PETROBRAS	**TECHNICAL SPECIFICATION**	**Nº:** I-ET-3010.00-5520-800-P4X-001	
	CLIENT:		**SHEET** 1 of 74
	JOB:		--
	AREA:		
SRGE	**TITLE:** **SUPERVISION AND OPERATION SYSTEM (SOS) SCREENS**		INTERNAL
			ESUP

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DESIGN	ESUP	ESUP	ESUP	ESUP	ESUP	ESUP	ESUP	ESUP	ESUP
EXECUTION	GNIEDU	CAMILA	CAMILA	U56D	Q082	Q082	U5D6	C27N	U361
CHECK	ANDRÉ LUIS	EDYLARA	ANDRÉ LUIS	CLWK	U49R	U49R	U49R	U5D6	U5D6
APPROVAL	PEDRO	ANDRÉ LUIS	ANDREAZC	U49R	U4JB	U4JB	TZN5	CDC1	CDC1

SUMMARY

1 INTRODUCTION

1.1 Object

1.1.1 This Typical Technical Specification describes the minimum functional and technical requirements for the design and supply of the Supervision and Operation System (SOS) Screens of the UNIT. SOS is the dedicated application that shall be configured and executed using a Supervisory System.

1.1.2 This document shall be read in conjunction with the documents listed in item 2.2.

1.1.3 The requirements presented on this technical specification apply both to Topsides and Hull SOS screens and windows, unless otherwise specified.

1.2 Definitions

1.2.1 Refer to I-ET-3010.00-1200-940-P4X-002 – GENERAL TECHNICAL TERMS for the definition of words emphasized in upper case along this document.

1.3 Abbreviations, Acronyms and Initialisms

1.3.1 The following abbreviations, acronyms and Initialisms are used in this document:

AFDS	Addressable Fire Detection System
ART	Allowable Response Time
CCR-OA	Central Control Room – Operation Ambiance
CCTV	Closed Circuit Television System
CSS	Control and Safety System
ESD	Emergency Shutdown
FAT	Factory Acceptance Test
FGS	Fire and Gas System
HAZOP	Hazard and Operability Study
HDS	Historical Data Server
HMI	Human Machine Interface
IEC	International Electrotechnical Commission
IPL	Independent Protection Layer
ISA	Instrumentation Systems and Automation Society
LOPA	Layer of Protection Analysis
PCS	Process Control System
RTDS	Real Time Data Server
SAT	Site Acceptance Test
SOS	Supervision and Operation System
VAC	Ventilation and air-conditioning

2 REFERENCE DOCUMENTS, CODES AND STANDARDS

2.1 External references

2.1.1 International Codes, Recommended Practices and Standards

IEC – INTERNACIONAL ELECTROTECHNICAL COMMISSION

IEC	62682	MANAGEMENT OF ALARMS SYSTEMS FOR THE PROCESS INSDUSTRIES

ISA – INTERNACIONAL SOCIETY OF AUTOMATION

ISA	18.1	ANNUNCIATOR SEQUENCES AND SPECIFICATIONS
ISA	101.01	HUMAN-MACHINE INTERFACES FOR PROCESS AUTOMATION SYSTEMS

2.1.2 Classification Society

2.1.2.1 Project's Detail Design Phase documents will be submitted to Classification Society's approval and/or certification.

2.1.2.2 The design, installation and operation shall strictly follow the Classification Society's requirements, along with the specific requirements identified in this document, including also all referenced document requirements.

2.2 Internal References

2.2.1 Typical Documents

2.2.1.1 Typical Documents are those that contain functional and technical description of a system or equipment. They shall be used as main specifications for the Project.

I-ET-3010.00-1200-940-P4X-002	GENERAL TECHNICAL TERMS
I-ET-3010.00-5520-861-P4X-002	SUPERVISION AND OPERATION SYSTEM - SOS
I-ET-3010.00-5520-861-P4X-001	CONTROL AND SAFETY SYSTEM – CSS
I-ET-3010.00-1200-800-P4X-002	AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS
I-ET-3010.00-5140-700-P4X-005	REQUIREMENTS FOR HUMAN ENGINEERING DESIGN FOR ELECTRICAL SYSTEMS OF OFFSHORE UNITS

I-ET-3000.00-1200-940-P4X-001	TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN
I-ET-3000.00-0000-940-P4X-002	SYMBOLS FOR PRODUCTION UNITS DESIGN
I-ET-3010.00-5520-888-P4X-001	AUTOMATION PANELS
I-ET-3010.00-5520-800-P4X-002	IMPLEMENTATION OF INTERLOCKING AND CONTROL LOGIC

2.2.2 Specific Project Documents

2.2.2.1 This section mentions documents that are part of a specific Project. The document title and number may slightly vary from one Project to another. Project's DOCUMENT LIST shall be consulted in order to verify the correct document number and title.

2.2.2.2 At least, these documents shall be used to create the screens and real time database in SOS. Note that this is an initial list, and that other documents may be included during the development of the SOS screens.

2.2.2.3 **Specific Project Document List**

- **TECHNICAL SPECIFICATIONS (I-ET)**

  SPECIAL MONITORING SYSTEMS

  AUTOMATION INTERFACE OF PACKAGE UNITS

  FLOW METERING LOCATIONS (FMS)

  All equipment and PACKAGE UNIT Technical Specifications

- **DRAWINGS (I-DE)**

  AUTOMATION AND CONTROL ARCHITECTURE

  All P&IDs (Process and Instrumentation Diagrams) and D&IDs (Ducts and Instrumentation Diagrams)

  CAUSE AND EFFECT MATRICES

- **DATA SHEETS (I-FD)**

  SAFETY DATA SHEET

- **DESCRIPTION MEMORANDUM (I-MD)**

  SCOPE DEFINITION

2.2.3 **Other PETROBRAS Internal References**

N-1710 – CODIFICAÇÃO DE DOCUMENTOS TÉCNICOS DE ENGENHARIA

3 GENERAL

3.1 The objective of the SOS screens is to allow the operators to supervise real time and historical data and send commands to the Process plant equipment from the Central Control Room (CCR-OA). This shall be done through SOS HMIs.

3.2 The SOS screens display field information in a suitable format, supporting plant operation and troubleshooting, while data gathering is performed by Control and Safety System (CSS), PACKAGE UNITS Automation Systems (PAS), Subsea Production Control System (SPCS) and Special Automation and Monitoring Systems. The abovementioned systems feature field interfacing capabilities - data acquisition (reading data) and actuation in final elements and in control loop parameters (writing data).

3.3 Through SOS HMIs, it shall be possible for the Operator to:

- Supervise (visualization of real-time process data values, in engineering units, quality and visualization of real-time equipment status, alarms and events);
- Operate (changing of equipment status – open/close valves, turn-off/on equipment/ electric devices, changing of control setpoints and parameters and execution of operation/ maintenance inhibition commands);
- Starting up and shutting down equipment and failure detection (when applicable);
- Equipment operational status signaling (on, off, failure);
- Set equipment and instruments into maintenance conditions, when applicable;
- Execute input signals and instruments inhibition (maintenance and operational inhibitions);
- Visualize and Acknowledge Real-time Alarms and Events using the Supervisory System's Alarm Summary function;
- Visualize Historical Alarms and Events using the Supervisory System's Alarm History function;
- Visualize historical data and generate historical data reports and historical data graphs using the Supervisory System's Historian function or module;
- Generate specific reports (at least: maintenance inhibitions, operational inhibitions, output override, daily total production, equipment operation duration time and active alarms reports);
- Visualize real-time trend graphs of chosen variables in order to help the operations;
- Visualize Platform ESD status (ESD-2, ESD-3P, ESD-3T, ESD-4 and Prepare for abandonment);
- Visualize failure status of process equipment and Automation equipment;
- Visualize logs, such as operational logs and system logs.

3.4 As depicted in I-ET-3010.00-5520-861-P4X-002 – SUPERVISION AND OPERATION SYSTEM – SOS, all SOS RTDS, SOS HDS, SOS HMIs and SOS Engineering Workstations are all part of the same Supervisory System. The Real Time Data Servers (RTDS), that acquire real time data from control and interlocking equipment, and the Historical Data Servers (HDS), that collect and register historical data from RTDS's, provide the data displayed in the SOS screens.

3.5 SOS, CSS, PAS, SPCS and Special Automation Monitoring Systems are described in I-ET-3010.00-5520-861-P4X-002 – SUPERVISION AND OPERATION SYSTEM – SOS, I-ET-3010.00-5520-861-P4X-001 - CONTROL AND SAFETY SYSTEM – CSS, I-ET-3010.00-1200-800-P4X-002 - AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS and project's technical specification entitled "SPECIAL MONITORING SYSTEMS", respectively.

3.6 The Automation and Control Architecture, including SOS and its integration with other systems, is represented in Project's drawing entitled "AUTOMATION AND CONTROL ARCHITECTURE".

3.7 The configuration/customization module(s) of the Supervisory System shall allow engineers/ automation technicians to create, configure, test, compile, edit and delete all the screens and database of Topsides and Hull SOS. This module shall be installed in the Engineering Workstations of the UNIT.

3.8 Before screens development, Company internal Maintenance and Operational Inhibition Policy or Standard shall be consulted. This specification takes into account that:

3.8.1 Maintenance inhibition (OM) command is applied for physical instruments (inputs), including fire and gas detectors, and, when issued, it inhibits output logic and alarm generation but does not inhibit real time values (variables and logic switches) reading and displaying at SOS screens. It is used for preventing the occurrence of a shutdown during maintenance of an instrument, a safety zone or a specific area;

3.8.2 Whenever a maintenance inhibition command is issued, operational inhibition is automatically applied to all the corresponding logical signals of the instrument (i.e., L, LL, LLL, H, HH, HHH);

3.8.3 Operational inhibition (OO) command is individually applied for input logical signals (i.e., L, LL, LLL, H, HH, HHH) of any instrument (control and safety interlocking) and, when issued, it inhibits output logic and alarm generation but does not inhibit real time values (variables and logic switches) reading and displaying at SOS screens;

3.8.4 Operational Inhibition commands have a pre-determined duration time (typically 2 hours) and, for each inhibition, an alarm shall occur before this time is reached (typically 2 to 5 minutes). These times shall be confirmed during Detail Engineering Design Phase. Operational inhibition shall not be automatically reset even if the duration time is elapsed.

3.8.5 Before resetting operational and/or maintenance inhibition command, the operator shall consult if the instrument is able to return by checking the associated real time values (variable and logic switches) in SOS screens.

3.8.6 Startup-bypass commands are allowed for specific equipment (for instance, pumps). This consists of automatic inhibition of trip signals during startup of the related equipment. The equipment subject to this type of inhibition shall be defined during Detail Engineering Design Phase.

3.8.7 Output override (OV) command is issued for output equipment (pumps, valves etc) and, when applied, it overwrites output command signals, independently of the input status and of the logic. The possibility of issuing output override commands shall be confirmed during Detail Engineering Design Phase according to Company´s Inhibition Policy or Standard.

3.8.8 Operational and Maintenance Inhibition and output override commands are subject to audit and shall be registered and periodically reported. These Reports are described in item 5.2 of this Specification.

4 SCREENS AND WINDOWS

4.1 General Definitions

4.1.1 SOS shall be configured as a tree of screens. The screens shall be classified into *general* and *specific* screens, according to the type of data to be displayed. Figure 1 shows an example of the mentioned hierarchy. The tree may be modified and/or completed by the time the SOS is configured.

4.1.1.1 The *Initial Screen* presented in item 4.3.3 corresponds to the first level of the screen hierarchy.

4.1.1.2 *General screens* show a general view of each subsystem. Only the main variables are shown on these screens. These screens are in the second level of screen hierarchy.

4.1.1.3 *Specific screens* show more detailed data from field and may allow execution of some specific commands. These screens are in the third level of screen hierarchy.

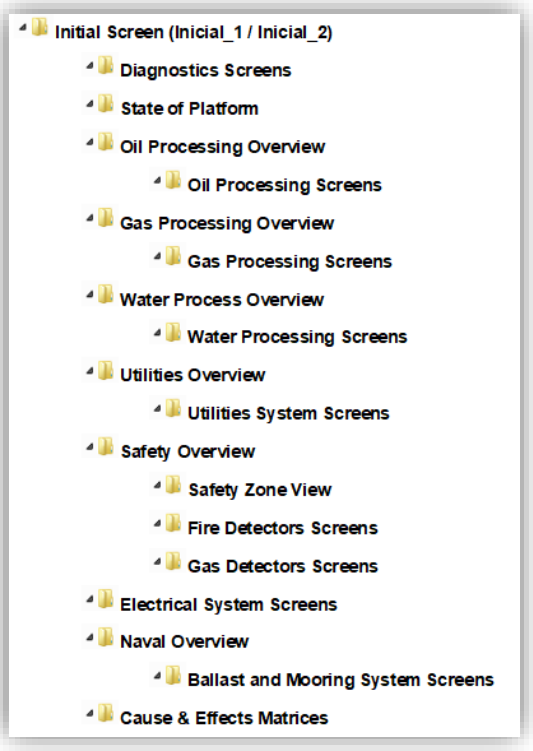


Figure 1 – Example of Screen Hierarchy

4.1.2 Specific pop-up windows shall also be configured.

4.1.3 A screen shall use all available space of the monitor display, while a window shall use only a portion of this space, being exhibited overlapping a screen.

4.1.4 All screens and windows shall be composed of dynamic data objects, which mainly represent real time data.

4.1.5 There shall be at least one screen per Project Process and Instrumentation Diagram (P&ID), considering Topsides, Hull, Safety, and Electrical System; one screen per Duct and Instrumentation Diagram (D&ID); one screen per Cause and Effect Matrix; and one screen per PACKAGE UNIT.

4.1.6 Additionally, there shall be 10 “General View” screens, including at least each of the following: Topsides, Hull, Electrical System, Fire and Gas Detectors, BDV’s, Maintenance & Diagnostics, and Safety. An additional 30% safety margin shall be applied to the total number of screens.

4.1.7 There shall be pre-defined pop-up windows for all control loops, all on-off valves, all pumps, VAC equipment and all instruments. These windows shall have a dedicated real-time trend graph of the involved process variables and an alarm/event sub window (tab) with alarms and events related to these instruments/equipment/systems.

4.1.8 All screens and windows shall be designed taking into consideration the quantity of dynamic objects and colors, in order to allow perfect interpretation of all data and process flow.

4.1.9 It shall be possible to visualize alarms in three ways: (i) In the Alarm window located at the top of the screens, (ii) by using the native Alarm Summary of the Supervisory System in an expanded screen, and (iii) by using Alarm History files generated by the Supervisory System. Additionally, dynamic objects shall also be displayed on the screens to precisely inform the alarm occurrence.

4.1.10 A backup routine and an operational procedure shall be defined so that the final user can easily recover any alarm recording and acknowledgment. For more information about alarms, see item 6 of this Technical Specification.

4.1.11 All colors represented in the screens and windows have the respective RGB code color detailed in item 8. The background color of all screens shall be Silver Gray.

4.1.12 SOS screens shall be designed in order to allow the operator to quickly identify an abnormal situation, the deviation, and its level of magnitude. Irrelevant information shall be avoided.

4.1.13 All relevant equipment for the operation of a system shall be present in a single screen, if ergonomically possible. For example, pumps and their associated alignment valves shall be present in a single screen.

4.1.14 It shall mainly be used the concept of “dark panel”, i.e., information shall only be displayed when there is a significant change in process status, such as an upset, alarm, failure, or end of operation. The use of light colors shall be maximized, and static equipment shall be of the same color as the screen background color.

4.1.15 Process fluids shall be identified by the use of different colors, according to Table 35.

4.1.16 In accordance with the International System of Units (SI), the engineering units listed below shall be used to display the variables. The engineering units shall be displayed at the right side of the instant value display. Whenever necessary, the value acquired from the control system shall be converted to the corresponding engineering unit. The instant values shall be displayed with two decimal places, unless otherwise informed.

Table 1 – Engineering Units.

VARIABLE	ENGINEERING UNIT
Temperature	ºC (degrees Celsius)
Manometric Pressure	bar or kPa (bar or kilopascal)
Level	% of range, m or mm (percentage, meters or millimeters)
Liquid Flow	m^3/h (cubic meters per hour)

Gas Flow	m^3/h (@20 ºC / 101.325 kPa)
Water vapor	t/h (tons per hour)
Vacuum	bar abs or kPa abs (absolute pressure)

4.1.17 As mentioned in item 4.2.4, all screens have a variable part, named "SCREEN AREA OF MONITORING AND OPERATION". This Technical Specification shows examples of layouts, but for all screens, the variable parts shall be defined during the development of SOS, in conjunction with the final client.

4.1.18 Some screens can have slightly different background colors to indicate different process trains (e.g. membrane trains). The use of "watermarks" is acceptable in order to indicate different process trains (e.g. turbogenerators, compressors, etc.). These background and watermark colors shall be always in tones very close to the default background color.

4.2 General Structure

4.2.1 All screen resolutions, quantity of pixels and simultaneous colors shall be defined by the time SOS is configured. The parameters described in this chapter shall be kept as the minimum desired.

4.2.2 Two language options shall be available on supervisory system screens for operator to choose: "Português" and "English". The language used in all screens (including buttons, symbols, reports etc.) and alarm messages shall be Brazilian Portuguese if "Português" option is selected by operator, or English if "English" option is selected. The engineering units listed in Table 1 shall be used. If the variable is not listed on Table 1, the engineering unit used in other Project documents shall be adopted. If the engineering unit for the particular variable is not listed on Table 1 and is not found on other project documents, the final client shall be consulted.

4.2.3 The total screen resolution shall be 160 x 90 (aspect ratio) and 1920 x 1080 (pixels), 8-bit color graphics (256 simultaneous colors).

4.2.4 All screens shall have the same general structure composed of four parts as presented on Figure 2 and described in Table 2.

Table 2 - Four parts of a screen.

		NAME	DESCRIPTION
SCREEN PART	1	ALARM WINDOW	110 x 12 (aspect ratio) and 1320 x 150 (pixels), at the left top.
	2	PAGING BUTTONS	50 x 12 (aspect ratio) and 600 x 150 (pixels), at the right top.
	3	SCREEN AREA OF MONITORING AND OPERATION	160 x 74 (aspect ratio) /1920 x 880 (pixels), immediately below Screen Header, occupying the whole width. The layout of the screen area may vary

			from Project to Project, and shall be defined in conjunction with the final client. Description and examples of screen areas are defined in items 4.3 and 4.4.
	4	BOTTOM BAR	160 x 4 (aspect ratio) /1920 x 50 (pixels), at the bottom of the screen occupying the entire width.

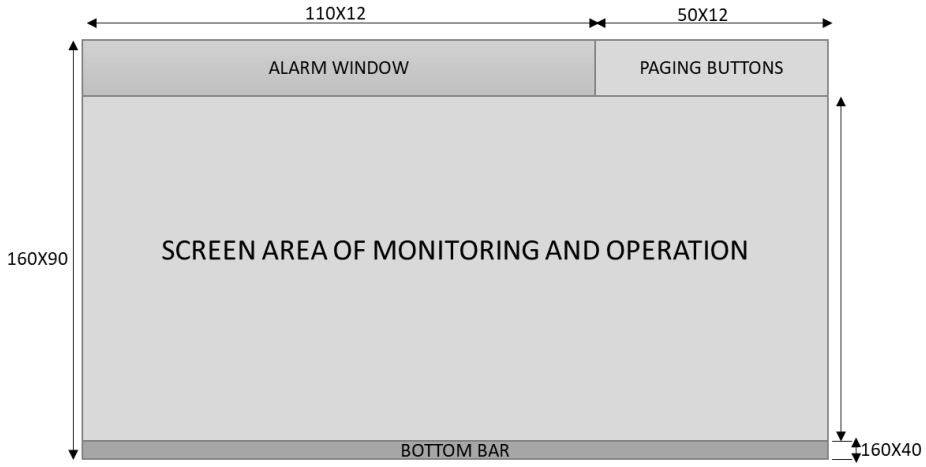


Figure 2 – General structure of a screen.

