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Process Automation System

Integrated Control Block Descriptions
Volume 3 of 3,
MSG – VLV

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Preface

This document, *Integrated Control Block Descriptions*, provides operational and reference information for using I/A Series®/Foxboro Evo™ Control Core Services control blocks, equipment control blocks (ECBs) and window equipment control blocks (window ECBs).

You use this document to gain detailed knowledge of the operation of each Control block. Using this knowledge, you can determine the correct block to apply to your control strategy. You configure your control strategy using the Foxboro Evo Control Editors (formerly known as Foxboro® Control Software (FCS) Configuration Tools), the Integrated Control Configurator (ICC), or the I/A Series Configuration Component (IACC). While configuring your control strategy, you select the appropriate block, and connect and/or configure the blocks individual parameters.

Before using this document you should be familiar with the concepts of the I/A Series or Foxboro Evo Control Core Services control system. For I/A Series software v8.0 (L03-2) and Control Core Services v9.0 and later, refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG). For I/A Series software prior to v8.0 (L03-2), refer to *Integrated Control Software Concepts* (B0193AW).

NOTE

Distributed Control Interface (DCI) blocks for FOUNDATION™ fieldbus devices (such as AI, AO, DI, DO, MAI, MAO, MDI and MDO) are provided in *Integrated Control Block Descriptions for FOUNDATION fieldbus Specific Control Blocks* (B0700EC).

Audience

This book is intended for experienced process engineers and application programmers.

Contents

The document is divided into sections. Each section describes one I/A Series block – with the exception of Equipment Control Blocks (ECBs) and Window Equipment Control Blocks, which describe multiple blocks of the same basic design.

Each control block section, if required, contains the following:

- A brief functional summary.
- A list of features and options.
- A list and a description of each of the parameters used by the block.
- Diagrams illustrating inputs, outputs, options and operation.
- A detailed description of block operation.

Revision Information

For this release of the document (B0193AX-AF), the following changes were made to this volume:

Chapter 98 "PID – Proportional Integral Derivative Block"

Chapter 99 "PIDA – Advanced PID Block"

Chapter 100 "PIDX – PID Extended Block"

Chapter 101 "PIDXE – PID Extended with EXACT Block"

Chapter 102 "PIDE – PID With EXACT Block"

- Added a note to the SUPOPT parameter description.

Chapter 114 "SIGSEL – Signal Selector Block"

- Updated the BYPAS1 to BYPAS8 parameter description.
- Added a note to the PROPT parameter description.

Reference Documents

Refer to the following documents for additional information:

- *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG) for I/A Series software v8.x and Foxboro Evo Control Core Services v9.0 or later releases
- *Integrated Control Software Concepts* (B0193AW) for I/A Series software prior to V8.0
- *Supervisory Set Point Control* (B0193RY)
- *Fieldbus Cluster I/O User's Guide* (B0193RB)
- *Enhanced PLC Block Descriptions* (B0193YQ)
- *System Manager* (B0750AP)
- *Integrated Control Configurator* (B0193AV)
- *I/A Series Configuration Component (IACC) User's Guide* (B0700FE)
- *Integrated Control Block Descriptions for FOUNDATION fieldbus Specific Control Blocks* (B0700EC)
- *FOUNDATION fieldbus H1 Interface Module (FBM220/221) User Guide* (B0400FD)
- *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA)
- *Field Device System Integrators (FBM230/231/232/233) User's Guide* (B0700AH)
- *PROFIBUS-DP™ Communication Interface Module (FBM223) User's Guide* (B0400FE)
- *HART Communication Interface Modules User's Guide* (B0400FF)
- *Modbus® Communication Interface Module (FBM224) User's Guide* (B0400FK)
- *Intrinsically Safe I/O Subsystem User's Guide* (B0700DP)
- *Foxboro Evo™ Process Automation System Deployment Guide* (B0750BA)

Most of these documents are available on the Foxboro Evo Electronic Documentation media (K0174MA). The latest revisions of each document are also available through our Invensys Global Customer Support at *http://support.ips.invensys.com.*

89. MSG – Message Generator Block

This chapter gives a general overview of the MSG (Message Generator Block), its options and parameters, describes block validation and initialization.

89.1 Overview

The Message Generator block (MSG) is designed to generate “STATE CHANGE” messages upon transitions of its boolean inputs.

After initialization and subsequent block scan periods, the MSG block reads its eight boolean message request indicators. If it detects a transition from 0-to-1 or 1-to-0, it sends the “STATE CHANGE” message for each type of transition. The block does not send a message on the transition if you did not configure any text or linkage name.

The block has no alarming functionality.

89.2 Options

You can choose where the block should look for the input information:

- If the SUBSET parameter is configured to 0 (default), the block uses the generic boolean inputs IN_1 through IN_8.
- If SUBSET is configured to 1, 2, 3, or 4, the block uses a byte from the long packed boolean input LNGPIN to obtain the message requests. 1 corresponds to the high-order byte of the LNGPIN; 4 corresponds to the low-order byte. The high-order bit of the byte represents IN_1; the low-order bit represents IN_8.

If SUBSET is configured to 1, 2, 3, or 4, the block unpacks the 8-bit field from LNGPIN into IN_1 through IN_8 each time there is a change in LNGPIN to bypass the faceplate display limitations on switching to the different source parameters.

89.2.1 I/O Diagram

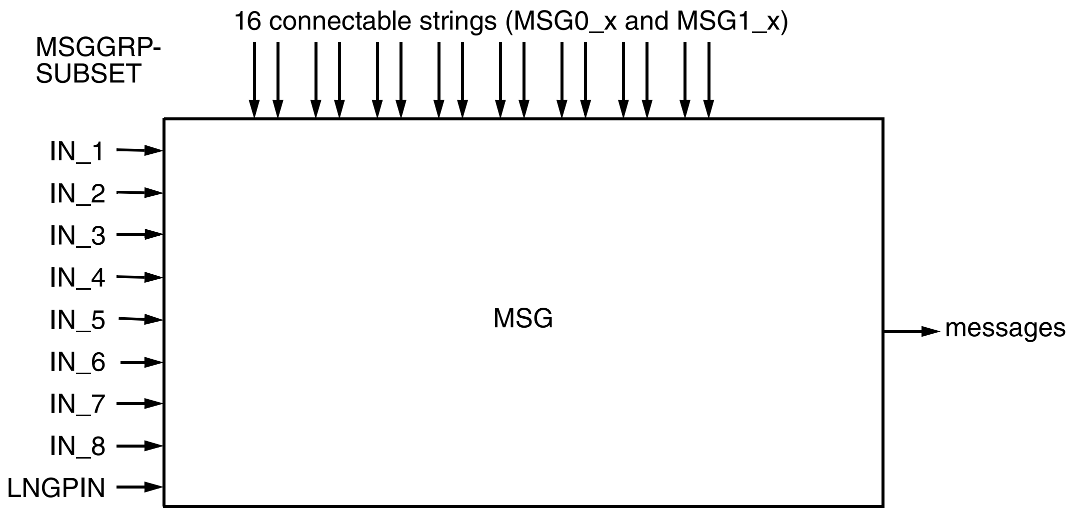


Figure 89-1. MSG Block I/O Diagram

89.3 Parameters

Table 89-1. MSG Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	94	MSG
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
SUBSET	bit subset	short	no-con/no-set	0	0 to 4
MSGGRP	message group	integer	no-con/set	1	[1..8]
LNGPIN	long packed input	pack_l	con/set	0	---
IN_1 to IN_8	input point 1 to 8	boolean	con/set	0	0 to 1
MSG1_1 to MSG1_8	message for 0-to-1, 1 to 8	string	con/set	blank	1 to 12 chars
MSG0_1 to MSG0_8	message for 1-to-0, 1 to 8	string	con/set	blank	1 to 12 chars
OUTPUTS					
BLKSTA	block status	pack_l	con/no-set	0	bit map
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	config error	string	no-con/no-set	0	1 to 43 chars
MSGSND	message sent	short	no-con/no-set	0	8-bit map
OWNER	owner name	string	no-con/set	blank	1 to 32 chars

89.3.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the MSG block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
																ON	UDEF														

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17

* Bit 0 is the least significant, low order bit.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block.

DESCRP

Description is a user-defined string of up to 32 characters that describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

ERCODE

Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block's DEFINE parameter to be set false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the MSG block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

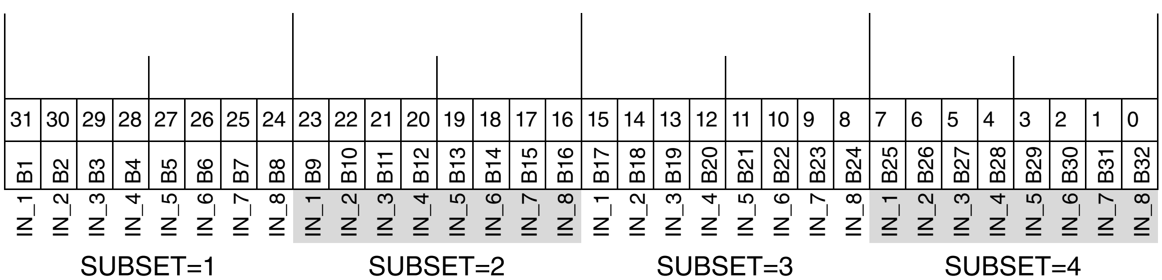
Message	Value
“W43 – INVALID PERIOD/ PHASE COMBINATION”	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
“W46 – INVALID INPUT CONNECTION”	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
“W48 – INVALID BLOCK OPTION”	The configured value of a block option is illegal.
“W53 – INVALID PARAMETER VALUE”	A parameter value is not in the acceptable range.
“W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK”	A Database Installer error has occurred.

IN_1 to IN_8

Inputs 1 through 8 are boolean inputs. They identify the upstream outputs that are being monitored by the inputs of the block.

LNGPIN

Long Packed Boolean Input is a packed input. If SUBSET is configured to 1, 2, 3, or 4, the block uses a byte from the long packed boolean input LNGPIN to obtain the message requests. 1 corresponds to the high-order byte of the LNGPIN; 4 corresponds to the low-order byte. The high-order bit of the byte represents IN_1; the low-order bit represents IN_8.



If SUBSET is configured to 1, 2, 3, or 4, the block unpacks the 8-bit field from LNGPIN into IN_1 through IN_8 each time there is a change in LNGPIN to bypass the faceplate display limitations on switching to the different source parameters.

LOOPID

Loop Identifier is a configurable string of up to 32 characters which identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.

MSG0_1 to MSG0_8

Message 0_1 through 0_8 are string inputs containing the text for one to zero transition annunciation. If no text is configured for these messages, no messages are sent.

MSG1_1 to MSG1_8

Message 1_1 through 1_8 are string inputs containing the text for zero to one transition annunciation. If no text is configured for these messages, no messages are sent.

MSGGRP
Message Group is the message device group number.

MSGSND
Messages Sent is an 8-bit mapped character indicating the points which have undergone transitions.

NAME
Name is a user-defined string of up to 12 characters used to access the block and its parameters.

OWNER
Owner is a string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are successful only if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.

PERIOD
Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PHASE
Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

SUBSET
Sub-Set is a short integer input that sets the byte group number to be used to derive IN_1 through IN_8 from LNGPIN.

If SUBSET is 0 (default), MSG uses the generic boolean inputs IN_1 through IN_8 to trigger "STATE CHANGE" messages.

If SUBSET is configured to 1, 2, 3, or 4, the block uses a byte from the long packed boolean input LNGPIN to obtain the message requests. 1 corresponds to the high-order byte of the LNGPIN; 4 corresponds to the low-order byte. The high-order bit of the byte represents IN_1; the low-order bit represents IN_8.

If SUBSET is configured to 1, 2, 3, or 4, the block unpacks the 8-bit field from LNGPIN into IN_1 through IN_8 each time there is a change in LNGPIN. See LNGPIN above for a diagram.

TYPE When you enter "MSG" or select "MSG" from the block type list under Show, an identifying integer is created specifying this block type.

89.4 Block Validation

The validation logic includes the following verifications:

- SUBSET is configured to 0, 1, 2, 3, or 4.
- No connection is specified for LNGPIN if SUBSET is configured to 0.
- No connection is specified for IN_1 through IN_8 if SUBSET is configured to 1, 2, 3, or 4.
- MSGGRP is configured to 1 through 8.

If the validation detects a problem, the block becomes undefined.

89.5 Block Initialization

The block executes a restart logic when its compound is switched from OFF to ON or when the block is installed or modified within a compound that is already ON. The block initializes to zeros the internal history of the inputs.

The station reboot operation forces initialization logic to run. After "reboot," LNGPIN and IN_1 through IN_8 are reset if they are not connected.

89.6 Example

Refer to the MEALM block description for an application example involving the use of the MEALM, STALM, and MSG blocks.

90. MTR – Motor Control Block

This chapter gives a general overview of the MTR (Motor Control Block), its features, parameters and detailed operations.

90.1 Overview

The Motor Control block (MTR, Figure 90-1) provides run/stop control of 2-wire or 3-wire motor circuits and interfaces to a discrete-type Fieldbus Module (FBM). The 2-wire configuration generates a single sustained output. The 3-wire configuration provides two pulsed outputs. The MTR block also provides mismatch timeout alarming if the motor's sensed operation does not match the requested operation within a user-defined time period.

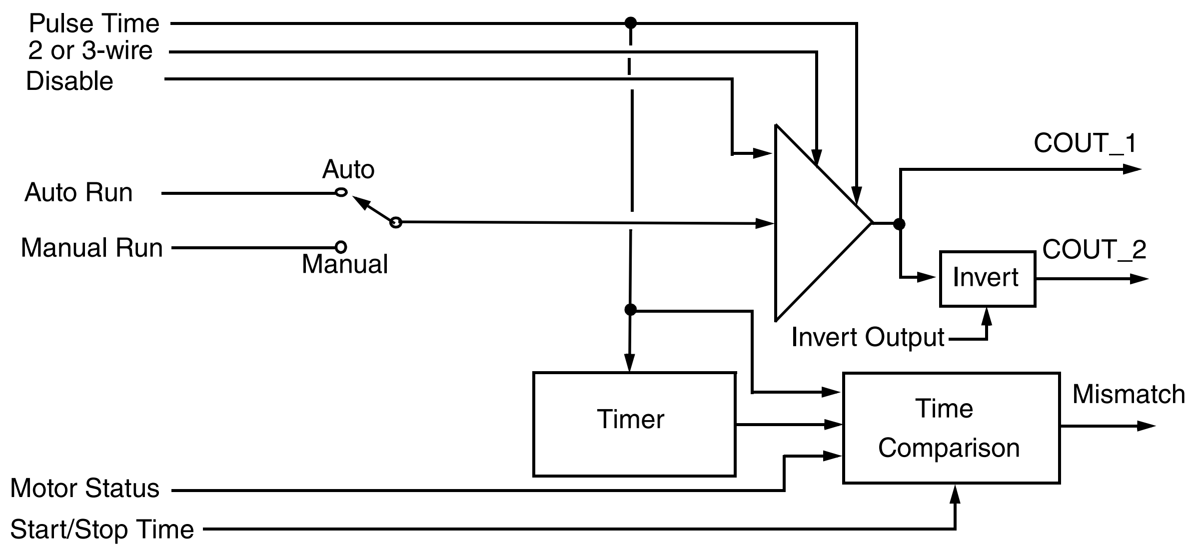


Figure 90-1. MTR Block Diagram

90.2 Features

The features are:

- Manual/Auto mode for "remote" control of the motor device
- Auto and Manual latch switch inputs (AUTSW and MANSW) that allow the block to be switched to Auto or Manual
- Open loop indication to upstream blocks
- User-specifiable pulse output time width
- State mismatch alarming
- Bad FBM alarming
- Disable input for "local" control of the motor device
- Alarm message inhibiting
- Failsafe support.

The options are:

- 2-wire or 3-wire configuration (OUTOP).
- FBM drive option (IOMOPT) for connecting COUT_1 and COUT_2 directly to a configured FBM.
- Invert the Stop output (INVOPT) polarity on COUT_2.
- Initialize Manual/Auto (INITMA) specifies the desired state of the MA input during initialization.
- Manual If Failsafe (MANFS), when configured true, drives the block to the Manual state if the block detects an incoming failsafe status.
- Inhibit Option (INHOPT) allows you to specify alarm inhibit options.
- Desired State Request Track (DSRTRK) option, when set true, forces Manual/Auto DSR parameters to track each other and prevents these parameters from being set while the block is not in the parameter's designated state.

90.3 Parameters

Table 90-1. MTR Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	29	MTR
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
IOMOPT	FBM output option	short	no-con/no-set	0	0 to 1
IOM_ID	FBM reference	string	no-con/no-set	blank	---
CO1_PT	contact out1 FBM point	string	no-con/no-set	0	[1..32]
CO2_PT	contact out2 FBM point	string	no-con/no-set	0	[1..32]
AUTRUN	auto run request	Boolean	con/set	0	0 to 1
MANRUN	manual run request	Boolean	con/set	0	0 to 1
DISABL	disable input	Boolean	con/set	0	0 to1
MSTAT	motor status	Boolean	con/set	0	0 to1
OUTOP	2 or 3 wire operation	Boolean	no-con/no-set	0 (2-wire)	0 to 1
TPULSE	out pulse time	real	no-con/no-set	0.0	[0..]minutes
TSTP	start/stop time	real	no-con/no-set	0.0	[0..]minutes
ANM	alarm name point 1	string	no-con/no-set	blank	1 to 12 chars
NM0 to NM1	alarm state name	string	no-con/no-set	blank	1 to 12 chars
INITI	initialize in	short	con/set	0	0 to 1
INITOP	initialization option	short	con/non-set	0	0 to 2
MA	manual/auto	Boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	[0|1|2]
MANSW	manual switch	Boolean	con/set	0	0 to 1
AUTSW	auto switch	Boolean	con/set	0	0 to 1

Table 90-1. MTR Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
MANFS	manual If failsafe	Boolean	no-con/no-set	0	0 to 1
INHOPT	inhibit option	short	no-con/no-set	0	0 to 3
INHIB	alarm inhibit	Boolean	con/set	0	0 to 1
INHALM	inhibit alarm	pack_b	con/set	0	0 to 0xFFFF
INVOP	contact out2 invert option	Boolean	no-con/no-set	0	0 to 1
SAP	state alarm priority	integer	con/set	5	[1..5]
SAG	state alarm group	short	no-con/set	1	[1..8]
BAP	bad alarm priority	integer	con/set	5	[1..5]
BAG	bad alarm group	short	no-con/set	1	[1..8]
BAT	bad alarm text	string	no-con/no-set	blank	1 to 32 chars
RSMMOP	reset mismatch option	short	no-con/no-set	0	0 to 3
DSRTRK	DSR tracking	Boolean	no-con/set	0	0 to 1
AMRTIN	alarm regeneration timer	integer	no-con/no-set	0	0 to 32767 s
OUTPUTS					
ALMSTA	alarm status	pack_l	con/no-set	0	bit map
BAD	bad I/O status	Boolean	con/no-set	0	0 to 1
BLKSTA	block status	pack_l	con/no-set	0	bit map
COUT_1	contact out 1	Boolean	con/no-set	0	0 to 1
COUT_2	contact out 2	Boolean	con/no-set	0	0 to 1
CRIT	criticality	integer	con/no-set	0	[0..5]
FS	failsafe state	Boolean	con/no-set	0	0 to 1
INHSTA	inhibit status	pack_l	con/no-set	0	0 to 0xFFFF
INITO	initialize out	short	con/no-set	0	0 to 1
MMAIND	mismatch alarm indicator	Boolean	con/no-set	0	0 to 1
PRTYPE	priority type	integer	con/no-set	0	[0..10]
UNACK	alarm notification	Boolean	con/no-set	0	0 to 1
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
ALMOPT	alarm options	pack_l	no-con/no-set	0	0 to 0xFFFFFFFF
DEFINE	no config errors	Boolean	no-con/no-set	1	0 to 1
DEV_ID	FBM letterbug	char[6]	no-con/no-set	blank	1 to 6 chars
ERCODE	config error	string	no-con/no-set	0	1 to 43 chars
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	Boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars
PERTIM	period time	real	no-con/no-set	0.1	seconds
TCOUNT	timeout count	integer	no-con/no-set	-2	block executions
TTOTAL	timeout length	integer	no-con/no-set	1	block executions
WCOUNT	pulse counter	integer	no-con/no-set	-1	block executions
WTOTAL	pulse width	integer	no-con/no-set	1	block executions

90.3.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

ALMOPT

Alarm Options contains packed long values representing the alarm types that have been configured as options in the block, and the alarm groups that are in use. For the MTR block, only the following unshaded bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1] (0 to 31)	Configured Alarm Option When True
0	Alarm Group 8 in Use
1	Alarm Group 7 in Use
7	Alarm Group 1 in Use
22[2]	Bad I/O Alarm Configured

1. Bit 0 is the least significant, low order bit.
2. Be aware that for this block, this bit defaults to 1 and cannot be cleared. If you do not want a Bad I/O alarm, you must inhibit Bad I/O alarms for this block.

ALMSTA

Alarm Status is a 32-bit output, bit-mapped to indicate the block's alarm states. For the MTR block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
	UNAK	INH							BAD															CRIT				PRTYPE			

Bit Number (0 to 31)[1]	Name	Description When True	Boolean Connection (B32 to B1)
0 to 4	PTYP_MSK	Priority Type: See parameter PRTYPE for values used in the MTR block	ALMSTA.B32–ALMSTA.B28
5 to 7	CRIT_MSK	Criticality; 5 = lowest priority, 1= highest	ALMSTA.B27–ALMSTA.B25
22	BAD	Input/Output Bad (BAD output of block)	ALMSTA.B10
29	INH	Alarm inhibit	ALMSTA.B3
30	UNAK	Unacknowledged	ALMSTA.B2

1. Bit 0 is the least significant, low order bit.

AMRTIN — Alarm Regeneration Timer is a configurable integer that specifies the time interval for an alarm condition to exist continuously, after which a new unacknowledged alarm condition and its associated alarm message is generated.

ANM — Alarm Name is a user-defined string of up to 12 characters that identify the input point as the source of the alarm in the alarm messages. It serves as a point descriptor label.

AUTRUN — Auto Run is a Boolean input. Typical sources for this transition-type event input are user programs or other blocks. In a two-wire configuration operating in Auto, a positive transition at AUTRUN sets COUT_1 true. In a three-wire configuration operating in Auto, a positive transition at AUTRUN sets the COUT_1 output true. A negative transition at AUTRUN sets the COUT_2 output false.

AUTSW — Auto Switch is a Boolean input that, when true, overrides the MA and INITMA parameters, and drives the block to the Auto state. If both MANSW and AUTSW are true, MANSW has priority.

BAD — Bad is a Boolean output parameter which is set true when the input to the block is unacceptable in any way. The BAD bit of BLKSTA (BLKSTA.BAD) is also set true whenever BAD is true.

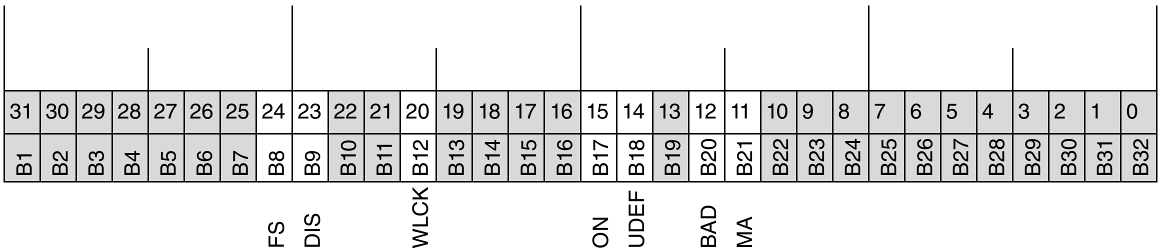
BAG — Bad Alarm Group is an integer input that directs Bad alarm messages to one of eight groups of alarm devices.

BAP — Bad Alarm Priority is an integer input, ranging from 1 to 5, that sets the priority level of the Bad alarm (1 is the highest priority).

BAT — Bad Alarm Text is a user-configurable text string of up to 32 characters, sent with the bad alarm message to identify it.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the MTR block, only the following bits are used:



Bit Number[1] (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
12	BAD	Bad I/O	BLKSTA.B20
13	PORS CHE	Block contains I/A Series v8.5 controller enhancements (parameters INITI and INITOP)	BLKSTA.B19
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
20	WLCK	Workstation Lock	BLKSTA.B12
23	DIS	Disable Status of Block	BLKSTA.B9
24	FS	Failsafe	BLKSTA.B8

1. Bit 0 is the least significant, low order bit.

CO1_PT

Contact Output 1 Point is a string input that specifies the point number on the FBM terminal board that connects to the Run Drive input of MTR block. Point number ranges for the applicable FBM types are:

FBM Type	Point Number
241	9 to 16
242	1 to 16
9	9 to 16
14	25 to 32
17	11 to 14

CO2_PT

Contact Output 2 Point is a string input that specifies, for a three-wire configuration, the point number on the FBM terminal board that connects to the Stop Drive input of the MTR block. CO2_PT is ignored in a two-wire configuration. See the CO1_PT definition for the point number ranges.

COUT_1	Contact Out 1 is one of the block's two Boolean outputs. The block always secures COUT_1. During two-wire operation (DISABL = false), the selected input, is written to COUT_1. During three-wire operation (DISABL = false, OUTOP = true), a positive transition at AUTRUN/MANRUN (depending on auto/manual mode) pulses COUT_1 for the time interval TPULSE. COUT_1, in turn, is written to the addressed channel of the FBM when IOMOPT is true. Refer to the MA and DISABL definitions for details on how they affect COUT_1.
COUT_2	Contact Out 2 is the other of the block's two Boolean outputs. The block always secures COUT_2. COUT_2 operates only in the three-wire configuration. In three-wire operation (DISABL = false, OUTOP = true), a negative transition at AUTRUN/MANRUN (depending on auto/manual mode) pulses COUT-2 for the time interval TPULSE. COUT_2, in turn, is written to the addressed channel of the FBM when IOMOPT is true. Refer to the MA and DISABL definitions for details on how they affect COUT_2.
CRIT	Criticality is an integer output that indicates the priority, ranging from 1 to 5, of the block's highest currently active alarm (1 is the highest priority). An output of zero indicates the absence of alarms.
DEFINE	Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block. DEFINE is the inverse of undefined (UDEF) in the BLKSTA parameter.
DESCRP	Description is a user-defined string of up to 32 characters that describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").
DEV_ID	Device Identifier is a character array that specifies the 6-character letterbug identifier of the connected FBM or FBC. DEV_ID differs from IOM_ID in that it is of character array rather than string type, and does not allow the use of the ECB NAME parameter or ECB pathname in specifying the connected FBM or FBC.
DISABL	Disable is a Boolean input. When true, DISABL sets the outputs COUT_1 and COUT_2 to stop states, and inhibits normal block operation in either Auto or Manual mode. While DISABL is false (block enabled), the block accepts requests from either the AUTRUN or MANRUN inputs. DISABL is independent of MA, and has a higher priority.
DSRTRK	Desired State Request Track is a configurable boolean option. When set true, it forces unlinked Manual/Auto DSR parameters to track each other. In Auto, with DSRTRK set true, the unlinked MANRUN parameter is secured and tracks AUTRUN. In Manual, with DSRTRK

set true, the unlinked AUTRUN parameter is secured and tracks MANRUN. When a parameter is secured, it cannot be set.

ERCODE

Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block's DEFINE parameter to be set false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the MTR block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
"W43 – INVALID PERIOD/PHASE COMBINATION"	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
"W44 – INVALID ENGINEERING RANGE"	High range value is less than or equal to low range value.
"W46 – INVALID INPUT CONNECTION"	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
"W48 – INVALID BLOCK OPTION"	The configured value of a block option is illegal.
"W51 – INVALID HARDWARE/ SOFTWARE TYPE"	An I/O block is connected to an ECB or the wrong type.
"W52 – INVALID I/O CHANNEL/GROUP NUMBER"	An I/O block is connected to an ECB when the specified point number is invalid or when the specified group or octet number is invalid.
"W53 – INVALID PARAMETER VALUE"	A parameter value is not in the acceptable range.
"W54 – ECB DOES NOT EXIST"	An I/O block has a connection to an ECB that does not exist or has not yet been installed. When the ECB is installed, previously installed I/O blocks waiting for that ECB will initialize automatically.
"W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK"	A Database Installer error has occurred.

Message	Value
"W59 – DUPLICATE OUTPUT CHANNEL"	This block and another output block are connected to the same output point. Since this may be intentional, this message is only a warning.

FS

Failsafe is a Boolean output that is set true when the block detects the FBM going to the Failsafe state. While in this state, the block retains the actual Failsafe value of the output point as it is read back from the FBM. This value, depending on the ECB Failsafe option, is either the fallback or the hold value.

INHALM

Inhibit Alarm contains packed Boolean values that represent alarm inhibit requests for each alarm type or point configured in the block. For the MTR block, only the following bits are used:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16

Bit Number* (0 to 15)	Description When True	Boolean Connection (B16 to B1)
6	Inhibit State Alarm	INHALM.B10
10	Inhibit Bad I/O Alarm	INHALM.B6

* Bit 0 is the least significant, low order bit

There are no mnemonic names for the individual bits of INHALM.

INHIB

Inhibit is a Boolean input. When true, it inhibits all block alarms; the alarm handling and detection functions are determined by the INHOPT setting. Alarms can also be inhibited based on INHALM and the compound parameter CINHIB.

INHOPT

Inhibit Option specifies the following actions applying to all block alarms:

0 = When an alarm is inhibited, disable alarm messages but do not disable alarm detection.

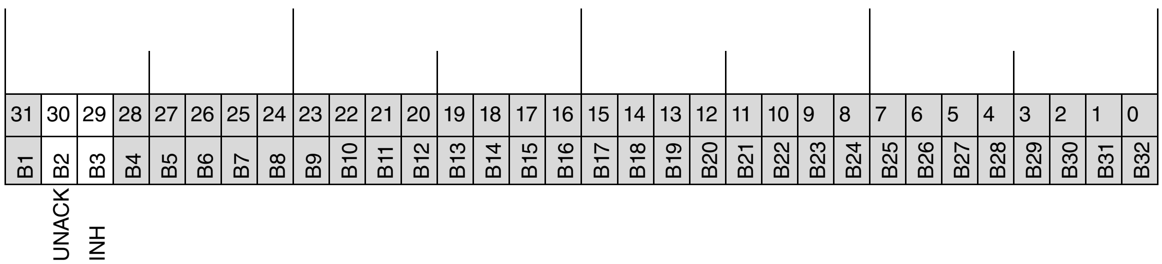
1 = When an alarm is inhibited, disable both alarm messages and alarm detection. If an alarm condition already exists at the time the alarm transitions into the inhibited state, clear the alarm indicator.

2 = Same as 0 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

3 = Same as 1 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

INHSTA

Inhibit Status contains packed long values that represent the actual inhibit status of each alarm type configured in the block. For the MTR block, only the following bits are used:



Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
29	INH	Inhibit Alarm	INHSTA.B3
30	UNACK	Inhibit Unacknowledged	INHSTA.B2

* Bit 0 is the least significant, low order bit

INITI

Initialization In defines the source block and parameter that drives this block into initialization. The source for this short integer input is the initialization output of a downstream block. With V4.2 or later software, BCALCI contains the cascade initialization request data bit eliminating the need to configure INITI connections in cascades. However, to preserve backward compatibility, the INITI parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITI short value is maintained, but the setting of the handshaking bits, via the INITI to INITO connection, is eliminated.

INITMA

Initialize Manual/Auto specifies the desired state of the MA input during initialization, where:

0 = Manual

1 = Auto

2 = The MA state as specified in the checkpoint file.

The block asserts this initial M/A state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a reboot operation.
- The compound in which it resides is turned on.
- The INITMA parameter itself is modified via the control configurator. (The block does not assert INITMA on ordinary reconfiguration.)

INITMA is ignored if MA has an established linkage.

INITO

Initialization Output is set true when:

- The block is in Manual or initializing.
- Permanent or temporary loss of FBM communications occurs.
- The ladder logic in the FBM is not running.
- MMAIND (mismatch indicator) is true.
- DISABL is true.

The block clears INITO when none of these conditions exist. You connect this parameter to the INITI input of upstream blocks so that these upstream blocks can sense when this block is open loop.

INITOP

Initialization Option is a configurable, non-settable short integer that is used to specify how to initialize the block's output when not directly connected to an I/O device (IOMOPT=0) and the block is installed, the compound containing the block is turned on, or the CP is rebooted. INITOP can have the following values (0 is default):

- 0 = use MSTAT (in Auto, set AUTRUN=MSTAT; in Manual, set MANRUN=MSTAT)
- 1 = start the motor (in Auto, set AUTRUN=1; in Manual, set MANRUN=1)
- 2 = stop the motor (in Auto, set AUTRUN=0; in Manual, set MANRUN=0)

INVOP

Invert Option, when true, inverts the Stop output (COUT_2) for three-wire applications requiring normally-closed Stop contacts in the field.

IOMOPT

Fieldbus Module Option is a short integer that specifies whether an FBM connection to the block exists.

IOMOPT, for the MTR block, has a range of 0 to 1 where:

0 = The block outputs are not connected to an FBM. This option may be used for simulation, or for connecting COUT_1/COUT_2 as inputs to other blocks.

1 = The block outputs are connected to a discrete-type FBM specified by the IOM_ID, CO1_PT/CO2_PT.

IOM_ID

Fieldbus Module Identifier is a configurable string that specifies the pathname of the ECB for the FBM or FBC to which the block is connected.

IOM_ID has the form CompoundName:BlockName, where Compound-Name is the 1-12 character name of the local compound containing the ECB, and BlockName is the 1-12 character block name of the ECB. For IFD inputs, the NAME parameter string of the parent ECB (12, 23, or 38R) must be used.

If the compound containing the ECB is the CPletterbug_ECB compound where CPletterbug is the station letterbug of the CP, the CompoundName may be omitted from the IOM_ID configuration. In this case, the 1-12 character ECB block name is sufficient. For IFD inputs, this is the letter-bug of the parent FBM (18, 43, 39, 44, or 46).

LOCKID	Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.
LOCKRQ	Lock Request is a Boolean input which can be set true or false only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.
LOOPID	Loop Identifier is a configurable string of up to 32 characters which identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.
MA	Manual Auto is a Boolean input that controls the Manual/Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. In Manual, output takes the value from MANRUN. The output is always secured. An external program can then set the output to a desired value.
MANFS	Manual If Failsafe is a Boolean input. When configured true, MANFS drives the block to the Manual state if the block detects an incoming failsafe status. MANFS has no effect when MA is linked.
MANRUN	Manual Run is a Boolean input. The typical use for this transition-type event input is to accept operator requests through the HI interface. In a two-wire configuration operating in Manual, a positive transition at MANRUN sets COUT_1 output true. In a three-wire configuration operating in Manual, a positive transition at AUTRUN sets the COUT_1

	output true. A negative transition at MANRUN sets COUT_2 output false.
MANSW	Manual Switch is a Boolean input. When true, MANSW overrides the MA and INITMA parameters and drives the block to the Manual state. If both MANSW and AUTSW are true, MANSW has priority.
MMAIND	Mismatch Indicator is a Boolean output that is set true whenever the sensed state of the valve (determined by MSTAT) does not match the requested state within the timer interval, TSTP. The block generates an alarm when it sets MMAIND true, if the INHIB input is false.
MSTAT	Motor Status is an input pointing to the program or block that monitors the state of the motor (logic 0 = Stopped; logic 1 = Running).
NAME	Name is a user-defined string of up to 12 characters used to access the block and its parameters.
NM0	Name 0 is a user-defined string of up to 12 characters. NM0 describes in alarm reports the action generated by the mismatch indicator MMAIND returning from alarm.
NM1	Name 1 is a user-defined string of up to 12 characters. NM1 describes, in alarm reports, the action generated by the mismatch indicator MMAIND going into alarm.
OUTOP	Output Option is a Boolean input that dictates whether the block is to control a two-wire (OUTOP = false) or a three-wire (OUTOP = true) motor. You can change OUTOP only by reconfiguring the block.
OWNER	Owner is a settable string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are only successful if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.
PERIOD	Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PERTIM	Period Time is the period of the block expressed in seconds.

PHASE Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PRTYPE Priority Type is an indexed output parameter that indicates the alarm type of the highest priority active alarm. The PRTYPE output of this block includes the following alarm types:

0 = No active alarm

8 = BAD Alarm

RSMMOP Reset Mismatch Option is used to specify that the AUTRUN and MANRUN inputs be reset when a mismatch alarm occurs in an MOVLV block.

- 0 = option is disabled (default)
- 1 = set AUTRUN, MANRUN and output of MTR block equal to MSTAT when a mismatch alarm occurs
- 2 = set AUTRUN, MANRUN and output of MTR block equal to 0 when a mismatch alarm occurs
- 3 = set AUTRUN, MANRUN and output of MTR block equal to 1 when a mismatch alarm occurs

SAG State Alarm Group is a short integer input that directs mismatch alarm messages to the corresponding group of alarm devices.

SAP State Alarm Priority is an integer input that sets the alarm priority for the mismatch alarm reporting (1 is the highest priority).

TCOUNT Timeout Count is an integer used by the MTR block as a temporary value in counting the alarm timeout.

TPULSE Time of Pulse sets the pulse duration of the two outputs, COUT_1 and COUT_2, in minutes. Enter a value consistent with the drive requirements of the motor. Minimum value is 1 block scan period.

TSTP Time to Run or Stop is a real value fixing the delay, in minutes, before the comparison for mismatch is made. Configure a delay at least as great as the maximum time required for the motor to go from one state to the other.

TTOTAL Timeout Length is an integer used by the MTR block as a local value containing the total number of block executions in the alarm timeout for output mismatch.

TYPE When you enter "MTR" or select "MTR" from the block type list under Show, an identifying integer is created specifying this block type.

UNACK	Unacknowledge is a Boolean output that the block sets to true when it detects an alarm. It is typically reset by operator action.
WCOUNT	Width Counter is an integer used by the MTR block as a temporary value in counting the pulse width.
WTOTAL	Pulse Width is an integer used by the MTR block as a local value containing the total number of block executions in the pulse width of a pulsed output.

90.4 Functions

90.4.1 Detailed Diagram

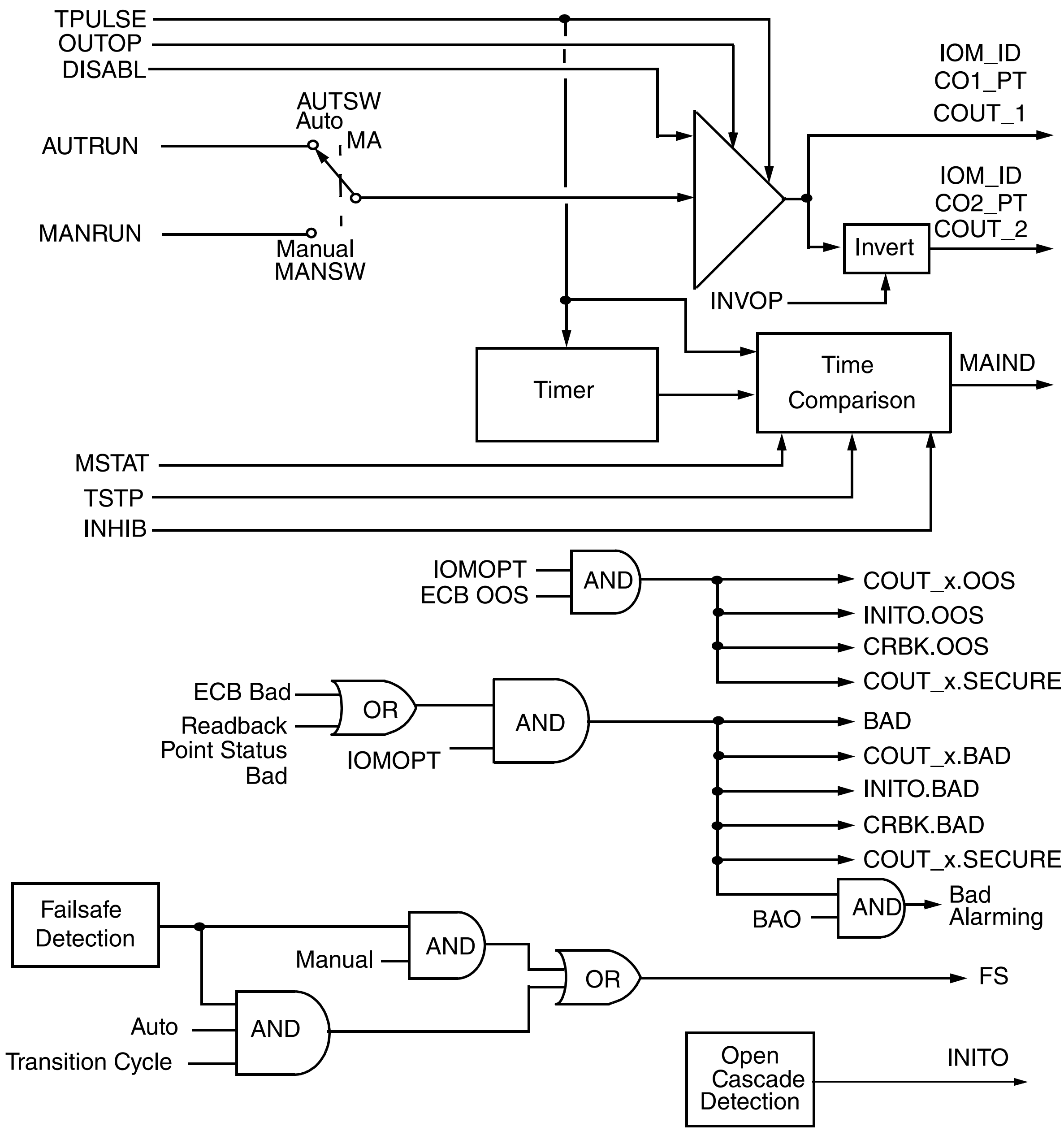


Figure 90-2. MTR Detailed Diagram

90.5 Detailed Operation

The MTR block has an operator (Manual) mode and an external (Auto) mode. In Manual, the block accepts operator-set Run/Stop commands to the MANRUN input. In Auto any block, task, or application program can initiate the Run/Stop actions to the AUTRUN input.

Desired state parameters are the MANRUN and AUTRUN parameters and can be changed as follows:

- ♦ MANRUN can be changed only when the block is in Manual.
- ♦ AUTRUN can be changed while the block is in Auto.

90.5.1 2-Wire Configuration Using Sustained Output

Key Parameters: OUTOP, COUT_1, IOM_ID, CO1_PT, IOMOPT

In the 2-wire configuration, COUT_1 is the sustained Open/Close or Run/Stop drive contact:

COUT_1 = 1 = Open/Run

COUT_1 = 0 = Close/Stop

The block drives COUT_1 directly to either the Open/Run or the Close/Stop position. When an FBM is connected for outputs (that is, IOMOPT = 1), the value of COUT_1 is copied to the output point specified by IOM_ID and CO1_PT.

During 2-wire operation (DISABL = false and OUTOP = false), the selected input (AUTRUN or MANRUN) is written to COUT_1. The block drives COUT_1 directly to either the Open/Run or the Close/Stop position (Figure 90-3). When an FBM is connected for outputs (IOMOPT = 1), the value of COUT_1 is copied to the output point specified by IOM_ID and CO1_PT.

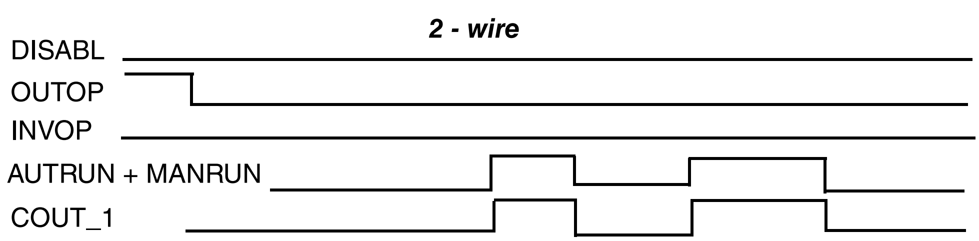


Figure 90-3. 2-wire Typical Timing Diagram

90.5.2 3-Wire Configuration Using Pulsed Outputs

Key Parameters: OUTOP, COUT_1, COUT_2, TPULSE, IOM_ID, CO1_PT, CO2_PT, IOMOPT, AUTRUN, MANRUN, INVOPT

In the 3-wire configuration, COUT_1 provides the Run drive pulse, while COUT_2 provides the Stop drive pulse. The width of these pulses is determined by TPULSE (seconds). The minimum value for TPULSE is one block scan period. The timer operates for both Run and Stop actions.

During 3-wire operation (DISABL = false and OUTOP = true), a positive transition at the selected input, AUTRUN or MANRUN, pulses the COUT_1 output for the time interval, TPULSE (Figure 90-4). A negative transition at the selected input, AUTRUN or MANRUN, generates a negative pulse at COUT_2 for the same time interval. Use the Invert Option, INVOPT, to reverse the polarity of the Stop output, COUT_2, for those applications requiring normally-closed Stop contacts in the field.

When an FBM is connected for outputs (IOMOPT =1), the value of COUT_1 is copied to the output point specified by IOM_ID and CO1_PT, and the value of COUT_2 is copied to the output point specified by IOM_ID and CO2_PT.

In a 3-wire configuration, at startup, or on a transition from DISABL to normal, or from BAD to normal, the block produces no pulse, assuming that the appropriate input parameter has no connection with a parameter from another block.

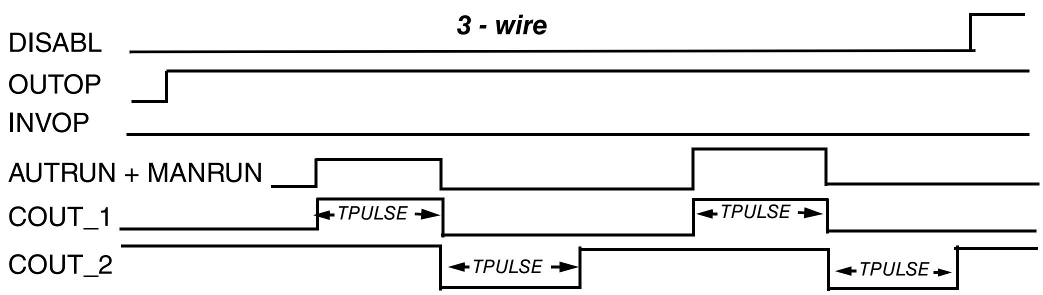


Figure 90-4. 3-wire Typical Timing Diagram

90.5.3 Output Processing

Key Parameters: COUT_1, COUT_2, IOM_ID, CO1_PT, CO2_PT

The block outputs, COUT_1 and COUT_2, are mapped to physical I/O points by specifying the Letterbug ID of the discrete-type FBM and the output point numbers. You specify the destination FBM in the Fieldbus Module Identifier (IOM_ID) parameter, and the points within the FBM by the CO1_PT and CO2_PT parameters. You can specify any output points provided both outputs connect to the same FBM.

At the beginning of an I/O Read cycle, the respective FBM output channels are read and stored in the ECB for that FBM. When the block initializes and the sustained option is configured, this value is used to update output COUT_1.

The MTR block interfaces with discrete-type FBMs that have either sustained or momentary configurations.

The following are the FBMs and point numbers providing valid output destinations for the MTR block:

FBM	Electrical Type	Valid Output Points
FBM219	Contact or dc In; Output Switch with Internal or External Source	Points 25 to 32
FBM241	Contact or dc In; Output Switch with Internal or External Source	Points 9 to 16
FBM242	Contact Output; Output Switch with External Source	Points 1 to 16
FBM09	Contact or dc In; Output Switch with Internal or External Source	Points 9 to 16
FBM10	120 V ac In; 120 V ac Output Switch	Points 9 to 16
FBM11	240 V ac In; 240 V ac Output Switch	Points 9 to 16
FBM14	Contact or dc In; Output Switch with Internal or External Source Expansion	Points 25 to 32

FBM	Electrical Type	Valid Output Points
FBM15	120 V ac In; 120 V ac Output Switch Expansion	Points 25 to 32
FBM16	240 V ac In; 240 V ac Output Switch Expansion	Points 25 to 32
FBM17	Contact or dc In; Output Switch with Internal or External Source (Plus Analog I/O)	Points 11 to 14
FBM26	Contact or 125 V dc or Contact Externally Powered In; Externally Powered Output Switch	Points 9 to 16
FBM27	Contact or 125 V dc or Contact Externally Powered In; Externally Powered Output Switch Expansion	Points 25 to 32

90.5.4 Auto/Manual State Tracking

Key Parameters: DSRTRK, AUTRUN, MANRUN

The block sets all unlinked desired state parameters (MANRUN and AUTRUN) to the actual output state, on any block Manual-Hold-Auto transition except for the Hold-to-Auto transition.

In Auto, with DSRTRK set true, the unlinked MANRUN parameter is secured and tracks AUTRUN. In Manual, with DSRTRK set true, the unlinked AUTRUN parameter is secured and tracks MANRUN.

90.5.5 Disable Mode

Key Parameters: DISABL, COUT_1, COUT_2

The DISABL input, when true, inhibits normal block operation in either Manual or Auto modes and the block outputs are set to the STOP states. You can drive DISABL with a local field contact and use it as a permissive input for maintenance or local control. If DISABL is true, the block:

- Continues to perform alarm detection, alarm message acknowledgment, and limit switch updating
- Indicates the actual position of the upstream device
- Inhibits operation in the Auto or Manual mode
- Sets COUT_1 to false, for a 2-wire configuration
- Sets COUT_1 to false and COUT_2 to true, for a 3-wire configuration.

When DISABL is false (block enabled), the block operates according to the MA status. In all modes of operation, the block always secures the COUT_1 and COUT_2 outputs.

90.5.6 Alarming

90.5.6.1 Mismatch Alarm

Key Parameters: MSTAT, TSTP, RSMMOP, AUTRUN, MANRUN, INHIB

Alarming occurs when the requested state of the motor does not match the actual state, as determined by the motor status (MSTAT), within the specified time interval, TSTP. For the 3-wire configuration, the timing begins at the start of the pulsed output period.

The option parameter RSMMOP (Reset Mismatch Alarm Option), when set to 1, causes the AUTRUN or MANRUN parameter to be reset to its original state when a mismatch alarm occurs. (Other settings are available with RSMMOP - see page 1684.) This allows you to retry the original request action, without having to toggle the request parameter in the wrong direction, by creating a leading edge for the timeout to begin again.

Mismatch alarms are cleared, and return-to-normal messages are generated, when the alarm is acknowledged by you, or the MSTAT input indicates that the field device has changed state as requested.

The motor status (MSTAT) input is normally connected from a CIN block. If this input goes bad, the block can be placed in Manual to disable it. In addition, alarm inhibit (INHIB) can be set true to inhibit erroneous alarms until the bad MSTAT input is repaired.

90.5.6.2 Bad FBM

Key Parameters: AUTRUN, MANRUN, DISABL

If the FBM becomes non-operational (BAD), the block enters the Bad state and the outputs remain at the last known driven state of the FBM contacts. Bad is a higher priority state than the Auto, Manual, and Disable states. No requests of the AUTRUN and MANRUN inputs are processed, and the DISABL input is not honored; that is, setting the DISABL input true while the block state is Bad does not set the outputs to the Stop state.

90.5.6.3 Alarm Acknowledge

Key Parameters: UNACK

Unacknowledge (UNACK) is a connectable Boolean output parameter which is set true, for notification purposes, whenever the block goes into alarm. It is settable, but sets are only allowed to clear UNACK to false, and never in the opposite direction. The clearing of UNACK is normally via an operator “acknowledge” pick on a default or user display, or via a user task.

90.5.7 Block Initialization

Key Parameter: INITO

An Initialization out parameter, INITO, provides a mechanism for indicating an open-loop condition at the MTR block. The block sets INITO true if:

- the block is initializing
- the FBM is bad
- the block is in Manual
- the mismatch indicator is true
- DISABL is true.

Programs and upstream blocks can use INITO to sense when this block is open loop.

90.5.8 Failsafe Action

Key Parameters: FS, MANFS

When the block detects that it is recovering from an FBM failure, it checks the appropriate channel bits in the FSAFE parameter in the ECB to determine if the failure was a Communications Failure. If the associated channel bits are true in FSAFE, the block parameter FS is set true. If the block is Auto and MANFS is false, FS is cleared in one block cycle. If MANFS is true, the block is switched from Auto to Manual. If the block was either already in Manual or if it switches to Manual, FS remains set true until the block switches to Auto or until the output parameter is written to by you.

On the cycle that the block recovers from a failure or initializes, the block reads back the output value from the FBM. This value is either the FBM Hold value or the Fallback value dependent upon the configuration of the FBM failsafe mask and failsafe data.

90.5.9 Validation Checks

The MTR block in the CP validates the configuration parameters when it is installed or reconfigured.

Duplicate output channel detection is intended to alert you to the fact that this block and another block capable of digital outputs are connected to the same output point. This does not necessarily constitute a conflict, since the other block may be in a compound which is not intended to run at the same time as the compound containing this MTR block, or the duplicate connection may be desired as part of an elaborate control scheme.

When the block undergoes one of the following actions, the entire data base is checked for duplicate output channels:

- The block is installed.
- The IOMOPT parameter is modified.
- The IOM_ID parameter is modified.
- A variable output point number (CO1_PT or CO2_PT) is modified.

The duplicate output channel check is also performed when the Control Processor is rebooted. It is not performed when a compound is switched On or Off.

All blocks connected to the same output point receive the DUPLICATE OUTPUT CHANNEL warning message, but are not set Undefined.

90.5.10 Block Mode Control

Key Parameters: DISABL, MA

The operating mode control parameters are DISABL and MA with DISABL having the highest priority. The status of these parameters determines the block operating mode as shown in Table 90-2.

Table 90-2. MTR Block Mode Control

DISABL	MA	Resulting Mode
True	*	Disable
False	False	Manual
False	True	Auto
*Don’t care		

90.6 Application Example

A typical application example for the MTR block is shown in Figure 90-5. Connecting the output to the FBM is optional. If you connect the output to an FBM, the output is sent to the FBM (IOM_ID) and point number (CO1_PT or CO2_PT) as specified.

The block operation can be disabled without turning off the compound. If the block DISABL parameter is true, then block operation is suspended. Since DISABL is a connectable parameter, a field switch can disable the block preventing inadvertent device operation while maintenance is being performed.

In this application, the motor starts running when a low measurement alarm occurs in a PIDA block. The AUTRUN input comes from a task (Process display, another block, etc.) external to the block, and is repeated at the output (COUT_1 or COUT_2) when the block is in automatic. In Figure 90-5, AUTRUN comes from:PIDA.MEASL1. The true AUTRUN parameter corresponds to a start request. The MANRUN input is used when the block is in manual; manipulated by the faceplate.

The MTR block parameter MSTAT indicates the motor's running/stopped state. The status switch is connected through an MCIN block to the MTR block's MSTAT parameter. If it takes longer than the time specified by the TSTP parameter to start the motor, a mismatch alarm is generated. Notification is in the form of messages sent to a printer, Boolean output MMAIND becomes true, and a STATE alarm is indicated in the block's faceplate.

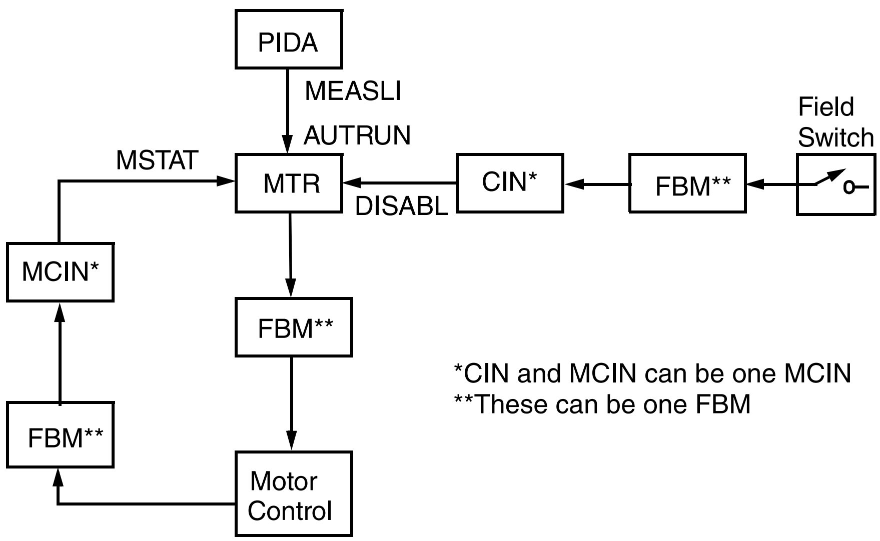


Figure 90-5. MTR Block Application

91. OUTSEL – Output Select Block

This chapter gives a general overview of the OUTSEL (Output Select Block) and describes its parameters and cascade and limit handling.

91.1 Overview

The Output Select (OUTSEL) block is used in control strategies that require the higher or lower of two output signals to be selected as the final output signal to the process, while providing the appropriate handshake data to prevent integral action from "winding up" in the block supplying the unselected signal. The OUTSEL block also provides initialization and limit indication signals to each of the two upstream blocks when the cascade is open, when the cascade closes, and when the OUTSEL or downstream block is limited.

The OUTSEL block supports a SELOPT parameter with these options:

1 = High Select, that is, select the higher input (default).

2 = Low Select, that is, select the lower input.

The OUTSEL block can be configured in any compound. A typical control block configuration using the OUTSEL block is illustrated below.

91.1.1 I/O Diagram

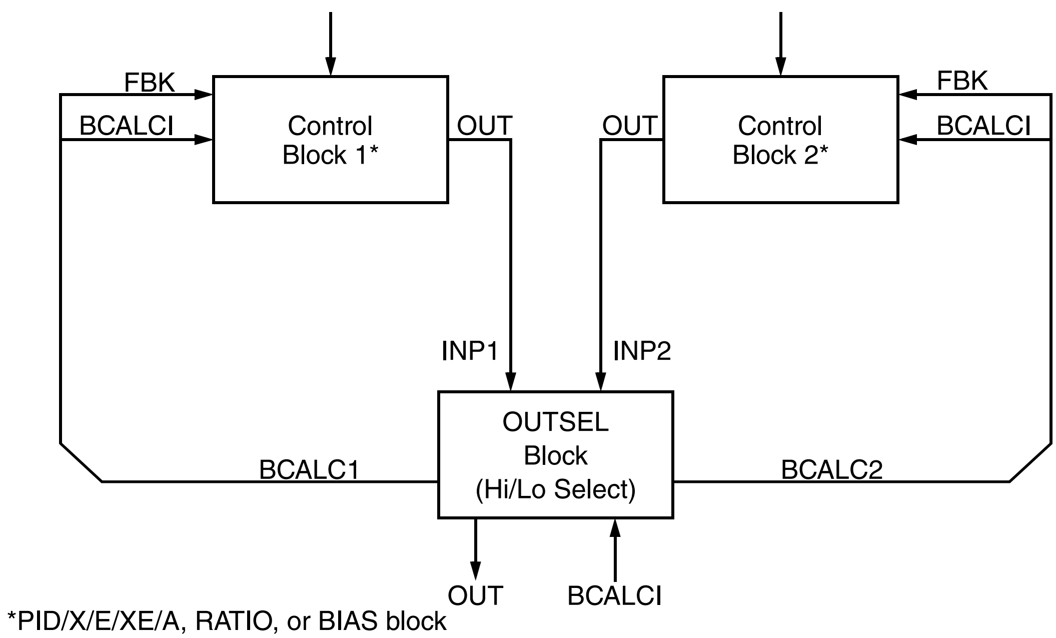


Figure 91-1. OUTSEL Block I/O Diagram

91.2 Parameters

Table 91-1. OUTSEL Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	91	OUTSEL
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
SELOPT	block options	integer	no-con/no-set	1	[1..2]
INP1 to INP2	input 1 to 2	real	con/set	0.0	RI1
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	[0|1|2]
HSCI1 to HSCI2	high scale 1 to 2	real	no-con/no-set	100.0	specifiable
LSCI1 to LSCI2	low scale 1 to 2	real	no-con/no-set	0.0	specifiable
DELTI1 to DELTI2	change delta 1 to 2	real	no-con/no-set	1.0	percent
EI1 to EI2	eng units input	string	no-con/no-set	%	specifiable
HSCO1	high scale 1	real	no-con/no-set	100.0	specifiable
LSCO1	low scale 1	real	no-con/no-set	0.0	specifiable
DELTO1	change delta 1	real	no-con/no-set	1.0	percent
EO1	eng unit output	string	no-con/no-set	%	specifiable
HOLIM	high output limit	real	con/set	100.0	RO1
LOLIM	low ouput limit	real	con/set	0.0	RO1
MCLOPT	manual clamp option	boolean	no-con/no-set	0	0 to 1
EROPT	error option	short	no-con/no-set	0	[0|1|2]
PRIBLK	primary block cascade operation	boolean	no-con/no-set	0	0 to 1
PRITIM	primary cascade timer	real	no-con/no-set	0.0	seconds
INITI	initialize in	short	con/set	0	0 to 1
BCALCI	back calculate in	real	con/set	0.0	RO1
OUTPUTS					
BCALC1 to 2	back calculate value 1 to 2	real	con/no-set	0	RI1
BLKSTA	block status	pack_l	con/no-set	0	bit map
HOLIND	high out limit indicator	boolean	con/no-set	0	0 to 1
INITO1	initialize out 1	short	con/no-set	0	0 to 1
INITO2	initialize out 2	short	con/no-set	0	0 to 1
LOLIND	low out limit indicator	boolean	con/no-set	0	0 to 1
OUT	output	real	con/no-set	0.0	RO1
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	config error	string	no-con/no-set	0	1 to 43 chars
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars

Table 91-1. OUTSEL Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
PRSCAS	cascade state	short	no-con/no-set	0	0 to 4
RI1 to RI2	eng range input	real[3]	no-con/no-set	100,0,1	specifiable
RO1	eng range output	real[3]	no-con/no-set	100,0,1	specifiable

91.2.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

BCALC1 to 2

Back-Calculated Output 1 or 2 (BCALC1 or BCALC2) is the value from a SWCH/OUTSEL block that is used by a primary block (via its BCALCI connection) to initialize its output to the current input (INPn) to the SWCH/OUTSEL block.

This parameter also contains the following status bits:

Bit 10: 1= Initialize the primary output value

Bit 13: 1= INP1/INP2 is Limited High

Bit 14: 1= INP1/INP2 is Limited Low

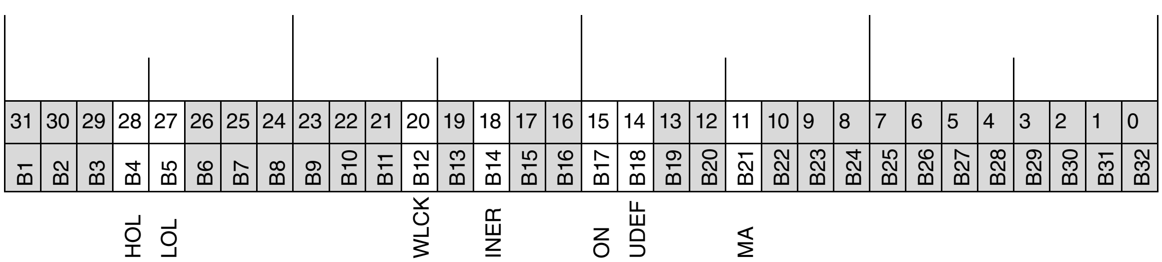
(Both B13 and B14 =1: indicates remote cascade is open)

BCALCI

Back Calculation In is a real input that provides the initial value of the output before the block enters the controlling state, so that the return to controlling is bumpless. It is also the source of the output value when its integration bit, which puts the block into output tracking, is non-zero. The source for this input is the back calculation output (BCALCO) of the downstream block. With V4.2 and later software, BCALCI contains the cascade initialization data bits which were formerly contained in the INITI parameter. Therefore, BCALCI defines the source block and parameter that drives this block into initialization, and INITI and INITO are not required for cascade initialization.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the OUTSEL block, only the following bits are used:



Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
18	INER	Input Error	BLKSTA.B14
20	WLCK	Workstation Lock	BLKSTA.B12
27	LOL	Low Output Limit (Clamped)	BLKSTA.B5
28	HOL	High Output Limit (Clamped)	BLKSTA.B4

* Bit 0 is the least significant, low order bit.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block.

DELTI1 to DELTI2

Change Delta for Input Range 1 or 2 is a real value that defines the minimum percent of the input range that triggers change driven connections for parameters in the range of RI1 or RI2. The default value is 1.

Entering a 1 causes the Object Manager to recognize and respond to a change of 1 percent of the full error range. If communication is within the same CP that contains the block's compound, change deltas have no effect.

Refer to "Peer-to-Peer Connections of Real-Type Block Inputs" on page 1703 for details on how the I/A Series software affects the change delta percentage during operation.

DELTO1

Change delta for Output Range 1 is a configurable real value that defines the minimum percent of the output range that triggers change-driven connections for parameters in the range RO1. The default value is 1.0 percent. If communication is within the same control station that contains the block's compound, DELTO1 has no effect.

DESCRP

Description is a user-defined string of up to 32 characters that describe the block's function (e.g., "PLT 3 FURNACE 2 HEATER CONTROL").

EI1 to EI2

Engineering Units for Input Ranges 1 and 2, as defined by the parameters HSCI1 to HSCI2, LSCI1 to LSCI2, and DELTI1 to DELTI2, provide the engineering units text for the values defined by Input Ranges 1 and 2. "Deg F" or "pH" are typical entries.

EO1

Engineering Units for Output Range 1, as defined by the parameters HSCO1, LSCO1, and DELTO1, provides the engineering units text for the values defined by Output Range 1. “Deg F” or “pH” are typical entries. Make the units for the Output Range (EO1) consistent with the units of Input Range 1 (EI1) and Input Range 2 (EI2).

ERCODE

Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block’s DEFINE parameter to be set false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the OUTSEL block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
“W43 – INVALID PERIOD/ PHASE COMBINATION”	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
“W44 – INVALID ENGINEERING RANGE”	High range value is less than or equal to low range value.
“W46 – INVALID INPUT CONNECTION”	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
“W48 – INVALID BLOCK OPTION”	The configured value of a block option is illegal.
“W53 – INVALID PARAMETER VALUE”	A parameter value is not in the acceptable range.
“W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK”	A Database Installer error has occurred.

EROPT

Error Option is a short integer that specifies how the block responds to INP when the INP parameter is in error. EROPT has a range of 0 to 2, where:

0 = The block ignores the errors.

1 = The block sets the ERROR bit in OUT if the INP parameter:

- has its BAD status bit set true;
- has its OOS status bit set true;
- is experiencing peer-to-peer path failure.

2 = The block sets the ERROR bit in OUT if the INP parameter:

- has its BAD status bit set true;

- has its OOS status bit set true;
- has its ERROR status bit set true
- is experiencing peer-to-peer path failure.

If EROPT = 0, a block in a cascaded scheme does not open the cascade in response to an error of its input signal, even if PRIBLK is configured true.

HOLIM High Output Limit is a real input that establishes the maximum output value, in OUT units. If the algorithm tries to drive the output to a higher value, the output is clamped at the HOLIM value and the indicator HOLIND is set true.

HOLIND High Output Limit Indicator is a boolean output that is set true whenever the output is clamped at the high output limit, HOLIM.

HSCI1 to HSCI2 High Scale for Input Ranges 1 and 2 are real values that define the upper limit of the measurement ranges. EI1 to EI2 define the units. Make the range and units consistent with the measurement source. A typical value is 100 (percent).

HSCO1 High Scale for Output Range 1 is a real value that defines the upper limit of the ranges for Output 1. A typical value is 100 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.

INITI Initialization In defines the source block and parameter that drives this block into initialization. The source for this short integer input is the initialization output of a downstream block. With V4.2 or later software, BCALCI contains the cascade initialization request data bit eliminating the need to configure INITI connections in cascades. However, to preserve backward compatibility, the INITI parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITI short value is maintained, but the setting of the handshaking bits, via the INITI to INITO connection, is eliminated.

INITMA Initialize Manual/Auto specifies the desired state of the MA input during initialization, where:

0 = Manual
1 = Auto
2 = The MA state as specified in the checkpoint file.

The block asserts this initial M/A state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a reboot operation.
- The compound in which it resides is turned on.
- The INITMA parameter itself is modified via the control configurator. (The block does not assert INITMA on ordinary reconfiguration.)

	INITMA is ignored if MA has an established linkage.
INITO1	With V4.2 or later software, BCALC1 contains the initialization request data bit eliminating the need to configure INITO1 connections. However, to preserve backward compatibility, the INITO1 parameter has been maintained for use in existing configurations. This block keeps INITO1 True, for one cycle (PRIBLK = 0), until the acknowledge is received from upstream (PRIBLK = 1 and PRITIM = 0.0), or for a fixed time delay (PRIBLK = 1 and PRITIM = nonzero).
INITO2	With V4.2 or later software, BCALC2 contains the functions of the INITO2 parameter eliminating the need to configure INITO2 connections. However, to preserve backward compatibility, the INITO2 parameter has been maintained in existing configurations. This block keeps INITO2 True, for one cycle (PRIBLK = 0), until the acknowledge is received from upstream (PRIBLK = 1 and PRITIM = 0.0), or for a fixed time delay (PRIBLK = 1 and PRITIM = nonzero).
INP1 to INP2	Inputs 1 and 2 are inputs that are selected to monitor the output when the TOGGLE input is false.
LOCKID	Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.
LOCKRQ	Lock Request is a boolean input which can be set true or false only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.
LOLIM	Low Output Limit is a real input that establishes the minimum output value. If the algorithm tries to drive the output to a lower value, the output is clamped at the LOLIM value and the indicator LOLIND is set true.
LOLIND	Low Output Limit Indicator is a boolean output that is set true whenever the output is clamped at the low output limit, LOLIM.
LOOPID	Loop Identifier is a configurable string of up to 32 characters which identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.

LSCI1 to LSCI2	Low Scale for Input Ranges 1 and 2 are real values that define the lower limit of the measurement ranges. A typical value is 0 (percent). EI1 to EI2 define the units. Make the range and units consistent with those of the measurement source.
LSCO1	Low Scale for Output Range 1 is a real value that defines the lower limit of the ranges for Output 1. A typical value is 0 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.
MA	Manual Auto is a boolean input that controls the Manual/ Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. The block automatically limits the output to the output range specified between LSCO1 and HSCO1. In Manual, the algorithm is not performed, and the output is unsecured. An external program can then set the output to a desired value.
MCLOPT	Manual Clamping Option allows you to invoke output clamping while the block is in manual. You can alter this configurable boolean input at the workstation.
NAME	Name is a user-defined string of up to 12 characters used to access the block and its parameters.
OUT	Output, in Auto mode, is the result of the block algorithm applied to one or more input variables. In Manual, OUT is unsecured, and can be set by you or by an external task.
OWNER	Owner is a string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are only successful if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.
PERIOD	Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PHASE	Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or

fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PRIBLK

Primary Block is a configuration option. When true (=1), PRIBLK enables a block in a cascaded configuration to initialize without bumping the process, either at initial startup or whenever control is transferred up to a primary block. Depending on the value of PRITIM, PRIBLK does this by forcing the OUTSEL block to remain in the Hold state until the Acknowledge status bit (Bit 10) of MEAS is detected from the upstream block (PRITIM = 0.0), or until the time defined by PRITIM expires (PRITIM > 0.0). In the latter case, the explicit acknowledge from the upstream block is not needed.

Use PRIBLK in a cascade situation when the source of the block's input connection needs to be initialized.

For correct operation, set EROPT = 1 or 2, and implement the two connections between each primary-secondary block combination. These connections include BCALCI/BCALCO, and OUT/RSP (or OUT/MEAS).

Except for the most primary controller block, Invensys recommends that PRIBLK be set true for all applicable blocks in a cascaded scheme. When PRIBLK is false (default value), no special handling takes place.

