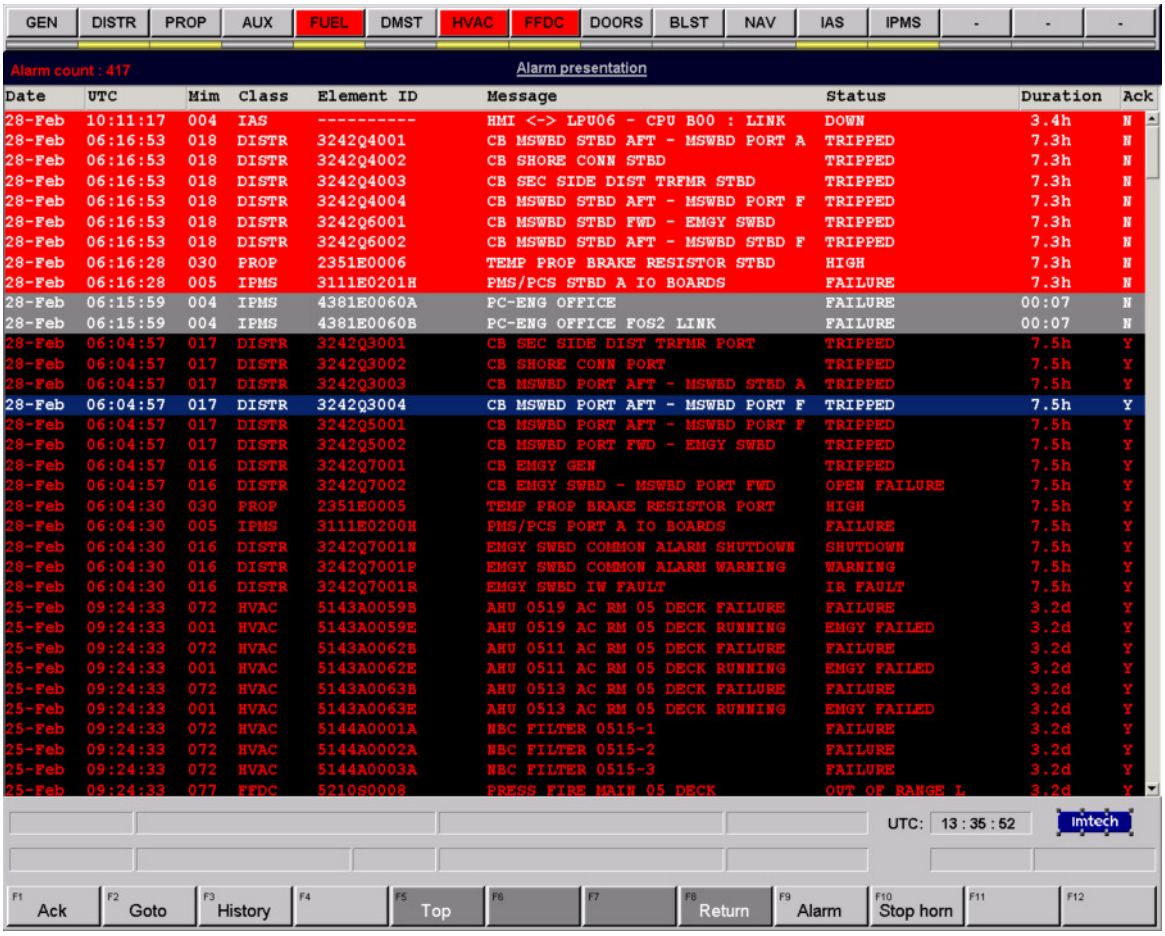



**Figure 5-1 A typical alarm presentation**

If the operator needs more information about the alarm context, he can press the 'Goto' button (F2) after the alarm message is highlighted. If a main mimic reference is attached to the alarm message, that mimic will be shown after the 'Goto' button has been pressed.

