Functional Description AIS01 - Analog Input Signal Version 5.2-0

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Release:	February 2012
Document number:	3BTG811792-3016

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# **Section 1 - Introduction**

### General

AIS01 is a functional unit for analog input signal in Control<sup>IT</sup>, to be operated from 800xA System. The signal comes from process in the field. An AIS01 normally performs a complete function independently.

AIS01 has the following functions and properties:

- Different control modes, set by operator
- Input filtering
- High & low limits supervision
- Signal status supervision
- Alarm & Event detection and handling

# **Section 2 - Function Block & Data Types**

### **Function Block**

Name	Data Type	Attributes	Directi on	FD Port	Initial value	Description	
IOSignal	RealIO		in_out	yes		Signal from I/O-board(s)	
Name	string	coldretain	in	yes	'AIS01'	Object name	
Description	string	coldretain	in	yes	'Descr'	Object description	
Enable	bool	coldretain	in	yes	true	Enable object	
Status	PB_Status	by_ref	in	yes		Profibus device status	
AL_P_Blk	bool	retain	in	yes		Block alarm	
AlarmAck	bool	retain	in	yes		Acknowledge alarm	
ExtCtrl	Ext_Analog	by_ref	in	yes		External control	
MVAlarms	Alarm4Limit	by_ref	in	yes		MV alarm configuration	
InPar	AIS01_InPar	by_ref	in	yes		In Parameter	
EventName	string	coldretain	in	yes	'  AIS01_'	Event name	
Value	real	retain	out	yes		Value	
IO_Value	real	retain	out	yes		I/O value	
Err	bool	retain	out	yes		Error	
Err_Type	string[20]	retain	out	yes		Error type	
Man	bool	retain	out	yes		Man mode	
E1	bool	retain	out	yes		E1 mode	
Forced	bool	retain	out	yes		Channel is forced	
MV_GT_H2	bool	retain	out	yes		MV greater than or equal to High High Limit (H2)	
MV_GT_H1	bool	retain	out	yes		MV greater than or equal to High Limit (H1)	
MV_LT_L1	bool	retain	out	yes		MV less than or equal to Low Limit (L1)	
MV_LT_L2	bool	retain	out	yes		MV less than or equal to Low Low Limit (L2)	
OutPar	AIS01_OutPar	by_ref	out	yes		Out Parameter	
Opr	AIS01_Opr	by_ref	out	yes		Operator order	

## **Data Types**

#### AIS01\_InPar

**AIS01\_InPar** data type contains all configuration parameter available in AIS01. Configuration can be entered by writing value to this structured data type and connecting it to input **InPar** of AIS01 function block.

Name	Data Type	Attributes	Initial value	ISP value	Description
Class	dint	coldretain	500		AE class
Severity	dint	coldretain	1000		AE severity
InitMode	dint	coldretain	7		Init mode (5 = Man ; 7 = E1)
ManBlk	bool	coldretain	false		Block operator order Man mode
E1Blk	bool	coldretain	false		Block operator order E1 mode
AlcBlkEvBlk	bool	coldretain	true		Block event for AlcBlk

Name	Data Type	Attributes	Initial value	ISP value	Description
ErrCtrl	bool	coldretain	false		No error at overflow
AEConfigAlErr	dint	coldretain	1		AE configuration for AI Error
AlarmDelay	time	coldretain	Os		Alarm delay
FilterP	time	coldretain	Os		Signal filter time
HystType	bool	coldretain	false		Hysterisis type (0 = Unit, 1 = Percent)

#### AIS01\_OutPar

**AIS01\_OutPar** data type contains all information on the object which not available on the output parameter of the function block.

Name	Data Type	Attributes	Initial value	ISP value	Description
AlarmBlk	bool	retain			Alarm blocked
Mode	dint	retain			Active mode
NormalMode	bool	retain			Normal mode (Active mode = Init mode)
MVH2	real	retain			Active High High MV alarm limit
MVH1	real	retain			Active High MV alarm limit
MVL1	real	retain			Active Low MV alarm limit
MVL2	real	retain			Active Low Low MV alarm limit
ALB_H2	bool	retain			High High MV alarm blocked
ALB_H1	bool	retain			High MV alarm blocked
ALB_L1	bool	retain			Low MV alarm blocked
ALB_L2	bool	retain			Low Low MV alarm blocked
AU_MVH2	bool	retain	UnAcknowledge alarm for MV > H2		UnAcknowledge alarm for MV > H2
AU_MVH1	bool	retain			UnAcknowledge alarm for MV > H1
AU_MVL1	bool	retain			UnAcknowledge alarm for MV < L1
AU_MVL2	bool	retain			UnAcknowledge alarm for MV < L2
AU_AIErr	bool	retain			UnAcknowledge alarm for Al Error
HWStatus	HwStatus	retain			Hardware status
SubStatus	dint	retain			Hardware substatus
TypeStrLength	dint	retain			Hardware str length
IOStatus	dint	retain			Hardware I/O status quality

#### AIS01\_Opr

AIS01\_Opr data type contains all operator order.