4.2.5 **Alarm Window**

4.2.5.1 The Alarm window shall be composed of an alarm message list at the left side, and two action buttons at the right side with the functions presented on Table 3.

Table 3 - Alarm window symbols and functions.

SYMBOL	FUNCTION
	Acknowledges the selected alarm and silence the horn of alarm group which the alarm is contained in (an alarm is selected with a simple left-click on its row). While there is no selected alarm, this button remains "inactive" in *Smoke Gray* color.
	Silence the horn of alarm group which the selected alarm is contained in, without the acknowledgment of the alarm. While there is no selected alarm, this button remains "inactive" in ***Smoke Gray*** color.

4.2.5.2 The alarm messages shall be composed of the following fields: (a) Date; (b) Time; (c) State; (d) Priority; (e) Group; (f) Name; and (g) Description, as presented on Figure 3.

4.2.5.3 The color of the alarm message depends on the priority of the alarm, and shall be in accordance with the standard established in item 6.4.5.

4.2.5.4 At least 5 (five) rows of alarms shall be displayed on the ALARM WINDOW (see Figure 3).

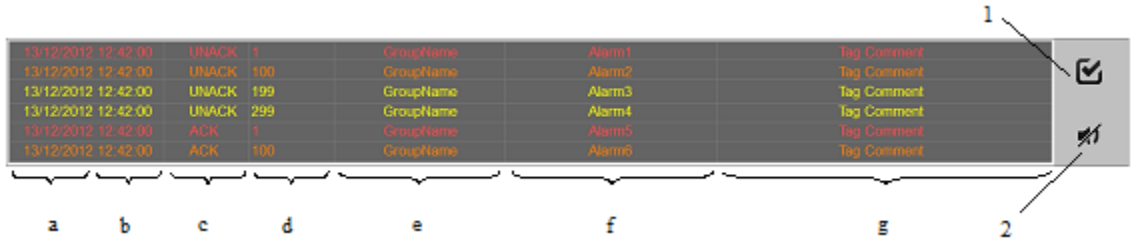


Figure 3 - Alarm Window

4.2.5.5 New alarms shall appear at the top of the ALARM WINDOW, in the following classification order: (1) most recent and unacknowledged alarm; (2) highest priority and unacknowledged alarm; (3) highest priority and acknowledged alarm.

4.2.5.6 If it is a native function of the Supervisory Software, it shall be possible to navigate to the corresponding screen by clicking in the alarm line located in the Alarm Window or Alarm Summary.

4.2.6 Paging Buttons

4.2.6.1 The screen paging among the SOS screens shall be done through paging buttons, located at the right top of all screens, i.e. the PAGING BUTTONS section.

4.2.6.2 The background color of the PAGING BUTTONS section shall be ***Light Gray*** and the color of the text shall be ***Black***.

4.2.6.3 The PAGING BUTTONS part shall be divided into 4 (four) columns and grouped as presented in Figure 4. This Figure shows a typical Topsides SOS PAGING BUTTONS screen section. The Hull SOS PAGING BUTTONS screen section shall be defined according to the Hull particularities.

Estado da plataforma	Segurança	VAC	Produção - Óleo
	Naval	Elétrica	Produção - Gás
Matriz CxE	Automação	Facilidades	Produção - Água

Figure 4 – Topsides SOS Paging Buttons

4.2.6.4 The first column of the PAGING BUTTONS screen section is divided into 2 (two) rows: “UNIT Status” and “Cause & Effect Matrix”.

- **UNIT Status (“*Estado da Plataforma*” Button)**

  This paging button shall be presented with the original text "Estado da Plataforma" (UNIT Status). When selected, this object executes a paging command to the UNIT status screen. It shall also present the current UNIT status, as well as alarm announcing.

In case of a shutdown, the UNIT Status paging button shall present the highest ESD level detected along with tag and description of the first initiator event that caused the shutdown. The signalization shall blink while unacknowledged: the background color shall change to ***Red Hot***. After acknowledged, if the ESD persists, the background color shall remain ***Red Hot***, without blinking. When ESD condition ends, the background color of the button shall turn back to ***Light Gray*** and text color shall turn back to ***Black***.

ESD-2 PALL-1223015 SG-1223001	Segurança	VAC	Produção - Óleo
	Naval	Elétrica	Produção - Gás
Matriz CxE	Automação	Facilidades	Produção - Água

Figure 5 – Example of Topsides UNIT status paging button during ESD event.

- **Cause & Effect Matrix ("*Matriz CxE*" Button)**

  The Cause & Effect Matrix paging button executes a paging command to the Cause & Effect Matrix of the currently displayed screen (typically Process screens). If the currently displayed screen does not have a corresponding Cause & Effect Matrix, this button shall be disabled and the text color shall be turned into ***Smoke Gray*** ("command not allowed").

4.2.6.5 The second column of the PAGING BUTTONS section refers to the Safety and Integrity of the UNIT and it shall be divided into 3 (three) rows: Safety, Hull and Automation.

- **Safety ("*Segurança*" Button)**

  This paging button opens the Safety Overview Screen of the UNIT, described in item 4.3.8.

- **Hull ("*Naval*" Button)**

  This paging button opens the Hull Overview Screen of the UNIT, described in item 4.3.18.

- **Automation ("*Automação*" Button)**

  This paging button opens the Automation Overview Screen of the UNIT, described in 4.3.17.

4.2.6.6 The third column of the PAGING BUTTONS section refers to VAC, Electrical System and Utilities.

- **VAC ("*VAC*" Button)**

  This paging button opens the VAC Overview Screen of the UNIT, described in item 4.3.11.

- **Electrical System (“*Elétrica*” Button)**

  This paging button opens the General One-Line Diagram Screen of the UNIT, described in item 4.3.16.

- **Utilities (“*Facilidades*” Button)**

  This paging button opens the Non-electrical Utilities Overview Screen of the UNIT, described in item 4.3.19.

4.2.6.7 The fourth column of the PAGING BUTTONS section is divided into 3 (three) rows: Oil Processing, Gas Processing and Water Processing.

- **Oil processing (“*Produção – Óleo*” Button)**

  This paging button opens the Oil Processing Overview Screen of the UNIT.

- **Gas processing (“*Produção – Gás*” Button)**

  This paging button opens the gas processing overview screen of the UNIT.

- **Water processing (“*Produção – Água*” Button)**

  This paging button opens the water processing overview screen of the UNIT.

4.2.6.8 The paging button objects shall have alarm color dynamics, except for the Cause & Effect Matrix paging button, as described in item 6.4.5.

4.2.7 Bottom Bar

4.2.7.1 The BOTTOM BAR section shall be designed according to Figure 6.

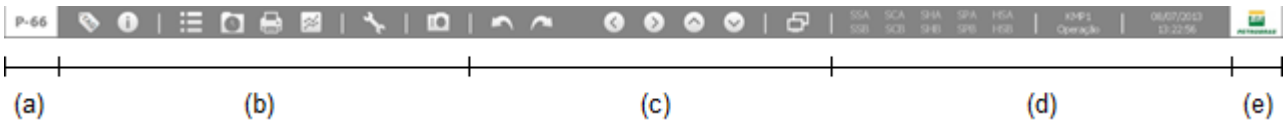


Figure 6 - Bottom Bar

4.2.7.2 The background color of the BOTTOM BAR section shall be ***Smoke Gray***.

4.2.7.3 The BOTTOM BAR section is composed of the following parts: (a) a button with UNIT identification, (b) a tool bar, (c) a paging bar, (d) an information bar, and (e) a button with the PETROBRAS logo.

4.2.7.4 The UNIT Identification button symbol and functions are presented in Table 4.

Table 4 - UNIT’s identification button at the BOTTOM BAR section.

SYMBOL	FUNCTION
P66	Button indicating the UNIT’s identification (in this example, P-66). This button shall open a drop-down menu with a list of general screens, by which it shall

	be possible to execute paging commands to the following screens: • Initial screen; • Fire detectors general view; • Gas detectors general view; • AFDS detectors general view; • Instruments general view.

4.2.7.5 The tool bar is composed of the buttons and functions presented in Table 5. The function “Tag show/Tag hide” is not mandatory if it is not a native function of the Supervisory Software. A “Tag Search” function may be implemented instead.

Table 5 - Tool bar buttons at the BOTTOM BAR section.

SYMBOL	FUNCTION
	This button allows showing / hiding all tags and values displayed for the instruments or equipment in the specific screens. In this mode, only the static equipment tags are visible.
	Paging button to a screen or window, which displays the identification of the data sheets and reference drawings of all instruments and equipment, displayed in the corresponding screen.
	Paging command to the Alarm Summary Screen, described in item 6.4 of this document.
	Paging command to Alarms and Events History Screen, described in item 6.4.2 of this document.
	Paging command to Reports Generation Screen, described in item 5 of this document.
	Paging command to Real Time Trend Generation Screen. Real time trends, in general, require a specific function or module of the Supervisory System.
	Paging button to Maintenance Screen (see item 4.3.5)
	Print screen to file command

4.2.7.6 The paging bar is composed of the buttons and functionalities presented in Table 6.

Table 6 - Paging bar buttons at the BOTTOM BAR section.

SYMBOL	FUNCTION
	Backwards history paging (last paged screen)

	Forwards history paging
	Paging command to the previous screen in the process flow
	Paging command to the subsequent screen in the process flow
	Paging command to previous screen according to the screen hierarchy (above screen)
	Paging command to subsequent screen according to the screen hierarchy (below screen)
	Swap screens between monitors

4.2.7.7 The Table 7 describes the items, which compose the Information Bar.

Table 7 - Information bar at the BOTTOM BAR section.

SYMBOL	FUNCTIONS
	Communication status with servers
	User logged in and user access profile
	Date and Time

4.2.7.8 The symbol and functions of the PETROBRAS logo button are presented in Table 8.

Table 8 - PETROBRAS logo button at the BOTTOM BAR section.

SYMBOL	FUNCTIONS
PETROBRAS Logo	The PETROBRAS logo button shall open a menu with administrative functions according to the user access profile, for example: “log in” / “log off”, “switch user” etc. HMI software version information shall be presented in this menu.

4.3 Screen Description

4.3.1 This section describes the content to be presented on the SCREEN AREA OF MONITORING AND OPERATION portion of the screen (see item 4.2.4).

4.3.2 The layout of all screens and windows shall be defined during SOS configuration time, and shall be approved by final client.

4.3.3 Initial Screen

4.3.3.1 The Initial Screen ("*Tela Inicial*") shall be composed of paging buttons that allow paging to specific screens (see example in Figure 7). The Initial Screen may also be called Main Screen ("*Tela Principal*").

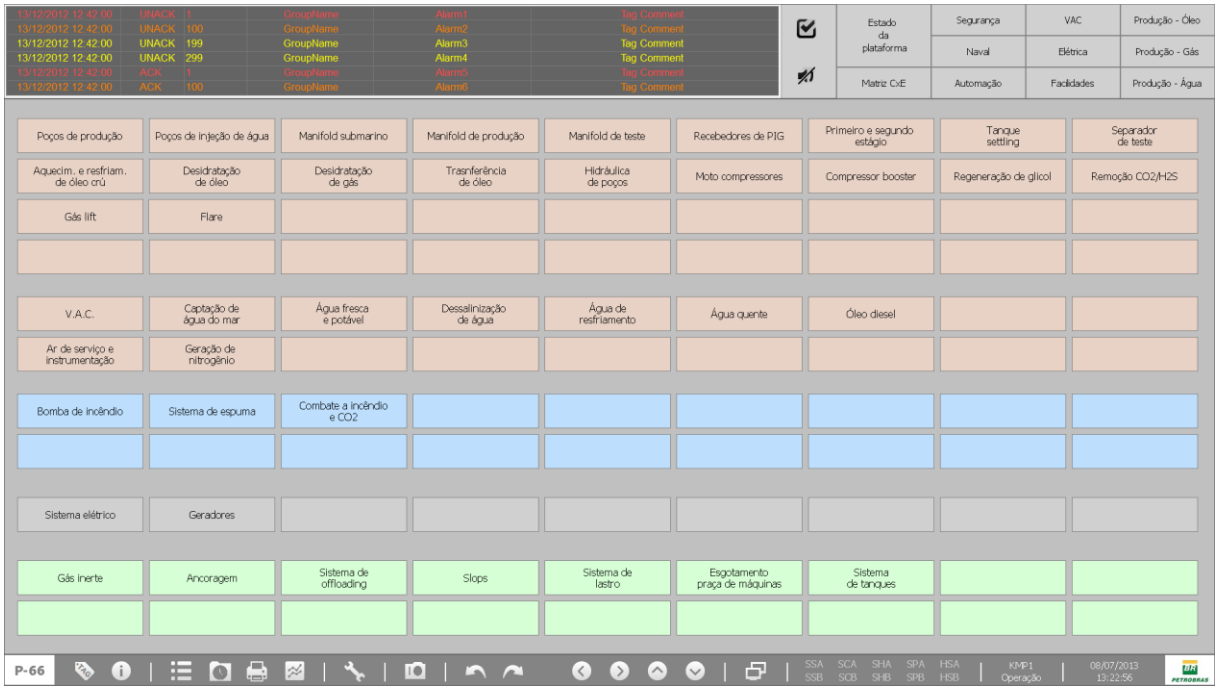


Figure 7 – Example of Initial Screen

4.3.3.2 The paging buttons shall be segregated in the following groups: Topsides Process and Non-Electrical Utilities, Topsides Electrical System, Hull Process and Non-Electrical Utilities, Hull Electrical System, Safety and VAC.

4.3.3.3 The colors of paging buttons shall indicate the specific screen type, according to Table 9. Texts shall be in ***Black*** color.

Table 9 - Initial Screen button colors according to groups

SPECIFIC SCREEN	COLOR
Topsides Process and Non-Electrical Utilities	***Regular Brown***
Safety	***Blue Ocean***
Topsides and Hull Electrical System(s)	***Light Gray***
Hull Process and Non-Electrical Utilities	***Lime Green***
VAC	***Normal Purple***

4.3.3.4 If the quantity of paging buttons described above does not fit into a single screen, the Initial Screen may be split into two or more screens, with sequential paging button amongst them. The definition of which buttons shall be presented on each screen shall be decided during the development of the SOS application, with the final client.

4.3.3.5 If there are distinct Supervisory Systems for Hull and Topsides, the Initial Screen may also be split to indicate Topsides Screens and Hull Screens, respecting the defined colors.

4.3.3.6 The paging buttons shall also have color dynamics as described in item 6.4.5. Whenever there is an alarm in the corresponding specific screen, the button border shall blink as an indication.

4.3.3.1 These buttons shall have paging commands to the corresponding specific screen.

4.3.4 UNIT Status Screen

4.3.4.1 The UNIT Status screen shall be composed of four objects with text in ***Black*** color indicating the emergency shutdown levels (ESD-4, ESD-3T, ESD-3P, ESD-2). The background color of the objects shall be ***Light Gray*** and its border color shall be ***Black***. Figure 8 shows an example of UNIT Status Screen area.

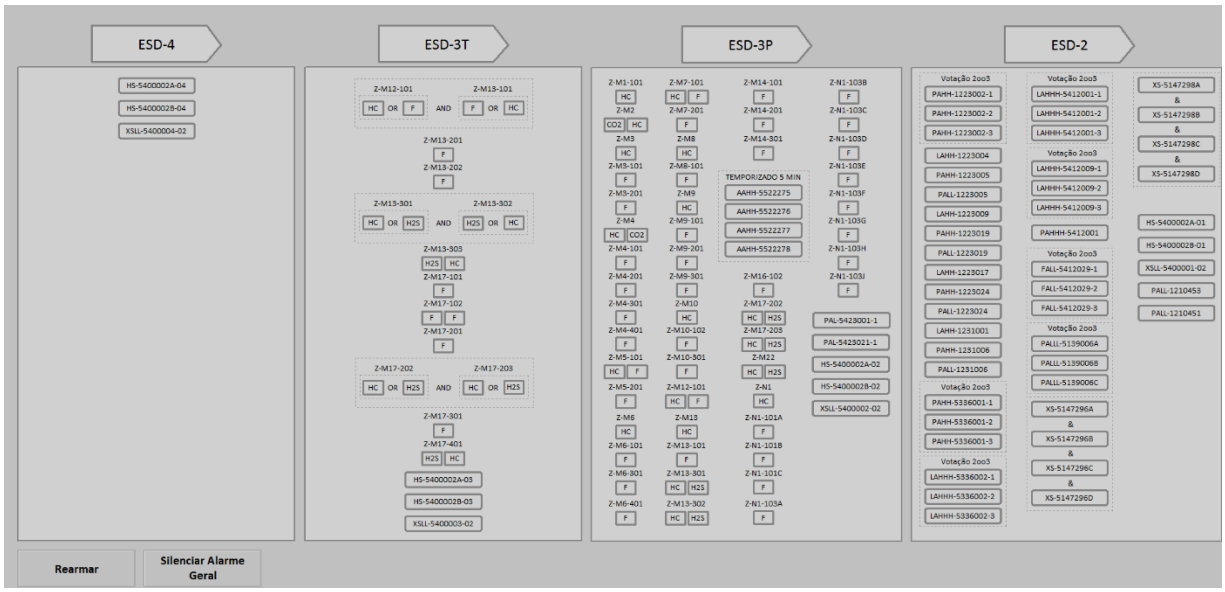


Figure 8 – Example of UNIT Status Screen area

4.3.4.2 These objects shall implement the annunciation function as follows:

- In case of shutdown (ESD), the corresponding ESD rectangle shall present the initiator of the shutdown. It will remain blinking with ***Black*** background and text in ***Light Gray*** color until its acknowledgment;
- In case of acknowledged ESD, the corresponding ESD rectangle will remain with fixed ***Black*** background, and text in ***Light Gray*** color;
- The ESD level initiators shall be displayed below the corresponding ESD button. Fire and Gas detectors shall be displayed as in the other screens. Other instruments shall be represented by their tag identification.
- The alarm annunciation shall be done through a rectangle around the condition, as described in item 6.4.5.

- A gray button with the text “REARMAR” in ***Black*** color shall execute the command to disable the stop status after all ESD causes are normalized. Another gray button with the text “SILENCIAR ALARME GERAL” in ***Black*** color shall execute the command to silence the general alarm.
- The ESD initiators symbols shall have paging command to the corresponding specific screen or window.

4.3.5 Supervisory System Maintenance Screen

4.3.5.1 Figure 9 presents the Supervisory System Maintenance Screen, which shows communication status, system tools and other maintenance related information.

