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DOCUMENT APPROVAL & CUSTOMER APPROVAL BOX

The person signing this document is representing the position listed in the approvals table. Signature confirms that the document has been reviewed or approved for technical content and complies with the relevant technical & project standards & specifications.

The signature-box is located on the front-page.

Revision history

Rev	Description
02	QA is added

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Attachments

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1 Abbreviations

Short	Meaning
OB	Organization Block
FB	Function Block
FC	Function
DB	Data Base
PLC	Programmable Logical Controller
TIA	Totally Integrated Automation
DI	Digital Input
DO	Digital Output
AD	Analog to Digital
DA	Digital to Analog
OS	Operator Station

2 Background

Process automation is entering more and more industries and will have a more central role in the years to come. Many existing installations are based of outdated and ad-hoc solutions, making systems expensive to troubleshoot, maintain and update.

2.1 Purpose

This document describes the industry independent standard for factory and process automation purposed by Dynamic Engineering AS. The standard utilizes industry leading systems for automation logic and visualization; Siemens TIA and Copa-Data Zenon.

The standard describes PLC software structure and standard function blocks for automation objects with associated faceplates in Zenon. The tested structure, function blocks and faceplates all enables the supplier to deliver a fault free and user-friendly system on schedule.

SCADA/HMI Software:	Copadata Zenon
Standard:	IEC 63131:2017

3 General

3.1 Modes

3.1.1 Auto/Manual mode

There are four states, Auto, Manual, Lock Auto and Lock Manual. One can give order to switch between Auto and Manual from Operator Station. Lock auto and Lock manual are set from the PLC, can not be overwritten by Operator Station.

Safeguarding mode Locked Low and Locked High will cause the mode to enter Locked Manual state, unless status blocked is active.

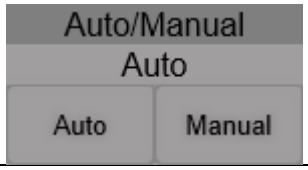
3.1.1.1 Event log

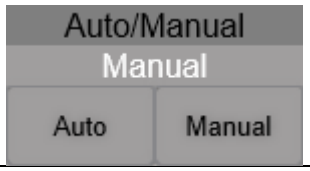
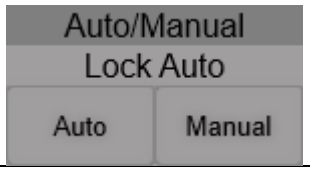
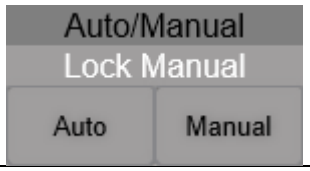
All four states will be logged in eventlist.

3.1.1.2 Symbol indication:

Mode	Description	Picture
Auto		
Manual		
Lock Auto		
Lock Manual		

3.1.1.3 Faceplate indication:

Mode	Description	Picture
Auto	Manal mode can be entered by pushing the button “Manual”	

Manual	Auto mode can be entered by pushing the button “Auto”	
Lock Auto	Function is locked in Auto. Mode is locked from the PLC and cannot be changed from operator station.	
Lock Manual	Function is locked in Manual. Mode is locked from the PLC and cannot be changed from operator station.	

3.1.2 Disable transition mode

Disable transition mode is used to prevent the output to go to a high or low state the next time this demand is made. If the output is already in low state, and a disable low (FDL) is requested, the output will remain in low state. But when high position is confirmed (BCH) while the Disable Transition Low state is entered, the output will remain in high state even if the input goes low as long as the FDL is true and there is no safeguarding.

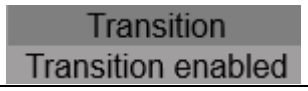
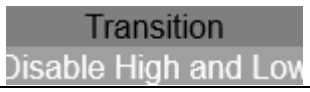
3.1.2.1 Event log

All four states will be logged in eventlist.

3.1.2.2 Symbol indication:

None

3.1.2.3 Faceplate indication:

Mode	Description	Picture
Enabled		
Disable Transition Low		
Disable Transition High		
FDL & FDH		

3.1.3 Outside Operation Mode

When in outside operation state, a valve or engine is controlled (i.e. started/stopped, opened/closed) from a local panel. The central control system can only observe (and if desired display) what happens, but not control the engine or valve. When in No Outside Operation state the valve or engine is controlled by the central control system.

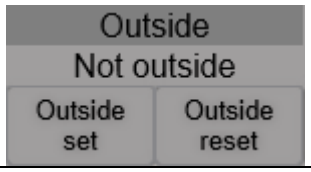
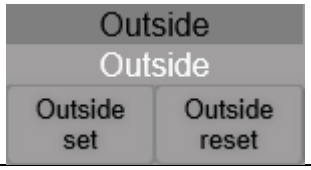
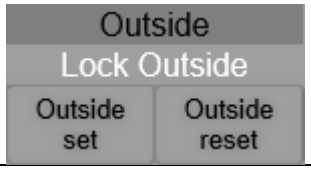
3.1.3.1 Event log

All three states will be logged in eventlist.

3.1.3.2 Symbol indication:

Mode	Description	Picture
Not outside		
Outside		
Lock outside		

3.1.3.3 Faceplate indication:

Mode	Description	Picture
Not outside		
Outside		
Lock outside		

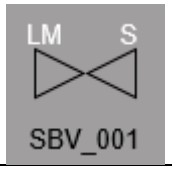
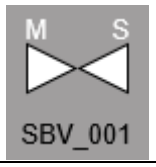
3.1.4 Safeguarding mode

Safeguarding mode is controlled by process shut down functionality of the plant, see function block LB.

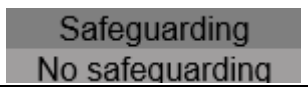
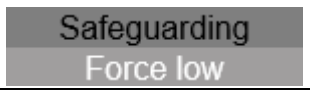
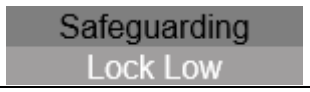
3.1.4.1 Event log

All five states will be logged in event log.

3.1.4.2 Symbol indication:

Mode	Description	Picture
No safeguarding		
Force low		
Lock low		
Lock High		
Force High		

3.1.4.3 Faceplate indication:

Mode	Description	Picture
No safeguarding		
Force Low		
Lock Low		

Lock High		
Force High		

3.1.5 Block mode

This state machine is used to determine blocking of actions. Annunciation of the alarm is still made. Blocking can be selected either from OS or via the logic input terminals, in this case the Force Block terminal, FB.

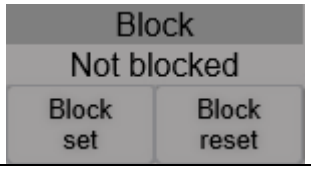
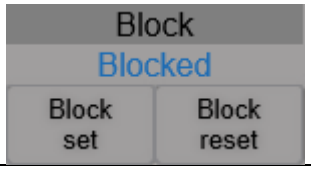
3.1.5.1 Event log

Both states will be logged in the event log

3.1.5.2 Symbol indication:

Mode	Description	Picture
Not blocked		
Blocked		

3.1.5.3 Faceplate indication:

Mode	Description	Picture
Not blocked		
Blocked		

3.1.6 Suppress mode

This mode is used to control suppression of annunciation and actions. The mode is controlled both from the logic (FU) and from the operator station (OS).

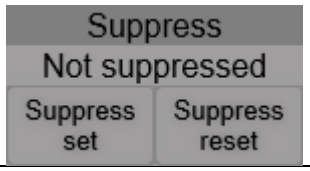
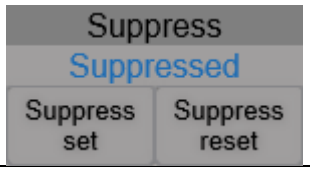
3.1.6.1 Event log

Both states will be logged in eventlist.

3.1.6.2 Symbol indication:

Mode	Description	Picture
Not suppressed		
Suppressed		

3.1.6.3 Faceplate indication:

Mode	Description	Picture
Not suppressed		
Suppressed		

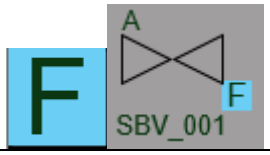
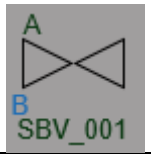
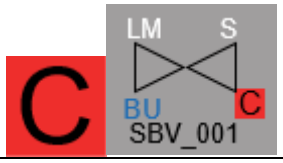
3.2 Alarm and Event classes

According to Norsok I-002 page 12 “Alarm/Event categories” with colour definition.

3.2.1 Colours

3	Class.Safety	#9555A0
4	Class.Fault	#6ACEF5
5	Class.Warning	#FDFD6D
6	Class.Event	#FFFFFF
7	Class.Action	#EE2E2C
8	Class.Suppressed	#1D6CB4
9	Class.Blocked	#1D6CB4
10	Class.Conflict	#EE2E2C

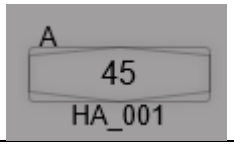
3.2.2 Symbol indication

Class	Description	Picture
Safety	Text “S” amd square filled with class colour.	
Fault	Text “F” and square filled with class colour.	
Warning	Text “W” and square filled with class colour.	
Action	Text “A” and square filled with class colour.	
Suppressed	Text “U” with class colour.	
Blocked	Text “B” with class colour.	
Conflict	Test “C” and square filled with class colour.	
Event (others)		

4 HA – Analogue input

The HA function template shall be used for entering an analogue value from the HMI. This analogue value can be used in logic, calculations etc. It is possible to follow an external value by setting the block in auto. The operator can disable this function by setting the block in manual.