Refer to "PRIBLK and PRITIM Functionality" on page 1703 for more information on this parameter.

PRITIM

Primary Cascade Timer is a configurable parameter used to delay the closing of the cascade to a primary block, when the output is initialized in the OUTSEL block. It is used only if the PRIBLK option is set. The cascade is closed automatically when the timer expires without requiring an explicit acknowledge by the upstream block logic.

Refer to "PRIBLK and PRITIM Functionality" on page 1703 for more information on this parameter.

PRSCAS

Present Cascade State is a data store that indicates the cascade state. It has the following possible values:

Value	State	Description
1	"INIT_U"	Unconditional initialization of the primary cascade is in progress.
2	"PRI_OPN"	The primary cascade is open.
3	"INIT_C"	Conditional initialization of the primary cascade is in progress.
4	"PRI_CLS"	The primary cascade is closed.

RI1 to RI2

Range Input is an array of real values that specify the high and low engineering scale and change delta of a particular real input. For a given block, it also forms an association with a group of real input parameters that have the same designated range and change delta.

RO1 Range Output is an array of real values that specify the high and low engineering scale of a particular real output. For a given block, it also forms an association with a group of real output parameters that have the same designated range.

SELOPT Select Option is an indexed, integer input parameter that dictates the block's selection criteria when the block is in the Auto mode. The SELOPT choices are:

1 = Select the input with the highest value.
2 = Select the input with the lowest value.

You can change SELOPT only by reconfiguring the block.

TYPE When you enter "OUTSEL" or select "OUTSEL" from the block type list under Show, an identifying integer is created specifying this block type.

91.3 Functions

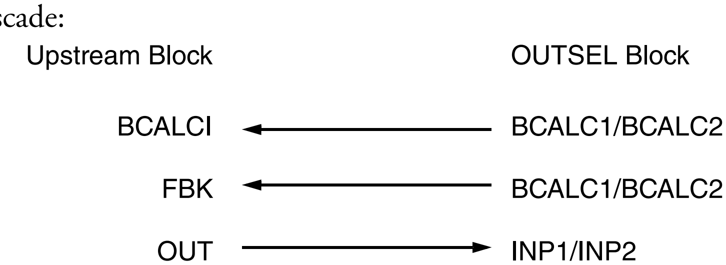
91.3.1 Cascade Handling

The PRIBLK option in the OUTSEL block provides bumpless initialization of both upstream blocks that provide the input values to the OUTSEL block.

The following block parameters support this function:

Parameter	Type	Meaning
PRIBLK	boolean	Primary Block option
BCALC1	real	Back-calculated Output 1
BCALC2	real	Back-calculated Output 2
PRSCAS	short	Cascade State

For PRIBLK to function properly, the following connections should be made to the upstream blocks in the cascade:



The OUTSEL block also propagates the Failsafe (FS) bit from the downstream block to the upstream blocks.

When it is in Auto, the OUTSEL block propagates the status of the selected input INP1 or INP2 to the output OUT as follows:

- The Bad status bit of OUT is set equal to the Bad status bit of the selected input.

- The Out-of-Service status bit of OUT is set equal to the Out-of-Service status bit of the selected input.
- If the selected input has the Bad, Out-of-Service, or Error status bit true, or if the om field of the selected input status has any other value than 1 (ON_SCAN), the Error status bit of OUT is set true. Any other value in this field indicates that the source of the connection has been deleted or is in a non-existent compound, or there has been a peer-to-peer path failure.

91.3.2 Limit Handling

When SELOPT is 2 (lower select), the unselected output is upper bounded. The LIM_HI bit of its BCALCn status is set to signal the upstream block to take action to avoid integral windup. The LIM_HI bit of both BCALCn status is set when the output is clamped at the HOLIM value.

When SELOPT is 1 (higher select), the unselected output is lower bounded. Therefore LIM_LO bit of its BCALCn status is set to signal the upstream block to take action to avoid integral windup.

91.3.3 PRIBLK and PRITIM Functionality

The Primary Block (PRIBLK) parameter indicates whether the OUTSEL block has a connection from an upstream block (PRIBLK=1) or not (PRIBLK=0). Its value, together with that of the Primary Cascade Timer (PRITIM), determines whether the OUTSEL block remains in Hold for a fixed time delay (of length defined by PRITIM), or ends the Hold when the Acknowledge status bit (Bit 10) of MEAS is detected from the upstream block (if PRITIM = 0.0). During initialization, the acknowledgement is not required and a Hold of one cycle only occurs.

91.3.4 Peer-to-Peer Connections of Real-Type Block Inputs

When a block input of type "real" is configured to a parameter of a block in a different control processor, a "change-driven" connection is established. The value of the receiving or "sink" parameter is updated every time the value of the "source" parameter changes more than a preset amount.

If the "sink" parameter has a configurable range (high and low scale values) and a change delta value (typically DELTI1, DELTI2, etc.), then the size of the change required to trigger the update is configurable.

Configuring a DELTI[1,2,etc.] value of zero (0.0) will NOT result in the "sink" being updated every cycle. Within the system, the zero (0.0) will be replaced by the value 0.1 and the effective change delta will be 0.1 percent of the "sink" parameter range (e.g. 0.1/100*(highscale-lowscale)).

When small changes must be communicated, specify an appropriate small, positive, non-zero change delta value. e.g. DELTI[1,2,etc.] = 0.00001 on a parameter with a range of 20 to 50 would result in an update for every change greater than [(0.00001/100)*(50-20)] = 0.0000030 units.

If the "sink" parameter does not have a configurable range or change delta value, as is the case with the real inputs RI01 - RI08 of the CALCA and MATH blocks, then the change delta used for peer-to-peer connections is a fixed value of 0.0001 (units of the source parameter, not percent of range).

When very small changes must be communicated, consider scaling the value with gain and bias at the source end. e.g. scale from tonnes to kilograms.

92. PACK – Packed Long Integer Variable Block

This chapter covers PACK (Packed Long Integer Variable Block) and its parameters.

92.1 Overview

The Packed Long Integer (PACK) variable block contains a packed long integer data variable parameter (32 bits) that can be set by an application to store boolean values for later retrieval and display (see Figure 92-1). You can make boolean extension connections to PACK blocks.

The PACK variable block does not contain PERIOD and PHASE parameters because it is not executed by the compound processor. Any number of PACK blocks can be configured in any compound. This block has a Detail Display for viewing and setting parameters.

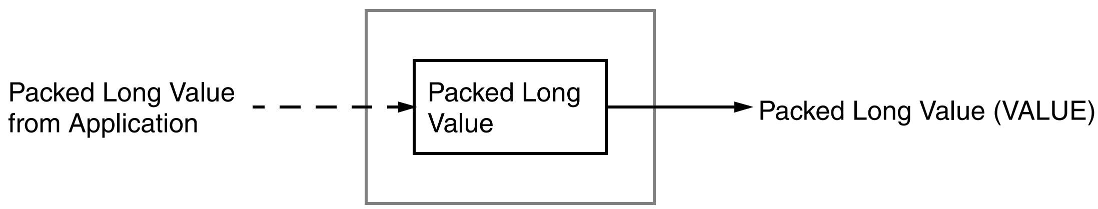


Figure 92-1. PACK Block Functional Diagram

92.2 Parameters

Table 92-1. PACK Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
Configured Parameters					
INPUTS					
NAME	variable name	string	no-con/no-set	2 blanks	1 to 12 chars
TYPE	variable type	integer	no-con/no-set	154	PACK
DESCRP	variable descriptor	string	no-con/no-set	2 blanks	1 to 32 chars
DATA VARIABLE					
VALUE	variable value	pack_l	con/set	0x00..0	0 to 0xFFFFFFFF

92.2.1 Parameter Definitions

DESCRP — Descriptor is a user-defined string of up to 32 characters that describe the variable (for example, BLENDER INPUT CONTACTS).

NAME — Name is a user-defined string of up to 12 characters used to access the data variable block and its parameters.

TYPE	Type is a system-level mnemonic label indicating the block type. Enter "PACK" or select "PACK" from the block type list under "Show" when configuring the block.
VALUE	Value is a packed long (32 bit) data variable that can be set by an application to store data for later retrieval and display.

93. PAKIN – Packed Input Block

This chapter describes the function of the Packed Input (PAKIN) block and defines its parameters.

— NOTE

This chapter describes the Distributed Control Interface (DCI) PAKIN block. For a description of how the PAKIN block is used in PLC applications, refer to *PLC Interface Block Descriptions* (B0193YQ).

— NOTE

CP270 and Later Only indicates PAKIN features supported only on the Field Control Processor 270 (FCP270) and Z-form Control Processor 270 (ZCP270) with I/A Series software v8.4 or later, or on any later control processors such as the Field Control Processor 280 (FCP280) with I/A Series software v9.0 or later.

93.1 Overview

The Packed Input (PAKIN) block is a Distributed Control Interface (DCI) block. (DCI blocks support connectivity of I/A Series control stations to various bus resident devices via a general purpose interface.) The Packed Input (PAKIN) block reads up to 32 contiguous bits from an external device. It stores that data as a single packed long parameter PAKCIN.

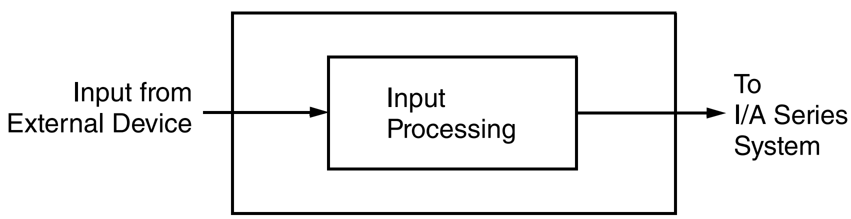


Figure 93-1. PAKIN Block Diagram

93.2 Basic Operation

PAKIN is used in applications where the external device is to provide binary data values to the I/A Series system for use in a Display Manager, FoxView™ display, or connection to an Invensys control strategy. Packed Input Group Address (PKINGP) is user configured to contain a PROFIBUS data identifier (string data). This information identifies, to the FBM, the address of the data in the PROFIBUS data stream that is to serve as the input data. The input data is presented as a single packed long parameter Packed Input (PAKCIN). Individual bits of PAKCIN may be connected to other blocks or displays.

The PAKIN block does not support a Manual mode.

The PAKIN block does not support any alarm detection or reporting capability. If alarms are desired, separate CIN blocks can be used with a Boolean extension connection to each of the bits in the PAKCIN parameter.

93.3 Features

The PAKIN block provides the following features:

- Operates in Auto mode at all times
- Individual bits of packed long input that are connectable to blocks or displays
- All necessary bit and byte reversals between the external device and I/A Series representations automatically performed.
- Simulation option enables testing input to the control strategy without actual field connections (*CP270 and Later Only*).

93.4 Parameters

Table 93-1. PAKIN Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
Configurable Parameters					
INPUTS					
NAME	block name	string	no-con/no-set	2 blanks	1 to 12 chars
TYPE	block type	integer	no-con/no-set	PAKIN_TYPE	141
DESCRP	description	string	no-con/no-set	2 blanks	1 to 32 chars
PERIOD	block sample time	short integer	no-con/no-set	1	0 to10, and 13 for CPs, 0 to 12 for Gateways
PHASE	block execute phase	integer	no-con/no-set	0	—
LOOPID	loop identifier	string	no-con/set	2 blanks	1 to 32 chars
IOM_ID	ECB identifier	string	no-con/no-set	2 blanks	1 to 12 chars
PKINGP	packed in group address	string	no-con/no-set	1	device specific
PKIOPT	I/O option	short integer	no-con/no-set	1	1 or 3
UPDPER	parm update period	integer	no-con/no-set	10000ms	0 to 2147483647 ms
SIMOPT	simulation option	boolean	no-con/no-set	0	0 = no simulation 1 = simulation
PKMASK	This parameter is not supported.				
OUTPUTS					
PAKCIN	packed input	packed long	con/no-set	0	—
Non-Configurable Parameters					
OUTPUTS					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
BLKSTA	block status	packed long	con/no-set	0	0 to 0xFFFFFFFF
TSTAMP	time stamp	long integer	con/no-set	0	ms after midnight

Table 93-1. PAKIN Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
DATA STORES					
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
DEV_ID	device identifier	character	no-con/no-set	blank	6 chars
ERCODE	configuration error	string	no-con/no-set	2 blanks	1 to 32 chars
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	2 blanks	1 to 32 chars

93.4.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate various block operational states. For the PAKIN block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
								DCIX								ON	UDEF						FBM								

Bit Number[1] (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
8	FBM	Bad Status of ECB	BLKSTA.B24
14	UDEF	Block Undefined	BLKSTA.B18
15	ON	Block On	BLKSTA.B17
23	DCIX	Enhanced DCI block (*CP270 and Later Only*)	BLKSTA.B9

1. Bit 0 is the least significant, low order bit.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing (see ERCODE for the list of all possible validation errors in this block). In that case, no further processing of the block occurs, including further validation of remaining parameters. To return DEFINE to a true value, you should correct all configuration errors and re-install the block.

DESCRP — Description is a user-defined string of up to 32 characters used to describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

DEV_ID — Device Identifier is a character array that specifies the 6-character identifier of the connected device. It is copied from the DEV_ID configured in the ECB specified by the IOM_ID parameter.

ERCODE — Error Code is a character data store which indicates the type of configuration error which caused the block's DEFINE parameter to be set false. Validation of configured parameters does not proceed past the first error encountered by the block logic. Each nonzero value of ERCODE results in an explanatory message at the block's detail display. For the PAKIN block, the following list shows the possible messages you may see:

ERCODE Message	Meaning
W48 – INVALID BLOCK OPTION	PKIOPT has been incorrectly configured.
W52 – INVALID I/O CHANNEL/GROUP NUMBER	The first character of PKINGP is blank.
W62 – UNRESOLVED CONNECTION	Connection is not yet resolved. (Block remains defined.)
W65 – INVALID POINT ADDRESS	FBM parsing algorithm found that PKINGP is invalid.
W66 – DUPLICATE CONNECTION	There is a duplicate connection to a point.
W67 – INSUFFICIENT FBM MEMORY/CONNECTIONS	There is no available memory or point connections in the FBM.
W68 – INVALID DEVICE CONNECTION	The device connection is invalid.
W69 – INVALID POINT CONNECTION	The point connection is invalid.

If a DCI data connection cannot be resolved due to a lack of configuration information, the block is marked DEFINED but the value is marked OOS and one of the following strings is stored in ERCODE to indicate the configuration error:

W77 - FIELDBUS COMMUNICATIONS FAULT (FBM228 only)
W78 - INVALID FUNCTION BLOCK (FBM228 only)
W80 - FIELDBUS DEVICE NOT FOUND (FBM228 only)
W73 - FF FUNCTION BLOCK CONFIGURATION ERROR (FBM228 only).

If a DCI data connection cannot be resolved for any other reason, the block is marked UNDEFINED and one of the following strings is stored in ERCODE to indicate the configuration error:

W74 - FF FUNCTION BLOCK DDITEM MISMATCH (FBM228 only)
W75 - FF FUNCTION BLOCK DDMBR MISMATCH (FBM228 only)
W76 - INVALID FF MODE CONFIGURATION (FBM228 only)
W79 - INVALID PARAMETER INDEX (FBM228 only)
W81 - INVALID PARENT DCI ECB PERIOD/PHASE (FBM228 only).

IOM_ID

ECB Identifier is a configurable string that specifies the pathname of the ECB201 for the device, for the purpose of connecting to (accessing) a field parameter that resides in a field device hosted by a (parent) ECB200/202. IOM_ID has the form CompoundName:BlockName, where CompoundName is the 1-12 character name of the local compound containing the ECB, and BlockName is the 1-12 character block name of the ECB.

If the compound containing the ECB is the CPletterbug_ECB compound where CPletterbug is the station letterbug of the CP, the CompoundName may be omitted from the IOM_ID configuration. In this case, the 1-12 character ECB block name is sufficient.

Note: Once configured, IOM_ID may not be modified. A delete/undelete operation will NOT allow IOM_ID to be changed. The block must be deleted and then re-entered into the data base. IOM_ID may then be reconfigured.

LOCKID
(CP270 and Later Only)

Lock Identifier is a string identifying the workstation that has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.

LOCKRQ
(CP270 and Later Only)

Lock Request is a Boolean input, which can be set true or false only by a set command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion, a workstation identifier accompanying the set command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block’s parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.

LOOPID

Loop Identifier is a configurable string of up to 32 characters that identifies the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.

NAME

Name is a user-defined string of up to 12 characters used to access the block and its parameters.

OWNER Owner is a settable string of up to 32 ASCII characters used to allocate control blocks to applications. Attempts to set OWNER are successful only if the present value of OWNER is the null string, an all-blank string, or identical to the value in the set request. Otherwise, the request is rejected with a LOCKED_ACCESS error. OWNER can be cleared by any application by setting it to the null string. This value is always accepted, regardless of the current value of OWNER. Once set to the null string, the value can then be set as desired.
This parameter is set by an Object Manager get/set call. Refer to *Object Manager Calls* (B0193BC) for more information.

PAKCIN Packed Input is the final block output. Since it is implemented with the structure of a block input, you may connect individual bits to the bits of PAKCIN to create a single packed long format for them.

PERIOD Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PHASE Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the I/A Series station is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PKINGP Packed Input Group Address identifies the address in the external device memory (or external device data stream) to which the block output is directed. It is a string whose syntax depends on the make and model of the external device.

- For the FDSI (FBM230/231/232/23), PKINGP contains a data identifier to identify, to the FBM, specific data in the I/O data stream and to specify the elements of the data. Refer to *Field Device System Integrators (FBM230/231/232/233) User's Guide* (B0700AH) for more information.
- For the FBM223 PROFIBUS interface, PKINGP must be configured to contain a PROFIBUS data identifier. This information identifies, to the FBM, the address of the input data unit from the device. Refer to *PROFIBUS-DP Communication Interface Module (FBM223) User's Guide* (B0400FE) for further details.
- For the FBM222 Redundant PROFIBUS interface, the PKINGP configuration string uses the FBM223 syntax with extensions for

PROFIBUS-PA status, custom status and other features. Refer to *Implementing PROFIBUS Networks in Foxboro Control Software Applications* (B0750BE) for further details.

- For the HART® interface (FBM214/214b/215/216/216b/218/244/245/247), PKINGP must be configured to contain a point address. This information identifies, to the FBM, specific data in the HART data stream that is to serve as the device data input to this block. Refer to *HART Communication Interface Modules User's Guide* (B0400FF) for details.
- For the Modbus interface (FBM224), PKINGP must be configured to contain the address of a set of coils in a Modbus device. Refer to *Modbus Communication Interface Module (FBM224) User's Guide* for details.
- For the FBM228, the point number syntax specifies reads of H1 device function block parameters using a client/server or publisher/subscriber connection, as described in *Implementing FOUNDATION fieldbus on an I/A Series System* (B0700BA), *Implementing FOUNDATION fieldbus* (B0750BC), and *Implementing FOUNDATION fieldbus in Foxboro Control Software Applications* (B0750DA).

PKIOPT

Packed Input Option is a short integer input that specifies whether the input bit stream from the device is packed in the PAKCIN output parameter in the I/A Series bit order, where Bit 1 is the most significant bit (MSB):

- 1 = Input is packed in the I/A Series bit order (default); Bit 1 is the MSB and Bit 32 is the least significant bit (LSB).
- 3 = Input is packed so that Bit 1 is the LSB and Bit 32 is the MSB.

The value of PKIOPT must be 1 or 3; all other values are invalid.

Refer to the device documentation to determine the bit order in the device data stream.

PKMASK

This parameter is not supported.

TSTAMP

Time Stamp is a long integer output that represents the time, in milliseconds since midnight, of the most recent updated input/output in a DCI block. This time stamp is supplied either by the FBM or by the I/A Series control station, depending on the type of FBM. If supplied by the FBM, TSTAMP indicates the time of the latest updated value in the FBM. If supplied by the I/A Series control station, TSTAMP indicates the time of the latest updated value in the I/A Series control station.

SIMOPT
(CP270 and Later Only)

Simulation Option is a configurable parameter that specifies if the DCI block input value is to be simulated. When SIMOPT is configured 1 (True), there is no DCI connection established for the block. The status and data values of PAKCIN are not recovered from the field. PAKCIN, which is normally secured, is released and becomes available for entry of simulated values, either through a link to a source parameter or operator sets.

TYPE

When you enter "PAKIN" or select it from a configurator list, an identifying integer is created specifying this block type. For this block, the value of TYPE is 141.

UPDPER

Update Period is a configurable non-settable long integer that specifies the update period for certain types of client/server access to FOUNDATION fieldbus H1 devices and PROFIBUS slave devices:

- For the FBM228, the parameter defines the update period for client/server access to device block parameters, as described in *Implementing FOUNDATION fieldbus on an I/A Series System* (B0700BA), *Implementing FOUNDATION fieldbus* (B0750BC), or *Implementing FOUNDATION fieldbus in Foxboro Control Software Applications* (B0750DA). The parameter is not used for publisher/subscriber connections.
- For the FBM222, the parameter defines the update period for acyclic communication between the FBM222 and the PROFIBUS slave device, as described in *Implementing PROFIBUS Networks in Foxboro Control Software Applications* (B0750BE). The parameter is not used for cyclic communications.

93.5 Functions

93.5.1 Detailed Diagram

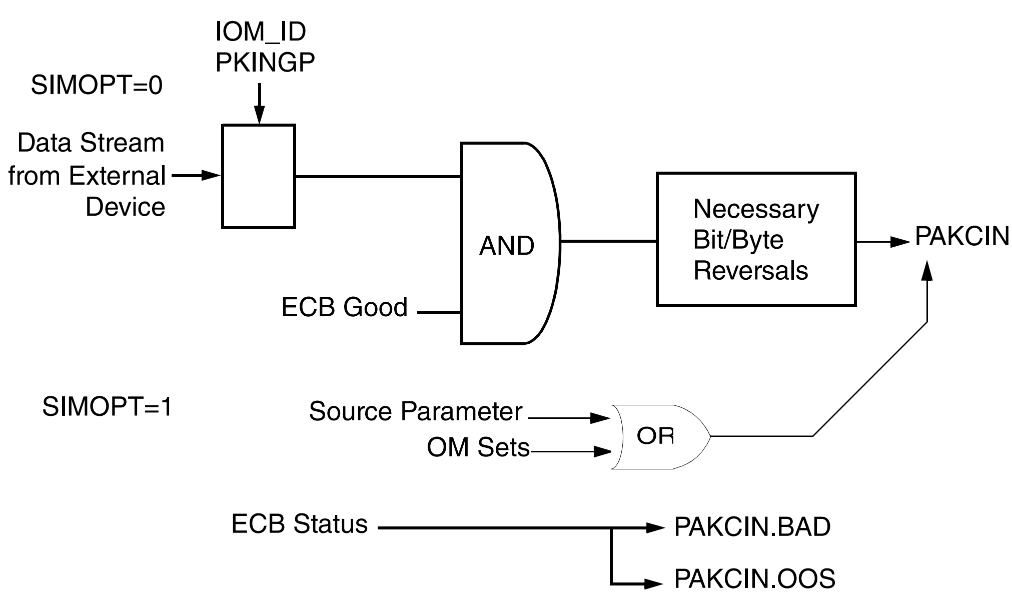


Figure 93-2. PAKIN Block Operational Diagram

93.5.2 Associated ECBs

The configured parameter IOM_ID of the PAKIN block specifies an ECB201 (the device ECB) to connect to a field parameter that resides in a field device hosted by an ECB200 (the FBM ECB). The PARENT parameter of the ECB201 specifies the associated ECB200 hosting the field device.

93.5.3 DCI Connection

The PAKIN block establishes one DCI connection to the specified ECB at any one of the following times:

- The I/A Series control station in which it resides has just been rebooted.
- The block has just been installed.
- A parameter of the block has been modified by the ICC or FoxCAE™ configurator.
- A device or parent ECB specified by the PAKIN block has just been installed.

A DCI connection is added to a linked list of all the DCI connections, of any type, for all blocks specifying the same ECB. This arrangement permits multiple DCI blocks, of differing data types, to communicate with a single device at input/output scan time, on a scatter-gather basis. It also allows multiple DCI connections in the same DCI block to be established when required (for example, connections in redundant type DCI blocks or INI_PT connections in output type blocks).

The DCI connection is deleted (that is, the linkage is removed from the linked list for the ECB when the PAKIN block is deleted.

93.5.4 Origin of Input Data

The device address supplying the input value is configured as a string in PKINGP. (If PKINGP is blank, the block is set undefined.)

The format of PKINGP is bus specific and device specific. When the PIO maintenance task runs after the DCI connection has been made (see “DCI Connection” above), the PKINGP string used by the block is passed to the FBM for parsing and validation. In DCI blocks, address identification strings are not parsed by the control station.

If the first character of PKINGP is blank, the PKINGP string is not sent to the FBM, and the block is set undefined with ERCODE = 52. The detail display shows “W52 – INVALID I/O CHANNEL/GROUP NUMBER”.

In all of the following cases, the block is also set undefined:

- If the FBM parsing algorithm finds that PKINGP is invalid, the detail display shows “W65 – INVALID POINT ADDRESS” with ERCODE = 65.
- If there is a duplicate connection to any point, the detail display shows “W66 – DUPLICATE CONNECTION” with ERCODE = 66.
- If there is no available memory in the FBM, or if the maximum number of connections have been allocated in the FBM, the detail display shows “W67 – INSUFFICIENT FBM MEMORY/CONNECTIONS” with ERCODE = 67.
- If the device connection is invalid, the detail display shows “W68 – INVALID DEVICE CONNECTION” with ERCODE = 68.

- If the point connection is invalid, the detail display shows "W69 – INVALID POINT CONNECTION" with ERCODE = 69.

In the following case, the block remains defined:

- If the connection is not yet resolved, the detail display shows "W62 – UNRESOLVED CONNECTION" with ERCODE = 62.

Use of the PAKIN block as an internal mechanism to pack individual bits into a packed long format is not supported. Therefore, PKIOPT must be configured as 1 or 3, and no connections may be configured to PAKCIN. Violation of either of these constraints causes the block to set undefined. (Note that PAKCIN is never settable).

93.5.5 Auto/Manual Switching

Auto/manual switching is not supported in the PAKIN block. The block functionality corresponds to the Auto mode at all times.

93.5.6 Status of PAKCIN

The status of the PKINGP input is checked, together with the status of the connected ECB, and the status of the PAKCIN parameter is then set according to the following rules.

The status of PAKCIN is set to Out-of-Service if:

- The status of the connected ECB indicates that the field device is off-line or out-of-service.
- The DCI connection cannot be configured, due to lack of configuration information in the FBM database.
- The DCI is not yet connected, that is, the PIO maintenance task has not yet sent the DATA_CONNECT message to the FBM for the linked-list addition described under "DCI Connection" above.
- The DCI connection status information, which specifies the condition of the accessed device parameter, indicates out-of-service, meaning (in general) that the parameter value is unavailable, or
- The connection status information indicates disconnected, meaning (in general) that the parameter is not connected or not defined.
- The connection status information indicates that the connection is not yet resolved. The detail display shows "W62 – UNRESOLVED CONNECTION" with ERCODE = 62.
- An ECB201 is specified and the ECB device status indicates that the DCI connection is unresolved.

The status of PAKCIN is set to Bad if:

- The ECB status indicates that the field device has failed.
- The DCI connection status information indicates a bad value of the field device parameter.

The status of PAKCIN is set to Error if the status information indicates an uncertain or questionable value for the field device parameter.

93.5.7 Change-Driven Input

The input function of the PAKIN block is change driven. New input is written to PAKCIN from the external device only when there is a change in at least one bit position, or if this is an initialization cycle. (See Section 93.5.9). Any necessary bit and/or byte reversals between the device representation of the input data and the I/A Series representation in PAKCIN are implemented during this transfer. PKIOPT specifies whether the input bit stream from the device is packed in the PAKCIN output with or without reversing the bit order (see Section 93.4.1).

93.5.8 Simulation Option (CP270 and Later Only)

With I/A Series software v8.4 or later, simulation of the PAKIN block is supported on the FCP280, FCP270 and ZCP270. It is not supported on other control processors.

When Simulation Option (SIMOPT) is configured true, there is no DCI connection established for the block. The PAKCIN parameter can be used to simulate the field data value and its status.

If PAKCIN is linked, the parameter value and its Bad, Out-of-Service, and Error status bits can be driven by the input connection. If PAKCIN is unlinked, its value and status can be changed by an application program using standard API/OM access mechanisms, or its value can be changed by an operator via key actions available at the detailed display. When the SIMOPT=1, the TSTAMP parameter is updated by the FCP280 or CP270 each time PAKCIN is changed.

The status and data value of PKINGP is not recovered from the field if SIMOPT is true.

93.5.9 PAKCIN Initialization

On any cycle in which the block is restarting, or there is a bad-to-good transition, a new PAKCIN input is accepted from the external device, whether or not there has been a change in the input value.

93.5.10 Time Stamp

The time stamp (TSTAMP) parameter of the block is updated every time there is a change in the value of PAKCIN. TSTAMP, which is expressed in units of milliseconds past midnight, is read from the FBM when it is available there; otherwise, it is computed by the I/A Series control station.

NOTE

For a FOUNDATION fieldbus connection, a 4-byte ms since midnight timestamp is provided by the FOUNDATION fieldbus FBM and stored in the TSTAMP parameter.

94. PAKINR – Redundant Packed Input Block

This chapter covers the Redundant Packed Input (PAKINR) block features, parameters and functions, and application diagrams.

— **NOTE**

The PAKINR is supported on the Field Control Processor 280 (FCP280), Field Control Processor 270 (FCP270) and the Z-form Control Processor 270 (ZCP270) with I/A Series software v8.4 or later.

94.1 Overview

The Redundant Packed Input (PAKINR) block is a Distributed Control Interface (DCI) block that runs on the FCP270 or ZCP270 (CP270). The PAKINR block is primarily used to support point redundancy with FDSI devices; however, the block supports connectivity of the FCP280, FCP270 or ZCP270 to various other bus-resident devices via its general purpose interface.

PAKINR reads up to 32 contiguous bits from an external device. The source of the value may be specified as either two or three redundant points in the same device or different devices (Figure 94-1).

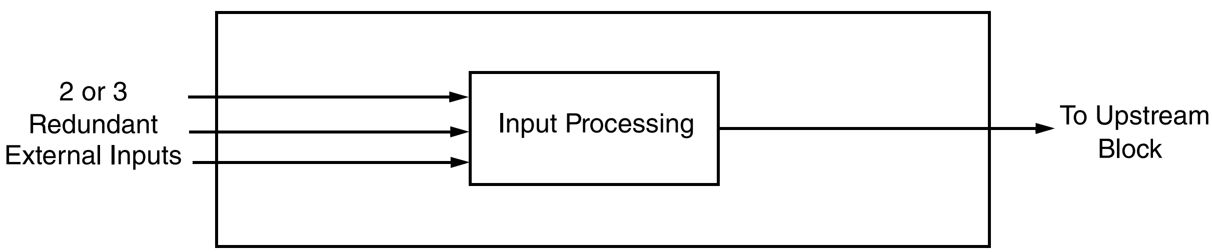


Figure 94-1. PAKINR Block Diagram

94.2 Basic Operation

The PAKINR reads a value consisting of up to 32 contiguous bits from one, two or three external sources. The source of the value may be specified as either two or three redundant inputs. The redundant inputs may be in the same device or different devices. The block's selection algorithm is invoked to determine which one of the two or three inputs is to be assigned to parameter PAKCIN. The actual receipt and processing of this value is subject to the conditions established by the Selection Option.

94.3 Features

The PAKINR block provides the following features:

- Reads one packed count input value from two or three redundant inputs
- Makes the selected input available in the PAKCIN parameter
- Time stamps the selected output.

94.4 Parameters

Table 94-1. PAKINR Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
Configurable Parameters					
INPUTS					
NAME	block name	string	no-con/no-set	2 blanks	1 to 12 chars
TYPE	block type	integer	no-con/no-set		58
DESCRP	description	string	no-con/no-set	2 blanks	1 to 32 chars
PERIOD	block sample time	short integer	no-con/no-set	1	0 to 9
PHASE	block execute phase	integer	no-con/no-set	0	period dependent
LOOPID	loop identifier	string	no-con/set	2 blanks	1 to 32 chars
SIMOPT	simulation option	boolean	no-con/no-set	0	0 to 1
ECBOPT	redundant ECB option	boolean	no-con/no-set	0	0 to 1
PKIOPT	I/O option	short integer	no-con/no-set	1	1 or 3
IOMID1	primary ECB identifier	string	no-con/no-set	2 blanks	1 to 12 chars
IOMD2	secondary ECB identifier	string	no-con/no-set	2 blanks	1 to 12 chars
IOMD3	tertiary ECB identifier	string	no-con/no-set	2 blanks	1 to 12 chars
PK1_PT	primary address	string	no-con/no-set	2 blanks	FBM dependent
PK2_PT	secondary address	string	no-con/no-set	2 blanks	FBM dependent
PK3_PT	tertiary address	string	no-con/no-set	2 blanks	FBM dependent
ARBOPT	arbitration option	boolean	no-con/no-set	0	0 to 1
SELOPT	selection option	boolean	no-con/no-set	0	0 to 1
PAKCIN	selected input	string	no-con/set	2 blanks	1 to 32 chars
UPDPER	parm update period	integer	no-con/no-set	10000ms	0 to 2147483647 ms
OUTPUTS					
Non-Configurable Parameters					
OUTPUTS					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
BLKSTA	block status	packed long	con/no-set	0	0 to 0xFFFFFFFF
PAKIN1	primary input	packed long	con/no-set	0	0 to 0xFFFFFFFF
PAKIN2	primary input	packed long	con/no-set	0	0 to 0xFFFFFFFF
PAKIN3	primary input	packed long	con/no-set	0	0 to 0xFFFFFFFF
PKBAD	PAKCIN bad status	packed long	con/no-set	0	0 to 0xFFFFFFFF
SELECT	selected point	short integer	con/no-set	0	0 to 3
TSTAMP	time stamp	long integer	con/no-set	0	ms after midnight
DATA STORES					

Table 94-1. PAKINR Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	configuration error	string	no-con/no-set	2 blanks	1 to 32 chars
LOCKID	lock identifier	string	no-con/no-set	2 blanks	1 to 32 chars
LOCKRQ	lock request	boolean	no-con/no-set	1	0 to 1
OWNER	owner name	string	no-con/set	2 blanks	1 to 32 chars

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

ARBOPT

Arbitration Option is a Boolean input that specifies dual redundancy (DMR) or triple redundancy (TMR):

- ♦ 0 = False = DMR
- ♦ 1 = True = TMR.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate various block operational states. For the PAKINR block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
											WLCK					ON	UDEF				FBM3	FBM2	FBM1						PNT3	PNT2	PNT1

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
0	PNT1 BAD	Primary point is BAD	BLKSTA.B32
1	PNT2 BAD	Secondary point is BAD	BLKSTA.B31
2	PNT3 BAD	Tertiary point is BAD	BLKSTA.B30
8	FBM1	Bad Status of primary ECB	BLKSTA.B24
9	FBM2	Bad Status of secondary ECB	BLKSTA.B23
10	FBM3	Bad Status of tertiary ECB	BLKSTA.B22
14	UDEF	Block Undefined	BLKSTA.B18
15	ON	Block ON	BLKSTA.B17
20	WLCK	Workstation Locked	BLKSTA.B12

* Bit 0 is the least significant, low order bit.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing (see ERCODE for the list of all possible validation errors in this block). In that case, no further processing of the block occurs, including further validation of remaining parameters. To return DEFINE to a true value, you should correct all configuration errors and re-install the block.

DESCRP — Description is a user-defined string of up to 32 characters used to describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

ECBOPT — Redundant ECB Option specifies whether a single device ECB is to be used for all input points or each input point is to be associated with a separate device ECB. The latter is required if the redundant input points are in different devices. If ECBOPT is 0 (False), only one device ECB is used for all points and is specified by IOMID1 (IOMID2 and IOMID3 are ignored). If ECBOPT is 1 (True), then either two or three separate device ECBs are used depending on whether dual or triple redundancy is specified. This decision is based on the configured parameter ARBOPT.

ERCODE — Error Code is a character data store which indicates the type of configuration error which caused the block's DEFINE parameter to be set false. Validation of configured parameters does not proceed past the first error encountered by the block logic. Each nonzero value of ERCODE results in an explanatory message at the block's detail display. For the PAKINR block, the following list shows the possible messages you may see:

ERCODE Message	Meaning
W43 – INVALID PERIOD/PHASE COMBINATION	The values specified in the block for PERIOD and PHASE are incompatible.
W48 – INVALID BLOCK OPTION	PKIOPT has been incorrectly configured.
W52 - INVALID CHANNEL	The first character of PK*n*_PT is blank and should be configured according to the parameter settings.
W54 - ECB DOES NOT EXIST	The ECB specified in an IOMIDx is not installed.
W62 – UNRESOLVED CONNECTION	Connection is not yet resolved. (Block remains defined.)
W65 – INVALID POINT ADDRESS	FBM parsing algorithm found that PKINGP is invalid.
W66 – DUPLICATE CONNECTION	There is a duplicate connection to a point.
W67 – INSUFFICIENT FBM MEMORY/ CONNECTIONS	There is no available memory or point connections in the FBM.
W68 – INVALID DEVICE CONNECTION	The device connection is invalid.
W69 – INVALID POINT CONNECTION	The point connection is invalid.
W81 - INVALID PARENT DCI ECB PERIOD/PHASE	The values specified in the FBM ECB for PERIOD and PHASE are incompatible.

If a DCI data connection cannot be resolved due to a lack of configuration information, the block is marked DEFINED but the value is marked

OOS and one of the following strings is stored in ERCODE to indicate the configuration error:

W77 - FIELDBUS COMMUNICATIONS FAULT
W78 - INVALID FUNCTION BLOCK
W80 - FIELDBUS DEVICE NOT FOUND
W73 - FF FUNCTION BLOCK CONFIGURATION ERROR.

If a DCI data connection cannot be resolved for any other reason, the block is marked UNDEFINED and one of the following strings is stored in ERCODE to indicate the configuration error:

W74 - FF FUNCTION BLOCK DDITEM MISMATCH
W75 - FF FUNCTION BLOCK DDMBR MISMATCH
W76 - INVALID FF MODE CONFIGURATION
W79 - INVALID PARAMETER INDEX
W81 - INVALID PARENT DCI ECB PERIOD/PHASE

IOMID1 Primary ECB Identifier is a configurable string that specifies the pathname of the ECB201 for the primary device, for the purpose of connecting to (accessing) a field parameter that resides in the primary field device hosted by a (parent) ECB200/202.

IOMID1 has the form CompoundName:BlockName, where CompoundName is the 1-12 character name of the local compound containing the ECB, and BlockName is the 1-12 character block name of the ECB.

If the compound containing the ECB is the CPletterbug_ECB compound where CPletterbug is the station letterbug of the CP, the CompoundName may be omitted from the IOMID1 configuration. In this case, the 1-12 character ECB block name is sufficient.

NOTE

Once configured, IOMID1 may not be modified. A delete/undelete operation will NOT allow IOMID1 to be changed. The block must be deleted and then reentered into the data base. IOMID1 may then be reconfigured.

IOMID2 Secondary ECB Identifier is a configurable string that specifies the pathname of the ECB201 for the secondary device, for the purpose of connecting to (accessing) a field parameter that resides in the secondary field device hosted by a (parent) ECB200/202.

IOMID2 must be configured when ECBOPT = 1. For other details, see IOMID1 above.

IOMID3 Tertiary ECB Identifier is a configurable string that specifies the pathname of the ECB201 for the tertiary device, for the purpose of connecting to (accessing) a field parameter that resides in the tertiary field device hosted by a (parent) ECB200/202.

IOMID3 must be configured when ECBOPT = 1 and triple redundancy is specified (ARBOPT = 1). For other details, see IOMID1 above.

LOCKID	Lock Identifier is a string identifying the workstation that has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1- to 6-character logical device name of the Display Manager task.
LOCKRQ	Lock Request is a Boolean input which can be set True or False only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set True in this fashion, a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are only honored (subject to the usual access rules) from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set False by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier is written to LOCKID.
LOOPID	Loop Identifier is a configurable string of up to 32 characters that identifies the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.
NAME	Name is a user-defined string of up to 12 characters used to access the block and its parameters.
OWNER	Owner is a settable string of up to 32 ASCII characters used to allocate control blocks to applications. Attempts to set OWNER are successful only if the present value of OWNER is the null string, an all-blank string, or identical to the value in the set request. Otherwise, the request is rejected with a LOCKED_ACCESS error. OWNER can be cleared by any application by setting it to the null string. This value is always accepted, regardless of the current value of OWNER. Once set to the null string, the value can then be set as desired. This parameter is set by an Object Manager get/set call. Refer to *Object Manager Calls* (B0193BC) for more information.
PAKCIN	Packed Input is the final block output. Since it is implemented with the structure of a block input, you may connect individual bits to the bits of PAKCIN to create a single packed long format for them.
PAKIN1	Primary PACKED LONG output contains the packed long value read from address PK1_PT in the device ECB specified by IOMID1.
PAKIN2	Secondary PACKED LONG output contains the packed long value read from address PK2_PT in the device ECB specified by IOMID2
PAKIN3	Tertiary PACKED LONG output contains the packed long value read from address PK3_PT in the device ECB specified by IOMID3
PERIOD	Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the

execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to “Scan Period” in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PHASE

Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the I/A Series station is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PK1_PT

Primary packed long input address specifies the source address in the external device from which the block input is obtained. It is a 1 to 32 character string whose syntax depends upon the type of the external device from which the packed long input is obtained.

The PK*n*_PT string syntax depends on the make and model of the external device.

- For the FDSI (FBM230/231/232/23), PK*n*_PT contains a data identifier to identify, to the FBM, specific data in the I/O data stream and to specify the elements of the data. Refer to *Field Device System Integrators (FBM230/231/232/233) User’s Guide* (B0700AH) for more information.
- For the FBM223 PROFIBUS interface, PK*n*_PT must be configured to contain a PROFIBUS data identifier. This information identifies, to the FBM, the address of the input data unit from the device. Refer to *PROFIBUS-DP Communication Interface Module (FBM223) User’s Guide* (B0400FE) for further details.
- For the FBM222 Redundant PROFIBUS interface, the PK*n*_PT configuration string uses the FBM223 syntax with extensions for PROFIBUS-PA status, custom status and other features. Refer to *Implementing PROFIBUS Networks in Foxboro Control Software Applications* (B0750BE) for further details.
- For the HART interface (FBM214/214b/215/216/216b/218/244/245/247), PK*n*_PT must be configured to contain a point address. This information identifies, to the FBM, specific data in the HART data stream that is to serve as the device data input to this block. Refer to *HART Communication Interface Modules User’s Guide* (B0400FF) for details.
- For the Modbus interface (FBM224), PK*n*_PT must be configured to contain the address of a set of coils in a Modbus device. Refer to *Modbus Communication Interface Module (FBM224) User’s Guide* for details.

- For the FBM228, the point number syntax specifies reads of H1 device function block parameters using a client/server or publisher/subscriber connection, as described in *Implementing FOUNDATION fieldbus on an I/A Series System* (B0700BA), *Implementing FOUNDATION fieldbus* (B0750BC), and *Implementing FOUNDATION fieldbus in Foxboro Control Software Applications* (B0750DA).

PK2_PT Secondary packed long input address specifies the source address in the external device from which the block input is obtained, as described for PK1_PT above.

PK3_PT Tertiary packed long input address specifies the source address in the external device from which the block input is obtained., as described for PK1_PT above.

NOTE

The syntax of the string is determined by the type of DCI FBM referenced. Therefore, any DCI FBM which supports PACKED LONG inputs may be referenced. Refer to the appropriate FBM documentation for specific details.

PKBAD PACKED LONG output which contains the bad status, of each PAKCIN bit, from the field device. A bit represents a bad condition when it is set to 1. Each bit position in PKBAD corresponds to the bad status of the same bit position in PAKCIN.

PKIOPT Packed Input Option is a short integer input that specifies whether the input bit stream from the device is packed in the PAKCIN output parameter in the I/A Series bit order, where Bit 1 is the most significant bit (MSB):

- 1 = Input is packed in the I/A Series bit order (default); Bit 1 is the MSB and Bit 32 is the least significant bit (LSB).
- 3 = Input is packed so that Bit 1 is the LSB and Bit 32 is the MSB.

The value of PKIOPT must be 1 or 3; all other values are invalid.

Refer to the device documentation to determine the bit order in the device data stream.

SELECT Selection Indicator shows which redundant PK*n*_PT has been chosen by the arbitration algorithm:

0 = none of the input values is selected

1 = primary input value is selected

2 = secondary input value is selected

3 = tertiary input value is selected.

SELOPT A configurable BOOLEAN which specifies the selection option for the block when the arbitration algorithm is unable to choose an input. If SEL-

OPT = 0, the last good value of PAKCIN is retained and is known as the LAST GOOD OPTION. If SELOPT = 1, the first good value is assigned to PAKCIN and is known as the FIRST GOOD OPTION.

SIMOPT

Simulation Option is a configurable parameter that specifies if the DCI block input/output value is to be simulated. When SIMOPT is configured 1 (True), there are no DCI connections established for the block. The status and data values of PK1_PT, PK2_PT and PK3_PT are not recovered from the field. PAKCIN, which is normally secured, is released (provided it is unlinked) and becomes available for entry of simulated values.

TSTAMP

Time Stamp is a long integer output that represents the time, in milliseconds since midnight, of the most recent updated input/output in a DCI block. This time stamp is supplied by the FBM, one of its connected field devices, or the I/A Series control station, depending on the type of FBM. If supplied by the FBM or field device, TSTAMP indicates the time of the latest updated value in the FBM. If supplied by the I/A Series control station, TSTAMP indicates the time of the latest updated value in the I/A Series control station. See Section 94.5.11.

TYPE

When you enter PAKINR or select it from a configurator list, an identifying integer is created specifying this block type. For this block, the value of TYPE is 58.

UPDPER

The parameter is not used with FDSI devices.

Update Period is a configurable non-settable long integer that specifies the update period for certain types of client/server access to FOUNDATION fieldbus H1 devices and PROFIBUS slave devices:

- For the FBM228, the parameter defines the update period for client/server access to device block parameters, as described in *Implementing FOUNDATION fieldbus on an I/A Series System* (B0700BA), *Implementing FOUNDATION fieldbus* (B0750BC), or *Implementing FOUNDATION fieldbus in Foxboro Control Software Applications* (B0750DA). The parameter is not used for publisher/subscriber connections.
- For the FBM222, the parameter defines the update period for acyclic communication between the FBM222 and the PROFIBUS slave device, as described in *Implementing PROFIBUS Networks in Foxboro Control Software Applications* (B0750BE). The parameter is not used for cyclic communications.

94.5 Functions

94.5.1 Detailed Diagram

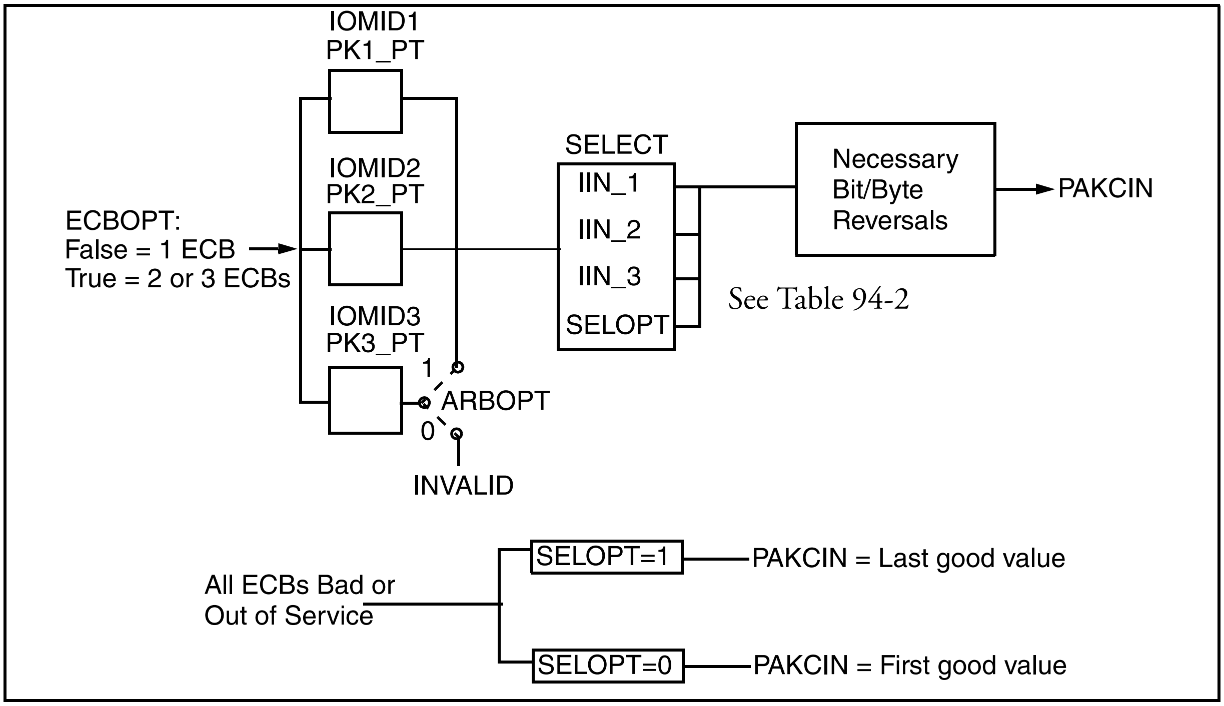


Figure 94-2. PAKINR Block Operational Diagram

94.5.2 Block Initialization

The PAKINR block initializes when any of these events occurs:

- The block is installed or reconfigured via the control configurator in a running compound.
- The compound in which the block resides is turned ON.
- The CP is rebooted and the compound in which the block resides initializes ON.
- Any of the ECBs connected to the block is installed or reconfigured.

When the PAKINR initializes, the ERCODE parameter is cleared.

94.5.3 Block Validation

When the PAKINR block initializes, the block validates the SELOPT parameter first. If SELOPT does not equal FIRST GOOD VALUE (SELOPT=1) or LAST GOOD VALUE (SELOPT=0), the block is marked undefined (BLKSTA.UDEF=1) with the error code parameter (ERCODE) set to “W48 – INVALID BLOCK OPTION.”

If the block simulation option is not used (SIMOPT=0), the following block validation tests are performed:

- If the PAKINR block is installed prior to the installation of any of the device ECBs, it is marked undefined (BLKSTA.UDEF=1) with the error code parameter (ERCODE) set to “W54 - ECB DOES NOT EXIST.” In this case, the PAKINR block configuration is re-validated automatically when any device ECB is installed.

- ♦ If PKIOPT does not equal 1 or 3 the block is undefined (BLKSTA.UDEF=1) with ERCODE set to "W48 – INVALID BLOCK OPTION."
- ♦ If a connection has been made to PAKCIN, the block is marked undefined (BLKSTA.UDEF=1) with ERCODE set to "W47 – INVALID PARAMETER CONNECTION."
- ♦ If any device ECB is not a DCI type ECB the block is marked undefined (BLKSTA.UDEF=1) with ERCODE set to "W51 - INVALID HARDWARE/ SOFTWARE TYPE."
- ♦ If the first character of any used PK*n*_PT is blank, the PK*n*_PT string is not sent to the FBM, and the block is marked undefined (BLKSTA.UDEF=1) with ERCODE set to "W52 - INVALID I/O CHANNEL/GROUP NUMBER."
- ♦ If the PERIOD/PHASE combination configured in the PAKINR block is inconsistent, or if the PERIOD/PHASE combination conflicts with the compound PERIOD/PHASE combination, the PAKINR block is marked undefined with ERCODE set to "W43 - INVALID PERIOD/PHASE COMBINATION."

If there are no configuration errors when the PAKINR block is installed, the block is marked defined (BLKSTA.UDEF=0) and ERCODE is cleared (nulled). If the compound containing the block is turned on, the block initializes and start running automatically, and all history variables are cleared.

94.5.4 Associated ECBs

The configured parameters IOMID1, IOMID2, and IOMID3 of the PAKINR block specify one or more ECB201s (the "Device ECBs") to connect to field parameters that reside in field devices hosted by one or more ECB200s/ECB202s (the "FBM ECBs").

The PARENT parameter of each ECB201 specifies the associated FBM ECB hosting the field device.

94.5.5 DCI Connections

Table 94-2 shows the DCI connections for all combinations of ECBOPT and ARBOPT:

Table 94-2. ECBOPT and ARBOPT Usage

ECBOPT	ARBOPT	Connections
0	0 (DMR)	Two DCI connections to one ECB using IOMID1
0	1 (TMR)	Three DCI connections to one ECB using IOMID1
1	0 (DMR)	Two DCI connections to two ECBs using IOMID1 and IOMID2
1	1 (TMR)	Three DCI connections to three ECBs using IOMID1, IOMID2, and IOMID3

94.5.6 Origins of Input Data

The device addresses supplying the input values are configured as strings in PK1_PT, PK2_PT, and PK3_PT.

- ♦ When ARBOPT is 0 (DMR) neither PK1_PT nor PK2_PT may be null, and PK3_PT is ignored.

- When ARBOPT is 1 (TMR) PK1_PT, PK2_PT, and PK3_PT must all be non-null.

These checks are made at block validation time, and violations of these rules result in the PAKINR block being set undefined. Processing does not proceed further.

The format of the PK*n*_PT parameters is bus-specific and device-specific. When the PIO Maintenance task runs after the DCI connections have been made (see Section 94.5.3), the PK*n*_PT strings used by the block are passed to the FBM for parsing and validation. In DCI blocks, point identification strings are not parsed by the CP.

If the first character of any used PK*n*_PT is blank, the PK*n*_PT string is not sent to the FBM, and the block is marked undefined with ERCODE = 52. The detail display shows "W52 – INVALID I/O CHANNEL/GROUP NUMBER."

In all of the following cases, the block will is also set undefined:

- If the FBM parsing algorithm finds that a used PK*n*_PT is invalid, the detail display shows "W65 – INVALID POINT ADDRESS" with ERCODE = 65.
- If there is a duplicate connection to any point, the detail display shows "W66-DUPLICATE CONNECTION" with ERCODE = 66.
- If there is no available memory in the FBM, the detail display shows "W67 – INSUFFICIENT FBM MEMORY" with ERCODE = 67.
- If the device connection is invalid, the detail display shows "W68 – INVALID DEVICE CONNECTION" with ERCODE = 68.
- If the point connection is invalid, the detail display will shows "W69 – INVALID POINT CONNECTION" with ERCODE = 69.

94.5.7 Simulation Option

When Simulation Option (SIMOPT) is configured true, there is no DCI connection established for the block. The PAKCIN parameter can be used to simulate the field data value and its status.

If PAKCIN is linked, the parameter value and its Bad, Out-of-Service, and Error status bits can be driven by the input connection. If PAKCIN is unlinked, its value and status can be changed by an application program using standard API/OM access mechanisms, or its value can be changed by an operator via key actions available at the detailed display.

The statuses and data values of PAKIN1, PAKIN2, and PAKIN3 are not recovered from the field if SIMOPT is true.

94.5.8 Auto/Manual Mode

Manual mode of operation is not supported in the PAKINR block; the block always runs in Auto mode.

94.5.8.1 Operation in Auto

The input data and status from the two or three redundant inputs are processed and arbitrated as described in the previous sections. The selected value is written to PAKCIN only when there is a change in at least one bit position, or when an initialization cycle is active. Any bit and/or byte reversals between the device representation of the input data and the I/A Series representation in PAKCIN occur when PAKCIN is updated with the selected value from the field device. The PKIOPT parameter specifies whether or not the input from the field device requires bit reversal before updating PAKCIN.

On any cycle in which the block is restarting or there is a bad-to-good transition, a new PAKCIN is accepted from the selected field device, whether or not there has been a change in the selected value.

94.5.8.2 Bit Reversal

The PKIOPT parameter specifies whether or not the input from the field device is transferred to the PAKCIN output with bit reversal. The possible values of PKIOPT are as follows:

- PKIOPT=1 – Bit reversal (Bit 1 through Bit 32 are mapped bit-by-bit to Bit 32 through Bit 1)
- PKIOPT=3 – No bit reversal (Bit 1 through Bit 32 are mapped bit-by-bit to Bit 1 through Bit 32)

All other values of PKIOPT are invalid.

94.5.9 Bad (BAD), Out-of-Service (OOS) and Error (ERR) Status

The statuses of the PK1_PT and PK2_PT inputs are determined, together with the statuses of their ECBs. If ARBOPT specifies TMR, there is similar processing for the status of the PK3_PT input and its ECB. For each of the two or three inputs, the status of its PAKINx parameter is set according to the following rules:

- The status of PAKINx is set to Out-of-Service if:
    - The Control Processor loses communications with an FBM.
    - The appropriate ECB status indicates that the field device is off-line or out-of-service.
    - The DCI connection cannot be configured, due to lack of configuration information in the FBM database.
    - The DCI is not yet connected, that is, the PIO Maintenance task has not yet sent the DATA_CONNECT message to the FBM for the linked-list addition described in Section 94.5.5.
    - The DCI connection status information, which specifies the condition of the accessed device parameter, indicates out-of-service, meaning in general that the parameter value is unavailable.
    - The connection status information indicates disconnected, meaning in general that the parameter is not connected or not defined.
    - The connection status information indicates that the connection is not yet resolved. The detail display show “W62 – UNRESOLVED CONNECTION” with ERCODE = 62.
    - An ECB201 is specified and the ECB device status indicates that the DCI connection is unresolved.
- The status of PAKINx is set to Bad if:
    - The Control Processor loses communications with an FBM.
    - The ECB status indicates that the field device has failed.
    - The DCI connection status information indicates a bad value of the field device parameter.
- The status of PAKINx is set to Error if:

- The status information indicates an uncertain or questionable value of the field device parameter.

If PAKINx is not Out-of-Service, the origin of the input is determined as described in Section 94.5.6, and the result is set into the value of PAKINx. Otherwise, the previous value (last good value) of PAKINx is retained.

The status and values of the individual PAKINx are available in the three output parameters, and, in addition, they are used as the inputs to the arbitration algorithm (Section 94.5.10).

94.5.10 Arbitration (Selection) Algorithm

Each of PAKIN1, PAKIN2, and PAKIN3 has a value and a status (Section 94.5.9), which are used in determining which value is copied to PAKCIN, as shown in Table 94-2. In the table, a PAKINx is "Valid" if its status is neither Bad nor Out-of-Service. Also, if ARBOPT indicates DMR, PAKIN3 is never "Valid".

The output parameter SELECT indicates which input has been selected. SELECT is set to 0 when the available signals are different and SELOPT=0 or when all the signals are invalid.

Table 94-3. Selection of a Value for PAKCIN

PAKIN_1 Valid	PAKIN_2 Valid	PAKIN_3 Valid	Test	Selection
Yes	Yes	Yes	PAKIN_1 = PAKIN_2 or PAKIN_1 = PAKIN_3 or PAKIN_1 = PAKIN_2 = PAKIN_3	PAKCIN = PAKIN_1; SELECT = 1
Yes	Yes	Yes	PAKIN_2 = PAKIN_3	PAKCIN = PAKIN_2; SELECT = 2
Yes	Yes	Yes	All Other Cases	If SELOPT = 0, PAKCIN retains its previous value and status is ERR; SELECT = 0 If SELOPT = 1, PAKCIN = PAKIN_1; SELECT = 1.
Yes	Yes	No	PAKIN_1 = PAKIN_2	PAKCIN = PAKIN_1; SELECT = 1;
Yes	Yes	No	PAKIN_1 <> PAKIN_2	If SELOPT = 0, PAKCIN retains its previous value and its status is ERR; SELECT = 0 If SELOPT = 1, PAKCIN = PAKIN_1; SELECT = 1
Yes	No	Yes	PAKIN_1 = PAKIN_3	PAKCIN = PAKIN_1; SELECT = 1

Table 94-3. Selection of a Value for PAKCIN (Continued)

PAKIN_1 Valid	PAKIN_2 Valid	PAKIN_3 Valid	Test	Selection
Yes	No	Yes	PAKIN_1 <> PAKIN_3	If SELOPT = 0, PAKCIN retains its previous value and its status ERR; SELECT = 0 If SELOPT=1 PAKCIN = PAKIN_1; SELECT = 1
No	Yes	Yes	PAKIN_2 = PAKIN_3	PAKCIN = PAKIN_2; SELECT = 2.
No	Yes	Yes	PAKIN_2 <> PAKIN_3	If SELOPT =0, PAKCIN retains its previous value and its status is ERR; SELECT = 0 If SELOPT=1, PAKCIN = PAKIN_2; SELECT = 2.
Yes	No	No	(No Test Required)	PAKCIN = PAKIN_1; SELECT = 1.
No	Yes	No	(No Test Required)	PAKCIN = PAKIN_2; SELECT = 2.
No	No	Yes	(No Test Required)	PAKCIN = PAKIN_3; SELECT = 3.
No	No	No	(No Test Required)	PAKCIN retains its last good value and its status is set to BAD and OOS; SELECT = 0.

94.5.11 Time Stamping

The PAKINR block provides a time stamp in the TSTAMP parameter every time there has been a change in the value of PAKCIN or whenever the block is installed. The time is expressed in units of milliseconds past midnight. TSTAMP is read from the FBM when it is available there, and, if not, is computed by the CP.

NOTE

For a FOUNDATION fieldbus connection, a 4-byte ms since midnight timestamp is provided by the FOUNDATION fieldbus FBM and stored in the TSTAMP parameter.

94.5.12 Block Shutdown

The PAKINR block shuts down when any of the following events occurs:

- The compound containing the block is turned off.
- The compound containing the block is deleted.

- Any of the ECBs connected to the block is deleted.
- The PAKINR block itself is deleted.

When block shutdown occurs, the following actions will be taken:

- All alarm status information (ALMSTA, CRIT, PRTYPE, UNACK) is cleared.
- An Alarm Disable message will be issued to all devices in the bad alarm group. If the Bad Alarm is unacknowledged, an Alarm Acknowledge message also will be sent to these devices.

95. PAKOUT – Packed Output Block

This chapter describes the function of the Packed Output (PAKOUT) block and defines its parameters.

NOTE

This chapter describes the Distributed Control Interface (DCI) PAKOUT block. For a description of how the PAKOUT block is used in PLC applications, refer to *PLC Interface Block Descriptions* (B0193YQ).

NOTE

CP270 and Later Only indicates PAKOUT features supported only on the Field Control Processor 270 (FCP270) and Z-form Control Processor 270 (ZCP270) with I/A Series software v8.4 or later, or on any later control processors such as the Field Control Processor 280 (FCP280) with I/A Series software v9.0 or later.

95.1 Overview

The Packed Output (PAKOUT) block is a Distributed Control Interface (DCI) block. (DCI blocks support connectivity of I/A Series control stations to various bus resident devices via a general purpose interface.) PAKOUT passes from 1 to 32 binary values to a field device. The block also continuously reports any changes made by the FBM to those values at the field device. In the outbound direction, the block accepts binary inputs from the control strategy or an operator set and sends them to the device's group address. In the inbound direction, the block's confirmed output structure allows any change made by the FBM to a value in the field device to be read back by the I/A Series block.

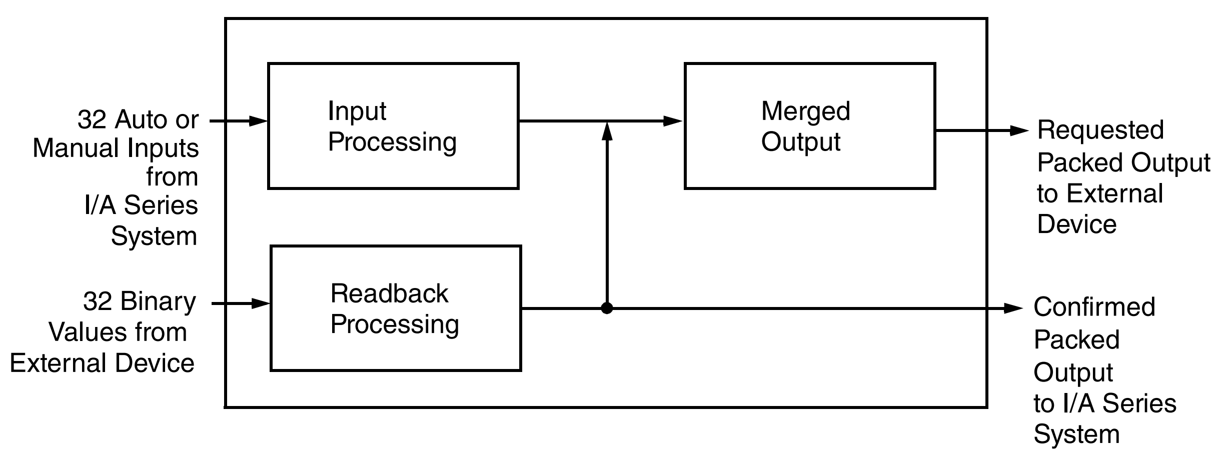


Figure 95-1. PAKOUT Block Diagram

95.2 Basic Operation

Manual mode inputs to the PAKOUT block are obtained from operator sets, generally from an I/A Series Display Manager or FoxView display, at the request component of parameter Packed Output (PAKCO). Auto mode inputs are obtained from parameters Binary Input 1-32 (IN1-32). It sends the packed value of PAKCO to the addresses of the data element specified in parameter Packed Output Group Address (PKCOGP). (The PKCOGP parameters contains a user-configured data identifier string, which identifies, to the FBM, specific data to be sent to the external device, as described in "PKCOGP" on page 1743.) Output from the block is change driven; the block only writes to the device when a change occurs in at least one of the bits.

The "confirmed" structure of parameter PAKCO allows the packed value sent to the field device address to be entered into the "request component" (also known as the "shadow component") of PAKCO and the value read back from the FBM to be reflected in the "confirmed component". The value of PAKCO, shown in displays or made available for connection to the control strategy, is always the confirmed component. This is the value which has been written successfully to the field device. The value which was sent to the field device as the request component of PAKCO is displayed at parameter Packed Request (PAKREQ) to aid in diagnostic testing.

A change timer mechanism is used to keep the I/A Series end synchronized with the device end. If a new I/A Series value is not accepted by the device within a pre-determined time, the I/A Series control station re-initializes its inputs and its output value. The output value is retained for future comparison against read-back values, but is not sent to the field device at this time.

The PAKOUT block does not provide any alarm detection or reporting capability. If alarms are desired, separate CIN blocks can be used with a Boolean extension connection to each of the bits in the PAKCO parameter of the PAKOUT block.

! CAUTION

In I/A Series Version 8.X or later systems, when using the PAKOUT block with the FBM224 or FDSI (FBM230-FBM233), you must ensure that all bits and registers in any field device associated with the PAKOUT block or controller are set exclusively by a single controller. If an additional source attempts to set bits and registers to the PAKOUT block, they may be overwritten by the primary controller, if the controller attempts to set bits or registers in a range that overlaps or encompasses the bits or registers set by the additional source. If you have values from a separate source which need to be co-located in a specific order, have the second source bring its values into a separate register, and then combine this register together with the values to be set in the primary controller to create a separate word.

95.3 Features

The PAKOUT block provides the following features:

- Auto/manual mode selection that arbitrates between inputs by the operator or application programs (Manual) and inputs from the control strategy (Auto)
- Packed long output written to device only when at least one bit changes
- Displayed output value that is always the read-back value
- A change timer that is used to synchronize values at both ends
- Simulation options that allows testing of the control strategy without actual connection to the field (*CP270 and Later Only*).

95.4 Parameters

Table 95-1. PAKOUT Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
Configurable Parameters					
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	PAKOUT_ TYPE	142
DESCRP	description	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short integer	no-con/no-set	1	0 to10, and 13 for CPs, 0 to 12 for Gateways
PHASE	block execute phase	integer	no-con/no-set	0	—
LOOPID	loop identifier	string	no-con/set	blank	1 to 32 chars
IOM_ID	ECB identifier	string	no-con/no-set	blank	1 to 12 chars
PKCOGP	packed out group address	string	no-con/no-set	1	device specific
PKCOPT	packco option	short integer	no-con/no-set	1	1,3
UPDPER	update period	long	no-con/no-set	10000	0-2147483647
MA	manual/auto	boolean	con/set	0	0 to 1
PFSOPT	packed fail-safe option	boolean	no-con/no-set	0	0 to 1
INITMA	initialize MA	short integer	no-con/no-set	1	0 to 2
AUTSW	auto switch	boolean	con/set	0	0 to 1
MANSW	manual switch	boolean	con/set	0	0 to 1
PRIBLK	primary block	short integer	no-con/no-set	0	0 to 1
PRITIM	cascade closure delay	real	no-con/no-set	0.0	seconds
RBKTIM	read-back timer	real	no-con/no-set	5.0	seconds
IN1 to 32	binary input 1-32	boolean	con/set	0	0 to 1
SIMOPT	simulation option	boolean	no-con/no-set	0	0 to 1
PKMASK	This parameter is not supported.				
OUTPUTS					
PFSOUT	fail-safe output	long integer	no-con/no-set	0	0-0xFFFFFFFF
Non-Configurable Parameters					
OUTPUTS					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
BLKSTA	block status	packed long	con/no-set	0	bit map
INITPO	initialization packed output	boolean	con/no-set	0	0 to 1
PAKCO	packed output	packed long	con/set	0	—
PAKREQ	packed request	packed long	con/set	0	—
TSTAMP	time stamp	long integer	con/no-set	0	ms after midnight
DATA STORES					
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
DEV_ID	device identifier	character	no-con/no-set	blank	6 chars
ERCODE	configuration error	string	no-con/no-set	blank	1 to 43 chars
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1

Table 95-1. PAKOUT Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
OWNER	owner name	string	no-con/set	blank	1 to 32 chars

95.4.1 Parameter Definitions

ACHNGE

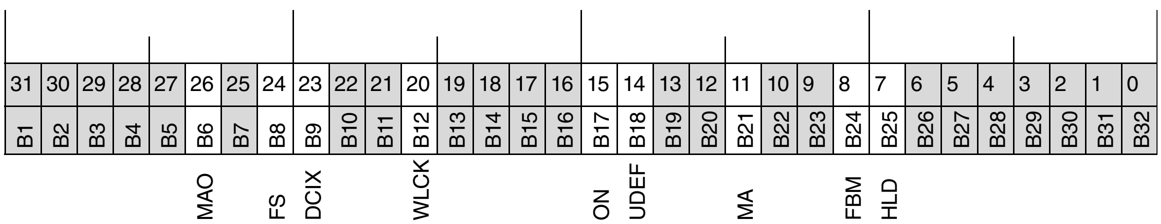
Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

AUTSW

Auto Switch forces the block mode to Auto. It is of higher priority than configured, set, or linked values in MA, or the value of INITMA. It is of lower priority than MANSW, however. If both MANSW and AUTSW are true, the block mode is forced to Manual.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate various block operational states. For the PAKOUT block, only the following bits are used:



Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
7	HLD	Block Output Holding	BLKSTA.B25
8	FBM	Bad Status of ECB	BLKSTA.B24
11	MA	Manual = 0, Auto = 1	BLKSTA.B21
14	UDEF	Block Undefined	BLKSTA.B18
15	ON	Block On	BLKSTA.B17
20	WLCK	Access Locked	BLKSTA.B12
23	DCIX	Enhanced DCI block (*CP270 and Later Only*)	BLKSTA.B9
24	FS	Fail-Safe Active	BLKSTA.B8
26	MAO	M/A Override Active	BLKSTA.B6

* Bit 0 is the least significant, low order bit.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing (see ERCODE for the list of all possible validation errors in this block). In that case, no further processing of the block occurs, including further validation of remaining parameters. To return DEFINE to a true value, you should correct all configuration errors and re-install the block.

