

GENERAL SPECIFICATION

INSTRUMENTATION

GS EP INS 196

Input and Output Standard Functions
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1. Scope

The purpose of this document is to define a set of Standard Functions for most common inputs and outputs.

It includes the following functions with some options:

- Digital input
- Line monitored digital input
- Process Analogue input
- Safety analogue input
- Digital output
- Analogue output
- Redundant analogue inputs.

2. Reference documents

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

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
Not applicable	

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 INS 150	Design method for system configuration - Standard functions
GS EP INS 198	Safety and Fire & Gas Standard Functions

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Chapter 1 Digital Input Standard Function - DI -

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1. Scope

The purpose of this document is to define the Standard Function for a digital input to the PCS, PSS, ESD and F&G system, with alarm detection in option.

Digital inputs may concern:

- Field switches processed by PCS or Safety systems (PSS, ESD and FGS)
- Hardwired signals between Safety logic solvers.

In order to assist in understanding, this document should be read in conjunction with **GS EP INS 150**, Design Methods for System Configuration Standard Functions.

This Standard Function is a fundamental building block. It may either be used standalone, e.g. for monitoring an equipment status, or associated to other Standard Functions (e.g. Safety Bar, Voting Logic).

2. General Description of Functions

2.1 List of main functions

- ON/OFF signal acquisition including signal filtering function
- Alarm detection (option DI_AL)
- Fault detection (Input card fault)
- Maintenance inhibit (PCS)
- Input enable/disable (option)

3. Description of Interfaces

INPUTS						OUTPUTS		
Field	HMI	Internal				Internal	HMI	Field
			Digital input	DI Standard Function	Status		Alm	Opt.
	Opt.		Start-up inhibit (PSS)		Fault status		Alm	
		Opt	Automatic masking		Start-up inhibit status			
			Maintenance inhibit (PCS)		Maintenance inhibit status (PCS)			
	Opt		Input enable/disable					
		Opt	Master key-switch					
		Opt	Inhibit key-switch					
			Opt. = optional Alm = Alarm					

4. Detailed Description of Functions

There are two field wiring principles possible, each with its own associated software treatment:

DI-D = “De-energised to trip” principle:

Switch OFF (loop electrical status = “0”) → *ACTIVE* or *ALARM* status

Switch ON (loop electrical status = “1”) → *INACTIVE* or *NORMAL* status

DI-E = “Energised to trip” principle:

Switch ON (loop electrical status = “1”) → *ACTIVE* or *ALARM* status

Switch OFF (loop electrical status = “0”) → *INACTIVE* or *NORMAL* status

4.1 Maintenance Functions

This section defines maintenance inhibit and input enable/disable principles, this last command being used only when detectors are processed by voting logics.

In case of brown field development and potentially new development within the same asset, the existing maintenance inhibit procedure will be maintained, unless otherwise specified in the project documents (e.g. operating philosophy, instrumentation and control philosophy).

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4.1.1 Definitions

4.1.1.1 Maintenance inhibit

- **DI used in PCS**

One maintenance inhibit command is required for DIs processed by the PCS.

When the maintenance inhibit is active, yCH/L or yAH/L is forced to its healthy state and the alarm is masked. In addition the loop fault alarm is also masked. However, the status of the input is still available and displayed.

- **DI used in PSS, ESD and FGS**

Activation of maintenance inhibit command will prevent the input signal to be processed by the Safety Bar.

This maintenance inhibit function is fully detailed within the Safety Bar Standard Function.

4.1.1.2 Input enable/disable (option)

When included in voting logic, the enable/disable command will prevent the input signal to be processed by the voting logic.

The primary voting logic arrangement shall automatically be reconfigured in accordance with the downgraded voting logic arrangement defined in the Voting Logic Standard Function (Refer to the [GS EP INS 198](#)).

When the input enable/disable is active, the fault status (invalid status) will be forced.

4.1.2 Input enable/disable logic (option)

A first maintenance inhibit MASTER hard wired key-switch shall enable the input enable/disable function and provide security control against accidental input enable/disable operation. No input enable/disable can be initiated until this MASTER key-switch is set in the ENABLE position.

All active input enable/disable will be reset when this key-switch is switched to the DISABLE position.

Adequate authority level shall operate this MASTER key switch.

A second maintenance inhibit hard wired key-switch shall allow the transfer of the individual input enable/disable command to the ESD system and PSS during a limited time interval (by default 30 minutes). This inhibit key switch will be set in the maintenance inhibit while the above MASTER key-switch is in the ENABLE position. Generally, this inhibit key switch is operated by the control room operator in line with the relevant work permit requirements.

All individual input enable/disable commands will be set /reset using Operator Working Stations (OWS).

Use of maintenance working station (MWS) might also be considered as alternative, as per Project Instrumentation and control philosophy.

Access to maintenance inhibit commands shall be access restricted (e.g. maintenance mode).

The individual input enable/disable command will be latched in the safety system logic.

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It will stay set until one of the following conditions is met:

- The input enable/disable command is reset from either Operator Working Stations, or MWS.
- The maintenance inhibit MASTER key-switch is switched to the DISABLE position.

4.1.3 Hardware Implementation (option)

The inhibit MASTER key-switch and the second maintenance inhibit key-switch shall be common to maintenance inhibit related to PSS, ESD and FGS (i.e. doesn't apply to PCS) and input enable/disable functions.

Those key-switches will be hardwired to one ESD controller and then dispatched to all over safety controllers (ESD, PSS and FGS) through the safety network. Hardwired links between safety systems might be considered as alternative where the safety network is not available.

Both key-switches shall be line monitored and therefore processed by DI-LM Standard Function.

The inhibit MASTER key-switch will be of "stay put" type with key reset and protected by lift flap, unlike the inhibit key-switch of a spring return type.

MASTER key-switch: 0 = Enable position

1 = Disable position

Inhibit key-switch:  = On rising edge detection timer will be launched

ESD/PSS/FGS shall capture the input enable/disable command only during the timer countdown.

4.1.4 Input enable/disable logging (option)

The status of the above key-switches (i.e. MASTER key-switch and maintenance key-switch) shall be logged by the FGS / PSS / ESD system as event.

Input enable/disable status shall be classified as events, as well.

Their number and their duration shall be available through the Operator Working Station and recorded.

Report and dedicated display shall be generated periodically and upon operator request showing all current active input enable/disable.

4.2 Loop fault management

Generally, loop fault of a safety bar trip initiator will trip the concerned safety bar, except if specified differently in Project Safety concept.

Special consideration will be made to signals starting Deluge or Fire fighting systems.

4.3 Automatic masking

Each individual alarm can be masked by an external event (as per [GS EP INS 150](#)). During this automatic masking, the alarm is not generated and the fault status treatment is no longer active.

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4.4 Start-up inhibit

Each individual alarm can be masked by a corresponding active start-up inhibit on the Safety bar.

During this masking, the alarm is not generated, but the fault status treatment and trip condition monitoring are still active.

When the start-up inhibit is removed (inhibit timer elapsed), the corresponding threshold alarm is not re-alarmed again (klaxon and flashing) if the trip condition is still active (the Safety bar will tripped again). First fault detection will help to identify the trip condition.

5. Tuning parameters and variables

Parameter	Access level
Filtering pre-set value	Engineer
Inhibit Timer (typically 30 minutes)	Engineer

6. Representation and Animation (HMI)

Events to be recorded:

- Alarm (option DI_AL)
- Fault status
- Maintenance inhibit (PCS)
- Input enable/disable (where applicable)
- Master key-switch status
- Maintenance inhibit key-switch.

Master key-switch and maintenance inhibit key-switch are common to maintenance inhibit and input enable/disable functions, whatever the concerned safety system (ESD, FGS or PSS).

6.1 Alarm handling

Alarm Description	Priority
PCS input alarm	level 1
PSS/ESD/FGS input alarm	level 2
PCS Fault alarm	level 1
PSS / ESD /FGS Fault alarm	level 2

6.2 Control display

The events which drive these displays may not be mutually exclusive. Therefore, the precedence on the display, from most to least important, shall be: magenta, white, blue, yellow.

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Chapter 1

6.2.1 PCS digital input without alarm for process mimic

yCz xxxx: Tag name of signal (e.g. position switch)

Internal data	Display	Text	Frame
Input status = <i>INACTIVE</i>		Hidden	NA
Input status = <i>ACTIVE</i>	yCz xxxx	Green	NA
Maintenance inhibit = <i>INHIBITED</i>	yCz xxxx	White	Yellow (external frame)
Fault status = <i>ACTIVE</i> Alarm unacknowledged	yCz xxxx xxxx	White	Flashing red (internal frame)
Fault status = <i>ACTIVE</i> Alarm acknowledged	yCz xxxx	White	Steady red (internal frame)
Communication fault = <i>ACTIVE</i>	yCz xxxx	White	Magenta (external frame)

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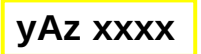
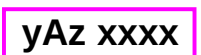
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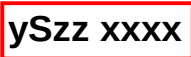
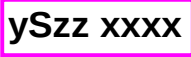
Chapter 1
6.2.2 PCS digital input with alarm (option DI_AL) for process mimic

yAz xxxx: Tag name of signal (e.g. digital alarm)

Internal data	Display	Text	Frame
Input status = <i>NORMAL</i>		Hidden (process displays)	NA
Input status = <i>ALARM</i> Alarm unacknowledged		Flashing colour (colour depends on alarm priority level)	NA
Input status = <i>ALARM</i> Alarm acknowledged	yAz xxxx	Colour steady (colour depends on alarm priority level)	NA
Maintenance inhibit = <i>INHIBITED</i>		If Input Status = <i>ALARM</i> then as above If Input status = <i>NORMAL</i> then white	Yellow (external frame)
Fault status = <i>ACTIVE</i> Alarm unacknowledged		Flashing colour or white	Flashing red (internal frame)
Fault status = <i>ACTIVE</i> Alarm acknowledged		White	Steady red (internal frame)
Communication fault = <i>ACTIVE</i>		White	Magenta (external frame)

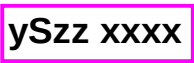
6.2.3 PSS /ESD digital input with alarm (option DI_AL) for process mimic

ySzz xxxx: Tag name of signal

Internal data	Display	Text	Frame
Input status = <i>NORMAL</i>		Hidden (process displays)	NA
Input status = <i>ALARM</i> Alarm unacknowledged		Flashing colour (colour depends on alarm priority level)	NA
Input status = <i>ALARM</i> Alarm acknowledged	ySzz xxxx	Colour steady (colour depends on alarm priority level)	NA
Corresponding bar input Maintenance inhibit active		as above	Yellow (external frame)
Corresponding bar input start-up inhibit active		Colour steady or white	Yellow (external frame)
Fault status = <i>ACTIVE</i> Alarm unacknowledged		Flashing colour or white	Flashing red (internal frame)
Fault status = <i>ACTIVE</i> Alarm acknowledged		White	Steady red (internal frame)
Communication fault = <i>ACTIVE</i>		White	Magenta (external frame)

6.2.4 PSS / ESD /FGS digital input with alarm (option DI_AL) for a safety mimic

ySzz xxxx: Tag name of signal (example for a Safety bar input)

Internal data	Display	Text	Frame
Input status = <i>NORMAL</i>	ySzz xxxx	Blue	NA
Input status = <i>ALARM</i> Alarm unacknowledged		Flashing red	NA
Input status = <i>ALARM</i> Alarm acknowledged	ySzz xxxx	Steady red	NA
Corresponding bar input Maintenance inhibit active		as above	Yellow (external frame)
Corresponding bar input Start-up inhibit active		as above	Yellow (external frame)
Fault status = <i>ACTIVE</i> Alarm unacknowledged		Flashing red or Blue	Flashing red (internal frame)
Fault status = <i>ACTIVE</i> Alarm acknowledged		Red or Blue	Steady red (internal frame)
Communication fault = <i>ACTIVE</i>		White	Magenta (external frame)

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1. Scope

The purpose of this document is to define the Standard Function for a Line monitored Digital Input.