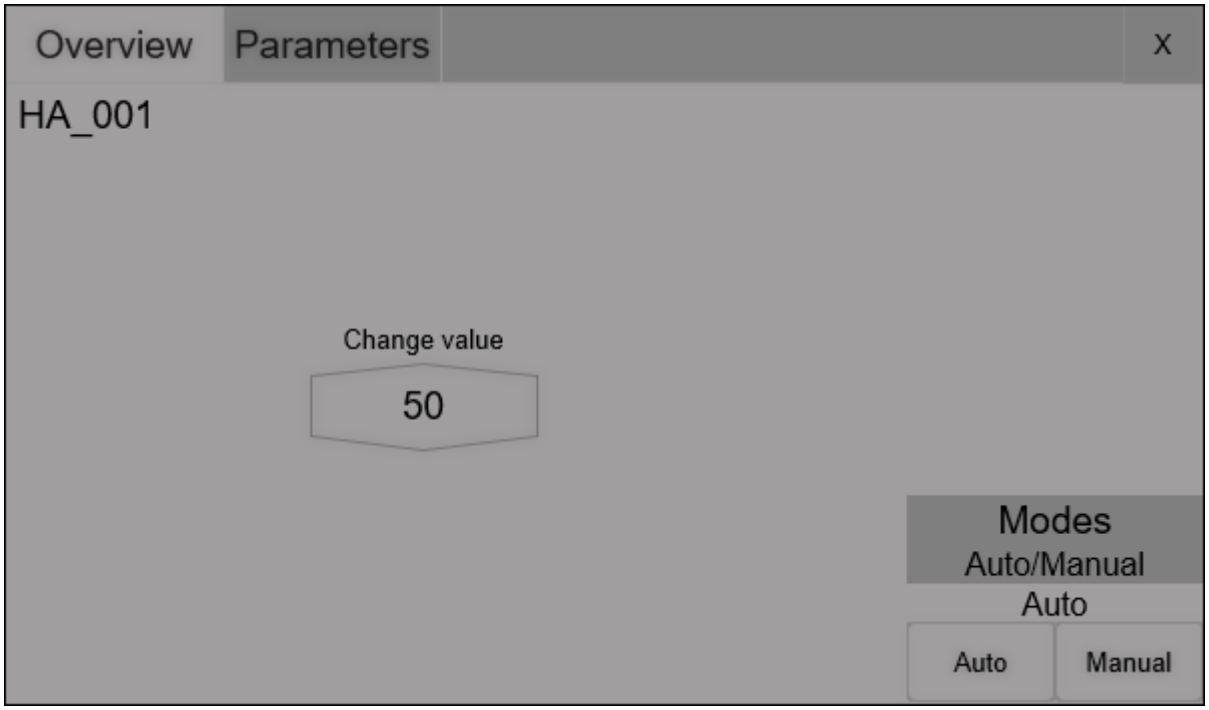
4.1 Symbol

Name	Condition	Picture
Default		

4.2 Events and alarms

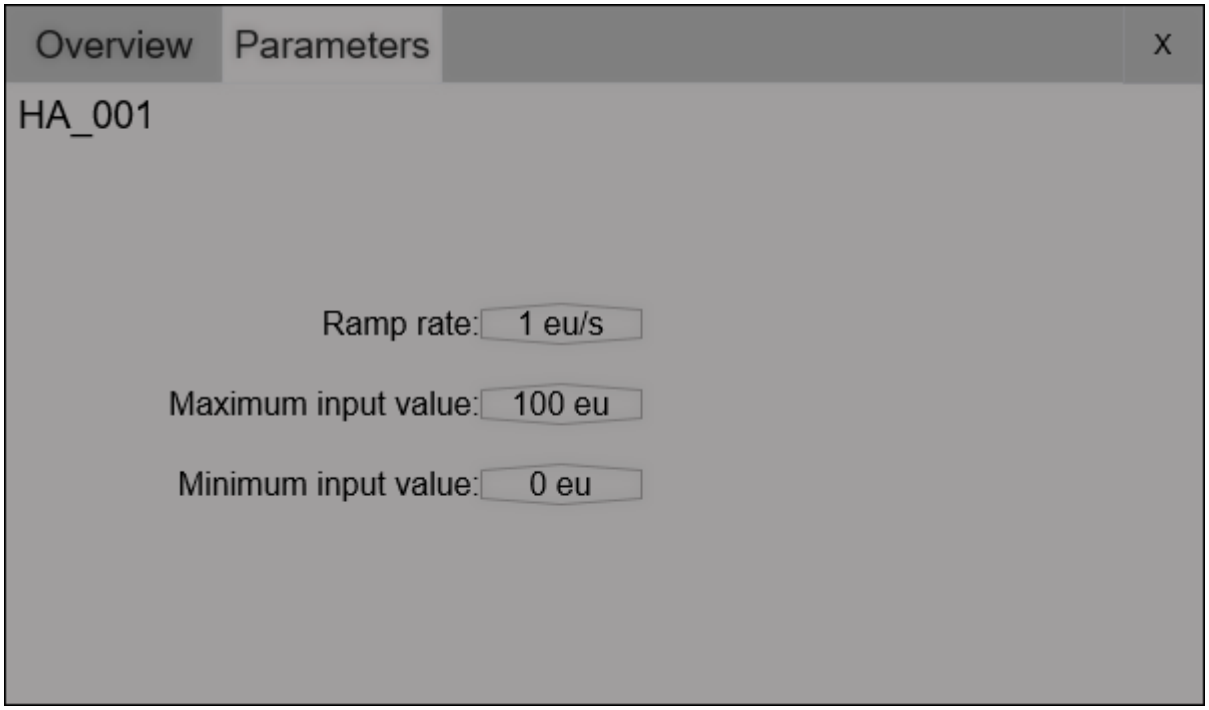
This function has no special alarms and only a single mode; auto/manual. See section 3.1.1 for more info.

4.3 Faceplate – Overview



The analogue input overview page is very simplistic – it has an input field showing the current manually set value and the option to change between auto and manual mode.
Clicking the analogue setpoint opens a dialog for value entry.
When running in auto mode the function will ramp linearly to the setpoint. When running in manual mode, the function will jump to the setpoint immediately. Changing from manual to auto also causes a linear ramp from the manual setpoint to the auto setpoint defined by the PLC.

4.4 Faceplate – Parameters



The analogue input function uses a generic unit called “Engineering Unit”. This unit should translate to a process unit, for example 100 eu = 100 liters per minute in a control loop.

4.4.1 Ramp rate

Rather than being specified in time to ramp from min to max the analogue input ramp rate is specified in engineering unit per second. This makes the ramping linear and independent of changing the minimum and maximum values.

Important: The analogue input function will only ramp when running in auto mode – manual mode setpoint will override the ramping.

4.4.2 Maximum input value

The highest value to output. You will not be able to set the setpoint higher than this, and the current value will always be equal to or below this. Must be at least 1 more than minimum input value. Can be negative.

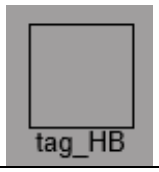
4.4.3 Minimum input value

The lowest value to output. Increasing it above maximum value will cause maximum value to increase to minimum value + 1. Can be negative.

5 HB – Binary Input from HMI

The HB function template shall be used for entering a binary value from the HMI. This binary value can be used in logic, calculations etc. It is possible to follow an external value by setting the function in auto (LA). The operator can disable this function by setting the function in manual (LM).

5.1 Symbol

Condition	Description	Picture
Output on		
Output off		

5.2 Colours

19	Binary.On	#FFFFFF
20	Binary.Off	#A09E9E

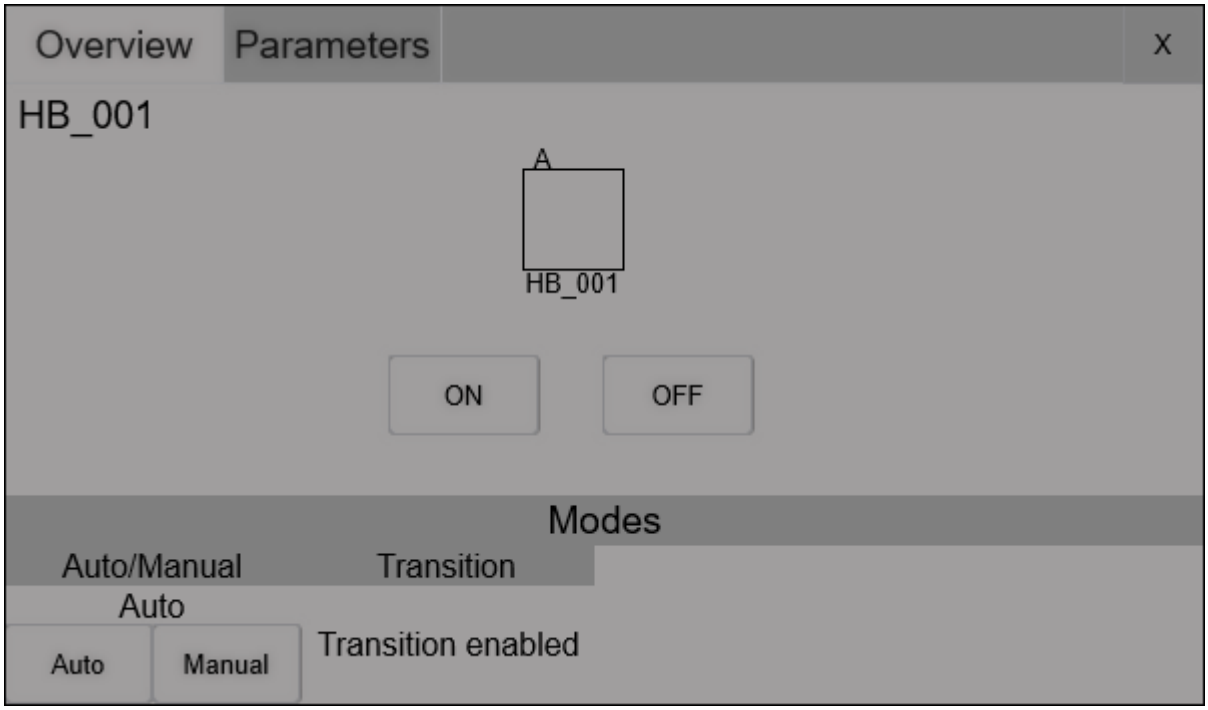
5.3 Events and alarms

This function will raise the following events and alarms. It will also raise events related to modes, documented in the section for modes.

5.3.1 Normal output

Event, Class.Event (white)

5.4 Faceplate – Overview



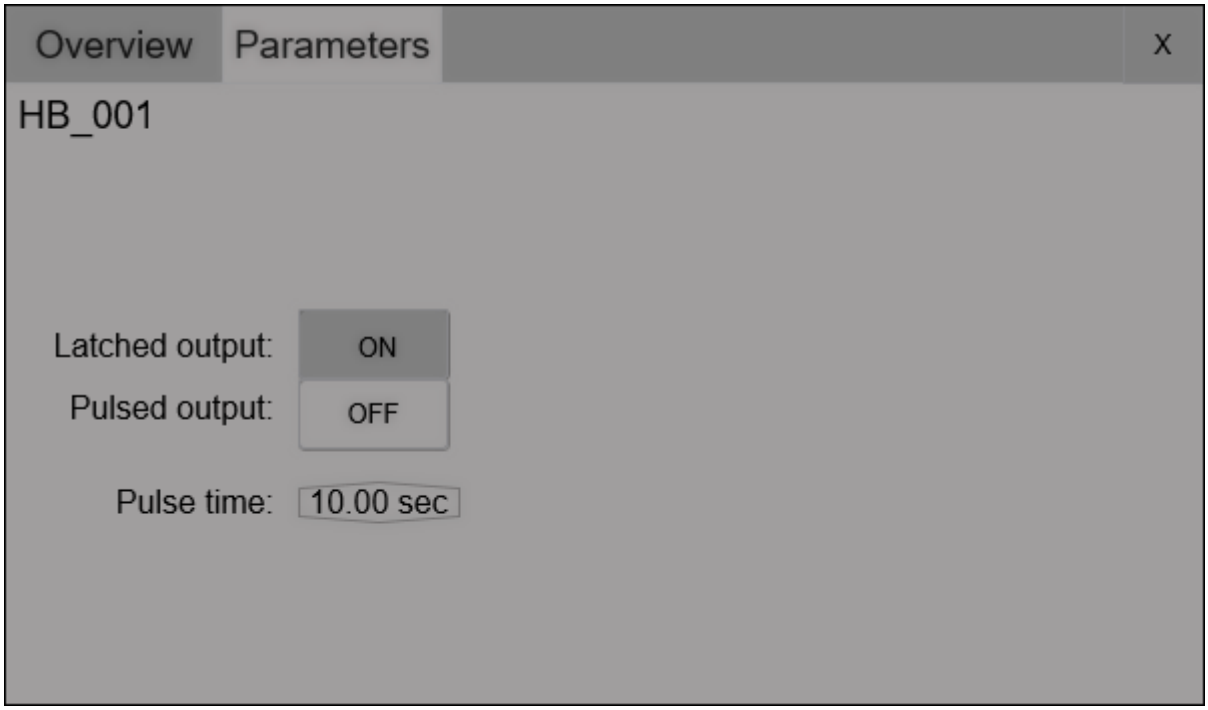
5.4.1 Controls

In the control section you will find a representation of the function output and status indicators. There are also buttons to control the output when in manual mode.

5.4.2 Modes

In the modes section you will find a listing of all the blocks modes. This block supports Auto/manual and transition mode, see section 3.1.1 Auto/Manual mode and 3.1.2 Disable transition mode.

5.5 Faceplate – Parameters



HB supports 3 parameters – Latched output, Pulsed output and Pulse time.

5.5.1 Latched output

Latches the function output. Has no effect if pulsed output is enabled.

A notable feature of using latched output is that it cannot be reset by operator, only by the PLC program.

5.5.2 Pulsed output

Pulsed output creates a pulse of a set length, starting when the out signal is triggered. After the pulse time has expired, the output signal will go low independent of transition mode and latched output. For example, if the block has mode Disable transition low and you press the ON button with pulsed output enabled, the signal will still turn off after the pulse time has expired.

