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User Manual

Integrated Platform Management System

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References

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

[2] **Title:** **Documentation Plan**
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From: R. v. Treuren
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Description: Overall System specification of the Integrated Automation System
Ref.: 190134-4000-IAS-SSC
From: E.J. Middeldorp
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Date: 9 May 2005

[4] **Title:** **Functional Specification IPMS**
Description: Functional specification of the Integrated Platform Management System.
Ref.: 190134-4380-FSC
From: R. Langeveld
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[5] **Title:** **Technical Specification IPMS HMI**
Description: Technical Specification of the Human Machine Interface of the IPMS
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[6] **Title:** **Technical Specification IPMS ELP**
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Description: Functional Specification of the Power Management System.
Ref.: 190134-3900-FSC
From: C. Schouten
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From: R. Bipat
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[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-ISC-001
From: H.J. Tigchelaar
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[11] **Title:** **IO List**
Description: List with Input/Ouput signals of the IPMS
Ref.: 190134-4380-IOL
From: E.J. Middeldorp
Issue: V1.0
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[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
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[13] **Title:** **IPMS User Manual**
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[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
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From: Tyco Safety Product
Issue: Z
Date: 1 Feb 2004

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Description: Modbus communication interface description with Pielstick main engines
Ref.: 17249S400372
From: SEMT Pielstick
Issue: A
Date: 31 Jan 2005

[17] **Title:** **IPMS Maintenance Manual**
Description: A guide for IPMS maintainers
Ref.: 190134-4380-MM
From: R. Langeveld
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Date: 1 Dec 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

Preface

Since this document intends to describe all IPMS' user aspects in a generic way, not all items described herein may apply to the project for which it is implemented. The exact scope of functions, features and facilities is specified by project specific specifications.

Besides this, applicable user dialogs, screen dumps or file paths may comprise generic terms or may not look exactly the same as shown for your application. It is assumed you are able to interpret the differences.

A generic project identification is represented by <<PROJECT-ID>>. For the TNI-AL project, the PROJECT-ID ='TNI-AL'. This means that in case a reference is made to <<*PROJECT-ID*>>, that you should read TNI-AL

Some tables intentionally might be left blank inside this document. A user can fill in the applicable data, which is specific for his project. These sections are superseded by the note: *"To be filled in with project specific data"*

Note:	*It must be clear that no rights can be derived from differences found between this document and final IPMS implementation onboard. For example: this document describes use of Local Operator Panels. For the TNI-AL project however there are no Local Operator Panels foreseen.*

Terms and definitions

Alarm	A state that indicates the occurrence of some undesirable event.
Mimic	Functional graphical display that represents one or more platform installations.
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

The document history is detailed in the following table.

Issue:	Date:	Change:	Reason:
1.0	10 Nov 2003	Initial version	
1.1	26 May 2004	Several layout and functional changes	Update
1.2	3 Aug 2004	Logging & trending related sections Section 3.4.2 (Function allocation)	Update
1.3	21 June 2005	Proportional valve element described. FDO mimic description added. Command history mimic and list of parameter changes described. Several other minor changes.	Keeping document up to date
1.4	1 December	Project specific issues abstracted.	Obtaining a generic document.

1. Introduction

1.1 Purpose of document

This document shall be used as a guide for both maintainers and operators of the Integrated Platform Management System (IPMS).

1.2 Scope of document

This document presents an overview of the IPMS functions available to the operators. As it is a User Manual, details of the underlying software/hardware or control algorithms shall not be discussed unless they will improve the understanding of the specific functionality.

The document covers the following topics:

- Section 1 – (this section) Introduction, detailing the purpose and scope of the document;
- Section 2 – Functional overview, showing the system architecture;
- Section 3 – IPMS operator control and monitoring features;
- Section 4 – IPMS alarm handling;
- Section 5 – Maintenance issues.

Throughout this document, it is assumed that the user is fully conversant with graphical user interface (GUI) techniques with regard to Windows operations and mouse/tracker ball control.

1.3 Relationship to other documents

As illustrated in Figure 1-1, this document is part of the documentation set for the Integrated Automation System (IAS).

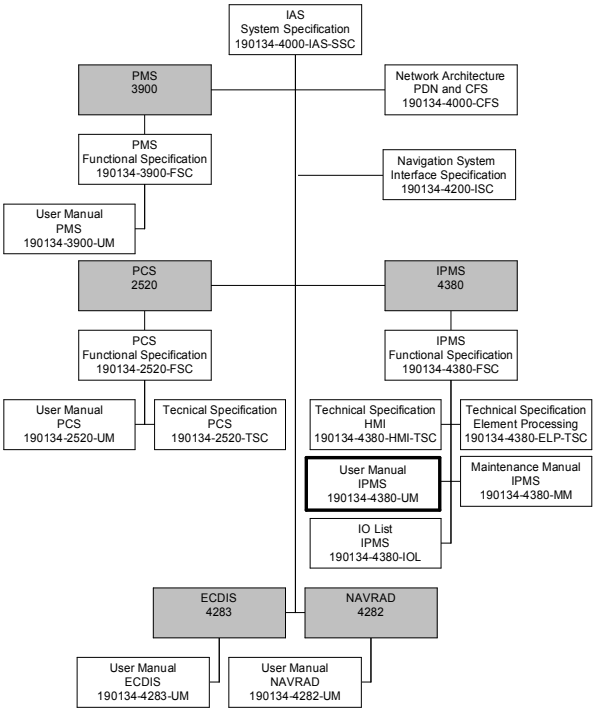


Figure 1-1 Documentation set

2. Integrated Platform Management System (IPMS)

2.1 Functional overview

The IPMS is one of the primary functions of the IAS. It provides facilities for the monitoring and control of the mechanical and electrical components (= platform) within the vessel. The platform components are grouped into a number of installation groups, with each platform component being allocated to only one installation group. This relationship is pre-defined and cannot be changed at run-time by the operator.

Installation groups are grouped into so called function groups. E.g. several installation groups applicable to the propulsion of the vessel are grouped in a function group called 'PROPULSION'. Only one operator station is able to control a certain group while each operator is able to monitor all objects classified for all those groups as all platform data is available to all workstations. The following function groups may be defined:

DG	Diesel Generators
DISTR	Power distribution
PROP	Propulsion control
AUX	Auxiliary systems
FUEL	Fuel systems
DMST	Domestic systems
HVAC	Heating ventilation and air conditioning
FFDC	Fire fighting and damage control
NAV	Navigation
BALL	Ballast
IPMS	Integrated Platform Management System
IAS	Integrated Automation System

Table 2-1 Typical IPMS Installation group summary

At run-time, technical supervision and control of these groups is assigned to the IPMS workstations.

Three hierarchical IPMS operating levels can be distinguished:

- Monitoring only
  This operating level applies to all workstations that do not have any function group assigned. As a result the operator is able to view all platform statuses. However the operator won't be able to control any platform component from remote. Moreover no alarm will appear on the workstation alarm presentation (accessible by pressing the F9 button on the keyboard or clicking at the F9 field on the CIP) and so it won't be able to accept any IPMS alarm by using this station.

- Remote control and monitoring (normal operator mode):
  This operating level applies to all workstations that have at least one function group assigned. As a result the operator is able to view all platform statuses. However, only those platform objects classified for function groups currently assigned to this workstation can be controlled from remote. Whenever an alarm is issued for an allocated function group then the operator will be notified by a sound and by a blinking F9 button on his screen. As the operator is responsible for this function group it is assumed that he will acknowledge the alarm. Moreover he should be aware of the consequences. Relevant measures must be taken to resolve the issue.

- Supervisory control (management facilities)
  This operating level is identical to the remote control and monitoring level. Whenever the operator is able to authorize (by password) then extra features applicable to IPMS configuration issues will be enabled.

2.2 System architecture

A simplified generic block diagram of the IPMS is shown in Figure 2-1

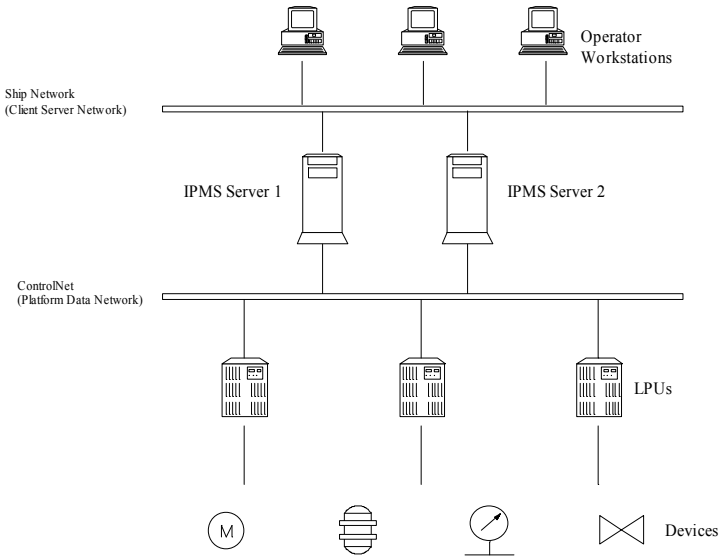


Figure 2-1 Simplified block diagram of IPMS

The interface with the platform devices (See Figure 2-1) is realised via Local Processing Units (LPU's) that are installed within some IPMS cabinets. The Platform Data Network diagram, ref [9] gives an overview of all LPU's that installed for this project.

Both IPMS servers interface the LPU's to gather relevant platform data. Platform data is needed to visualize the platform status on IPMS client workstations, platform alarm notification and logging. One IPMS server performs a master role while the other one is in standby mode. As soon as the master IPMS server fails then the standby IPMS server takes over the master role either manually or automatically. Only the master server serves all attached clients and forwards platform command given by the remote operators.

Local Operator Panels, indicating group alarms and having IPMS monitoring only access may be provided in some cabins and common rooms to provide an IPMS alarm overview locally.

Printers are provided according to document: Functional Specification IPMS, ref. [4]

The IPMS may have interfaces to other IAS sub systems such as: Power Management System (PMS), Propulsion Control System (PCS), Infrastructure (INFRA), Steering Control System (SCS). Besides this, external systems IPMS such as fire detection system etc. may interface the IPMS as well. Most of these IPMS interfaces are required to provide IPMS monitoring & alarm features.

3. Operating the IPMS

3.1 Start up procedure

Although there is no formal start up procedure, it is considered best practice to power up the individual systems of the IPMS in the following order:

- LPU's;
- Secondary IPMS Server and within the next minute …
- … Primary IPMS Server;
- Operator workstations (and - if applicable - local operator panels).

Powering up the platform servers should automatically start the SCADA system on both the primary and secondary platform servers in about 5 minutes. (An extra 5 minutes might be needed to achieve redundant IPMS server operation) If it is necessary to manually start the SCADA system on either one or both of the platform servers, then the procedure for doing this is detailed in the IPMS Maintenance Manual, ref.[17].