This standard is used for linear heat sensing cables or loops based on “energise to trip” principle (e.g. local Manual Call Points, push buttons included in the F&G matrix and ESD panels, local ESD push buttons).

This Standard Function is a fundamental building block. It may either be used standalone, e.g. for monitoring an equipment status, or associated to other Standard Functions (e.g. Safety Bar, Voting Logic).

In order to assist in understanding, this document should be read in conjunction with **GS EP INS 150**, Design Methods for System Configuration Standard Functions.

2. General description of functions

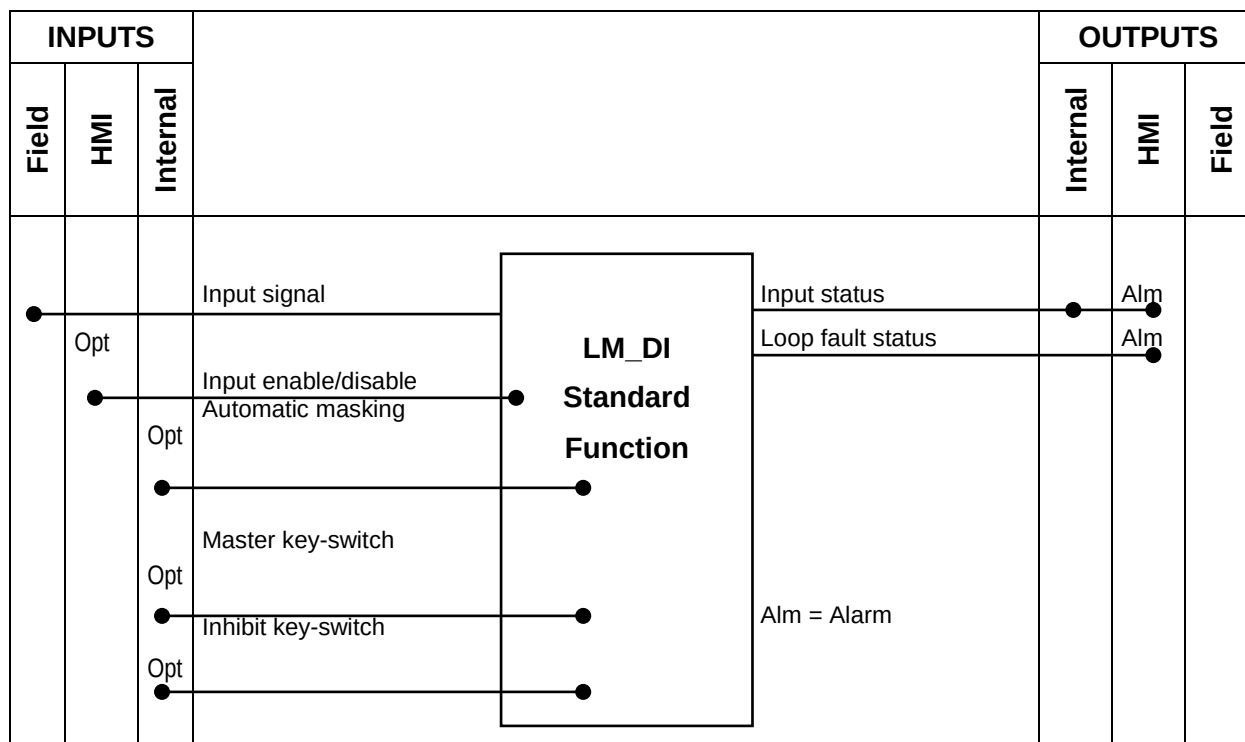
2.1 List of main functions

- ON/OFF signal acquisition including signal filtering function
- Alarm detection
- Loop Fault detection (open & short circuits)
- Input enable/disable (option).

Signal acquisition may be achieved through standard analogue inputs card. This analogue loop will include up to four individual contacts.

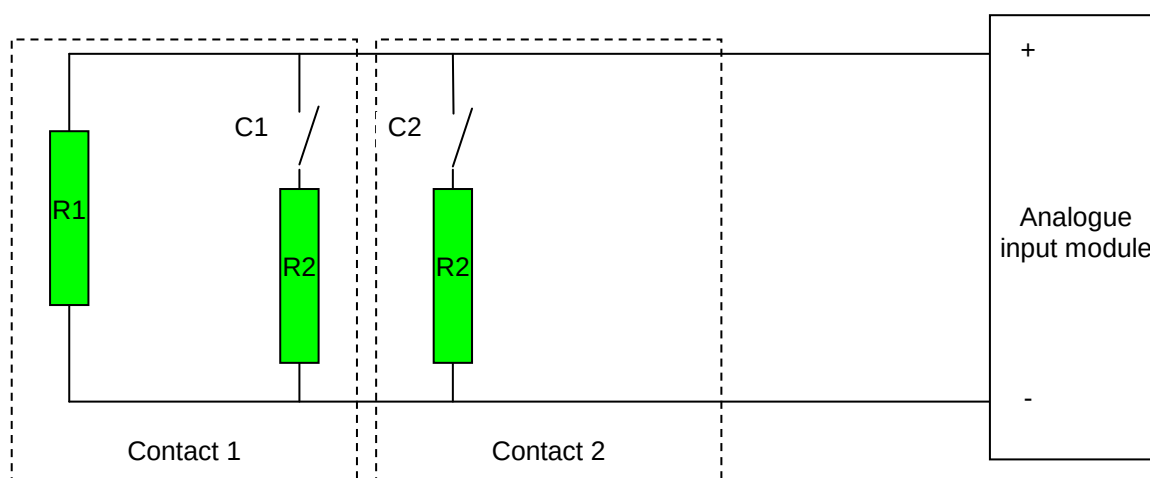
3. Interfaces description

3.1 General description



3.2 Field interface description

The field wiring principle for this type of ON/OFF data acquisition shall be designed as below (example showing two individual contacts):



R1 = 4.7 Kohm

R2 = 3.3 Kohm

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Chapter 2

The resistors R1 and R2 shall be calculated to ensure the signal levels suit the system capabilities.

Typical input signal characteristics:

- Signal ≤ 0.8 mA Loop status = INVALID (open circuit)
- Signal = 4 mA Loop status = NORMAL (loop healthy, no contacts activated)
- Signal ≥ 7 mA Loop status = ALARM (at least 1 contact activated)
- Signal ≥ 23.2 mA Loop status = INVALID (short circuit).

For linear heat detector, the above description doesn't apply since the principle is slightly different:

The wiring principle includes RTD converter as well as "beginning of line" and "end of line" resistors.

Calculation of resistors will depend on the RTD converter type, cable type and length.

Typical input signal characteristics:

- Signal ≤ 4 mA INVALID (open circuit)
- Signal = 6 mA ALARM (detected fire at the beginning of the cable)
- $9 \text{ mA} \leq \text{Signal} \leq 12 \text{ Ma}$ ALARM (detected fire at the end of the sensitive cable)
- Signal ≥ 18 mA NORMAL
- Signal ≥ 20 mA INVALID (short-circuit)

4. Detailed description of functions

4.1 Status definition

Internal data	Calculation rules	Status
Input status	$7 \text{ mA} < \text{signal}$ (at least 1 contact activated)	<i>ALARM</i>
	Else	<i>NORMAL</i>
Loop fault	$\text{Signal} < 0.8 \text{ mA}$ or $> 23.2 \text{ mA}$	<i>ALARM</i>
	Else	<i>NORMAL</i>

For linear heat detector:

Internal data	Calculation rules	Status
Input status	$6 \text{ mA} < \text{signal} < 12 \text{ mA}$	<i>ALARM</i>
	Else	<i>NORMAL</i>
Loop fault	$\text{Signal} < 4 \text{ mA}$ or $> 20 \text{ mA}$	<i>ALARM</i>
	Else	<i>NORMAL</i>

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4.2 Functional standard behavior

In the case of a short or open circuit detection (loop fault activated), the Input status will be forced *NORMAL* and the loop fault signal will generate an alarm.

For loops based on “energize to trip” principle, loop fault will not trip any Safety Bar or initiate any safety-related action.

For the linear heat detectors, loop fault will be processed by associated voting logic.

4.3 Maintenance Functions

This section defines maintenance inhibit and input enable/disable principles, this last command being used only when detectors are processed by voting logics.

In case of brown field development and potentially new development within the same asset, the existing maintenance inhibit procedure will be maintained, unless otherwise specified in the project documents (e.g. operating philosophy, instrumentation and control philosophy).

4.3.1 Definitions

4.3.1.1 Maintenance inhibit

Activation of maintenance inhibit command will prevent the input signal to be processed by the Safety Bar.

This maintenance inhibit function is fully detailed within the Safety Bar Standard Function.

4.3.1.2 Input enable/disable (option)

When included in voting logic, the enable/disable command will prevent the input signal to be processed by the voting logic.

The primary voting logic arrangement shall automatically be reconfigured in accordance with the downgraded voting logic arrangement defined in the Voting Logic Standard Function (Refer to the **GS EP INS 198**).

When the input enable/disable is active, the fault status (invalid status) will be forced.

4.3.2 Input enable/disable logic (option)

A first maintenance inhibit MASTER hard wired key-switch shall enable the input enable/disable function and provide security control against accidental input enable/disable operation. No input enable/disable can be initiated until this MASTER key-switch is set in the ENABLE position.

All active input enable/disable will be reset when this key-switch is switched to the DISABLE position.

Adequate authority level shall operate this MASTER key switch.

A second maintenance inhibit hard wired key-switch shall allow the transfer of the individual input enable/disable command to the ESD system and PSS during a limited time interval (by default 30 minutes). This inhibit key switch will be set in the maintenance inhibit while the above MASTER key-switch is in the ENABLE position. Generally, this inhibit key switch is operated by the control room operator in line with the relevant work permit requirements.

All individual maintenance inhibit commands will be set /reset using the Operator Working Stations (OWS).

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Use of maintenance working station (MWS) might also be considered as alternative, as per Project Instrumentation and control philosophy.

Access to maintenance inhibit commands shall be access restricted (e.g. maintenance mode).

The individual maintenance inhibit command will be latched in the safety system logic.

It will stay set until one of the following conditions is met:

- The maintenance inhibit is reset from either OWS, or MWS
- The maintenance inhibit MASTER key-switch is switched to the DISABLE position.

4.3.3 Hardware Implementation (option)

The inhibit MASTER key-switch and the second maintenance inhibit key-switch shall be common to maintenance inhibit related to PSS, ESD and FGS (i.e. doesn't apply to PCS) and input enable/disable functions.