5.5.3 Pulse time

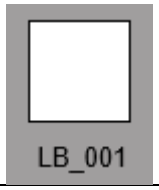
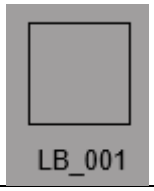
Time of pulse when using pulsed output. Accepts values from 0.05s to 300s (5m)

6 LB – Safeguarding shutdown level

The LB function template shall be used for control of safety shutdown levels in PSD and ESD nodes etc. requiring SIL-level. It may additionally be used for control of utility shutdown levels located in PCS node. One LB function template shall be used per shutdown level. The shutdown levels should form a shutdown hierarchy. The LB shall supervise the shutdown performance per level. All shutdown initiators and shutdown action elements shall have the possibility to group alarms and status up to the LB.

The lb function template is typically used in a safety system, where the action signals from shutdown initiators (e.g. ALL from MA, AHH from MA and or Y from MB) are combined into an OR-gate before it is connected to the X-input on the LB. For the highest level in the shutdown hierarchy the XS-input on the LB shall not be used. The Y-output from the LB is linked to shutdown action elements, e.g. X on SB and/or LSL on SBV. If any lower shutdown levels exist, the YX-output from the LB on the highest level shall be linked to the XS-input on the LB function that represents the next lower level.

6.1 Symbol

Condition	Description	Picture
Shutdown Active		
Shutdown Inactive	Normal operation	

6.2 Colours

19	Binary.On	#FFFFFF
20	Binary.Off	#A09E9E

6.3 Events and alarms

This function will raise the following events and alarms. It will also raise events related to modes, documented in the section for modes.

6.3.1 Level released

Inverted, Alarm, Class.Action (red)

6.3.2 External level released

Inverted, Event, Class.Event (white)

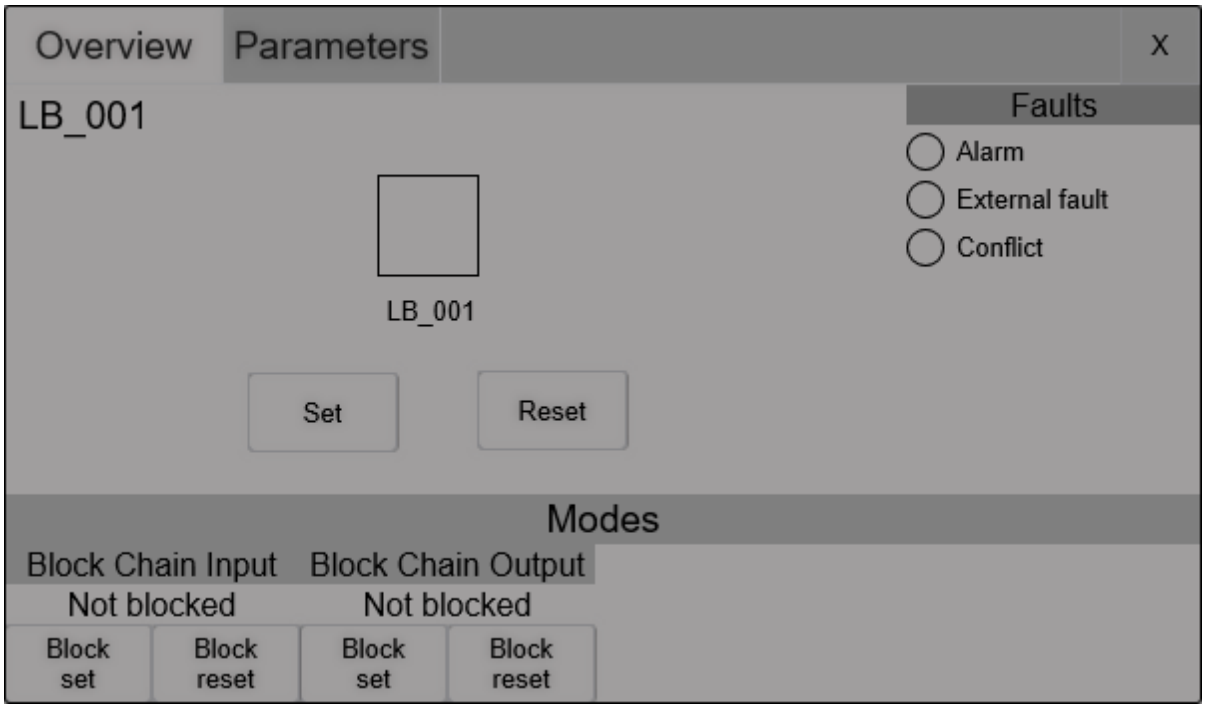
6.3.3 Group fault status

Alarm, Class.Fault (light blue)

6.3.4 Group conflict status

Alarm, Class.Conflict (red)

6.4 Faceplate – Overview



6.4.1 Display

On the left you will find a section displaying the current state of the selected object.

6.4.2 Faults

On the right you will find a list of possible alarms.

6.4.2.1 Alarm

When a shutdown is initiated directly from this block, the Alarm lamp will light up in addition to triggering all lower shutdown levels. The Alarm lamp on LBs lower in the shutdown chain will not trigger.

6.4.2.2 External fault

When the equipment that is supposed to shut down goes into a fault state, that will be reflected here.

6.4.2.3 Conflict

When the equipment that is supposed to shut down goes into a conflict state, that will be reflected here.

6.4.3 Modes

LB has 2 distinct blocking modes, one for blocking the chain input and one for blocking the chain output. Both follow the Norsok specification for a block mode described in section 0.

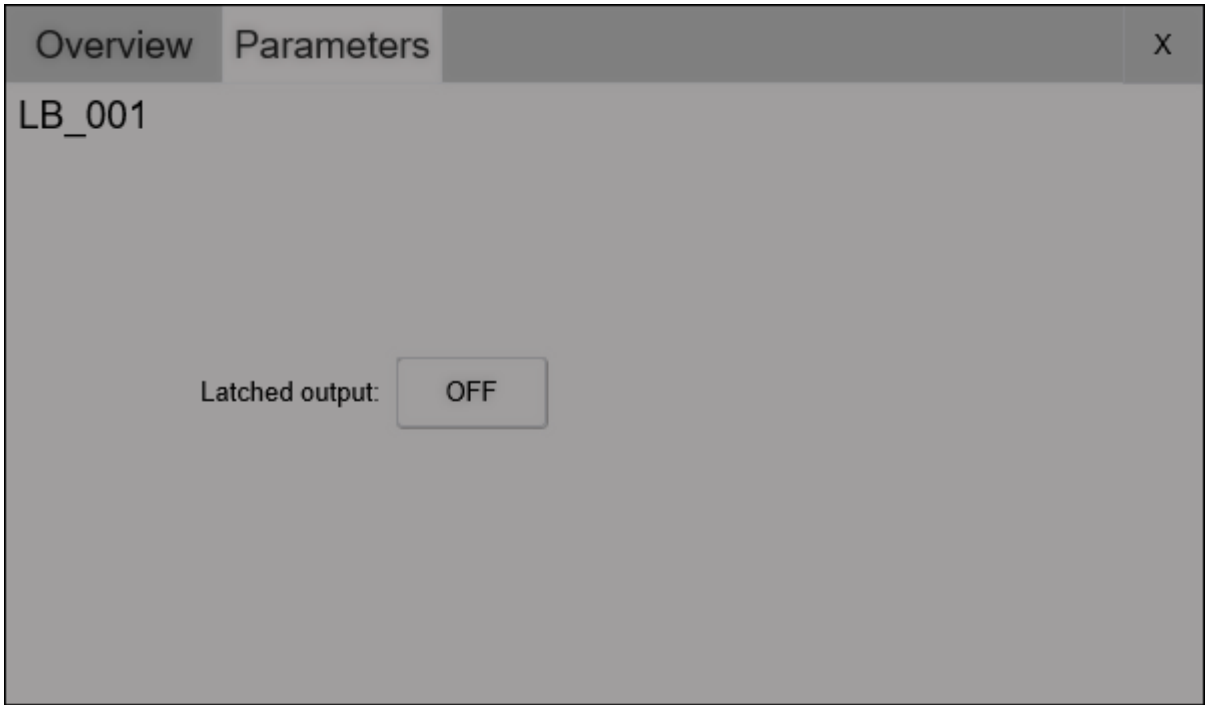
6.4.3.1 Block Chain Input

Activating this block means the current shutdown level won't get triggered by higher shutdown levels.

6.4.3.2 Block Chain Output

Activating this block means the current blocks shutdown level won't impact lower shutdown levels.

6.5 Faceplate – Parameters



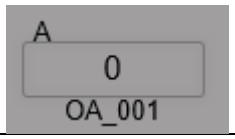
6.5.1 Latched output

When this parameter is set, output Y will be latched, but only when triggered from normal input X. Chain input from XS will never latch, and neither will chain output YX.

7 MA – Monitor analogue

The MA function template shall be used for scaling, display (indication) and monitoring (alarming) of process variable or control variable. The template comprises handling of field instrument and signalling faults.

7.1 Symbol

Name	Condition	Picture
Default		

7.2 Events and alarms

This function will raise the following events and alarms. It will also raise events related to modes, documented in the section for modes.

7.2.1 External fault

Alarm, Class.Fault (light blue)

7.2.2 AHH

Alarm, Class.Action (red)

7.2.3 BHH

Event, Class.Warning (yellow)

7.2.4 WH

Event, Class.Warning (yellow)

7.2.5 WL

Event, Class.Warning (yellow)

7.2.6 ALL

Alarm, Class.Action (red)

7.2.7 BLL

Event, Class.Warning (yellow)

7.2.8 BXHH

Event, Class.Event (white)

7.2.9 BXH

Event, Class.Event (white)

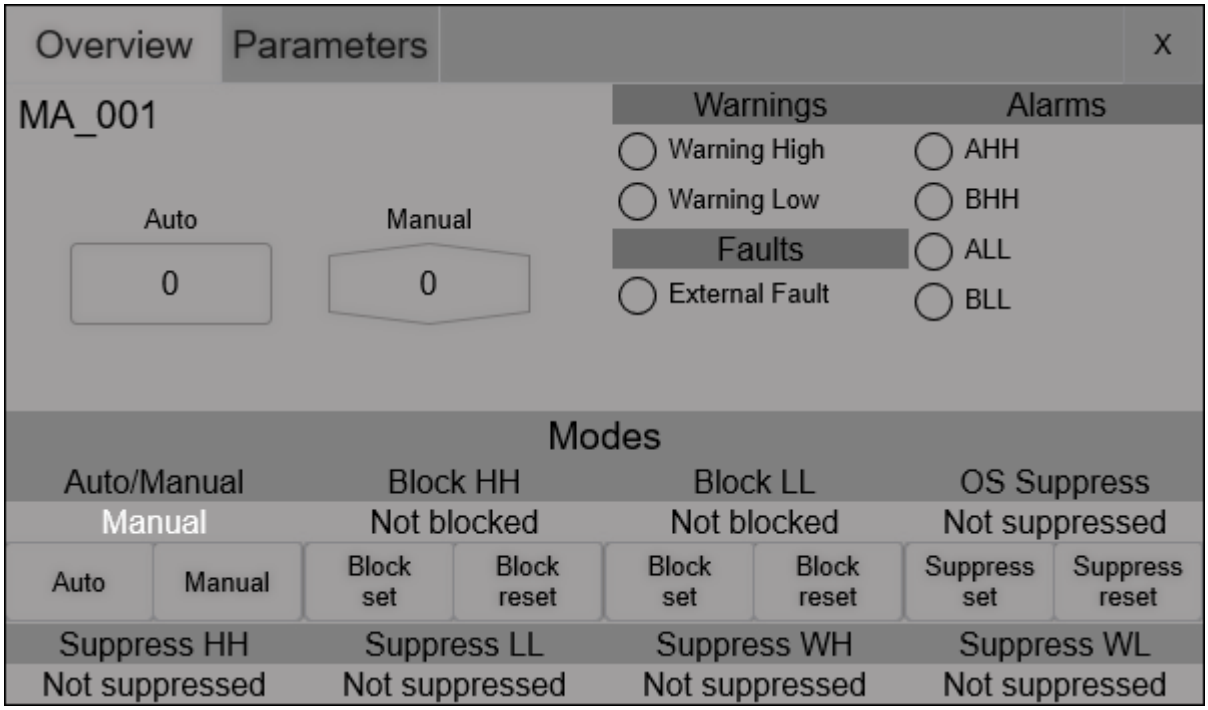
7.2.10 BXL

Event, Class.Event (white)

7.2.11 BXLL

Event, Class.Event (white)

7.3 Faceplate – Control



The monitor analogue overview faceplate has 3 sections: Control, Alarms/evens and Modes.