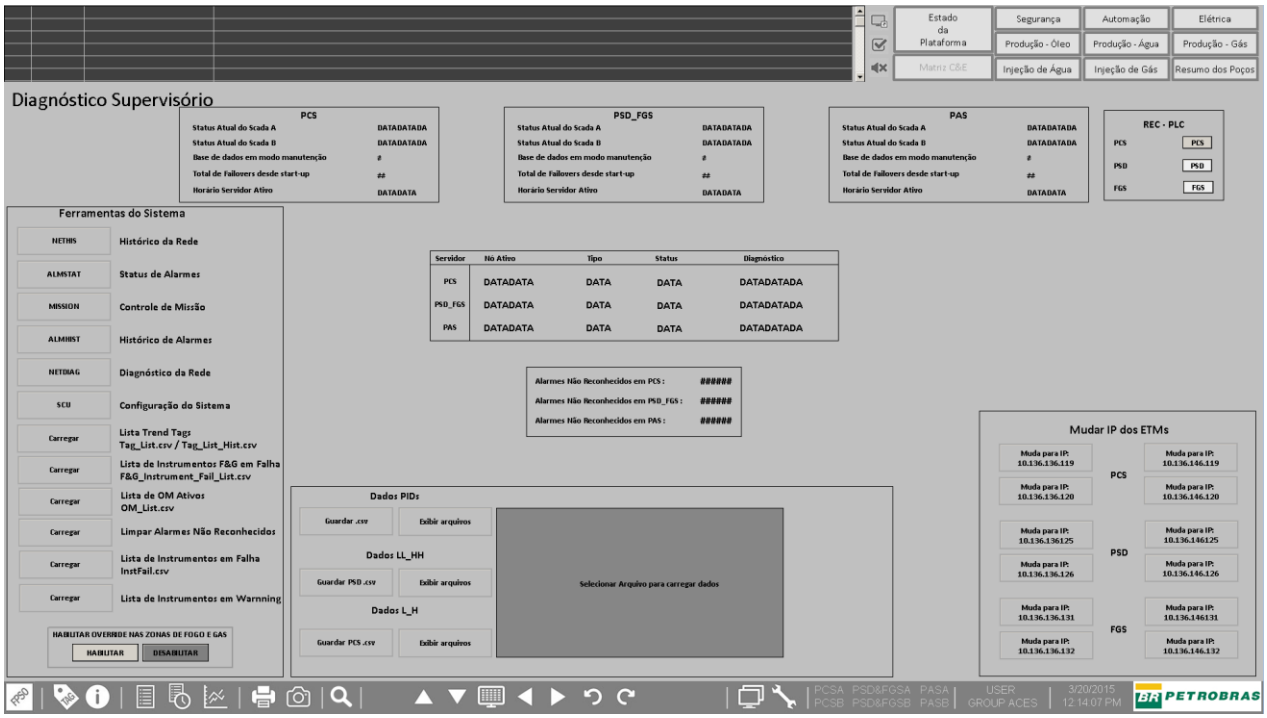


Figure 9 – Example of Supervisory System Maintenance Screen

4.3.6 General View Screens (“RESUMÃO”)

4.3.6.1 The General View Screens shall be used to present main data in a single screen. The main values of the process variables shall be displayed in real time with their engineering units. The following types of General Screens shall be foreseen:

a) Topsides:

- Oil Production General View;
- Gas Production General View;
- Water Production General View;
- Water Injection General View;
- Gas Treatment (Exportation, Injection, CO2);
- Chemical Injection General View;
- Topsides Flow Metering System General View (fiscal, allocation and operational);

- Topsides Safety General View;
- Topsides Gas Detectors General View;
- Topsides Flame Detectors General View;
- Topsides Blowdown Valves (BDVs) General View;
- Topsides Electrical System General View;
- Topsides Utilities General View;
- Topsides Packaged Units General View;
- Topsides Automation General View;
- Topsides Package Units General View.

b) Hull:

- Ballast and Bilge General View;
- Oil and Ballast Tanks General View;
- Hull Utilities General View;
- Hull Flow Metering System General View (fiscal, allocation and operational);
- Hull Blowdown valves (BDVs) General View;
- Hull Electrical System General View;
- Hull Packaged Units General View;
- Hull Automation General View;
- Hull Package Units General View.

c) Safety and VAC (in all SOS HMI´s, including Main F&G HMI):

- Safety General View;
- UNIT Status;
- Topsides VAC System General View;
- Hull VAC System General View;
- Topsides and Hull Gas Detectors General View;
- Topsides and Hull Flame Detectors General View;
- Topsides and Hull AFDS General View.

4.3.6.2 In General View Screens, it shall be displayed an overview of the flow with the main equipment, main valves, main instrumentation values and main alarms. Manual and auto-controlled valves may also be displayed, even though they do not have associated dynamics. This shall be defined by the final user during the development of the screens.

4.3.6.3 By clicking on a symbol of a subsystem or equipment, the specific screen that contains the instrument/equipment shall be displayed (as a “zoom”).

4.3.6.4 In General View Screens, each system or subsystem shall be represented by one object with a symbol of the equipment, which best describes it.

4.3.6.5 In Hull General View, if it is a vessel, it shall be displayed a top view of all the tanks that are part of the UNIT, with their respective level, pressure and temperature real time indications, as well as tank valves´ real time states. If it is

a semi-submersible platform, all the main equipment and instrumentation symbol representations of all the legs shall be displayed, with their corresponding dynamic information (colors and real time data).

4.3.6.6 Each system shall be represented by a rectangle. In order to indicate the presence of alarm in each system, when a corresponding alarm is active (acknowledged or not), a contour shall be displayed with the same dynamics as defined in item 6.4.5 (paging and color).

4.3.6.7 For Package Units General View Screens, see item 4.3.20.

4.3.6.8 Some of the abovementioned General View Screens may be merged if a single Automation system (CSS and SOS) is supplied for Topsides and Hull. This shall be defined in conjunction with the final client.

4.3.6.9 All Safety screens and alarms shall be accessible for supervision and operation from Topsides and Hull SOS.

4.3.6.10 Figure 10 shows an example of an Oil Production General View Screen area.

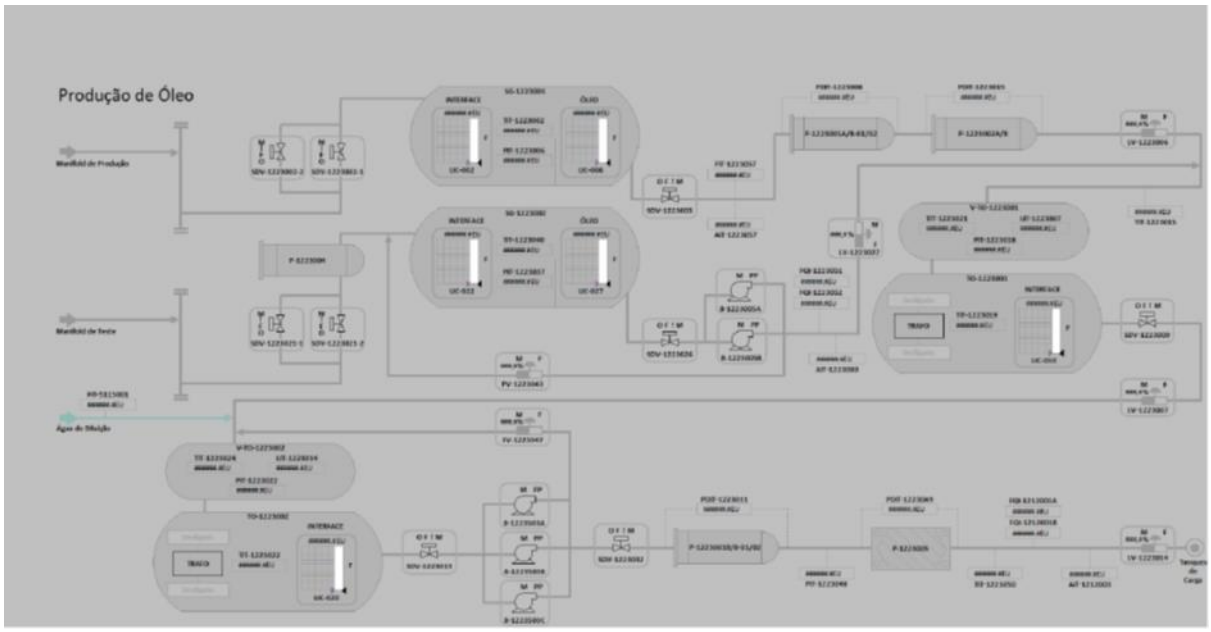


Figure 10 – Example of Oil Production General View Screen area

4.3.7 **Specific Screens**

4.3.7.1 In normal operation, instrument identification (tags) and their corresponding analog values/engineering units do not need to be displayed in the specific screens. The display of these information may be chosen by clicking the symbol 

at the bottom bar described in item 4.2.7, or individually, at the Command Windows described in item 4.4.6. This function is not mandatory and shall only be implemented if it is a native function of the supervisory software.

4.3.7.2 As a general guideline, an entire process or utility system may be represented by five specific screens. Exceptions are accepted and shall be defined during the development of the screens in conjunction with the final client.

4.3.7.3 All level variables shall be displayed in instant numeric value/engineering units and in the percentage scale.

4.3.7.4 The display of the remaining variables shall be done in instant numeric values and with their engineering units.

4.3.7.5 All Specific Screens shall present a title indicating the process area or the utilities system represented at its left top, in ***Black*** text.

4.3.7.6 As a general rule, the most important information should be arranged from the left top, central, and right bottom of the screen, following the instinctive trajectory of the scanning on search actions, as shown in Figure 11.

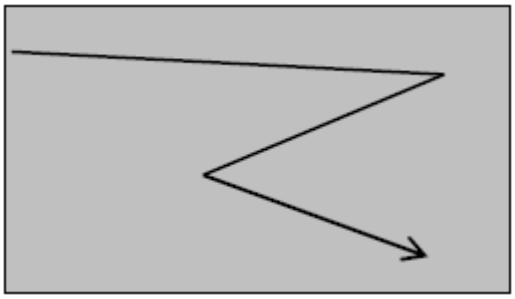


Figure 11 - Instinctive Trajectory of the Scanning on Screen

4.3.7.7 Screens with representation of electric pumps shall not have the corresponding electric motor symbol. These pump representations shall have a paging command to the corresponding electrical system screen. The corresponding electrical system screen shall have a paging command to return to the production or utilities screen.

4.3.7.8 Auxiliary information, such as tables, selection buttons, and bar graphs of support variables shall be placed in the left bottom of the screen, outside area of first scan, as shown in Figure 12.

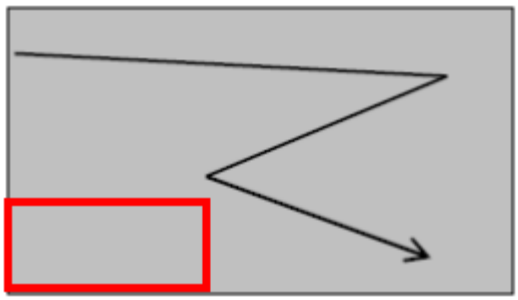


Figure 12 - Outside Area of First Scan

4.3.7.9 The specific screens shall have the minimum necessary information to allow operation of equipment or system.

4.3.7.10 The line drawing should show the fluid flow/ power, whenever possible, from left to right and from top to bottom. At each change of direction, an arrow should be used to indicate the direction of flow before the vertex.

4.3.8 Safety General View Screen

4.3.8.1 In the Safety General View Screen, the starboard view of the UNIT shall be displayed, with a graphical representation of all elevations and their corresponding safety areas, separately. Each level shall be displayed by a different object with color dynamics representing an alarm summary function: a specific color shall be displayed when there is at least one detected fire, confirmed fire, detected gas or confirmed gas alarm. The identification of the levels shall be written in ***Black*** and the number of the corresponding safety area shall be indicated.

4.3.8.2 The top view of the UNIT with the identification of the modules shall also be represented. Each module shall be represented by a different object with alarm summary color dynamics as described in item 4.3.8.1. The identification of the modules shall be written in ***Black***.

4.3.8.3 The paging command to the safety specific screen shall be done through the top view of the platform, by selecting the respective module. Figure 13 and Figure 14 show examples of Safety General Screen View for Topsides and Hull, respectively.

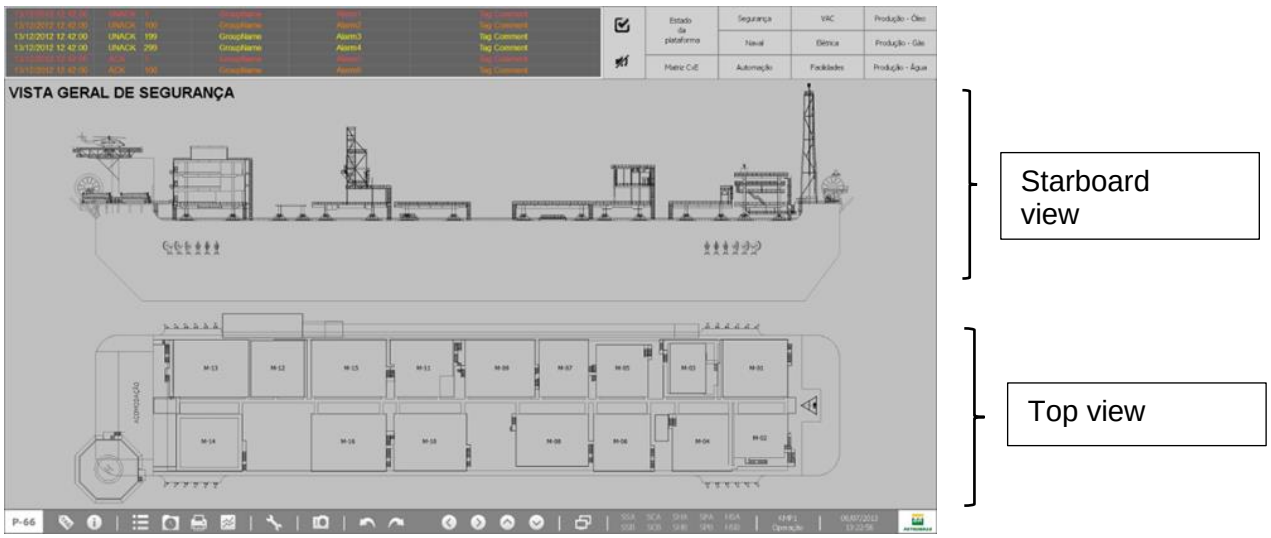


Figure 13 – Example of Safety General View Screen for Topsides

Figure 14 – Example of Safety General View Screen for Hull

4.3.9 Safety Specific Screens

4.3.9.1 In Safety Specific Screens, for all elevations, the top view of a module shall be represented, allowing the identification of the different Safety Zones separately.

4.3.9.2 In each Safety Specific Screen and Window, the geographic location and status of the respective safety devices and main equipment shall be represented:

- Flame, smoke and heat detectors;
- Gas detectors;
- Manual fire alarms (AMIs);
- Door switches;
- VAC equipment (fans/air-conditioning units/air extractors and start/stop push-buttons, fire/gas dampers, flow switches and ducts). Note: whenever there are Safety and VAC devices in the same zone (for example, rooms/enclosed areas), they shall be represented in the same Safety Screen/Window;
- All CO_2 firefighting instruments and equipment;
- All manual firefighting;
- ADVs (automatic deluge valves);
- Position and identification of CCTV cameras;
- Main process equipment located in the Zone (vessels, pumps, panels etc), in order to help operators to locate them in the plant.

4.3.9.3 The activation and confirmation of firefighting by CO2 shall be displayed in a specific Safety Windows.

4.3.9.4 If the representations of all modules with their respective devices do not fit in one safety specific screen, detailed safety windows shall be created for each zone. The Safety Zones shall have alarm summary dynamic as described in item 6.4.5. A feature to indicate how many detail safety windows there are in each module shall be provided in order to grant to the operator the use of the navigation buttons. For example, after screen title put in parentheses (n of m).

4.3.9.5 The paging command to a safety window shall be done through the Safety Specific Screens, by selecting the respective Safety Zone.

4.3.9.6 The screen title shall indicate the platform module and the generic safety zone tag of the represented area.

4.3.9.7 At the left bottom of the safety specific screens, a drawing of the starboard or topside view of the UNIT, in a reduced scale, shall be displayed. At these outlines, the location of the module shall be indicated, in Dark Gray, without alarm summary function, in order to help operators to easily locate the fire & gas event.

4.3.9.8 Ship directions shall be represented in all Safety and Hull screens (top, bottom and sides). The direction shall be from stem (left) to bow (right).

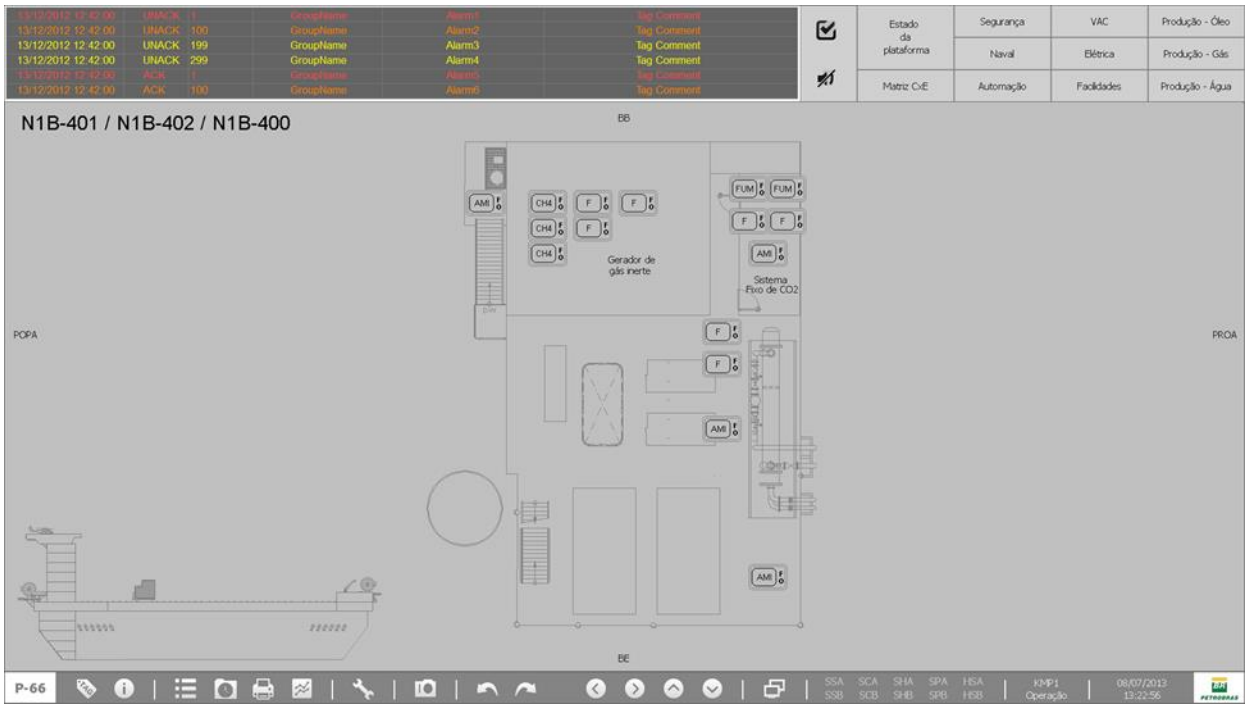
- Stern – AFT, Popa;
- Bow – FWD, Proa;
- Starboard – BE, Boreste;
- Portside – BB, Bombordo;.

4.3.9.9 The fire detectors shall be represented by the letter “F” within a rectangle. Gas detectors shall be represented by a text according to the gas type (CH4, CO2, H2 or H2S) within a rectangle and the manual fire alarms shall be represented by the abbreviation “AMI” within a rectangle.

4.3.9.10 A dashed line shall link the gas open path detectors.

4.3.9.11 The alarm annunciation shall be done through a rectangle around the representation of the detector or AMI, as described in item 6.4.5.2.

4.3.9.12 The corresponding operation window shall be displayed when a detector representation is selected. In the Safety Windows, the main equipment shall also be represented, as mentioned in item 4.3.9.2.