Those key-switches will be hardwired to one ESD controller and then dispatched to all over safety controllers (ESD, PSS and FGS) through the safety network. Hardwired links between safety systems might be considered as alternative where the safety network is not available.

Both key-switches shall be line monitored and therefore processed by DI-LM Standard Function.

The inhibit MASTER key-switch will be of "stay put" type with key reset and protected by lift flap, unlike the inhibit key-switch of a spring return type.

MASTER key-switch: 0 = Enable position

1 = Disable position

Inhibit key-switch:  = On rising edge detection timer will be launched

ESD/PSS/FGS shall capture the input enable/disable command only during the timer countdown.

4.3.4 Input enable/disable logging (option)

The status of the above key-switches (i.e. MASTER key-switch and maintenance key-switch) shall be logged by the FGS / PSS / ESD system as event.

Input enable/disable status shall be classified as events, as well.

Their number and their duration shall be available through the Operator Working Station and recorded.

Report and dedicated display shall be generated periodically and upon operator request showing all current active input enable/disable.

4.4 Automatic masking

Each individual alarm can be masked by an external event (as per [GS EP INS 150](#)). During this automatic masking, the alarm is not generated and the fault status treatment is no longer active.

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5. Tuning parameters and variables

Parameter	Access level
Filtering pre-set value	Engineer

6. Representation and animation description (HMI)

6.1 Events to be recorded

- Fault
- Loop invalidity
- Input enable/disable (where applicable)
- Master key-switch status
- Maintenance inhibit key-switch.

Master key-switch and maintenance inhibit key-switch are common to maintenance inhibit and input enable/disable functions, whatever the concerned safety system (ESD, FGS or PSS).

6.2 Alarm management

Alarm Description	Priority
Input alarm	Level 2 (for PSS) Level 3 (for FGS and ESD system)
Loop fault alarm	Level 2

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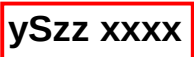
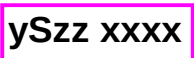
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Chapter 2

6.3 Control Display

6.3.1 DI-LM for process mimic

ySzz xxxx: Tag name of signal

Internal data	Display	Text	Frame
Input status = <i>NORMAL</i>		Hidden (process displays)	NA
Input status = <i>ALARM</i> Alarm unacknowledged		Flashing colour (colour depends on alarm priority level)	NA
Input status = <i>ALARM</i> Alarm acknowledged	ySzz xxxx	Colour steady (colour depends on alarm priority level)	NA
Corresponding bar input Maintenance inhibit active		as above	Yellow (external frame)
Fault status = <i>ACTIVE</i> Alarm unacknowledged		Flashing colour or white	Flashing red (internal frame)
Fault status = <i>ACTIVE</i> Alarm acknowledged		White	Steady red (internal frame)
Communication fault = <i>ACTIVE</i>		White	Magenta (external frame)

6.3.2 DI-LM for safety mimic

ySzz xxxx: Tag name of signal (example for a Safety bar input)

Internal data	Display	Text	Frame
Input status = <i>NORMAL</i>	ySzz xxxx	Blue	NA
Input status = <i>ALARM</i> Alarm unacknowledged		Flashing red	NA
Input status = <i>ALARM</i> Alarm acknowledged	ySzz xxxx	Steady red	NA
Corresponding bar input Maintenance inhibit active		as above	Yellow (external frame)
Fault status = <i>ACTIVE</i> Alarm unacknowledged		Flashing red or Blue	Flashing red (internal frame)
Fault status = <i>ACTIVE</i> Alarm acknowledged		Red or Blue	Steady red (internal frame)
Communication fault = <i>ACTIVE</i>		White	Magenta (external frame)

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1. Scope

The purpose of this document is to define the Standard Function for an analogue input to control systems.

In order to assist in understanding, this document should be read in conjunction with **GS EP INS 150**, Design Methods for System Configuration Standard Functions.

This standard is only used for the measurement acquisition and may be linked to other Standard Functions, e.g.

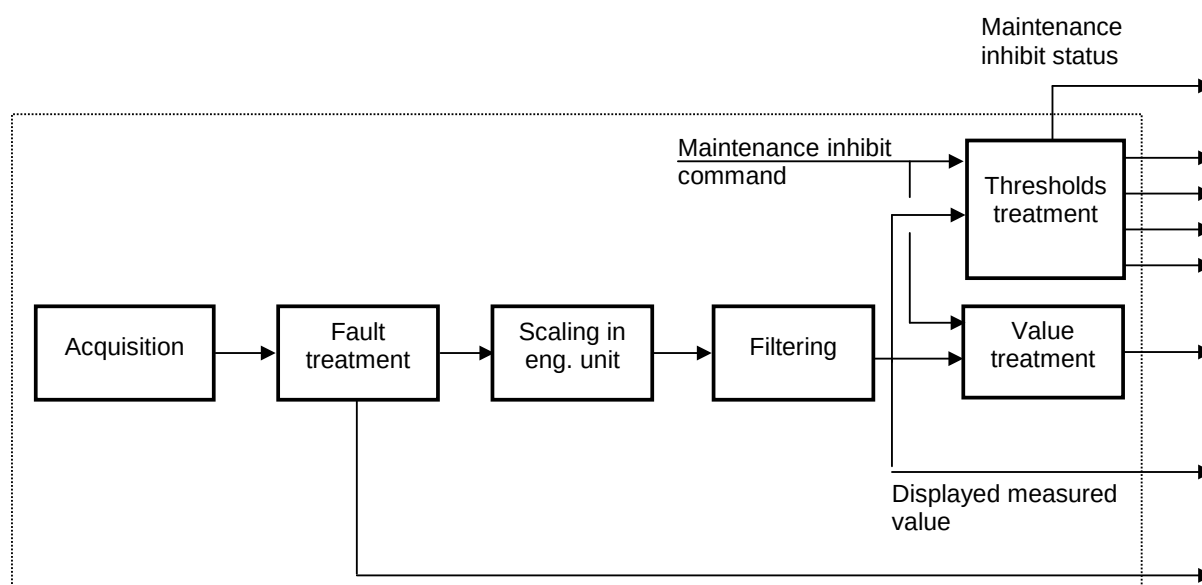
- PID
- RAI (Redundant analogue inputs) including the deviation alarm between process and safety transmitters where applicable
- GCF (Temperature & Pressure compensated Flow), etc.

2. General description of functions

2.1 List of main functions

- Signal acquisition
- Loop fault detection
- Signal conversion to a numerical value in engineering unit
- Engineering value filtering (first order)
- Square root extraction for flow measurement (Delta P transmitters)
- Process thresholds handling (alarm and/or control)
- Maintenance inhibit.

2.2 Functional scheme



Input and Output Standard Functions

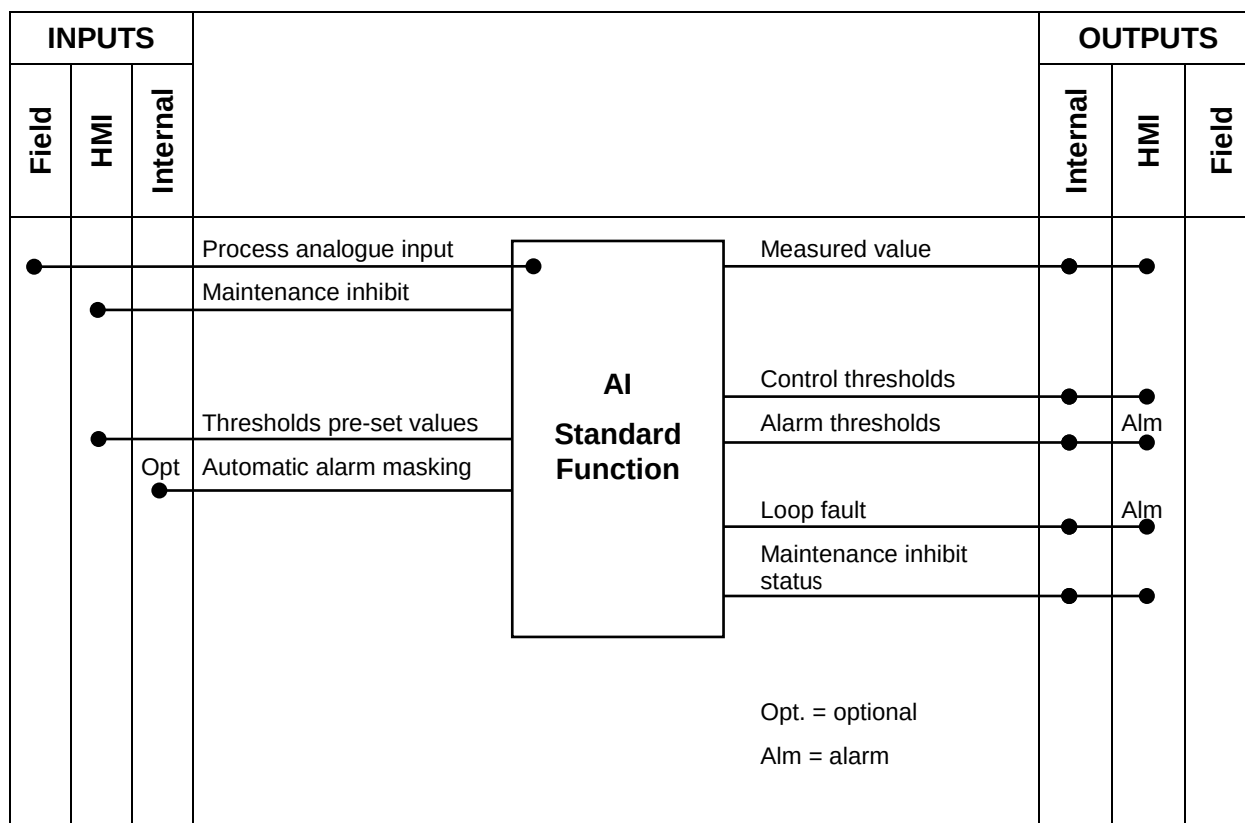
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Chapter 3

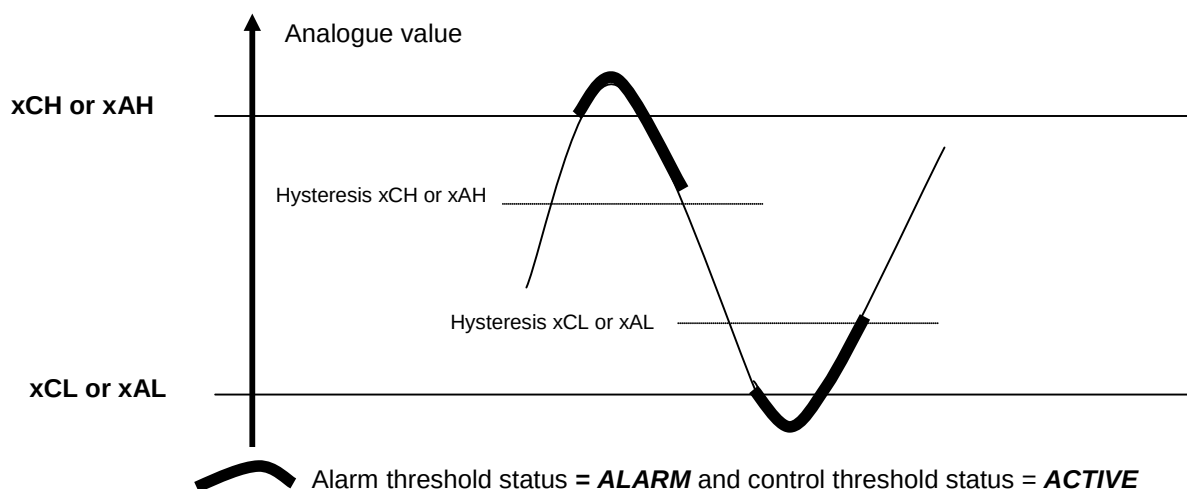
3. Interface description



4. Detailed description of functions

4.1 Thresholds activation handling

Four thresholds per analogue value shall be available for equipment automatic control or operator alarming purposes. Utilisation of the thresholds shall be as defined on the PIDs and instrument schedule.