7.3.1 Control

The control section has 2 boxes – one which shows the current output signal (Y) and one which allows for entering a manual value to be output when the block is running in manual mode. You are allowed to enter and prepare a manual value when the block is running in auto as well, but the value won't be applied before changing the mode to auto.

7.3.2 Alarms

7.3.2.1 External Fault

Lights up when a Fault is detected, either as an input to the block or as defined by parameters.

The cause is usually a faulty IO card or signal loop.

7.3.2.2 AHH

Alarm High High – triggered when the monitored value goes above the Limit AHH set in parameters for a specified amount of time. Generates an alarm.

7.3.2.3 BHH

Triggered when the monitored value goes above the limit BXHH set in parameters. Not affected by blocking. Does not generate an alarm, does generate an event.

7.3.2.4 ALL

Alarm Low Low – triggered when the monitored value goes below the Limit ALL set in parameters for a specified amount of time. Generates an alarm.

7.3.2.5 BLL

Triggered when the monitored value goes above the limit BXLL set in parameters. Not affected by blocking. Does not generate an alarm, does generate an event.

7.3.2.6 Warning High

Triggered when the monitored value goes above the Limit WH set in parameters. Generates an event.

7.3.2.7 Warning Low

Triggered when the monitored value goes below the Limit WL set in parameters. Generates an event.

7.3.3 Modes

Monitor analogue supports 7 modes, although many of them are variations of the same modes.
All modes are documented under section 3.1 Modes, but there are a few notable things about this specific faceplate.
You will find that there are 5 distinct suppression modes, but only 2 buttons to set and reset them. As an operator, you can only suppress everything or nothing, while the PLC software has more granular control. Using the Operator suppress functions will trigger all the alarm and warning suppression functions at once.

7.4 Faceplate – Alarms

7.4.1 Limit AHH

Set the limit value for Alarm High High. Disabled when set equal to minimum range.

7.4.2 Limit WH

Set the limit value for Warning High. Disabled when set equal to minimum range.

7.4.3 Limit WL

Set the limit value for Warning Low. Disabled when set equal to minimum range.

7.4.4 Limit ALL

Set the limit value for Alarm Low Low. Disabled when set equal to minimum range.

7.4.5 Time delay AHH

Delay in seconds before Alarm High High is raised.

7.4.6 Time delay WH

Delay in seconds before Warning High is raised.

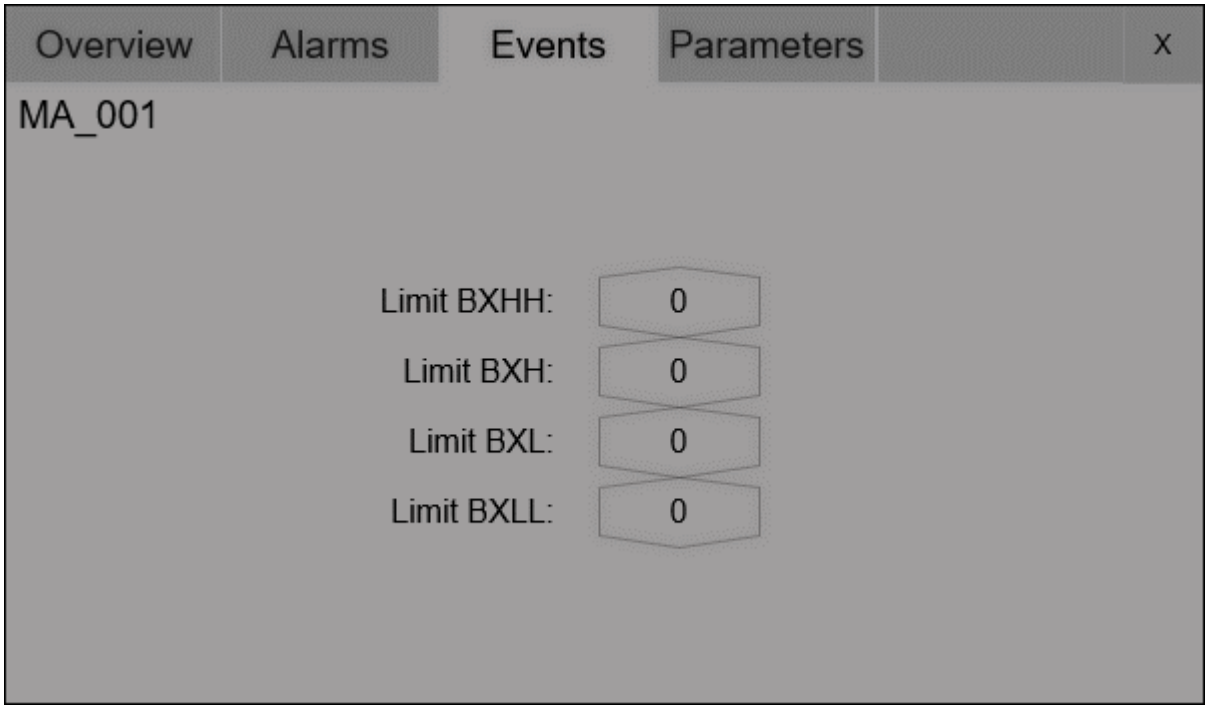
7.4.7 Time delay WL

Delay in seconds before Warning Low is raised.

7.4.8 Time delay ALL

Delay in seconds before Alarm Low Low is raised.

7.5 Faceplate – Events



7.5.1 Limit BXHH

Limit value for the BXHH output. Should in most cases be set the same as Limit AHH.

The output is triggered without regard for blocking and time delay but does not generate an alarm. Does generate an event. Disabled when set equal to minimum range.

7.5.2 Limit BXH

Limit value for the BXH output. Should in most cases be set the same as Limit WH.

The output is triggered without regard for blocking and time delay but does not generate an alarm. Does generate an event. Disabled when set equal to minimum range.

7.5.3 Limit BXL

Limit value for the BXL output. Should in most cases be set the same as Limit WL.

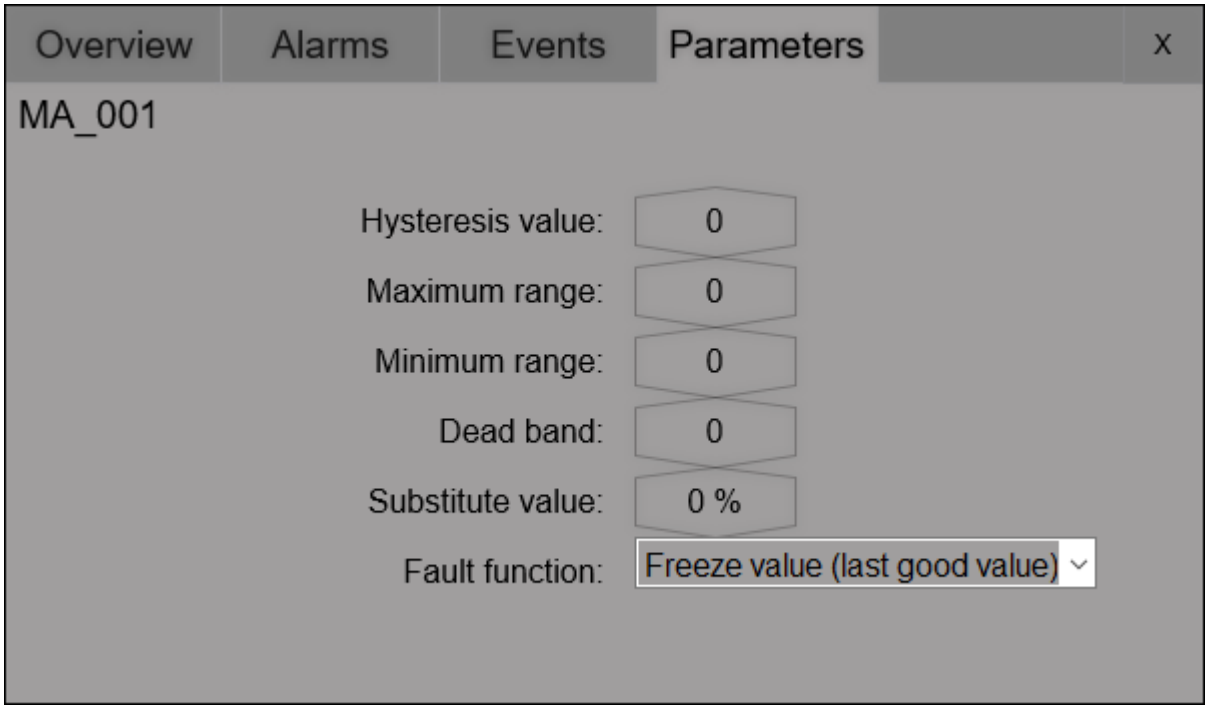
The output is triggered without regard for blocking and time delay but does not generate an alarm. Does generate an event. Disabled when set equal to minimum range.

7.5.4 Limit BXLL

Limit value for the BXLL output. Should in most cases be set the same as Limit ALL.

The output is triggered without regard for blocking and time delay but does not generate an alarm. Does generate an event. Disabled when set equal to minimum range.

7.6 Faceplate – Parameters



7.6.1 Fault function

Mode	Description
Undefined	Not yet set – should never be used
Freeze value (last good value)	When a fault is detected, keep outputting the last observed good value from before the fault
Show current measured value	Show the value measured, even with the fault existing
Substitute value	Output the value from the parameter Substitute value

7.6.2 Hysteresis value

When the monitored value has exceeded an alarm limit, an alarm will be triggered. The alarm won't disappear before the monitored value has become lower than (alarm limit – Hysteresis value). This ensures alarms don't go away before the issue is properly resolved.

7.6.3 Maximum range

Maximum display range

7.6.4 Minimum range

Minimum display range

7.6.5 Substitute value

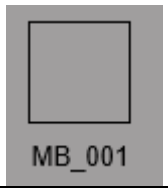
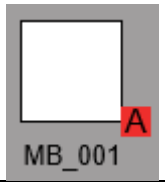
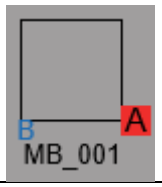
Value to output when parameter Fault function is set to 3 - Substitute value and a fault is detected

7.6.6 Dead band

In percent, from 0 – 100. Clamp output to never be below X% of range. If you have a dead band of 10%, a min value of 50 and a max of 150, input values below 60 would output 60.

8 MB – Monitor binary

8.1 Symbol

Name	Condition	Picture
Inactive		
Active		
Active but blocked		

The symbol gives a quick insight into the functions current status. The object symbol (here represented by a square) changes color depending on the alarm state. Around the main symbol you will find status indicators relevant for the blocks operation.

F signals an external fault – usually a problem with the IO cards

B signals the function is blocked

U signals the function is suppressed

You will never see the object symbol and U/B indicator active at the same time.

8.2 Events and alarms

This function will raise the following events and alarms. It will also raise events related to modes, documented in the section for modes.

