



OMC

**High-performanceHMI
Toolkit
User Manual**

20230901

Copyright Notice

Trademarks or marks SUPCON, SPlant, Webfield, ESP-iSYS, MultiF, InScan, SupField are all registered, registering and being used by SUPCON Technology Co., Ltd., which owns the properties of all the above trademarks or marks. It is strictly prohibited to use any of the above trademarks or marks without a written permission from SUPCON Company. We reserve the right to take legal action against any individuals or companies using trademarks or marks above illegally.

The reproduction, transmission or use of this document or its contents is not permitted without express written authority. Information and specifications in this document are subject to change without notice. While information in this document is well edited and checked, mistakes or omissions may exist. Please don't hesitate to contact SUPCON if you have any questions about this document. Please contact SUPCON via email "SMS@supcon.com" if you have any questions.

Copyright © 2023 **SUPCON Technology**. All rights reserved.

SUPCON Technology Co., Ltd.
No.309 Liuhe Road, Binjiang District
Hangzhou, 310053
P.R.China
<http://global.supcon.com>

Symbol Definitions



WARNING:

Indicates a potentially hazardous situation which, if not avoided, could result in serious injuries or death.



RISK OF ELECTRICAL SHOCK:

Indicates a Potential shock hazard where HAZARDOUS LIVE voltages greater than 30V RMS, 42.4V peak, or 60V DC may be accessible.



ESD HAZARD:

Indicates the Danger of an electro-static discharge to which equipment may be sensitive. Observe precautions for handling electrostatic sensitive devices



ATTENTION:

Identifies information that requires special consideration.



TIP:

Identifies advice or hints for users.

Table of Contents

1 Preface.....	1
2 Overview.....	2
2.1 Work Mode of Function Block.....	2
2.1.1 OOS (Out of Service).....	3
2.1.2 Initial Status (IMAN).....	3
2.1.3 LMAN/LTR Modes.....	3
2.1.4 Track (TR).....	3
2.1.5 ROUT Mode.....	4
2.1.6 RCAS Mode.....	4
2.1.7 Manual (MAN)/AUTO/CAS Modes.....	4
2.2 Active/Inactive.....	4
2.3 Data Type.....	5
2.4 Parameter Types of Function Block.....	5
2.5 Function Block Panel.....	6
2.5.1 Fixed Button.....	7
2.5.2 Close Button.....	7
2.5.3 FB Tag Name.....	8
2.5.4 Selected, Alarm, ACK.....	8
2.5.5 Detailed Information of Alarm.....	8
2.5.6 Analog Data Area.....	8
2.5.7 Basic Operation Area.....	8
2.5.8 Digital Button or Analog Bar Diagram Display Area.....	8
2.5.9 Auxiliary Operation Area.....	9
2.5.10 Switchover Button Area.....	9
2.5.11 Tag Description.....	10
2.5.12 Operation Authority of Panel.....	10
2.5.13 Operator Keyboard Operation.....	10
2.5.14 Function Block Panel Example.....	10
3 Control Function Block Library.....	15
3.1 Control Function Block Application Foundation.....	15

3.1.1 Mode and Parameter Status (MODE).....	15
3.1.2 Input Process.....	18
3.1.3 Set Variable Process.....	19
3.1.4 Operation Process.....	21
3.1.5 Output Process.....	26
3.1.6 Integral Removing.....	27
3.1.7 Alarm.....	28
3.1.8 Others.....	33
3.1.9 PID Parameter Tune.....	34
3.1.10 Difference between Various PID Function Blocks.....	37
3.2 PIDBX Function Block.....	38
3.2.1 Parameter Description.....	38
3.2.2 Function Overview.....	55
3.2.3 Mode Calculation.....	55
3.2.4 Input Processing.....	58
3.2.5 Setting Values.....	60
3.2.6 Operation Processing.....	61
3.2.7 Output Processing.....	61
3.2.8 BKOUT Processing.....	63
3.2.9 Valve Position Deviation Alarm.....	63
3.2.10 Others.....	63
3.2.11 Panel Parameter Instruction.....	64
3.2.12 Flag.....	70
3.3 RATIOBX Function Block.....	72
3.3.1 Parameter Description.....	72
3.3.2 Function Overview.....	84
3.3.3 Mode Calculation.....	84
3.3.4 Input Processing.....	87
3.3.5 Setting Values.....	88
3.3.6 Operation Processing.....	89
3.3.7 Output Processing.....	90
3.3.8 BKOUT Processing.....	91
3.3.9 Others.....	91

3.3.10 Panel Parameter Instruction.....	92
3.3.11 Flag.....	93
3.4 SPLITBX Control Function Block.....	94
3.4.1 Parameter Description.....	95
3.4.2 Function Overview.....	104
3.4.3 Mode Calculation.....	105
3.4.4 Setting Values.....	106
3.4.5 Output Processing.....	107
3.4.6 Switch.....	108
3.4.7 Action Direction.....	108
3.4.8 Others.....	108
3.4.9 Panel Parameter Instruction.....	109
3.4.10 Flag.....	113
3.5 MANUALBX Function Block.....	114
3.5.1 Parameter Description.....	114
3.5.2 Function Enable.....	120
3.5.3 Mode Calculation.....	121
3.5.4 Output Processing.....	123
3.5.5 Others.....	124
3.5.6 Panel Parameter Instruction.....	125
3.5.7 Flag.....	127
4 Logical Control Function Block Library.....	129
4.1 HVFC Valve Function Block with OFF in Priority.....	129
4.1.1 Parameter Description.....	129
4.1.2 Mode Description.....	132
4.1.3 Alarm Enabling Settings.....	135
4.1.4 Panel Parameter Instruction.....	136
4.1.5 Flag.....	138
4.2 HVFO Valve Function Block with ON in Priority.....	138
4.2.1 Parameter Description.....	139
4.2.2 Mode Description.....	142
4.2.3 Settings for Enabling Alarms.....	144
4.2.4 Panel Parameter Instruction.....	145

4.2.5 Flag.....	147
4.3 MOT Motor Control Function Block.....	148
4.3.1 Parameter Description.....	148
4.3.2 Mode Description.....	153
4.3.3 Settings for Enabling Alarms.....	156
4.3.4 Panel Parameter Instruction.....	157
4.3.5 Flag.....	159
4.4 CNT Counter Function Block.....	160
4.4.1 Parameter Description.....	160
4.4.2 Working Mode.....	163
4.4.3 Settings for Enabling Alarms.....	164
4.4.4 Panel Parameter Instruction.....	165
4.4.5 Flag.....	167
4.5 DOBX Function Block.....	167
4.5.1 Parameter Description.....	167
4.5.2 Panel Parameter Instruction.....	169
4.5.3 Flag.....	170
4.6 DOS Feeding Control Function.....	171
4.6.1 Parameter Description.....	171
4.6.2 Working Status.....	175
4.6.3 Control of Logic.....	176
4.6.4 Settings for Enabling Alarms.....	180
4.6.5 Panel Parameter Instruction.....	181
4.6.6 Flag.....	183
5 Analog Processing Function Block Library.....	184
5.1 PVBX Function Block.....	184
5.1.1 Parameter Description.....	184
5.1.2 Panel Parameter Instruction.....	188
5.1.3 Flag.....	192
6 Logical Operation Function Block Library.....	194
6.1 PVDIBX Function Block.....	194
6.1.1 Parameter Description.....	194
6.1.2 Panel Parameter Instruction.....	195

6.1.3 Flag.....	197
7 Revision.....	199

1 Preface

The Toolkit function library is developed based on specific control functions and is included in the SUPCON High-performanceHMI control function block library, including IO processing, PID control, switching control and some other commonly used control functions. The application of Toolkit function library can significantly improve the efficiency of project implementation, save the time of project configuration, function testing and on-site debugging, thereby reducing customer input.

2 Overview

This section describes the work mode, data type, parameter type and other options of the toolkit function block.

2.1 Work Mode of Function Block

There are 10 work modes for function block, from high priority to low priority: OOS (out of service), IMAN (initial value), LMAN (Interlock manual)/ LTR (Interlock Tracking), TR (Tracking), ROUT (Remote Manual), RCAS (Remote Cascade), MAN (manual)/AUTO (automatic)/CAS (cascade).

Six running statuses are mutual exclusive and a function block is only in one status.

Function blocks can be set 7 work modes: OOS (out of service), TR (track), ROUT (Remote Manual), RCAS (Remote Cascade), MAN (manual), AUTO (automatic), CAS (cascade). IMAN, . LMAN, LTR modes cannot be chosen.

It's noted that the priority sequence is under the condition that the override function isn't enabled. After the override function is enabled, MAN/AUTO/CAS priority is higher than ROUT and RCAS.

SWOOS	BKIN-ERR	SWIK	SWTR	SWROUT	SWR-CAS	SWMAN	SWAUTO	SWCAS	Mode	Priority
ON	-	-	-	-	-	-	-	-	OOS	1
OFF	ON	-	-	-	-	-	-	-	IMAN	2
OFF	OFF	1	-	-	-	-	-	-	LMAN	3
OFF	OFF	2	-	-	-	-	-	-	LTR	3
OFF	OFF	Non 1/2	ON	-	-	-	-	-	TR	4
OFF	OFF	Non 1/2	OFF	ON	-	-	-	-	ROUT	5
OFF	OFF	Non 1/2	OFF	OFF	ON	-	-	-	RCAS	6
OFF	OFF	Non 1/2	OFF	OFF	OFF	Rising Edge	-	-	MAN	7
OFF	OFF	Non 1/2	OFF	OFF	OFF	-	Rising Edge	-	AU-TO	7
OFF	OFF	Non 1/2	OFF	OFF	OFF	-	-	Rising Edge	CAS	7

2.1.1 OOS (Out of Service)

When the function block is in OOS status, calculation is stopped and output is kept the set value (previous period or security value). However, data multicast, parameter validity check and redundancy process proceed forward. When the function block is downloaded first time, OOS status is suggested.

2.1.2 Initial Status (IMAN)

The function block is in initial status when conditions below are reached:

- When AO function block connected with pre-positive control function block is in manual, track or AO tag fault status, pre-positive control function block is in initial status.
- When two control function blocks are constructed cascaded loop, if postposition is in non-cascade status, pre-positive control function block is in initial status.

When a function block is in initial status, its output tracks inversion calculating input value (BKIN) of the function block. BKIN should be connected with inversion calculating output value (BKOUT) of postposition. In this case, the function block only can be transferred to OOS mode.

2.1.3 LMAN/LTR Modes

Please refer to Figure 3.2 for the fallback process of function block mode (including mode levels). When SWOOS = OFF, BKINERR = OFF, and SWIK = 1, it enters the LMAN mode. The output value $MV = IV$, and the operator cannot perform operations on the panel.

When SWOOS = OFF, BKINERR = OFF, and SWIK = 2, it enters the LTR mode. The output value $MV = IV$, and the operator cannot perform operations on the panel.

The configuration example when used with the PIDBX function block is shown in the figure below.

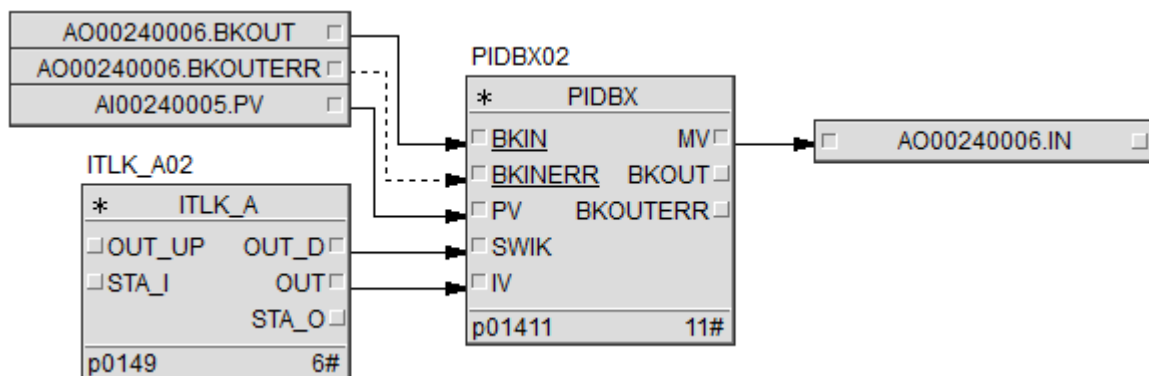


Figure 2.1 Configuration example

2.1.4 Track (TR)

If high priority mode is not achieved, when the track switch SWTR is ON, it is in track mode and output tracks input track value.

SWTR is set by input or output of other function blocks.

2.1.5 ROUT Mode

When the high priority mode is not satisfied, when SWROUT equals ON, it enters remote manual mode and the output changes with the RMV value.

2.1.6 RCAS Mode

When the high priority mode is not satisfied, when SWRCAS equals ON, it enters remote cascade mode and the setting value changes with the RSV value

2.1.7 Manual (MAN)/AUTO/CAS Modes

If higher priority mode is not satisfied, you can switch modes by SWMAN, SWAUTO, SWCAS buttons.

- In the manual mode, the output can be set values manually.
- In the auto mode, the output is calculated and output by the control algorithm.
- In the CAS mode, the setting value equals the cascade setting value and the output is calculated and output by the control algorithm.
- When the RMT_OVRD=ON, the mode of Manual (MAN)/AUTO/CAS Modes is more priority than the ROUT mode and the RCAS mode.

2.2 Active/Inactive

There are two flags for each function block: Input active/Close flag and output active/Close flag. The function block cannot deal with the Active/Inactive flag and the two flags are responded by FBD program. When a function block is in status of input close, all inputs are not updated by program; When a function block is in status of output close, the function block is implemented and output normally. However, its output is not updated to input of postposition function block (output value of postposition function block is not updated by program).

After the function block is downloaded to the main controller, its input and output can be set close in FBD software. In status of input close, input of the function block can be set forced and the function block logic can be debugged, in which way to find out if it is right. In status of output close, the debug does not bump the field.

Note: It may destroy the running process status and the output may be bumped when it is transferred from the close status to the active status. The engineer should select an appropriate time to transfer.

2.3 Data Type

Table 2.1 Data Type Parameter List

Type	Byte	Range of Data	Explain
BOOL	1	ON/OFF	0=OFF, Not 0=ON
USINT	1	0~255	-
SINT	1	-128~127	-
UNIT	2	0~65535	-
INT	2	-32768~32767	-
UDINT	4	0~4294967295	-
DINT	4	-2147483648~2147483647	-
REAL	4	$\pm (\sim 10^{-44.85} \sim 10^{38.53})$	Exponential term is 8 digit, and fraction term is 23 digit
LREAL	8	$\pm (\sim 10^{-323.3} \sim 10^{308.3})$	Exponential term is 11digit, and fraction term is 52 digit

2.4 Parameter Types of Function Block

Function block parameter includes operation parameter, config parameter, supervising parameter, alarm parameter, input pin and output parameter.

- **Operation parameter**
Normally, the function block panels can be used to set parameter while the system is running. Specific to every block, it depends on the working mode of the function block.
- **Config parameter**
Config parameter can be set while FBD programming. While programming, the parameter can be set in the Properties window of the function block.
- **Supervising parameter**
Supervising parameter can be showed by supervising image or panel. Whether to show it or not can be set in the Properties window of the function block.
- **Alarm parameter**
Enable/disable the alarm of all kinds of parameters. It can be selected in the Properties window of the function block.

- Input/ output parameter

To find out the characters which are connected to input/ output pins, refer to line “Link Reference”.



ATTENTION:

Except for config parameter, parameters can be set during debug.
Function block Properties setting interface is divided into Basic Parameters and expansion parameter, for normal PID control there is only need for Basic Parameters setting.

2.5 Function Block Panel

Function block evolves from instrument panel, which includes information list of function block and operation commands of operators. It has three functions: monitor and modify status and parameters of function block, set parameters and operation and switch to different supervision panels.

Only complicated function block (the function block which can be named when configuration) possesses function block panel, does not simple function block.

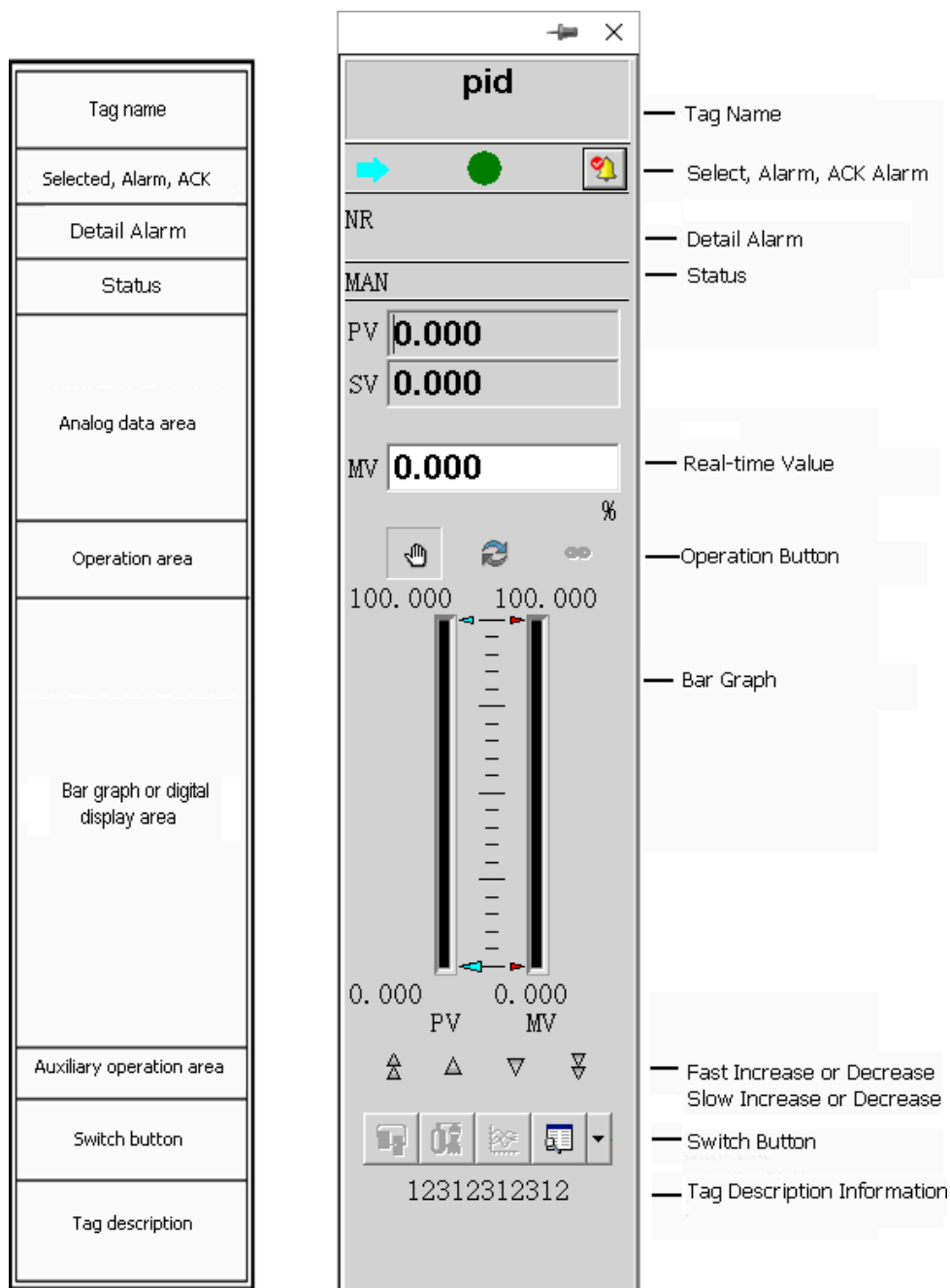




Figure 2.2 Window of panel layout of function block and function block pane

2.5.1 Fixed Button

The button is on the top right of the pop-up panel. When click the button , it will become  and the panel will always be on top.

2.5.2 Close Button

The button ✕ is on the top right of the panel and there is no close button on the panel of control group display.

2.5.3 FB Tag Name

Tag name or instance name of function block will be displayed in the part of tag instance name, which is used to distinguish function blocks.

2.5.4 Selected, Alarm, ACK



Select: Select the panel to be operated currently.



Alarm: Indicate alarm status of the tag which the panel corresponds to.



ACK: Alarm acknowledgement of corresponding tags is implemented.




2.5.5 Detailed Information of Alarm

Display the current alarm information (such as HH, LL and so on) and status (such as manual, auto, cascade and OOS, etc.) of tags or function blocks.

2.5.6 Analog Data Area

Display value and unit of analogy in tag or function block, for example, PV, MV, SV in PID function block.

2.5.7 Basic Operation Area

Basic operation of operators area in tag or function block, which includes manual , auto , cascade , is used to set work status of function block.

2.5.8 Digital Button or Analog Bar Diagram Display Area

- Digital data: display digital value by bottom. Text likes “ON” or “OFF” will be shown on the button. DI and DO button color can be set when configuring tag.
- Analog data: Real-time values of import parameters are dynamically displayed in form of histogram. High and low span values are displayed on two sides of scale. There are also marks of HH Limit, high Limit, low Limit and LL Limit. Color of bar diagram is same with alarm

status of function block or tag. As shown below, the bar diagram is green because their parameter has no alarm.

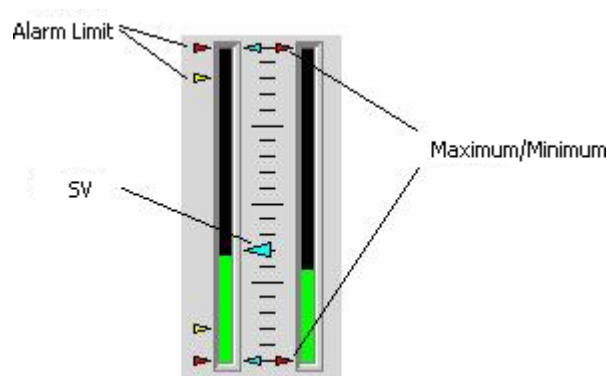






Figure 2.3 Trend display

Color of bar diagram is shown by following rules:

- If tag only has H limit alarm, color of bar diagram is shown as configured in monitoring configuration for H limit alarm.
- If tag has H/ HH limit alarms together, color of bar diagram is shown as configured in monitoring configuration for HH limit alarm.
- Other alarms are also shown in the same manner.

2.5.9 Auxiliary Operation Area

Data can be operated by keyboard besides by basic operation buttons.

1.  Fast-increased button: set the percentage when configuring function block properties. The default value is 2.5%.
2.  Slowly-increased button: set the percentage when configuring function block properties. The default value is 0.25%.
3.  Slowly-decreased button: its value is the same as the slowly-increased value.
4.  Fast-decreased button: its value is the same as the fast-increased value.

2.5.10 Switchover Button Area

There are 5 switchover buttons at the bottom of the panel, from left to right, logic diagram, graphics button, trend display button, Alarm view button and tuning panel:



Figure 2.4 Switchover buttons

- Logic diagram button: Pop up the logic diagram associated with tag (set in VFFBDBuilder). The button will be grey and cannot be clicked if the function block isn't configured in logic diagram.
- Graphics button: Pop up graphics associated with the tag (set in supervision configuration). The button will be grey and cannot be clicked if the function block isn't configured in graphics.
- Trend display button: Pop up trend display associated with the tag (set in supervision configuration). The button will be grey and cannot be clicked if the function block isn't configured in trend.
- Adjust screen button: the adjust screen pops up.
- Drop-down button: Click to select the screen you want to view in the extended menu.
 - Select "Alarm Screen" to jump to the process alarm associated with this tag.
 - Select Operation Log to jump to the operation log associated with this tag.

2.5.11 Tag Description

Display description information of the tag or function block. It includes 64 English characters.

2.5.12 Operation Authority of Panel

There are operation authorities for each parameter in panel or tuning panel, which can be set in panel authority setting of supervision configuration software.

The authorities includes observer, operator-, operator, operator+, engineer-, engineer, engineer+, privilege-, privilege, privilege+.

2.5.13 Operator Keyboard Operation

Some parameters can be operated by operator keyboard:

DO digital operation, fast-increased and fast-decreased of function block operation



and tuning panel switch.

2.5.14 Function Block Panel Example

PID Tuning Panel is shown as follow.

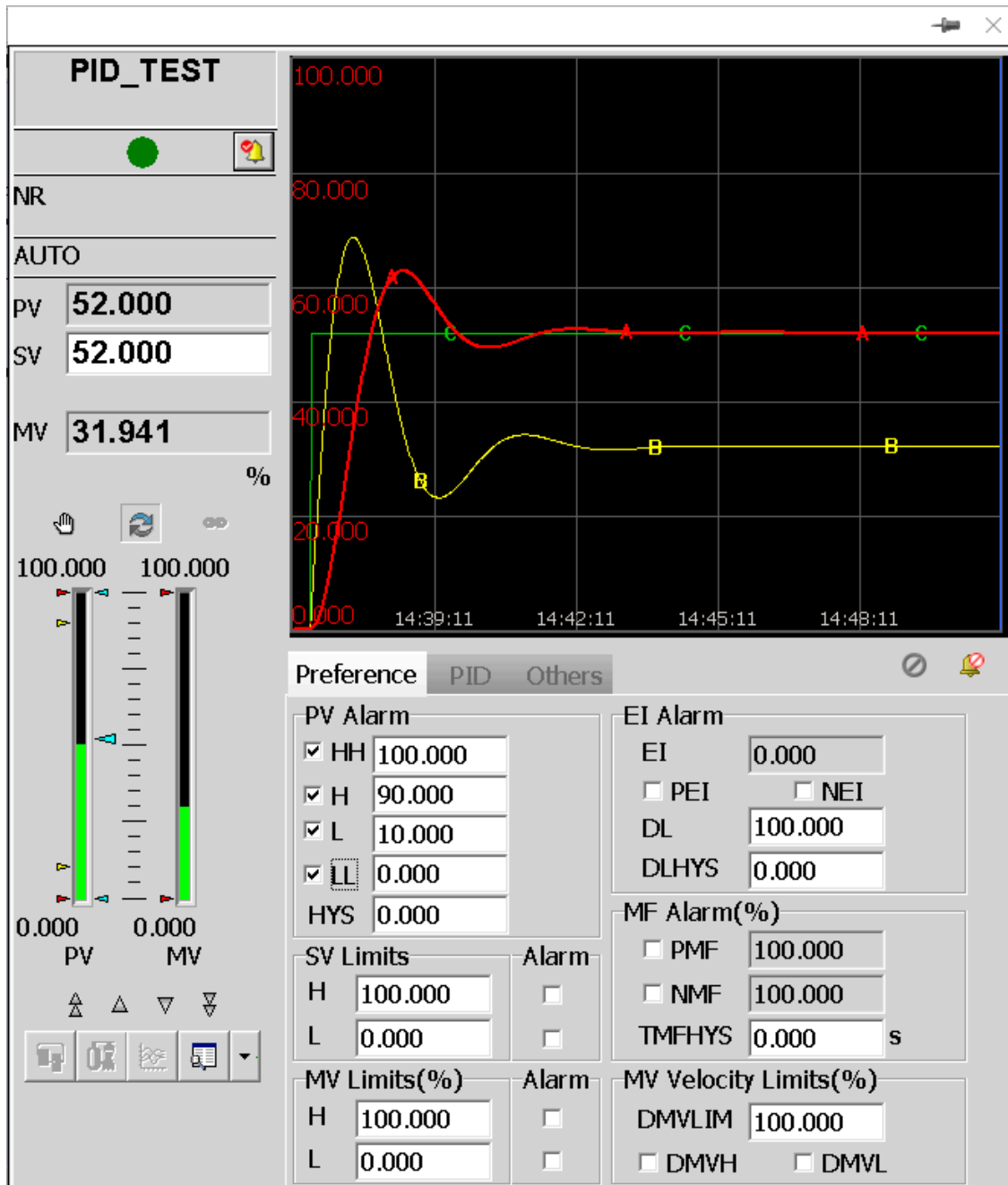





Figure 2.5 PID tuning panel













Main operations can be implemented on function block panel is shown as follows:

1. Status Switch

Click , , , to switch work status. As shown in Figure 2.5 the function block is in the status of auto, and the status area displays "AUTO".

1. Set Value for SV&MV

The value of SV can be set in the status of auto while the value of MV can be set in the status of manual. Two modes of setting value are shown as follows:

- Input the value via keyboard and then press “Enter”.
- Click     to set value. ,  are fast increase button and slow increase button, ,  are fast decrease button and slow decrease button. The fast increase/decrease values are set in the function block properties interface. As default, click  once to increase by 2.5% of range, click  once to increase by 0.25% of range, click  once to decrease by 0.25% of range, click  once to decrease by 2.5% of range.

2. Parameter Setting

- Set parameter via select the “select box” or not.
- Modify parameter value via Input the value and press “Enter”.
- Some parameters such as HH Limit, high Limit, etc, should be selected the “select box” first, and then the corresponding parameter will be modified, as shown in Figure 1-4.

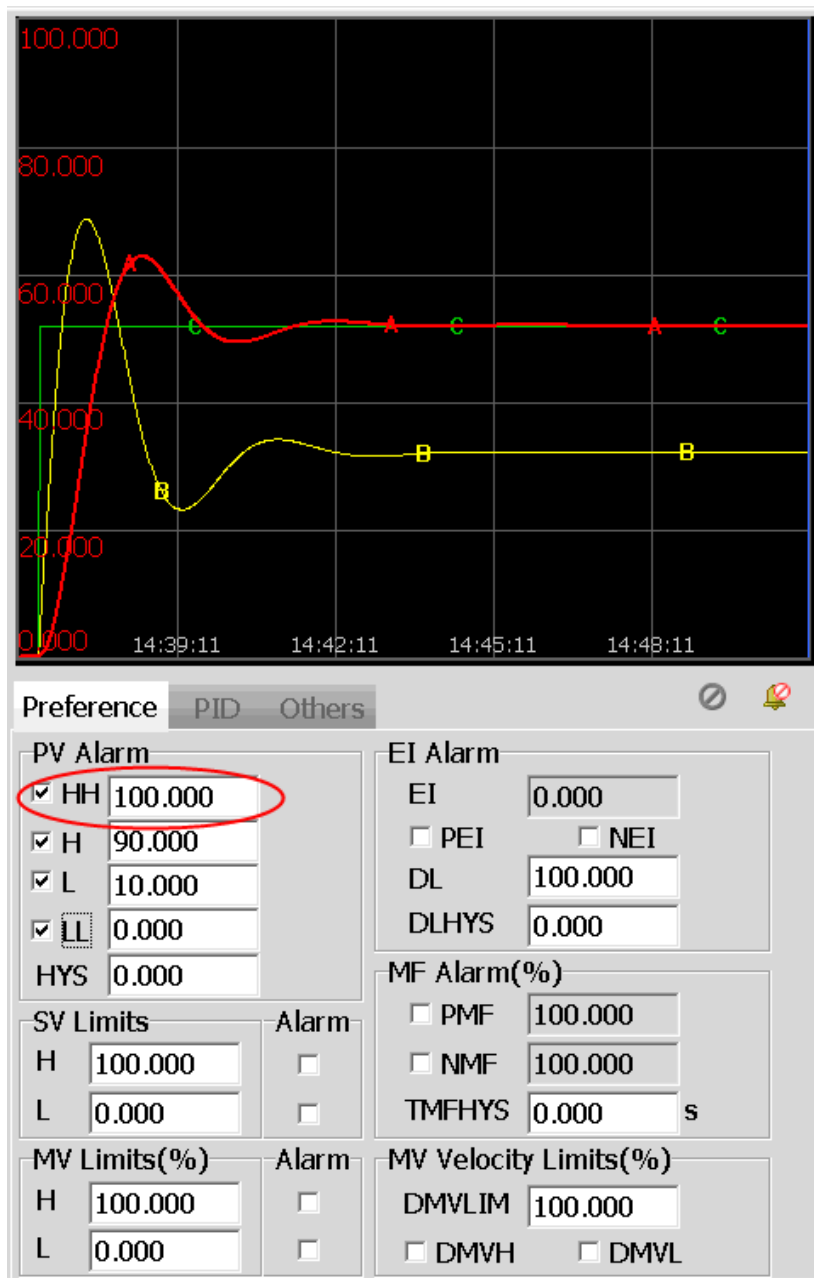





Figure 2.6 Set the HH limit

1. Switchover Window

Click  to switch to corresponding window. Logic diagram should be configured in VFFBDBuilder, and graphics and trend should be configured in VFHMICfg first.

2. Alarm Acknowledgement and Alarm Shield

- Click  to acknowledge alarm.
- Click  to implement alarm shield or cancel alarm shield.

3. Parameter Page Switch

Click **Preference** **PID** **Others** to switch to each parameter page.

4. Trend View

Right-click on the trend display area of function block tuning panel, then implement trend setting in the pop-up right-click menu, as shown in Figure 2.7. The function of commands in right-click menu is the same as the right-click menu in trend display, please refer to *Real-time Supervision Software User Manual* for the corresponding instruction.

Select "Save Custom Page" after setting, then a file (.TCP) named after a tag will be saved.

In custom page of trend, click "Read Page", users can select this file in the pop-up dialog box of "File Selection", and then the trend diagram of this tag can be viewed in custom page.

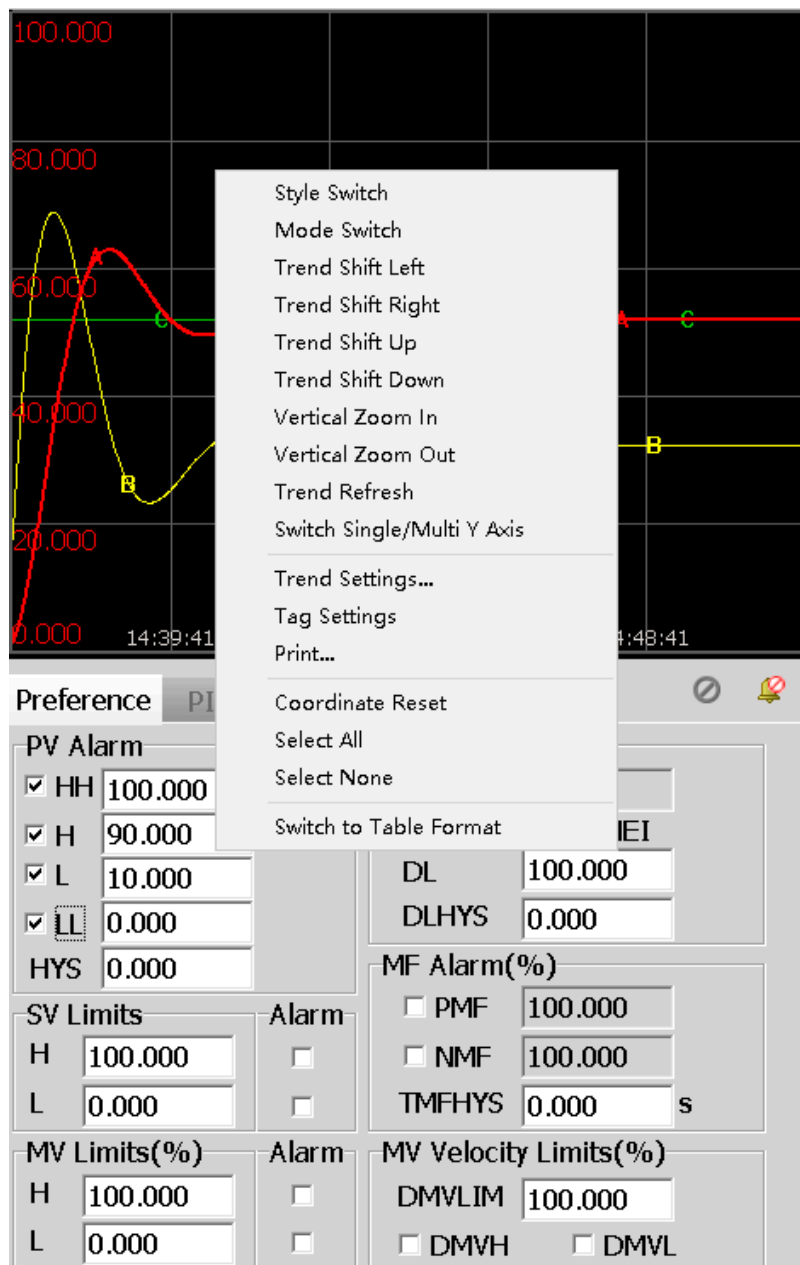


Figure 2.7 Trend view

3 Control Function Block Library

3.1 Control Function Block Application Foundation

The basic work flow of the control function block is shown in Figure 3.1.

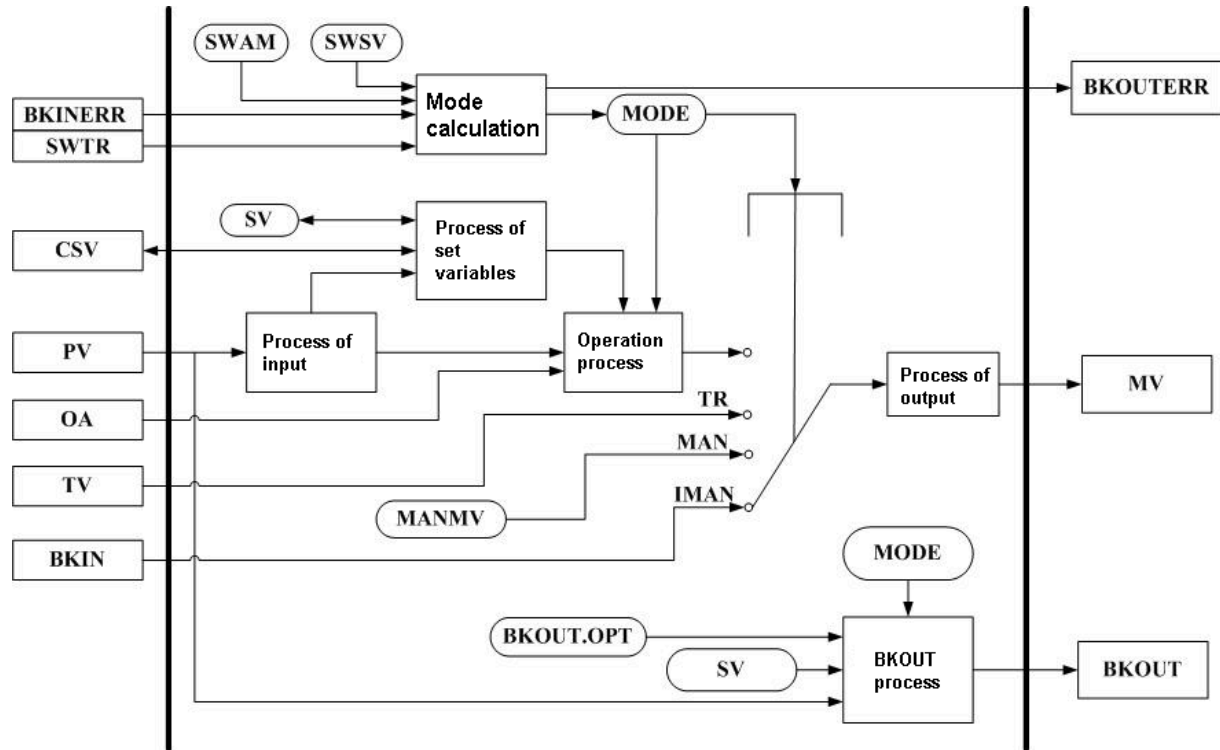


Figure 3.1 Basic work flow of control function block

3.1.1 Mode and Parameter Status (MODE)

Corresponding parameter status in different operation modes is shown in Table 3.1 - represents any status.

Table 3.1 Operation mode list

SWOOS	BKIN-ERR	SWIK	SWTR	SWROUT	SWR-CAS	SWMAN	SWAU-TO	SWCAS	MODE	Prior-ity
ON	-	-	-	-	-	-	-	-	OOS	1
OFF	ON	-	-	-	-	-	-	-	IMAN	2
OFF	OFF	1	-	-	-	-	-	-	LMAN	3
OFF	OFF	2	-	-	-	-	-	-	LTR	3
OFF	OFF	Non-1/2	ON	-	-	-	-	-	TR	4

Table 3.1 Operation mode list (continued)

SWOOS	BKIN-ERR	SWIK	SWTR	SWROUT	SWR-CAS	SWMAN	SWAU-TO	SWCAS	MODE	Prior-ity
OFF	OFF	Non-1/2	OFF	ON	-	-	-	-	ROUT	5
OFF	OFF	Non-1/2	OFF	OFF	ON	-	-	-	RCAS	6
OFF	OFF	Non-1/2	OFF	OFF	OFF	Rising Edge	-	-	MAN	7
OFF	OFF	Non-1/2	OFF	OFF	OFF	-	Rising Edge	-	AUTO	7
OFF	OFF	Non-1/2	OFF	OFF	OFF	-	-	Rising Edge	CAS	7

1. Operation Mode

- OOS

The output value MV is configured according to OOS_OPT in this mode. Choose to hold output or output OOSVAL safe value.

- Initial mode (IMAN)

When feedback value and feedback status of downstream function block are connected to BKIN and BKINERR, output will be updated according to BKOUT value of downstream function block.

Only when BKINERR1= ON and BKINERR2= ON for split control (SPLIT), function block is in IMAN mode.

- LMAN Mode/LTR Mode

Under this mode, the output value tracks the changing of OUT and the operator cannot do any action in this process on the panel.

- Track (TR)

When the function block is in track mode, output is equal to the track input value TV.

Output MV is still limited. If TV value is over limit, it will be in the limit range. If TV is less than MV_L, MV is equal to MV_L. If TV is greater than MV_H, MV is equal to MV_H.

- Remote Manual Mode

The output changes with the RMV value.

- Remote Cascade Mode

The setting value changes with the RSV value.

- Manual (MAN)

Set values manually, when MV=MANMV, while the output MV is limited.

- Auto (AUTO)

Output is output after the control algorithm. In the AUTO mode, BKOUTERR=OFF. In other modes, BKOUTERR=ON.

- Cascade (CAS)

The setting value equals cascade setting values and the output is output after the control algorithm.



TIP:

details of operation mode refer to "Work Mode of Function Block".

2. Function Block Mode Switching

Function block fallback can be divided to manual fallback and automatic fallback, manual fall back can be set as default. The backup operation mode (IMODE) corresponding to each operation mode (MODE) is only a reference for field operator.

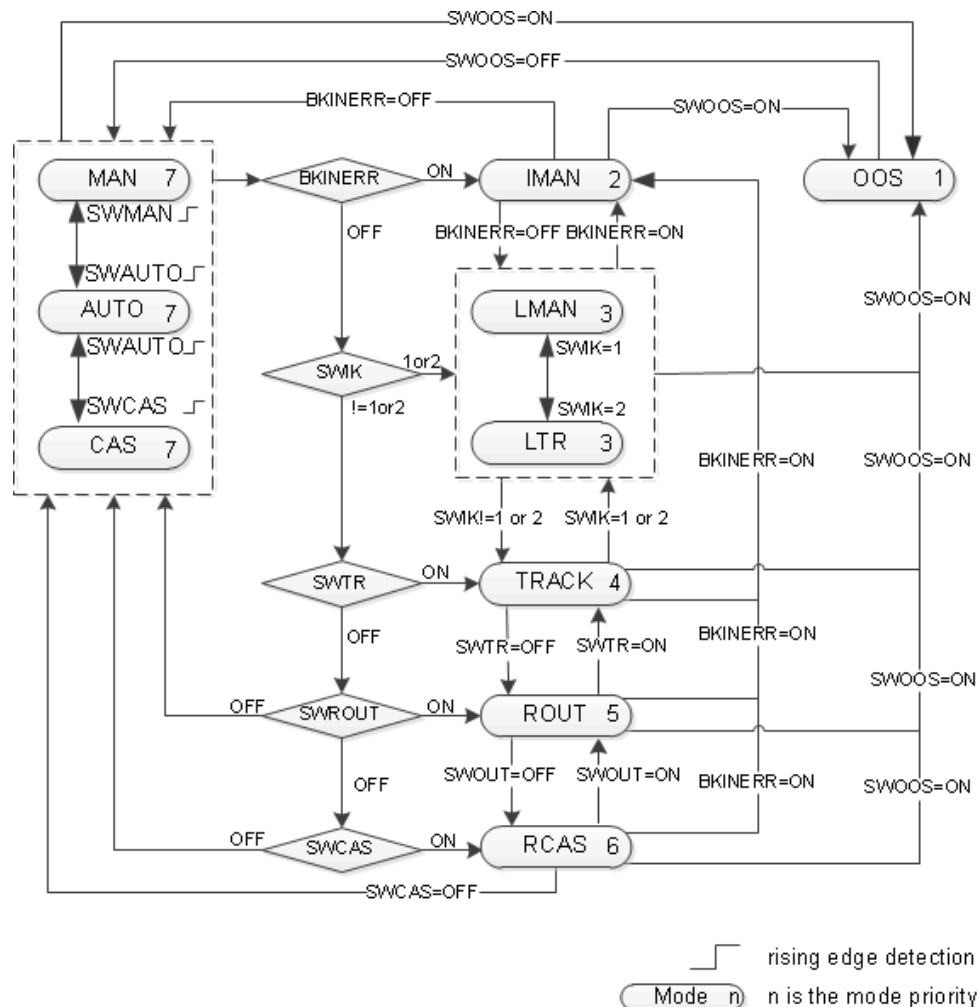


Figure 3.2 Mode of control function block

3.1.2 Input Process

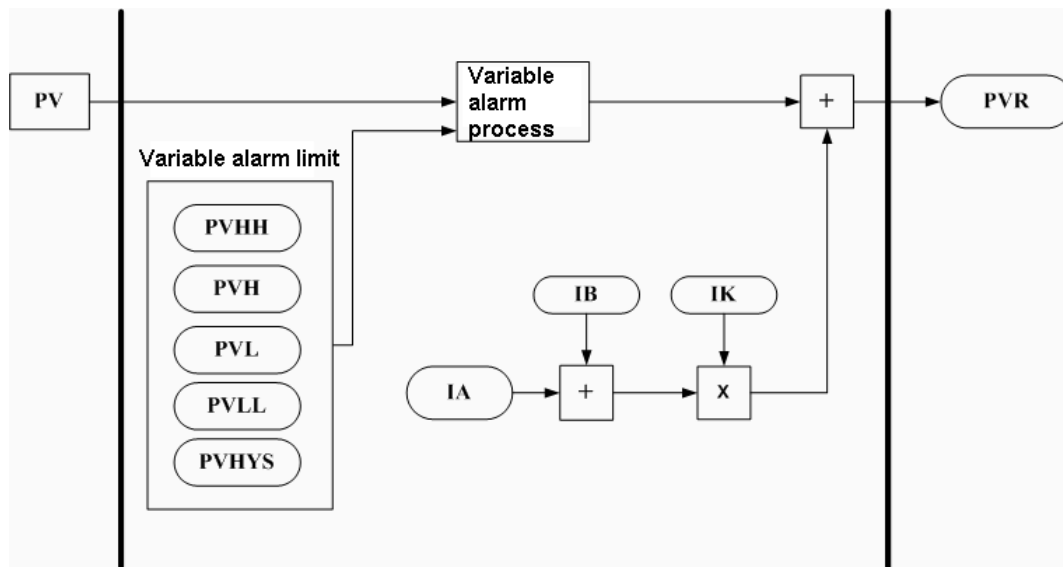


Figure 3.3 Input process of control function block

1. Process variable alarm

There are four limit alarm for process input variables: HH limit alarm (PVHH), high limit alarm (PVH), low limit alarm (PVL) and LL limit alarm (PVLL), which are hysteresis. When PV is greater than or equal to PVHH, HH limit alarm and high limit alarm are generated; When PV is greater than or equal to PVH, high limit alarm is generated; When PV is less than PVL, low limit alarm is generated; When PV is less than or equal to PVLL, LL limit alarm and low limit alarm are generated.

Following conditions should be reached for these four values: $PVHH - PVHYS \geq PVH$, $PVH - PVHYS > PVL + PVHYS$, $PVL \geq PVLL + PVHYS$.