DESCRP

Description is a user-defined string of up to 32 characters used to describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

DEV_ID

Device Identifier is a character array that specifies the 6-character identifier of the connected device. It is copied from the DEV_ID configured in the ECB specified by the IOM_ID parameter.

ERCODE

Error Code is a character data store which indicates the type of configuration error which caused the block's DEFINE parameter to be set false. Validation of configured parameters does not proceed past the first error encountered by the block logic. Each nonzero value of ERCODE results in an explanatory message at the block's detail display. For the PAKOUT block, the following list shows the possible messages you may see:

ERCODE Message	Meaning
W52 – INVALID I/O CHANNEL/GROUP NUMBER	The first character of PKCOGP is blank.
W62 – UNRESOLVED CONNECTION	Connection is not yet resolved. (Block remains defined.)
W65 – INVALID POINT ADDRESS	FBM parsing algorithm found that PKCOGP is invalid
W66 – DUPLICATE CONNECTION	There is a duplicate connection to a point.
W67 – INSUFFICIENT FBM MEMORY/CONNECTIONS	There is no available memory or point connections in the FBM.
W68 – INVALID DEVICE CONNECTION	The device connection is invalid.
W69 – INVALID POINT CONNECTION	The point connection is invalid.

IN1-32

Binary Inputs 1 to 32 are the values used as the inputs when the block is in Auto mode. They normally originate from upstream blocks in the control strategy.

INITMA

Initialize Manual/Auto specifies the desired state of the MA input under certain initialization conditions, namely:

- The block has just been installed into the I/A Series control station database.
- The I/A Series control station is rebooted.
- The compound in which the block resides is turned on.
- The INITMA parameter is modified via the Integrated Control Configurator.

INITMA is ignored if MA has an established linkage.

When INITMA is asserted, the value set into MA is:

- 0 (Manual) if INITMA = 0
- 1 (Auto) if INITMA = 1
- The MA value from the checkpoint file if INITMA = 2.

INITPO

Initialize Packed Output is a cascade initialization signal which is set true by the block logic whenever the cascade is opened. You should connect INITPO to the INITI input of each upstream block.

IOM_ID

ECB Identifier is a configurable string that specifies the pathname of the ECB201 for the device, for the purpose of connecting to (accessing) a field parameter that resides in a field device hosted by a (parent) ECB200/202.

IOM_ID has the form CompoundName:BlockName, where CompoundName is the 1-12 character name of the local compound containing the ECB, and BlockName is the 1-12 character block name of the ECB.

If the compound containing the ECB is the CPletterbug_ECB compound where CPletterbug is the station letterbug of the CP, the CompoundName may be omitted from the IOM_ID configuration. In this case, the 1-12 character ECB block name is sufficient.

Note: Once configured, IOM_ID may not be modified. A delete/undelete operation will NOT allow IOM_ID to be changed. The block must be deleted and then re-entered into the data base. IOM_ID may then be reconfigured.

LOCKID

Lock Identifier is a string identifying the workstation that has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.

LOCKRQ

Lock Request is a Boolean input, which can be set true or false only by a set command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion, a workstation identifier accompanying the set command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.

LOOPID

Loop Identifier is a configurable string of up to 32 characters used to identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.

MA

Manual/Auto is a Boolean input that controls the block's operating state (0 = false = Manual; 1= true = Auto). When in Auto, the block input is taken from IN1-32, usually from upstream connections. In Manual, the input is taken from the request component of PAKCO.

MANSW	Manual Switch unconditionally forces the block mode to Manual. It is of higher priority than any other method of establishing the value MA, since it overrides configured, set, or linked values. MANSW is also of higher priority than AUTSW or INITMA.
NAME	Name is a user-defined string of up to 12 characters used to access the block and its parameters.
OWNER	Owner is a settable string of up to 32 ASCII characters used to allocate control blocks to applications. Attempts to set OWNER are successful only if the present value of OWNER is the null string, an all-blank string, or identical to the value in the set request. Otherwise, the request is rejected with a LOCKED_ACCESS error. OWNER can be cleared by any application by setting it to the null string. This value is always accepted, regardless of the current value of OWNER. Once set to the null string, the value can then be set as desired. This parameter is set by an Object Manager get/set call. Refer to *Object Manager Calls* (B0193BC) for more information.
PAKCO	Packed Output is the output of the PAKOUT block. Its request component contains the packed long value sent to the external device per PKCOGP specification (addressing), and its confirmed component contains the device readback.
PAKREQ	Packed Request displays the value of the request component of PAKCO at all times, for diagnostic purposes. PAKREQ cannot be set or configured.
PERIOD	Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PFSOUT	Packed Fail-Safe Output is the fail-safe value configured in the PAKOUT block and downloaded into the FBM. It is used by the FBM, if the PFSOPT option is set in the PAKOUT block, to assert fail-safe action to the packed boolean output of the field device. The actions taken by the FBM (for example, whether or not the FBM sends the fail-safe value to the field device) are unique to the particular FBM subsystem. Refer to the subsystem user guide for descriptions on how fail-safe functionality is implemented for specific FBM types. PFSOUT is also used to set the initial output value when the PAKOUT block is installed and when the CP station is rebooted.

This parameter is currently not supported by Modbus FBM224.

PFSOPT

Packed Fail-Safe Option is a configurable option that specifies the fail-safe conditions and action to be taken in an FBM for the output point in the PAKOUT block:

0 = no fail-safe option

1 = assert fail-safe if control station-to-FBM communication is lost (FBM option). This option will be enabled only if fail-safe is enabled at the FBM level via the FSENAB parameter in ECB200 or ECB202.

This parameter is currently not supported by Modbus FBM224.

PHASE

Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the I/A Series Station is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PKCOGP

Packed Output Group Address identifies the address in the external device memory (or external device data stream) to which the block output is directed. It is a string whose syntax depends on the make and model of the external device.

- For the FDSI (FBM230/231/232/23), PKCOGP contains a data identifier to identify, to the FBM, specific data in the I/O data stream and to specify the elements of the data. Refer to *Field Device System Integrators (FBM230/231/232/233) User's Guide* (B0700AH) for more information.
- For the FBM223 PROFIBUS interface, PKCOGP must be configured to contain a PROFIBUS data identifier. This information identifies, to the FBM, the address of the input data unit from the device. Refer to *PROFIBUS-DP Communication Interface Module (FBM223) User's Guide* (B0400FE) for further details.
- For the FBM222 Redundant PROFIBUS interface, the PKCOGP configuration string uses the FBM223 syntax with extensions for PROFIBUS-PA status, custom status and other features. Refer to *Implementing PROFIBUS Networks in Foxboro Control Software Applications* (B0750BE) for further details.
- For the HART interface (FBM214/214b/215/216/216b/218/244/245/247), PKCOGP must be configured to contain a point address. This information identifies, to the FBM, specific data in the HART data stream that is to serve as the device data input to this block. Refer to *HART Communication Interface Modules User's Guide* (B0400FF) for details.
- For the Modbus interface (FBM224), PKCOGP must be configured to contain the address of a set of coils in a Modbus device.

Refer to *Modbus Communication Interface Module (FBM224) User's Guide* for details.

- For the FBM228, the point number syntax specifies reads of H1 device function block parameters using a client/server or publisher/subscriber connection, as described in *Implementing FOUNDATION fieldbus on an I/A Series System* (B0700BA), *Implementing FOUNDATION fieldbus* (B0750BC), and *Implementing FOUNDATION fieldbus in Foxboro Control Software Applications* (B0750DA).

PKCOPT

Packed Output Option is a non-settable short integer which can be set to either 1 or 3:

- 1 = bits in PAKCO parameter and in the packed output written to the FBM are swapped; IN1 causes the high-order bit to be set in the PAKCO parameter and the low-order bit to be set in the packed output written to FBM
- 3 = bits in PAKCO parameter and in the packed output written to the FBM are NOT swapped; IN1 causes the high-order bit to be set in both the PAKCO parameter and in the packed output written to FBM

PKMASK

This parameter is not supported.

PRIBLK

Primary Block specifies the cascade behavior of the PAKOUT block. When PRIBLK is 1, PAKOUT remains in Holding for PRITIM seconds when the cascade has been opened.

Use PRIBLK in a cascade situation when the source of the block's input connection needs to be initialized.

Be aware that the combination of PRIBLK = 1 and PRITIM = 0.0 is invalid.

When PRIBLK = 0, PAKOUT ends the Hold after one cycle.

PRITIM

Primary Cascade Timer is a configurable parameter used to delay the closing of the cascade to a primary block when the output is initialized in the PAKOUT block. It is used only if the PRIBLK option is set. If PRITIM = 0 and PRIBLK is used, the cascade remains open indefinitely, or until acknowledged by the primary block.

RBKTIM

Read-back Timer is a configurable parameter used to time-out changes made by the I/A Series system to the output of the PAKOUT block. If the output change is not confirmed within the allowable time-out, the output is re-initialized to the read-back value.

SIMOPT
(CP270 and Later Only)

Simulation Option is a configurable parameter that specifies whether the block input/output value is to be simulated. In the PAKOUT block, the inputs IN_1 through IN_32 are packed into PAKCO directly each block cycle when the block is in Auto to simulate confirmation by the field device. TSTAMP is updated by the FCP280 or CP270 each time PAKCO is changed.

TSTAMP
: Time Stamp is a long integer output that represents the time, in milliseconds since midnight, of the most recent updated input/output in a DCI block. This time stamp is supplied either by the FBM or by the I/A Series control station, depending on the type of FBM. If supplied by the FBM, TSTAMP indicates the time of the latest updated value in the FBM. If supplied by the I/A Series control station, TSTAMP indicates the time of the latest updated value in the I/A Series control station.

TYPE
: When you enter "PAKOUT" or select it from a configurator list, an identifying integer is created specifying this block type. For this block, the value of TYPE is 142.

UPDPER
: Update Period is a configurable, non-settable long integer that is used to specify the update period for client/server connections scheduled by the FBM228 to read the device function block View 1, View 2 and View 4 parameters. The range is 0 to 2147483647 milliseconds; the default is 10000.

95.5 Functions

95.5.1 Detailed Diagram

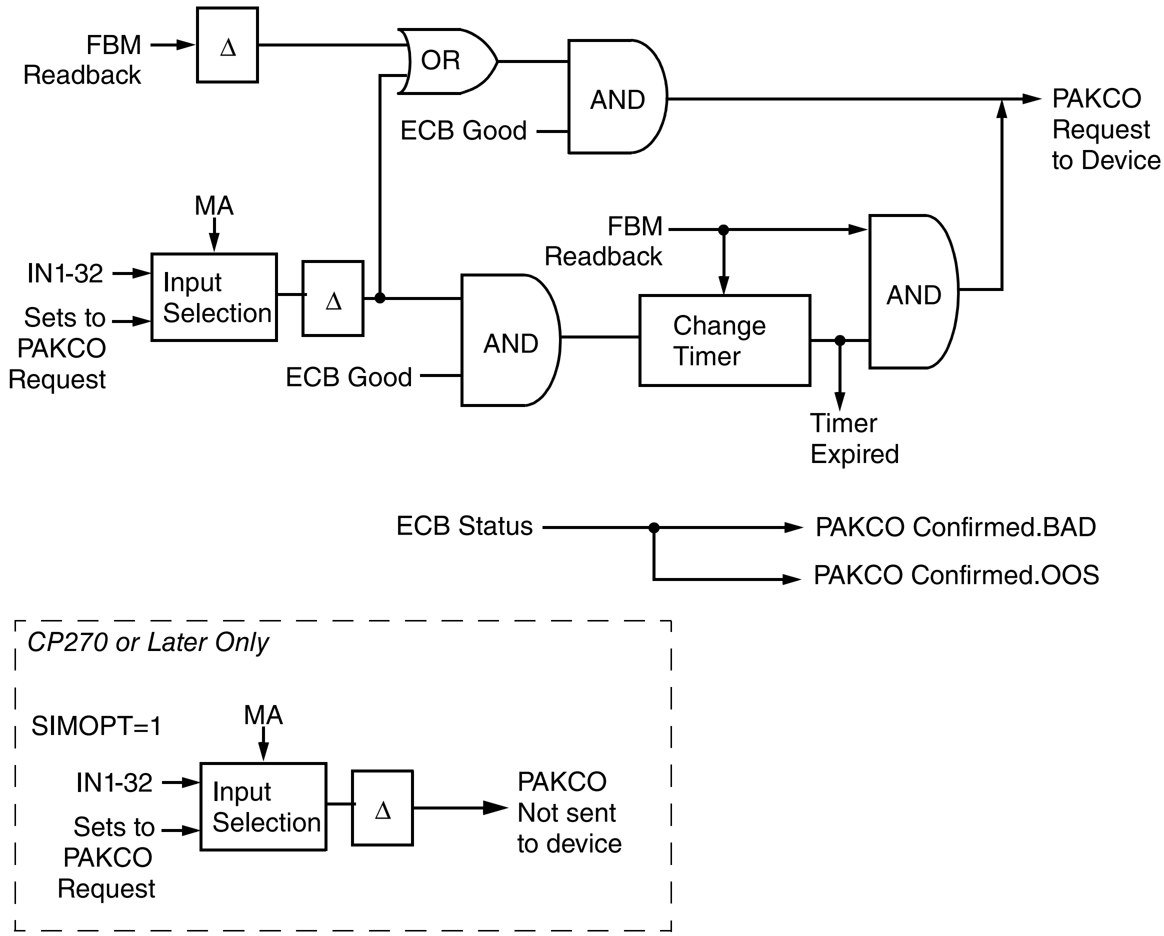


Figure 95-2. PAKOUT Block Operational Diagram

95.5.2 Associated ECBs

The configured parameter IOM_ID of the PAKOUT block specifies an ECB201 (the device ECB) to connect to a field parameter that resides in a field device hosted by an ECB200 (the FBM ECB). The PARENT parameter of the ECB201 specifies the associated ECB200 hosting the field device.

95.5.3 DCI Connection

The PAKOUT block establishes one DCI connection to the specified ECB in any one of the following instances:

- The I/A Series control station in which it resides has just been rebooted.
- The block has just been installed.
- A parameter of the block has been modified by the ICC or FoxCAE configurator.
- A device or parent ECB specified by the PAKOUT block has just been installed.

A DCI connection is added to a linked list of all the DCI connections, of any type, for all blocks specifying the same ECB. This arrangement permits multiple DCI blocks, of differing data types, to communicate with a single device at input/output scan time. It also allows multiple DCI connections in the same DCI block to be established when required (for example, connections in redundant type DCI blocks or INI_PT connections in certain output type blocks).

These parameter connections are made by the FBM on a client/server basis at the frequency specified in the UPDPER parameter. The parameter can be set from 0 to 2147483647 milliseconds; the default is 10000 (10 seconds). Increasing the frequency of the client/server communication can significantly add to the load on the H1 segment.

The DCI connection is deleted (that is, the linkage is removed from the linked list for the ECB) when the PAKOUT block is deleted.

95.5.4 Destination of Output Data

The device group address receiving the output value is configured as a string in PKCOGP. (If the first character of PKCOGP is blank, the block is set undefined.)

The format of PKCOGP is bus specific and device specific. When the PIO maintenance task runs after the DCI connection has been made, (see “DCI Connection” above), the PKCOGP string used by the block is passed to the FBM for parsing and validation. In DCI blocks, address identification strings are not parsed by the I/A Series control station.

If the first character of PKCOGP is blank, the PKCOGP string is not sent to the FBM, and the block is set undefined with ERCODE = 52. The detail display shows “W52 – INVALID I/O CHANNEL/GROUP NUMBER”.

In all the following cases, the block is also set undefined:

- If the FBM parsing algorithm finds that PKCOGP is invalid, the detail display shows “W65 – INVALID POINT ADDRESS” with ERCODE = 65.
- If there is a duplicate connection to any point, the detail display shows “W66 – DUPLICATE CONNECTION” with ERCODE = 66.
- If there is no available memory in the FBM, or if the maximum number of connections have been allocated in the FBM, the detail display shows “W67 – INSUFFICIENT FBM MEMORY/CONNECTIONS” with ERCODE = 67.
- If the device connection is invalid, the detail display shows “W68 – INVALID DEVICE CONNECTION” with ERCODE = 68.
- If the point connection is invalid, the detail display shows “W69 – INVALID POINT CONNECTION” with ERCODE = 69.

In the following case, the block remains defined:

- If the connection is not yet resolved, the detail display shows “W62 – UNRESOLVED CONNECTION” with ERCODE = 62.

95.5.5 Confirmed Output Parameters

As with most output parameters in DCI blocks, PAKCO is a confirmed output. A confirmed output contains two values: a request value and a read-back value. The request value is changed by an I/A Series user and sent to the external device. The read-back value is the value read back each block cycle from the FBM. In the PAKOUT block, the request value is available as parameter PAKREQ. Also, the read-back value is visible to the user as parameter PAKCO.

The following documentation convention is used: if the name of a confirmed parameter is, for example, PARM, then its request value is referred to as PARM_request and its read-back value is referred to as PARM_readback.

95.5.6 Status of PAKCO

The status of the PAKCO output is checked, together with the status of the connected ECB, and the status of the PAKCO parameter is then set according to the following rules:

The status of the confirmed block output PAKCO is set to Out-of-Service if:

- The status of the connected ECB indicates that the field device is Off-line or Out-of-Service.
- The connected ECB is an ECB201 (device ECB) and its device status parameter indicates that the connection is unresolved.
- The DCI connection cannot be configured due to lack of configuration information in the FBM database.
- The DCI is not yet connected, that is, the PIO maintenance task has not yet sent the DATA_CONNECT message to the FBM for the linked-list addition described under "DCI Connection" above.
- The connection status information indicates that there is an unresolved DCI connection. (In this case, ERCODE is set to 62. The detail display shows "W62 – UNRESOLVED CONNECTION".)
- The DCI connection status information, which specifies the condition of the accessed device parameter, indicates Out-of-Service, meaning (in general) that the parameter value is unavailable, or
- The connection status information indicates disconnected, meaning (in general) that the parameter is not connected or not defined.

The status of PAKCO is set to Bad if:

- The ECB status indicates that the field device has failed.
- The DCI connection status information indicates a bad value for the field device parameter.

The status of PAKCO is set to Error if:

- The status information indicates an uncertain or questionable value for the field device parameter.
- No processing is performed in any cycle in which PAKCO is either Bad or Out-of-Service.

95.5.7 Auto/Manual Arbitration

Auto/manual mode selection arbitrates between inputs by the operator or application programs (Manual) and inputs from the control strategy (Auto). Parameters MA, INITMA, AUTSW, and MANSW are used to establish the control mode of the block.

95.5.8 Inputs in Auto Mode

In Auto, the input parameters IN1-IN32 are used to drive the output. Upstream blocks may connect to one or more of IN1-IN32 or, if any of the INx parameters is unlinked, it is settable by operator action. IN1-IN32 are used only on a change-driven basis. If the value of an IN differs from its value on the last cycle, the new value of that bit position is set into PAKCO_request. An output change mask is maintained to identify which bit positions are new. In either Auto or Manual mode, PAKREQ contains the value in PAKCO_request, for display in user-created displays or access via Object Management Access (OMA).

95.5.9 Inputs in Manual Mode

In Manual, the values set into PAKCO_request are used to drive the output. As in the case of IN1-IN32 in Auto, PAKCO_request only acts on a bit-wise change basis. The output change mask identifies which of the bit positions have changed on this cycle. PAKCO_readback continues to monitor value changes from the device when in Manual.

95.5.10 Read-Back Changes

The read-back value from the external device is always copied into PAKCO, regardless of the auto/manual state. A read-back change mask, similar to the output change mask, is maintained to identify which bit positions of the readback are new (that is, differ from the corresponding PAKCO bits) before the updating occurs.

95.5.11 Output Processing

The first step in output processing is to merge and reconcile the two masks: the output change mask and the read-back change mask. If the same bit is changed by the I/A Series system and by the field device (via the readback) on any one cycle, the I/A Series change is accepted for that bit, and the read-back change is ignored. In this way, the field device remains informed of I/A Series system changes at all times. Thus, when the same bit is true in the two masks, that bit is reversed to zero in the read-back mask. The net effect is that the bit is considered only an I/A Series (output) change. Note that the two masks are now mutually exclusive.

For all true bits in the output change mask, the I/A Series value for that bit is written into the output data value. For all true bits in the read-back change mask, the read-back value for that bit is written into the output data value. The output data value is, therefore, a merger of the changes from both directions. In the general case, there may be certain bits of the output data value which are changed by neither side, and may be considered "don't care" positions. The two masks are merged into a single mask which is sent to the device via the DCI connection (see "DCI Connection" above), together with the final output data value. Therefore, the identification of the "don't-care" bits is possible, and they can be handled in a device dependent way.

If the only true bits in the merged output mask are the result of read-back changes, with none resulting from output changes (or if there are no changes from either side), no writing of the output occurs. If at least one bit is the result of output changes from the I/A Series side, the final output data value consists of a merger of the two types of change, and is sent to the field device.

95.5.12 Initialization and Cascade Processing

The PAKOUT block initializes whenever the block is restarted, or there is either a bad-to-good transition of PAKCO or an Out-of-Service to good transition of PAKCO (see "Status of PAKCO" above). Initialization consists of turning on INITPO and opening the upstream cascade. INITPO may be connected to the INITI inputs of the blocks immediately upstream from the PAKOUT block, if those blocks support an INITI input. The upstream blocks (the blocks connected to the INx inputs) are then commanded to run immediately. This feature causes a "Run" flag in the header of the upstream blocks to be set, causing the compound processor to execute those blocks on the next BPC, without regard to their periods and phases.

If there is no support for cascade processing in the upstream blocks, PRIBLK should be configured as 0. In this case, the cascade is held open for one cycle. If cascade closure is to be delayed until a specific time constant has expired, then PRIBLK should be configured as 1, and the time constant should be configured into PRITIM. (The ACK option, normally specified by configuring PRITIM as 0.0, is not supported. It results in a configuration error at validation time).

On the initialization cycle, the entire readback is considered newly changed. The final output data value consists of the entire readback only, and all bits of the output data mask are set true.

95.5.13 Unlinked IN Inputs

If any of the IN parameters is unlinked, the read-back value for that bit position is set into an unlinked IN on each cycle, thus serving as the baseline for further change-driven determinations.

95.5.14 Change Timer

A change timer is initialized to the value of RBKTIM (in seconds) each time any bit is changed by the I/A Series side. It is then decremented on each cycle for which there is no change from the I/A Series system.

If the timer expires, or a transition to Manual occurs, the entire read-back value is passed to the DCI connection as the final output. This serves only for initialization purposes, however, since all "write flags" in the DCI connection are forced to zero. No writing to the external device can occur without output changes from the I/A Series end.

95.5.15 Fail-Safe Functions

Fail-safe support is based on the following parameters:

- ♦ PFSOPT: This configured value specifies the condition(s) under which fail-safe is to be asserted.
- ♦ PFSOUT: This configured value specifies the fail-safe value that is to be used by the FBM when any condition specified in PFSOPT exists.

The PFSOPT conditions are:

- ♦ Go into fail-safe using the PFSOUT value when communications between the I/A Series control station and the FBM is lost. This action is carried out by the FBM software. This option will be enabled only if fail-safe is enabled at the FBM level via the FSENAB parameter in ECB200 or ECB202.

If PFSOPT is set, and PAKCO is not Bad or Out-of-Service, the fail-safe value is sent to the FBM when the PAKOUT block is shut down. This happens when turning off the compound containing the PAKOUT block and when deleting the PAKOUT block or the compound containing the PAKOUT block from the CP database. The actions taken by the FBM (for example, whether or not the FBM sends the fail-safe value to the field device) are unique to the particular FBM subsystem. Refer to the subsystem user guide for descriptions on how fail-safe functionality is implemented for specific FBM types.

In addition, the PFSOUT value is sent to the field device via the FBM when the CP is rebooted. This action is independent of the PFSOPT configuration.

95.5.16 Simulation (CP270 and Later Only)

With I/A Series software v8.4 or later, simulation of the PAKOUT block is supported on the FCP280, FCP270 and ZCP270. It is not supported on earlier control processors.

When Simulation Option (SIMOPT) is configured true, there is no DCI connection established for the block. In Auto mode, the IN_1 through IN_32 inputs are packed into PACKCO parameter each block cycle, simulating feedback fro the field device. In Manual mode, PACKCO is updated each block cycle with changes to PAKCO_request.

When SIMOPT = 1, the auto/manual switching function operates as is does in normal operation (Section 95.5.7).

95.5.17 Time Stamp

The time stamp (TSTAMP) parameter of the block is updated every time there is a change in the value of PAKCO. TSTAMP, which is expressed in units of milliseconds past midnight, is read from the FBM when it is available there; otherwise, it is computed by the I/A Series control station.

NOTE

For a FOUNDATION fieldbus connection, a 4-byte ms since midnight timestamp is provided by the FOUNDATION fieldbus FBM and stored in the TSTAMP parameter.

96. PATALM – Pattern Alarm Block

This chapter describes PATALM (Pattern Alarm Block), including its features, parameters and detailed operations.

96.1 Overview

The Pattern Alarm block, PATALM, provides masking, bit compare, and alarming capabilities for a specific pattern of up to 16 boolean inputs.

96.1.1 I/O Diagram

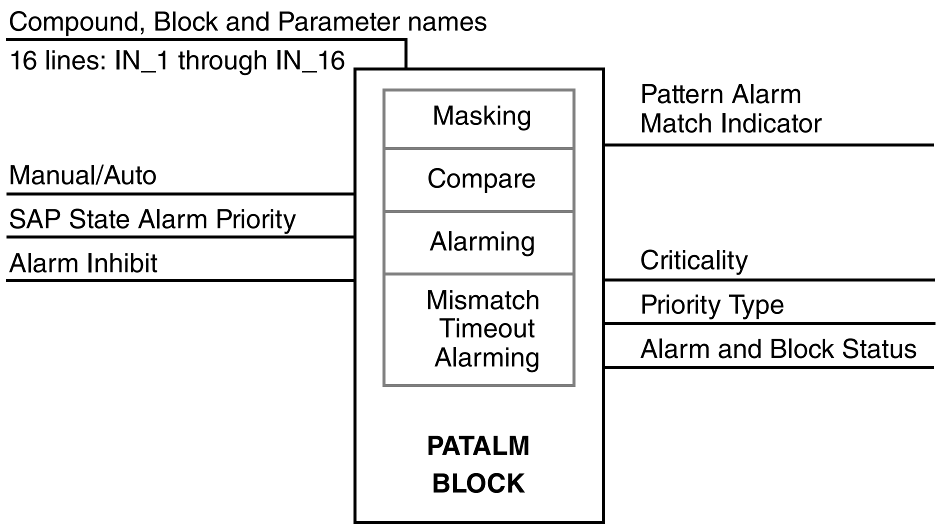


Figure 96-1. PATALM Block I/O Diagram

96.2 Features

The features are:

- ♦ Manual/Auto control of output
- ♦ Up to 16 boolean inputs
- ♦ Alarm message generation on pattern match
- ♦ Alarm message and alarm notification inhibiting
- ♦ State change alarming.

The options are:

- ♦ Mismatch alarming option, MMAOPT, which generates a state alarm on a mismatch of the configured pattern
- ♦ Inhibit Option (INHOPT) lets you specify alarm inhibit options.

96.3 Parameters

Table 96-1. PATALM Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	25	PATALM
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	0 to 2
IN_1 to IN_16	input point 1 to 16	boolean	con/set	0	0 to 1
PAT_1 to PAT_16	alarm pattern bit 1 to 16	boolean	no-con/set	0	0 to 1
MSK_1 to MSK16	alarm pattern mask 1 to 16	boolean	no-con/set	0	0 to 1
ANM	alarm name point 1	string	no-con/no-set	blank	1 to 12 chars
NM0	alarm state name	string	no-con/no-set	blank	1 to 12 chars
NM1	alarm state name	string	no-con/no-set	blank	1 to 12 chars
MMAOPT	mismatch alarm option	boolean	no-con/no-set	0	0 to 1
INHOPT	inhibit option	short	no-con/no-set	0	0 to 3
INHIB	alarm inhibit	boolean	con/set	0	0 to 1
SAP	state alarm priority	integer	con/set	5	[1..5]
SAG	state alarm group	short	no-con/set	1	[1..8]
AMRTIN	alarm regeneration timer	integer	no-con/no-set	0	0 to 32767 s
OUTPUTS					
ALMSTA	alarm status	pack_l	con/no-set	0	bit map
BLKSTA	block status	pack_l	con/no-set	0	bit map
CRIT	criticality	integer	con/no-set	0	[0..5]
INHSTA	inhibit status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
PIND	pattern indicator	boolean	con/no-set	0	0 to 1
PRTYPE	priority type	integer	con/no-set	0	[0..10]
UNACK	alarm notification	boolean	con/no-set	0	0 to 1
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
ALMOPT	alarm options	pack_l	no-con/no-set	0	0 to 0xFFFFFFFF
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	config error	string	no-con/no-set	0	1 to 43 chars
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars

96.3.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

ALMOPT

Alarm Options contains packed long values representing the alarm types that have been configured as options in the block, and the alarm groups that are in use. For the PATALM block, only the following unshaded bits are used

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1] (0 to 31)	Configured Alarm Option When True
0	Alarm Group 8 in Use
1	Alarm Group 7 in Use
7	Alarm Group 1 in Use

1. Bit 0 is the least significant, low order bit.

ALMSTA

Alarm Status is a 32-bit output, bit-mapped to indicate the block's alarm states. For the PATALM block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
	UNAK	INH			STA																				CRIT				PRTYPE		

Bit Number (0 to 31)[1]	Name	Description When True	Boolean Connection (B32 to B1)
0 to 4	PTYP_MSK	Priority Type: See parameter PRTYPE for values used in the PATALM block	ALMSTA.B32– ALMSTA.B28
5 to 7	CRIT_MSK	Criticality; 5 = lowest priority, 1= highest	ALMSTA.B27– ALMSTA.B25
26	STA	State Alarm - indicates alarm state when the block is in alarm	ALMSTA.B6

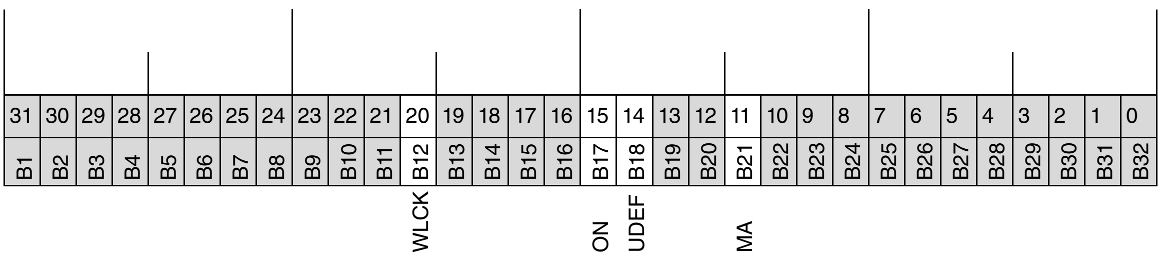
Bit Number (0 to 31)[1]	Name	Description When True	Boolean Connection (B32 to B1)
29	INH	Alarm inhibit	ALMSTA.B3
30	UNAK	Unacknowledged	ALMSTA.B2

[1] Bit 0 is the least significant, low order bit.

AMRTIN — Alarm Regeneration Timer is a configurable integer that specifies the time interval for an alarm condition to exist continuously, after which a new unacknowledged alarm condition and its associated alarm message is generated.

ANM — Alarm Name is a user-defined string of up to 12 characters that identify the input point as the source of the alarm in the alarm messages. It serves as a point descriptor label.

BLKSTA — Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the PATALM block, only the following bits are used:



Bit Number[1] (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
20	WLCK	Workstation Lock	BLKSTA.B12

[1] Bit 0 is the least significant, low order bit.

CRIT — Criticality is an integer output that indicates the priority, ranging from 1 to 5, of the block's highest currently active alarm (1 is the highest priority). An output of zero indicates the absence of alarms.

DEFINE — Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return

DEFINE to a true value, correct all configuration errors and re-install the block.

DESCRP

Description is a user-defined string of up to 32 characters that describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

ERCODE

Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block's DEFINE parameter to be set false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the PATALM block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
"W43 – INVALID PERIOD/ PHASE COMBINATION"	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
"W46 – INVALID INPUT CONNECTION"	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
"W48 – INVALID BLOCK OPTION"	The configured value of a block option is illegal.
"W53 – INVALID PARAMETER VALUE"	A parameter value is not in the acceptable range.
"W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK"	A Database Installer error has occurred.

INHIB

Inhibit is a boolean input. When true, it inhibits all block alarms; the alarm handling and detection functions are determined by the INHOPT setting. Alarms can also be inhibited based on the compound parameter CINHIB.

INHOPT

Inhibit Option specifies the following actions applying to all block alarms:

0 = When an alarm is inhibited, disable alarm messages but do not disable alarm detection.

1 = When an alarm is inhibited, disable both alarm messages and alarm detection. If an alarm condition already exists at the time the alarm transitions into the inhibited state, clear the alarm indicator.

2 = Same as 0 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

3 = Same as 1 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

INHSTA

Inhibit Status contains packed long values that represent the actual inhibit status of each alarm type configured in the block. For the PATALM block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
	UNACK	INH																													

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
29	INH	Inhibit Alarm	INHSTA.B3
30	UNACK	Unacknowledged	INHSTA.B2

* Bit 0 is the least significant, low order bit.

INITMA

Initialize Manual/Auto specifies the desired state of the MA input during initialization, where:

0 = Manual
1 = Auto
2 = The MA state as specified in the checkpoint file.

The block asserts this initial M/A state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a reboot operation.
- The compound in which it resides is turned on.
- The INITMA parameter itself is modified via the control configurator. (The block does not assert INITMA on ordinary reconfiguration.)

INITMA is ignored if MA has an established linkage.

IN_1 to IN_16	Inputs 1 through 16 are boolean inputs. They identify the upstream outputs that are being monitored by the inputs of the block.
LOCKID	Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.
LOCKRQ	Lock Request is a boolean input which can be set true or false only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.
LOOPID	Loop Identifier is a configurable string of up to 32 characters which identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.
MA	Manual Auto is a boolean input that controls the Manual/ Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. In Manual, the algorithm is not performed, and the output is unsecured. An external program can then set the output to a desired value.
MMAOPT	Mismatch Alarm Option specifies that a state alarm be generated when the masked input bit pattern mismatches a user-defined bit pattern in the PATALM block.
MSK_1 to MSK_16	
	Masks 1 through 16 are boolean inputs. When set true, MSK_1 enables a comparison of Bit 1 of the input bit pattern (IN_1–IN_16) against Bit 1 of a user-defined bit pattern (PAT_1–PAT_16). MSK_2 through MSK_16 apply to Bit 2 through Bit 16 in the same manner as MSK_1 is applied to Bit 1.
NAME	Name is a user-defined string of up to 12 characters used to access the block and its parameters.
NM0	Name 0 is a user-defined string of up to 12 characters. NM0 describes in alarm reports the action generated by the mismatch indicator MMAIND returning from alarm.

NM1	Name 1 is a user-defined string of up to 12 characters. NM1 describes, in alarm reports, the action generated by the mismatch indicator MMAIND going into alarm.
OWNER	Owner is a string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are successful only if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.
PAT_1 to PAT_16	Patterns Bits 1 through 16 are boolean inputs used for comparison against the corresponding bits of Inputs 1 through 16 (IN_1–IN_16). For example, Pattern Bit 1 is compared to IN_1.
PERIOD	Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PHASE	Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PIND	The Pattern Match Alarm Indicator output is set true when all the masked Inputs (IN_1–IN_16) match the corresponding pattern specified by Pattern Bits (PAT_1–PAT_16). Mask Bits (MSK_1 to MSK_16) determine which Inputs are compared to their corresponding Pattern Bits (see Figure 96-3).
PRTYPE	Priority Type is an indexed output parameter that indicates the alarm type of the highest priority active alarm. The PRTYPE output of this block includes the following alarm types: 0 = No active alarm 9 = State Alarm
SAG	State Alarm Group is a short integer input that directs mismatch alarm messages to the corresponding group of alarm devices. You can change the group number through the workstation.

SAP	State Alarm Priority is an integer input that sets the alarm priority for the mismatch alarm reporting (1 is the highest priority).
TYPE	When you enter "PATALM" or select "PATALM" from the block type list under Show, an identifying integer is created specifying this block type.
UNACK	Unacknowledge is a boolean output that the block sets to True when it detects an alarm. It is typically reset by operator action.

96.4 Functions

96.4.1 Detailed Diagram

Figure 96-2 is a simplified block diagram that depicts the functional signal flow of the PATALM block. It shows the forward path of the block as it relates to the various states, logic control signals, and options represented by toggle switches.

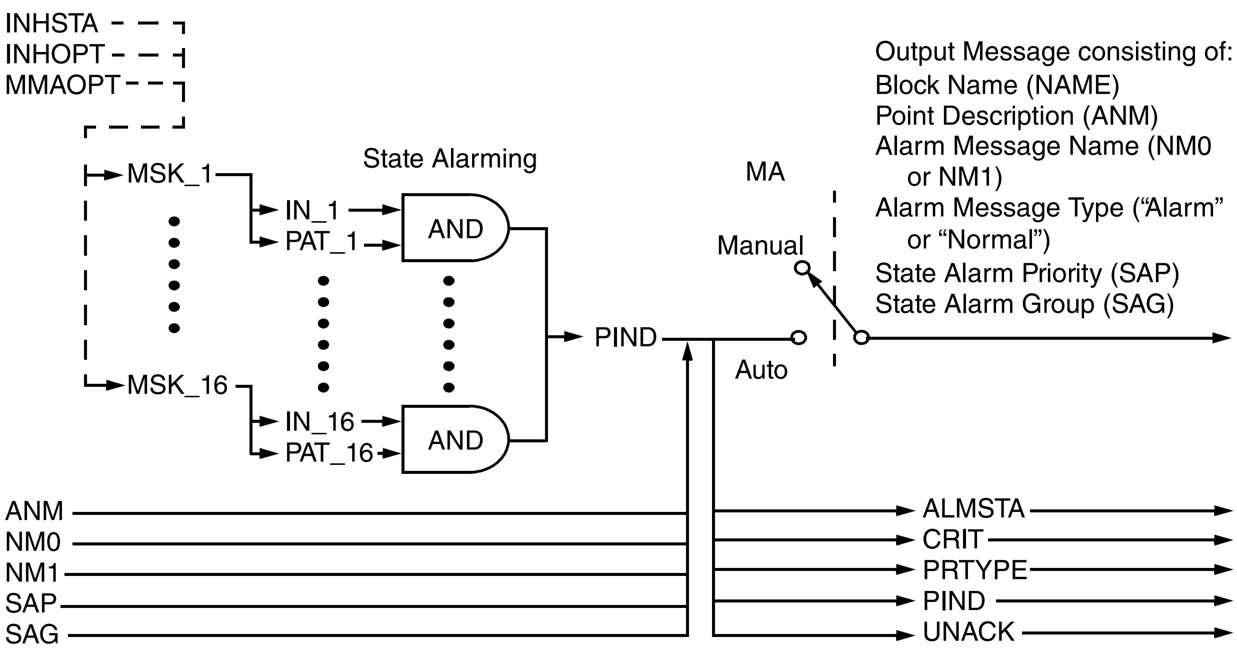


Figure 96-2. PATALM, Detailed Block Diagram

96.4.2 Detailed Operation

In Auto mode, the PATALM block reads the inputs (up to 16 inputs) and compares them to the set of mask bits (MSK_1 through MSK_16). All input bits with a corresponding mask bit set to true (T) are considered "masked". These bits are flagged for testing against a set of pattern bits (PAT_1 through PAT_16), to determine if there are any mismatches.

This is illustrated in Figure 96-3.

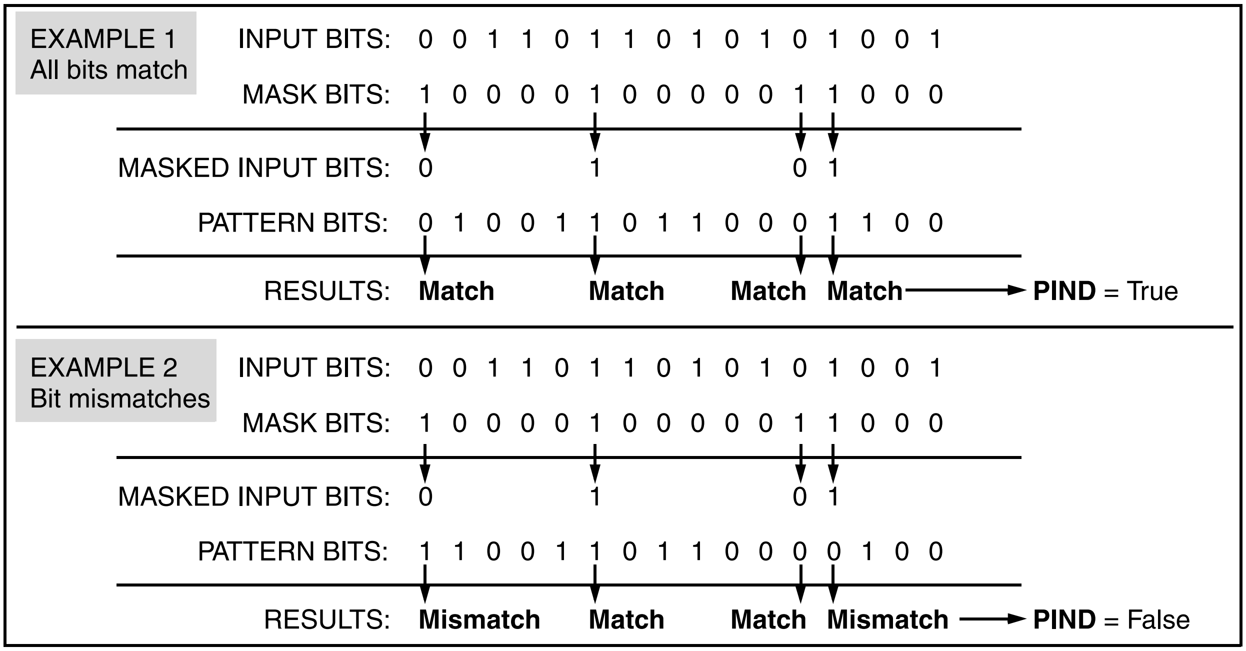


Figure 96-3. Input, Mask, and Pattern Bit Comparison

Each of the masked input bits is compared with a pattern bit having the same bit position as the input bit (for example, a masked IN_2 is compared to PAT_2).

If all the tested bits match, the pattern match indicator, PIND, is set true and, unless inhibited, an alarm message is generated. The message includes the following information:

- The Block Name (NAME)
- The Point Descriptor (ANM)
- The Alarm State Name (NM0 if going to the mismatched state, or, NM1 if going to the matched state)
- Alarm Message Type (“Alarm” or “Normal”)
- Priority (SAP)
- Group (SAG).

If any of the tested bits do not match, the pattern match indicator, PIND, is set false and, unless inhibited, the state alarm is initiated, indicated via the above message. This state alarm continues until PIND is set to true.

All input bits with a corresponding mask bit set to false (F) are not tested. “Don’t Test” means the position always matches – unless all positions are “Don’t Test”, in which case the block does not generate a match alarm.

96.4.3 Initial PATALM Configuration

Key Parameters: IN_1 to IN_16, MSK1 to MSK16, PAT_1 to PAT_16

Set up the Pattern Alarm (PATALM) block operation by:

1. Configuring as many of the boolean inputs, IN_1 to IN_16, as you want in the pattern.

2. Establishing which bits are to be tested by inputting the MSK_x parameters at configuration or on-line, through the workstation.
3. Establishing the pattern to be matched by inputting the PAT_x parameters at configuration or on-line, through the workstation.

96.4.4 Block States

The PATALM block has three states: Initialization, Manual and Auto.

96.4.4.1 Initialization

Key Parameters: INITMA

At initialization, the block initializes MA. DEFINE is set to 0 if any configured parameters fail validation testing.

96.4.4.2 Manual

Key Parameters: MA

In Manual, pattern matching is inhibited and the pattern match indicator, PIND, is set to false. PIND is unsecured and can be set by an external task or program to simulate process conditions.

96.4.4.3 Auto

Key Parameters: MA

In Auto mode, the block operates as described in this chapter.

96.4.5 Inhibit Alarming

Key Parameters: ALMSTA, CINHIB, CRIT, INHALM, INHIB, INHOPT, MMAOPT, PIND, PRTYPE

INHALM is a parameter that is used in conjunction with the CINHIB compound parameter and the INHIB block parameter to determine which alarm types/points are to be inhibited in the block. See Table 96-1 for its formatting.

The INHOPT parameter specifies the actions to be taken when alarms are inhibited in the block. When INHIB, CINHIB and INHALM specify that alarms are to be inhibited, and INHOPT = 1 or 3, indicating that alarm detection itself is disabled, the following actions are taken:

- PRTYPE is cleared to zero.
- CRIT is cleared to zero.
- ALMSTA.STA is cleared to false.
- PIND is cleared to false.

MMAOPT is a boolean inhibit option parameter which enables/disables state alarming.

96.4.6 Alarm Response and Return to Normal Transition

Key Parameters: ALMSTA, CRIT, NM0, NM1, PIND, PRTYPE, UNACK

When alarm conditions are detected (PIND=false), PRTYPE and CRIT are set to the highest priority alarm in the block, and message NM1 is sent to the appropriate device. PRTYPE reflects the alarm type of the highest priority active alarm, and CRIT is set to this alarm's priority level. The corresponding bits in ALMSTA are set to 1. The UNACK parameter is set to 1.

Unacknowledge (UNACK) is a boolean output parameter which is set true, for notification purposes, whenever the block goes into alarm. It is settable, but sets are only allowed to clear UNACK to false, and never in the opposite direction. The clearing of UNACK is normally via an operator "acknowledge" pick on a default or user display, or via a user task. UNACK remains unchanged until the acknowledge, after which it reverts to 0.

If the block detects a transition out of alarm, PIND, PRTYPE, CRIT, and the appropriate ALMSTA bits are reset, and the message NM0 is sent to the appropriate device.

97. PATT – Pattern Block

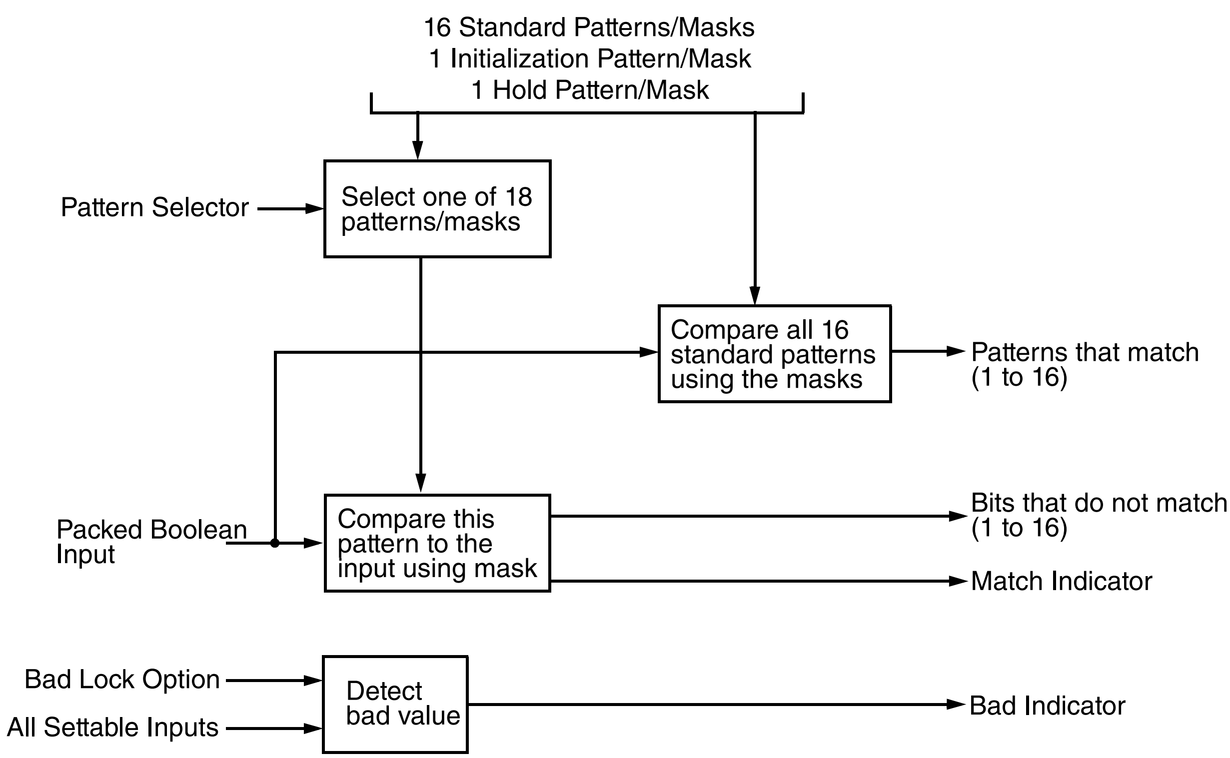
This chapter gives a general overview of the PATT (Pattern Block), including its basic operations, features, parameters, and functions and provides an application example.

97.1 Overview

The Pattern (PATT) block is configured with up to 16 standard patterns, a hold pattern, and an initialization pattern; each pattern contains up to 16 boolean values (see Figure 97-1). The block compares the requested pattern against a 16-bit packed boolean input and outputs indications of:

- Whether the input matches the specified pattern or not
- Which bits in the input do not match the specified pattern
- Which, if any, of the 16 standard patterns match the input.

The PATT block easily interfaces with the STATE block. PATT blocks can be cascaded to handle patterns of more than 16 bits.



97.2 Basic Operation

The PATT block compares one of 16 preconfigured boolean patterns (16 bits each) against a packed boolean input (PAKINP) parameter for the bits specified by the pattern mask. The pattern select (PATSEL) parameter specifies the pattern to be compared and the match boolean (MATCHB) parameter indicates whether the pattern matched PAKINP or not.

In addition, there is a process initialization pattern (PTRN_I) and process hold pattern (PTRN_H) that can be selected by PATSEL.

The match output (MCHOUT) parameter is a 16-bit packed boolean that contains the match status for all 16 patterns, that is, each bit is assigned to a specific pattern. The mismatch (MMATCH) output parameter is a 16-bit packed boolean that contains the mismatch status for all bits in the pattern, that is, each bit is assigned to a specific pattern bit.

If more than 16 boolean inputs need to be compared, PATT blocks can be cascaded.

97.3 Features

The PATT block provides the following features:

- Compares up to 18 preconfigured patterns (16 bits each) against a packed boolean input for the bits specified by the associated pattern mask.
- Provides a boolean output that indicates the pattern match status for the selected pattern.
- Provides a packed boolean output that contains the pattern match status for patterns 1 to 16, that is, each bit is assigned to a specific pattern.
- Provides a packed boolean output that contains the pattern mismatch status for each bit in the selected pattern, that is, each bit is assigned to a specific pattern bit.
- Can be cascaded to provide the pattern match indication when more than 16 process variables need to be compared.
- Provides process initialization and hold patterns.
- Provides an option to lock out updating of the match and mismatch outputs if the input parameter is out-of-service (OOS), bad (BAD), or off-scan (OFF). These outputs retain their last good value.
- Supports the standard block-level manual/auto capability for all of its outputs.

97.4 Parameters

Table 97-1. PATT Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
Configured Parameters					
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	78	PATT
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 10
PHASE	block phase number	integer	no-con/no-set	0	see param def
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	0 to 2
MTHOPT	match option	boolean	no-con/no-set	0	0 to 1

Table 97-1. PATT Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
MATCHF	feedback drive	boolean	con/set	0	0 to 1
PATSEL	pattern number	integer	con/set	0	0 to 17
PAKINP	packed input	pack_b	con/set	0x0000	0x0000 to 0xFFFF
PTRN_I	initialize pattern	pack_b	no-con/set	0x0000	0x0000 to 0xFFFF
MASK_I	mask for Initialize	pack_b	no-con/no-set	0xFFFF	0x0000 to 0xFFFF
CNAM_I	name for initialize	string	no-con/no-set	blank	1 to 32 chars
PTRN_H	hold pattern	pack_b	no-con/set	0x0000	0x0000 to 0xFFFF
MASK_H	mask for hold	pack_b	no-con/no-set	0xFFFF	0x0000 to 0xFFFF
CNAM_H	name for hold	string	no-con/no-set	blank	1 to 32 chars
PTRN01 to PTRN16	patterns 1 to 16	pack_b	no-con/set	0x0000	0x0000 to 0xFFFF
MASK01 to MASK16	masks 1 to 16	pack_b	no-con/no-set	0xFFFF	0x0000 to 0xFFFF
CNAM01 to CNAM16	pattern names 1 to 16	string	no-con/no-set	blank	1 to 32 chars
BADLCK	bad input lock	boolean	no-con/no-set	0	0 to 1
Non-Configured Parameters					
OUTPUTS					
BADIND	health problem	boolean	con/no-set	0	0 to 1
BLKSTA	block status	pack_1	con/no-set	0x00...0	0 to 0xFFFFFFFF
MATCHB	match indicator	boolean	con/no-set	0	0 to 1
MCHOUT	matched patterns	pack_b	con/no-set	0x0000	0x0000 to 0xFFFF
MMATCH	mismatched patterns	pack_b	con/no-set	0x0000	0x0000 to 0xFFFF
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	configuration error	string	no-con/no-set	2 blanks	0 to 14 chars
LOCKID	lock identifier	string	no-con/no-set	2 blanks	1 to 32 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	0 to 32 chars

97.4.1 Parameter Definitions

ACHNGE
: Alternate Change is a integer output that is incremented each time a settable parameter is changed externally. It wraps around from 32767 to -32768.

BADIND
: Bad Indication is a boolean output that is set true when BADLCK is true and one of the settable inputs is unhealthy, that is, out-of-service (OOS), bad input/output (BAD), or off-scan (OFF).

BADLCK
: Bad Lock is a boolean input, that when true, sets MATCHB to false and BADIND true if a settable input is unhealthy, that is, bad I/O (BAD), out-of-service (OOS), or off-scan. MCHOUT and MMATCH retain their last good value excepting:

- ♦ If PAKINP is healthy, MCHOUT is always updated.
- ♦ If only MATCHF is unhealthy and MTHOPT is true (cascade configuration), then MMATCH is always updated.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate various block operational states. The PATT block uses only the following bits:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
										WLCK						ON	UDEF			MA											

Bit Number* (0 to 31)	Name	Description	Boolean Connection (B32 to B1)**
11	MA	(0 = Manual, 1 = Auto)	BLKSTA.B21
14	UDEF	(1 = Block Undefined)	BLKSTA.B18
15	ON	(1 = Compound ON)	BLKSTA.B17
20	WLCK	(1 = Workstation Lock)	BLKSTA.B12

* Bit 0 is the least significant, low order bit.

CNAM01 to CNAM16

Character Names 1 through 16 are user-defined strings of up to 32 characters each that describe patterns PTRN01 through PTRN16.

CNAM_H

Character Name for Hold pattern is a user-defined string of up to 32 characters that describes pattern PTRN_H.

CNAM_I

Character Name for Initialization pattern is a user-defined string of up to 32 characters that describes pattern PTRN_I.

DEFINE

Define is a boolean data store which when true indicates that the block has no configuration errors. It is the inverse of UDEF in parameter BLKSTA. When the block initializes, DEFINE is set to 0 (undefined) if the block detects a parameter configuration error. To return DEFINE to a true state, correct all configuration errors and re-install the block.

DESCRP

Descriptor is a user-defined string of up to 32 characters that describe the block's function (for example, PLT 3 FURNACE 2 HEATER CONTROL).

ERCODE

Error Code is a string data store that indicates the type of configuration error that first caused the block to set the DEFINE parameter to false. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block uses only the following error strings:

W46 - INVALID INPUT CONNECTION

W58 - INSTALL ERROR; DELETE/UNDELETE BLOCK

INITMA

Initialize Manual/Auto is a short integer input that specifies the desired state of the MA input during initialization:

0 = Manual
1 = Auto
2 = No change, except if a reboot, use the MA state as specified in the checkpoint file.

The block asserts this initial Manual/Auto state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a reboot operation.
- The compound in which the block resides is turned on.
- The INITMA parameter itself is modified via the Integrated Control Configurator. The block does not assert INITMA on ordinary reconfiguration.

INITMA is ignored if the MA input has an established linkage.

LOCKID

Lock Identifier is a string data store that identifies the workstation that has exclusive write access to the block. LOCKID arbitrates write access to the control block parameters by operator workstations on the network. It is set when LOCKRQ is set true, and nulled when LOCKRQ is cleared.

LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.

LOCKRQ

Lock Request is a boolean data store. When set true, it locks workstation write access to the block and sets LOCKID to the identifier of the requesting workstation. When LOCKRQ is reset to false, it unlocks write access to the block and nulls LOCKID. An operator at any other workstation can lock and unlock the block by toggling the LOCK U/L key on the Block Detail Display.

LOOPID

Loop Identifier is a user-defined string of up to 32 characters that identify the control loop or process unit that contains this block.

MA

Manual/Auto is a boolean input that controls the block's operating state:

0 = Manual
1 = Auto

In Manual, each PATT block output is unsecured, which makes it settable by an external process (program or display). In Auto, the block secures each output so that they cannot be set externally.

MASK01 to MASK16

Masks 1 through 16 are packed boolean inputs that specify which bits in PTRN01 through PTRN16 are compared against the packed boolean input PAKINP when computing the pattern match outputs. If a MASK bit is set true, the block compares the corresponding bit in PAKINP to the pattern; if a MASK bit is false, the block ignores the corresponding bit.

MASK_H
: Mask for Hold pattern is a packed boolean input that specifies which bits in PTRN_H are compared against the packed boolean input PAKINP when computing the pattern match status outputs. If a MASK bit is set true, the block compares the corresponding bit in PAKINP to the pattern; if a MASK bit is false, the block ignores the corresponding bit.

MASK_I
: Mask for Initialization pattern is a packed boolean input that specifies which bits in PTRN_I are compared against the packed boolean input PAKINP when computing the pattern match status outputs. If a MASK bit is set true, the block compares the corresponding bit in PAKINP to the pattern; if a MASK bit is false, the block ignores the corresponding bit.

MATCHB
: Match Boolean is a boolean output that, when true, indicates that PAKINP matches the selected pattern.

MATCHF
: Match Feedback is a boolean input, that when true, indicates a pattern match status to the second PATT block when using two PATT blocks in a cascade configuration. MATCHB of the first block connects to MATCHF of the second block, which has its MTHOPT set to 1.

MCHOUT
: Match Output is a packed boolean output that shows the pattern match status (1 = match, 0 = mismatch) for patterns 1 through 16.

Bit Number* (15 to 0)*	**Pattern Number**	**Boolean Connection (B1 to B16)****
15	1	MCHOUT.B1
14	2	MCHOUT.B2
13	3	MCHOUT.B3
12	4	MCHOUT.B4
11	5	MCHOUT.B5
10	6	MCHOUT.B6
9	7	MCHOUT.B7
8	8	MCHOUT.B8
7	9	MCHOUT.B9
6	10	MCHOUT.B10
5	11	MCHOUT.B11
4	12	MCHOUT.B12
3	13	MCHOUT.B13
2	14	MCHOUT.B14
1	15	MCHOUT.B15
0	16	MCHOUT.B16

* Bit 0 is the least significant, low order bit.

MMATCH Mismatch is a packed boolean output that shows the mismatch status (1 = mismatch, 0 = match) for each bit that did not match the pattern selected by PATSEL after the mask has been applied.

MTHOPT Match Option is a boolean input, that when true, allows the MATCHB output to be set only when the MATCHF input is true. Set MTHOPT only when two PATT blocks are cascaded, that is, set MTHOPT to 1 only in the second block. MATCHB of the first block connects to MATCHF of the second block.

NAME Name is a user-defined string of up to 12 characters used to access the block and its parameters.

OWNER Owner is a string of up to 32 ASCII characters that are used to allocate control blocks to applications. Attempts to set OWNER are y successful only if its present value is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Any application can clear OWNER by setting it to the null string, which is always accepted. Once set to the null string, an application can then set the value as desired.

PAKINP Packed Input is a packed boolean input that is compared to the selected pattern to set the MATCHB and MMATCH outputs. PAKINP is also compared to all patterns to set the MCHOUT output.

PATSEL Pattern Selector is an integer input that selects the pattern to which PAKINP is compared to set the MATCHB and MMATCH outputs.

PATSEL	Pattern	PATSEL	Pattern
0	PTRN_I	9	PTRN09
1	PTRN01	10	PTRN10
2	PTRN02	11	PTRN11
3	PTRN03	12	PTRN12
4	PTRN04	13	PTRN13
5	PTRN05	14	PTRN14
6	PTRN06	15	PTRN15
7	PTRN07	16	PTRN16
8	PTRN08	17	PTRN_H

PERIOD Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PHASE

Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For a CP with a BPC of 0.5 s and a PERIOD of 2.0 s, the legal phase periods are 0, 1, 2, and 3. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PTRN01 to PTRN16

Patterns 1 through 16 are selectable packed boolean inputs to which PAKINP is compared when computing the pattern match status outputs.

PTRN_H

Pattern for Hold is a selectable packed boolean input to which PAKINP is compared when computing the pattern match status outputs for the process Hold state.

PTRN_I

Pattern for Initialization is a selectable packed boolean input to which PAKINP is compared when computing the pattern match status outputs for the process Initialization state.

TYPE

Type is a system-level mnemonic label indicating the block type. Enter “PATT” or select “PATT” from the block type list under Show when configuring the block.

97.5 Functions

97.5.1 Detailed Functional Diagram

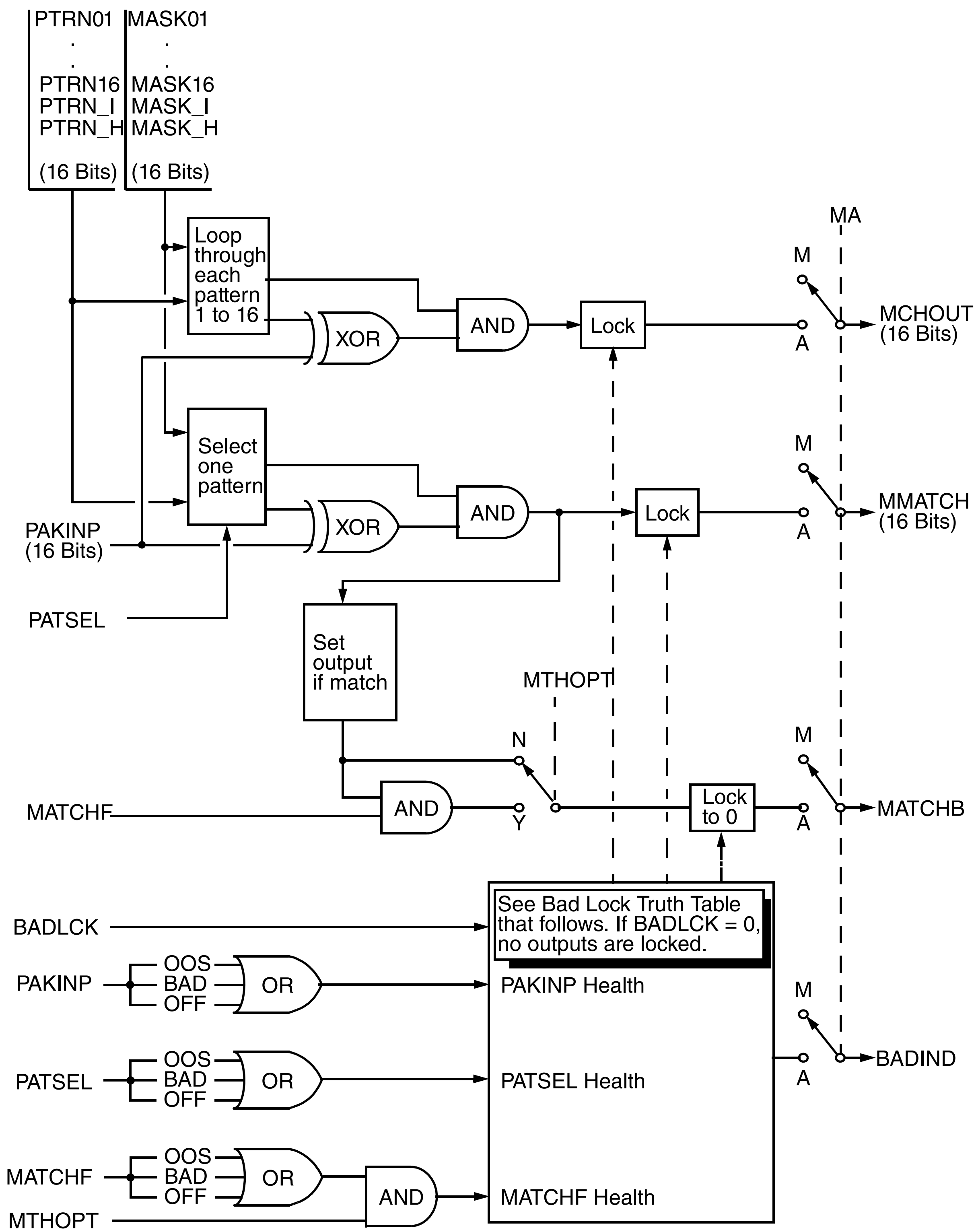


Figure 97-1. PATT Block Detailed Functional Diagram

Table 97-2. Bad Lock Truth Table

	PATSEL Healthy	PATSEL Unhealthy
BADLCK = 1 and (MTHOPT = 0, or MTHOPT = 1 and MATCHF is Healthy)		
PAKINP Healthy	MATCHB – updated MCHOUT – updated MMATCH – updated BADIND – set to 0	MATCHB – lock to 0 MCHOUT – updated MMATCH – not changed BADIND – set to 1
PAKINP Unhealthy	MATCHB – lock to 0 MCHOUT – not changed MMATCH – not changed BADIND – set to 1	MATCHB – lock to 0 MCHOUT – not changed MMATCH – not changed BADIND – set to 1
BADLCK = 1 and (MTHOPT = 1 and MATCHF is Unhealthy)		
PAKINP Healthy	MATCHB – lock to 0 MCHOUT – updated MMATCH – updated BADIND – set to 1	MATCHB – lock to 0 MCHOUT – updated MMATCH – not changed BADIND – set to 1
PAKINP Unhealthy	MATCHB – lock to 0 MCHOUT – not changed MMATCH – not changed BADIND – set to 1	MATCHB – lock to 0 MCHOUT – not changed MMATCH – not changed BADIND – set to 1

97.5.2 Detailed Operation

The PATT block performs a bitwise XOR operation with the packed boolean input PAKINP and the pattern (PTRNn, PTRN_I, or PTRN_H) selected by the PATSEL input (see Figure 97-1). The block then performs a bitwise AND operation with the resultant pattern and the associated mask (MASKn, MASK_I, or MASK_H) to produce the results which are stored in the 16 bit MMATCH output (1 = mismatch, 0 = match). If MMATCH is 0x0000, there is a match and the block sets the MATCHB output to 1. If MTHOPT is set to 1, MATCHB is set to 1 only when MATCHF is also 1.

The PATT block also performs a bitwise XOR operation with PAKINP and one PTRNn. The block then performs a bitwise AND operation with the resultant pattern and the associated mask to produce the results which is stored in the MCHOUT output (1 = match, 0 = mismatch). The block loops through these operations for each pattern (PTRN01 to PTRN16) and sets the results in the 16-bit MCHOUT output (see the MCHOUT parameter definition). If all the mask bits are configured to 0 for a pattern, its corresponding MCHOUT bit remains at 0.

Whenever PATSEL or PAKINP change value, the block compares them and sets MATCHB, MMATCH, and MCHOUT to show the results.

When the bad lock (BADLCK) parameter is set true, the block is sensitive to the status of its inputs, that is, out-of-service (OOS), bad (BAD), and off-scan (OFF). If one of these statuses is true for one of the input parameters, MATCHB is set unconditionally to 0, and BADIND is set to 1 (see Table 97-2). The other outputs retain their *last good values,* but there are exceptions:

- If PAKINP is healthy, MCHOUT is always updated.

- If only MATCHF is unhealthy and the match option (MTHOPT) parameter is set to 1 (cascade configuration), then MMATCH is always updated.

97.5.2.1 Manual Operation

Key Parameters: MA, MATCHB, MCHOUT, MMATCH

In Manual, the block does not compare PAKINP to any pattern and does not set the outputs, but the operator can set the outputs from workstation displays. A transfer from Auto to Manual does not change the output values.

97.5.2.2 Auto Operation

Key Parameters: MA, MATCHB, MCHOUT, MMATCH, PAKINP, PATSEL

In Auto, the block compares PAKINP values to the selected pattern and sets the outputs MATCHB, MCHOUT, and MMATCH accordingly (see Figure 97-1). When transferred from Manual to Auto, the block starts the comparison process and set the outputs whenever PATSEL or PAKINP change value; otherwise, the outputs retain their Manual values.

97.5.2.3 Cascading PATT Blocks

Key Parameters: MATCHB, MATCHF, MTHOPT

If the status of more than 16 devices must be verified, you can configure two PATT blocks with MATCHB of the first block connected to MATCHF of the second block, which has its match option parameter MTHOPT set to 1. MATCHB of the second block indicates a match between PAKINP and PTRNn. See Figure 97-2.

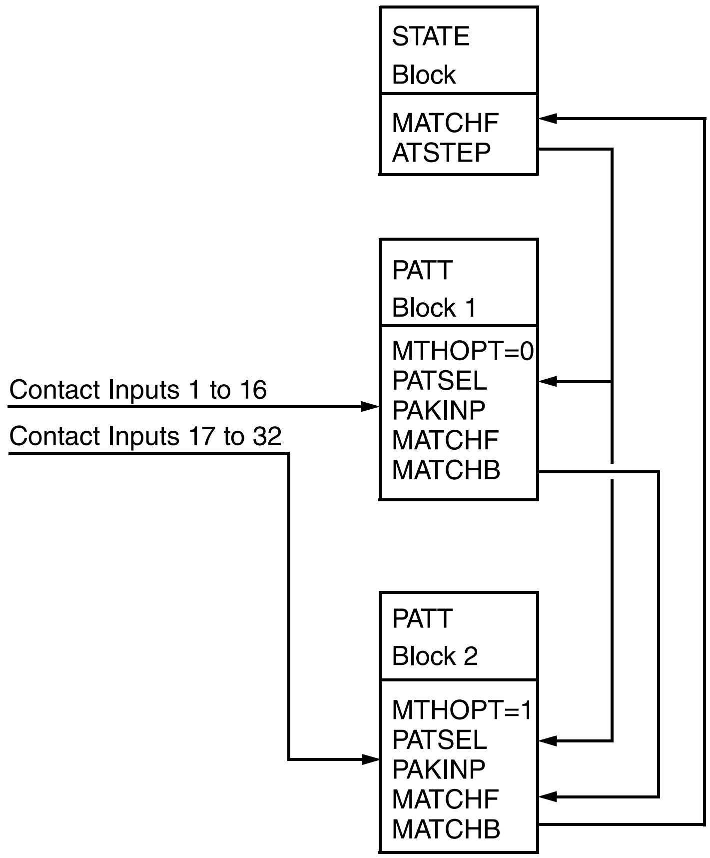


Figure 97-2. Cascade Configuration for PATT Block

97.5.2.4 Matching Logic Example

Key Parameters: MASKn, MATCHB, MCHOUT, MMATCH, PAKINP, PATSEL, PTRNn

The following example illustrates how the block uses MASKn, PTRNn, and PAKINP to perform the comparisons. The MASKn bits specify which pattern bits are to be compared (MASK bit = 1) or which bits are to be ignored (MASK bit = 0). In a process step, you may not care if a particular device is open, closed, on, or off. For such devices, setting the associated bit in MASKn causes the block to ignore the selected bit position.

In this example, bits 5 through 9 in MASK03 are *don't care* bit positions. PATSEL is 3.