8.2.1 Alarm

Action alarm, Class.Action (red)

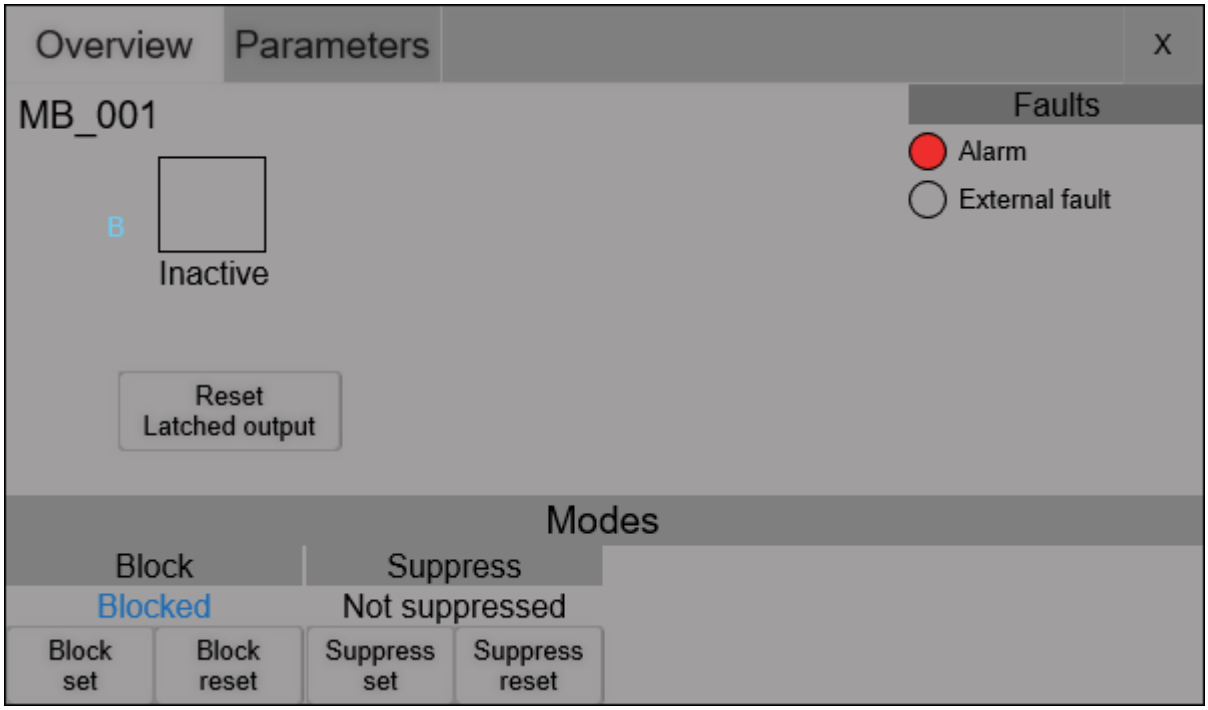
8.2.2 Normal output

Event, Class.Event (white)

8.2.3 External fault

Alarm, Class.Fault (light blue)

8.3 Faceplate – Overview



The MB Control faceplate allows you to monitor the state of a binary signal. On the immediate left you will find a symbol representing the signal monitored, in this case it is a box.

8.3.1 Status

In the status section you will find messages about the functions current operating modes. In this case, you can see that the operator chose to block the alarm, in addition to the PLC program forcing it to be suppressed. In this case, the alarm section on the right and symbol on the left would be gray as suppression prevents display of alarms.

The 2 messages each have 3 states, depending on how and where they are blocked from.

- When the text is not shown, the block is operating normally.
- "Suppressed/Blocked by operator" means an operator used the buttons to suppress or block the function. It can be deactivated by operator input.
- "Force suppressed/blocked by PLC" means the software is blocking the signal. This cannot be overridden by operator input.

8.3.2 Alarms

In the alarms section you will find the OS Alarm output. It is susceptible to suppression, but not blocking. This output won't be linked to further automated actions – automated responses are affected by blocking.

8.3.3 Signal Error

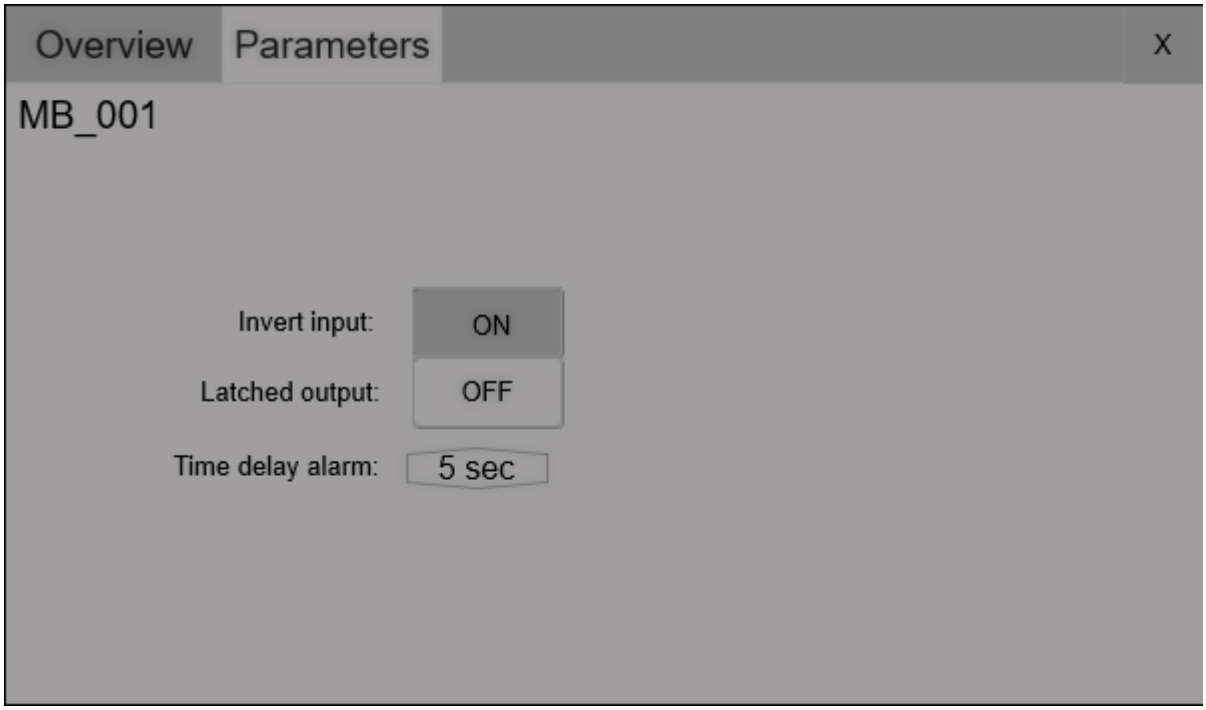
In the error section you will find an indicator for external faults – in most cases, this means there is a problem with the remote IO cards.

8.3.4 Controls

Finally, in the control section you can operate the suppression and blocking of the alarm signal. If the block is configured as Latched output, you will also have the option of resetting the latched output here.

User inputs are overridden by blocking/suppression in the PLC software.

8.4 Faceplate - Parameters



On this page you can control the functions operating parameters.

8.4.1 Invert input

Invert input will invert the input signal

8.4.2 Latched output

Latched output will cause the output to latch – there will be a new button on the control page to reset the output. Keep in mind that enabling suppression or blocking will also reset the latched output.

8.4.3 Time delay alarm

Time delay alarm allows you to specify the number of seconds the alarm must be triggered before producing an output. This input can be set from 0 to 120 seconds.

8.5 Events/Alarms

8.5.1 Blocked by operator

Event group: MB_Blocked

Event class: Blocked

8.5.2 Suppressed by operator

Event group: MB_Suppressed

Event class: Suppressed

8.5.3 Alarm triggered

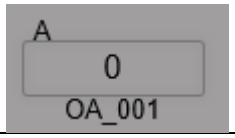
Alarm group: Not set

Alarm class: Action

9 OA – Output analogue

The OA function template shall be used for analogue control of flow device of medium (electricity, heat or fluid) where the CA block do not represent required functionality, e.g. split range output. The controlled element is a unit such as a motor, pump, heater, fan etc.

9.1 Symbol

Name	Condition	Picture
Default		

9.2 Events and alarms

This function will raise the following events and alarms. It will also raise events related to modes, documented in the section for modes.

9.2.1 Conflict

Alarm, Class.Conflict (red)

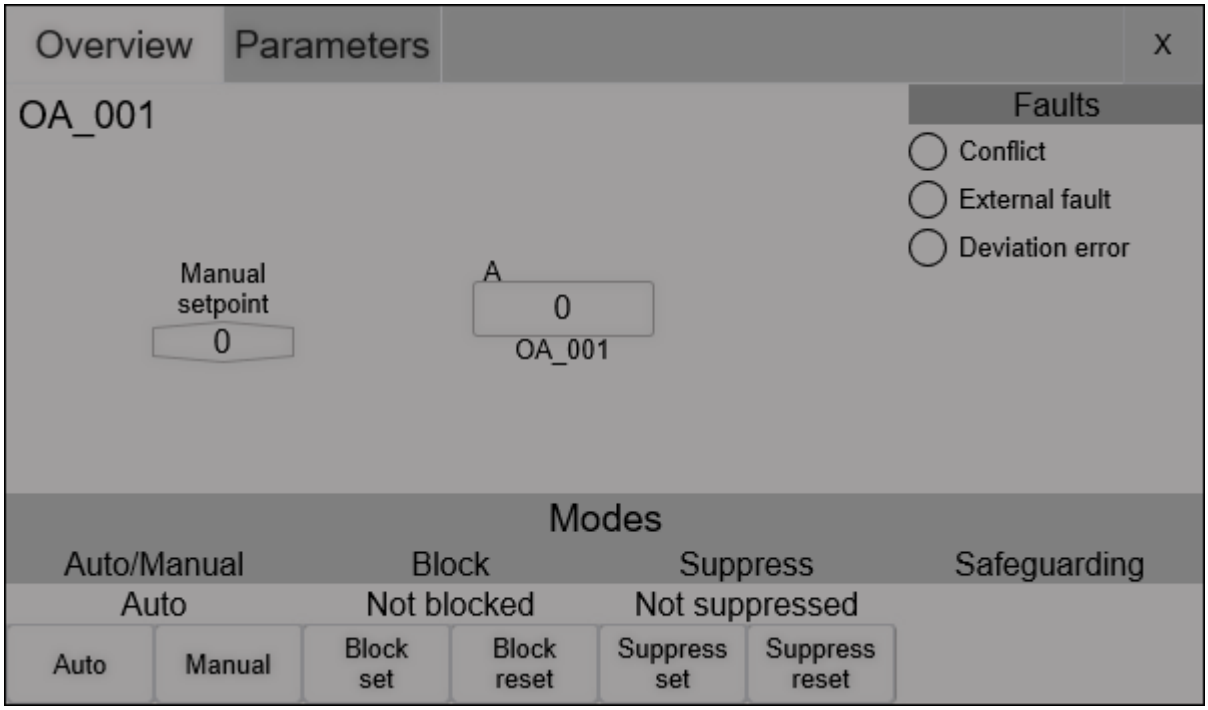
9.2.2 External fault

Alarm, Class.Fault (light blue)

9.2.3 Deviation error

Alarm, Class.Fault (light blue)

9.3 Faceplate – Overview



The analogue output overview page has 3 sections – control, faults and modes.

9.3.1 Controls

The controls section contain 2 symbols – a setpoint input box for manual mode and a representation of the function with all indicators and the current output value.

9.3.2 Faults

The analogue output shows 3 different faults in the UI – Conflict, External fault and deviation error.

9.3.2.1 Conflict

Triggered when both safeguarding and blocked is active

9.3.2.2 External fault

Either an external fault (Loop failed / dead IO card) or function failed. The latter can happen if there has been a deviation error for a set amount of time and the parameters are set to generate a fault on deviations.

9.3.2.3 Deviation error

A deviation error is triggered when the output signal has deviated a set amount from the process feedback signal for a certain amount of time.