Each operator workstation has a unique username and password assigned to it. Log on is automatically completed during the start up process and requires no operator intervention. Once the operator workstation has been powered up and the automated log-on procedure completed, all relevant software applications will be automatically initiated resulting in an IPMS welcome mimic being displayed on the screen.

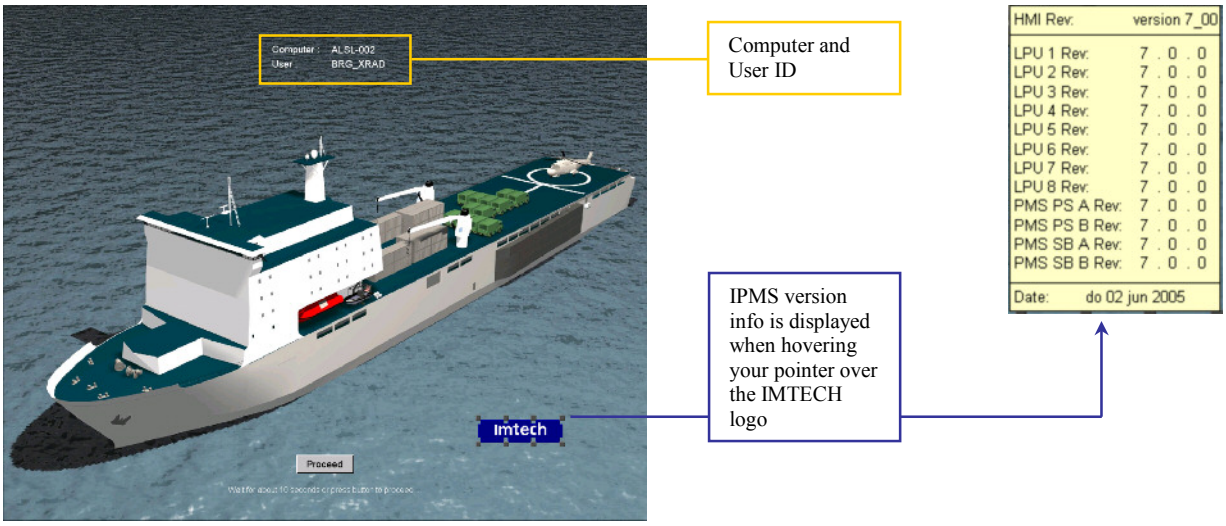


Figure 3-1 Typical IPMS welcome mimic

The welcome mimic is being overlaid by a 'Table of Contents' mimic after 10 seconds. To regain access to this screen type a zero and then press the 'Enter' key. (See also section 3.5.1)

As shown by Figure 3-1 the welcome mimic comprises general information about the workstation identification and the IPMS version currently installed.

3.2 Operator interface (HMI)

3.2.1 HMI fundamentals

Most (not all) of the workstations provide the interface to the IPMS. (See document Functional Specification IPMS, ref. [4] for a summary of workstations that feature the IPMS) A schematic representation of the IPMS mimic screen is shown in Figure 3-2. It can be seen that a typical mimic is divided into three distinct sections: an alarm group bar at the top of the screen; an application window in the centre; and a component information presentation (CIP) section at the bottom of the screen.

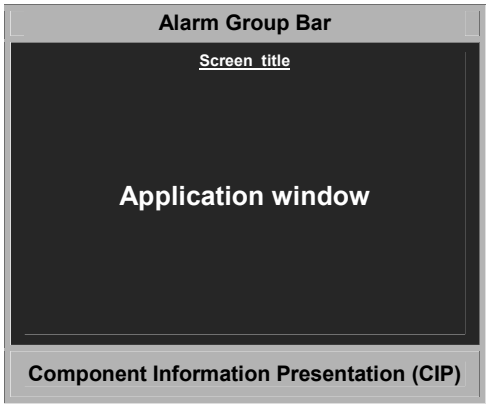


Figure 3-2 Schematic depiction of the screen lay-out of a mimic

- The alarm group bar provides an overview of the existence of an alarm within each function group. (section 3.2.2)
- The application window presents a mimic, alarm page etc. The screen title is displayed at the top of this section.
- The CIP displays dynamic information about a specific platform component that has been selected by the operator. Function keys display all of the applicable operator commands pertinent to the selected platform component. (section 3.2.4)

An example of a typical mimic screen is shown in Figure 3-3.

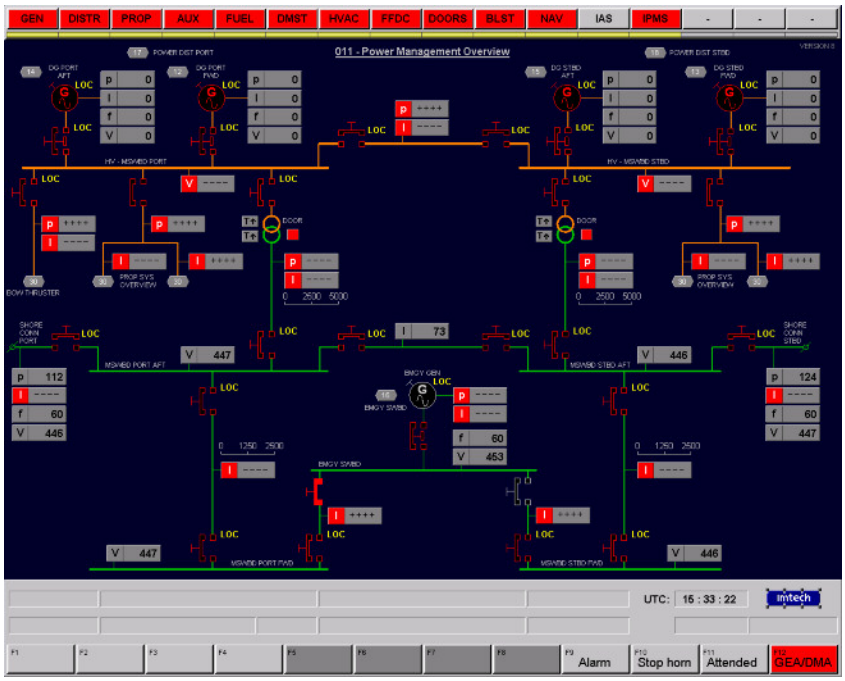


Figure 3-3 Example of a typical mimic

3.2.2 Alarm group bar

The alarm group bar comprises a number of animated buttons, one for each function group. The link between each button and its assigned function group is clarified by an abbreviated text displayed onto the button face. If there is an alarm occurrence within a certain group then its relevant group button will start blinking regardless its current workstation assignment. If it is steady red then alarms applicable to that group are active but all of them have been acknowledged. Pressing one of the alarm group bar buttons will open an alarm summary that displays the alarm messages applicable to that function group only. It is not possible to acknowledge an alarm by using these alarm summaries.

Underneath each button in the alarm group bar there is bar shaped indicator. This shows which function groups are currently allocated to your workstation. (See section 3.5.2 for details about the workstation function allocation mechanism) If it is yellow, then this workstation is the 'station in control' of that group. On the other hand, if it is grey then the operator is not responsible for monitoring and control tasks regarding that group.

Furthermore, alarm count information will be displayed when the pointer hovers over the relevant function group button. As the alarm group bar is visible for all IPMS workstations (regardless of their current function) all of them have access to all of the IPMS alarm events.

A typical alarm group bar is shown in Figure 3-4.

Figure 3-4 Typical alarm group bar

3.2.3 Application window

The application window provides the schematic graphical overviews of the ship's systems. On each mimic, the structure of a selected installation is presented using a number of pre-defined symbols. These symbols along with their applicable PLC processing software are known as elements. These elements and their properties, including animation properties, are defined in more detail in section 3.2.6 of this manual.

The usual Windows-type GUI actions are applicable to navigating around the application window. To select an element, simply use the pointer device (track ball, mouse etc.) to position the cursor over the element symbol and then left-click. This displays a yellow box around the element and its details are displayed in the CIP. Note, that after 10 seconds the function buttons are disabled and greyed out to prevent accidentally invoking commands, e.g. leaning on the keyboard.

3.2.4 Component Information Presentation (CIP)

An operator may monitor and control a platform element by means of the component information presentation (CIP), which is displayed at the bottom of each mimic. This is the most important part of the mimic screen as it provides the operator with all of the element control facilities. By selecting the element, information is gathered and displayed in the CIP window. Also, the controls applicable to the selected element are displayed on the function keys. The CIP window template is shown in Figure 3-5.

Figure 3-5 CIP window template

The text displayed in the 'CIPTxt' fields and on the function key buttons is dependent upon the element selected. Table 3-1, Table 3-2 and Table 3-3 describe in more detail the functionality of the CIP fields indicated in Figure 3-5.

Table 3-1 indicates the details that will be displayed in the text fields shown in Figure 3-5.

For further details of the function button text, see Table 3-3.

3.2.4.1 CIP field functions

Field code	Display function:
Cip1Txt	Element ID code, e.g. 3111Q1013
Cip2Txt	Element description, e.g. LOW LEVEL LO TC DG PORT FWD
Cip3Txt *	Actual element status, e.g. STATUS: NORMAL
Cip4Txt *	Enabled / Alarm inhibited
Cip5Txt	Function group the element belongs to, e.g. GENERATORS
Cip6Txt	Nuclear, biological and chemical damage (NBCD) code (only if it applies to the project)
Cip7Txt	Element setpoint input field (Applicable to proportionally controlled platform elements)
Cip8Txt *	If element type is an analogue sensor type, then the actual sensor value is displayed. If the element type is a proportional element, then the actual set point value is displayed. If the element type is remote controllable, then the last command given is displayed. Otherwise, the field is blank.
Cip9Txt *	If applicable to the element, then the actual element control mode is displayed. Otherwise, the field is blank.
F1Txt - F8Txt (F1 - F8)	Reserved for element control. All button faces grey. Text is black or grey.

* *Since the status of an element may change whilst its details are being displayed in the CIP, the CIP fields marked with an asterisk are updated automatically as soon as the element status change is detected …*

Table 3-1 CIP field element functionality

3.2.4.2 CIP generic functions

Furthermore, the functions detailed in Table 3-2 are integrated within the CIP at the screen locations shown in Figure 3-5.