Name	Data Type	Attributes	Initial value	ISP value	Description
BlockAlarm	bool	retain			Operator block alarms
ALB_H2	bool	retain			Operator block alarm limit H2
ALB_H1	bool	retain			Operator block alarm limit H1
ALB_L1	bool	retain			Operator block alarm limit L1
ALB_L2	bool	retain			Operator block alarm limit L2
Man	bool	retain			Operator order Manual mode
E1	bool	retain			Operator order E1 mode
ManOut	real	coldretain	0.0		Operator enter value

### **Permission**

All variables in **AIS01\_InPar** data type are set with *Configure* permission in 800xA system. All variables in **AIS01\_Opr** data type are set with *Operate* permission.

The variable permission can be configured according to the plant requirement. This can be done by adding **Property Attribute Override** aspect for the object in Control Structure or for the object type in Object Type Structure.

# **Section 3 - Function**

### **Control Modes**

Two control modes are available: E1 and Man. Active mode is indicated on the faceplate and object display. These modes can also be blocked individually from operator access.

#### E1 Mode

E1 mode is the default init mode of the AIS01. In this mode, output **Value** is obtained from input **IOSignal**. E1 mode can be activated from the **E1** button on the faceplate.

#### **Manual Mode**

In this mode, operator directly sets the output **Value** from the faceplate's dialog entry window. Manual mode can be activated from the **Man** button on the faceplate.

### Forced

Forced is a condition where the operator blocks the I/O module input and writes directly to the I/O module input variable. Forced condition can be obtained by enabling the **Forced** check box in the I/O hardware of the controller.

### **Range and Filtering**

Range parameter (Min, Max, Decimal / Fraction and Unit) is derived from the **IOSignal** parameter and not configurable in interaction window. This value is defined in the IO Channel in hardware structure.

AIS01 support software filtering of the **IOSignal** value. The filter time is entered in time format and can be set from the interaction window. A filter time which is greater than 0 but less than task scan time will be set equal to scan time. The filter corresponds to a one-pole low pass filter.

### **Signal Status**

AIS01 monitor the **IOSignal** status which connected to IO module. Error occurs if the IO module function is deemed nonfunctional. Typical caused of errors are missing or faulty hardware and out of range values.

Errors generated from IO module are passed to AIS01. The output parameter **Err** is set to *True* when there is error and **Err\_Type** will display the error code as described in Control Builder help file. Faceplate element **Status** gives detail information about the error code.

Overflow or underflow will occur if the A/D converter is given value out of its range. In interaction window, it's possible to select no error when overflow to prevent alarm from being generated.

### **Fieldbus Device Status**

When AIS01 is connected to fieldbus devices, it can be configured to present the status of the devices in the faceplate. A separate function block containing the fieldbus data mapping should be created. This function block then can be connected to AIS01 at the input parameter **Status**.

### **Alarm Limits**

AIS01 monitor the measured value MV and compared it with two upper (H1 and H2) and two lower (L1 and L2) alarm limits. When determining the MV alarm limits, it is recommended to follow the rule: H2 > H1 > L1 > L2. Alarm limit can be entered from interaction window or extended faceplate.

It's possible to select whether the hysteresis is in unit or in percentage. If percentage is selected, then actual hysteresis used internally is calculated by multiplying the percentage against the signal range.

For upper alarm limit, the value of  $MV_GT_H1$  and  $MV_GT_H2$  will be set when MV > H1 and MV > H2 respectively. It will be reset when the MV is lower than the alarm limit minus the respective hysteresis. For lower alarm limit, the value of  $MV_LT_L1$  and  $MV_LT_L2$  will be set when MV < L1 and MV < L2 respectively. It will be reset when the MV is greater than the alarm limit plus the respective hysteresis.

The value of **MV\_GT\_H2**, **MV\_GT\_H1**, **MV\_LT\_L1** and **MV\_LT\_L2** will always be monitored even if the alarm and event is not activated (**AEConfig** set to 0).

All alarm limits can be blocked altogether or individually. Alarm blocking can be done from faceplate or from function block using **AI\_P\_BIk** or **MVAIarms**.

### **External Control**

Alarm limit parameter can be controlled externally by logic using the input parameter **ExtCtrl**. When external control is enabled, alarm limit will take the value from the external control. When it is released, the alarm limit will take value set in the function block.