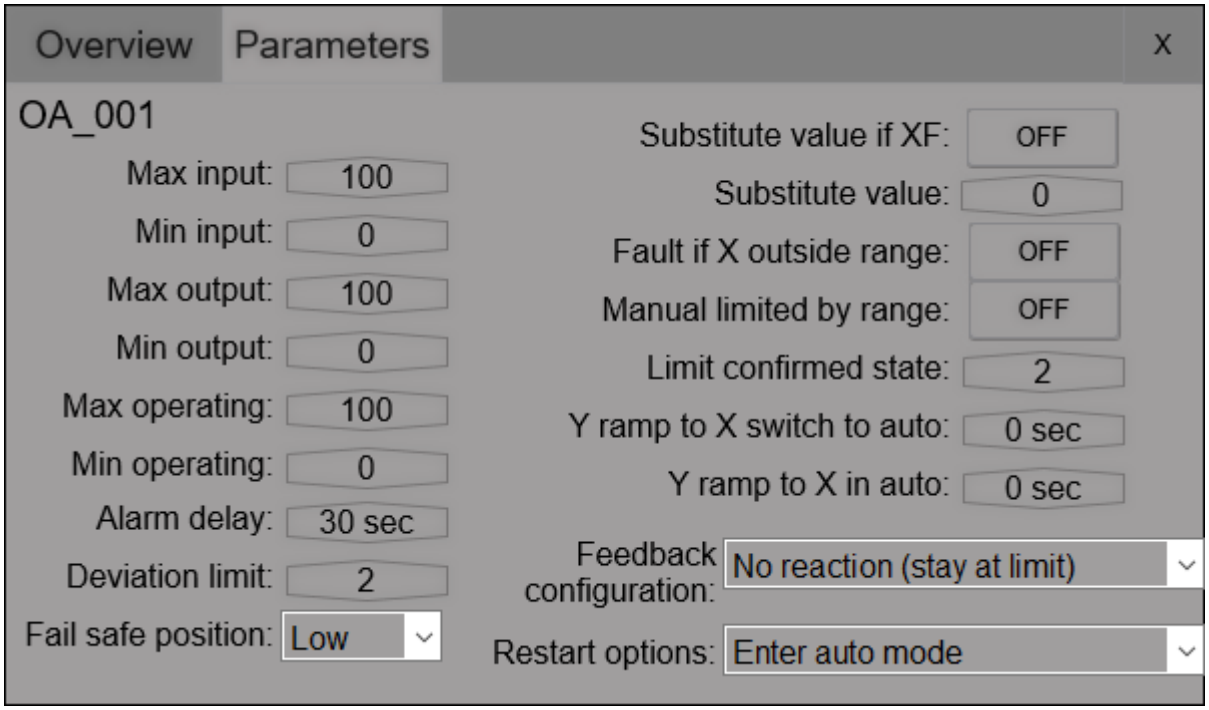
9.3.3 Modes

The analogue output function supports 4 modes – Auto/Manual, block, suppress and safeguarding. For detailed documentation on the various modes, see section 3.1 Modes

Blocked: When OA is blocked, safeguarding action is ignored.

Suppressed: When OA is suppressed, no alarms will be raised and external fault (XF), analogue feedback (XG), Feedback low (XGL) and feedback high (XGH) is ignored.

9.4 Faceplate – Parameters



The analogue output function has a total of 18 parameters to customize the blocks function.

9.4.1 Max input

Maximum range value in, used for scaling

9.4.2 Min input

Minimum range value in, used for scaling

9.4.3 Max output

Maximum range value out, used for scaling

9.4.4 Min output

Minimum range value out, used for scaling

9.4.5 Max operating

Maximum allowed output value. This value is less or equal to maximum range out.

9.4.6 Min operating

Minimum allowed output value. This value is greater or equal to minimum range out.

9.4.7 Alarm delay

Deviation alarm XG compared to y.

9.4.8 Deviation limit

Deviation in % of output range between Y and XG. If the output range is 0-100, deviation limit is 10%, Y is 50 and XG is 59 the alarm won't trigger. If XG is 71 the alarm will trigger after the Alarm delay expires.

9.4.9 Fail safe position

1 = High, 0 = Low

9.4.10 Substitute value if XF

Compared to operating range high or low. The % value is calculated in relation to the full range.

9.4.11 Substitute value

Value to be used when substitution is enabled

9.4.12 Fault if X outside range

Generate a fault signal (YF) is X is outside the operating range

9.4.13 Manual limited by range

ON = Manual output limited by operating range. OFF = No limit for manual.

In the case of no limit, it is still limited to Max input

9.4.14 Limit confirmed state

Compared to operating range high or low. The % value is calculated in relation to the full range.

9.4.15 Y ramp to X switch to auto

Ramp time while switching from manual to auto. Y ramp to X. Time to travel the full range.

9.4.16 Y ramp to X in auto

Ramp time while in auto. Y ramp to X. Time to travel the full range.

9.4.17 Feedback configuration

No feedback

Position low feedback (XGL)

Position high feedback (XGH)

Position low and high feedback (XGH and XGL)

Analog position feedback (XG)

Analog and position low feedback (XG and XGL)

Analog and position high feedback (XG and XGH)

Analog, position high and position low feedback (XG and XGH and XGL)

9.4.18 Restart options

Enter manual mode and substitute value

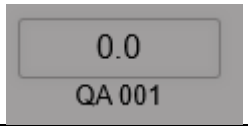
Enter manual mode and assume failsafe position

Enter auto mode where Y initializes to XG (if available)

10 QA – Totalizer

The QA function template shall be used for accumulation (totalizing) of process values based on time intervals.

10.1 Symbol

Name	Condition	Picture
Default		

10.2 Events and alarms

This function will raise the following events and alarms. It will also raise events related to modes, documented in the section for modes.

10.2.1 External fault

Alarm, Class.Fault (light blue)

10.2.2 AHH

Alarm, Class.Action (red)

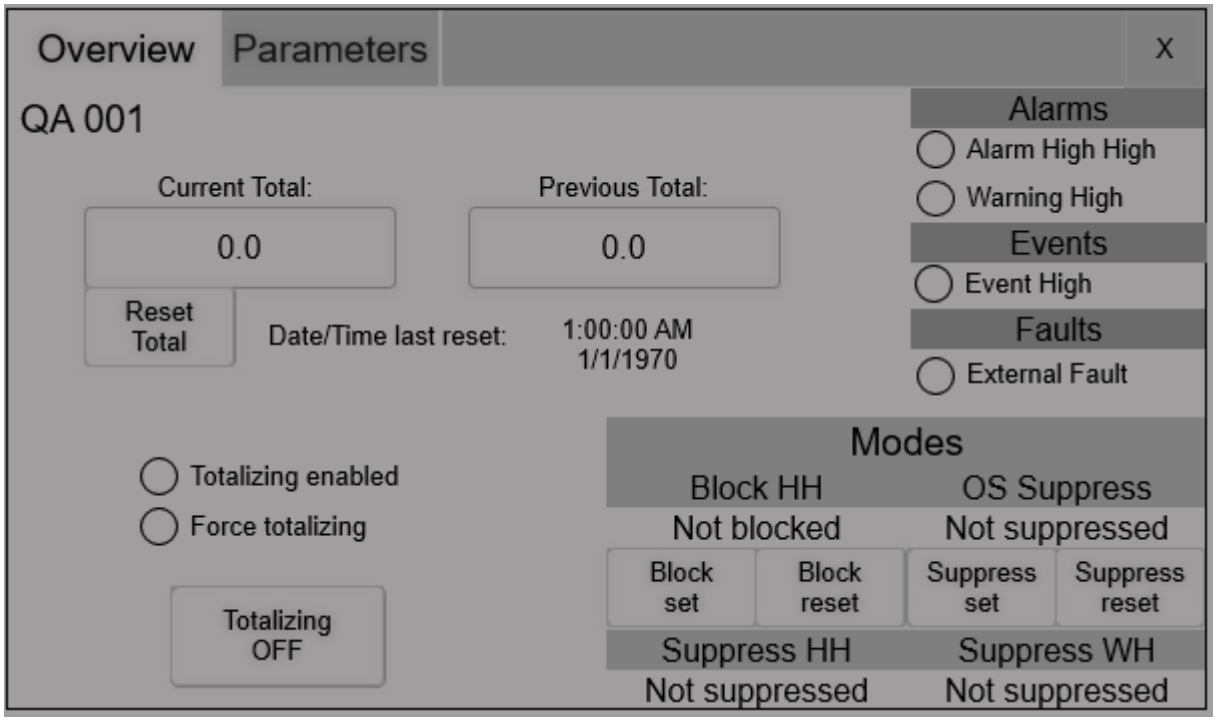
10.2.3 WH

Event, Class.Warning (yellow)

10.2.4 BXH

Event, Class.Event (white)

10.3 Faceplate – Overview



The analogue output overview page has 3 sections – control, Alarm/Events/faults and modes.

10.3.1 Controls

Current total - Shows the current accumulated value.

Previous total – Shows the previous accumulated value when it was reset.

Reset total – Resets the accumulated value.

Date/Time last reset – Shows the date and time the accumulation was last reset.

Totalizing enabled – PLC signal that enabled totalizing. This must be on to be able to turn the totalizing ON.

Force totalizing – PLC signal that forces the totalizing ON.

Totalizing On/Off Button – Turn on or off the totalizing.

10.3.1.1 External Fault

Lights up when a Fault is detected, either as an input to the block or as defined by parameters.

The cause is usually a faulty IO card or signal loop.

10.3.1.2 Alarm High High

Alarm High High – triggered when the monitored value goes above the Limit AHH set in parameters for a specified amount of time. Generates an alarm.

10.3.1.3 Warning High

Triggered when the monitored value goes above the Limit WH set in parameters. Generates a warning.

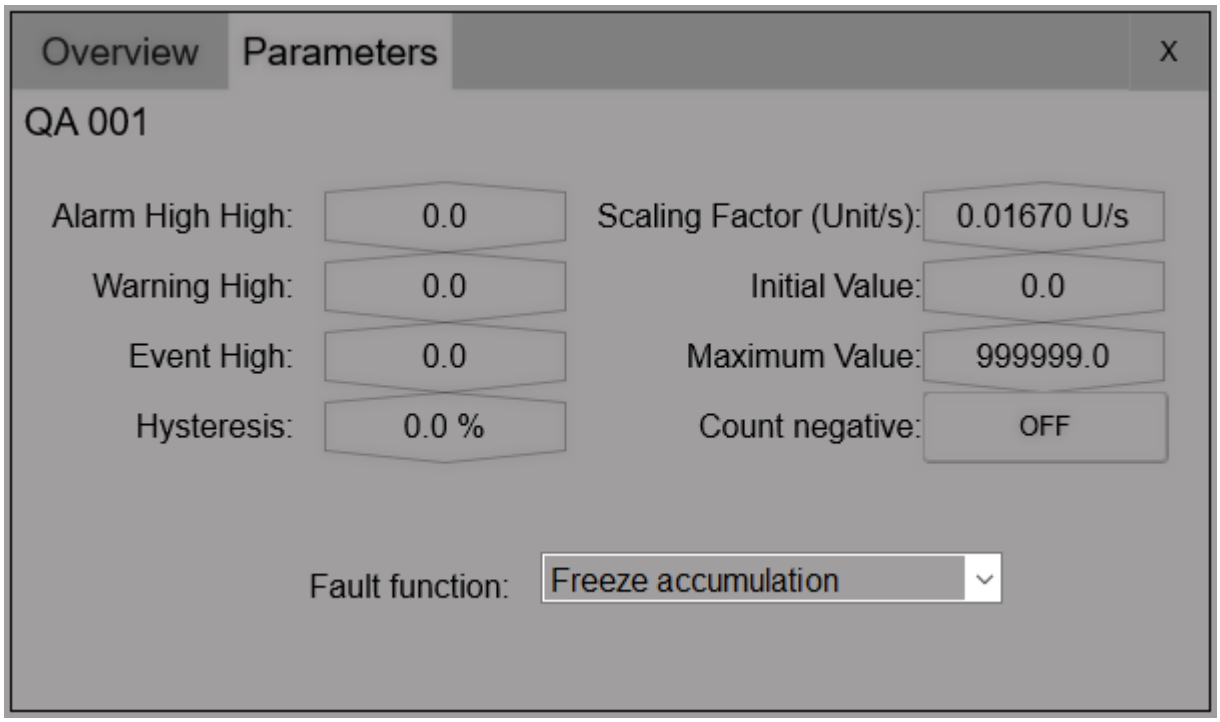
10.3.1.4 Event High

Triggered when the monitored value goes above the Limit BXH set in parameters. Generates an event.

10.3.2 Modes

Monitor analogue supports 2 modes.
All modes are documented under section 3.1 Modes, but there are a few notable things about this specific faceplate.