Field code	Function:
UTC: HH:MM:SS	Displays the Universal Time Convention (UTC) time. The date can be displayed in a tool tip format by moving the mouse over this field
Alarm (F9)	If no alarms to this station are active, then the button face is grey. If all active alarms allocated to this station are acknowledged, then the button face is red. If any alarm allocated to this station is not acknowledged, then the button face is blinking red/grey. When the button is pressed, the alarm presentation page is displayed.
Stop horn (F10)	Button face is grey. When the button is pressed, the local horn is silenced (but NOT acknowledged!) until a new alarm is activated.
F11Txt (F11)	Reserved
F12Txt (F12)	Reserved

Table 3-2 CIP generic functions

3.2.4.3 CIP Function key behaviour

Table 3-3 shows the text that will be displayed on the function buttons (F1 – F8) in the CIP whenever the operator focuses an element. As the CIP is implemented on several display types its behaviour especially those that apply to

button face texts may differ. The type of screen display will determine the details of this text and this is reflected in Table 3-3

	Display Type	F1Txt	F2Txt	F3Txt	F4Txt	F5Txt	F6Txt	F7Txt	F8Txt
	Mimics	< ---------- Element controls (element type specific)---------- >							Assist
	CAP (Assist)	Disable	Enable	Reset	< - Reserved - >		Select	Authorize	Return
	Alarm Presentation	ACK	Goto	History	< ---------- Reserved ---------- >				Return
	Historic pages (logs)	User Span	Default Span	< ---------- Reserved ---------- >					Return

Table 3-3 Function key texts

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 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. (See section 3.3 for details concerning the element control mode)
- The focussed element is classified for an function group currently not attached to your workstation. Function groups must be assigned to your workstation to be able to control the elements classified for that group. (See section 3.5.2 considering function allocation)
- 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.

3.2.5 Component Assist Page (CAP)

On each IPMS workstation, the component assist page (CAP) can be requested for each selectable platform component. When an element is focussed by a left-click the operator is able to access the CAP by pressing the 'Assist' key (F8)

The CAP presents general information relevant to the selected component such as parameters settings and additional information for maintenance purposes. To prevent unauthorised alteration of IPMS parameters, modification of those settings is password-protected.

Figure 3-6 shows an example of a typical CAP.

Figure 3-6 Example of a typical CAP

The CAP provides the following information:

- Generic element information such as:
  - Element ID;
  - Element type;
  - Element description;
  - Function group;
  - Controller location;
  - Main mimic associated with the element;
  - Alarm class
- Element I/O map information:
  - Physical Input(s) (including LPU_ID, I/O board, channel, reference ID);
  - Physical Output(s) (including LPU_ID, I/O board, channel, reference ID);
  - Virtual IO
- Element parameters:
  - User configurable IPMS parameters – Parameter changes are password protected.
- Extra information:
  - Logical functions showing the relations attached to the element in case it is not directly connected to physical IO. This may be applicable for unused element inputs or alarm inhibit functions; Logical functions are referenced by a reference ID that is also shown in the I/O map section.
- Tank tables:
  - This section is applicable to the tank sensor element (SSL) only. It will show the interpolation points defined for a specific tank to determine its contents (m^3) based on a calculated fluid height (m)

Table 3-4 details the function key assignment whilst displaying the CAP.

Key	Function
F1	Disable element. On entering the CAP, this function key is disabled by default, since disabling an element may disturb the automatic controls involved. The operator must 'Authorize' first using the F7 function key.
F2	Enable element. On entering the CAP, this function key is disabled by default, since the reason for disabling the element must be verified by authorized personnel. Once verified, the operator must 'Authorize' first using the F7 function key.
F3	When an event - or running hours element type is selected you may reset the accumulated value by pressing this button. The operator must 'Authorize' first using the F7 function key.
F4	Reserved for future use
F5	Reserved for future use
F6	Select another element. As already indicated, the CAP displays all the information available for the element in focus. Pressing the F6 key, displays a pop-up dialog box, allowing the focus to be shifted to another element.
F7	Authorize. Whenever parameter values need to be modified or the disable/enable status needs to be changed, the operator must 'Authorize' first. Pressing the F7 function key, displays a pop-up dialog box that prompts the operator to enter a password. Once validated, the operator may change the password by pressing the 'C'-key on the keyboard. On leaving the CAP, the 'Authorize' status is reset.
F8	Return to mimic as indicated for the element currently in focus. When focus has been shifted to another element (By using the 'Select' key (F6)) the HMI will attempt to find that object as soon as the 'Return' button is pressed. Element search may take about 5 seconds.

Table 3-4 CAP function key assignment

3.2.6 Introduction to mimic symbols

This sub-section details the symbols used on the mimic screens of the IPMS. For further details of the element types and their related animations, refer to the Technical Specification HMI, [5]

3.2.6.1 Mimic colour scheme

The colour scheme detailed in Table 3-5 is employed on the IPMS mimics.

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

Table 3-5 Mimic colour scheme

The static colours for pipeline circuits and non-animated symbols employed on the IPMS mimics are shown in Table 3-6.

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

Table 3-6 Colours for pipeline circuits and non-animated symbols

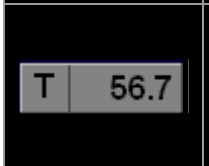
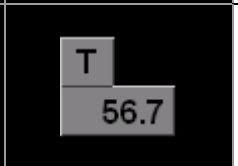
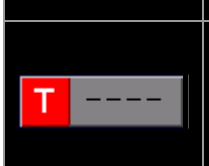
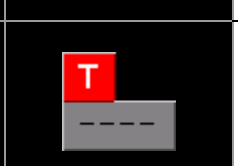
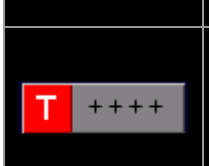
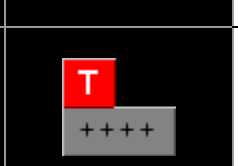
3.2.6.2 Sensor elements

Sensor elements shown on the mimics indicate the measured values, for example, pressures, temperatures, etc. The actual sensor value is shown as black text on a grey background. Where the measured value is one of the default-engineering units listed in Table 3-7

Character	Meaning	Default engineering unit []
T	Temperature	Degrees centigrade [°C]
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 3-7 Engineering units used for analogue sensor elements

The sensor symbol shows the status of the sensor by its colour. The applicable animations are show in Table 3-8.

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)

Symbol animation	Symbol animation	Type indicator	Display	Status description
		White type ID on a red background	Black asterisks on a grey background	Wire break detection (Not applicable to all analogue element types)

Table 3-8 Symbol animations of an analogue sensor value

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. Since it is deemed to be more apparent numeric sensor symbols (See Table 3-8) will be used along with the use of bar graphs.

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

Figure 3-7 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'

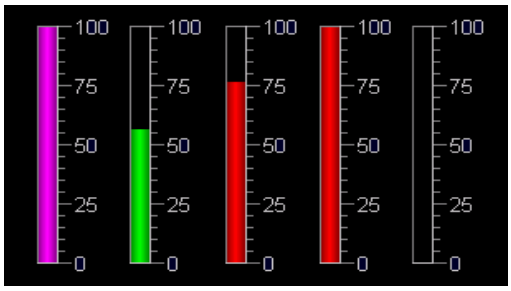


Figure 3-7 Examples of the use bar graphs

The bar graph symbol might be used for tank elements (SSL) also. By default, the tank content is displayed in cubic metres, but other engineering units used for 'fluid level', 'fluid mass' or 'tank content in terms of percentage' may be used as well. (This is application specific) When focussing on this type of element the CIP however will display the actual tank volume (m^3).

3.2.6.3 Motors, pumps and fans

Motors, pumps, fans etc. are controlled via their relevant starter unit. Colour animation is used to show the actual status. Table 3-9 shows several applicable symbols along with their state description.

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

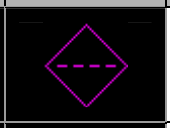
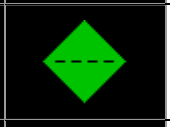
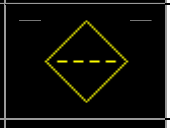
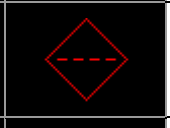
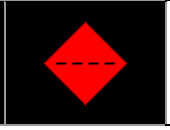
Centrifugal pump	Piston pump	Fan (single speed)	Generator	Separator	Filter	Status description
						Disabled OR Unavailable
						Stopped
						Running
						Stopped, the device is not ready for use
						Stopped, but device failed to start
						The device is running but failed to stop OR Faulted OR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

Table 3-9 Single speed motor colour animation

Some fans can run in both directions (supply or exhaust) or feature a low - and a high-speed mode. To cover this the monitoring states are extended (see Table 3-10).

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)

Bi-directional fan	Double speed fan	Circle	Fan	Arrows	Status description
		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 3-10 Dual speed motor colour animations

3.2.7 Standby pumps

Some motor starter units support a 'motor standby' mode. 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 (Table 3-9). However, some extra animations have to be specified to indicate the 'not in standby' mode. Table 3-11 shows animations additional to those specified for a single speed motor element along with their state description gained by the symbols used for a centrifugal pump.

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 3-11 Standby pump additional animations

3.2.7.1 Valve control element

Valves are represented on the mimics in accordance with the details shown in Table 3-12

Element	Symbol animation Standard valve	Symbol animation Non-return valve (→)	Status description
Valve Control Element Or 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 3-12 Valve colour animation

3.2.8 Proportionally Controlled Valve Element (VCP)

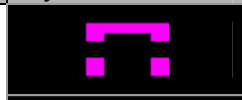
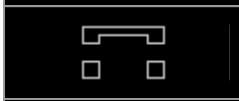
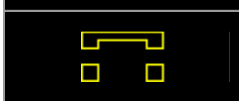
This type of element features proportionally controlled valve monitoring and control functions. Colour animation is done according to Table 3-13. A numerical display beneath indicates the valve ‘open’ value in terms of percentage.

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 3-13 Proportionally controlled valve colour animation

3.2.8.1 Circuit breaker element

Circuit breakers are represented on the mimics in accordance with the details shown in Table 3-14.

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

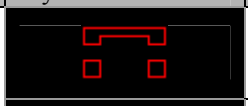
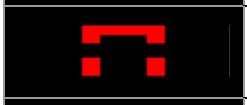
Element	Symbol animation	Description	Status description
		Not connected, Red border, filled black	Failed to close OR Tripped
		Not connected, Red border, filled red	Undetermined
		Connected, Red border, filled red	Failed to open

Table 3-14 Circuit breaker colour animation

3.2.8.2 Switch element

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 3-7) 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 3-15) 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 3-15.

All switch symbols are animated according to the following table:

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

Table 3-15 Switch element colour animation

3.3 HMI Operator control

Besides the user role that indicates if the operator has control rights or not, the control mode of the applicable element is relevant also. Several control modes might be applicable:

LOCAL	The element is controlled nearby the object itself using a local control panel
REMOTE and MANUAL	The element is remote controlled by an operator via an IPMS workstation
REMOTE and AUTO	The element is remote controlled by an automatic process

A selector switch illustrated by Figure 3-8 visualizes the control mode mechanism applied.