Boolean Connection	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16
Bit Number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
PAKINP	1	0	1	0	1	0	1	1	1	1	1	0	1	0	1	0
PTRN03	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
MASK03	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1
MMATCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Since MMATCH is 0x0000, indicating that there is a match, the MATCHB parameter is set to true. The hexadecimal values that are entered in the Integrated Control Configurator for the above pattern and mask are:

PTRN03 = 0xAAAA
MASK03 = 0xFC1F

If bits 0 and 2 of the PAKINP parameter change to 1s instead of 0s, the results are:

Boolean Connection	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16
Bit Number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
PAKINP	1	0	1	0	1	0	1	1	1	1	1	0	1	1	1	1
PTRN03	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
MASK03	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1
MMATCH	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1

MMATCH is not 0x0000, therefore, MATCHB is set to false.

If PTRN01 and PTRN03 are the only patterns that match PAKINP, MCHOUT is set as follows:

Boolean Connection	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16
Bit Number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MCHOUT	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

97.6 Application Example

Figure 97-3 shows and example of a STATE block used in conjunction with a PATT block to control a simple process with sequence logic. An MCOUT block in conjunction with CIN blocks provides contact status inputs to the STATE and PATT blocks. The state patterns in the STATE block in conjunction with COUT blocks drive the output contacts for controlling the process on/off devices, that is, inlet valve, drain valve, and heater.

In this example, the STATE block drives one of nine preconfigured state patterns into its packed boolean output (PAKOUT) parameter one step at a time. The PATT block receives a 16-bit packed boolean input (PAKCRB) from the MCOUT block and compares this input to one of several preconfigured patterns, as selected by the STATE block. The PATT block then feeds back a pattern match status to the STATE block for the purpose of stepping through the STATE block steps. The PATT block thus confirms the desired process status before the STATE block proceeds to the next step.

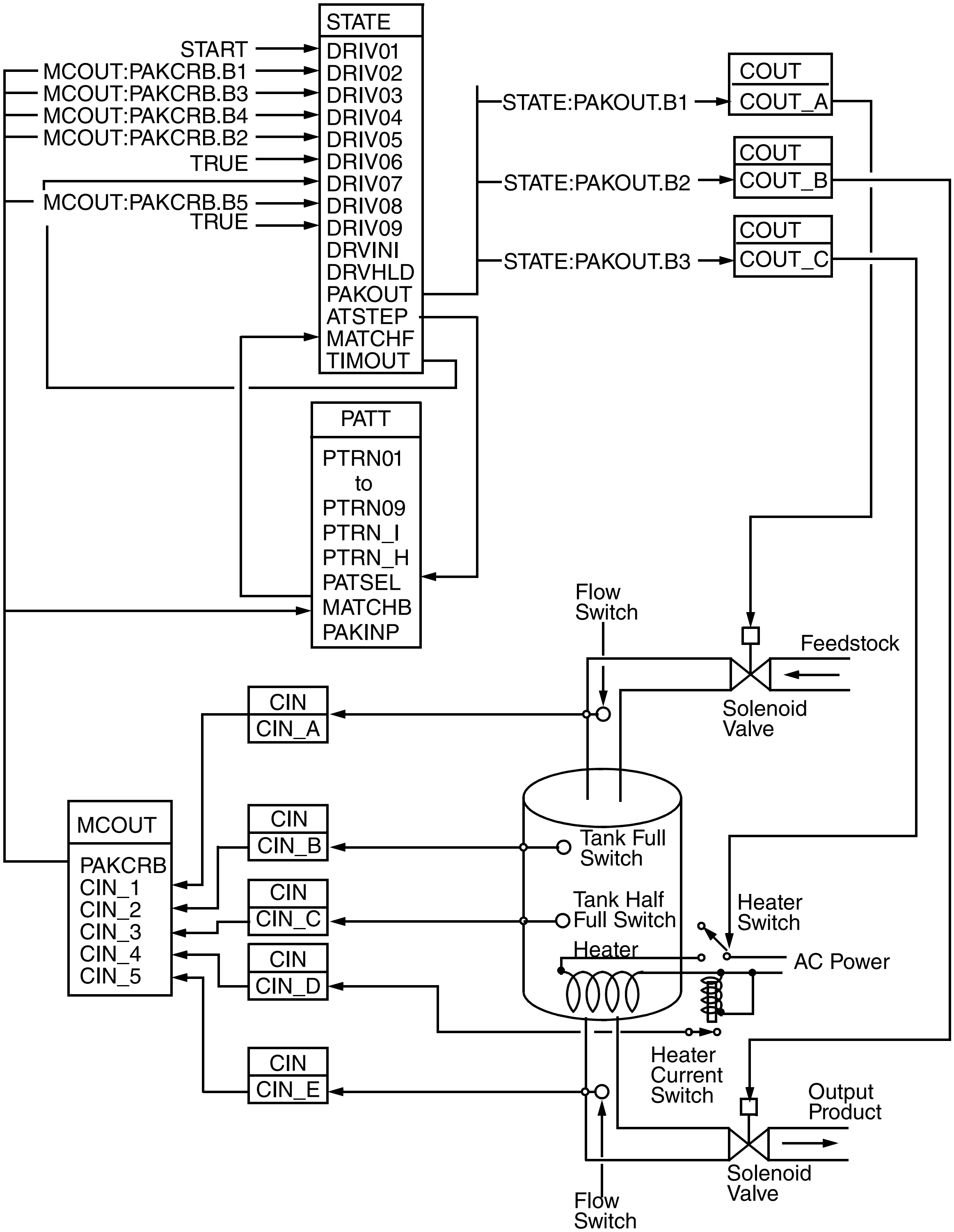


Figure 97-3. Application Diagram

97.6.1 Parameter Configuration

For the example in Figure 97-3, you configure the following PATT block *key* parameters as shown below:

MA = 1

INITMA = 1

PATSEL = TANK:STATE.ASTEP

PAKINP = TANK:MCOUT.PAKCRB

CNAM01 = Filling tank

CNAM02 = Tank half full

CNAM03 = Heater on

CNAM04 = Tank full

CNAM05 = Tank full, heater on

CNAM06 = Time heat

CNAM07 = Heater off, drain on

CNAM08 = Drain off

CNAM09 = End

CNAM_I = Initialization

CNAM_H = Hold

BADLCK = 1

Table 97-3 shows only the first five bits of the feedback pattern (FP) because there are five feedback switches to be monitored. FPxx in Table 97-3 are not actual PATT block parameters, but they represent the result of applying the MASKxx to PTRNxx thus producing the true (1), false (0) and *don't care* (shaded X) for the feedback pattern. Table 97-4 shows the pattern, mask, and hexadecimal value that you enter in the Integrated Control Configurator to define each feedback pattern (FP).

For more information on this example, refer to the STATE block description section of this document.

Table 97-3. PATT Block Feedback Patterns

<table>
<tr><td></td><td>CIN_1</td><td>— —</td><td>— —</td><td>— —</td><td>— —</td><td>— Inlet flow</td></tr>
<tr><td></td><td>|</td><td>CIN_2</td><td>— —</td><td>— —</td><td>— —</td><td>— Tank full</td></tr>
<tr><td></td><td>|</td><td>|</td><td>CIN_3</td><td>— —</td><td>— —</td><td>— Tank half full</td></tr>
<tr><td></td><td>|</td><td>|</td><td>|</td><td>CIN_4</td><td>— —</td><td>— Heater on/off</td></tr>
<tr><td></td><td>|</td><td>|</td><td>|</td><td>|</td><td>CIN_5</td><td>— Outlet flow</td></tr>
<tr><td></td><td>|</td><td>|</td><td>|</td><td>|</td><td>|</td><td></td></tr>
<tr><td>PAKCRB*</td><td>B1</td><td>B2</td><td>B3</td><td>B4</td><td>B5</td><td></td></tr>
<tr><td>FP_I</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td></tr>
<tr><td>FP01</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td></tr>
<tr><td>FP02</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td></td></tr>
<tr><td>FP03</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td></td></tr>
<tr><td>FP04</td><td>X</td><td>1</td><td>X</td><td>X</td><td>X</td><td></td></tr>
<tr><td>FP05</td><td>0</td><td>1</td><td>X</td><td>1</td><td>X</td><td></td></tr>
<tr><td>FP06</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr>
<tr><td>FP07</td><td>0</td><td>X</td><td>X</td><td>0</td><td>1</td><td></td></tr>
<tr><td>FP08</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td></tr>
<tr><td>FP09</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td></tr>
<tr><td>FP_H</td><td>0</td><td>X</td><td>X</td><td>0</td><td>0</td><td></td></tr>
</table>

* B1 to B5 are boolean connection bits.

** Shaded areas are *don't care* bits.

Table 97-4. PATT Block Pattern and Mask Configuration

PAKCRB*	B1	B2	B3	B4	B5	Hexadecimal
PTRN_I	0	0	0	0	0	0x0000
MASK_I	1	1	1	1	1	0xF800
FP_I	0	0	0	0	0	
PTRN01	1	0	0	0	0	0x8000
MASK01	1	1	1	1	1	0xF800
FP01	1	0	0	0	0	
PTRN02	1	0	1	0	0	0xA000
MASK02	1	1	1	1	1	0xF800
FP02	1	0	1	0	0	
PTRN03	1	0	1	1	0	0xB000
MASK03	1	1	1	1	1	0xF800
FP03	1	0	1	1	0	
PTRN04	1	1	1	1	1	0xF800
MASK04	0	1	0	0	0	0x4000
FP04	X	1	X	X	X	
PTRN05	0	1	1	1	1	0x7800
MASK05	1	1	0	1	0	0xD000
FP05	0	1	X	1	X	
PTRN06	0	1	1	1	1	0x7800
MASK06	0	0	0	0	0	0x0000
FP06	0	1	X	1	X	
PTRN07	0	1	1	0	1	0x6800
MASK07	1	0	0	1	1	0x9800
FP07	0	X	X	0	1	
PTRN08	0	0	0	0	0	0x0000
MASK08	1	1	1	1	1	0xF800
FP08	0	0	0	0	0	
PTRN09	0	0	0	0	0	0x0000
MASK09	1	1	1	1	1	0xF800
FP09	0	0	0	0	0	
PTRN_H	0	0	0	0	0	0x0000
MASK_H	1	0	0	1	1	0x9800
FP_H	0	X	X	0	0	

* B1 to B5 are boolean connection bits.

** Shaded areas are *don't care* bits.

98. PID – Proportional Integral Derivative Block

This chapter gives a general overview of the PID (Proportional Integral Derivative Block), provides an I/O diagram and describes its features, parameters and detailed operations.

98.1 Overview

The PIDA (with FBTUNE and FFTUNE when necessary) is recommended for use in all PID applications. The PIDA block has all of the functionality of the older PID algorithms plus additional functionality. See "PIDA – Advanced PID Block" on page 1819 for more details.

The PID (Proportional-Integral-Derivative) block performs the functions of a traditional three-term interacting PID controller. It can be configured to operate in one of five modes:

- Proportional Only (PO),
- Integral Only (IO),
- Proportional Plus Derivative (PD),
- Proportional Plus Integral (PI), and
- Proportional Plus Integral Plus Derivative (PID).

98.2 I/O Diagram

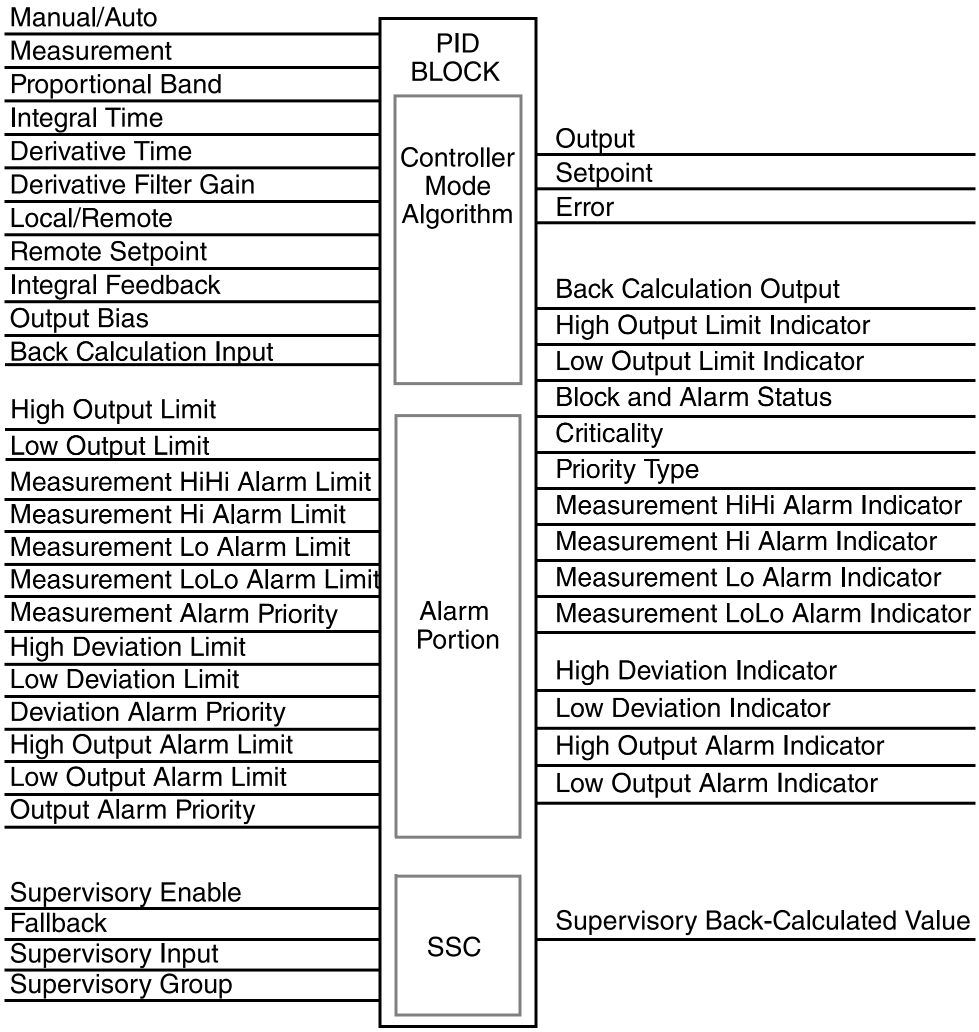


Figure 98-1. PID Block I/O Diagram

98.3 Features

The features are:

- Manual/Auto control of the outputs, which can be initiated by a host process or another block.
- Auto and Manual latch switch inputs (AUTSW and MANSW) that allow the block to be switched to Auto or Manual.
- Local/Remote setpoint source selection.
- Local and Remote latch switch inputs (LOCSW and REMSW) that force the block to be switched to Local or Remote setpoint mode.
- Derivative filtering using a second-order Butterworth filter for high frequency noise rejection.
- External integral feedback to prevent windup during closed loop operation.

- Separate assignable engineering range and units for the block's inputs and output.
- Bumpless transfer when the block switches between Manual and Auto.
- Adjustable derivative filter parameter (KD).
- Automatic scaling, based on assigned engineering ranges, so that the controller proportional band (percent) is dimensionless.
- Output biasing with the bias term subject to scaling.
- Output clamping between user-selectable output limits.
- Bad inputs detection and handling.
- Automatic cascade handling using an input and output parameter (back-calculate) that includes:
  - Initialization of cascade schemes
  - Back calculation of the BCALCO output for the upstream block, to provide bumpless transfer to cascade operation. For the PID block, BCALCO is always equal to either SPT (conditional initialization) or MEAS (all other times).
- Supervisory Control (SSC) allows user application software to perform supervisory control over the PID block's setpoints.

The options are:

- Setpoint Tracking Option (STRKOP) forces the setpoint to track the Measurement input. See Figure 98-2. STRKOP takes this action when the LR parameter has transitioned in either direction and 1) either the output is in Manual or a cascade is broken (a downstream block is in open loop - INITI true) or the block is in Manual, or 2) when the block is in Manual only. The block does not perform STRKOP if any critical data errors are detected.
- Manual if Bad Option (MBADOP) is a Manual override feature. When MBADOP = 1 or 2, the block sets an unlinked MA input to Manual when it detects bad status of a control input (MEAS, FBK, and/or INITI) or optionally (when MBADOP = 2), if the Remote Setpoint (RSP) is not healthy (i.e., value status is BAD or has a broken OM connection). This forces the output state to Manual. Returning to Auto requires external intervention, unless AUTSW is true.
- Increase/Increase Option (INCOPT) reverses the normal sense of the control action so that the controller output increases with increasing measurement. MALOPT, Measurement Alarming Option, provides independent activation of high and low absolute alarming of the measurement during auto operation. This option also provides standard alarm notification and reporting features.
- Deviation Alarm Option (DALOPT) enables independent activation of high and low deviation alarming of the measurement-setpoint deviation signal. This option also provides standard alarm notification and reporting features.
- High-High Alarm Option (HHAOPT) provides independent activation of High-High and Low-Low absolute alarming of the measurement. This option also provides standard alarm notification and reporting features.
- Output Alarm Option (OALOPT) provides independent activation of high and low absolute alarming of the block output signal (OUT). This option also provides standard alarm notification and reporting features.

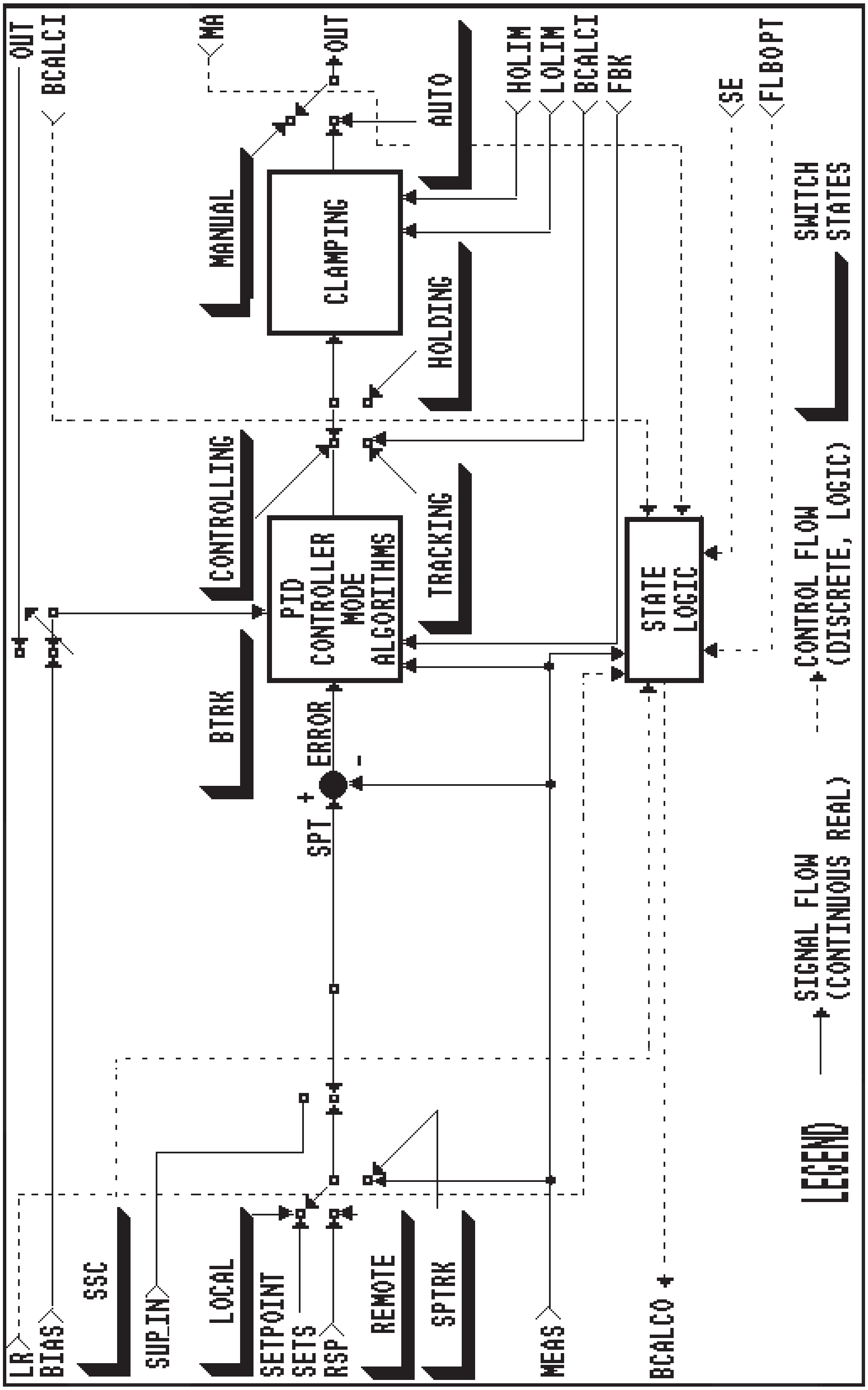


Figure 98-2. PID Simplified Signal Flow Diagram

- Manual Alarming Option (MANALM) allows you to invoke, while the block is in manual, either all configured alarm options or all configured alarm options *except* output alarming. Otherwise, alarming is normally performed only in Auto.
- Manual Clamping Option (MCLOPT) allows you to invoke output clamping while the block is in manual. You can alter this boolean input at the workstation.
- Bias Track Option (BTRKOP), when true, forces the algorithm's output Bias to track the block output (OUT) provided the block is in Manual and the mode is P or PD. See Figure 98-2. BTRKOP is a boolean input that you can change only by reconfiguring the block.
- Control Error Option (CEOPT) allows you to enable, or disable, the block's implicit Hold action when it detects an error in the MEAS, FBK, or BCALCI input.
- Propagate Error Option (PROPT) gives you the option of propagating certain input errors to the status of the block's OUT parameter. If PROPT is set to 1 and the block is in Auto, a BAD, Out-of-Service (OOS), ERROR, or peer-to-peer path failure condition of the MEAS input causes the status of OUT to have an ERROR condition. If PROPT is set to 2, the BAD, Out-of-Service (OOS), and ERROR status bits are copied from the MEAS input to OUT. Several conditions of the Setpoint (SPT) input also cause OUT to have an ERROR status. These are BAD or OOS status of SPT, or, when CEOPT is set to 2, the ERROR status of SPT as well.
- Local Setpoint Secure (LOCSP) enables you to secure against any write access to the LR parameter. This secure condition can be temporarily overridden by setting LOCSW or REMSW.
- Manual Failsafe (MANFS) allows you to have the block go to the Manual state when the block receives a Failsafe notification, provided the MA parameter is unlinked. Failsafe is originally detected by the AOUT block at the bottom of the cascade, and ripples upward via the cascade status bits of the BCALCI inputs and BCALCO outputs.
- Supervisory Option (SUPOPT) specifies whether or not the block is under control of a Supervisory Application Program.
- Fallback Option (FLBOPT) specifies the action taken in a block when Supervisory fallback occurs. The fallback options can be: normal fallback, Auto, Manual, Remote, or Local.

98.4 Parameters

Table 98-1. PID Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	7	PID
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars

Table 98-1. PID Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
MEAS	process input	real	con/set	0.0	RI1
HSCI1-HSCI2	high scale in 1 to 2	real	no-con/no-set	100.0	specifiable
LSCI1-LSCI2	low scale in 1 to 2	real	no-con/no-set	0.0	specifiable
DELTI1-DELTI2	change delta 1 to 2	real	no-con/no-set	1.0	percent
EI1-EI2	eng units input	string	no-con/no-set	%	specifiable
PROPT	propagate error	short	no-con/no-set	0	0 to 2
SPT	setpoint	real	con/set	0.0	RI1
FBK	reset feedback	real	con/set	0.0	RO1
MODOPT	controller mode option	short	no-con/no-set	1	[1..5]
PBAND	proportional band	real	con/set	1000.0	[0.1..]percent
INT	integral time	real	con/set	100.0	[0..]minutes
DERIV	derivative time	real	con/set	0.0	[0..]minutes
KD	derivative gain	real	con/set	10.0	[10.0..50.0]
INCOPT	increase/increase option	boolean	no-con/no-set	0	0 to 1
HSCO1	high scale out 1	real	no-con/no-set	100.0	specifiable
LSCO1	low scale out 1	real	no-con/no-set	0.0	specifiable
DELTO1	change delta 1	real	no-con/no-set	1.0	percent
EO1	eng unit output	string	no-con/no-set	%	specifiable
HOLIM	high output limit	real	con/set	100.0	RO1
LOLIM	low ouput limit	real	con/set	0.0	RO1
OSV	span variance	real	no-con/no-set	2.0	[0..25]percent
BIAS	bias	real	con/set	0.0	RI2
BBIAS	offset for the bias	real	no-con/no-set	0.0	RO1
KBIAS	bias scale or gain factor	real	no-con/no-set	1.0	scalar
BTRKOP	bias track option	boolean	no-con/no-set	0	0 to 1
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	[0|1|2]
MANFS	manual If failsafe	boolean	no-con/no-set	0	0 to 1
MBADOP	manual bad option	short	no-con/no-set	0	[0|1|2]
MANSW	manual switch	boolean	con/set	0	0 to 1
AUTSW	auto switch	boolean	con/set	0	0 to 1
MCLOPT	manual clamp option	boolean	no-con/no-set	0	0 to 1
CEOPT	control error option	short	no-con/no-set	1	0 to 3
HOLD	hold mode	boolean	con/set	0	0 to 1
PRIBLK	primary block cascade operation	boolean	no-con/no-set	0	0 to 1
PRITIM	primary cascade timer	real	no-con/no-set	0.0	seconds
INITI	initialize in	short	con/set	0	0 to 1
BCALCI	back calculation in	real	con/set	0.0	RO1
LR	local/remote	boolean	con/set	0	0 to 1
INITLR	initialize LR	short	no-con/no-set	2	[0|1|2]
LOCSP	local setpoint	boolean	no-con/no-set	0	0 to 1
LOCSW	local switch	boolean	con/set	0	0 to 1
REMSW	remote switch	boolean	con/set	0	0 to 1
RSP	remote setpoint	real	con/set	0.0	RI1
STRKOP	setpoint track option	short	no-con/no-set	0	[0|1|2]
MANALM	manual alarm option	short	no-con/no-set	1	0 to 4

Table 98-1. PID Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
INHOPT	inhibit option	short	no-con/no-set	0	0 to 3
INHIB	alarm inhibit	boolean	con/set	0	0 to 1
INHALM	inhibit alarm	pack_b	con/set	0	0 to 0xFFFF
MEASNM	meas alarm name	string	no-con/no-set	blank	1 to 12 chars
MALOPT	meas alarm option	short	no-con/no-set	0	0 to 3
MEASHL	meas high alarm limit	real	con/set	100.0	RI1
MEASHT	meas high alarm text	string	no-con/no-set	blank	1 to 32 chars
MEASLL	meas low alarm limit	real	con/set	0.0	RI1
MEASLT	meas low alarm text	string	no-con/no-set	blank	1 to 32 chars
MEASDB	meas alarm deadband	real	no-con/set	0.0	RI1
MEASPR	meas alarm priority	integer	con/set	5	[1..5]
MEASGR	meas alarm group	short	no-con/set	1	[1..8]
DALOPT	deviation alarm option	short	no-con/no-set	0	0 to 3
HDALIM	high deviation limit	real	con/set	100.0	RI1
HDATXT	high deviation alarm text	string	no-con/no-set	blank	1 to 32 chars
LDALIM	low deviation limit	real	con/set	-100.0	RI1
LDATXT	low deviation alarm text	string	no-con/no-set	blank	1 to 32 chars
DEVADB	deviation alarm deadband	real	no-con/set	0.0	RI1
DEVPRI	deviation alarm priority	integer	con/set	5	[1..5]
DEVGRP	deviation alarm group	short	no-con/set	1	[1..8]
HHAOPT	high-high option	short	no-con/no-set	0	0 to 3
HHALIM	high-high limit	real	con/set	100.0	RI1
HHATXT	high-high alarm text	string	no-con/no-set	blank	1 to 32 chars
LLALIM	low-low alarm limit	real	con/set	0.0	RI1
LLATXT	low-low absolute text	string	no-con/no-set	blank	1 to 32 chars
HHAPRI	high-high priority	integer	con/set	5	[1..5]
HHAGRP	high-high group	short	no-con/set	1	[1..8]
OALOPT	output alarm option	short	no-con/no-set	0	0 to 3
OUTNM	output alarm name	string	no-con/no-set	blank	1 to 12 chars
HOALIM	high output alarm limit	real	con/set	100.0	RO1
HOATXT	high output alarm text	string	no-con/no-set	blank	1 to 32 chars
LOALIM	low out alarm limit	real	con/set	0.0	RO1
LOATXT	low out alarm text	string	no-con/no-set	blank	1 to 32 chars
OUTADB	out alarm deadband	real	no-con/set	[0.0	RO1
OUTPRI	out alarm priority	integer	con/set	5	[1..5]
OUTGRP	out alarm group	short	no-con/set	1	[1..8]
FLBOPT	fallback option	short_i	no-con/no-set	0	0 to 4
FLBREQ	fallback request	short_i	con/set	0	0 to 2
INITSE	intial SE	short_i	no-con/no-set	0	0 to 2
SE	supervisory enable	boolean	no-con/set	0	0 to 1
SUP_IN	supervisory setpoint	real	con/set	0.0	RI1
SUPGRP	supervisory group	short_i	no-con/no-set	1	1 to 8
SUPOPT	supervisory option	short_i	no-con/no-set	0	0 to 4
AMRTIN	alarm regeneration timer	integer	no-con/no-set	0	0 to 32767 s
NASTDB	alarm deadband timer	long integer	no-con/no-set	0	0-2147483647 ms
NASOPT	nuisance alarm suppression option	short	no-con/no-set	0	0 to 2

Table 98-1. PID Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
OUTPUTS					
ALMSTA	alarm status	pack_l	con/no-set	0	bit map
BCALCO	back calculate out	real	con/no-set	0.0	RI1
BLKSTA	block status	pack_l	con/no-set	0	bit map
CRIT	criticality	integer	con/no-set	0	[0..5]
ERROR	control error	real	con/no-set	0.0	RI1
HDAIND	high deviation indicator	boolean	con/no-set	0	0 to 1
HHAIND	high-high absolute indicator	boolean	con/no-set	0	0 to 1
HOAIND	high out alarm indicator	boolean	con/no-set	0	0 to 1
HOLIND	high out limit indicator	boolean	con/no-set	0	0 to 1
INHSTA	inhibit status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
INITO	initialize out	short	con/no-set	0	0 to 1
LDAIND	low deviation indicator	boolean	con/no-set	0	0 to 1
LLAIND	low-low alarm indicator	boolean	con/no-set	0	0 to 1
LOAIND	low out alarm indicator	boolean	con/no-set	0	0 to 1
LOLIND	low out limit indicator	boolean	con/no-set	0	0 to 1
MEASHI	meas high alarm indicator	boolean	con/no-set	0	0 to 1
MEASLI	meas low alarm indicator	boolean	con/no-set	0	0 to 1
OUT	output	real	con/no-set	0.0	RO1
PRTYPE	priority type	integer	con/no-set	0	[0..10]
QALSTA	quality status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
SUPBCO	back-calculated value	real	con/no-set	0	RI1
UNACK	alarm notification	boolean	con/no-set	0	0 to 1
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
ALMOPT	alarm options	pack_l	no-con/no-set	0	0 to 0xFFFFFFFF
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	config error	string	no-con/no-set	0	1 to 43 chars
KSCALE	gain scaler	real	no-con/no-set	1.0	scalar
LOCKID	lock identifier	string	no-con/no-set	---	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars
PRSCAS	cascade state	short	no-con/no-set	0	0 to 7
PRSCON	present control	short	no-con/no-set	0	0 to 3
RI1	eng range input	real[3]	no-con/no-set	100,0,1	specifiable
RI2	eng range input	real[3]	no-con/no-set	100,0,1	specifiable
RO1	eng range output	real[3]	no-con/no-set	100,0,1	specifiable

98.4.1 Parameter Definitions

ACHNGE — Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

ALMOPT — Alarm Options contains packed long values representing the alarm types that have been configured as options in the block, and the alarm groups that are in use. For the PID block, only the following unshaded bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1] (0 to 31)	Configured Alarm Option When True
0	Alarm Group 8 in Use
1	Alarm Group 7 in Use
7	Alarm Group 1 in Use
16	Low Absolute Alarm Configured
17	High Absolute Alarm Configured
24	Low-Low Absolute Alarm Configured
25	High-High Absolute Alarm Configured

1. Bit 0 is the least significant, low order bit.

ALMSTA

Alarm Status is a 32-bit output, bit-mapped to indicate the block's alarm states. For the PID block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
	UNAK	INH	OOR			HHA	LLA	RATE	BAD	HDA	LDA	HOA	LOA	HMA	LMA										CRIT				PRTYPE		

Bit Number (0 to 31)*	Name	Description When True	Boolean Connection (B32 to B1)
0 to 4	PTYP_MSK	Priority Type: See parameter PRTYPE for values used in the PID block	ALMSTA.B32–ALMSTA.B28
5 to 7	CRIT_MSK	Criticality; 5 = lowest priority, 1= highest	ALMSTA.B27–ALMSTA.B25
16	LMA	Low Measurement Alarm	ALMSTA.B16
17	HMA	High Absolute Alarm	ALMSTA.B15
18	LOA	Low Output Alarm	ALMSTA.B14

Bit Number (0 to 31)*	Name	Description When True	Boolean Connection (B32 to B1)
19	HOA	High Output Alarm	ALMSTA.B13
20	LDA	Low Deviation Alarm	ALMSTA.B12
21	HDA	High Deviation Alarm	ALMSTA.B11
22	BAD	Input/Output Bad (BAD output of block)	ALMSTA.B10
23	RATE	Rate of Change Alarm	ALMSTA.B9
24	LLA	Low-Low Absolute Alarm	ALMSTA.B8
25	HHA	High-High Absolute Alarm	ALMSTA.B7
28	OOR	Out of Range Alarm	ALMSTA.B4
29	INH	Alarm inhibit	ALMSTA.B3
30	UNAK	Unacknowledged	ALMSTA.B2

* Bit 0 is the least significant, low order bit.

AMRTIN

Alarm Regeneration Timer is a configurable integer that specifies the time interval for an alarm condition to exist continuously, after which a new unacknowledged alarm condition and its associated alarm message is generated.

AUTSW

Auto Switch is a boolean input that, when true, overrides the MA and INITMA parameters, and drives the block to the Auto state. If both MANSW and AUTSW are true, MANSW has priority.

BBIAS

Offset for the Bias is a real input used for offsetting the product of the BIAS input with KBIAS.

BCALCI

Back Calculation In is a real input that provides the initial value of the output before the block enters the controlling state, so that the return to controlling is bumpless. It is also the source of the output value when its integration bit, which puts the block into output tracking, is non-zero. The source for this input is the back calculation output (BCALCO) of the downstream block. With V4.2 and later software, BCALCI contains the cascade initialization data bits which were formerly contained in the INITI parameter. Therefore, BCALCI defines the source block and parameter that drives this block into initialization, and INITI and INITO are not required for cascade initialization.

BLKSTA includes bits which can indicate when the downstream output is limited in either direction. BLKSTA.B11 monitors the Limited High condition (BCALCI.LHI) and BLKSTA.B10 monitors the Limited Low condition (BCALCI.LLO).

BCALCO

Back Calculation Output is a real output that is equal to MEAS except in the following situations, where it is equal to SPT:

- The block is transitioning from Local to Remote mode on this cycle.
- MEAS has Bad status.
- MEAS has Out-of-Service status.
- MEAS has Error status.
- MEAS is experiencing source connection problems.

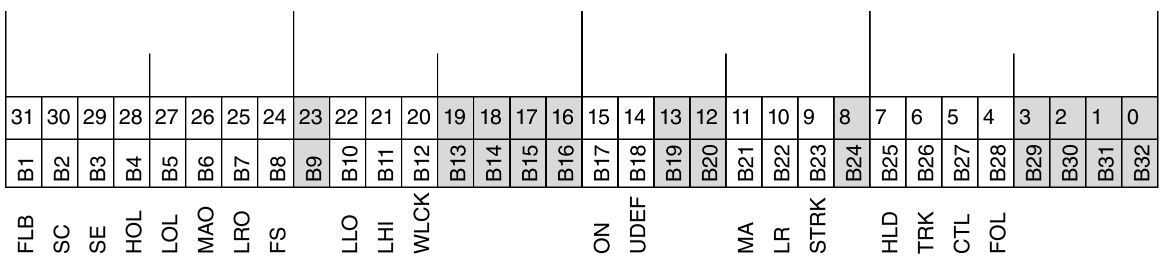
With V4.2 and later software, the status bits of BCALCO contain the cascade initialization requests formerly contained in the INITO parameter. You connect the BCALCO parameter to the BCALCI input of an upstream block so that this upstream block can sense when the PID block is open. Therefore, with V4.2 and later software, INITO is not required for cascade initialization.

BIAS

Bias is a real input added to the controller or algorithm output, to achieve OUT.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the PID block, only the following bits are used:



Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
4	FOL	Follow	BLKSTA.B28
5	CTL	Controlling	BLKSTA.B27
6	TRK	Tracking	BLKSTA.B26
7	HLD	Holding	BLKSTA.B25
9	STRK	Setpoint Tracking	BLKSTA.B23
10	LR	Local(= false)/Remote(= true)	BLKSTA.B22
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
20	WLCK	Workstation Lock	BLKSTA.B12
21	LHI	Downstream Limited High	BLKSTA.B11
22	LLO	Downstream Limited Low	BLKSTA.B10
24	FS	Failsafe	BLKSTA.B8

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
25	LRO	Local/Remote Override	BLKSTA.B7
26	MAO	Manual/Auto Override	BLKSTA.B6
27	LOL	Low Output Limit (Clamped)	BLKSTA.B5
28	HOL	High Output Limit (Clamped)	BLKSTA.B4
29	SE	Supervisory Enabled	BLKSTA.B3
30	SC	Supervisory Control	BLKSTA.B2
31	FLB	Supervisory Control Fallback State	BLKSTA.B1

* Bit 0 is the least significant, low order bit.

BTRKOP

Bias Track Option, when true, forces the PID algorithm's BIAS input to track the block output (OUT) when the block is in Manual, and operating in the PO or PD controller mode.

CEOPT

Control Error Option is a short integer that specifies how the block responds to the MEAS and BCALCI inputs when either of those inputs is in error. To provide backward compatibility, CEOPT defaults to 1. CEOPT has a range of 0 to 2 where:

0 = The block takes no implicit Hold action when it detects a control error.

1 = The block goes to the Hold state if, while MBADOP = 0, either MEAS or BCALCI: (a) has its BAD status bit set true; (b) has its Out-of-Service status bit set true; (c) is experiencing peer-to-peer path failure.

2 = The block goes to the Hold state if, while MBADOP = 0, either MEAS or BCALCI meets any of the conditions described for CEOPT = 1, or if MEAS has its ERROR status bit set true.

CEOPT is independent of the propagate error option, PROPT, and does not affect the external logical input, HOLD. The HOLD input, when true, still drives the block into the Hold state whenever the block is in Auto (and MBADOP = 0).

CRIT

Criticality is an integer output that indicates the priority, ranging from 1 to 5, of the block's highest currently active alarm (1 is the highest priority). An output of zero indicates the absence of alarms.

DALOPT

Deviation Alarm Option is a short integer input that enables High and Low deviation alarming, or disables alarming altogether.

0 = No alarming.
1 = High and Low deviation alarming.

2 = High deviation alarming only.
3 = Low deviation alarming only.

You can change DALOPT only by reconfiguring the block.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block.

DELTI1 to DELTI2

Change Delta for Input Range 1 or 2 is a real value that defines the minimum percent of the input range that triggers change driven connections for parameters in the range of RI1 or RI2. The default value is 1.

Entering a 1 causes the Object Manager to recognize and respond to a change of 1 percent of the full error range. If communication is within the same CP that contains the block's compound, change deltas have no effect.

Refer to "Peer-to-Peer Connections of Real-Type Block Inputs" on page 1703 for details on how the I/A Series software affects the change delta percentage during operation.

DELTO1

Change delta for Output Range 1 is a configurable real value that defines the minimum percent of the output range that triggers change-driven connections for parameters in the range RO1. The default value is 1.0 percent. If communication is within the same control station that contains the block's compound, DELTO1 has no effect.

DERIV

Derivative Time is a real input that adjusts the derivative time constant in minutes.

NOTE

The working DERIV value is indirectly limited by the working INT value.

DESCRP

Description is a user-defined string of up to 32 characters that describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

DEVADB

Deviation Alarm Deadband is a real input, in MEAS units, that applies to both High and Low Deviation Limits. You can adjust this parameter at the workstation.

DEVGRP

Deviation Group is a short integer input that directs deviation alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.

DEVPRI

Deviation Priority is an integer input, from 1 to 5, that sets the priority level of the deviation alarm (1 is the highest priority).

EI1 to EI2

Engineering Units for Input Ranges 1 and 2, as defined by the parameters HSCI1 to HSCI2, LSCI1 to LSCI2, and DELTI1 to DELTI2, provide the engineering units text for the values defined by Input Ranges 1 and 2. “Deg F” or “pH” are typical entries.

EO1

Engineering Units for Output Range 1, as defined by the parameters HSCO1, LSCO1, and DELTO1, provides the engineering units text for the values defined by Output Range 1. “Deg F” or “pH” are typical entries. Make the units for the Output Range (EO1) consistent with the units of Input Range 1 (EI1) and Input Range 2 (EI2).

ERCODE

Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block’s DEFINE parameter to be set false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the PID block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
“W43 – INVALID PERIOD/ PHASE COMBINATION”	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
“W44 – INVALID ENGINEERING RANGE”	High range value is less than or equal to low range value.
“W46 – INVALID INPUT CONNECTION”	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
“W48 – INVALID BLOCK OPTION”	The configured value of a block option is illegal.
“W49 – INVALID BLOCK EXTENSION”	An illegal block extension has been configured.
“W53 – INVALID PARAMETER VALUE”	A parameter value is not in the acceptable range.
“W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK”	A Database Installer error has occurred.

ERROR

Control Error is a real output that equals Setpoint minus Measurement. ERROR can be sourced to other blocks.

FBK

Feedback is a real input used to generate integration action. Its function is to prevent integral windup. FBK is normally connected to BCALCI or BCALCO of downstream blocks.

FLBOPT

Fallback Option is a short integer input that defines the control action to be taken by the block when a Supervisory fallback occurs:

0 = Take no fallback action (default)
1 = Set MA parameter to Auto
2 = Set MA parameter to Manual
3 = Set LR parameter to Remote
4 = Set LR parameter to Local

FLBOPT overrides linked MA and LR parameters, but does *not* override the AUTSW, MANSW, REMSW, and LOCSW parameters.

FLBREQ

Fallback Request is a short integer output that is an explicit request for the block to go to the Fallback state, with recovery at the block level (when SE is set), and/or at the group level (when the appropriate group enable bit is set in SUPENA).

0 = No fallback requested
1 = Fallback requested; recovery at block or group level
2 = Fallback requested; recovery *only* at block level

HDAIND

High Deviation Alarm Indicator is a boolean output set true when the measurement exceeds the setpoint by more than the deviation limit HDALIM. When the measurement passes back through the DEVADB deadband, the block sets HDAIND to false.

HDALIM

High Deviation Alarm Limit is a real input that establishes the amount by which the measurement must exceed the setpoint to initiate a high deviation alarm and set the High Deviation Alarm Indicator, HDAIND, true.

HDATXT

High Deviation Alarm Text is a user-configurable text string of up to 32-characters, output with the alarm message to identify the alarm.

HHAGRP

High-High Absolute Alarm Group is a short integer input that directs High-High Absolute alarm messages to one of eight groups of alarm devices.

HHAIND

High-High Alarm Indicator is a boolean output set true when the block-dependent parameter value (generally the measurement input) exceeds the high-high absolute alarm limit (HHALIM). HHAIND is set to false when the value is less than HHALIM. Once the Indicator is set true, it does not return to false until the value falls below the limit less a deadband.

HHALIM

High-High Absolute Alarm Limit is a real input that defines the value of the block-dependent parameter (generally the measurement input) that triggers a High-High alarm.

HHAOPT

High-High Alarm Option is a configured short integer input that enables High-High and Low-Low absolute alarming for alarming of a block-

	dependent value, generally the measurement input, or disables absolute alarming altogether. Each alarm triggers an indicator and text message. 0 = No alarming 1 = High-High and Low-Low alarming 2 = High-High alarming only 3 = Low-Low alarming only
HHAPRI	High-High Absolute Priority is an integer input, from 1 to 5, that sets the priority level of the high-high absolute alarm (1 is the highest priority).
HHATXT	High-High Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the high-high absolute alarm message to identify it.
HOAIND	High Output Alarm Indicator is a boolean output that is set true whenever the output is greater than HOALIM.
HOALIM	High Output Alarm Limit is a real input, int OUT units, that defines the value of the output that initiates a high output alarm.
HOATXT	High Output Alarm Message Text is a user-defined text string of up to 32 characters that is output with the alarm message to identify the alarm. You can change HOATXT only by reconfiguring the block.
HOLD	Hold is a boolean input. When true, HOLD forces the block into the Hold substate of Auto, holding the output at its last computed value.
HOLIM	High Output Limit is a real input that establishes the maximum output value, in OUT units. If the algorithm tries to drive the output to a higher value, the output is clamped at the HOLIM value and the indicator HOLIND is set true.
HOLIND	High Output Limit Indicator is a boolean output that is set true whenever the output is clamped at the high output limit, HOLIM.
HSCI1 to HSCI2	High Scale for Input Ranges 1 and 2 are real values that define the upper limit of the measurement ranges. EI1 to EI2 define the units. Make the range and units consistent with the measurement source. A typical value is 100 (percent).
HSCO1	High Scale for Output Range 1 is a real values that define the upper limit of the ranges for output 1. A typical value is 100 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.
INCOPT	Increase/Increase Option is a boolean input. When set true, INCOPT reverses the normal sense of the control action so that the controller output increases with increasing measurement.

INHALM

Inhibit Alarm contains packed boolean values that represent alarm inhibit requests for each alarm type or point configured in the block. For the PID block, only the following bits are used:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16

Bit Number* (0 to 15)	Description When True	Boolean Connection (B16 to B1)
0	Inhibit Low Absolute Alarm	INHALM.B16
1	Inhibit High Absolute Alarm	INHALM.B15
2	Low Output Alarm	INHALM.B14
3	High Output Alarm	INHALM.B13
4	Low Deviation Alarm	INHALM.B12
5	High Deviation Alarm	INHALM.B11
8	Inhibit Low-Low Absolute Alarm	INHALM.B8
9	Inhibit High-High Absolute Alarm	INHALM.B7

* Bit 0 is the least significant, low order bit.

There are no mnemonic names for the individual bits of INHALM.

INHIB

Inhibit is a boolean input. When true, it inhibits all block alarms; the alarm handling and detection functions are determined by the INHOPT setting. Alarms can also be inhibited based on INHALM and the compound parameter CINHIB.

INHOPT

Inhibit Option specifies the following actions applying to all block alarms:

0 = When an alarm is inhibited, disable alarm messages but do not disable alarm detection.

1 = When an alarm is inhibited, disable both alarm messages and alarm detection. If an alarm condition already exists at the time the alarm transitions into the inhibited state, clear the alarm indicator.

2 = Same as 0 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

3 = Same as 1 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

INHSTA

Inhibit Status contains packed long values that represent the actual inhibit status of each alarm type configured in the block. For the PID block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
	UNACK	INH				HHA	LLA			HDA	LDA	HOA	LOA	HMA	LMA																

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
16	LMA	Low Absolute Alarm Inhibited	INHSTA.B16
17	HMA	High Absolute Alarm Inhibited	INHSTA.B15
18	LOA	Low Output Alarm	INHSTA.B14
19	HOA	High Output Alarm	INHSTA.B13
20	LDA	Low Deviation Alarm	INHSTA.B12
21	HDA	High Deviation Alarm	INHSTA.B11
24	LLA	Low-Low Absolute Alarm Inhibited	INHSTA.B8
25	HHA	High-High Absolute Alarm Inhibited	INHSTA.B7
29	INH	Inhibit Alarm	INHSTA.B3
30	UNACK	Unacknowledged	INHSTA.B2

* Bit 0 is the least significant, low order bit.

INITI

Initialization In defines the source block and parameter that drives this block into initialization. The source for this short integer input is the initialization output of a downstream block. With V4.2 or later software, BCALCI contains the cascade initialization request data bit eliminating the need to configure INITI connections in cascades. However, to preserve backward compatibility, the INITI parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITI short value is maintained, but the setting of the handshaking bits, via the INITI to INITO connection, is eliminated.

INITLR

Initialize Local/Remote is an integer input that specifies the desired state of the LR input during initialization, where:

0 = Local
1 = Remote
2 = The LR state as specified in the checkpoint file.

The block asserts this initial LR state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a restart operation.
- The compound in which it resides is turned on.

The Initialize LR state is ignored if the LR input has an established linkage.

INITMA

Initialize Manual/Auto specifies the desired state of the MA input during initialization, where:

0 = Manual
1 = Auto
2 = The MA state as specified in the checkpoint file.

The block asserts this initial M/A state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a reboot operation.
- The compound in which it resides is turned on.
- The INITMA parameter itself is modified via the control configurator. (The block does not assert INITMA on ordinary reconfiguration.)

INITMA is ignored if MA has an established linkage.

INITO

Initialization Output is set true when:

- The block is in Manual or initializing.
- Permanent or temporary loss of FBM communications occurs.
- The ladder logic in the FBM is not running.
- MMAIND (mismatch indicator) is true.
- DISABL is true.
- RSP (the remote setpoint) is not the setpoint source.

The block clears INITO when none of these conditions exist. You connect this parameter to the INITI input of upstream blocks so that these upstream blocks can sense when this block is open loop. This block keeps INITO True, for one cycle (PRIBLK = 0), until the acknowledge is received from upstream (PRIBLK = 1 and PRITIM = 0.0), or for a fixed time delay (PRIBLK = 1 and PRITIM = nonzero).

With V4.2 or later software, BCALCO contains the initialization output eliminating the need to configure INITO connections in cascades. However, to preserve backward compatibility, the INITO parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITO short value has been maintained, but the setting of the handshaking bits, via the INITI to INITO connection, is eliminated.

INITSE — Initial Supervisory Enable specifies the initial state of the SE parameter in a block configured for Supervisory Control (SUPOPT = 1 or 3) when the block initializes due to reboot, installing the block, or turning on the compound. Options are:

0= Disable
1= Enable
2= Do not change SE parameter.

INT — Integral Time is a real input that adjusts the integral time constant when the controller operates in the PI, IO, or PID modes. When a PID block is in PO or PD mode (that is, MODOPT=1 or MODOPT=3), the INT parameter appears on the default displays as BTIME because it becomes the balance time (explained below) for those controller modes. Balance time is utilized so that a bumpless transfer can be accomplished without compromising the algorithm of the PO or PD controller. In other words, if a PO or PD controller is either initialized or transferred from manual to auto, where the actual output is different from the algorithm's calculated output, the controller output is not bumped but instead is integrated (or balanced) over time until it matches its calculated value. The actual balance time is a function of a first-order lag and adjustable via the lag time constant, which is the INT (or BTIME) parameter expressed in minutes. The PID block does not have a parameter labeled BTIME associated with it so all Object Manager access to the BTIME value must refer to INT.

KBIAS — BIAS scale or gain factor is a real input that multiplies the BIAS input. It is expressed in OUT units divided by BIAS units.

KD — Derivative Filter Gain is a real input that adjusts the derivative filter gain.

KSCALE — KSCALE is a conversion factor used to make the time units of the rate parameters, which are in EI1 units per minute, dimensionally compatible with the time units of the output, as defined by EO1.

LDAIND — The Low Deviation Alarm Indicator is a boolean output that is set true when the measurement falls below the setpoint by more than the deviation limit, LDALIM. When the measurement passes back through the DEVADB deadband, the block sets LDAIND to false.

LDALIM — Low Deviation Alarm Limit is a real input that defines how far the measurement must fall below the setpoint to initiate a low deviation alarm and set the Low Deviation Alarm Indicator LDAIND true.

LDATXT — Low Deviation Alarm Text is a user-defined text string of up to 32-character that is output with the alarm message to identify the alarm.

LLAIND — Low-Low Alarm Indicator is a boolean output set true when the block-dependent parameter value (generally the measurement input) falls below the low-low absolute alarm limit (LLALIM). LLAIND is set to false when the value is greater than LLALIM. Once the Indicator is set true, it does return to false until the value exceeds the limit plus a deadband.

LLALIM
: Low-Low Absolute Alarm Limit is a real input that defines the value of the block-dependent parameter (generally the measurement input) that triggers a Low-Low Alarm.

LLATXT
: Low-Low Absolute Alarm Text is a user-defined text string of up to 32 characters, that are sent with the low-low absolute alarm message to identify it.

LOAIND
: Low Output Alarm Indicator is a boolean output that is set true whenever the output is less than LOALIM.

LOALIM
: Low Output Alarm Limit is a real input, in OUT units, that defines the value of the output that initiates a low output alarm.

LOATXT
: Low Output Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can change LOATXT only by reconfiguring the block.

LOCKID
: Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.

LOCKRQ
: Lock Request is a boolean input which can be set true or false only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.

LOCSP
: Local Setpoint Secure is a boolean input. When true, LOCSP provides lockout of user write access to the LR parameter. If LOCSP is configured true, the block secures LR when it initializes and maintains LR in the secured state. The LOCSW and REMSW overrides have higher precedence, but LR remains secured when they are no longer asserted.

LOCSW
: Local Switch is a boolean input. When true, LOCSW overrides the LR and INITLR parameters and drives the block to the Local state. If both LOCSW and REMSW are true, LOCSW has priority.

LOLIM	Low Output Limit is a real input that establishes the minimum output value. If the algorithm tries to drive the output to a lower value, the output is clamped at the LOLIM value and the indicator LOLIND is set true.
LOLIND	Low Output Limit Indicator is a boolean output that is set true whenever the output is clamped at the low output limit, LOLIM.
LOOPID	Loop Identifier is a configurable string of up to 32 characters which identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.
LR	Local/Remote is a boolean input that selects the setpoint source (0 = false = Local; 1 = true = Remote). If LR is set to Remote, the source of the setpoint value is the real input parameter RSP. When LR is set to Local, there are two possible sources for the setpoint: (a) MEAS or (b) a user settable input. The choice is based on the conditions of STRKOP and MA, as described under STRKOP.
LSCI1 to LSCI2	Low Scale for Input Ranges 1 and 2 are real values that define the lower limit of the measurement ranges. A typical value is 0 (percent). EI1 to EI2 define the units. Make the range and units consistent with those of the measurement source.
LSCIN	Low Scale for Input MULTIN is a real value that defines the lower limit of MULTIN. A typical value is 0 (percent). EIN defines the units.
LSCO1	Low Scale for Output Range 1, a value that defines the lower limit of the range for Output 1. A typical value is 0 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.
MA	Manual Auto is a boolean input that controls the Manual/Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. The block automatically limits the output to the output range specified between LSCO1 and HSCO1, for analog blocks. In Manual, the algorithm is not performed, and the output is unsecured. An external program can then set the output to a desired value.
MALOPT	Measurement Alarm Option is a configured short integer input that enables absolute High and Low measurement alarming, or disables absolute alarming altogether. 0 = No alarming. 1 = High and Low measurement alarming. 2 = High measurement alarming only. 3 = Low measurement alarming only. You can change MALOPT only by reconfiguring the block.
MANALM	Manual Alarm Option is a configurable input which enables and disables configured alarm options to function in Manual. Normally alarms are processed only in the Auto mode.

0 = No alarming in Manual

1 = Full alarming in Manual

2 = No Output alarming in Manual

3 = No output alarming in Track

4 = No output alarming in Manual or Track

MANFS — Manual If Failsafe is a boolean input. When configured true, MANFS drives the block to the Manual state if the block detects an incoming fail-safe status.

MANSW — Manual Switch is a boolean input. When true, MANSW overrides the MA and INITMA parameters and drives the block to the Manual state. If both MANSW and AUTSW are true, MANSW has priority.

MBADOP — Manual if Bad Option is a manual override feature. When MBADOP is set to 1 or 2, the block sets the unlinked MA input to manual if it detects a BAD status bit in the MEAS, BCALCI or FBK input, and when set to 2, it detects that the Remote Setpoint (RSP) is not healthy (i.e., value status is BAD or has a broken OM connection). This forces the output state to manual as long as the BAD status remains. After the BAD status clears, returning to Auto requires external intervention unless AUTSW is true.

0 = no option enabled

1 = Switch to Manual when MEAS, BCALCI, or FBK value status is BAD

2 = Same as option 1, plus switch to Manual when RSP is not healthy

You can change MBADOP only by reconfiguring the block. MBADOP has the same priority as the MANSW override, and it has precedence over the AUTSW override. MBADOP has no effect when MA is linked. If any of the MBADOP conditions are true, the block will be switched to Manual regardless of the MANSW and AUTSW settings.

MCLOPT — Manual Clamping Option allows you invoke output clamping while the block is in manual. You can alter this configurable boolean input at the workstation.

MEAS — Measurement is an input identifying the source of the block's input, or the controlled variable.

MEASDB — Measurement Alarm Deadband is a configured input, expressed in MEAS units, that applies to both High and Low Alarm Limits. You can adjust this parameter at the workstation.

MEASGR — Measurement Group is a short integer input that directs measurement alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.

MEASHI — Measurement High Alarm Indicator is a boolean output that is set true when the measurement exceeds the high alarm limit (MEASHL). When the measurement passes back through the deadband, the block sets MEASHI to false.

MEASHL
Measurement High Alarm Limit is a real input that defines the value of the measurement that initiates a high absolute alarm.

MEASHT
Measurement High Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can only change the message text by reconfiguring the block.

MEASLI
Measurement Low Alarm Indicator is a boolean output that is set true when the measurement falls below the low alarm limit (MEASLL). When the measurement passes back through the MEASDB deadband, the block sets MEASLI to false.

MEASLL
Measurement Low Alarm Limit is a real input that defines the value of the measurement that initiates a low absolute alarm.

MEASLT
Measurement Low Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can only change the message text by reconfiguring the block.

MEASNM
Measurement Alarm Name is a user-defined text string of up to 12 characters that identify the alarm source in the alarm message. It serves as a point descriptor label (for example, Furn 37 Temp).

MEASPR
Measurement Priority is an integer input (1 to 5), that sets the priority level of the measurement alarm (1 is the highest priority).

MODOPT
Mode Option is a configurable short integer. When the block is in Auto, MODOPT dictates the controller mode. The integer value ranges from 1 to 5 for PID blocks:

1 = PO - Proportional Only.
2 = IO - Integral Only.
3 = PD - Proportional and Derivative.
4 = PI - Proportional and Integral.
5 = PID - Proportional, Integral and Derivative.

NAME
Name is a user-defined string of up to 12 characters used to access the block and its parameters.

NASOPT
Nuisance Alarm Suppression Option is a configurable, non-settable short integer that specifies how the nuisance alarm delay is implemented:

- 0 = Suppress nuisance alarms by delaying the Return-to-Normal (default) by the length of time specified in NASTDB
- 1 = Suppress nuisance alarms by delaying alarm detection by the length of time specified in NASTDB

- 2 = Suppress nuisance alarms by delaying both the Alarm Detection and the Return-to-Normal by the length of time specified in NASTDB

NASTDB
: Alarm Deadband Timer is a configurable long integer. Depending on the value of NASOPT, it either specifies the deadband time interval that must elapse before an alarm condition is allowed to return to normal, or the length of a delay-on timer which specifies the amount of time between an alarm's detection and the announcement of the alarm. The parameter value ranges from zero (default, no delay) to 2147483647 ms.

OALOPT
: Output Alarm Option is a configured short integer input that enables absolute High and Low alarming of the block output (OUT) or disables output alarming altogether.

0 = No alarming.
1 = High and Low output alarming.
2 = High output alarming only.
3 = Low output alarming only.

You can change OALOPT only by reconfiguring the block.

OSV
: Output Span Variance is a real input that defines the amount by which the output clamp limits (HOLIM, LOLIM) can exceed the specified output range, as defined by HSCO1 and LSCO1.

OUT
: Output, in Auto mode, is the result of the block algorithm applied to one or more input variables. In Manual, OUT is unsecured, and can be set by you or by an external task.

OUTADB
: Output Alarm Deadband is a real input that specifies the size of the deadband for both High and Low Output Alarm Limits. You can adjust this parameter at the workstation.

OUTGRP
: Output Group is a short integer input that directs high and low output alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.

OUTNM
: The Output Alarm Name is a user-defined string of up to 12 characters that identify the alarm source in the alarm message. It serves as a point descriptor label (for example, F2 Fuel Ctrl).

OUTPRI
: Output Priority is an integer input (1 to 5) that sets the priority level of the High and Low Output Alarms (1 is the highest priority).

OWNER
: Owner is a string of up to 32 ASCII characters which allocate control blocks to applications. Attempts to set Owner are successful only if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the

current value of Owner. Once set to the null string, the value can then be set as desired.

PBAND Proportional Band is an input expressed in percent. PBAND is the percent of span change in input, that causes a full-span change in output. [100 / PBAND] determines the gain of the controller when MEAS and OUT are converted to percent of span. It is adaptively set by FBTUNE.

PERIOD Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PHASE Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG.

PRIBLK Primary Block is a configuration option. When true (=1), PRIBLK enables a block in a cascaded configuration to initialize without bumping the process, either at initial startup or whenever control is transferred up to a primary block. Depending on the value of PRITIM, PRIBLK does this by forcing the PID block to remain in the Hold state until the Acknowledge status bit (Bit 10) of MEAS is detected from the upstream block (PRITIM = 0.0), or until the time defined by PRITIM expires (PRITIM > 0.0). In the latter case, the explicit acknowledge from the upstream block is not needed.

Use PRIBLK in a cascade situation when the source of the block's input connection needs to be initialized.

For correct operation, set EROPT = 1 or 2, and implement the connections between each primary-secondary block combination. These connections include BCALCI/BCALCO and OUT/RSP (or OUT/MEAS).

Except for the most primary controller block, it is recommended that PRIBLK be set true for all applicable blocks in a cascaded scheme. When PRIBLK is false (default value), no special handling takes place.

Refer to "PRIBLK and PRITIM Functionality" on page 1817 for more information on this parameter.

PRITIM Primary Cascade Timer is a configurable parameter used to delay the closing of the cascade to a primary block, when the output is initialized in the PID block. It is used only if the PRIBLK option is set. The cascade is closed automatically when the timer expires without requiring an explicit acknowledge by the upstream block logic.

Refer to "PRIBLK and PRITIM Functionality" on page 1817 for more information on this parameter.

PROPT Propagate Error Option is a short integer input. PROPT was changed from a Boolean to a Short Integer in I/A Series software v8.5 for this block. It can be set to 0-2, with the following exception:

NOTE

If PROPT is configured from IACC v2.4 or later, it can only be set to 0 or 1.

- 0 = option is disabled (default)
- 1 = set the ERROR Status bit of the output parameter (OUT) if the input to the MEAS parameter is in error (see below) while the block is in Auto
- 2 = copy (propagate) the BAD, OOS (Out-of-Service), and ERROR status bits from the MEAS parameter to the output parameter (OUT). This value cannot be set from IACC v2.4 or later.

The input to the MEAS parameter is in error when:

- Its BAD status bit is set true
- Its OOS (Out-of-Service) status bit is set true
- Its ERROR status bit is set true
- It is experiencing peer-to-peer path failure.

If a transition to Manual occurs while the ERROR status is true, it remains true until either a set command is written to that output or until the block transfers to Auto with the error condition returned to normal.

PRSCAS Present Cascade State is a data store that indicates the cascade state. It has the following possible values:

Value	State	Description
1	"INIT_U"	Unconditional initialization of the primary cascade is in progress.
2	"PRI_OPN"	The primary cascade is open.
3	"INIT_C"	Conditional initialization of the primary cascade is in progress.
4	"PRI_CLS"	The primary cascade is closed.
5	"SUP_INIT"	The supervisory cascade is initializing.
6	"SUP_OPN"	The supervisory cascade is open.
7	"SUP_CLS"	The supervisory cascade is closed.

PRSCON

Present Control state is a short integer data store that contains the substates of Auto:

1 = Holding
2 = Tracking
3 = Controlling (not open loop).

PRTYPE

Priority Type is an indexed output parameter that indicates the alarm type of the highest priority active alarm. The PRTYPE output of this block includes the following alarm types:

0 = No active alarm
1 = High Absolute
2 = Low Absolute
3 = High-High
4 = Low-Low
5 = High Deviation
6 = Low Deviation
7 = Rate alarm
8 = BAD Alarm

QALSTA

Quality Status parameter (QALSTA) is a non-configurable packed long that provides a combination of value record status, block status (BLKSTA), and alarm status (ALMSTA) information in a single connectable output parameter. Available bits for this block are provided below.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1]	Definition	Contents	Boolean Connection (B32 to B1)
30	Alarms Unacknowledged	ALMSTA.UNA	QALSTA.B2
29	Alarms Inhibited	ALMSTA.INH	QALSTA.B3
25	High-High Absolute Alarm	ALMSTA.HHA	QALSTA.B7
24	Low-Low Absolute Alarm	ALMSTA.LLA	QALSTA.B8
21	High Deviation Alarm	ALMSTA.HDA	QALSTA.B11
20	Low Deviation Alarm	ALMSTA.LDA	QALSTA.B12
19	High Output Alarm	ALMSTA.HOA	QALSTA.B13
18	Low Output Alarm	ALMSTA.LOA	QALSTA.B14
17	High Absolute Alarm	ALMSTA.HMA	QALSTA.B15
16	Low Absolute Alarm	ALMSTA.LMA	QALSTA.B16
5	Manual	BLKSTA.MA	QALSTA.B27

Bit Number[1]	Definition	Contents	Boolean Connection (B32 to B1)
4	Low Limited	MEAS.LLO status	QALSTA.B28
3	High Limited	MEAS.LHI status	QALSTA.B29
2	Uncertain	MEAS.ERR status	QALSTA.B30
1	Out-of-Service	MEAS.OOS status	QALSTA.B31
0	Bad	MEAS.BAD status	QALSTA.B32

1. Bit 0 is the least significant, low order bit.

REMSW — Remote Switch is a boolean input. When true, REMSW overrides the unlinked LR and INITLR parameters, and drives the block to the Remote state. If both LOCSW and REMSW are true, LOCSW has priority.

RI1 to RI2 — Range Input is an array of real values that specify the high and low engineering scale and change delta of a particular real input. For a given block, it also forms an association with a group of real input parameters that have the same designated range and change delta.

RO1 — Range Output is an array of real values that specify the high and low engineering scale of a particular real output. For a given block, it also forms an association with a group of real output parameters that have the same designated range.

RSP — Remote Setpoint is the selected setpoint source when LR is set to Remote. RSP is a real input. Typically RSP connects to an upstream block in a cascade scheme. RSP and its source must be expressed in MEAS units.

SE — Supervisory Enable is a boolean input that enables or disables Supervisory Control in this block:

0 = Disable
1 = Enable.

SPT — Setpoint always represents the active controller setpoint. Setpoint is the reference variable that is compared with the MEAS input to produce the ERROR signal. SPT is implemented as a configurable output that determines its source from the Local/Remote setpoint selector, LR. When LR is true (Remote), SPT assumes the Remote Setpoint (RSP) value. When LR is false (Local), SPT is an unsecured, and thus settable, output and the SPT source is the set value. Configure the value you want the SPT to assume when it first goes to Local. As an output, SPT can also source the setpoint value to other blocks.

While settable by default, SPT is nonsettable while setpoint tracking is active. (See STRKOP.)

STRKOP — Setpoint Track Option is a short integer input. When active, STRKOP enables the setpoint to track the measurement input under the following conditions.

0 = No option enabled

1 = SPT parameter tracks the measurement input when the block is in Manual, or the cascade is open downstream (Initialization input INITI is true).

2 = SPT parameter tracks the measurement only when the block is in Manual.

STRKOP is active only when the setpoint source selector LR is in Local.

SPT is nonsettable while setpoint tracking is active. You can change STRKOP only by reconfiguring the block.

SUPBCO

Supervisory Back-Calculated Output is a real output that specifies the value to be used by the Supervisory application to initialize its output to the current setpoint. SUPBCO also contains the following status bits:

Status	Meaning
Bit 10 = 1	Initialize SUP_IN
Bit 13 = 1	SUP_IN is limited high
Bit 14 = 1	SUP_IN is limited low
Bit 13 = 1 and Bit 14 =1	Supervisory cascade is open

SUPGRP

Supervisory Group is a short integer input (1 to 8) that specifies one of eight groups to which this block is assigned for Supervisory Control.

SUPOPT

Supervisory Option is a configurable short integer input that specifies whether or not this block is under control of a Supervisory Control application:

0 = No Supervisory control

1 = Set Point Control (SPC) of the block's set point (Supervisory setpoint control (SSC))

2 = Direct Digital Control (DDC) of the block output (Supervisory output control)

NOTE

Setting SUPOPT=2 enables DDC control only, i.e. supervisory control over the output in the PID block. It is not intended to be used with Advanced Process Control (APC), which performs SSC, i.e., supervisory control of the setpoint in the PID. To use APC, configure SUPOPT=1 (or 3 if automatic acknowledgement of a setpoint change is desired).

3 = SPC, with an implicit acknowledge by the CP

4 = DDC, with an implicit acknowledge by the CP

Be aware that options 1 and 2 require an explicit acknowledge by the application software to close the supervisory cascade. This must be done by setting the ACK status bit in the SUP_IN parameter using special OM access functions.

SUP_IN	Supervisory Input is a real output that is the parameter set by a Supervisory application when performing supervisory control of this block's setpoint. SUP_IN also contains a status bit (Bit 10) that must be set by the supervisor to acknowledge a request to initialize (Bit 10 in SUPBCO).
TYPE	When you enter "PID" or select "PID" from the block type list under Show, an identifying integer is created specifying this block type.
UNACK	Unacknowledge is a boolean output that the block sets to True when it detects an alarm. It is typically reset by operator action.

98.5 Detailed Operation

This block performs the functions of an analog PID controller. The output is the product of factors, provided they are enabled by the MODOPT selection:

1. A Proportional factor based on a user-specified proportional band applied to an error term that equals the setpoint (SPT) minus the measurement (MEAS), minus the Derivative factor, if any.
2. An Integral factor derived from a first-order lag of the block's integral feedback (FBK) input.
3. A Derivative factor with a second-order Butterworth filter applied to the measurement (MEAS).

The MEAS parameter is an input identifying the source of the signal that is coming to this block as the controlled variable in the control loop.

The SPT parameter is the active controller setpoint. SPT can be set in Local, or is made equal to RSP in Remote, or is made equal to SUP_IN in Supervisory Control. SPT can be used as a source for other blocks.

The setpoint sources are prioritized as follows:

1. Supervisory Control
2. Local (LOCSW) and Remote Switch (REMSW)
3. Local or Remote.

When the Supervisory Option (SUPOPT) is set to 1-4, it specifies that the block can be under control of a Supervisory Application Program. The Supervisory Back Calculated Output (SUPBCO) provides the current setpoint and initialization bits to the Supervisory Application Program. When Supervisory Enable (SE) is set by the application program or operator, the PID block is prepared to do Supervisory Setpoint Control (SSC) functions. When the proper handshaking occurs with the application software, the block accepts sets to the Supervisory Setpoint, (SUP_IN). If the block is in Auto, it then uses the supervisory setpoint in the calculation of the block's output.

If SUPOPT is set to 1 or 2, the handshake requires the application software to return an explicit acknowledge to close the supervisory cascade. The software must set the ACK status bit in the SUP_IN parameter using special OM access functions. However, if SUPOPT is set to 3 or 4, this acknowledgement is implicitly provided by the CP and is not required from the user application software. In the latter case, the CP closes the supervisory cascade automatically when the supervisory input (SUP_IN) is written by the application, provided the block is in the Supervisory Initialization (SUP_INIT) state. The control block enters the SUP_INIT state when supervisory control is enabled in the block and the cascade is closed downstream. Upon entering this state, the CP sets the initialize request bit (INITC) in the SUPBCO parameter for the application software. When SUP_IN is then written by the software, the CP access logic sets the ACK status automatically in the SUP_IN parameter. When the block runs, the CP block logic then closes the supervisory cascade automatically.