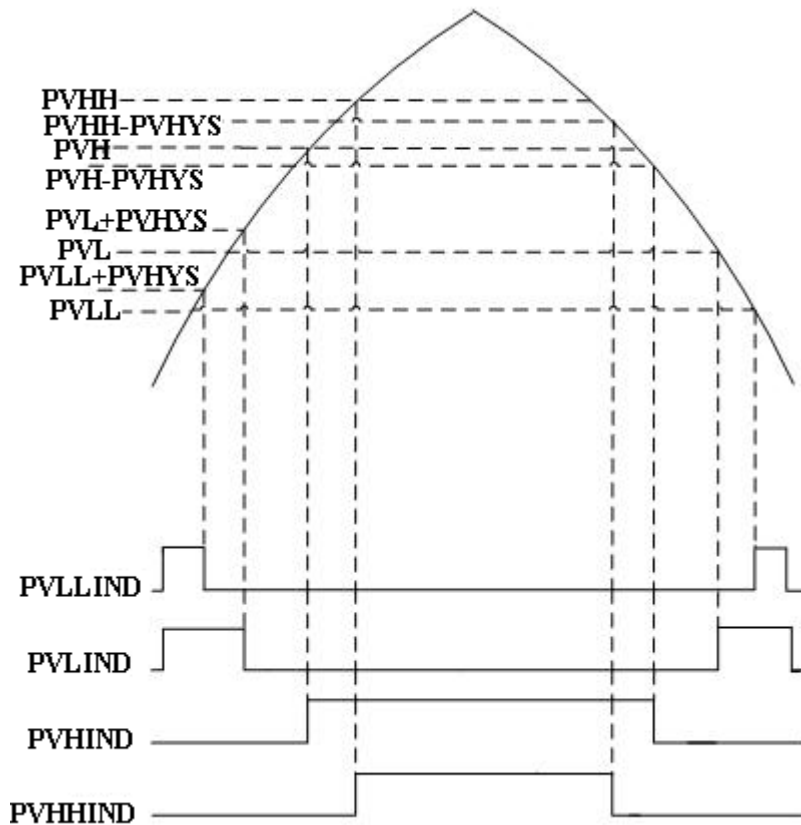


Figure 3.4 Alarm process of control function block

2. Input Compensation

Input compensation is used to add compensation value derived outside to input signal PV operated by control function block. The expression is:

$$PVR = PV + IK(IA + IB)$$

Input compensation is used to improve controllability of process with long deadband.

3. Check Validity

Note: Only function blocks PID, PIDEX and PIDEP have the function.

Check the validity of PV after input compensation, which can exclude the PV noise signal caused by transducer disturbance and signal transmission interference.

Enable the function via SWPV. If PV exceeds the check limit PVLMT after compensation of this and last periods, and it happens for the first time continuously, this period is applied for holding PV in PID calculation. There will be no filter after exceeding once continuously because the signal may change quickly.

3.1.3 Set Variable Process

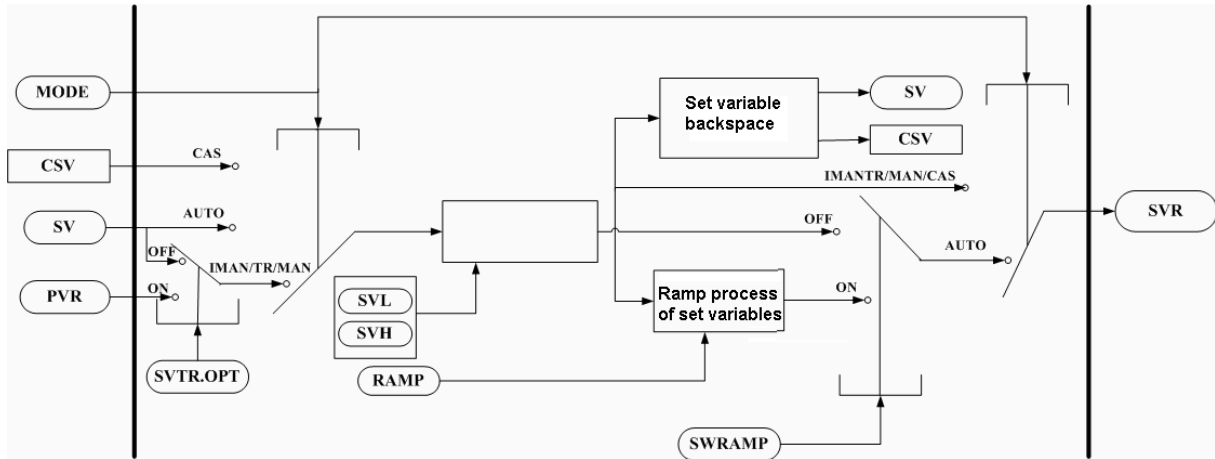


Figure 3.5 Set variable process of control function block

1. Set variable track

When the control mode is transferred from manual mode to auto mode or from track mode to auto mode, there may be huge error, which cause MV fluctuate to bump. Therefore, in manual or track mode, forced SV tracks change of PV after output compensation (PVR), which can avoid bumping when the control mode is transferred from manual mode to auto mode and from track mode to auto mode.

In the cascade control loop, the master loop can run in auto or cascade mode. If the slave loop is transferred from cascade mode to auto mode, the cascaded loop is open, the master loop is in IMAN mode and the slave loop can be controlled separately. In this case, SV of the master loop can be consistent with PV by tracking PV.

Whether process value is tracked by set value can be selected by SVTR_OPT: When SVTR_OPT is ON, track; When SVTR_OPT is OFF, not track. When it is in not track mode, there is slight bump, transferring from manual to auto.

If PVR is over SVH and SVL, SV is equal to range limit and not equal to PVR.

2. Set value limit and alarm

High limit of set value (SVH) must be greater than or equal to low limit of set value (SVL). Otherwise, limit will not be processed and configuration error alarm (CFGERR) will be generated.

The set value SV is limit between high limit of set value SVH and low limit of set value SVL. When the set value is out range of SVH and SVL, it is set as high limit or low limit and an alarm is generated. If SVH is less than SVL, SV maintains the value of last period. Similarly, in mode of cascade, if CSV is between SVH and SVL, SV is equal to CSV. If CSV is greater than SVH, SV is equal to SVH. If CSV is less than SVL, SV is equal to SVL; If SVH is less than SVL, SV maintains the value of last period.

3. SV and CSV

There are two set values in the control function block, SV and CSV. When one is used, the other will be consistent with this.

4. Ramp action of set value

Ramp action of set value indicates that in auto or cascade mode, when the set value is changed, the set value inclines to SV according to the set ramp RAMP and RAMP is in unit of second. Ramp action of set value is enabled or disabled by switch SWRAMP. When SWRAMP is ON, ramp action of set value is enabled; When SWRAMP is OFF, ramp action of set value is disabled.

3.1.4 Operation Process

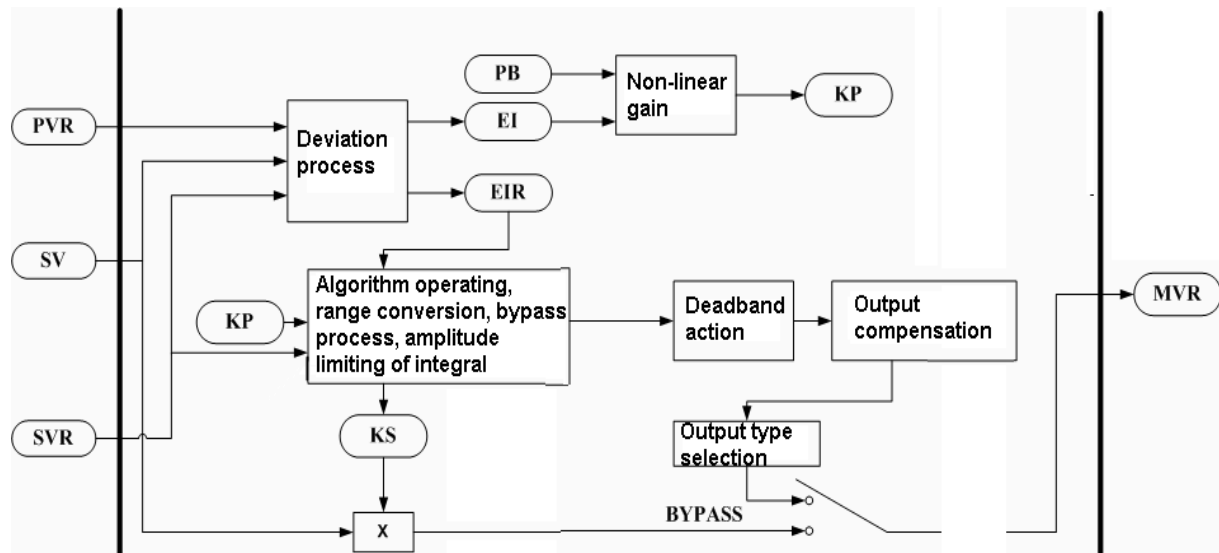


Figure 3.6 Operation process of control function block

1. Nonlinear gain

The function of nonlinear gain can process processes with nonlinear gain by providing a gain contrary to the process, for example, PH control, its process gain will become very big near the target value.

The actual proportion gain KP can be gained by revising proportion gain $100/PB$ nonlinearly (PB cannot be less than 0.1).

The function block provides two kinds of nonlinear gain, including gap action and EI square action.

- Gap action

When deviation EI is in the set nonlinear gain range GW, whose range is [SCSCL-SVSCH], the actual proportion gain KP is $100.0/PB \times KN$, KN is gain factor whose valid range is [0.0, 1.0].

When deviation EI is out of the nonlinear gain range GW, the actual proportion gain is

$$KP=[1-(1-KN)*\frac{GW}{|EI|}]*100.0/PB$$

- El square action

When deviation EI is in the set nonlinear gain range GW, the actual proportion gain is

$$KP = \frac{|EI|}{GW} * 100.0 / PB$$

When deviation EI is out nonlinear gain range GW, the actual proportion gain KP is 100.0/PB.

Gap action (NGN_OPT=ON) and EI square action (NGN_OPT=OFF) can be selected by the nonlinear gain option parameter NGN_OPT.

2. Deviation deadband action

Some process control system, such as tank level control system, is not required to control the tank level at the set value accurately and the tank level can change in the set range. In this case, deviation deadband action is introduced to avoid adjustment valve acting frequently and system oscillation.

When absolute value of deviation EI between SV and PV is less than deviation deadband DB minus lag value DBHYS, dMV is set 1 (except PD_SI block, MV is set 0) and output value MV is not changed (if DB is equal to DBHYS, dMV is not 0 for the action of deviation deadband); When deviation EI is greater than DB, the deadband action is disabled and output value is added dMV, shown as Figure 3.7.

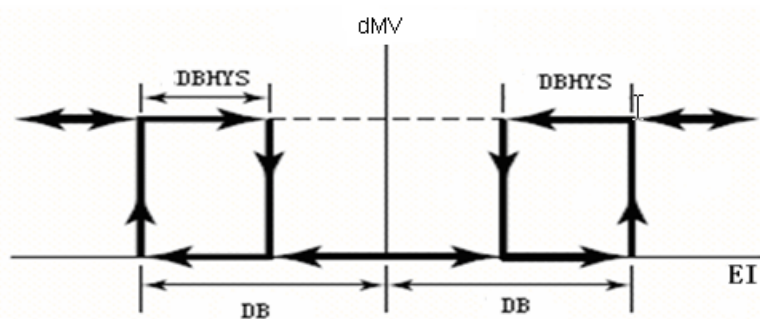


Figure 3.7 Deviation deadband action

When the deviation deadband action switch SWDB is ON, deviation deadband action is enabled. When SWDB is OFF, deviation deadband action is disabled.

3. Bypass action

Bypass action is available only in auto or cascade mode.

When STOPI is ON, integral action is unavailable. Only PID, PI_PLS and PI_AE function block have integral stop function.

When STOPP is ON, integral action is not available.

When bypass output is calculated (BYPASS=ON), output $MV = (SV - SVSCL) \times \text{range conversion coefficient} + MVSCL$.

SV——Set value

SVSCL——Low limit of set value range,

MVSCL——Low limit of output value range.

4. PID single function stop

When STOPI = ON, the integral action is not executed, function blocks PID, PI_PLS, PI_AE, PIDEX, PID_TP, LEPID and PIDEP have the integral stop function.

When STOPP = ON, the proportional action is not executed.

When TD is 0, the derivative action is disabled.

Similarly, P, I action controlled in PI_PLS and PI_AE can be disabled. P, D action controlled in PD_SI can be disabled. Bypass action of function blocks is available only in the control calculation stage and does not affect these values in the holding stage.

5. Deviation process

- Direct or reverse action

When set value SV is fixed and direct action is available, increment of PV will cause MV value to increase; when reverse action is available, increment of PV will cause MV value to decrease. Direct action (SWPN = OFF) and reverse action (SWPN = ON) can be selected by parameter SWPN.

When direct action is available:

$$EI = PV - SV;$$

When reverse action is available:

$$EIR = SVR - PVR;$$

- Deviation alarm

When absolute value of deviation EI is greater than absolute value of set value of deviation DLp, deviation alarm is generated. When EI is greater than DL, positive deviation alarm (PEI) is generated. When EI is less than - DLp, negative deviation alarm (NEI) is generated. There is alarm deadband action (DLHYS) when deviation is recovered, shown as Figure 3.8.

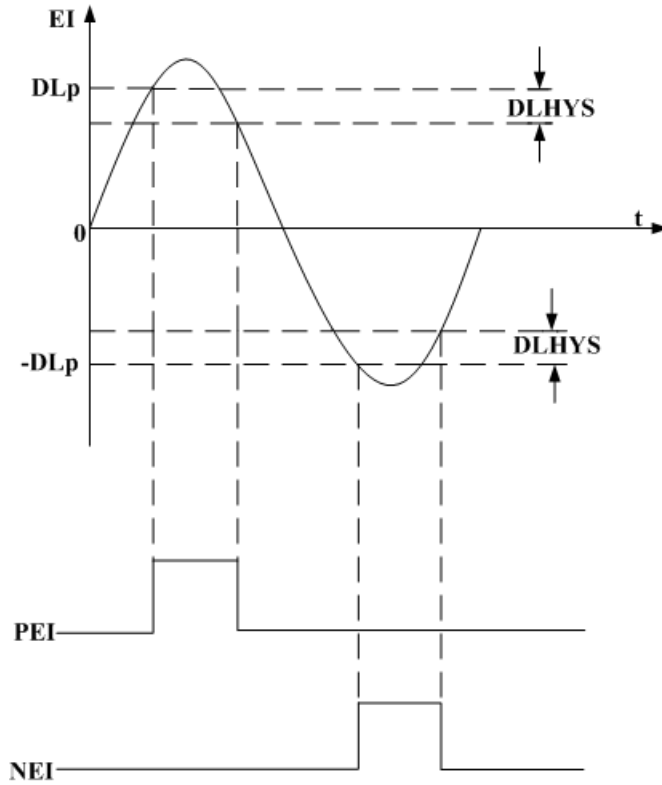


Figure 3.8 Error alarm process

In order to avoid deviation alarm caused by mutation of set value, the value r got by filtering the set value is used as compensation coefficient of deviation alarm set value (DL). Deviation set value compensated (DLp) is deviation alarm set value DL adding compensation coefficient r , shown as Figure 3.9.

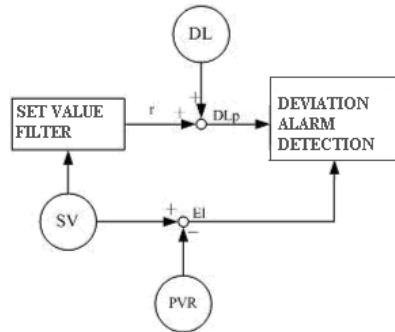


Figure 3.9 Diagram of deviation alarm

$$r(s) = \frac{K_{SV} * T_{SV} s}{1 + T_{SV} s} * SV(s)$$

Expression of set value filter:

$$r_n = \frac{K_{SV} * T_{SV} (SV_n - SV_{n-1}) + T_{SV} * r_{n-1}}{T_s + T_{SV}}$$

Expression after discretion:

6. Output compensation

Output compensation is used to add the compensation value got outside to the output signal MV calculated by the control block. Expression: $MV = MV_0 + OK(OA + OB)$.

Output compensation is mainly used to add feedforward signal to output signal to achieve feedforward function.

7. Control output

Increment dMV output in this period is got by PID calculation. dMV should be converted to the actual output value MV in this period. There are commonly two output modes: increment and position.

- Increment

New output value is got by adding increment dMV of the current output value to feedback input BKIN. Expression: $MV = dMV + BKIN$.

- Position

New output value MV is got by adding increment dMV of the current output value to output value LMV of last time. Expression: $MV = dMV + LMV$.

Output mode option OUT_OPT: when OUT_OPT is OFF, position output is selected.

When OUT_OPT is ON, increment output is selected.

8. Range conversion

For general control function block, set value commonly has the same range as process value and output value is in another range. Because range is inconsistent, the input range should be mapped to the output range. The mapping coefficient is called range conversion coefficient KS.

Expression:

$$K_s = \frac{MVSCH - MVSCL}{SVSCH - SVSCL}$$

If process value is PV, the PV is mapped to MV. The value is equal to:

$$MV = (PV - SVSCL) \times KS + MVSCL$$

For ratio function block, because SV is conversion coefficient, SV is not required to converse range. Only process value PV is converted range.

9. Integral limit action

In control calculation of PID, PI_PLS, PI_AE, PIDEX, PID_TP, LEPID and PIDEF, the integral item is the integral of deviation for time, the integral saturation is easily caused, and the control results may cause overshoot and lead to unsteady process. The integral limit action is used to limit the integral item and prevented from the integral saturation.

BKIN and RRL are used to updating calculation to dMV. When MV is limited to between MVH and MVL, integral limit action acts on integral item of MV' of before amplitude limiting.

$$dMV_n = dMV_{n0} + \frac{\Delta T}{T_i} (BKIN - RRL - MV'_{n-1})$$

dMV_{n0} : operating output gain value (before updating) in PID, PI_PLS, PI_AE calculation

MV'_{n-1} : operating output value (before output amplitude limiting) in last time calculation.

3.1.5 Output Process

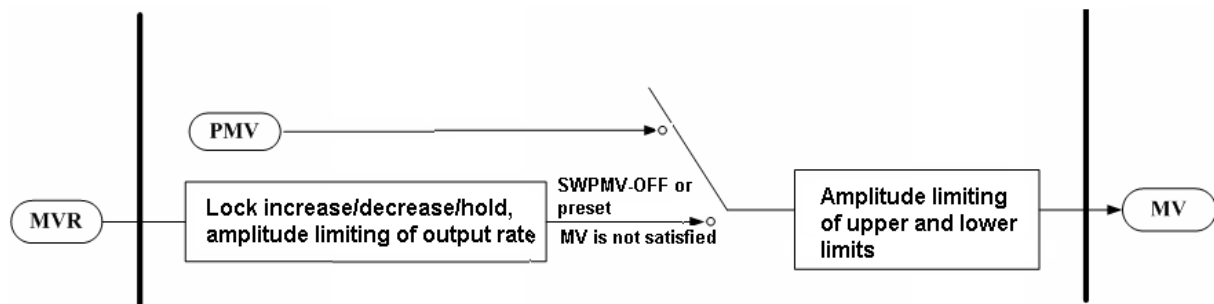


Figure 3.10 Output process of control function block

1. Preset MV process

If mode of last period is OOS, IMAN, TR, MAN and mode of this period is AUTO or CAS and SWPMV = ON, MV = PMV. In this case, MV velocity alarm, lock increase/decrease/maintain are unavailable.

If mode of last period is not MAN mode and mode of this period is MAN mode and SWMMV = ON, MV = MMV.

2. Output limit and alarm

When output value is over its limit, the output is limited, and alarm is generated. High limit of output limit (MVH) must be greater than or equal to low limit of output limit (MVL). Otherwise, output limit alarm is disabled and the configuration error alarm (CFGERR) is generated.

Output maximum MVH must be less than $\text{HORLIM} \times (\text{MVSCH} - \text{MVSCL})/100 + \text{MVSCH}$ and output minimum MVL must be greater than

$\text{MVSCL} - \text{LORLIM} \times (\text{MVSCH} - \text{MVSCL})/100$.

3. Output velocity limit and alarm

When change velocity of output is over change limit, the output is limited, and alarm is generated. Velocity limit is only available in mode of auto and cascade. In mode of auto and cascade, when change velocity of output MV is over velocity limit DMVLIM, an alarm is generated. When the velocity increased of MV is over DMVLIM, positive velocity alarm is generated, i.e., DMVHIND = ON; When the velocity decreased of MV is over DMVLIM, negative velocity alarm is generated, i.e., DMVLIND = ON. When the velocity is over limit, output is increased or decreased according to the velocity limit.

4. Lock increase/decrease/maintain (invalid for RATIO and split control)

In the mode of auto and cascade, lock increase/decrease can be implemented for MV.

- Lock increase

When SWING = ON, lock increase. Output MV cannot be increased.

- Lock decrease

When SWDEC = ON, lock decrease. Output MV cannot be decreased.

- Output maintain

In the mode of auto and cascade, when HOLD is equal to ON, output is maintained.

3.1.6 Integral Removing

The purpose of introducing integrals in ordinary PID control is mainly to eliminate static errors and improve control accuracy. However, when the controlled object starts, stops, or greatly increases or decreases the set value, the system outputs a large deviation in a short time, which will cause the integral of the PID operation to accumulate. Accumulation of the integral will cause the data to overflow, so that the control amount exceeds the limit control amount corresponding to the maximum range of motion that the device may allow, which eventually causes a large overshoot of the system and even causes a large oscillation of the system.

The basic principles of integral separation are:

- When the deviation between the measured value and the set value is large, the integral action is canceled to avoid the stability of the system being reduced due to the integral action, and avoid a large oscillation due to the increased overshoot amount.
- When the measured value is close to the given value, the integral action is introduced to eliminate the static error and improve the control precision.

The specific working process of the integral separation is:

1. Set the threshold EA according to the actual situation. If $EA \neq 0$, the integral separation works.
2. If $| \text{Deviation} | > EA$, the integral is removed and only the PD control is performed. At the same time, the proportional coefficient KP is corrected according to the set-well proportional correction value DK, and the corrected proportional coefficient is $KP = KP + DK$.
3. If $| \text{deviation} | \leq EA$, the integral shall be added and PID control is performed.

The flow of the integral separation is shown in the figure below, where $| \text{deviation} |$ = the absolute value of the difference value between the given value and the measured value.

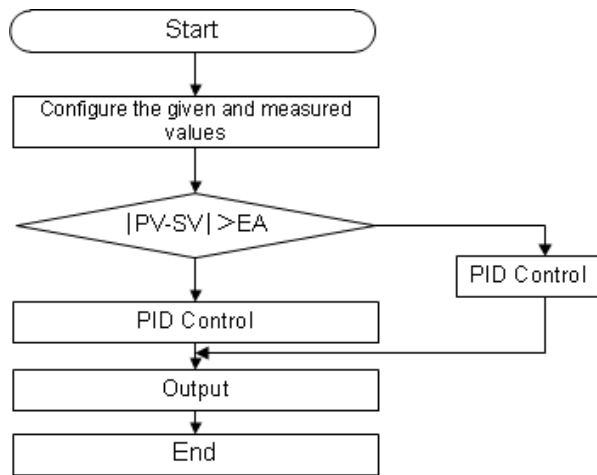


Figure 3.11 The workflow of integral separation

3.1.7 Alarm

1. Enabling alarm and alarm indication

- Enabling alarm

Alarms can be enabled by ENALM. The type of ENALM is ALMTYPE. For example, PID function block can be set initial value of alarm enabled under "Function block properties/Alarm Enabled and Suppress", shown as Figure 3.12.

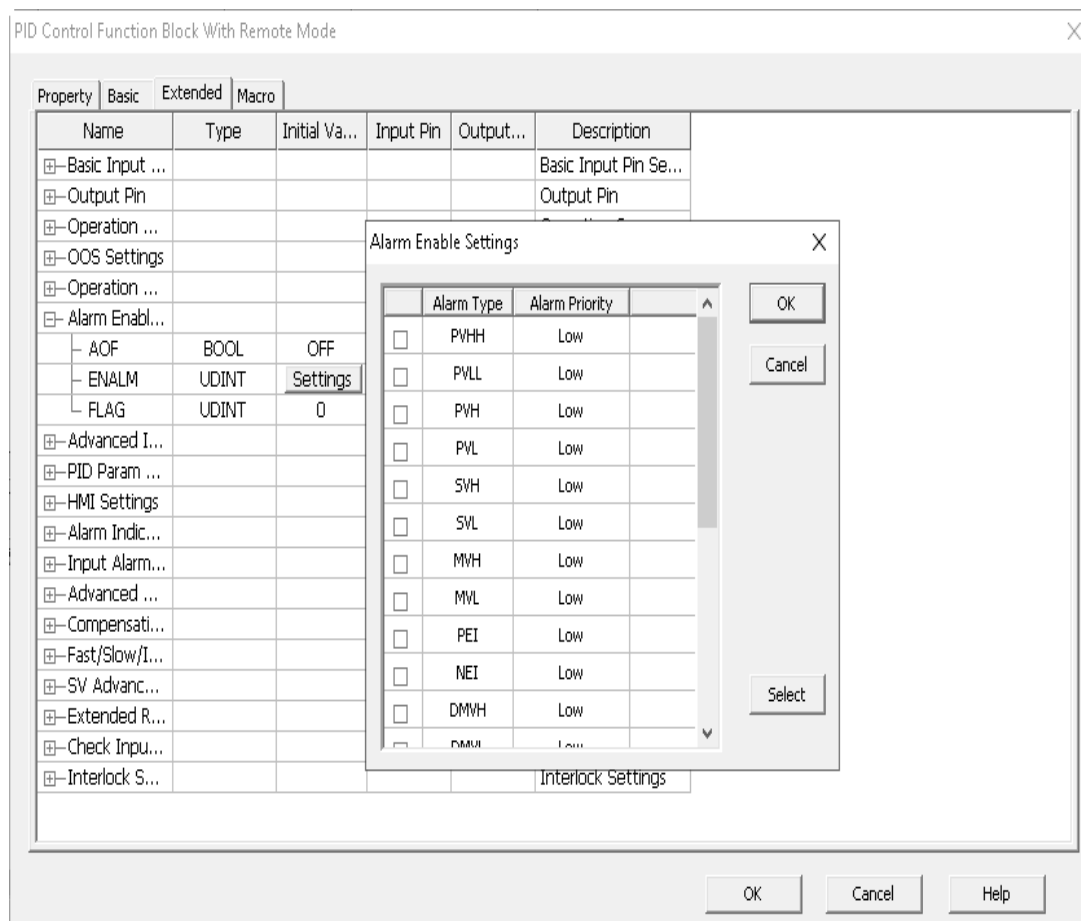


Figure 3.12 Alarm enable setting

When an alarm is selected, the alarm is enabled. The alarm not selected will be shielded.

When the function block is debugged, the alarm enabled option can be modified in real time under "Function Block Parameter Debug", shown as Figure 3.13.

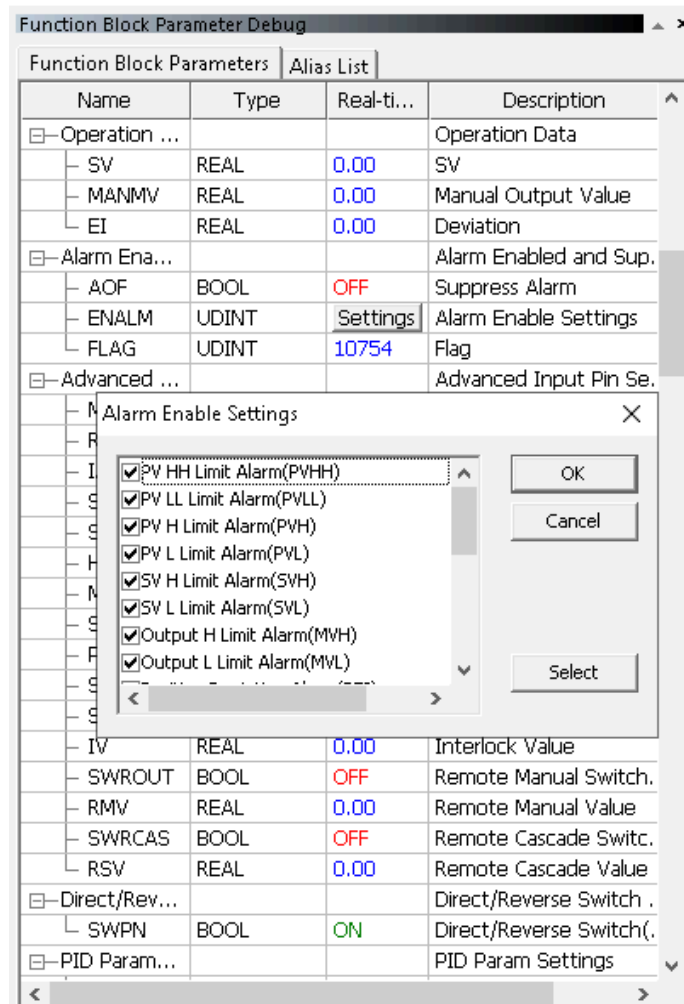


Figure 3.13 Modify alarm enable

- Alarm indication

The parameter Alarm in Extended Parameters can be data excerpt. Details of data excerpt refer to the *VFFBDBuilder User Manual*.

You can debug the alarm parameters in the debugging mode as shown in Figure 3.14.

Name	Type	Real-ti...	Description
Basic Input...			Basic Input Pin Settings
BKIN	REAL	0.00	Back Calculation Input
BKINERR	BOOL	ON	Back Calculation Input ..
PV	REAL	0.00	Process Value
CSV	REAL	0.00	Cascade Input
TV	REAL	0.00	Track Input Value
SWTR	BOOL	OFF	Track Switch(OFF=Not.
OA	REAL	0.00	Output Compensation .
Output Pin			Output Pin
MV	REAL	0.00	Operation Output Value
BKOUT	REAL	0.00	Back Calculation Output
BKOUT...	BOOL	ON	Back Calculation Outpu.
BK_OPT	BOOL	OFF	BKOUT Value Switch(O.
Operation ...			Operation Command
SWCAS	BOOL	OFF	Cascade Switch(ON=to.
SWMAN	BOOL	OFF	Manual Switch(ON=to .
SWAUTO	BOOL	OFF	Auto Switch(ON=to A..
MODE	USINT	2	Work Mode(1=OOS,2=
IMODE	USINT	4	Standby Work Mode(1=.
LOCK	BOOL	OFF	Mode Lock(OFF=UnLoc.
RMT_O...	BOOL	OFF	Override Remote Mode.
SWPMV	BOOL	OFF	Whether to equal to pr
PMV	REAL	0.00	Preset MV
SWMMV	BOOL	OFF	Whether to equal to pr
MMV	REAL	0.00	Preset MV Value(Swite.
MODE_...	BOOL	OFF	ON=Auto Return, OFF..
OOS Setti...			OOS Settings
SWOOS	BOOL	OFF	Switch of Out of Servic.

Figure 3.14 Alarm Instructions

If the alarm is selected in the panel, when it occurs, it shows in the detail alarm area in the panel, and the real-time value in the function block parameter debug interface shows ON.

2. Flag code parse of general control function block list

Table 3.2 Flag code list

Name	symbols	skewing	PID	PI_PLS	PD_SI	PI_AE	RATIO	SPLIT
FB Disable	OOS	0	√	√	√	√	√	√
Manual Initialization	IMAN	1	√	√	√	√	√	√
Manual	MAN	2	√	√	√	√	√	√
Tracking	TR	3	√	√	√	√	√	√
Automatic	AUTO	4	√	√	√	√	√	√
Cascade	CAS	5	√	√	√	√	√	√

Table 3.2 Flag code list (continued)

Name	symbols	skewing	PID	PI_PLS	PD_SI	PI_AE	RATIO	SPLIT
High Limit Alarm of Output 1	MVH1	8	-	-	-	-	-	√
Low Limit Alarm of Output 1	MVL1	9	-	-	-	-	-	√
High Limit Alarm of Output 2	MVH2	10	-	-	-	-	-	√
Low Limit Alarm of Output 2	MVL2	11	-	-	-	-	-	√
PV HH Alarm	PVHH	8	√	√	√	√	√	-
PV LL Alarm	PVLL	9	√	√	√	√	√	-
PV High Limit Alarm	PVH	10	√	√	√	√	√	-
PV Low Limit Alarm	PVL	11	√	√	√	√	√	-
SV High Limit Alarm	SVH	12	√	√	√	√	√	√
SV Low Limit Alarm	SVL	13	√	√	√	√	√	√
MV High Limit Alarm	MVH	14	√	√	√	√	√	-
MV Low Limit Alarm	MVL	15	√	√	√	√	√	-
Positive Deviation Alarm	PEI	16	√	√	√	√		-
Minus Deviation Alarm	NEI	17	√	√	√	√		-
High/Low Limit Reversal Alarm for Alarm	REVS-CL	18	√	√	√	√	√	√
Alarm for Config Error	CFGERR	19	√	√	√	√	√	√
Alarm for Control Deviation is High	AEH	20	-	-	-	√	-	-
Alarm for Control Deviation is Low	AEL	21	-	-	-	√	-	-
Alarm for MV Velocity High Limit	DMVH	22	√	√	√	√	√	-
Alarm for MV Velocity Amplitude Limiting is Low	DMVL	23	√	√	√	√	√	-

Table 3.2 Flag code list (continued)

Name	symbols	skewing	PID	PI_PLS	PD_SI	PI_AE	RATIO	SPLIT
Valve Position Minus Deviation Alarm	NMF	27	√	√	√	√	-	-
Valve Position Positive Deviation Alarm	PMF	28	√	√	√	√	-	-

3. Alarm for range high/low limit reversal
When $SVSCH < SVSCL$ or $MVSCH < MVSCL$, alarm for range high/low limit reversal (REVSCL) is generated.
4. Alarm for Config Error
When alarm limit of SV or MV is reversed, configuration error (CFGERR) alarm will be generated, limit will not work.
5. Valve position deviation alarm
The proposition is $DVLV = MV - MF$.
If $DVLV < 0$ and absolute value of DVLV is greater than NMFLIM in TMFHYS seconds, NMF alarm is generated.
If $DVLV > 0$ and absolute value of DVLV is greater than PMFLIM in TMFHYS seconds, PMF alarm is generated.

3.1.8 Others

1. BKOUT
When BK_OPT is ON, BKOUT tracks the process value. When BK_OPT is OFF, BKOUT tracks the set value.
2. Fast increase and fast decrease (invalid for RATIO and split control)
There are buttons of fast increase, fast decrease, slow increase and slow decrease on the panel, by which MV or SV can be modified.
 - **MODE = MAN**
In this case, the four buttons on the panel are valid for MV. Value (engineering unit) of fast increase or decrease is equal to $(MVSCH - MVSCL) \times FMV/100$ and value of slow increase or decrease is equal to $(MVSCH - MVSCL) \times SMV/100$.
 - **MODE = AUTO**
In this case, the four buttons are valid for SV. Value of fast increase or decrease is equal to $(SVSCH - SVSCL) \times FSV/100$ and value of slow increase or decrease is equal to $(SVSCH - SVSCL) \times SSV/100$.

The four buttons are invalid in other modes.

3. Select manual and auto signal source and auto and cascade signal source
 Manual and auto signal source can be selected by parameter MAN_OPT. When MAN_OPT is ON, it is controlled by PSWAM. When MAN_OPT is OFF, it is controlled by SWAM.
 Auto and cascade signal source can be selected by parameter SV_OPT. When SV_OPT is ON, it is controlled by PSWSV. When SV_OPT is OFF, it is controlled by SWSV.
4. Decimal digits
 Decimal digits configuration of SVDLEN and MVDLEN referred in the control function block library is used to display data in the function block panel.

3.1.9 PID Parameter Tune

The proportional control is a basic control method and has the control effect corresponding to derivation. PB selection largely affects the control performance of the system. Decrease of PB can improve the control precision, shorten the respond time and speed up the respond action, while reduce the stability. Adjustment for PB should consider these two indexes.

The integral action weakens with the increase of TI. Adding integral control can eliminate the residual error which cannot be eliminated by pure proportional control, while reduce the system stability. PB should be added to keep the original attenuation ratio of system, which will reduce the other control indexes of system. Thus the proportional action should not be added if the attenuation ratio is not the main control index.

Adding differential control can suppress at the moment of fast variation interference for the system and increase its stability. The differential action is strengthened with the increase of the differential time TD. Proper differential action can improve the control quality, while overlarge differential will cause uncontrollable strict shock.

Integral and differential should be used with proportional action.

1. Experience Tune
 It is an actually trial and error of experience. It needs no advance calculation and experiment, while determines a group of control parameter first according to the running experience (shown in Table 3.3), starts the system operation, through observing the transition process curve after adding man-made interference (changing the set value), to change the corresponding control parameter value according to the various effects of different control actions on the transition process, and to perform repeat trial and error till the satisfying control quality is obtained.

Table 3.3 Experience data for controller parameter

Controlled Variable	Rule Selection	Proportional Band PB (%)	Integral Time TI/s	Differential Time TD/s
Flow	Object time constant is small, parameter has variation, PB should be large; TI should be short; differential is not used	40~100	18~60	-
Temperature	Object volume lag is large, means the parameter variation becoming slow with interference, PB should be small; TI should be long; differential should be added generally	20~60	180~600	30~180
Pressure	Object volume lag is not rather large, differential is not added generally	30~70	24~180	-
Fluid Level	Object time constant range is large, the requirements are not high, PB can be selected in a range, differential is not used generally	20~80	-	-

As the proportional action is the basic control action, the experience tune meets the quality index mainly by adjusting proportional band PB. There are two ways to tune:

- 1) First use the pure proportional (P) action, means to find the proper proportional band PB, and change the transition process after adding man-made interference to the attenuation oscillation process of 4:1. Then add integral action (I), and take the integral time TI as a half of the attenuation oscillation cycle. As the integral action enhances the oscillation, the proportional action should be weakened before adding integral action, and enlarge 10%~20% of the proportional band generally. Adjust the integral time till the 4:1 attenuation oscillation occurs. Add differential (D) action if needed, means to start from 0 and enlarge the differential time TD gradually. As the differential action can suppress the oscillation, the proportional band can be adjusted to be less than pure proportional action before adding integral action, and shorten the integral time. The transition time

can be adjusted to be shortest and the overshoot to be smallest via the trial and error of differential time.

- 2) Select integral time T_I and differential time T_D , take $T_D = (1/3 \sim 1/4) T_I$ generally. Perform repeat trial and error for the proportional band PB till the satisfying result is obtained. The satisfying curve may not be obtained if the setting of T_I and T_D are not proper at beginning. Then adjust T_I and T_D properly and perform trial and error again to meet the curve to the control requirements.

The experience tune method applies to various control system, especially the control system with frequent object interference and irregular transition process curve. However, it will cost more time for operator lacking of experience.

2. Critical Proportional Band

Critical proportional band refers to obtain critical oscillation data in the method of pure proportional control in the system closed loop, means the critical proportional band PB_k and the critical oscillation cycle T_k , and use some experience formulas to get the controller parameter meeting the 4:1 attenuation oscillation process. The formula are shown in Table 3.4. The steps are shown below.

- 1) Set the integral time of controller as maximum ($T_I = \infty$), differential time as minimum ($T_D = 0$), proportional band PB behind a comparatively large value, and start system operation.
- 2) Reduce the proportional band gradually. Exert stage interference for the system via changing the set value once the PB value is modified, and observe the output of system till the continuous oscillation occurs to the transition process. The transition process here called critical oscillation process. PB_k is critical proportional band and T_k is critical oscillation cycle.
- 3) Use two testing data PB_k and T_k and by the corresponding formula in Table 3.4 to figure out various tune parameters of controller.

Table 3.4 Controller parameter calculation in critical proportional band method (attenuation ratio 4:1)

Control Rule	Proportional Band PB (%)	Integral Time T_I/s	Differential Time T_D/s
P	$2PB_k$	-	-
PI	$2.2PB_k$	$51T_k$	-
PD	$1.8PB_k$	-	$6T_k$
PID	$1.7PB_k$	$30T_k$	$7.5T_k$

- 4) Change the proportional band of controller to the tuned value, and put the tune of integral time and differential time successively.

3. Attenuation Curve

It is a little like the tune process of critical proportional band method, means set the integral time as maximum in closed loop system, the differential time as minimum and the proportional time as comparatively large value, then input the change of set value as interference, decrease the proportional band PB value gradually, and observe the output response curve of the system. Change the PB value according to the attenuation of transition process till the 4:1 attenuation oscillation. Record the proportional band PB_s and the attenuation oscillation cycle T_s , and figure out the tune parameter of controller via the corresponding experience formula in table below.

Control Rule	Proportional Band PB (%)	Integral Time TI/s	Differential Time TD/s
P	PB_s	-	-
PI	$1.2PB_s$	$30T_s$	-
PID	$0.8PB_s$	$18T_s$	$6T_s$

The attenuation curve method can apply to most systems. For its short test transition process oscillation time, and all are attenuation oscillation, it is acceptable for operator. Thus this kind of tune method is widely used.

3.1.10 Difference between Various PID Function Blocks

Table 3.5 Difference of PID Function Blocks

Difference Item	PID	PIDEP	PIDEX	EPID	LEPID
Supported Operation Mode	OOS, IMAN, TR, MAN, AU-TO, CAS	OOS, IMAN, AU-TO	OOS, IMAN, TR, MAN, AU-TO, CAS	OOS, AU-TO, CAS	OOS, TR, AU-TO
PID Algorithm Selection	PID, D_PI, PD_I	PID, D_PI, PD_I	PID, D_PI, PD_I	PID	PID
SV Ramp Action	√	√	√	-	-
SV Track Action	√	√	√	-	-
Proportional Nonlinear Gain	√	√	√	-	-
Integral Cutting	√	√	√	-	-
Wind-up	√	√	√	-	-

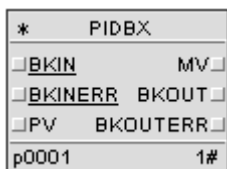
Table 3.5 Difference of PID Function Blocks (continued)

Difference Item	PID	PIDEP	PIDEX	EPID	LEPID
PID Single Function Stop	Stop P, I, D Separately	Stop P, I, D Separately	Stop P, I, D Separately	-	-
Bypass	√	√	√	-	-
Lock Increase/Decrease and Maintain	√	√	√	-	√
MV Output Mode	Position type, Increment Type	Position Type	Position Type, Increment Type	Position Type	Position Type
Recommended Industry	General	Electrical Power Industry	General (recommended)	Electrical Power Industry	Electrical Power Industry

3.2 PIDBX Function Block

PIDBX function block executes general PID control and has remote output mode. It is a complex function block and its running time is 150μs.

Please read “Function Block Overview” and “Control Function Block Application Foundation” in *Function Block User Manual* first before using PIDBX function block.



3.2.1 Parameter Description

For the data type, initial value and default pin of function block parameter in Table 3.6, please refer to the property setting window of function blocks.

When the parameter in Table 3.6 is uploaded as TRUE, it means the corresponding parameter can upload the data of controller and save to the configuration later. When offline download is performed next time, the saved data can be downloaded.

Table 3.6 Parameter instruction and application of PIDBX Function Block

Name			Description	Upload	Properties	Application Reference
Basic Para-	Range Setting	MVSCH	MV high scale	-	Configuration Parameter	The same as MV actual value H limit

Table 3.6 Parameter instruction and application of PIDBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
me- ters		MVSCL	MV low scale	-	Configuration Parameter	The same as MV actual value L limit
		SVSCH	SV high scale	-	Configuration Parameter	The same as SV actual value H limit
		SVSCL	SV low scale	-	Configuration Parameter	The same as SV actual value L limit
		SVEU	SV engineer unit	-	Configuration Parameter	Set in the function block properties setting interface
		MVEU	MV engineer unit	-	Configuration Parameter	Set in the function block properties setting interface
		SVDLEN	SV decimal digits [0,5]	-	Configuration Parameter	Used for data displayed on function block panel (equal to 3 as default)
		MVDLEN	MV decimal digits [0,5]	-	Configuration Parameter	Used for data displayed on function block panel (equal to 3 as default)
	Limits	MVH	MV H limit value	TRUE	Operation Parameter	Value range [MVSCL,MVSCH]
		MVL	MV L limit value	TRUE	Operation Parameter	Value range [MVSCL,MVSCH]
		SVH	SV H limit value	TRUE	Operation Parameter	Value range [SVSCL,SVSCH]
		SVL	SV L limit value	TRUE	Operation Parameter	Value range [SVSCL,SVSCH]
		DMVLIM	MV output rate variety limit value. Used to prevent the MV from overlarge modification in a short time.	TRUE	Operation Parameter	Refer to the "Alarm" section in <i>Function Block User Manual</i> .
		MVLM_-OPT	Output Over-range Limit When in Man-	-	Configuration Parameter	-

Table 3.6 Parameter instruction and application of PIDBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
			ual(ON=Enable, OFF=Disable)			
	Direct/Reverse Switch Settings	SWPN	Direct/Reverse Switch(OFF=Direct Action, ON=Reverse action)	TRUE	Operation Parameter	OFF=Direct action, ON=Reverse action
	Interlock Configuration	I_IVO	Interlock Negate Options(ON=Negate, OFF=Not to negate)	-	Configuration Parameter	-
Extended Parameters	Base Input Pin Settings	BKIN	Feedback input	-	Input Pin	Connect to BKOUT of downstream block
		BKINERR	Feedback status input	-	Input Pin	Connect to BKOUTERR of downstream block
		PV	Process value	-	Input Pin	Connect to measuring point AI
		CSV	Cascade/given externally	-	Input Pin	Connect to outer loop control value MV
		TV	Track input value (in track mode, MV=TV)	-	Input Pin	Connect to measuring point AI, Related parameter: SWTR
		SWTR	Track Switch(OFF=Not Track, ON=Track)	-	Input Pin	Upstream interlock condition input, related parameter: TV and TVERR
		OA	Output Compensation Value	-	Input Pin	Connect to measuring point AI (feedforward signal), related parameters: OK, OB
	Advanced Input Pin Settings	PVERR	ON=PV Fault	--	Input Pin	Connect tags AI.ERR
		SVERR	ON=SV Fault	-	Input Pin	Connect the upstream output

Table 3.6 Parameter instruction and application of PIDBX Function Block (continued)

Name		Description	Upload	Properties	Application Reference
	IV	Interlock Value	FALSE	Input Pin	Used in conjunction with the function block ITLK_A (related with the OUT of the interlock function block.) refer to LMAN/LTR Modes
	SWIK	Interlock Input Mode(0=No Interlock,1=L-MAN,2=LTR))	FALSE	Input Pin	Used in conjunction with the function block ITLK_A (related with the OUT_D of the interlock function block.) refer to LMAN/LTR Modes
	SWRCAS	Remote Cascade Switch(ON=to Remote Cascade)	FALSE	Input Pin	-
	MF	MV Feedback Value	-	Input Pin	When connecting measuring point AI and the real-time value of the SHOWMF parameter is set to ON, the panel's bar chart can display the real-time value of that parameter. The default value for SHOWMF is OFF.
	IA	Input Compensation Value	-	Input Pin	Connect to the measuring point AI. For details, please refer to the "output operation" section in <i>Function Block User Manual</i> . The associated parameters are IK and IB.
	SWROUT	Remote Manual Switch(ON=to Remote Manual)	FALSE	Input Pin	-

Table 3.6 Parameter instruction and application of PIDBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
		RMV	Remote Manual Value	FALSE	Input Pin	-
		RSV	Remote Cascade Value	FALSE	Input Pin	-
		MAN_OPT	Control Switch Source of Manual or Auto (OFF=Faceplate Control, ON=Program Control)	-	Input Pin	Connect to upstream output
		SV_OPT	Auto/Cascade Control Source Selection (OFF=Panel Control, ON=Program Control)	-	Input Pin	Connect to upstream output, related parameters: SWSV, SHOWCAS
		SWINC	Lock Increase	-	Input Pin	Connect to upstream output, valid when function block is automatic or cascade
		RRL	Anti-integral Windup Auxiliary Input	-	Input Pin	Connect to the measuring point AI and the associated parameter is BKIN; Please refer to the "calculation operation" section in <i>Function Block User Manual</i>
		SWDEC	Lock Decrease	-	Input Pin	Connect to upstream output, valid when function block is automatic or cascade
		HOLD	Hold the Current Output Value	-	Input Pin	Connect to upstream output, valid when function block is automatic or cascade
	Output Pin	MV	Operation output value	-	Output Pin	Connect to AO tags.