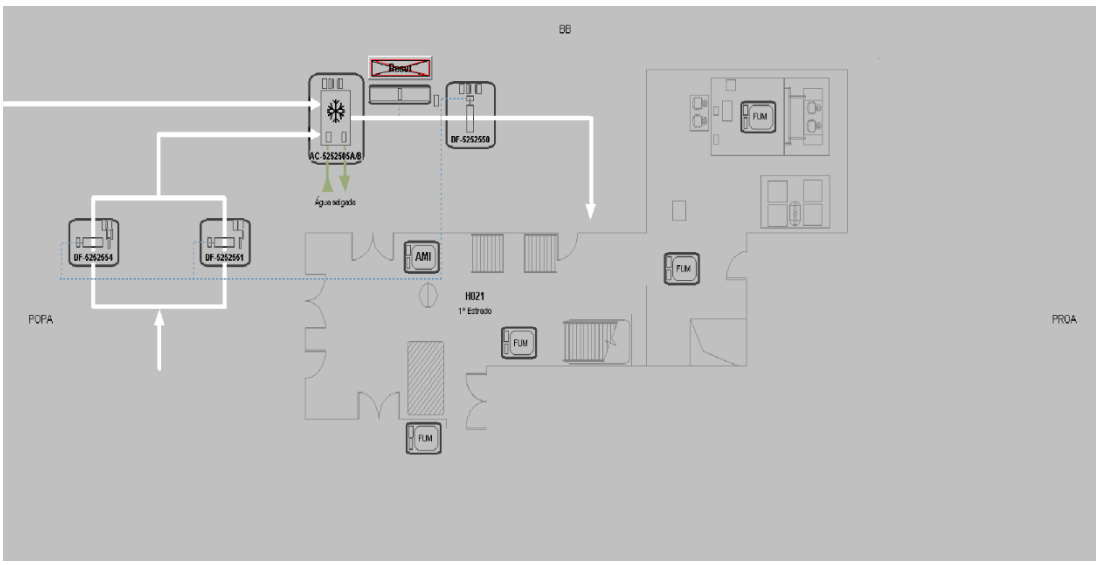


Figure 15 – Examples of Safety Specific Screens/Windows
(The second screen area is an example of a Safety Screen with VAC ducts)

4.3.10 F&G Detectors Operation Window

4.3.10.1 The detectors operation windows shall be composed of the Operation Tab and Maintenance Tab.

4.3.10.2 **Operation Tab**

4.3.10.2.1 The Operation Tab shall have the following elements: real time numeric values, unit, inhibition status and inhibition commands.

4.3.10.2.2 The units used for numeric values shall be %LEL for CH4 gas, ppm for toxic gas and (4 to 20 mA) for flame detectors.

4.3.10.2.3 The text of inhibition status shall be according to Table 10, within a rectangle.

Table 10 – Example of Inhibition status text

MAINTENANCE INHIBITION	OPERATIONAL INHIBITION	TEXT
Not Actuated	Not Actuated	*Não Atuado*
Actuated	Not Actuated	*OM Atuado*

4.3.10.2.4 An example of F&G detectors' Operation Tab is presented in Figure 16. It shall be confirmed which types of inhibition the fire and gas detectors will be subject (maintenance inhibition, operational inhibition or both).

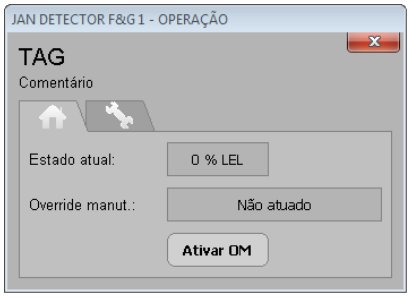


Figure 16 – Example of (Gas) Detector Operation Tab.

4.3.10.3 Maintenance Tab

4.3.10.3.1 On Maintenance Tab, the detector´s failure status shall be displayed. The text shall be displayed according to Table 11.

Table 11 - Maintenance tab failure status text.

FAILURE	TEXT
I/O module	Módulo em Falha
Chanel	Falha de Monitoramento de Linha
Out of range	Instrumento Fora da Faixa

4.3.10.3.2 An example of F&G detectors´ Maintenance Tab is presented in Figure 17.

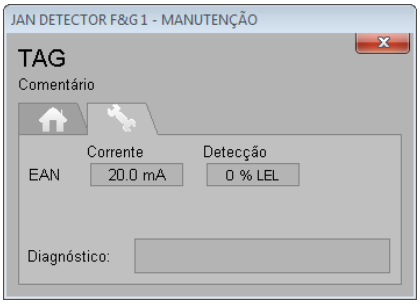


Figure 17 – Example of Flame/Gas Detector maintenance tab.

4.3.11 VAC General View and VAC General Flow Screens

4.3.11.1 In VAC General Flow Screen, each safety zone shall be represented by a rectangle with ***Black*** text and ***Snow Gray*** background with alarm summary function.

4.3.11.2 The selection of each safety zone rectangle shall execute paging command to the corresponding Safety Window or room where VAC equipment are located.

4.3.11.3 VAC General View Screen shall be composed of rectangles that represent VAC equipment (fans, air-conditioners and air extractors), where it shall be possible to display their status and start-stop commands pushbuttons.

4.3.11.4 The equipment that assist more than one safety zone shall be represented, as well as the equipment and dampers status, flow switches and ducts, as in D&IDs.

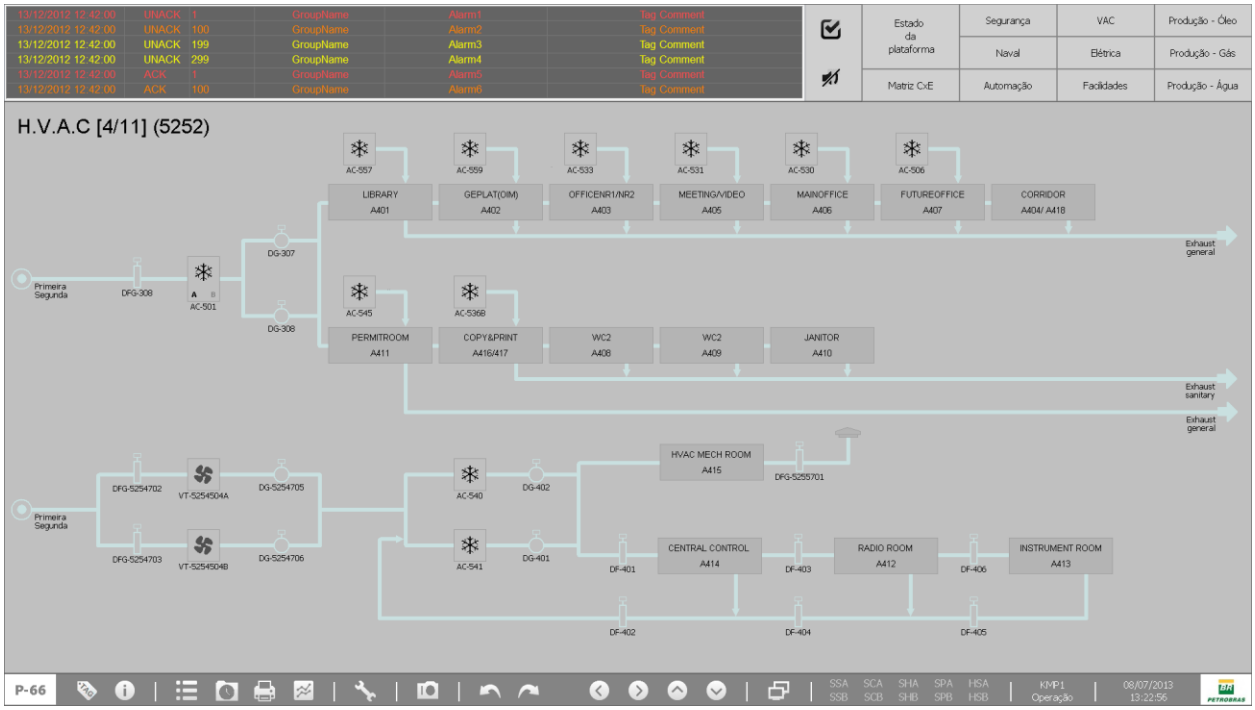


Figure 18 – Example of VAC General View Screen

4.3.12 Cause & Effect Matrix Screens

4.3.12.1 All physical and virtual switches that are part of interlocking logic shall be presented (inputs and outputs).

4.3.12.2 The Cause and Effect Matrix is a representation of the actions taken due to the abnormal events detected, as foreseen on the safety interlocking system. The matrix rows indicate the events in terms of the sensors which define the events by its actuation (inputs). The columns indicate the actions executed in terms of the equipment to be actuated (outputs).

4.3.12.3 The screen title shall indicate the equipment, system or process area for which the Cause & Effect matrix is related.

4.3.12.4 The background color of the CxE matrix screens shall be ***Snow Gray***.

4.3.12.5 The rows shall be composed by the fields presented below:

- Description: provides a description of the event represented by the sensor actuation in ***Black*** text. The color dynamic of the description field's background shall be according with the physical status of the sensor, independently of inhibitions, according to Table 12.

Table 12 – Color dynamic of description field's background.

PHYSICAL STATUS	COLOR
Normal	***Snow Gray***
Actuated	***Soft Pink***

- Sensor's tag: the tag shall be written in ***Black*** color. The color dynamic of background of the Sensor's tag field shall be according with the physical status of the sensor, independently of inhibitions, according to Table 13.

Table 13 – Color dynamic of sensor's tag background.

PHYSICAL STATUS	COLOR
Normal	***Snow Gray***
Actuated	***Soft Pink***

- Inhibition Status: the dynamic of the inhibition status field shall be according to the physical status, Operational and Maintenance inhibitions, according to Table 14.

Table 14 – Color/text dynamic of inhibition status.

PHYSICAL STATUS	MAINTENANCE INHIBITION	OPERATIONAL INHIBITION	TEXT	BACKGROUND COLOR
Not Actuated	Not Actuated	Not Actuated	Blank field	***Snow Gray***
Actuated	Not Actuated	Not Actuated	Blank field	***Soft Pink***
-	Actuated	Not Actuated	OM	***Blue Oster***

-	Not Actuated	Actuated	OO	***Blue Oster***
-	Actuated	Actuated	OM e OO	***Blue Oster***

- If defined by design, remaining time of operational inhibition shall also be displayed when operational inhibition is actuated (Table 15):

Table 15 – Color/Text dynamic of operational inhibition remaining time

PHYSICAL STATUS	MAINTENANCE INHIBITION	OPERATIONAL INHIBITION	TEXT	BACKGROUND COLOR
Not Actuated	Not Actuated	Not Actuated	Blank field	***Snow Gray***
Actuated	Not Actuated	Not Actuated	Blank field	***Soft Pink***
-	Actuated	Not Actuated	Blank field	***Blue Oster***
-	Not Actuated	Actuated	Remaining time in seconds	***Blue Oster***
-	Actuated	Actuated	Remaining time in seconds	***Blue Oster***

- Row x Column intersection: if there is no correspondence between the cause (row) and effect (column) the intersection shall always shows the background color ***Snow Gray***. Whenever there is some correspondence, the background color shall indicate that the command to execute the corresponding action is being issued. The colors displayed by the object are presented on Table 16.

Table 16 - Colors dynamic of Row x Column intersection.

PHYSICAL STATUS	COLORS
Not Actuated or Overridden/inhibited	***Silver Gray***
Actuated	***Soft Pink***

- Area description: indicates the process or utility area where the sensor is installed. The selection of this object shall execute a paging command for the corresponding specific screen. The text shall be in ***Black***, corresponding of process/utility screen title.

4.3.12.6 The columns shall be composed by the fields presented below:

- Equipment's identification tag: the tag shall be written in ***Black*** color. The color dynamic of background of the Equipment's tag field shall be according with the interlocking logic resulted, independently of inhibitions, according to Table 17. The equipment usually are ADV, SDV, BDV and XV valves´ actuators, pumps and other electrical equipment and package units.

Table 17 - Color dynamic of equipment's tag background.

PHYSICAL STATUS	COLORS
Normal	***Snow Gray***
Actuated	***Soft Pink***

- Output Override Status: the dynamic of the output override status field shall be according to the interlocking logic result and output overrides to open or close/ startup or stop, according to Table 18. The possibility of issuing output override commands shall be confirmed during Detail Engineering Design Phase.

Table 18 - Color dynamic of output override status.

Interlocking logic resulted	Output Override Open/Start	Output Override Close/Stop	Text	Background Color
Not Actuated	Not Actuated	Not Actuated	Blank field	***Snow Gray***
Actuated	Not Actuated	Not Actuated	Blank field	***Soft Pink***
-	Actuated	Not Actuated	OV Abrir /OV Ligar	***Blue Oster***
-	Not Actuated	Actuated	OV Fechar /OV Desligar	***Blue Oster***

- Effect: the dynamic of effect field shall be according to the effect of the output over the valve or equipment. The text shall be a verb written in ***Black*** color (“abrir”-open, “fechar”-close, “ligar”-startup, “desligar”-stop) indicating the command to be executed. After the execution of the command, the text shall be an adjective (“aberta”-open, “fechada”-closed, “ligada”-turned on, “desligada”-turned off, “falha” - valve and equipment failure, according the real status of the equipment. The color dynamic of the effect field background shall be according to Table 19.

Table 19 - Color dynamic of effect field background.

Interlocking logic resulted	Output Override	Failure Status	Background Color
Not Actuated	Not Actuated	Off	***Snow Gray***
Actuated	Not Actuated	Off	***Soft Pink***
-	Actuated	Off	***Blue Oster***
-	-	On	***Light Yellow***

4.3.12.7 The Process/Utilities Cause and Effect Matrix screens shall be grouped by effect, i.e, each effect shall only be displayed once.

4.3.12.8 The Fire & Gas and VAC cause and effect matrix screens shall be grouped by cause and voting logics.

4.3.12.9 Scroll bars may be created, in case of the amount of lines and/or columns exceed the size of the screens.

4.3.12.10 There shall be Cause and Effect Matrix and VAC screens for the PACKAGE UNITS whenever necessary. It shall be noted, however, that the availability of input inhibition and/or output overrides commands depends on the manufacturers.

4.3.12.11 Rows of different processes shall be separated with a thicker line.

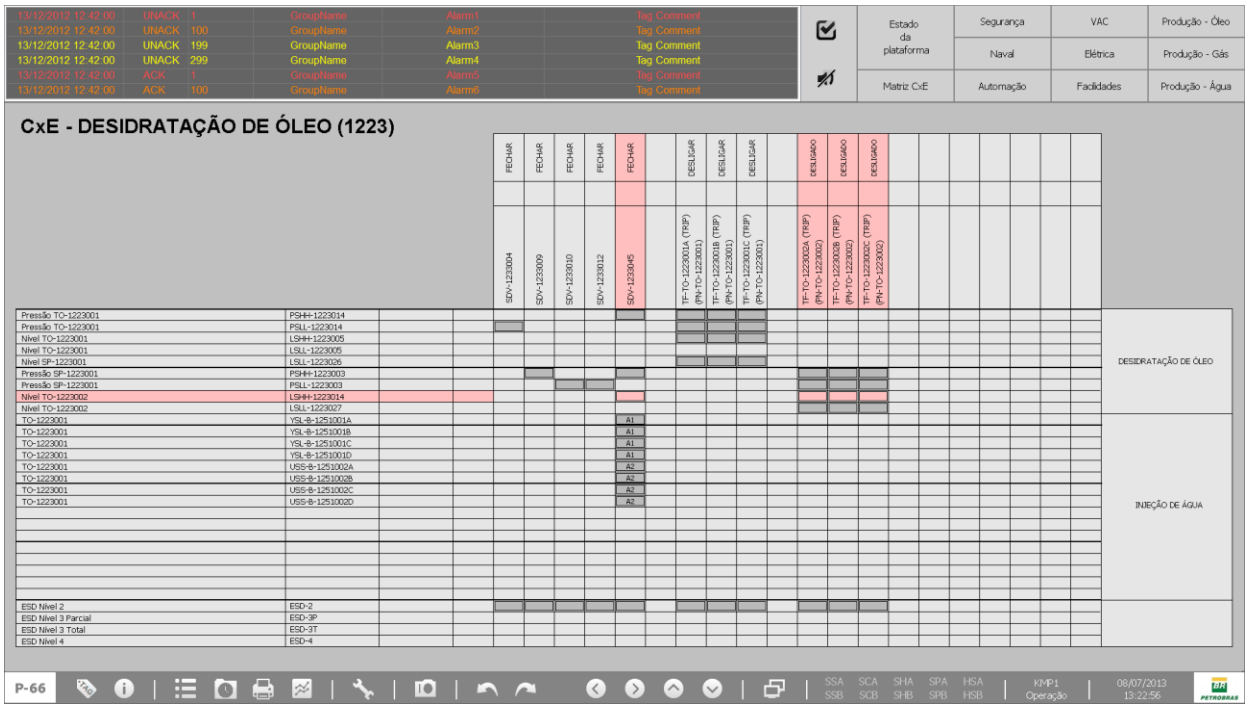


Figure 19 – Example of a Cause & Effect Matrix screen.

4.3.13 Gas Detectors Screens

4.3.13.1 On gas detectors screens, it shall be presented one or more tables containing a list of the gas detectors grouped by safety zone, with layout similar to the one shown in .

4.3.13.2

4.3.13.3 Table 20.

Table 20 - Gas Detectors Table.

ZONA M1-101			
AST-M001	CH4	OM	0 % LEL
AST-M002	CH4		0 % LEL
AST-M003	CO2		0 ppm
AST-M004	CO2		0 ppm
AST-M005	H2S		0 ppm
AST-M006	H2S		0 ppm

Where:

- 1° Column - Detector's identification tag (omitting the zone).
- 2° Column - Gas Type

The alarms annunciation related to the gas detectors shall be done through a rectangle around of the gas type with the same dynamic described in item 6.

- 3°Column - Maintenance inhibition Status

  The maintenance inhibition status shall be indicated with the same dynamic presented on cause and effect matrix screen.

- 4°Column - Read numeric value, i.e. %LEL for CH4 Gas and ppm for Toxic Gas.

4.3.13.4 The corresponding operational window shall be displayed when the row is selected.

4.3.14 Flame Detectors Screens

4.3.14.1 Similar to Gas detectors screen(s), in Flame Detectors Screens, one or more tables containing a list of the fire detectors grouped by safety zone shall be presented with the layout similar to the one shown in Table 21.

Table 21 - Flame Detectors Table.

ZONA M1-101			
UST-M001	F	OM	4 mA
UST-M002	F		4 mA
UST-M003	F		4 mA
UST-M004	F		4 mA
UST-M005	F		4 mA
UST-M006	F		4 mA

Where:

- 1° Column – Detector identification tag (omitting the zone).
- 2° Column – Sensor type ([F]fire or [G]gas).

  The alarms annunciation related to the flame detectors shall be done through a rectangle around of the sensor type with the same dynamic described in item 6.

- 3°Column – Inhibition Status

  The inhibition status (OM or OO) shall be indicated with the same dynamic presented in Cause and Effect Matrix screen.

- 4°Column - Numeric value in mA.

4.3.14.2 The corresponding operational window shall be displayed when the row is selected.

4.3.15 Flow Metering System Screens

4.3.15.1 In SOS, it shall be configured at least one Flow Metering System Screen considering a summary of all metering points, typically as represented in project drawing entitled FLOW METERING LOCATIONS;

4.3.15.2 All fiscal, allocation, custody transfer and operational points shall be indicated;

4.3.15.3 All topsides and hull flow metering system variables shall be displayed;

4.3.15.4 It shall be supplied at least two more Flow Metering Screens according to project specific definitions (examples: topsides/hull segregation, Flow Metering System Architecture etc).

