



Exploration & Production

GENERAL SPECIFICATION

INSTRUMENTATION

GS INS 155

**Redundant Analogue Inputs
standard function
- RAI -**

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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 INS 150**, Design Method for System Configuration Standard Functions.

This standard shall only apply when :

- PSS and PCS functions are handled by the same type of controllers.
- two similar transmitters (same scale,...) are used to measure the same process parameter (e.g. pressure, temperature, level with the process tapping at the same elevation) and dedicated to PCS and PSS (i.e. one single transmitter for each system)

This standard is designed to increase analogue availability by utilising the correct value in both systems (PCS and PSS) upon :

- fault detection of one of the transmitters (automatic function)
- discrepancy detection between measurements (manual function)

This standard shall be considered with AI and AIS standards.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Standards

Reference	Title
Not applicable	

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

**Other documents**

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS INS 150	Design Method for System Configuration Standard Functions

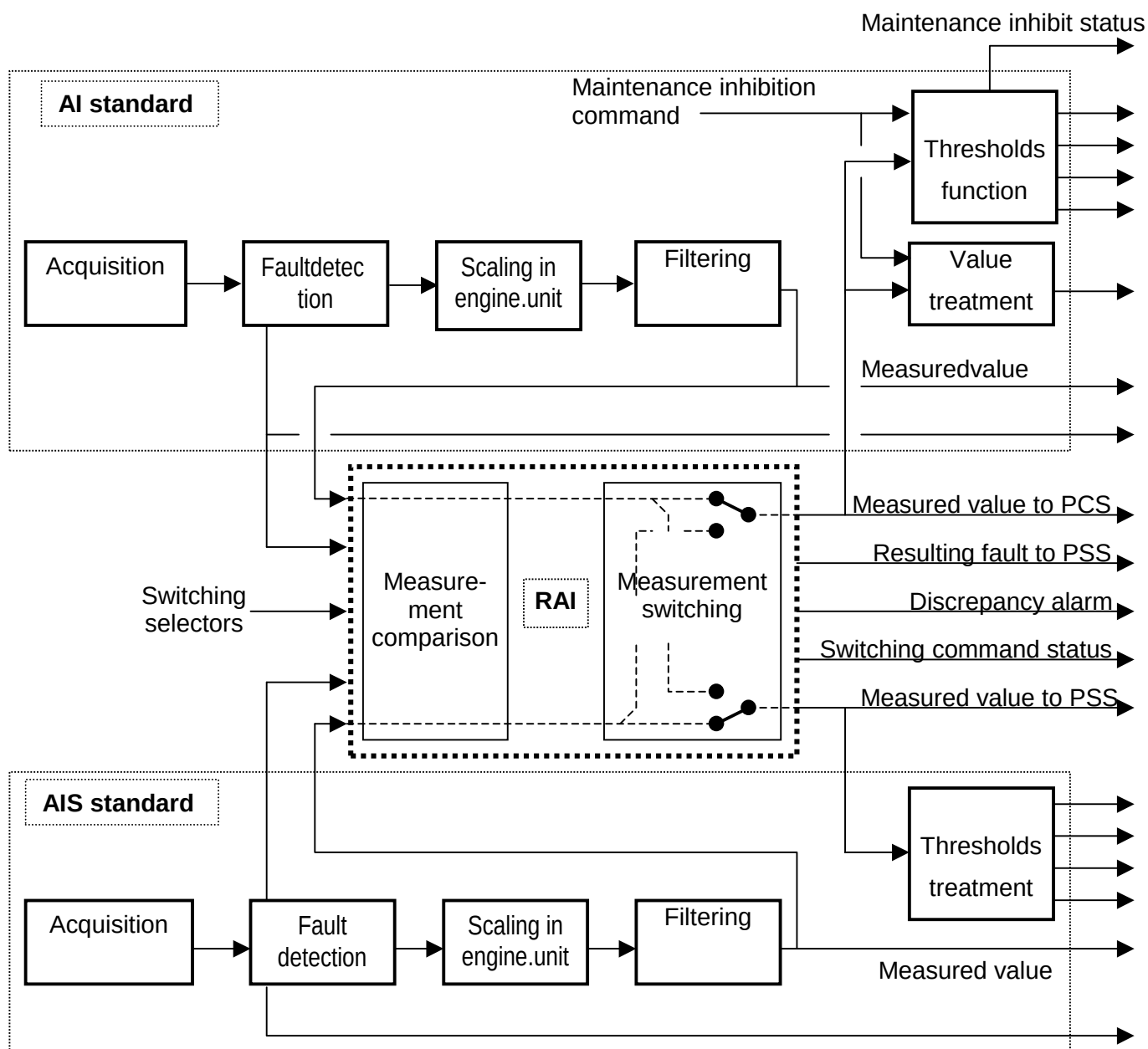
3. General description of functions

3.1 List of main functions

RAI functions are :

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

3.2 Functional scheme



Switching functions shall be implemented within PCS and PSS.

4. Interfaces description

INPUTS				OUTPUTS		
Field	HMI	Internal		Internal	HMI	Field
		• PCS transmitter value • PSS transmitter value • PCS loop fault • PSS loop fault • PCS maintenance inhibit status • PSS maintenance inhibit status (each threshold) • Switching selectors • Threshold of discrepancy • Value of discrepancy alarm timer • Value of "Switching back" timer	RAI Standard	- Value to PCS treatment - Value to PSS treatment - Resulting fault - Discrepancy alarm - Status of switching commands	• • • Alm • Alm •	
Alm = Alarm						

5. Detailed description of functions

5.1 Switching rules

Conventions :

S means measurement dedicated to PSS

P means measurement dedicated to PCS

$S \rightarrow P$ means PSS and PCS will utilise the transmitter normally dedicated to PSS

$P \rightarrow S$ 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 utilising 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
$S \rightarrow P$	YES		NO	NO
$P \rightarrow S$		YES	NO	NO

Manual switching	S healthy and not inhibited	P healthy and not inhibited
$S \rightarrow P$	YES	
$P \rightarrow S$		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

5.2 General points

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

Process and safety measurements shall always have the same scale.

5.3 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.

5.4 Automatic switching upon loop fault detection

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

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

5.4.2 Automatic switching P → 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.

5.4.3 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 ↔ 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.

5.5 Manual switching

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

- the use of the PCS transmitter by the PSS : "P → S",
- the use of the PSS transmitter by the PCS : "S → P",
- the "switching back" function

5.5.1 Manual switching commands (S → P or P → S)

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

5.5.2 Manual “Switching back” command

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

5.6 Maintenance inhibit

5.6.1 During switching S → 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.

5.6.2 During switching P → S

The maintenance inhibit command of the PCS transmitter is forbidden

5.7 Resulting fault

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

6. 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

7. Representation and animation description (HMI)

7.1 Events to record

- Discrepancy alarm
- Switching commands status
- Resulting fault

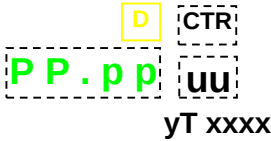
7.2 Alarm handling

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

7.3 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.

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.

7.4 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 §7.5).

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

7.5 "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 mn	 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