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4.2 Maintenance inhibit handling

One maintenance inhibit command is required for this type of analogue value.

Numerical value	Control thresholds	Alarm thresholds
HMI shows actual measured value of the sensor (in engineering unit). Memorised value is the last valid value measured value (before inhibit). Associated PID controller calculation is stopped with last calculated output. Automatic control sequences still run (with the memorised value).	xCL and xCH are deactivated and forced to their <i>NORMAL</i> state	xAL and xAH are deactivated and forced to their <i>NORMAL</i> state

The loop fault shall not be alarmed when the maintenance inhibit is active.

4.3 Loop Fault handling

Signal value	Signal status	Displayed value
Signal < 0.8 mA	<i>INVALID</i>	- 20% (a)
0.8 mA ≤ signal ≤ 23.2 mA	<i>VALID</i>	Current value
Signal > 23.2 mA	<i>INVALID</i>	120% (a)
Card fault	<i>INVALID</i>	Last value

(a) The predefined values -20% and 120% can be replaced by specific characters when the DCS has a loop fault status standard display.

HMI consoles shall always display the current measured value while within valid signal limits.

When the loop is *INVALID*, the thresholds treatment is no longer performed.

When associated with the RAI Standard Function, the loop fault will not affect process control functions and the measured value will only be used for display purpose. Loop fault will be replaced by the “total invalidity”, coming from the RAI Standard Function (e.g. set in MAN the associated controller).

4.4 Automatic masking

Each threshold can be masked by an external event (as per [GS EP INS 150](#)).

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5. Tuning parameters and variables

Parameter	Access level
Min. scale pre-set value	Engineer
Max. scale pre-set value	Engineer
Filtering pre-set value	Engineer
Alarm thresholds (xAH/xAL) pre-set values	Method
Control thresholds (xCH/xCL) pre-set values	Method
Thresholds hysteresis pre-set values	Engineer

6. Representation and animation description (HMI)

6.1 Events and Values to be recorded

6.1.1 Events

- Loop fault
- Alarm thresholds
- Maintenance inhibit command.

6.1.2 Analogue value

Analogue value (in engineering units).

6.2 Alarm handling

Alarm description	Priority
Alarm thresholds (xAH, xAL)	Level 1
Loop fault alarm	Level 1

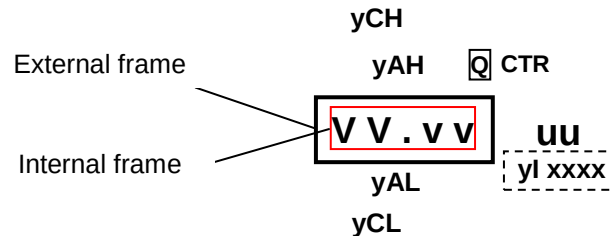
6.3 Control display

This description gives examples of representation. However, they may be amended dependant on the DCS features.

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6.3.1 Displayed data representation

The measurement representation shall be as below:



- V V . v v = Measured value (in engineering unit)
- Target area for the loop faceplate display (alarm thresholds tuning)
- uu = Engineering unit
- CTR = Process control (only appears on operator request)
- Target area for the loop faceplate display (control thresholds tuning)
- yl xxxx = Sensor tag name (only appears on operator request)
- Target area for the maintenance inhibit command
- yCH = High control threshold activated
- (can also be displayed near the associated equipment)
- yAH = High alarm threshold activated
- yAL = Low alarm threshold activated
- yCL = Low control threshold activated
- (can also be displayed near the associated equipment)

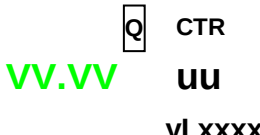
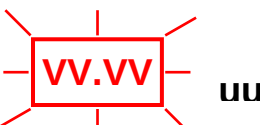
Control thresholds shall not be displayed on process mimics.

Process control function and associated control thresholds are optional.

All existing threshold (s) on process mimics are displayed in white colour on operator request (hidden if not active).

Symbol  is used as target area for the display of the totalized flow summary mimic (optional: only in case of associated totalized flow).

6.3.2 Measurement display

Internal data	Display	Text	Frame
Measured value = <i>NORMAL</i> Label + CTR + Q Units		Green White/hidden White	NA
Measured value = <i>ALARM</i>		Colour steady (only depending on alarm priority level)	NA
Maintenance inhibit = <i>INHIBITED</i>		As above	Yellow steady (external frame)
Loop fault = <i>ALARM</i> Alarm unacknowledged		Red steady	Flashing red (internal frame)
Loop fault = <i>ALARM</i> Alarm acknowledged		Red steady	Red steady (internal frame)
Loop fault occurred after Maintenance inhibition activation		Red steady	Yellow (external frame) Red Alarm (internal frame)
Communication fault = <i>ACTIVATED</i>		White	Magenta steady (external frame)

The events which drive these frame displays may not be mutually exclusive. Therefore, the precedence on the display, from most to least important, shall be: magenta, white, blue, yellow.

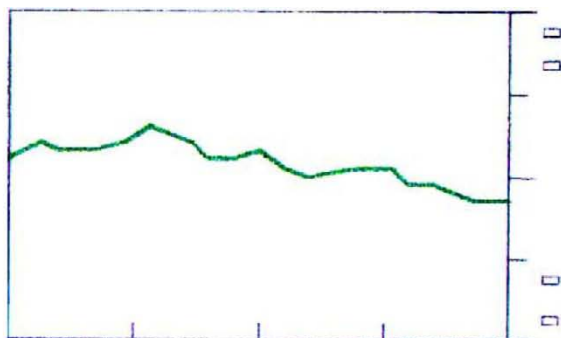
6.3.3 Alarm thresholds display

Internal data	Display	Text	Frame
Alarm threshold = <i>NORMAL</i>		Hidden	NA
Alarm threshold = <i>ALARM</i> Alarm unacknowledged		Flashing colour (Colour depends on alarm priority level)	NA
Alarm threshold = <i>ALARM</i> Alarm acknowledged		Colour steady (Colour depends on alarm priority level)	NA

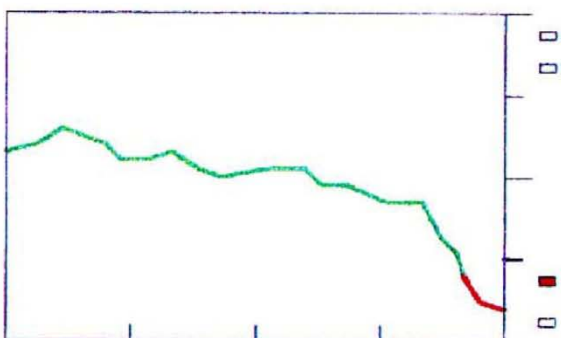
6.3.4 Control thresholds display

Internal data	Display	Text	Frame
Control threshold = <i>NORMAL</i>		Hidden	NA
Control threshold = <i>ACTIVE</i>		Green	NA

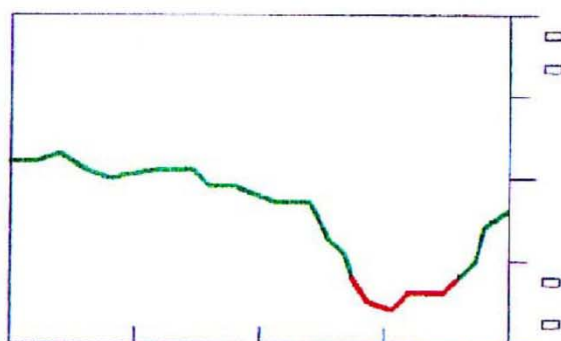
6.4 Trend curves display



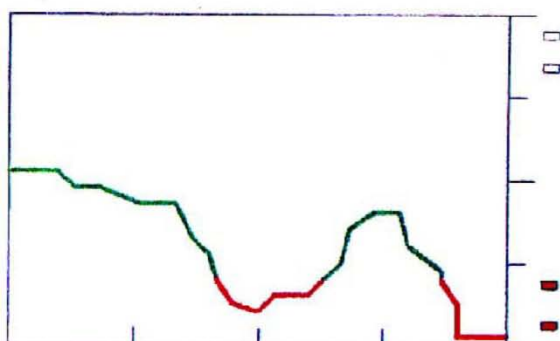
Curve within alarm thresholds limits
Curve is green



Lower alarm threshold overshooting
Curve is green in normal zone
Curve is red in alarm zone

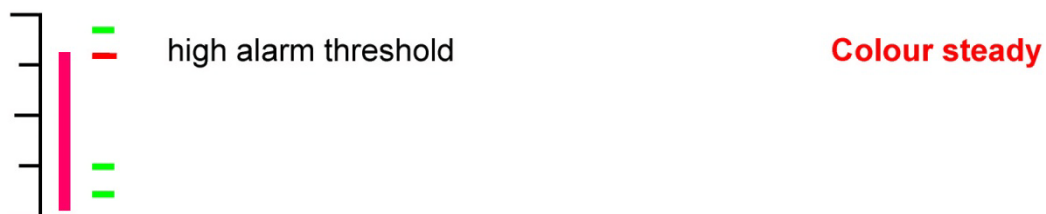


Threshold overshooting
storage
Curve is green in normal zone
Curve is red in alarm zone



Lower safety threshold
overshooting
Curve is green in normal zone
Curve is red in alarm zone

6.5 Bar graph graphic symbol display



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Chapter 4 Analogue Input Safety Standard Function - AIS -

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1. Scope

The purpose of this document is to define the Standard Function for an Analogue Input specific to safety systems.

In order to assist in understanding, this document should be read in conjunction with **GS EP INS 150**, Design Methods for System Configuration Standard Functions.