4.3.16 Electrical System Screens

4.3.16.1 Figure 20 shows an example of Electrical System General View Screen area.

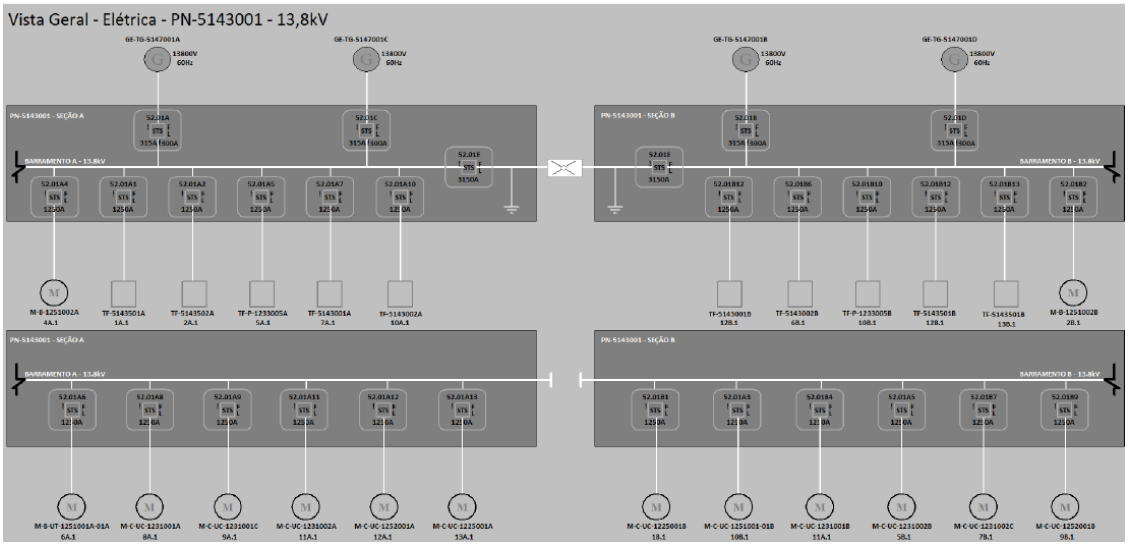


Figure 20 – Example of Electrical System General View Screen area

4.3.16.2 Electrical System General View Screen(s) shall display key one-line diagrams representation for low, medium and high voltage. The use of more than one graphic screen is allowed. Main electrical system equipment status and alarms shall be displayed.

4.3.16.3 Colors and symbols for the Electrical System screens shall be according to Electrical System Typical Document I-ET-3010.00-5140-700-P4X-005 – REQUIREMENTS FOR HUMAN ENGINEERING DESIGN FOR ELECTRICAL SYSTEMS OF OFFSHORE UNITS. If any symbol or color is not defined in that document, PETROBRAS shall be consulted.

4.3.16.4 Only Electrical System components shall be displayed in Electrical System screens. Process electric equipment shall only be represented in Process / Non-

Electrical Utilities screens, and shall be commanded from the specific command window, according to item 4.4.6 and not through Electrical system screens.

4.3.16.5 All UPS status, alarms and outlet voltage indication shall be displayed at all Electrical System Screens.

4.3.16.6 The color of the bars shall be according to the voltage level, presented in Table 22.

Table 22 - Voltage level colors.

VOLTAGE LEVEL	COLOR
Low voltage (<1kV)	***Normal Purple***
Medium, high voltage (>1kV)	***Dark Purple***
Deenergized bus bar	***Smoke Gray***

4.3.17 Automation screens

4.3.17.1 Navigation to these screens shall be done from the "*Automação*" paging button located at the right top of all screens.

4.3.17.2 Besides displaying programmable logic controllers (PLC) status, automation screens shall also display the control and safety system architecture with information about communication status between the systems and their remote terminal units.

4.3.17.3 For each CSS cluster or PACKAGE UNIT controller, there shall be, at least, the following set of information signals:

- Master PLC active status;
- PLC A communications available status;
- PLC B communications available status;
- Low battery indication;
- CPU Forcing;
- I/O Forcing;
- I/O failure alarms;
- Rack or CPU failure status;
- Network cards failure status;
- Power supply failure status and alarms;
- Inlet voltage and current values indication;
- Inlet voltage and current failure status/alarms.

4.3.17.4 For all CSS Remote I/O Panels (and PACKAGE UNIT Remote I/O Panel, if any):

- Communication status with PLC CPUs;
- Internal pressure indication;
- Internal low pressure indication/alarm;
- Open doors status/alarms;
- Ground fault detection status/alarms;
- Power supplies failure indication/alarms;
- Power consumption, inlet voltage and inlet current indications;
- Inlet voltage and current failures status/alarms.

4.3.18 Hull General View Screen

4.3.18.1 Navigation to this screen shall be done from the "*Naval*" paging button located at the right top of all screens.

4.3.18.2 Figure 21 shows an example of Hull General View Screen area.

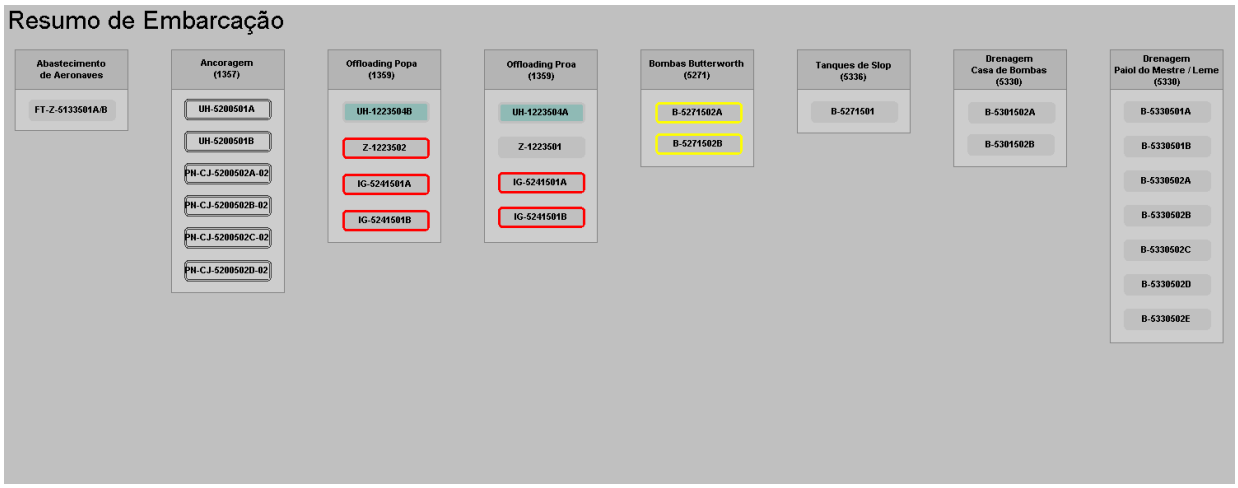


Figure 21 - Example of Hull General View Screen area

4.3.19 Facilities (non electrical utilities) General View Screen

4.3.19.1 Figure 22 shows an example of Hull Facilities General View Screen area.

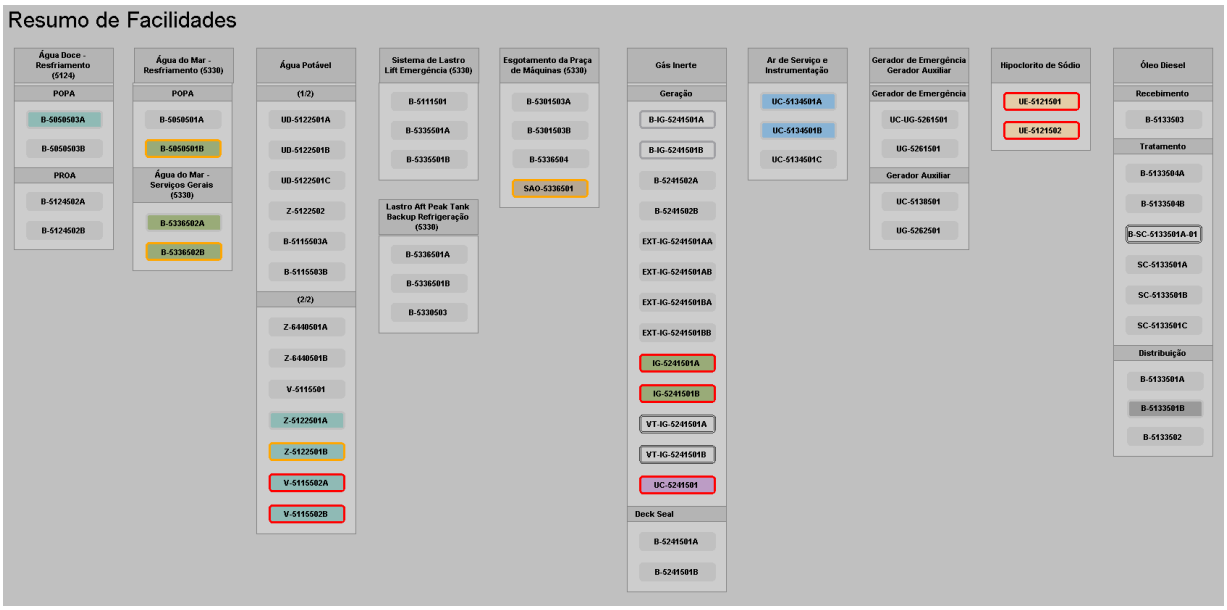


Figure 22 - Example of Hull Facilities General View Screen area

4.3.20 **PACKAGE UNITS Screens**

4.3.20.1 Each PACKAGE UNIT shall have at least one screen with the following information:

- CSS hardwired interface signals, according to project´s document entitled AUTOMATION INTERFACE OF PACKAGE UNITS;
- Other process data sent by network to SOS Package Units RTDS, to be defined before SOS configuration;
- PACKAGE UNIT alarms and acknowledgement, to be defined before SOS configuration;
- At least UAM (Unit Alarm Malfunction) signal and alarm shall be displayed and announced in SOS.

4.3.20.2 Symbols and color codes shall be according to item 7.2 (k).

4.3.20.3 Besides PACKAGE UNITS specific screens, it shall be defined one PACKAGE UNIT General View Screen for Topsides and one PACKAGE UNIT General View Screen for Hull. In these screens, each PACKAGE UNIT shall be represented by a rectangle containing at least UAM (Unit Alarm Malfunction), REC-UAM (acknowledged UAM) and UAS (Unit Alarm Shutdown) indications. These signals shall be represented by screen objects with the same color dynamic as their corresponding alarm messages. When UAM or UAS are actuated, operator shall acknowledge them in SOS and investigate the cause of the alarm in PACKAGE UNIT specific screen or in PACKAGE UNIT dedicated HMI, also located at operator´s desk.

4.3.20.4 It is important to note that UAM shall be actuated at any new malfunction indication of the Package Unit. UAM acknowledgment by operator at SOS shall trigger a procedure that sets REC-UAM signal to “true” value. This shall release UAM annunciation for other malfunctioning alarm, so that a single malfunctioning alarm sets UAM at once. Note: this is different from alarm resume, where one or more alarms actuate UAM by means of an [OR] logic.

4.3.20.5 It is considered that the PACKAGE UNIT internal logic receives from CSS or from SOS a signal called REC-UAM to be used to release USM and, consequently, UAM. PACKAGE UNIT internal logic shall be programmed accordingly. See I-ET-3010.00-1200-800-P4X-002 – AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS.

4.3.20.6 Depending on the size of PACKAGE UNIT and the quantity of data exchanged with CSS/SOS, one PACKAGE UNIT data may be displayed only at the PACKAGE UNIT General View Screen. This may be agreed during SOS configuration.

4.4 Pop-up Windows

4.4.1 Pop-up windows shall be used for sending commands and displaying real time status and values of field equipment and instrumentation.

4.4.2 The pop-up windows shall have adjustable position.

4.4.3 Pop-up windows shall be supplied for every analog instrument/control loop, on-off valve (XV, SDV, BDV, ADV), pump, VAC equipment and field instrument, including flame and gas detectors.

4.4.4 All pop-up windows and their tabs shall be submitted to PETROBRAS for approval.

4.4.5 All commands to field equipment/instrument (stop/start/open/close), as well as maintenance and operational inhibitions (OM/OO) shall have an associated confirmation sub-window (see Figure 23).

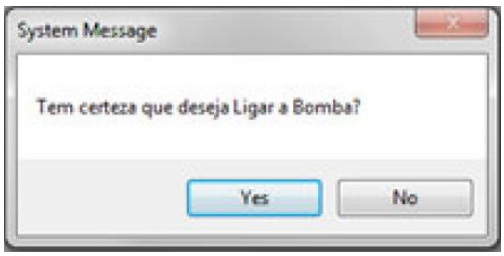


Figure 23 – Example of command confirmation sub-window.

4.4.6 Equipment command windows

4.4.6.1 Equipment command windows shall have two tabs: Operation Tab and Maintenance Tab.

4.4.6.2 Operation tab shall be composed of equipment identification tag, service, status, equipment command, equipment maintenance inhibition command or output override command and equipment inhibition/override status. Figure 24 shows an example of the layout of an Operation Tab of an Equipment command window.

Figure 24 – Example of Command window Operation tab

4.4.6.3 Valves and/or equipment status shall be composed as a text within a rectangle according to Table 23.

Table 23 - Valve or equipment status.

STATUS	TEXT
Opened	Aberta
Closed	Fechada
On	Operando
Off	Parado
Failure	Em Falha

4.4.6.4 Valve open/close or equipment start/stop commands pushbuttons may be configured as toggle bits or as distinct memory addresses.

4.4.6.5 Maintenance inhibition command push button shall be configured as a rectangle with the word “OM” in ***Black*** text.

4.4.6.6 Local or remote operation status: a text within a rectangle shall be displayed according to Table 24.

Table 24 - Local or remote operation status.

OPERATION	TEXT
Local	Local
Remote	Remota

4.4.6.7 Equipment command window Maintenance Tab shall have at least the following information: equipment identification tag, service, command return (limit switches or relays), failure status, command status and internal logic values.

4.4.6.8 Figure 25 shows an example of the layout of the Command window Maintenance tab.

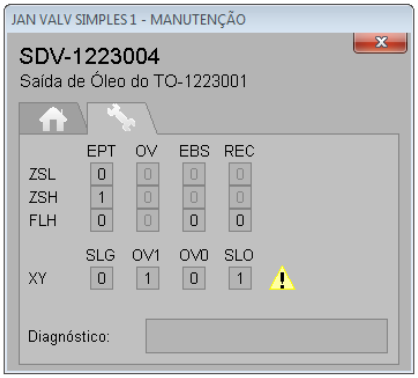


Figure 25 – Example of Equipment command window Maintenance Tab.

4.4.7 Instruments Windows

4.4.7.1 Operation Tab

4.4.7.1.1 The Operation Tab shall have the following elements: setpoints, instruments range, maintenance inhibition status and maintenance inhibition commands.

4.4.7.1.2 All setpoints shall be displayed within a rectangle.

4.4.7.1.3 Maintenance and Operational Inhibition status: a text within a rectangle shall be displayed according to Table 25.

Table 25 - Maintenance and Operational inhibition status of instruments operation tab.

MAINTENANCE INHIBITION	OPERATIONAL INHIBITION	TEXT
Not Actuated	Not Actuated	Não Atuado
Actuated	Not Actuated	OM Atuado
Not Actuated	Actuated	OO Atuado

Actuated	Actuated	OM e OO Atuados

4.4.7.1.4 Only control setpoints (L, H) are available for modification at the Operation Tab. Safety setpoints (LL, HH) are only available for reading. All these setpoints shall be kept at the retentive memory of the automatic logic device (PLC), and modifications in safety interlocking setpoints shall be authorized only through a formal and trackable procedure.

4.4.7.1.5 An example of layout of the instrument windows Operation Tab is presented in Figure 26. In Figure 26, “Tempo restante OO” means operational inhibition remaining time, that shall be confirmed in Company´s internal Maintenance and Operational inhibitions Policy.

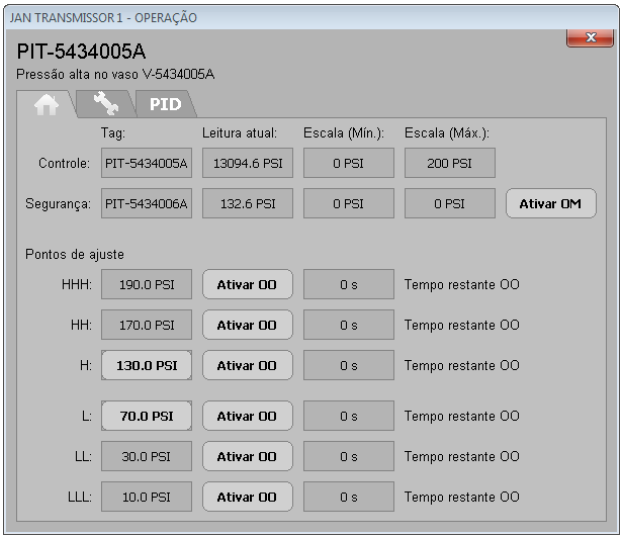


Figure 26 – Example of analog instrument windows operation tab.

4.4.7.1.6 Both Control and Safety interlock instrument real time values shall be displayed in the Operation Tab.

4.4.7.1.7 When OM is activated for a safety instrument, all its associated logic switches (H, HH, HHH, L, LL, LLL) shall also receive OO command. This is necessary in order to avoid possible emergency shutdown by the time the instrument returns operational.

4.4.7.2 Maintenance Tab

4.4.7.2.1 Analog instrument windows´ Maintenance Tab shall be used for diagnostic. The following information shall be displayed: control and safety transmitters currents in mA, automatic logic internal variables, described in I-ET-3010.00-5520-800-P4X-

002 - IMPLEMENTATION OF INTERLOCKING AND CONTROL LOGIC and indication/alarm of discrepancy readings between control and safety transmitters.

4.4.7.2.2 Level transmitters windows Maintenance Tab shall also have its time counter.

4.4.7.2.3 Nucleonic level instruments operation and maintenance tabs shall be defined during SOS configuration with the final client.

4.4.7.2.4 Failure status shall be shown according to Table 26.

Table 26 - Failure status of instruments maintenance tab.

FAILURE	TEXT
I/O module	Módulo em Falha
Chanel	Falha de Monitoração de Linha
Out of range	Instrumento Fora da Faixa

4.4.7.2.5 An example of layout of the instruments windows Maintenance Tab is presented in Figure 27.

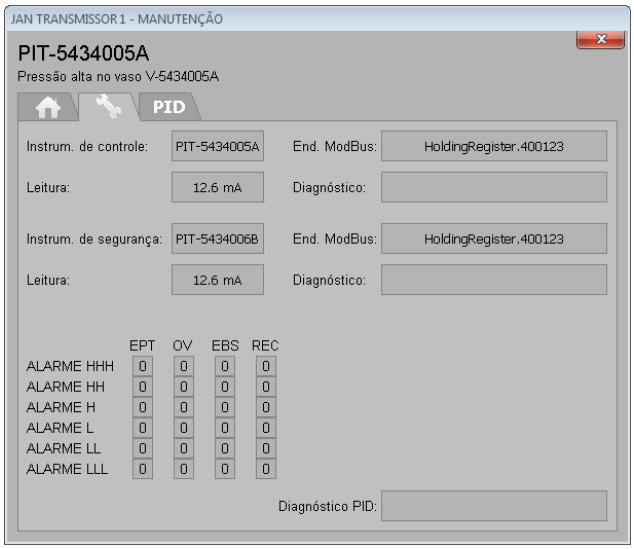


Figure 27 – Example of Instruments maintenance tab (in this example, discrepancy status/alarm is not shown).