10.4 Faceplate – Parameters



The analogue output function has a total of 9 parameters to customize the blocks function.

10.4.1 Limit AHH

Set the limit value for Alarm High High. Disabled when set to 0.

10.4.2 Limit WH

Set the limit value for Warning High. Disabled when set to 0.

10.4.3 Limit BXH

Limit value for the BXH output.

The output is triggered without regard for blocking and time delay but does not generate an alarm. Does generate an event. Disabled when set to 0.

10.4.4 Hysteresis value

When the monitored value has exceeded an alarm/event limit, an alarm will be triggered. The alarm won't disappear before the monitored value has become lower than (alarm limit – Hysteresis value). This ensures alarms don't go away before the issue is properly resolved.

10.4.5 Scaling Factor

Scaling factor for accumulating value. The accumulation always calculates in seconds, so if you are monitoring a value in another unit e.g. Min/hours scaling factor must be applied.

E.g.: Monitoring flow in litres/min scaling factor must be 0.0167 (1sec/60sec)

10.4.6 Initial value

The value to start accumulation with after reset.

10.4.7 Maximum range

Maximum accumulation range, if accumulation exceed this range a fault is generated.

10.4.8 Count negative

Allows the accumulation to count negative values.

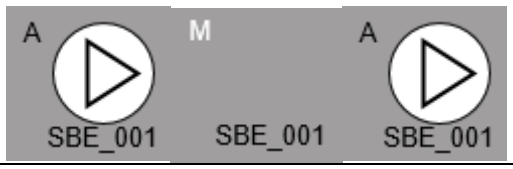
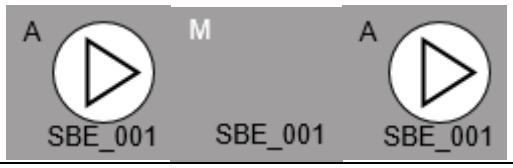
10.4.9 Fault function

Mode	Description
Undefined	Not yet set – should never be used
Freeze value accumulation	When a fault is detected, keep outputting the last accumulated value.
Total = 0	When a fault is detected, output accumulated value will be zero.

11 SBE – Control of electrical equipment

The SBE function template shall be used for binary (on/off) control of flow element of medium /(electricity, heat or fluid). The controlled element is a unit, e.g. motor, pump, heater, fan etc.

11.1 Symbol

Condition	Description	Picture
Running		
Stopped		
Starting	Flashing	
Stopping	Flashing	

11.2 Events and alarms

This function will raise the following events and alarms. It will also raise events related to modes, documented in the section for modes.

11.2.1 State

1-4 (starting/stopping/running/stopped): Event, Class.Event (white)
5 (error): Alarm, Class.Fault (light blue)

11.2.2 Conflict

Alarm, Class.Conflict (red)

11.2.3 External fault

Alarm, Class.Fault (light blue)

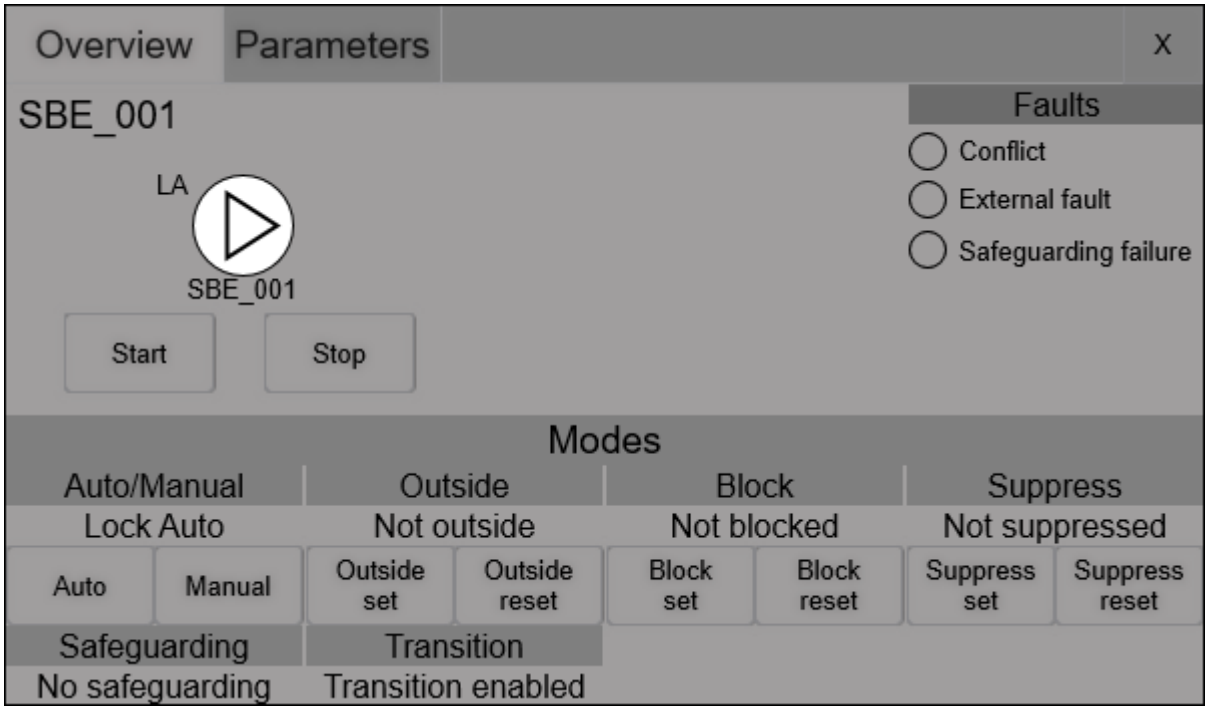
11.2.4 Feedback failure

Alarm, Class.Fault (light blue)

11.2.5 Safeguarding failure

Event, Class.Event (white)

11.3 Faceplate – Overview



The overview section of the faceplate is divided into 3 sections – control, faults and modes.

11.3.1 Control

In the control section you will see a representation of the function object and control buttons. When the block is in local and manual mode, these buttons will allow you to control the actuator.

11.3.2 Faults

11.3.2.1 Conflict

If the block is both suppressed and in safeguarding mode the conflict fault will be triggered. The circle symbols colour will change to Class.Conflict (see section 3.2.1)

11.3.2.2 External fault

When an external fault is detected the indicator will light up with the colour Class.Fault (see section 3.2.1). This is usually caused by issues with IO or another function failing.

11.3.2.3 Deviation error

Alarm is generated when there is a discrepancy between output command and feedback from valve.

The following conditions is defined as discrepancies:

- Opening timeout
  - Open signal is given and open feedback is not present after timer value given in parameter "Travel time open" has ran out.
- Closing timeout
  - Close signal is given and close feedback is not present after timer value given in parameter "Travel time close" has ran out.
- Both Open and Close feedback set
- Loss of open feedback after open was confirmed

- Loss of close feedback after close was confirmed

11.3.2.4 Safeguarding failure

Dedicated alarm when feedback failure (Deviation error) has been obtained and safeguarding is set.

11.3.3 Modes

In the Modes section you can see and control the functions current operating modes. For documentation on the respective modes, see section 3.1

Auto/Manual – section 3.1.1

Transition – section 0

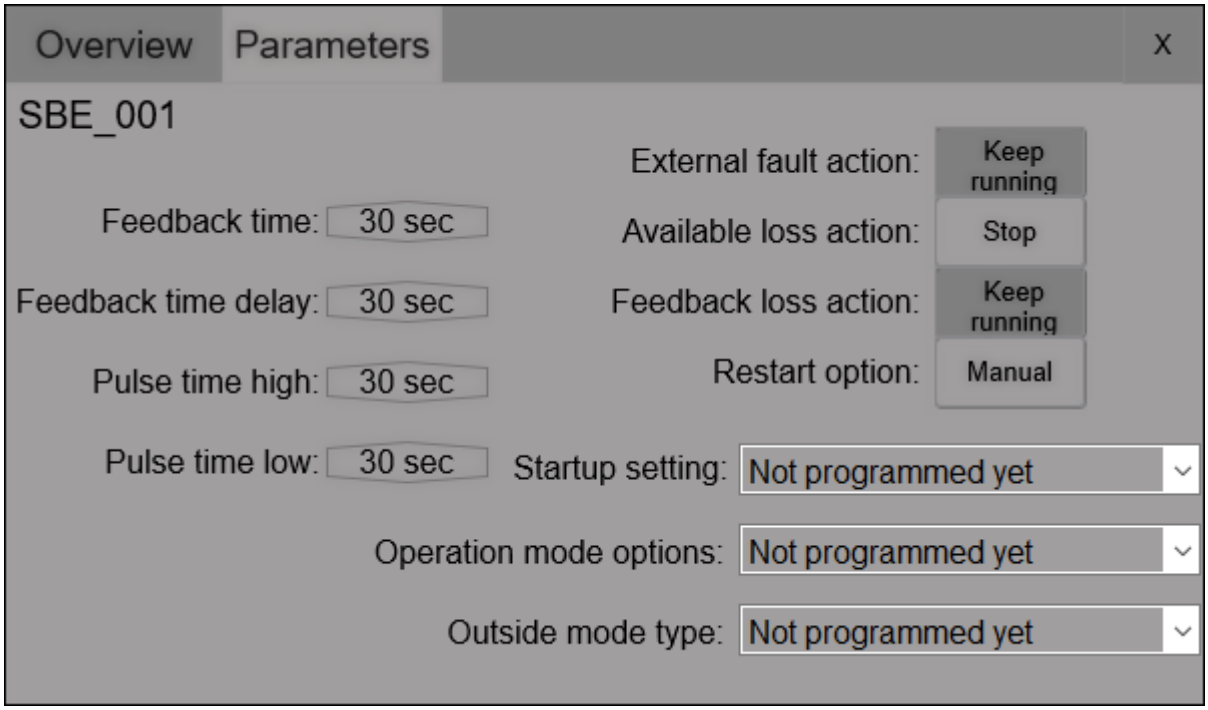
Outside – section 0

Safeguarding – section 0

Block – section 0

Suppress – section 0

11.4 Faceplate – Parameters



11.4.1 Feedback time

In seconds, 0-60s. Time from start/stop signal is given to feedback signal is expected. If a feedback signal isn't detected within this time, an external fault will be raised.

11.4.2 Feedback time delay

Time before action when feedback is lost. Depends on Feedback loss action being set – if it is set, the motor will be stopped when feedback has been lost for this amount of time.

11.4.3 Pulse time high

Pulse length when using equipment that requires a pulse for starting (YH), such as relay controlled motors hardwired with an external holding circuit.

11.4.4 Pulse time low

Pulse length when using equipment that requires a pulse for stopping (YL), such as relay controlled motors with an external holding circuit.

11.4.5 External fault action

Choose whether to stop the motor or keep it running when an external fault is detected, such as a failed IO card.

11.4.6 Available loss action

Choose whether to stop the motor or keep it running when the motor availability signal (XE) is lost.

11.4.7 Feedback loss action

Choose whether to stop the motor after the Feedback time delay expires or keep it running when run feedback is lost (XGH)

11.4.8 Restart option

Option	Description
Manual	When the controller is restarted, assume manual mode and stopped state.
Auto	When the controller is restarted, assume automatic mode and follow XH/XL feedback signals – if running feedback is detected, the motor will keep running. If the stopped feedback is detected, the motor will stop.

11.4.9 Startup state

If restart option is set to manual, this parameter determines what state the equipment will assume when the PLC restarts.

Option	Description
Undefined	Parameter not yet selected
Manual and run	Run
Manual and stop	Default
As previous state	Same state as before the PLC stopped

11.4.10 Operation mode options

Option	Description
Undefined	Parameter not yet selected
Outside, manual and automatic	Possible to switch between outside, manual and automatic mode
Manual and automatic mode	Default, possible to switch between manual and automatic mode
Manual and outside mode	Possible to switch between manual and outside mode
Locked in manual mode	Template is locked in manual mode. It is not possible to switch operating modes.
Locked in outside mode	Template is locked in outside mode. The function is used for monitoring only.