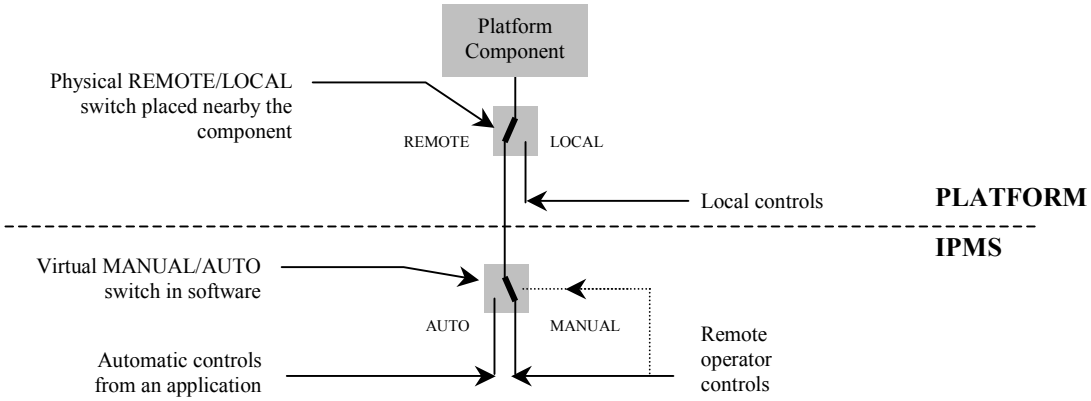


Figure 3-8 Control mode switch mechanism

Considering Figure 3-8 it can be seen that when the control mode is REMOTE and AUTO then an automatic process is in control of the platform component. An operator is able to control the component via the IPMS from remote provided that the component's control mode is REMOTE and 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.

Notice that a local operator is able to override all commands given from remote by toggling the 'REMOTE/LOCAL' switch to state 'LOCAL'. This might be the reason that a platform element is not controllable from an IPMS workstation despite the fact that its function group is allocated. Likewise, if the control mode is 'REMOTE/AUTO' then a remote operator is still not able to control the element manually since an automatic process controls it. The remote operator is able to toggle the 'MANUAL/AUTO' mode of an element as long as its 'REMOTE/LOCAL' switch is in state 'REMOTE'. Once the control mode is 'REMOTE' and 'MANUAL' then he is able to control the element from his workstation provided that the function group of the element is allocated. Notice that the actual element control mode is displayed by the CIP whenever the operator focuses it by a left-click on its symbol. (See section 3.2.4 considering CIP functions.)

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 3-16)

If both control modes are applicable then hence both handles will be displayed.

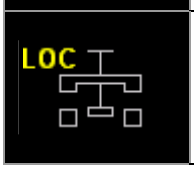
Symbol shown	Description
	A centrifugal pump that is currently running in control mode REMOTE/AUTO. Control mode REMOTE/MANUAL applies to this component also.
	A centrifugal pump that is currently running in control mode REMOTE/MANUAL. Since this control mode deviates from the default mode, 'MAN' is 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.
	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 3-16 Control mode label examples

3.4 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's id-code.

The element's id-code is attached to the symbol that represents the component to link it with the element processing software that resides in 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 aiding the search for a certain element id.

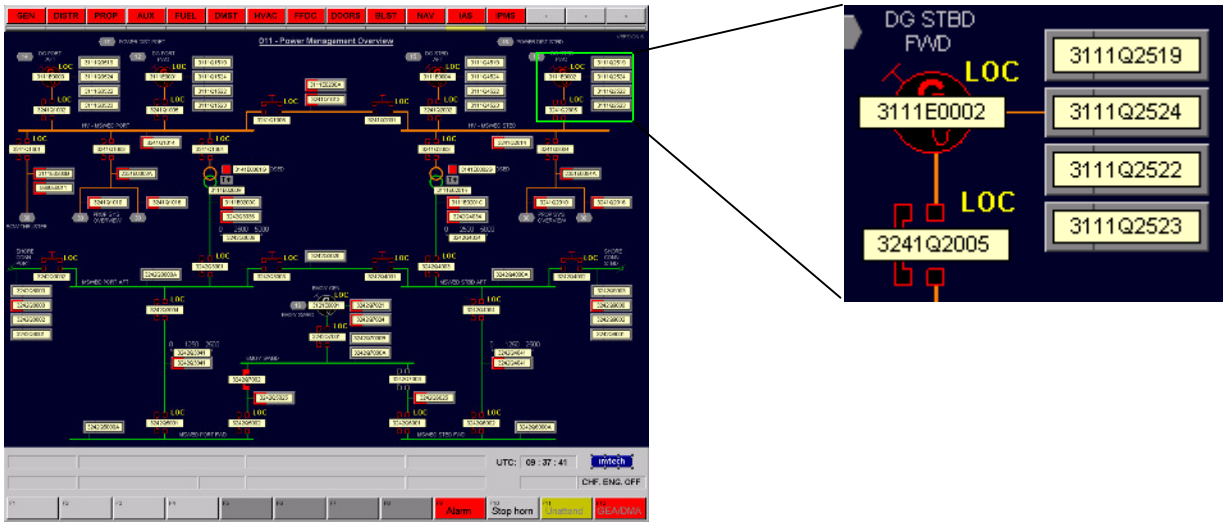


Figure 3-9 Element id's visualized by their labels

3.5 HMI functions

Besides basic monitoring and control functions the HMI features several additional functions to support both the operator and the maintainer.

3.5.1 Mimic screen navigation

A mimic is a functional graphical display that represents one or more platform installations by showing relevant schematics wherein actual platform object's statuses are visualized by colour and/or shape animations that are specified by document: Technical Specification IPMS HMI, ref.[5]. Some mimics do not represent installations. Instead they offer relevant information to the operator, such as an alarm list, table of contents etc.

Mimic screen navigation can be done several ways:

As soon as the IPMS client application starts it will show an IPMS welcome screen for about 10 seconds. After this the IPMS 'Table Of Contents' page is shown. The operator can call the 'Table Of Contents' page from any mimic (except when the welcome screen or the CAP is shown) by pressing the 'HOME' key on the keyboard. A typical Table Of Contents mimic is shown in Figure 3-10.

Figure 3-10 Typical Table Of Contents mimic

The mimics are grouped under headings according to the functionality available within them.

Select a mimic from the table of contents mimic by a left-click of your pointing device on one of the mimic titles shown. The numbers shown are a reference to access the required mimic immediately from any other mimic by typing the number.

When a mimic is called by reference a dialog like the one displayed in Figure 3-11 will appear on the workstation screen as soon as the first numeric character is detected. Click the 'OK' button or press the 'Enter' key afterwards to jump to the applicable mimic;

Figure 3-11 Navigation dialog

Another way to jump to another mimic is possible by left clicking the special hyperlink icons sometimes used when mimics are related to each other. An example of a typical hyperlink icon applicable to mimic number 550 is shown in Figure 3-12.

Figure 3-12 A typical mimic hyperlink icon

When there is no keyboard available the operator still is able to navigate using his pointing device by clicking on the IMTECH logo that is displayed in the lower right corner of the screen. The navigation dialog, like the one displayed in Figure 3-11 will be shown. (This is not supported from the assist screen. When the assist screen is shown you have to enter a mimic first by clicking on the 'Return' (F8) or 'Backspace' key)

Additionally there are certain keys that are configured to perform special functions to aid navigation of the mimic screens. These are identified in Table 3-17:

Key	Function
HOME	Return to home page, i.e. mimic 001.
↑	Jumps to previous mimic identified in mimic 001, i.e. if operator is currently viewing mimic 025, then pressing PAGE UP, will allow mimic 024 to be viewed.
↓	Jumps to next mimic identified in mimic 001, i.e. if operator currently viewing mimic 025, then pressing PAGE DOWN, will allow mimic 026 to be viewed.
←	Returns to previous mimic visited. Further use of the '←' key will allow the operator to re-visit the mimics previously viewed in this session (max. history depth is 8).*
→	Forward to a mimic previously visited. Further use of the '→' key will allow the operator to re-visit the mimics previously viewed in this session (max. history depth is 8).*

* : Once the operator creates a mimic navigation loop i.e by calling a mimic that already exist in the navigation history, the history depth might be shorter. Mimics will be revisited over and over again by pressing either key '←' or '→'. Escape from the loop by entering another mimic reference number.

Table 3-17 Special keys to aid navigation around mimics

In some configurations, dual screens workstations may apply. In these instances, it is possible to move the cursor between both screens using your pointing device. When both screens show the IPMS, CIP buttons are moved to the focussed screen to indicate the active function key assignment.

3.5.2 Function allocation (and other IPMS related functions)

The function allocation mimic shown in Figure 3-13 is used to allocate the control functionality of function groups to the relevant operator workstations. IPMS Components (like sensors, motors, circuit breakers etc.) are grouped in so called function groups. An operator needs control access rights for a relevant group before components allocated to this group can be controlled from his workstation. Each group can only be allocated to a single workstation and similarly, the underlying components within the function groups can only be allocated to a single group. In this way it is not possible to control a component from two different places at the same time.

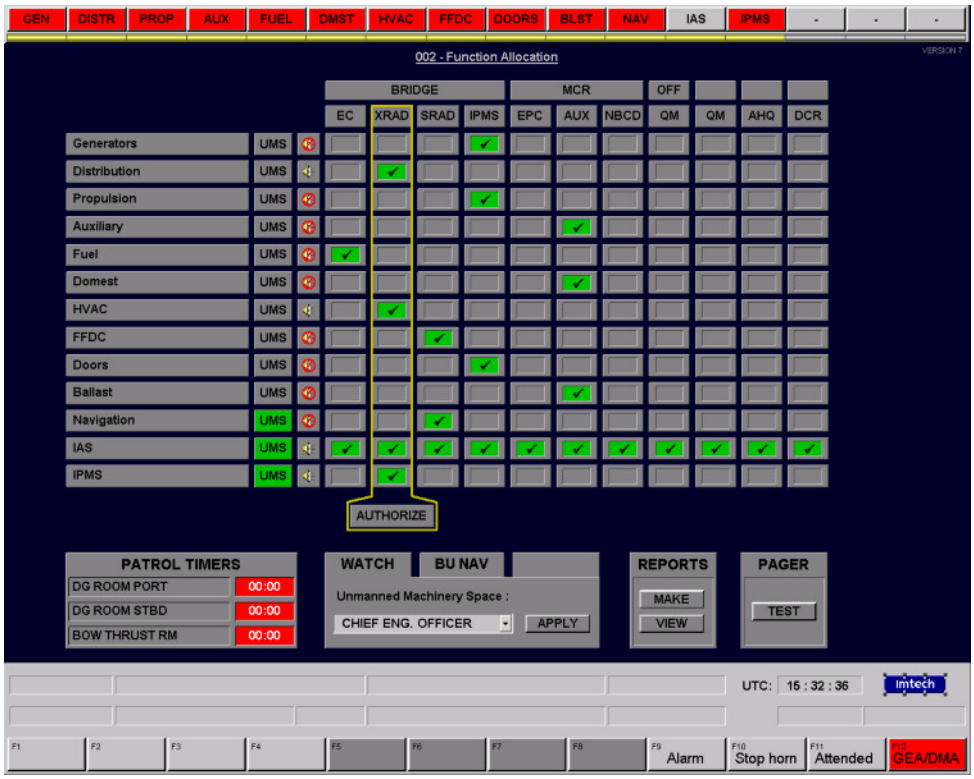


Figure 3-13 Typical function allocation mimic

To assume control of a group, access the function allocation mimic (refer to the 'Table Of Contents' mimic to search for the reference number) from your workstation and then perform the following sequence of operations.