4.4.8 **Control Loop Tuning Tab**

4.4.8.1 The control loop tuning tab shall be composed of three sections: data input, graph, and faceplate.

4.4.8.2 Data inputs shall be on the left side of the window. The instruments and controllers' parameters changes shall be made through selection of the rectangle containing the current value and entering the new value.

4.4.8.3 To change the controller mode (automatic or manual), the corresponding mode button shall be selected;

4.4.8.4 The components that shall be available on data inputs are shown below.

a) For PID Controllers:

- Valve opening (percentage). This value shall correspond to the percentage of opening of the valve, and not the output sign at the controller;
- Set point of the unit of process variable (percentage or engineering unit);
- Deadband;
- Maximum value of valve opening;
- Minimum value of valve opening;
- Proportional gain;
- Integral time;
- Derivative time;
- Direct/reverse (DIRETA/INVERSA) action indication;
- Manual/Automatic (MANUAL/AUTOMÁTICO) controller action;
- Controller Failure mode – FO/FC (FA/FF).

b) For Gas Flow Totalizers:

- Meter configuration data;
- Gas composition constants;
- Scale adjustments - instant flow, temperature and pressure (when applicable).

4.4.8.5 Instrument's tag and two scale graph, one with the engineering unit of the process variable, and the other in percentage (0 - 100%).

4.4.8.6 The graphic area shall be located on the right side of the window.

4.4.8.7 The components that shall be available on graphic area are shown below. All of them shall be displayed for the latest 120 seconds.

a) For PID Controllers:

- Process variable (PV);
- Setpoint (SP);
- Expected % of manipulated variable (%MV);
- Real position (returned ZIT); in case it is available.

b) For Gas Flow Totalizers:

- Instant flow;
- Corrected instant flow;
- Temperature;
- Pressure.

c) For Oil Flow Totalizers:

- Instant flow;
- Corrected instant flow.

d) For Water Flow Totalizers:

- Instant flow

4.4.8.8 The instruments' faceplate is located in the middle of the window.

4.4.8.9 The components that shall be available at faceplate area are shown below.

a) For PID Controllers:

- Input variable numeric value and Engineering unit;
- Real position of valve in percentage, if available;

Note: In case of split-range valve configurations, all valves opening percentage shall be indicated, if available.

b) For Oil Flow Totalizers:

- Numeric value of instant flow and Engineering unit;
- Numeric value of totalized flow and Engineering unit;
- Numeric value of totalized flow in the latest production period (to be used in platform production bulletin, for 24 of production);
- Numeric value of partial totalized flow since the last balance;
- Partial totalized flow reset button;
- Flow totalizer time (hh:mm:ss);
- Synchronizing button between supervision workstations clocks and flow totalizers. This button copies workstations time to flow totalizers;
- Instant flow graph in 0-100% scale.

c) For Gas Flow Totalizers:

- Instant flow, temperature and pressure graphs, in 0-100% scale;
- Numeric value of instant flow, temperature and pressure;
- Orifice plate constant;
- Numeric value of totalized flow;
- Numeric value of totalized flow in the latest production period (to be used in platform production bulletin, for 24 hours of production);
- Numeric value of partial totalized flow since the last balance;

- Partial totalized flow reset button;
- Flow totalizer time (hh:mm:ss);
- Synchronizing button between supervision workstations clocks and flow totalizers. This button copies workstations time to flow totalizers.

4.4.8.10 An example of layout of the instrument Control Loop Tuning Tab for PID controllers is presented in Figure 28.

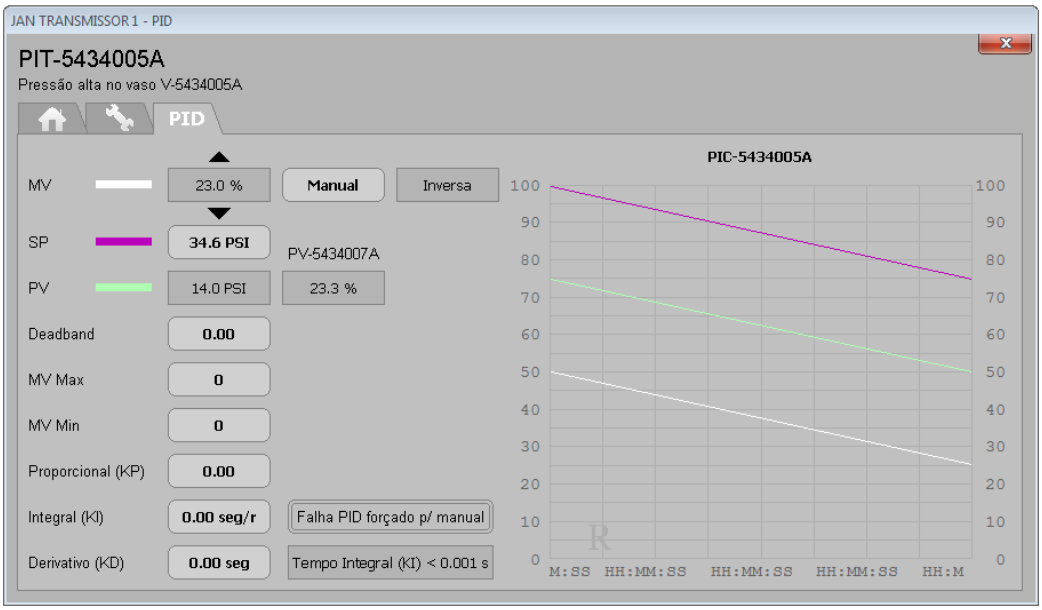


Figure 28 - Instrument Control Loop Tuning Tab

5 REPORTS

5.1 General Requirements

5.1.1 The Reports are called from the bottom bar, item 4.2.7 of this document.

5.1.2 Reports shall be automatically generated or at operator´s request, and recorded on disk, in order to allow recovery. The period will be informed during SOS configuration by PETROBRAS.

5.1.3 All Reports formats shall be compatible with the Company Office Automation package used by the UNIT.

5.1.4 It shall be able to print or display the Reports in a special screen of any SOS HMI. Each Report shall be associated to a specific logic pushbutton.

5.1.5 All Reports shall be issued in the active language mode, i.e. in the language selected by the operator on the supervisory system (see item 4.2.2).

5.1.6 All Reports headers shall contain, at least:

- PETROBRAS logo

- UNIT Name
- Report name
- Date and Time of issuance
- User
- Page number/quantity of Pages

5.1.7 It shall be possible to generate custom reports from Historical Data Servers, using the Historical Data collection and registering native function of the Supervisory System.

5.1.8 Additionally, pre-defined reports, such as Inhibition Reports, shall also be configured and be available from a proper direct access (items 5.2, 5.3, 5.4 and 5.5).

5.2 Inhibitions Report

5.2.1 This report shall be generated at operator´s request and automatically in a periodicity to be informed during SOS configuration time. It shall display the inhibited instruments and signals at the time it is generated.

5.2.2 This Report shall show tables with a list of all inhibitted instruments, independently of the type of inhibition (maintenance or operational), and the overridden outputs.

5.2.3 The Inhibition Report shall include at least the following data:

- Instrument/signal tag identification
- Instrument Location
- Inhibition Date/Time
- User ID of the person responsible for activating the inhibition
- Reason
- Description
- Operational inhibition time, if considered necessary by Company´s Inhibition Policy

5.2.4 This Report shall be split into 3 (three) sections: Maintenance inhibition (OM), Operational inhibition (OO) and Output Overrides. Maintenance inhibition section shall have three subsections: Gas Detectors, Flame Detectors and Other Instruments. Operational inhibition shall be issued by chronological order according to inhibition date/time, as well as Output Overrides.

5.2.5 The final layout will be informed by PETROBRAS during SOS configuration time.

5.3 Utilities Consumption Report

5.3.1 This report shall be generated at operator’s request and automatically in a periodicity to be informed during SOS configuration time.

5.3.2 This report shall be issued in order to show the main utilities consumption.

5.3.3 Minimal contents of Utilities Report:

- Available Level and/or volume of diesel oil

- Available level and/or volume of potable water;
- Amount of chemical products (units to be defined) – split by chemical product.

5.3.4 The final layout will be informed by PETROBRAS during SOS configuration time.

5.4 Daily Production

5.4.1 This report shall be generated at operator´s request and automatically in 24 hour periodicity.

5.4.2 This report shall be issued in order to show the daily production of oil, gas and water.

5.4.3 The final layout will be informed by PETROBRAS during SOS configuration time.

5.5 Stability Report

5.5.1 This report shall be generated at operator´s request and automatically in 24 hours periodicity.

5.5.2 This report shall be issued in order to show the stability programming, based on Stability and Load Calculation data.

5.5.3 The final layout will be informed by PETROBRAS during SOS configuration time.

5.6 Historical Data Collecting and Recording

5.6.1 All real time data read from all RTDS, including Package Units Real Time Data Servers, shall be historically collected and registered in the native Supervisory System Historical data collector. The periodicity of collection will be informed during SOS configuration.

5.6.2 According to I-ET-3010.00-5520-861-P4X-002 - SUPERVISION AND OPERATION SYSTEM - SOS, the native Supervisory System Historical data collector shall be properly dimensioned by SOS SUPPLIER.

6 ALARM AND EVENTS MANAGEMENT AND TREATMENT

6.1 General

6.1.1 For all topics related to alarms, IEC-62682 shall be followed, complemented by the items described in this chapter.

6.1.2 Alarm is an information to the operator, always related to an abnormal situation, which requires an action in limited time.

6.1.3 For the Supervisory System, alarm is a text message that is displayed in Alarm Summary and is historically collected and registered in Alarm History. Besides the text messages, the screens may also contain dynamic objects that may change color, format or drawing due to specific alarm annunciation methods. The color of the text

messages and the dynamic objects located in the screens shall be defined according to the alarm priorities mentioned in item 6.4.4.

6.1.4 All alarms are generated in PLC logic according to I-ET-3010.00-5520-800-P4X-002 - IMPLEMENTATION OF INTERLOCKING AND CONTROL LOGIC and sent to the Supervisory Software to be announced and historically collected and registered.

6.2 Criteria for Alarm Rationalization and Prioritization

6.2.1 All alarms shall be prioritized so that their displays are properly designed.

6.2.2 During the assessment of these impacts, the protective layers which are available on the plant at the time of analysis shall be considered for alarms whose operator response has not been classified as IPL (independent protection layers). These protective layers may be safety instrumented functions or mechanical protective devices such as safety relief valves.

NOTE: The lack of adequate protection layer tends to leave to a high priority alarm. The availability of a safety instrumented system, for example, tends to reduce the impact associated with the environment and personnel safety, and to increase the impact associated with production loss, since in the lack of operator response to the alarm will leave the safety instrumented system to demand. High priority alarms may indicate an eventual need to revise the upper protection layers. The impact of an alarm status changed to an alert, or an alarm removal (status changed to event), may be verified in other analysis such as HAZOP studies. The same applies to a plant designed without a formal LOPA study.

6.2.3 Alarms whose operator response has been classified as IPL shall be prioritized disregarding the presence of any protective layers.

6.2.4 All alarms shall be assessed and properly documented according to PETROBRAS template during a multidisciplinary meeting, with the presence of Automation, Operation, Safety and Process personnel (Electrical, Mechanical, Nava Systems and other disciplines may also be called to attend the meetings).

6.2.5 One of the abovementioned asessment result is a proper alarm priority, which can be used to lead the operator to choose which alarm shall be dealt first, when two or more alarms are announced simultaneously.

6.2.6 All alarms shall be prioritized based on the allowable response time (ART) for the operator's response, and the impacts caused on the plant when no response is taken. These impacts may be related to loss of production and assets, environment damage and/or personnel safety, considering, within these categories, the alarms defined to comply with local legislation or company's internal policies. Table 27 shall be used to identify the allowable response time (ART) for each alarm. In Portuguese, this is named as *Tempo de Resposta do Operador*.

Table 27 - Allowable response Time (ART)

ART	Criterion
Long	More than 10 minutes and less than an hour

ART	Criterion
Medium	Between 3 and 10 minutes
Short	Less than 3 minutes

NOTE: Concept of Allowable Response Time is graphically represented in IEC-62682.

6.2.7 When ART is shorter than 1 minute, it shall be evaluated if the operator's action can be performed accordingly. In case this action is not possible, it shall be foreseen an automatic actuation. For periods of time between 1 and 3 minutes, special alarm annunciation mechanisms and special training for the operation staff shall be considered in order to promptly respond to the abnormal event.

6.2.8 If ART is longer than one hour, the abnormal signaling shall be considered as an ALERT.

6.2.9 The alarm priority shall be determined taking into account the operator allowable response time (ART) versus the impact on the plant if the operational action is not adopted (non-action impact). This analysis shall be performed using Tables 28 (Risks to Assets), 29 (Risks to Environment) and 30 (Risks to Personnel Safety). The highest priority value obtained shall be considered for the alarm. The consequence severity categories are aligned with other internal documents and policies.

6.2.10 If non-action impact in a determined aspect – Personnel safety, Environmental or Assets – is not found, there is no need to define alarm prioritization for that aspect.

6.2.10.1 For determining risks to Assets (Table 28- Determination of Priority by Risk to Assets / Operational Continuity (Complemented by 6.2.10.1), the following criteria shall be used:

- Negligible Consequences (financial loss up to US$ 100,000.00)
  - relief of minor amounts of fluids;
  - cavitation in conventional pumps.

- Marginal Consequences (financial loss between US$ 100,000.00 and US$ 1,000,000.00)
  - production out of specification;
  - possibility of damage in essential and non-essential equipment, caused by long term duration events, but does not requiring quick intervention of the operator.

- Medium Consequences (financial loss between US$ 1,000,000.00 and US$ 10,000,000.00)
  - disturbance in the utility area affecting other areas, as liquid injection into gas streams as to the fuel gas system;
  - relief of large amounts of fluids;
  - overflow of process fluids;
  - feed reduction or stop of production of the unit up to 60 minutes;
  - cavitation in high-speed pumps or multi-stage pumps;
  - damage on non-essential equipment with no reserve.

- Critical Consequences (financial loss between US$ 10,000,000.00 and US$ 100,000,000.00)
  - abrupt relief of large amount of mass causing violent release of energy, as sudden depressurization in high pressure systems;
  - product solidification in large lines requiring costly corrective actions;
  - mechanical damage to compressors, with no reserve, due to liquid income;
  - stop of production or feed to the unit higher than 60 minutes;
  - need for costly repairs on essential equipment with reserve;
  - need for low cost repairs on essential equipment with no reserve.

- Catastrophic Consequences (financial loss higher than US$ 100,000,000.00)
  - temperature excursion in exothermic reactions out of control;
  - overpressure in systems where the safety instrumented function is the final protection-device, due to the impossibility of installation of a safety relief device;
  - shutdown of the plant for unpredictable time;
  - explosion of fired heaters and boilers;
  - need for costly repairs on essential equipment with no reserve.

Table 28- Determination of Priority by Risk to Assets / Operational Continuity (Complemented by 6.2.10.1)

Consequence severity categories		Description/ characteristics	ART		
			Long	Medium	Short
V	Catastrophic	Catastrophic damage which may lead to industrial plant loss	Critical	Critical	Critical
IV	Critical	Severe damage to the systems (large time to repair)	High	High	Critical
III	Medium	Moderate damage to the systems	Medium	Medium	High
II	Marginal	Light damage to the systems/ equipments	Low	Low	Medium
I	Negligible	Light damage to equipments without affecting operational continuity	Low	Low	Low

Table 29 - Priority Determination by Risk to the Environment

Consequence Severity Categories		Description/ characteristics	ART		
			Long	Medium	Short
V	Catastrophic	Severe damage in sensitive areas or extending to other places	Critical	Critical	Critical
IV	Critical	Severe damage with localized effect	High	Critical	Critical
III	Medium	Moderate damage	High	High	Critical
II	Marginal	Light damage	Medium	High	High
I	Negligible	Insignificant damage	Low	Low	Medium

Table 30- Priority Determination by Risk to Personnel Safety

Severity categories of consequences		Description/ characteristics	ART		
			Long	Medium	Short
V	Catastrophic	Multiple plant inside or outside fatalities	Critical	Critical	Critical
IV	Critical	Plant inside fatality or plant outside serious injury	Critical	Critical	Critical
III	Medium	Plant inside serious injuries or plant outside light injuries	High	Critical	Critical
II	Marginal	Light injuries	Medium	High	High
I	Negligible	Cases of first aid at most	Low	Medium	Medium

6.3 Alarm Documentation

6.3.1 Before the configuration of the SOS Alarm System, SOS SUPPLIER shall create a document named Alarm List, numbered according to PETROBRAS internal numbering standard (N-1710), with information about each alarm, using the fields described below:

Table 31– Fields of Alarm List

ALARM LIST FIELD	DESCRIPTION
IDENTIFICAÇÃO DO ALARME (*ALARM TAG*)	Alarm identification (imported from Instrument List or from P&ID/D&ID)
IDENTIFICAÇÃO DO INSTRUMENTO (*INSTRUMENT TAG*)	Identification of physical instrument (imported from Instrument List or from P&ID/D&ID)
SERVIÇO (*SERVICE*)	Instrument service (imported from Instrument List)

P&ID/D&ID (P&ID/D&ID)	Process/Duct and Instrumentation Diagram where alarm is found (imported from Instrument List or from P&ID/D&ID). (if alarm is not present in P&ID/D&ID, this field is N/A)
ÁREA (*AREA*)	Area according to N-1710 (imported from Instrument List or from P&ID/D&ID)
MÓDULO (*MODULE*)	Module where the alarm or physical instrument is located (imported from Instrument List or from P&ID/D&ID)
GRUPO *(GROUP*)	Operation groups that alarm belongs, according to 6.4.3
GRUPO FUNCIONAL (*FUNCTIONAL GROUP*)	Operation sub-groups that alarm belongs, according to 6.4.3
CLASSE DO ALARME (IPL/SMS/General) (*ALARM CLASS*)	Information if the alarm is an independent protection layer (IPL), specific for Health and Safety (SMS) or other purpose (General)
CAUSAS POSSÍVEIS (*POSSIBLE CAUSES*)	According to client
AÇÃO REQUERIDA (*REQUIRED ACTION*)	According to client
IMPACTO DA NÃO AÇÃO (*NO ACTION IMPACT*)	According to item 6.2.9
TEMPO DE RESPOSTA DO OPERADOR (ALLOWABLE *OPERATOR RESPONSE TIME*)	According to item 6.2.9
SEVERIDADE (RISCOS A PESSOAS) (*SEVERITY 1 (SAFETY)*)	According to item 6.2.9
SEVERIDADE (RISCOS AO MEIO-AMBIENTE) (*SEVERITY 2 (ENVIRONMENT*))	According to item 6.2.9
SEVERIDADE (RISCOS A EQUIPAMENTOS/CONTINUIDADE OPERACIONAL) (*SEVERITY 3 (EQUIPMENT*))	According to item 6.2.9
PRIORIDADE (*PRIORITY*)	Allowable Response Time x Worst Severity (item 6.2.9)
LIMITE DE ALARME (*ALARM LIMIT*)	Alarm setpoint, by design
UNIDADE DE ENGENHARIA (*ENG UNIT)*	Alarm setpoint engineering unit, by design
BANDA MORTA *(DEAD BAND)*	Pre-trip alarm deadband, by design
TEMPORIZAÇÃO *(TIME DELAY)*	Trip alarm time delay, by design
MENSAGEM DE ALARME *(ALARM MESSAGE)*	Alphanumeric text message in the active supervisory system language (40 to 120 characters, depending on the chosen Supervisory System)
AVISO SONORO EM BUZINA EXTERNA? (S/N) *(SOUND IN EXTERNAL HORN? (Y/N*))	Indication of sound alarm in a dedicated external horn or beacon (activates a CLP output)
INICIADOR DE AÇÃO AUTOMÁTICA? (S/N) (AUTOMATIC ACTION INITIATOR? (Y/N))	Indication if the alarm initiates any automatic action or if the corresponding logic switch initiates emergency shutdown (ESD)
POSSIBILIDADE DE SUPRESSÃO? (S/N) (*SUPPRESSION POSSIBLE? (Y/N*))	Indication of the existence of automatic suppression by logic

LÓGICA DE SUPRESSÃO (*SUPPRESSION LOGIC*)	Description of Suppression logic (for example, "*PALL at pump discharge is suppressed if pump is off")*
DATA DA ANÁLISE (*ALARM ANALYSIS DATE*)	Indicates the date of alarm analysis
PARTICIPANTES DA ANÁLISE (ALARM ANALYSIS TEAM)	Indication of the persons who participated of the alarm analysis
OBSERVAÇÕES (*NOTES*)	Free notes

6.3.2 The Alarm List fields shall be defined before the alarm system configuration in SOS, in conjunction with the client. Alarm Messages shall be both in Brazilian Portuguese and English. The language in which the message will be displayed on the screen depends on the active language mode (see item 4.2.2).