Table 3.6 Parameter instruction and application of PIDBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
						If there's a float abnormal happened to the MV value, the MV will be set as the value of previous period or lower limit. Please refer to "Output Process" for details.
		BKOUT	Feedback output value	-	Output Pin	Connect to the BKIN of Upstream Block, The related parameter: BK_OPT
		BKOUTERR	Feedback status value	-	Output Pin	Connect to the BKIN-ERR of Upstream Block
		BK_OPT	BKOUT value switch (ON=track PV, OFF=track SV)	-	Configuration Parameter	The related parameter: BKOUT
	PID Parameter Setting	PB	Proportion band size	TRUE	Operation Parameter	Please refer to the "Other operation" section in <i>Function Block User Manual</i>
		TI	Integral time (s)	TRUE	Operation Parameter	Please refer to the "Other operation" section in <i>Function Block User Manual</i>
		TD	Derivative time (s)	TRUE	Operation Parameter	When TD=0, the derivative function is shielded. For details, please refer to <i>Function Block User Manual</i> .
		KD	Derivative filter coefficient	TRUE	Operation Parameter	Refer to the Note1,2,3,4 in the section "PID Parameter Description" in <i>Function Block User Manual</i>
	Operator Command	MODE	Work Mode (1=OOS, 2=IMAN, 3=TRACK, 4=MAN, 5=AU-	-	Monitoring Parameter	Refer to the "PID Parameter Description" in <i>Function Block User Manual</i>

Table 3.6 Parameter instruction and application of PIDBX Function Block (continued)

Name		Description	Upload	Properties	Application Reference
		TO, 6=CAS, 7=RCAS, 8=ROUT, 12=LMAN, 13=LTR)			
	SWCAS	Cascade Switch (ON=to Cascade)	FALSE	Input Pin	-
	SWMAN	Manual Switch (ON=to Manual)	FALSE	Input Pin	-
	SWAUTO	Auto Switch (ON=to Auto)	FALSE	Input Pin	-
	IMODE	Standby Work Mode (1=OOS, 2=IMAN, 3=TRACK, 4=MAN, 5=AUTO, 6=CAS, 7=RCAS, 8=ROUT, 12=LMAN, 13=LTR)	-	Monitoring Parameter	Refer to the "PID Parameter Description" in <i>Function Block User Manual</i>
	LOCK	Mode Lock (OFF=Unlock, ON=Lock)	-	Operation parameter	-
	RMT_- OVRD	Override Remote Mode (ON=Override)	FALSE	Operation parameter	-
	MODE_- OPT	ON=auto return, OFF>manual return (default)	-	Configuration Parameter	Refer to the "PID Parameter Description" in <i>Function Block User Manual</i>
	SWAM	Manual and auto switch: OFF>manual, ON=auto	-	Operation Parameter	Valid when MAN_OPT=OFF
	SWSV	Auto/ cascade selection: OFF=auto, ON=cascade	-	Operation Parameter	Valid when SV_OPT=OFF

Table 3.6 Parameter instruction and application of PIDBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
		SWMMV	Whether to equal to preset MV value when switch to manual status	TRUE	Operation Parameter	Related parameter: MMV
		MMV	Preset MV value (switch to manual)	TRUE	Operation Parameter	Valid when SWM-MV=ON
		SWPMV	Whether to equal to preset MV value when switch to auto status	TRUE	Operation Parameter	Related parameter: PMV
		PMV	Preset MV	TRUE	Operation Parameter	Valid when SWP-MV=ON
	Operator Data	SV	SV	TRUE	Operation Parameter	Refer to the “setting value operation” section in <i>Function Block User Manual</i>
		MANMV	Manual output value	-	Operation Parameter	MV = MANMV in manual mode
		EI	Deviation	-	Monitoring Parameter	Refer to the “calculation operation” section in <i>Function Block User Manual</i>
	Input Alarm Settings	PVHH	PV HH limit alarm value	TRUE	Operation Parameter	Refer to the “Input Operation” section in <i>Function Block User Manual</i> for details
		PVH	PV H limit alarm value	TRUE	Operation Parameter	Refer to the “Input Operation” section in <i>Function Block User Manual</i> for details
		PVL	PV L limit alarm value	TRUE	Operation Parameter	Refer to the “Input Operation” section in <i>Function Block User Manual</i> for details
		PVLL	PV LL limit alarm value	TRUE	Operation Parameter	Refer to the “Input Operation” section in

Table 3.6 Parameter instruction and application of PIDBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
						<i>Function Block User Manual</i> for details
		PVHYS	Process Value Alarm Hysteresis	TRUE	Operation Parameter	Refer to the “Input Operation” section in <i>Function Block User Manual</i> for details
		DL	Deviation alarm set value	TRUE	Operation Parameter	Refer to the “Calculation Operation” section in <i>Function Block User Manual</i> for details
		DLHYS	Deviation alarm hysteresis value	TRUE	Operation Parameter	Refer to the “Calculation Operation” section in <i>Function Block User Manual</i> for details
		KSV	Deviation filter coefficient	TRUE	Operation Parameter	Refer to the “Calculation Operation” section in <i>Function Block User Manual</i> for details
		TSV	Deviation filter time constant (s)	TRUE	Operation Parameter	Refer to the “Calculation Operation” section in <i>Function Block User Manual</i> for details
		PVHHTON	PVHH Alarm TON(s)	TRUE	Operation Parameter	-
		PVHHTOFF	PVHH Alarm TOFF(s)	TRUE	Operation Parameter	-
		PVHTON	PVH Alarm TON(s)	TRUE	Operation Parameter	-
		PVHTOFF	PVH Alarm TOFF(s)	TRUE	Operation Parameter	-
		PVLTON	PVL Alarm TON(s)	TRUE	Operation Parameter	-
		PVLTOFF	PVL Alarm TOFF(s)	TRUE	Operation Parameter	-
		PVLLTON	PVLL Alarm TON(s)	TRUE	Operation Parameter	-

Table 3.6 Parameter instruction and application of PIDBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
		PVLLTOFF	PVLL Alarm TOFF(s)	TRUE	Operation Parameter	-
		NMFLIM	Valve position negative error thresholds	TRUE	Operation Parameter	Be associated with NMF. Refer to the "Alarm" section in <i>Function Block User Manual</i> for details.
		PMFLIM	Valve position positive error thresholds	TRUE	Operation Parameter	Be associated with PMF. Refer to the "Alarm" in <i>Function Block User Manual</i> for details.
		TMFHYS	Valve position positive error Valve position error alarm hysteresis time(s)	TRUE	Operation Parameter	Refer to the "Alarm" in <i>Function Block User Manual</i> for details.
	Advanced Calculation Settings	BYPASS	Bypass PID operation, when BYPASS=ON, excise PID calculation, switch SV to MV directly for output	TRUE	Operation Parameter	When it is in the cascade debugging mode, if the inner ring faults, this function can be used to cut off this inner ring. For details, please refer to "operation process" section in <i>Function Block User Manual</i> .
		STOPP	Stop Proportional Action	TRUE	Operation Parameter	Refer to the "Calculation Operation" in <i>Function Block User Manual</i> for details.
		STOPI	Stop Integral Action	TRUE	Operation Parameter	Refer to the "Calculation Operation" in <i>Function Block User Manual</i> for details.
		SWDB	Enable Deadband	TRUE	Operation Parameter	Related parameter: DB
		DB	Deadband band size	TRUE	Operation Parameter	Valid when SWDB=ON
		DBHYS	Deadband band hysteresis	TRUE	Operation Parameter	Refer to the "Calculation Operation" in

Table 3.6 Parameter instruction and application of PIDBX Function Block (continued)

Name		Description	Upload	Properties	Application Reference
					<i>Function Block User Manual</i> for details.
	GW	Non-linear gain range non-linear gain range	TRUE	Operation Parameter	Refer to the "Calculation Operation" in <i>Function Block User Manual</i> for details.
	KN	Non-linear gain coefficient [0,1.0]	TRUE	Operation Parameter	Refer to the "Calculation Operation" in <i>Function Block User Manual</i> for details.
	NGN_OPT	Non-linear Gain Selection(OFF=Deviation Square Root Function, ON=Gap Action Function)	-	Configuration Parameter	Related parameters: GW, PB and KN When NGN_OPT = ON; GW and PB when NGN_OPT = OFF
	EA	Integral excise coefficient. when EI > EA, excise coefficient, when EI < EA, excising coefficient is disabled, used for prevent MV change from overlarge	TRUE	Operation Parameter	Related parameter: DK
	DK	Proportion modified value when integral excising ^{Note5}	TRUE	Operation Parameter	Related parameter: EA
	OUT_OPT	Control Output Type(OFF=Position Type,ON=Increment Type)	-	Configuration Parameter	Related parameter: MV Refer to the "PID Parameter Description" in <i>Function Block User Manual</i>
	PID_OPT	PID Type Selection(0=PID,1=D_ - PI,2=PD_I)	-	Configuration Parameter	Refer to the "PID Parameter Description" in <i>Function Block User Manual</i>

Table 3.6 Parameter instruction and application of PIDBX Function Block (continued)

Name		Description	Upload	Properties	Application Reference	
		ATI_OPT	Anti-integral saturation mode selection: 0=Keep the original mode 1= No Resection 2= Total Resection	-	Configuration Parameter	0: Keep the original processing mode. When the derivative time is set to 0, the internally calculated MV will be limited by high and low limits. 1: Regardless of whether the differential time is 0 or not, the internally calculated MV will not be limited. 2: Regardless of whether the differential time is 0, limit the internally calculated MV.
	Alarm	PVHHIND	PVHH alarm indication	-	Monitoring Parameter	Refer to the “Alarm” in <i>Function Block User Manual</i> for details.
		PVHIND	PV H Limit alarm indication	-	Monitoring Parameter	Refer to the “Alarm” in <i>Function Block User Manual</i> for details.
		PVLIND	PV L limit alarm indication	-	Monitoring Parameter	Refer to the “Alarm” in <i>Function Block User Manual</i> for details.
		PVLLIND	PV LL limit alarm indication	-	Monitoring Parameter	Refer to the “Alarm” in <i>Function Block User Manual</i> for details.
		MVHIND	MV H limit alarm indication	-	Monitoring Parameter	Refer to the “Alarm” in <i>Function Block User Manual</i> for details.
		MVLIND	MV L limit alarm indication	-	Monitoring Parameter	Refer to the “Alarm” in <i>Function Block User Manual</i> for details.
		SVHIND	SV H limit alarm indication	-	Monitoring Parameter	Refer to the “Alarm” in <i>Function Block User Manual</i> for details.
		SVLIND	SV L limit alarm indication	-	Monitoring Parameter	Refer to the “Alarm” in <i>Function Block User Manual</i> for details.

Table 3.6 Parameter instruction and application of PIDBX Function Block (continued)

Name		Description	Upload	Properties	Application Reference	
		PEIIND	Positive deviation alarm indication	-	Monitoring Parameter	Refer to the “Alarm” in <i>Function Block User Manual</i> for details.
		NEIIND	Negative deviation alarm indication	-	Monitoring Parameter	Refer to the “Alarm” in <i>Function Block User Manual</i> for details.
		DMVHIND	MV positive rate limit indication	-	Monitoring Parameter	Refer to the “Alarm” in <i>Function Block User Manual</i> for details.
		DMVLIND	MV negative rate limit indication	-	Monitoring Parameter	Refer to the “Alarm” in <i>Function Block User Manual</i> for details.
		NMFIND	Valve position error negative alarm indication	-	Monitoring Parameter	Refer to the “Alarm” in <i>Function Block User Manual</i> for details.
		PMFIND	Valve position error positive alarm indication	-	Monitoring Parameter	Refer to the “Alarm” in <i>Function Block User Manual</i> for details.
	Compensation Settings	IK	Input compensation gain	TRUE	Operation Parameter	Refer to the “Input Operation” in <i>Function Block User Manual</i> for details. Be associated with IA.
		IB	Input compensation bias value	TRUE	Operation Parameter	Refer to the “Input Operation” in <i>Function Block User Manual</i> for details. Be associated with IA.
		OK	Output compensation gain	TRUE	Operation Parameter	Refer to the “Calculation Operation” in <i>Function Block User Manual</i> for details. Be associated with OA.
		OB	Output compensation bias value	TRUE	Operation Parameter	Refer to the “Calculation Operation” in <i>Function Block User Manual</i> for details. Be associated with OA.

Table 3.6 Parameter instruction and application of PIDBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
	Fast/ Slow/In- crease/De- crease Set- tings	SMV	Manual Slow Increase/Decrease Value	TRUE	Operation Parameter	Set MV manual slow increase/decrease percentage in function block properties setting
		FMV	Manual Fast Increase/Decrease Value	TRUE	Operation Parameter	Set MV manual fast increase/decrease percentage in function block properties setting
		SSV	SV Slow Increase/Decrease Value	TRUE	Operation Parameter	Set SV manual slow increase/decrease percentage in function block properties setting
		FSV	SV Fast Increase/Decrease Value	TRUE	Operation Parameter	Set SV manual fast increase/decrease percentage in function block properties setting
		GMV	MV safety protection input increase or decrease value	TRUE	Operation Parameter	-
		GSV	SV safety protection input increase or decrease value	TRUE	Operation Parameter	-
	Extended Range Set- tings	HORLIM	Extended range maximum percentage	-	Configuration Parameter	Refer to the “output operation” section in <i>Function Block User Manual</i>
		LORLIM	Extended range minimum percentage	-	Configuration Parameter	Refer to the “Output operation” in the 《Function Block Operation》
	SV Ad- vanced Settings	SWRAMP	SV Ramp Switch(OFF=NOT START,ON=START)	TRUE	Operation Parameter	Related parameter:: RAMP, valid when in automatic or cascade mode
		SV_RAMP	SV Ramp Target	FALSE	Operation	-

Table 3.6 Parameter instruction and application of PIDBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
		RAMP_- OPT	SV Ramp Mode(0=Time,1=Slope)	TRUE	Operation	-
		CASRAMP	CAS and RCAS SV ramping (0=not ramp, 1=ramp by slope). 0 by default.	-	Configuration Parameter	-
		TRAMP_- EU	SV Ramp Time Unit(0=sec, 1=min, 2=hour)	TRUE	Operation	-
		TRAMP	SV Ramp Time(s)	TRUE	Operation	-
		KRAMP_- EU	SV Ramp Slope Unit(0=Slope/s, 1=Slope/m)	TRUE	Operation	-
		KRAMP	Ramp Coefficient	TRUE	Operation	-
		SVTR_- OPT	SV Track PV Switch Enable/Disable(OFF=Not Track, ON=Track)	-	Configuration Parameter	Refer to the "setting value operation" in <i>Function Block User Manual</i>
	Alarm Enabled and Suppress	AOF	Shield Alarm	TRUE	Operation Parameter	Refer to the "Alarm" section in <i>Function Block User Manual</i>
		ENALM	Alarm Enabled	TRUE	Alarm Parameter	Refer to the "Alarm" section in <i>Function Block User Manual</i>
		FLAG	Flag	-	Output Pin	Refer to the "Alarm" section in <i>Function Block User Manual</i>
	OOS Settings	SWOOS	Switch of Out of Service (ON=Disable)	TRUE	Operation Parameter	Set as ON at the first time of function block downloading

Table 3.6 Parameter instruction and application of PIDBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
		OOSVAL	Output value in OOS status	TRUE	Operation Parameter	Related parameter: OOS_OPT=ON
		OOS_OPT	Output Value Type in OOS Status(ON:MV=OOS-VAL, OFF:MV=MANMV)	-	Configuration Parameter	For details, refer to the "Calculation stops OOS mode" section in <i>Function Block User Manual</i>
	Check Input Validity	SWPV	PV Validity Check Switch (ON=Turn On, OFF=Turn Off)	TRUE	Operation Parameter	Refer to the "Input operation" section in <i>Function Block User Manual</i>
		PVLMT	PV change limit (%)	TRUE	Operation Parameter	Refer to the "Input operation" section in <i>Function Block User Manual</i>
	Panel Display Settings	OPR_EI	Desirable Operating Range Deviation Value	-	Monitoring parameter	-
		SHOWMF	Show MF	TRUE	Operation Parameter	When the real-time value of the SHOWMF parameter is set to ON, the bar chart on the panel will display the real-time value of the MF parameter, as shown in Figure 3.19.
		SHOWCAS	Show SWCAS Button"	TRUE	Operation Parameter	When SV_OPT = OFF and SHOWCAS = ON, the cascade icon on the panel is enabled, and you can switch to cascade mode through the panel.
		OPR_EN	Desirable Operating Range Enable	TRUE	Operation Parameter	-
		OPR_H	Desirable Operating Range High Limit	TRUE	Operation Parameter	-

Table 3.6 Parameter instruction and application of PIDBX Function Block (continued)

Name		Description	Upload	Properties	Application Reference	
		OPR_L	Desirable Operating Range Low Limit	TRUE	Operation Parameter	-
		T_PEAK	Recent History (0=Not Show, 1=2min, 2=10min, 3=30min, 4=1h, 5=2h, 6=4h, 7=8h, 8=12h, 9=24h)	TRUE	Operation Parameter	-
	Interlock Settings	I_H_O	H Interlock Output	-	Output Pin	-
		I_L_O	L Interlock Output	-	Output Pin	-
		IH_EN	Interlock H Enable	TRUE	Operation	-
		IH_LIM	Interlock H Limit	TRUE	Operation	-
		IH_TON	Interlock H TON(s)	TRUE	Operation	-
		IH_TOFF	Interlock H TOFF(s)	TRUE	Operation	-
		IL_EN	Interlock L Enable	TRUE	Operation	-
		IL_LIM	Interlock L Limit	TRUE	Operation	-
		IL_TON	Interlock L TON(s)	TRUE	Operation	-
		IL_TOFF	Interlock L TOF-F(s)	TRUE	Operation	-
MARCO		LOCKTAG	Interlock Tag Name	-	-	-

Note 1: Description of Ramping

When CASRAMP=1, Ramping is enabled.

- If ramp by slope is selected in CAS or RCAS mode, SV ramping coefficient (KRAMP) is the same as the ramp coefficient in the original automatic mode, and the ramp switch does not reset itself.
- If ramp by time is selected in CAS or RCAS mode, the ramp function is invalid and the SV takes effect immediately.

3.2.2 Function Overview

The basic workflow of PIDBX is shown in the figure below.

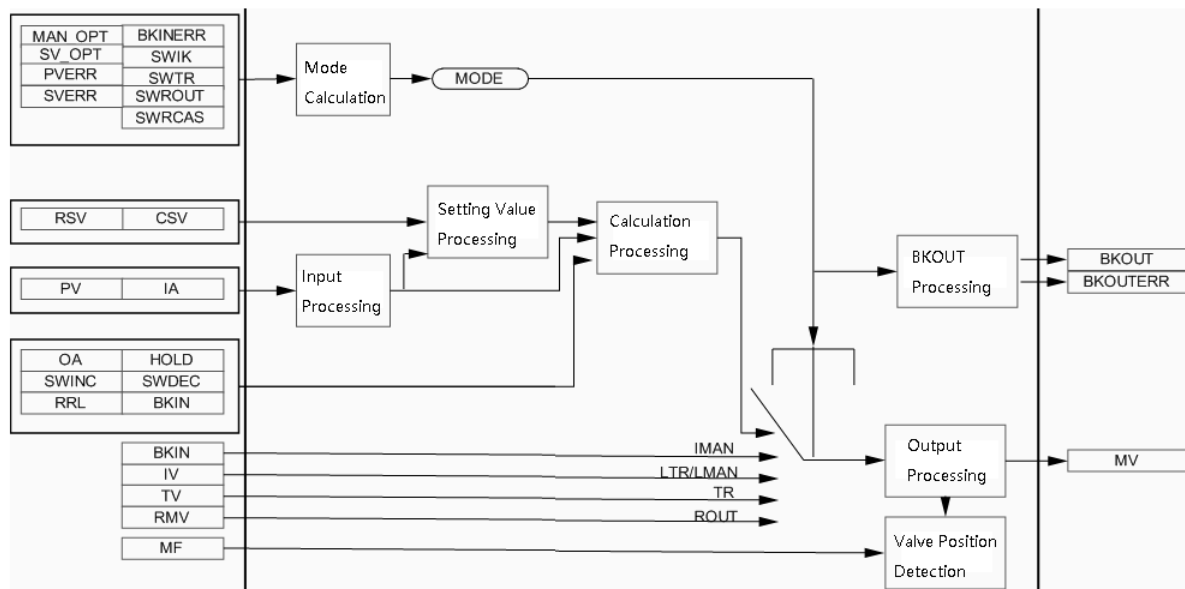


Figure 3.15 Basic Workflow of PIDBX

3.2.3 Mode Calculation

Mode Switching

- When SWOOS = ON, the mode is the OOS regardless of the value of other mode-related parameters.
- When SWOOS = OFF and BKINERR = ON, the mode is the IMAN regardless of other mode-related parameters.
- When SWOOS = OFF, BKINERR = OFF, SWIK = 1, the mode is the LMAN regardless of other mode-related parameters.
- When SWOOS = OFF, BKINERR = OFF, SWIK = 2, the mode is the LTR regardless of other mode-related parameters.
- When SWOOS = OFF, BKINERR = OFF, SWIK = 0, SWTR = ON, the mode is the TR regardless of other mode-related parameters..
- When SWOOS = OFF, BKINERR = OFF, SWIK = 0, SWTR = OFF:

- If LOCK = ON:

If the previous cycle is in the OOS / IMAN / LMAN / LTR / TR status, and if it is a manual degrading, this cycle will be in the MAN status, if it is an automatic degrading, it will enter the mode prior to OOS / IMAN / LMAN / LTR / TR.

If the previous cycle is in the MAN / ROUT / RCAS / AUTO / CAS status and PVERR = OFF and SVERR = OFF, the status of this cycle will keep unchanged.

If the previous cycle is in the MAN / ROUT / RCAS / AUTO / CAS status and PVERR = ON, then this cycle will be in the MAN status.

If the previous cycle is in the RCAS / CAS status and PVERR = OFF and SVERR = ON, then this cycle will be in the AUTO status.

If the previous cycle is in the MAN / ROUT / AUTO status, and PVERR = OFF and SVERR = ON, then this cycle will keep unchanged.
- If LOCK = OFF and RMT_OVRD = OFF

If SWROUT = ON, it enters ROUT mode.

If SWROUT = OFF, SWRCAS = ON, PVERR = OFF, SVERR = OFF then it enters RCAS mode.

If SWROUT = OFF, SWRCAS = ON, PVERR = ON, SVERR = ON / OFF then it enters MAN mode.

If SWROUT = OFF, SWRCAS = ON, PVERR = OFF and SVERR = ON, then it enters AUTO mode.

If SWROUT = OFF, SWRCAS = OFF, and SWMAN = ON, it enters the MAN mode.

If SWROUT = OFF, SWRCAS = OFF, and SWMAN = OFF, PVERR = ON, it enters the MAN mode.

If SWROUT = OFF, SWRCAS = OFF, and SWMAN = OFF, PVERR = OFF, SWAUO = ON, then it enters the AUTO mode.

If SWROUT = OFF, SWRCAS = OFF, SWMAN = OFF, SWAUTO = OFF, SWCAS = ON, PVERR = OFF, SVERR = OFF, it enters CAS mode.

If SWROUT = OFF, SWRCAS = OFF, SWMAN = OFF, SWAUTO = OFF, SWCAS = ON, PVERR = OFF, SVERR = ON then it enters the AUTO mode.

If SWROUT = OFF, SWRCAS = OFF, SWMAN = OFF, SWAUTO = OFF, SWCAS = ON, PVERR = ON, SVERR = ON / OFF then it enters MAN mode.

If SWROUT = OFF, SWRCAS = OFF, SWMAN = OFF, SWAUTO = OFF, SWCAS = OFF, PVERR = OFF, SWAUO = ON, and meanwhile the previous cycle is OOS / IMAN / LMAN / LTR / TR status,

 - If it is a manual degrading, then the cycle will be in the MAN status. If it is an automatic degrading, it will enter the mode prior to OOS / IMAN / LMAN / LTR / TR.
 - If the previous cycle is in the MAN / ROUT / RCAS / AUTO / CAS status, the status of this cycle will keep unchanged.
- If LOCK = OFF and RMT_OVRD = ON

The values of SWROUT and SWRCAS do not affect the mode.

If SWMAN = ON, it will enter MAN mode.

If SWMAN = OFF, SWAUTO = ON, PVERR = OFF, and SVERR = ON / OFF then it will enter the AUTO mode.

If SWMAN = OFF, SWAUTO = ON, PVERR = ON, and SVERR = ON / OFF then it will enter MAN mode.

If SWMAN = OFF, SWAUTO = OFF, SWCAS = ON, PVERR = OFF, and SVERR = OFF, it will enter CAS mode.

If SWMAN = OFF, SWAUTO = OFF, SWCAS = ON, PVERR = OFF, and SVERR = ON, then it will enter the AUTO mode.

If SWMAN = OFF, SWAUTO = OFF, SWCAS = ON, PVERR = ON, and SVERR = ON / OFF then it will enter MAN mode.

If SWMAN = OFF, SWAUTO = OFF, SWCAS = OFF, and meanwhile the previous cycle is OOS / IMAN / LMAN / LTR / TR,

- If it is a manual degrading, this cycle will be in the MAN status. If it is an automatic degrading, it will enter the mode prior to OOS / IMAN / LMAN / LTR / TR.
- If the previous cycle is in the MAN / ROUT / RCAS / AUTO / CAS status, then the status of this cycle will keep unchanged.

Work Mode

- OOS

In this mode, the output value MV is selected according to the OOS_OPT configuration, where you can hold the output or output the OOSVAL safety value.

- Initial status (IMAN)

If the feedback value of the downstream function block and feedback status are connected to BKIN and BKINERR, the output can follow the BKOUT value of the downstream function block.

- Interlock tracking (LTR)

Interlock tracking mode and the output is IV.

- Manual Interlock (LMAN)

Manual interlock mode and the output is IV.

- Tracking (TR)

The function block is in the tracking status, and the output is the tracking input value TV. The output MV still has the effect to limit the amplitude. If the TV value exceeds the limiting range, it will be forced to be within the limiting value, that is, $MV = MV_L$ when $TV < MV_L$ and $MV = MV_H$ when $TV > MV_H$.

- Manual (MAN)

Set manually, $MV = MANMV$, and the output MV has a limiting effect on amplitude.

- **Automatic (AUTO)**
Automatic control output. BKOUTERR = OFF when it is in the automatic mode, while BKOUTERR = ON when it is in other modes;
- **Cascade (CAS)**
The setting value CSV comes from the output of the upstream module. In CAS mode, BKOUTERR=OFF; in other modes, BKOUTERR=ON.
- **Remote Cascade (RCAS)**
Remote cascade, the setting value RSV comes from the sequence control or upper layer software.
- **Remote output (ROUT)**
Remote output, RMV comes from sequence control or upper layer software.

The Degrading of Function Block Modes

The degrading of function block mode is divided into manual degrading and automatic degrading. The default setting is manual degrading. The standby working mode (IMODE) corresponding to each working mode (MODE) is only a reference for field operators.

- When MODE_OPT = OFF, the function block mode adopts manually degrading.
- When MODE_OPT = ON, the function block mode adopts automatically degrading.
- Regardless of automatically or manually degrading, if a degrading occurred after the system had a cold start, it goes into manual mode.

3.2.4 Input Processing

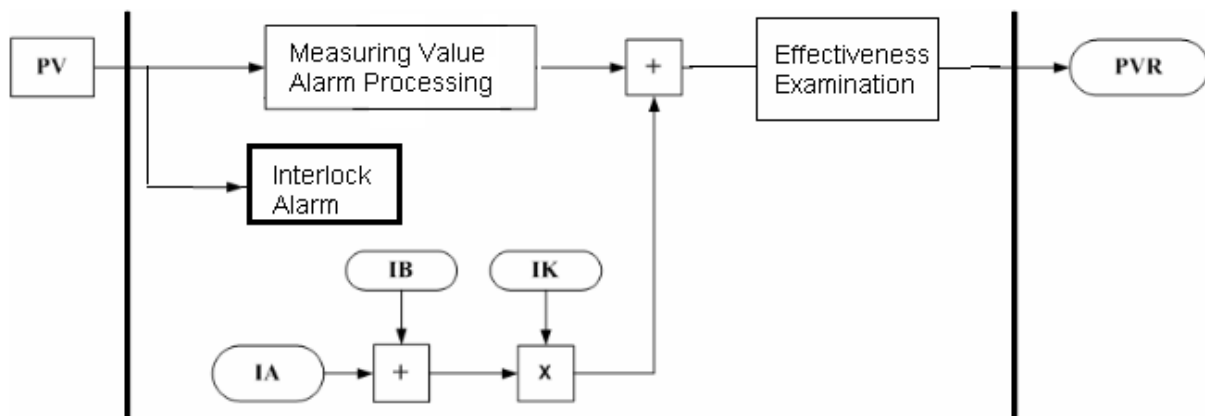


Figure 3.16 Processing processing

Measuring Value Alarm

The process input variable PV has 4 amplitude alarms: HH limit alarm (PVHH), H limit alarm (PVH), L limit alarm (PVL), and LL limit alarms (PVLL). It has an alarm hysteresis function. When PV is greater than or equal to PVHH, the HH limit alarm occurs; when PV is greater than or equal to PVH, the H limit alarm occurs; when PV is less than or equal to PVL, a L limit alarm occurs; when PV is less than or equal to PVLL, a LL limit alarm occurs, and the alarm has functions to generate or eliminate the delay.

These four values must satisfy the following relationships: $PVHH - PVHYS > PVH$, $PVH - PVHYS > PVL + PVHYS$, $PVL > PVLL + PVHYS$.

These four alarms could be shielded.

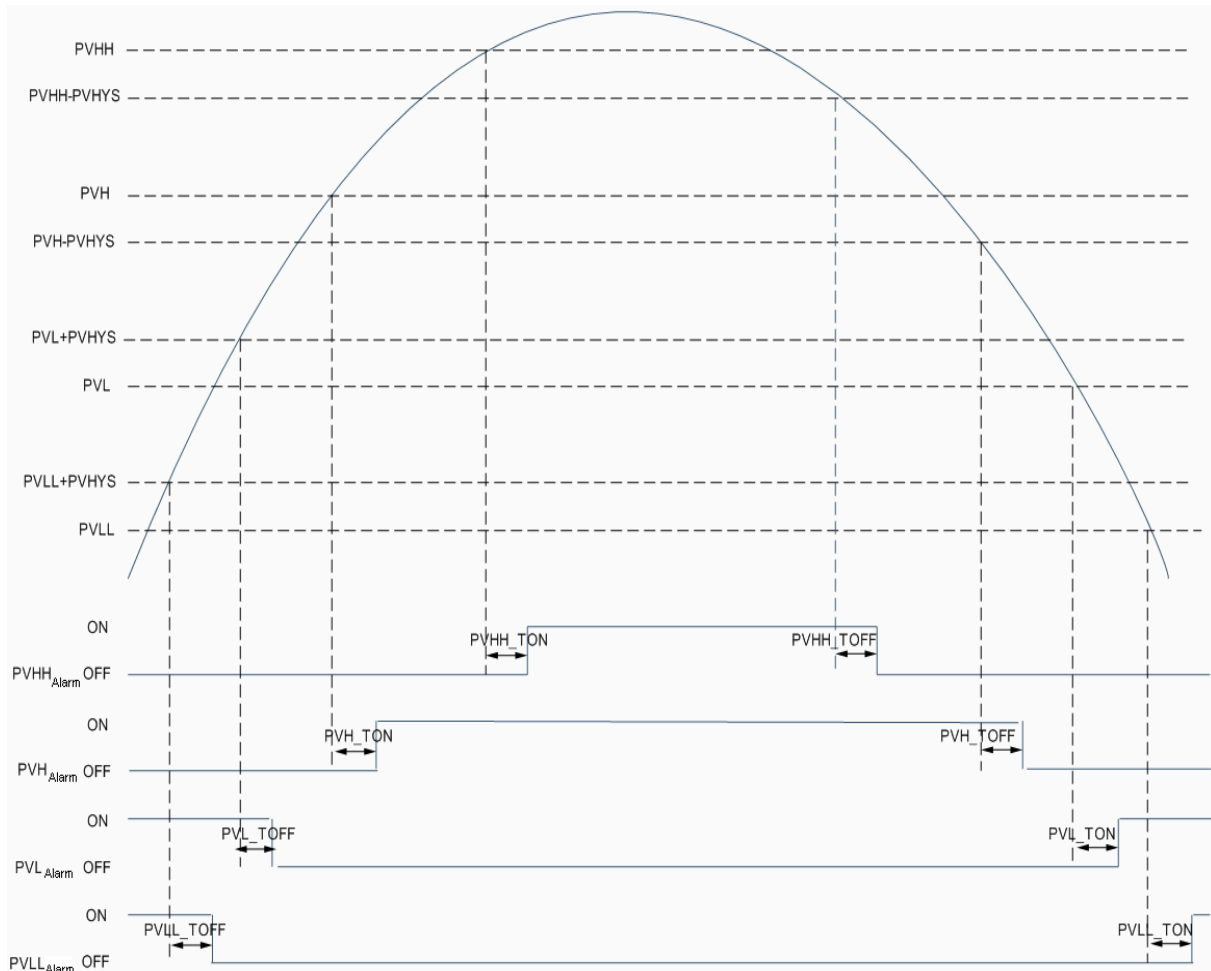


Figure 3.17 Measuring Value Alarm

Interlock Alarms

The process input variable PV has 2 interlock alarms: interlock H limit alarm (IH_LIM) and interlock L limit alarm (IL_LIM).

- When IH_EN = ON, interlock H limit alarm detection will be performed. When IH_EN = OFF, interlock H limit alarm detection will not be performed.
- When IL_EN = ON, interlock L limit alarm detection will be performed. When IL_EN = OFF, interlock L limit alarm detection will not be performed.
- When PV is greater than or equal to IH_LIM, an interlock H limit alarm occurs; when PV is less than or equal to IL_LIM, a L limit alarm occurs; the alarm has the functions to generate or eliminate delay.
- When an interlock H limit alarm is detected, if I_IVO = ON, then I_H_O = OFF; if I_IVO = OFF, then I_H_O = ON;
- When no interlock H limit alarm is detected or the detection is not performed, if I_IVO = ON, then I_H_O = ON; if I_IVO = OFF, then I_H_O = OFF;
- When an interlock low limit alarm is detected, if I_IVO = ON, then I_H_O = OFF; if I_IVO = OFF, then I_H_O = ON;
- When no interlock L limit alarm is detected or the detection is not performed, if I_IVO = ON, then I_L_O = ON; if I_IVO = OFF, then I_L_O = OFF;

Interlock alarms can be shielded or enabled.

Input Compensation

Input compensation is to add the compensation value obtained from the outside to the input signal PV calculated by the control function block. The expression is as follows:

$$PVR = PV + IK(IA + IB)$$

Input compensation is mainly used to improve the controllability of processes with long dead time.

Effectiveness Examination

Effectiveness Examination is performed on the PV value after being input compensated. This process can eliminate PV noise signals introduced from the transmitter disturbance, signal transmission interference and other causes.

This function is enabled through SWPV. When the PV value variation after the compensation of both this cycle and the previous cycle exceed the detection limit PVLMT, and they appear for the first time in a row, the PV value used for PID calculation in this cycle will be held. Considering that the signal may vary quite fast, the effectiveness detection will not be performed after their first time occurrence.

3.2.5 Setting Values

Track Setting Values

By configuring SVTR_OPT to set whether or not the setting value tracks the measured value: when SVTR_OPT = ON, it tracks; when SVTR_OPT = OFF, it doesn't track. When it is not tracking, slight disturbance will occur if you switch the mode from the manual to the automatic. If PVR exceeds SVH or SVL, then SV is equal to the range limit and will not be equal to PVR.

Select Setting Values

When it is in cascade RCAS mode, SV is equal to CSV.

When it is in remote cascade RCAS mode, SV is equal to RSV.

When it is automatic, the setting value is equal to SV, and CSV is equal to SV.

The Limiting Amplitude of Setting Values and Alarms

The H limit (SVH) of setting values must be greater than or equal to the L limit (SVL). Otherwise, the amplitude limiting will not work meanwhile a configuration alarm (CFGERR) will be generated.

The setting value SV is limited between the H limit SVH and the L limit SVL of setting values.

When setting values exceed the range specified by SVH and SVL, then they will be limited to the H and L limits and alarm. If $SVH < SVL$, the amplitude limiting will not work.

The Ramp Function of Setting Values

- In the automatic mode, the SV set value supports two modes of time climbing and slope climbing. When the climbing switch SWRAMP = ON is activated, the climbing starts.
 - When RAMP_OPT = 0, it climbs according to time, and climb from the current setting value to SVRAMP at a constant speed within the TRAMP time.
 - When RAMP_OPT = 1, it climbs according to the speed, and climb from the current setting value to SVRAMP at the constant speed of KRAMP.
- When the climbing target value SVRAMP is reached, the climbing switch SWRAMP = OFF.
- In other modes, SWRAMP = OFF.
- During the climbing process, it is not allowed to modify the SV target value, RAMP slope, RAMPTIME time, RAMPMODE climbing mode and other parameters to ensure keeping slope value unchanged.
- During the climbing process, you can set SWRAMP to OFF to stop the climbing process.
- To modify the parameters, you need to stop the climbing first.

3.2.6 Operation Processing

Please refer to "Operation Process" in *Function Block User Manual*.

3.2.7 Output Processing

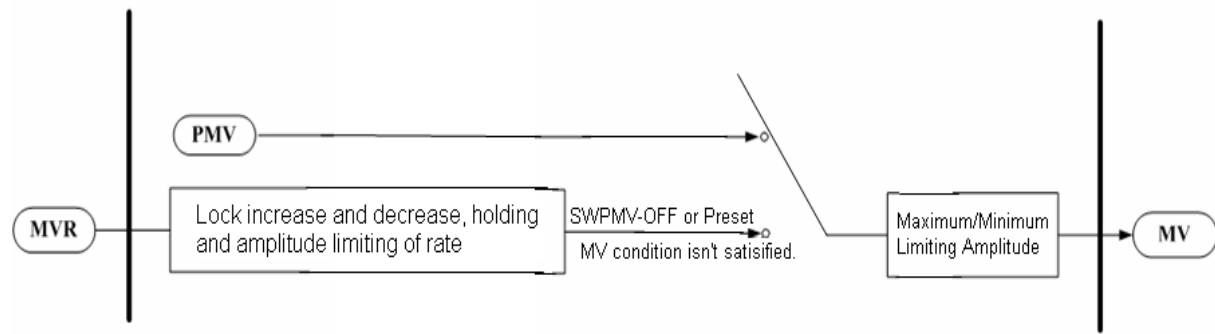


Figure 3.18 Output processing

Preset MV Processing

If the previous cycle mode was OOS, IMAN, TR, MAN, LTR, LMAN, ROUT and the current cycle mode is AUTO, RCAS, or CAS, and SWPMV = ON, then MV = PMV. Meanwhile, the MV rate alarms, the lock increase, lock decrease and holding won't work.

If the previous cycle mode is non-MAN status, the current cycle mode is MAN status, and SWMMV = ON, then MV = MMV.

Output the Amplitude Limiting and Alarms

If the output value exceeds its amplitude limiting value, the amplitude of the output will be limited and an alarm will be issued. The maximum amplitude limiting of the output (MVH) must be greater than or equal to the minimum amplitude limiting of the output (MVL), otherwise the amplitude limiting will not work and a configuration alarm (CFGERR) will be generated.

The MVH must be less than $\text{HORLIM} \times (\text{MVSCH} - \text{MVSCL}) / 100 + \text{MVSCH}$, and the MVH must be greater than $\text{MVSCL} - \text{LORLIM} \times (\text{MVSCH} - \text{MVSCL}) / 100$.

When MVLM_OPT = ON, IMAN, MAN, LMAN mode is limited by MVH and MVL.

When MVLM_OPT = OFF, IMAN, MAN, LMAN modes are not limited by MVH and MVL, but must be within the range of $[\text{MVSCL} - \text{LORLIM} \times (\text{MVSCH} - \text{MVSCL}) / 100, \text{HORLIM} \times (\text{MVSCH} - \text{MVSCL}) / 100 + \text{MVSCH}]$.

The amplitude limiting doesn't work in OOS mode.

In other modes, when the output value exceeded its amplitude limiting value, the amplitude of the output will be limited and an alarm will be issued.

The Amplitude Limiting of the Output Rate and Alarms

When the varying rate of the output exceeds the variable of the amplitude limiting, the output will be limited and an alarm will be issued. The rate limit is only detected in the automatic and cascade status. In the automatic, cascaded status, an alarm will occur when the varying rate of the output MV exceeds the amplitude limiting of its rate DMVLIM. When the increasing rate of MV

exceeds DMVLIM, a positive rate alarm occurs, that is, DMVHIND = ON; when the decreasing rate of MV exceeds DMVLIM, a negative rate alarm occurs, that is, DMVLIND = ON. When the amplitude limiting of rate occurs, the output is increased or decreased by the values of the amplitude limiting of rate.

Lock Increase and Decrease and Output Holding

In automatic, cascade mode, lock increase or decrease can be performed on the output MV.

- Lock increase
When SWINC = ON, the lock increases, that is, the output MV cannot increase.
- Lock decrease
When SWDEC = ON, the lock decreases, that is, the output MV cannot decrease.
- Output holding
In auto, cascade, when HOLD is equal to ON, the output remains unchanged.

3.2.8 BKOUT Processing

BKOUT tracks the measured value when BK_OPT = ON, and BKOUT tracks the setting value when BK_OPT = OFF.

When the mode is in CAS or RCAS, BKOUTERR = OFF, while BKOUTERR = ON in other modes.

3.2.9 Valve Position Deviation Alarm

Under the precondition of DVLV = MV-MF, when $DVLV < 0$, if $|DVLV| > NMFLIM$ is satisfied and the absolute value of DVLV is always greater than NMFLIM within TMFHYS seconds, an NMF alarm will occur.

When $DVLV > 0$, if $|DVLV| > PMFLIM$ is satisfied and the absolute value of DVLV is always greater than PMFLIM within TMFHYS seconds, a PMF alarm will occur.

3.2.10 Others

- Fast increase and decrease There are fast increase, fast decrease, slow increase, and slow decrease buttons on the panel. Users can modify MV or SV through these buttons.
 - MODE = MAN
In this mode, these four buttons on the panel are available for MV. The amplitude (engineering amount) of fast increase and decrease is equal to $(MVSCH-MVSCL) \times$

$FMV / 100$, and the amplitude of slow increase and decrease is equal to $(MVSCH - MVSCL) \times SMV / 100$.

- **MODE = AUTO**

In this mode, these four buttons on the panel are available for SV. The amplitude of the fast increase and decrease is equal to $(SVSCH - SVSCL) \times FSV / 100$, and the amplitude of the slow increase and decrease is equal to $(SVSCH - SVSCL) \times SSV / 100$. The increase / decrease buttons are invalid in other modes.

- Manual, automatic signal source and internal, external given signal source selection The manual signal source can be selected through the parameter MAN_OPT. When MAN_OPT = ON is satisfied, the auto and cascade buttons on the panel cannot be operated. You can use the parameter SV_OPT to select the signal source given inside or outside. When SV_OPT = ON is satisfied, the cascade buttons on the panel cannot be operated.
- Decimal places
The configuration of the SVDLEN and MVDLEN parameters involved in the control function block library is used to display data on the function block panel.
- Whether or not the bar graph on the panel shows MF and valve position deviation alarm SHOWMF
- Whether or not the panel displays the cascade button SHOWCAS.
- The latest historical segment T_PEAK displayed on the panel trend
- The panel shows the most appropriate operating area OPR_EN OPR_H OPR_L
- Operational Effectiveness Examination GMV GSV

3.2.11 Panel Parameter Instruction

PIDBX

NR

IMAN

PV

0.0000

SV

0.0000

M

MV

0.00000

%

100.0000

0.0000

100.00000

100.0000

80.0000

60.0000

40.0000

20.0000

0.0000

16:11:37

16:12:01

16:12:25

16:12:49

Alarm

Advance

Limits

Interlock

PV Alarm(M)

Enable	Limits	TON(s)	TOFF(s)	SUP
<input type="checkbox"/> HH	100.0000	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> H	90.0000	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> L	10.0000	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> LL	0.0000	0.0	0.0	<input type="checkbox"/>
HYS	0.0000			

EI Alarm(M)

<input type="checkbox"/> PEI	<input type="checkbox"/> SUP
<input type="checkbox"/> NEI	<input type="checkbox"/> SUP
EI	0.0000
DL	100.0000
DLHYS	0.0000

MF Alarm(%)

<input type="checkbox"/> PMF	100.00000	<input type="checkbox"/> SUP
<input type="checkbox"/> NMF	100.00000	<input type="checkbox"/> SUP
TMFHYS	0.0 s	

Alarm

Advance

Limits

Interlock

PID Parameter

DeadBand(M)

Control Direction

SV Auto Ramp

Mode Lock

Override

SV Limits(M)

DMVLIM(%/s)

Desirable Operating Range(M)

Interlock(M)

Figure 3.19 PIDBX Function Block Panel Parameter

Table 3.7 Panel Parameter Description

Panel Parameter Name			Parameter Name of Function Block	Initial Value	Application Description
Alarm	PV Alarm	Enable	EN_PVHH	-	Enable the HH limit alarm of the measuring values.
			EN_PVH	-	Enable the H limit alarm of the measuring values.
			EN_PVL	-	Enable the L limit alarm of the measuring values.
			EN_PVLL	-	Enable the LL limit alarm of the measuring values.
		HH	PVHH	100.000	Alarm value settings of the HH limit alarm of PV in the loop.(the selected alarms are valid, otherwise not)
		H	PVH	90.000	Alarm value settings of the H limit alarm of PV in the loop.(the selected alarms are valid, otherwise not)
		L	PVL	10.000	Alarm value settings of the L limit alarm of PV in the loop.(the selected alarms are valid, otherwise not)
		LL	PVLL	0.000	Alarm value settings of the LL limit alarm of PV in the loop.(the selected alarms are valid, otherwise not)
		HYS	PVHYS	0.000	Alarm hysteresis of PV measuring value
		TON (s)	PVHHTON	0.0	PVHH Alarm TON(s)
			PVHTON	0.0	PVH Alarm TON(s)
			PVLTON	0.0	PVL Alarm TON(s)
			PVLLTON	0.0	PVLL Alarm TON(s)
		TOFF (s)	PVHHTOFF	0.0	PVHH Alarm TOFF(s)
			PVHTOFF	0.0	PVH Alarm TOFF(s)
			PVLTOFF	0.0	PVL Alarm TOFF(s)
			PVLLTOFF	0.0	PVLL Alarm TOFF(s)
		SUP	PVHHSUP	-	PVHH Alarm Suppress Status

Table 3.7 Panel Parameter Description (continued)

Panel Parameter Name			Parameter Name of Function Block	Initial Value	Application Description
			PVHSUP	-	PVH Alarm Suppress Status
			PVLSUP	-	PVL Alarm Suppress Status
			PVLLSUP	-	PVLL Alarm Suppress Status
	EI Alarm	PEI	PEI	0.000	Positive Deviation Alarm. Read-only. EI=PV - S (Alarms selected are valid, otherwise are invalid).
		NEI	NEI	100.000	Negative Deviation Alarm. It is valid to select the positive deviation alarm.
		EI	EI	0.0	Deviation
		DL	DL	100.000	Deviation Alarm Set Value
		DLHYS	DLHYS	0.0	Deviation Alarm Hysteresis Value
		SUP	PEISUP	-	PEI Alarm Suppress Status
			NEISUP	-	NEI Alarm Suppress Status
	MF Alarm (%)	PMF	PMFIND	OFF	Valve Position Positive Deviation Alarm Indication
		NMF	NEIIND	OFF	Negative Deviation Alarm Indication
		TMFHYS	TMFHYS	0.0	Valve Position Alarm Hysteresis Time(s)
		SUP	PMFSUP	-	PMF Alarm Suppress Status
			NMFSUP	-	NMF Alarm Suppress Status
PID Parameter	PID Parameter	PB	PB	100.000	Proportion Band Size (%)
		TI	TI	20.000	Integral Time (s)
		TD	TD	0.000	Derivative Time (s)
	DeadBand	Enable/Disable	SWDB	OFF	Deadband Enabled
		Dead Band (DB)	DB	0.000	Deadband Band Size

Table 3.7 Panel Parameter Description (continued)

Panel Parameter Name			Parameter Name of Function Block	Initial Value	Application Description
		DBHYS	DBHYS	0.000	Deadband Band Hysteresis
	Control Direction	Direct/Reverse	SWPN	ON	Direct/Reverse Switch(OFF=Direct Action,ON=Reverse action)
	SV Auto Ramp	Target	SV_RAMP	0.0	SV Ramp Target, if the input exceeds [SVL,SVH], the input is invalid and the original value is maintained
		Mode	RAMP_OPT	0	SV Ramp Mode(0=Time,1=Slope)
		Time	TRAMP_EU	0	SV Ramp Time Unit(0=sec,1=min,2=hour)
		Ramp	KRAMP_EU	0	SV Ramp Slope Unit(0=Slope/s,1=Slope/m)
		Start/Stop	SWRAMP	OFF	SV Ramp Switch(OFF=STOP,ON=RUN)
	Mode Lock	Enable	LOCK	OFF	Mode Lock(OFF=UnLock,ON=Lock)
	Override	Enable	RMT_OVRD	OFF	Override Remote Mode(ON=Override)
Amplitude limiting	SV Limits(M)	H	SVH	100.0	SV H Limit Value. Upper amplitude limiting value settings of Loop SV value (the selected alarms are valid, otherwise not) Note: the SV amplitude limiting is not influenced by the selected options.
		L	SVL	0.000	SV L Limit Value. The lower amplitude limiting value settings of loop SV value (the selected alarms are valid, otherwise not.) Note: SV amplitude limiting is not influenced by the selected options.
		ALM	SVH_B	-	SV H Limit Alarm
			SVL_B	-	SV L Limit Alarm
		SUP	SVHSUP	-	SVH Alarm Suppress Status
			SVLSUP	-	SVL Alarm Suppress Status
	MV Limits (%)	H	MVH	100.000	MV H Limit Value H limit settings of loop MV value (the selected alarms are valid, otherwise not.)