Alarm status information can be obtained from the alarm presentation by applied row colour animation; all applicable colour animations are shown by Table 5-1.

| Date | Time | Message | Duration | Ack |
|---|---|---|---|---|
| 30 May | 12:34:56 | This alarm is active and NOT acknowledged | 12:34 | N |
| 30 May | 12:34:55 | This alarm is active and acknowledged | 23:45 | Y |
| 30 May | 12:34:54 | This alarm is rectified but it is not NOT acknowledged | 01:23 | N |
| 30 May | 12:34:53 | The status of this alarm is unavailable now | 01:23 | N |
| 30 May | 12:34:53 | This alarm message is highlighted by the operator | 01:23 | N |

**Table 5-1 An impression of an alarm list**

The operator is not able to acknowledge alarm messages that apply to installation groups that are not attached to his workstation, since he is not responsible for them. However, the operator can still see those messages by calling the slave alarm summary lists from the alarm group bar. Although they look like the alarm presentation shown by Figure 5-1 slave alarm summaries display the alarm messages applicable to their relevant installation group only. Furthermore, it is not possible to acknowledge any alarm whilst using the slave alarm summary even if the installation group being involved with it is assigned to your workstation.

## 5.2 Alarm Group Bar

The alarm group bar comprises a number of animated buttons, one for each installation group. The link between each button and its assigned installation group is clarified by an abbreviated text displayed onto the button face. If there is an alarm occurrence within a certain installation group then its relevant installation group button will start blinking regardless its current workstation assignment. Pressing this button will open a slave alarm summary (Comparable to the one shown by Figure 5-1) that displays the alarm messages applicable to that installation group only.

Underneath each button in the alarm group bar there is bar shaped indicator. This shows which installation groups are currently assigned to your workstation. If it is yellow, then the relevant installation group is assigned to the workstation. On the other hand, if it is grey then the operator is not responsible for monitoring and control tasks regarding that installation group.

An alarm occurrence applicable to an installation group currently assigned to your workstation not only causes the applicable group button to start blinking (on all IPMS workstations) but your alarm button (CIP – F9) will start blinking as well. (Only on the workstation that is responsible for watching this installation group)

Moreover, alarm count information will be displayed when the pointer hovers over the relevant installation group button.

A typical alarm group bar is shown in Figure 5-2.


**Figure 5-2 A typical alarm group bar**

## 5.3 Alarm history

Since the HMI server logs all alarm events into a database, an alarm history list can be obtained from that database. The alarm history list is derived from the alarm log table. It shows the operator the following information:

- Sequence number : A unique tag number for each alarm event;
- Time stamp : Time of log action;
- Alarm message : Alarm message as shown on the alarm presentation;
- Previous state : The previous alarm state, before the logged event occurred;
- Log action : The actual logged event. I.e. **G**enerated / **R**eset / **A**cknowledged or **D**eleted;
- Final state : The final alarm state after the log action;
- Logged_by : Identification of process or user responsible for the log action.