Assuming that the function allocation mimic is visible now you may click on the 'AUTHORIZE' button and enter the relevant password.

- If the 'AUTHORIZE' button is not visible then your workstation is configured for monitoring access only!
- If the 'AUTHORIZE' button has been greyed out, function allocation is in progress. Try again later.
- If there is no 'AUTHORIZE' button but a 'EXECUTE' button instead then you've authorized already.

Once you've authorized, the button label will change to 'EXECUTE'. Then in your highlighted column, click on the square at the intersection with the row labelled IPMS. The square will begin to blink to indicate that a function re-allocation is pending for this user. The EXECUTE button will start blinking as well. To complete the action, click on the 'EXECUTE' button to perform the activation.

Note:	Due to safety regulations, elements installed in the 'NAVIGATION' group must be allocated to one of the IPMS workstations located on the bridge. It is not possible to allocate this group from one of the other IPMS workstations.

Note:	Due to safety regulations, elements installed in the 'IAS' group are allocated to each workstation with IPMS control abilities. I.e. when an IAS alarm is activated, it will appear on the alarm presentation of all of the workstations that have group IAS attached to them. However an IAS alarm must be acknowledged just once by one of the IPMS workstation operators.

Once the ‘EXECUTE’ button has been pressed, an alarm list will be displayed listing all active alarms applicable to the groups to be assigned to your workstation. You have to confirm acceptance of these alarms before the workstation can assume control of the group(s) being reallocated to your station. This confirmation is actioned by pressing the ‘CONFIRM’ button on the alarm list page within 30 seconds – failure to perform this action within the time limit will result in the function allocation being cancelled. Similarly, if the user accesses another mimic screen once the password has been entered, then on returning to the Function Allocation page, the authorization password will have to be re-entered.

3.5.2.1 Other IPMS related functions

Besides function allocation, the IPMS may feature the following functions

- It is possible to enable/mute the alarm horn when alarms occur in function groups other than the group(s) currently assigned to your workstation. To do this, simply click on the relevant loudspeaker button. Once you’ve enabled the alarm horn for at least one of the groups currently NOT attached to your station you will be notified on alarm occurrences classified for that (those) group(s). Though you are not allowed to acknowledge these alarms (after all, you are not responsible for them) you are able to have a look at the alarm message by accessing the applicable slave alarm list from the alarm group bar.

  It is not possible to mute alarms occurring in the function group(s) currently assigned to your workstation since you are responsible for those function groups. Hence, you must be notified on every alarm occurrence that applies to one of them.

- If the ‘Unmanned Machinery Space’ (UMS) is provided then this mimic enables function groups to be marked as unmanned provided that UMS is currently not active. To do this, simply click on the relevant ‘UMS’ button. The button is coloured green to indicate that the selected machinery space is assigned to UMS. Note that this is just a pre-selection since UMS is not activated yet!

  Once all alarms in the UMS have been acknowledged UMS mode can be activated. The CIP will provide a button to activate/deactivate UMS, provided that the IPMS group is assigned to your workstation.

  UMS mode indicates that the operator is not present at the ‘station-in-control’ workstation(s) that have the Unmanned Machinery Space installations allocated to them and is either patrolling the machinery spaces or doing routine maintenance in the engine rooms. The Duty Supervisor will be notified (either by his pager and/or the local operator panels) in case an alarm applicable to the UMS allocated groups is activated. Whenever this happens the duty supervisor is expected to silence his pager/local operator panel sound and to access one of the IPMS workstations as soon as possible in order to acknowledge the alarm within 6 minutes. Otherwise a General Engineering Alarm (GEA) will be issued.

- If the ‘Unmanned Machinery Space’ (UMS) applies then the Duty Supervisor can be selected by using the functions available on this mimic provided that the workstation has control of the IPMS function group and UMS is not activated. To alter the current selection, simply make a new selection from the list displayed on the ‘WATCH’ sub-page and click ‘APPLY’ afterwards. All of the local operator panels will reflect the selection made.

- If the ‘Unmanned Machinery Space’ (UMS) applies then any of the Duty Supervisors, whether ‘On Duty’ or not, can be called by his local alarm panel from any of the IPMS workstations provided that the IPMS group has been allocated to that workstation. A ‘CALL’ checkbox is provided for each of the ‘callable’ Duty Supervisors on the ‘CALL’ sub-page. It is possible to call more than one person at a time. If the IPMS group has not been allocated to your workstation, then the CALL buttons are locked/disabled. However it is still possible to view

who has been called as the relevant CALL checkbox is ticked.

Clicking on a CALL checkbox from an authorized workstation will cause the TAB title start flashing yellow. This will cause an audible alarm signal at that person's Cabin Alarm Panel. Subsequently the call can be acknowledged by pressing the 'STOP HORN' button on the applicable Local Operator Panel. This will cause the 'CALLING' status to be reset. As a result the CALL checkbox will return to its normal state. The person being called is expected to contact the 'calling' operator. If the person being called does not acknowledge the call, then the caller may reset the call by ticking the CALL checkbox again.

- If the backup navigator feature applies then a 'BU NAV' sub-page is shown on this mimic as well. You can select a backup navigator from the list provided that the IPMS group is currently attached to your workstation. Once UniMACS detects no activity on the bridge for a certain period of time the backup navigator selected will be notified by a horn sound. Furthermore an IPMS alarm will be issued for function group 'Navigation'

- If at least on Patrol Watch Timer is featured then an indication of the Patrol Watch Timer status is also given on this mimic.

- If the pager IPMS option is installed then this mimic enables you to test IPMS - Paging system link by pressing the 'TEST' button. Your pager should respond as specified for your project.

- The operator is able to take a look at the user defined reports stored on either the primary or the secondary server. The reports stored on the master server are listed once the operator presses the 'VIEW' button in the 'REPORTS' section. The dialog comparable to the one shown in Figure 3-14 will appear. Reports older than 30 days are assumed to be out of date and therefore they will automatically be removed from the system. Assuming the operator wants to open the latest report this is the report that is selected by default.

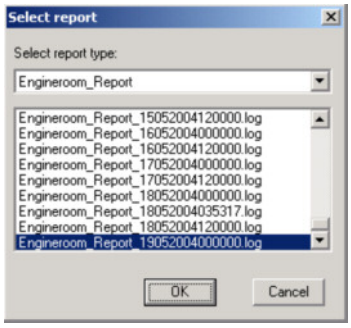


Figure 3-14 Typical View report dialog

Normally reports are generated in a pre-defined time schedule. (Notice that the timestamp of report generation is embedded in the report file name.) However, you can trigger report generation manually at any time by pressing the 'MAKE' button in the 'REPORTS' section provided that the workstation is in control of the IPMS group.

See Maintenance Manual, ref. [17] for a detailed description about making report template files.

3.5.3 Integrated Automation System diagnostics

The IAS overview mimic (An example of this mimic is shown in Figure 3-15) is used to display and monitor the status of the IAS Client Server Network components, for example, network switches, servers, etc.

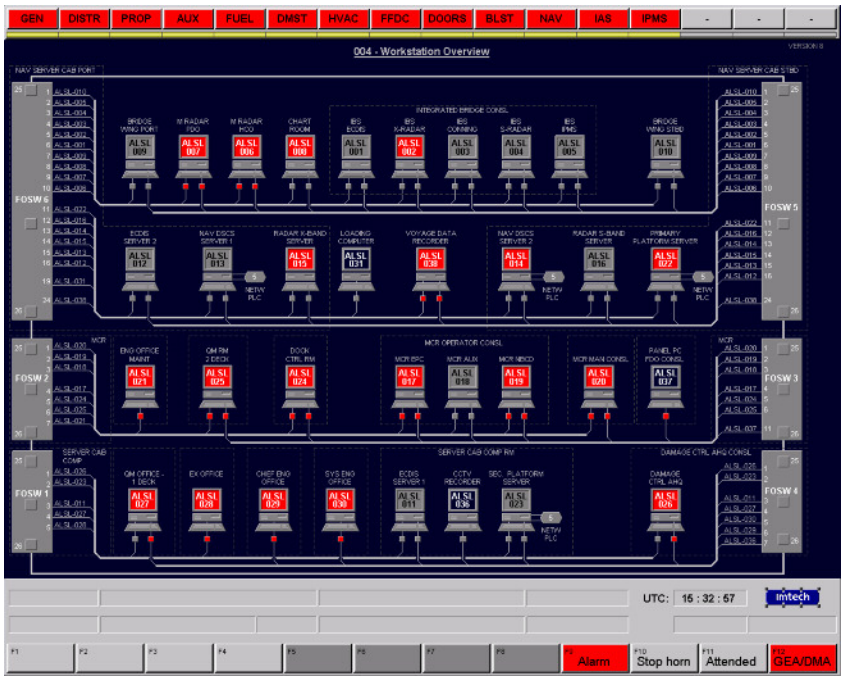


Figure 3-15 Typical IAS overview mimic

The computer name, identifying each computer on the network, is shown inside each computer icon along with a colour indicating the status of the computer itself.

Where applicable, the status of the computer's network interface cards (used to interface the Client Server Network) is indicated by a square shaped dot below the relevant computer icon. Whenever the PC features a redundant network interface then the status of both network interface links is shown.

Similarly, for the network switches, their status shows both the fiber-optic network status and the healthiness of the network switch itself.

The following colour code is used on this mimic:

- Status OK – grey;
- Status Unavailable/Indeterminate – purple; and
- Fault status – red.

The exact mimic layout is project specific and depends on the applicable IAS structure.

3.5.4 IPMS equipment diagnostics

The PLC network architecture mimic (An example is shown in Figure 3-16) shows the availability and status of the Platform Data Network along with IPMS interfaces' statuses. Moreover, this mimic shows you diagnostic information about both the IPMS servers and the applicable LPU's and LOP's.

The exact mimic layout is project specific and depends on the relevant IAS structure.

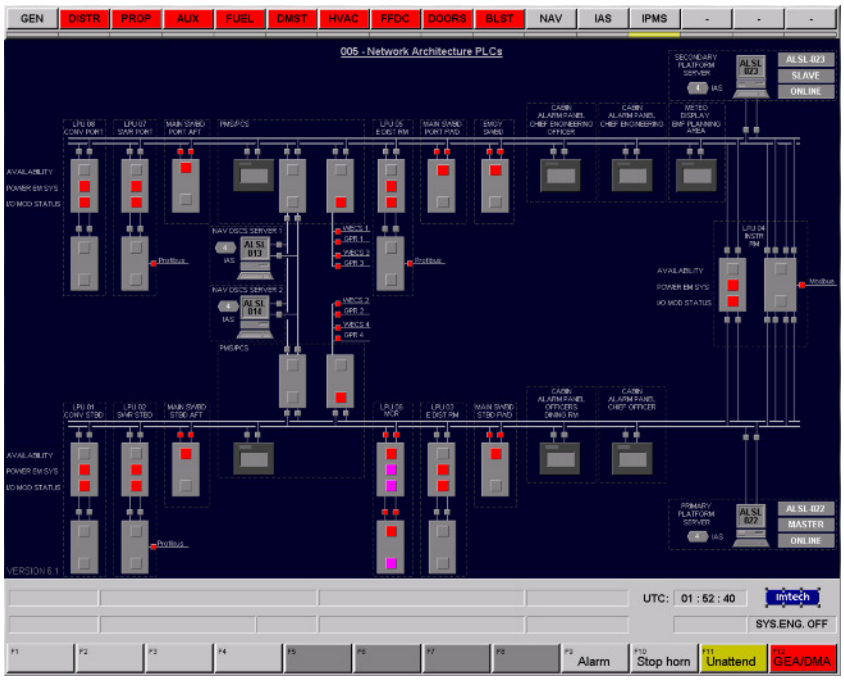


Figure 3-16 Typical PLC network architecture mimic

The following colour code is used on this mimic:

- Status OK – grey;
- Status Unavailable/Indeterminate – purple; and
- Fault status – red.