The setpoint source selector input, LR (Local/Remote), together with the two overrides, LOCSW and REMSW, determines the setpoint source at any time. LOCSW drives the setpoint state to Local; REMSW, which is of lower priority than LOCSW, drives the setpoint state to Remote.

When LR is switched to local, the block sets INITO initialization status value to true in BCALCO and releases the SPT parameter, allowing you to input the desired controller setpoint value.

When LR is switched to Remote, SPT is no longer settable and takes on the value of the remote setpoint input, RSP. RSP provides a link to the remote setpoint source.

LOCSP allows the block to secure the LR parameter when the block initializes and to maintain that secured state thereafter.

When the block is in the Remote mode, the value of the local setpoint (SPT) tracks the value of the remote setpoint (RSP), and the BAD, OOS, and ERR status bits of RSP are copied to the status of SPT. In addition, if RSP status shows Object Manager Disconnect, then the ERR bit is set in the SPT status.

When the block is switched to Local mode, the setpoint status depends on the setpoint tracking option (STRKOP).

The local setpoint is clamped each cycle when the setpoint mode is Remote, Local, or Supervisory. The clamp limits used are the measurement scale limits HSCI1 and LSCI1. If the setpoint value before clamping is equal to or less than LCSI1, status bit LLO of SPT is set true. If the value before clamping is equal to or higher than HSCI1, status bit LHI of SPT is true.

The PID block has two output states, Auto and Manual. In Manual, the block releases the output, allowing it to be set by you. In Auto, the block secures the output.

Auto has three substates: Controlling, Tracking, and Holding.

Closed loop automatic PID control is actually done in a substate of Auto called Controlling. See Figure 98-2. In this state, the block computes the output signal based on the configured control mode option and the values of SPT and MEAS. Proportional control is fixed by the steady state gain term (100/PBAND).

Integral control action is generated by feeding back the external integral feedback signal (FBK) through a first order lag. INT, the integral setting of the controller, fixes the time constant of the lag. By connecting FBK to the BCALCI input, integral windup caused by limiting in a downstream block is avoided. See “Normal Configuration” on page 1816 for more details.

Derivative control action uses a second-order Butterworth filtering of the measurement signal to reduce high-frequency output noise. The derivative time is specified with the DERIV parameter and the filter time with DERIV/KD.

In Auto, the computed output value undergoes limiting. Limiting clamps the output between the output limits HOLIM and LOLIM, which are configurable. You can place these limits anywhere within the range defined by LSCO1 and HSCO1. Moreover, the output span variance parameter (OSV) enables you to extend this range at both the high and low ends by an equal amount, up to 25 percent. If you set LOLIM higher than HOLIM, then HOLIM is automatically set equal to the higher of the two values, which is LOLIM. The block provides, for control purposes, output limit indicators that are active when the output is clamped at either limit.

In Auto, when you switch the setpoint source selector from Local to Remote, the transfer is made bumpless by removing derivative dynamics (if applicable) and forcing the integral to absorb any proportional action.

Switching from Remote to Local is always bumpless, because SPT retains the last value transferred from the remote setpoint. For cascade purposes, the block sets the BCALCO initialization status value true when the setpoint is under local control, or when the block's BCALCI initialization status value is set, indicating an open cascade downstream. This tells an upstream block to perform an explicit initialization, so that the return to remote setpoint operation is bumpless.

The block goes to Tracking when the BCALCI initialization status value is set true, as long as the block is not in HOLD, and there is no control error. The block performs explicit initialization in the Tracking substate. When the BCALCI initialization status value returns to false, the block returns to the Controlling substate to resume closed-loop control.

In the Tracking substate, OUT = BCALCI unless BCALCI is out of range, in which case OUT is clamped between the LOLIM and HOLIM values. The block calculates the BCALCO parameter, sets the BCALCO initialization status value to true (requesting upstream blocks to perform their own explicit initialization), and sets bit 6 (TRCK) in the BLKSTA parameter.

When the PID block is the upstream block in a cascade control scheme, output tracking (BTRKOP = true) assures a bumpless transfer for the downstream block.

For the PID block, BLKSTA includes bits which indicate when the downstream output is limited in either direction by monitoring for the Limited High condition (BCALCI.LHI via BLKSTA.B11) and Limited Low condition (BCALCI.LLO via BLKSTA.B10).

During Auto operation, the block checks the critical inputs MEAS, FBK, and INITI for data errors (off-scan, or BAD, OOS or ERROR status bits set). If an error is detected, the PID block, depending on the value of the CEOPT parameter (see CEOPT definition), may set the block into the Hold state.

The block goes to Hold if, while MBADOP = 0 and CEOPT = 1 or 2, either the HOLD parameter goes true, or a condition required by the CEOPT parameter is met.

In the Hold substate, OUT keeps the last good value before the block went into Hold, and the block secures this value against any changes. The block sets the BCALCO status to bad and sets bit 7 (HOLD) in the BLKSTA parameter.

When all error conditions have ceased, the block returns to the Controlling substate and resumes closed loop control.

No implicit Hold action takes place if CEOPT = 0.

A transition to Manual clears all alarm indicators if MANALM = 0, or only the output alarm indicators if MANALM = 2. If MANALM = 1 (Manual Alarming), no alarm indicators are cleared.

Unacknowledge (UNACK) is a boolean output parameter which is set true, for notification purposes, whenever the block goes into alarm. It is settable, but sets are only allowed to clear UNACK to false, and never in the opposite direction. The clearing of UNACK is normally via an operator "acknowledge" pick on a default or user display, or via a user task.

If MBADOP = 1 or 2 (and the MA parameter is unlinked), the block goes to the Manual state when it detects bad status in the MEAS, INIITI, or FBK inputs. MBADOP has precedence over

AUTSW. Therefore, if MBADOP = 1 or 2 and a bad input is detected, while MA is unlinked, the block goes to Manual regardless of the AUTSW setting.

When the block is switched to Auto, the BAD and OOS bits of the OUT status are cleared.

During Manual operation, PID control is not performed. Alarm outputs are settable. The controller output (OUT) is unsecured and may have its value set by an external task or program and if the manual clamp option (MCLOPT) is configured, these set values undergo output clamping.

The setpoint track option forces the local setpoint (SPT) to track the measurement. While setpoint tracking is active, SPT becomes nonsettable to prevent you from manipulating the local setpoint value. Setpoint tracking is only performed if the setpoint source selector is switched to Local and the block is either operating in Manual or the BCALCI Iinitialization Input value status is true. BCALCI value status being true indicates that a block downstream in the cascade is open loop.

The following summarizes the secured/released condition of the SPT parameter:

SPT is secured (non-settable) if any of the following are true:

- ♦ The block is in Remote mode, that is, LR is true. In this case, BLKSTA.LR is also true.
- ♦ Supervisory control is enabled, that is, SUPOPT is 1 or 3 and BLKSTA.SE is true, and SUP_IN is not in error.
- ♦ Setpoint tracking is active, that is, BLKSTA.STRK is true. In order for this status bit to be true, all of the following conditions must exist:
  - ♦ The STRKOP parameter must be 1 or 2
  - ♦ There must be no control error condition.
  - ♦ One of the following conditions must be true:
    - ♦ The block is in Manual mode.
    - ♦ The cascade is open downstream (either the data value of INITI is true, or the LHI and LLO status bits of BCALCI are simultaneously true).
    - ♦ A request for conditional initialization has been received from downstream.

Otherwise SPT is released (settable).

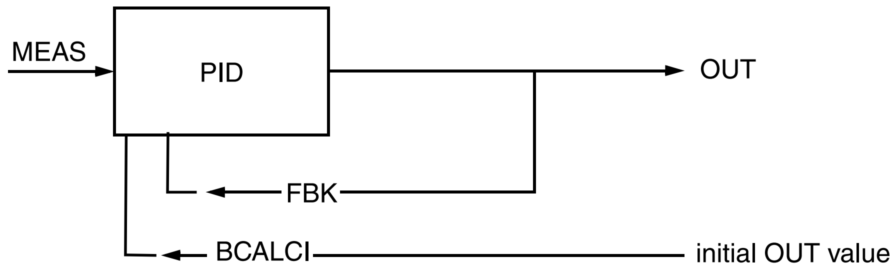
When the block restarts, the INITMA configured option specifies the value of the MA parameter, unless MA has an established linkage, or MANSW or AUTSW is set true. Likewise, the INITLR specifies the value of the LR parameter, unless LR is linked, or LOCSW or REMSW is set true.

In SCC, when the Fallback Option (FLBOPT) is set, the block falls back to the configured normal, Auto, Manual, Remote, or Local mode of operation when Fallback occurs.

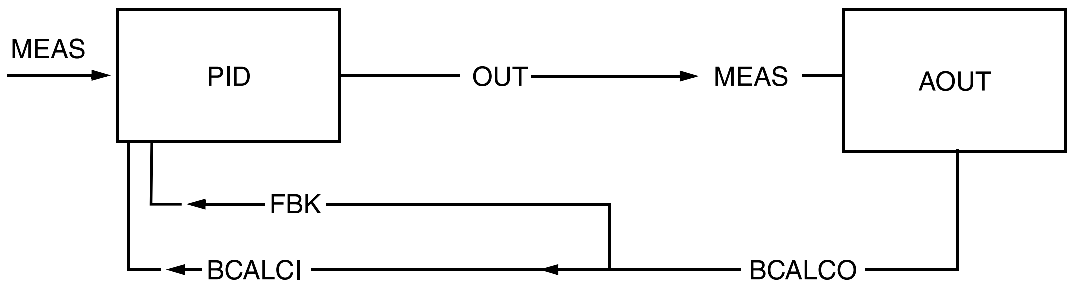
98.5.1 Normal Configuration

Normal configuration of the PID block is as follows.

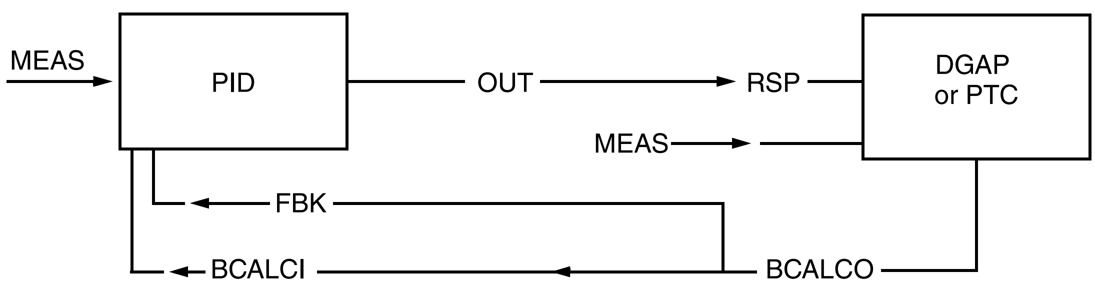
If there are no downstream control blocks, then link FBK to the OUT parameter.



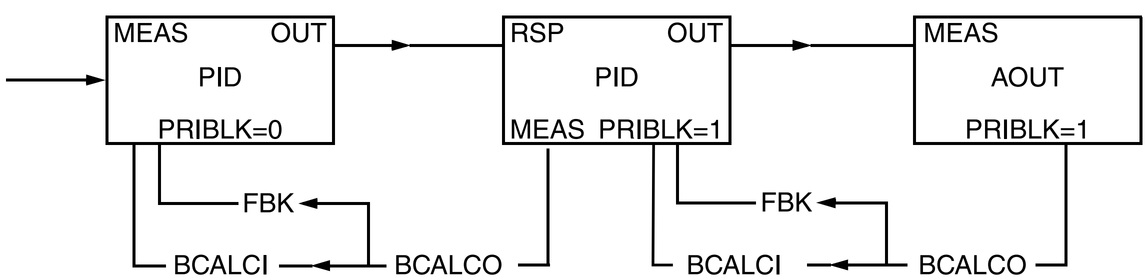
If the downstream block is an AOUT block, link BCALCI and FBK to the downstream block's BCALCO parameter.



If the secondary block is a DGAP or PTC block, link BCALCI and FBK to the secondary block's BCALCO parameter.



In a cascade configuration, connect the FBK of the primary to the BCALCO of the secondary controller to prevent windup.



Use the PRIBLK option in all cascade configurations.

98.5.2 PRIBLK and PRITIM Functionality

The Primary Block (PRIBLK) parameter indicates whether the PID block has a connection from an upstream block (PRIBLK=1) or not (PRIBLK=0). Its value, together with that of the Primary Cascade Timer (PRITIM), determines whether the PID block remains in Hold for a fixed time delay (of length defined by PRITIM), or ends the Hold when the Acknowledge status bit (Bit 10) of MEAS is detected from the upstream block (if PRITIM = 0.0). During initialization, the acknowledgement is not required and a Hold of one cycle only occurs.

99. PIDA – Advanced PID Block

This chapter gives a general overview of the PIDA (Advanced PID Block), including its features, parameters and detailed operations.

99.1 Overview

The PIDA controller implements continuous PID feedback and additive and multiplicative feed-forward control of an analog loop (see Figure 99-1). Its principal inputs, setpoint and measurement, are used to compute its output, the manipulated variable, based on user-set or adaptively tuned values of the tuning parameters – proportional band, integral time, derivative time, delay time, and setpoint relative gain. The feedforward capability can be used to decouple interacting loops, such as a slow level control cascading to a fast flow control, in addition to compensating for measured load upsets.

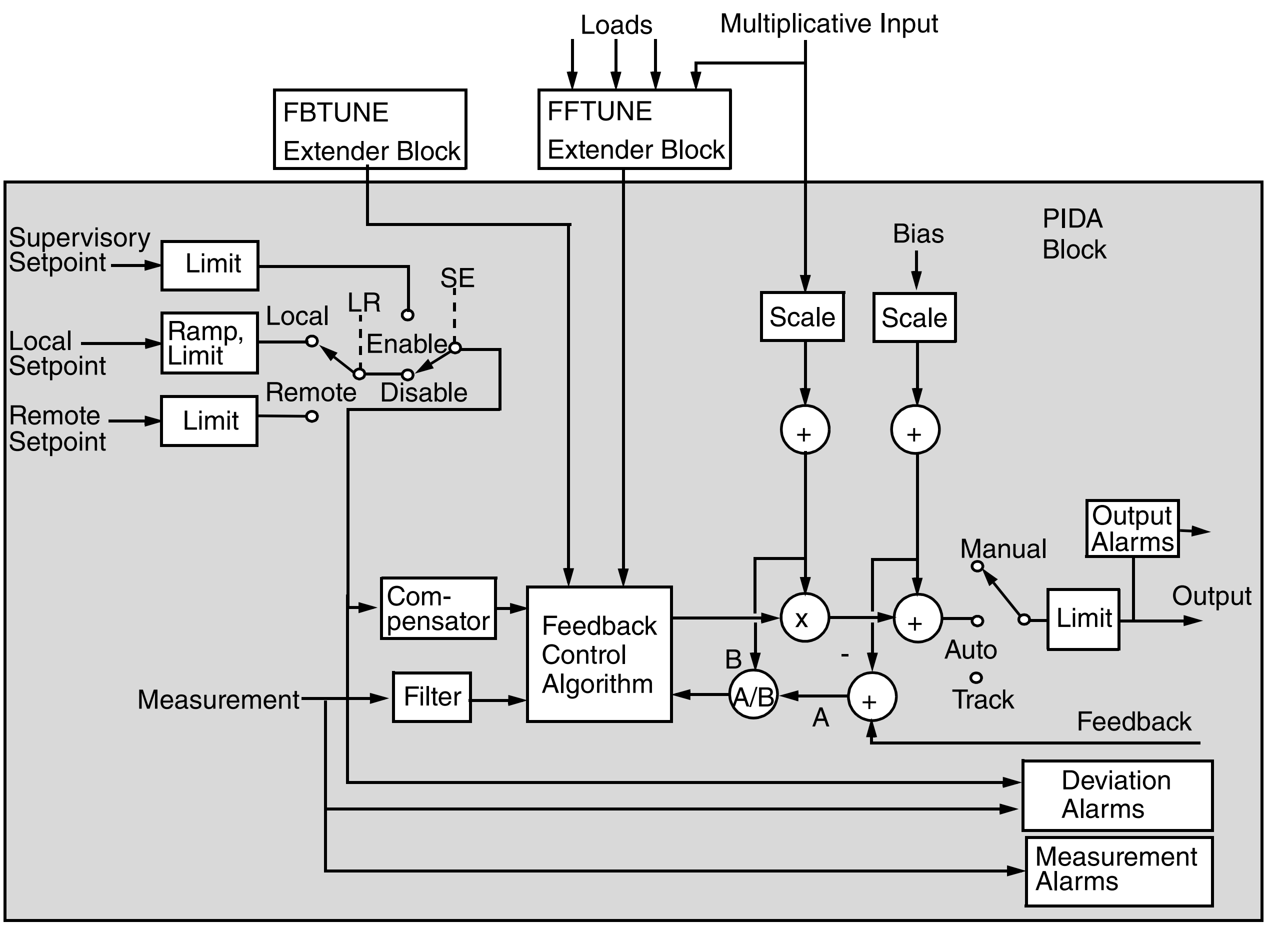


Figure 99-1. PIDA Functional Diagram

The combination of the PIDA block, plus FBTUNE and FFTUNE extender blocks provide adaptive control capabilities of the I/A Series patented EXACT MultiVariable control (see the FBTUNE and FFTUNE Block Descriptions in this document). Connections can be made to the FBTUNE and FFTUNE blocks, while the PIDA controller is operating, by configuring the PIDA block's BLKSTA into the PIDBLK parameter in the FBTUNE and FFTUNE extender blocks.

The FBTUNE extender block adaptively tunes the feedback controller parameters for controller modes containing proportional and integral terms. The FFTUNE extender block provides dynamic compensation for an absolute multiplicative or additive feedforward input and both static and dynamic compensations for 3 or 4 incremental feedforward inputs and adapts the compensator parameters. Also an extension connection can be made to a CHARC (characterizer) block, that applies matched functions to setpoint and measurement.

99.1.1 PIDA is Recommended Over Other PID Algorithms

It is recommended that you use the PIDA block instead of the PID and PIDX blocks, except on the memory limited CP10 control processor. PIDA provides all of the functionality of the earlier PID blocks as well as several important new functions.

As described in the Overview, the FBTUNE block is an extender attached to the PIDA. It adaptively pretunes and selftunes all of the PIDA tuning parameters for most of the PIDA MODOPTS (control mode options). The PIDA-FBTUNE combination can replace the PIDE and PIDXE for new applications. PIDE is a PID and PIDXE is a PIDX each with an Exact tuner permanently attached. By configuring one FBTUNE parameter, FBTUNE can be bumplessly attached to or detached from a running PIDA. FBTUNE uses unique model-based methods to achieve improved rapid and robust adaptive tuning of gain scheduling with little process upset.

A new feature included in the PIDA is the relative gain applied to the SPLLAG (setpoint lead/lag) parameter. This lets you achieve a non-overshooting response to a setpoint step when the controller is tuned for good unmeasured load rejection. Without this feature the response would overshoot as much as 50% with a very common lag-dominant process. SPLLAG is adaptively tuned with the pretune function of FBTUNE.

The PIDA has additional MODOPTS that provide non-interacting PID, PIτ, and PIDτ behaviors. The non-interacting PID (MODOPT 6) mode can be tuned for better load rejection than the interacting PID (MODOPT 5) when the process has a secondary lag larger than the deadtime. The PIτ (MODOPT 7) is recommended for a deadtime-dominant process. It can reduce the integrated absolute error (IAE) by a factor of 1.5 from that achieved with a well-tuned PI (MODOPT 4). The PIDτ (MODOPT 8) is useful for a non-deadtime-dominant process. With a lag-dominant process it can reduce the IAE by a factor of 2 from that achieved with a well-tuned PID (MODOPT 6). FBTUNE adaptively tunes gain schedules for all of these MODOPTs without requiring any difficult configuration decisions.

The pretune function of FBTUNE establishes initial tuning. While the controller is in manual, a doublet pulse is applied at the controller output and the process measurement is monitored. With little process upset, model parameters are identified and initial controller tuning is calculated. The sampling period is not critical. While the controller is in auto, selftune updates the model and tuning based on either control error or controller output response shape features in response to natural (or deliberate) disturbances.

The PIDA has a multiplicative feedforward input, MULT_IN, in addition to the additive feedforward input, BIAS, which is also available on the PID and PIDX. Feedforward of a load signal is used to counteract or cancel the load's effect on the process. A multiplicative compensation for a measured-load (wild) flow is useful for a quality (composition or temperature) control loop. An additive compensation is useful for an inventory (level or pressure) control loop. The FFTUNE extender block provides dynamic compensators and adaptively tunes their gain schedules for these PIDA feedforward inputs and up to 4 additive FFTUNE inputs, LOADx. No difficult configuration decisions are needed. FFTUNE can also be used to adaptively decouple interacting loops.

An extender to the PIDA can apply matched characterizers to setpoint and measurement. This feature is particularly useful for linearizing a pH loop. FBTUNE uses the linearized error signal in its calculations.

The PIDA provides options for the style of anti-windup recovery from output or downstream limiting. The default option (which is not available with either the PID or PIDX) enables rapid recovery with little or no overshoot, eliminating the need for the difficult-to-tune batch option BATCHO.

The PIDA sampled data option SPLCOP works differently from that of the PIDX. Whereas the PIDX provides a short burst of short-period control action on each trigger action, the PIDA provides one step of measured-period control with each trigger action. The result is more conventional tuning values and non-pulsing derivative behavior. If the process dynamic is dominated by the delay between trigger actions, zero integral time and the proper proportional band produce ideal (Smith Predictor) closed-loop behavior.

99.2 Features

99.2.1 Control Modes

The PIDA block can be configured to operate in one of the following control modes:

- Proportional (P)
- Integral (I)
- Proportional-plus-Derivative (PD)
- Proportional-plus-Integral (PI)
- Proportional-plus-Integral-plus-Derivative (PID)
- Non-Interactive PID (NIPID)
- Proportional, integral, deadtime (interacting if derivative not 0) (PITAU)
- Non-interacting proportional, integral, derivative, deadtime (PIDTAU)

99.2.2 Standard PIDA Features

The features are:

- Setpoint limiting, SPCLMP
- Local setpoint ramping by rate or time to target, SPROPT
- Setpoint compensation to prevent overshoot, SPLLAG
- Improved measurement (derivative) filtering, KD
- Feedforward ratio and bias inputs, MULTIN and BIAS
- Dead-time control
- Variable control update interval, SPLCOP

- Non-interacting tuning
- Improved recovery from output limiting, LIMOPT.
- Manual/Auto selection of the controller output that can be switched by an operator, another block, or a supervisory program.
- Local/Remote setpoint selection with setpoint limiting that can be switched by an operator, another block, or a supervisory program.
- Measurement low-pass (second-order Butterworth) filtering has its time constant equal to the derivative time (0.25 times the dead-time for PITAU and PIDTAU) divided by the gain KD. Its purpose is to reduce high-frequency valve activity. KD is commonly set to 10, but is adjusted by FBTUNE's pretune. Measurement filtering can be useful even when derivative action is not, such as when the process has a high frequency resonance. In this case, choose DERIV to have a small non-zero value and KD to have a value less than 1, such that the filter time constant DERIV/KD is large enough to provide significant attenuation at the resonant frequency. The range of KD is restricted to be not less than 0.1.
- External integral feedback (FBK) can be used to prevent integral windup caused by a downstream block action. In a cascade, FBK can be used to compensate the integral action of a primary loop for the dynamic behavior of a secondary loop. In the PIDA, a default connection inside the PIDA block to FBK is made from BCALCI if it is linked, otherwise from OUT.
- Range and engineering units can be assigned to the measurement MEAS (and setpoint SPT), the output OUT (and integral feedback FBK), the bias (or additive feedforward input BIAS), and to the multiplicative feedforward input MULTIN. The ranges are used for analog displays and for relating proportional band (PBAND in percent) to inputs and output.
- Bad input detection with user options for fallback actions.
- Bumpless cascade and single loop start-up and auto-manual transfer. Fast initialization and fast reaction to operator changes occurs for loops with greater than 0.5 sec block period.
- Supervisory Control (SSC) allows user application software to perform supervisory control over the PIDA block's setpoint.
- Direct Digital Control (DDC) allows user application software to directly specify the PIDA block's output.

99.2.3 Standard PIDA Options

The options are:

- Setpoint tracking (STRKOP) of the measurement signal allows bumpless return to automatic control when the controller returns to closed-loop operation. STRKOP takes this action when the LR parameter has transitioned in either direction and 1) either the output is in Manual or a cascade is broken (a downstream block is in open loop - INITI true) or the block is in Manual, or 2) when the block is in Manual only. The block does not perform STRKOP if any critical data errors are detected.
- Manual if Bad Option (MBADOP) is a Manual override feature. When MBADOP = 1 or 2, the block sets an unlinked MA input to Manual when it detects bad status of a control input (MEAS, FBK, and/or INITI) or optionally (when MBADOP = 2), if

the Remote Setpoint (RSP) is not healthy (i.e., value status is BAD or has a broken OM connection). This forces the output state to Manual. Returning to Auto requires external intervention, unless AUTSW is true.

- Increase/Increase Option (INCOPT) reverses the normal sense of the control action so that the controller output increases with increasing measurement.
- Measurement Alarming Option (MALOPT) enables absolute alarming of the measurement during auto operation. This option also provides standard alarm notification and reporting features.
- Deviation Alarm Option (DALOPT) enables deviation alarming of the measurement-setpoint error signal.
- High-High Alarm Option (HHAOPT) enables High-High and/or Low-Low absolute alarming of the measurement input with indicators and text messages, at a given priority level, which are sent to the configured alarm group.
- Manual Alarming Option (MANALM) enables all configured alarm options to be operational in Manual.
- Output Alarm Option (OALOPT) enables absolute alarming of the controller output (OUT).
- Manual Clamping Option (MCLOPT) enables output clamping in Manual.
- Control Error Option (CEOPT) enables implicit Holding action when an error in the MEAS input is detected.
- Propagate Error Option (PROPT) propagates the ERR status bit from the MEAS input to the OUT parameter.
- Local Setpoint Secure (LOCSP), typically used for local only controllers, secures against any write access to the LR parameter.
- Workstation lock (LOCKRQ) allows write access to the block parameters only by the Display Manager (LOCKID) that owns the lock. Any other workstation must first unlock the lock to gain write access.
- Loop identifier (LOOPID) allows you to identify the loop or process unit that contains the lock.
- Setpoint Ramp Option (SPROPT) allows you to ramp the setpoint to a new target value (SPTARG) at a rate (SPRATE) in engineering units per minute or by time (SPRATE) to target in minutes.
- Setpoint clamping between limits.
- Nonlinear Option (NONLOP) allows you to change the gain in a zone about zero error. The zone is defined by HZONE and LZONE, and the gain by KZONE.
- Output Tracking (TRKENL) allows the output to track an independent signal source (TRACK).
- Limit Option (LIMOPT) lets you specify the anti-windup strategy used for recovering from a limiting condition. For the default value of LIMOPT (1), integral action is frozen, when the output or a downstream block is limited and the integral term is between output limits. Downstream block limiting is propagated back through status bits in the BCALCI input.

99.3 Parameters

Table 99-1. PIDA Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank---	1 to 12 chars
TYPE	block type	integer	no-con/no-set		PIDA
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	see param definition
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
MEAS	process input	real	con/set	0.0	RI1
HSCI1 to HSCI2	high scale 1 to 2	real	no-con/no-set	100.0	specifiable
LSCI1 to LSCI2	low scale 1 to 2	real	no-con/no-set	0.0	specifiable
DELTI1 to DELTI2	change delta 1 to 2	real	no-con/no-set	1.0	0 to 100
EI1 to EI2	eng units input	string	no-con/no-set	%	specifiable
NLNBLK	CHARC block connection	long	con/set	0	---
SPT	setpoint	real	con/set	0.0	RI1
SPCLMP	setpoint clamp	short	no-con/no-set	0	0 to 2
SPHLIM	local setpoint high limit	real	con/set	100.0	RI1
SPLLIM	local setpoint low limit	real	con/set	0.0	RI1
STRKOP	setpoint track option	short	no-con/no-set	0	[0|1|2]
SPROPT	local setpoint ramp option	short	no-con/no-set	0	0 to 4
SPRATE	local setpoint ramp rate	real	con/set	0.0	eng units per min
SPTARG	local setpoint target	real	con/set	0.0	RI1
SPRAMP	local setpoint ramp	Boolean	con/set	0	0 to 1
RSP	remote setpoint	real	con/set	0.0	RI1
LR	local/remote	Boolean	con/set	0	0 to 1
INITLR	initialize LR	short	no-con/no-set	2	[0|1|2]
LOCSW	local switch	Boolean	con/set	0	0 to 1
LOCSP	local setpoint secure	Boolean	no-con/no-set	0	0 to 1
REMSW	remote switch	Boolean	con/set	0	0 to 1
MODOPT	control mode option	short	no-con/no-set	1	1 to 8
INCOPT	increase/increase option	Boolean	no-con/no-set	0	0 to 1
PBAND	proportional band	real	con/set	1000.0	[0.1..]percent
INT	integral time	real	con/set	100.0	[0..]minutes
DERIV	derivative time	real	con/set	0.0	[0..]minutes
KD	meas filter factor	real	con/set	10.0	At least 0.1
SPLLAG	setpoint lead/lag	real	con/set	1.0	0, 1
DTIME	dead time	real	con/set	0.0	minutes
FILTER	filter time	real	con/set	0.0	minutes
NONLOP	non linear option	Boolean	no-con/no-set	0	0 to 1
HZONE	high zone limit	real	con/set	100.0	[0..]RI3
LZONE	low zone limit	real	con/set	100.0	[0..]RI3
KZONE	nonlinear gain	real	con/set	1.0	[0..]
SPLCOP	sample controller option	Boolean	no-con/no-set	0	0 to 1

Table 99-1. PIDA Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
SPLRDY	sample ready	Boolean	con/set	0	0 to 1
TSAMPL	sampling time	real	con/set	0.0	[0..]minutes
BIAS	bias	real	con/set	0.0	RI2
BBIAS	offset for the bias	real	no-con/no-set	0.0	RO1
KBIAS	bias scale or gain factor	real	no-con/no-set	1.0	real number
BTRKOP	bias track option	Boolean	no-con/no-set	0	0 to 1
MULTIN	multiplication feedforward input	real	con/set	100.0	eng. units
HSCIN	input high scale	real	no-con/no-set	100.0	specifiable
LSCIN	input low scale	real	no-con/no-set	0.0	specifiable
EIN	input eng units	string	no-con/no-set	%	specifiable
HSCO1	high scale out 1	real	no-con/no-set	100.0	specifiable
LSCO1	low scale out1	real	no-con/no-set	0.0	specifiable
DELTO1	change delta, output	real	no-con/no-set	1.0	percent
EO1	eng unit output	string	no-con/no-set	%	specifiable
OSV	span variance	real	no-con/no-set	2.0	[0..25]percent
HOLIM	high output limit	real	con/set	100.0	RO1
LOLIM	low output limit	real	con/set	0.0	RO1
LIMOPT	limiting option	short	no-con/no-set	1	[1..3]
MCLOPT	manual clamp option	Boolean	no-con/no-set	0	0 to 1
BATCHO	batch control option	Boolean	no-con/no-set	0	0 to 1
PRLOAD	batch preload	real	con/set	0.0	0-100%
TRACK	track input	real	con/set	0.0	RO1
TRKENL	track enable	Boolean	con/set	0	0 to1
HOLD	hold mode	Boolean	con/set	0	0 to1
PRIBLK	non-primary block	Boolean	no-con/no-set	0	0 to 1
PRITIM	primary cascade timer	real	no-con/no-set	0.0	seconds
INITI	initialize input	short	con/set	0	0 to 1
BCALCI	back calculate input	real	con/set	0.0	RO1
FBK	integral feedbck	real	con/set	0.0	RO1
MA	manual/auto	Boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	[0|1|2]
MANFS	manual If failsafe	Boolean	no-con/no-set	0	0 to 1
MBADOP	manual bad option	short	no-con/no-set	0	[0|1|2]
CEOPT	control error option	short	no-con/no-set	1	0 to 2
PROPT	propagate error	short	no-con/no-set	0	0 to 2/0 to 1 (If configured from IACC v2.4 or later)
MANSW	manual switch	Boolean	con/set	0	0 to 1
AUTSW	auto switch	Boolean	con/set	0	0 to 1
MANALM	manual alarm option	short	no-con/no-set	1	0 to 4
INHOPT	inhibit option	short	no-con/no-set	0	0 to 3
INHIB	alarm inhibit	Boolean	con/set	0	0 to 1
INHALM	inhibit alarm	pack_b	con/set	0	0 to 0xFFFF
MEASNM	meas alarm name	string	no-con/no-set	blank	1 to 12 chars
MALOPT	meas alarm option	short	no-con/no-set	0	0 to 3

Table 99-1. PIDA Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
MEASHL	meas high alarm limit	real	con/set	100.0	RI1
MEASHT	meas high alarm text	string	no-con/no-set	blank	1 to 32 chars
MEASLL	meas low alarm limit	real	con/set	0.0	RI1
MEASLT	meas low alarm text	string	no-con/no-set	blank	1 to 32 chars
MEASDB	meas alarm deadband	real	no-con/set	[0.0	RI1
MEASPR	meas alarm priority	integer	con/set	5	[1 to 5]
MEASGR	meas alarm group	short	no-con/set	1	[1to 8]
DALOPT	deviation alarm option	short	no-con/no-set	0	0 to 3
DEVTIM	deviation time	integer	no-con/no-set	0	[0..] sec
HDALIM	high deviation limit	real	con/set	100.0	RI1
HDATXT	high deviation alarm text	string	no-con/no-set	blank	1 to 32 chars
LDALIM	low deviation limit	real	con/set	-100.0	RI1
LDATXT	low deviation alarm text	string	no-con/no-set	blank	1 to 32 chars
DEVADB	deviation alarm deadband	real	no-con/set	[0.0	RI1
DEVPRI	deviation alarm priority	integer	con/set	5	[1to 5]
DEVGRP	deviation alarm group	short	no-con/set	1	[1 to 8]
HHAOPT	high-high alarm option	short	no-con/no-set	0	0 to 3
HHALIM	high-high alarm limit	real	con/set	100.0	RI1
HHATXT	high-high alarm text	string	no-con/no-set	blank	1 to 32 chars
LLALIM	low-low alarm limit	real	con/set	0.0	RI1
LLATXT	low-low alarm text	string	no-con/no-set	blank	1 to 32 chars
HHAPRI	high-high alarm priority	integer	con/set	5	[1to 5]
HHAGRP	high-high alarm group	short	no-con/set	1	[1to8]
OALOPT	output alarm option	short	no-con/no-set	0	0 to 3
OUTNM	output alarm name	string	no-con/no-set	blank	1 to 12 chars
HOALIM	high output alarm limit	real	con/set	100.0	RO1
HOATXT	high output alarm text	string	no-con/no-set	blank	1 to 32 chars
LOALIM	low output alarm limit	real	con/set	0.0	RO1
LOATXT	low output alarm text	string	no-con/no-set	blank	1 to 32 chars
OUTADB	output alarm deadband	real	no-con/set	[0.0	RO1
OUTPRI	output alarm priority	integer	con/set	5	[1 to 5]
OUTGRP	output alarm group	short	no-con/set	1	[1 to 8]
BAO	bad alarm option	boolean	no-con/no-set	0	0 to 1
BAT	bad alarm text	string	no-con/no-set	blank	1 to 32 chars
BAP	bad alarm priority	integer	con/set	5	1 to 5
BAG	bad alarm group	short	no-con/set	1	1 to 8
FLBOPT	fallback option	short	no-con/no-set	0	0 to 4
FLBREQ	fallback request	short	con/no-set	0	0 to 2
SE	supervisory enable	Boolean	no-con/set	0	0 to 1
SUP_IN	supervisory setpoint	real	con/no-set	0.0	RI1
INITSE	initial SE	short	no-con/no-set	0	0 to 2
SUPGRP	supervisory group	short	no-con/no-set	1	1 to 8
SUPOPT	supervisory option	short	no-con/no-set	0	0 to 4
AMRTIN	alarm regeneration timer	integer	no-con/no-set	0	0 to 32767 s
NASTDB	alarm deadband timer	long integer	no-con/no-set	0	0-2147483647 ms

Table 99-1. PIDA Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
NASOPT	nuisance alarm suppression option	short	no-con/no-set	0	0 to 2
OUTPUTS					
ALMSTA	alarm status	pack_l	con/no-set	0	bit map
BCALCO	back calculation out	real	con/no-set	0.0	RI1
BLKSTA	block status	pack_l	con/no-set	0	bit map
CRIT	criticality	integer	con/no-set	0	[0 to 5]
ERROR	control error	real	con/no-set	0.0	RI1
FBTBLK	feedback tune block status	long	con/set	0	---
FFTBLK	feedforward tune block status	long	con/set	0	---
HDAIND	high deviation indicator	Boolean	con/no-set	0	0 to 1
HHAIND	high-high alarm indicator	Boolean	con/no-set	0	0 to 1
HOAIND	high out alarm indicator	Boolean	con/no-set	0	0 to 1
HOLIND	high out limit indicator	Boolean	con/no-set	0	0 to 1
INITO	initialize out	short	con/no-set	0	0 to 1
INHSTA	inhibit status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
LDAIND	low deviation indicator	Boolean	con/no-set	0	0 to 1
LLAIND	low-low alarm indicator	Boolean	con/no-set	0	0 to 1
LOAIND	low out alarm indicator	Boolean	con/no-set	0	0 to 1
LOLIND	low out limit indicator	Boolean	con/no-set	0	0 to 1
MEASHI	meas high alarm indicator	Boolean	con/no-set	0	0 to 1
MEASLI	meas low alarm indicator	Boolean	con/no-set	0	0 to 1
OUT	output	real	con/no-set	0.0	RO1
OUT2	back calculated internal controller output	real	con/no-set	0	%
PRTYPE	priority type	integer	con/no-set	0	[0 to 10]
QALSTA	quality status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
STATEB	feedback adaptor state	integer	con/no-set	-1	-3 to 6
STATEF	feedforward adaptor state	integer	con/no-set	-1	-2 to 6
SUPBCO	supervisory back calculation	real	con/no-set	0	RI1
UNACK	alarm notification	Boolean	con/no-set	0	0 to 1
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
ALMOPT	alarm options	pack_l	no-con/no-set	0	0 to 0xFFFFFFFF
DEFINE	no config errors	Boolean	no-con/no-set	1	0 to 1
ERCODE	config error	string	no-con/no-set	0	0 to 43 chars
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	Boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	0 to 32 chars
PERTIM	period time	real	no-con/no-set	0.1	seconds
PRSCAS	cascade state	short	no-con/no-set	0	0 to 7
PRSCON	present control state	short	no-con/no-set	0	0 to 3
RI1	eng range input	real[3]	no-con/no-set	100,0,1	specifiable
RI2	eng range input	real[3]	no-con/no-set	100,0,1	specifiable
RIN	eng range input	real[3]	no-con/no-set	100,0,1	ein

Table 99-1. PIDA Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
RO1	eng range output	real[3]	no-con/no-set	100,0,1	specifiable

99.3.1 Parameter Definitions

ACHNGE — Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command. It wraps around from 32767 to -32768.

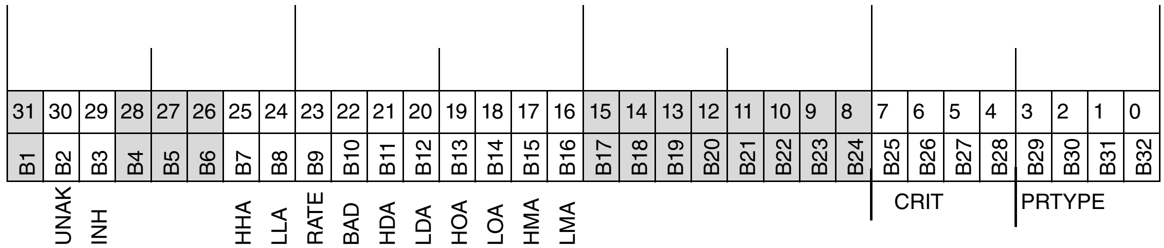
ALMOPT — Alarm Options contains packed long values representing the alarm types that have been configured as options in the block, and the alarm groups. For the PIDA block, only the following unshaded bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1] (0 to 31)	Configured Alarm Option When True
0	Alarm Group 8 in use
1	Alarm Group 7 in use
7	Alarm Group 1 in use
16	Low measurement alarm configured
17	High measurement alarm configured
18	Low output alarm configured
19	High output alarm configured
20	Low deviation alarm configured
21	High deviation alarm configured
22	Bad I/O alarm configured
24	Low-Low alarm configured
25	High-High alarm configured

[1] Bit 0 is the least significant, low order bit.

ALMSTA Alarm Status is a 32-bit output, bit-mapped to indicate the block's alarm states. For the PIDA block, only the following bits are used:



Bit Number (0 to 31)[1]	Name	Description When True	Boolean Connection (B32 to B1)
0 to 4	PTYP_MSK	Priority Type: See parameter PRTYPE for values used in the PIDA block	ALMSTA.B32–ALMSTA.B28
5 to 7	CRIT_MSK	Criticality; 5 = lowest priority, 1= highest	ALMSTA.B27–ALMSTA.B25
16	LMA	Low Measurement Absolute Alarm	ALMSTA.B16
17	HMA	High Measurement Absolute Alarm	ALMSTA.B15
18	LOA	Low Output Alarm	ALMSTA.B14
19	HOA	High Output Alarm	ALMSTA.B13
20	LDA	Low Deviation Alarm	ALMSTA.B12
21	HDA	High Deviation Alarm	ALMSTA.B11
22	BAD	Input/Output Bad (BAD output of block)	ALMSTA.B10
24	LLA	Low-Low Absolute Alarm	ALMSTA.B8
25	HHA	High-High Absolute Alarm	ALMSTA.B7
29	INH	Alarm inhibit	ALMSTA.B3
30	UNAK	Unacknowledged	ALMSTA.B2

1. Bit 0 is the least significant, low order bit.

AMRTIN Alarm Regeneration Timer is a configurable integer that specifies the time interval for an alarm condition to exist continuously, after which a new unacknowledged alarm condition and its associated alarm message is generated.

AUTSW Auto Switch is a Boolean input that, when true, overrides the MA and INITMA parameters, and drives the block to the Auto state. If both MANSW and AUTSW are true, MANSW has priority.

BAG — Bad Alarm Group is a short integer input that directs Bad alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.

BAO — Bad Alarm Option is a configurable option that enables alarm generation for each state change of the BAD parameter. The parameter values are:

- 0= No generation of Bad alarms.
- 1= Bad alarm generation if the FBM or FBC has Bad status.
- 2= Bad alarm generation in the measurement (MEAS or OUTPUT parameter) of a PID block family, RATIO block, or BIAS block when the MEAS or OUT parameter is connected to the PIDA block.

BAP — Bad Alarm Priority is an integer input, ranging from 1 to 5, that sets the priority level of the Bad alarm (1 is the highest priority).

BAT — Bad Alarm Text is a user-configurable text string of up to 32 characters, sent with the bad alarm message to identify it.

BATCHO — Batch Control Option is a Boolean input that enables the PIDA block to operate as a preloadable controller. You can change BATCHO only by reconfiguring the block. When BATCHO is true, and a limit condition exists, the integral term is set to the value nearer the limit, PRLOAD or the value selected when LIMOPT is 2. This tends to avoid saw-tooth ratcheting and excessively slow recovery.

BBIAS — Offset for the Bias is a real input used to offset the BIAS.
b_term = KBIAS*BIAS + BBIAS

BCALCI — Back Calculation In is a real input that provides the initial value of the output before the block enters the controlling state, so that the return to controlling is bumpless. The source for this input is the back calculation output (BCALCO) of the downstream block. With I/A Series software v4.2-v8.8 and Control Core Services v9.0 and later, BCALCI contains the status bits which were formerly contained in the INITI parameter. Therefore, INITI and INITO are not required for cascade initialization.

BLKSTA includes bits which can indicate when the downstream output is limited in either direction. BLKSTA.B11 monitors the Limited High condition (BCALCI.LHI) and BLKSTA.B10 monitors the Limited Low condition (BCALCI.LLO). Note that for the (primary) PIDA block, the BLKSTA.B10 and BLKSTA.B11 bits switch roles if the downstream block INCOPT is changed.

BCALCO — Back Calculation Output is a real output that is usually equal to the Measurement input. BCALCO is the value that, when connected to BCALCI of the upstream block, provides the initial value of the upstream block output required for bumpless initialization. With version 4.2, the BCALCO data record also contains status bits previously contained in INITO. You connect BCALCO to the BCALCI input of the upstream block. The setting of the handshaking bits is transmitted with status bits in the BCALCO to BCALCI connection.

BIAS

Bias is a real input added, after applying KBIAS and BBIAS, to the controller output to achieve OUT. BIAS can be dynamically compensated by employing the FFTUNE block.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the PIDA block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
FLB	SC	SE	HOL	LOL	MAO	LRO	FS		LLO	LHI	WLCK	SPRU		FTN	FTNI	ON	UDEF	PORSCHE	BAD	MA	LR	STRK		HLD	TRK	CTL	FOL		PTN	STN	MTN

Bit Number[1] (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
0	MTN	Manual Tune Mode	BLKSTA.B32
1	STN	Self-Tune Mode	BLKSTA.B31
2	PTN	Pre-Tune Mode	BLKSTA.B30
4	FOL	Follow	BLKSTA.B28
5	CTL	Controlling	BLKSTA.B27
6	TRK	Tracking	BLKSTA.B26
7	HLD	Holding	BLKSTA.B25
9	STRK	Setpoint Tracking	BLKSTA.B23
10	LR	Local(= false)/ Remote(= true)	BLKSTA.B22
11	MA	Manual(= false)/ Auto(= true)	BLKSTA.B21
12	BAD	Block in BAD state	BLKSTA.B20
13	PORSCHE	Block contains I/A Series v8.5 controller enhancements (parameters BAO, BAG, BAP and BAT)	BLKSTA.B19
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17

Bit Number[1] (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
16	FTNI	Feedforward Tune Inactive	BLKSTA.B16
17	FTN	Feedforward Tune Active	BLKSTA.B15
19	SPRU	Setpoint Ramp Up	BLKSTA.B13
20	WLCK	Workstation Lock	BLKSTA.B12
21[2]	LHI	Downstream Limited High	BLKSTA.B11
22[2]	LLO	Downstream Limited Low	BLKSTA.B10
24	FS	Failsafe	BLKSTA.B8
25	LRO	Local/Remote Override	BLKSTA.B7
26	MAO	Manual/Auto Override	BLKSTA.B6
27	LOL	Low Output Limit (Clamped)	BLKSTA.B5
28	HOL	High Output Limit (Clamped)	BLKSTA.B4
29	SE	Supervisory Enabled	BLKSTA.B3
30	SC	Supervisory Control	BLKSTA.B2
31	FLB	Supervisory Control Fallback State	BLKSTA.B1

1. Bit 0 is the least significant, low order bit.
2. Be aware that for the (primary) PIDA, the BLKSTA.B10 and BLKSTA.B11 bits switch roles if the downstream block INCOPT is changed.
Also be aware that BLKSTA.B10 and BLKSTA.B11 are not supported in CP60 or earlier control processors.

BTRKOP — Bias Track Option, when true, forces the PID algorithm's BIAS input to track the block output (OUT) when the block is in Manual, and operating in the Proportional Integral (PI) or Proportional Derivative (PD) controller mode.

CEOPT — Control Error Option is a short integer that specifies how the block responds to the MEAS and BCALCI inputs when either of those inputs is in error. To provide backward compatibility, CEOPT defaults to 1. CEOPT has a range of 0 to 2 where:

0 = The block takes no implicit Hold action when it detects a control error.

1 = The block goes to the Hold state if, while MBADOP = 0 either MEAS or BCALCI:

- has its BAD status bit set true
- has its Out-of-Service status bit set true
- is experiencing peer-to-peer path failure.

2 = The block goes to the Hold state if, while MBADOP = 0, either

- MEAS or BCALCI meets any of the conditions described for CEOPT = 1.
- MEAS has its ERROR status bit set true.

CEOPT is independent of the propagate error option, PROPT, and does not affect the external logical input, HOLD. The HOLD input, when true, still drives the block into the Hold state whenever the block is in Auto (and MBADOP = 0).

CEOPT enables implicit control error handling of HOLD, STRKOP, and MBADOP. When CEOPT is enabled, a control error is detected if the MEAS input has a status such as OOS, BAD, or off-scan. If MBADOP = 1 or 2, a control error forces the controller to Manual. If MBADOP = 0, a control error forces the controller to Hold if MA is set to Auto, and it disables setpoint tracking if SPTRKOP is set true.

If CEOPT is not enabled, then control error detection is not performed, and MBADOP, HOLD, and SPTRK handling is performed explicitly by asserting the HOLD input.

CRIT Criticality is an integer output that indicates the priority, ranging from 1 to 5, of the block's highest currently active alarm (1 is the highest priority). An output of zero indicates the absence of alarms.

DALOPT Deviation Alarm Option is a short integer input that enables High and Low deviation alarming, or disables alarming altogether.

0 = No alarming

1 = High and Low deviation alarming

2 = High deviation alarming only

3 = Low deviation alarming only.

You can change DALOPT only by reconfiguring the block.

DEFINE Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block. DEFINE is the opposite of the Block Status parameter Undefine (UDEF).

DELTI1 to DELTI2	Change Delta for Input Range 1 or 2 is a real value that defines the minimum percent of the input range that triggers change driven connections for parameters in the range of RI1 or RI2. The default value is 1. Entering a 1 causes the Object Manager to recognize and respond to a change of 1 percent of the full error range. If communication is within the same CP that contains the block's compound, change deltas have no effect. Refer to "Peer-to-Peer Connections of Real-Type Block Inputs" on page 1703 for details on how the I/A Series software affects the change delta percentage during operation.
DELTO1	Change delta for Output Range 1 is a configurable real value that defines the minimum percent of the output range that triggers change-driven connections for parameters in the range RO1. The default value is 1.0 percent. If communication is within the same CP that contains the block's compound, DELTO1 has no effect.
DERIV	Derivative Time is a real input in minutes. DERIV in the PID, NIPID and PIDTAU modes can be set by employing the FBTUNE block.

NOTE

The working DERIV value is indirectly limited by the working INT value.

DESCRP	Description is a user-defined string of up to 32 characters that describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").
DEVADB	Deviation Alarm Deadband is a real input, in MEAS units, that apply to both High and Low Deviation Limits.
DEVGRP	Deviation Group is a short integer input that directs deviation alarm messages to one of eight groups of alarm devices.
DEVPRI	Deviation Priority is an integer input, from 1 to 5, that sets the priority level of the deviation alarm (1 is the highest priority).
DEVTIM	Deviation Time specifies the time to delay the detection of a deviation alarm in the PIDA block. When the block goes into alarm, a counter delays the alarm message in units of BPC. Each time the block is processed, the counter is decremented by one, if there is a pending deviation alarm. When the counter is zero, the alarm is activated. When a PIDA block goes into deviation alarm and then returns to normal the value of the counter is restored.
DTIME	Deadtime is an input parameter that specifies the dead time in minutes placed in the integral-feedback path for the PIDTAU or PITAU controller mode. It is adaptively set by FBTUNE.

EI1 to EI2

Engineering Units for Input Ranges 1 and 2, as defined by the parameters HSCI1 to HSCI2 and LSCO1 to LSCO2, provides the engineering units text for the values defined by Input Ranges 1 and 2. “DEG F” or “PH” are typical entries. EI1 is used for the measurement and EI2 is used for bias.

EIN

Engineering Input units, as defined by the parameters HSCIN and LSCIN, provides the engineering units text for the multiplicative input MULTIN. “DEG F” or “PH” are typical entries. Make the units consistent with the signal source.

EO1

Engineering Units for Output Range 1, as defined by the parameters HSCO1 and LSCO1, provides the engineering units text for the values defined by Output Range 1. “DEG F” or “%” are typical entries. Make the units for the Output Range (EO1) consistent with the units of its sink in the downstream block.

ERCODE

Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block’s DEFINE parameter to be set false. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the PIDA block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
“W43 – INVALID PERIOD/PHASE COMBINATION”	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
“W44 – INVALID ENGINEERING RANGE”	High range value is less than or equal to low range value.
“W46 – INVALID INPUT CONNECTION”	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid Boolean extension connection has been configured.
“W47 – INVALID PARAMETER CONNECTION”	A tuning block is connected to a PIDA block containing a connected tuning constant.
“W48 – INVALID BLOCK OPTION”	The configured value of a block option is illegal.
“W49 – INVALID BLOCK EXTENSION”	An illegal block extension has been configured for NLNBLK (PIDA block).
“W53 – INVALID PARAMETER VALUE”	A parameter value is not in the acceptable range.

Message	Value
“W55 – CONTROLLER DOES NOT EXIST”	An FBTUNE or FFTUNE block has an unspecified or unresolved extension connection to a PIDA controller block. When the PIDA is installed, previously installed tuning blocks waiting for that PIDA will initialize automatically.
“W56 – INVALID CONTROLLER MODE”	An FBTUNE or FFTUNE block has an extension connection to a PIDA block whose mode (MODOPT) is not tunable.
“W57 – TUNING_CONSTANT LINKED”	An FBTUNE or FFTUNE block has an extension connection to a PIDA block that has a linked tuning constant.
“W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK”	A Database Installer error has occurred.

ERROR

Control Error is a real output that equals setpoint SPT minus measurement MEAS.

FBK

Integral Feedback is a real input that provides external integral feedback behavior. Its function is to prevent integral windup when LIMOPT = 3. If FBK is not linked to a source, it is connected to BCALCI, provided BCALCI is linked. Otherwise FBK is internally connected to OUT.

FBTBLK

Feed Back Tuning Block is automatically set to the BLKSTA of the FBTUNE extender.

FFTBLK

Feed Forward Tuning Block is automatically set to the BLKSTA of the FFTUNE extender.

FILTER

Filter is a real input parameter defining the time constant of a first order lag filter in minutes. FILTER diminishes the destabilizing effect of mismatch between process delay and controller delay in a PIDTAU or PITAU control mode. This term is adaptively set by FBTUNE.

FLBOPT

Fallback Option is a short integer input that defines the control action to be taken by the block when a Supervisory fallback occurs:

0 = Take no fallback action (default)

1 = Set MA parameter to Auto

2 = Set MA parameter to Manual

3 = Set LR parameter to Remote

4 = Set LR parameter to Local.

FLBOPT overrides linked MA and LR parameters, but does *not* override the AUTSW, MANSW, REMSW, and LOCSW parameters.

FLBREQ — Fallback Request is a short integer input that is an explicit request for the block to go to the Fallback state. The Fallback state of the block is defined by the FLBOPT parameter. Recovery from the Fallback state occurs at the block level (when SE is set), and/or at the group level (when the appropriate group enable bit is set in SUPENA).

0 = No fallback requested

1 = Fallback requested; recovery at block or group level

2 = Fallback requested; recovery *only* at block level

HDAIND — High Deviation Alarm Indicator is a Boolean output set true when the measurement exceeds the setpoint by more than the deviation limit HDALIM. When the measurement passes back through the DEVADB deadband, the block sets HDAIND to false.

HDALIM — High Deviation Alarm Limit is a real input that establishes the amount by which the measurement must exceed the setpoint to initiate a high deviation alarm and set the High Deviation Alarm Indicator, HDAIND, true.

HDATXT — High Deviation Alarm Text is a user-configurable text string of up to 32-characters, output with the alarm message to identify the alarm.

HHAGRP — High-High Absolute Alarm Group is a short integer input that directs High-High Absolute alarm messages to one of eight groups of alarm devices.

HHAIND — High-High Alarm Indicator is a Boolean output set true when the measurement input MEAS exceeds the high-high absolute alarm limit (HHALIM). HHAIND is set to false when the MEAS value is less than HHALIM. Once the Indicator is set true, it does not return to false until the MEAS value falls below the HHALIM less a deadband MEASDB.

HHALIM — High-High Absolute Alarm Limit is a real input that defines the value of the measurement input MEAS that triggers a High-High alarm.

HHAOPT — High-High Alarm Option is a configured short integer input that enables High-High and Low-Low absolute alarming for alarming the measurement input MEAS, or disables High-High and Low-Low alarming altogether. Each alarm triggers an indicator and text message.

0 = No alarming

1 = High-High and Low-Low alarming

2 = High-High alarming only

3 = Low-Low alarming only.

HHAPRI — High-High Alarm Priority is an integer input, from 1 to 5, that sets the priority level of the high-high absolute alarm (1 is the highest priority).

HHATXT — High-High Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the high-high absolute alarm message to identify it.

HOAIND	High Output Alarm Indicator is a Boolean output that is set true whenever the output is greater than HOALIM.
HOALIM	High Output Alarm Limit is a real input, (range RO1), that defines the value of the output OUT that initiates a high output alarm.
HOATXT	High Output Alarm Message Text is a user-defined text string of up to 32 characters that is output with the alarm message to identify the alarm.
HOLD	Hold is a Boolean input. When true, HOLD forces the block into the Hold substate of Auto, holding the output at its last computed value.
HOLIM	High Output Limit is a real input that establishes the maximum output value, (range RO1). If the algorithm tries to drive the output to a higher value, the output is clamped at the HOLIM value and the indicator HOLIND is set true.
HOLIND	High Output Limit Indicator is a Boolean output that is set true whenever the output is clamped at the high output limit, HOLIM.
HSCI1 to HSCI2	High Scale for Input Ranges 1 and 2 are real values that define the upper limit of the measurement ranges. EI1 to EI2 define the units. Make the range and units consistent with the measurement source. A typical value is 100 (percent). HSCI1 is used for the measurement and HSCI2 is used for bias.
HSCIN	High Scale for Input MULTIN is a real value that defines the upper limit of MULTIN. The default value is 100 (percent). EIN defines the units.
HSCO1	High Scale for Output Range 1 is a real value that defines the upper limit of the ranges for the output OUT. The default value is 100 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.
HZONE	High Zone is a real input that defines, in terms of the error, the upper limit of the zone in which the nonlinear gain option is exercised. HZONE is expressed as a percentage of the measurement span. If you enter a value less than 0 for HZONE, it is set to 0.
INCOPT	Increase/Increase Option is a Boolean input. When set true, INCOPT reverses the normal sense of the control action so that the controller output increases with increasing measurement.
INHALM	Inhibit Alarm is a packed Boolean input value that specifies the alarm inhibit requests for each alarm type configured in the block. The PIDA block, uses the following bits:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16

Bit Number* (0 to 15)	Description When True	Boolean Connection (B16 to B1)
0	Inhibit Low Measurement Alarm	INHALM.B16
1	Inhibit High Measurement Alarm	INHALM.B15
2	Low Output Alarm	INHALM.B14
3	High Output Alarm	INHALM.B13
4	Low Deviation Alarm	INHALM.B12
5	High Deviation Alarm	INHALM.B11
8	Inhibit Low-Low Absolute Alarm	INHALM.B8
9	Inhibit High-High Absolute Alarm	INHALM.B7
* Bit 0 is the least significant, low order bit.		

There are no mnemonic names for the individual bits of INHALM.

INHIB

Inhibit is a Boolean input. When true, it inhibits all block alarms; the alarm handling and detection functions are determined by the INHOPT setting. Alarms can also be inhibited based on INHALM and the compound parameter CINHIB.

INHOPT

Inhibit Option specifies the following actions applying to all block alarms:

0 = When an alarm is inhibited, disable alarm messages but do not disable alarm detection.

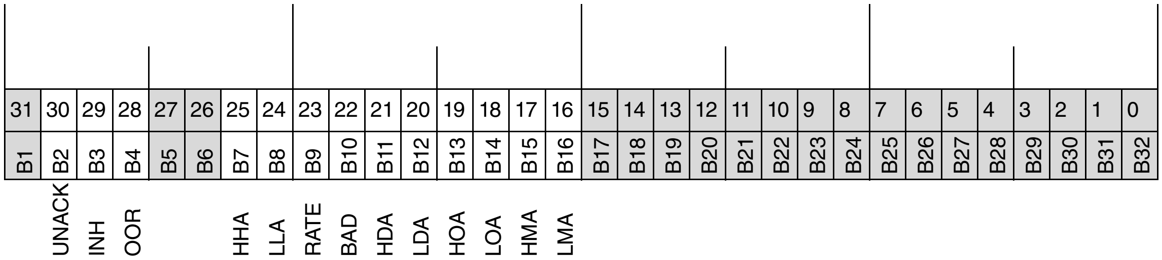
1 = When an alarm is inhibited, disable both alarm messages and alarm detection. If an alarm condition already exists at the time the alarm transitions into the inhibited state, clear the alarm indicator.

2 = Same as 0 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

3 = Same as 1 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

INHSTA

Inhibit Status is a packed long output that contains the actual inhibit status of each alarm type configured in the block. The PIDA block uses the following bits:



Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
16	LMA	Low Measurement Alarm Inhibited	INHSTA.B16
17	HMA	High Measurement Alarm Inhibited	INHSTA.B15
18	LOA	Low Output Alarm	INHSTA.B14
19	HOA	High Output Alarm	INHSTA.B13
20	LDA	Low Deviation Alarm	INHSTA.B12
21	HDA	High Deviation Alarm	INHSTA.B11
22	BAD	Bad I/O Alarm Inhibited	INHSTA.B10
23	RATE	Rate of Change Alarm	INHSTA.B9
24	LLA	Low-Low Absolute Alarm Inhibited	INHSTA.B8
25	HHA	High-High Absolute Alarm Inhibited	INHSTA.B7
28	OOR	Out-of-Range Alarm Inhibited	INHSTA.B4
29	INH	Inhibit Alarm	INHSTA.B3
30	UNACK	Unacknowledged	INHSTA.B2

* Bit 0 is the least significant, low order bit.

INITI

Initialization In defines the source block and parameter that drives this block into initialization. The source for this input is the initialization output of a downstream block. With V4.2 or later software, BCALCI contains the cascade initialization request data bit eliminating the need to configure INITI connections in cascades. However, to preserve backward compatibility, the INITI parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITI Boolean value is maintained, but the setting of the handshaking bits, via the INITI to INITO connection, is eliminated.

INITLR

Initial Local/Remote is an integer input that specifies the desired state of the LR input during startup, where:

0 = Local

1 = Remote

2 = The LR state as specified in the checkpoint file.

The block asserts this initial LR state when other parameters of the block are modified:

- ♦ The block is installed into the Control Processor database.
- ♦ The Control Processor undergoes a reboot operation.
- ♦ The compound in which the block resides is turned on.

The INITLR state is ignored if the LR input has an established linkage.

INITMA

Initial Manual/Auto specifies the desired state of the MA input during startup, where:

0 = Manual

1 = Auto

2 = The MA state as specified in the checkpoint file.

The block asserts this initial M/A state whenever:

- ♦ It is installed into the Control Processor database.
- ♦ The Control Processor undergoes a reboot operation.
- ♦ The compound in which it resides is turned on.
- ♦ The INITMA parameter itself is modified via the control configurator. (The block does not assert INITMA on ordinary reconfiguration.)

INITMA is ignored if MA has an established linkage.

INITO

Initialization Output is set true when:

- ♦ The block is in Manual or initializing.
- ♦ Permanent or temporary loss of FBM communications occurs.
- ♦ RSP (the remote setpoint) is not the setpoint source.

The block clears INITO when none of these conditions exist. Optionally, you connect this parameter to the INITI input of upstream blocks so that these upstream blocks can sense when this block is open loop. This block keeps INITO True, for one cycle (PRIBLK = 0), until the acknowledge is received from upstream (PRIBLK = 1 and PRITIM = 0.0), or for a fixed time delay (PRIBLK = 1 and PRITIM = nonzero).

With V4.2 or later software, BCALCO contains the initialization logic bits eliminating the need to configure INITO connections in cascades. The logic to set or reset the INITO Boolean value has been maintained, but the setting of the handshaking bits previously transmitted with the

	INITI to INITO connection, is transmitted with status bits in the BCALCO to BCALCI connection. INITI and INITO are not required for cascade initialization.
INITSE	Initial Supervisory Enable (INITSE) specifies the initial state of the SE parameter in a block configured for Supervisory Control (that is: SUPOPT =1 or 3) when the block starts up. 0= Disable 1= Enable 2= Do not change SE parameter.
INT	Integral Time is a real input in minutes. INT in the PI, PID, NIPID, PITAU, and PIDTAU modes can be set by employing the FBTUNE block. When a PIDA block is in PO or PD mode (that is, MODOPT=1 or MODOPT=3), the INT parameter appears on the default displays as BTIME because it becomes the balance time (explained below) for those controller modes. Balance time is utilized so that a bumpless transfer can be accomplished without compromising the algorithm of the PO or PD controller. In other words, if a PO or PD controller is either initialized or transferred from manual to auto, where the actual output is different from the algorithm's calculated output, the controller output is not bumped but instead is integrated (or balanced) over time until it matches its calculated value. The actual balance time is a function of a first-order lag and adjustable via the lag time constant, which is the INT (or BTIME) parameter expressed in minutes. The PIDA block does not have a parameter labeled BTIME associated with it so all Object Manager access to the BTIME value must refer to INT.
KBIAS	BIAS scale or gain factor is a real input that multiplies the BIAS input. It is expressed in OUT (RO1) units divided by BIAS (RI2) units.
KD	Measurement Filter Factor is a real input that adjusts the time constant of the measurement filter. For PD and NIPID, the filter time constant is: [DERIV / KD]. For PID, the filter time is: 1/[(1/INT) + (1/DERIV)]KD. For PITAU and PIDTAU, the filter time is: [DTIME / 4KD]. The value of KD is adjusted during FBTUNE's pretune.
KZONE	Middle Zone Gain establishes the relative gain within the zone defined by HZONE and LZONE. KZONE is usually set at less than unity for pH control applications, or for desensitizing the control to noise. If you enter a value less than 0 for KZONE, it is set to 0.

CAUTION

1. If KZONE is set to zero, the block behaves as a dead zone controller, causing most loops to limit cycle.
2. If KZONE is set to greater than 1, the block may cause oscillations in the process model.

LDAIND
: The Low Deviation Alarm Indicator is a Boolean output that is set true when the measurement falls below the setpoint by more than the deviation limit, LDALIM. When the measurement passes back through the DEVADB deadband, the block sets LDAIND to false.

LDALIM
: Low Deviation Alarm Limit is a real input that defines how far the measurement must fall below the setpoint to initiate a low deviation alarm and set the Low Deviation Alarm Indicator LDAIND true.

LDATXT
: Low Deviation Alarm Text is a user-defined text string of up to 32-character that is output with the alarm message to identify the alarm.

LIMOPT
: Limit Option is a configurable integer that specifies the anti-windup strategy for recovering from a limiting condition. LIMOPT values range from 1 to 3 and map to the following strategies:

1 = Freezes the integral term between the effective limit values when limiting is detected. This is the default choice. The net proportional and derivative term must subside to the difference between the effective limit value and the integral term before the output comes out of limit and integration resumes.

2 = Adjusts the integral term so that the prelimited output is equal to the effective limit value when limiting is detected. As soon as the net proportional and derivative terms change direction, the output comes out of limits and integration resumes. This produces a more sluggish non-overshooting recovery.

3 = Allows the integral term to exponentially coast up to the effective limit value with the integral time constant. If the limit condition persists long enough (several integral time constants), the net proportional and derivative term must change sign before the output comes out of limit and integration resumes. The result may be an overly-aggressive overshooting recovery.

LLAIND
: Low-Low Alarm Indicator is a Boolean output set true when the MEAS input falls below the low-low absolute alarm limit (LLALIM). LLAIND is set to false when the value is greater than LLALIM. Once the Indicator is set true, it does not return to false until the MEAS value exceeds the limit plus a deadband MEASDB.

LLALIM
: Low-Low Absolute Alarm Limit is a real input that defines the value of the MEAS that triggers a Low-Low Alarm.

LLATXT — Low-Low Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the low-low absolute alarm message to identify it.

LOAIND — Low Output Alarm Indicator is a Boolean output that is set true whenever the output is less than LOALIM.

LOALIM — Low Output Alarm Limit is a real input, in OUT units, that defines the value of the output that initiates a low output alarm.

LOATXT — Low Output Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm.

LOCKID — Lock Identifier is a string data store that identifies the workstation that has exclusive write access to the block. LOCKID arbitrates write access to the control block parameters by operator workstations on the network. Set requests to any of the block's parameters are honored only if the requesting workstation's identifier matches the contents of LOCKID.

LOCKID does not lock out sequence code write access to block parameters. Sequence block set requests to any of the block's parameters are always honored.

The lock-request message sets LOCKRQ to true and sets LOCKID to the identifier of the requesting workstation. The lock-release message clears LOCKRQ and nulls LOCKID.

LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 6-character logical name of the Display Manager.

LOCKRQ — Lock Request is a Boolean data store that is set true or false by toggling the LOCK U/L key on the Block Detail Display. An operator at any other workstation can lock and unlock the block by toggling the LOCK U/L key.

The lock-request message sets LOCKRQ true, sets LOCKID to the identifier of the requesting workstation, and sets the WLCK bit in the BLKSTA parameter. Set requests to any of the block's parameters are only honored if the requesting workstation's identifier matches the contents of LOCKID.

LOCKID does not lock out sequence code write access to block parameters. Sequence block set requests to any of the block's parameters are always honored.

The lock-release message resets LOCKRQ, nulls LOCKID, and resets the WLCK bit.

NOTE

Do not set LOCKRQ with an application program. Contention for the use of the block may make the block inaccessible.

LOCSP	Local Setpoint Secure is a Boolean input. When true, LOCSP provides lockout of user write access to the LR parameter. If LOCSP is configured true, the block secures LR in local when it initializes and maintains LR in the secured state. The LOCSW and REMSW overrides have higher precedence, but LR remains secured when they are no longer asserted.
LOCSW	Local Switch is a Boolean input. When true, LOCSW overrides the LR and INITLR parameters and drives the block to the Local state. If both LOCSW and REMSW are true, LOCSW has priority.
LOLIM	Low Output Limit is a real input that establishes the minimum output value. If the algorithm tries to drive the output to a lower value, the output is clamped at the LOLIM value and the indicator LOLIND is set true.
LOLIND	Low Output Limit Indicator is a Boolean output that is set true whenever the output is clamped at the low output limit, LOLIM.
LOOPID	Loop Identifier is a configurable string of up to 32 characters that identify the loop or process associated with the block. It is displayed on the detail display of the block, immediately below the faceplate.
LR	Local/Remote is a Boolean input that selects the setpoint source (0 = Local; 1 = Remote). If LR is set to Remote, the source of the setpoint value is the real input parameter RSP. When LR is set to Local, the source is the user set input SPT.
LSCI1 to LSCI2	Low Scale for Input Ranges 1 and 2 are real values that define the lower limit of the measurement ranges. A typical value is 0 (percent). EI1 to EI2 define the units. Make the range and units consistent with those of the measurement source. LSCI1 is used for the measurement and LSCI2 is used for bias.
LSCIN	Low Scale for Input MULTIN is a real value that defines the lower limit of MULTIN. The default value is 0 (percent). EIN defines the units.
LSCO1	Low Scale for Output Range 1 is a real value that defines the lower limit of the ranges for Output 1. The default value is 0 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.
LZONE	Low Zone is a real input that defines, in terms of the error, the absolute value of the negative error level that sets the lower limit of the zone in which the nonlinear gain option is exercised. LZONE is expressed as a percentage of the measurement span RI1. If you enter a value less than 0 for LZONE, it is set to 0.
MA	Manual /Auto is a Boolean input that controls the block's operating state: 0 = Manual 1 = Auto.