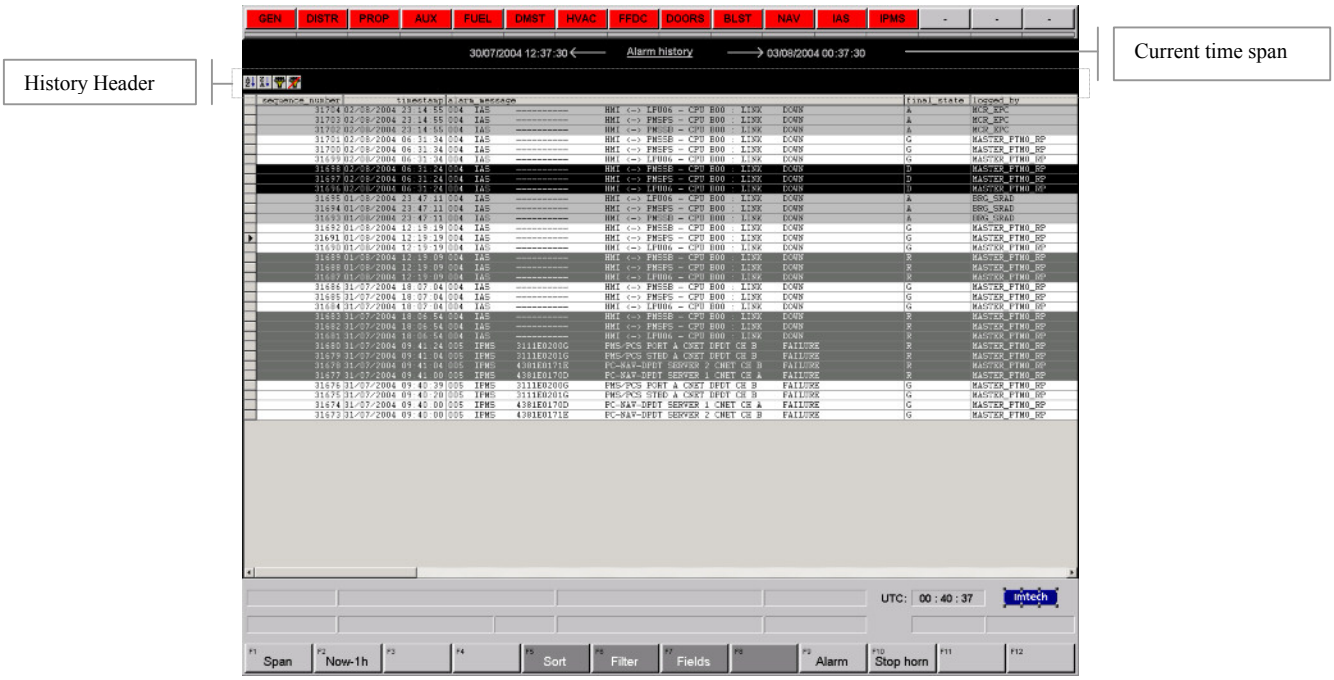



**Figure 5-3 A typical Alarm history list**

Alarm events and states are clarified by a unique row colour:

| Alarm event | Abbreviation | Row style applicable to alarm 'final state |
|---|---|---|
| Generated | G | Black coloured text on a white background |
| Acknowledged | A | Black coloured text on a silver grey background |
| Reset | R | White coloured text on a grey background |
| Deleted | D | White coloured text on a black background |

**Table 5-2 Row styles defined for each alarm event**

Whenever the alarm history is called it will show all the IPMS alarm events relevant to the last hour. The operator is able to alter the historical time span by clicking at the 'Span' button. Besides this, the alarm history features the following:

- Now – 1 h : Refreshes the list to show alarm occurrences for the last hour;
- Sort : Opens a sort order dialog;
- Filter : Hides some of the record based on filter criteria;
- Field selection : Shows/hides available fields of each record.

A print list feature is available from the pop-up menu that will appear when the operator right-clicks at the alarm history header.

# 6. Function allocation

Function allocation is used to assign controllability of installation groups to the relevant operator workstations. IPMS Components (like sensors, motors, circuit breakers etc) are grouped into so called installation groups. An operator needs control access rights for a relevant group before components classified for this group can be controlled from his workstation. Except for the IAS group, which comprises some important health monitoring functions (HMT), each installation group can only be allocated to a single workstation and likewise, the underlying components within the installation groups can only be allocated to a single installation group.


**Figure 6-1 A typical function allocation matrix**

A function allocation matrix like the one shown by Figure 6-1 is used to visualize the current workstation assignments. Each column represents each IPMS workstation that might control the platform. The column that applies to the current station will be highlighted. Each row signifies an installation group recognized for the project.

Each intersection of rows and columns visualizes the allocation of installation groups currently valid for the IPMS. An installation is allocated to a workstation if a tick is shown on the intersection with the relevant column. Only the IPMS components classified for installation groups that are allocated to a certain station can be controlled from that station. Besides this, all alarms applicable to those installation groups will appear on the alarm presentation shown on that particular station as well. It is assumed that the operator in concern is responsible for them.

Any authorized operator can alter function allocation settings. Authorization is achieved by entering a password. Once authorized, the authorize button changes into an execute button. The operator may now click on the square at the intersection between the highlighted column and any installation group row that is not already assigned to his station. The square will start to blink to indicate that a function allocation setting is pending for this workstation.

After the 'EXECUTE' button has been pressed, an alarm summary will be displayed. This summary shows all alarm messages relevant for the installation groups that are involved with the function reallocation. The operator has to confirm the existence of these alarms before the workstation can assume control of those installation groups.

If the operator doesn't confirm to these alarms within 30 seconds or when he cancels function allocation then the reassignment of installation groups will be aborted.

| | |
|---|---|
| Note: | Due to Lloyds classification rules, the 'IAS' group is to be assigned to each IPMS workstation with control abilities. When activated, alarms attached to the 'IAS' group will appear on the alarm presentation of each of those stations. Just one operator has to acknowledge the alarm message. |

# 7. Logging and trending presentations

For the purpose of technical monitoring of installations on the ship, the condition of certain parts of the installation is to be recorded regularly. Moreover, information regarding alarm events, command history and IPMS parameters is to be recorded as well.