Table 3.7 Panel Parameter Description (continued)

Panel Parameter Name			Parameter Name of Function Block	Initial Value	Application Description
					Note: the MV amplitude limiting is not influenced by the selected options.
		L	MVL	0.000	MV L Limit Value Lower limit value settings of loop MV value (the selected alarms are valid, otherwise not) Note: the MV amplitude limiting is not influenced by the selected options.
		ALM	MVH_B	-	MV H Limit Alarm
			MVL_B	-	MV L Limit Alarm
		SUP	MVHSUP	-	MVH Alarm Suppress Status
			MVLSUP	-	MVL Alarm Suppress Status
	DMVLIM(%/S)	ALM	DMVH	-	MV Positive Rate Limit Alarm
			DMVL	-	MV Negative Rate Limit Alarm
		SUP	DMVHSUP	-	DMVH Alarm Suppress Status
			DMVLSUP	-	DMVL Alarm Suppress Status
		DMVLIM	DMVLIM	100.00	MV Output Rate Variety Limit Value
	Change Limits of SV&MV	GSV	GSV	0	SV safety protection input increase or decrease value
		GMV	GMV	0	MV safety protection input increase or decrease value
		MVLM_OPT	MVLM_OPT	OFF	Output Overrange Limit When in Manual (ON=Enable,OFF=Disable)
	Desirable Operating Range(M)	Enable	OPR_EN	OFF	Desirable Operating Range Enable
		OPR_L	OPR_L	40.0	Desirable Operating Range Low Limit
		OPR_H	OPR_H	60.0	Desirable Operating Range High Limit
Inter-lock	Interlock	H	IH_EN	OFF	Interlock H Enable
		L	IL_EN	OFF	Interlock L Enable
		Limits	IH_LIM	95.0	Interlock H Limit

Table 3.7 Panel Parameter Description (continued)

Panel Parameter Name			Parameter Name of Function Block	Initial Value	Application Description
	Alm		IL_LIM	5.0	Interlock L Limit
			I_H	-	Interlock H Alarm
			I_L	-	Interlock L Alarm
	TON		IH_TON	0.0	Interlock H TON (s)
			IL_TON	0.0	Interlock L TON (s)
	TOFF		IH_TOFF	0.0	Interlock H TOFF (s)
			IL_TOFF	0.0	Interlock L TOFF (s)
	SUP		I_HSUP	-	I_H Alarm Suppress Status
			I_LSUP	-	I_L Alarm Suppress Status

Click “Related Tag” from the drop-down list on the function block panel (as shown in the following figure) to open the panel of the related tag configured during user program configuration. If the panel of the related tag is configured, click this option to open its panel. If the “Related tag” parameter is not set in the configuration of the function block tag, “Related Tag” is not displayed on the drop-down list.

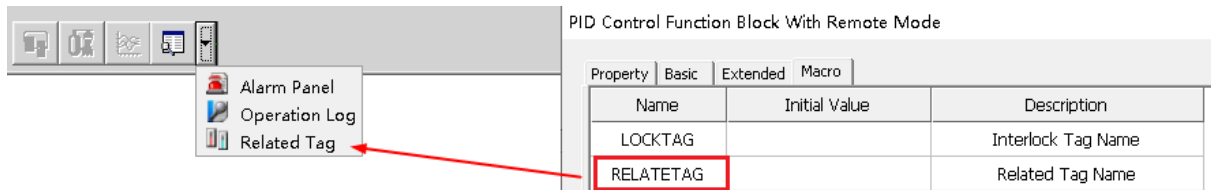


Figure 3.20 Related tag option

3.2.12 Flag

Table 3.8 Flag List

Flag	Alarm	Instruction	Type
D0	OOS	Disable	Status
D1	IMAN	Initialize Manually	Status
D2	MAN	Manual	Status
D3	TR	Track	Status

Table 3.8 Flag List (continued)

Flag	Alarm	Instruction	Type
D4	AUTO	Auto	Status
D5	CAS	Cascade	Status
D6	RCAS	Remote Cascade	Status
D7	ROUT	Remote Output	Status
D8	PVHH	PV HH Limit Alarm	Alarm
D9	PVLL	PV LL Limit Alarm	Alarm
D10	PVH	PV H Limit Alarm	Alarm
D11	PVL	PV L Limit Alarm	Alarm
D12	SVH	SV H Limit Alarm	Alarm
D13	SVL	SV L Limit Alarm	Alarm
D14	MVH	Output H Limit Alarm	Alarm
D15	MVL	Output L Limit Alarm	Alarm
D16	PEI	Positive Deviation Alarm	Alarm
D17	NEI	Negative Deviation Alarm	Alarm
D18	LK	Interlock	Status
D19	CFGERR	Configuration Error	Status
D20	LMAN	Interlock Manual	Alarm
D21	LTR	Interlock Track	Alarm
D22	DMVH	MV Positive Rate Limit Alarm	Alarm
D23	DMVL	MV Negative Rate Limit Alarm	Alarm
D24	I_H	Interlock H Limit Alarm	Alarm
D25	AOF	Shield Alarm	Status
D26	I_L	Interlock L Limit Alarm	Alarm
D27	NMF	Valve Negative Deviation Alarm	Alarm
D28	PMF	Valve Positive Deviation Alarm	Alarm

Table 3.8 Flag List (continued)

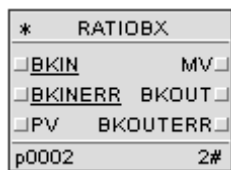
Flag	Alarm	Instruction	Type
D29	PVERR	PV Fault	Alarm
D30	SVERR	SV Fault	Alarm

3.3 RATIOBX Function Block

Output value of ratio setting function block (RATIOBX) is changed with the value of PV multiplied by set value of ratio. RATIOBX setting function block is used to control two variables at setting ratio.

It is a complex function block and its running time is 60μs.

Please read “Function Block Overview” and “Control Function Block Application Foundation” first before using RATIOBX function block.



3.3.1 Parameter Description

Table 3.9 Parameter instruction and application of RATIOBX Function Block

Name			Description	Upload	Properties	Application Reference
Basic Parameters	Range Settings	MVSCH	MV high scale	-	Configuration Parameter	The same as MV actual value H limit.
		MVSCL	MV low scale	-	Configuration Parameter	The same as MV actual value L limit.
		SVSCH	SV high scale	-	Configuration Parameter	The same as SV actual value H limit.
		SVSCL	SV low scale	-	Configuration Parameter	The same as SV actual value L limit.
		SVEU	SV engineer unit	-	Configuration Parameter	Set in the function block

Table 3.9 Parameter instruction and application of RATIOBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
						properties settings interface.
		MVEU	MV engineer unit	-	Configuration Parameter	Set in the function block properties settings interface.
		SVDLEN	SV decimal digits [0,5]	-	Configuration Parameter	Used for data displayed on function block panel (equal to 3 as default).
		MVDLEN	MV decimal digits [0,5]	-	Configuration Parameter	Used for data displayed on function block panel (equal to 3 as default).
	Limits	MVH	MV H limit value	TRUE	Operation Parameter	Value range [MVS-CL,MVSCH]
		MVL	MV L limit value	TRUE	Operation Parameter	Value range [MVS-CL,MVSCH]
		SVH	SV H limit value	TRUE	Operation Parameter	Value range [SVS-CL,SVSCH]
		SVL	SV L limit value	TRUE	Operation Parameter	Value range [SVS-CL,SVSCH]
		DMVLIM	MV output rate variety limits value. Used to prevent the MV from overlarge modification in a short time.	TRUE	Operation Parameter	Refer to the "Alarm" in <i>Function Block User Manual</i>
	Panel Display	SHOWMF	Show MF	TRUE	Operation	When the real-time value of the SHOWMF parameter is set

Table 3.9 Parameter instruction and application of RATIOBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
						to ON, the bar chart on the panel will display the real-time value of the MF parameter, as shown in Figure 3.19.
		SHOWSF	Show SF	TRUE	Operation	When the real-time value of SHOWMF is ON, display SVF value on the panel.
Extend Parameter	Base Input Pin Settings	BKIN	Feedback input	-	Input Pin	Connect to BKOUT of downstream block
		BKINERR	Feedback status input	-	Input Pin	Connect to BKOUT of downstream block ERR
		PV	Process Value	-	Input Pin	Connect to measuring point AI
		CSV	Cascade Input	-	Input Pin	Connect to outer loop control value MV
		TV	Track Input Value	-	Input Pin	Connect to measuring point AI. Related parameter: SWTR.
		SWTR	Track Switch(OFF=Not Track, ON=Track)	-	Input Pin	Upstream interlock condition input, Related parameter: TV
		PVF	PV Reference Value	-	Input Pin	-

Table 3.9 Parameter instruction and application of RATIOBX Function Block (continued)

Name		Description	Upload	Properties	Application Reference
	MF	MV Feedback Value	-	Input Pin	When the SHOWMF is set to ON, the bar chart on the panel can display the real-time value of that parameter. The default value is OFF.
	RSV	Remote Cascade Value	-	Input Pin	-
	SWRCAS	Remote Cascade Switch(ON=to Remote Cascade)	-	Input Pin	-
	SWIK	Interlock Input Mode(0=No Interlock, 1=L-MAN, 2=LTR)	-	Input Pin	Used in conjunction with the function block ITLK_A (related with the OUT_D of the interlock function block.) refer to LMAN/ LTR Modes
	IV	Interlock Value	-	Input Pin	Used in conjunction with the function block ITLK_A (related with the OUT of the interlock function block.) refer to LMAN/ LTR Modes
	MAN_OPT	Control Switch Source of Manual or Auto (OFF=Faceplate Control,	-	Input Pin	Connect the upstream output

Table 3.9 Parameter instruction and application of RATIOBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
			ON=Program Control)			
		SV_OPT	Auto/Cascade Control Source Selection(OFF=Panel Control, ON=Program Control)	-	Input Pin	Connect the upstream output Related parameter: SWSV
	Output Pin	MV	operation output value	-	Output Pin	Connect to electric manual instrument
		BKOUT	Feedback output value	-	Output Pin	Connect to the BKIN of Upstream Block, Related parameter: BK_OPT
		BKOUTERR	Feedback status value	-	Output Pin	Connect to the BKINERR of Upstream Block
		BK_OPT	BKOUT value switch (ON=track PV, OFF=track SV)	-	Configuration Parameter	Related parameter: BKOUT
	Operator Command	MODE	Work Mode(1=OOS,2=I-MAN,3=TRACK,4=MAN,5=AUTO,6=CAS,7=R-CAS,12=L-MAN,13=LTR)	-	Monitoring Parameter	Refer to the “mode and parameter status (MODE)” section in <i>Function Block User Manual</i> for details.
		IMODE	Standby Work Mode(1=OOS,2=I-MAN,3=TRACK,4=MAN,5=AUTO,6=CAS,7=R-CAS,12=L-MAN,13=LTR)	-	Monitoring Parameter	Refer to the “mode and parameter status (MODE)” section in <i>Function Block User Manual</i> for details.

Table 3.9 Parameter instruction and application of RATIOBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
		MODE_OPT	ON=auto return, OFF>manual return (default)	-	Configuration Parameter	Refer to the “mode and parameter status (MODE)” section in <i>Function Block User Manual</i> for details.
		SWMAN	Manual Switch(ON=to Manual)	-	Input Pin	-
		SWAUTO	Auto Switch(ON=to Auto)	-	Input Pin	-
		SWCAS	Cascade Switch(ON=to Cascade)	-	Input Pin	-
		RMT_OVRD	Override Remote Mode(ON=Override)	FALSE	Operation Parameter	-
		LOCK	Mode Lock(OFF=Unlock, ON=Lock)	-	Operation Parameter	-
		SWMMV	Whether to equal to preset MV value when switch to manual status	TRUE	Operation Parameter	Related parameter: MMV
		MMV	Preset MV Value(Switch to Manual)	TRUE	Operation Parameter	Enabled when SWMMV=ON
	Operator Data	SV	Percentage SV	TRUE	Operation Parameter	Refer to the “setting value operation” section in <i>Function Block User Manual</i> for details.

Table 3.9 Parameter instruction and application of RATIOBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
		MANMV	Manual output value	-	Operation Parameter	Output value= MANMV in manual mode
	Input Alarm Settings	PVHH	PV HH limit alarm value	TRUE	Operation Parameter	Refer to the "Input operation" section in <i>Function Block User Manual</i> for details.
		PVH	PV H limit alarm value	TRUE	Operation Parameter	Refer to the "Input operation" section in <i>Function Block User Manual</i> for details.
		PVL	PV L limit alarm value	TRUE	Operation Parameter	Refer to the "Input operation" section in <i>Function Block User Manual</i> for details.
		PVLL	PV LL limit alarm value	TRUE	Operation Parameter	Refer to the "Input operation" section in <i>Function Block User Manual</i> for details.
		PVHYS	Process value alarm hysteresis	TRUE	Operation Parameter	Refer to the "Input operation" section in <i>Function Block User Manual</i> for details.
		NMFLIM	Valve Position Negative Deviation Alarm Limit	TRUE	Operation Parameter	-
		PMFLIM	Valve Position Positive Deviation Alarm Limit	TRUE	Operation Parameter	-

Table 3.9 Parameter instruction and application of RATIOBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
		TMFHYS	Valve Position Alarm Hysteresis Time(s)	TRUE	Operation Parameter	-
		NSFLIM	SV Negative Deviation Alarm Limit	TRUE	Operation Parameter	-
		PSFLIM	SV Positive Deviation Alarm Limit	TRUE	Operation Parameter	-
		SF_TON	SV Deviation Alarm TON(s)	TRUE	Operation Parameter	-
		SF_TOFF	SV Deviation Alarm TOFF(s)	TRUE	Operation Parameter	-
	Advanced Calculation Settings	BIAS	Modify coefficient (compensation)	TRUE	Operation Parameter	Refer to ^{Note1}
		GAIN	Gain	TRUE	Operation Parameter	-
	Alarm	PVHHIND	PVHH limit alarm indication	-	Monitoring Parameter	Refer to the "Alarm" section in <i>Function Block User Manual</i> for details.
		PVHIND	PV H limit alarm indication	-	Monitoring Parameter	Refer to the "Alarm" section in <i>Function Block User Manual</i> for details.
		PVLIND	PV L limit alarm indication	-	Monitoring Parameter	Refer to the "Alarm" section in <i>Function Block User Manual</i> for details.
		PVLLIND	PV LL limit alarm indication	-	Monitoring Parameter	Refer to the "Alarm" section in <i>Function</i>

Table 3.9 Parameter instruction and application of RATIOBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
						<i>tion Block User Manual</i> for details.
		MVHIND	MV H limit alarm indication	-	Monitoring Parameter	Refer to the “Alarm” section in <i>Function Block User Manual</i> for details.
		MVLIND	MV L limit alarm indication	-	Monitoring Parameter	Refer to the “Alarm” section in <i>Function Block User Manual</i> for details.
		SVHIND	SV H limit alarm indication	-	Monitoring Parameter	Refer to the “Alarm” section in <i>Function Block User Manual</i> for details.
		SVLIND	SV L limit alarm indication	-	Monitoring Parameter	Refer to the “Alarm” section in <i>Function Block User Manual</i> for details.
		DMVHIND	MV positive rate limit indication	-	Monitoring Parameter	Refer to the “Alarm” section in <i>Function Block User Manual</i> for details.
		DMVLIND	MV negative rate limit indication	-	Monitoring Parameter	Refer to the “Alarm” section in <i>Function Block User Manual</i> for details.
	Extended	HORLIM	Extended range maximum percentage	-	Configuration Parameter	Refer to the “Output Operation” section in

Table 3.9 Parameter instruction and application of RATIOBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
	Range Settings					<i>Function Block User Manual</i> for details.
		LORLIM	Extended range minimum percentage	-	Configuration Parameter	Refer to the “Output Operation” section in <i>Function Block User Manual</i> for details.
	SV Advanced Settings	RP	Ramp constant	TRUE	Operation Parameter	Related parameter: SWRAMP
		SVTR_OPT	SV Tracks Percentage Enable/Disable	-	Configuration Parameter	Refer to the “Setting Value Operation” section in <i>Function Block User Manual</i> for details.
	Alarm Enabled and Suppress	AOF	Shield module alarm, On=disable to display alarm.	TRUE	Operation Parameter	Refer to the “Integrate Remove” section in <i>Function Block User Manual</i> for details.
		ENALM	Alarm Enabled	TRUE	Alarm Parameter	Refer to the “Integrate Remove” section in <i>Function Block User Manual</i> for details.
		FLAG	Flag	-	Output Pin	Refer to the “Integrate Remove” section in <i>Function Block User Manual</i> for details.

Table 3.9 Parameter instruction and application of RATIOBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
	OOS Settings	SWOOS	Switch of Out of Service (ON=Disable)	TRUE	Operation Parameter	Set as ON at the first time of function block downloading
		OOSVAL	OOS mode output value	TRUE	Operation Parameter	Related parameter: OOS_OPT=ON
		OOS_OPT	Output Value Type in OOS Status(ON:MV=OOS-VAL)	-	Configuration Parameter	Refer to the “Calculation Stop OOS Mode” section in <i>Function Block User Manual</i> for details.
	Panel display settings	SVF	(PVF-BIAS)/PV*GAIN	-	Monitoring parameters	Relevant parameter: SHOWSF
		T_PEAK	Recent History (0=Not Show,1=2min,2=10min,3=30min,4=1h,5=2h,6=4h,7=8h,8=12h,9=24h)	TRUE	Operation Parameter	-
MARCO		LOCKTAG	Interlock Tag Name	-	-	-

Note 1. Calculate ratio

Ratio is calculated according to the following expression:

$$MV_n = SV_e \times PV_n \times GAIN + BIAS$$

SV_e : Valid set value of ratio which is enabled set value of ratio after set value of RATIOBX SV is implemented ramp process of set value. Ramp process of set value is used for bumpless transfer of function block mode.

GAIN is gain (the default value is 1.0), BIAS is the correction factor for compensation (the default value is 0.0) The engineering unit of BIAS is the same as MV.

Note 2: SV Deviation Alarm

$$SVF = (PVF - BIAS) / PV \times GAIN;$$

$$SV \text{ Deviation} = SV - SVF;$$

When SV positive deviation value exceeds the positive alarm limit of SV deviation, the positive deviation alarm occurs.

When SV positive deviation value is less than or equals the positive alarm limit of SV deviation as well as the positive deviation alarm elimination delay time is up, the positive deviation alarm will be eliminated.

When SV negative deviation value exceeds the negative alarm limit of SV deviation as well as the negative deviation alarm elimination delay time is up, the negative deviation alarm occur.

When SV negative deviation value is less than or equals the negative alarm limit of SV deviation as well as the negative deviation alarm elimination delay time is up, the negative deviation alarm will be eliminated.

SV deviation alarm limit can only be set as positive numbers.

Note 3. Bumpless transfer

Bumpless transfer indicates that output value will not be mutant in the mode of transfer function block. The movement of bumpless transfer which is selected automatically will be different with difference of output movement and control mode. There are two bumpless transfer modes for RATIOBX function block: ratio track and ramp movement of set value of ratio.

- Ratio track

When ratio calculation is stopped, set value of ratio SV is calculated according to output value MV, by which bumpless transfer from manual mode to auto mode can be achieved.

$$SV = (MV - BIAS) * \frac{1}{PV * GAIN}$$

The function of ratio track can be implemented in manual mode (MAN). If $PV \times GAIN = 0$, then $SV = SVH$.

- Ramp movement of setting values of ratio

When setting values of ratio SV are changing, the variable of setting values of valid ratio SV_e per second is limited to be less than or equal to the ramp constant RP by the ramp of setting values of ratio. When function block mode is transferred from manual mode to auto mode,

SV_e calculated according to MV is the initial value of setting values of valid ratio. And when the setting value SV is changing, the ramp of ratio setting value works.

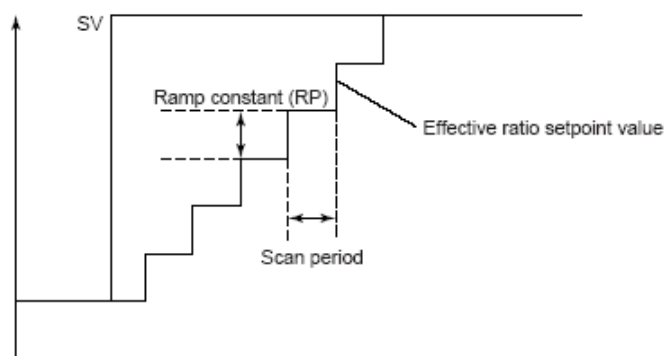


Figure 3.21 Ramp Principles of Ratio Setting Values

3.3.2 Function Overview

The basic workflow of RATIOBX is shown below.

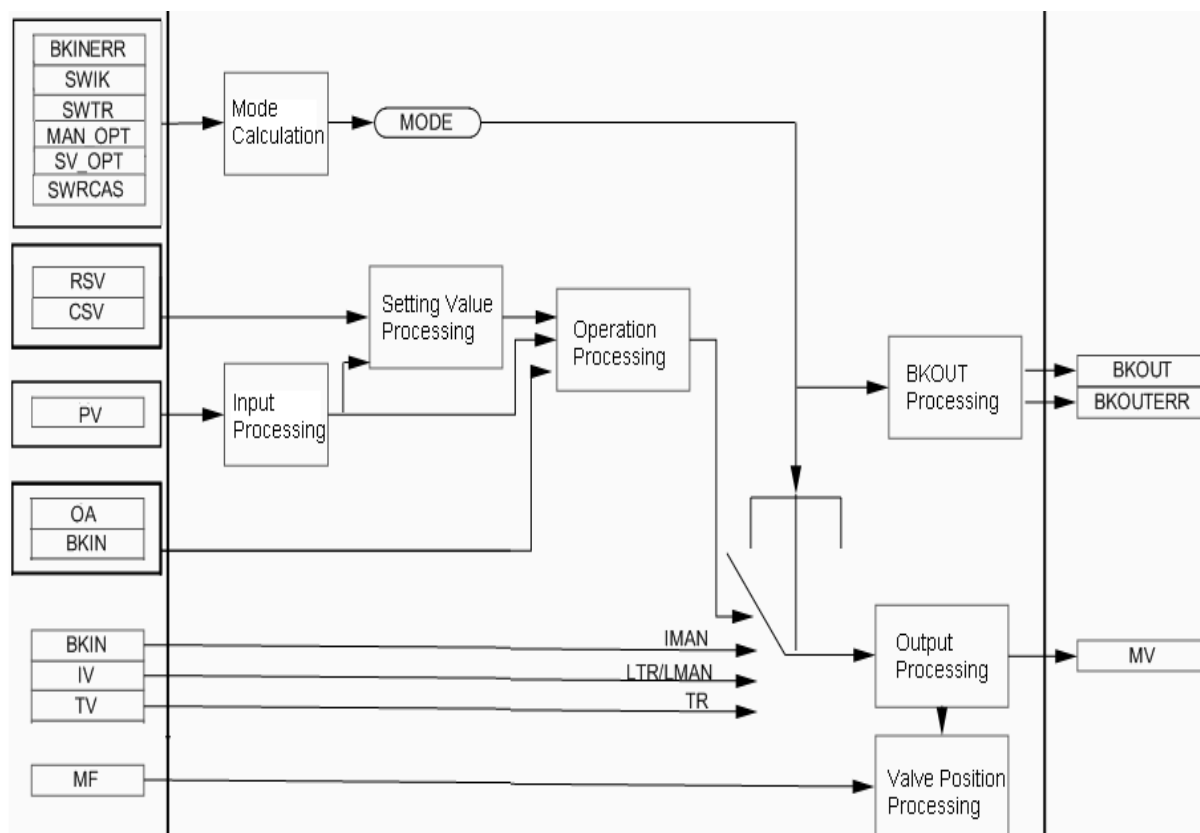


Figure 3.22 Basic Workflow of RATIOBX

3.3.3 Mode Calculation

RATIOBX function block supports such running modes as OOS, IMAN, TR, MAN, AUTO, CAS, RCAS, LMAN and LTR.

Mode Switching

- When SWOOS = ON, the mode is the OOS regardless of other mode-related parameters.
- When SWOOS = OFF and BKINERR = ON, the mode is the IMAN regardless of other mode-related parameters.
- When SWOOS = OFF, BKINERR = OFF, SWIK = 1, the mode is the LMAN regardless of other mode-related parameters.
- When SWOOS = OFF, BKINERR = OFF, SWIK = 2, the mode is the LTR regardless of other mode-related parameters.
- When SWOOS = OFF, BKINERR = OFF, SWIK = 0, SWTR = ON, the mode is the TR regardless of other mode-related parameters.
- When SWOOS = OFF, BKINERR = OFF, SWIK = 0, SWTR = OFF:
 - If LOCK = ON:

If the previous cycle is in the OOS / IMAN / LMAN / LTR / TR status and it is a manual degrading, this cycle will be in the MAN status, if it is an automatic degrading, it will enter the mode prior to OOS / IMAN / LMAN / LTR / TR.

If the previous cycle is in the MAN / ROUT / RCAS / AUTO / CAS status and PVERR = OFF and SVERR = OFF, the status of this cycle will keep unchanged.

If the previous cycle is in the MAN / ROUT / RCAS / AUTO / CAS status and PVERR = ON, then this cycle will be in the MAN status.

If the previous cycle is in the RCAS / CAS status and PVERR = OFF and SVERR = ON, then this cycle will be in the AUTO status.

If the previous cycle is in the MAN / ROUT / AUTO status, and PVERR = OFF and SVERR = ON, then this cycle will keep unchanged.
 - If LOCK = OFF and RMT_OVRD = OFF

If SWRCAS = ON, it enters RCAS mode.

If SWRCAS = OFF and SWMAN = ON, then it enters MAN mode.

If SWRCAS = OFF, SWMAN = OFF and SWAUTO = ON, then it enters AUTO mode.

If SWRCAS = OFF, SWMAN = OFF, SWAUTO = OFF and SWCAS = ON, then it enters CAS mode.

If SWROUT = OFF, SWRCAS = OFF, and SWMAN = ON, it enters the MAN mode.

If SWRCAS = OFF, SWRMAN = OFF, SWAUTO = OFF and SWCAS = OFF and meanwhile the status of last cycle is OOS/IMAN/LMAN/LTR/TR,

 - If it is a manual degrading, then this cycle will be in the MAN status. If it is an automatic degrading, it will enter the mode prior to OOS / IMAN / LMAN / LTR / TR.
 - If the previous cycle is in the MAN / RCAS / AUTO / CAS status, the status of this cycle will not change.

- If LOCK = OFF and RMT_OVRD = ON
The value of SWRCAS does not affect the mode.
If SWMAN = ON, it enters MAN mode.
If SWMAN = OFF, SWAUTO = ON, then it enters the AUTO mode.
If SWMAN = OFF, SWAUTO = OFF and SWCAS = ON, it enters CAS mode.
If SWMAN = OFF, SWAUTO = OFF, SWCAS = OFF, meanwhile the previous cycle is OOS/IMAN/LMAN/LTR/TR,
 - If it is a manual degrading, this cycle will be in the MAN status. If it is an automatic degrading, it will enter the mode prior to OOS / IMAN / LMAN / LTR / TR.
 - If the previous cycle is in the MAN / ROUT / RCAS / AUTO / CAS status, then the status of this cycle will not change.

Work Mode

- OOS
In this mode, the output value MV is set according to the OOS_OPT configuration, where you can hold the output or output the OOSVAL safety value.
- Initial status (IMAN)
If the feedback value of the downstream function block and feedback status are respectively connected to BKIN and BKINERR, the output can follow the BKOUT value of the downstream function block.
- Interlock tracking (LTR)
Interlock tracking mode and the output equals IV.
- Manual Interlock (LMAN)
Manual interlock mode and the output is IV.
- Tracking (TR)
The function block is in the tracking status, and the output is the tracking input value TV. The output MV still has the effect to limit the amplitude. If the TV value exceeds the limiting range, it will be forced to be within the limiting value, that is, $MV = MV_L$ when $TV < MV_L$ and $MV = MV_H$ when $TV > MV_H$.
- Manual mode(MAN)
Set manually, $MV = MANMV$, and the output MV has a limiting effect on amplitude.
- Automatic mode
Automatic control output. BKOUTERR = OFF when it is in the automatic mode, while BKOUTERR = ON when it is in other modes;
- Cascade (CAS)
The setting value CSV comes from the output of the upstream module.

- Remote Cascade (RCAS)

Remote cascade, the setting value RSV comes from the sequence control or upper layer software.

The Degrading of Function Block Modes

The degrading of function block mode is divided into manual degrading and automatic degrading. The default setting is manual degrading. The standby working mode (IMODE) corresponding to each working mode (MODE) is only a reference for field operators.

- When MODE_OPT = OFF, the function block mode adopts manually degrading.
- When MODE_OPT = ON, the function block mode adopts automatically degrading.
- Regardless of automatically or manually degrading, if a degrading occurred after the system had a cold start, it goes into manual mode.

3.3.4 Input Processing

The process input variable PV has 4 amplitude alarms: HH limit alarm (PVHH), H limit alarm (PVH), L limit alarm (PVL), and LL limit alarms (PVLL). It has an alarm hysteresis function. When PV is greater than or equal to PVHH, the HH limit alarm occurs; when PV is greater than or equal to PVH, the H limit alarm occurs; when PV is less than or equal to PVL, a L limit alarm occurs; when PV is less than or equal to PVLL, a LL limit alarm occurs, and the alarm has functions to generate or eliminate the delay.

These four values must satisfy the following relationships: $PVHH - PVHYS > PVH$, $PVH - PVHYS > PVL + PVHYS$, $PVL > PVLL + PVHYS$.

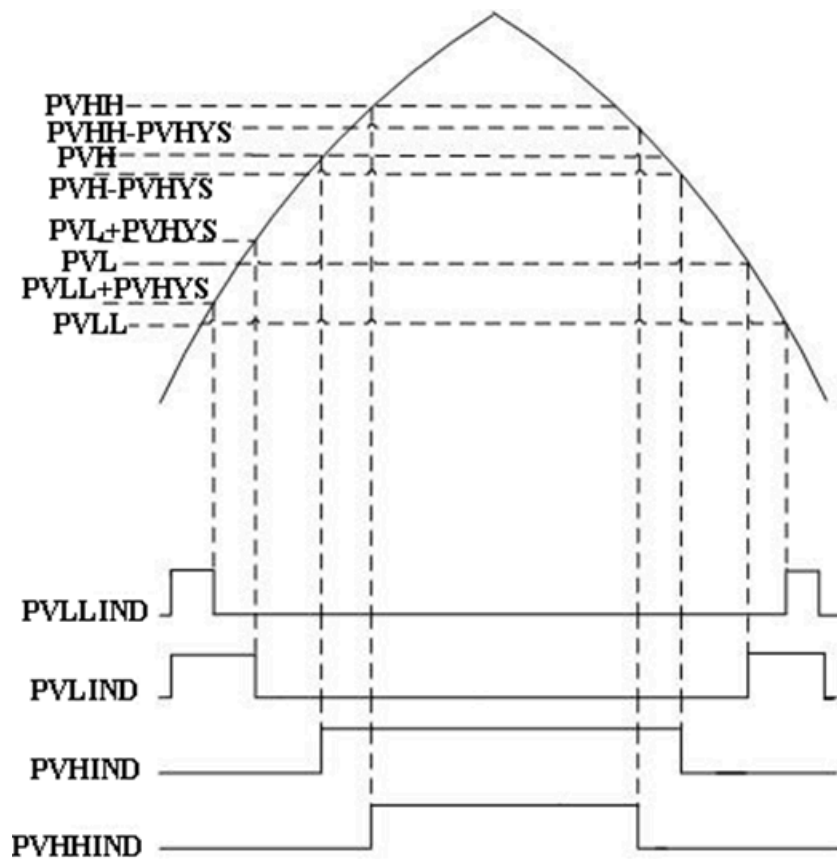


Figure 3.23 Alarm Processing of RATIOBX

3.3.5 Setting Values

This section mainly introduces how the RATIOBX function block processes set values.

Track Setting Values

By configuring SVTR_OPT to determine whether or not the setting value tracks the measured value:

- when SVTR_OPT = ON, it tracks;
- when SVTR_OPT = OFF, it doesn't track. When it is not tracking, slight disturbance will occur if you switch the mode from the manual to the automatic.

Setting Values Selection

- When it is in cascade RCAS mode, SV is equal to CSV.
- When it is in remote cascade RCAS mode, SV is equal to RSV.
- When it is automatic, the setting value is equal to SV, and CSV is equal to SV.

The Limiting Amplitude of Setting Values and Alarms

The H limit (SVH) of setting values must be greater than or equal to the L limit (SVL). Otherwise, the amplitude limiting will not work meanwhile a configuration alarm (CFGERR) will be generated. The setting value SV is limited between the H limit SVH and the L limit SVL of setting values. When setting values exceed the range specified by SVH and SVL, then they will be limited to the H and L limits and alarm. If $SVH < SVL$, the amplitude limiting won't work.

3.3.6 Operation Processing

Ratio Calculation

$$MV = SV \times PV \times GAIN + BIAS$$

The Feedback Calculation of SV

$$SVF = (PVF - BIAS) / (PV \times GAIN)$$

The Feedback Deviation Alarm of SV

$$SV \text{ deviation} = SV - SVF$$

If $SV \text{ deviation} < -NSFLIM$ is satisfied, then NSF alarm will be issued. If $SV \text{ deviation} > PSFLIM$ is satisfied, then PSF alarm will be issued.

The deviation supports delay being generated and eliminated, which means you can by SF_TON, set the hysteresis time of the generation of SV deviation alarm while by SF_TOFF, set the hysteresis time of the elimination.

Switching without Disturbance

Switching without disturbance means the output value won't vary suddenly when function block modes are switched. The switching acts without disturbance are different responding to different control output acts and control modes and will be selected automatically. RATIOBX function block has two ways of switching without disturbance: ratio tracking and the ramp act of ratio values.

- Ratio Tracking

when the ratio calculation stops, the ratio value SV is obtained from the operation output value MV in a reversed way, which can realize switching from manual to automatic modes without any disturbance.

$$SV = (MV - BIAS) * \frac{1}{PV * GAIN}$$

Ratio tracking is performed in the manual mode(MAN). If $PV \times GAIN = 0$ is satisfied, then $SV = SVL$.

- Ramp Acts of Ratio Values

when the ratio value SV varies, the ramp of ratio value will make the variable of the effective ratio value SV_e limited within the ramp constant RP per second. When the function block is switched from manual to automatic mode, the SV_e that is derived from MV in a reversed way,

will be set as the initial value of the effective ratio value. Then, when the setting value SV varies, the ramp of the ratio value will work.

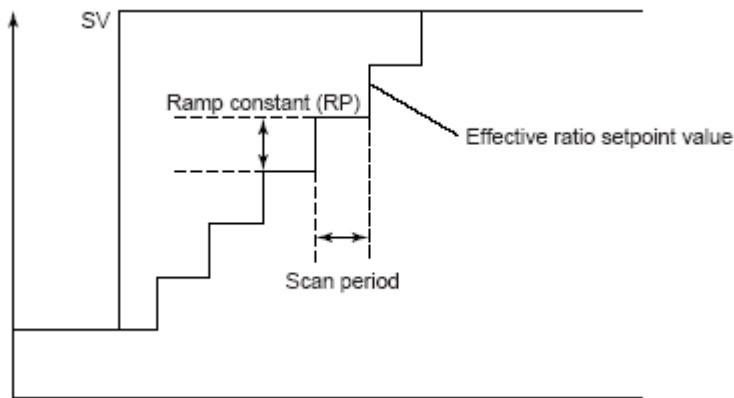


Figure 3.24 The ramp of the ratio value

3.3.7 Output Processing

This section mainly introduces how the RATIOBX function block processes output.

Output the Amplitude Limiting and Alarms

If the output value exceeds its amplitude limiting value, the amplitude of the output will be limited and an alarm will be issued. The maximum amplitude limiting of the output (MVH) must be greater than or equal to the minimum amplitude limiting of the output (MVL), otherwise the amplitude limiting will not work and a configuration alarm (CFGERR) will be generated.

The MVH must be less than $\text{HORLIM} \times (\text{MVSCH} - \text{MVSCL}) / 100 + \text{MVSCH}$, and the MVH must be greater than $\text{MVSCL} - \text{LORLIM} \times (\text{MVSCH} - \text{MVSCL}) / 100$.

When $\text{MVLM_OPT} = \text{ON}$, IMAN, MAN, LMAN mode is limited by MVH and MVL.

When $\text{MVLM_OPT} = \text{OFF}$, IMAN, MAN, LMAN modes are not limited by MVH and MVL, but must be within the range of $[\text{MVSCL} - \text{LORLIM} \times (\text{MVSCH} - \text{MVSCL}) / 100, \text{HORLIM} \times (\text{MVSCH} - \text{MVSCL}) / 100 + \text{MVSCH}]$.

The amplitude limiting doesn't work in OOS mode.

In other modes, when the output value exceeded its amplitude limiting value, the amplitude of the output will be limited and an alarm will be issued.

The Amplitude Limiting of the Output Rate and Alarms

When the varying rate of the output exceeds the variable of the amplitude limiting, the output will be limited and an alarm will be issued. The rate limit is only detected in the automatic and cascade status. In the automatic, cascaded status, an alarm will occur when the varying rate of the output MV exceeds the amplitude limiting of its rate DMVLIM. When the increased rate of MV

exceeds DMVLIM, a positive rate alarm occurs, that is, DMVHIND = ON; when the decreased rate of MV exceeds DMVLIM, a negative rate alarm occurs, that is, DMVLIND = ON. When the amplitude limiting of rate occurs, the output is increased or decreased by the values of the amplitude limiting of rate.

3.3.8 BKOUT Processing

BKOUT tracks the measured value when BK_OPT = ON, and BKOUT tracks the setting value when BK_OPT = OFF.

When the mode is in CAS or RCAS, then BKOUTERR = OFF, while BKOUTERR = ON in other modes.

3.3.9 Others

- Fast increase and decrease

There are fast increase, fast decrease, slow increase, and slow decrease buttons on the panel. Users can modify MV or SV through these buttons.

- MODE = MAN

In this mode, these four buttons on the panel are available for MV. The amplitude (engineering amount) of fast increase and decrease is equal to $(MVSCH - MVSCL) \times FMV / 100$, and the amplitude of slow increase and decrease is equal to $(MVSCH - MVSCL) \times SMV / 100$.

- MODE = AUTO

In this mode, these four buttons on the panel are available for SV. The amplitude of the fast increase and decrease is equal to $(SVSCH - SVSCL) \times FSV / 100$, and the amplitude of the slow increase and decrease is equal to $(SVSCH - SVSCL) \times SSV / 100$.

The increase / decrease buttons are invalid in other modes.

- Manual, automatic signal source and internal, external given signal source selection

The manual signal source can be selected through the parameter MAN_OPT. When MAN_OPT = ON is satisfied, the auto and cascade buttons on the panel cannot be operated. You can use the parameter SV_OPT to select the signal source given inside or outside. When SV_OPT = ON is satisfied, the cascade buttons on the panel cannot be operated.

- Decimal places

The configuration of the SVDLEN and MVDLEN parameters involved in the control function block library is used to display data on the function block panel.

- Whether or not the bar graph on the panel shows MF and valve position deviation alarm SHOWMF

- Whether or not the bar graph on the panel displays the SV deviation alarm SHOWSF.
- The latest historical segment T_PEAK displayed on the panel trend

3.3.10 Panel Parameter Instruction

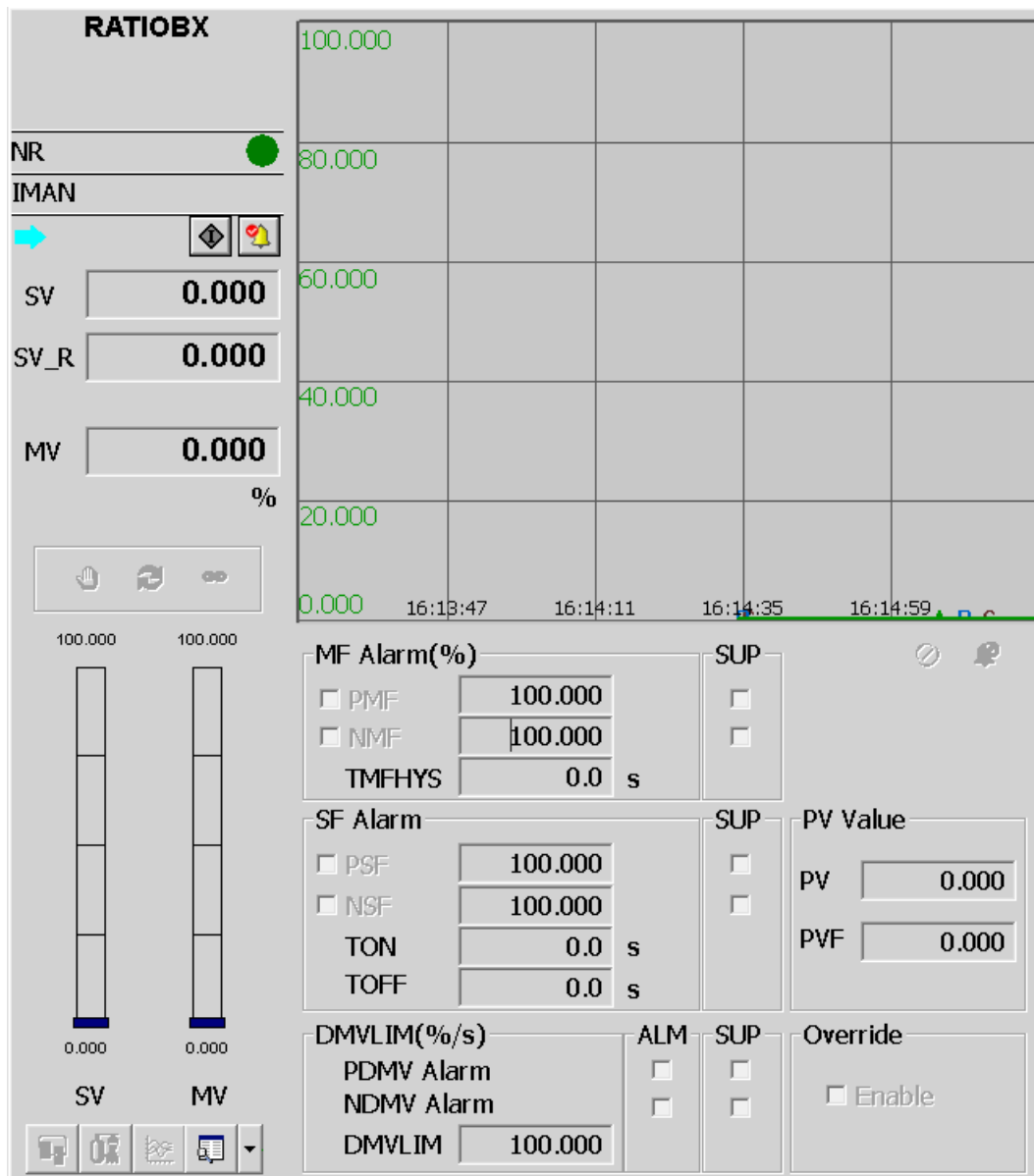


Figure 3.25 RATIBOX Function Block Panel Parameter

Table 3.10 Operation Instruction for Panel Parameter

Panel Parameter Name		Function Block Parameter Name	Initial Value	Application Description
Valve off-set alarm (%)	PMF	PMF	-	Valve Position Positive Deviation Alarm
	NMF	NMF	-	Valve Position Negative Deviation Alarm

Table 3.10 Operation Instruction for Panel Parameter (continued)

Panel Parameter Name		Function Block Parameter Name	Initial Value	Application Description
	SUP	PMFSUP	-	PMF Alarm Suppress Status
		NMFSUP	-	NMF Alarm Suppress Status
	TMFHYS	PVHYS	0.000	Process Value Alarm Hysteresis
SV offset alarm	PSF	PSF	-	SV Positive Deviation Alarm
	NSF	NSF	-	SV Negative Deviation Alarm
	TON	SF_TON	0	SV Deviation Alarm TON(s)
	TOFF	SF_TOFF	0	SV Deviation Alarm TOFF(s)
	SUP	PSFSUP	-	PSF Alarm Suppress Status
		NSFSUP	-	NMF Alarm Suppress Status
PV parameters	PV	PV	0.0	Process Value
	PVF	PVF	0.0	PV Reference Value
MV rate amplitude limiting	ALM	DMVH	-	MV Positive Rate Limit Alarm
		DMVL	-	MV Negative Rate Limit Alarm
	SUP	DMVHSUP	-	DMVH Alarm Suppress Status
		DMVLSUP	-	DMVL Alarm Suppress Status
	DMVLIM	DMVLIM	100.000	MV Output Rate Variety Limit Value
Override	Override	RMT_OVRD	OFF	Override Remote Mode(ON=Override)

3.3.11 Flag

Table 3.11 Flag List

Flag	Alarm	Description	Type
D0	OOS	Disable	Status
D1	IMAN	Initialize Manually	Status
D2	MAN	Manual	Status
D3	TR	Track	Status

Table 3.11 Flag List (continued)

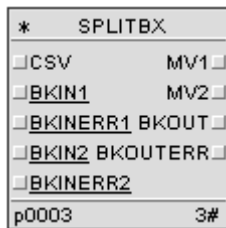
Flag	Alarm	Description	Type
D4	AUTO	Auto	Status
D5	CAS	Cascade	Status
D6	RCAS	Remote Cascade	Status
D8	PVHH	PV HH Limit Alarm	Alarm
D9	PVLL	PV LL Limit Alarm	Alarm
D10	PVH	PV H Limit Alarm	Alarm
D11	PVL	PV L Limit Alarm	Alarm
D12	SVH	SV H Limit Alarm	Alarm
D13	SVL	SV L Limit Alarm	Alarm
D14	MVH	Output H Limit Alarm	Alarm
D15	MVL	Output L Limit Alarm	Alarm
D18	LK	Interlock	Status
D19	CFGERR	Configuration Error	Alarm
D20	LMAN	Interlock Manual	Alarm
D21	LTR	Interlock Track	Alarm
D22	DMVH	MV Positive Rate Limit Alarm	Alarm
D23	DMVL	MV Negative Rate Limit Alarm	Alarm
D25	AOF	Shield Alarm	Status
D27	NMF	Valve Negative Deviation Alarm	Alarm
D28	PMF	Valve Positive Deviation Alarm	Alarm
D29	NSF	SV Negative Deviation Alarm	Alarm
D30	PSF	SV Positive Deviation Alarm	Alarm

3.4 SPLITBX Control Function Block

The input signal is allocated by split control function block according to each range of two output. It only has the control output action of position type.