This standard is only used for the measurement acquisition and may be linked to other standard functions, e.g.:

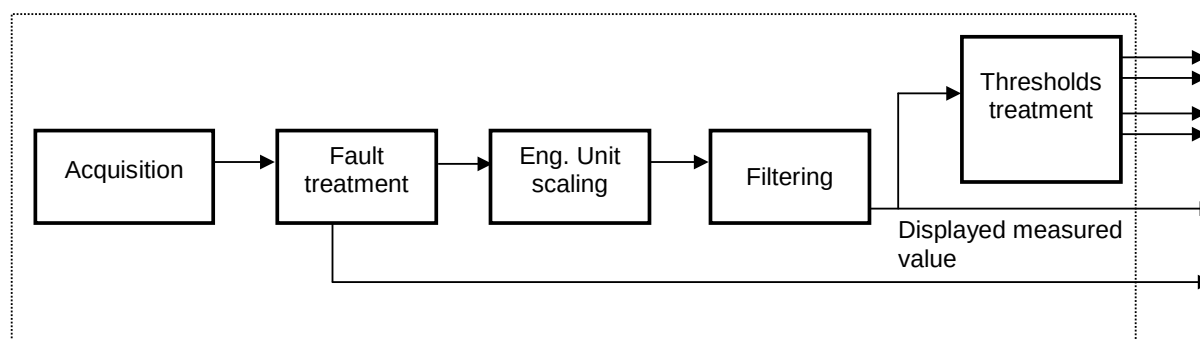
- DI-LM
- RAI (Redundant analogue inputs)
- Safety Bar
- Voting logic 2ooN, etc.

2. General description of functions

2.1 List of main functions

- Signal acquisition
- Loop fault detection
- Signal conversion to a numerical value in engineering unit
- Engineering value filtering (first order)
- Thresholds handling (alarm and safety)
- Input enable/disable (option).

2.2 Functional scheme



3. Interfaces description

INPUTS				OUTPUTS		
Field	HMI	Internal		Internal	HMI	Field
●			Safety analogue input	●	●	
		●	Thresholds pre-set values			
		Opt ●	Start-up inhibit		●	Alm
		Opt ●	Automatic alarm masking		●	Alm
	Opt ●		Input enable / disable		●	Alm
		Opt ●	Master key-switch			
		Opt ●	Inhibit key-switch			

**Standard
AIS**

Measured value

Safety thresholds

Alarm thresholds

Loop fault

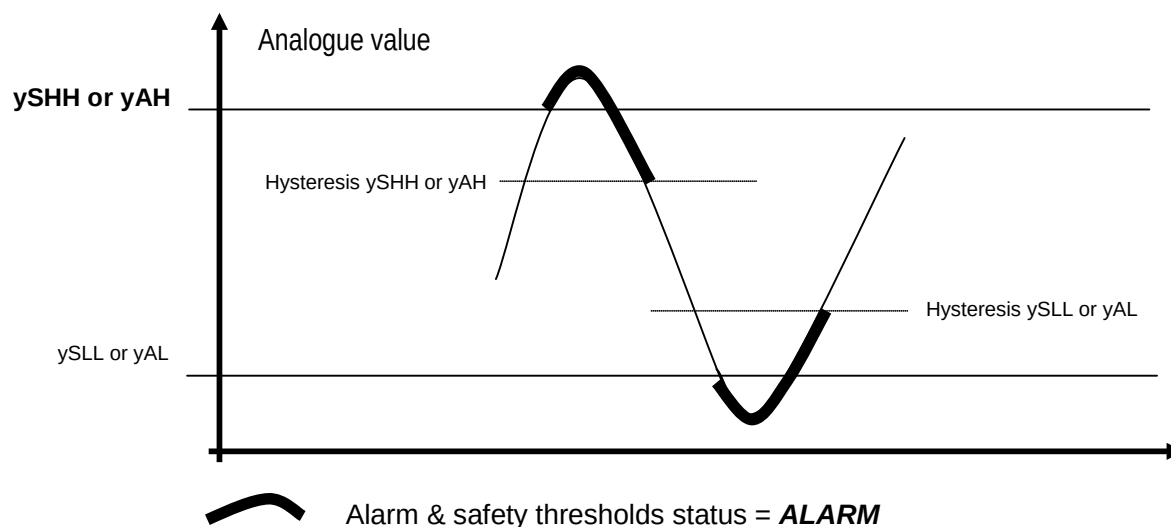
Opt. = optional

Alm = alarm

4. Detailed description

4.1 Thresholds activation handling

Four thresholds per analogue value shall be available for safety trip initiations or operator alarming purposes. Utilisation of the thresholds shall be as defined on the PIDs, instruments schedule and ESD functional diagrams.



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4.2 Maintenance Functions

This section defines maintenance inhibit and input enable/disable principles, this last command being used only when transmitters/detectors are processed by voting logics.

In case of brown field development and potentially new development within the same asset, the existing maintenance inhibit procedure will be maintained, unless otherwise specified in the project documents (e.g. operating philosophy, instrumentation and control philosophy).

4.2.1 Definitions

4.2.1.1 Maintenance inhibit

When several thresholds are used in the Safety Logic Diagrams, each threshold will be inhibited individually.

Activation of maintenance inhibit command will prevent the input signal to be processed by the Safety Bar.

This maintenance inhibit function is fully detailed within the Safety Bar Standard Function.

4.2.1.2 Input enable/disable (option)

When included in voting logic, the enable/disable command will prevent the input signal to be processed by the voting logic (necessary for calibration purpose for instance).

The primary voting logic arrangement shall automatically be reconfigured in accordance with the downgraded voting logic arrangement defined in the Voting Logic Standard Function (Refer to the [GS EP INS 198](#)).

This allows simultaneous calibration of input signals related to the same voting logic without initiation of the voting logic output signal (refer to the Voting Logic Standard Function).

When the input enable/disable is active, the fault status (invalid status) will be forced.

4.2.2 Input enable/disable logic (option)

A first maintenance inhibit MASTER hard wired key-switch shall enable the input enable/disable function and provide security control against accidental input enable/disable operation. No input enable/disable can be initiated until this MASTER key-switch is set in the ENABLE position.

All active input enable/disable will be reset when this key-switch is switched to the DISABLE position.

Adequate authority level shall operate this MASTER key switch.

A second maintenance inhibit hard wired key-switch shall allow the transfer of the individual input enable/disable command to the ESD system and PSS during a limited time interval (by default 30 minutes). This inhibit key switch will be set in the maintenance inhibit while the above MASTER key-switch is in the ENABLE position. Generally, this inhibit key switch is operated by the control room operator in line with the relevant work permit requirements.

All individual input enable/disable commands will be set /reset using the Control systems Operator Working Stations. A dedicated maintenance inhibit station might also be considered as alternative, as per Project Instrumentation and control philosophy.

Control systems Operator Working Stations shall be set in Maintenance Mode; dedicated maintenance inhibit station shall be access restricted.

The individual input enable/disable command will be latched in the safety system logic.

It will stay set until one of the following conditions is met:

- The input enable/disable command is reset from the Control systems Operator Working Stations (set in Maintenance mode) or the dedicated maintenance inhibit station (with restricted access)
- The maintenance inhibit MASTER key-switch is switched to the DISABLE position.

4.2.3 Hardware Implementation (option)

The inhibit MASTER key-switch and the second maintenance inhibit key-switch shall be common to maintenance inhibit and input enable/disable functions.

Those key-switches will be hardwired to one ESD controller and then dispatched to all over safety controllers (ESD, PSS and FGS) through the safety network. Hardwired links between safety systems might be considered as alternative where the safety network is not available.

Both key-switches shall be line monitored and therefore processed by DI-LM Standard Function.

The inhibit MASTER key-switch will be of "stay put" type with key reset and protected by lift flap, unlike the inhibit key-switch of a spring return type.

MASTER key-switch: 0 = Enable position

1 = Disable position

Inhibit key-switch:  = On rising edge detection timer will be launched

ESD/PSS/FGS shall capture the input enable/disable command only during the timer countdown.

4.2.4 Input enable/disable logging (option)

The status of the above key-switches (i.e. MASTER key-switch and maintenance key-switch) shall be logged by the FGS / PSS / ESD system as event.

Input enable/disable status shall be classified as events, as well.

Their number and their duration shall be available through the Operator Working Station and recorded.

Report and dedicated display shall be generated periodically and upon operator request showing all current active input enable/disable.

4.3 Loop fault management

Signal value	Signal status	Displayed value
Signal < 0.8 mA	INVALID	- 20% (a)
$0.8 \text{ mA} \leq \text{signal} \leq 23.2 \text{ mA}$	VALID	Current value
Signal > 23.2 mA	INVALID	120% (a)
Card fault	INVALID	Last value

- (a) The predefined values -20% and 120% can be replaced by specific characters when the DCS has a loop fault status standard display.

HMI consoles shall always display the current measured value while within valid signal limits. When the loop is invalid, the thresholds treatment is no longer performed.

Generally, loop fault of a safety bar trip initiator will trip the concerned safety bar, except if specified differently in Project Safety concept. Special consideration will be made to signals starting Deluge or Fire fighting systems.

When associated with the RAI Standard Function, the loop fault will not trip any safety function; only display functions will be performed. Loop fault will then be replaced by the “total invalidity”, coming from the RAI Standard Function.

4.4 Automatic masking

Each individual alarm can be masked by an external event (as per **GS EP INS 150**). During this automatic masking, the alarm is not generated and the fault status treatment is no longer active.

4.5 Start-up inhibition

Each individual alarm can be masked by a corresponding active start-up inhibit on the Safety bar.

During this masking, the alarm is not generated, but the fault status treatment and trip condition monitoring are still active.

When the start-up inhibit is removed (inhibit timer elapsed), the corresponding threshold alarm is not re-alarmed again (klaxon and flashing) if the trip condition is still active (the Safety bar will tripped again). First fault detection will help to identify the trip condition.

5. Tuning parameters and variables

Parameter	Access level
Min. scale pre-set value	Engineer
Max. scale pre-set value	Engineer
Filtering pre-set value	Engineer
Alarm thresholds (yAH/yAL) pre-set values	Engineer
Safety thresholds (ySHH/ySLL) pre-set values	Engineer
Thresholds hysteresis pre-set values	Engineer
Inhibit Timer (typically 30 minutes)	Engineer

6. Representation and animation description (HMI)

6.1 Events and Values to be recorded

6.1.1 Events

- Loop fault
- Alarm thresholds

- Safety thresholds
- Input enable/disable status (where applicable)
- Master key-switch Enable / Disable status
- Maintenance inhibit key-switch

Master key-switch and maintenance inhibit key-switch are common to maintenance inhibit and input enable/disable functions, whatever the concerned safety system (ESD, FGS or PSS).

6.1.2 Analogue value

- Analogue value (in engineering unit).

6.2 Alarm handling

Alarm description	Priority
Safety thresholds (ySHH, ySLL)	Level 2 for PSS Level 3 for FGS & ESD system
Alarms thresholds (yAH, yAL)	Level 1 for PSS Level 2 for FGS & ESD system
Loop fault alarm	Level 2 for PSS Level 3 for FGS & ESD system

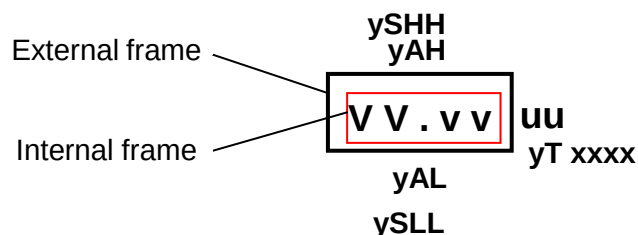
6.3 Control display

The below description gives examples of representation. However, they may be amended dependant on the DCS features.