The HMI features several tools to gain insight into the IPMS historical behaviours. If the data-log was triggered by an event then a list of events suits best to have a look at the records. This, for instance, applies to the alarm history viewer (described by section 5.3) but it is useful for visualization of 'Command History' and 'Changed Parameters History' as well.

If the data was logged periodically then it suits to have a look at it by using a graphical trend presentation (historical and real time) rather than staring at a list of numeric values.

The signal trend mimic is displayed as a pop-up child window and can be called from every IPMS workstation by a right-click at an animated analogue symbol. Select the 'Add to Trend' entry from the pop-up menu. The following dialog will appear.

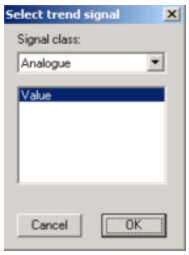



**Figure 7-1 Trend signal selection (analogue)**

Although it is assumed that the operator intends to trend an analogue value in case the element is of analogue type the drop-list box may be used to select an element state (e.g 'Value OK', 'Value High Alarm' etc.) as well. As soon as the OK button is clicked the system will look for historical data. If historical data can be obtained from the data-logger the trend window will show this data. If not, then a notification concerning this will be displayed. The operator may still proceed adding the signal however since there is no historical data available only real time trend data will be displayed.

Consider the typical trend window displayed by Figure 7-2. As soon as the focus is returned to the original mimic, then the signal trending mimic will disappear into the background. It is possible to call up another mimic and from there, add another signal to the trend by right clicking on the relevant element. This causes the signal trending mimic to re-appear. The <ALT>+T key combination can be used to display the trend mimic without adding further signals. Buttons for changing time span, pause etc. are available alongside the trend. Advanced trend functions such as adding axes, changing scale values etc. are available by calling user dialogs that will appear if the operator double-clicks the trend object.

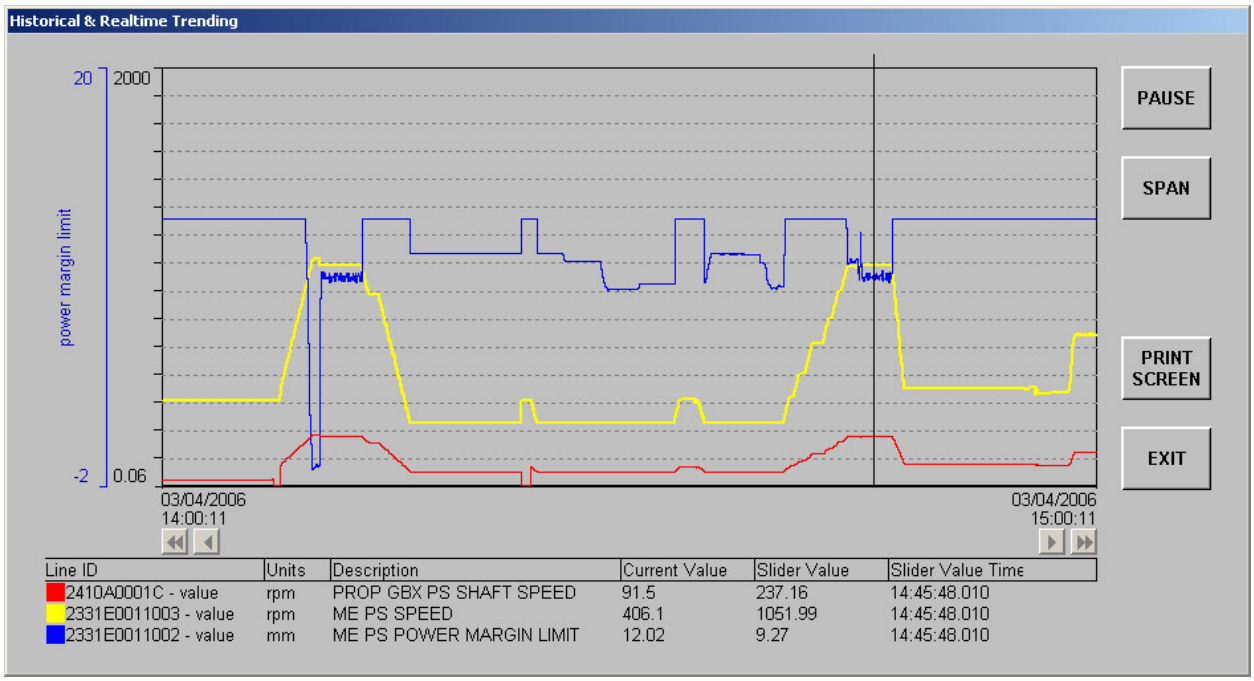



**Figure 7-2 Typical signal trending mimic**

# Appendix A
# Element type dependent CIP functions

The table of appendix A, Element type dependent CIP functions will be used during design of the IPMS system and will be used for internal configuration purposes. The following table specifies CIP texts by element type:

| **Element type** | **Status** (Cip3Txt) | **Value** (Cip8Txt) | **Applicable text sets** (F1Txt – F8Txt) | | | | | |
|---|---|---|---|---|---|---|---|---|
| SSE | DISABLED<br>SENSOR OK<br>INVALID<br>SENSOR VALUE LOW<br>SENSOR VALUE HIGH<br>OUT OF RANGE LOW<br>OUT OF RANGE HIGH | <Sensor value> <Unit> | | **1** | **2** | **3** | **4** | **5** |
| | | | F1 | | | | | |
| | | | F2 | | | | | |
| | | | F3 | | | | | |
| | | | F4 | | | | | |
| | | | F5 | | | | | |
| | | | F6 | | | | | |
| | | | F7 | | | | | |
| | | | F8 | Assist | Assist | Assist | Assist | Assist |
| AAE/SAE | DISABLED<br>SENSOR OK<br>SENSOR VALUE LOW<br>SENSOR VALUE HIGH<br>INVALID<br>WIRE BREAK | <Sensor value> <Unit> | | **1** | **2** | **3** | **4** | **5** |
| | | | F1 | | | | | |
| | | | F2 | | | | | |
| | | | F3 | | | | | |
| | | | F4 | | | | | |
| | | | F5 | | | | | |
| | | | F6 | | | | | |
| | | | F7 | | | | | |
| | | | F8 | Assist | Assist | Assist | Assist | Assist |
| SS1/SS2 | DISABLED<br>SENSOR OK<br>INVALID<br>SENSOR VALUE HIGH<br>SENSOR VALUE HIGHHIGH<br>SENSOR VALUE TOO HIGH<br>OUT OF RANGE LOW<br>OUT OF RANGE HIGH | <Sensor value> <Unit> | | **1** | **2** | **3** | **4** | **5** |
| | | | F1 | | | | | |
| | | | F2 | | | | | |
| | | | F3 | | | | | |
| | | | F4 | | | | | |
| | | | F5 | | | | | |
| | | | F6 | | | | | |
| | | | F7 | | | | | |
| | | | F8 | Assist | Assist | Assist | Assist | Assist |
| SSL | DISABLED<br>SENSOR OK<br>SENSOR VALUE LOW<br>SENSOR VALUE HIGH<br>OUT OF RANGE LOW<br>OUT OF RANGE HIGH | <Tank content> $m^3$ | | **1** | **2** | **3** | **4** | **5** |
| | | | F1 | | | | | |
| | | | F2 | | | | | |
| | | | F3 | | | | | |
| | | | F4 | | | | | |
| | | | F5 | | | | | |
| | | | F6 | | | | | |
| | | | F7 | | | | | |
| | | | F8 | Assist | Assist | Assist | Assist | Assist |
| MCE | DISABLED<br>STOPPED<br>RUNNING<br>IN TRANSITION<br>NOT READY FOR USE<br>RUN FAILURE<br>STOP FAILURE<br>UNDETERMINED<br>FAULT | <Last command given> | | **1** | **2** | **3** | **4** | **5** |
| | | | F1 | Stop | | Stop | | |
| | | | F2 | Start | | Start | | |
| | | | F3 | | | | | |
| | | | F4 | | | | | |
| | | | F5 | | | | | |
| | | | F6 | Manual | | | | |
| | | | F7 | Auto | | | | |
| | | | F8 | Assist | Assist | Assist | | |