3.5.5 Element enable/disable functionality

Platform components that are out of order or that are in repair may transmit signals that are wrong or that are not significant for the operator. It is possible to suppress these signals and to prohibit operations. Moreover, when the parameters of an element have to be altered the concerning element has to be disabled first.

As a result of element disable the concerning alarm notifications are rectified on the alarm screen while the element's actual status is no longer reflected by its animated symbol (See section 3.2.6 for an animation overview of symbols in their disabled state.). Furthermore most of the operator commands for this element are disabled.

When an element has been repaired or when the maintenance has been finished, the concerning element can be enabled again. For the IPMS this means that the element is included (again) in the installation. So, then element states are generated, all operator commands are permitted (if they were enabled before) and current alarm notifications are presented on the alarm screen.

To enable/disable an element the operator has to focus it by clicking on its symbol. In a next step pressing the 'Assist' button (F8) will call the CAP screen. Provided that the function group the element is classified into is attached to the workstation, the operator can press the 'Authorize' button (F7). A dialog window wills pop-up asking the operator to type-in a password. When authorized, the operator buttons (element enable (F2) and element disable (F1)) are enabled. Pressing the F1 or F2 button will send the relevant command to the CPU controlling the element concerned.

To get an overview of all the elements being in a disabled state the operator may call mimic 200. A list of disabled elements is generated on screen open. An example of this screen is displayed in Figure 3-17

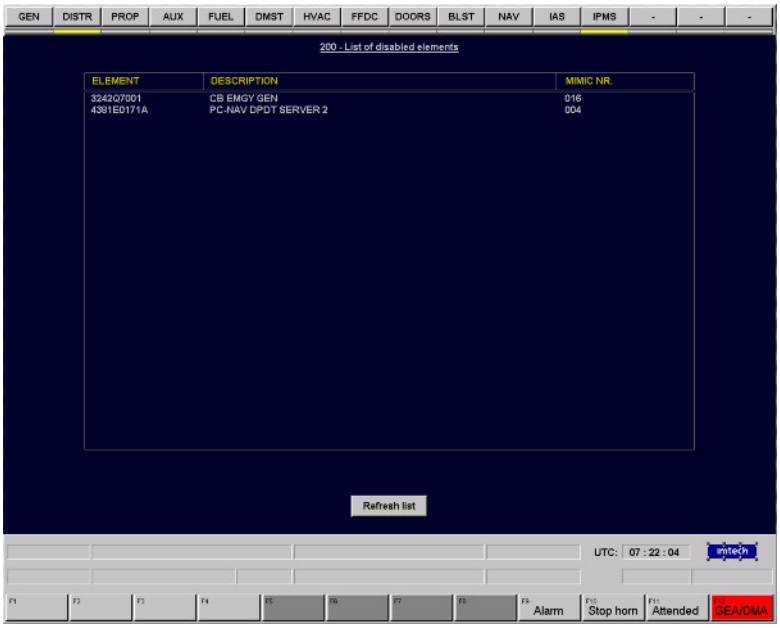


Figure 3-17 List of disabled elements mimic

Along with the element ID and the element description, this list also indicates the mimic number on which the elements are displayed.

3.5.6 Modifying an element parameter value

Element parameters can be modified from the CAP screen. The element needs to be disabled first before its parameter values can be altered. Section 3.5.5 describes how this can be done. As soon as the element is in a disabled state and authorizing is done the operator is able to select a parameter value by a left-click of his pointing device. A dialog window like the one displayed in Figure 3-18 enables the operator to type-in a new parameter.

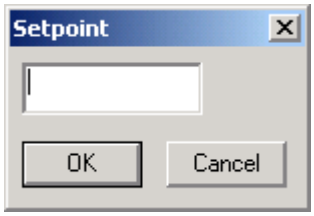


Figure 3-18 The parameter setpoint input dialog

Clicking the 'OK' button or pressing the 'Enter'-key on the keyboard will forward the parameter value to the applicable PLC, as this is the place where parameter values are stored. Accepted parameter changes will be reflected to the HMI within 5 seconds.

3.5.7 Altering setpoints

If the operator intends to alter a setpoint value concerning a proportionally controlled platform object he has to focus at the relevant valve element first by clicking on its applicable symbol. In case the operator is authorized to alter the setpoint then the CIP display changes as shown in Figure 3-19.

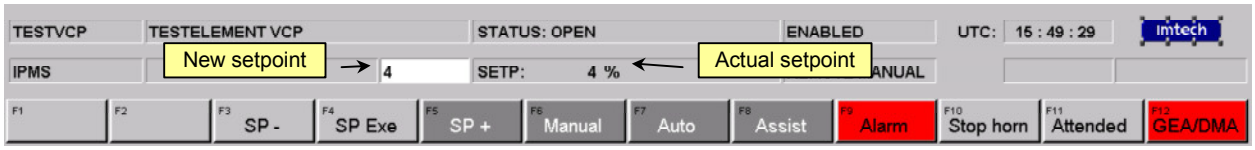


Figure 3-19 Example of changing a setpoint value

A white field appears showing a 'new setpoint' value. Initially this field will show the current setpoint value. Pressing function key 'F3' will lower the new setpoint value by 1 percent of its range till its low limit is reached. Likewise, pressing function key 'F5' will raise the new setpoint value till its upper limit is reached. Notice that the actual setpoint stays unchanged till function key 'F4' is pressed. If the operator wants to enter a value immediately rather than by pressing the 'SP-' (F3) or 'SP+' (F5) buttons a number of times he may click on the value displayed in the white box. A pop-up dialog window like the one shown in Figure 3-18 makes it possible to enter the new setpoint value.

The control time-gate (See 3.2.4.3) timer halts as long as the pop-up dialog is shown. This enables the operator to input a new setpoint value. As soon as the dialog is closed and the 'new setpoint' field shows the correct setpoint value it must be sent to the PLC by clicking at the 'SP Exe' (F4) button. Note that the 10-second control time gate is operational again after you've closed the 'new setpoint' dialog. If the control time expires before you're able to press the 'SP Exe'(F4) button your new setpoint input will be ignored.

Once the relevant platform controller accepts the new setpoint then the actual setpoint field will show the new setpoint shortly after you've pressed the 'SP Exe'(F4) button.

3.5.8 Running hours

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 component are in operation. The predefined platform components are in most cases components with rotating parts, like compressors, pumps and engines.

Figure 3-20 Typical running hours mimic

The mimic shown in Figure 3-20 is used to show the time (in hours) a component has been in operation. Whenever a component is replaced or a maintenance action is performed, the operator can reset this value from the CAP provided that he can authorize.

3.5.9 Switching events

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 keeps counts and records the number of switch events of selected, predefined platform components. The predefined platform components are in most cases components with switching elements, like circuit breakers.

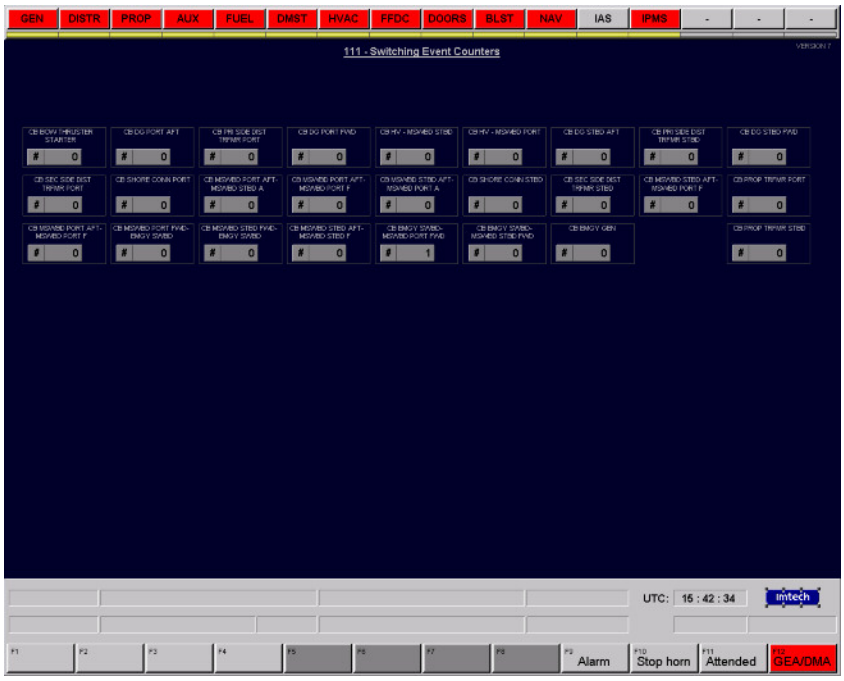


Figure 3-21 Typical switching event counters mimic

The mimic shown in Figure 3-21 is used to show the number of switching events a component has completed. Whenever a component is replaced or a maintenance action is performed, the operator can reset this value from the CAP provided that he can authorize.

3.6 Data logger

To enable the technical monitoring of the installation groups, the condition of certain parts of the installation is recorded regularly.

On the basis of this data, and with the help of technical analysis, it is possible to predict the future behaviour and/or performance of the installation group concerned. As a consequence, it is possible to plan for major, preventive repairs during periods when the ship is in harbour as well as aiding the planning of routine maintenance on board the ship.

The following data types are logged with a predefined sampling rate or on a certain event:

Data instance	Sampling rate	Event description	Archive period
Alarm events	-	Generate, acknowledge, reset and delete	TBD
Analogue values	3 seconds	-	TBD
IPMS platform commands		On command	TBD
Platform parameters		On change	TBD
Running hours counters	3 seconds	-	TBD
Switch event counters	3 seconds	-	TBD

Table 3-18 Data logger properties

3.6.1 Obtaining IPMS history information from the logger

There are several ways to access the information being logged by the data-logger. The most convenient way however to access this data is by using the tools provided by the HMI. The HMI features several tools to gain insight into the IPMS historical behaviour. If the data-log was triggered by an event then a list of events suits the best to have a look at the records. This, for instance, applies to the alarm history viewer (described by section 4.3) but it is useful for visualization of 'Command History' (section 3.6.1.1) and 'Parameters History' (section 3.6.1.2) as well.

