

GENERAL SPECIFICATION

INSTRUMENTATION

GS EP INS 156

Human Machine Interfaces (HMI)

01	05/2015	Organisation change – January 2015
00	09/2014	First issue
Rev.	Date	Purpose of the revision

Document update realised by
standards coordination
Reorganisation 2015

Owning entity: DSO/TEC

Managing entity: DSO/TEC/INS

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1. Scope

This document defines the minimum requirement for the Human Machine Interface (HMI) for the ICSS and P3 packages.

The primary function of the Human Machine Interface is to allow the operator to efficiently monitor the plant status, carry out start-up and normal control operations and to handle abnormal situations including monitoring and responding to alarms. The design principles defined in this specification have been developed to help ensure that the required level of standardisation, effectiveness, efficiency and satisfaction are met.

The ICSS HMI is the centralised interface for all control, monitoring and safety systems and subsystems and shall fully adhere to the present specification with the exception of extensions to existing facilities using the existing ICSS, in which case the existing conventions will be used.

P3 packages HMI, as defined by **GS EP INS 110**, shall comply, as far possible, with the present specification. Deviations in convention shall be subject to Company's approval. There shall be no contradiction between package HMI and ICSS HMI.

2. Reference Documents

The reference documents listed below shall form an integral part of this General Specification.

The equipment shall satisfy the requirements and regulations of the country of installation and specific standards referred to in this specification.

Where national regulations exist, their provisions and those of the standards and codes to which they refer shall apply, supplementing or amending the provisions of this document.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

Reference	Title
EEMUA PUB No 191	Engineering Equipment and Material User's Association Alarm Systems - A Guide to Design, Management and Procurement
EEMUA PUB No 201	Process plant control desks utilising Human-Computer interfaces'
ISA 18.2	Management of Alarms Systems for the Process Industries

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection

Reference	Title
GS EP ECI 002	Drawings and symbols principles of presentation at project definition phase (cancelled document)
GS EP EXP 131	Design and installation of Process Data Server
GS EP EXP 139	Alarm Management
GS EP INS 110	Instrumentation for package units
GS EP INS 131	Standard Functions and Functional Analysis Development Requirements
GS EP INS 134	Design and supply of integrated control and safety system
GS EP INS 135	Cyber Security requirements for design and supply of ICSS and Package Systems
GS EP INS 150	Design method for system configuration - Standard functions
GS EP INS 196	Input and Output Standard Functions
GS EP INS 197	Process Standard Functions
GS EP INS 198	Safety and Fire & Gas Standard Functions

3. Terminology and Definitions

There are five types of statements in this specification, the “shall”, “should”, “may”, “can” and “must” statements. They are to be understood as follows:

Shall	Is to be understood as mandatory. Deviating from a “shall” statement requires derogation approved by Company.
Should	Is to be understood as strongly recommended to comply with the requirements of the specification. Alternatives shall provide a similar level of protection and this shall be documented.
May	Is to be understood as permission.
Can	Is to be understood as a physical possibility.
Must	Expresses a regulatory obligation.
Company	TOTAL E&P or any TOTAL E&P subsidiary.
Contractor	Any Party that has signed a Contract with Company for the Engineering, Procurement, Construction, and Installation in part(s) or in full of a project.
Vendor	The package Vendor sub-contracted by the Contractor or by Company.

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Supplier The Party that manufactures or supplies equipment, either individually or as a Packaged unit for the project.

End User The end user of the HMI, for example, the panel operator, the package operator, the maintenance engineer.

3.1 Abbreviations

The following terms and abbreviations will be used in this document:

CAD	Chronological Alarm Display
CCR	Central Control Room
DVT	Design Validation Test
ESD	Emergency Shut-Down
FAT	Factory Acceptance Test
FCW	Full Control of Wells
F&G	Fire and Gas
FGS	Fire and Gas System
GCF	Gas Compensated Flow
HMI	Human Machine Interface
ICSS	Integrated Control and Safety System
KPI	Key Performance Indicator
LED	Light Emitting Diode
OWS	Operator Work Station
OCD	Operator Control Desk
OCWR	Overall Control of Wells & Risers
OTS	Operator Training Simulator
PC	Personal Computer
PCS	Process Control System
PFD	Process Flow Diagram
P&ID	Piping and Instrumentation Diagram
PSD	Process Shut Down
PSS	Process Safety System
RAI	Redundant Analogue Input
SIE	Enterprise System Network
SII	Industrial System Network

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SOE Sequence of Events
UCP Unit Control Panel

3.2 Definitions

The following definitions are used throughout the specification:

Alarm: An audible or visible means of indicating to the operator an equipment or process malfunction or abnormal situation.

Alarm priority: The ranking of alarms by severity and response time.

Display: (Graphic / Mimic / View) a software generated picture on the HMI.

Sequence Chart: A mode of representation and analysis of automation, particularly well suited to sequences, broken down into steps with associated actions and transitions between stages with associated transition conditions.

Alarm Masking: A method to prevent alarm annunciation and display on the CAD.

Alarm Shelving: A facility where the operator is able to temporarily prevent an alarm from being displayed to him when it is causing a nuisance. A shelved alarm will be removed from the list and will not re-annunciate until un-shelved.

4. General Requirements

4.1 Organisation and HMI Development Process

It shall be recognised that HMI and alarm system design is time and resource intensive and iterative. The equipment project execution plan shall specifically address the HMI development process. The HMI development roadmap in Appendix 2 presents the development process and should be used in conjunction with guidance from [EEMUA PUB No 201](#) to develop the project execution plan.