| Element type | Status (Cip3Txt) | Value (Cip8Txt) | Applicable text sets (F1Txt – F8Txt) | | | | | |
|---|---|---|---|---|---|---|---|---|
| MCD | DISABLED<br>STOPPED<br>RUNNING <F2Txt><br>RUNNING <F3Txt><br>IN TRANSITION<br>NOT READY FOR USE<br>FAILED TO < F2Txt ><br>FAILED TO < F3Txt ><br>UNDETERMINED<br>FAULT | <Last command given> | | **1** | **2** | **3** | **4** | **5** |
| | | | F1 | Stop | | Stop | Stop | |
| | | | F2 | Supply | | Supply | Low | |
| | | | F3 | Exhaust | | Exhaust | High | |
| | | | F4 | | | | | |
| | | | F5 | | | | | |
| | | | F6 | Manual | | | | |
| | | | F7 | Auto | | | | |
| | | | F8 | Assist | Assist | Assist | Assist | |
| MCS | DISABLED<br>STOPPED<br>STANDBY<br>RUNNING<br>IN TRANSITION<br>NOT READY FOR USE<br>FAILED TO START<br>FAILED TO STOP<br>FAILED TO STANDBY<br>UNDETERMINED<br>FAULT | <Last command given> | | **1** | **2** | **3** | **4** | **5** |
| | | | F1 | Stop | | Stop | | |
| | | | F2 | Start | | Start | | |
| | | | F3 | Standby | | Standby | | |
| | | | F4 | | | | | |
| | | | F5 | | | | | |
| | | | F6 | Manual | | | | |
| | | | F7 | Auto | | | | |
| | | | F8 | Assist | Assist | Assist | | |
| SWE/SWB/SWN | DISABLED<br><TEXT0>*<br><TEXT1>*<br>INVALID<br><br>*: Text0/Text1 can be any text string max 20 characters | <Cleared> | | **1** | **2** | **3** | **4** | **5** |
| | | | F1 | | | | | |
| | | | F2 | | | | | |
| | | | F3 | | | | | |
| | | | F4 | | | | | |
| | | | F5 | | | | | |
| | | | F6 | | | | | |
| | | | F7 | | | | | |
| | | | F8 | Assist | Assist | Assist | Assist | Assist |
| RHE | DISABLED<br>COUNTING<br>NOT COUNTING<br>INVALID | <Cleared> | | **1** | **2** | **3** | **4** | **5** |
| | | | F1 | | | | | |
| | | | F2 | | | | | |
| | | | F3 | | | | | |
| | | | F4 | | | | | |
| | | | F5 | | | | | |
| | | | F6 | | | | | |
| | | | F7 | | | | | |
| | | | F8 | Assist | Assist | Assist | Assist | Assist |

| Element type | Status (Cip3Txt) | Value (Cip8Txt) | Applicable text sets (F1Txt – F8Txt) | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEE | DISABLED<br>VALUE OK<br>INVALID | <Cleared> | | **1** | **2** | **3** | **4** | **5** |
| | | | F1 | | | | | |
| | | | F2 | | | | | |
| | | | F3 | | | | | |
| | | | F4 | | | | | |
| | | | F5 | | | | | |
| | | | F6 | | | | | |
| | | | F7 | | | | | |
| | | | F8 | Assist | Assist | Assist | Assist | Assist |
| VCE/VCH | DISABLED<br>CLOSED<br>OPEN<br>IN TRANSITION<br>NOT READY FOR CLOSE<br>NOT READY FOR USE/OPEN<br>FAILED TO CLOSE<br>FAILED TO OPEN<br>UNDETERMINED<br>FAULT | <Last command given> | | **1** | **2** | **3** | **4** | **5** |
| | | | F1 | Close | | Close | | |
| | | | F2 | Open | | Open | | |
| | | | F3 | | | | | |
| | | | F4 | | | | | |
| | | | F5 | | | | | |
| | | | F6 | Manual | | | | |
| | | | F7 | Auto | | | | |
| | | | F8 | Assist | Assist | Assist | | |
| VCP | DISABLED<br>CLOSED<br>OPEN<br>IN CONTROL<br>NOT READY FOR USE<br>FAILED<br>OUT OF RANGE LOW<br>OUT OF RANGE HIGH | <Actual setpoint> | | **1** | **2** | **3** | **4** | **5** |
| | | | F1 | | | | | |
| | | | F2 | | | | | |
| | | | F3 | SP - | | SP - | | |
| | | | F4 | SP Exe | | SP Exe | | |
| | | | F5 | SP + | | SP + | | |
| | | | F6 | Manual | | | | |
| | | | F7 | Auto | | | | |
| | | | F8 | Assist | Assist | Assist | | |
| CBE/CBA | DISABLED<br>CLOSED<br>OPEN<br>IN TRANSITION<br>NOT READY FOR CLOSE<br>NOT READY FOR OPEN<br>TRIPPED<br>FAILED TO CLOSE<br>FAILED TO OPEN<br>UNDETERMINED<br>FAULT | <Actual setpoint> | | **1** | **2** | **3** | **4** | **5** |
| | | | F1 | Close | | Close | | |
| | | | F2 | Open | | Open | | |
| | | | F3 | | | | | |
| | | | F4 | | | | | |
| | | | F5 | | | | | |
| | | | F6 | Manual | | | | |
| | | | F7 | Auto | | | | |
| | | | F8 | Assist | Assist | Assist | | |