6.3.1 Displayed data representation

When displayed, the analogue value standard representation shall be:

(**Note:** In majority of cases, safety analogue values shall not be displayed on process mimics)



- V V . v v = Measured value (in engineering unit)
Target area for the face plate display (alarm & safety thresholds tuning)
- uu = Engineering unit
- yT xxxx = Sensor tag name (only appears on operator request)
- ySHH = High high safety threshold activated
- yAH = High alarm threshold activated
- yAL = Low alarm threshold activated
- ySLL = Low low safety threshold activated

6.3.2 Analogue value display

When the analogue value display is required, please refer to AI standard (without animation associated with the face plate target area nor the maintenance inhibit command).

6.3.3 Alarm thresholds display

Internal data	Display	Text	Frame
Alarm threshold = <i>NORMAL</i>		Hidden	NA
Alarm threshold = <i>ALARM</i> Alarm unacknowledged		Flashing yellow (PSS) Flashing red (ESD system)	NA
Alarm threshold = <i>ALARM</i> Alarm acknowledged		Yellow steady (PSS) Red steady (ESD system)	NA

6.3.4 Safety thresholds display (for process mimics)

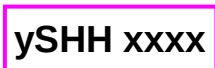
Internal data	Display	Text	Frame
Safety threshold = <i>NORMAL</i>		Hidden	NA
Safety threshold = <i>ALARM</i> Alarm unacknowledged		Flashing red	NA
Safety threshold = <i>ALARM</i> Alarm acknowledged		Red steady	NA

When the analogue value is not displayed on a process mimic, then the frame animation shall be performed on each safety threshold, according to the animation used for safety mimics (refer to section 6.3.5). In this case, safety thresholds shall also be used as target areas for calling the associated loop face plate.

Note that, in case of RAI association, an internal frame (fault) is managed on a safety threshold display in the same way as a safety mimic.

6.3.5 Safety thresholds display (for safety mimics)

When RAI switching is active, the text is displayed with an Orange background **ySHH xxxx**

Internal data	Display	Text	Frame
Safety threshold = <i>NORMAL</i>	ySHH xxxx	Blue	NA
Safety threshold = <i>ALARM</i> Alarm unacknowledged		Flashing red	NA
Safety threshold = <i>ALARM</i> Alarm acknowledged	ySHH xxxx	Red steady	NA
Corresponding bar input maintenance inhibit active		as above	Yellow steady (external frame)
Corresponding bar input start-up inhibit active		Red steady or blue	Yellow steady (external frame)
Threshold invalidity = <i>INVALID</i> Alarm unacknowledged		Flashing red or blue	Flashing red (internal frame)
Threshold invalidity = <i>INVALID</i> Alarm acknowledged		Blue	Red steady (internal frame)
Communication fault = <i>ACTIVATED</i>		White	Magenta steady (external frame)

The events which drive these frame displays may not be mutually exclusive. Therefore, the precedence on the display, from most to least important, shall be: magenta, white, blue, yellow.



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Chapter 4

6.4 Short time trend curves display

As per AI standard.

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1. Scope

The purpose of this document is to define the Standard Function for Redundant Analogue Inputs (RAI).

In order to assist in understanding, this document should be read in conjunction with **GS EP INS 150**, Design Method for System Configuration Standard Functions.

This Standard Function applies where process and safety transmitters measure the same process parameter (e.g. pressure, temperature, level with process tapplings at the same elevation) and have the same scale.

This standard is designed:

- To detect a discrepancy between the process and the safety measurements and issue alarm, whatever the type of PCS, PSS and ESD controllers
- To increase the control and safety functions availability avoiding any spurious trip due to faulty transmitter or faulty loop. For that reason, this function has to be considered as a downgraded mode which cannot be used permanently. The PCS measurement will be used in PSS or vice versa:
 - Either automatically upon fault detection of one of the two transmitters
 - Or manually upon operator command.

This manual or automatic switching function shall be implemented only if PSS and PCS are based **on the same type of controllers**, with communication between both systems based on a system built-in feature providing direct, high speed, redundant and reliable communication.

This Standard Function will be considered with AI and AIS Standards Functions:

- The switching function shall be implemented in both PCS and PSS
- The discrepancy detection will be implemented in the PCS.

2. General description of functions

2.1 List of main functions

RAI functions are:

- Comparison of both measurements
- Discrepancy alarm
- Automatic switching upon loop fault detection
- Manual switching.

Input and Output Standard Functions

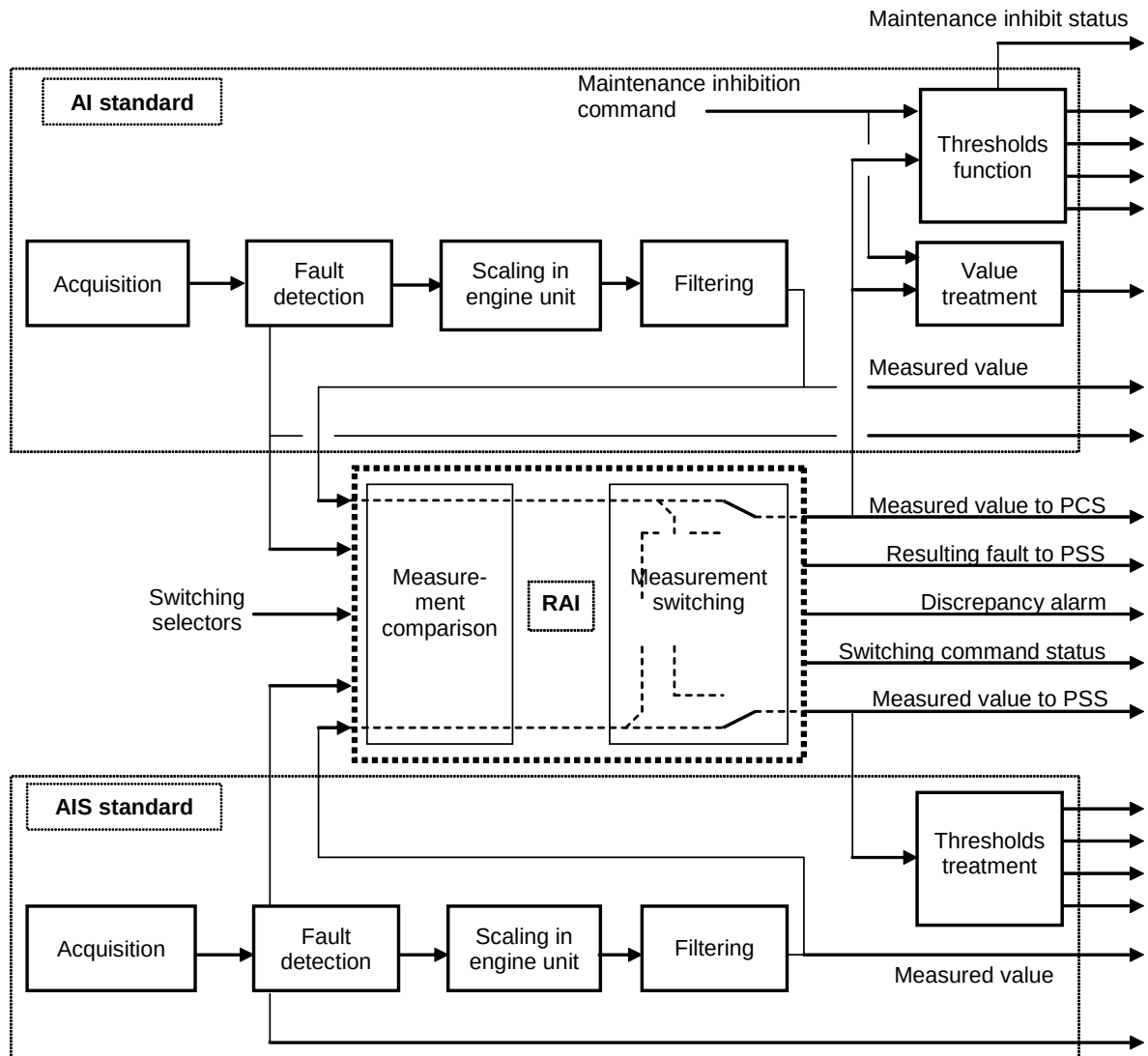
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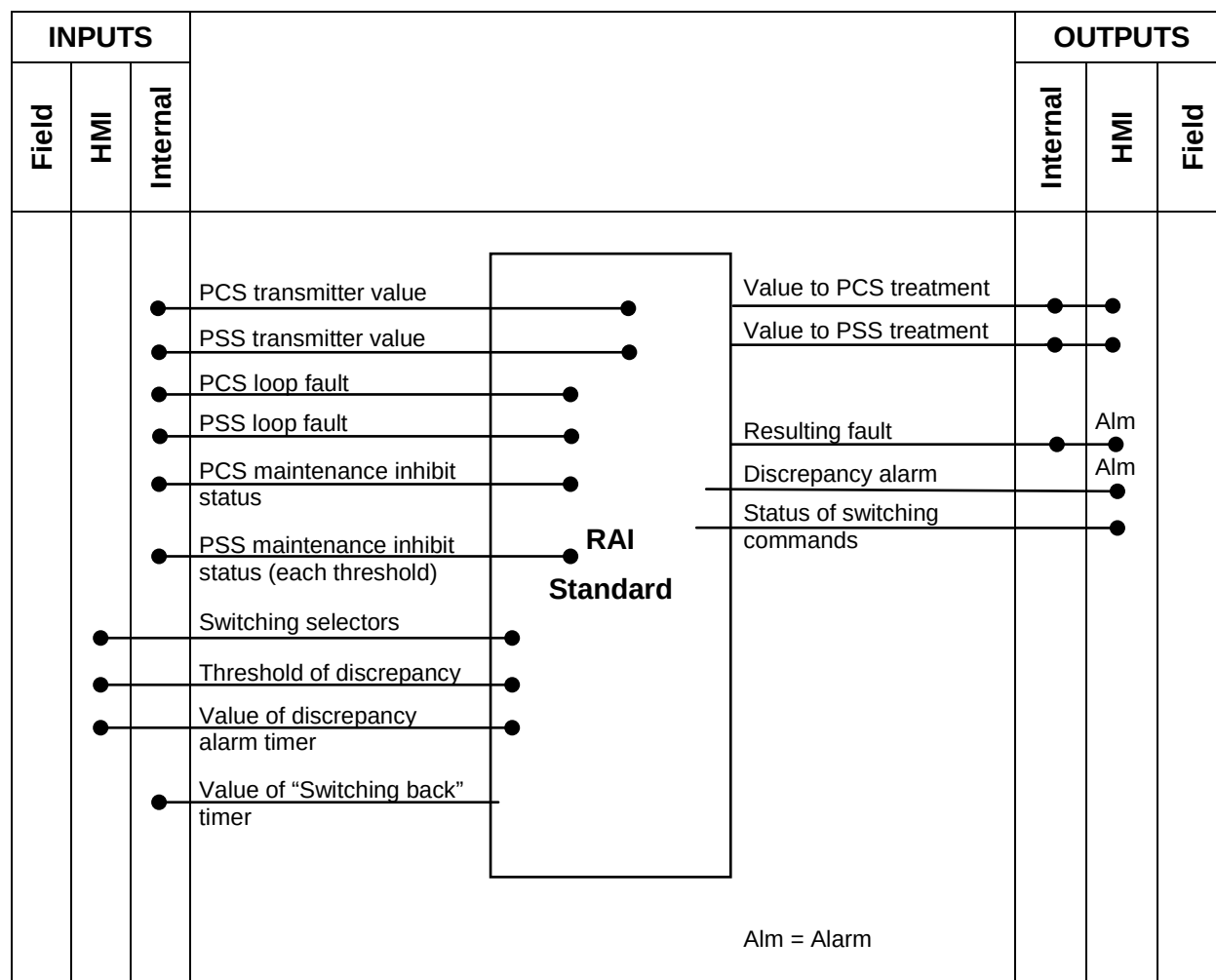
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Chapter 5

2.2 Functional scheme



3. Interfaces description



4. Detailed description of functions

4.1 Switching rules

Conventions

S means measurement dedicated to PSS

P means measurement dedicated to PCS

S → P means PSS and PCS will utilise the transmitter normally dedicated to PSS

P → S means PSS and PCS will utilise the transmitter normally dedicated to PCS

"Switching back" means retrieval of normal situation: PCS will utilise its regular transmitter as well as PSS utilizing its regular transmitter.