In Manual, each PIDA block output is unsecured, which makes it settable by an external process (program or display). In Auto, the block secures each output so that they cannot be set externally.

MALOPT

Measurement Alarm Option is a configured short integer input that enables absolute High and Low measurement alarming, or disables absolute alarming altogether.

0 = No alarming

1 = High and Low measurement alarming

2 = High measurement alarming only

3 = Low measurement alarming only.

You can change MALOPT only by reconfiguring the block.

MANALM

Manual Alarm Option is a configurable input which enables and disables configured alarm options to function in Manual or Track mode. Normally alarms are processed only in the Auto mode.

0 = No alarming in Manual
1 = Full alarming in Manual
2 = No output alarming in Manual.
3 = No output alarming in Track.
4 = No output alarming in Manual or Track.

MANFS

Manual if Failsafe is a Boolean input. When configured true, MANFS drives the block to the Manual state if the block detects an incoming failsafe status on its incoming BCALCI input.

MANSW

Manual Switch is a Boolean input. When true, MANSW overrides the MA and INITMA parameters and drives the block to the Manual state. If both MANSW and AUTSW are true, MANSW has priority.

MBADOP

Manual if Bad Option is a manual override feature. When MBADOP is set to 1 or 2, the block sets the unlinked MA input to manual if it detects a BAD status bit in the MEAS, BCALCI or FBK input, and when set to 2, it detects that the Remote Setpoint (RSP) is not healthy (i.e., value status is BAD or has a broken OM connection). This forces the output state to manual as long as the BAD status remains. After the BAD status clears, returning to Auto requires external intervention unless AUTSW is true.

0 = no option enabled

1 = Switch to Manual when MEAS, BCALCI, or FBK value status is BAD

2 = Same as option 1, plus switch to Manual when RSP is not healthy

You can change MBADOP only by reconfiguring the block. MBADOP has the same priority as the MANSW override, and it has precedence over the AUTSW override. MBADOP has no effect when MA is linked. If any of the MBADOP conditions are true, the block will be switched to Manual regardless of the MANSW and AUTSW settings.

MCLOPT	Manual Clamping Option allows you to invoke output clamping while the block is in manual.
MEAS	Measurement is an input identifying the source of the block's measurement input, the controlled variable.
MEASDB	Measurement Alarm Deadband is a configured input, expressed in MEAS units, that applies to High, Low, High-High, and Low-Low Alarm Limits.
MEASGR	Measurement Group is a short integer input that directs measurement alarm messages to one of eight groups of alarm devices.
MEASHI	Measurement High Alarm Indicator is a Boolean output that is set true when the measurement MEAS exceeds the high alarm limit MEASHL. When the measurement passes back through the deadband, the block sets MEASHI to false.
MEASHL	Measurement High Alarm Limit is a real input that defines the value of the measurement MEAS that initiates a high absolute alarm.
MEASHT	Measurement High Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can only change the message text by reconfiguring the block.
MEASLI	Measurement Low Alarm Indicator is a Boolean output that is set true when the measurement MEAS falls below the low alarm limit MEASLL. When the measurement passes back through the MEASDB deadband, the block sets MEASLI to false.
MEASLL	Measurement Low Alarm Limit is a real input that defines the value of the measurement that initiates a low absolute alarm.
MEASLT	Measurement Low Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can only change the message text by reconfiguring the block.
MEASNM	Measurement Alarm Name is a user-defined text string of up to 12 characters that identify the alarm source in the alarm message. It serves as a point descriptor label (for example, Furn 37 Temp).
MEASPR	Measurement Priority is an integer input (1 to 5), that sets the priority level of the measurement alarm (1 is the highest priority).
MODOPT	Mode Option is a configurable short integer. When the block is in Auto, MODOPT dictates the controller mode. The integer value ranges from 1 to 8: 1 = P – proportional only 2 = I – integral only 3 = PD – proportional plus derivative 4 = PI – proportional plus integral

5 = PID – proportional, integral, derivative (product of factors)

6 = NIPID – non-interacting PID (sum of terms)

7 = PIτ– proportional, integral, deadtime (interacting if derivative not 0)

8 = PIDτ – non-interacting proportional, integral, derivative, deadtime

MULTIN

Multiplicative Feedforward Input is an input, in engineering units, as defined by the parameters HSCIN and LSCIN. Dynamic compensation is adaptively set by FFTUNE.

NAME

Name is a user-defined string of up to 12 characters used to access the block and its parameters.

NASOPT

Nuisance Alarm Suppression Option is a configurable, non-settable short integer that specifies how the nuisance alarm delay is implemented:

- 0 = Suppress nuisance alarms by delaying the Return-to-Normal (default) by the length of time specified in NASTDB
- 1 = Suppress nuisance alarms by delaying alarm detection by the length of time specified in NASTDB
- 2 = Suppress nuisance alarms by delaying both the Alarm Detection and the Return-to-Normal by the length of time specified in NASTDB

NASTDB

Alarm Deadband Timer is a configurable long integer. Depending on the value of NASOPT, it either specifies the deadband time interval that must elapse before an alarm condition is allowed to return to normal, or the length of a delay-on timer which specifies the amount of time between an alarm's detection and the announcement of the alarm. The parameter value ranges from zero (default, no delay) to 2147483647 ms.

NLNBLK

Nonlinear block is the Block Status (BLKSTA) of the characterizer (CHARC) extension block, where matched nonlinear functions are specified. These functions are inserted into the measurement (MEAS) and setpoint (SPT) paths, ahead of any dynamic compensations. The measurement and set point are in engineering units. The function outputs are in percent of full scale.

To embed a CHARC function in a PIDA or AIN, you must connect the BLKSTA of the CHARC block into the PIDA's NLNBLK or the AIN's EXTBLK parameter. You must set the CHARC's EXTOPT parameter to 1. When the CHARC is used as an extender, its inputs and outputs are not explicitly configured. In the PIDA, CHARC applies matched piece wise functions to :PIDA.SPT and to :PIDA. MEAS. The PIDA's CHARC output is expressed in percent of span. For a pH application, this allows the operator to view SPT and MEAS in nonlinear pH units and for the internal controller to view the process in more linear ion-concentration units.

NONLOP	Nonlinear Option is a configured Boolean input that allows you to customize the gain in a zone about zero error. If true, the relative gain of the controller is set to KZONE in the error band between LZONE and HZONE. You can use NONLOP to reduce the sensitivity to measurement noise.
OALOPT	Output Alarm Option is a configured short integer input that enables absolute High and Low alarming of the block output (OUT) or disables output alarming altogether. 0 = No alarming 1 = High and Low output alarming 2 = High output alarming only 3 = Low output alarming only.
OSV	Output Span Variance is a configurable, real input that defines the amount by which the output clamp limits (HOLIM, LOLIM) can exceed the specified output range, as defined by HSCO1 and LSCO1. OSV is not used when determining output limiting for this block.
OUT	Output, in Auto mode, is the real result of the block algorithm. In Manual, OUT is unsecured, and can be set by you or by an external task.
OUT2	Output 2 is a real output used as a feedforward input for other blocks. OUT2 is the back-calculated indication of the internal controller output, expressed in percent or engineering units.
OUTADB	Output Alarm Deadband is a real input that specifies the size of the deadband for both High and Low Output Alarm Limits.
OUTGRP	Output Group is a short integer input that directs high and low output alarm messages to one of eight groups of alarm devices.
OUTNM	The Output Alarm Name is a user-defined string of up to 32 characters that identifies the alarm source in the alarm message. It serves as a point descriptor label (for example, F2 Fuel Ctrl).
OUTPRI	Output Priority is an integer input (1 to 5) that sets the priority level of the High and Low Output Alarms (1 is the highest priority).
OWNER	Owner is a string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set OWNER are successful only if the present value is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. OWNER can be cleared by setting it to the null string; this value is always accepted. Once set to the null string, the value can then be set as desired.
PBAND	Proportional Band is an input expressed in percent. PBAND is the percent of span change in input, that causes a full-span change in output. [100 /

PBAND] determines the gain of the controller when MEAS and OUT are converted to percent of span. It is adaptively set by FBTUNE.

PERIOD Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PERTIM Period Time is the period of the block expressed in seconds.

PHASE Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute with phases 0, 1, 2, or 3, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PRIBLK Primary Block is a cascade configuration option. PRIBLK must be configured 0 in a primary block, and 1 in a non-primary (secondary) block. A PRIBLK value of 1 causes a secondary block to wait for its primary block to initialize before it uses the remote setpoint. Depending on the value of PRITIM, PRIBLK does this by forcing the PIDA block to remain in the Hold state until the Acknowledge status bit (Bit 10) of MEAS is detected from the upstream block (PRITIM = 0.0), or until the time defined by PRITIM expires (PRITIM > 0.0). In the latter case, the explicit acknowledge from the upstream block is not needed.

Use PRIBLK in a cascade situation when the source of the block's input connection needs to be initialized.

Refer to "PRIBLK and PRITIM Functionality" on page 1871 for more information on this parameter.

PRITIM Primary Cascade Timer is a configurable parameter used to delay the closing of the cascade to a primary block, when the output is initialized in the PIDA block. It is used only if the PRIBLK option is set. The cascade is closed automatically when the timer expires without requiring an explicit acknowledge by the upstream block logic.

Refer to "PRIBLK and PRITIM Functionality" on page 1871 for more information on this parameter.

PRLOAD Batch Preload is a real input that is loaded into the controller's integral term whenever the output is being limited at either the LOLIM or HOLIM values. PRLOAD is operational only when the block is in Auto and the Batch Control Option BATCHO is configured. It provides a normalized output between 0-100%.

PROPT

Propagate Error Option is a short integer input. PROPT was changed from a Boolean to a Short Integer in I/A Series software v8.5 for this block. It can be set to 0-2, with the following exception:

NOTE

If PROPT is configured from IACC v2.4 or later, it can only be set to 0 or 1.

- 0 = option is disabled (default)
- 1 = set the ERROR Status bit of the output parameter (OUT) if the input to the MEAS parameter is in error (see below) while the block is in Auto
- 2 = copy (propagate) the BAD, OOS (Out-of-Service), and ERROR status bits from the MEAS parameter to the output parameter (OUT). This value cannot be set from IACC v2.4 or later.

The input to the MEAS parameter is in error when:

- Its BAD status bit is set true
- Its OOS (Out-of-Service) status bit is set true
- Its ERROR status bit is set true
- It is experiencing peer-to-peer path failure.

If a transition to Manual occurs while the ERROR status is true, it remains true until either a set command is written to that output or until the block transfers to Auto with the error condition returned to normal.

PRSCAS

Present Cascade State is a data store that indicates the cascade state. It has the following possible values:

Value	State	Description
1	“INIT_U”	Unconditional initialization of the primary cascade is in progress.
2	“PRI_OPN”	The primary cascade is open.
3	“INIT_C”	Conditional initialization of the primary cascade is in progress.
4	“PRI_CLS”	The primary cascade is closed.
5	“SUP_INIT”	The supervisory cascade is initializing.
6	“SUP_OPN”	The supervisory cascade is open.
7	“SUP_CLS”	The supervisory cascade is closed.

PRSCON

Present Control state is a short integer data store that contains the substates of Auto:

1 = Holding

2 = Tracking

3 = Controlling (not open loop).

PRTYPE

Priority Type is an indexed output parameter that indicates the alarm type of the highest priority active alarm. The PRTYPE outputs of this block include the following alarm types:

0 = No active alarm

1 = High Absolute

2 = Low Absolute

3 = High-High Absolute

4 = Low-Low Absolute

5 = High Deviation

6 = Low Deviation

8 = BAD Alarm

23 = High Output

24 = Low Output

25 = Out-of-Range.

If there is more than one active alarm with highest priority, PRTYPE reports the alarm type according to which occurs first as follows: Out-of-Range, High-High Absolute, Low-Low Absolute, High Absolute, Low Absolute and Bad Deviation.

For example: if the Bad and High-High Absolute alarms both have priority 3 and the Out-of-Range alarm has priority 4, and all three alarms are active, then CRIT = 3 and PRTYPE = 8.

QALSTA

Quality Status parameter (QALSTA) is a non-configurable packed long that provides a combination of value record status, block status (BLKSTA), and alarm status (ALMSTA) information in a single connectable output parameter. Available bits for this block are provided below.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1]	Definition	Contents	Boolean Connection (B32 to B1)
30	Alarms Unacknowledged	ALMSTA.UNA	QALSTA.B2
29	Alarms Inhibited	ALMSTA.INH	QALSTA.B3
25	High-High Absolute Alarm	ALMSTA.HHA	QALSTA.B7
24	Low-Low Absolute Alarm	ALMSTA.LLA	QALSTA.B8
21	High Deviation Alarm	ALMSTA.HDA	QALSTA.B11
20	Low Deviation Alarm	ALMSTA.LDA	QALSTA.B12

Bit Number[1]	Definition	Contents	Boolean Connection (B32 to B1)
19	High Output Alarm	ALMSTA.HOA	QALSTA.B13
18	Low Output Alarm	ALMSTA.LOA	QALSTA.B14
17	High Absolute Alarm	ALMSTA.HMA	QALSTA.B15
16	Low Absolute Alarm	ALMSTA.LMA	QALSTA.B16
5	Manual	BLKSTA.MA	QALSTA.B27
4	Low Limited	MEAS.LLO status	QALSTA.B28
3	High Limited	MEAS.LHI status	QALSTA.B29
2	Uncertain	MEAS.ERR status	QALSTA.B30
1	Out-of-Service	MEAS.OOS status	QALSTA.B31
0	Bad	MEAS.BAD status	QALSTA.B32

1. Bit 0 is the least significant, low order bit.

REMSW Remote Switch is a Boolean input. When true, REMSW overrides the unlinked LR and INITLR parameters, and drives the block to the Remote state. If both LOCSW and REMSW are true, LOCSW has priority.

RI1 Range Input 1 is an array of real values that specify the high and low engineering scale (HSCI - LSCI) of the MEAS input. RI1 also applies to SPT and related parameters.

RI2 Range Input 2 is an array of real values that specify the high and low engineering scale (HSCI - LSCI) of the BIAS input.

RIN Range Input is a data store array of real values that specifies the high and low engineering scale and change delta for input MULTIN.

RO1 Range Output is an array of real values that specify the high and low engineering scale (HSCO - LSCO) of the controller output OUT and other related parameters.

RSP Remote Setpoint is the selected setpoint source when LR is set to Remote. RSP is a real input. Typically RSP connects to an upstream block in a cascade scheme. RSP and its source must be expressed in MEAS units RI1.

SE Supervisory Enable is a Boolean input that enables or disables Supervisory Control in this block:

0 = Disable

1 = Enable.

SPCLMP Setpoint Clamp is a configurable short integer that specifies the limits to be used when clamping or limiting the Supervisory setpoint (SUP_IN), and Remote setpoint (RSP).

	0 = clamp using the measurement scale limits (HSCI1 and LSCI1) if the setpoint mode is SUPERVISORY, REMOTE, or TRACKING. If the setpoint mode is LOCAL, use the setpoint limits (SPHLIM and SPLLIM) subject to the ballooning feature described in "Setpoint Limiting" on page 1876. 1 = clamp using the setpoint limits (SPHLIM and SPLLIM) regardless of the setpoint mode 2 = reject values outside of the setpoint limits (SPHLIM and SPLLIM)
SPHLIM	Setpoint High Limit is the upper limit for the local setpoint value in engineering units RI1. It is an input. With SPCLMP = 0, if the setpoint is greater than SPHLIM at the instant before switching to local, the effective limit is stretched to allow the initial setpoint value. As the local setpoint is decreased, the effective upper limit is decreased until the SPHLIM value is reached.
SPLCOP	Sample Controller Option is a configurable Boolean that allows the PIDA to operate with a period between output updates larger than the block's PERIOD parameter. When SPLCOP is 1, the update period is defined by TSAMPL or the update triggered by SPLRDY.
SPLLAG	The Relative Gain applied to setpoint is an input parameter. Its optimum value depends on the process type: 0.2 for a dominant lag process, 1.0 for a dominant delay. It is adaptively set by FBTUNE.
SPLLIM	Setpoint Low Limit is the lower limit for the local setpoint value in engineering units. It is an input. With SPCLMP = 0, if the setpoint is less than SPLLIM at the instant before switching to local, the effective limit is stretched to allow the initial setpoint value. As the local setpoint is increased, the effective lower limit is increased until the SPLLIM value is reached.
SPLRDY	Sample Ready is a Boolean pulse input. On a 0-to-1 transition, SPLRDY triggers an output update. SPLCOP option must be selected.
SPRAMP	Setpoint Ramp state is a Boolean input. It is set to 1 to trigger the start of a setpoint ramp.
SPRATE	Setpoint Ramp Rate is a positive real input that specifies ramping of the setpoint to a new target value (SPTARG) by rate in engineering units per minute or by time to target in minutes, depending on the value of SPROPT.

SPROPT

Setpoint Option is a configurable short integer input that specifies the setpoint ramping option:

0 = No setpoint ramping.

1 = Ramp using SPRATE as ramp rate (units/minutes). The setpoint ramps to a new target value SPTARG at the rate SPRATE, when the operator or a program starts the ramp by setting SPRAMP to 1.

2 = Ramp using SPRATE as ramp rate. Ramping stops whenever the block is in deviation alarm and continued setpoint ramping would increase the deviation. When the measurement catches up to the setpoint, reducing the deviation, setpoint ramping is uninhibited and resumes.

3 = Ramp using SPRATE as ramp time (minutes). The setpoint ramps to a new target value SPTARG during the time period SPRATE, when the operator or a program starts the ramp by setting SPRAMP to 1.

4 = Ramp using SPRATE as ramp time. Ramping stops whenever the block is in deviation alarm and continued setpoint ramping would increase the deviation. When the measurement catches up to the setpoint, reducing the deviation, setpoint ramping is uninhibited and resumes.

If SPTARG is changed during ramping, the block continues to ramp at the initial rate calculated for the SPRATE time.

SPRAMP is reset and ramping stops when the setpoint reaches the target or when an operator makes a manual setpoint change.

SPT

Setpoint always represents the active controller setpoint. Setpoint is the reference variable that is compared with the MEAS input to produce the ERROR signal. LR and SE determine the source of SPT.

When LR is set to Remote, RSP is the source of SPT, which is secured.

When LR is Local and SE is Disable, the user set value is the source of SPT. When using the controller in only the Local mode, set LOCSP to 1 (True). SPT can source the setpoint value to other blocks.

When SE is enabled, Supervisory setpoint overrides all other setpoint sources.

While settable by default, SPT is nonsettable while setpoint tracking is active. (See STRKOP.)

SPTARG

Setpoint Target, an input, is the final value for a setpoint ramp in engineering units. It must be set within the setpoint SPHLIM and SPLLIM limits, otherwise SPRAMP is reset to 0 and no ramping occurs.

STATEB

The state of the feedback adaptor is an output. Its values are:

-3 = Pretune

-2 = Off

-1 = Hold last tuning
0 = Quiet, waiting for new (isolated) response
1 = Locating and confirming peak 1
2 = Locating and confirming peak 2
3 = Locating and confirming peak 3
4 = Locating and confirming peak 4
5 = Wait for output peak search to finish
6 = Settle (A non-isolated response can trigger a new search from this state).

If a peak is not confirmed, later states may be bypassed.

STATEF

The state of the feedforward adaptor is an output. Its values are:

-2 = Off
-1 = Hold last tuning
0 = Quiet, waiting for new disturbance
1 = Unmeasured disturbance (or non-isolated response)
2 = Measured disturbance
3 = Significant (isolated) response
4 = Confirmed response
5 = Wait
6 = Settle.

States 4, 5, and 6 are bypassed if an FBTUNE extension block is not active on the PIDA block.

STRKOP

Setpoint Track Option is a short integer input. When active, STRKOP enables the setpoint to track the measurement input under the following conditions.

0 = no option enabled

1 = SPT parameter tracks the measurement input when the block is in Manual, or the cascade is open downstream (Initialization input INITI is true).

2 = SPT parameter tracks the measurement only when the block is in Manual.

STRKOP is active only when the setpoint source selector LR is in Local.

SPT is nonsettable while setpoint tracking is active. You can change STRKOP only by reconfiguring the block.

SUPBCO

Supervisory Back-Calculated Output is a real output that specifies the value used by the Supervisory application program to initialize its output to the current setpoint. SUPBCO also contains the following status bits:

Status	Meaning
Bit 10 = 1	Initialize SUP_IN
Bit 13 = 1	SUP_IN is limited high
Bit 14 = 1	SUP_IN is limited low
Bit 13 = 1 and Bit 14 =1	Supervisory cascade is open

These status bits of SUPBCO are non configurable and can only be accessed by an application program.

SUPGRP

Supervisory Group is a short integer input (1 to 8) that specifies one of eight groups to which this block is assigned for Supervisory Control.

SUPOPT

Supervisory Option is a configurable short integer input that specifies whether or not this block is under control of a Supervisory Control application:

0 = No Supervisory control

1 = Set Point Control (SPC) of the block's setpoint (Supervisory setpoint control (SSC)) - This mode indicates that SSC is configured for the computer to control the setpoint. When a PIDA block is in this mode, the LR parameter is secured while the MA parameter can be toggled. The LR parameter is secured because it is being written from the SUP_IN input (the computer input) and toggling the block from Remote would change the source of the setpoint. The MA parameter is not secured so the block can be set to Manual to allow an operator to enter an OUTput valve (this is consistent with regulatory cascade where LR= and RSP=remote setpoint). Once the block has been toggled to Manual, the supervisory control is immediately disabled.

2 = Direct Digital Control (DDC) of the block output (Supervisory output control) - This mode indicates that SSC is configured for the computer to control the output. In this mode, the computer "setpoint" is actually going directly to the block's OUTput. When a PIDA block is in this mode, the MA parameter is secured while the LR parameter can be toggled. The MA parameter is secured to prevent a change in the source of the PIDA's OUTput. The LR parameter is not secured since neither SPT nor RSP are being used to compute the block's OUTput and thus toggling LR would have no effect.

NOTE

Setting SUPOPT=2 enables DDC control only, i.e. supervisory control over the output in the PIDA block. It is not intended to be used with Advanced Process Control (APC), which performs SSC, i.e., supervisory control of the setpoint in the PIDA. To use APC, configure SUPOPT=1 (or 3 if automatic acknowledgement of a setpoint change is desired).

	3 = Same as 1,SPC, with an implicit acknowledge by the CP 4 = Same as 2, DDC, with an implicit acknowledge by the CP Be aware that options 1 and 2 require an explicit acknowledge by the application software to close the supervisory cascade. This must be done by setting the ACK status bit in the SUP_IN parameter using special OM access functions.
SUP_IN	Supervisory Input is a real input that is the parameter set by a Supervisory application program when performing supervisory control of this block's setpoint. SUP_IN also contains a status bit (Bit 10) that must be set by the supervisory program to acknowledge a request to initialize (Bit 10 in SUPBCO).
TRACK	Track is a real input that provides the input signal that block output OUT tracks when the block is in Auto and TRKENL is 1. If TRKENL is true (set to 1) when the block is in Manual, tracking is not performed.
TRKENL	Track Enable is a Boolean input that enables the block output to follow the TRACK input. 0 - Disable Tracking 1 - Enable Tracking.
TSAMPL	Sampling Time is a real input parameter that specifies the period, in minutes, of an internal timer that triggers an output update. If external triggering of the control action is desired, set TSAMPL to 0 and use SPLRDY to trigger the output update.
TYPE	Type is a system-level mnemonic label indicating the block type. Enter "PIDA" or select "PIDA" from the block type list under Show when configuring the block.
UNACK	Unacknowledge is a Boolean output that the block sets to True when it detects an alarm. It is typically reset by operator action.

99.4 Detailed Functions

99.4.1 PIDA Operational Introduction

The controller provides P, I, PI, PD, PID, NIPID, PITAU, and PIDTAU control modes. The following controller tuning parameters are set by you or adaptively tuned by the FBTUNE block (see the FBTUNE Block Description for details):

- Proportional band (PBAND)
- Integral time (INT)
- Derivative time (DERIV)
- Derivative gain (KD)
- Relative gain on setpoint (SPLLAG).

The FFTUNE block provides adaptive feedforward control by compensating the multiplicative input (MULTIN) or BIAS input (see the FFTUNE Block Description for details).

The PIDA block's control algorithm supports tuning, scaling and alarming functions (see Figure 99-2). The block provides:

- Absolute and deviation alarming of the measurement (see Figure 99-4)
- Absolute alarming of the controller output
- Bad I/O alarming.

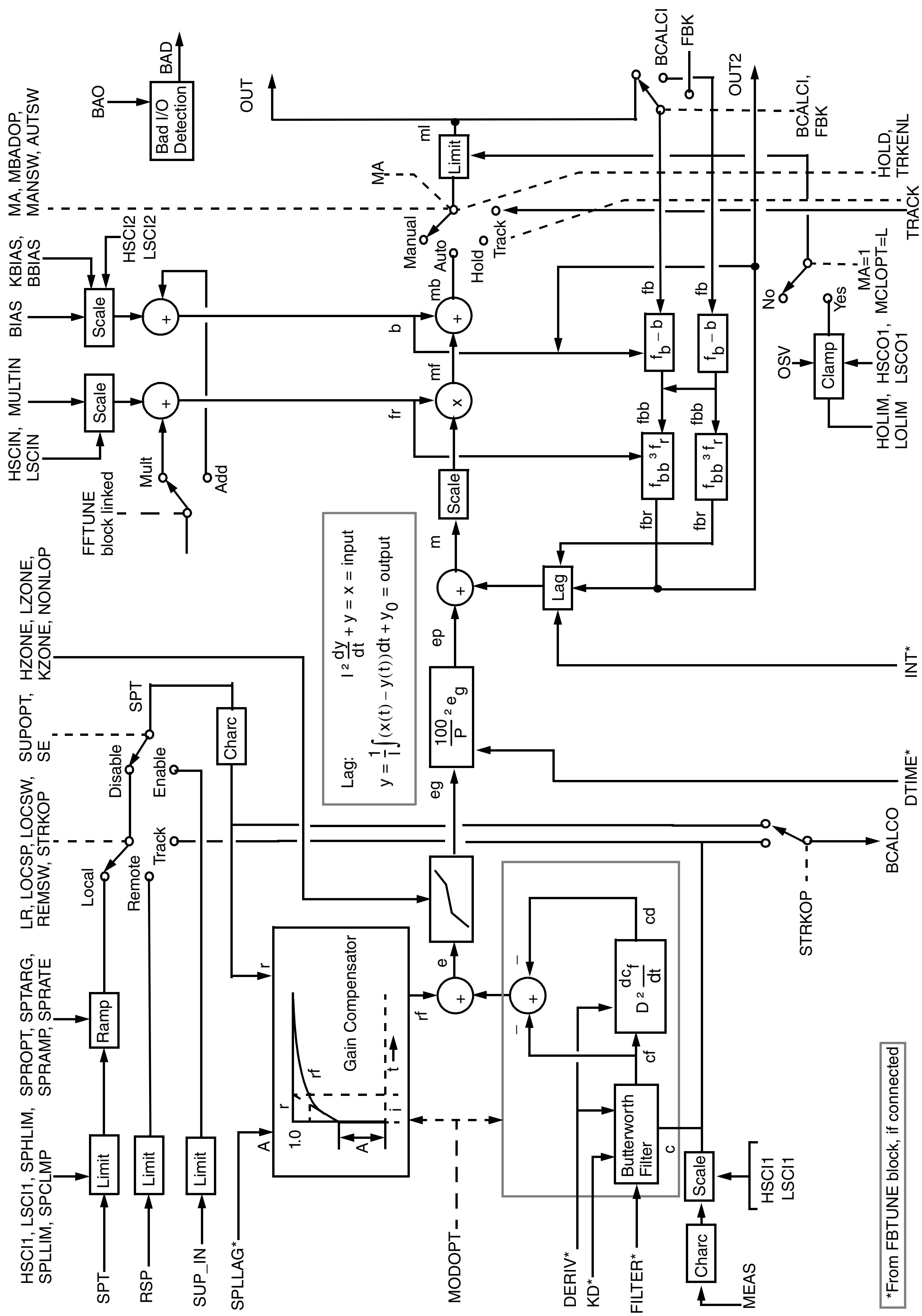


Figure 99-2. PIDA Controller Detailed Functional Diagram

Variables used in Figure 99-2 and the following sections to describe controller operations are listed and defined in Table 99-2.

Table 99-2. Variable Definitions

Variable	Description
A	Setpoint lead/lag ratio (SPLLAG)
b	b = KBIAS*BIAS + BBIAS
c	Controlled variable – selected measurement
c_f	Butterworth filtered measurement
c_d	Derivative filtered c_f
c_i	Integral filtered c_d
D	Derivative time (DERIV)
e	Control error
DTIME	Time delay or deadtime
e_g	Nonlinear gain adjusted e
e_p	Proportional filtered e_g
f_r	Scaled MULTIN
f_b	Integral feedback
f_{bb}	$f_{bb} = f_b$ - bias
f_{br}	$f_{br} = f_{bb}/f_r$
I	Integral time (INT)
K_D	Derivative gain (KD)
K_z	Zone gain for nonlinear gain
m	Internal feedback controller output
m_f	$m_f = m \bullet f_r$
m_b	$m_b = m_f + b$
m_l	Limited m_b
m_s	$m_s = (HOSCAL - LOSCAL)\frac{m}{100} + LOSCAL$
meas	Measurement
P	Proportional band (PBAND)
r	Selected setpoint
r_f	Compensated setpoint
t	Time constant
x	Lag input
y	Lag output

99.4.2 Control Modes

The PIDA controller performs the functions of a PID controller as well as additional functions. The PIDA can be configured with the following values of mode option (MODOPT) to perform a variety of control algorithms:

1 = Proportional (P)

2 = Integral (I)

3 = Proportional-plus-Derivative (PD)

4 = Proportional-plus-Integral (PI)

5 = Proportional-plus-Integral-plus-Derivative (PID)

6 = Non-Interacting Proportional-plus-Integral-plus-Derivative (NIPID).

7 = Proportional-plus-Integral-plus-Deadtime (interacting if derivative not 0) (PITAU)

8 = Non-Interacting Proportional-plus-Integral-plus-Derivative-plus-Deadtime (PIDTAU)

The first five modes (MODOPT = 1 to 5) are the same as those of a PID controller, except that those having proportional and integral action also have a setpoint lead-lag compensator. The P and PI modes are the same as the PD and PID modes except the derivative time is set to 0.

The setpoint compensator allows the amount of proportional action applied to the setpoint to be less than that applied to the measurement (see Figure 99-2). This enables the block to be tuned for both good load rejection and non-overshooting setpoint response simultaneously. When the setpoint lead/lag ratio (SPLLAG) = 1, the block applies the proportional term to the control error. This choice is best for a dominant deadtime process. When SPLLAG = 0, no proportional term is applied to the setpoint. A value of 0.2 is best for a dominant lag process. SPLLAG is adaptively tuned by the FBTUNE block.

MODOPT = 6, non-interacting PID (NIPID) action, introduces the capability of tuning to achieve complex (underdamped) numerator roots. This capability is needed in order to achieve best performance when the process has two dominant lags.

MODOPT = 7, proportional, integral, deadtime (PITAU), is an interacting deadtime algorithm that can provide derivative action as well, but less effectively than the PIDTAU. This mode is the preferred mode of deadtime controller when the process has a dominant deadtime (delay) or has so much measurement noise as to make derivative action undesirable. This mode of control is capable of out performing PID (MODOPT = 5) action for a lag-delay process, but its tuning is less tolerant of changes in process dynamics. The time constant tau of the measurement filter is 0.25/KD times the DTIME, instead of DERIV/KD as it is for non dead-time controllers.

MODOPT = 8, non-interacting proportional, integral, derivative, deadtime (PIDTAU), is a non-interacting deadtime algorithm, where the derivative time is tuned to be larger than the integral time. This mode of control is capable of out performing non-interacting PID (MODOPT = 6) action for any process, but its tuning is less robust. The time constant tau of the measurement filter is 0.25/KD times the deadtime DTIME, instead of DERIV/KD as it is for non-deadtime controllers.

99.4.2.1 Operational Notation for Block Algorithms

The block algorithms can be expressed using the differential operator (s = d()/dt) as follows (see Table 99-2 for variable definitions):

- Proportional only (P):

$$m_b = \frac{100}{P}(r - c_f)f_r + b$$
$$\tau = 0$$

- Integral only (I):

$$m_b = \frac{1}{Is}(r - c_f)f_r + b$$
$$\tau = 0$$

- Proportional and derivative (PD):

$$m_b = \frac{100}{P}(r - (1 + Ds)c_f)f_r + b$$
$$\tau = \frac{D}{K_D}$$

- Proportional and integral (PI):

$$m_b = \frac{100}{P}\left(\left(\frac{1}{Is} + A\right)r - \left(\frac{1}{Is} + 1\right)c_f\right)f_r + b$$
$$\tau = 0$$

- Proportional, integral and derivative (PID):

$$m_b = \frac{100}{P}\left(\left(\frac{1}{Is} + A\right)r - \left(\frac{1}{Is} + 1\right)(1 + Ds)c_f\right)f_r + b$$
$$\frac{1}{\tau} = \left(\frac{1}{I} + \frac{1}{D}\right)K_D$$

- Non-interacting PID (NIPID):
- Proportional, integral and deadtime (PITAU):
- Proportional, integral, derivative and deadtime (PIDTAU):
- In the above expressions of measurement filter:

$$m_b = \frac{100}{P}\left(\left(\frac{1}{Is} + A\right)r - \left(\frac{1}{Is} + 1 + Ds\right)c_f\right)f_r + b$$
$$\tau = \frac{D}{K_D}$$

$$m_b = \frac{100}{P}\left(\frac{(1 + Is)(r - (1 + Ds)c_f)}{1 - e^{-DTIMEs} + Is}\right)f_r + b$$
$$\tau = \frac{DTIME}{4 \bullet K_D}$$

$$m_b = \frac{100}{P}\left(\frac{r - 1(1 + Ds + IDs^2)c_f}{1 - e^{-DTIMEs} + Is}\right)f_r + b$$
$$\tau = \frac{DTIME}{4 \bullet K_D}$$

$$c_f = \frac{c}{1 + \tau s + 0.5(\tau s)^2}$$

99.4.2.2 Time Domain Notation for Block Algorithms

The controller algorithms can also be expressed in the time domain as follows:

- Proportional only (P):

$$m_b = \frac{100}{P}(r - c_f)f_r + b$$

t = 0

- Integral only (I):

$$m_b = \left(\frac{1}{I}\int_0^t (r - c_f)dt\right)f_r + b$$

t = 0

- Proportional and derivative (PD):

$$m_b = \frac{100}{P}\left(r - \left(c_f + D\frac{dc_f}{dt}\right)\right)f_r + b$$

$$\tau = \frac{D}{K_D}$$

- Proportional and integral (PI):

$$m_b = \frac{100}{P}\left(\frac{1}{I}\int_0^t (r - c_f)dt + Ar - c_f\right)f_r + b$$

t = 0

- Proportional, integral, and derivative (PID):

$$m_b = \frac{100}{P}\left(\frac{1}{I}\int_0^t (r - c_f)dt + Ar - \left(1 + \frac{D}{I}\right)c_f - D\frac{dc_f}{dt}\right)f_r + b$$

$$\frac{1}{\tau} = \left(\frac{1}{I} + \frac{1}{D}\right)K_D$$

- Non-interacting PID (NIPID):

$$m_b = \frac{100}{P}\left(\frac{1}{I}\int_0^t (r - c_f)dt + Ar - c_f - D\frac{dc_f}{dt}\right)f_r + b$$

$$\tau = \frac{D}{K_D}$$

- Proportional, integral and deadtime (PITAU):

$$I\frac{dm_b(t)}{dt} = -m_b(t) + m_b(t–DTIME) + \frac{100}{P}\left(r(t)–c_f(t) - (D + I)\frac{dc_f(t)}{dt} - ID\frac{d^2c_f(t)}{dc^2}\right)fr + b$$

- Proportional, integral, derivative and deadtime (PIDTAU):

$$I\frac{dm_b(t)}{dt} = -m_b(t) + m_b(t–DTIME) + \frac{100}{P}\left(r(t)–c_f(t) - D\frac{dc_f(t)}{dt} - ID\frac{d^2c_f(t)}{dc^2}\right)fr + b$$

- In the above expressions:

$$\frac{\tau^2}{2} \bullet \frac{d^2c_f}{dt^2} + \tau\frac{dc_f}{dt} + c_f = c$$

— NOTE

The above expression for c_f can also be expressed as two simultaneous integral equations, but the above expression more clearly shows the effect of τ on c_f.

The sign of the deviation (c_f - r) signal is opposite that of the error (r - c). Scaling for engineering units and normalized FBM counts and provision for sign reversal (INCOPT) is not shown in the above simplified mathematical representations.

The measurement filter response is shown in Figure 99-5. The setpoint gain compensation response is shown in Figure 99-7.

Table 99-3 summarizes the filtering and tuning features for these control modes.

Table 99-3. Control Mode Filtering and Tuning Features

	Control Mode							
Feature	**P**	**I**	**PD**	**PI**	**PID**	**NIPID**	**PITAU**	**PIDTAU**
Measurement filtering			X		X	X	X	X
Setpoint compensation				X	X	X		
Nonlinear gain	X	X	X	X	X	X	X	X
Multiplicative input MULTIN	X	X	X	X	X	X	X	X
Bias input BIAS	X	X	X	X	X	X	X	X
FFTUNE feedforward tuning				X	X	X	X	X
FBTUNE feedback tuning				X	X	X	X	X

The PIDA supports multiplicative and additive feedforward compensation, and local setpoint ramping and limiting. Using extender blocks, the PIDA block can accommodate matched nonlinear setpoint and measurement compensations (CHARC) and also adaptive tuning of feedback (FBTUNE) and feedforward (FFTUNE) parameters.

The outputs of the matched nonlinear functions, CHARC, are expressed in percent of full scale. The functions are realized with a CHARC extender block invoked by specifying its BLKSTA in the NLNBLK entry. The extender block must be configured ahead of the PIDA block and must have its EXTOPT parameter set to 1. The CHARC block's MEAS input should not be configured, and its OUT not used.

99.4.3 Block States

99.4.3.1 Manual State

PIDA Key Parameters: MA, OUT

In Manual (MA = 0), the controller does not perform PID control and the controller output (OUT) is settable. In Manual, the controller does not adjust OUT2, the back-calculated indication of the internal controller output expressed in percent.

During a transition to Manual while MANALM is false, the controller clears all alarms and limit indicators. If the manual clamp option MCLOPT is true, the controller limits any value sets of the output parameter.

The MA parameter allows an operator, another block, or a supervisory program to switch between the Manual and Auto states. Transfer to Auto is bumpless (see "Bumpless Start-up and Transfers" on page 1869). When MA is toggled, its status is immediately displayed on the faceplate of the Block Detail Display.

99.4.3.2 Auto State

PIDA Key Parameters: MA, MEAS, OUT, SPT

In Auto (MA = 1), the controller performs the appropriate mode of control. Closed loop automatic control is actually performed in the substate of Auto called Controlling. In this state, the controller computes the output command signal in response to the setpoint (r) and measurement (c_f), according to the configured controller mode. The controller generates integral control action using the integral-feedback signal (f_b) that is back calculated (f_{br}) and fed through a first-order lag in a positive feedback arrangement. The feedback connection (FBK) avoids integral windup and allows control that tolerant of changes in process dynamics and provides tighter primary tuning of cascade structures. The integral (INT) setting establishes the time constant of the lag if FBK and BCALCI are not linked.

99.4.3.3 Manual/Auto Overrides

PIDA Key Parameters: AUTSW, FLBOPT, INITMA, MA, MANSW, MANFS, MBADOP

Since it is possible to set the parameters which invoke these block states simultaneously, certain states have priority over other states for execution. If multiple block states are set, states with higher priority will override those with lower priority as listed below.

The priority of the Manual/Auto overrides is as follows when MA is *unlinked*, with “1” being the highest priority:

1. MBADOP and MANSW have equal priority
2. AUTSW
3. INITMA
4. MA
5. FLBOPT
6. MANFS

If AUTSW is true, it drives the controller to Auto by setting MA to true and securing it.

If MBADOP = 1 or 2 and the MA parameter is unlinked, the controller sets the MA input to Manual and secures it when the MEAS.BAD or MEAS.OOS status bit is true. This forces the output state to Manual as long as one or both of these bits is true. After the BAD or OOS status clears, returning to Auto requires external intervention unless AUTSW is true.

MBADOP has the same priority as the MANSW override, and it has precedence over the AUTSW override. If MBADOP = 1 or 2 and a BAD or OOS status is detected while MA is unlinked, the controller goes to Manual regardless of the AUTSW setting.

If MANSW is true, it drives the controller to Manual by setting MA to false and securing it. MANSW has priority over AUTSW. If both MANSW and AUTSW are true, the controller goes to Manual.

FLBOPT (Fallback) defines the control action to be taken by the block when a Supervisory fallback occurs. You can select fallback options to set the MA parameter to Auto or Manual, or set the LR parameter to Remote or Local. FLBOPT overrides linked MA and LR parameters, but does *not* override the AUTSW, MANSW, REMSW, and LOCSW parameters.

When configured true, MANFS drives the block to the Manual state if the block detects an incoming failsafe status on its incoming BCALCI input.

99.4.3.4 Holding State

PIDA Key Parameters: HOLD, MBADOP

If the HOLD input is set to 1 while controlling in Auto, the controller stops the control calculation and holds the output at the last good value. If the controller experiences an open loop condition, it automatically transitions to Hold or Manual to prevent integral windup depending on MBADOP. Transfer back to Auto is bumpless (see “Bumpless Start-up and Transfers” on page 1869).

CEOPT enables implicit control error handling of HOLD, STRKOP, and MBADOP. When CEOPT is enabled, a control error is detected if the MEAS input has a status such as OOS, BAD, or off-scan. If MBADOP = 1 or 2, a control error forces the controller to Manual. If MDADOP is set false, a control error forces the controller to Hold if MA is set to Auto, and it disables setpoint tracking if SPTRKOP is set true.

If CEOPT is not enabled, then control error detection is not performed, and MBADOP, HOLD, and SPTRK handling is performed explicitly by asserting the HOLD input.

99.4.3.5 Output Tracking State

PIDA Key Parameters: OUT, TRACK, TRKENL

If TRKENL is set to 1 while controlling in Auto, the controller output (OUT) is forced immediately to follow the TRACK input. Transfer back to Auto is bumpless (see “Bumpless Start-up and Transfers” on page 1869). If TRKENL is true (set to 1) while in Manual, tracking is not performed.

99.4.4 Bumpless Start-up and Transfers

PIDA Key Parameters: BCALCO, HOLD, MEAS, PRIBLK, SPT, STRKOP, TRKENL

Any transition from Manual, Holding, or Tracking to the Controlling state is performed bumplessly by back-calculating the PID dynamics (that is, the integral term absorbs any proportional action and the derivative term is set to zero), so that the output maintains its present value at the moment the transition occurs.

A transfer of the setpoint source from Remote to Local is inherently bumpless, because SPT retains the last value that was transferred from the remote setpoint.

The setpoint track option (STRKOP) forces the local setpoint (SPT) to track the measurement when the block reinitializes or initializes with a local setpoint. While setpoint tracking is active, SPT is secured (nonsettable) to prevent you from manipulating the local setpoint value.

99.4.5 Cascade Handling

PIDA Key Parameters: BCALCO, BLKSTA, CEOPT, INCOPT, LIMOPT, MEAS, PRIBLK, RSP, SPT

A typical cascade configuration using the PIDA controller is shown in Figure 99-3.

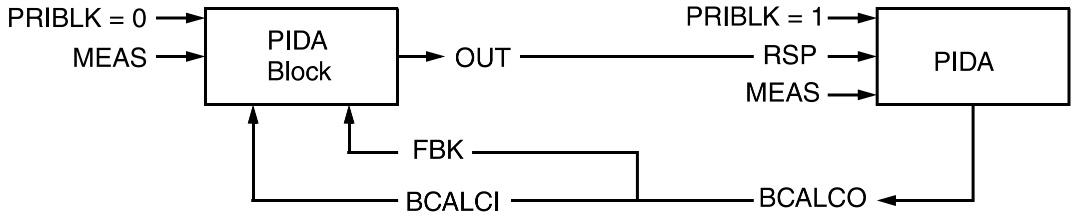


Figure 99-3. Cascade Configuration (Typical)

To provide bumpless initialization of the upstream block in the cascade:

- Set PRIBLK to true for the secondary controller (PIDA).
- Set PRIBLK to false for the primary controller.
- Link BCALCI of the primary controller to BCALCO.
- Link FBK (external reset) of the primary controller to BCALCO of the secondary controller.

In a cascade configuration, the FBK (external integral feedback) of the primary controller can be connected to it's BCALCI or it's OUT variable. Set LIMOPT as described in "Output Limiting" on page 1871. Use the PRIBLK option in all cascade configurations.

The cascade initialization information is contained in the status bits of BCALCO which is connected to BCALCI of the upstream block.

For the PIDA block, BLKSTA includes bits which indicate when the downstream output is limited in either direction by monitoring for the Limited High condition (BCALCI.LHI via BLKSTA.B11) and Limited Low condition (BCALCI.LLO via BLKSTA.B10).

The settings of SPT and BCALCO on transition from initialization depend on the type of initialization, conditional or unconditional.

> Conditional initialization occurs when the controller returns from an open cascade that was caused by a Remote/Local, Auto/Manual, or Track transition. For a PIDA secondary controller, SPT remains unchanged, and BCALCO = SPT at transition.
>
> Unconditional initialization occurs when the controller returns from an open cascade that was *not* caused by a Remote/Local, Auto/Manual, or Track transition. For a PIDA secondary controller, SPT tracks MEAS, and BCALCO = MEAS at transition.

In order to trigger upstream initialization in a cascade, the appropriate BCALCO status bits remain set while the setpoint is switched to Local. This notifies an upstream block to perform its own explicit initialization, while the cascade remains open, enabling a return to remote setpoint operation to be bumpless.

If the upstream block is in Auto, it initializes when its BCALCI initialization status bit is true and then acknowledges the initialization request by setting the RSP acknowledge status bit. During initialization, the output tracks the value of the BCALCI input. If the downstream block is a PIDA controller, this action causes its remote setpoint to track its BCALCO output when it is connected to the upstream block's BCALCI input. As a result, a return to closed loop control is bumpless.

The appropriate BCALCO status bits of the PIDA controller are set in the Tracking (TRKENL = 1) or Holding (HOLD = 1) state. This requests its upstream block to perform its own initialization. When TRKENL or HOLD are reset to 0, the controller returns to the Controlling substate of Auto to resume closed loop control.

The PRIBLK option allows a downstream block to initialize before the upstream block has matched its output to its BCALCI input. The PRIBLK feature is needed if the upstream block's computing interval is the greater than the downstream block, or peer-to-peer connections have been made to a remote setpoint.

The BCALCO status is updated each BPC to indicate when SPT has exceeded the high or low limit. The upstream block uses this status to prevent integral windup.

99.4.6 PRIBLK and PRITIM Functionality

The Primary Block (PRIBLK) parameter indicates whether the PIDA block has a connection from an upstream block (PRIBLK=1) or not (PRIBLK=0). Its value, together with that of the Primary Cascade Timer (PRITIM), determines whether the PIDA block remains in Hold for a fixed time delay (of length defined by PRITIM), or ends the Hold when the Acknowledge status bit (Bit 10) of MEAS is detected from the upstream block (if PRITIM = 0.0). During initialization, the acknowledgement is not required and a Hold of one cycle only occurs.

99.4.7 Output Limiting

PIDA Key Parameters: HOLIM, HOLIND, HSCO1, LOLIM, LOLIND, LSCO1, MCLOPT

In Auto, the computed controller output (m_l) value undergoes limiting, whereby it is limited between the output limits, HOLIM and LOLIM (see Figure 99-4). These limits can be placed anywhere within the range defined by HSCO1 and LSCO1. If you set HOLIM less than LOLIM, then HOLIM is automatically set equal to LOLIM. If the controller output (OUT) is limited at HOLIM or LOLIM, the respective Boolean output limit indicator, HOLIND or LOLIND, is set true.

MCLOPT affects output limiting as follows:

- When MCLOPT = 1 (true), the computed controller output (m_l) value undergoes limiting as above.
- When MCLOPT = 1 (true), or MCLOPT = 0 (false), and the controller is in Manual, the output is limited between HSCO1 and LSCO1 as shown in Figure 99-4.

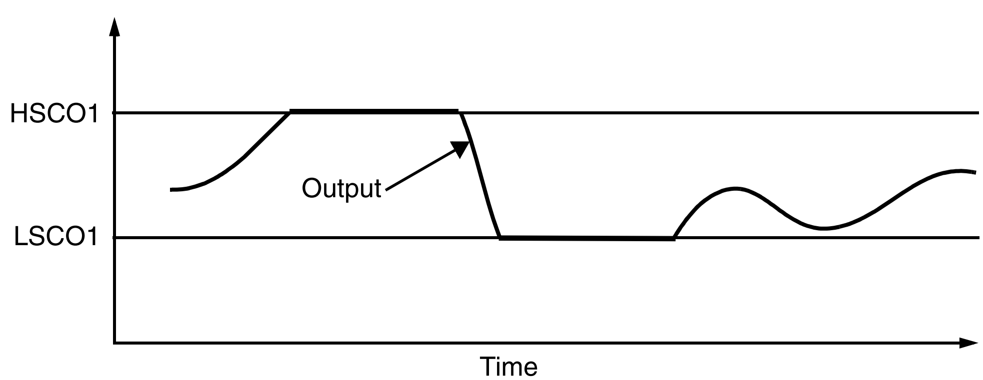


Figure 99-4. Output Limiting

When an output limiting condition is detected in a controller with integral action, the integral term is managed to prevent integrator windup. If the controller prelimited output becomes greater than HOLIM or less than LOLIM, the integral term is managed to provide rapid recovery with almost no overshoot (similar to LIMOPT = 1 in the PIDA block).

Depending on the configured value of LIMOPT one of three anti-windup strategies can be followed. When an output limiting condition is detected in this block or in a downstream block:

1. If LIMOPT is 1, the integral term is frozen until the output limit condition clears provided the integral term remains between the effective output limits.
2. If LIMOPT is 2, the integral term is set to the value that allows the output to come out of effective limit when the net proportional and derivative term reverses direction. This action may cause an output offset due to noise rectification and a more sluggish recovery from the limit condition.
3. If LIMOPT is 3, the integral term lags the integral-feedback signal with the integral time constant. If the limit condition persists for several time constants, the net proportional and derivative term must change sign before the output comes out of limit. This produces an overshooting recovery.

For any of these options, an exception is required for a variable external limit application. When the integral-feedback term which is the effective high (low) limit value becomes less (greater) than the integral term, the integral term is reset to the integral-feedback value unless this action would cause the output to come out of limit. LIMOPT equal to 1 is preferred in most applications because it causes a rapid recovery with almost no overshoot. Therefore the default value of LIMOPT is 1.

When the BATCHO batch option is selected and a limit condition exists, the integral term is set to the value nearer the limit, PRLOAD or the value selected when LIMOPT is 2.

These strategies prevent output limiting from causing integrator windup. Output limiting in the PIDA controller is propagated to an upstream block through the status bits of its BCALCI input, provided that it is linked to the BCALCO output of the PIDA controller.

99.4.8 Measurement Filtering

PIDA Key Parameters: DERIV, KD

For the PD, PID, NIPID, PITAU and PIDTAU control modes, the measurement low-pass filter is a second order Butterworth filter with time constant DERIV / KD (see Figure 99-5). Its purpose is to reduce high-frequency valve activity. The default setting of KD is 10.

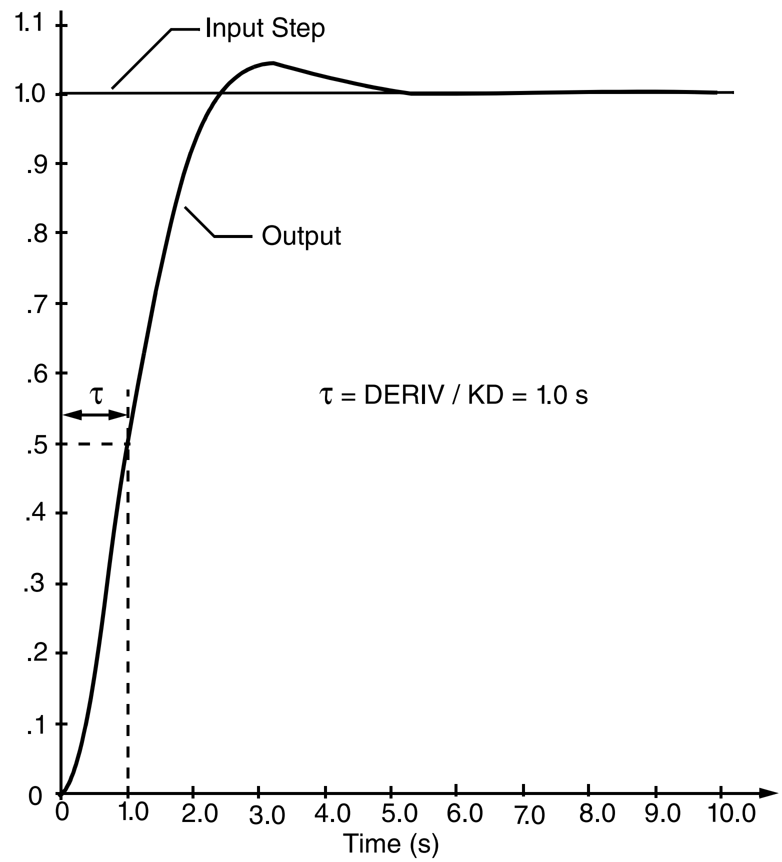


Figure 99-5. Butterworth Measurement Filter Response

The Butterworth measurement filter response can be expressed as follows:

$$\frac{\tau^2}{2} \bullet \frac{d^2 c_f}{dt^2} + \tau\frac{dc_f}{dt} + c_f = c = \text{input measurement}$$

or

$$c_f = \frac{c}{1 + \tau s + 0.5\tau s^2} = \text{output filtered measurement}$$

Measurement filtering can be useful even when derivative action is not used, such as when the process has a high frequency resonance. In this case, choose DERIV to have a small nonzero value and KD to have a value less than one, such that the filter time constant (DERIV / KD) is large enough to provide significant attenuation at the resonant frequency. The range of KD is restricted to be not less than 0.1 and not greater than 100.

In all control modes, the measurement (c) is fed through a Butterworth filter. For the P, I, and PI control modes, the derivative time (DERIV) is set to 0, thus providing no measurement filtering.

A noisy measurement requires proper filtering to remove unwanted noise:

- For noisy measurements, set KD appropriately (decreasing KD provides more filtering).
- With FBTUNE feedback tuning, increase the threshold FBTUNE block parameter "THRESH" for peak detection.

In addition, the measurement filter time constant factor KD is adjusted by pretune and the deviation alarm delay DEVTIM is adapted. In a dead-time controller mode (PIDTAU or PITAU) the filter time FILTER is added or can be adjusted if needed to prevent high frequency instability.

99.4.9 Setpoint Processing

The setpoint sources are prioritized as follows:

1. Supervisory enable (SE) when SUPOPT is 1 or 3
2. Local switch (LOCSW)
3. Remote switch (REMSW)
4. Local setpoint (LOCSP)
5. Local or Remote (LR).

The selected setpoint is scaled, limited, and gain-compensated before calculating the control error (e) (see Figure 99-2). When the supervisory option (SUPOPT) is set to 1 or 3, it allows an application program to control the setpoint. The LR parameter allows an operator or another block to switch between the local and remote setpoint. The Local and Remote latch switch inputs (LOCSW and REMSW) allow the controller to be switched to Local or Remote setpoint by overriding the LR parameter. In Local, you can ramp the setpoint from the Block Detail display.

When STRKOP = 1 or 2 while SUPOPT is 0, 2 or 4 and LR is false, the local setpoint (SPT) tracks the measurement when the block reinitializes or initializes with a local setpoint. This allows bumpless return to automatic control when the controller returns to closed-loop operation.

99.4.9.1 Supervisory Setpoint

PIDA Key Parameters: SE, SUP_IN, SUPBCO, SUPOPT

If supervisory option (SUPOPT) is 1 or 3 and supervisory enable (SE) is true, the controller uses the supervisory setpoint (SUP_IN) for calculating the controller output (see Figure 99-2). When the supervisory option (SUPOPT) is set to 1 or 3, it specifies that the controller can be under control of a supervisory application program. The supervisory back calculated output (SUPBCO) provides the current setpoint and initialization bits to the supervisory application program.

When supervisory enable (SE) is set by the application program or operator, the PIDA controller is prepared to do supervisory setpoint control (SSC) functions. When the proper handshaking occurs with the application software, the controller accepts sets to the supervisory setpoint (SUP_IN). If the controller is in Auto, it then uses the supervisory setpoint in the calculation of the controller output.

If SUPOPT is set to 1 or 2, the handshake requires the application software to return an explicit acknowledge to close the supervisory cascade. The software must set the ACK status bit in the SUP_IN parameter using special OM access functions. However, if SUPOPT is set to 3 or 4, this acknowledgement is implicitly provided by the CP and is not required from the user application software. In the latter case, the CP closes the supervisory cascade automatically when the supervisory input (SUP_IN) is written by the application, provided the block is in the Supervisory Initialization (SUP_INIT) state. The control block enters the SUP_INIT state when supervisory control is enabled in the block and the cascade is closed downstream. Upon entering this state, the CP sets the initialize request bit (INITC) in the SUPBCO parameter for the application software. When SUP_IN is then written by the software, the CP access logic sets the ACK status automatically in the SUP_IN parameter. When the block runs, the CP block logic then closes the supervisory cascade automatically.

NOTE

If you utilize the SUPBCO parameter within a Supervisory program, you should be aware that in certain setpoint limiting situations where SPCLMP is equal to either 1 or 2, SUPBCO may not represent the actual setpoint value used by the controller. This situation arises because, for the PIDA algorithm, the SUPBCO value is calculated prior to the setpoint limiting logic. For this reason, it is advisable to utilize the SPT value in place of the SUPBCO value if actual controller setpoints are required within some calculations as part of an overall supervisory control scheme.

A typical Supervisory Setpoint Control cascade configuration using the PIDA controller is shown in Figure 99-6.

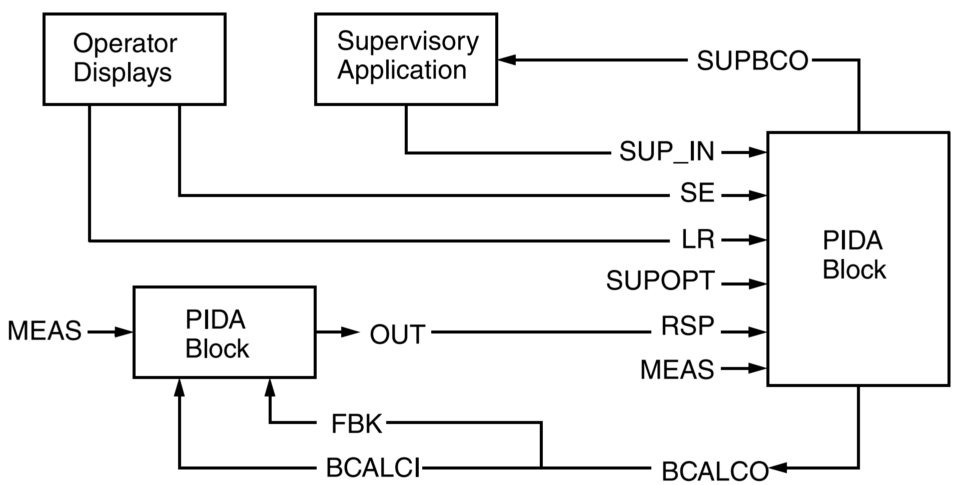


Figure 99-6. Supervisory Setpoint Control Cascade Configuration (Typical)

For more information, refer to the *Supervisory Setpoint Control* (SSC) (B0193RY) document.

99.4.9.2 Local/Remote Overrides

PIDA Key Parameters: INITLR, LOCSP, LOCSW, LR, REMSW

The Local/Remote overrides are prioritized as follows:

1. Supervisory enable (SE) when SUPOPT is 1 or 3
2. Local switch (LOCSW)
3. Remote switch (REMSW)
4. Local setpoint (LOCSP)

5. Local or Remote (LR).

If SUPOPT is 0, 2 or 4, the LR setpoint source selector, together with the two overrides, LOCSW and REMSW, determines the setpoint source at any time. In Local, you can ramp the setpoint from the Block Detail display.

When the Local switch (LOCSW) override is true, it sets LR to false (Local) and secures it. LOCSW has priority over REMSW, INITLR, and LOCSP. If both LOCSW and REMSW are true, LR is set to Local.

When the Remote switch (REMSW) override is true, it sets LR to true (Remote) and secures it. REMSW has priority over INITLR and LOCSP.

99.4.9.3 Setpoint State

PIDA Key Parameters: INITLR, LOCSW, LR, MEAS, REMSW, SPT, STRKOP, TRKENL

The setpoint states are:

- Remote
- Tracking
- Local.

The INITLR, REMSW, and LOCSW overrides are applied to the LR parameter as described above and in “Block Initialization” on page 1884.

If LR is true, the setpoint state is Remote. If STRKOP = 1 or 2, the setpoint state is Local, and the status of MEAS is *not* Bad, the setpoint SPT tracks MEAS when the block is in Manual, or TRKENL is true, or the cascade state is Open.

The controller provides the MANSW and AUTSW override inputs to force the controller to the Manual or Auto state. In Manual, you can ramp the controller output from the Block Detail display.

When TRKENL is true, the output tracks an independent signal source (TRACK).

99.4.9.4 Local/Remote Setpoint Selection

PIDA Key Parameters: LR, MEAS, PRIBLK, RSP, SPT, STRKOP

The setpoint (SPT) is a source whose value can be determined by LR. If LR is true (Remote), SPT is secured (can not be written to from outside of the block) and assumes the Remote setpoint (RSP) value. If LR is false (Local), SPT is unsecured and can be changed by the operator. When LR is toggled, its status is immediately displayed on the faceplate of the Block Detail Display.

99.4.9.5 Setpoint Limiting

PIDA Key Parameters: HSCI1, LSCI1, SPCLMP, SPHLIM, SPLLIM

The setpoint limits are clamped as follows.

- If SPLLIM < LSCI1, it is set to LSCI1.
- If SPLLIM > HSCI1, it is set to HSCI1.
- If SPHLIM < SPLLIM, it is set to SPLLIM.
- If SPHLIM > HSCI1, it is set to HSCI1.

If SPCLMP = 0, and the setpoint state is Supervisory, Remote, or Tracking, the SUP_IN/RSP value is clamped as follows:

- If SUP_IN/RSP <= LSCI1, it is set to LSCI1
- If SUP_IN/RSP >= HSCI1, it is set to HSCI1.

If SPCLMP = 1, the SPT value in Local mode (RSP in Remote mode, SUP_IN in Supervisory mode) is clamped as follows:

- If RSP/SUP_IN <= SPLLIM, it is set to SPLLIM.
- If RSP/SUP_IN >= SPHLIM, it is set to SPHLIM.

If SPCLMP = 2, an attempt to set SPT in Local mode (RSP in Remote mode, SUP_IN in Supervisory mode) less than SPLLIM or greater than SPHLIM via an OM Setval or OM Write operation will be rejected with an OUT_OF_RANGE error code. If RSP has a source connection, it is clamped as follows:

- If RSP <= SPLLIM, it is set to SPLLIM.
- If RSP >= SPHLIM, it is set to SPHLIM.

NOTE

When SPCLMP=0, the following special rules regarding setpoint limiting apply:
1. The SPHLIM and SPLLIM limits will be ignored while the block is in Remote mode.
2. The SPHLIM and SPLLIM limits will be used to limit the setpoint value when the block is switched to Local mode if the setpoint is within these limits when the switch occurs.
3. If the setpoint is above SPHLIM (or below SPLLIM) when the block is switched to Local mode, it will remain above SPHLIM (or below SPLLIM) when the switch occurs to avoid a bump in the control action. The effective limits are allowed to “balloon” beyond the actual limits while the block is in Remote mode to accomplish this action when the block is switched to Local mode.
4. If the setpoint is above SPHLIM (or below SPLLIM) when the block is switched to Local mode, it can be lowered (or raised), but once lowered (or raised), it cannot be raised (or lowered) if it continues to be above SPHLIM (or below SPLLIM). (For example, if the setpoint is 90.0 and SPHLIM=80.0, the setpoint will remain at 90.0 when the block is switched to Local mode. If the setpoint is lowered to 85.0, it cannot be raised since 85.0 exceeds the SPHLIM value of 80.0. Once the setpoint is lowered below SPHLIM, the SPHLIM value will then be used once again to limit the setpoint value.).

99.4.9.6 Setpoint Gain Compensation

PIDA Key Parameters: INT, SPLLAG, SPT

Lead/lag compensation is applied to the setpoint with a user specified lead/lag ratio (SPLLAG see Figure 99-7). SPLLAG adjustment allows the amount of proportional action applied to the setpoint to be different from that applied to the measurement (see Figure 99-2). This enables the controller to be tuned for both good load rejection and non-overshooting setpoint response simultaneously.

When the setpoint lead/lag ratio (SPLLAG) = 1, the controller applies the proportional term to the control error. This choice is best for a dominant deadtime process.

When SPLLAG = 0, no proportional term is applied to the setpoint. A value of 0.2 is best for a dominant lag process. SPLLAG is adaptively tuned by the FBTUNE block.

For the input (r) step shown in Figure 99-7, the lead/lag compensator output immediately rises to the value SPLLAG (A). Then the output (r_f) rises exponentially from SPLLAG to 1.0r with a first order lag response of time constant INT.

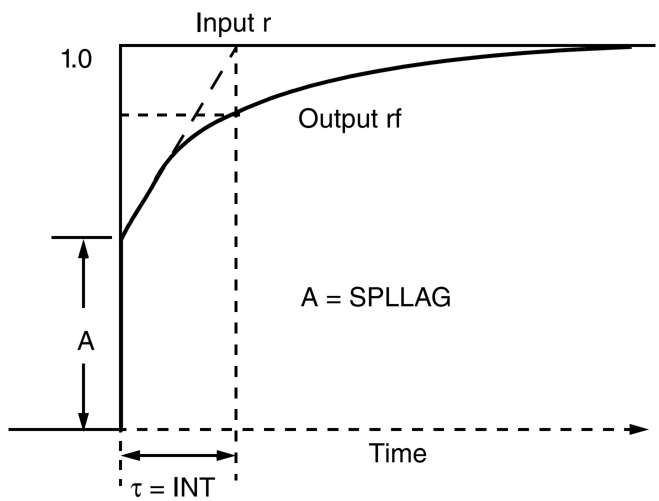


Figure 99-7. Setpoint Lead/Lag Compensation

For example if SPLLAG is set to 0.5, the output at the end of one time constant is:

$$r_f = A + 0.63(r - A) = 0.5 + 0.63(1.0 - 0.5) = 0.815 \text{ or } 0.815r$$

99.4.9.7 Setpoint Ramping

PIDA Key Parameters: SPHLIM, SPLLIM, SPRAMP, SPRATE, SPROPT, SPT, SPTARG

If SPROPT is 1 and LR is Local, the setpoint ramps at the rate SPRATE (units/minute) from its initial value to SPTARG, following an SPRAMP transition from 0 to 1.

If SPROPT is 2, ramping stops whenever the deviation (MEAS - SPT) is in alarm and continued setpoint ramping would increase the deviation. If ramping decreases the deviation, ramping is not inhibited.

If SPROPT is 3 and LR is Local, the setpoint ramps from its initial value to SPTARG during the time period SPRATE (minutes).

If SPROPT is 4, ramping stops whenever the deviation (MEAS - SPT) is in alarm and continued setpoint ramping would increase the deviation. If ramping decreases the deviation, ramping is not inhibited.

Table 99-4 summarizes the setpoint ramping action for the SPROPT options.

Table 99-4. Ramping Action for SPROPT Options

SPROPT	Rate (Units/Minutes)	Time (Minutes)	Stop on Deviation Alarm
1	X		

Table 99-4. Ramping Action for SPROPT Options (Continued)

SPROPT	Rate (Units/Minutes)	Time (Minutes)	Stop on Deviation Alarm
2	X		X
3		X	
4		X	X

To be accepted, an SPTARG value must be within the local setpoint limits, SPLLIM and SPHLIM. When SPT reaches SPTARG or if the operator makes a local SPT change, setpoint ramping stops and SPRAMP is reset to 0.

If SPTARG is changed during ramping, the block continues to ramp at the initial rate calculated for the SPRATE time.

99.4.9.8 Error Propagation

PIDA Key Parameters: CEOPT, MEAS, OUT, PROPT, SPT

Errors in the MEAS and SPT parameters are propagated to the ERR status bit of the OUT parameter based on the control error option (CEOPT) and propagate error option (PROPT).

If the MEAS or SPT status is BAD or OOS while in Auto with PROPT set to 1 and CEOPT set to 1, the ERR status bit of OUT is set true. If PROPT is set to 2, the BAD, Out-of-Service (OOS), and ERROR status bits are copied from the MEAS input to OUT.

If the MEAS or SPT status is BAD, OOS, or ERR while in Auto with PROPT set true and CEOPT set to 2, the ERR status bit of OUT is set true.

NOTE

The ERR status bit of the OUT parameter is not set when RSP status is BAD because the block automatically switches from remote to local setpoint mode upon detecting that the remote setpoint is BAD.

99.4.10 Nonlinear Gain

PIDA Key Parameters: KZONE, LZONE, NONLOP, HZONE

A nonlinear gain option (NONLOP) specifies a gain factor (KZONE) and a zone of control error values in which this alternate gain multiplies 100/PBAND (see Figure 99-8). This nonlinear zone is defined by the HZONE and LZONE **positive** real values, and is situated, but not necessarily centered, about zero error.

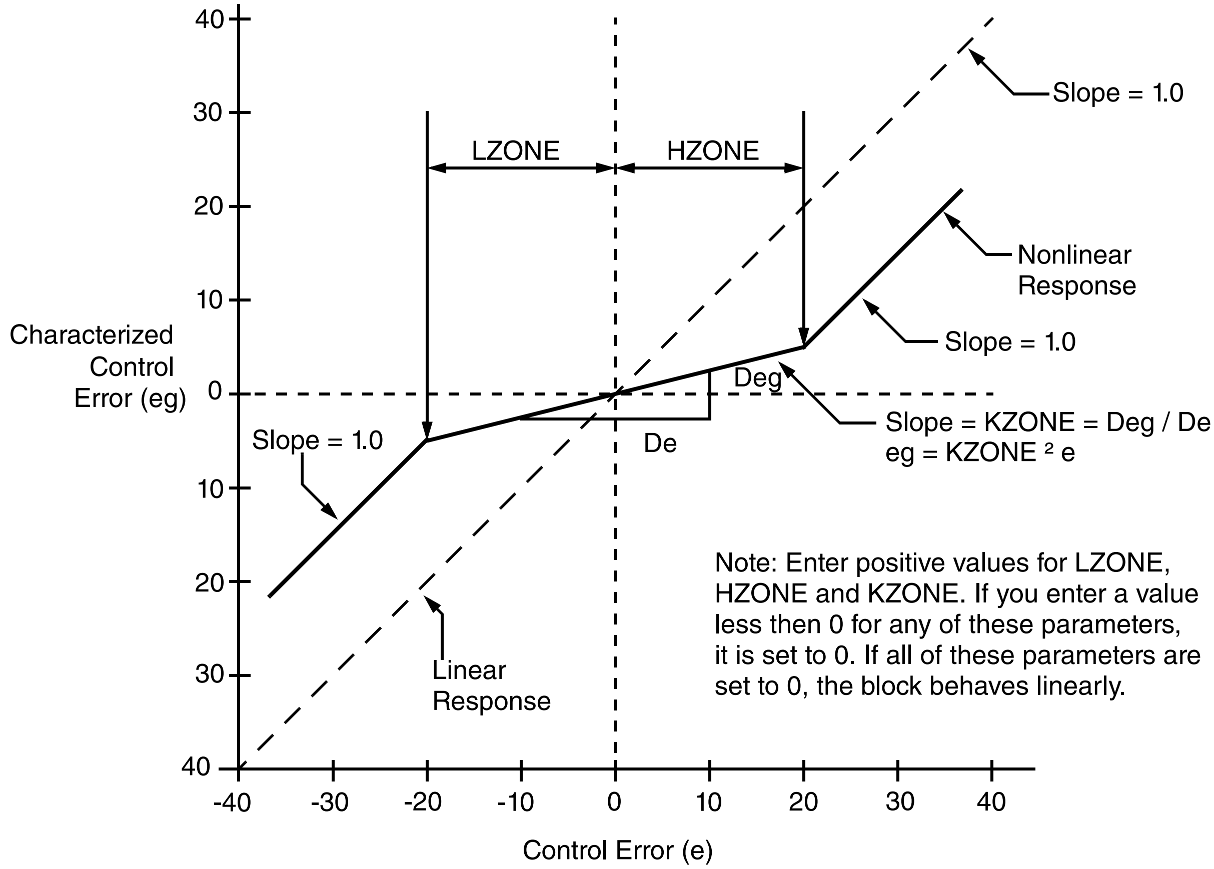


Figure 99-8. Nonlinear Gain Response

Nonlinear gain allows the controller to handle a process with nonlinear gain (for example, a pH process) by providing a gain characteristic that is opposite that of the process. You set the width of the zone and the gain (slope) of the line within the zone. The slope typically varies from 0 to 1.0. At zero slope, the line between the low and high zone limits is horizontal. At a slope of 1.0, the nonlinear characteristic is completely removed, and the controller behaves as a conventional linear controller as shown by the dashed line in Figure 99-8.