It is a complex function block and the running time is 50μs.

Please read the “Function Block Overview” and “Control Function Block Application Foundation” in *Function Block User Manual* before using SPLITBX function block.



3.4.1 Parameter Description

Table 3.12 Parameter instruction and application of SPLITBX Function Block

Name			Description	Upload	Properties	Application Reference
Basic Parameters	Range Settings	SVSCH	SV high scale	-	Configuration Parameter	Make sure that SVSCH is greater than or equal to SVSCL.
		SVSCL	SV low scale	-	Configuration Parameter	Make sure that SVSCH is greater than SVSCL.
		MVSCH1	MV1 high value	-	Configuration Parameter	The same as MV1 actual value H limit.
		MVSCL1	MV1 low value	-	Configuration Parameter	The same as MV1 actual value L limit.
		MVSCH2	MV2 high value	-	Configuration Parameter	The same as MV2 actual value H limit.
		MVSCL2	MV2 low value	-	Configuration Parameter	The same as MV2 actual value L limit.
		SVEU	SV engineer unit	-	Configuration Parameter	Set in the function block property settings interface.
		MVEU1	MV1 actual value unit	-	Configuration Parameter	Set in the function block property settings interface.
		MVEU2	MV2 actual value unit	-	Configuration Parameter	Set in the function block property settings interface.

Table 3.12 Parameter instruction and application of SPLITBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
		SVDLEN	SV decimal digits [0,5]	-	Configuration Parameter	Used for function block panel displaying data (equal to 3 as default).
		MVDLEN1	MV1 decimal digits [0,5]	-	Configuration Parameter	Used for function block panel displaying data (equal to 3 as default).
		MVDLEN2	MV2 decimal digits [0,5]	-	Configuration Parameter	Used for function block panel displaying data (equal to 3 as default).
	Output Action Limit Setting	SRH1	Output1 action maximum	-	Configuration Parameter	Refer to ^{Note1, 3}
		SRL1	Output1 action minimum	-	Configuration Parameter	Refer to ^{Note1, 3}
		SRH2	Output2 action maximum	-	Configuration Parameter	Refer to ^{Note1, 3}
		SRL2	Output2 action minimum	-	Configuration Parameter	Refer to ^{Note1, 3}
	Limits	MVH1	MV1 H limit value	TRUE	Operation Parameter	Value range [MVS-CL,MVSCH]
		MVL1	MV1 L limit value	TRUE	Operation Parameter	Value range [MVS-CL,MVSCH]
		MVH2	MV2 H limit value	TRUE	Operation Parameter	Value range [MVS-CL,MVSCH]
		MVL2	MV2 L limit value	TRUE	Operation Parameter	Value range [MVS-CL,MVSCH]
		SVH	SV H limit value	TRUE	Operation Parameter	Value range [SVS-CL,SVSCH]
		SVL	SV L limit value	TRUE	Operation Parameter	Value range [SVS-CL,SVSCH]
	Direct/Reverse	SWPN1	Output 1 Direct/Reverse Select	TRUE	Operation Parameter	SWPN1 = OFF, direct, SWPN1 = ON, reverse.

Table 3.12 Parameter instruction and application of SPLITBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
	Switch Settings		tion:ON=Reverse action			
		SWPN2	Output 2 Direct/Reverse Selection:ON=Reverse action	TRUE	Operation Parameter	SWPN2 = OFF, direct, SWPN2 = ON, reverse.
	Panel display settings	SHOWMF1	Show MF1	TRUE	Operation	-
		SHOWMF2	Show MF2	TRUE	Operation	-
Extended Parameters	Base Input Pin Settings	CSV	Cascade	-	Input Pin	Connect to outer loop control value MV
		BKIN1	Feedback value1 input	-	Input Pin	Connect to downstream BKOUT
		BKINERR1	Feedback status1 input	-	Input Pin	Connect to downstream BKOUTERR
		BKIN2	Feedback value2 input	-	Input Pin	Connect to downstream BKOUT
		BKINERR2	Feedback status2 input	-	Input Pin	Connect to downstream BKOUTERR
		TV1	Track input value 1	-	Input Pin	Connect to measuring point AI
		TV2	Track input value 2	-	Input Pin	Connect to measuring point AI
		SWTR	Track switch: OFF=not track, ON=track	-	Input Pin	Upstream interlock condition input, Related parameter: TV
		MF1	MV1 Feedback Value	-	Input Pin	-
		MF2	MV2 Feedback Value	-	Input Pin	-
		MAN_OPT	Control Switch Source of Manual or Auto (OF-	-	Input Pin	Connect the upstream output

Table 3.12 Parameter instruction and application of SPLITBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
			F=Faceplate Control, ON=Program Control)			
		SV_OPT	Auto/Cascade Control Source Selection(OF-F=Panel Control, ON=Program Control)	-	Input Pin	Connect the upstream output Related parameter: PSWSV, SWSV
	Output Pin	MV1	Operation Output Value 1	-	Output Pin	Connect to electric manual instrument Refer to ^{Note1}
		MV2	Operation Output Value 2	-	Output Pin	Connect to electric manual instrument Refer to ^{Note1}
		BKOUT	Feedback output value	-	Output Pin	Connect to the BKIN of Upstream Block, Related parameter: BK_OPT
		BKOUTERR	Feedback status value	-	Output Pin	Connect to the BKINERR of Upstream Block
	Operator Command	MODE	Work Mode(1=OOS,2=IMAN,3=TRACK,4=MAN,5=AUTO,6=CAS)		Monitoring Parameter	Refer to the “Mode and Parameter Status (MODE)” section in the <i>Function Block User Manual</i> for details
		IMODE	Standby Work Mode(1=OOS, 2=IMAN, 3=TRACK, 4=MAN, 5=AUTO, 6=CAS)	-	Monitoring Parameter	Refer to the “Mode and Parameter Status (MODE)” section in the <i>Function Block User Manual</i> for details
		MODE_-OPT	ON=auto return, OFF=manual return (default)	-	Configuration Parameter	Refer to the “Mode and Parameter Status (MODE)” section in the <i>Function Block User Manual</i> for details

Table 3.12 Parameter instruction and application of SPLITBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
		SWMAN	Manual Switch(ON=to Manual)	-	Input Pin	-
		SWAUTO	Auto Switch(ON=to Auto)	-	Input Pin	-
		SWCAS	Cascade Switch(ON=to Cascade)	-	Input Pin	-
	Operator Data	MANMV1	Manual output value1	-	Operation Parameter	Output value= MAN-MV in manual mode
		MANMV2	Manual output value2	-	Operation Parameter	Refer to ^{Note1}
		SV	SV	TRUE	Operation Parameter	Value range [SVS-CL,SVSCH]
	Advanced Calculation Settings	SW	Selector Switch	TRUE	Operation Parameter	Refer to ^{Note2}
		RP1	Balance ramp coefficient1	TRUE	Operation Parameter	Related parameter: SW
		RP2	Balance ramp coefficient2	TRUE	Operation Parameter	Related parameter: SW
		RP_OPT	Balance ramp mode	TRUE	Operation Parameter	Refer to Note 7
	Alarm	SVHIND	SV H limit alarm indication	-	Monitoring Parameter	Refer to the “Integrate Remove” section in the <i>Function Block User Manual</i> for details
		SVLIND	SV L limit alarm indication	-	Monitoring Parameter	Refer to the “Integrate Remove” section in the <i>Function Block User Manual</i> for details
		MV1HIND	MV1HAlarm	-	Monitoring Parameter	Refer to the “Integrate Remove” section in the <i>Function</i>

Table 3.12 Parameter instruction and application of SPLITBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
						<i>Block User Manual</i> for details
		MV1LIND	MV1LAlarm	-	Monitoring Parameter	Refer to the “Integrate Remove” section in the <i>Function Block User Manual</i> for details
		MV2HIND	MV2HAlarm	-	Monitoring Parameter	Refer to the “Integrate Remove” section in the <i>Function Block User Manual</i> for details
		MV2LIND	MV2LAlarm	-	Monitoring Parameter	Refer to the “Integrate Remove” section in the <i>Function Block User Manual</i> for details
	Ex- tended Range Settings	HORLIM1	Output 1Extended range maximum percentage	-	Configuration Parameter	Refer to the “Output Calculation” section in the <i>Function Block User Manual</i> for details
		LORLIM1	Output 1Extended range minimum percentage	-	Configuration Parameter	Refer to the “Output Calculation” section in the <i>Function Block User Manual</i> for details
		HORLIM2	Output 2Extended range maximum percentage	-	Configuration Parameter	Refer to the “Output Calculation” section in the <i>Function Block User Manual</i> for details
		LORLIM2	Output 2Extended range minimum percentage	-	Configuration Parameter	Refer to the “Integrate Remove” section in the <i>Function Block User Manual</i> for details
	Alarm Enabled and Suppress	AOF	Shield module alarm,, On=disable to display alarm	TRUE	Operation Parameter	Refer to the “Integrate Remove” section in the <i>Function</i>

Table 3.12 Parameter instruction and application of SPLITBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
						<i>Block User Manual</i> for details
		ENALM	Alarm Enabled	TRUE	Alarm Parameter	Refer to the “Integrate Remove” section in the <i>Function Block User Manual</i> for details
		FLAG	Flag	-	Output Pin	Refer to the “Integrate Remove” section in the <i>Function Block User Manual</i> for details
	Amplitude limiting settings	GMV1	MV1 safety protection input increase or decrease value	TRUE	Operation	-
		GMV2	MV2 safety protection input increase or decrease value	TRUE	Operation	-
		GSV	SV safety protection input increase or decrease value	TRUE	Operation	-
	Panel display settings	T_PEAK	Recent History (0=Not Show, 1=2min, 2=10min, 3=30min, 4=1h, 5=2h, 6=4h, 7=8h, 8=12h, 9=24h)	TRUE	Operation	-
	Offset alarm settings	NMFLIM1	Valve1 Position Negative Deviation Alarm Limit	TRUE	Operation	-
		PMFLIM1	Valve1 Position Positive Deviation Alarm Limit	TRUE	Operation	-

Table 3.12 Parameter instruction and application of SPLITBX Function Block (continued)

Name			Description	Upload	Properties	Application Reference
		TMFHYS1	Valve1 Position Alarm Hysteresis Time(s)	TRUE	Operation	-
		NMFLIM2	Valve2 Position Negative Deviation Alarm Limit	TRUE	Operation	-
		PMFLIM2	Valve2 Position Positive Deviation Alarm Limit	TRUE	Operation	-
		TMFHYS2	Valve2 Position Alarm Hysteresis Time(s)	TRUE	Operation	-
	OOS Settings	SWOOS	Disable feature of Function block and ON means disable	TRUE	Operation Parameter	Set as ON at the first time of function block downloading Refer to ^{Note5}
		OOSVAL1	OOS mode safe value 1	TRUE	Operation Parameter	Related parameter: OOS_OPT=ON
		OOSVAL2	OOS mode safe value 2	TRUE	Operation Parameter	Related parameter: OOS_OPT=ON
		OOS_OPT	Output Value Type in OOS Status(ON: MV1=OOS-VAL1, MV2=OOS-VAL2)	-	Configuration Parameter	Refer to the "Calculation Stop OOS Mode" section in the <i>Function Block User Manual</i> for details

Note 1. Calculate output value

The two output values MV1 and MV are calculated by SPLITBX function block according to SV. Users can preset the range of the output value (SRH1, SRL1, SRH2, SRL2) according to SV. The range of output value must be in the range of SV and SRH1>SRL1, SRH2>SRL2, SRL1=SVSCL, SRH2=SVSCH.

MV1 and MV2 can be calculated by the following expression:

$$MV_i = CALC_i + BL_i(n)$$

When MV outputs forward:

$$CALC_i = MVSCl_i + \frac{MVSCH_i - MVSCl_i}{SRH_i - SRL_i} * (SV - SRL_i)$$

When MV outputs backward:

$$CALC_i = MVSCH_i - \frac{MVSCH_i - MVSCl_i}{SRH_i - SRL_i} * (SV - SRL_i)$$

i=1 or 2, and $BL_i(n)$ is balance item.

Note 2. Selection Switch (Signal allocation switch)

The function block calculates output value of each output pin according to SV and allocates signals to output terminals. And output pin can be specified by signal allocation switch.

When SW=0, signal allocation is stopped;

When SW=1, only MV1 is allocated signal;

When SW=2, only MV2 is allocated signal;

When SW=3, the two output pin are allocated signal.

Output pin not selected by SW tracks TV value.

Note 3. Control movement direction

Direct movement: Output value MV changes in the same direction with set value SV.

Reverse movement: Output value MV changes in the reverse direction with set value SV.

Note 4. Limit set value

Set value SV is limited between high limit of set value SVH and low limit of set value SVL.

Low limit of output 1 movement is equal to low limit of set value range;

High limit of output 2 movement is equal to high limit of set value range;

High limit of output 1 movement is less than or equal to high limit of set value range;

Low limit of output 2 movement is less than or equal to low limit of set value range.

Note 5. SV fallback

SV fallback function is used to keep set values consistent for bumpless transfer. In auto and manual mode, CSV is equal to SV. In cascade mode, SV is equal to CSV.

When only one channel of the function block is used to output and the function block is in auto or manual mode, set value will be figured out inversely according to the manual value.

When two channels of the function block are used to output and the function block is in the mode of manual or track, set value will be figured out inversely according to the manual values of two

channels. If differential value between reversely calculated SV and SV is smaller than 1% of the range, reversely calculated SV fallbacks, otherwise does not fallback.

When MV is direct output:

$$SV_i = \frac{(MV_i - MV_{SCL_i}) * (SRH_i - SRL_i)}{(MV_{SCH_i} - MV_{SCL_i})} + SRL_i$$

When MV is reverse output:

$$SV_i = \frac{(MV_{SCH_i} - MV_i) * (SRH_i - SRL_i)}{(MV_{SCH_i} - MV_{SCL_i})} + SRL_i$$

i=1 or 2.

Note 6. Mode process

When SWOOS is OFF, if BKINERR1 and BKINERR2 are ON, the function block is in IMAN mode; if one of them is OFF, the function block will be change to other valid mode from IMAN. Output of the one with value OFF is in manual mode and output value of the one with value ON tracks corresponding BKIN value.

Note 7. Balance ramp mode selection

RP_OPT =0, normal mode, SPLITBX function block switch from other modes to AUTO or CAS mode, and the output ramps according to the set balanced ramp coefficient.

RP_OPT =1, apart from normal mode, the handoperator's working mode in the downstream switch from MAN to AUTO, and the output also ramps according to the set balanced ramp coefficient.

3.4.2 Function Overview

The basic workflow of SPLITBX is shown below.

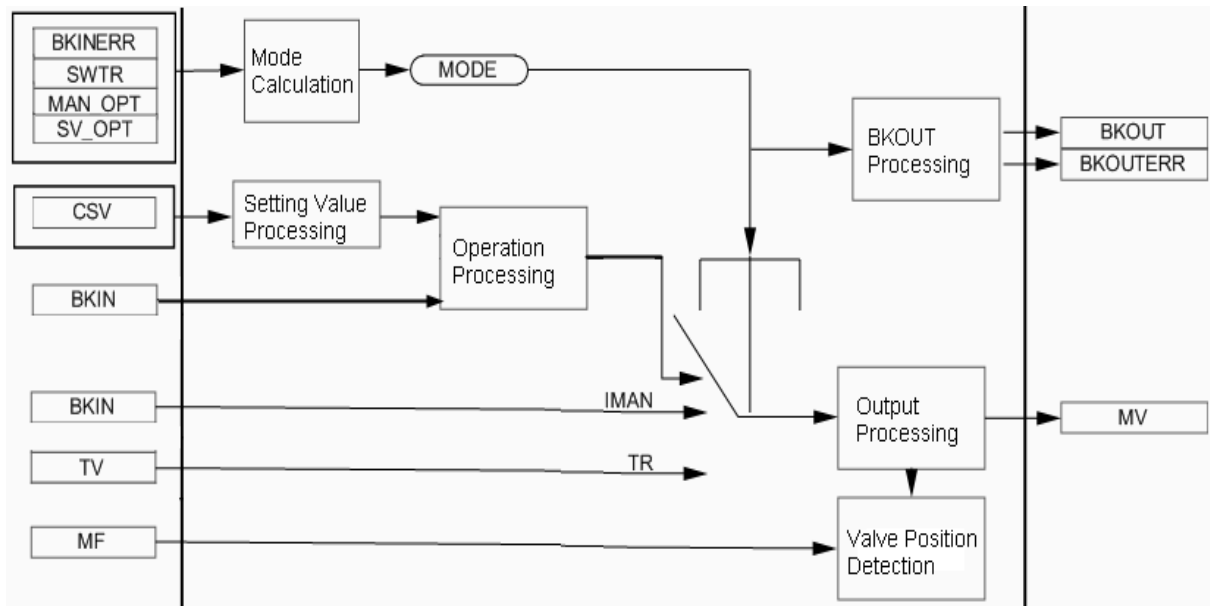


Figure 3.26 The basic workflow of SPLITBX

3.4.3 Mode Calculation

SPLITBX function block supports such work modes as OOS, IMAN, TR, MAN, AUTO and CAS.

Mode Switching

- When SWOOS = ON, the mode is the OOS regardless of the value of other mode-related parameters.
- When SWOOS = OFF and BKINERR = ON, the mode is the IMAN regardless of the value of other mode-related parameters.
- When SWOOS = OFF, BKINERR = OFF, SWTR = ON, the mode is the TR regardless of the value of other mode-related parameters.
- When SWOOS = OFF, BKINERR = OFF, SWTR = OFF and SWMAN=ON, it enters MAN mode.
- When SWOOS = OFF, BKINERR = OFF, SWTR = OFF, SWMAN = OFF and SWAUTO=ON, it enters AUTO mode.
- When SWOOS = OFF, BKINERR = OFF, SWTR = OFF, SWMAN=OFF, SWAUTO = OFF and SWCAS=ON, it enters CAS mode.

Work Mode

- **OOS**
In this mode, the output value MV is set values according to the OOS_OPT configuration, where you can hold the output or output the OOSVAL safety value.
- **Initial status (IMAN)**
If the feedback value of the downstream function block and feedback status are connected to BKIN and BKINERR, the output can follow the BKOUT value of the downstream function block.
- **Tracking (TR)**
The function block is in the tracking status, and the output is the tracking input value TV. The output MV still has the effect to limit the amplitude. If the TV value exceeds the limiting range, it will be forced to be within the limiting value, that is, $MV = MVL$ when $TV < MVL$ and $MV = MVH$ when $TV > MVH$.
- **Manual (MAN)**
Set manually, $MV = MANMV$, and the output MV has a limiting effect on amplitude.
- **AUTO**
Automatic control output. BKOUTERR = OFF when it is in the automatic mode, while BKOUTERR = ON when it is in other modes;
- **Cascade (CAS)**
The setting value CSV comes from the output of the upstream module.

The Degrading of Function Block Modes

The degrading of function block mode is divided into manual degrading and automatic degrading. The default setting is manual degrading. The standby working mode (IMODE) corresponding to each working mode (MODE) is only a reference for field operators.

- When $MODE_OPT = OFF$, the function block mode adopts manually degrading.
- When $MODE_OPT = ON$, the function block mode adopts automatically degrading.
- Regardless of automatically or manually degrading, if a degrading occurred after the system had a cold start, it goes into manual mode.

3.4.4 Setting Values

The selection of setting values

When the function block is in the automatic mode, the setting value is equal to SV and CSV is equal to SV.

The amplitude limiting of setting values

Limit the setting value SV between the SVH and SVL.

- SRL1 is equal to the minimum limit of the setting value.
- SRH2 is equal to the maximum limit of the setting value.
- SRH1 cannot be greater than the maximum limit of the setting value.
- SRL2 cannot be less than the minimum limit of the setting value.

Setting Value Degrading

Setting value degrading makes the setting value consistent and makes switching without disturbance. In manual and automatic modes, it makes CSV equal to SV while in the cascade mode, it makes SV equal to CSV.

When only one channel is configured as output and if it is in the manual or tracking status, you can get the setting value reckoned as per the values set manually.

When two channels are configured as output and if it is in the manual or tracking status, you can get the setting value reckoned as per these two-channel values set manually. If the setting value reckoned as per the values set manually is less than the 1% of the measuring range, then the values will degrade. Otherwise, it won't.

When MV outputs forward:

$$SV_i = \frac{(MV_i - MVSCL_i) * (SRH_i - SRL_i)}{(MVSCH_i - MVSCL_i)} + SRL_i$$

When MV outputs backward:

$$SV_i = \frac{(MVSCH_i - MV_i) * (SRH_i - SRL_i)}{(MVSCH_i - MVSCL_i)} + SRL_i$$

(i=1 or 2)

3.4.5 Output Processing

SPLITBX function block figures out two values MV1 and MV2 as per SV. Users can set the movement range of MV1 and MV2 in advanced based on SV (SRH1, SRL1, SRH2, SRL2) and their values shall be within the range of SV, and SRH1>SRL1, SRH2>SRL2, SRL1=SVSCL, SRH2=SVSCH is required.

MV1 and MV2 can be obtained by the following expression:

$$MV_i = CALC_i + BL_i(n)$$

When MV outputs forward:

$$CALC_i = MVSCL_i + \frac{MVSCH_i - MVSCL_i}{SRH_i - SRL_i} * (SV - SRL_i)$$

When MV outputs backward:

$$CALC_i = MVSCH_i - \frac{MVSCH_i - MVSL_i}{SRH_i - SRL_i} * (SV - SRL_i)$$

(i=1 or 2, and $BL_i(n)$ is the balance item)

3.4.6 Switch

This function block figures out the operational output value for each output tag as per SV and assign signals to the output terminal. However, you can make the switch to point to a specific output tag by assigning signals.

- When SW=0 is satisfied, signal assigning is stopped.
- When SW=1 is satisfied, it only assigns signals to MV1.
- When SW=2 is satisfied, it only assigns signals to MV2
- When SW=3 is satisfied, it assigns signals to two output tags.
- The operational output tag not selected by SW tracks TV.

3.4.7 Action Direction

- Forward action: the operational output value MV has positive correlation with the setting value SV;
- Backward action: the operational output value MV has negative correlation with the setting value SV.

3.4.8 Others

- Fast increase and decrease

There are fast increase, fast decrease, slow increase, and slow decrease buttons on the panel. Users can modify MV or SV through these buttons.

- MODE = MAN

In this mode, these four buttons on the panel are available for MV. The amplitude (engineering amount) of fast increase and decrease is equal to $(MVSCH - MVSL) \times FMV / 100$, and the amplitude of slow increase and decrease is equal to $(MVSCH - MVSL) \times SMV / 100$.

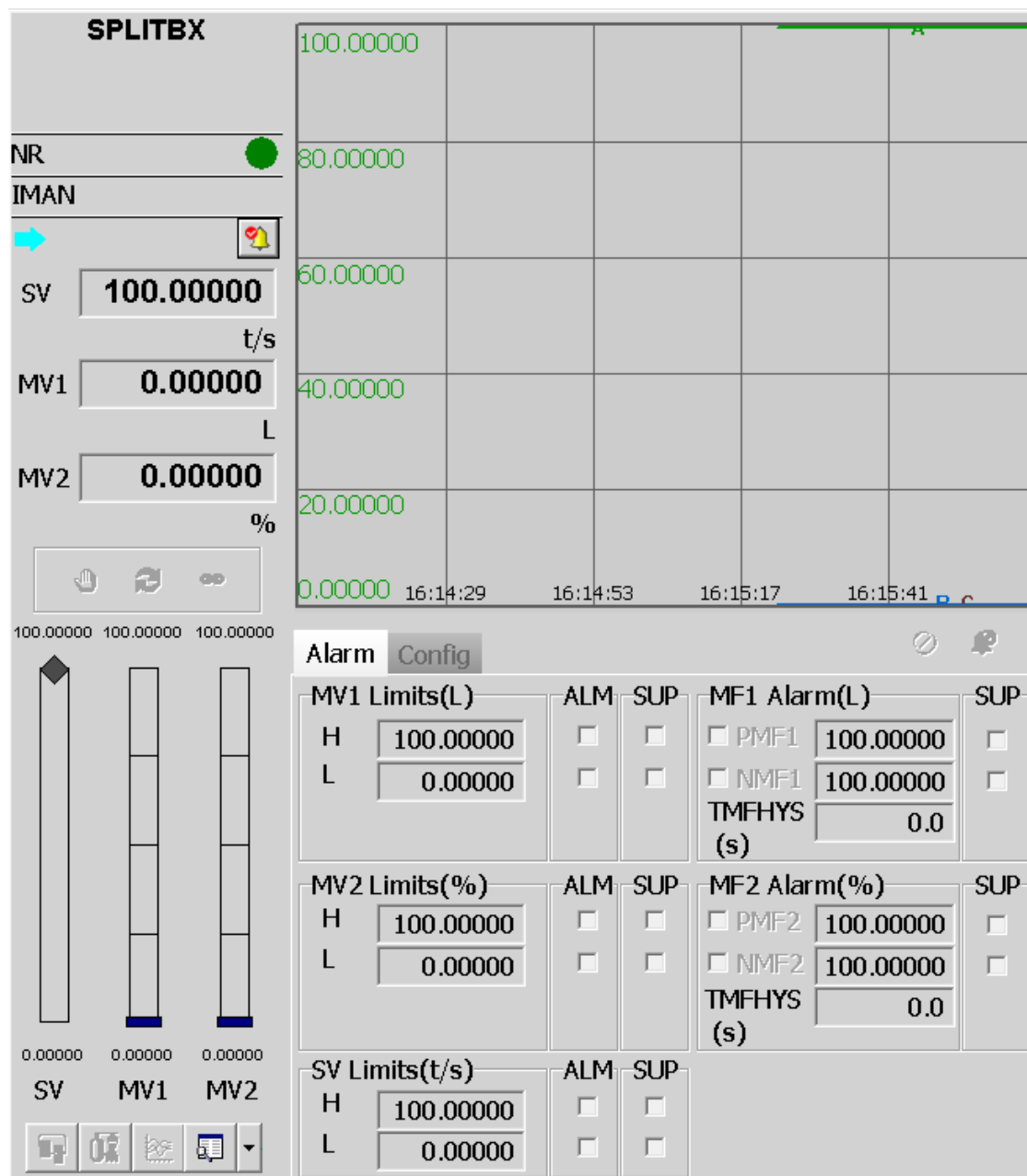
- MODE = AUTO

In this mode, these four buttons on the panel are available for SV. The amplitude of the fast increase and decrease is equal to $(SVSCH - SVSCL) \times FSV / 100$, and the amplitude of the slow increase and decrease is equal to $(SVSCH - SVSCL) \times SSV / 100$.

The increase / decrease buttons are invalid in other modes.

- Manual, automatic signal source and internal, external given signal source selection
The manual signal source can be selected through the parameter MAN_OPT. When MAN_OPT = ON is satisfied, the auto and cascade buttons on the panel cannot be operated. You can use the parameter SV_OPT to select the signal source given inside or outside. When SV_OPT = ON is satisfied, the cascade buttons on the panel cannot be operated.
- Decimal places
The configuration of the SVDLEN and MVDLEN parameters involved in the control function block library is used to display data on the function block panel.
- Whether or not the bar graph on the panel shows MF and valve position deviation alarm SHOWMF
- The latest historical segment T_PEAK displayed on the panel trend

3.4.9 Panel Parameter Instruction



Alarm **Config**

MV1 Action Limits(t/s)
H
L

MV2 Action Limits(t/s)
H
L

MV1 Balance Ramp(L/s)
RP1

MV2 Balance Ramp(%/s)
RP2

Output 1
☐ Direct ☒ Reverse

Output 2
☐ Direct ☒ Reverse

Change Limits of SV & MV
GSV t/s
GMV1 L
GMV2 %

Figure 3.27 SPLITBX Function Block Panel Parameter

Table 3.13 Operation Instruction for Panel Parameter

Panel Parameter Name			Function Block Parameter Name	Initial Value	Application Description
Alarm	MV1 Limits(L)	H	SRH1	100.000	Output 1 Operation Action Maximum
		L	SRL1	0.000	Output 1 Operation Action L Limit Value
		ALM	MVH1_B	-	MV1 H Limit Alarm
			MVL1_B	-	MV1 L Limit Alarm
		SUP	MVH1SUP	-	MVH1 Alarm Suppress Status
			MVL1SUP	-	VL1 Alarm Suppress Status
	MV2 MV2 Limits (%)	H	SRH2	100.000	Output 2 Operation Action Maximum
		L	SRL2	0.000	Output 2 Operation Action L Limit Value
		ALM	MVH2_B	-	MV2 H Limit Alarm
			MVL2_B	-	MV2 L Limit Alarm
		SUP	MVH2SUP	-	MVH2 Alarm Suppress Status
			MVL2SUP	-	MVL2 Alarm Suppress Status

Table 3.13 Operation Instruction for Panel Parameter (continued)

Panel Parameter Name			Function Block Parameter Name	Initial Value	Application Description
	MF1 Alarm(L)	PMF1	PMF1	-	Valve1 Position Positive Deviation Alarm
		NMF1	NMF1	-	Valve1 Position Negative Deviation Alarm
		SUP	PMF1SUP	-	PMF1 Alarm Suppress Status
			NMF1SUP	-	NMF1 Alarm Suppress Status
		TMFHYS1	TMFHYS1	0.0	Valve1 Position Alarm Hysteresis Time(s)
	MF2 Alarm (%)	PMF2	PMF2	-	Valve2 Position Positive Deviation Alarm
		NMF2	NMF2	-	Valve2 Position Negative Deviation Alarm
		SUP	PMF2SUP	-	PMF2 Alarm Suppress Status
			NMF2SUP	-	NMF2 Alarm Suppress Status
		TMFHYS2	TMFHYS2	0.0	Valve2 Position Alarm Hysteresis Time(s)
	SV Limits	H	SVH	100.0	SV H Limit Value
		L	SVL	0.0	SV L Limit Value
		ALM	SVH_B	-	SV H Limit Alarm
			SVL_B	-	SV L Limit Alarm
		SUP	SVHSUP	-	SVH Alarm Suppress Status
			SVLSUP	-	SVL Alarm Suppress Status
	MV1 Action Limits	H	MVH1	100.0	MV1 H Limit Value
		L	MVL1	0.0	MV1 L Limit Value
	MV2 Action Limits	H	MVH2	100.0	MV2 H Limit Value
		L	MVL2	0.0	MV2 L Limit Value
	MV1 Balance Ramp	RP1	RP1	100.0	Balance Ramp Coefficient 1

Table 3.13 Operation Instruction for Panel Parameter (continued)

Panel Parameter Name			Function Block Parameter Name	Initial Value	Application Description
	MV2 Balance Ramp	RP2	RP2	100.0	Balance Ramp Coefficient 2
	Output1	Direct/Reverse	SWPN1	ON	Output 1 Direct/Reverse Selection:ON=Reverse action
	Output2	Direct/Reverse	SWPN2	ON	Output 2 Direct/Reverse Selection:ON=Reverse action
	Change Limits of SV & MV	GSV	GSV	0.0	SV safety protection input increase or decrease value
		GMV1	GMV1	0.0	MV1 safety protection input increase or decrease value
		GMV2	GMV2	0.0	MV2 safety protection input increase or decrease value

3.4.10 Flag

Table 3.14 Function Block Flag Code List

Flag (Flag code)	Alarm	Description	Type
D0	OOS	Disable	Status
D1	IMAN	Initialize Manually	Status
D2	MAN	Manual	Status
D3	TR	Track	Status
D4	AUTO	Auto	Status
D5	CAS	Cascade	Status
D8	MVH1	Output 1 H Limit Alarm	Alarm
D9	MVL1	Output 1 L Limit Alarm	Alarm
D10	MVH2	Output 2 H Limit Alarm	Alarm
D11	MVL2	Output 2 L Limit Alarm	Alarm
D12	SVH	SV H Limit Alarm	Alarm

Table 3.14 Function Block Flag Code List (continued)

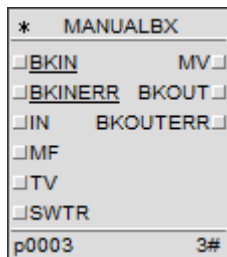
Flag (Flag code)	Alarm	Description	Type
D13	SVL	SV L Limit Alarm	Alarm
D19	CFGERR	Configuration Error	Alarm
D25	AOF	Shield Alarm	Status
D27	NMF1	Valve1 Position Negative Deviation Alarm	Alarm
D28	PMF1	Valve1 Position Positive Deviation Alarm	Alarm
D29	NMF2	Valve2 Position Negative Deviation Alarm	Alarm
D30	PMF2	Valve2 Position Positive Deviation Alarm	Alarm

3.5 MANUALBX Function Block

Auto/manual output can be set by handheld function block. In manual mode, output value can be tuned; in auto mode, output can be tuned according to the input value of upstream FB; In track mode, output value changes with track value set; The function of forced manual mode is same as manual mode but this mode cannot be transferred to manual mode and auto mode.

It is a complex function block and its running time is 150μs.

Please read “Function Block Overview” and “Control Function Block Application Foundation” first before using MANUALBX function block in *Function Block User Manual*.



3.5.1 Parameter Description

Table 3.15 Parameter instruction and application of MANUAL Function Block

Name			Description	Upload	Properties	Application Reference
Basic Parameters	Range Settings	MVSCH	MV high scale	-	Configuration Parameter	The same as MV actual value H limit.

Table 3.15 Parameter instruction and application of MANUAL Function Block (continued)

Name			Description	Upload	Properties	Application Reference
		MVSCL	MV low scale	-	Configura- tion Para- meter	The same as MV actual value L limit.
		MVEU	MV engineer unit	-	Configura- tion Para- meter	Set in the function block properties settings inter- face.
		MVDLEN	MV decimal digits [0,5]	-	Configura- tion Para- meter	Used for data displayed on function block panel (equal to 3 as default).
	Output Limits	MVH	MVH limit value	TRUE	Operation Parameter	Value range [MVS-CL,MVSCH] Perform H limits for out- put value
		MVL	MVL limit value	TRUE	Operation Parameter	Value range [MVS-CL,MVSCH] Perform L limits for output value
Extended Parameters	Base Input Pin Settings	BKIN	Feedback input	-	Input Pin	Connect to BKOUT of downstream block
		BKIN-ERR	Feedback status input	-	Input Pin	Connect to BKOUTER- ROR
		IN	Upstream block input value	-	Input Pin	External loop control value MV
		MF	MV Feedback Value	-	Input Pin	When the SHOWMF is set to ON, the bar chart on the panel can display the real-time value of that parameter. The default value is OFF.
		PV	Process value of loop closed control process	-	Input Pin	Connect to measuring point AI
		TV	Track input value	-	Input Pin	Connect to measuring point AI Related parameter: SWTR

Table 3.15 Parameter instruction and application of MANUAL Function Block (continued)

Name		Description	Upload	Properties	Application Reference
	SWTR	Track Switch(OFF=Not Track, ON=Track)	-	Input Pin	Connect to upstream interlock condition input, Related parameter: TV
	SWMAN	Manual Switch(ON=to Manual)	FALSE	Input Pin	-
	SWAUTO	Auto Switch(ON=to Auto)	FALSE	Input Pin	-
	SWIK	Interlock Input Mode(0=No Interlock, 1=LMAN, 2=LTR)	FALSE	Input Pin	Used in conjunction with the function block ITLK_A (related with the OUT_D of the interlock function block.) refer to LMAN/LTR Modes
	IV	Interlock Value	FALSE	Input Pin	Used in conjunction with the function block ITLK_A (related with the OUT of the interlock function block.) refer to LMAN/LTR Modes
	SWR-CAS	Remote Cascade Switch(ON=to Remote Cascade)	FALSE	Input Pin	-
	RSV	Remote Cascade Value	FALSE	Input Pin	-
	MAN_OPT	Control Switch Source of Manual or Auto (OFF=Panel Control, ON=Program Control)	-	Input Pin	Connect the upstream output.
	SWINC	Lock Increase	-	Input Pin	Connect the upstream output Enabled when the function block is auto or cascade.
	SWDEC	Lock Decrease	-	Input Pin	Connect the upstream output. Enabled when

Table 3.15 Parameter instruction and application of MANUAL Function Block (continued)

Name			Description	Upload	Properties	Application Reference
						function block is automatic or cascade.
		HOLD	Hold the Current Output Value	-	Input Pin	Connect to upstream output. when function block is automatic or cascade.
	Output Pin	MV	operation output value	-	Output Pin	Connect to AO tags.. If MV floating point is abnormal, MV equals to the value of the last cycle or the lower limit of the range.
		BKOUT	Feedback output value	-	Output Pin	Connect to the BKIN of Upstream Block. Related parameter: BK_OPT
		BKOUTERR	Feedback status value	-	Output Pin	Connect to the BKINERR of Upstream Block
		MODE- Note 1	Work mode	-	Output Pin	-
	Advanced Settings	MODE_- OPT	ON=auto return, OFF=manual return	-	Configuration Parameter	Refer to the “Mode and Parameter Status (MODE)” section in <i>Function Block User Manual</i> for details
		TB ^{Note 2}	Balance time	TRUE	Operation Parameter	Refer to Note 2
		TB_OPT- Note 3	Balance time option: 0: fall off 1: ramp	0	Configuration Parameter	-
		COLD_- OPT	Cold Start Man/Auto Mode Options(0=Hold,1=MAN,2=AUTO)	-	Configuration Parameter	-
		SWMMV	Whether to equal to preset MV value when switch to manual status	TRUE	Operation Parameter	Related parameter: MMV

Table 3.15 Parameter instruction and application of MANUAL Function Block (continued)

Name			Description	Upload	Properties	Application Reference
		MMV	Preset MV value (switch to manual)	TRUE	Operation Parameter	Enabled when SWM-MV=ON
	Fast/Slow/Increase/Decrease Settings	SMV	Manual Slow Increase/Decrease Value	TRUE	Operation Parameter	Set MV manual slow increase/decrease percentage in function block properties setting, $SMV \leq FMV$ Related parameter: MVSCH, MVSCL.
		GMV	MV safety protection input increase or decrease value	TRUE	Operation Parameter	-
		FMV	Manual Fast Increase/Decrease Value	TRUE	Operation Parameter	Set MV manual fast increase/decrease percentage in function block properties setting Related parameter: MVSCL, MVSCL.
		MVHIND	MV H limit alarm indication	-	Monitoring Parameter	Refer to the "Alarm" section in <i>Function Block User Manual</i>
		MVLIND	MV L limit alarm indication	-	Monitoring Parameter	Refer to the "Alarm" section in <i>Function Block User Manual</i>
	Manual Output Value	MANMV	Manual output value	-	Operation Parameter	The output value MV is equal to manual SVMAN-MV in forced manual or manual mode.
	Extended Range Settings	HORLIM	Extended range maximum percentage	-	Configuration Parameter	Refer to the "Output Operation" section in <i>Function Block User Manual</i>
		LORLIM	Extended range minimum percentage	-	Configuration Parameter	Refer to the "Output Operation" section in <i>Function Block User Manual</i> .
	Alarm Enabled and Suppress	AOF	Shield Alarm	TRUE	Operation Parameter	Refer to the "Alarm" section in <i>Function Block User Manual</i> .

Table 3.15 Parameter instruction and application of MANUAL Function Block (continued)

Name			Description	Upload	Properties	Application Reference
		ENALM	Alarm Enable	TRUE	Alarm Parameter	Refer to the “Alarm” section in <i>Function Block User Manual</i> .
		FLAG	Flag	-	Output Pin	Refer to the “Alarm” section in <i>Function Block User Manual</i> .
	OOS Settings	SWOOS	Switch of Out of Service (ON=Disable)	TRUE	Operation Parameter	Set as ON at the first time of function block downloading.
		OOSVAL	OOS mode output value	TRUE	Operation Parameter	Related parameter: OOS_OPT=ON
		OOS_OPT	Output Value Type in OOS Status(ON: MV=OOS-VAL)	-	Configuration Parameter	Refer to the “Calculation Stop OOS Mode” section in <i>Function Block User Manual</i> for details.
	Operation Parameter	RMT_OVRD	Override Switch(OFF=Disable,ON=Enable)	-	Operation Parameter	-
		LOCK	Mode Lock(OFF=Unlock,ON=Lock)	FALSE	Operation Parameter	-
		SWFIX	Fix Command	FALSE	Operation Parameter	-
	Input Alarm Settings	NMFLIM	Negative alarm limit of valve position deviation	TRUE	Operation Parameter	-
		PMFLIM	Positive alarm limit of valve position deviation	TRUE	Operation Parameter	-
		TMFHYS	Hysteresis time (s) for valve position alarm	TRUE	Operation Parameter	-
	Panel Display Settings	T_PEAK	Recent History (0=Not Show,1=2min,2=10min,3=30min,4=1h,5=2h,6=4h,7=8h,8=12h,9=24h)	TRUE	Operation Parameter	-
		SHOWMF	Show MF	TRUE	Operation Parameter	When the real-time value of the SHOWMF parameter is set to ON, the

Table 3.15 Parameter instruction and application of MANUAL Function Block (continued)

Name			Description	Upload	Properties	Application Reference
						bar chart on the panel will display the real-time value of the MF parameter, as shown in Figure 3.19.

Note 1: Work Mode

For details about work mode, refer to "Mode Calculation".

Note 2

If TB is less than TS and under the automatic status, MV=IN. If TB is greater than TS, MV will be gradually close to IN rather than directly jump to IN.

Note 3: Balance Time Options

- Fall-off

When the MANUALBX function block switches from non-automatic or non-remote cascade to automatic (AUTO) or remote cascade (RCAS), the system calculates the deviation between the MV of the previous cycle and the IN of this cycle, and then according to the balance time TB, gradually make MV to approach IN. During the fall-off process, if IN changes, MV will change accordingly.

- Ramp

When the MANUALBX block switches from non-automatic or non-remote cascade to automatic (AUTO) or remote cascade (RCAS), the system calculates the deviation between the MV of the previous cycle and the IN of this cycle, and calculates the gradient based on this deviation. $\text{Gradient} = \text{deviation} / \text{balance time (seconds)} \times \text{program scheduling cycle (seconds)}$. Then it makes MV to ramp up with this gradient until the MV catches up with IN; the ramping function is disabled when MV follows IN and MV changes with IN accordingly. During the ramping process, if the input changes in the same direction, MV continues to ramp up to the target value according to the gradient; if the input changes in the opposite direction, the ramping fails and MV immediately follows the input value.

For example, before ramping, the MV is 20.0, and the original ramping target IN is 30.0. MV will ramp up from 20.0 to 30.0. During the ramping process, if the IN changes to 40.0, MV will continue to ramp up to 40.0. If the IN changes to 10.0, MV will immediately follow it to 10.0.

3.5.2 Function Enable

The basic workflow of MANUALBX is shown below.

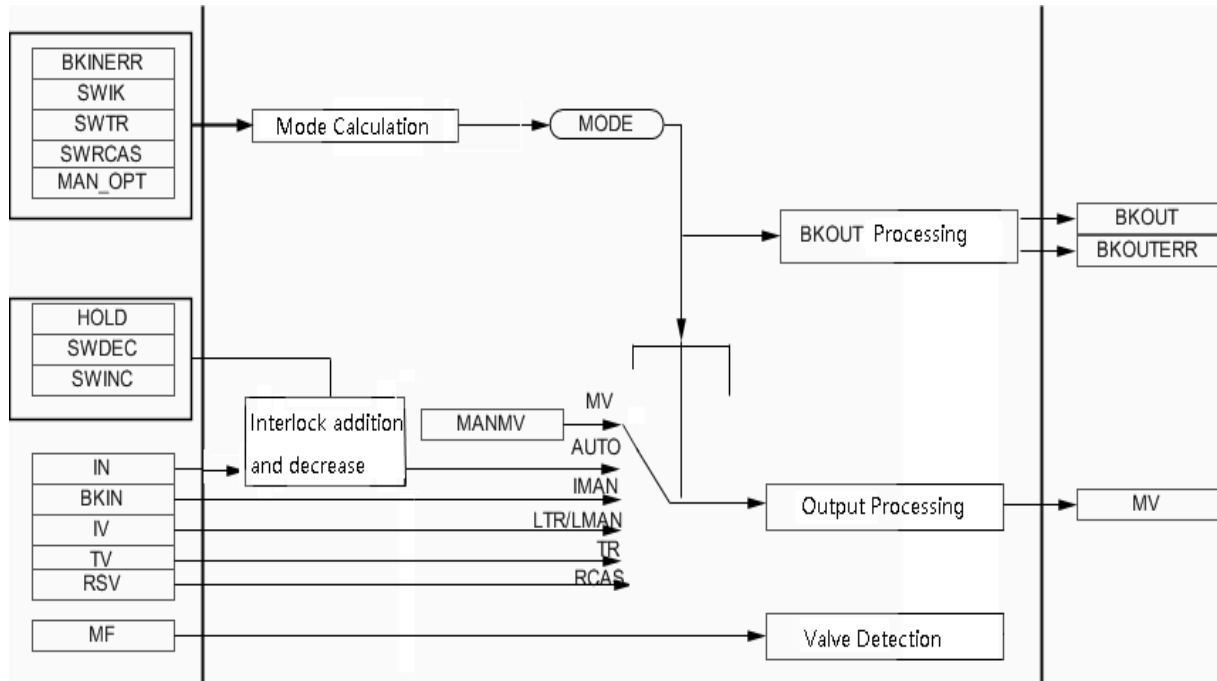


Figure 3.28 Basic workflow of MANUALBX

3.5.3 Mode Calculation

The running modes for MANUALBX function block for analog tags include OOS, IMAN, LMAN, LTR Track, Manual, Auto and Remote Cascade. Their priority order is OOS > IMAN > LMAN > LTR > TR > RCAS > MAN/AUTO.

Mode Switching

In the normal mode, function blocks start process as per the flowchart below.