If the data was logged periodically then it is best 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. See section 3.6.1.3 for details concerning signal trending.

3.6.1.1 Command history

A lists of IPMS historical operator commands like the one shown in Figure 3-22 is available from the command history. The records shown are derived from the data-logger database being linked to the IPMS server that is currently acting as the master server. I.e. no records can be retrieved when the current master server was offline at the time span of interest.

The command history comprises three columns:

- timestamp UTC timestamp logged for the applicable command;
- point_id Workstation identification responsible for giving the applicable command. For example: 'USERS.**MCR_AUX**.CMD' indicates that the command was given by an operator at workstation MCR_AUX (=Machinery Control Room, Auxiliary position)
- _VAL The element_id code along with operator command (separated by a hyphen). If the command applies to a proportionally controlled element then the new setpoint value is logged as well as soon as the operator presses the 'SP Exe' (F4) button.

By default all IPMS operator commands given in the past 24 hours are shown when this mimic is called. You can adapt this time span as well as the start- and end time by pressing the 'Span'(F1) button. Furthermore it is possible to filter for commands given for a specific element or given by a certain workstation by using the 'Filter'(F6) button.

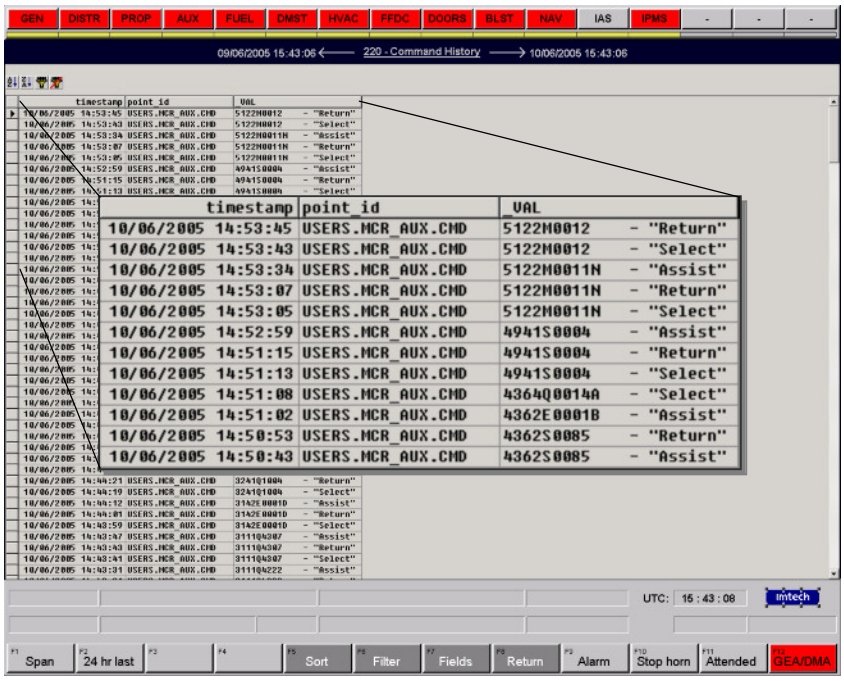


Figure 3-22 Typical command history

3.6.1.2 List of parameter changes

A list of IPMS parameter changes like the one shown in Figure 3-23 is available from the parameter change history. The records shown are derived from the data-logger database being linked to the IPMS server that is currently acting as the master server. I.e. no records can be retrieved when the current master server was offline at the time span of interest.

The list of IPMS parameter changes comprises five columns:

- timestamp UTC timestamp logged for the applicable parameter change;
- point_id Parameter identification composed of 'Element_id' and 'parameter_id';
- _PREV Old parameter value;
- _VAL New parameter value;
- _ENG Engineering value applicable for the parameter.

By default the list of parameter changes shows all records logged during the past 30 days as soon as this mimic is called. You can adapt this time span as well as the start- and end time by pressing the 'Span'(F1) button.

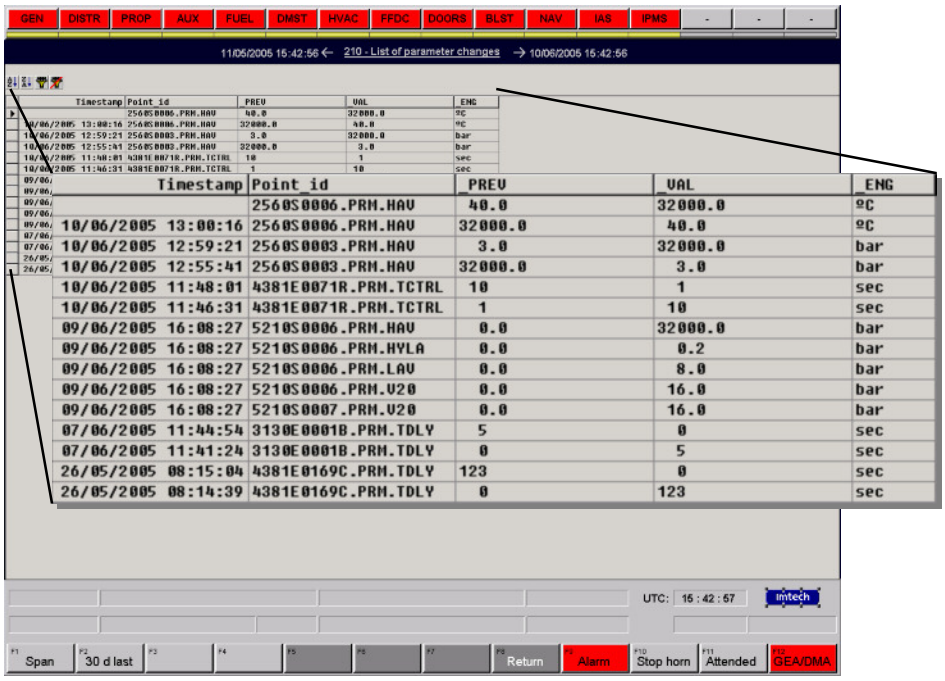


Figure 3-23 Typical list of parameter history

3.6.1.3 Signal trending

To gain insight into the behaviour and the performance of platform components, it is possible to record, for a limited period of time and with a predefined sampling rate, the values that are derived from the output signals of platform components, and to present the results of the recording in a graphical trend presentation (historical and real time).

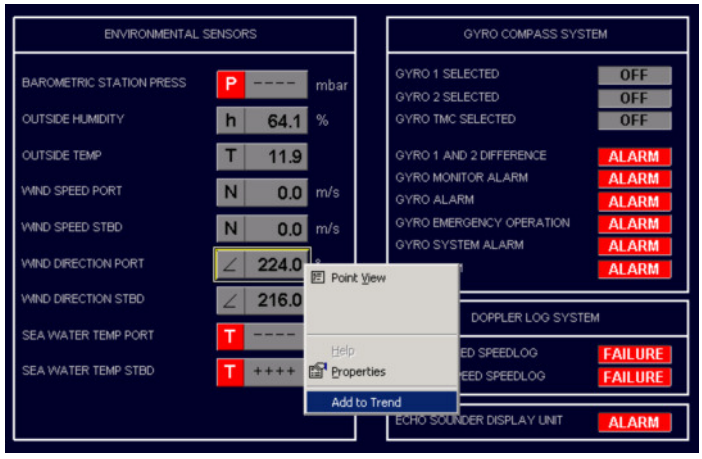


Figure 3-24 How to open a trend window

The signal trending mimic is displayed as a pop-up child window and can be called from every IPMS workstation by right-clicking an animated symbol and then selecting 'Add to Trend' from the menu (See Figure 3-24). Depending the type of element involved one of the following pop-up dialogs will appear.

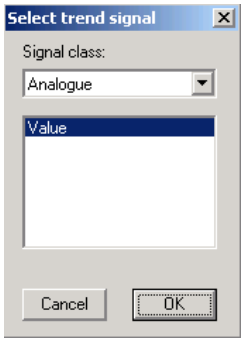


Figure 3-25 Trend signal selection (analogue)

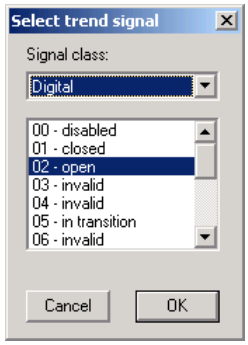


Figure 3-26 Trend signal selection (digital)

Although it is assumed that the operator wants 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. 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 will be displayed. The operator may still proceed adding the signal however since there is no historical data available only real time trending data is displayed.

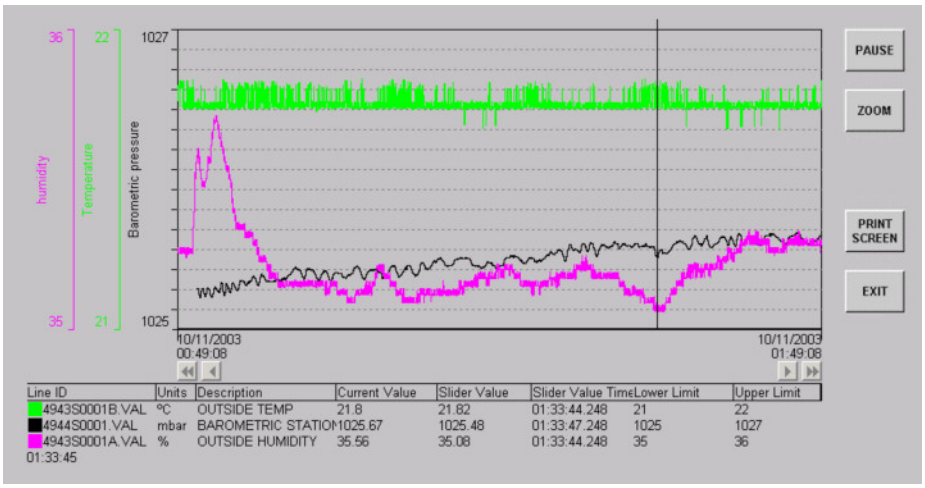


Figure 3-27 Signal trending mimic

A maximum of ten signals is supported. 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 signal trending mimic without adding further signals. Functions for changing time span, pause, zoom, etc. are available via buttons located along the trend. Advanced functions are available by double clicking the trend object.

3.7 RFA condition monitoring

Having reliable information about the status of the main doors and hatches is vital for making the correct decision on the actions to be taken, especially during damage-, fire- and NBC-alert conditions. Therefore the status of the main doors and hatches is presented on various mimic pages of the IPMS.

For RFA condition monitoring, the IPMS optionally provides a dedicated NBCD mimic. (Figure 3-28 shows an example). This mimic provides a brief overview of the NBCD state of the ship.

Figure 3-28 Typical NBCD overview mimic

The defined RFA conditions are shown in Table 3-19.

