



Group Practice

GP 30-45

Human Machine Interface for Process Control

REVISION FOR REVIEW

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Foreword

This is a revised issue of Engineering Technical Practice (ETP) GP 30-45. This Group Practice (GP) has been revised to align content on alarm management with the new GP 30-47, specifically removal of clause 7 and Annex A. Where appropriate, this GP has been revised to make references to GP 30-47 and to make minor corrections and general updates.



1. Scope

- a. This GP provides requirements for the layout, design, and configuration of the human machine interface (HMI) associated with automation systems.
- b. This GP presumes prior knowledge of the ASM Consortium and EEMUA documents in the normative references.

2. Normative references

The following referenced documents may, to the extent specified in subsequent clauses and normative annexes, be required for full compliance with this GP:

- For dated references, only the edition cited applies.
- For undated references, the latest edition (including any amendments) applies.

BP

GP 30-47	Alarm System Design and Management.
GP 30-50	Advanced Control (Adcon) Applications.
GP 30-55	Control Rooms.
GP 30-60	Automation Systems Digital Security and Integrity.

Abnormal Situation Management (ASM) Consortium Guidelines

ISBN 1440431647	Effective Operator Display Design Practices, Jan 14 2009. Available via internet at www.asmconsortium.net .
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Engineering Equipment and Materials Users Association (EEMUA)

EEMUA 191	Alarm Systems - A Guide to Design, Management and Procurement, Edition 2.
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International Instrument Users Association (IIB)

IIB M 2656 X 98	Ergonomics in Process Control Rooms Part 2: Design Guideline.
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National Electrical Manufacturers Association (NEMA)

NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum).
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3. Terms and definitions

For the purposes of this GP, the following terms and definitions apply:

Alarm

Notification to an operator of an abnormal situation that requires some timely action to be performed.

Alert (message)

Notification to an operator that he or she should be aware of something (e.g., laboratory result has just been received), and there is no serious consequence if ignored or missed. An alert or message is not an alarm. An alarm has an accompanying action to prevent or address an abnormal situation, but an alert or message does not and as such is risk ranked lower than an alarm.



Automation system

The collective term for equipment and legacy equipment types such as:

- a. Integrated control and safety system (ICSS).
- b. Supervisory control and data acquisition (SCADA).
- c. Distributed control system (DCS).
- d. Process automation system (PAS).
- e. Process control system (PCS).
- f. Process shutdown (PSD).
- g. Emergency shutdown system (ESD).
- h. Safety instrumented system (SIS).
- i. Fire and gas (F&G).
- j. Panel mounted controls and alarms.

Equipment and legacy equipment types that perform safety, control, and/or monitoring functions on process facilities and may reside on or across process control networks (PCNs), process information networks (PINs), or similar systems segregated from and below business information technology (IT) systems. Automation systems encompass all functional types (e.g., process, drilling, marine, subsea, packaged control and safety systems, etc.).

Critical corrective action

An automated predefined engineered expected response to an undesirable scenario. It can be implemented in an integrated control and safety system (ICSS) or programmable logic controller (PLC). It is not a safety system and therefore not subject to those availability requirements. Critical corrective action is most useful if moving the process from its current operating condition to a condition known to provide a stable point for control and operability, even more so if the movement requires speed, arithmetic calculation, or several sequential and coordinated control moves.

Safepark

Synonymous with critical corrective action. May also deliberately move the process such that product is no longer being produced while keeping systems at suitable temperatures and/or pressures to facilitate a rapid restart.

4. Symbols and abbreviations

For the purpose of this GP, the following symbols and abbreviations apply:

AC	Alternating current.
BPCS	Basic process control system.
C&E	Cause and effect.
CCTV	Closed circuit television.
CCR	Centralised control room.
CIF	Continuous improvement forum.
CoP	Community of practice.



CPU	Central processor unit.
CSH	Control system hardware.
DCS	Distributed control system.
DHS	Data historian system.
ESS	Emergency support system.
ESD	Emergency shutdown.
F&G	Fire and gas.
HMI	Human machine interface.
I/O	Input/output.
ICSS	Integrated control and safety system.
LCD	Liquid crystal display.
OP	Output.
PA	Public address.
PAS	Process automation system.
PC	Personal computer.
PECS	Packaged equipment control system.
PLC	Programmable logic controller.
PSS	Process safety system.
PV	Process variable.
SIL	Safety integrity level.
SIF	Safety instrumented function.
SIS	Safety instrumented system.
VDU	Visual (or video) display unit (i.e., computer monitor).

5. General

5.1. Common

- a. HMI shall integrate all facility systems to provide a common “look and feel” for operator monitor, control, and diagnostics.
- b. Facility systems may include:
 1. ICSS.
 2. DCS.



3. DHS.
 4. PSS.
 5. ESS.
 6. PECS.
 7. PLC.
 8. Marine system.
 9. Other support systems.
- c. The HMI should be procured with the CSH. HMI shall comply with relevant requirements of CSH.