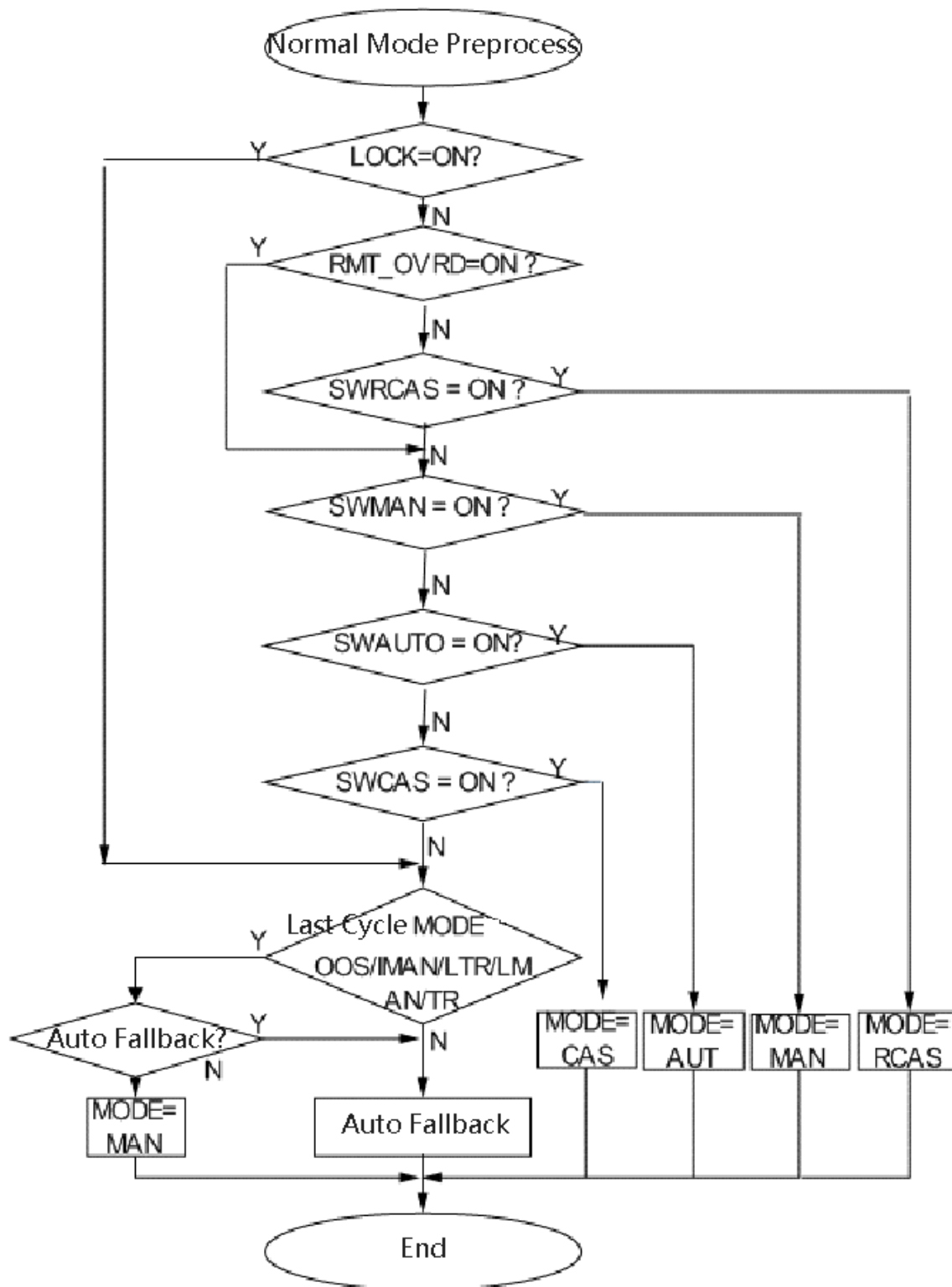


Figure 3.29 Normal mode function block processing flowchart

Work Mode

- **OOS**
In this mode, the output value MV is selected according to the OOS_OPT configuration, where you can hold the output or output the OOSVAL safety value.
- **Initial status (IMAN)**
If the feedback value of the downstream function block and feedback status respectively are connected to BKIN and BKINERR, the output can follow the BKOUT value of the downstream function block.
- **LMAN/LTR**
When the higher-priority mode is not satisfied and SWIK=1, it enters LMAN mode. When SWIK=2, it enters LTR mode. Under LMAN/LTR mode, the output tracks the change of IV and operator is not allowed to operate on panel.
- **TR**
The function block is in the tracking status, and the output is the tracking input value TV. The output MV still has the effect to limit the amplitude. If the TV value exceeds the limiting range, it will be forced to be within the limiting value, that is, $MV = MVL$ when $TV < MVL$ and $MV = MVH$ when $TV > MVH$.
- **RCAS**
When the higher-priority mode is not satisfied and the remote manual switch = ON, it enters the remote cascade mode and the setting value will follow the change of RSV.
- **Manual (MAN)**
Set manually, $MV = MANMV$, and the output MV has a limiting effect on amplitude.
- **AUTO**
Automatic control output. BKOUTERR = OFF when it is in the automatic mode, while BKOUTERR = ON when it is in other modes;

The Degrading of Function Block Modes

The degrading of function block mode is divided into manual degrading and automatic degrading. The default setting is manual degrading. The standby working mode (IMODE) corresponding to each working mode (MODE) is only a reference for field operators.

- When MODE_OPT = OFF, the function block mode adopts manually degrading.
- When MODE_OPT = ON, the function block mode adopts automatically degrading.
- Regardless of automatically or manually degrading, if a degrading occurred after the system had a cold start, it definitely goes into manual mode.

3.5.4 Output Processing

Output the Amplitude Limiting and Alarms

If the output value exceeded its amplitude limiting value, the amplitude of the output will be limited and an alarm will be issued. The maximum amplitude limiting of the output (MVH) must be greater than or equal to the minimum amplitude limiting of the output (MVL), otherwise the amplitude limiting will not work and a configuration alarm (CFGERR) will be generated.

The MVH must be less than $\text{HORLIM} \times (\text{MVSCH} - \text{MVSCL}) / 100 + \text{MVSCH}$, and the MVH must be greater than $\text{MVSCL} - \text{LORLIM} \times (\text{MVSCH} - \text{MVSCL}) / 100$.

The amplitude limiting doesn't work in OOS mode.

In other modes, when the output value exceeds its amplitude limiting value, the amplitude of the output will be limited and an alarm will be issued.

Output Holding

When the function block is in the automatic status and if HOLD=ON is satisfied, the output will keep unchanged.

3.5.5 Others

- Fast increase and decrease

There are fast increase, fast decrease, slow increase, and slow decrease buttons on the panel. Users can modify MV or SV through these buttons.

- MODE = MAN

In this mode, these four buttons on the panel are available for MV. The amplitude (engineering amount) of fast increase and decrease is equal to $(\text{MVSCH} - \text{MVSCL}) \times \text{FMV} / 100$, and the amplitude of slow increase and decrease is equal to $(\text{MVSCH} - \text{MVSCL}) \times \text{SMV} / 100$.

- MODE = AUTO

In this mode, these four buttons on the panel are available for SV. The amplitude of the fast increase and decrease is equal to $(\text{SVSCH} - \text{SVSCL}) \times \text{FSV} / 100$, and the amplitude of the slow increase and decrease is equal to $(\text{SVSCH} - \text{SVSCL}) \times \text{SSV} / 100$.

The increase / decrease buttons are invalid in other modes.

- Manual, automatic signal source selection

The manual signal source can be selected through the parameter MAN_OPT. When MAN_OPT = ON is satisfied, the button of Auto on the panel cannot be operated.

- Whether or not the bar graph on the panel shows MF and valve position deviation alarm is decided by the value of SHOWMF.
- The latest historical segment displayed on the panel trend is decided by T_PEAK.
- Operational Effectiveness Examination is decided by GMV.
- Override

3.5.6 Panel Parameter Instruction

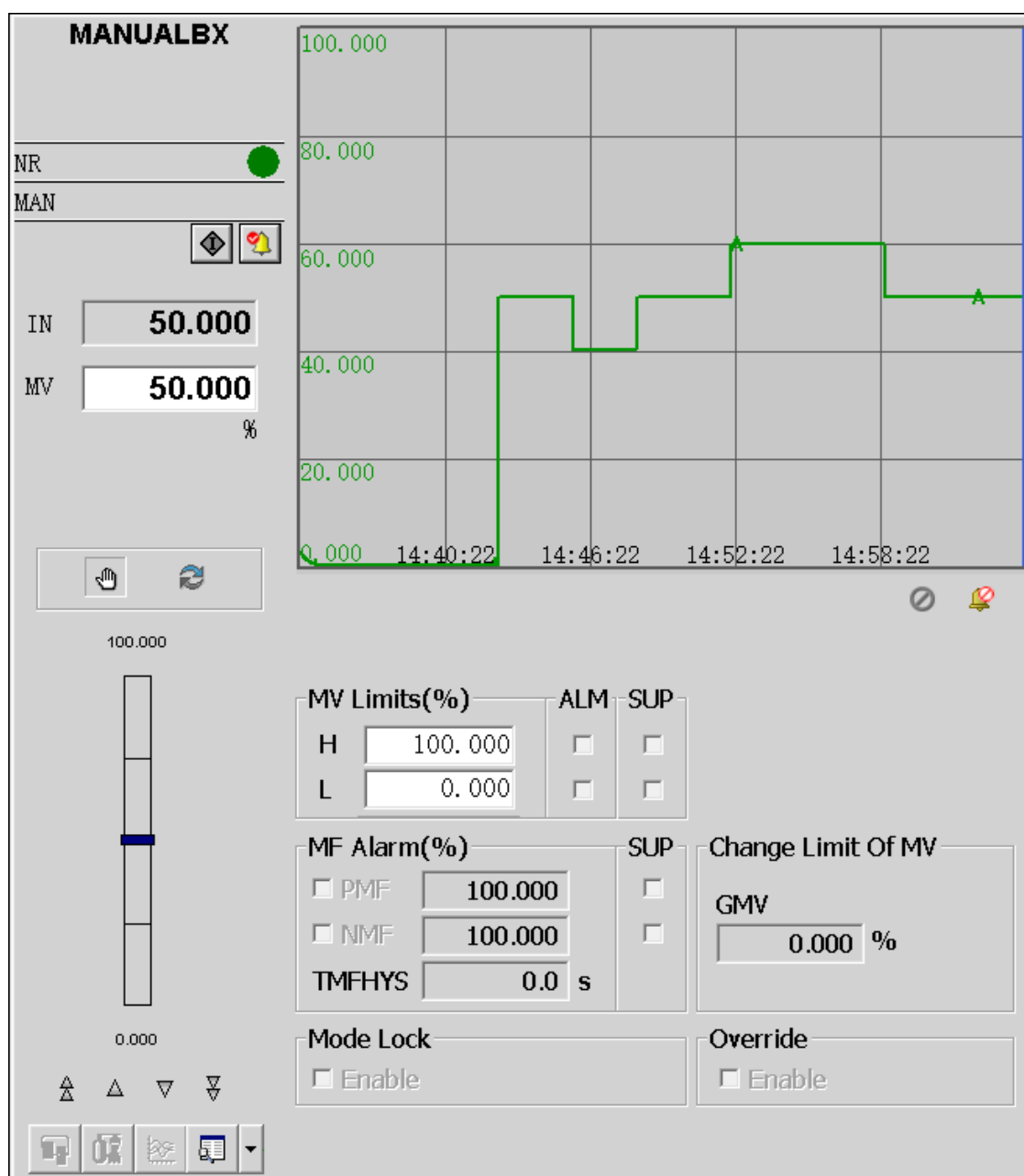


Figure 3.30 MANUALBX Function Block Panel Parameter Graph

Table 3.16 Operation Instruction for Panel Parameter

Panel Parameter Name		Function Block Parameter	Application Description
MV limit (%)	H	MVH	MVH Limit Value
	L	MVL	MVL Limit Value
	ALM	MVH_B	MVH Limit Alarm

Table 3.16 Operation Instruction for Panel Parameter (continued)

Panel Parameter Name		Function Block Parameter	Application Description
	SUP	MVL_B	MVL Limit Alarm
		MVHSUP	MVH Alarm Suppress Status
		MVLSUP	MVL Alarm Suppress Status
MF Alarm (%)	PMF	PMF	Valve Position Positive Deviation Alarm
	NMF	NMF	Valve Position Negative Deviation Alarm
	Amplitude limiting	PMFLIM	The positive alarm limiting of the valve position deviation
		NMFLIM	The negative alarm limiting of the valve position deviation
	TMFHYS	TMFHYS	Valve Position Alarm Hysteresis Time(s)
	SUP	NMFSUP	NMF Alarm Suppress Status
		PMFSUP	PMF Alarm Suppress Status
	GMV	GMV	MV safety protection input increase or decrease value
Mode Lock	Enable	LOCK	Mode Lock (OFF=Unlock,ON=Lock)
Override	Enable	RMT_OVRD	Override Switch(OFF=Disable,ON=Enable)

Click “Related Tag” from the drop-down list on the function block panel (as shown in the following figure) to open the panel of the related tag configured during user program configuration. If the panel of the related tag is configured, click this option to open its panel. If the “Related tag” parameter is not set in the configuration of the function block tag, “Related Tag” is not displayed on the drop-down list.

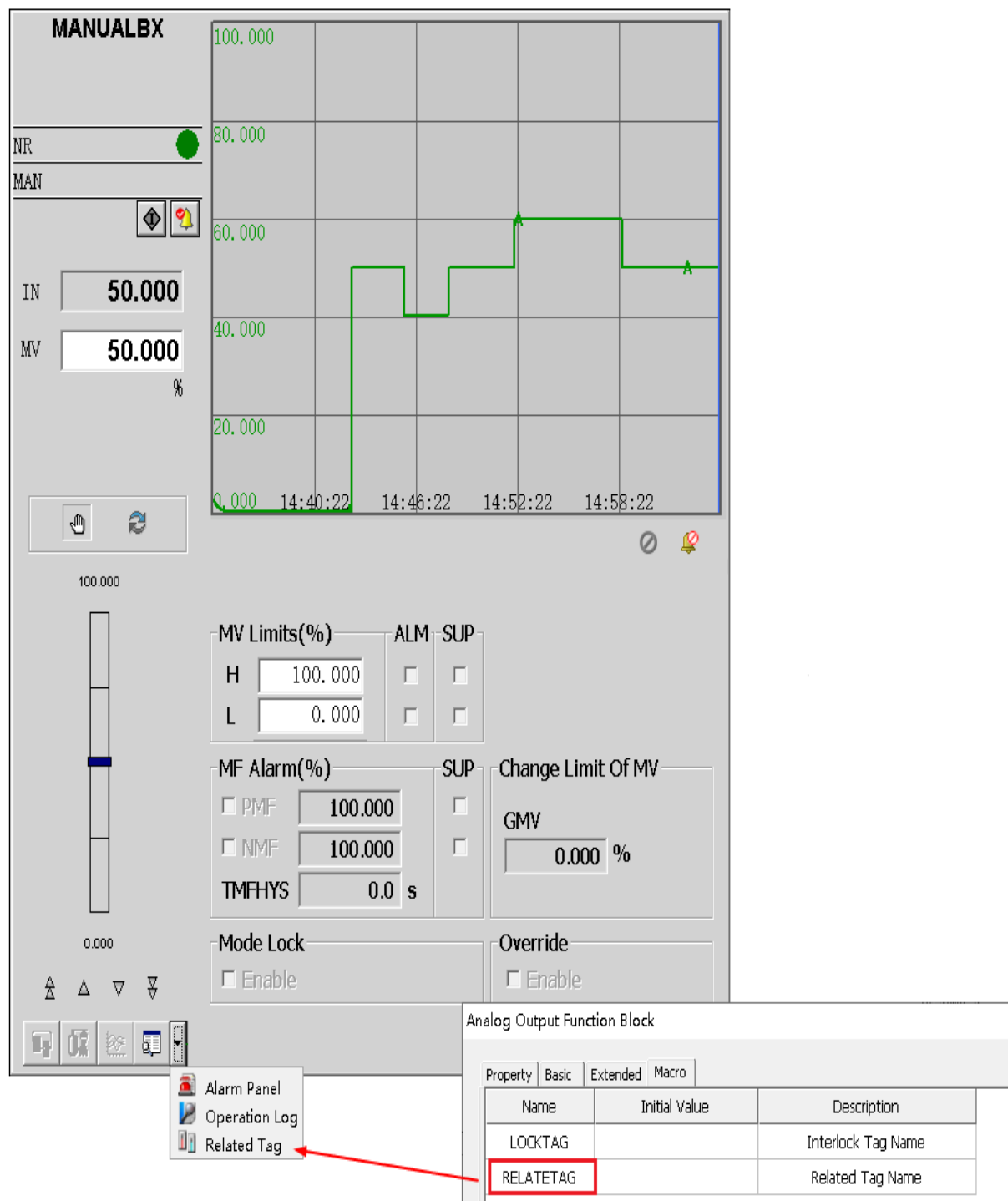


Figure 3.31 Related tag option

3.5.7 Flag

Table 3.17 Flag List

Flag	Alarm	Description	Type
D0	OOS	Disable	Status

Table 3.17 Flag List (continued)

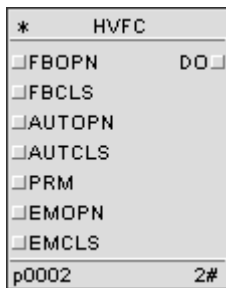
Flag	Alarm	Description	Type
D1	IMAN	Initialize Manually	Status
D2	MAN	Manual	Status
D3	TR	Track	Status
D4	AUTO	Auto	Status
D6	RCAS	Remote Cascade	Status
D14	MVH	Output H Limit Alarm	Alarm
D15	MVL	Output L Limit Alarm	Alarm
D18	LK	Interlock	Status
D19	CFGERR	Configuration Error	Alarm
D20	LMAN	Interlock Manual	Alarm
D21	LTR	Interlock Track	Alarm
D24	EMMAN	Force Manual Alarm	Status
D25	AOF	Shield Alarm	Status
D26	FIX	FIX	Status
D27	NMF	Valve Negative Deviation Alarm	Alarm
D28	PMF	Valve Positive Deviation Alarm	Alarm

4 Logical Control Function Block Library

This section introduces logical control function blocks related to motors and valves.

4.1 HVFC Valve Function Block with OFF in Priority

This function block realizes the ON and OFF control on the valves and executes the control protection with OFF in priority. The individual controlled equipment can be controlled and operated by the SFC command in the upper level or operators through the panel.



4.1.1 Parameter Description

Table 4.1 Parameter Description of HVFC valve switch function block

Parameter Name			Description	Parameter Type	Application
Expand parameter	Input pin	FBOPN	Open Status Feedback	BOOL	-
		FBCLS	Close Status Feedback	BOOL	-
		AUTOPN	Auto Open Command(ON=Open)	BOOL	Output in the upstream
		AUTCLS	Auto Close Command(OFF=Close)	BOOL	Output in the upstream
		PRM	Permit Signal(ON=Permit)	BOOL	Output in the upstream
		EMOPN	Interlock Open Command(ON=Open)	BOOL	Output in the upstream
		EMCLS	Interlock Close Command(OFF=Close)	BOOL	Output in the upstream
		RMOPN	Remote Open Command (ON=Open)	BOOL	-

Table 4.1 Parameter Description of HVFC valve switch function block (continued)

Parameter Name			Description	Parameter Type	Application
		RMCLS	Remote Close Command(OFF=Close)	BOOL	-
		SWRCAS	Remote Cascade Switch(ON=Switch to Remote Cascade)	BOOL	-
		SWMAN	Manual Switch(ON=Switch to Manual)	BOOL	-
		SWAUTO	Auto Switch(ON=Switch to Auto)	BOOL	-
	Output pin	DO	Output, ON=output ON, OFF=output OFF	BOOL	Output DO
	Operational parameter	RMT_OVRD	Override Switch(OFF=Disable,ON=Enable)	BOOL	-
		SIMUL	Simulate Switch(OFF=Disable,ON=Enable)	BOOL	-
		MANOPN	Manual Open Command(ON=Open)	BOOL	-
		MANCLS	Manual Close Command(OFF=Close)	BOOL	-
		LOCK	Switch Lock(ON=Lock,OFF=Unlock)	BOOL	-
		SWDO	Valve output method during simulation (SWDO=OFF, DO outputs according to the input command; SWDO=ON, DO outputs OFF, the output is off or stopped)	BOOL	-
	Status instruction	FLAG	Flag	UDINT	-
		FAULT	Fault (ON=Fault)		
		MODE	Mode(1=OOS,4=MAN,5=AUTO,6=LK,7=RCAS)	BOOL	-
		OPENING	Open Command Output Process (ON=Opening)	BOOL	-
		CLOSING	Close Command Output Process(ON=Closing)	BOOL	-

Table 4.1 Parameter Description of HVFC valve switch function block (continued)

Parameter Name			Description	Parameter Type	Application
		STATE ^{Note2}	Status Instruction (0=No definition, 1=Closed, 2=Opened, 3=Closing, 4=Opening, 7=Interlock conflict, 8=Fault) 8 is the highest priority, 0 is the lowest priority, and only the current high priority status is displayed	USINT	-
	Enable alarm and shield	AOF	Module alarm shield	BOOL	-
		ENALM	Alarm Enabled	UDINT	-
	OOS setting	SWOOS	Function block disables (ON=Disable)	BOOL	-
Basic Parameters	Time settings	TOC_OPN	Device Opening Runtime(s)	REAL	-
		TOC_CLS	Device Closing Runtime(s)	REAL	-
	Configuration parameters	PRM_OPT	Permit Signal Options(PRM=OFF,0=Open Command Not Allowed,1=Close Command Not Allowed,2=Open And Close Command Not Allowed)	USINT	-
		FLT_OPT	Fault Output Options(0=Hold,1=Close) When both FBOPN and FBCLO are ON, the DO is controlled by this parameter.	USINT	-
Macro		LOCKTAG	Interlock tag name	-	-

Note 1: if there is no special description, BOOL parameters are level signals.

Note 2: Description of STATE

- 0: No definition
- 1: Closed
 - In actual operation, Closed means the close status feedback is received.
 - In simulation, Closed means output is closed, and the closing is delayed for 1/2 TOC_CLS.
- 2: Opened

- In actual operation, Open means the open status feedback is received.
- In simulation, Opened means output is opened, and the opening is delayed for 1/2 TOC_OPN.
- 3: Closing
- 4: Opening
- 7: Interlock conflict. This status is pulse output (After a single trigger, the status lasts only one pulse period, regardless of whether the conflict always exists), the duration is consistent with the opening time.
 - In automatic mode, if an interlock command is received and the auto command is opposite to the interlock command, the interlock conflict status is displayed, STATE=7.
 - In remote mode, if an interlock command is received and the interlock command is opposite to the remote command, the interlock conflict status is displayed, STATE=7.
 - In interlock mode, if the auto command or remote command conflicts with the interlock command, no interlock conflict is displayed.

After entering the interlock conflict status, if a higher priority status is generated, switch to the high priority state immediately; and if a low priority status is generated while exiting the interlock status and maintaining the interlock status output, switch to the low priority status after the interlock conflict status time is up.
- 8: Fault

When the function block tag generates an opening fault or closing fault, the STATE is 8 (fault status).

4.1.2 Mode Description

Function block mode and priority: OOS> Interlock> Remote Cascade> Manual> Auto.

In the status indication parameters, MODE indicates the current mode: 1=OOS, 4=MAN manual, 5=AUTO automatic, 6=LK interlock, 7=RCAS remote cascade.

OOS mode

When SWOOS=ON is satisfied, the function block is in the OOS mode, and does not respond to various input commands, and the output remains. In non-OOS mode, the function block can respond to various input commands.

In OOS mode, all status are cleared except for the status of the input pins.

Interlocking mode (non-OOS)

When the interlock command is triggered, the function block enters the interlock mode. After the interlock command is canceled, it returns to the manual mode.

Remote Cascade, Manual, Auto Mode

After you exit the interlock mode, the function block is unlocked. If the override switch is not enabled, you can switch to the respective mode through the remote cascade switch, manual switch, and automatic switch. The priority is remote cascade> manual> automatic. If the override switch is enabled, even if the remote cascade switch is enabled, it can be forced to switch to manual or automatic mode through the manual or automatic switch.

In the locked status, the mode cannot be switched.

When the controller is in the cold start, the mode lock is unlocked and the override switch is disabled.

Input command processing

HVFC function block undertakes detection on the input commands as per the table below and then outputs signals.

Work Mode	SWOOS	EM-CLS	EMOPI	PRM	PRM_-OPT	MAN-CLS	MANOP	AUT-CLS	AU-TOPN	RM-CLS	RMOPI	DO
OOS	ON	-	-	-	-	-	-	-	-	-	-	Hold
-	OFF	OFF	-	-	-	-	-	-	-	-	-	OFF
	OFF	ON	ON	-	-	-	-	-	-	-	-	ON
	OFF	ON	OFF	-	-	-	-	-	-	-	-	Hold
	OFF	ON	OFF	ON	-	OFF		-	-	-	-	OFF
Man-ual	OFF	ON	OFF	ON	-	ON	ON	-	-	-	-	ON
	OFF	ON	OFF	ON	-	ON	OFF	-	-	-	-	Hold
	OFF	ON	OFF	OFF	0	OFF		-	-	-	-	OFF
	OFF	ON	OFF	OFF	0	ON	ON/OFF	-	-	-	-	Hold
	OFF	ON	OFF	OFF	1	ON/OFF	ON	-	-	-	-	ON
	OFF	ON	OFF	OFF	1	ON/OFF	OFF	-	-	-	-	Hold

Work Mode	SWOOS	EM-CLS	EMOPI	PRM	PRM_-OPT	MAN-CLS	MANOP	AUT-CLS	AU-TOPN	RM-CLS	RMOPI	DO
	OFF	ON	OFF	OFF	2	ON/OFF	ON/OFF	-	-	-	-	Hold
AU-TO	OFF	ON	OFF	ON	-	-	-	OFF		-	-	OFF
	OFF	ON	OFF	ON	-	-	-	ON	ON	-	-	ON
	OFF	ON	OFF	ON	-	-	-	ON	OFF	-	-	Hold
	OFF	ON	OFF	OFF	0	-	-	OFF		-	-	OFF
	OFF	ON	OFF	OFF	0	-	-	ON	ON/OFF	-	-	Hold
	OFF	ON	OFF	OFF	1	-	-	ON/OFF	ON	-	-	ON
	OFF	ON	OFF	OFF	1	-	-	ON/OFF	OFF	-	-	Hold
	OFF	ON	OFF	OFF	2	-	-	ON/OFF	ON/OFF	-	-	Hold
RCAS	OFF	ON	OFF	ON	-	-	-	-	-	OFF		OFF
	OFF	ON	OFF	ON	-	-	-	-	-	ON	ON	ON
	OFF	ON	OFF	ON	-	-	-	-	-	ON	OFF	Hold
	OFF	ON	OFF	OFF	0	-	-	-	-	OFF		OFF
	OFF	ON	OFF	OFF	0	-	-	-	-	ON	ON/OFF	Hold
	OFF	ON	OFF	OFF	1	-	-	-	-	ON/OFF	ON	ON
	OFF	ON	OFF	OFF	1	-	-	-	-	ON/OFF	OFF	Hold
	OFF	ON	OFF	OFF	2	-	-	-	-	ON/OFF	ON/OFF	Hold

Fault Alarm

After the output command is issued, if the correct feedback signal is not received within the travel time, a fault alarm is set. The fault condition is as follows:

- The feedback on and off signals are both ON, and the fault of the feedback of on and off signals occur;
- If the output is on, and the feedback signal is still OFF after the over-stroke time, then an ON feedback fault occurs. If the output signal is reset, then the fault will be held for 2s and then will disappear.
- The output is off, and the feedback off signal is still OFF after the over-stroke time, and the fault of the feedback of off signals occur;

After the fault is reported, if the feedback signal returns to normal, it means the fault is fixed. If the same fault starts again, the timer starts to count again.

Output processing after fault

- When the fault output configuration is set as Hold, the output is held after a feedback fault occurs.
- When the fault output configuration is set as Close, after a feedback fault occurs, the output is Closed (output=OFF, safety off).

Interlock alarm

When the interlock command is triggered, an interlock alarm is reported.

Simulation status

After the simulation function is enabled, the feedback fault alarm and reset output are shielded. After you exit the simulation, the feedback fault is detected again.

4.1.3 Alarm Enabling Settings

- Alarm Bar Display

The alarm bar displays all the alarms currently active for this tag (the configuration can be enabled, and the default is disabled), including:

Description	Identifier	Configuration Item
On feedback fault alarm	OPNFL	Enable/Disable.
Off feedback fault alarm	CLSFL	Enable/Disable
Interlock On alarm	EMOPN	Enable/Disable
Interlock OFF alarm	EMCLS	Enable/Disable

- Status Bar Display

The status bar displays the current status of the tag, including:

Description	Identifier
Tag disable	OOS
Manual mode	MAN
Auto mode	AUTO
Interlock mode	LK
Remote cascade mode	RCAS
Mode lock	LOCK (Lock Icon)
Simulation status	SIMUL
Alarm shield	AOF

4.1.4 Panel Parameter Instruction

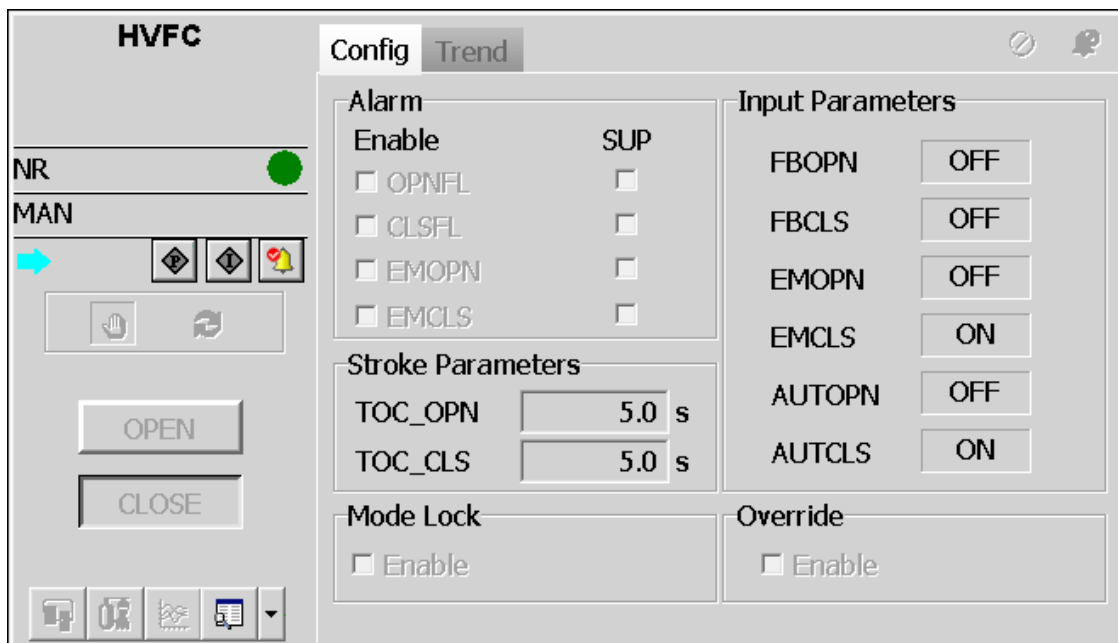


Figure 4.1 HVFC Function block Parameter Diagram

Table 4.2 HVFC Function Block Parameter Operation Description

Panel Parameter			Parameter Name	Initial Value	Remark
Remote On Command	Alarm	OPNFL	OPNFL	OFF	Alarm enable: tick it and then the alarm is enabled. Otherwise, it is prohibited.

Table 4.2 HVFC Function Block Parameter Operation Description (continued)

Panel Parameter			Parameter Name	Initial Value	Remark
(ON=Turn on)		CLSFL	CLSFL	OFF	Alarm enable: tick it and then the alarm is enabled. Otherwise, it is prohibited.
		EMOPN	EMOPN	OFF	Alarm enable: tick it and then the alarm is enabled. Otherwise, it is prohibited.
		EMCLS	EMCLS	OFF	Alarm enable: tick it and then the alarm is enabled. Otherwise, it is prohibited.
		SUP	OPNFLSUP	-	OPNFL Alarm Suppress Status
		SUP	CLSFLSUP	-	CLSFL Alarm Suppress Status
		SUP	EMOPNSUP	-	EMOPN Alarm Suppress Status
		SUP	EMCLSSUP	-	EMCLS Alarm Suppress Status
	Stroke Parameters	TOC_-OPN	TOC_OPN	5.0	Equipment Opening Runtime(s)
		TOC_-CLS	TOC_CLS	5.0	Equipment Closing Runtime(s)
	Input Parameters	AUTOPN	AUTOPN	OFF	Auto Open Command(ON=Open)
		AUTCLS	AUTCLS	OFF	Auto Close Command(OFF=Close)
		FBOPN	FBOPN	OFF	Open Status Feedback
		FBCLS	FBCLS	OFF	Close Status Feedback
		EMOPN	EMOPN	OFF	Interlock Open Command(ON=Open)
		EMCLS	EMCLS	ON	Interlock Close Command(OFF=Close)
	Mode Lock	Enable	LOCK	OFF	Switch Lock(ON=Lock,OFF=Unlock)
	Override	Enable	RMT_OVRD	OFF	Override Switch(OFF=Disable,ON=Enable)

Note: if there is no special explanation, BOOL type parameters are all electricity level signals.

Click “Related Tag” from the drop-down list on the function block panel (as shown in the following figure) to open the panel of the related tag configured during user program configuration. If the panel of the related tag is configured, click this option to open its panel. If the “Related tag” parameter is not set in the configuration of the function block tag, “Related Tag” is not displayed on the drop-down list.



Figure 4.2 Related tag option

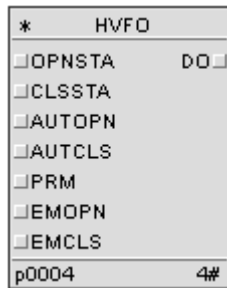
4.1.5 Flag

Table 4.3 Flag Code List

Flag	Description	Type
D0	Disable(OOS)	Status
D1	Manual(MAN)	Status
D2	Auto(AUTO)	Status
D7	Simulation(SIMUL)	Status
D8	Remote Cascade(RCAS)	Status
D9	Interlock Open(EMOPN)	Alarm
D10	Interlock Close(EMCLS)	Alarm
D13	Running Fault(OPNFL)	Alarm
D18	Close Feedback Fault Alarm(CLSFL)	Alarm
D19	Shield Alarm(AOF)	Status
D20	Interlock(LK)	Status

4.2 HVFO Valve Function Block with ON in Priority

The function block realizes the ON and OFF control of the valves and executes the control protection with ON in priority. The single controlled device can be controlled and operated by the SFC commands in the upper level or by operators through the panel.



4.2.1 Parameter Description

Table 4.4 The parameter description of HVFO valve switch function block

Parameter Name			Description	Parameter Type	Application
Expand parameter	Input pin	FBOPN	Open Status Feedback	BOOL	-
		FBCLS	Close Status Feedback	BOOL	-
		AUTOPN	Auto Open Command(ON=Open)	BOOL	Output in the upstream
		AUTCLS	Auto Close Command(OFF=Close)	BOOL	Output in the upstream
		PRM	Permit Signal(ON=Permit)	BOOL	Output in the upstream
		EMOPN	Interlock Open Command(ON=Open)	BOOL	Output in the upstream
		EMCLS	Interlock Close Command(OFF=Close)	BOOL	Output in the upstream
		RMOPN	Remote Open Command (ON=Open)	BOOL	-
		RMCLS	Remote Close Command(OFF=Close)	BOOL	-
		SWRCAS	Remote Cascade Switch(ON=to Remote Cascade)	BOOL	-
		SWMAN	Manual Switch(ON=to Manual)	BOOL	-
		SWAUTO	Auto Switch(ON=to Auto)	BOOL	-

Table 4.4 The parameter description of HVFO valve switch function block (continued)

Parameter Name			Description	Parameter Type	Application
	Output pin	DO	Output, ON=output ON, OFF=output OFF	BOOL	Output DO
	Operational parameter	RMT_OVRD	Override Switch(OFF=Disable,ON=Enable)	BOOL	-
		SIMUL	Simulate Switch(OFF=Disable,ON=Enable)	BOOL	-
		MANOPN	Manual Open Command(ON=Open)	BOOL	-
		MANCLS	Manual Close Command(OFF=Close)	BOOL	-
		LOCK	Switch Lock(ON=Lock,OFF=Unlock)	BOOL	-
		SWDO	Valve output method during simulation (SWDO=OFF, DO outputs according to the input command; SWDO=ON, DO outputs OFF, which means the output is off or stopped)	BOOL	-
	Status instruction	FLAG	Flag	UDINT	-
		FAULT	Fault (ON=Fault)		
		MODE	Mode(1=OOS,4=MAN,5=AUTO,6=LK,7=RCAS)	BOOL	-
		OPENING	Open Command Output Process (ON=Opening)	BOOL	-
		CLOSING	Close Command Output Process(ON=Closing)	BOOL	-
		STATE ^{Note2}	Status indication (0=No definition, 1=Closed, 2=Opened, 3=Closing, 4=Opening, 7=Interlock conflict, 8=fault) 8 is the highest priority, 0 is the lowest priority, and only the current high priority status is displayed	USINT	-
	Enable alarm and shield	AOF	Module alarm shield	BOOL	-

Table 4.4 The parameter description of HVFO valve switch function block (continued)

Parameter Name			Description	Parameter Type	Application
		ENALM	Alarm Enabled	UDINT	-
	OOS setting	SWOOS	Function block disables (ON=disable)	BOOL	-
Basic Parameters	Time settings	TOC_OPN	Device Opening Runtime(s)	REAL	-
		TOC_CLS	Device Closing Runtime(s)	REAL	-
	Configuration parameters	PRM_OPT	Permit Signal Options(PRM=OFF,0=Open Command Not Allowed,1=Close Command Not Allowed,2=Open And Close Command Not Allowed)	USINT	-
		FLT_OPT	Fault Output Options(0=Hold,1=Open) When both FBOPN and FB-CLO are ON, the DO is controlled by this parameter.	USINT	-
Macro		LOCKTAG	Interlock Tag Name	-	-

Note 1: if there is no special description, BOOL parameters are all level signals.

Note 2: Description of STATE

- 0: No definition
- 1: Closed
 - In actual operation, Closed means the close status feedback is received.
 - In simulation, Closed means output is closed, and the closing is delayed for 1/2 TOC_CLS.
- 2: Opened
 - In actual operation, Open means the open status feedback is received.
 - In simulation, Opened means output is opened, and the opening is delayed for 1/2 TOC_OPN.
- 3: Closing
- 4: Opening
- 7: Interlock conflict. This status is pulse output (After a single trigger, the status lasts only one pulse period, regardless of whether the conflict always exists), the duration is consistent with the opening time.

- In automatic mode, if an interlock command is received and the auto command is opposite to the interlock command, the interlock conflict status is displayed, STATE=7.
 - In remote mode, if an interlock command is received and the interlock command is opposite to the remote command, the interlock conflict status is displayed, STATE=7.
 - In interlock mode, if the auto command or remote command conflicts with the interlock command, no interlock conflict is displayed.
 - After entering the interlock conflict status, if a higher priority status is generated, switch to the high priority state immediately; and if a low priority status is generated while exiting the interlock status and maintaining the interlock status output, switch to the low priority status after the interlock conflict status time is up.
- 8: Fault
When the function block tag generates an opening fault or closing fault, the STATE is 8 (fault status).

4.2.2 Mode Description

Function block mode and priority: OOS> Interlock> Remote Cascade> Manual> Auto.

In the status indication parameters, MODE indicates the current mode: 1=OOS, 4>manual, 5=automatic, 6=interlock, 7=remote cascade.

OOS mode

When SWOOS=ON, the function block is in the OOS mode, and does not respond to various input commands, and the output remains. In non-OOS mode, the function block can respond to various input commands.

In OOS mode, all status are cleared except for the status of the input pins.

Interlocking mode (non-OOS)

When the interlock command is triggered, the function block enters the interlock mode. After the interlock command is canceled, it returns to the manual mode.

Remote Cascade, Manual, Auto Mode

After you exit the interlock mode, the function block is unlocked. If the override switch is not enabled, you can switch to the respective mode through the remote cascade switch, manual switch, and automatic switch. The priority is remote cascade> manual> automatic. If the override switch is enabled, even if the remote cascade switch is enabled, it can be forced to switch to manual or automatic mode through the manual or automatic switch.

In the locked status, the mode cannot be switched.

When the controller is in the cold start, the mode lock is unlocked and the override switch is disabled.

Input command processing

The interlock on and interlock off commands are not restricted by the mode and the allow signals, and the remaining commands are restricted by the respective mode and the allow signals.

- If the interlock off command is valid, output=OFF; if the interlock off command is invalid, the interlock on command is valid, output=ON; if both the interlock on and off commands are invalid, the output is determined by the input command in each mode.
- Manual on and off commands are only valid in manual mode. When the enable signal is satisfied, if the ON command is valid, output=OFF, if the ON command is invalid, the OFF command is valid, output=ON; if both the ON and OFF commands are invalid, output remains. When the allow signal is not satisfied and the configuration is OFF command is not allowed, it does not respond to the input of the OFF command, when the configuration is set to not allow the ON command, it does not respond to the input of the ON command. When the configuration is neither ON nor OFF command is allowed, the on and off commands do not respond neither.
- Auto ON and OFF commands are only valid in automatic mode. When the allow signal is satisfied, if the off command is valid, the output=OFF, if the OFF command is invalid, the ON command is valid, the output=ON; if both the ON and OFF commands are invalid, output remains. When the allow signal is not satisfied, and the configuration is ON command is not allowed, it does not respond to the input of the ON command. When the configuration is OFF command is not allowed, it does not respond to the input of the OFF command. When the configuration is neither ON nor OFF is allowed, the on and off commands do not respond neither.
- The remote ON and OFF commands are only valid in the remote cascade mode. When the allow signal is satisfied, if the off command is valid, output=OFF, if the off command is invalid, the on command is valid, output=ON; if the on and off commands are invalid, the output remains. When the allow signal is not satisfied and the configuration is ON command is not allowed, it does not respond to the input of the ON command. When the configuration is the OFF command is not allowed, it does not respond to the input of the OFF command. When the configuration is neither ON nor OFF is allowed, the on and off commands do not respond neither.

Fault Alarm

After the output command is issued, if the correct feedback signal is not received within the travel time, a fault alarm is set. The fault condition is as follows:

- The feedback on and off signals are both on, and the fault of the feedback of on and off signals occur;
- The output is on, and the feedback off signal is still off after the over-stroke time and the off feedback fault occur;
- The output is off, and the feedback signal is still off after the over-stroke time and the fault of the feedback of off signal occur. After an off feedback fault occurs, the fault remains for 2s (if the output is reset);

After the fault is reported, if the feedback signal returns to normal, it means the fault is fixed. If the same fault starts again, the timer starts to count again.

Output processing after fault

- When the fault output configuration is set to hold, the output is held after a feedback fault occurs.
- When the fault output configuration is set as outputting Open, after a feedback fault occurs, the output is Open (output=OFF, safety ON).

Interlock alarm

When the interlock command is triggered, an interlock alarm is reported.

Simulation status

After the simulation function is enabled, the feedback fault alarm and reset output are shielded. After you exit the simulation, the feedback fault will be detected again.

4.2.3 Settings for Enabling Alarms

- Alarm Bar Display

The alarm bar displays all the alarms currently active for this tag (the configuration can be enabled, and the default is disabled), including:

Description	Identifier	Configuration Item
On feedback fault alarm	OPNFL	Enable/Disable
Off feedback fault alarm	CLSFL	Enable/Disable
Interlock ON alarm	EMOPN	Enable/Disable

Description	Identifier	Configuration Item
Interlock OFF alarm	EMCLS	Enable/Disable

- Status Bar Display

The status bar displays the current status of the tag, including:

Description	Identifier
Tag disable	OOS
Manual mode	MAN
Auto mode	AUTO
Interlock mode	LK
Remote cascade mode	RCAS
Mode lock	LOCK (Lock Icon)
Simulation mode	SIMUL
Shield Alarm	AOF

4.2.4 Panel Parameter Instruction

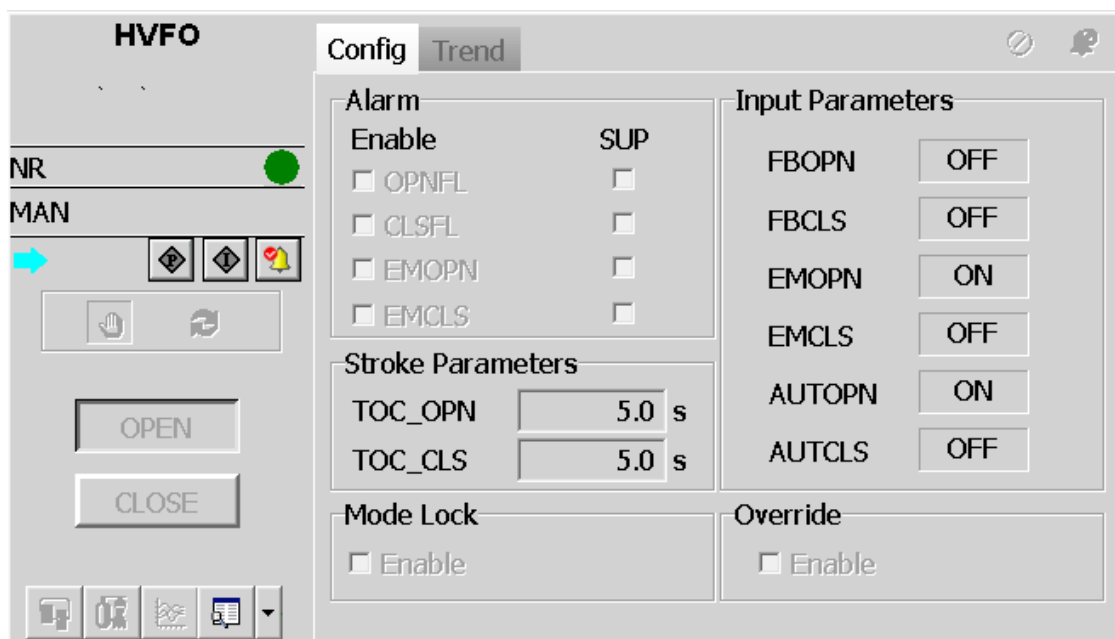


Figure 4.3 HVFO Function Block Parameter Panel Diagram

Table 4.5 The operational instruction of HVFO function block panel parameter

Panel Parameters			Parameter Name	Initial Value	Remark
Remote On Command (ON=Turn on)	Alarm	OPNFL	OPNFL	OFF	Alarm enable: tick it and then the alarm is enabled. Otherwise, it is prohibited.
		CLSFL	CLSFL	OFF	Alarm enable: tick it and then the alarm is enabled. Otherwise, it is prohibited.
		EMOPN	EMOPN	OFF	Alarm enable: tick it and then the alarm is enabled. Otherwise, it is prohibited.
		EMCLS	EMCLS	OFF	Alarm enable: tick it and then the alarm is enabled. Otherwise, it is prohibited.
		SUP	OPNFLSUP	-	OPNFL Alarm Suppress Status
		SUP	CLSFLSUP	-	CLSFL Alarm Suppress Status
		SUP	EMOPNSUP	-	EMOPN Alarm Suppress Status
		SUP	EMCLSSUP	-	EMCLS Alarm Suppress Status
	Stroke Parameters	TOC_OPN	TOC_OPN	5.0	Device Opening Runtime(s)
		TOC_CLS	TOC_CLS	5.0	Device Closing Runtime(s)
	Input Parameters	AUTOPN	AUTOPN	ON	Auto Open Command(ON=Open)
		AUTCLS	AUTCLS	OFF	Auto Close Command(OFF=Close)
		FBOPN	FBOPN	OFF	Open Status Feedback
		FBCLS	FBCLS	OFF	Close Status Feedback
		EMOPN	EMOPN	ON	Interlock Open Command(OFF=Open)
		EMCLS	EMCLS	OFF	Interlock Close Command(ON=Close)
	Mode Lock	Enable	LOCK	OFF	Switch Lock(ON=Lock,OFF=Unlock)

Table 4.5 The operational instruction of HVFO function block panel parameter (continued)

Panel Parameters			Parameter Name	Initial Value	Remark
	Override	Enable	RMT_OVRD	OFF	Override Switch(OFF=Disable,ON=Enable)

Click “Related Tag” from the drop-down list on the function block panel (as shown in the following figure) to open the panel of the related tag configured during user program configuration. If the panel of the related tag is configured, click this option to open its panel. If the “Related tag” parameter is not set in the configuration of the function block tag, “Related Tag” is not displayed on the drop-down list.