6.3.3 The Alarm List shall be created during Detail Engineering Design Phase and updated for SOS FAT/SAT and by the time the UNIT is delivered. It shall be used to help configuring SOS. It shall also be kept updated during UNIT life cycle.

6.3.4 The alarm rationalization and prioritization, as well as its documentation, shall be performed whenever new alarms are included.

6.3.5 According to IEC-62682, alarm dead band is the range in which the state of the alarm is not altered, regardless of the variation of the signal. The use of alarm dead band is recommended to reduce the number of nuisance alarms. The values shall be adjusted based on operational experience according to the process variable. This item presents suggested preliminary values for alarm dead band. Time delay shall be used to avoid spurious trip alarms due to signal noise. Preliminary time delay values are also suggested for trip alarm annunciation. Both alarm dead band and time delay shall be confirmed during Detail Engineering Design Phase.

- Level: alarm dead band 5% / time delay: 10 seconds;
- Pressure: alarm dead band 2% / time delay: 5 seconds;
- Temperature: alarm dead band 1% / time delay 10 seconds;
- Flow: alarm dead band 5% / time delay 5 seconds.

6.3.6 Suppression logic: alarm suppression shall be defined by design in order to avoid alarm flood specially during equipment and plant shutdown. Suppression requirements shall be confirmed in alarm documentation, and suppression functional strategies shall be implemented. The suppressions shall be tested during CSS and SOS approval tests.

6.3.7 All documentation of alarms, including those from PACKAGE UNITS, shall be organized, registered and merged in digital media for future management of change.

6.4 Implementation in the Supervisory System

6.4.1 Alarm Summary Screen

6.4.1.1 Alarm Summary shall be a native function of the chosen Supervisory System. This shall be composed of alarm annunciation with the parameters mentioned in 6.4.1.2. Each alarm shall occupy one text line in a color that indicates its priority.

6.4.1.2 The Alarm Summary Screen shall be able to show a list of the active alarms, independently if they are acknowledged or not. Each text line shall contain at least the following fields: alarm tag, alarm activation date/time, alarm state (acknowledged or not), alarm setpoint, priority, alarm message and alarm group/subgroup to which the alarm belongs.

6.4.1.3 Alarm Summary screen shall be able to execute the following functions:

- Alarm annunciation through text messages;
- Alarm presentation and acknowledgement: individually, by group, by subgroup and by priority;
- Alarm sorting by chronological order, priority, alarm identification and group;
- Alarm filtering by date/time, priority, alarm identification and group;
- Alarm list scrolling.

NOTE: if any of the abovementioned function is not possible to be executed using the Alarm Summary native function of the Supervisory System, PETROBRAS shall be informed.

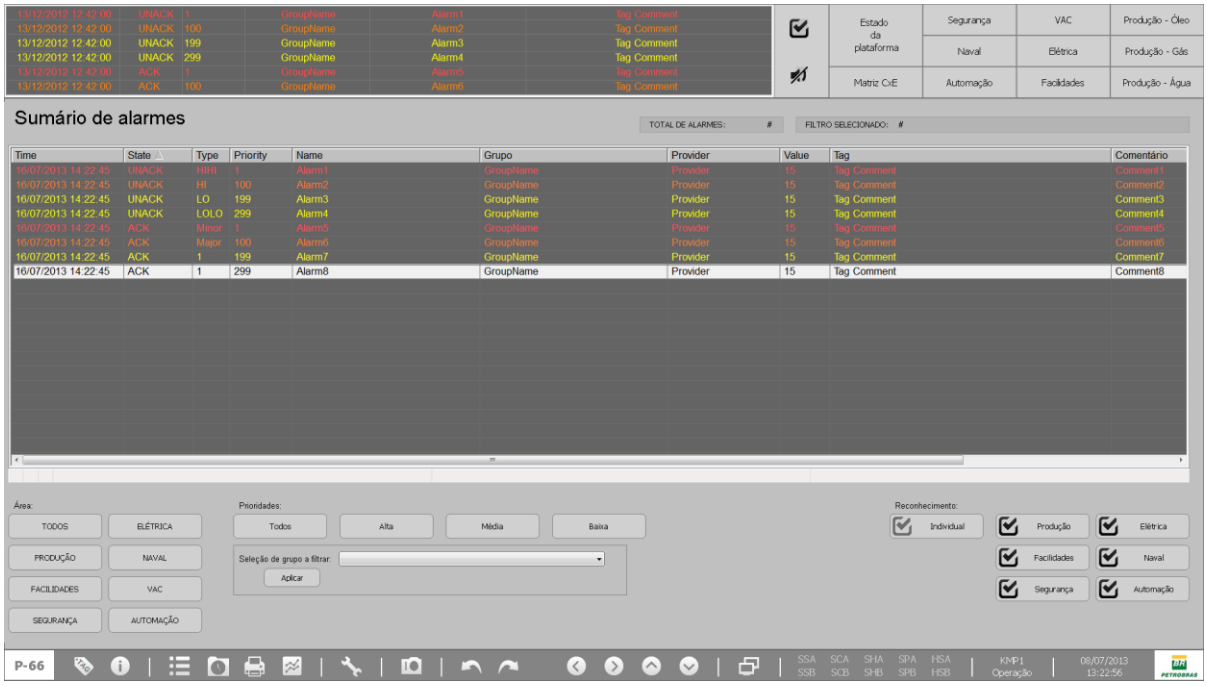


Figure 29 - Alarm Summary

6.4.1.4 The lines text colors shall be according to the alarm priority.

6.4.1.5 It shall be possible to sort alarms by groups in Alarm Summary.

6.4.2 Alarms and Events History

6.4.2.1 Alarm and Events (A&E) History shall be a native function of the Supervisory System.

6.4.2.2 All alarms and events shall be recorded in disk with the same information as in the Alarm Summary.

6.4.2.3 SOS SUPPLIER shall inform the internal mechanism to record and recover the A&E historical files. Operator and System logs shall also be available, either in the same file or not. For all events, daily files are preferred.

6.4.2.4 For the Alarm and Events, each text line shall contain at least the following fields: alarm tag, alarm activation date/time, alarm state (acknowledged or not), alarm setpoint, priority, alarm message and alarm group/subgroup to which the alarm belongs.

6.4.2.5 It shall be able to recover A&E History files in known file formats, such as .xls and/or .csv. It shall also be able to sort and filter the alarms, as well as plotting graphs with relevant information about the alarms.

6.4.3 Alarm Class, Groups and Functional Groups

6.4.3.1 Alarm class indicates if an alarm is related to an independent protection layer (IPL), to Health, Safety and Environmental issues or to General issues (Production, Naval systems, Maintenance etc).

6.4.3.2 Alarm group is a group of alarms which have common operation or maintenance requirements.

6.4.3.3 The alarms shall be classified into groups and functional groups, allowing its visualization and acknowledgement by the responsible operator.

6.4.3.4 The alarm groups and functional groups are arranged at least according to the structure presented on

6.4.3.5 Figure 30. Other groups and functional groups may be created during alarms configuration.

SEGURANÇA – FIRE AND GAS ALARMS

PRODUCTION (PROD) – TOPSIDES ALARMS
- ÓLEO (Oil processing systems)
- GÁS (Gas processing systems)
- WATER (Water treatment systems)

EMBARCAÇÃO (EMB)
- Hull and Stability Alarms
- Naval Systems

MANUTENÇÃO (MANUT) – Maintenance and diagnostic alarms

Automation failures
VAC Alarms
Electrical System alarms
Non-electrical utilities alarms

PACKAGE UNITS

Alarms originated in Package Units´ Automation systems and sent to SOS by means of network, if considered necessary to be displayed in SOS.

Figure 30 - Alarm groups and functional groups.

6.4.3.6 Besides the operational groups mentioned above, it shall also be possible to classify the alarms by ESD2 initiators and ESD3 initiators.

6.4.3.7 Each Operation workstation (HMI) may be configured to only show determined groups. The group named *Segurança* (Fire and Gas system alarms) shall be displayed in all Operation workstations.

6.4.3.8 Each group shall have a different sound alarm (horn), in order to guarantee quick identification of the alarm origin. The horns shall be actuated by discrete outputs in the corresponding programmable logic controller.

6.4.3.9 It shall be defined specific push buttons to access alarms for the pre-defined groups (see Figure 29 - Alarm Summary, at the top right of each screen).

6.4.3.10 Alarms generated in PACKAGE UNITs´ UCPs and sent to SOS through network shall be assigned to a dedicated group named PACKAGE.

6.4.3.11 Group named MANUTENÇÃO and its functional groups shall be created in order to redirect diagnostic and maintenance alarms.

6.4.4 Priority Levels

6.4.4.1 All alarm messages shall have an associated priority, depending on their criticality defined in Alarm List. It shall be defined seven (07) levels of priorities in SOS. Table 32 shows the priorities and their corresponding colors of the text messages. Whenever there is a screen object associated to an alarm message, the object shall have the same color dynamic as the text message.

Table 32– Priority levels and color dynamic

NUMBER	PRIORITY	COLOR DYNAMICS	COLOR NAME (see Table 55)
1	Critical	Not Acknowledge: Blinking color Acknowledged: Fixed color	Dark Purple
2	High	Not Acknowledge: Blinking color Acknowledged: Fixed color	Red Hot
3	Medium	Not Acknowledge: Blinking color Acknowledged: Fixed color	Citric Orange

4	Low	Not Acknowledge: Blinking color Acknowledged: Fixed color	**Live Yellow**
5	Alert	Fixed color (does not require acknowledgment)	**Light Yellow**
6	Package Unit	Fixed color (does not require acknowledgment)	**Snow White**
7	Event	Fixed color (does not require acknowledgment)	**Normal Green**

6.4.4.2 Events do not need to be presented in screen objects, however, event text messages shall be collected and registered in Alarms and Events History.

6.4.4.3 Screen objects in normal state shall be displayed in ***Silver Gray*** (screen background color).

6.4.4.4 Priority 6 (Package Unit) shall be used for alarms and events generated in PACKAGE UNITS UCPs and sent to SOS by network, if any. PACKAGE UNITS´ UAM and UAS, as they are generated in CSS, shall be analyzed in Alarm List and receive priorities 1 to 5 of Table 32.

6.4.4.5 The alarm system metrics defined in IEC-62682 for distribution of priorities and for active alarms shall be followed.

6.4.4.6 Alarm priorities shall be defined during the execution of Alarm List according to item 6.2. However, some alarms may receive pre-defined priorities, according to Table 33. This does not exclude the necessity of generating the Alarm List. The criteria presented in Table 33 shall be confirmed with the final client if it is distinct from an alarm analysis.

Table 33– Specific priorities

DESCRIPTION	PRIORITY
ADVs, SDVs, BDVs failures	High
ESD-2 and ESD-3 initiators	High
XVs and pumps failures	Alert
OO Time expiration	Alert
Valves limit switches status	Event
Pumps and Other equipment status	Event
Control loops warnings	Event
Instrument calibration failure	Event
Instrumentation failure	Event
Fire and Gas Alarms (Group SAFETY)	
Individual gas signal (20% LEL)	Event, with color change in the corresponding object in Safety screen or window
Individual gas signal (60% LEL)	Event, with color change in the corresponding object in Safety screen or window
Individual flame signal	Event, with color change in the corresponding object in Safety screen or window
Detected Gas, Detected Fire	Medium
Confirmed Gas, Confirmed Fire	Critical
Manual Alarm Fire signal	High
F&G Detectors failure	Low
Low pressure in fusible plug network (PAL)	High
CO2 actuation pushbutton	High
CSS Diagnostics (Group MANUT)	
CSS CPUs failures	High
Communication failures between CSS CPUs or from CSS CPUs and other systems (e.g., Electrical System, AFDS), HSDN failures	High
Panels pressurization failures, low internal pressure, open doors, ground fault detection	High

Communication cards, I/O cards, networks, power supplies failures	Medium
I/O cards failures	Alert
Cards status	Event
Discrepancy between control and safety transmitters Medium	Medium
Package Units´ Alarms (Group PACKAGE)	
UAM (Unit Alarm Malfunction)	By design
UAS (Unit Alarm Shutdown)	By design
Other Package Units´ alarms and events	Package Unit

6.4.5 Alarm Annunciation

6.4.5.1 SOS shall be configured according to Alarm List mentioned in 6.3. Alarm annunciation shall be done by means of text messages, screen objects and external sound (horn).

6.4.5.2 The alarm text messages shall be displayed in the alarm window (item 4.2.5), in the Alarm Summary (item 6.4.1) and shall also be recorded in Alarms and Events History (item 6.4.2). The color of the text messages and screen objects shall be according to the priority of the alarm (Table 32).

6.4.5.3 In screen objects, the alarm annunciation shall be done through a rectangular outline around the objects, such as an instrument or equipment representation. In the occurrence of an alarm, the rectangle shall be displayed in a color according to the alarm priority (Table 32).

6.4.5.4 For each alarm, the following aspects, at least, shall be configured on specific SOS screens: possible cause, required actions, non-action impact and allowable response time, according to Alarm Documentation mentioned in 6.3.

6.4.5.5 The blinking colors shall have lighter hue for background (light red, light orange, light yellow).

6.4.5.6 When a physical input and its corresponding alarm are inhibited, the color of the rectangular outline shall be according to the real physical state, without blinking, associated with the corresponding inhibition information. This shall be done in

order to help operators to take inhibition off–only when the physical input is ok, preventing from undesired emergency shutdown.

6.4.5.7 The indication of the object that shall have the alarm summary dynamic is described in the contents of each screen.

6.4.5.8 The text messages shall contain at least the following information: Alarm TAG, Description and Priority, according to Alarm List, and Ocurrence date and Ocurrence time. Other information may be added.

6.4.5.9 Alarm manual suppression (shelving) shall be configured in SOS. Every alarm shelving shall be registered by means of a report in SOS, with time and duration of its suppression. Alarm shelving shall be tested during SOS approval tests.

6.4.6 Integration amongst SOS and PACKAGE UNITS´ alarm systems

6.4.6.1 Configuration shall be provided in order to avoid alarm flooding during malfunction of equipment and PACKAGE UNITS.

6.4.6.2 CONTRACTOR shall develop a method of alarm suppression (individual and/or block of alarms) for Modules and its equipment and PACKAGE UNITS that are still in commissioning phase, out of operation or during communication loss, in order to avoid unnecessary alarms annunciation in SOS.

6.5 Alarm Performance Monitoring

6.5.1 During all unit life cycle, a periodic mechanism of statistical alarm performance monitoring shall be configured (by means of BR-ALARMExpert or other), in order to periodically get the most frequent alarm annunciations and classify their occurrence according to the performance indicators defined in IEC-62682, identifying the 10 “bad actors”. The suggested periodicity is every week, but other may be defined by user.

6.5.2 The main performance indicators (IEC-62682) to be assessed during the alarm system operation are:

- The most frequent alarms per period of time (every ten minutes, hour, day, week, and month) per operational console, according to ISA 101.01;
- Average duration of each alarm;
- Distribution of alarms per group;
- Distribution of alarms per priority;
- Alarm floods;
- Amount of unacknowledged alarms;
- Amount of suppressed alarms.

6.5.3 CONTRACTOR shall configure the software tool and integrate it to SOS in order to perform periodic alarm performance monitoring during all plant life cycle, since commissioning and startup, in order to contribute to SOS Alarm System healthy operation.

NOTE: According to ISA 101.01, operation console means a set of hardware, software, cabinets and furniture where plant is monitored and operated. It may contain more than one operation HMI, as well as other equipment such radios, telephones, CCTV monitors etc.

7 SIMBOLOGY

7.1 Line Representation

7.1.1 Lines Types

7.1.1.1 When developing screens drawings, piping and interconnections shall be displayed as lines.

7.1.1.2 Three types of lines shall be represented: Process/Utilities piping, Secondary piping, and electrical and instrumentation connections. They shall be identified by their weight.

Table 34– Line weight according to line type

LINE TYPE	LINE WEIGHT
Process/Utilities	1.00
Secondary	0.50
Electrical/Instrumentation	0.25

7.1.2 Lines Crossing

7.1.2.1 During screen development, in case of crossing lines with different weights, the thickest line shall be continuous and the least thick line shall be interrupted.

7.1.2.2 In case of crossing lines with the same thickness, the horizontal line shall be continuous and the vertical line shall be interrupted.

7.1.3 Line Colors

7.1.3.1 The pipes are identified by lines, which colors are defined in Table 55, according to the fluids. This table shows the composition of red (R), green (G) and blue (B) that shall be configured in Supervisory System´s color palette. Other colors may be configured.

Table 35 – Identification of fluids by line colors (R=red; G=green; B=blue)

FLUID	R	G	B	SAMPLE
Diesel Fuel, Aviation Kerosene Hydrocarbon Liquid, Oil, Closed Drain, Condensate, Cargo system	153	153	153	
Fuel Gas, Process Gas	221	222	165	
Bilge Water Oily, Open Drain, Gray Water (kitchen, shower, sink, laundry, etc.), Black Water (sewage)	183	168	147	
Sea Water (Ballast, Bilge)	153	171	120	
Fresh Water (Potable Water, Industrial Water, Water Injection)	143	186	181	
Inert Gas, Nitrogen	188	156	197	
Compressed Air	136	179	213	
Chemical Products, Glycol, Lubricating Oil, Hydraulic Fluid	228	204	167	
Deluge Water, Foam, Carbon Dioxide	200	160	160	
Air (VAC), Steam	201	224	224	
Instrumentation (dotted line from process line to instruments and from instruments to valves)	132	132	132	
Low voltage (<1kV)	188	156	197	
Medium, high voltage (>1kV)	145	108	153	
Deenergized bus bar (electrical panels)	132	132	132	

7.1.3.2 Feedback lines of control loops shall be dashed and the line color shall be ***Smoke Gray.***

7.1.4 Arrows

7.1.4.1 Flow direction shall be indicated by arrows with the same color of the line.

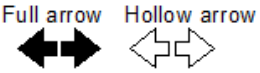


Figure 31 – Types of flow direction.