5.2. Physical considerations

- a. Communications equipment (e.g., radios or telephones) should be:
 1. Located within the console.
 2. Positioned to allow easy access and to particularly avoid trailing leads running across screens or other stations and potentially interfering with touch screens.
- b. Each section of the plant should have an HMI console.
- c. HMI console should be under the control of either:
 1. An individual operator.
 2. An operations team, if all members are responsible for the same process units.
- d. CSH, within a console, should have facilities to provide alarm logging and report production.
- e. A printer should be provided for printing services other than alarm and event logging information printing.
- f. A colour printer should be available near the operator consoles for taking colour images of the displays.
- g. The extent of hardwired equipment mounted on consoles should be minimised to that required for safe operation of the plant.
- h. Pen recorders should not be used.
- i. CSH backup and redundant capabilities should be used instead of individual loop backup controllers.
- j. Trip panels may be installed in the console and placed where the operator can access the controls (reset, defeat, or accept).
- k. Alarms should annunciate within the automation system even if source systems are logically separated.
- l. CSH should be capable of trending all process data.
- m. CSH screens with configured software buttons to allow the operator to trip equipment should be used instead of switches.
- n. If switches are used, they may be mounted on the CSH console to allow the operator to trip equipment.
- o. Trip switches required to meet SIL requirements normally shall be hardwired as input to the SIS.



- p. Data from other sources (e.g., management information, lab data, procedures, operator advisory, help screens) required by the operator for process operations should be displayed at the console, preferably on CSH screens.
- q. Window based displays should be used if feasible.
- r. If window based displays are not feasible, secondary information screens may be integrated into the operator console.
- s. Consoles for staff other than operators (e.g., plant management, engineers, maintenance) should not be in the main control area.
- t. Preferred access for staff other than operators shall be through a networked PC with adequate network security.

5.3. HMI data integrity

- a. Regardless of originating system (e.g., BPCS, SIS, package controls, etc.), the HMI assignment within the automation system of each tagged signal (e.g., SIF, control loop, field instrument indication, discrete controller, alarm, etc.) shall be defined and documented.
- b. For each SIF, regardless of originating system, the operator shall be able to:
 - 1. Access the operational state (e.g., override status, etc.).
 - 2. View all pertinent parameter information (e.g., PV or PVs within a voted set, trip value, etc.) via a C&E graphic or equivalent.
- c. For each regulatory control loop, regardless of originating system, the operator shall be able to view/access at least the following via one or more process graphics:
 - 1. Mode.
 - 2. Set point.
 - 3. PV.
 - 4. OP.
- d. For each discrete controller (e.g., motor stop/start), regardless of originating system, the operator shall be able to view/access at least the mode and discrete state via one or more process graphics.
- e. Field indications that have alarms configured in the automation system should be depicted on one or more process graphics.
- f. HMI representation of other parameters (e.g., current value, alarm limits, operating limits, etc.) that are associated with every tag (including field indications, calculations, etc.) should be considered.
- g. Any safety, regulatory, or discrete control or field instrument tag that does not have an HMI assignment shall have documentation which justifies the exclusion.
- h. Regardless of the data transmission technique used to transfer data from a package system to the automation system HMI, handshaking/failsafe watchdog(s) shall be configured to ensure that the operator is alerted in a timely manner of any data that is stale.

5.4. Operator console

5.4.1. General

- a. Operator consoles should include fully independent and redundant operator stations, each composed of VDUs, keyboards, and pointing devices with all associated electronics.



- b. Operator workstations should have identical capability and be interchangeable for all functions, including interactive graphics.
- c. Operator workstation should be able to save and load configuration data.
- d. No single failure (e.g., loss of a power supply) should cause loss of more than half of the workstations being used by a single operator at one console.
- e. Addition of displays and keyboards to an operator station that shares electronics should not degrade operator station performance.
- f. Any console may monitor any section of the plant, but manipulation of a control loop should be limited to only one console at a time. Control access from other consoles should be selectively inhibited by configuration, password, or keylock.
- g. Control should not include backup operator stations located in remote control rooms due to the potential for conflicting operator actions. Such stations should be used only for monitoring.
- h. VDU displays should be high resolution and support full colour.
- i. Flat panel LCDs, or similar, should be used.
- j. The console furniture and associated graphics software for the HMI should be able to accommodate both wide screen and normal aspect ratios.
- k. Ergonomics should be considered in the design and layout of the operator console. Items should include:
 - 1. Room arrangement.
 - 2. Lighting.
 - 3. Climate.
 - 4. Air purity.
 - 5. Sound levels.
- l. Console base sections should have:
 - 1. Front and rear removable panels for access to workstation PC and AC power.
 - 2. Removable inside side panels for access to network cables.
- m. The design of audible alarm annunciation at the operator console shall comply with GP 30-47, 8.7.
- n. A large, 1,3 m (50 in) flat screen, wall mounted display may be provided to view HMI, CCTV, weather, or other functions for several people from positions other than directly in front of the operator console.
- o. CPUs for large (1,3 m [50 in]), flat screen wall mounted displays should be controlled from a keyboard and pointing device located near but not interfering with operators (e.g., on a table behind the operators). The wall mounted display should be where operators can see it.
- p. Operator workstations should be PC based and should use professional level Windows operating systems (e.g., Windows XP, Windows 7).

5.4.2. Console layout

- a. Console layout shall comply with GP 30-55.
- b. Operators should visit Vendor facilities or sites where similar equipment is installed to establish layout preferences early in a project.
- c. Console layout should be reviewed and agreed upon with the plant operations team.