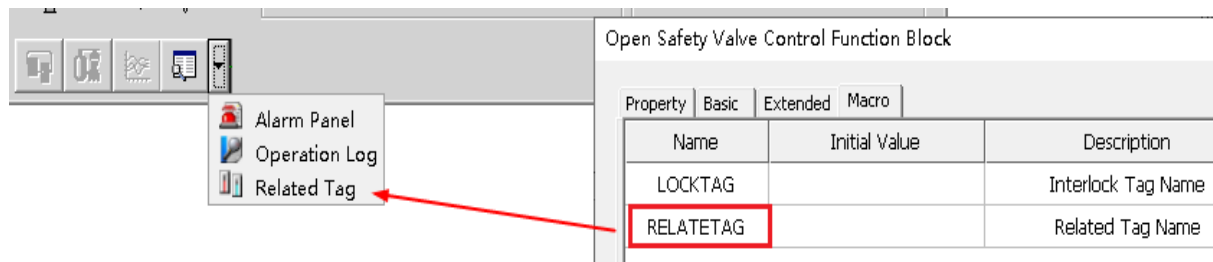


Figure 4.4 Related tag option

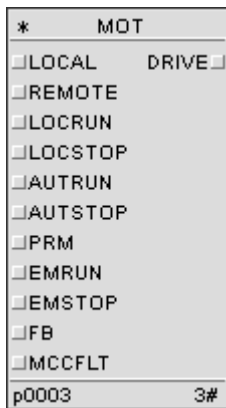
4.2.5 Flag

Table 4.6 Flag Code List

Flag	Description	Type
D0	Disable (OOS)	Status
D1	Manual (MAN)	Status
D2	Auto (AUTO)	Status
D7	Simulation (SIMUL)	Status
D8	Remote Cascade (RCAS)	Status
D9	Interlock Open (EMOPN)	Alarm
D10	Interlock Close (EMCLS)	Alarm
D13	Running Fault (OPNFL)	Alarm
D18	Close Feedback Fault Alarm (CLSFL)	Alarm
D19	Shield Alarm (AOF)	Status
D20	Interlock (LK)	Status

4.3 MOT Motor Control Function Block

The function block realizes the basic control and interlock protection of the device with single DI feedback and double DO output. The single controlled device can be controlled and operated by the upper SFC command or the operator through the panel.



4.3.1 Parameter Description

Table 4.7 Parameter Application Description of MOT Control Function Block

Parameter Name			Description	Parameter Type	Application
Basic Parameter	Time Settings	TOC	Device Runtime (s)	REAL	-
		TPW1	Feedback Reset Duration(t1:s)	REAL	-
		TPW2	Feedback Set Duration(t2:s,t2>t1)	REAL	-
	Configuration Parameters	PRM_OPT	Permit Signal Options(PRM=OFF,0=Startup Command Not Allowed,1=Stop Command Not Allowed,2=Startup And Stop Command Not Allowed)	USINT	-
		MCC_OPT	Equipment Fault Check Options(0=Only Check MCCFLT,1=Check MCCFLT And BUSFLT)	USINT	-
		PAL_OPT	Panel Display Options(0=MOT1,1=MOT2)	USINT	-

Table 4.7 Parameter Application Description of MOT Control Function Block (continued)

Parameter Name			Description	Parameter Type	Application
Extended Parameter		TR_OPT	Output Tracking Options(OFF=Not Track, ON=Track)	BOOL	-
		FACK_OPT	Whether to Confirm Running Fault Alarm(ON=Yes)	BOOL	-
		LOCAL	Switch Local Mode(ON=Switch Local)	BOOL	-
	Input Pin	REMOTE	Switch Remote Mode(ON=Switch Remote)	BOOL	-
		LOCRUN	Local Start Command(Effective In Local Mode,ON=Run)	BOOL	-
		LOCSTOP	Local Stop Command(OFF=Stop)	BOOL	-
		EMRUN	Interlock Startup Command(ON=Run)	BOOL	-
		EMSTOP	Interlock Stop Command(OFF=Stop)	BOOL	-
		RMRUN	Remote Startup Command(Effective In Remote Mode,ON=Run)	BOOL	-
		RMSTOP	Remote Stop Command(Effective In Remote Mode,OFF=Stop)	BOOL	-
		AUTRUN	Auto Startup Command(Effective In Remote Mode,ON=Run)	BOOL	-
		AUTSTOP	Auto Stop Command(Effective In Remote Mode,OFF=Stop)	BOOL	-
		PRM	Permit Signal(ON=Permit)	BOOL	-
		SWRCAS	Remote Cascade Switch(ON=to Remote Cascade)	BOOL	-

Table 4.7 Parameter Application Description of MOT Control Function Block (continued)

Parameter Name			Description	Parameter Type	Application
		SWMAN	Manual Switch(ON=to Manual)	BOOL	-
		SWAUTO	Auto Switch(ON=to Auto)	BOOL	-
		FB	Equipment Status Feed-back(ON=Run,OFF=Stop)	BOOL	-
		MCCFLT	Device fault signal (OFF=fault, ON=normal)	BOOL	-
		BUSFLT	BUS Fault Signal(OFF=Fault)	BOOL	-
		IN_CTA	Cooling Process Input(ON=Cooling)	BOOL	-
		IN_OVLD	Overload Input(OFF=Overload)	BOOL	-
		IN_TEST	Test Mode Input(ON=Test)	BOOL	-
	Output Pin	DRIVE	Output (OFF=stop, ON=start)	BOOL	DO
		N_DRIVE	Negate Output(OFF=Run,ON=Stop)	BOOL	-
		OUT_CTA	Cooling Process Output(ON=Cooling)	BOOL	-
		OUT_RST	Overload Protect Reset Output(ON=Reset)	BOOL	-
	Operational Parameter	MANRUN	Manual Startup Command (ON=Run)	BOOL	-
		MANSTOP	Manual Stop Command(OFF=Stop)	BOOL	-
		RMT_OVRD	Override Switch(OFF=Disable,ON=Enable)	BOOL	-
		LOCK	Switch Lock(ON=Lock,OFF=Unlock)	BOOL	To avoid the mistake switch between manual and automatic

Table 4.7 Parameter Application Description of MOT Control Function Block (continued)

Parameter Name			Description	Parameter Type	Application
		SIMUL	Simulate Switch(OFF=Disable,ON=Enable)	BOOL	-
		OPFLACK	Running Fault Alarm Acknowledge(ON=Acknowledge)	BOOL	-
		RST_CTA	Cooling Process Acknowledge(ON=Acknowledge)	BOOL	-
		RST_MCC	Equipment Overload Protection Reset (ON=reset)	BOOL	-
		SWDO	Valve output method during simulation (SWDO=OFF, DO outputs according to the input command; SWDO=ON, DO outputs OFF, the output is off or stopped)	BOOL	-
	Status Indication	FLAG	Flag	UDINT	Display status and alarms and so on.
		LRMODE	Local/Remote Mode(2=LOC,3=REM)	USINT	-
		MODE	Mode(1=OOS,4=MAN,5=AUTO,6=LK,7=RCAS)	USINT	-
		FAULT	Fault(ON=Fault)	BOOL	Device signal fault
		RUNNING	Startup Command Output Process(ON=Running)	BOOL	-
		STOPPING	Stop Command Output Process (ON=Stopping)	BOOL	-
		STATE ^{Note1}	Status indication (0=No definition, 1=Closed, 2=Opened, 3=Closing, 4=Opening, 7=Interlock conflict, 8=fault) 8 is the highest priority, 0 is the lowest priority, and only	USINT	-

Table 4.7 Parameter Application Description of MOT Control Function Block (continued)

Parameter Name			Description	Parameter Type	Application
			the current high priority status is displayed		
	Alarm enable and shield	AOF	Shield Alarm	BOOL	-
		ENALM	Alarm Enabled	UDINT	-
	OOS Settings	SWOOS	Switch of Out of Service (ON=Disable)	BOOL	-
Macro		LOCKTAG	Interlock Tag Name	-	-

Note 1: Description of STATE

- 0: No definition
- 1: Closed
 - In actual operation, Closed means the close status feedback is received.
 - In simulation, Closed means output is closed, and the closing is delayed for 1/2 TOC_CLS.
- 2: Opened
 - In actual operation, Open means the open status feedback is received.
 - In simulation, Opened means output is opened, and the opening is delayed for 1/2 TOC_OPN.
- 3: Closing
- 4: Opening
- 7: Interlock conflict. This status is pulse output (After a single trigger, the status lasts only one pulse period, regardless of whether the conflict always exists), the duration is consistent with the closing time.
 - In automatic mode, if an interlock command is received and the auto command is opposite to the interlock command, the interlock conflict status is displayed, STATE=7.
 - In remote mode, if an interlock command is received and the interlock command is opposite to the remote command, the interlock conflict status is displayed, STATE=7.
 - In interlock mode, if the auto command or remote command conflicts with the interlock command, no interlock conflict is displayed.

After entering the interlock conflict status, if a higher priority status is generated, switch to the high priority state immediately; and if a low priority status is generated while exiting the interlock status and maintaining the interlock status output, switch to the low priority status after the interlock conflict status time is up.

- 8: Fault

When the function block tag generates a fault (OPFL, MCCFLT, BUSLFT), the STATE is 8 (fault status).

4.3.2 Mode Description

Function block mode: The function block is divided into OOS, interlocking, remote cascade, manual, automatic and local, remote mode. The local mode is local control, and the remote mode is DCS control. The mode priority is OOS> Interlock> Remote Cascade> Manual> Automatic, OOS> Local> Remote.

In the status indication parameters, MODE indicates the current mode: 1=OOS, 4=Manual, 5=Automatic, 6=Interlock, 7=Remote cascade.

LRMODE means local and remote mode: 2=Local, 3=Remote

OOS Mode

When SWOOS=ON, the function block is in the OOS mode, and does not respond to various input commands, and the output remains. In non-OOS mode, the function block can respond to various input commands.

In OOS mode, all status are cleared except for the status of the input pins.

Interlock Mode (non-OOS)

When the interlock command is triggered, the function block enters the interlock mode. After the interlock command is canceled, it returns to the manual mode.

Remote Cascade, Manual, Auto Mode

After you exit the interlock mode, in the unlocked status, if the override switch is not enabled, you can switch to the respective mode through the remote cascade switch, manual switch, and automatic switch. The priority is remote cascade> manual> automatic. If the override switch is enabled, even if the remote cascade switch is enabled, it can be forced to switch to manual or automatic mode through the manual or automatic switch.

In the locked status, the mode cannot be switched.

When the controller is in the cold start, the mode lock is unlocked and the override switch is disabled to use.

Local, Remote Mode

- LOCAL is in local mode. When the local input command is valid or the local stop input command is valid, local mode is entered.
- REMOTE is in remote mode. When it is not in local mode and the input command of remote mode is valid, it enters remote mode.
- When the local and remote mode commands are invalid, the original mode is maintained.

Input command processing

- The fault signal (equipment fault, feedback fault, etc.), local stop command, interlock command are not limited by the mode and the allow signal. Fault detection can be configured. When MCC_OPT=0, it means only MCCFLT is detected. When MCC_OPT=1, it means MCCFLTL and BUSFLT are detected. After the device and bus fault are resolved, FAULT becomes OFF.
- There is a local start command in local mode, which is only valid in local mode and is not restricted by the allow signal.
- The remote mode includes manual run, automatic run, automatic stop, remote cascade run, and remote cascade stop commands. The commands are limited by their respective modes and allow signals. When the allow signal is satisfied, if the STOP command is valid, the output is stopped, if the STOP command is invalid, the RUN command is valid, the output is enabled; if both RUN and STOP commands are invalid, the output is maintained. When the allow signal is not satisfied, when the configuration is set to not allow the RUN command, it does not respond to the input of the RUN command. When the configuration is the STOP command is not allowed, it does not respond to the input of the STOP. When the configuration is neither RUN nor STOP is allowed, it does not respond to RUN or STOP commands.
- There is also a manual stop command in manual mode, which is only valid in manual mode and is restricted by the allow signal.
- The stop command in the input command has priority. When the stop command is valid, the output is stopped. When the stop command is invalid and the start command is valid, the output is started. When the start and stop commands are invalid, the original output is maintained.

Troubleshooting

After the output command is issued, the correct feedback signal is not received within the travel time, a fault alarm is set, and the output processing is performed as follows:

- If the output is in a stop status, and the feedback signal has transitions, a fault will be reported, the stop command in the T1 cycle will be output, and the start command of the T2 cycle is output as well. When the cycle time is reached, the output command is canceled (configuration output tracking, TR_OPT=ON).
- If the output is in a start status and the feedback signal is still OFF after the over-stroke time, a fault will be reported. and the stop command will be output. When the configuration is set to start and the fault alarm needs to be acknowledged, the alarm can be eliminated only after being acknowledged. If the configuration is not required to be acknowledged, the alarm will be eliminated in 2s;
- If the output is in a stop status, the feedback signal is still ON after the over-stroke time, a fault will be reported, and a stop command will be output;

Output tracking

When the output is in a stop status, the feedback signal will jump. If the output tracking is set to track, the tracking feedback status will be output, and an output tracking alarm will be generated. If it is set to not track, the feedback status without tracking will be output and no alarm will be generated.

Cold processing

If devices fail due to overloading, it is necessary to cool devices down. During the cooling time, the prompt of being in the cooling time will pop up. When the device fails and still in the cooling process, you are not able to reset the device. When the device fails but the cooling process ends, you are able to reset the device.

Cooling process of MOT function block:

- If the equipment signal has no fault (MCCFLT=ON) and is not in the cold processing (IN_CTA=OFF), the output of the cold processing is OUT_CTA = OFF.
- If the signal MCCFLT of device has no fault (MCCFLT=ON) and is in the cold processing (IN_CTA=ON), the output of the cold processing is OUT_CTA = ON.
- If the signal MCCFLT is faulty (MCCFLT=OFF) and is not in the cold processing (IN_CTA = OFF). The fault can be acknowledged (RST_CTA, single-cycle rising edge trigger). After confirmation, the cold process outputs OUT_CTA = OFF.
- If the signal MCCFLT of device is faulty (MCCFLT=OFF) and is in the cold processing (IN_CTA=ON), the output of the cold process is OUT_CTA = ON, and cannot be reset by fault acknowledgment.
- When the output of the cold processing is OUT_CTA = ON, the status bar shows the cold process (CTA).

Simulation status

After the simulation function is enabled, the feedback fault alarm (OPFL) and reset output are shielded. After you exit the simulation, the feedback fault will be detected again.

4.3.3 Settings for Enabling Alarms

- Alarm Bar Display

The alarm bar displays all the alarms currently active for this tag (the configuration can be enabled, and the default is disabled), including:

Description	Identifier	Configuration Item
Operation Fault Alarm	OPFL	Enable/Disable
Device Fault Alarm	MCCFL	Enable/Disable
Interlock Operation Alarm	EMRUN	Enable/Disable
Interlock Stop Alarm	EMSTOP	Enable/Disable
Output Track Alarm	TRACK	Enable
Overload Alarm	OVL	Enable/Disable

- Status Bar Display

The status bar displays the current status of the tag, including:

Identifier	Description
OOS	Tag disable
LOCAL	Local mode
MAN	Manual mode
AUTO	Automatic mode
LK	Interlock mode
RCAS	Remote cascade mode
LOCK (lock icon)	Mode lock
SIMUL	Simulation status
TEST	Test status

Identifier	Description
CTA	Cold processing
AOF	Alarm shield

4.3.4 Panel Parameter Instruction

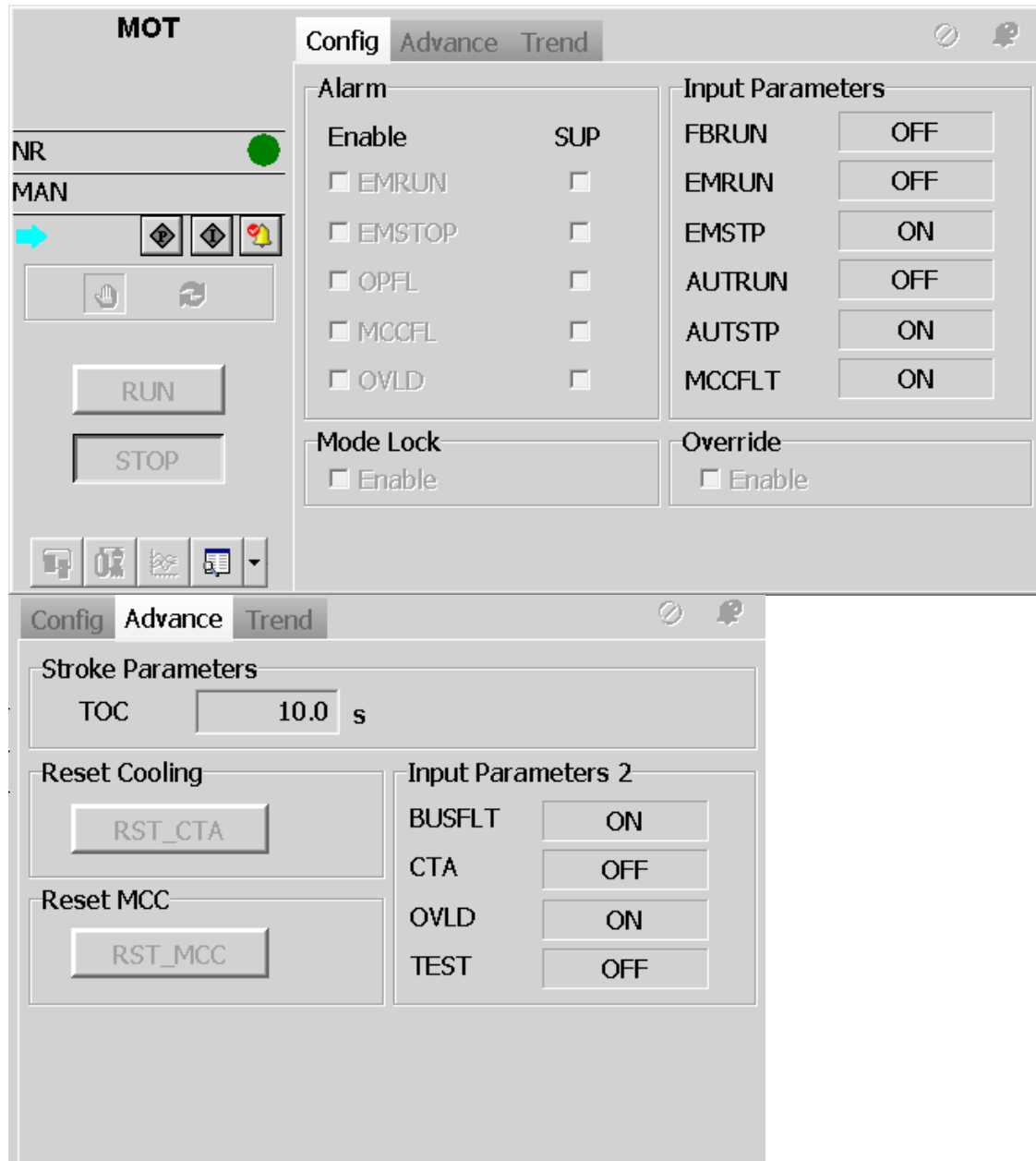


Figure 4.5 MOT Control Function Block Parameter Panel

Table 4.8 The operational instruction of MOT function block panel parameters











Panel Parameter			Parameter Name	Initial Value	Remark
 Interlock indication			<ul style="list-style-type: none"> Non-interlock and non-bypass, it displays . Interlock and non-bypass, it displays . Non-interlock but bypass, it displays . Interlock and bypass, it displays . 		
 Interlock of PRM_OPT			<p>HVFC/HVFO/MOT have another interlock button to represent PRM_OPT.</p> <ul style="list-style-type: none"> PRM_OPT is not set as OFF and non-bypass, it displays . PRM_OPT is OFF and non-bypass, it displays . PRM_OPT is not set as OFF but bypass, it displays . PRM_OPT is OFF and bypass, it displays . 		
Configura- tion	Enable	EMRUN	EMRUN	OFF	Alarm enable: tick it and then the alarm is enabled. Otherwise, it is prohibited.
		EMSTOP	EMSTOP	OFF	Alarm enable: tick it and then the alarm is enabled. Otherwise, it is prohibited.
		OPFL	OPFL	ON	Running Fault Alarm
		MCCFL	MCCFL	-	Device Fault Alarm
		OVL	OVL	-	Overload Alarm
	SUP	EM-RUNS	EM-RUNS	-	EMRUN Alarm Suppress Status
		EMSTOP	EMSTOP	-	EMSTOP Alarm Suppress Status
		OPFLSUP	OPFLSUP	-	OPFL Alarm Suppress Status
		MC-CFLSUP	MC-CFLSUP	-	MCCFL Alarm Suppress Status
		OVLDSUP	OVLDSUP	-	OVL Alarm Suppress Status
	Input Pa- rameter	FBRUN	FB	OFF	Equipment Status Feed-back(ON=Run,OFF=Stop)
		EMRUN	EMRUN	OFF	Interlock Startup Command(ON=Run)
		EMSTOP	EMSTOP	ON	Interlock Stop Command(OFF=Stop)

Table 4.8 The operational instruction of MOT function block panel parameters (continued)

Panel Parameter			Parameter Name	Initial Value	Remark
		AUTRUN	AUTRUN	OFF	Auto Startup Command(Effective In Remote Mode,ON=Run)
		AUTSTOP	AUTSTOP	ON	Auto Stop Command(Effective In Remote Mode,OFF=Stop)
		MCCFLT	MCCFLT	ON	Device Fault Signal(OFF=Fault)
Advance	Mode Lock	Enable	LOCK	OFF	Switch Lock(ON=Lock,OFF=Unlock)
	Override	Enable	RMT_-OVRD	OFF	Override Switch(OFF=Disable,ON=Enable)
	Stroke Parameter	TOC	TOC	10.0	Device Runtime(s)
	Reset Cooling	RST_CTA	RST_CTA	OFF	Cooling Process Acknowledge(ON=Acknowledge)
	Reset MCC	RST_MCC	RST_MCC	OFF	Device Overload Protect Reset(ON=Reset)
	Input Parameter2	BUSFLT	BUSFLT	ON	BUS Fault Signal(OFF=Fault)
		CTA	CTA	OFF	Cooling Status
		OVL	OVL	ON	Overload Alarm
		TEST	TEST	OFF	Test Status

Click “Related Tag” from the drop-down list on the function block panel (as shown in the following figure) to open the panel of the related tag configured during user program configuration. If the panel of the related tag is configured, click this option to open its panel. If the “Related tag” parameter is not set in the configuration of the function block tag, “Related Tag” is not displayed on the drop-down list.

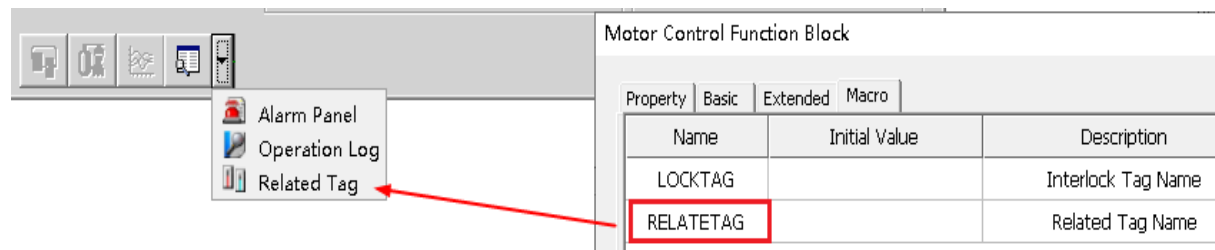


Figure 4.6 Related tag option

4.3.5 Flag

Table 4.9 Flag Code List

Flag	Description	Type
D0	Disable(OOS)	Status
D1	Manual(MAN)	Status
D2	Auto(AUTO)	Status
D4	On-site(LOC)	Status
D5	Simulation(SIMUL)	Status
D12	Remote Cascade(RCAS)	Status
D13	Output Tracking Alarm(TRACK)	Alarm
D14	Running Fault(OPFL)	Alarm
D15	Interlock Startup (EMRUN)	Alarm
D16	Interlock Stop (EMSTOP)	Alarm
D18	Equipment Failure Alarm (MCCFL)	Alarm
D24	Shield Alarm (AOF)	Status
D25	Interlock (LK)	Status
D26	Cooling Status (CTA)	Status
D27	Overload Alarm (OVLD)	Alarm
D28	Test (TEST)	Status

4.4 CNT Counter Function Block

Counter function block is used to count the numbers of the input signal. It has two modes to count: standard count and period count. Each parameter description is shown as Table 4.10.

* CNT	
<input type="checkbox"/> IN	OUT <input type="checkbox"/>
<input type="checkbox"/> AUTRUN	HALM <input type="checkbox"/>
<input type="checkbox"/> AUTSTOP	HHALM <input type="checkbox"/>
<input type="checkbox"/> AUTRST	
p0002	2#

4.4.1 Parameter Description

Table 4.10 Calculator Function Block Parameter

Parameter Name			Description	Parameter Type	Application
Expansion Parameters	Input pins	IN	Input Value	REAL	Input counting signal
		AUTRUN	Auto Startup Command(Rising Edge Startup)	BOOL	-
		AUTSTOP	Auto Stop Command(Rising Edge Stop)	BOOL	-
		AUTRST	Auto Reset Command(Rising Edge Reset)	BOOL	-
		RMRUN	Remote Startup Command(Rising Edge Startup)	BOOL	-
		RMSTOP	Remote Stop Command(Rising Edge Stop)	BOOL	-
		RMRST	Remote Reset Command(Rising Edge Reset)	BOOL	-
		SWRCAS	Remote Cascade Switch(ON=to Remote Cascade)	BOOL	-
		SWMAN	Manual Switch(ON=to Manual)	BOOL	-
		SWAUTO	Auto Switch(ON=to Auto)	BOOL	-
	Output pins	OUT	Output Value	REAL	-
		POUT	Period Output Value	REAL	-
		HALM	Count Over H Limit Alarm Output(IVO=ON,OFF=Alarm;IVO=OFF,ON=Alarm)	BOOL	-
		HHALM	Count Over HH Limit Alarm Output(IVO=ON,OFF=Alarm;IVO=OFF,ON=Alarm)	BOOL	-
		ZERO	Clear Status(ON=Clear)	BOOL	-
	Operation parameters	RMT_OVRD	Override Switch(OFF=Disable,ON=Enable)	BOOL	-
		LOCK	Switch Lock(ON=Lock,OFF=Unlock)	BOOL	-

Table 4.10 Calculator Function Block Parameter (continued)

Parameter Name			Description	Parameter Type	Application
		MANRST	Manual Reset Command(Rising Edge Reset)	BOOL	-
		MANRUN	Manual Startup Command(Rising Edge Startup)	BOOL	-
		MANSTOP	Manual Stop Command(Rising Edge Stop)	BOOL	-
	Status indicators	FLAG	Flag	UDINT	-
		MODE	Mode(1=OOS,4=MAN,5=AUTO,7=RCAS)	USINT	-
		ET	Cumulative Time	REAL	-
	Alarm enable and shield	AOF	Shield Alarm	BOOL	-
		ENALM	Alarm Enabled	UDINT	-
	OOS settings	SWOOS	Switch of Out of Service (ON=Disable)	BOOL	-
Basic parameters	Configuration parameters	TC_MODE	Count Mode(ON=Time,OFF=Standard)	BOOL	-
		TC_UNIT	Time Unit(0=sec,1=min,2=hour,3=day)	USINT	-
		TC	Time	REAL	-
		OUTSCH	Output Value Maximum	REAL	-
		OUTSCL	Output Value Minimum	REAL	-
		OUTEU	Output Value Unit	EUTYPE	-
		INSCH	Input Value Maximum	REAL	-
		INSCL	Input Value Minimum	REAL	-
		INEU	Input Value Unit	EUTYPE	-
		OUTDLEN	Output Value Decimal Digits[0,5]	USINT	-
		INDLEN	Input Value Decimal Digits[0,5]	USINT	-
		IVO	Alarm Output Negate Options(ON=Negate, OFF=Not to negate)	BOOL	-

Table 4.10 Calculator Function Block Parameter (continued)

Parameter Name			Description	Parameter Type	Application
	Alarm parameters	H	Count H Limit	REAL	-
		HH	Count HH Limit	REAL	-
	Counting parameters	KFCT	Equivalent Coefficient	REAL	-
		TFCT	Time Coefficient	REAL	-

4.4.2 Working Mode

Function block mode and priority: OOS>Remote Cascade>Manual>Automatic mode.

MODE indicates the current mode: 1=OOS, 4=Manual, 5=Automatic, 7=Remote cascade.

OOS Mode

When SWOOS=ON is satisfied, the function block is in the OOS mode, and does not respond to various commands, and the output is maintained.

In OOS mode, all status are cleared except for the status of the input pins.

Remote Cascade, Manual, Auto Mode

After you exit OOS, the default is manual mode.

In the unlocked status, if the override switch is not enabled, you can switch to the respective modes through the remote cascade switch, manual switch, and automatic switch. The priority is remote cascade>manual>automatic. If the override switch is enabled, even if the remote cascade switch is enabled, it can be forced to switch to manual or automatic mode through the manual or automatic switch.

In the locked status, the mode cannot be switched.

When the controller is in the cold start, the mode lock is unlocked and the override switch is disabled.

Input Commands

- In manual mode, counting is controlled by manual start and the stop input commands. The priority order of the commands is Stop>Start. When the stop command input is valid, the count stops; when the start command input is valid, the count starts. When all the commands are invalid, the count resumes according to the previous command.

- In automatic mode, counting is controlled by automatic start and the stop input commands. The priority order of the commands is Stop>Start. When the stop command input is valid, the count stops; when the start command input is valid, the count starts. When all the commands are invalid, the count resumes according to the previous command.
- In remote cascade mode, counting is controlled by remote cascade start and stop input commands. The priority order of the commands is stop> start. When the stop command input is valid, the count stops; when the start input command is valid, the count starts. When all the commands are invalid, the count resumes according to the previous command.
- Reset Command
 - You can clear the count by the reset switch in each mode. The reset operation only takes effect in standard count mode. After the reset operation, the current count gets clear and records the counts before the reset operation.
 - Under the cyclical counting mode, it gets reset till counting time is up. In this case, it will clear the current count and record the count before the reset.
 - If the count won't be accumulated after the reset operation, then the reset output will always set ON. If the count continues to accumulate, then the reset output will set OFF.
 - The current accumulation is always being zero, the reset output will always set ON.

Cold Start

When the controller is in the cold start, whether or not to zero clearing can be set.

Alarm Output

- When the current count value is greater than the H limit of the count, an over H limit alarm will be released;
- When the current count value is greater than the HH limit of the count, an over HH limit alarm will be released;
- When the alarm output is set to be inverted, HHALM and HALM output OFF when the alarm is released, and HHALM and HALM output ON when no alarm is released. When is set to be not inverted, the output is ON when the alarm is released and OFF when the alarm is not released.

Count Value Conversion

$OUT = TS \times IN / KCOEFF / TCOEFF$, TS is the scheduling period.

4.4.3 Settings for Enabling Alarms

- Alarm Bar Display

The status bar displays all the alarms of the tag in the current activity, including:

Description	Identifier	Configuration Item
H Limit Alarm	H	Enable/Disable
HH Limit Alarm	HH	Enable/Disable

- Status Bar Display

The status bar displays the current status of the tag, including:

Description	Identifier
Tag Disable	OOS
Manual Mode	MAN
Automatic Mode	AUTO
Remote Cascade Mode	RCAS
Mode Lock	LOCK (Lock Icon)
Alarm Shield	AOF

4.4.4 Panel Parameter Instruction

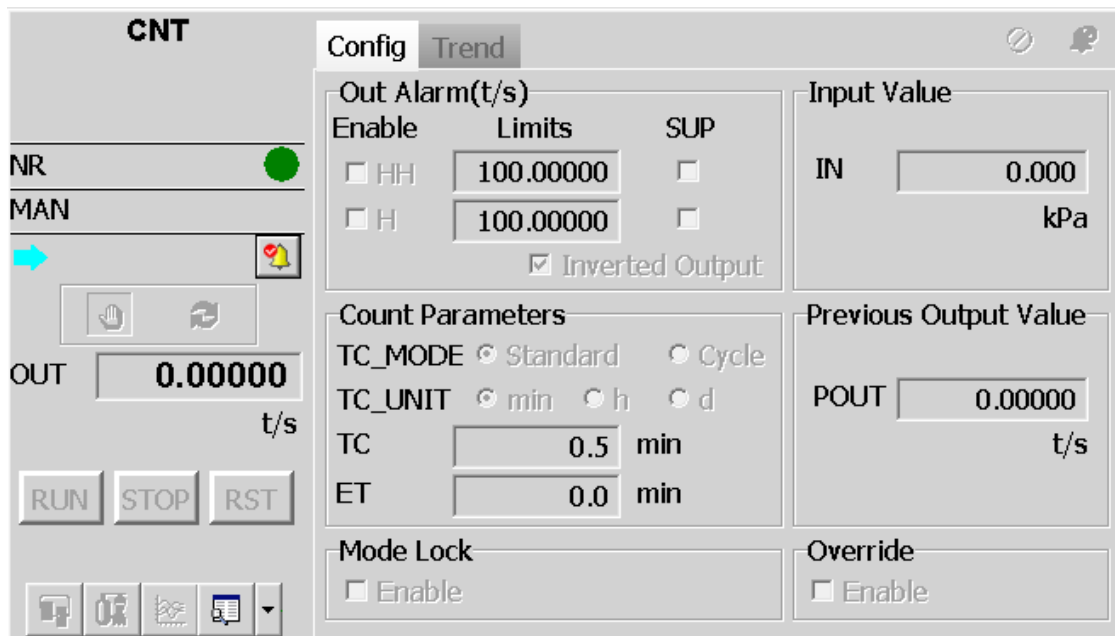


Figure 4.7 CNT Function Block Panel Parameter Diagram

Table 4.11 The operational instruction of CNT function block panel parameter

Panel Display		Parameter Name	Initial Value	Remark
OUT Alarm	HH	HHALM	ON	Count Over HH Limit Alarm Output(IVO=ON,OFF=Alarm;I-VO=OFF,ON=Alarm)
	H	HALM	ON	Count Over H Limit Alarm Output(IVO=ON,OFF=Alarm;I-VO=OFF,ON=Alarm)
	Limits	HH	100.0	Count HH Limit
		H	100.0	Count H Limit
	SUP	HHSUP		HH Alarm Suppress Status
		HSUP		H Alarm Suppress Status
	Inverted Output	IVO	ON	Alarm Output Negate Options(ON=Negate, OFF=Not to negate)
Count Parameters	TC_MODE	TC_MODE	OFF	Count Mode(ON=Time,OFF=Standard)
	TC_UNIT	TC_UNIT	0	Time Unit(0=sec,1=min,2=hour,3=day)
	TC	TC	0.0	Time
	ET	ET	0.0	Cumulative Time
Input Value	IN	IN	OUT	Input Value
Pervious Output Value	POUT	POUT	0.0	Period Output Value
ModeLock	Enable	LOCK	OFF	Switch Lock(ON=Lock,OFF=Unlock)
Override	Enable	RMT_OVRD	OFF	Override Switch(OFF=Disable,ON=Enable)

Click “Related Tag” from the drop-down list on the function block panel (as shown in the following figure) to open the panel of the related tag configured during user program configuration. If the panel of the related tag is configured, click this option to open its panel. If the “Related tag” parameter is not set in the configuration of the function block tag, “Related Tag” is not displayed on the drop-down list.

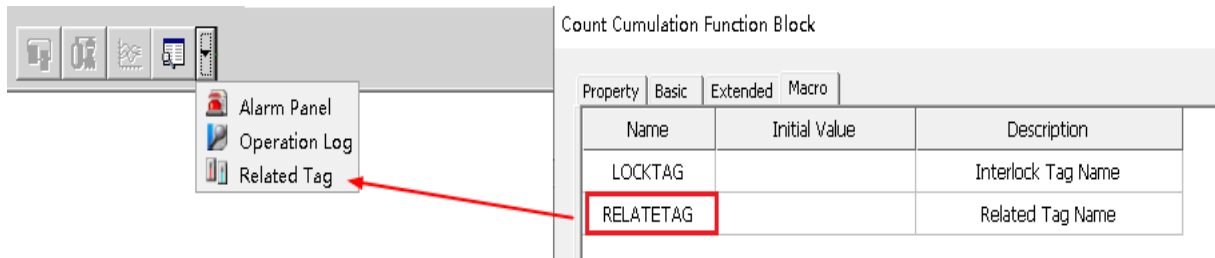


Figure 4.8 Related tag option

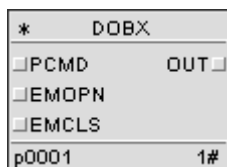
4.4.5 Flag

Table 4.12 Flag Code List

Flag	Description	Type
D0	Disable (OOS)	Status
D1	Manual (MAN)	Status
D2	Auto (AUTO)	Status
D6	HH alarm (HH)	Alarm
D7	H alarm (H)	Alarm
D8	Shield Alarm (AOF)	Status
D9	Remote Cascade (RCAS)	Status

4.5 DOBX Function Block

DOBX function block is used to control the output DO signals. The control function of DOBX is similar to HVFC but without output feedback. For details, please refer to "HVFC Valve Function Block with OFF in Priority"..



4.5.1 Parameter Description

Table 4.13 FBD Parameter List

Parameter Name	Type	Initial Value	Description
Input pin	PCMD	BOOL	OFF
Command Input (OFF=Close,ON=Open)			

Table 4.13 FBD Parameter List (continued)

Parameter Name		Type	Initial Value	Description
	EMOPN	BOOL	OFF	Interlock Open Command (IVO=OFF:ON=Open;-VO=ON:OFF=Open)
	EMCLS	BOOL	ON	Interlock Close Command (IVO=OFF:OFF=Close;IVO=ON:ON=Close)
	SWRCAS	BOOL	OFF	Remote Cascade Switch (ON=to Remote Cascade)
	RCMD	BOOL	OFF	Remote Command Input (OFF=Close,ON=Open)
	SWMAN	BOOL	OFF	Manual Switch (ON=to Manual)
	SWAUTO	BOOL	OFF	Auto Switch (ON=to Auto)
Output pin	OUT	BOOL	OFF	Output
Monitoring parameter	FLAG	UDINT	0	Flag
	MODE	USINT	0	Mode (1=OOS,4=MAN,5=AUTO,6=LK,7=RCAS)
Operational parameter	ON_TON	REAL	0	ON Status Alarm TON (s)
	ON_-TOFF	REAL	0	ON Status Alarm TOFF (s)
	OFF_-TON	REAL	0	OFF Status Alarm TON (s)
	OFF_-TOFF	REAL	0	OFF Status Alarm TOFF(s)
	MCMD	BOOL	OFF	Manual Command (OFF=Close,ON=Open)
	LOCK	BOOL	OFF	Mode Lock (OFF=UnLock,ON=Lock)
	RMT_-OVRD	BOOL	OFF	Override Switch (OFF=Disable,ON=Enable)
	SWOOS	BOOL	OFF	Switch of Out of Service (ON=Disable)
	AOF	BOOL	OFF	Shield Alarm (ON= Shield)
Alarm parameter	ENALM	UDINT	0	Alarm Enable
Configuration parameter	IVO	BOOL	OFF	Interlock Input Negate Options (ON=Negate,OFF=Not to negate)

Table 4.13 FBD Parameter List (continued)

Parameter Name		Type	Initial Value	Description
	COLD_- OPT	USINT	0	Cold Start Man/Auto Mode Options (0=Hold,1=MAN,2=AUTO)

4.5.2 Panel Parameter Instruction

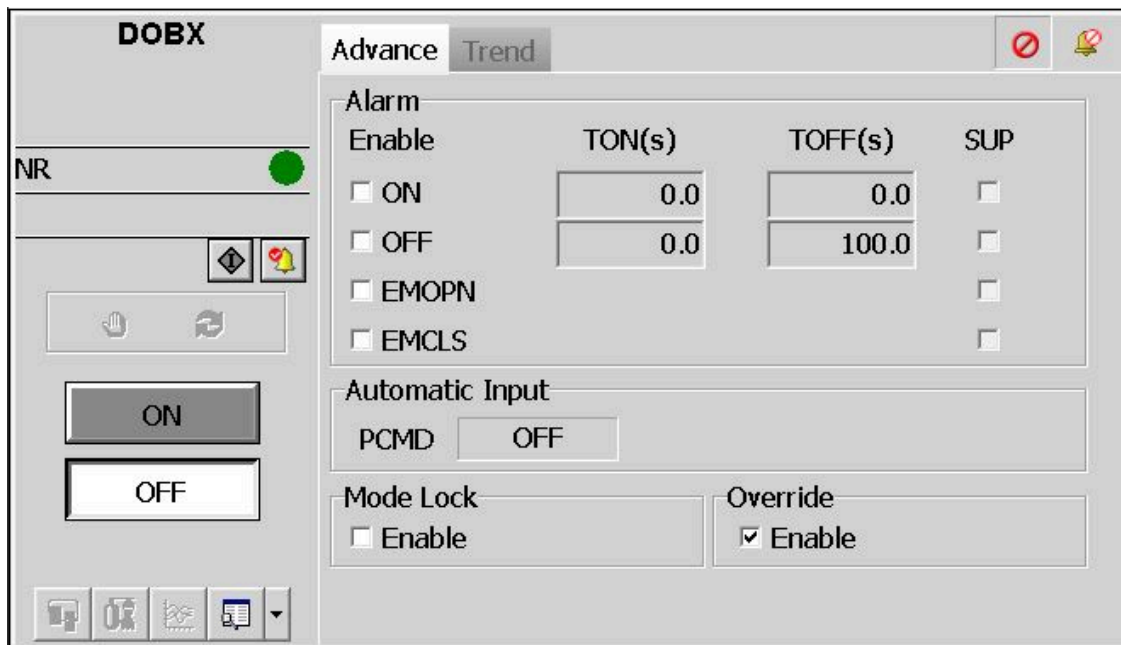


Figure 4.9 DOBX Function Block Panel Parameter Graph

Table 4.14 DOBX Function Block Panel Parameter Operational Description

Panel Parameter			Function Block Name	Initial Value	Remark
Ad- vanced	Alarm	ON	ON	-	ON Status Alarm
		OFF	OFF	-	OFF Status Alarm
		EMOPN	EMOPN_B	OFF	Interlock Open Alarm
		EMCLS	EMCLS_B	ON	Interlock Close Alarm
		TON (s)	ON_TON	0.0	ON Status Alarm TON(s)
			OFF_TON	0.0	OFF Status Alarm TON(s)
		TOFF (s)	ON_TOFF	0.0	ON Status Alarm TOFF(s)
			OFF_- TOFF	0.0	OFF Status Alarm TOFF(s)

Table 4.14 DOBX Function Block Panel Parameter Operational Description (continued)

Panel Parameter			Function Block Name	Initial Value	Remark
		SUP	ONSUP	-	ON Alarm Suppress Status
			OFFSUP	-	OFF Alarm Suppress Status
			EMOP-NSUP	-	EMOPN Alarm Suppress Status
			EM-CLSSUP	-	EMCLS Alarm Suppress Status
	Automatic Input	PCMD/OFF	PCMD	OFF	Command Input (OFF=Close,ON=Open)
	Mode Lock	Enable	LOCK	OFF	Mode Lock (OFF=UnLock,ON=Lock)
	Override	Enable	RMT_-OVRD	OFF	Override Switch (OFF=Disable,ON=Enable)

Alarm bar displays all the alarms of the current tag (could be enabled, the default is not to be enabled). DOBX is similar to DOEX but with another two alarms added.

Description	Identifier	Configuration Items
Interlock ON Alarm	EMOPN	Enable/Disable
Interlock OFF Alarm	EMCLS	Enable/Disable

4.5.3 Flag

Table 4.15 Flag Code List

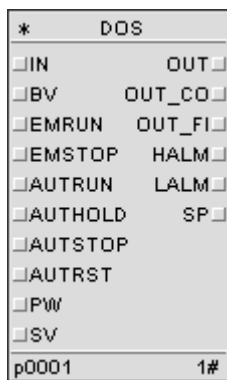
Flag Code	Alarm Code	Description	Type
D0	OOS	Disable	Status
D1	IMAN	Initialize Manually	Status
D2	AUTO	Auto	Status
D4	LK	Interlock	Alarm
D5	EMOPN	Interlock Open	Alarm
D6	EMCLS	Interlock Close	Alarm
D7	ON	ON Status Alarm	Alarm

Table 4.15 Flag Code List (continued)

Flag Code	Alarm Code	Description	Type
D8	OFF	OFF Status Alarm	Alarm
D9	AOF	Shield Alarm	Status
D11	RCAS	Remote Cascade	Alarm

4.6 DOS Feeding Control Function

This function block is used to adjust the output of the feeding valve by monitoring the feeding amount as to make the feeding amount achieve the set value..



4.6.1 Parameter Description

Table 4.16 Parameter Application Description of DOS Ingredient-feeding Control Function Block

Parameter Name			Description	Parameter Type	Applications
Expansion Parameters	Input Pins	IN	Input Value	REAL	-
		BV	Basic Value(Residual Amount In The Tank)	REAL	The residual volume of the feeding in the tank.
		EMRUN	Interlock Startup Command(ON=Run)	BOOL	-
		EMSTOP	Interlock Stop Command(OFF=Stop)	BOOL	-
		AUTRUN	Auto Startup Command(ON=Run)	BOOL	-
		AUTHOLD	Auto Hold Command(ON=Hold)	BOOL	-

Table 4.16 Parameter Application Description of DOS Ingredient-feeding Control Function Block
(continued)

Parameter Name		Description	Parameter Type	Applications
	AUTSTOP	Auto Stop Command(ON=Stop)	BOOL	Coarse and fine tuning of feeding valves are closed. Automatic mode is active.
	AUTRST	Auto Reset Command(ON=Reset)	BOOL	Reset the feeding accumulation. The automatic mode is active. It would be reset only when the fine tuning output is stopped.
	RMRUN	Remote Startup Command(ON=Run)	BOOL	This pin isn't displayed by default but can be displayed by checking it.
	RMHOLD	Remote Hold Command(ON=Hold)	BOOL	This pin isn't displayed by default but can be displayed by checking it.
	RMSTOP	Remote Stop Command(ON=Stop)	BOOL	This pin isn't displayed by default but can be displayed by checking it.
	RMRST	Remote Reset Command(ON=Reset)	BOOL	This pin isn't displayed by default but can be displayed by checking it.
	SWRCAS	Remote Cascade Switch(ON=switch to Remote Cascade)	BOOL	This pin isn't displayed by default but can be displayed by checking it.
	SWMAN	Manual Switch(ON=switch to Manual)	BOOL	This pin isn't displayed by default but can be displayed by checking it.
	SWAUTO	Auto Switch(ON=switch to Auto)	BOOL	This pin isn't displayed by default but can be displayed by checking it.