### **Interaction Window**

Interaction Window is used to configure the object's parameter in the Control Builder. It is only accessible when Control Builder is in *Online* mode by right clicking the function block.

The main Interaction Window shows the name and description of the function block. The buttons are link to open the sub-window.

AIS01	
AIS01	
Descr	
s1 General Par	
s2 Order & Event	Block, Init Mode
s3 Unit & Range	
s4 Alarm Setting	

#### 1. General Par

**Name** and **Description** can be entered from interaction window or from function block parameters directly. After performing *Name Uploader*, these values will be used as Object Name and Description and shown in faceplate.

**Class** defines the process section or area in which alarms are grouped. By utilizing **Class**, the alarms can be filtered. Valid values are 1 - 9999. **Severity** defines the alarm priority for general alarms. Valid values are 1 - 1000 where 1000 is the highest priority.

AIS01		×
Name :	AIS01	
Description :	Descr	
Class :	500	
Severity :	1000	

#### 2. Order & Event Block, Init Mode

**Order Block** is used to prevent operator from giving an order of certain activity. The faceplate button will be dimmed if order block is activated (set to 1).

**Event Block** is used to block the event message generated due to changes in value from logic connection. To enable event for selected message, press the button to set the value to 0. The text message for each event is stored in the **AE Translator** aspect. List of events for all operator activity is managed in 800xA system with Audit Trail functionality.

**Init Mode** defines the initial mode of the object when cold download is performed. By default, the init mode for AIS01 is E1 mode.

AIS01	<b>.</b>
Order Block	Init Mode
0 Manual Mode	O Manual Mode
0 E1 Mode	• E1 Mode
Event Block	
1 Alarm Ctrl Blk	

#### 3. Unit & Range

Unit & Range covers minimum and maximum range, unit and decimal number, including the filter time.

Unit & Range			
Max :	100.0	<mark>l/m</mark> in	
Min :	0.0	l/min	
Unit :	l/min		
Decimal :	1		
Filter Time :	0d0h0m0	sOms	

#### 4. Alarm Setting

Four MV alarm limits can be configured, two high limits and two low limits. Each alarm limit has its own configuration and can be defined individually. AE Config can be set in 3 different ways:

- 0 = No Alarm or Event will be generated
- 1 = Alarm and Event will be generated
- 2 = Only Event will be generated

If AE Config is set to 1, alarm will be generated if the limit stays active longer than alarm delay time. Otherwise, alarm will not be generated.

When **MV Alarm Hysteresis in Percentage (%)** is activated (set to 1), the hysteresis will be in percentage and calculated against the range.

PP_AIS01							
Alarm Setting							
	MV L2	MV L1	MV H1	MV H2			
AE Config :	1	1	1	1			
Limit :	10.0 l/min	20.0 l/min	80.0 l/min	90.0 l/min			
Hyst :	2.0 l/min	2.0 l/min	2.0 l/min	2.0 l/min			
Severity :	1000	1000	1000	1000			
Alarm Delay :	0d0h0m10s0ms	0d0h0m10s0ms	0d0h0m10s0ms	0d0h0m10s0ms			
0 MV Alarm Hysteresis in Percentage (%)							
1 AE Config A	Al Err						
0 No Error at Overflow							
Alarm Delay :	0d0h0m0s0m	5					

## **Text Configuration**

**Text Configuration** aspect is used to define the text properties of the object, such as info texts. It is accessible in the Control Structure. The length of the each text should not exceed more than 50 characters.

() () •AI• ▼ PP_	AIS01:Text Configu	ration	- S & S -	- 🖻 🔹		
Name	Value	Туре	Description	Readable?	R/Permission	Writable
Info1Text	Info1 Text	String	Info 1 Text	Yes		Yes
Info2Text	Info2 Text	String	Info 2 Text	Yes		Yes

# **Section 3 - Operator Function**

## **Process Display**

AIS01 has the following graphic elements which can be inserted into graphic displays.



The following display shows the presentation in graphic elements under different states.



# Faceplate

#### Aspect Link

Icon	Aspect View
=	Operator Note
	Object Display
~	Object Trend Display

#### **Reduced Faceplate and Faceplate**

Reduced Faceplate and Faceplate give basic information about the object. Size and contents have been optimized to cover most of the normal process operator action. Process values presented in bargraph are available in Faceplate.

- 0 X

PP\_AIS01 : Faceplate PP\_AIS01 Descr PP\_AIS01 : Faceplate PP AISO1 E1 Descr MV E1 10 MV 70.0 |/min Alarm Alarm Man E1 E1 Man 00 000 1 de • 0 00







Faceplate

#### **Extended Faceplate**

The extended faceplate gives more detailed information about the object. Additional information about the object is available in tabs.