7.1.4.2 There shall be two types of arrows. The hollow arrow indicates flow direction only, while the full one, when selected by pointing device, executes paging command to the subsequent screen in the process flow. The full arrow shall have the same color of the line, and the hollow arrow shall have the same color as the background with border in the same line color.

7.1.4.3 The indication of the flow sequence is complemented by a text which shows the name of the next system or the tag of the next equipment in the process flow. The text color of the flow sequence shall be ***Black***.

7.2 Equipment Color Dynamics

7.2.1 Equipment that has status information (valves, pumps, dampers and others) shall be represented according the following color dynamic:

a) Opened or running status: same color of the pipe (all on-off valves, pumps, dampers)

Figure 32 - Example of pump in running status

b) Closed or stopped status (all on-off valves, pumps, dampers): hollow symbol. The border shall have the same color of the line.

Figure 33 - Example of pump in stopped status (hollow symbol)

Note: regarding electric equipment, relays status colors are shown only in the Electrical System screens.

c) Control valves, chokes and other equipment related to analog output variables: % MV or position indication, if available, shall be displayed through a horizontal bar graph. Full bar graph indicates 100% of opening, hollow symbol indicates 0% of opening. The filling direction of the bar graph shall be the same of the fluid flow.

Figure 34 - Example of control valve partial opening

d) Alarm indication: alarm indications in the screens shall be represented by a rectangle around the equipment. Its color shall be according to the alarm color dynamic established in Table 32.

e) Maintenance inhibition (OM) status: in the specific screens, a symbol with the letter “O” in ***Black*** text placed above the instrument indication, at the right side, shall be displayed to indicate maintenance inhibition status. In the specific pop-up window, according to Figure 26.

f) Emergency shutdown status: above the equipment an exclamation mark inside a yellow triangle in ***Black*** text shall be displayed to indicate emergency shutdown status.

g) Local/Remote operation status: above the equipment indication, at the left side, the letter “L” or “R” in ***Black*** bold text shall be displayed to indicate local or remote operation status.

h) Manual/Automatic operation status: above the equipment indication, at the left side, the letter “M” or “A” in ***Black*** bold text shall be displayed to indicate Manual or Automatic operation status.

i) Failure status: above the equipment indication, at the right side, the letter “F” in ***Black*** text shall be displayed to indicate failure status.

j) The corresponding pop-up window shall be displayed when equipment’s or instrument representation is selected.

k) PACKAGE UNITS

The PACKAGE UNITS shall be represented in the Process/Utilities Specific screens as a rectangle (see below).

PACKAGE UNITS specific screens shall be defined in conjunction with the final client during SOS configuration, according to the defined in the Project. Whenever there is a Package Unit alarm indication (UAM or UAS), operator shall navigate to the Package Unit specific screen or access the Package Unit dedicated monitor.

(1) Symbol without color dynamic

Table 36– Symbol without color dynamic

	Color
Background	***Regular Gray***
Border	***Dark Gray***

(2) Running status: the text “OPERANDO” within a rectangle.

Table 37– Running status

	Color
Border	***Dark Gray***
Background	***Regular Gray***
Text	***Black***

(3) Stop status: the text “PARADO” within a rectangle.

Table 38 – Stop status

	Color
Border	***Dark Gray***
Background	***Regular Gray***
Text	***Black***

(4) PACKAGE UNIT identification tags shall be in ***Black*** color.

(5) PACKAGE UNITS´ Alarms (UAS, UAM)

The PACKAGE UNIT alarms shall be represented by rectangles around the equipment. Its color shall be according to the color dynamic established in item 6. The higher priority alarm shall be shown in the external border.

Alarms with the same priority shall be represented in the same rectangle.

Alarms tag identification shall be presented below the PACKAGE UNIT tag identification, according to Figure 35. (Note: in Figure 35, the package unit is on, thus, the representation “OPERANDO” is highlighted.)

Table 39 – Package Units´status

Status	Color
Normal	***Smoke Gray***
Actued	***Black***

Figure 35 - Package units´ representation.

l) Equipment that does not have color dynamic shall be displayed according to Table 40.

Table 40- Color of equipment without color dynamic

	Color
Background	***Regular Gray***
Border	***Dark Gray***

7.3 Instrumentation

7.3.1 Analog transmitters shall be represented as in Figure 36.

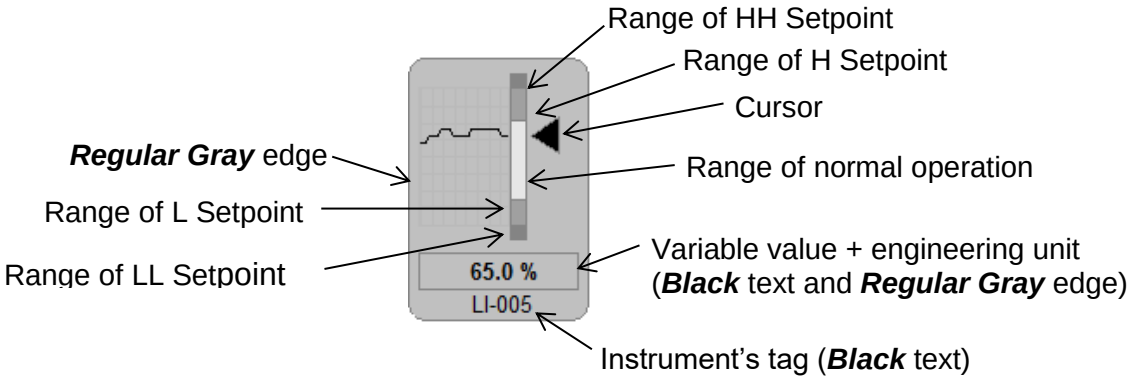


Figure 36 – General Transmitter.

7.3.2 The corresponding pop-up window shall be displayed when transmitter representations are selected.

7.3.3 Whenever there are control and safety analog transmitters for the same variable (PCS and PSD or HCS and HSD), both shall be displayed at the Process screen and at the analog transmitter pop-up window, according to item 4.4.7.1. It shall be configured in SOS a procedure to detect discrepancy between control and safety transmitters readings, and a discrepancy indication shall be informed. The discrepancy calculation result shall be used to compound failure logic mentioned in 7.3.4. Discrepancy indication shall be informed in instrument window.

7.3.4 The instrument failure status shall be represented by the letter “F” in ***Black*** text at the right side of the cursor, as well as the maintenance or operational inhibition status, that shall be represented by the letter “O” (see Figure 37).

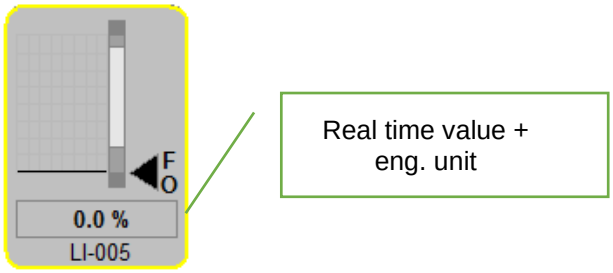


Figure 37 - Instrument's value, failure and inhibition status.

7.3.5 Flow totalizers representation in the process/utilities screens shall be displayed as in Figure 38.

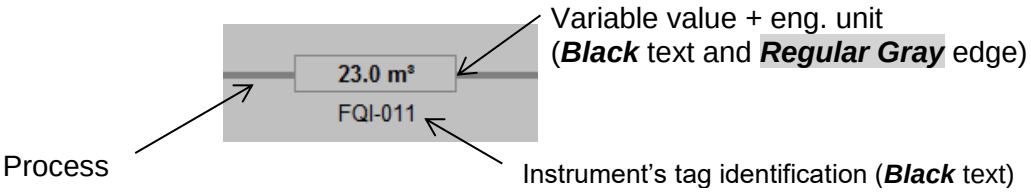


Figure 38 - Flow totalizer.

7.3.6 Instrument tag identification shall contain only the sequential number of the instrument. The four digits corresponding to the specific area shall be displayed on the top of the screen with the screen title. Example: LI-5134001 will be displayed as LI-001 on the screen "SISTEMA DE AR COMPRIMIDO (5134)".

7.3.7 Level instruments real time values shall be displayed by instant values and bar graphs. These bar graphs shall be placed in vertical position, near or inside the vessels and tanks drawings.

7.3.8 Other variables (pressure, flow and temperature) real time values may be displayed by using instant value.

7.3.9 The engineering units are defined in Table 1.

7.4 Rupture Discs (PSE)

7.4.1 Rupture discs only have open or closed status according to Table 41.

Table 41 - Color dynamic of rupture disc status.

Rupture Disc Status	Fill color	External Border
Normal (closed)	FULL (according to fluid line table color)	None
Broken (open)	HOLLOW	None

7.5 Fire and Gas Detectors

7.5.1 Fire and gas detectors at Safety screens shall inform status from active detection and fail state according to Table 42.

Table 42 - Color dynamic of Fire and Gas detectors.

Detector Status	Fill color	External Border
ACTUATED	*Red Hot*	None
NORMAL	HOLLOW	None
FAIL (Unacknowledged)	-	Blink (priority color)
FAIL (Acknowledged)	-	Fixed (priority color)

7.6 Pumps and Blowers

7.6.1 The status of the equipment shall be represented according to Table 43.

Table 43 - Color status of Pump and Blowers.

Pump/ Blower Status	Fill color	External Border
ON	FULL (according to fluid line table color)	None
OFF	HOLLOW	None
FAIL (Unacknowledged)	Blinking	Blink (priority color)
FAIL (Acknowledged)	Blinking	Fixed (priority color)

7.6.2 The line color of the object shall be always the same as fluid line color. Clicking over the pump or blower, the system shows a command window.

7.6.3 Besides, there are 08 additional flags inside the object area, presented in Table 44.

Table 44 – Pump and Blowers additional flags.

Flag	Description
O	Indicates active output override
F	Indicates active failure status
A	Indicates automatic operation mode
M	Indicates manual operation mode
!	Occurs when active output override is blocking the automatic logic. (According to I-ET-3010.00-5520-800-P4X-002 - IMPLEMENTATION OF INTERLOCKING AND CONTROL LOGIC, it Indicates that SLG is different from SLO).
L	Indicate local operation mode
PP	Indicate equipment ready to start
NP	Indicate equipment not ready to start

7.7 Valves

7.7.1 Valves Symbols

7.7.1.1 The valve symbols are represented in Figure 39.

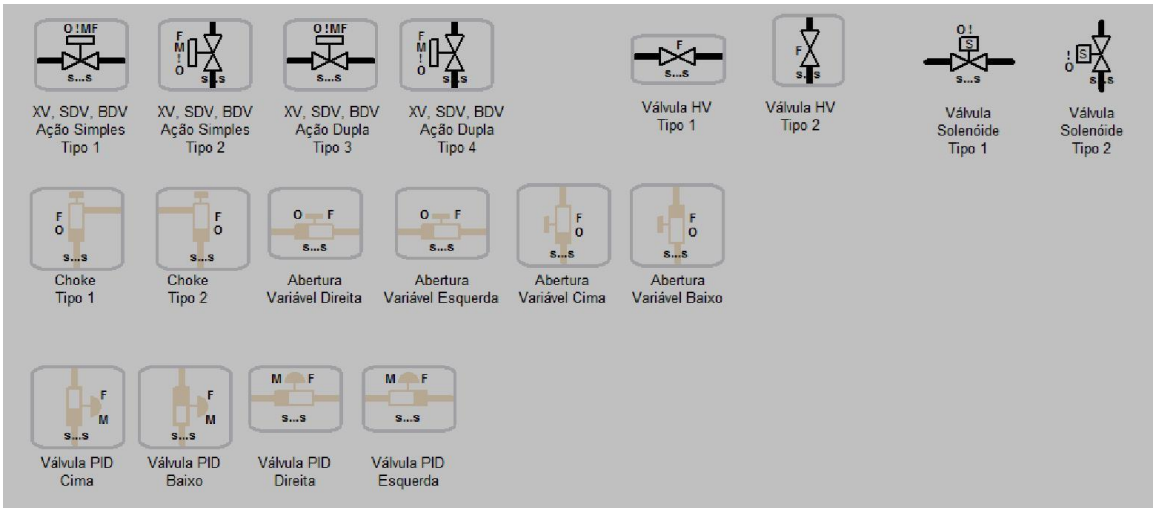


Figure 39 - Valve Library

7.7.2 XV, SDV and BDV valves (single action)

7.7.2.1 Characteristics: 01(one) solenoid to open or close and two limit switches to status indication.

7.7.2.2 The status from this kind of valves shall be represented according to Table 45.

Table 45 - Color dynamic of XV, SDV and BDV valves (single action)

Single action valve status	Fill color	External Border
Not ZSH + Not ZSL (don't care)	Blinking (according to fluid line color)	None
OPEN	FULL (according to fluid line color)	None
CLOSED	HOLLOW	None
FAIL (Unacknowledged)	Blinking	Blink (priority color)
FAIL (Acknowledged)	Blinking	Fixed (priority color)

Note: Priority in Table 45 means the priority defined for the valve failure alarm.

7.7.2.3 The line color of the object shall always be the same as fluid line color. Clicking over the valve, the system shows its pop-up window.

7.7.2.4 Besides, there are 05 (five) additional flags inside the object area, presented in Table 46.

Table 46 - XV, SDV and BDV valves (single action) additional flags.

Flag	Description
O	Indicates active output override
F	Indicates active fail state
A	Indicates automatic mode
M	Indicates manual mode
!	Occurs when active output override is blocking the automatic logic. (According to I-ET-3010.00-5520-800-P4X-002 - IMPLEMENTATION OF INTERLOCKING AND CONTROL LOGIC, it Indicates that SLG is different from SLO). Head valves are animated with ZSL and ZSH status switch only. The output from automatic logic (PLC) is no longer considered in animation

7.7.3 XV valves (double action)

7.7.3.1 Two micro switches and 02 (two) solenoids.

7.7.3.2 The status from this kind of valves shall be represented according to Table 47.

Table 47 - Color dynamic of XV valves (double action).

Double action valve status	Fill color	External Border
Not ZSH + Not ZSL (don't care)	Blinking (according to fluid line color)	None
OPEN	FULL (according to fluid line color)	None
CLOSED	HOLLOW	None
FAIL (Unacknowledged)	Blinking	Blink (priority color)
FAIL (Acknowledged)	Blinking	Fixed (priority color)

7.7.3.3 The line color of the object shall be always the same as fluid line color. Clicking over the valve, the system shows a command window.

7.7.3.4 Besides, there are 05 additional flags inside the object area, presented in Table 48.

Table 48 - XV valves (double action) additional flags.

Flag	Description
O	Indicate active output override
F	Indicate active fail state
A	Indicate automatic mode
M	Indicate manual mode
!	Occurs when active output override is blocking the automatic logic. (According to I-ET-3010.00-5520-800-P4X-002 - IMPLEMENTATION OF INTERLOCKING AND CONTROL LOGIC, it Indicates that SLG is different from SLO). Head valves are animated with ZSL and ZSH status switch only. The output from PLC is no longer considered in animation

7.7.4 Choke Valves

7.7.4.1 Choke valves shall be displayed with the same color as the corresponding line color (hollow or filled, depending on percentage of opening). Those with position indicator (ZIT) shall have a rectangle, with a bar graph that shall be filled according to the opening percentage of the valve. The filling direction of the bar graph shall be the same of the fluid flow.

7.7.4.2 Clicking over the valve, the system shows its pop-up command window.

7.7.4.3 Additionally, there are 02 (two) other flags inside the object area, presented in Table 49.

Table 49 - Choke valves additional flags.

Flag	Description
O	Indicates active output override
F	Indicates active fail state (read from the choke actuator and/or from the logic)

7.7.5 Control Valves

7.7.5.1 Control valves are represented with the same color as the line color (hollow or filled, depending on the percentage of opening). The fill color of rectangle depends on the opening percentage of the valve (%MV) or position indication, if available. The filling direction of the bar graph shall be the same of the fluid flow.

7.7.5.2 Clicking over the control valve, the system shall display the corresponding analog transmitter pop-up window, where the PID tab is associated. Additionally, there shall be 02 (two) more flags inside the object area, presented in Table 50.

Table 50 - Control valves additional flags.

Flag	Description
M	Indicates manual operation mode (when automatic this flag will be hidden)
F	Indicates active failure status (read from the valve positioner and/or from the control logic)

7.7.6 HV valves

7.7.6.1 The status from this kind of valve shall be represented according to Table 51.

Table 51 - Color dynamic of HV valves.

HV valve status	Fill color	External Border
Not ZSH + Not ZSL (don't care)	Blinking (according to fluid line color)	None
OPEN	FULL (according fluid line color)	None
CLOSED	HOLLOW	None
FAIL (Unacknowledged)	Blinking	Blink (priority color)
FAIL (Acknowledged)	Blinking	Fixed (priority color)

7.7.6.2 This is a manual valve, so it does not have output solenoid. The additional flag is presented in Table 52.

Table 52 - HV valves additional flag.

Flag	Description
F	Indicates active fail state

7.7.7 Solenoid Valves

7.7.7.1 The status from this type of valves shall be represented according to Table 53, based on SLO table (according to I-ET-3010.00-5520-800-P4X-002 - IMPLEMENTATION OF INTERLOCKING AND CONTROL LOGIC).

Table 53 - Solenoid valves status representation.

Solenoid valve status	Fill color	External Border
SLO OUTPUT ON (1)	FULL (according fluid line color)	None
SLO OUTPUT OFF(0)	HOLLOW	None

7.7.7.2 There are 2 (two) additional flags inside the object area presented in Table 54.

Table 54 - Solenoid valves additional flags.

Flag	Description
O	Indicates active output override
!	Occurs when active output override is blocking the automatic logic. (According to I-ET-3010.00-5520-800-P4X-002 - IMPLEMENTATION OF INTERLOCKING AND CONTROL LOGIC, it Indicates that SLG is different from SLO).

7.8 Symbol Library

7.8.1 All symbols shall be according to I-ET-3000.00-0000-940-P4X-002 - SYMBOLS FOR PRODUCTION UNITS DESIGN and shall be made available in a symbol library. This library shall be delivered to PETROBRAS at the end of the project.

7.8.2 It shall be possible to create and configure new symbols in the symbol library.

8 APPENDIX A – COLOR TABLE

8.1 Table 55 shows all the colors used in SOS software screens. It shall be possible to configure and add new colors (R, G, B) to the color palette.

Table 55 - Index of colors used in SOS software screens.

COLOR NAME	R	G	B	SAMPLE
SNOW WHITE	255	255	255	
SNOW GRAY	230	230	230	
LIGHT GRAY	208	208	208	
SILVER GRAY	192	192	192	
REGULAR GRAY	180	180	180	
DARK GRAY	160	160	160	
GRAPHITE GRAY	153	153	153	
SMOKE GRAY	132	132	132	
BLACK	0	0	0	
BLUE OSTER	191	255	255	
BLUE OCEAN	189	223	253	
BLUE POOL	135	182	245	
DARK BLUE	130	133	255	
LIME GREEN	214	255	214	
LIGHT GREEN	175	255	179	
NORMAL GREEN	153	171	120	
SOFT PINK	255	191	191	
RED LIGHT	255	128	128	
REGULAR RED	255	86	96	
RED HOT	255	50	50	
LIGHT YELLOW	255	255	191	
YELLOW SUN	255	255	164	
REGULAR YELLOW	255	255	40	
LIVE YELLOW	255	255	0	
ACID ORANGE	255	199	94	
REGULAR ORANGE	255	124	72	
CITRIC ORANGE	255	166	0	
DARK BROWN	208	106	4	
REGULAR BROWN	232	210	198	
LIGHT PURPLE	208	167	233	
NORMAL PURPLE	188	156	197	
DARK PURPLE	145	108	153	