Automatic Switching	P faulty & not inhibited S healthy and not inhibited	S faulty and not inhibited P healthy and not inhibited	S in fault and P in fault	PSS/PCS communication failure
S → P	YES		NO	NO
P → S		YES	NO	NO

Manual switching	S healthy and not inhibited	P healthy and not inhibited
S → P	YES	
P → S		YES

Switching back	S healthy and not inhibited P healthy and not inhibited and "Switching back" timer elapsed and no discrepancy alarm	S in fault and P in fault	PSS / PCS communication failure	S healthy and P healthy
Automatic	YES	YES	YES	
Manual				YES

4.2 General points

The replacement of values is achieved after the filtering function, which requires the same filtering value on both analogue inputs.

Process and safety measurements shall always have the same scale.

4.3 Discrepancy alarm

Both measurements are permanently compared when healthy and not inhibited. If the difference exceeds a specific pre-set value of discrepancy, the system will provide a discrepancy alarm.

4.4 Automatic switching upon loop fault detection

This function is only allowed when one of the loops is in fault.

4.4.1 Automatic switching S → P

This function is performed when the transmitter normally dedicated to the PCS is in fault and not inhibited and when the transmitter normally dedicated to the PSS is healthy and not inhibited.

If a discrepancy alarm is active at the switching time, auto/man mode of the associated process function (e.g. PID) will be forced to man, to avoid any process upset. In this case, the

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discrepancy detection has to be considered at time t-1, while the fault detection is considered at time t.

4.4.2 Automatic switching $P \rightarrow S$

This function is performed when the transmitter normally dedicated to the PSS is in fault and not inhibited and when the transmitter normally dedicated to the PCS is healthy and not inhibited.

4.4.3 Automatic "Switching back"

This function is performed when:

both PSS & PCS transmitters are healthy and not inhibited and the "Switching back" timer has elapsed and discrepancy alarm is not active

or

transmitters PSS and PCS are both in fault

or

PSS $\leftrightarrow$ PCS communication failure

"Switching back" timer (maximum duration of 48 hours) starts to count down after an automatic switching, when both the PSS & PCS transmitters are healthy and not inhibited.

4.5 Manual switching

This switching selector is available in method access level to initiate:

- The use of the PCS transmitter by the PSS: " $P \rightarrow S$ "
- The use of the PSS transmitter by the PCS: " $S \rightarrow P$ "
- The "switching back" function.

4.5.1 Manual switching commands ($S \rightarrow P$ or $P \rightarrow S$)

These commands are only authorised when the source transmitter is healthy and not inhibited.

4.5.2 Manual "Switching back" command

This command is authorised when both PSS and PCS transmitters are healthy.

4.6 Maintenance inhibit

4.6.1 During switching $S \rightarrow P$

The PCS transmitter inhibition will not affect the PSS transmitter, which is currently utilised by the PCS: thresholds handling is active and the measurement is not frozen.

The maintenance inhibit command of the safety thresholds is still authorised. The PSS transmitter is considered to be in maintenance inhibit when all associated safety thresholds have a maintenance inhibit on them.

4.6.2 During switching $P \rightarrow S$

The maintenance inhibit command of the PCS transmitter is forbidden.

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4.7 Resulting fault

This alarm is activated upon failure of the transmitter utilised by the PSS and is handled by the ESD level bar standard.

5. Tuning parameters and variables

Parameters	Access level
Pre-set value of the discrepancy threshold	Method
Pre-set value of the discrepancy alarm timer	Method
Switching selector	Method
Pre-set value of the "switching back" timer	Method

6. Representation and animation description (HMI)

6.1 Events to record

- Discrepancy alarm
- Switching commands status
- Resulting fault.

6.2 Alarm handling

Alarm description	Priority
Discrepancy alarm	Level 1
Resulting fault alarm	Level 2

6.3 Switched measurements animation

The standard representation of the measurements shall be in according with the AI / AIS Standard Functions, but a specific animation will be added upon activation of switching: both measurements shall be displayed adjacent to each other.

The descriptions below give examples of representation animations. However, they may be amended dependant on the DCS features.

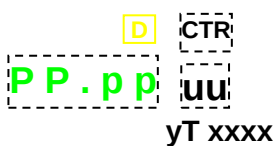
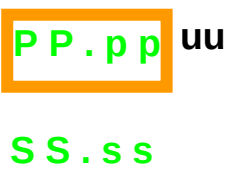
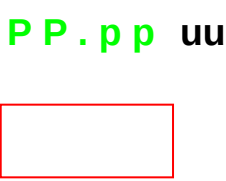
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Chapter 5

Internal data	Display	Text	Frame
Symbol  Process value = <i>NORMAL</i> Label + CTR Units		Yellow (*) / hidden Green White / hidden White	NA
Switching command (S→P) = <i>ACTIVATED</i> (upon manual switching)		(for text colour, as per AI standard function) with specific orange frame Display of PSS transmitter current value	NA
Switching command (P→S) = <i>ACTIVATED</i> (upon manual switching)		Display of PCS transmitter current value (for text colour, as per AIS standard function) with specific orange frame	NA
Switching command (S→P) = <i>ACTIVATED</i> (upon PCS loop fault)		Display of PCS transmitter current value in red with specific orange frame Display of PSS transmitter current value	Red (*) (internal frame)
Switching command (P→S) = <i>ACTIVATED</i> (upon PSS loop fault)		Display of PCS transmitter current value Display of PSS transmitter current value in red with specific orange frame	Red (*) (internal frame)

(*) The animation includes flashing prior to operator acknowledgement.

Measurements currently utilised by functions shall only be available from the loop face plates (pop-up) of each analogue input.

Symbol  is used as call-up area of the mimics dedicated to the transmitters switching.

Clicking on the PCS measurement allows display of the resulting measurement faceplate (value and alarms).

Clicking on the PCS symbol  allows display of the resulting measurement faceplate (control thresholds).

Clicking on each safety threshold allows display of the resulting Safety measurement faceplate.

6.4 Discrepancy alarm animation

The discrepancy alarm animation shall be as per alarm priority level 1 (flashing yellow / yellow steady).

This alarm shall be displayed within the “transmitter switched mimics” (as per § 6.5).

The discrepancy pre-set value is set in engineering unit.

6.5 “Transmitters switching mimic” presentation

Process transmitter		Safety transmitter		Discrepancy				Switching		
Identifier	Value	Identifier	Value	Value	Thres-hold	Alarm	Timer	Timer	P → S	S → P
LT 1001	-20.00 %	LT 1002	52.55 %	14 %	10 %		15 s	600 min	YES	YES

Above values are given for information

 Target area (for parameters tuning or operator commands).

Target area on value display (PCS and PSS) allows access to the corresponding transmitter faceplate display.

Target area on the status of P → S / S → P switch gives access to the switching selector faceplate display.

P → S switch status display:

The animation is based on the switch status of PSS.

S → P switch status display:

The animation is based on the switch status of PCS.

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1. Scope

The purpose of this document is to define the Standard Function of a Digital Output.

In order to assist in understanding, this document should be read in conjunction with **GS EP INS 150**, Design Method for System Configuration Standard Functions.

This standard has only to be considered for standalone digital outputs and not those that are part of other standards (e.g. safety valves, motors, fire extinguishing standards).

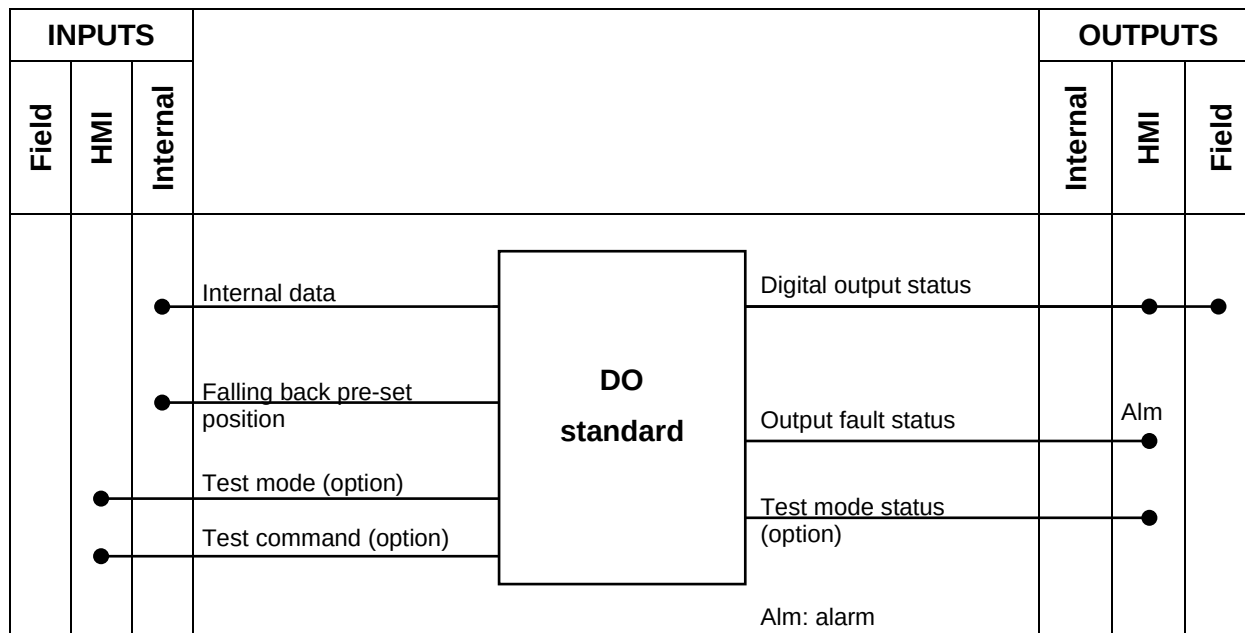
Such outputs are dedicated for instance to ESD/F&G matrix panels, public address interface, electrical distribution, etc.

2. General description of functions

2.1 List of main functions

- Digital output (DO_E / DO_D)
- Output fault
- Test (optional).

3. Interfaces description



4. Detailed description of functions

4.1 Digital output treatment

Each digital output shall be used as ON/OFF contact.