RFA condition	Description
4	Harbour
4N	Harbour with NBC threat
3	Peace time cruising
3N	Peace time cruising with NBC threat
2	War cruising
2N	War cruising with NBC threat
1	Immediate risk of damage
1N	Immediate risk of damage with NBC threat

Table 3-19 RFA conditions

The information shown on the NBCD mimic is grouped in terms of components (e.g. fire doors, fire detectors, etc.), fire zones and decks. Using the overview mimic, it is possible to quickly navigate to the relevant fire detection/NBCD/ventilation mimic that provides more detailed information.

Using the NBCD overview mimic, the RFA condition can be set from a workstation that has been allocated the FFDC function group. This is achieved by simply clicking the relevant tick box corresponding to the RFA condition prevalent at the time.

The actual RFA condition and the component's NBCD marking determine whether or not an alarm is presented on the alarm screen.

3.7.1 Citadel Monitoring

During a NBC alert situation, some parts of the ship need to be sealed off from the environment to create a "citadel". During that situation, a number of doors and hatches need to be closed to create the citadel. The selected "NBC alert condition" determines which doors and hatches need to be closed. The citadel monitoring function compares the actual state of the doors and hatches with the required state of doors and hatches during a certain "NBC alert condition". Using the NBCD overview mimic it is possible to indicate whether or not the bridge forms part of the citadel.

The doors and hatches that are not according the required state are clearly indicated on the mimics. The IPMS generates an alarm for each identified opening that gives access to or from the citadel when the citadel monitoring function is activated.

3.8 Shutdown procedure

Although there is no formal shutdown procedure, it is considered best practice to power down the individual systems of the IPMS in the following order:

- Operator workstations (including Local Operator Panels);
  - Prior to powering down the operator workstations they should be stopped by a shutdown.
- IPMS servers
  - Prior to powering down the platform servers, the SCADA system on both the primary and secondary platform servers should be stopped by a shutdown. The procedure for doing this is detailed in the IPMS Maintenance Manual, ref. [17]
- PLC's. (LPU's, PMS and PCS)
  - Please mind the PLC processor memory backup capacities whenever the IPMS system is powered down. Since PLC memory might be volatile and a fresh battery lasts about 1 month maximum, down time should be minimized (at least for the PLC processor modules) otherwise you might need to download the latest PLC software into the applicable module(s) again. Moreover, these backup batteries cannot be recharged so their conditions might not be optimal after all.

    See IPMS Maintenance manual, ref. [17] for a detailed description about downloading IPMS software.

4. Alarm handling

4.1 General

The operator's attention is drawn to the existence of any abnormal platform status by means of an alarm notification.

To aid the operator to detect such an abnormal platform status, the 'station-in-control' workstation activates an audible alarm. By pressing the 'Alarm' button (F9) from the CIP the applicable alarm message(s) will appear on the alarm presentation screen.

Note:
The 'station-in-control' workstation is the workstation that has been granted control of the function group via the function allocation mimic (see section 3.5.2). When groups are allocated to operator workstations a distinction is made between a master and a slave allocation. In the case of a master allocation, the function group can be monitored (including alarm notification) and controlled from that operator workstation. As this is the workstation that is responsible only this workstation is able to acknowledge the alarm.
In the case of a slave allocation, the same group can only be monitored (including audible alarm notification) but there is no allowable control over the function group neither may the operator acknowledge the relevant alarm.

The following alarm information is available to the operator:

- Alarm Presentation
- Alarm History

4.2 Alarm Presentation

Alarms are displayed on a dedicated alarm presentation mimic. Notice that this mimic only shows the alarms of the function group(s) 'owned' by the workstation.

Alarms are displayed in descending date and time order and have to be acknowledged by the operator at the station-in-control. The operator can acknowledge an alarm by selection of the alarm row(s) and pressing the 'ACK' (F1) button. The 'Go to' button (F2) can be used to display more information about the context of the alarm. A template of the alarm list showing the relevant colour animation for a given alarm status is shown in Figure 4-1.

Date	Time	Mimic	Class	Element ID	Message	Duration	Ack
29-Oct	12:34:56	077	FFDC	5210A0002	Alarm active but NOT ACK'd	12:34	N
29-Oct	12:34:55	077	FFDC	5210A0002	Alarm active and ACK'd	23:45	Y
29-Oct	12:34:54	077	FFDC	5210A0002	Alarm rectified but NOT ACK'd	01:23	N
29-Oct	12:34:53	077	FFDC	5210A0002	Alarm highlighted by the operator	01:23	N
29-Oct	12:34:52	077	FFDC	5210A0002	Alarm state unavailable	01:23	N

Figure 4-1 Alarm list animation

The operator cannot acknowledge alarms attached to function group(s) not 'owned' by that workstation, as these alarms will not appear on the alarm list. However, the operator can still view those alarms not applicable to his workstation by selecting the relevant alarm group button from the alarm group bar displayed across the top of each mimic (see section 3.2.2).

4.3 Alarm history

Since all alarm events are logged, an alarm history can be derived showing 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
- Final state — The final alarm state
- Logged by — Identification of process or user responsible for the logged event

Other fields available from the database considering the ALARM_LOG table:

- Generation_time — Timestamp the alarm was generated.
- Alarm_id — Cimplicity alarm identifier
- Alarm_class — CIMPLICITY alarm class associated with the alarm. I.e 1-16 corresponding with the function group buttons on top of your screen.
- Resource — CIMPLICITY resource associated with the alarm.
- Reference — Reference information for the alarm logged.
- Previous state — The previous alarm state, before the logged event occurred
- Log action — The actual logged event, i.e. **N**ormal / **G**enerated / **R**eset / **A**cknowledged / **D**eleted

A typical alarm history page is shown in Figure 4-2.

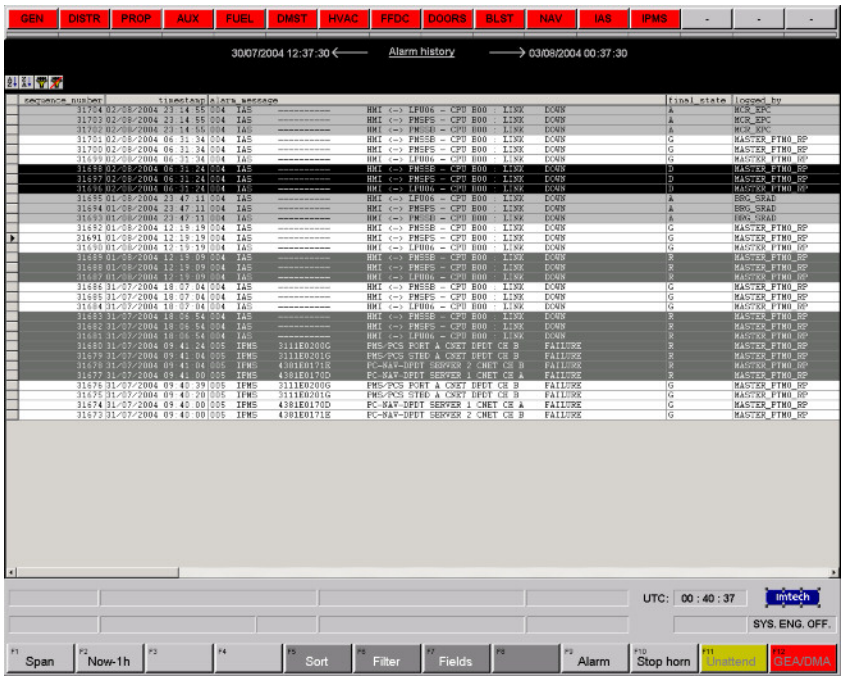


Figure 4-2 Typical Alarm history

The alarm list is sorted in descending sequence number order, so that the most recent event is displayed at the top of the list. The start and end date/time can be adjusted using the 'Span' button (F1). Other functionality available via buttons on this mimic includes:

- 'NOW – 1h' lists alarms raised in the past hour;
- 'SORT' modify sort order;
- 'FILTER' filter alarm list; and
- 'FIELDS' select fields to be displayed.

For clarifying purpose row colour animation is used to mark the final state of the alarm:

- White The alarm was generated; Final state = 'G'
- Silver gray The alarm is acknowledged; Final state = 'A'
- Dark grey The alarm is rectified; Final state = 'R'
- Black The alarm has been deleted; Final state = 'D'

4.4 Alarm Extension Systems

4.4.1 Watch responsibility functions (optional)

The optional watch responsibility function extends the alarm presentation function for Unmanned Machinery Space (UMS) operation and comprises:

- On duty selection;
- Attended/unattended UMS operation;
- Patrol watch alarm (DMA);
- General engineers alarm (GEA); and
- Engineer calling.

If Watch responsibility functions are installed then these alarm extension functions are co-ordinated through the Function Allocation mimic on the IPMS workstations, Local Alarm Panels, Patrol timer units and watch entrance units.

A Duty Supervisor can be selected from the function allocation mimic on an IPMS workstation having control of the IPMS function group. All Local Operator Panels, including that of the selected engineer reflect the selection made. If UMS is activated then the Duty Supervisor will be notified by his local panel and/or his pager (See section 4.4.2) on any IPMS alarm event classified for an function group being assigned to the Unmanned Machinery Space (UMS)

The activated/deactivated UMS selection can be made via the watch entrance unit provided that all alarms are acknowledged. Another way to toggle UMS mode is by pressing the reserved UMS key on the CIP. Another restriction here is that the workstation must have the IPMS function group attached to it.

When an IPMS alarm is detected on the IPMS, it is passed to the engine room alarm function. When UMS is activated the alarm is signalled on the local panel of the Duty Supervisor and on the local panels installed in common spaces. On these panels, the alarm signal can be silenced (only locally). If the alarm is not acknowledged within 6 minutes, then a general engineer alarm (GEA) will be invoked.

A patrol watch alarm provides a safety timer for the engineer's protection. The presence of an engineer must be acknowledged every 30 minutes by pressing the 'RESET' button on the patrol alarm panel. If not, a local warning sound is issued after 27 minutes. If the 'RESET' button is still not pressed within the final 3 minutes, then the patrol Watch Alarm (DMA) is activated. This alarm can also be activated on demand by pressing the appropriate button. Patrol alarm reset units are located throughout the engine room and the MCR to enable the patrol alarm timer to be reset. The timer can be disabled via a key-switch on the watch entrance unit.

4.4.2 Paging system (optional)

The optional paging system within the IPMS provides the means of alerting the ship's personnel to the presence of alarms requiring attention in the MCR. These alarm conditions can be investigated using the alarm presentation and other mimics. The paging functionality does not allow control of the platform's systems.

A number of pagers are included in the paging system, each providing paging status and failure indication, group alarm information, a silence pager button and a test facility. It is also possible to test the paging system using the button provided on the Function Allocation mimic.

5. Maintenance

Only suitably qualified service personnel shall perform any maintenance activities on the system, and then this shall be done with the IPMS off-line. Any testing performed with the IPMS on-line may activate components resulting in undesirable/unstable system behaviour leading to dangerous consequences for the crew and/or vessel.

Please refer to the Maintenance Manual, ref. [17] for further details.