#### 1. T Curve

Trim Curve is used to present value in the last 4 minutes period. It contains 1 trace only: Value.



#### 2. Limits

MV alarm limit, hysteresis and alarm delay can be defined in this tab. Alarm limit will be visible if configured as alarm & event (indicated with **AE**) or event only (indicated with **E**). If alarm is blocked, then it will be indicated with **B**.

When alarm limit is active, a red square indication is shown in front of the limit. Alarm will be generated if the limit stays active for more than the alarm delay time. It will be indicated with the blinking red square indication as long as not acknowledged.

User with *Tune* permission can change the alarm limits, while hysteresis and alarm delay can be adjusted by user with *Configure* permission. Input field for alarm limit will be disabled if the external control for the respective limit is active. If **MV Alarm Hyst in Percentage (%)** is checked, then hysteresis entered is calculated as percentage of the range.

AE H1 80.0 2.0 10s   AE L1 20.0 2.0 10s   AE L2 10.0 2.0 10s   MV Alarm Hyst in Percentage (%) 10s 10s 10s		H2	90.0	2.0	10s
AE L1 20.0 2.0 10s   AE L2 10.0 2.0 10s   MV Alarm Hyst in Percentage (%) 10 10 10	AE	H1	80.0	2.0	10s
AE L2 10.0 2.0 10s MV Alarm Hyst in Percentage (%)	AE	L1	20.0	2.0	10s
MV Alarm Hyst in Percentage (%)	AE	L2	10.0	2.0	10s
	- 33	in reality	i i jos ar i ci	consigo (	

#### 3. Block

Operator can block each MV alarm limit individually or all alarms by ticking on the checkbox. Checkbox **Block All Alarms** is enabled when at least one of MV limits or signal fault is configured as alarm. Checkbox for blocking individual MV alarm limit is enabled when the respective MV limit is configured as alarm. It will be disabled when external control for the respective MV limit is activated.

Un-ticking checkbox **Enable Object** will bring the object to **Out Of Service** mode.



#### 4. Status

Status of the IO Signal is shown in this tab. It also shows the type of the device where the IO Signal is connected to.

I Curve Limi	ts Block	Status	-	
Status				
Device	S800 I/O			
Description	ABB			

#### 5. Info

Relevant information about the object can be entered here.

Limits	Block	Status	Info	M	•
Info					
Info1	Text				
Info2	Text				1

#### 6. Max Dialog

This tab is only accessible for user with *Application Engineer Role* to limit the operator access to different control modes. When checkbox **Block Man mode** is checked, the faceplate button **Man** will be dimmed. Operator will not be possible to change the object to Manual mode. The same way goes to **Block E1 mode**.



## **Object Display**

**Object Display** can be used to get the complete overview of the object. It has detailed information of the measured value, range, alarm limit and available control modes.



## **Object Trend Display**

Values stored can be presented graphically in the form of curves in **Object Trend Display** aspect. By default, AIS01 presents 1 trace only: **Value**. It uses the trend template **PP Library Standard Object Trend** in Library Structure.

PP_AIS01 : Object Tre	end Display						83
	)1:Object Trend Di	isplay 👻 👻	x 🕹 💀	- 🖂 -			
	Trend Displa	ay require special p	rivileges to be	modified. // 1 Ho	our *		- 2 - 1
50.0 l/min							
0.0 (/min _]	1	 14:40	1	15:00	-	▲   15:20	
📓 🗠 🗗 🔛 🔇 i	§   <b>- -</b>	▶ ▲ ▼   ◀	1 🌬 🔍 🖯	XY 🛛	1 Hou	Jr	
Vi St Tr Obj Ol	bject Na Obje	ect Des Aspect	Proper Lo	og Na Currer	Low R	High R	St
1 📝 -AI- PP	_AIS01 Desc	r Functio	Value SE	EAMLE 65.0 V	0.01	100.	Line
•	III						+

## Alarm & Event

#### Alarm & Event List

All alarm & event list aspect is configured to follow the templates defined in **PP Library Alarm** & Event List Configurations in Library Structure.

#### **Alarm Message**

The **Message Description** is hardcoded in the function block and cannot be modified. The **Condition** text is stored in the **AE Translator** aspect in Object Type Structure and support NLS functionality.

Resource Id	Condition	Message Description
AIErr	AI Error	Alarm
MVH1	MV > H1	Alarm
MVH2	MV > H2	Alarm
MVL1	MV < L1	Alarm
MVL2	MV < L2	Alarm

#### **Event Message**

The **Message Description** is stored in the **AE Translator** aspect in Object Type Structure and support NLS functionality.

Resource Id	Message Description
AlarmAck	Alarm acknowledged by program
AlcBlk	Alarm blocked by program