The proportional gain (G) in the linear part of the response curve where the slope = 1.0 is:

$$G = \frac{100}{PBAND}$$

The effective gain (G_e) within the zone is:

$$G_e = \text{KZONE} \bullet \frac{100}{PBAND}$$

The effective proportional band (P_e) within the zone is:

$$P_e = \frac{PBAND}{KZONE}$$

99.4.11 Feedforward

PIDA Key Parameters: BIAS, MULTIN

Multiplicative MULTIN and additive BIAS parameters can be used for feedforward inputs (see Figure 99-2). The multiplicative input divided by its span (f_r) multiplies the output (m) of the linear part of the control algorithm. The gain/offset adjusted and scaled bias input (b) is added to m_f before output limiting is applied. A back calculation is applied to feedback input f_b, using the previous values of these feedforward terms to achieve the integral-feedback input f_{br} to the linear part of the algorithm.

If either the BIAS or MULTIN value becomes invalid, its last valid value is used.

99.4.12 Error Detection

PIDA Key Parameters: BCALCO, CEOPT, MA, MEAS, RSP, SPT

During Auto operation, the critical inputs MEAS, SPT, and MA are checked for any errors. Such errors include: off scan, out-of-service, and bad, which are reflected by the status of the connected source. If any of these errors are detected, the error is indicated.

If CEOPT is set and any of these errors are detected, the controller output is forced to a substate of Auto called Holding, whereby the last controller output (OUT) value is retained. In the Holding state, the “held” output value undergoes output limiting. When all error conditions have ceased, the controller returns to the Controlling substate of Auto to resume closed loop control.

Input errors are classified on a functional basis related to feedback control. Control errors affect the ability to perform control in a local setpoint mode. Control errors include any errors detected in the feedback portion of the local control loop. They do not include errors that originate upstream through the remote setpoint path. If the remote setpoint RSP is in error, the controller simply transitions to local SPT, holds the last valid value, and indicates that the cascade has opened. When the error conditions clears, the appropriate BCALCO status bits reset to cause the upstream block to initialize its OUT to BCALCI.

Global error detection is propagated to upstream blocks via the BAD status indicator of the BCALCO parameter record. In this manner, any errors detected along the cascade are propagated up through the cascade, from block to block, by the BCALCO-to-BCALCI connections.

99.4.13 Alarms

PIDA Key Parameters: BAD, CRIT, HDALIM, HHALIM, HOALIM, INHALM, INHIB, INHOPT, LDALIM, LLALIM, LOALIM, MANALM, MEAS, MEASHL, MEASLL, OUT, PRTYPE, SPT, UNACK

The PIDA block optionally supports the following alarms:

- Bad I/O
- Measurement absolute high-high (HHA) and low-low (LLA)
- Measurement absolute high (HMA) and low (LMA)
- Deviation high (HDA) and low (LDA)
- Output high (HOA) and low (LOA)

The block generates alarm messages on transition into the alarm state, and on return to normal of the alarm condition.

Bad I/O Alarm occurs when the BAD parameter is set. If redundant measurements are used, the block generates a separate alarm message when any measurement is bad, but it sets the Bad I/O Alarm state and BAD parameter only when all of the measurements are bad.

High, low, high-high, or low-low absolute alarming occurs when the measurement exceeds the related alarm limit (MEASHL, MEASLL, HHALIM, or LLALIM).

High or low deviation alarming occurs when the deviation (MEAS - SPT) exceeds the related alarm limit (HDALIM or LDALIM).

High or low output alarming occurs when OUT exceeds the related alarm limit (HOALIM or LOALIM).

Separate deadbands for absolute, deviation, and output alarming establish hysteresis about the limits to avoid intermittent state changes, when the MEAS, deviation (MEAS - SPT), or OUT is close to one of the limits.

High-high and low-low absolute, high and low absolute, deviation, and output alarms have their own alarm group parameter that is used for dispatching alarm messages to the alarm devices contained in the group.

The CINHIB (compound parameter), INHIB, or INHALM parameter settings allow each alarm to be dynamically inhibited.

The INHOPT value defines the type of alarm inhibiting:

- 0 = When an alarm is inhibited, disable alarm messages but do not disable alarm detection.
- 1 = When an alarm is inhibited, disable both alarm messages and alarm detection. If an alarm condition already exists at the time the alarm transitions into the inhibited state, clear the alarm indicator.
- 2 = Same as 0 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.
- 3 = Same as 1 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

Clearing the UNACK parameter acknowledges the alarms.

In Auto, the block processes all alarms.

When the block is in Manual, the MANALM value determines which alarms are processed:

- 0 = Disable all alarms in Manual
- 1 = Process all alarms in Manual
- 2 = Disabled only Output alarming in Manual

When an Auto-to-Manual state transition occurs, the block examines the MANALM option.

If MANALM = 0, the block clears the alarm information that it contains and queues an ALARM_ACK message if the UNACK parameter was set prior to the transition. This alarm information includes the alarm status (ALMSTA), CRIT, PRTYPE, and alarm output parameters for high-high, high, and low absolute, deviation, and output alarms.

If MANALM = 1, the block does not clear the alarm information that it contains.

If MANALM = 2, the block clears the alarm information that it contains only for the output alarms.

If MANALM = 3, no output alarms are detected when the PIDA block, configured as a primary block (PRIBLK = 1) in a cascade scheme, goes into the Track mode due to a downstream open loop condition. There is no indication that the output alarm detection has been disabled. If an output alarm already exists when the PIDA goes into track mode, the output alarm indication in the faceplate and the indication in the Block Alarm Summary is cleared. If the PIDA primary is then put into Manual, the Manual alarming status overrides the tracking status.

If MANALM = 4, no output alarms are detected when the block is in Manual mode or the PDIA block, configured as a primary block (PRIBLK = 1) in a cascade scheme, goes into the Track mode due to a downstream open loop condition. In Manual mode, the disabled output alarm detection is indicated on the alarm overlay by displaying inhibited/disabled (depending on the setting of INHOPT) for the output alarms. Inhibited is not displayed, regardless of the setting of INHOPT. The output alarming is disabled, not inhibited. Also, the output alarm inhibited/disabled status remains if the block is switched back to Auto and the Track condition still exists.

The block clears the CRIT and PRTYPE parameters only if there are no outstanding output alarms prior to the transition to Manual. In this case, it queues an ALARM_ACK message if the UNACK parameter had been set prior to the transition.

When the compound is turned on or off, or when the block is switched from Auto to Manual, an appropriate ALARM_ENA or ALARM_DSB message is sent to all alarm devices configured in the block; if the Station Block is configured to do this.

If you turn off an existing alarm option by reconfiguring an alarm option parameter, an ALARM_DSB message is issued when the block is restarted. If an alarm was active prior to the reconfiguration, and no other alarms are now active, and INHOPT specifies auto-acknowledge, the alarm is acknowledged, an ALARM_ACK is sent to all alarm devices configured in the block, and CRIT and PRTYPE are cleared.

99.4.14 Validation Checks

The PIDA block in the CP validates the configuration parameters when it is installed, reconfigured, or restarted.

99.4.14.1 Tuning Block Connections

PIDA Key Parameters: STATEB, STATEF

If either tuning extender parameter, FBTBLK (for FBTUNE) or FFTBLK (for FFTUNE) is configured, the PIDA block verifies that the specified tuning block is currently connected to it. If the tuning block is not connected, the PIDA block sets the STATEF and/or STATEB parameter to off, and clears the connection to the tuning block.

99.4.14.2 Mode Option

PIDA Key Parameters: MODOPT, ERCODE

The block checks MODOPT for valid range (1 to 8). If it is invalid, the block sets ERCODE to INV_OPTION, and enters the “undefined” state.

99.4.14.3 Engineering Ranges

PIDA Key Parameters: HSCI1, HSCI2, HSCIN, HSCO1, LSCI1, LSCI2, LSCIN, LSCO1

The block checks the engineering ranges (RI1, RI2,RIN, and RO1) for crossover of the high and low values. If any high value is less than its corresponding low value, the block sets ERCODE to INV_ENG_RANGE and enters the “undefined” state.

99.4.15 Block Initialization

PIDA Key Parameters: See Table 99-5.

After parameter validation, the PIDA block in the CP initializes when the:

- Block is installed.
- Block is reconfigured.
- Block is restarted.
- Control Processor is rebooted.
- Compound containing the block is turned on.

Table 99-5 lists the block parameter settings for block initialization.

Table 99-5. Parameter Settings for Block Initialization

Parameter	Condition	Resulting Value
LR	LOCSP = 1	LR = 0 and secured
LR[1]	INITLR = 0	LR = 0 (local)
	INITLR = 1	LR = 1 (remote)
	INITLR = 2	LR is unchanged
MA[2]	INITMA = 0	MA = 0 (manual)
	INITMA = 1	MA = 1 (auto)
	INITMA = 2	MA is unchanged
OUT	---	OUT = BCALCI
BCALCO	---	BCALCO = MEAS or SPT depending on the setpoint state.
STATEB	---	STATEB = off
STATEF	---	STATEF = off
SPTARG[3]	SPROPT = 1	SPTARG = SPT
INITSE	SUPOPT = 1 or 3	SE = 0 (disable), SE = 1 (enable)

1. If the block is NOT restarting following an on-line upgrade warm start or a turning on of the compound.
2. If the block is NOT restarting following an on-line upgrade warm start or a turning on of the compound, else MA =1.
3. If the block is restarting due to a CP reboot, block install, or turning ON of the compound.

99.4.16 Exception Processing

PIDA Key Parameters: BCALCO, ERCODE, MA, MEAS

Each basic processing cycle (BPC), the PIDA block in the CP performs the following exception processing:

- Validation of the FBTUNE and FFTUNE block connections
- Status updating of all parameters
- Failsafe action
- Auto/Manual override actions
- Remote/Local override actions

The block validates the tuning block connections as it does during initialization (see “Validation Checks” on page 1883).

The block updates the status of the critical parameters MEAS, MA, and BCALCO for the following important status:

Table 99-6. Status of Critical Parameters

Status	Condition
MEAS.OOS = 1	FBM communications failure
MEAS.BAD = 1	FBM communications failure or bad measurement
BCALCO.OOS = 1	FBM communications failure
BCALCO.BAD = 1	FBM communications failure or bad measurement
MA.OOS = 1	FBM communications failure

For more information on block Bad, Shutdown and Bad states, refer to the appropriate *Integrated Control Software Concepts* document (B0700AG or B0193AW).

If the connected AOUT transitions to the Failsafe state, the PIDA block opens the upstream cascade by setting the appropriate BCALCO status bits to true.

99.4.17 Measurement Sampling

The sampling interval is the time between OUT updates in minutes. This can be the block period, or if SPLCOP is selected, the variable TSAMPL, or the time between set transitions of SPLRDY. TSAMPL or SPLRDY can be used for chromatograph or other applications where an update is required at a length of time greater than the block period.

When the measurement is updated nonperiodically or periodically at nonstandard I/A Series intervals, the :PIDA.SPLCOP should be set to 1. Nonperiodic output updates can then be triggered by toggling :PIDA.SPLRDY to 1. SPLRDY is automatically reset to 0 when the update takes place to await the next toggle. Periodic update intervals can be configured in minutes with :PIDA.TSAMPL. An internal counter determines the number of block :PIDA.PERIODs since the last update and adds this time to the :PIDA.INT value to determine the effective integral time, compensating for the possibly variable update interval. If the interval between updates were the dominant loop dynamic, perfect (Smith Predictor) compensation would be achieved with :PIDA.MODOPT = 4 (PI) and :PIDA.INT = 0.0 and :PIDA.PBAND set to 100 over the normalized (span compensated) process gain.

99.4.18 Cascade Control Loops

A cascade of control loops, where the output of a primary (outer-loop) controller is the setpoint of the secondary (inner-loop) controller, can improve performance of the outer loop, particularly when the primary measurement responds relatively slowly. A fast secondary loop can react to a load disturbance contained within it to prevent the disturbance from affecting the primary measurement. Also nonlinearity, such as results from a sticking valve can usually be made to have little effect on the slow outer loop. Limits on the primary output constrain the setpoint of the secondary loop and thereby the secondary measurement. Typical secondary controlled variables are valve position and flow. Jacket temperature may be the secondary variable for a batch reactor.

Primary integrator windup must be prevented when the secondary controller limits or is in local or manual. If integral action is not prevented, the prelimited output could windup, greatly exceeding the effective limit value. Then secondary output recovery from limiting might occur long after the primary control error changed sign because of its slow integral action, causing the controlled primary variable to significantly overshoot its setpoint. If LIMOPT is 1 or 2, windup is prevented by the response to logic bits transmitted with the secondary-BCALCO-to-primary-BCALCI connection. If LIMOPT is 3, windup is suppressed passively through the FBK input provided it is connected to the secondary BCALCO or its equivalent.

In a cascade, the connection of the primary FBK to its BCALCI, or to the secondary BCALCO, compensates the integral action of a primary loop for the dynamic behavior of a secondary loop, allowing tighter primary tuning.

Initialization of upstream blocks is triggered by a downstream manual-to-auto transition or local-to-remote transition. When PRIBLK of all but the most primary block is set to 1, a secondary's remote setpoint RSP is not accepted until its upstream block's OUT has been set to the downstream block's BCALCO value. This is signaled with logic bits carried in the BCALCO to BCALCI and OUT to RSP connections.

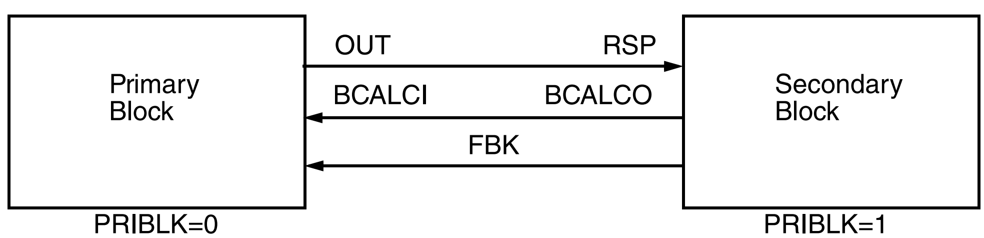


Figure 99-9. Cascade Connection

For a controller, the BCALCO value is usually set to its MEAS value. However, it is set to its local setpoint SPT if a local-remote transition has occurred. BCALCO may be back-calculated from its BCALCI value in other types of blocks.

The logic handshake caused by setting PRIBLK to 1 is not necessary if the period and phase of the cascaded blocks is the same and they are ordered primary to secondary in the same compound. This is exploited in Figure 99-10 to achieve a split range. In Figure 99-10 two valves are driven from two AOUTs. The AOUTs are driven from the same PIDA. When the PIDA's OUT goes from 0 to 30% the first AOUT is scaled so that its output goes full scale in the desired direction. The other AOUT's output is scaled to go full scale when the PIDA's output goes from 30 to 100%. If either of the AOUT's BCALCO were connected to PIDA BCALCI, the limit at 30%, sensed through logic bits, would cause the PIDA to misbehave. Instead a CALC block is used to back calculate the real value connected to the PIDA's BCALCI input without supplying logic bits.

The AOUT INITO Booleans are “anded” in the CALC block and the result linked to the PIDA INITI input. Both AOUTs must request initialization for the AOUT to initialize. The CALC block should be executed after the AOUTs (or ahead of the PIDA) to prevent an extra time step in the upstream propagation.

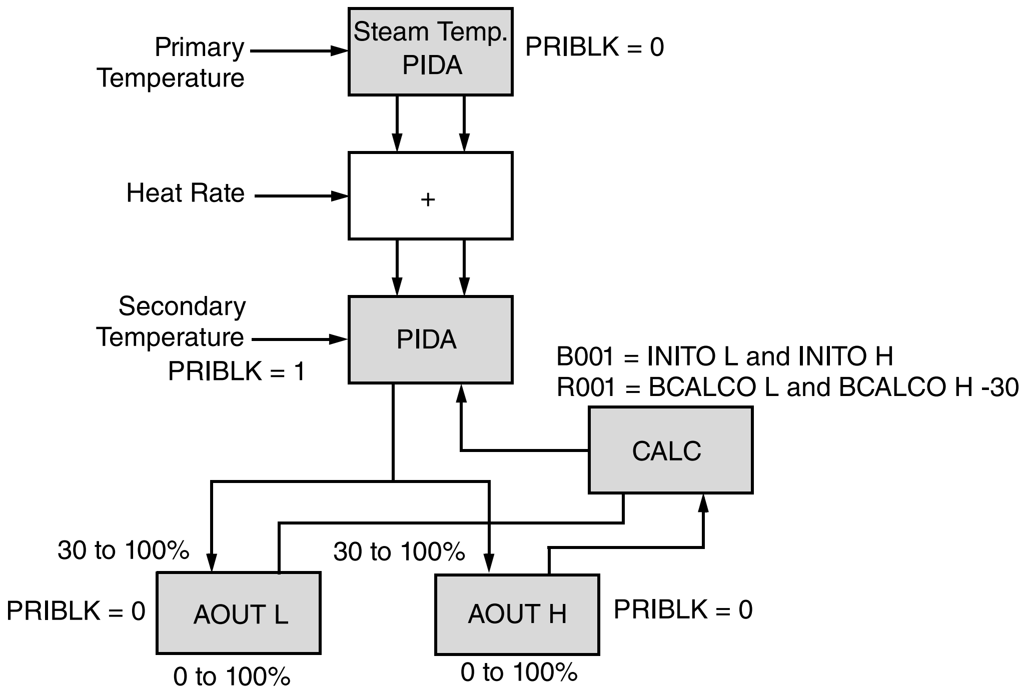


Figure 99-10. Cascade Control Loop Example (Split Range)

Controllers can also be structured in parallel to provide a safety override of a normal control function. For example, the normal controlled variable can be a composition indicative of product quality. In an emergency, a pressure controller can take over the final manipulated variable by selecting the controller with the smaller (or larger) output to drive the final manipulated variable. Integrator windup of the unselected controller is prevented by the same method used to recover from downstream limiting, actively using BCALCI limit bits or passively using FBK. If the controllers are tuned to have good unmeasured load rejection (high low-frequency gain) and LIMOPT = 1, constraint enforcement (like output-limit recovery) will have a small controlled-variable overshoot.

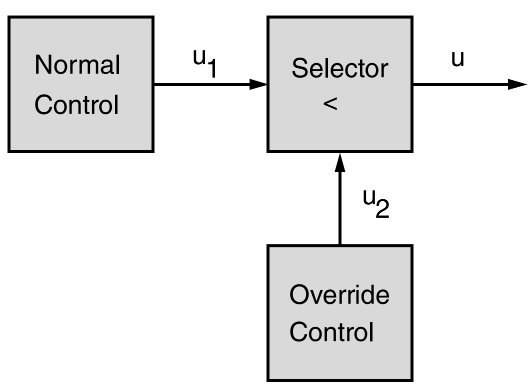


Figure 99-11. Output Selection Provides a Safety Override

99.4.19 Linearizing the Measurement

To embed a CHARC function in a PIDA or AIN, you must connect the BLKSTA of the CHARC block into the PIDA's NLNBLK or the AIN's EXTBLK parameter. When you use the CHARC as an extender, its inputs and outputs are not explicitly configured. In the PIDA, CHARC applies matched piecewise functions to :PIDA.SPT and to :PIDA.MEAS. The PIDA's CHARC output is expressed in percent of span. For a pH application, this allows the operator to view SPT and MEAS in nonlinear pH units and for the internal controller to view the process in more linear ion-concentration units.

99.5 Application Example

This application example demonstrates an adaptively tuned PIDA block controlling a simulated lag-delay process having both measured and unmeasured loads (see Figure 99-12). FBTUNE and FFTUNE extender blocks are attached to the PIDA to provide adaptive feedforward compensation and feedback tuning. The application described in this section requires that you configure the blocks shown in Figure 99-12. The example then describes the control actions caused by the manipulation of specified parameters.

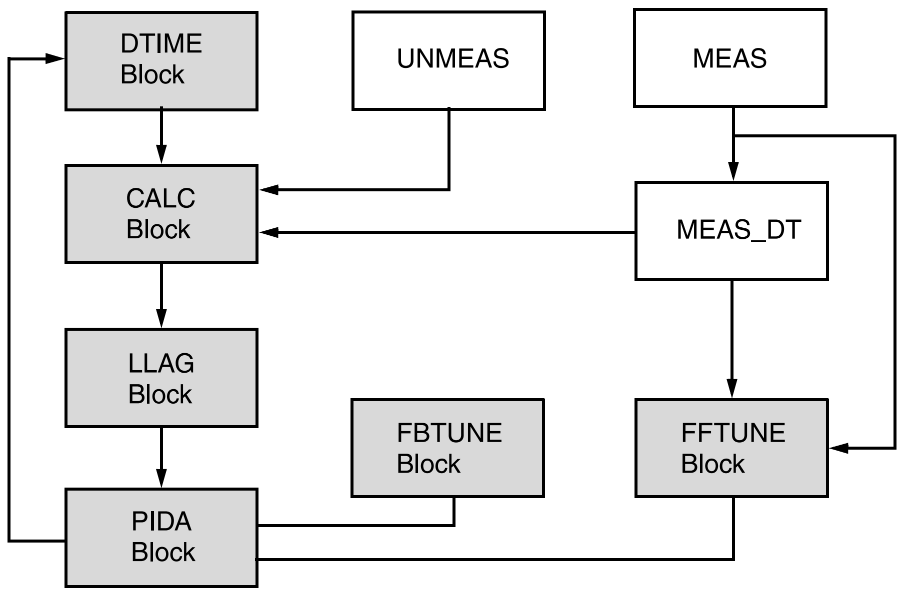


Figure 99-12. PIDA Sample Configuration

99.5.1 Sample PIDA Configuration

Enter the Integrated Control Configurator (ICC), to configure the application example shown in Figure 99-12. Start a new compound with the first process block (DTIME) which provides a deadtime set to 0.1 minute applied to the controller output. Arbitrarily assign this deadtime block's name as DTIME.

NAME: DTIME

TYPE: DTIME

MEAS: :PIDA.OUT

DT: 0.1

You can use the default values for other parameters in the DTIME configure list.

A LLAG block named UNMEAS supplies the manual output.

NAME: UNMEAS

TYPE: LLAG

INITMA: 0

Setting INITMA to 0 causes the block to startup in manual. You can use the default values for other parameters in the UNMEAS configure list.

A LLAG block named MEAS supplies the manual output.

NAME: MEAS

TYPE: LLAG

INITMA: 0

You can use the default values for other parameters in the MEAS configure list.

The measured load is delayed by 0.2 minutes in the MEAS_DT block.

NAME: MEAS_DT

TYPE: DTIME

MEAS: :MEAS.OUT

DT: 0.2

You can use the default values for other parameters in the UNMEAS configure list.

A calculation block named CALC sums the three signals.

NAME: CALC

TYPE: CALC

RI01: :DTIME.OUT

RI02: :UNMEAS.OUT

RI03: :MEAS_DT.OUT

RI04: 1.0

M01: 50.0

STEP01: IN RI01

STEP02: IN M01

STEP03: SUB

STEP04: IN RI04

STEP05: MUL

STEP06: IN RI02

STEP07: ADD

STEP08: IN RI03

STEP09: ADD

STEP10: IN M01

STEP11: ADD

STEP12: OUT RO01

STEP13: END

Default values for other parameters in the CALC configure list are accepted. CALC.RI04 is the process gain.

The CALC output is linked to the input of a lead-lag block. The lag time is set to 0.2 minutes providing a unity gain first order lag.

NAME: LLAG

TYPE: LLAG

MEAS: :CALC RO01

LAGTIM: 0.2

You can use the default values for other parameters in the LLAG configure list. If a quadratic lag were desired configure a positive :LLAG.LAG2 value. The result is:

$$OUT = \frac{1 + \text{LGAIN LAGTIM s}}{1 + \text{LAGTIM s} + \text{LAGTIM LAG2 s}^2}$$

When LAG2/LAGTIM is greater than 0.25, the quadratic has complex (underdamped) roots.

The lag output is applied to the measurement input of the PIDA controller.

NAME: PIDA

TYPE: PIDA

MEAS: :LLAG.OUT

MODOPT: 6

INITMA: 0

Default values can be accepted for the other parameters in the PIDA configure list. For this example, MODOPT = 6 selects noninteracting PID, NIPID. Later you could try other MODOPT choices such as PIDTAU = 8.

An FBTUNE extender block attached to the PIDA block provides adaptive feedback tuning.

NAME: FBTUNE

TYPE: FBTUNE

PIDBLK: :PIDA.BLKSTA

You can use the default values for other parameters in the UNMEAS configure list.

An FFTUNE extender block attached to the PIDA block adaptive feedforward tuning.

NAME: FFTUNE

TYPE: FFTUNE

PIDBLK: :PIDA.BLKSTA

LOAD1: :MEAS.OUT

Default values can be accepted for other parameters in the FFTUNE configure list.

99.5.2 A Sample PIDA Operation

When you have completed configuring the blocks, start the compound. Choose the Select screen for the PIDA block to view its operation. Pick the Trend square in the option matrix and then the Tune square. The PIDA starts in Manual. Set the PIDA's output to 30. Set the PIDA's setpoint to 70. With another Select screen set the output of UNMEAS to 40.

99.5.2.1 A Sample Pretune

The simulated process should respond, producing a MEAS value of 70 after one minute. When settling occurs, use the second Select screen to view the FBTUNE block. Toggle its STNREQ parameter to 1, toggle the FBTUNE's PTNREQ to 1 to start Pretune. When FBTUNE's Pretune is completed, it causes the PIDA to switch to Auto and FBTUNE's Selftune to start.

Pretune applies a doublet pulse to :PIDA.OUT. The pulse height is the :FBTUNE.BMP value in percent of PIDA output span. The pulse width is determined by the absolute change in :PIDA.MEAS exceeding :FBTUNE.THRESH in percent of the PIDA input span.

Pretune uses response pattern features to identify a gain-lag-delay model of the process. If the process actually had additional smaller lags, the identifier would lump them with the model's delay. (If :FBTUNE.DFCT had been greater than 1, Pretune would have tried to identify a gain-lag-lag-delay model. If :FBTUNE.DFCT had been less than 1, Pretune would have calculated less aggressive tuning, producing PI control if :FBTUNE.DFCT were 0.)

Pretune then uses the algebraic tuning method to determine the feedback tuning parameters. FBTUNE can be used for :PIDA.MODOPT of 4 = PI, 5 = PID, 6 = NIPID, 7 = PITAU, or 8 = PIDTAU. Pretune sets values for the tuning constants :PIDA.PBAND, :PIDA.INT, :PIDA.DERIV, :PIDA.SPLLAG, :PIDA.KD, :PIDA.DTIME. Pretune also sets values for :FBTUNE.PBMAX, :FBTUNE.PBMIN, :FBTUNE.ITMAX, :FBTUNE.ITMIN, :FBTUNE.PR_TYP, :PIDA.DEVTIM, and may override :FBTUNE.PRFL and :FBTUNE.DFCT.

For Pretune to complete successfully, the first :PIDA.MEAS response-peak absolute height must be at least 2.5 times the :FBTUNE.THRESH value measured in percent of input span. This assures that the pulse width is only slightly greater than the process deadtime. For a very low-gain process (typically a temperature loop), it is necessary to increase :FBTUNE.BMP and/or decrease :FBTUNE.THRESH. Also for a successful Pretune, :PIDA.INCOPT must be correctly configured and :PIDA.OUT must not be at a limit.

99.5.2.2 A Sample Feedback Selftune

You can apply a number of :UNMEAS.OUT and :PIDA.SPT steps to demonstrate selftuning responses to an unmeasured load and setpoint. Use the second Select screen for UNMEAS to prevent erasing the PIDA trend. The fourth tuning parameter :PIDA.SPLLAG applies a gain to setpoint relative to that applied to :PIDA.MEAS, allowing a low overshooting setpoint response when the other parameters are tuned for good unmeasured load rejection. To create "isolated" responses, wait for :PIDA.STATEB to return to Quiet before applying a new step. When :PIDA.BIAS is not linked, it can also be used to introduce an unmeasured load step.

For :FBTUNE.PRFL = 1, Selftune sets values for the tuning constants :PIDA.PBAND, :PIDA.INT, :PIDA.DERIV, :PIDA.DTIME, :PIDA.FILTER.

For a non-deadtime :PIDA.MODOPT, specify the overshoot target (the negative of the ratio of the second to first error-peak amplitude) with :FBTUNE.OVR. The range should be between 0.0 and 0.1 with the default 0.1 (10%).

In a low-gain process such as temperature, you can selftune based on the :PIDA.OUT peak pattern in addition to the control-error (after optional linearization with a CHARC extender, and measurement filtering) pattern. An output :PIDA.OUT2 peak search is triggered from the :PIDA.STATEB Quiet state by an absolute output change greater than :FBTUNE.LIM in percent of span. To activate the output peak search, set :FBTUNE.LIM to a value slightly greater than the background output peak-to-peak noise, perhaps 2%.

You can also test Selftune's ability to cope with process changes in :DTIME.DT, :LLAG.LAGTIM, and :CALC.RI04 (gain). It may be necessary to follow process changes with a load or setpoint upset. Since Selftune may use a different gainset for up-transients than for down-transients, it is often necessary to wait until the next transient of the same sign to view the result of adaptation.

To cope with process nonlinearity, the use of :FBTUNE.PROG, whose span is divided into three subranges by :FBTUNE.PROGLT and :FBTUNE.PROGUT, can cause up to six adapted gain-sets to be employed, one for each subrange-direction pair.

Note that, :FBTUNE.PR_FL can change the style of Selftuning. A value of 0 uses a fuzzy-interpolation method for isolated error responses when :PIDA.MODOPT is 4 (PI) or 5 (PID). A value of 2 suspends retuning but inserts the appropriate stored gainset to cope with each new disturbance. For :FBTUNE.PRFL = 0, Selftune sets values for :PIDA.PBAND, :PIDA.INT, :PIDA.DERIV, :PIDA.SPLLAG, and :PIDA.PR_TYP.

If :PIDA.MODOPT is changed or if the process changes dramatically, for example from/to lag dominant to/from deadtime dominant, you should run a new Pretune. Running a new Pretune, or toggling :FBTUNE.PIDRCL from the FBTUNE Hold state, erases all stored gainsets. This inserts into the PIDA the fallback tuning parameters :FBTUNE.PM, :FBTUNE.IM, :FBTUNE.DM. Enter the FBTUNE Hold state by toggling to :FBTUNE.STHREQ to 1. This state suspends both retuning and gainset insertion. When :FBTUNE.STNREQ is toggled to 0, FBTUNE is turned off and all stored gainsets are erased. However, gainsets can be remembered by checkpointing before FBTUNE is turned off.

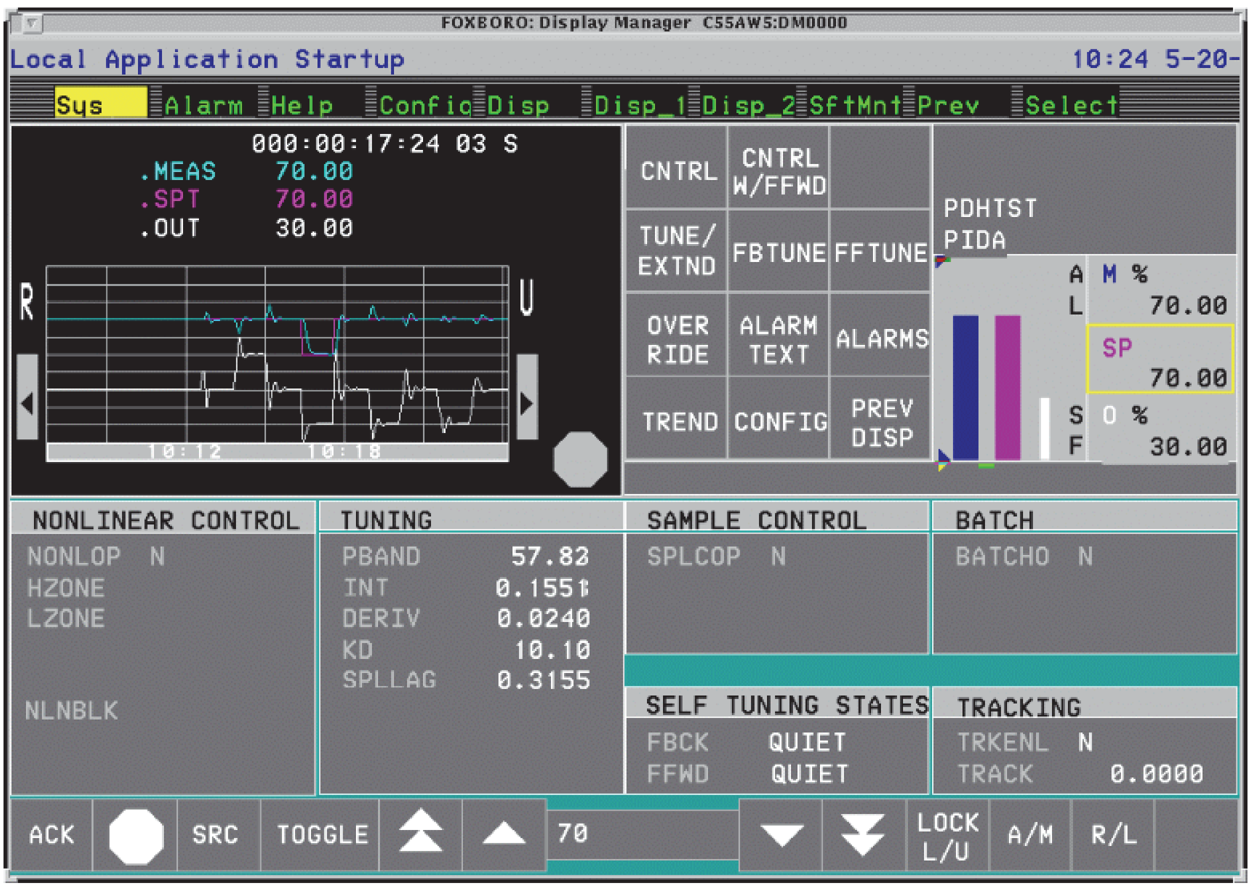


Figure 99-13. NONLOP Display

99.5.2.3 Sample Feedforward Selftune

FFTUNE does not have a Pretune. FFTUNE's selftune is started by toggling :FFTUNE.FTNREQ to 1. When :PIDA.STATEF is Quiet and an absolute change in :FFTUNE.LOAD1 larger than :FFTUNE.THRESH in percent is detected, a new process-model identification is triggered.

(A change in any :FFTUNE.LOADx input or linked :PIDA.MULTIN or :PIDA.BIAS input can trigger identification.) If at some point in the response transient, the control error exceeds :FFTUNE.THRESH, indicated by :PIDA.STATEF changing to Signif, and the :PIDA.STATEF finally returns to Quiet without first becoming Unmeas, the FFTUNE compensators are updated provided there is a steady-state change in a measured load. Adaptation will not occur on a :PIDA.STATEF transition from Unmeas to Quiet.

Run a sequence of :MEAS.OUT steps to adapt and observe the results. Like FBTUNE, FFTUNE may have six gainsets. After the first set of adaptations, it is necessary to wait for a repeat of the load-change direction and :FTUNE.PROG subrange to see the effect of adaptation. FBTUNE and FFTUNE may be active simultaneously, but either can operate independently.

When :FFTUNE.FTHREQ is 1, adaptation and gainset insertion are suspended, but compensation is not. When :FFTUNE.FTNREQ is toggled to 0, FFTUNE is turned off and stored gainsets are erased. However, gainsets can be remembered by checkpointing before FFTUNE is turned off.

FFTUNE provides dynamic compensation for a multiplicative feedforward linked to :PIDA.MULTIN. Then no compensation is applied to :FFTUNE.LOAD4, since only four feedforwards can be compensated. To avoid overcompensation, :PIDA.MULTIN should not be linked also to an :FFTUNE.LOADx input.

FFTUNE will not significantly improve the measured-load rejection if there is more effective delay in the manipulated-variable path than in the load path. Cancellation would require an unrealizable negative-delay compensator. In this case FFTUNE applies reduced gain to a :FFTUNE.LOADx input, depending on the size of the calculated negative delay relative to the closed-loop characteristic time, and no dynamic compensation.

99.5.2.4 Decoupling of Interacting Loops

Decoupling is typically performed between primary and secondary controllers in parallel cascades (Figure 99-14). The secondary measurements in other paths are used as feedforward-load inputs to each primary controller. Then output limiting and the auto-manual or local-remote state of other controllers in other paths do not affect their decoupling from this path.

A common situation involves secondary flows that affect both inventory and quality variables. An inventory variable such as liquid level or gas pressure is affected by the sum or difference of flows. A quality variable such as composition or temperature is affected by the ratio of flows. When there is one primary variable of each type, such as in the distillation example below, pair the larger secondary flow setpoint with the inventory primary and the smaller flow setpoint with the quality primary. Decouple from the inventory controller's internal output sum with a subtractive feedforward compensation. Decouple the smaller flow from the inventory controller's internal output sum with a subtractive feedforward compensation. Decouple the larger flow from the quality controller's internal output ratio with a multiplicative feedforward compensation.

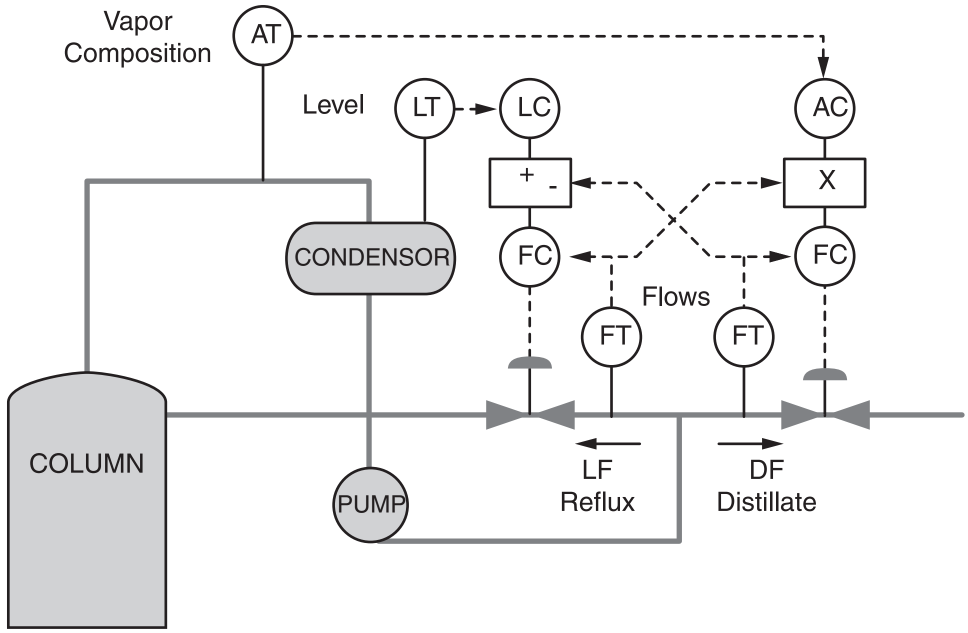


Figure 99-14. Parallel Cascades

Using secondary flows as feedforward variables in a full decoupling application introduces an additional feedback loop. Setting a :FFTUNE.DETUNx value of less than 1 eliminates the oscillatory behavior of this loop. This factor multiplies the gain compensation applied to the :FFTUNE.LOADx input.

:PIDA.OUT2 is a back-calculated internal output of the feedback controller, before feedforward compensation, expressed in percent of span. You can use this variable as a feedforward input in another controller.

100. PIDX – PID Extended Block

This chapter gives a general overview of the PIDX (PID Extended Block), including its features, parameters and detailed operations.

100.1 Overview

The PIDA (with FBTUNE and FFTUNE when necessary) is recommended for use in all PID applications. The PIDA block has all of the functionality of the older PID algorithms plus additional functionality. See “PIDA – Advanced PID Block” on page 1819 for more details.

The PIDX (Proportional-Integral-Derivative Extended) block is a traditional PID controller with added features. Like the PID block, PIDX can be configured to operate in one of five modes:

1. Proportional Only (PO)
2. Integral Only (IO)
3. Proportional Plus Derivative (PD)
4. Proportional Plus Integral (PI), and
5. Proportional Plus Integral Plus Derivative (PID).

In addition, the PIDX includes Output Tracking as a feature and options for:

1. Nonlinear Gain Compensation
2. Sampling mode
3. Batch control preload.

100.1.1 I/O Diagram

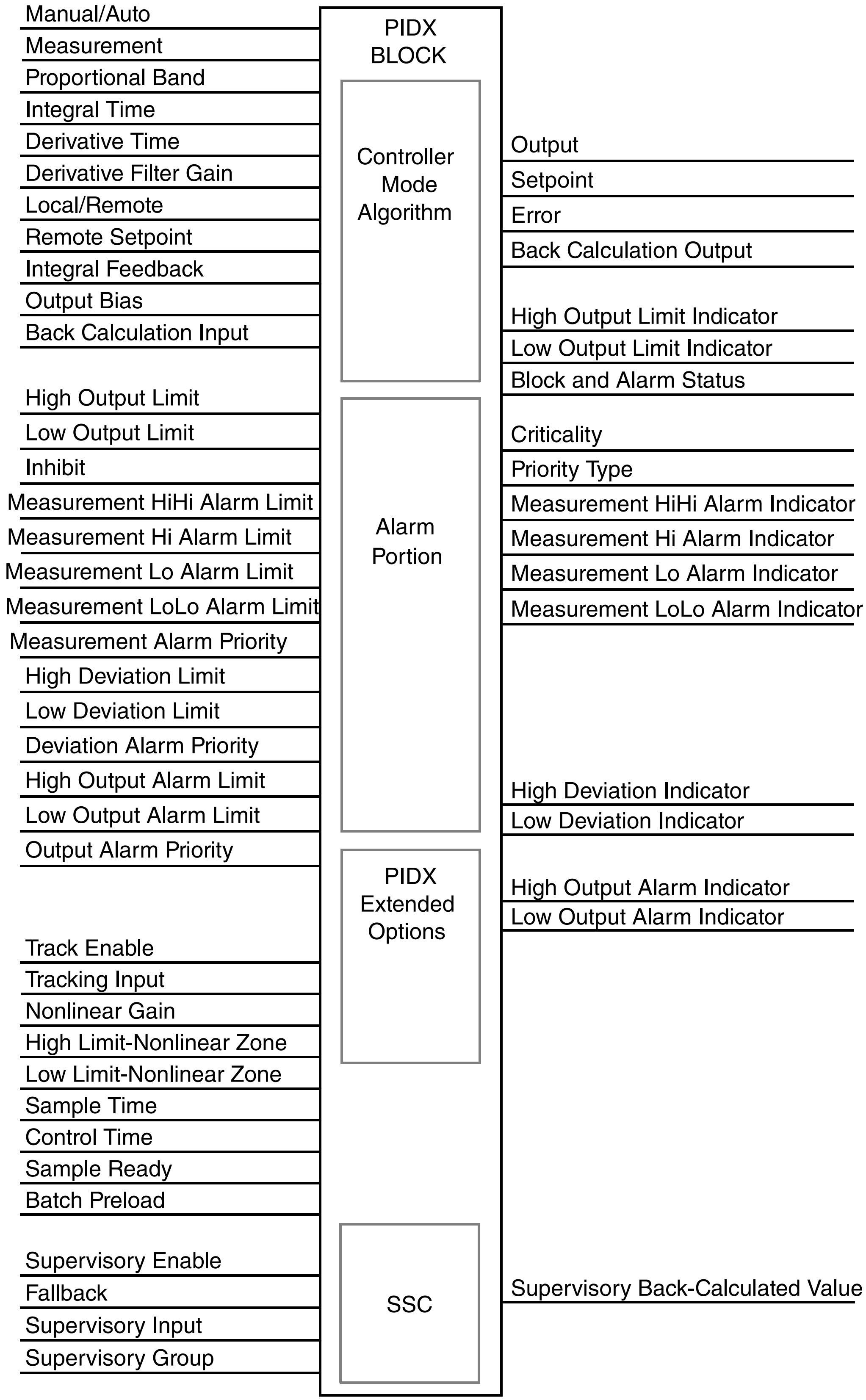


Figure 100-1. PIDX Block I/O Diagram

100.2 Features

The features are:

- Manual/Auto control of the outputs, which can be initiated by a host process or another block
- Auto and Manual latch switch inputs (AUTSW and MANSW) that allow the block to be switched to Auto or Manual
- Local/Remote setpoint source selection
- Local and Remote latch switch inputs (LOCSW and REMSW) that allow the block to be switched to Auto or Manual
- Derivative filtering using a second-order Butterworth filter for high frequency noise rejection
- External integral feedback to prevent windup during closed loop operation
- Separate assignable engineering range and units to the parameters Measurement, Bias, and Input
- Bumpless transfer of the output signal when the block returns to controlling operation in Auto
- Adjustable derivative gain parameter (KD)
- Automatic scaling, based on assigned engineering ranges, so that the controller gain is normalized
- Output biasing with scaling
- Output clamping between variable output limits
- Bad inputs detection and handling
- Automatic cascade handling using an input and output parameter (back-calculate) that includes:
  - Initialization of cascade schemes.
  - Back calculation of the setpoint input for the upstream block, to provide bumpless cascade operation when the cascade is open loop.
- Output Tracking allows the output to track an independent signal source
- Supervisory Control (SSC) allows user application software to perform supervisory control over the PIDX block's set point.

The options are:

- Setpoint Tracking Option (STRKOP) forces the setpoint to track the Measurement signal. STRKOP takes this action when the LR parameter has transitioned in either direction and 1) either the output is in Manual or a cascade is broken (a downstream block is in open loop - INITI true) or the block is in Manual, or 2) when the block is in Manual only. This feature allows bumpless return to automatic control when the PIDX or any downstream block returns to closed-loop operation. The block does not perform STRKOP if any critical data errors are detected.
- Manual if Bad Option (MBADOP) is a Manual override feature. When MBADOP = 1 or 2, the block sets an unlinked MA input to Manual when it detects bad status of a control input (MEAS, FBK, and/or INITI) or optionally (when MBADOP = 2), if the Remote Setpoint (RSP) is not healthy (i.e., value status is BAD or has a broken

OM connection). This forces the output state to Manual. Returning to Auto requires external intervention, unless AUTSW is true.

- Increase/Increase Option (INCOPT) reverses the normal sense of the control action so that the controller output increases with increasing measurement.
- Measurement Alarming Option (MALOPT) provides absolute alarming of the measurement during auto operation. This option also provides standard alarm notification and reporting features.
- Deviation Alarm Option (DALOPT) enables (when true) deviation alarming of the measurement-setpoint error signal.
- High-High Alarm Option (HHAOPT) enables High-High and Low-Low absolute alarming for the measurement input, or disables absolute alarming altogether. Each alarm triggers an indicator (HHAIND or LLAIND) and text message (HHATXT and LLATXT) at a given priority level (HHAPRI) to be sent to the configured alarm group (HHAGRP). Once an alarm limit (HHALIM or LLALIM) is exceeded, the indicators remain set until the measurement returns within the defined limit plus (or minus) the deadband (MEASDB).

  0 = No alarming

  1 = High-High and Low-Low alarming

  2 = High-High alarming only

  3 = Low-Low alarming only.
- Manual Alarming Option (MANALM) allows you to invoke, while the block is in manual, either all configured alarm options or all configured alarm options *except* output alarming. Otherwise, alarming is normally performed only in Auto.
- Output Alarm Option (OALOPT) enables (when true) absolute alarming of the block output signal (OUT).
- Unacknowledge (UNACK) is a boolean output parameter which is set true, for notification purposes, whenever the block goes into alarm. It is settable, but sets are only allowed to clear UNACK to false, and never in the opposite direction. The clearing of UNACK is normally via an operator "acknowledge" pick on a default or user display, or via a user task.
- Manual Clamping Option (MCLOPT) allows you to invoke output clamping while the block is in manual. The operator can alter this boolean input at the workstation.
- Bias Track Option (BTRKOP), when true, forces the algorithm's output Bias to track the block output (OUT). BTRKOP is a boolean input that you can change only by reconfiguring the block.
- Nonlinear Option (NONLOP) allows you to change the gain in a zone about zero error. The zone is defined by HZONE and LZONE, and the gain by KZONE.
- Sample Controller Option (SPLCOP) enables the PID to operate as a sampling controller over a time period that is much greater than the block's execution period.
- Batch Control Option (BATCHO) works with the integral modes of the controller and the integral preload input to allow the PID to operate as a preloadable controller.
- Control Error Option (CEOPT) allows you to enable, or disable, the block's implicit Hold action when it detects an error in the MEAS, FBK, or BCALCI input.

- Propagate Error Option (PROPT) gives you the option of propagating the ERROR status bit from the MEAS input to the block's OUT parameter.
- Local Setpoint Secure (LOCSP) enables you to secure against any write access to the LR parameter.
- Manual If Failsafe (MANFS) allows you to have the block go to the Manual state when the block receives a Failsafe notification.
- Supervisory Option (SUPOPT) specifies whether or not the block is under control of a Supervisory Application Program.
- Fallback Option (FLBOPT) specifies the action taken in a block when Supervisory fallback occurs. The fallback options can be: normal fallback, Auto, Manual, Remote, or Local.

100.3 Parameters

Table 100-1. PIDX Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	9	PIDX
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
MEAS	process input	real	con/set	0.0	RI1
HSCI1 to HSCI2	high scale in 1 to 2	real	no-con/no-set	100.0	specifiable
LSCI1 to LSCI2	low scale in 1 to 2	real	no-con/no-set	0.0	specifiable
DELTI1 to DELTI2	change delta 1 to 2	real	no-con/no-set	1.0	percent
EI1 to EI2	eng units input	string	no-con/no-set	%	specifiable
PROPT	propagate error	short	no-con/no-set	0	0 to 2
SPT	setpoint	real	no-con/set	0.0	RI1
FBK	reset feedback	real	con/set	0.0	RO1
MODOPT	control mode option	short	no-con/no-set	1	[1..5]
PBAND	proportional band	real	con/set	1000.0	[0.1..]percent
INT	integral time	real	con/set	100.0	[0..]minutes
DERIV	derivative tim	real	con/set	0.0	[0..]minutes
KD	derivative gain	real	con/set	10.0	[10.0..50.0]
INCOPT	increase/increase option	boolean	no-con/no-set	0	0 to 1
HSCO1	high scale out 1	real	no-con/no-set	100.0	specifiable
LSCO1	low scale out 1	real	no-con/no-set	0.0	specifiable
DELTO1	change delta out 1	real	no-con/no-set	1.0	percent
EO1	eng unit output	string	no-con/no-set	%	specifiable
HOLIM	high output limit	real	con/set	100.0	RO1
LOLIM	low ouput limit	real	con/set	0.0	RO1
OSV	span variance	real	no-con/no-set	2.0	[0..25]percent
TRACK	track input	real	con/set	0.0	RO1

Table 100-1. PIDX Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
TRKENL	track enable	boolean	con/set	0	0 to 1
BIAS	bias	real	con/set	0.0	RI2
BBIAS	offset for the bias	real	no-con/no-set	0.0	RO1
KBIAS	bias scale or gain factor	real	no-con/no-set	1.0	scalar
BTRKOP	bias track option	boolean	no-con/no-set	0	0 to 1
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	[0|1|2]
MANFS	manual If failsafe	boolean	no-con/no-set	0	0 to 1
MBADOP	manual bad option	short	no-con/no-set	0	[0|1|2]
MANSW	manual switch	boolean	con/set	0	0 to 1
AUTSW	auto switch	boolean	con/set	0	0 to 1
MCLOPT	manual clamp option	boolean	no-con/no-set	0	0 to 1
CEOPT	control error option	short	no-con/no-set	1	0 to 2
HOLD	hold mode	boolean	con/set	0	0 to 1
PRIBLK	primary block cascade option	boolean	no-con/no-set	0	0 to 1
PRITIM	primary cascade timer	real	no-con/no-set	0.0	seconds
INITI	initialize in	short	con/set	0	0 to 1
BCALCI	back calculate input	real	con/set	0.0	RO1
LR	local/remote	boolean	con/set	0	0 to 1
INITLR	initialize LR	short	no-con/no-set	2	[0|1|2]
LOCSP	local setpoint	boolean	no-con/no-set	0	0 to 1
LOCSW	local switch	boolean	con/set	0	0 to 1
REMSW	remote switch	boolean	con/set	0	0 to 1
RSP	remote setpoint	real	con/set	0.0	RI1
STRKOP	setpoint tracking option	short	no-con/no-set	0	[0|1|2]
MANALM	manual alarm option	short	no-con/no-set	1	0 to 4
INHOPT	inhibit option	short	no-con/no-set	0	0 to 3
INHIB	alarm inhibit	boolean	con/set	0	0 to 1
INHALM	inhibit alarm	pack_b	con/set	0	0 to 0xFFFF
MEASNM	meas alarm name	string	no-con/no-set	blank	1 to 12 chars
MALOPT	meas alarm option	short	no-con/no-set	0	0 to 3
MEASHL	meas high alarm limit	real	con/set	100.0	RI1
MEASHT	meas high alarm text	string	no-con/no-set	blank	1 to 32 chars
MEASLL	meas low alarm limit	real	con/set	0.0	RI1
MEASLT	meas low alarm text	string	no-con/no-set	blank	1 to 32 chars
MEASDB	meas alarm deadband	real	no-con/set	0.0	RI1
MEASPR	meas alarm priority	integer	con/set	5	[1..5]
MEASGR	meas alarm group	short	no-con/set	1	[1..8]
DALOPT	deviation alarm option	short	no-con/no-set	0	0 to 3
HDALIM	high deviation limit	real	con/set	100.0	RI1
HDATXT	high deviation alarm text	string	no-con/no-set	blank	1 to 32 chars
LDALIM	low deviation limit	real	con/set	-100.0	RI1
LDATXT	low deviation alarm text	string	no-con/no-set	blank	1 to 32 chars
DEVADB	deviation alarm deadband	real	no-con/set	[0.0	RI1
DEVPRI	deviation alarm priority	integer	con/set	5	[1..5]
DEVGRP	deviation alarm group	short	no-con/set	1	[1..8]

Table 100-1. PIDX Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
HHAOPT	high-high option	short	no-con/no-set	0	0 to 3
HHALIM	high-high limit	real	con/set	100.0	RI1
HHATXT	high-high alarm text	string	no-con/no-set	blank	1 to 32 chars
LLALIM	low-low alarm limit	real	con/set	0.0	RI1
LLATXT	low-low absolute text	string	no-con/no-set	blank	1 to 32 chars
HHAPRI	high-high priority	integer	con/set	5	[1..5]
HHAGRP	high-high group	short	no-con/set	1	[1..8]
OALOPT	out alarm option	short	no-con/no-set	0	0 to 3
OUTNM	out alarm name	string	no-con/no-set	blank	1 to 12 chars
HOALIM	high out alarm limit	real	con/set	100.0	RO1
HOATXT	high out alarm text	string	no-con/no-set	blank	1 to 32 chars
LOALIM	low out alarm limit	real	con/set	0.0	RO1
LOATXT	low out alarm text	string	no-con/no-set	blank	1 to 32 chars
OUTADB	out alarm deadband	real	no-con/set	0.0	RO1
OUTPRI	out alarm priority	integer	con/set	5	[1..5]
OUTGRP	out alarm group	short	no-con/set	1	[1..8]
NONLOP	non linear option	boolean	no-con/no-set	0	0 to 1
HZONE	high zone limit	real	con/set	100.0	[0..]RI3
LZONE	low zone limit	real	con/set	100.0	[0..]RI3
KZONE	nonlinear gain	real	con/set	1.0	[0..]
SPLCOP	sample controller option	boolean	no-con/no-set	0	0 to 1
SPLRDY	sample ready	boolean	con/set	0	0 to 1
TCTRL	control time	real	con/set	0.0	[0..]minutes
TSAMPL	sampling time	real	con/set	0.0	[0..]minutes
BATCHO	batch control option	boolean	no-con/no-set	0	0 to 1
FLBOPT	fallback option	short	no-con/no-set	0	0 to 4
FLBREQ	fallback request	short	con/no-set	0	0 to 2
INITSE	intial SE	short	no-con/no-set	0	0 to 2
PRLOAD	batch preload	real	con/set	0.0	0-100%
QALSTA	quality status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
SE	supervisory enable	boolean	no-con/set	0	0 to 1
SUPBCO	back calculate value	real	con/no-set	0	RI1
SUPGRP	supervisory group	short	no-con/no-set	1	1-8
SUPOPT	supervisory option	short	no-con/no-set	0	0 to 4
SUP_IN	supervisory setpoint	real	con/no-set	0.0	RI1
AMRTIN	alarm regeneration timer	integer	no-con/no-set	0	0 to 32767 s
NASTDB	alarm deadband timer	long integer	no-con/no-set	0	0-2147483647 ms
NASOPT	nuisance alarm suppression option	short	no-con/no-set	0	0 to 2
OUTPUTS					
ALMSTA	alarm status	pack_l	con/no-set	0	bit map
BCALCO	back calculation out	real	con/no-set	0.0	RI1
BLKSTA	block status	pack_l	con/no-set	0	bit map
CRIT	criticality	integer	con/no-set	0	[0..5]
ERROR	control error	real	con/no-set	0.0	RI1
HDAIND	high deviation indicator	boolean	con/no-set	0	0 to 1

Table 100-1. PIDX Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
HHAIND	high-high absolute indicator	boolean	con/no-set	0	0 to 1
HOAIND	high out alarm indicator	boolean	con/no-set	0	0 to 1
HOLIND	high out limit indicator	boolean	con/no-set	0	0 to 1
INHSTA	inhibit status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
INITO	initialize out	short	con/no-set	0	0 to 1
LDAIND	low deviation indicator	boolean	con/no-set	0	0 to 1
LLAIND	low-low alarm indicator	boolean	con/no-set	0	0 to 1
LOAIND	low out alarm indicator	boolean	con/no-set	0	0 to 1
LOLIND	low out limit indicator	boolean	con/no-set	0	0 to 1
MEASHI	meas high alarm indicator	boolean	con/no-set	0	0 to 1
MEASLI	meas low alarm indicator	boolean	con/no-set	0	0 to 1
OUT	output	real	con/no-set	0.0	RO1
PRTYPE	priority type	integer	con/no-set	0	[0..10]
UNACK	alarm notification	boolean	con/no-set	0	0 to 1
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
ALMOPT	alarm options	pack_l	no-con/no-set	0	0 to 0xFFFFFFFF
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	config error	string	no-con/no-set	0	0 to 43 chars
KSCALE	gain scaler	real	no-con/no-set	1.0	scalar
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars
PERTIM	period time	real	no-con/no-set	0.1	---
PRSCAS	cascade state	short	no-con/no-set	0	0 to 7
PRSCON	present control	short	no-con/no-set	0	0 to 3
RI1 to RI2	eng range input	real[3]	no-con/no-set	100,0,1	specifiable
RO1	eng range output	real[3]	no-con/no-set	100,0,1	specifiable

100.3.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

ALMOPT

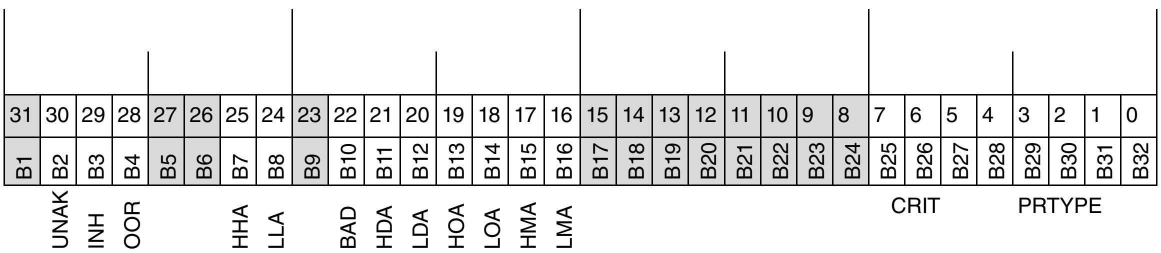
Alarm Options contains packed long values representing the alarm types that have been configured as options in the block, and the alarm groups that are in use. For the PIDX block, only the following unshaded bits are used.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1] (0 to 31)	Configured Alarm Option When True
0	Alarm Group 8 in Use
1	Alarm Group 7 in Use
7	Alarm Group 1 in Use
16	Low Absolute Alarm Configured
17	High Absolute Alarm Configured
24	Low-Low Absolute Alarm Configured
25	High-High Absolute Alarm Configured

1. Bit 0 is the least significant, low order bit.

ALMSTA Alarm Status is a 32-bit output, bit-mapped to indicate the block's alarm states. For the PIDX block, only the following bits are used:



Bit Number (0 to 31)*	Name	Description When True	Boolean Connection (B32 to B1)
0 to 4	PTYP_MSK	Priority Type: See parameter PRTYPE for values used in the PIDX block	ALMSTA.B32–ALMSTA.B28
5 to 7	CRIT_MSK	Criticality; 5 = lowest priority, 1= highest	ALMSTA.B27–ALMSTA.B25
16	LMA	Low Measurement Alarm	ALMSTA.B16
17	HMA	High Absolute Alarm	ALMSTA.B15
18	LOA	Low Output Alarm	ALMSTA.B14
19	HOA	High Output Alarm	ALMSTA.B13
20	LDA	Low Deviation Alarm	ALMSTA.B12
21	HDA	High Deviation Alarm	ALMSTA.B11
22	BAD	BAD output of block	ALMSTA.B10
24	LLA	Low-Low Absolute Alarm	ALMSTA.B8
25	HHA	High-High Absolute Alarm	ALMSTA.B7
28	OOR	Out of Range Alarm	ALMSTA.B4
29	INH	Alarm inhibit	ALMSTA.B3

Bit Number (0 to 31)*	Name	Description When True	Boolean Connection (B32 to B1)
30	UNAK	Unacknowledged	ALMSTA.B2

* Bit 0 is the least significant, low order bit.

AMRTIN — Alarm Regeneration Timer is a configurable integer that specifies the time interval for an alarm condition to exist continuously, after which a new unacknowledged alarm condition and its associated alarm message is generated.

AUTSW — Auto Switch is a boolean input that, when true, overrides the MA and INITMA parameters, and drives the block to the Auto state. If both MANSW and AUTSW are true, MANSW has priority.

BATCHO — Batch Control Option is a boolean input that enables the PIDX block to operate as a preloadable controller. You can change BATCHO only by reconfiguring the block. When BATCHO is true, and a limit condition exists, the integral term is set to the value nearer the limit PRLOAD, or the value selected when LIMOPT is 2. In the PIDX block, the only choice is PRLOAD. The PIDA version tends to avoid saw-tooth ratcheting and excessively slow recovery.

BBIAS — Offset for the Bias is a real input used for offsetting the product of the BIAS input with KBIAS.

BCALCI — Back Calculation In is a real input that provides the initial value of the output before the block enters the controlling state, so that the return to controlling is bumpless. It is also the source of the output value when its integration bit, which puts the block into output tracking, is non-zero. The source for this input is the back calculation output (BCALCO) of the downstream block. With V4.2 and later software, BCALCI contains the cascade initialization data bits which were formerly contained in the INITI parameter. Therefore, BCALCI defines the source block and parameter that drives this block into initialization, and INITI and INITO are not required for cascade initialization.

BLKSTA includes bits which can indicate when the downstream output is limited in either direction. BLKSTA.B11 monitors the Limited High condition (BCALCI.LHI) and BLKSTA.B10 monitors the Limited Low condition (BCALCI.LLO).

BCALCO — Back Calculation Output is a real output that is equal to MEAS except in the following situations, where it is equal to SPT:

- The block is transitioning from Local to Remote mode on this cycle.
- MEAS has Bad status.
- MEAS has Out-of-Service status.

- MEAS has Error status.
- MEAS is experiencing source connection problems.

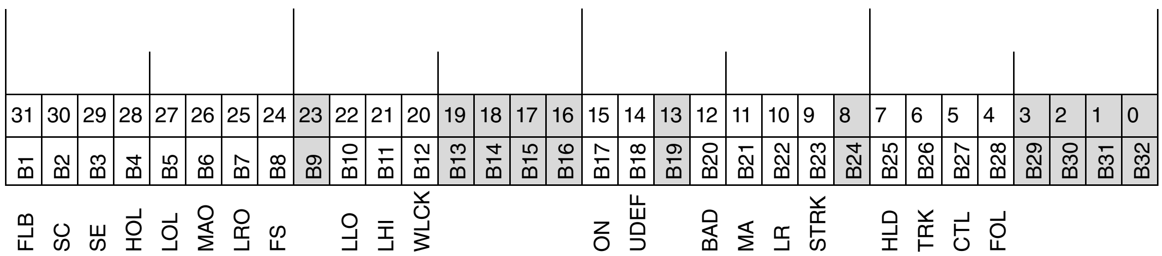
With V4.2 and later software, the status bits of BCALCO contain the cascade initialization requests formerly contained in the INITO parameter. You connect the BCALCO parameter to the BCALCI input of an upstream block so that this upstream block can sense when the PIDX block is open. Therefore, with V4.2 and later software, INITO is not required for cascade initialization.

BIAS

Bias is a real input added to the controller or algorithm output, to achieve OUT.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the PIDX block, only the following bits are used:



Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
4	FOL	Follow	BLKSTA.B28
5	CTL	Controlling	BLKSTA.B27
6	TRK	Tracking	BLKSTA.B26
7	HLD	Holding	BLKSTA.B25
9	STRK	Setpoint Tracking	BLKSTA.B23
10	LR	Local(= false)/Remote(= true)	BLKSTA.B22
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
12	BAD	block in BAD state	BLKSTA.B20
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
20	WLCK	Workstation Lock	BLKSTA.B12
21	LHI	Downstream Limited High	BLKSTA.B11
22	LLO	Downstream Limited Low	BLKSTA.B10
24	FS	Failsafe	BLKSTA.B8
25	LRO	Local/Remote Override	BLKSTA.B7
26	MAO	Manual/Auto Override	BLKSTA.B6
27	LOL	Low Output Limit (Clamped)	BLKSTA.B5

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
28	HOL	High Output Limit (Clamped)	BLKSTA.B4
29	SE	Supervisory Enabled	BLKSTA.B3
30	SC	Supervisory Control	BLKSTA.B2
31	FLB	Supervisory Control Fallback State	BLKSTA.B1

* Bit 0 is the least significant, low order bit.

BTRKOP

Bias Track Option, when true, forces the PID algorithm's BIAS input to track the block output (OUT) when the block is in Manual, and operating in the PO or PD controller mode.

CEOPT

Control Error Option is a short integer that specifies how the block responds to the MEAS and BCALCI inputs when either of those inputs is in error. To provide backward compatibility, CEOPT defaults to 1. CEOPT has a range of 0 to 2 where:

0 = The block takes no implicit Hold action when it detects a control error.

1 = The block goes to the Hold state if, while MBADOP = 0, either MEAS or BCALCI: (a) has its BAD status bit set true; (b) has its Out-of-Service status bit set true; (c) is experiencing peer-to-peer path failure.

2 = The block goes to the Hold state if, while MBADOP = 0, either MEAS or BCALCI meets any of the conditions described for CEOPT = 1, or if MEAS has its ERROR status bit set true.

CEOPT is independent of the propagate error option, PROPT, and does not affect the external logical input, HOLD. The HOLD input, when true, still drives the block into the Hold state whenever the block is in Auto (and MBADOP = 0).

CRIT

Criticality is an integer output that indicates the priority, ranging from 1 to 5, of the block's highest currently active alarm (1 is the highest priority). An output of zero indicates the absence of alarms.

DALOPT

Deviation Alarm Option is a short integer input that enables High and Low deviation alarming, or disables alarming altogether.

0 = No alarming.
1 = High and Low deviation alarming.
2 = High deviation alarming only.
3 = Low deviation alarming only.

You can change DALOPT only by reconfiguring the block.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block.

DELTI1 to DELTI2

Change Delta for Input Range 1 or 2 is a real value that defines the minimum percent of the input range that triggers change driven connections for parameters in the range of RI1 or RI2. The default value is 1.

Entering a 1 causes the Object Manager to recognize and respond to a change of 1 percent of the full error range. If communication is within the same CP that contains the block's compound, change deltas have no effect.

Refer to "Peer-to-Peer Connections of Real-Type Block Inputs" on page 1703 for details on how the I/A Series software affects the change delta percentage during operation.

DELTO1 Change delta for Output Range 1 is a configurable real value that defines the minimum percent of the output range that triggers change-driven connections for parameters in the range RO1. The default value is 1.0 percent. If communication is within the same control station that contains the block's compound, DELTO1 has no effect.

DERIV Derivative Time is a real input that adjusts the derivative time constant in minutes.

NOTE

The working DERIV value is indirectly limited by the working INT value.

DESCRP Description is a user-defined string of up to 32 characters that describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

DEVADB Deviation Alarm Deadband is a real input, in MEAS units, that applies to both High and Low Deviation Limits. You can adjust this parameter at the workstation.

DEVGRP Deviation Group is a short integer input that directs deviation alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.

DEVPRI Deviation Priority is an integer input, from 1 to 5, that sets the priority level of the deviation alarm (1 is the highest priority).

EI1 to EI2 Engineering Units for Input Ranges 1 and 2, as defined by the parameters HSCI1 to HSCI2, LSCI1 to LSCI2, and DELTI1 to DELTI2, provide the engineering units text for the values defined by Input Ranges 1 and 2. "Deg F" or "pH" are typical entries.

EO1

Engineering Units for Output Range 1, as defined by the parameters HSCO1, LSCO1, and DELTO1, provides the engineering units text for the values defined by Output Range 1. “Deg F” or “pH” are typical entries. Make the units for the Output Range (EO1) consistent with the units of Input Range 1 (EI1) and Input Range 2 (EI2).

ERCODE

Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block’s DEFINE parameter to be set false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the PIDX block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
“W43 – INVALID PERIOD/ PHASE COMBINATION”	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
“W44 – INVALID ENGINEERING RANGE”	High range value is less than or equal to low range value.
“W46 – INVALID INPUT CONNECTION”	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
“W48 – INVALID BLOCK OPTION”	The configured value of a block option is illegal.
“W53 – INVALID PARAMETER VALUE”	A parameter value is not in the acceptable range.
“W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK”	A Database Installer error has occurred.