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According to the internal data type (command, status, alarm, safety trip), two field wiring principles can be used to perform the digital output activation:

- “Energise for action” principle / DO_E (for commands and status)

Contact ON (closed loop) = *ACTIVE* position (*START*, *OPEN*, etc.)

Contact OFF (open loop) = *INACTIVE* position (*STOP*, *CLOSE*, etc.)

e.g. package start/stop, public address activation, horn start/stop, etc.

- “De energise to trip” principle / DO_D (for alarms and safety trips)

Contact ON (closed loop) = *NORMAL* position (*HEALTHY*, *NO ALARM*, etc.)

Contact OFF (open loop) = *SAFETY* position (*TRIPPED*, *ALARM*, etc.)

e.g. circuit breakers trips, battery isolation, package safety trips, lamps on ESD and F&G matrix panels, etc.

4.2 Output fault

The fault status of each card output shall be individually detected, primarily for alarming purposes.

In case of card fault, each digital output will be forced to its fall back position.

If line monitored outputs are used, the status of each loop (open circuit, short circuit) shall be included within the fault status.

4.3 Test function (option)

Digital outputs will be able to be individually tested from the HMI.

Once test mode has been selected, then the test command will only be able to be activated in method access level.

5. Representation and animation description (HMI)

5.1 Events to be recorded

- Digital output status
- Output fault status
- Test mode status (optional).

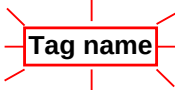
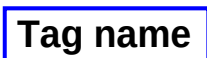
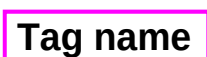
5.2 Alarm levels handling

Data	Alarm
Output fault status (on ESD system & FGS/PSS/PCS)	Level (3/2/1)

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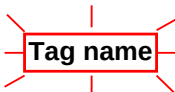
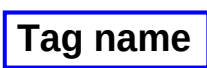
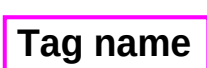
5.3 Specific animation description

5.3.1 Commands & status display

Displayed data	Animation	Text colour	Frame colour
Command = <i>START</i> or Equipment status = <i>RUNNING</i>	Tag name	Blue (or fluid colour)	NA
Command = <i>STOP</i> or Equipment status = <i>STOPPED</i>	Tag name	White	NA
Output fault status = <i>ALARM</i>	 	as above	Internal: Red flashing (before acknowledgement) Red steady (after acknowledgement)
Test mode = <i>ACTIVE</i>		(depends on test command)	External: Blue steady
Communication fault = <i>ACTIVE</i>		White	External: Magenta

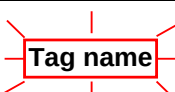
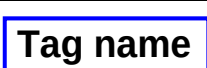
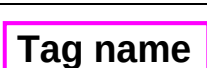
The events which drive these frame displays may not be mutually exclusive. Therefore, the precedence on the display, from most to least important, shall be: magenta, white, blue, yellow.

5.3.2 Alarm display

Displayed data	Animation	Text colour	Frame colour
Alarm status = <i>ALARM</i>	Tag name	Red	NA
Else	Tag name	White	NA
Output fault status = <i>ALARM</i>	 	as above	Internal: Red flashing (before acknowledgement) Red steady (after acknowledgement)
Test mode = <i>ACTIVE</i>		(depends on test command)	Blue steady
Communication fault = <i>ACTIVE</i>		White	External: Magenta

5.3.3 Safety trip display

The text animation is only depending on the associated equipment status (if available).

Displayed data	Animation	Text colour	Frame colour
Individual safety trip = <i>TRIPPED</i>		(depends on equipment status)	External: White
Output fault status = <i>ALARM</i>	 	as above	Internal: Red flashing (before acknowledgement) Red steady (after acknowledgement)
Test mode = <i>ACTIVE</i>		(depends on test command)	External: Blue steady
Communication fault = <i>ACTIVE</i>		White	External: Magenta

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1. Scope

The purpose of this document is to define the Standard Function for an Analogue Output Command.

In order to assist in understanding, this document should be read in conjunction with **GS EP INS 150**, Design Methods for System Configuration Standard Functions.

This standard shall not be considered for analogue outputs handled by PID standard; its application is dedicated to speed variator or choke valves.

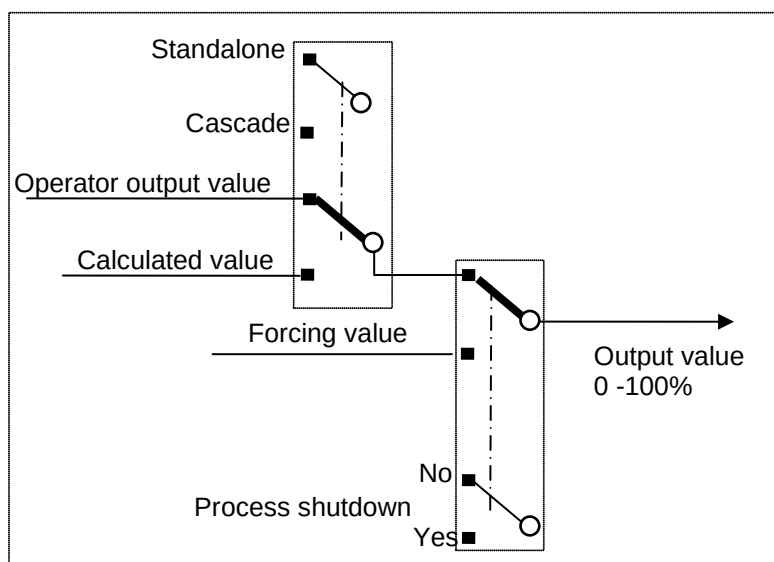
Generally the set point is set by the operator, but in some cases it may be processed by an algorithm (e.g. Full Control of Well).

2. General description of functions

2.1 List of main functions

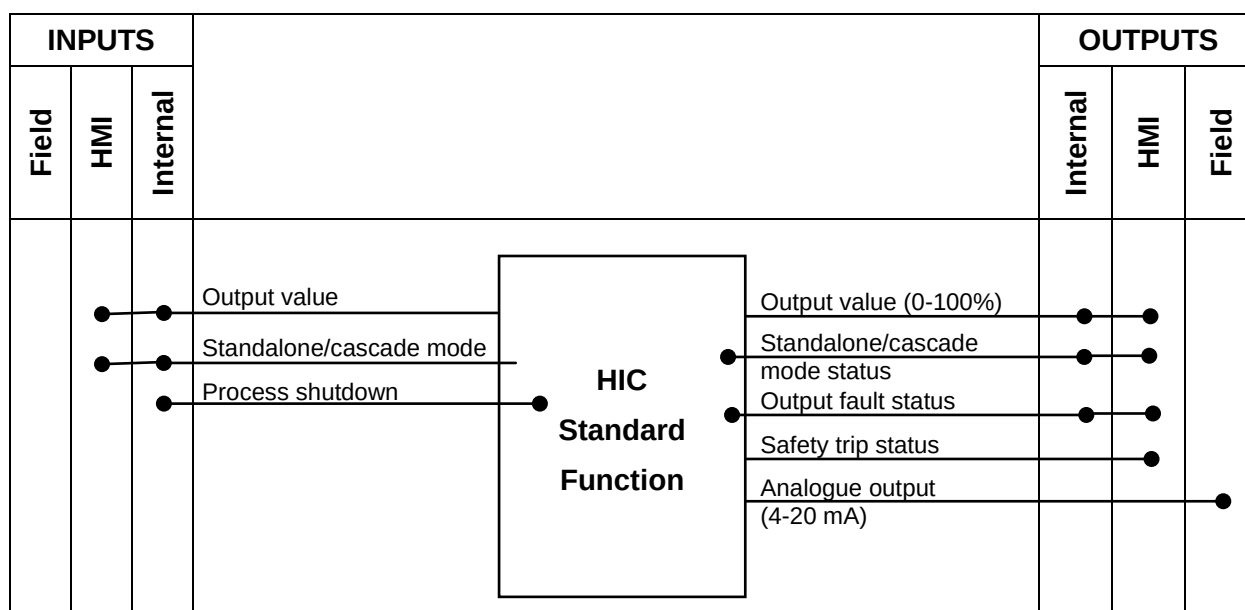
- Output adjustment
- Process shutdown (initiated for instance upon associated SDV status)
- Analogue output fault.

2.2 Functional scheme



3. Interface description

3.1 General description



4. Detailed description of functions

4.1 Standalone/cascade mode

Standalone/cascade mode is normally set in standalone mode, except if higher level automatic control exits.

4.1.1 Cascade/standalone transitions

4.1.1.1 Cascade → Standalone transition

The HMI output value is aligned to the last calculated value.

4.1.1.2 Standalone → Cascade transition

The calculated output value is not affected by the HMI value.

4.2 Output value handling

The Output value range is 0 to 100%.

4.3 Process shutdown function

The process shutdown function is initiated upon activation of the corresponding input command (e.g. closed status of the associated SDV).

The output value is forced to the defined value and the safety trip animation is activated.

The operator can no longer access the output value.

4.4 Analogue output fault status

This status is active when the signal is out of range or when the output card is faulty.

5. Tuning parameters and variables

Parameter	Access level
Output limits (High and Low)	Method

6. Representation and animation description animation (HMI)

6.1 Events and values to be recorded

6.1.1 Events

- Standalone/cascade command (if available to the operator)
- Output fault status.

6.1.2 Values

- Operator output value.

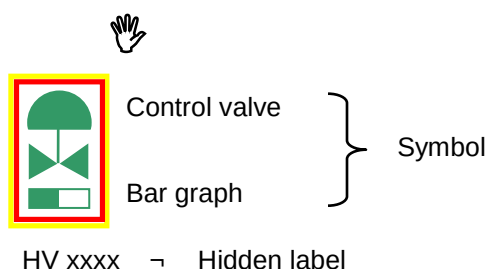
6.2 Alarm handling

Alarm Description	Priority
Output fault alarm	Level 1

6.3 Control display

The hereafter description gives examples of representation. However, they may be amended dependant on the DCS features.

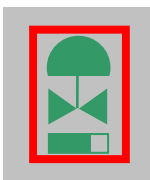
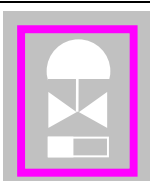
6.3.1 Control valve representation



HV xxxx instrument label appears on operator request (soft key).

Symbol and HV xxxx instrument tag are used as call-up area for the faceplate display.

6.3.2 Animation of the control valve (Symbol and Frames)

Display description	Display	Valve and bargraph	Frames (Signalling and Alarm)
Opening > 5%		Fluid colour	NA
Opening ≤ 5%		White	NA
Safety trip		as above	External frame: White
Output fault		as above	Internal frame: Red flashing before acknowledgement Red steady after acknowledgement
Communication or system fault		White	External frame: Magenta

The bar graph shows the opening percentage of the valve. This information reflects the command signal or the position transmitter when available.

The events which drive these frame displays may not be mutually exclusive. Therefore, the precedence on the display, from most to least important, shall be: magenta, white, blue, yellow.

6.3.3 Animation of the “hand” symbol

A full yellow “hand” symbol is displayed near the valve when output value is available to the operator.