# Appendix B
# Element specific parameters

The following table marks all element parameters that can be viewed and set by the operator.

| Element type | Elementtype Description | TCTRL | TTRANS | TTRO | TDLY | HAV | LAV | HHAV | XHAV | HY | TA | HYHA | HYLA | THA | TLA | V4 | V20 | SF | SG | TAU | OFFSET |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Control pulse length [s] | Transition time allowed [s] | Time needed for turn around | Time delay [s] | Alarm threshold high | Alarm threshold low | Alarm threshold highhigh | Alarm threshold extra high | Hysteresis (common) | Time delay alarm (common) | Hysteris alarm high | Hysteresis Alarm low | Time delay alarm high [s] | Time delay alarm low[s] | Scaled value @ 4 mA | Scaled value @ 20 mA | Scale factor | Specific gravity (kg/m$^3$) | 1$^{st.}$ order filter constant | Offset value |
| AAE | Analogue Application-element | | | | | ● | ● | | | | | ● | ● | ● | ● | | | ● | | | |
| CBA | Circuit Breaker element application | | | | | | | | | | | | | | | | | | | | |
| CBE | Circuit breaker-element | ● | ● | | | | | | | | | | | | | | | | | | |
| CTR | Control-element | ● | | | | | | | | | | | | | | | | | | | |
| DAE | Digital Application Element | | | | | | | | | | | | | | | | | | | | |
| MCD | Motor starter double speed-element | ● | ● | ● | | | | | | | | | | | | | | | | | |
| MCE | Motor starter-element | ● | ● | | | | | | | | | | | | | | | | | | |
| MCS | Motor starter standby-element | ● | ● | | | | | | | | | | | | | | | | | | |
| RHE | Running Hours Element | | | | | | | | | | | | | | | | | | | | ● |
| SAE | Serial Application-element | | | | | | | | | | | | | | | | | ● | | | |
| SEE | Switching event element | | | | | | | | | | | | | | | | | | | | ● |
| SPE | Setpoint element | | | | | | | | | | | | | | | | | | | | |
| SS1 | Sensor-element alarms H HH XH | | | | | ● | | ● | ● | ● | ● | | | | | ● | ● | | | | |
| SS2 | Application element alarms H HH XH | | | | | ● | | ● | ● | ● | ● | | | | | | | ● | | | |
| SSE | Sensor-element | | | | | ● | ● | | | | | ● | ● | ● | ● | ● | ● | | | | |
| SSL | Tank level-element | | | | | ● | ● | | | | | ● | ● | ● | ● | ● | ● | | ● | ● | |
| SWB | Switch-element basic function | | | | | | | | | | | | | | | | | | | | |
| SWE | Switch-element | | | | ● | | | | | | | | | | | | | | | | |
| SWN | Switch element NBCD | | | | ● | | | | | | | | | | | | | | | | |
| VCE | Valve-element | ● | ● | | | | | | | | | | | | | | | | | | |
| VCH | Valve-element Hydraulic | ● | ● | | | | | | | | | | | | | | | | | | |
| VCP | Valve-element Proportional | ● | ● | | | | | | | | | | | | | | | | | | |

# Appendix C
# Static symbols

| Component name | Description of relevant medium | | | | | | |
|---|---|---|---|---|---|---|---|
| | Fuel oil | Lub oil | Fresh water | Sea water | Bilge water | Air / Exh. gas | Electrical |
| Standard valve | | | | | | | |
| Standard 3-way valve | | | | | | | |
| 1-way valve (left to right) | | | | | | | |
| Filter | | | | | | | |
| Pump / Fan | | | | | | | |
| Circuit breaker | | | | | | | |
| Transformer Medium/Medium Voltage | | | | | | | |
| Transformer High/Medium Voltage | | | | | | | |
| Sea water inlet / outlet | | | | | | | |
| Suction inlet | | | | | | | |
| Connector | | | | | | | |
| Sprinkler outlet | | | | | | | |