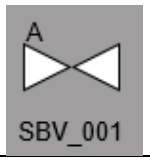
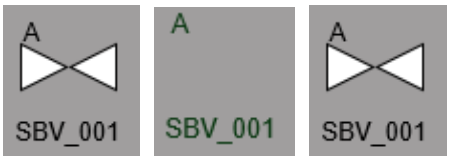
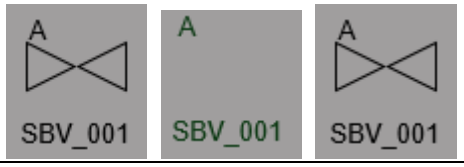
11.4.11 Outside mode type

Option	Description
Undefined	Parameter not yet selected
Outside	Output controlled by SAS – When in this mode, the motor will still receive its run signal from the sentral control system, but the sentral control system will use external (physical) inputs from the field, effectively acting like a local control system.
Local	Output controlled locally – When in this mode, the motor will be controlled by a local control system in the field. The PLC will only attempt to display the motors current state.

12 SBV – Control of pneumatic/hydraulic equipment

The SBV function template shall be used for binary (on/off) control of a flow element by means of changing flow of medium (heat or fluid). Typically, controlled elements are valves, dampers, etc.

12.1 Symbol

Condition	Description	Picture
Open		
Closed		
Opening	Flashing with open colour	
Closing	Flashing with closing colour	

12.2 Colours

21	SBV.Open	#FFFFFF
22	SBV.Closed	#A09E9E

12.3 Events and alarms

This function will raise the following events and alarms. It will also raise events related to modes, documented in the section for modes.

12.3.1 State

1 – 4 (stop/run/starting/stopping): Event, Class.Event (white)

5 (error): Alarm, Class.Fault (light blue)

12.3.2 Conflict

Alarm, Class.Conflict (red)

12.3.3 External fault

Alarm, Class.Fault (light blue)

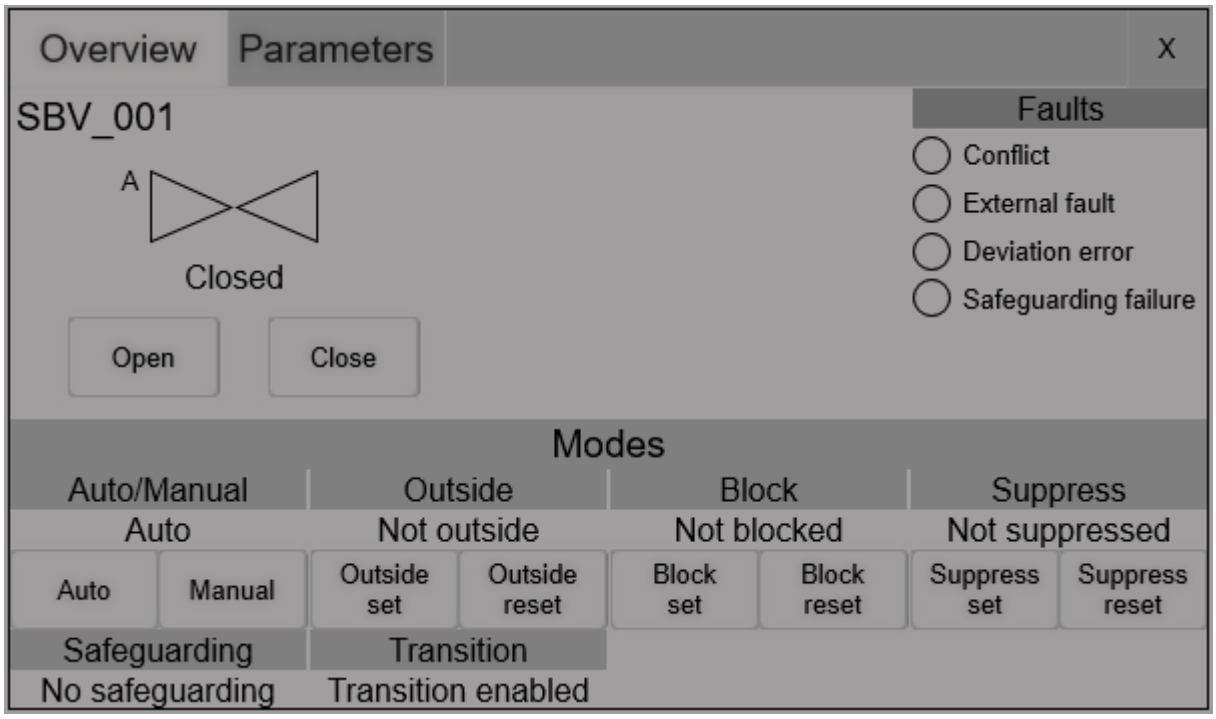
12.3.4 Deviation error

Alarm, Class.Fault (light blue)

12.3.5 Safeguarding failure

Event, Class.Event (white)

12.4 Faceplate – Overview



The overview section of the faceplate is divided into 3 sections – control, faults and modes.

12.4.1 Control

In the control section you will see a representation of the function object and control buttons. When the block is in local and manual mode, these buttons will allow you to control the actuator.

12.4.2 Faults

12.4.2.1 Conflict

If the block is both suppressed and in safeguarding mode the conflict fault will be triggered. The circle symbols colour will change to Class.Conflict (see section 3.2.1)

12.4.2.2 External fault

When an external fault is detected the indicator will light up with the colour Class.Fault (see section 3.2.1). This is usually caused by issues with IO or another function failing.

12.4.2.3 Deviation error

Alarm is generated when there is a discrepancy between output command and feedback from valve.

The following conditions is defined as discrepancies:

- Opening timeout
  - Open signal is given and open feedback is not present after timer value given in parameter "Travel time open" har run out.
- Closing timeout
  - Close signal is given and close feedback is not present after timer value given in parameter "Travel time close" har run out.
- Both Open and Close feedback set
- Loss of open feedback after open was confirmed
- Loss of close feedback after close was confirmed

12.4.2.4 Safeguarding failure

Dedicated alarm when feedback failure (Deviation error) has been obtained and safeguarding is set.

12.4.3 Modes

In the Modes section you can see and control the functions current operating modes. For documentation on the respective modes, see section 3.1

Auto/Manual – section 3.1.1

Transition – section 0

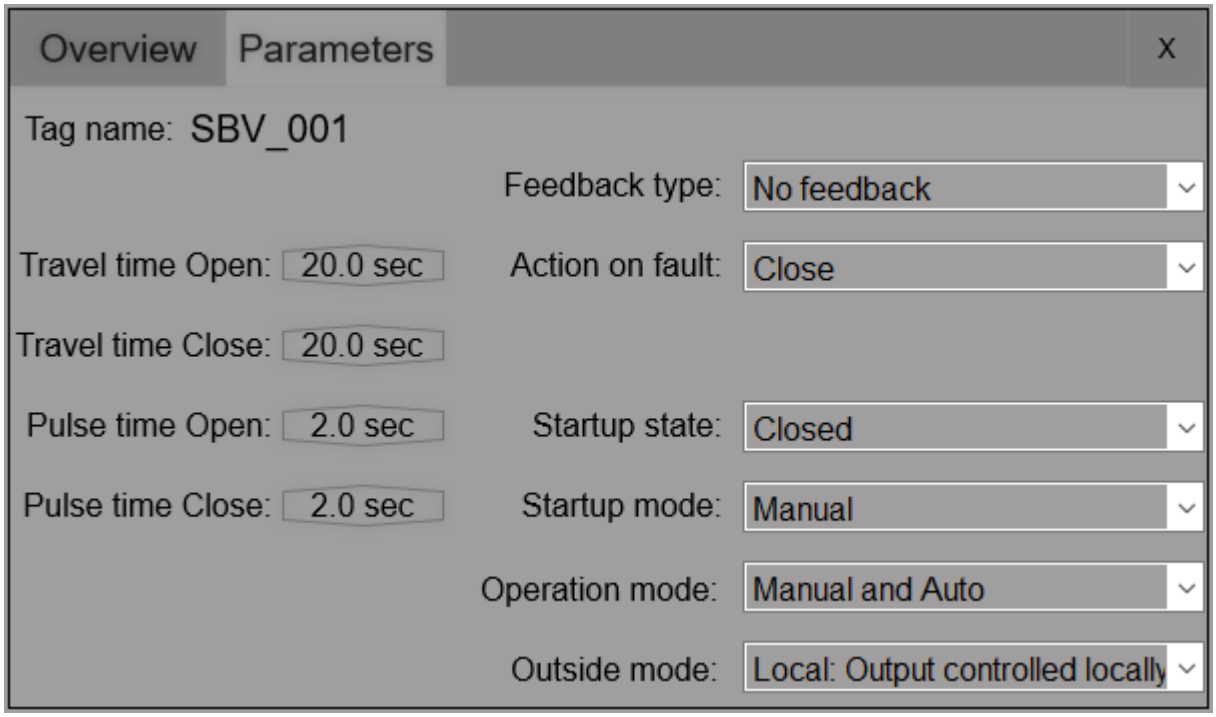
Outside – section 0

Safeguarding – section 0

Block – section 0

Suppress – section 0

12.5 Faceplate – Parameters



On the parameters page you will find the functions operating parameters. These should be configured depending on the physical equipment installed.

12.5.1 Travel time Open

0 – 300 seconds. If the valve doesn't open in this amount of time, a deviation error alarm will be raised. When not having any feedback (Feedback type: No feedback) it will determine how long the symbol shows the "opening" state.

12.5.2 Travel time Close

0 – 300 seconds. If the valve doesn't close in this amount of time, a deviation error alarm will be raised. When not having any feedback (Feedback type: No feedback) it will determine how long the symbol shows the "closing" state.

12.5.3 Pulse time Open

0 – 120 seconds. Used with equipment that requires a pulse to open. Define the length of pulse required to open the valve.

12.5.4 Pulse time Close

0 – 120 seconds. Used with equipment that requires a pulse to close. Define the length of pulse required to close the valve.

12.5.5 Feedback type

Type	Description
Undefined	Not yet set – should never be used
No feedback	For valves with no feedback signal. Symbol will take colour from function output instead. Travel time parameters are unused.
High feedback only	Feedback when the valve is open. Travel time Close won't be used
Low feedback only	Feedback when the valve is closed. Travel time Open won't be used.
High and Low feedback	Feedback for both valve positions. Full monitoring of valve open and close time.

12.5.6 Action on fault

Define what happens when a fault type signal is detected, such as a broken wire.

Action	Description
Undefined	Not yet set – should never be used
No action	Keep going when faults are detected
Close	Send the close signal when faults are detected
Open	Send the open signal when faults are detected

12.5.7 Startup state

Valve state to assume after a PLC reinitialization, such as after a power reset.

State	Description
Undefined	Not yet set – should never be used
Closed	Close valve
Open	Open valve
Based on feedback	PLC will keep the valve in the same position by reading the feedback signal

12.5.8 Startup mode

Control mode to assume after a PLC reinitialization, such as after a power reset.

Mode	Description
Undefined	Not yet set – should never be used
Manual	Assume manual mode after reinitialization
Auto	Assume automatic mode after reinitialization
As previous state	Remember last state

12.5.9 Operation mode

Defines what operation modes should be available

Mode	Description
Undefined	Not yet set – should never be used
Outside, Manual and Auto	Possible to switch between outside, manual and automatic mode
Manual and Auto	Default, possible to switch between manual and automatic mode
Manual and Outside	Possible to switch between manual and outside mode
Locked in Manual	Template is locked in manual mode. It is not possible to switch operating modes.
Locked in Outside	Template is locked in outside mode. The function is used for monitoring only.

12.5.10 Outside mode type

Outside mode is used when an operator assumes direct control of the equipment from local control interfaces in the factory.

Mode	Description
Undefined	Not yet set – should never be used
Outside	Output controlled by SAS – When in this mode, the motor will still receive its run signal from the sentral control system, but the sentral control system will use external (physical) inputs from the field, effectively acting like a local control system.
Local	Output controlled locally – When in this mode, the motor will be controlled by a local control system in the field. The PLC will only attempt to display the motors current state.