Table 4.16 Parameter Application Description of DOS Ingredient-feeding Control Function Block (continued)

Parameter Name			Description	Parameter Type	Applications
		PW	Pre-shutdown Coarse Output Value	REAL	-
		SV	Set Value	REAL	-
	Output Pins	OUT	Output Value	REAL	
		OUT_CO	Coarse Output(ON=Run,OFF=S-top)	BOOL	Coarse tuning valve switch
		OUT_FI	Fine Output(ON=Run,OFF=S-top)	BOOL	Fine tuning valve switch
		HALM	Input Over High Limit Alarm Output(IVO=ON,OFF=Alarm;I-VO=OFF,ON=Alarm)	BOOL	-
		LALM	Input Over Low Limit Alarm Output(IVO=ON,OFF=Alarm;I-VO=OFF,ON=Alarm)	BOOL	-
		ZERO	Clear Status (ON=Clear)	BOOL	This pin isn't displayed by default but can be displayed by checking it.
		END	Feed Status (ON=Feeding,OFF=Feed End)	BOOL	This pin isn't displayed by default but can be displayed by checking it.
		SP	Pre-shutdown Fine Output Value	REAL	It is used to stop fine-tuning valves.
	Operation Parameters	MAN_CO	Manual Coarse Startup Command(ON=Run)	BOOL	Turn on the coarse tuning valves manually. It is active in the manual mode.
		MAN_FI	Manual Fine Startup Command(ON=Run)	BOOL	Turn on fine tuning manually. It is active in the manual mode.
		MANRUN	Manual Startup Command(ON=Run)	BOOL	-
		MANHOLD	Manual Hold Command(ON=Hold)	BOOL	-

Table 4.16 Parameter Application Description of DOS Ingredient-feeding Control Function Block (continued)

Parameter Name			Description	Parameter Type	Applications
		MANSTOP	Manual Stop Command(ON=S-top)	BOOL	Coarse and fine tuning valves are closed. Manual mode is valid.
		MANRST	Manual Reset Command(ON=Reset)	BOOL	Reset the feeding accumulation. It is active in the manual mode. It would be reset only when the fine tuning output is stopped.
		RMT_OVRD	Override Switch(OFF=Disable,ON=Enable)	BOOL	-
		LOCK	Switch Lock(ON=Lock,OFF=Unlock)	BOOL	Prevent from mistake operation between manual and automation.
	Status Indicators	FLAG	Flag	UDINT	Display status and alarms.
		MODE	Mode(1=OOS,4=MAN,5=AUTO,6=LK,7=RCAS)	USINT	-
		STATUS	Status(1=CO_Dosing,2=FI_Dosing,3=Running,4=Held,5=Stopped,6=End,7=Idle)	USINT	-
	Alarm Enabling and Shielding	AOF	Shield Alarm(ON= Shield)	BOOL	-
		ENALM	Alarm Enabled	UDINT	-
	OOS Settings	SWOOS	Switch of Out of Service (ON=Disable)	BOOL	-
Basic Parameters	Configuration Parameters	OUTSCH	Output Value Maximum	REAL	-
		OUTSCL	Output Value Minimum	REAL	-
		OUTEU	Output Unit	EU-TYPE	-
		INSCH	Input Value Maximum	REAL	-
		INSCL	Input Value Minimum	REAL	-

Table 4.16 Parameter Application Description of DOS Ingredient-feeding Control Function Block (continued)

Parameter Name			Description	Parameter Type	Applications
		INEU	Input Unit	EU-TYPE	-
		OUTDLEN	Output Value Decimal Digits[0,5]	USINT	-
		INDLEN	Input Value Decimal Digits[0,5]	USINT	-
		IVO	Alarm Output Negate Options(ON=Negate,OFF=Not to negate)	BOOL	Default Negation.
		COLD_OPT	Cold Start Clear Output Value Options(ON=Clear,OFF=Hold)	BOOL	-
	Alarm Parameters	T1	Alarm INH TON(s)	REAL	Not less than 0.0,and the unit is s.
		T2	Alarm INL TON(s)	REAL	Not less than 0.0,and the unit is s.
		T3	Startup Inhibition TON(s)	REAL	Not less than 0.0,and the unit is s.
		H	Input High Limit	REAL	-
		L	Input Low Limit	REAL	-
	Feeding Parameters	KFCT	Equivalent Coefficient	REAL	-
		TFCT	Time Coefficient	REAL	-
		DRIBBLE	Dribble Offset	REAL	-
		T4	Stop Fine Output TON(s)	REAL	-
Macro		LOCKTAG	Interlock tag name	-	-

4.6.2 Working Status

Function block status and priority: OOS> Interlock> Remote Cascade> Manual> Auto.

In the status indication, MODE indicates the current mode: 1=OOS, 4=MAN, 5=AUTO, 6=interlock(LK), 7=remote cascade(RCAS).

OOS mode

When SWOOS = ON, the function block is in OOS mode, and does not respond to various input commands, and the output is holding.

In OOS mode, all status are cleared except for the status of the input pins.

Interlock mode

When the interlock command is triggered, the function block enters the interlock mode. After the interlock command is canceled, it returns to the manual mode.

Remote Cascade, Manual, Auto Mode

After you exit the interlock mode, in the unlocked status, if the override switch is not enabled, you can switch to the respective mode through the remote cascade switch, manual switch, and automatic switch. The priority is remote cascade> manual> automatic. If the override switch is enabled, even if the remote cascade switch is enabled, it can be forced to switch to manual or automatic mode through the manual or automatic switch.

In the locked status, the mode cannot be switched.

When the controller is in the cold start, the mode lock is unlocked and the override switch is disabled.

4.6.3 Control of Logic

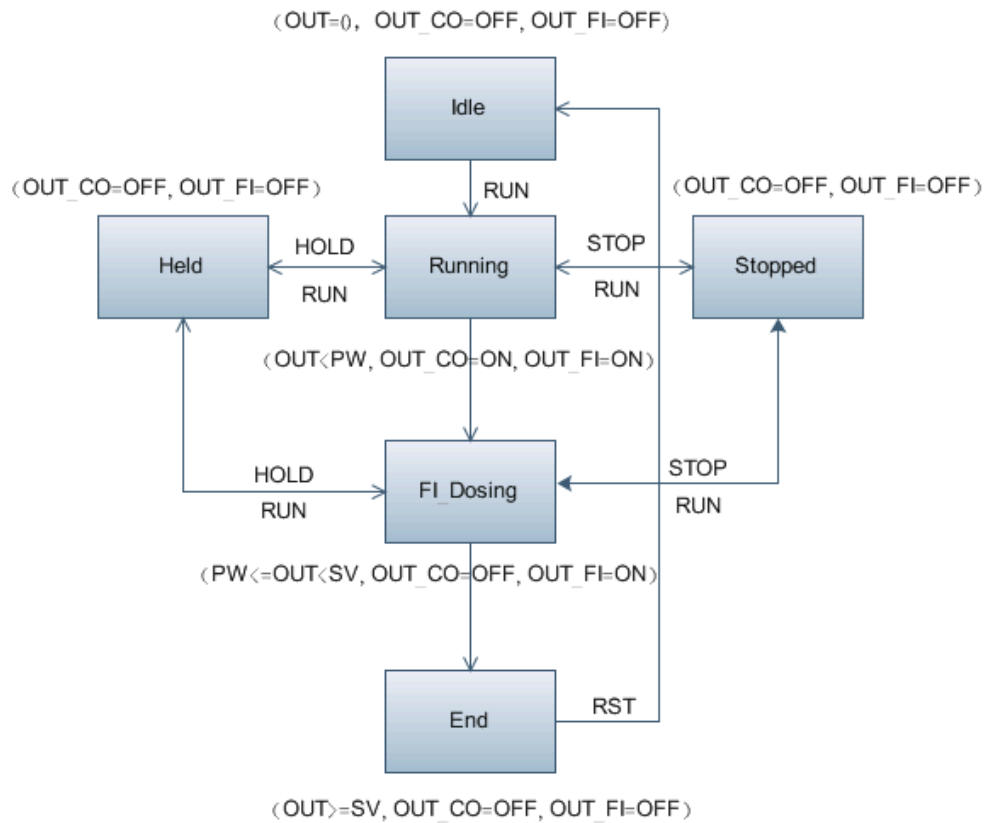
Switching between mode and feeding phase

DOS function block manages the whole feeding phase, supporting such status as Idle, Running, Stopped, Held, FI Dosing, Co Dosing and End.

DOS function block mode and its priority: OOS > interlock > remote cascade > manual > auto.

Mode indicates the current mode: 1=OOS, 4=manual, 5=auto, 6=interlock, 7=remote cascade.

Each state transition of feeding and the state of valve output is shown below:



OOS mode

When SWOOS=ON, the function block is in the OOS mode, and does not respond to various input commands, the output remains, and OUT doesn't accumulate. It keeps the original status after exiting OOS mode.

In OOS mode, all status are cleared except for the status of the input pins.

Interlock mode

When the interlock command is triggered, the function block enters the interlock mode. After the interlock command is canceled, it returns to the manual mode. Apart from OOS, interlock command is not limited by modes.

When the interlock stop and start commands take into effect at the same time, the interlock stop command comes first.

When the interlock start command is triggered, if it is in the state of idle, stopped, held, Co Dosing, it enters running state, if it is in the state of FI_Dosing, it will keep in the state of FI_Dosing; if it is in the state of End, it will keep in the state of End.

When the stop command is triggered, if it is in the state of running, CO_Dosing, and FI_Dosing, it enters Stopped state.

Remote Cascade

SWOOS=OFF, EMSTOP=ON, EMRUN=OFF, if SWRCAS=ON and RMT_OVRD=OFF, it enters remote mode.

In the remote mode, feeding status is controlled by RMRUN\RMHOLD\RMSTOP\RMRST.

Remote command priority is stop>pause>start, when commands take into effect, it responds to the command in high priority.

When the remote start command is triggered, if it is in the Idle, Stopped or Held phase, it enters Running phase. If it is in FI_Dosing phase, it keeps in FI_Dosing phase. If it is in the END phase, it keeps in END phase.

When the remote end command is triggered, if it is in the Running or Held phase, it enters Stopped phase. If it is in FI_Dosing phase, it enters the Stopped phase in T4. If it is in the Idle, End or Stopped phase, it keeps in the original phase.

When the remote pause command is triggered, if it is in the Running, FI_Dosing or Stopped phase, it enters Held phase. If it is in Idle, End or Held phase, it keeps in the original phase.

When the remote reset command is triggered, if it is in the End phase, it enters Held phase.

Otherwise, it doesn't influence the phase change.

Auto Mode

SWOOS=OFF, EMSTOP=ON, EMRUN=OFF, SWRCAS=OFF or RMT_OVRD=ON, if SWAUTO=ON, it enters the auto mode.

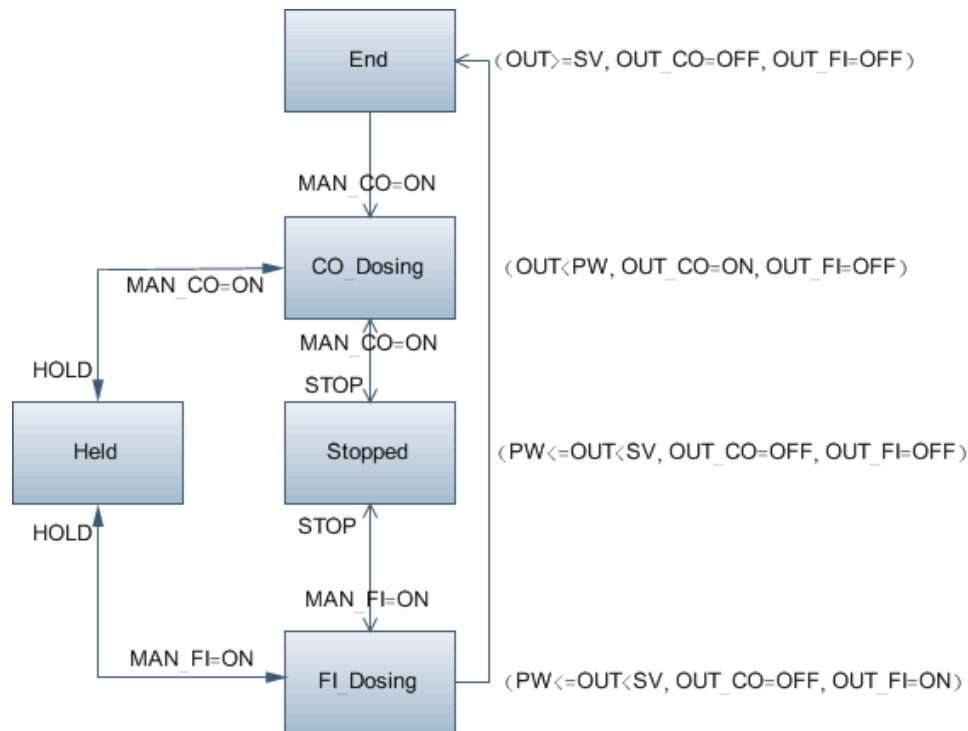
In the auto mode, the feeding status is controlled by AUTRUN\AUTHOLD\AUTSTOP\AUTRST, and its effect is as the same as the corresponding commands in the remote mode.

Manual Mode

SWOOS=OFF, EMSTOP=ON, EMRUN=OFF, SWRCAS=OFF or RMT_OVRD=ON, if SWMAN=ON, it enters the manual mode.

In the manual mode, the feeding status is controlled by MANRUN\MANHOLD\MANSTOP\MANRST, and its effect is as the same as the corresponding commands in the remote mode..

It also supports manually feeding operation in the manual mode. If it needs manually further feeding after the feeding process ends, MAN_CO and MAN_FI can help for further feeding. It is required to reset SV and PW before further feeding. Manual stop and pause commands are still effective, and the transitions are shown in the figure below:



Mode lock

When LOCK=ON, it is not allowed to switch among auto, manual and remote modes.

Calculation about flow accumulation

When the feeding command is ordered, the feeding starts and the accumulation of it also starts.

$$OUT(n) = OUT(n-1) + TS \times PV/KCOEFF/TCOEFF$$

OUT(n): the OUT value in this period

OUT(n-1): the OUT value in last period

TS: control period

Turning off the Valve once the Feeding Amount is Met

When the feeding amount met PW, OUT_CO outputs OFF. When the feeding amount met SP, OUT_FI outputs OFF in T4.

$$SP=SV-DRIBBLE-BV$$

Cold start

When the controller is in cold start, clearing or not can be set.

When the controller is in cold start, the mode lock is unlocked, the override switch is disabled.

Flow Alarm

1. When the feeding command does not start, the low limit alarm of flow will not start detection.
2. If the feeding command starts and the feeding flow is less than the lower limits within the set time, an L limit alarm is output;
3. When the feeding flow rate is greater than the set upper limit within the given time, an H limit alarm is output;
4. When the feeding flow rate doesn't exceed the H and L limits within the given time, there is no alarm reported.
5. If the alarm output is set to negate, when the alarm is being released, LALM、HALM output OFF. Otherwise, they output ON. If the alarm output is set to not negate, when the alarm is being released, they output ON. Otherwise, they output OFF.

4.6.4 Settings for Enabling Alarms

- Alarm Bar Display

The alarm bar displays all the alarms currently active for this tag (the configuration can be enabled, and the default is disabled), including:

Description	Identifier	Configuration Item
Interlock start alarm	EMRUN	Enable/Disable
Interlock stop alarm	EMSTOP	Enable/Disable
High limit alarm	H	Enable/Disable
Low limit alarm	L	Enable/Disable

- Status Bar Display

The status bar displays the current status of the tag, including:

Description	Identifier
Disable tags	OOS
Manual mode	MAN
Automatic mode	AUTO
Interlock mode	LK
Remote cascade mode	RCAS
Mode lock	LOCK (Lock icon)
Alarm shield	AOF

4.6.5 Panel Parameter Instruction

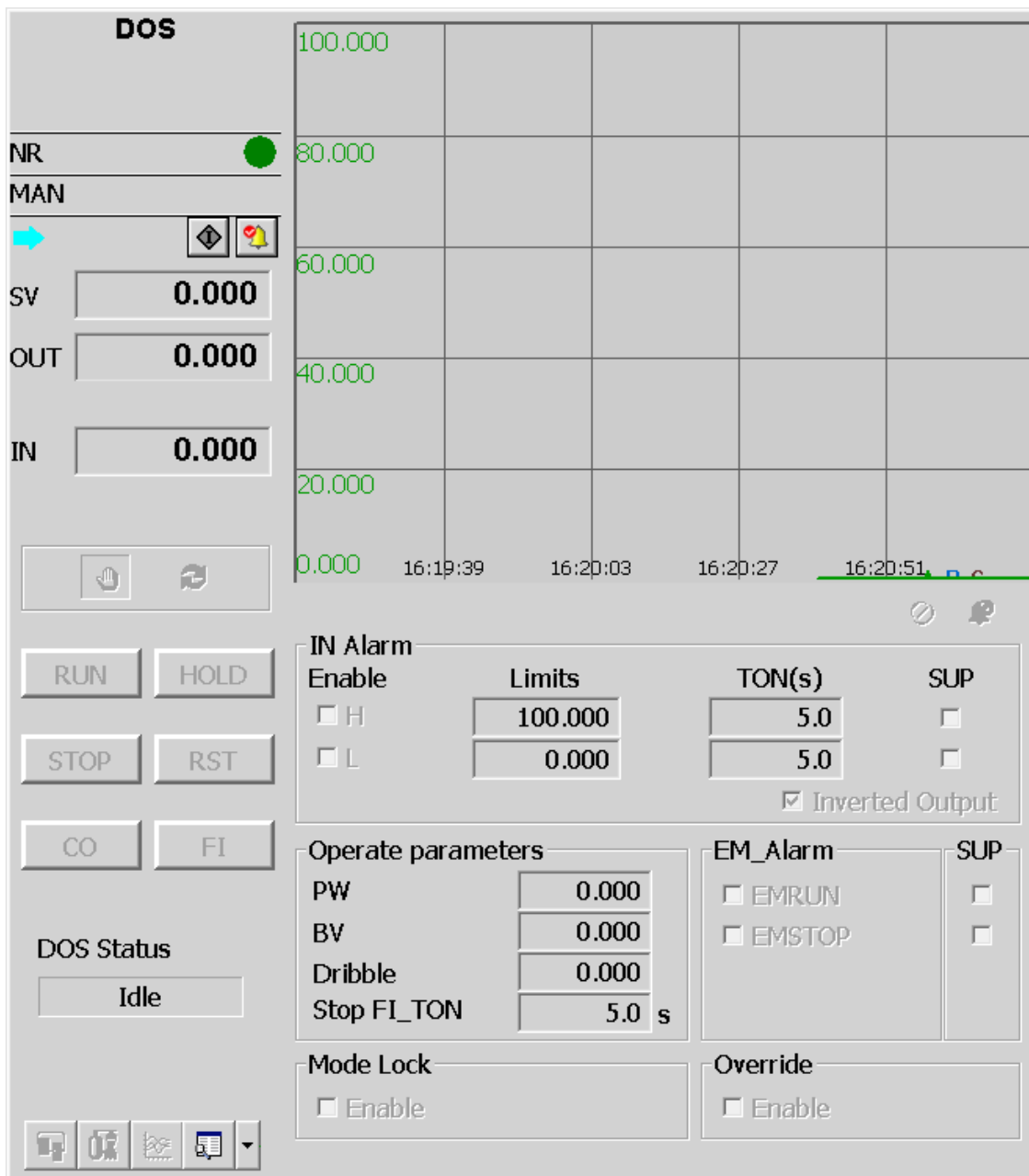


Figure 4.10 DOS Function Block Parameter Panel Graph

Table 4.17 The operational instruction of DOS function block panel parameter

Panel Parameter			Parameter Name	Initial Value	Remark
Expansion Parameters	IN Alarm	H	HALM	ON	Input Over Range High Limit Alarm Output(IVO=ON,OFF=Alarm;IVO=OFF,ON=Alarm)

Table 4.17 The operational instruction of DOS function block panel parameter (continued)

Panel Parameter			Parameter Name	Initial Value	Remark
		L	LALM	ON	Input Over Range Low Limit Alarm Output(IVO=ON,OFF=Alarm;IVO=OFF,ON=Alarm)
		Limits	H	100.0	Input High Limit
			L	0.0	Input Low Limit
		TON(s)	T1	5.0	Alarm INH TON(s)
			T2	5.0	Alarm INL TON(s)
		SUP	HSUP	-	H Alarm Suppress Status
			LSUP	-	L Alarm Suppress Status
		Inverted Output	IVO	ON	Options about alarm output negation(ON=Negate,OFF=Not Negate)
	Operate Parameters	PW	PW	0.0	Pre-shutdown Coarse Output Value
		BV	BV	0.0	Basic Value(Residual Amount In The Tank)
		DRIBBLE	DRIBBLE	0.0	Dribble Offset
		Stop FI_TON	T4	5.0	Stop Fine Output TON(s)
	EM_Alarm	EMRUN	EMRUN	OFF	Interlock Startup Command(ON=Run)
		EMSTOP	EMSTOP	ON	Interlock Stop Command(OFF=Stop)
		SUP	EM-RUNSUP	-	EMRUN Alarm Suppress Status
		SUP	EMS-TOPSUP	-	EMSTOP Alarm Suppress Status
	ModeLock	Enable	LOCK	OFF	Mode Lock(ON=Lock,OFF=Unlock)
	Override	Enable	RMT_OVRD	OFF	Override Switch(OFF=Disable,ON=Enable)

Click “Related Tag” from the drop-down list on the function block panel (as shown in the following figure) to open the panel of the related tag configured during user program configuration. If the panel of the related tag is configured, click this option to open its panel. If the “Related tag” parameter is not set in the configuration of the function block tag, “Related Tag” is not displayed on the drop-down list.

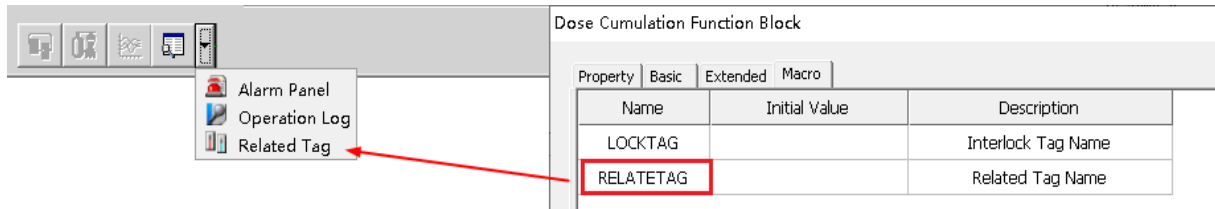


Figure 4.11 Related tag option

4.6.6 Flag

Table 4.18 Flag code list

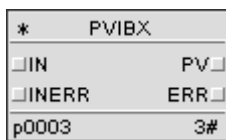
Flag	Description	Type
D0	Disable(OOS)	Status
D1	Manual(MAN)	Status
D2	Auto(AUTO)	Status
D6	Interlock Startup(EMRUN)	Alarm
D7	Interlock Stop(EMSTOP)	Alarm
D12	Over range low limit alarm of the output A change rate (DMVL1)	Status
D13	H Limit Alarm(H)	Alarm
D14	L Limit Alarm(L)	Alarm
D20	Shield Alarm(AOF)	Status
D21	Interlock(LK)	Status

5 Analog Processing Function Block Library

This Status introduces the parameters and usage of PVIBX function block.

5.1 PVIBX Function Block

PVIBX function block is used to receive AI input signals. It can execute input process according to the configuration and execute computation on the actual values. The calculation process of PVIBX is similar to AI. For details, please refer to "AI Tag" of "Tag of FCU713-S" in *IO Tag User Manual*. In addition, PVIBX only receives AI input signals. It doesn't equip with AI hardware diagnosis and address information.



5.1.1 Parameter Description

Table 5.1 FBD Parameter List(PVIBX)

Parameter Name		Type	Initial Value	Description
Input value	IN	REAL	0	Raw Input Value
	INERR	BOOL	OFF	Raw Input Signal Flag
	SIMIN	REAL	0	Simulation Input Value
Output value	PV	REAL	0	Process Variable Value
	ERR	BOOL	OFF	Analog Input Status Flag:ON=Bad(Forced Status OFF When Bad)
	ERR_R	BOOL	OFF	Hardware Status Flag:ON=Bad(Forced Status ON When Bad)
	I_HH_O	BOOL	ON	HH Interlock Output
	I_H_O	BOOL	ON	H Interlock Output
	I_LL_O	BOOL	ON	LL Interlock Output
	I_L_O	BOOL	ON	L Interlock Output
Monitoring parameter	OPR_EI	REAL	0	Desirable Operating Range Deviation Value
	FLAG	UDINT	0	Flag code

Table 5.1 FBD Parameter List(PVIBX) (continued)

Parameter Name		Type	Initial Value	Description
Operational parameter	SWAM	BOOL	ON	Force Switch(OFF=Force,ON=Unforce)
	SWLCUT	BOOL	OFF	Low Cut Switch(ON=Cut)
	SWOOS	BOOL	OFF	Switch of Out of Service(ON=Disable,OFF=Enable)
	SWSIM	BOOL	OFF	Simulation Input Switch(ON=Simulation Input,OFF=Module Input)
	AOF	BOOL	OFF	Shield Alarm
	HHH	REAL	100	Alarm HHH Limit
	HHH_TON	REAL	0	Alarm HHH TON(s)
	HHH_TOFF	REAL	0	Alarm HHH TOFF(s)
	HH	REAL	95	Alarm HH Limit
	HH_TON	REAL	0	Alarm HH TON(s)
	HH_TOFF	REAL	0	Alarm HH TOFF(s)
	H	REAL	90	Alarm H Limit
	H_TON	REAL	0	Alarm H TON(s)
	H_TOFF	REAL	0	Alarm H TOFF(s)
	L	REAL	10	Alarm L Limit
	L_TON	REAL	0	Alarm L TON(s)
	L_TOFF	REAL	0	Alarm L TOFF(s)
	LL	REAL	5	Alarm LL Limit
	LL_TON	REAL	0	Alarm LL TON(s)
	LL_TOFF	REAL	0	Alarm LL TOFF(s)
	LLL	REAL	0	Alarm LLL Limit
	LLL_TON	REAL	0	Alarm LLL TON(s)
	LLL_TOFF	REAL	0	Alarm LLL TOFF(s)
	TPV	REAL	60	Rate Alarm Detection Cycle(s)

Table 5.1 FBD Parameter List(PVIBX) (continued)

Parameter Name	Type	Initial Value	Description
PR_LIM	REAL	5	Positive Rate Limit
PR_TON	REAL	0	Alarm DPVH TON(s)
PR_TOFF	REAL	0	Alarm DPVH TOFF(s)
NR_LIM	REAL	5	Negative Rate Limit
NR_TON	REAL	0	Alarm DPVL TON(s)
NR_TOFF	REAL	0	Alarm DPVL TOFF(s)
IHH_EN	BOOL	OFF	Interlock HH Enable
IHH_LIM	REAL	100	Interlock HH Limit
IHH_TON	REAL	0	Interlock HH TON(s)
IHH_TOFF	REAL	0	Interlock HH TOFF(s)
IH_EN	BOOL	OFF	Interlock H Enable
IH_LIM	REAL	100	Interlock H Limit
IH_TON	REAL	0	Interlock H TON(s)
IH_TOFF	REAL	0	Interlock H TOFF(s)
IL_EN	BOOL	OFF	Interlock L Enable
IL_LIM	REAL	0	Interlock L Limit
IL_TON	REAL	0	Interlock L TON(s)
IL_TOFF	REAL	0	Interlock L TOFF(s)
ILL_EN	BOOL	OFF	Interlock LL Enable
ILL_LIM	REAL	0	Interlock LL Limit
ILL_TON	REAL	0	Interlock LL TON(s)
ILL_TOFF	REAL	0	Interlock LL TOFF(s)
OPR_EN	BOOL	OFF	Desirable Operating Range Enable
OPR_H	REAL	60	Desirable Operating Range High Limit
OPR_L	REAL	40	Desirable Operating Range Low Limit

Table 5.1 FBD Parameter List(PVIBX) (continued)

Parameter Name		Type	Initial Value	Description
	HYS	REAL	0	H/L Limit Alarm Hysteresis
	HYS_OPT	USINT	0	H/L Limit Alarm Hysteresis Conversion Type (0=Actual Value, 1=Percentage)
	TFLT	REAL	0	Filter Time Coefficient(s)
	LCUT	REAL	0.5	Low Cut Value (%)
	ENERRVAL	BOOL	ON	Fault Safety Switch (ON=Enable,OFF=Dis-able)
	SAFEVAL	REAL	50	Substitute Value
	ERRVAL	USINT	0	Fault Safety Setting Options (0=Hold,1=SCH,2=SCL,3=Substitute Value, 4=Closest Extended Range Limit)
	T_PEAK	UINT	0	Recent History (0=Not Show, 1=2min, 2=10min, 3=30min, 4=1h, 5=2h, 6=4h, 7=8h, 8=12h, 9=24h)
Alarm pa- rameter	ENALM	UDINT	12	Alarm Enable
Configura- tion para- meter	SCH	REAL	100	Actual Value Maximum
	SCL	REAL	0	Actual Value Minimum
	EU	EUTYPE	0	Engineer Unit
	DLEN	USINT	3	Decimal Digits Length[0,5]
	HORLIM	REAL	25	High Overrange Limit
	LORLIM	REAL	25	Low Overrange Limit
	HOR_TON	REAL	0	High Overrange Limit Alarm TON (s)
	HOR_TOFF	REAL	0	High Overrange Limit Alarm TOFF (s)
	LOR_TON	REAL	0	Low Overrange Limit Alarm TON (s)
	LOR_TOFF	REAL	0	Low Overrange Limit Alarm TOFF (s)
	IVO	BOOL	ON	Interlock Negate Options (ON=Negate,OF-F=Not to negate)
	COLD_OPT	USINT	0	Cold Start SWAM Mode Options (0=Hold,1=Force,2=Unforce)

5.1.2 Panel Parameter Instruction

Alarm

Config

Interlock

Trend

PV Alarm(%)

Enable	Limits	TON(s)	TOFF(s)	SUP
<input type="checkbox"/> HHH	0	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> HH	0	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> H	0	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> L	0	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> LL	0	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> LLL	0	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> PRIN	0	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> NRIN	0	0.0	0.0	<input type="checkbox"/>
HYS	0	TDPV	0.0	

Overrange Alarm

☒ MAX
 ☐ MIN

Alarm

Config

Interlock

Trend

Signal Processing

☐ Low Cut 0.000 %

Filter Time 0.0 s

Fault Safety Setting

☐ Enable

☐ Hold

☐ Substitute 0

☐ Span Max
 ☐ Span Min

Desirable Operating Range(%)

☐ Enable
 OPR_L 0 OPR_H 0

Force

FORCE

UNFORCE

Simulate(%)

☐ Simulate 0

Alarm Config Interlock Trend

PV Alarm(%)

Enable	Limits	TON(s)	TOFF(s)	SUP
<input type="checkbox"/> HHH	0	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> HH	0	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> H	0	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> L	0	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> LL	0	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> LLL	0	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> PRIN	0	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> NRIN	0	0.0	0.0	<input type="checkbox"/>
HYS	0	TDPV	0.0	

Overrange Alarm
☒ MAX ☐ MIN

Interlock Config Interlock Trend

Interlock(%)

Enable	Limits	Alarm	TON(s)	TOFF(s)	SUP
<input type="checkbox"/> HH	0	<input type="checkbox"/>	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> H	0	<input type="checkbox"/>	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> L	0	<input type="checkbox"/>	0.0	0.0	<input type="checkbox"/>
<input type="checkbox"/> LL	0	<input type="checkbox"/>	0.0	0.0	<input type="checkbox"/>

☐ Inverted Output

Figure 5.1 PIVBX Function Block Panel Parameter Graph

Table 5.2 PIVBX Function Block Panel Parameter Operation Description

Panel Parameter			Parameter Name	Initial Value	Remark
Alarm	PV Alarm(%)	HHH	HHH	100.0	Alarm HHH Limit
		HH	HH	95.0	Alarm HH Limit
		H	H	90.0	Alarm H Limit
		L	L	10.0	Alarm L Limit
		LL	LL	5.0	Alarm LL Limit
		LLL	LLL	0.0	Alarm LLL Limit
		PRIN	PR_LIM	5.0	Positive Rate Limit

Table 5.2 PIVBX Function Block Panel Parameter Operation Description (continued)

Panel Parameter			Parameter Name	Initial Value	Remark
		NRIN	NR_LIM	5.0	Negative Rate Limit
		HYS	HYS	0.0.	H/L Limit Alarm Hysteresis
		TON (s)	HHH_TON	0.0	Alarm HHH TON(s)
			HH_TON	0.0	Alarm HH TON(s)
			H_TON	0.0	Alarm H TON(s)
			L_TON	0.0	Alarm L TON(s)
			LL_TON	0.0	Alarm LL TON(s)
			LLL_TON	0.0	Alarm LLL TON(s)
		TOFF (s)	HHH_TOFF	0.0	Alarm HHH TOFF(s)
			HH_TOFF	0.0	Alarm HH TOFF(s)
			H_TOFF	0.0	Alarm H TOFF(s)
			L_TOFF	0.0	Alarm L TOFF(s)
			LL_TOFF	0.0	Alarm LL TOFF(s)
			LLL_TOFF	0.0	Alarm LLL TOFF(s)
		SUP	HHHSUP	-	HHH Alarm Suppress Status
			HHSUP	-	HH Alarm Suppress Status
			HSUP	-	H Alarm Suppress Status
			LSUP	-	L Alarm Suppress Status
			LLSUP	-	LL Alarm Suppress Status
			LLLSUP	-	LLL Alarm Suppress Status
		TPV	TPV	60.0	Rate Alarm Detection Cycle(s)
	Over-range Alarm	MAX	ORH	-	Overrange Maximum Alarm
		MIN	ORL	-	Overrange Minimum Alarm
Config	Signal Processing	Low Cut	SWOOS	OFF	Switch of Out of Service(ON=Disable,OFF=Enable)

Table 5.2 PIVBX Function Block Panel Parameter Operation Description (continued)

Panel Parameter			Parameter Name	Initial Value	Remark
		Low Cut	LCUT	0.5	Low Cut Value (%)
		Filter Time	TFLT	0.0	Filter Time Coefficient(s)
	Fault Safety Setting	Enable	EN_ERRVAL	0	Fault Safety Switch(ON=Enable,OFF=Disable)
		Preset Value	SAFEVAL	50.0	Substitute Value
		Hold/Span Max/Span Min/ Substitute	ERRVAL	0	Fault Safety Setting Options(0=Hold,1=SCH,2=SCL,3=Substitute Value, 4=Closest Extended Range Limit)
	Desirable Operating Range	Enable	OPR_EN	OFF	Desirable Operating Range Enable
		OPR_H	OPR_H	60.0	Desirable Operating Range High Limit
		OPR_L	OPR_L	40.0	Desirable Operating Range Low Limit
	Force	FORCE/UN-FORCE	SWAM_B	-	Whether In Forced Status
	Simulation (%)	Simulate	SWSIM	-	Simulation Input Switch(ON=Simulation Input,OFF=Module Input)
Interlock	Interlock (%)	Enable	IHH_EN	OFF	Interlock HH Enable
			IH_EN	OFF	Interlock H Enable
			IL_EN	OFF	Interlock L Enable
			ILL_EN	OFF	Interlock LL Enable
		HH	IHH_LIM	100.0	Interlock HH Limit
		H	IH_LIM	100.0	Interlock H Limit
		L	IL_LIM	0.0	Interlock L Limit
		LL	ILL_LIM	0.0	Interlock LL Limit
		Alarm	I_HH	-	Interlock HH Limit Alarm
			I_H	-	Interlock H Limit Alarm

Table 5.2 PIVBX Function Block Panel Parameter Operation Description (continued)

Panel Parameter			Parameter Name	Initial Value	Remark
			I_L	-	Interlock L Limit Alarm
			I_LL	-	Interlock LL Limit Alarm
		TON(s)	IHH_TON	0.0	Interlock HH TON(s)
			IH_TON	0.0	Interlock H TON(s)
			IL_TON	0.0	Interlock L TON(s)
			ILL_TON	0.0	Interlock LL TON(s)
		TOFF(s)	IHH_TOFF	0.0	Interlock HH TOFF(s)
			IH_TOFF	0.0	Interlock H TOFF(s)
			IL_TOFF	0.0	Interlock L TOFF(s)
			ILL_TOFF	0.0	Interlock LL TOFF(s)
		SUP	I_HHSUP	-	I_HH Alarm Suppress Status
			I_HSUP	-	I_H Alarm Suppress Status
			I_LSUP	-	I_L Alarm Suppress Status
			I_LLSUP	-	I_LL Alarm Suppress Status
		Inverted Output	IVO	ON	Interlock Negate Options(ON=Negate,OFF=Not to negate)

5.1.3 Flag

Table 5.3 Flag Code List

Flag code	Supervising assign	Explain	Type
D0	Disable	Run Fault	Alarm
D1	Enable (AOF)	Shield Alarm (AOF)	Status
D2	Disable	Overrange Maximum Alarm (ORH)	Status
D3	Disable	Overrange Minimum Alarm (ORL)	Status
D4	Disable	Fault (ERR)	Alarm

Table 5.3 Flag Code List (continued)

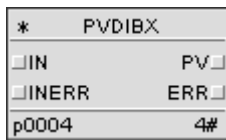
Flag code	Supervising assign	Explain	Type
D5	Disable	Force (FORCE)	Status
D6	Enable (SWOOS)	Disable (OOS)	Status
D8	Disable	H Limit Alarm (H)	Alarm
D9	Disable	L Limit Alarm (L)	Alarm
D10	Disable	HH Limit Alarm (HH)	Alarm
D11	Disable	LL Limit Alarm (LL)	Alarm
D12	Disable	HHH Limit Alarm (HHH)	Alarm
D13	Disable	LLL Limit Alarm (LLL)	Alarm
D14	Disable	Change Rate Over Limit Alarm (DPV)	Alarm
D15	Disable	Simulation (SIMUL)	Status
D16	Disable	Positive Rate Alarm (PRIN)	Alarm
D17	Disable	Negative Rate Alarm (NRIN)	Alarm
D18	Disable	Configuration Error (CFGERR)	Alarm
D23	Disable	Interlock HH Limit Alarm (I_HH)	Alarm
D24	Disable	Interlock LL Limit Alarm (I_LL)	Alarm
D25	Disable	Interlock H Limit Alarm (I_H)	Alarm
D26	Disable	Interlock L Limit Alarm (I_L)	Alarm

6 Logical Operation Function Block Library

This section introduces the parameters and usage of PVDIBX function block.

6.1 PVDIBX Function Block

PVDIBX function block is used to receive DI input signals. It can execute input process according to the configuration and execute computation on the actual values. The calculation process of PVDIBX is similar to DI. For details, please refer to "DI Tag" of "Tag of FCU713-S" in *IO Tag User Manual*. In addition, PVDIBX only receives DI input signals. It doesn't equip with DI hardware diagnosis and address information.



6.1.1 Parameter Description

Table 6.1 FBD Parameter List

Parameter Name		Type	Initial Value	Description
Input Pin	IN	BOOL	OFF	Raw Input Value
	INERR	BOOL	OFF	Raw Input Signal Flag
	SIMIN	BOOL	OFF	Simulation Input Value
Output Pin	PV	BOOL	OFF	Process Variable Value
	ERR	BOOL	OFF	Input Status Flag: ON=Bad (Forced Status OFF when bad)
	ERR_R	BOOL	OFF	Hardware Status Flag: ON=Bad (Forced Status ON when bad)
	AV	UDINT	0	Rising Edge Counts Accumulation
Operational Parameter	SWAM	BOOL	ON	Force Switch (OFF=Force,ON=Unforce)
	SWSIM	BOOL	OFF	Simulation Input Switch (ON=Simulation Input,OFF=Module Input)
	AVRST	BOOL	OFF	Rising Edge Counts Accumulation Reset Switch (ON=Reset)

Table 6.1 FBD Parameter List (continued)

Parameter Name		Type	Initial Value	Description
	AVSTRT	BOOL	OFF	Rising Edge Counts Accumulation Start Switch (ON=Start)
OOS Settings	SWOOS	BOOL	OFF	Tag Switch (ON=Disable, OFF=Enable)
Alarm Enable and Suppress	AOF	BOOL	OFF	Module Alarm Shield
	ENALM	UDINT	0	Alarm Enable
Monitoring Parameter	FLAG	UDINT	0	Flag
Alarm Parameters	ON_TON	REAL	0	Delay time for ON status alarm generation (s)
	ON_TOFF	REAL	0	Delay time for ON status alarm elimination (s)
	OFF_TON	REAL	0	Delay time for OFF status alarm generation (s)
	OFF_-TOFF	REAL	0	Delay time for OFF status alarm elimination (s)
Fail-Safety Processing	EN-ERRVAL	BOOL	ON	Fault safety value-setting switch (ON=Enable, OFF=Disable)
	ERRVAL	USINT	0	Fault safety value-setting options (0=Hold, 1=On, 2=OFF)
Configuration Parameter	IVO	BOOL	OFF	Negate Options (ON=Negate, OFF=Not Negate)
	COLD_-OPT	USINT	0	Cold Start SWAM Mode Options (0=Hold, 1=Force, 2=Unforce)
Macro	ONDESC	STRING	ON	ON description
	OFFDESC	STRING	OFF	OFF description

6.1.2 Panel Parameter Instruction

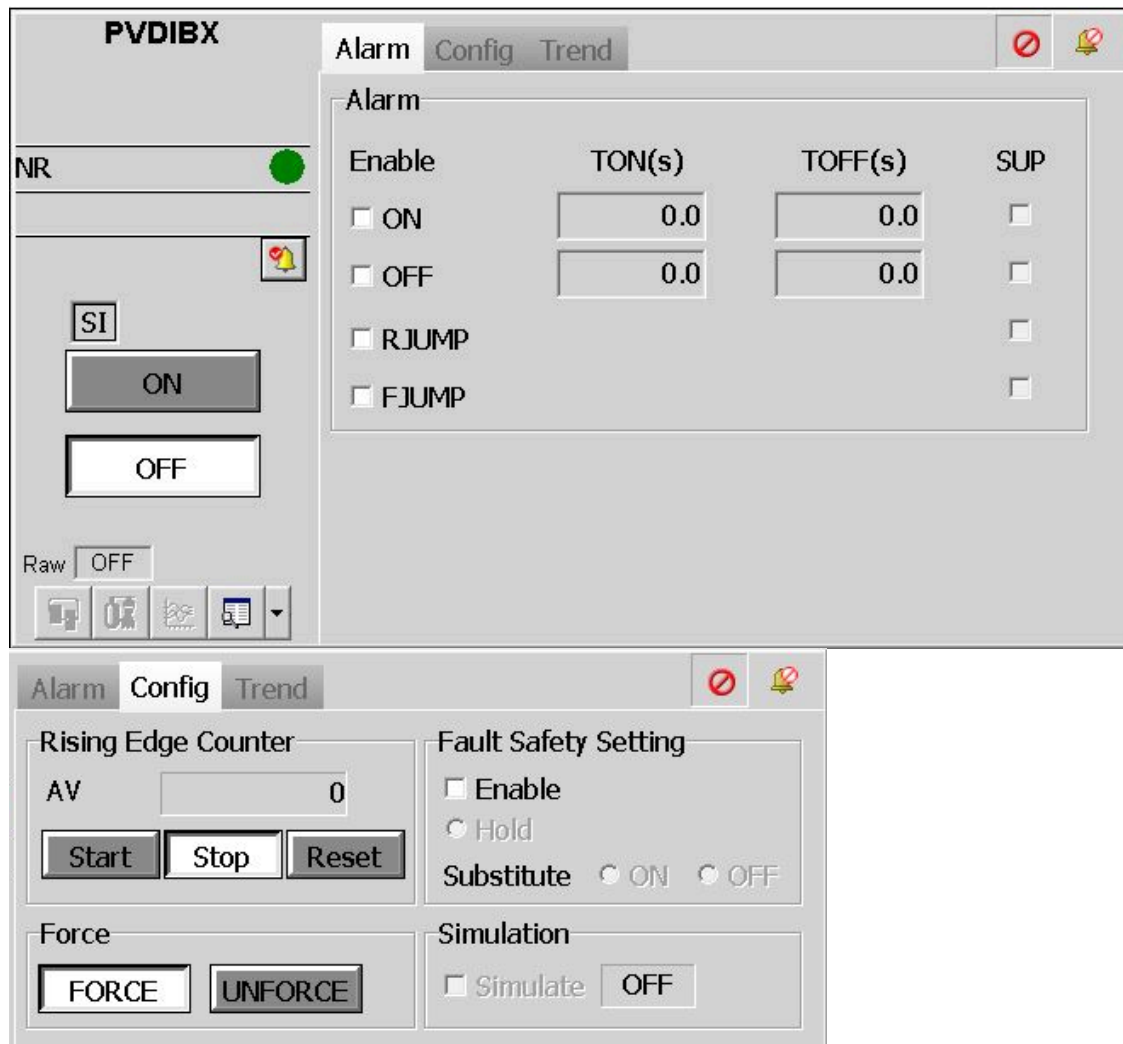


Figure 6.1 PVDIBX Function Block Panel Parameter Graph

Table 6.2 PVDIBX Function Block Panel Parameter Operational Description

Panel Parameter			Parameter Name	Initial Value	Remark
Alarm	Alarm	ON	ON	-	ON Status Alarm
		OFF	OFF	-	OFF Status Alarm
		RJUMP	RJUMP	-	Positive Jump Alarm
		FJUMP	FJUMP	-	Negative Jump Alarm
		TON (s)	ON_TON	0.0	ON Status Alarm TON(s)
			OFF_TON	0.0	OFF Status Alarm TON(s)
		TOFF(s)	ON_TOFF	0.0	ON Status Alarm TOFF(s)
			OFF_TOFF	0.0	OFF Status Alarm TOFF(s)

Table 6.2 PVDIBX Function Block Panel Parameter Operational Description (continued)

Panel Parameter			Parameter Name	Initial Value	Remark
		SUP	ONSUP	-	ON Alarm Suppress Status
			OFFSUP	-	OFF Alarm Suppress Status
			RJUMPSUP	-	RJUMP Alarm Suppress Status
			FJUMPSUP	-	FJUMP Alarm Suppress Status
Config	Rising Edge Counter	AV	AV	0.0	Rising Edge Counts Cumulation
		Start/Stop	AVSTRT	OFF	Rising Edge Counts Cumulation Start Switch(ON=Start)
		Reset	AVRST	OFF	Rising Edge Counts Cumulation Reset Switch(ON=Reset)
	Fault Safety Setting	Enable	ENERRVAL	ON	Fault Safety Switch(ON=Enable,OFF=Disable)
		Hold/ON/OFF	ERRVAL	0	Fault Safety Setting Options(0=Hold,1=ON,2=OFF)
	Force	FORCE/UN-FORCE	SWAM	ON	Force Switch(OFF=Force,ON=Un-force)
	Simulation	Simulation	SWSIM	OFF	Simulation Input Switch(ON=Simulation Input,OFF=Module Input)

6.1.3 Flag

Table 6.3 Flag Code List

Flag code	Supervising Assign	Explain	Type
D4	Disable	Fault(ERR)	Alarm
D5	Disable	FORCE(FORCE)	Status
D6	Enable(SWOOS)	Disable(OOS)	Status
D7	Disable	Simulation (SIMUL)	Status
D8	Disable	ON Status Alarm(ON)	Alarm
D9	Disable	OFF Status Alarm(OFF)	Alarm
D10	Disable	Positive Jump Alarm (RJUMP)	Alarm

Table 6.3 Flag Code List (continued)

Flag code	Supervising Assign	Explain	Type
D11	Disable	Negative Jump Alarm (FJUMP)	Alarm
D12	Enable(AOF)	Shield Alarm(AOF)	Status

7 Revision

Table 7.1 *Revision history*

Document Version	Applicable to	Modification
V1.0 (20230301)	OMC High-performanceHMI V4.70.00.00	First release.
V1.1 (20230901)	OMC High-performanceHMI V5.10.00.00	Modified TB_OPT parameter description in MANUALBX function block. Modified FLT_OPT parameter description in HVFC and HF- VO.