An HMI expert in ergonomics and human factors shall be involved during the development process.

The end user (panel operator) shall be consulted during the complete HMI development process, to ensure the input of real operating knowledge and help achieve acceptance and ownership of the final interface.

An ongoing evaluation of the HMI usability should be performed throughout its lifecycle. Examples of criteria for usability evaluation are specified in [GS EP INS 134](#) Appendix 5.

4.2 HMI Design Principles and Ergonomics

4.2.1 HMI General Principles

The HMI shall be intuitive, simple to use and easy to learn, providing a complete picture without unnecessary detail. The HMI shall provide a recognisable view of the plant and the big picture, enabling the operator to build a clear mental picture and have good situational awareness. Ergonomics and human factors shall be carefully weighed.

The HMI design shall be based on guidance from [EEMUA PUB No 201](#).

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Graphics shall be built in a consistent, repeatable and unambiguous fashion, with the same conventions and behaviours reflected throughout. Display elements shall be neatly aligned with consistent rules applied for sizes, shapes, line thicknesses, text and spatial position. Care shall be taken to differentiate between different graphics that depict similar process units or trains. This may require the use of specific graphical features (text, title, colour spatial variation, etc.).

The process displays shall be carefully developed using the engineering input documents such as functional analysis, PFDs, P&IDs, layouts, etc. The displays should only include the elements necessary for the operator to do the job, giving a clear mental picture of the process and layout. The displays should not be an exact copy of the P&IDs. Details of non-routine elements or elements with no automatic control, such as maintenance drains and drain network with no instrumentation, manual bypasses, relief valves, flare networks with no instrumentation, should generally be excluded from the displays, unless they provide particularly useful information related to the operator tasks or in building a clear mental picture. Relevant items may include self regulating control valves, atmospheric vents and bursting disks.

P&IDs shall be used to ensure that all instruments are taken into account and that the process, tie-ins, equipment and instrument locations are accurately represented.

Prototyping and DVT of each graphic type shall be used to validate the display principles and library of process equipment symbols and animation, which are not already covered by the standard function DVT. HMI usability shall be evaluated at each stage of the HMI development process with feedback from the end-user.

4.2.2 Categories of view

The views are categorised as follows:

Main categories: Process, Utility (may be combined with process), Shutdown, Fire & Gas, Parameters, Maintenance, CAD.

Additional detailed categories: P3 Packages, Sequences, Control Group, Trend Group, Faceplates.

These categories are presented in detail in section 5.

4.2.3 Overviews

Overviews are of great importance in giving the operator an overall situational awareness of the plant status and tendencies. They are not just a graphic navigation mechanism. They shall provide key performance information such as alarm situation and key measurement tendencies, using embedded trends for example. Advanced dashboard overviews are defined in section 5.5.

The CAD alarm display and advanced dashboard overview(s) should be permanently on view.

4.2.4 Layout

Each display will have a title displayed in the same position.

The process flow shall generally be represented from left to right.

The boundaries of the process section to be displayed shall be determined giving consideration to showing all process flows into and out of a system / subsystem on the same graphic to facilitate mass-balance comparison. The main equipment items and process flow lines should be defined first using the Process Flow Diagram as a guide. The split of a unit into multiple

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displays shall be made in such a way as to respect the logical functional boundaries whilst avoiding both excessive subdivision and overcrowding.

Process lines should preferably be arranged such that control valves, shutdown valves and other equipment are in the horizontal position.

Process equipment shall be drawn as 2 dimensional, no 3-D effects.

The impact of displaying complex control must be considered, the whole loop should be visible from any control point, splitting control loops across graphics shall be minimised.

4.2.5 Language

All text on graphics shall be in the English language unless specified otherwise by the Project.

4.2.6 Display Density

The amount of information displayed on graphics shall be limited, though this must be balanced with the requirement to group interconnected process units on the same graphic and to avoid under-utilisation of graphic space. In general, control display packing density should be around 30% (and not more than 50%) of available area covered with graphics / dynamic objects / text. Overviews may have higher density if necessary but shall meet the performance requirements specified in [GS EP INS 134](#).

4.2.7 Static and Dynamic Display Components

Symbols and related colour/animation rules used for ICSS and P3 package HMI shall be standardised and submitted for Company approval before implementation. As far as possible, P3 package HMI shall apply the same static and dynamic component animation conventions to their equivalent of the typical logic standard functions, there shall be no contradiction between ICSS and package animation conventions.

4.2.7.1 Static Components

Static process equipment representations shall be based on [GS EP ECI 002](#) Appendix 4 and 5.

4.2.7.2 Dynamic Components

Dynamic components (pumps, motors, valves, safety bars, analogue and digital measurements, detectors, etc.) shall be represented using a consistent set of standard symbols. The animation rules for all dynamic components shall adhere to the rules defined in the typical logics standard function specifications [GS EP INS 150](#), [GS EP INS 196](#), [GS EP INS 197](#) and [GS EP INS 198](#), and complemented by the conventions given in Appendix 1 of this specification.

When the data is available, the same animation conventions shall also apply to the ICSS animation of P3 packages via serial link. A subset of animation typical logics, adapted to serial link interface with packages shall be developed.

Animated process equipment representations, which are not already covered by the typical logic standard function specifications, shall comply with [GS EP ECI 002](#).

Safety logic shall be animated using safety bars. P3 packages with serial links to the ICSS should send the status of the package safety bars and trip initiators for animation including