ERROR

Control Error is a real output that equals Setpoint minus Measurement. ERROR can be sourced to other blocks.

FBK

Feedback is a real input used to generate integration action. Its function is to prevent integral windup. FBK is normally connected to BCALCI or BCALCO of downstream blocks.

FLBOPT

Fallback Option is a short integer input that defines the control action to be taken by the block when a Supervisory fallback occurs:

0 = take no fallback action (default).
1 = set MA parameter to Auto.
2 = set MA parameter to Manual.

	3 = set LR parameter to Remote. 4 = set LR parameter to Local. FLBOPT overrides linked MA and LR parameters, but does *not* override the AUTSW, MANSW, REMSW, and LOCSW parameters.
FLBREQ	Fallback Request is a short integer output that is an explicit request for the block to go to the Fallback state, with recovery at the block level (when SE is set), and/or at the group level (when the appropriate group enable bit is set in SUPENA). 0 = No fallback requested. 1 = Fallback requested; recovery at block or group level. 2 = Fallback requested; recovery *only* at block level.
HDAIND	High Deviation Alarm Indicator is a boolean output set true when the measurement exceeds the setpoint by more than the deviation limit HDALIM. When the measurement passes back through the DEVADB deadband, the block sets HDAIND to false.
HDALIM	High Deviation Alarm Limit is a real input that establishes the amount by which the measurement must exceed the setpoint to initiate a high deviation alarm and set the High Deviation Alarm Indicator, HDAIND, true.
HDATXT	High Deviation Alarm Text is a user-configurable text string of up to 32-characters, output with the alarm message to identify the alarm.
HHAGRP	High-High Absolute Alarm Group is a short integer input that directs High-High Absolute alarm messages to one of eight groups of alarm devices.
HHAIND	High-High Alarm Indicator is a boolean output set true when the block-dependent parameter value (generally the measurement input) exceeds the high-high absolute alarm limit (HHALIM). HHAIND is set to false when the value is less than HHALIM. Once the Indicator is set true, it does not return to false until the value falls below the limit less a deadband.
HHALIM	High-High Absolute Alarm Limit is a real input that defines the value of the block-dependent parameter (generally the measurement input) that triggers a High High alarm.
HHAOPT	High-High Alarm Option is a configured short integer input that enables High-High and Low-Low absolute alarming for alarming of a block-dependent value, generally the measurement input, or disables absolute alarming altogether. Each alarm triggers an indicator and text message. 0 = No alarming. 1 = High-High and Low-Low alarming. 2 = High-High alarming only. 3 = Low-Low alarming only.
HHAPRI	High-High Absolute Priority is an integer input, from 1 to 5, that sets the priority level of the high-high absolute alarm (1 is the highest priority).

HHATXT	High-High Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the high-high absolute alarm message to identify it.
HOAIND	High Output Alarm Indicator is a boolean output that is set true whenever the output is greater than HOALIM.
HOALIM	High Output Alarm Limit is a real input, in OUT units, that defines the value of the output that initiates a high output alarm.
HOATXT	High Output Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can change HOATXT only by reconfiguring the block.
HOLD	Hold is a boolean input. When true, HOLD forces the block into the Hold substate of Auto, holding the output at its last computed value.
HOLIM	High Output Limit is a real input that establishes the maximum output value, in OUT units. If the algorithm tries to drive the output to a higher value, the output is clamped at the HOLIM value and the indicator HOLIND is set true.
HOLIND	High Output Limit Indicator is a boolean output that is set true whenever the output is clamped at the high output limit, HOLIM.
HSCI1 to HSCI2	High Scale for Input Ranges 1 and 2 are real values that define the upper limit of the measurement ranges. EI1 to EI2 define the units. Make the range and units consistent with the measurement source. A typical value is 100 (percent).
HSCO1	High Scale for Output Range 1 is a real value that defines the upper limit of the ranges for output 1. A typical value is 100 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.
HZONE	High Zone is a real input that defines, in terms of the error, the upper limit of the zone in which the nonlinear gain option is exercised. In the PIDX block, HZONE is expressed in engineering units. Also, refer to “HZONE and LZONE (Conversion to PIDA)” on page 1934.
INCOPT	Increase/Increase Option is a boolean input. When set true, INCOPT reverses the normal sense of the control action so that the controller output increases with increasing measurement.
INHALM	Inhibit Alarm contains packed boolean values that represent alarm inhibit requests for each alarm type or point configured in the block. For the PIDX block, only the following bits are used:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16

Bit Number* (0 to 15)	Description When True	Boolean Connection (B16 to B1)
0	Inhibit Low Absolute Alarm	INHALM.B16
1	Inhibit High Absolute Alarm	INHALM.B15
2	Low Output Alarm	INHALM.B14
3	High Output Alarm	INHALM.B13
4	Low Deviation Alarm	INHALM.B12
5	High Deviation Alarm	INHALM.B11
8	Inhibit Low-Low Absolute Alarm	INHALM.B8
9	Inhibit High-High Absolute Alarm	INHALM.B7

* Bit 0 is the least significant, low order bit.

There are no mnemonic names for the individual bits of INHALM.

INHIB

Inhibit is a boolean input. When true, it inhibits all block alarms; the alarm handling and detection functions are determined by the INHOPT setting. Alarms can also be inhibited based on INHALM and the compound parameter CINHIB.

INHOPT

Inhibit Option specifies the following actions applying to all block alarms:

0 = When an alarm is inhibited, disable alarm messages but do not disable alarm detection.

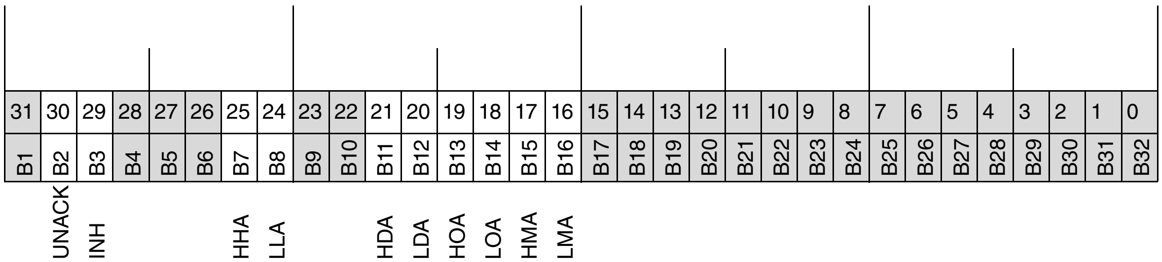
1 = When an alarm is inhibited, disable both alarm messages and alarm detection. If an alarm condition already exists at the time the alarm transitions into the inhibited state, clear the alarm indicator.

2 = Same as 0 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

3 = Same as 1 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

INHSTA

Inhibit Status contains packed long values that represent the actual inhibit status of each alarm type configured in the block. The PIDX block uses the following bits:



Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
16	LMA	Low Absolute Alarm Inhibited	INHSTA.B16
17	HMA	High Absolute Alarm Inhibited	INHSTA.B15
18	LOA	Low Output Alarm	INHSTA.B14
19	HOA	High Output Alarm	INHSTA.B13
20	LDA	Low Deviation Alarm	INHSTA.B12
21	HDA	High Deviation Alarm	INHSTA.B11
24	LLA	Low-Low Absolute Alarm Inhibited	INHSTA.B8
25	HHA	High-High Absolute Alarm Inhibited	INHSTA.B7
29	INH	Inhibit Alarm	INHSTA.B3
30	UNACK	Unacknowledged	INHSTA.B2

* Bit 0 is the least significant, low order bit.

INITI

Initialization In defines the source block and parameter that drives this block into initialization. The source for this short integer input is the initialization output of a downstream block. With V4.2 or later software, BCALCI contains the cascade initialization request data bit eliminating the need to configure INITI connections in cascades. However, to preserve backward compatibility, the INITI parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITI short value is maintained, but the setting of the handshaking bits, via the INITI to INITO connection, is eliminated.

INITLR

Initialize Local/Remote is an integer input that specifies the desired state of the LR input during initialization, where:

0 = Local
1 = Remote
2 = The LR state as specified in the checkpoint file.

The block asserts this initial LR state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a restart operation.
- The compound in which it resides is turned on.

The Initialize LR state is ignored if the LR input has an established linkage.

INITMA

Initialize Manual/Auto specifies the desired state of the MA input during initialization, where:

0 = Manual
1 = Auto
2 = The MA state as specified in the checkpoint file.

The block asserts this initial M/A state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a reboot operation.
- The compound in which it resides is turned on.
- The INITMA parameter itself is modified via the control configurator. (The block does not assert INITMA on ordinary reconfiguration.)

INITMA is ignored if MA has an established linkage.

INITO

Initialization Output is set true when:

- The block is in Manual or initializing.
- Permanent or temporary loss of FBM communications occurs.
- The ladder logic in the FBM is not running.
- MMAIND (mismatch indicator) is true.
- DISABL is true.
- RSP (the remote setpoint) is not the setpoint source.

The block clears INITO when none of these conditions exist. You connect this parameter to the INITI input of upstream blocks so that these upstream blocks can sense when this block is open loop. This block keeps INITO True, for one cycle (PRIBLK = 0), until the acknowledge is received from upstream (PRIBLK = 1 and PRITIM = 0.0), or for a fixed time delay (PRIBLK = 1 and PRITIM = nonzero).

With V4.2 or later software, BCALCO contains the initialization output eliminating the need to configure INITO connections in cascades. However, to preserve backward compatibility, the INITO parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITO

	short value has been maintained, but the setting of the handshaking bits, via the INITI to INITO connection, is eliminated.
INITSE	Initial Supervisory Enable is a configurable short integer value that specifies the initial state of the SE parameter in a block configured for Supervisory Control (with SUPOPT = 1 or 3) when the block initializes due to reboot, installing the block, or turning on the compound. Options are: 0 = Disable 1 = Enable 2 = do not change SE parameter.
INT	Integral Time is a real input that adjusts the integral time constant when the controller operates in the PI, IO, or PID modes. When a PIDX block is in PO or PD mode (that is, MODOPT=1 or MODOPT=3), the INT parameter appears on the default displays as BTIME because it becomes the balance time (explained below) for those controller modes. Balance time is utilized so that a bumpless transfer can be accomplished without compromising the algorithm of the PO or PD controller. In other words, if a PO or PD controller is either initialized or transferred from manual to auto, where the actual output is different from the algorithm's calculated output, the controller output is not bumped but instead is integrated (or balanced) over time until it matches its calculated value. The actual balance time is a function of a first-order lag and adjustable via the lag time constant, which is the INT (or BTIME) parameter expressed in minutes. The PIDX block does not have a parameter labeled BTIME associated with it so all Object Manager access to the BTIME value must refer to INT.
KBIAS	BIAS scale or gain factor is a real input that multiplies the BIAS input. It is expressed in OUT units divided by BIAS units.
KD	Derivative Filter Gain is a real input that adjusts the derivative filter gain.
KSCALE	KSCALE is a conversion factor used to make the time units of the rate parameters, which are in EI1 units per minute, dimensionally compatible with the time units of the output, as defined by EO1.
KZONE	Zone Gain establishes the gain within the nonlinear zone defined by HZONE and LZONE. KZONE is usually set at less than unity for pH control applications. If KZONE is set to zero, the block behaves as a dead zone controller.
LDAIND	The Low Deviation Alarm Indicator is a boolean output that is set true when the measurement falls below the setpoint by more than the deviation limit, LDALIM. When the measurement passes back through the DEVADB deadband, the block sets LDAIND to false.
LDALIM	Low Deviation Alarm Limit is a real input that defines how far the measurement must fall below the setpoint to initiate a low deviation alarm and set the Low Deviation Alarm Indicator LDAIND true.

LDATXT	Low Deviation Alarm Text is a user-defined text string of up to 32-character that are output with the alarm message to identify the alarm.
LLAIND	Low-Low Alarm Indicator is a boolean output set true when the block-dependent parameter value (generally the measurement input) falls below the low-low absolute alarm limit (LLALIM). LLAIND is set to false when the value is greater than LLALIM. Once the Indicator is set true, it does not return to false until the value exceeds the limit plus a deadband.
LLALIM	Low-Low Absolute Alarm Limit is a real input that defines the value of the block-dependent parameter (generally the measurement input) that triggers a Low-Low Alarm.
LLATXT	Low-Low Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the low-low absolute alarm message to identify it.
LOAIND	Low Output Alarm Indicator is a boolean output that is set true whenever the output is less than LOALIM.
LOALIM	Low Output Alarm Limit is a real input, in OUT units, that defines the value of the output that initiates a low output alarm.
LOATXT	Low Output Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can change LOATXT only by reconfiguring the block.
LOCKID	Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.
LOCKRQ	Lock Request is a boolean input which can be set true or false only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.
LOCSP	Local Setpoint Secure is a boolean input. When true, LOCSP provides lockout of user write access to the LR parameter. If LOCSP is configured true, the block secures LR when it initializes and maintains LR in the secured state. The LOCSW and REMSW overrides have higher precedence, but LR remains secured when they are no longer asserted.

LOCSW	Local Switch is a boolean input. When true, LOCSW overrides the LR and INITLR parameters and drives the block to the Local state. If both LOCSW and REMSW are true, LOCSW has priority.
LOLIM	Low Output Limit is a real input that establishes the minimum output value. If the algorithm tries to drive the output to a lower value, the output is clamped at the LOLIM value and the indicator LOLIND is set true.
LOLIND	Low Output Limit Indicator is a boolean output that is set true whenever the output is clamped at the low output limit, LOLIM.
LOOPID	Loop Identifier is a configurable string of up to 32 characters which identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.
LR	Local/Remote is a boolean input that selects the setpoint source (0 = false = Local; 1 = true = Remote). If LR is set to Remote, the source of the setpoint value is the real input parameter RSP. When LR is set to Local, there are two possible sources for the setpoint: (a) MEAS or (b) a user settable input. The choice is based on the conditions of STRKOP and MA, as described under STRKOP.
LSCI1 to LSCI2	Low Scale for Input Ranges 1 and 2 are real values that define the lower limit of the measurement ranges. A typical value is 0 (percent). EI1 to EI2 define the units. Make the range and units consistent with those of the measurement source.
LSCO1	Low Scale for Output Range 1 is a real value that defines the lower limit of the ranges for Output 1. A typical value is 0 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.
LZONE	Low Zone is a real input that defines, in terms of the error, the absolute value of the negative error level that sets the lower limit of the zone in which the nonlinear gain option is exercised. In the PIDX block, LZONE is expressed in engineering units. Also, refer to “HZONE and LZONE (Conversion to PIDA)” on page 1934.
MA	Manual Auto is a boolean input that controls the Manual/Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. The block automatically limits the output to the output range specified between LSCO1 and HSCO1, for analog blocks. In Manual, the algorithm is not performed, and the output is unsecured. An external program can then set the output to a desired value.

MALOPT

Measurement Alarm Option is a configured short integer input that enables absolute High and Low measurement alarming, or disables absolute alarming altogether.

0 = No alarming
1 = High and Low measurement alarming
2 = High measurement alarming only
3 = Low measurement alarming only.

You can change MALOPT only by reconfiguring the block.

MANALM

Manual Alarm Option is a configurable input which enables and disables configured alarm options to function in Manual. Normally alarms are processed only in the Auto mode.

0 = No alarming in Manual

1 = Full alarming in Manual

2 = No Output alarming in Manual

3 = No output alarming in Track

4 = No output alarming in Manual or Track

MANFS

Manual if Failsafe is a boolean input. When configured true, MANFS drives the block to the Manual state if the block detects an incoming failsafe status.

MANSW

Manual Switch is a boolean input. When true, MANSW overrides the MA and INITMA parameters and drives the block to the Manual state. If both MANSW and AUTSW are true, MANSW has priority.

MBADOP

Manual if Bad Option is a manual override feature. When MBADOP is set to 1 or 2, the block sets the unlinked MA input to manual if it detects a BAD status bit in the MEAS, BCALCI or FBK input, and when set to 2, it detects that the Remote Setpoint (RSP) is not healthy (i.e., value status is BAD or has a broken OM connection). This forces the output state to manual as long as the BAD status remains. After the BAD status clears, returning to Auto requires external intervention unless AUTSW is true.

0 = no option enabled

1 = Switch to Manual when MEAS, BCALCI, or FBK value status is BAD

2 = Same as option 1, plus switch to Manual when RSP is not healthy

You can change MBADOP only by reconfiguring the block. MBADOP has the same priority as the MANSW override, and it has precedence over the AUTSW override. MBADOP has no effect when MA is linked. If any of the MBADOP conditions are true, the block will be switched to Manual regardless of the MANSW and AUTSW settings.

MCLOPT

Manual Clamping Option allows you to invoke output clamping while the block is in manual. You can alter this configurable boolean input at the workstation.

MEAS	Measurement is an input identifying the source of the block's input, or the controlled variable.
MEASDB	Measurement Alarm Deadband is a configured input, expressed in MEAS units, that applies to both High and Low Alarm Limits. You can adjust this parameter at the workstation.
MEASGR	Measurement Group is a short integer input that directs measurement alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.
MEASHI	Measurement High Alarm Indicator is a boolean output that is set true when the measurement exceeds the high alarm limit (MEASHL). When the measurement passes back through the deadband, the block sets MEASHI to false.
MEASHL	Measurement High Alarm Limit is a real input that defines the value of the measurement that initiates a high absolute alarm.
MEASHT	Measurement High Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can only change the message text by reconfiguring the block.
MEASLI	Measurement Low Alarm Indicator is a boolean output that is set true when the measurement falls below the low alarm limit (MEASLL). When the measurement passes back through the MEASDB deadband, the block sets MEASLI to false.
MEASLL	Measurement Low Alarm Limit is an real input that defines the value of the measurement that initiates a low absolute alarm.
MEASLT	Measurement Low Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can only change the message text by reconfiguring the block.
MEASNM	Measurement Alarm Name is a user-defined text string of up to 12 characters that identifies the alarm source in the alarm message. It serves as a point descriptor label (for example, Furn 37 Temp).
MEASPR	Measurement Priority is an integer input (1 to 5), that sets the priority level of the measurement alarm (1 is the highest priority).
MODOPT	Mode Option is a configurable short integer. When the block is in Auto, MODOPT dictates the controller mode. The integer value ranges from 1 to 5 for PID blocks. 1 = PO – Proportional Only 2 = IO – Integral Only 3 = PD – Proportional plus Derivative

4 = PI – Proportional plus Integral

5 = PID – Proportional, Integral, Derivative (product of factors)

NAME
: Name is a user-defined string of up to 12 characters used to access the block and its parameters.

NASOPT
: Nuisance Alarm Suppression Option is a configurable, non-settable short integer that specifies how the nuisance alarm delay is implemented:

- 0 = Suppress nuisance alarms by delaying the Return-to-Normal (default) by the length of time specified in NASTDB
- 1 = Suppress nuisance alarms by delaying alarm detection by the length of time specified in NASTDB
- 2 = Suppress nuisance alarms by delaying both the Alarm Detection and the Return-to-Normal by the length of time specified in NASTDB

NASTDB
: Alarm Deadband Timer is a configurable long integer. Depending on the value of NASOPT, it either specifies the deadband time interval that must elapse before an alarm condition is allowed to return to normal, or the length of a delay-on timer which specifies the amount of time between an alarm's detection and the announcement of the alarm. The parameter value ranges from zero (default, no delay) to 2147483647 ms.

NONLOP
: Nonlinear Option is a configured boolean input that allows you to customize the gain in a zone about zero error. The zone is defined by HZONE and LZONE, the gain by KZONE. You can change NONLOP only by reconfiguring the block.

OALOPT
: Output Alarm Option is a configured short integer input that enables absolute High and Low alarming of the block output (OUT) or disables output alarming altogether.

0 = No alarming

1 = High and Low output alarming

2 = High output alarming only

3 = Low output alarming only.

You can change OALOPT only by reconfiguring the block.

OSV
: Output Span Variance is a real input that defines the amount by which the output clamp limits (HOLIM, LOLIM) can exceed the specified output range, as defined by HSCO1 and LSCO1.

OUT
: Output, in Auto mode, is the result of the block algorithm applied to one or more input variables. In Manual, OUT is unsecured, and can be set by you or by an external task.

OUTADB	Output Alarm Deadband is a real input that specifies the size of the deadband for both High and Low Output Alarm Limits. You can adjust this parameter at the workstation.
OUTGRP	Output Group is a short integer input that directs high and low output alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.
OUTNM	The Output Alarm Name is a user-defined string of up to 12 characters that identifies the alarm source in the alarm message. It serves as a point descriptor label (for example, F2 Fuel Cutler).
OUTPRI	Output Priority is an integer input (1 to 5) that sets the priority level of the High and Low Output Alarms (1 is the highest priority).
OWNER	Owner is a string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are successful only if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.
PBAND	Proportional Band is an input expressed in percent. PBAND is the percent of span change in input, that causes a full-span change in output. [100 / PBAND] determines the gain of the controller when MEAS and OUT are converted to percent of span. It is adaptively set by FBTUNE.
PERIOD	Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PERTIM	Period Time is the period of the block expressed in seconds.
PHASE	Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PRIBLK	Primary Block is a configuration option. When true (=1), PRIBLK enables a block in a cascaded configuration to initialize without bumping

the process, either at initial startup or whenever control is transferred up to a primary block. Depending on the value of PRITIM, PRIBLK does this by forcing the PIDX block to remain in the Hold state until the Acknowledge status bit (Bit 10) of MEAS is detected from the upstream block (PRITIM = 0.0), or until the time defined by PRITIM expires (PRITIM > 0.0). In the latter case, the explicit acknowledge from the upstream block is not needed.

Use PRIBLK in a cascade situation when the source of the block's input connection needs to be initialized.

For correct operation, set EROPT = 1 or 2, and implement the connections between each primary-secondary block combination. These connections include BCALCI/BCALCO and OUT/RSP (or OUT/MEAS).

Except for the most primary controller block, Invensys recommends that PRIBLK be set true for all applicable blocks in a cascaded scheme. When PRIBLK is false (default value), no special handling takes place.

Refer to “PRIBLK and PRITIM Functionality” on page 1933 for more information on this parameter.

PRITIM

Primary Cascade Timer is a configurable parameter used to delay the closing of the cascade to a primary block, when the output is initialized in the PIDX block. It is used only if the PRIBLK option is set. The cascade is closed automatically when the timer expires without requiring an explicit acknowledge by the upstream block logic.

Refer to “PRIBLK and PRITIM Functionality” on page 1933 for more information on this parameter.

PRLOAD

Batch Preload is a real input that is loaded into the controller's integral term whenever the output is being limited at either the LOLIM or HOLIM values. PRLOAD is operational only when the block is in Auto and the Batch Control Option is configured. It provides a normalized output between 0-100%.

PROPT

Propagate Error Option is a short integer input. PROPT was changed from a Boolean to a Short Integer in I/A Series software v8.5 for this block. It can be set to 0-2, with the following exception:

NOTE

If PROPT is configured from IACC v2.4 or later, it can only be set to 0 or 1.

- 0 = option is disabled (default)
- 1 = set the ERROR Status bit of the output parameter (OUT) if the input to the MEAS parameter is in error (see below) while the block is in Auto
- 2 = copy (propagate) the BAD, OOS (Out-of-Service), and ERROR status bits from the MEAS parameter to the output parameter (OUT). This value cannot be set from IACC v2.4 or later.

The input to the MEAS parameter is in error when:

- Its BAD status bit is set true
- Its OOS (Out-of-Service) status bit is set true
- Its ERROR status bit is set true
- It is experiencing peer-to-peer path failure.

If a transition to Manual occurs while the ERROR status is true, it remains true until either a set command is written to that output or until the block transfers to Auto with the error condition returned to normal.

PRSCAS

Present Cascade State is a data store that indicates the cascade state. It has the following possible values:

Value	State	Description
1	“INIT_U”	Unconditional initialization of the primary cascade is in progress.
2	“PRI_OPN”	The primary cascade is open.
3	“INIT_C”	Conditional initialization of the primary cascade is in progress.
4	“PRI_CLS”	The primary cascade is closed.
5	“SUP_INIT”	The supervisory cascade is initializing.
6	“SUP_OPN”	The supervisory cascade is open.
7	“SUP_CLS”	The supervisory cascade is closed.

PRSCON

Present Control state is a short integer data store that contains the sub-states of Auto:

1 = Holding
2 = Tracking
3 = Controlling (not open loop).

PRTYPE

Priority Type is an indexed output parameter that indicates the alarm type of the highest priority active alarm. The PRTYPE output of this block includes the following alarm types:

0 = No active alarm

1 = High Absolute

2 = Low Absolute

3 = High High

4 = Low Low

5 = High Deviation

6 = Low Deviation

7 = Rate alarm

8 = BAD I/O Alarm

QALSTA

Quality Status parameter (QALSTA) is a non-configurable packed long that provides a combination of value record status, block status

(BLKSTA), and alarm status (ALMSTA) information in a single connectable output parameter. Available bits for this block are provided below.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1]	Definition	Contents	Boolean Connection (B32 to B1)
30	Alarms Unacknowledged	ALMSTA.UNA	QALSTA.B2
29	Alarms Inhibited	ALMSTA.INH	QALSTA.B3
25	High-High Absolute Alarm	ALMSTA.HHA	QALSTA.B7
24	Low-Low Absolute Alarm	ALMSTA.LLA	QALSTA.B8
21	High Deviation Alarm	ALMSTA.HDA	QALSTA.B11
20	Low Deviation Alarm	ALMSTA.LDA	QALSTA.B12
19	High Output Alarm	ALMSTA.HOA	QALSTA.B13
18	Low Output Alarm	ALMSTA.LOA	QALSTA.B14
17	High Absolute Alarm	ALMSTA.HMA	QALSTA.B15
16	Low Absolute Alarm	ALMSTA.LMA	QALSTA.B16
5	Manual	BLKSTA.MA	QALSTA.B27
4	Low Limited	MEAS.LLO status	QALSTA.B28
3	High Limited	MEAS.LHI status	QALSTA.B29
2	Uncertain	MEAS.ERR status	QALSTA.B30
1	Out-of-Service	MEAS.OOS status	QALSTA.B31
0	Bad	MEAS.BAD status	QALSTA.B32

1. Bit 0 is the least significant, low order bit.

REMSW

Remote Switch is a boolean input. When true, REMSW overrides the unlinked LR and INITLR parameters, and drives the block to the Remote state. If both LOCSW and REMSW are true, LOCSW has priority.

RI1 to RI2

Range Input is an array of real values that specify the high and low engineering scale and change delta of a particular real input. For a given block, it also forms an association with a group of real input parameters that have the same designated range and change delta.

RO1

Range Output is an array of real values that specify the high and low engineering scale of a particular real output. For a given block, it also forms an association with a group of real output parameters that have the same designated range.

RSP
: Remote Setpoint is the selected setpoint source when LR is set to Remote. RSP is a real input. Typically RSP connects to an upstream block in a cascade scheme. RSP and its source must be expressed in MEAS units.

SE
: Supervisory Enable is a boolean input that enables or disables Supervisory Control in this block:

0 = Disable
1 = Enable.

SPLCOP
: Sample Controller Option enables the PIDX to operate as a sampling controller with an effective control period much larger than the block's PERIOD parameter. The effective period can be controlled asynchronously by TSAMPL or synchronously by SPLRDY. In the PIDX and PIDXE blocks, SPLCOP invokes a run-hold duty cycle mode of operation. If True, the control algorithm can be executed when triggered by SPLRDY or with the variable update interval TSAMPL. In the PID and PIDX, SPLCOP invokes a run-hold duty cycle.

SPLRDY
: Sample Ready is a boolean pulse input. On a 0-to-1 transition, SPLRDY clocks the block from the Sample and Hold state to the Control state. If used with the TSAMPL timer, SPLRDY synchronizes the timer with an external event.

SPT
: Setpoint always represents the active controller setpoint. Setpoint is the reference variable that is compared with the MEAS input to produce the ERROR signal. SPT is implemented as a configurable output that determines its source from the Local/Remote setpoint selector, LR. When LR is true (Remote), SPT is nonsettable and assumes the Remote Setpoint (RSP) value. When LR is false (Local), SPT is an unsecured, and thus settable, output and the SPT source is the set value. Configure the value you want the SPT to assume when it first goes to Local. As an output, SPT can also source the setpoint value to other blocks.

STRKOP
: Setpoint Track Option is a short integer input. When active, STRKOP enables the setpoint to track the measurement input under the following conditions.

0 = no option enabled

1 = SPT parameter tracks the measurement input when the block is in Manual, or the cascade is open downstream (Initialization input INITI is true), or Track Enable (TRKENL) is set.

2 = SPT parameter tracks the measurement only when the block is in Manual.

STRKOP is active only when the setpoint source selector LR is in Local.

SPT is nonsettable while setpoint tracking is active. You can change STRKOP only by reconfiguring the block.

SUPBCO

Supervisory Back-Calculated Output is a real output that specifies the value to be used by the Supervisory application to initialize its output to the current setpoint. SUPBCO also contains the following status bits:

Status	Meaning
Bit 10 = 1	Initialize SUP_IN
Bit 13 = 1	SUP_IN is limited high
Bit 14 = 1	SUP_IN is limited low
Bit 13 = 1 and Bit 14 =1	Supervisory cascade is open

SUPGRP

Supervisory Group is a short integer input (1 to 8) that specifies one of eight groups to which this block is assigned for Supervisory Control.

SUPOPT

Supervisory Option is a configurable short integer input that specifies whether or not this block is under control of a Supervisory Control application:

0 = No Supervisory control

1 = Set Point Control (SPC) of the block's set point (Supervisory setpoint control (SSC))

2 = Direct Digital Control (DDC) of the block output (Supervisory output control)

NOTE

Setting SUPOPT=2 enables DDC control only, i.e. supervisory control over the output in the PIDX block. It is not intended to be used with Advanced Process Control (APC), which performs SSC, i.e., supervisory control of the setpoint in the PIDX. To use APC, configure SUPOPT=1 (or 3 if automatic acknowledgement of a setpoint change is desired).

3 = SPC, with an implicit acknowledge by the CP

4 = DDC, with an implicit acknowledge by the CP

Be aware that options 1 and 2 require an explicit acknowledge by the application software to close the supervisory cascade. This must be done by setting the ACK status bit in the SUP_IN parameter using special OM access functions.

SUP_IN

Supervisory Input is a real output that is the parameter set by a Supervisory application when performing supervisory control of this block's setpoint. SUP_IN also contains a status bit (Bit 10) that must be set by the supervisor to acknowledge a request to initialize (Bit 10 in SUPBCO).

TCTRL

Control Time is a real input that specifies the number of minutes the block stays in the Controlling substate when the sample controller option is active. If used with the TSAMPL timer, TCTRL establishes the duty cycle between the Controlling and the Sample and Hold states.

TRACK	Track is a real input that provides the input signal block output tracks when the block is in Auto and TRKENL is true.
TRKENL	Track Enable is a boolean input that enables the block output to follow the TRACK input.
TSAMPL	Sampling Time is a real input parameter that specifies the period, in minutes, of an internal timer that triggers an output update. If external triggering of the control action is desired, set TSAMPL to 0 and use SPLRDY to trigger the output update.
TYPE	When you enter “PIDX” or select “PIDX” from the block type list under Show, an identifying integer is created specifying this block type.
UNACK	Unacknowledge is a boolean output that the block sets to True when it detects an alarm. It is typically reset by operator action.

100.4 Detailed Operation

This block performs the functions of an analog PID controller. The output is the product of factors, provided they are enabled by the MODOPT selection:

- A Proportional factor based on a user-specified proportional band applied to an error term that equals the setpoint (SPT) minus the derivative factor applied to the measurement (MEAS)
- An Integral factor derived from a first-order lag of the block’s integral feedback (FBK) input
- A Derivative factor with a second-order Butterworth filter applied to the measurement (MEAS).

The MEAS parameter is an input identifying the source of the signal that is coming to this block as the controlled variable in the control loop.

The SPT parameter is the local setpoint and always represents the active controller setpoint or is made equal to SUP_IN in Supervisory Control. SPT can be used as a source for other blocks.

The setpoint sources are prioritized as follows:

1. Supervisory Control
2. Local (LOCSW) and Remote Switch (REMSW)
3. Local or Remote.

When the Supervisory Option (SUPOPT) is set greater than 0, it specifies that the block can be under control of a Supervisory Application Program. The Supervisory Back Calculated Output (SUPBCO) provides the current setpoint and initialization bits to the Supervisory Application Program. When Supervisory Enable (SE) is set by the application program or operator, the PIDX block is prepared to do Supervisory Setpoint Control (SSC) functions. When the proper handshaking occurs with the application software, the block accepts sets to the Supervisory Setpoint (SUP_IN). If the block is in Auto, it then uses the supervisory setpoint in the calculation of the block’s output.

If SUPOPT is set to 1 or 2, the handshake requires the application software to return an explicit acknowledge to close the supervisory cascade. The software must set the ACK status bit in the

SUP_IN parameter using special OM access functions. However, if SUPOPT is set to 3 or 4, this acknowledgement is implicitly provided by the CP and is not required from the user application software. In the latter case, the CP closes the supervisory cascade automatically when the supervisory input (SUP_IN) is written by the application, provided the block is in the Supervisory Initialization (SUP_INIT) state. The control block enters the SUP_INIT state when supervisory control is enabled in the block and the cascade is closed downstream. Upon entering this state, the CP sets the initialize request bit (INITC) in the SUPBCO parameter for the application software. When SUP_IN is then written by the software, the CP access logic sets the ACK status automatically in the SUP_IN parameter. When the block runs, the CP block logic then closes the supervisory cascade automatically.

The setpoint source selector input, LR (Local/Remote), together with the two overrides, LOCSW and REMSW, determines the setpoint source at any time.

When LR is switched to Local, the block sets the BCALCO initialization status value to true, and releases the SPT parameter, allowing you to input the desired controller setpoint value. The setpoint track option, STRKOP, can be used to assure bumpless transfer.

When LR is switched to Remote (true), SPT is no longer settable and takes on the value of the remote setpoint input, RSP. RSP provides a link to the remote setpoint source. If RSP is unlinked when LR is true, the block forces the LR parameter to local and secures it.

The PIDX block also provides the LOCSW and REMSW parameters to drive the setpoint state to Local or Remote.

The following summarizes the secured/released condition of the SPT parameter:

SPT is secured (non-settable) if any of the following are true:

- The block is in Remote mode, that is, LR is true. In this case, BLKSTA.LR is also true.
- Supervisory control is enabled, that is, SUPOPT is set to 1 or 3 and BLKSTA.SE is true, and SUP_IN is not in error.
- Setpoint tracking is active, that is, BLKSTA.STRK is true. In order for this status bit to be true, all of the following conditions must exist:
  - The STRKOP parameter must be 1 or 2.
  - There must be no control error condition.
  - One of the following conditions must be true:
    - The block is in Manual mode.
    - The cascade is open downstream (either the data value of INITI is true, or the LHI and LLO status bits of BCALCI are simultaneously true).
    - A request for conditional initialization has been received from downstream.
    - Parameter TRKENL is true.

Otherwise SPT is released (settable).

LOCSP allows the block to secure the LR parameter when the block initializes and to maintain that secured state except when LOCSW and/or REMSW is asserted.

When the block is in the Remote mode, the status of the local setpoint (SPT) tracks the status of the remote setpoint (RSP).

When the block is switched to Local mode, the setpoint status depends on the setpoint tracking option (STRKOP):

- If STRKOP = 1 or 2, the SPT status is cleared.
- If STRKOP = 0, the SPT status reflects the RSP status at the time the switch to Local occurred. The block maintains this status as long as block is in Local, unless you change the SPT value via data access. At that time the status is cleared.

The local set point is clamped each cycle when the set point mode is Remote, Local, or Supervisory. The clamp limits used are the measurement scale limits HSCI1 and LSCI1. If the setpoint value before clamping is equal to or less than LCSI1, status bit LLO of SPT is set true. If the value before clamping is equal to or higher than HSCI1, status bit LHI of SPT is true.

The PIDX block has two output states, Auto and Manual. In Manual, the block releases the output, allowing it to be set by you. In Auto, the block secures the output.

Auto has three substates: Controlling, Tracking, and Holding.

Closed loop automatic PID control is actually done in a substate of Auto called Controlling. In this state, the block computes the output signal based on the configured control mode option and the deviation between SPT and MEAS. Proportional control is fixed by the steady state gain term (100/PBAND).

Integral control action is generated by feeding back the external integral feedback signal (FBK) through a first order lag. INT, the integral setting of the controller, fixes the time constant of the lag. Such a scheme avoids the pitfalls of integral windup. See “Normal Configuration” on page 1932 for more details.

Derivative control action consists of a second-order Butterworth filtering of the Measurement signal. Both the time constant and the derivative gain of this filtering action are selected by you using the DERIV parameter.

In Auto, the computed output value undergoes limiting. Limiting clamps the output between the variable output limits, HOLIM and LOLIM. You can place these limits anywhere within the range defined by LSCO1 and HSCO1.

Moreover, the output span variance parameter (OSV) enables you to extend this range at both the high and low ends by an equal amount, up to 25 percent. If you set LOLIM higher than HOLIM, then HOLIM is automatically set equal to the higher of the two values, which is LOLIM. The block provides, for control purposes, output limit indicators that are active when the output is clamped at either limit.

In Auto, when you switch the setpoint source selector from Local to Remote, the transfer is made bumpless by removing derivative dynamics (if applicable) and forcing the integral to absorb any proportional action.

Switching from Remote to Local is always bumpless, because SPT retains the last value transferred from the remote setpoint. For cascade purposes, the block sets the BCALCO initialization status value true when the setpoint is under local control, or when the block is open-looped. This tells an upstream block to perform an explicit initialization, so that the return to remote setpoint operation is bumpless.

The block goes to Tracking when the BCALCI initialization status value is set true, as long as the block is not in HOLD, and there is no control error. The block performs explicit initialization in the Tracking substate. When the BCALCI initialization status value returns to false, the block returns to the Controlling substate to resume closed-loop control.

In the Tracking substate, OUT = BCALCI unless BCALCI is out of range, in which case OUT is clamped between the LOLIM and HOLIM values. The block calculates the BCALCO parameter, sets the BCALCO initialization status value to true (requesting upstream blocks to perform their own explicit initialization), and sets bit 6 (TRCK) in the BLKSTA parameter.

When the PIDX block is the upstream block in a cascade control scheme, output tracking (BTRKOP = true) assures a bumpless transfer for the downstream block.

For the BIAS block, BLKSTA includes bits which indicate when the downstream output is limited in either direction by monitoring for the Limited High condition (BCALCI.LHI via BLKSTA.B11) and Limited Low condition (BCALCI.LLO via BLKSTA.B10).

Output tracking, a feature of the PIDX block, functions only when the controller is in Auto. While the TRKENL input is true, the output is forced into the Tracking substate of Auto; but the output tracks the Track input instead of the BCALCI input as in the explicit initialization that occurs when the BCALCI initialization status value is true. If both the BCALCI initialization status value and TRKENL are true, BCALCI takes precedence and the output tracks BCALCI. Output clamping is still active. If the block detects control errors, it bypasses output tracking and goes to the Holding substate, which holds the last good output.

During Auto operation, the block checks the critical inputs MEAS, FBK, and BCALCI for data errors (off-scan, or BAD, OOS, or ERROR status bits set). If an error is detected, the PID block, depending on the value of the CEOPT parameter (see CEOPT definition), may propagate the error to its outputs by setting the ERROR status bit of the output, OUT.

The block goes to Hold if, while MBADOP = 0 and CEOPT = 1 or 2, either the HOLD parameter goes true, or a condition required by the CEOPT parameter is met.

In the Hold substate, OUT keeps the last good value before the block went into Hold, and the block secures this value against any changes. The block sets the BCALCO status to bad and sets bit 7 (HOLD) in the BLKSTA parameter.

When all error conditions have ceased, the block returns to the Controlling substate and resumes closed loop control.

No implicit Hold action takes place if CEOPT = 0.

A transition to Manual sets all alarm and limit indicators to false.

If MBADOP = 1 or 2 (and the MA parameter is unlinked), the block goes to the Manual state when it detects a control error or when the HOLD input goes true, regardless of the CEOPT value. MBADOP has the same priority as MANSW and has precedence over AUTSW. Therefore, if MBADOP = 1 or 2 and a bad input is detected, the block goes to Manual regardless of the AUTSW setting.

When the block is switched to Manual, the OUT status reflects the MEAS/SPT status at the time the switch occurred. While the block is in Manual, it maintains this status until you change the OUT output via data access. At that time, the block clears the status.

During Manual operation, PID control is not performed. Alarm outputs are settable. The controller output (OUT) is unsecured and can have its value set by an external task or program and, if the manual clamp option (MCLOPT) is configured, these set values undergo output clamping.

In SCC, when the Fallback Option (FLBOPT) is set, the block falls back to the configured normal, Auto, Manual, Remote, or Local mode of operation.

The setpoint track option forces the local setpoint (SPT) to track the measurement. While setpoint tracking is active, SPT becomes nonsettable to prevent you from manipulating the local setpoint value. Setpoint tracking is only performed if the setpoint source selector is switched to Local and the block is either operating in Manual or the BCALCI initialization Input value status is true. BCALCI status value being true indicates that a block downstream in the cascade is open loop.

When the block restarts, the INITMA configured option specifies the value of the MA parameter, unless MA has an established linkage, or MANSW or AUTSW are set true. Likewise, the INITLR specifies the value of the LR parameter, unless LR is linked, or LOCSW or REMSW are set true.

The PIDX block offers a Nonlinear Gain Option to specify a gain factor and a zone of error values in which this alternate gain multiplies 100/PBAND. This nonlinear zone is defined by the HZONE and LZONE parameters, and is situated, but not necessarily centered, about zero error.

The PIDX block offers two other options, the Batch Control option and the Sampling Controller option. Both function only while the block is in the Automatic state.

The Batch Option presets the integral term of the PID to the value of PRLOAD while the controller output is limited, a situation often arising at the start of a batch process.

Operationally, the Batch Option preloads the integral term of the controller to the value of the preload (PRLOAD) input whenever the output is being clamped at either its high or low output limit. The PRLOAD input is usually set according to the anticipated load conditions to prevent overshoot following a startup.

The Sampling Controller option operates in two modes, synchronous and asynchronous. Both modes cycle the block between the S/Hold (Sample and Hold) and the Controlling substates of Auto and both use the Control Time parameter (TCTRL) to fix the length of time that the controller stays in the Controlling substate.

The synchronous mode presumes a strobe input from the measurement source that tells the controller that collection of the data from a chromatograph or other slow-sampling measuring instrument is completed. This “Sample Ready” strobe input is connected to the block’s SPLRDY (Sample Ready) parameter.

In operation, the block waits in the S/Hold state taking data until a positive transition of the SPLRDY input drives the block to the Controlling substate. In this substate, the block performs normal closed-loop automatic PID control. After a time period defined by TCTRL (Control Time), the controller is forced back to the S/Hold state to await the next SPLRDY input. Controller tuning must take the duty cycle into account.

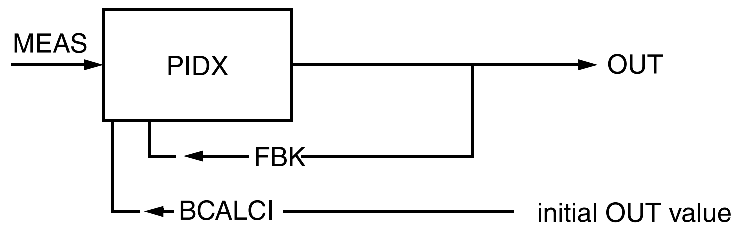
The asynchronous mode presumes no timing inputs from the source. In this mode, the block waits in the S/Hold state collecting data until a strobe from an internal Sample Timer drives the block to the Controlling substate. After controlling for a time period defined by TCTRL, the controller is forced back to the S/Hold state to await the next Sample Timer strobe. The Sample Time parameter (TSAMPL) fixes the period of the internal repeating Sample Timer. TCTRL = 0 results in one control cycle execution of the block in each TSAMPL period.

In a synchronous operation, you can disable the Sample Timer by setting TSAMPL (Sample Time) to zero. This ensures that the controller initializes to the S/Hold state and produces no control action before a valid measurement is available.

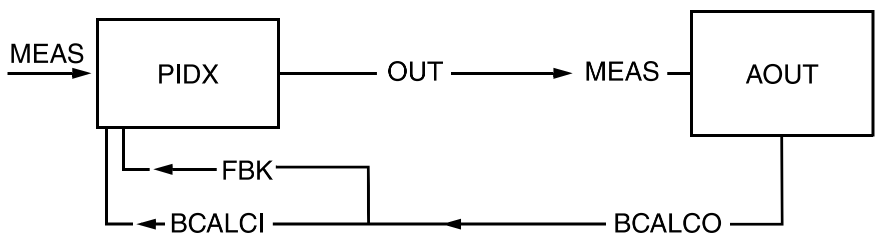
100.4.1 Normal Configuration

Normal configuration of the PIDX block is as follows:

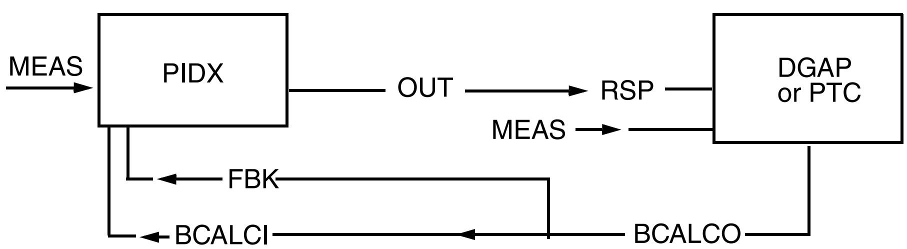
If there are no downstream control blocks, then link FBK to the OUT parameter.



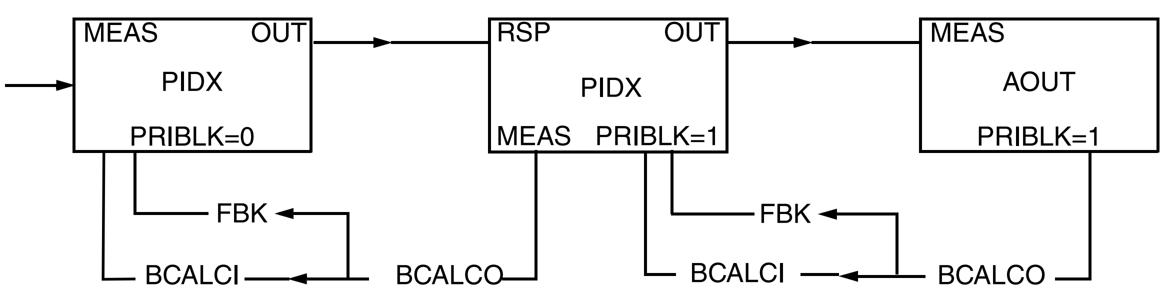
If the downstream block is an AOUT block, link BCALCI and FBK to the downstream block's BCALCO parameter.



If the secondary block is a DGAP or PTC block, link BCALCI and FBK to the secondary block's BCALCO parameter.



In a cascade configuration, connect the FBK of the primary to the BCALCO of the secondary controller to prevent windup.



Use the PRIBLK option in all cascade configurations.

100.4.2 PRIBLK and PRITIM Functionality

The Primary Block (PRIBLK) parameter indicates whether the PIDX block has a connection from an upstream block (PRIBLK=1) or not (PRIBLK=0). Its value, together with that of the

Primary Cascade Timer (PRITIM), determines whether the PIDX block remains in Hold for a fixed time delay (of length defined by PRITIM), or ends the Hold when the Acknowledge status bit (Bit 10) of MEAS is detected from the upstream block (if PRITIM = 0.0). During initialization, the acknowledgement is not required and a Hold of one cycle only occurs.

100.4.3 HZONE and LZONE (Conversion to PIDA)

As mentioned in “PIDA is Recommended Over Other PID Algorithms” on page 1820, you may wish to convert existing PIDX blocks to PIDA blocks. Before performing this conversion, be aware that in the PIDX block, the HZONE and LZONE parameters are expressed in engineering units, while in the PIDA block (and other PID-type blocks), these parameters are expressed as a percentage of the measurement span.

You must change HZONE and LZONE accordingly if you wish to retain the same behavior in the PIDA block as was performed in the PIDX block.

The following formulas are provided for converting HZONE and LZONE values in a PIDX block to the values needed for a PIDA block.

For HZONE:

[PIDA HZONE] = (([PIDX HZONE])/([PIDX HSCI1] - [PIDX LSCI1])) * 100

For LZONE:

[PIDA LZONE] = (([PIDX LZONE])/([PIDX HSCI1] - [PIDX LSCI1])) * 100

where:

[PIDA HZONE] is the value of HZONE in the PIDA block

[PIDA LZONE] is the value of LZONE in the PIDA block

[PIDX HZONE] is the value of HZONE in the PIDX block

[PIDX LZONE] is the value of LZONE in the PIDX block

101. PIDXE – PID Extended with EXACT Block

This chapter covers the PIDXE (PID Extended with EXACT Block), including its features, parameters and detailed operations.

101.1 Overview

The PIDA (with FBTUNE and FFTUNE when necessary) is recommended for use in all PID applications. The PIDA block has all of the functionality of the older PID algorithms plus additional functionality. See "PIDA – Advanced PID Block" on page 1819 for more details.

The PIDE (Proportional-Integral-Derivative Extended with EXACT) block adds extended features and a self-tuning function to the traditional functions of a three-term interacting PID controller. The PID portion of this block and its extended features behave exactly as the PID block except that the PIDXE block does not support the MODOPT parameter.

The extended features that the PIDXE block adds to the PIDE block include Output Tracking as a feature and options for:

1. Nonlinear gain compensation
2. Sampling mode
3. Batch control preload.

101.1.1 I/O Diagram

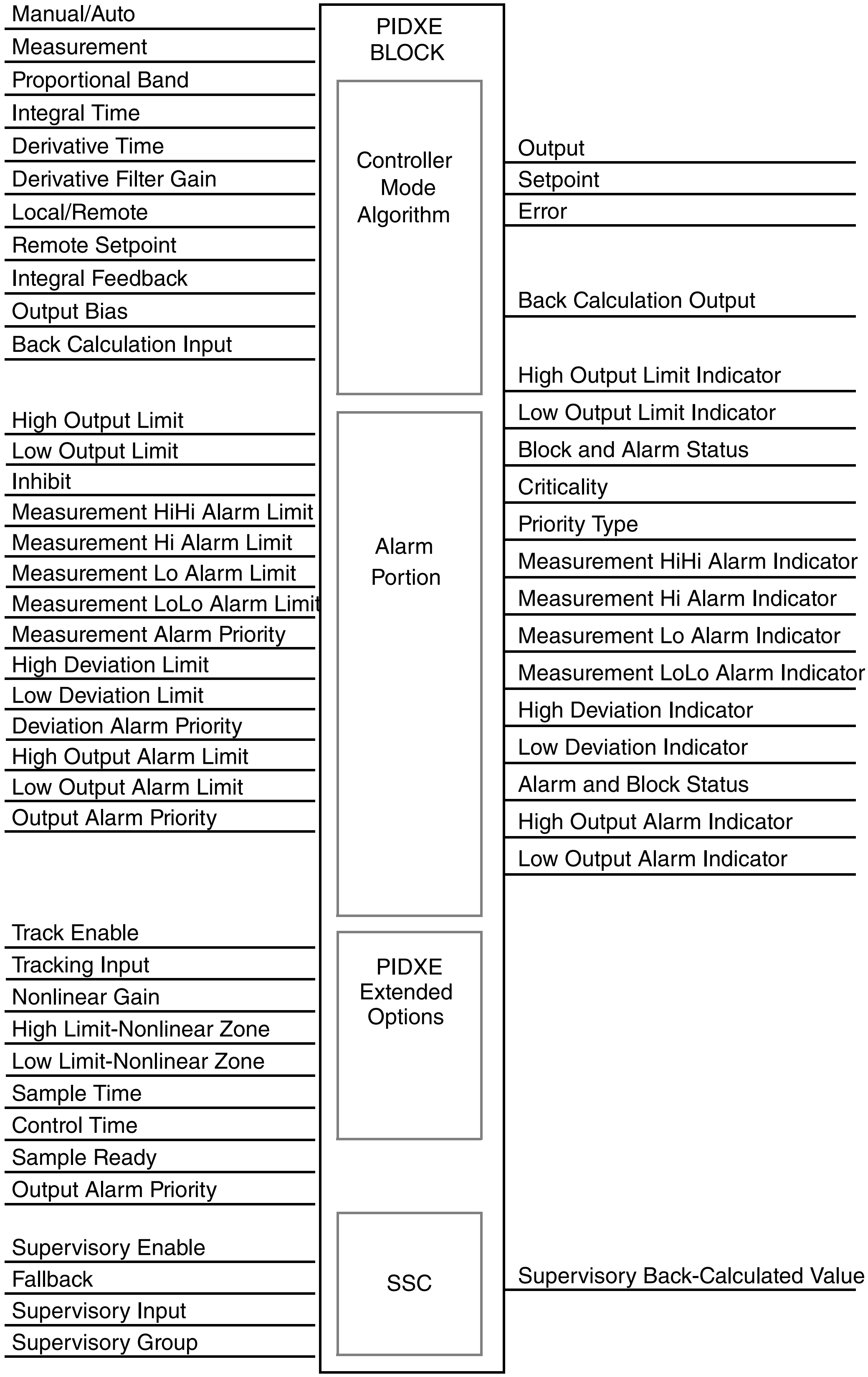


Figure 101-1. PIDXE Block I/O Diagram

101.2 Features

The features are:

- Manual/Auto control of the outputs, which can be initiated by a host process or another block
- Auto and Manual latch switch inputs (AUTSW and MANSW) that allow the block to be switched to Auto or Manual
- Local/Remote setpoint source selection
- Local and Remote latch switch inputs (LOCSW and REMSW) that allow the block to be switched to Auto or Manual
- Derivative filtering using a second-order Butterworth filter for high frequency noise rejection
- External integral feedback to prevent windup during closed loop operation
- Separate assignable engineering range and units to the parameters Measurement, Bias, and Input
- Bumpless transfer of the output signal when the block returns to controlling operation in Auto
- Adjustable derivative gain parameter (KD)
- Automatic scaling, based on assigned engineering ranges, so that the controller gain is normalized
- Output biasing with scaling
- Output clamping between variable output limits
- Bad inputs detection and handling
- Automatic cascade handling using an input and output parameter (back-calculate) that includes:
  - Initialization of cascade schemes
  - Back calculation of the setpoint input for the upstream block, to provide bumpless cascade operation when the cascade is open loop
- Output Tracking allows the output to track an independent signal source
- Supervisory Control (SSC) allows user application software to perform supervisory control over the PIDXE block's setpoint

The options are:

- Setpoint Tracking Option (STRKOP) forces the setpoint to track the Measurement signal. STRKOP takes this action when the LR parameter has transitioned in either direction and 1) either the output is in Manual or a cascade is broken (a downstream block is in open loop - INITI true) or the block is in Manual, or 2) when the block is in Manual only. This feature enables a bumpless return to automatic control when the PIDXE or any downstream block returns to closed-loop operation. The block does not perform STRKOP if any critical data errors are detected.
- Manual if Bad Option (MBADOP) is a Manual override feature. When MBADOP = 1 or 2, the block sets an unlinked MA input to Manual when it detects bad status of a control input (MEAS, FBK, and/or INITI) or optionally (when MBADOP = 2), if the Remote Setpoint (RSP) is not healthy (i.e., value status is BAD or has a broken

OM connection). This forces the output state to Manual. Returning to Auto requires external intervention, unless AUTSW is true.

- Increase/Increase Option (INCOPT) reverses the normal sense of the control action so that the controller output increases with increasing measurement.
- Measurement Alarming Option (MALOPT) provides absolute alarming of the measurement during auto operation. This option also provides standard alarm notification and reporting features.
- Deviation Alarm Option (DALOPT) enables (when true) deviation alarming of the measurement-setpoint error signal.
- High-High Alarm Option (HHAOPT) enables High-High and Low-Low absolute alarming for the measurement input, or disables absolute alarming altogether. Each alarm triggers an indicator (HHAIND or LLAIND) and text message (HHATXT and LLATXT) at a given priority level (HHAPRI) to be sent to the configured alarm group (HHAGRP). Once an alarm limit (HHALIM or LLALIM) is exceeded, the indicators remain set until the measurement returns within the defined limit plus (or minus) the deadband (MEASDB).

  0 = No alarming

  1 = High-High and Low-Low alarming

  2 = High-High alarming only

  3 = Low-Low alarming only.
- Manual Alarming Option (MANALM) allows you to invoke, while the block is in manual, either all configured alarm options or all configured alarm options *except* output alarming. Otherwise, alarming is normally performed only in Auto.
- Output Alarm Option (OALOPT) enables (when true) absolute alarming of the block output signal (OUT).
- Unacknowledge (UNACK) is a boolean output parameter which is set true, for notification purposes, whenever the block goes into alarm. It is settable, but sets are only allowed to clear UNACK to false, and never in the opposite direction. The clearing of UNACK is normally via an operator “acknowledge” pick on a default or user display, or via a user task.
- Manual Clamping Option (MCLOPT) allows you to invoke output clamping while the block is in manual. You can alter this boolean input at the workstation.
- Bias Track Option (BTRKOP), when true, forces the algorithm’s output Bias to track the block output (OUT). BTRKOP is a boolean input that you can change only by reconfiguring the block.
- Nonlinear Option (NONLOP) allows you to change the gain in a zone about zero error. The zone is defined by HZONE and LZONE, and the gain by KZONE.
- Sample Controller Option (SPLCOP) enables the PID to operate as a sampling controller over a time period that is much greater than the block’s execution period.
- Batch Control Option (BATCHO) works with the integral modes of the controller and the integral preload input to allow the PID to operate as a preloadable controller.
- Control Error Option (CEOPT) allows you to enable, or disable, the block’s implicit Hold action when it detects an error in the MEAS, FBK, or BCALCI input.

- Propagate Error Option (PROPT) gives you the option of propagating the ERROR status bit from the MEAS input to the block's OUT parameter.
- Local Setpoint Secure (LOCSP) enables you to secure against any write access to the LR parameter.
- Manual If Failsafe (MANFS) allows you to have the block go to the Manual state when the block receives a Failsafe notification.
- Supervisory Option (SUPOPT) specifies whether or not the block is under control of a Supervisory Application Program.
- Fallback Option (FLBOPT) specifies the action taken in a block when Supervisory fallback occurs. The fallback options can be: normal fallback, Auto, Manual, Remote, or Local.

101.3 Parameters

Table 101-1. PIDXE Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	122	PIDXE
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
MEAS	process input	real	con/set	0.0	RI1
HSCI1 to HSCI2	high scale in 1 to 2	real	no-con/no-set	100.0	specifiable
LSCI1 to LSCI2	low scale in 1 to 2	real	no-con/no-set	0.0	specifiable
DELTI1 to DELTI2	change delta 1 to 2	real	no-con/no-set	1.0	percent
EI1 to EI2	eng units input	string	no-con/no-set	%	specifiable
PROPT	propagate error	short	no-con/no-set	0	0 to 2
SPT	setpoint	real	con/set	0.0	RI1
FBK	reset feedback	real	con/set	0.0	RO1
PBAND	proportional band	real	con/set	1000.0	[0.1..]percent
INT	integral time	real	con/set	100.0	[0..]minutes
DERIV	derivative time	real	con/set	0.0	[0..]minutes
INCOPT	increase/increase option	boolean	no-con/no-set	0	0 to 1
KD	derivative gain	real	con/set	10.0	[10.0..50.0]
HSCO1	high scale out 1	real	no-con/no-set	100.0	specifiable
LSCO1	low scale out 1	real	no-con/no-set	0.0	specifiable
DELTO1	change delta 1	real	no-con/no-set	1.0	percent
EO1	eng unit output	string	no-con/no-set	%	specifiable
HOLIM	high output limit	real	con/set	100.0	RO1
LOLIM	low ouput limit	real	con/set	0.0	RO1
OSV	span variance	real	no-con/no-set	2.0	[0..25]percent
TRACK	track input	real	con/set	0.0	RO1
TRKENL	track enable	boolean	con/set	0	0 to 1

Table 101-1. PIDXE Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
BIAS	bias	real	con/set	0.0	RI2
BBIAS	offset for the bias	real	no-con/no-set	0.0	RO1
KBIAS	bias scale or gain factor	real	no-con/no-set	1.0	scalar
BTRKOP	bias track option	boolean	no-con/no-set	0	0 to 1
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	[0|1|2]
MANFS	manual If failsafe	boolean	no-con/no-set	0	0 to 1
MBADOP	manual bad option	short	no-con/no-set	0	[0|1|2]
MANSW	manual switch	boolean	con/set	0	0 to 1
AUTSW	auto switch	boolean	con/set	0	0 to 1
MCLOPT	manual clamp option	boolean	no-con/no-set	0	0 to 1
CEOPT	control error option	short	no-con/no-set	1	0 to 2
HOLD	hold mode	boolean	con/set	0	0 to 1
PRIBLK	primary block cascade option	boolean	no-con/no-set	0	0 to 1
PRITIM	primary cascade timer	real	no-con/no-set	0.0	seconds
INITI	initialize in	short	con/set	0	0 to 1
BCALCI	back calculate in	real	con/set	0.0	RO1
LR	local/remote	boolean	con/set	0	0 to 1
INITLR	initialize LR	short	no-con/no-set	2	[0|1|2]
LOCSP	local setpoint	boolean	no-con/no-set	0	0 to 1
LOCSW	local switch	boolean	con/set	0	0 to 1
REMSW	remote switch	boolean	con/set	0	0 to 1
RSP	remote setpoint	real	con/set	0.0	RI1
STRKOP	setpoint track option	short	no-con/no-set	0	[0|1|2]
MANALM	manual alarm option	short	no-con/no-set	1	0 to 4
INHOPT	inhibit option	short	no-con/no-set	0	0 to 3
INHIB	alarm inhibit	boolean	con/set	0	0 to 1
INHALM	inhibit alarm	pack_b	con/set	0	0 to 0xFFFF
MEASNM	meas alarm name	string	no-con/no-set	blank	1 to 12 chars
MALOPT	meas alarm option	short	no-con/no-set	0	0 to 1
MEASHL	meas high alarm limit	real	con/set	100.0	RI1
MEASHT	meas high alarm text	string	no-con/no-set	blank	1 to 32 chars
MEASLL	meas low alarm limit	real	con/set	0.0	RI1
MEASLT	meas low alarm text	string	no-con/no-set	blank	1 to 32 chars
MEASDB	meas alarm deadband	real	no-con/set	[0.0	RI1
MEASPR	meas alarm priority	integer	con/set	5	[1..5]
MEASGR	meas alarm group	short	no-con/set	1	[1..8]
DALOPT	deviation alarm option	short	no-con/no-set	0	0 to 3
HDALIM	high deviation limit	real	con/set	100.0	RI1
HDATXT	high deviation alarm text	string	no-con/no-set	blank	1 to 32 chars
LDALIM	low deviation limit	real	con/set	-100.0	RI1
LDATXT	low deviation alarm text	string	no-con/no-set	blank	1 to 32 chars
DEVADB	deviation alarm deadband	real	no-con/set	0.0	RI1
DEVPRI	deviation alarm priority	integer	con/set	5	[1..5]
DEVGRP	deviation alarm group	short	no-con/set	1	[1..8]
HHAOPT	high-high option	short	no-con/no-set	0	0 to 3

Table 101-1. PIDXE Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
HHALIM	high-high limit	real	con/set	100.0	RI1
HHATXT	high-high alarm text	string	no-con/no-set	blank	1 to 32 chars
LLALIM	low-low alarm limit	real	con/set	0.0	RI1
LLATXT	low-low absolute alarm text	string	no-con/no-set	blank	1 to 32 chars
HHAPRI	high-high priority	integer	con/set	5	[1..5]
HHAGRP	high-high group	short	no-con/set	1	[1..8]
OALOPT	output alarm option	short	no-con/no-set	0	0 to 3
OUTNM	output alarm name	string	no-con/no-set	blank	1 to 12 chars
HOALIM	high out alarm limit	real	con/set	100.0	RO1
HOATXT	high out alarm text	string	no-con/no-set	blank	1 to 32 chars
LOALIM	low out alarm limit	real	con/set	0.0	RO1
LOATXT	low out alarm text	string	no-con/no-set	blank	1 to 32 chars
OUTADB	out alarm deadband	real	no-con/set	0.0	RO1
OUTPRI	out alarm priority	integer	con/set	5	[1..5]
OUTGRP	out alarm group	short	no-con/set	1	[1..8]
NONLOP	non linear option	boolean	no-con/no-set	0	0 to 1
HZONE	high zone limit	real	con/set	100.0	[0..]RI3
LZONE	low zone limit	real	con/set	100.0	[0..]RI3
KZONE	nonlinear gain	real	con/set	1.0	[0..]
SPLCOP	sample controller option	boolean	no-con/no-set	0	0 to 1
SPLRDY	sample ready	boolean	con/set	0	0 to 1
TCTRL	control time	real	con/set	0.0	[0..]minutes
TSAMPL	sampling time	real	con/set	0.0	[0..]minutes
BATCHO	batch control option	boolean	no-con/no-set	0	0 to 1‘
PRLOAD	batch preload	real	con/set	0.0	0-100%
PR	reference proportional band	real	con/set	1000.0	[0.1..]%
IR	reference integral	real	con/set	100.0	[0..]minutes
DR	reference derivative	real	con/set	0.0	[0..]minutes
NB	noise band	real	con/set	1.0	[1.0..30.0]%
DFCT	derivative factor	real	con/set	[1.0	[0.0..4.0]
WMAX	wait maximum time	real	con/set	0.5	[0..]minutes
CLM	change limit	real	con/set	4.0	[1.25..16.0]
LMT	output cycle limit	real	con/set	80.0	[2.0..80.0]%
OVR	overshoot	real	con/set	0.5	[0.0..1.0]
DMP	damping factor	real	con/set	0.3	[0.1..1.0]
BMP	output bump	real	con/set	10.0	[-50.0..50.0]%
SETTLE	selftune override	boolean	con/set	0	0 to 1
STNREQ	request selftune	boolean	con/set	0	0 to 1
PM	memory proportional band	real	no-con/set	1000.0	[0.1..]%
IM	memory integer	real	no-con/set	100.0	[0..]minutes
DM	memory derivative	real	no-con/set	0.0	[0..]minutes
FLBOPT	fallback option	short	no-con/no-set	0	0 to 4
FLBREQ	fallback request	short	con/no-set	0	0 to 2
INITSE	intial SE	short	no-con/no-set	0	0 to 2
SE	supervisory enable	boolean	no-con/set	0	0 to 1
SUPGRP	supervisory group	short	no-con/no-set	1	1 to 8

Table 101-1. PIDXE Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
SUPOPT	supervisory option	short	no-con/no-set	0	0 to 4
SUP_IN	supervisory setpoint	real	con/set	0.0	RI1
AMRTIN	alarm regeneration timer	integer	no-con/no-set	0	0 to 32767 s
NASTDB	alarm deadband timer	long integer	no-con/no-set	0	0 to 2147483647 ms
NASOPT	nuisance alarm suppression option	short	no-con/no-set	0	0 to 2
OUTPUTS					
ALMSTA	alarm status	pack_l	con/no-set	0	bit map
BCALCO	back calculate out	real	con/no-set	0.0	RI1
BLKSTA	block status	pack_l	con/no-set	0	bit map
CRIT	criticality	integer	con/no-set	0	[0..5]
ERROR	control error	real	con/no-set	0.0	RI1
HDAIND	high deviation indicator	boolean	con/no-set	0	0 to 1
HHAIND	high-high absolute indicator	boolean	con/no-set	0	0 to 1
HOAIND	high out alarm indicator	boolean	con/no-set	0	0 to 1
HOLIND	high out limit indicator	boolean	con/no-set	0	0 to 1
INHSTA	inhibit status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
INITO	initialize out	short	con/no-set	0	0 to 1
LDAIND	low deviation indicator	boolean	con/no-set	0	0 to 1
LLAIND	low-low alarm indicator	boolean	con/no-set	0	0 to 1
LOAIND	low out alarm indicator	boolean	con/no-set	0	0 to 1
LOLIND	low out limit indicator	boolean	con/no-set	0	0 to 1
MEASHI	meas high alarm indicator	boolean	con/no-set	0	0 to 1
MEASLI	meas low alarm indicator	boolean	con/no-set	0	0 to 1
MESSAG	message index	integer	con/set	-100	---
OUT	output	real	con/no-set	0.0	RO1
PRTYPE	priority type	integer	con/no-set	0	[0..10]
QALSTA	quality status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
SUPBCO	supervisory back-calculate	real	con/no-set	0	RI1
TSTATE	tuner state	integer	con/set	-1	---
UNACK	alarm notification	boolean	con/no-set	0	0 to 1
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
ALMOPT	alarm options	pack_l	no-con/no-set	0	0 to 0xFFFFFFFF
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	config error	string	no-con/no-set	0	1 to 43 chars
KSCALE	gain scaler	real	no-con/no-set	1.0	scalar
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars
PCTMES	percent meas span	real	no-con/no-set	1.0	---
PCTOUT	percent output span	real	no-con/no-set	1.0	---
PERTIM	period time	real	no-con/no-set	0.1	---
PIDRCL	recall memory pid	boolean	no-con/set	0	0 to 1
PRSCAS	cascade state	short	no-con/no-set	0	0 to 7

Table 101-1. PIDXE Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
PRSCON	present control	short	no-con/no-set	0	0 to 3
PRSTUN	state of exact	integer	no-con/no-set	-1	-1, 0 or 1
RATD	ratio derivative	real	no-con/no-set	0.125	scalar
PTNREQ	pretune request	short	con/set	0	0 to 1
RATI	ratio integral	real	no-con/no-set	0.5	scalar
RI1	eng range input 1	real[3]	no-con/no-set	100,0,1	specifiable
RI2	eng range input 2	real[3]	no-con/no-set	100,0,1	specifiable
RO1	eng range output	real[3]	no-con/no-set	100,0,1	specifiable
SIGN	sign of error	real	no-con/no-set	1.0	scalar

101.3.1 Parameter Definitions

ACHNGE Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

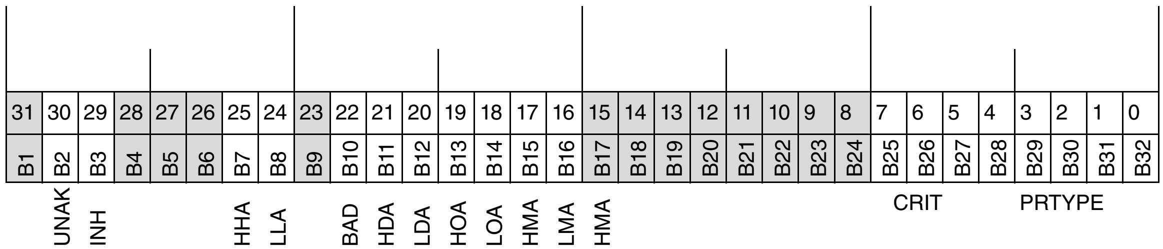
ALMOPT Alarm Options contains packed long values representing the alarm types that have been configured as options in the block, and the alarm groups that are in use. For the PIDXE block, only the following unshaded bits are used

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1] (0 to 31)	Configured Alarm Option When True
0	Alarm Group 8 in Use
1	Alarm Group 7 in Use
7	Alarm Group 1 in Use
16	Low Absolute Alarm Configured
17	High Absolute Alarm Configured
24	Low-Low Absolute Alarm Configured
25	High-High Absolute Alarm Configured

1. Bit 0 is the least significant, low order bit.

ALMSTA Alarm Status is a 32-bit output, bit-mapped to indicate the block's alarm states. For the PIDXE block, only the following bits are used:



Bit Number (0 to 31)*	Name	Description When True	Boolean Connection (B32 to B1)
0 to 4	PTYP_MSK	Priority Type: See parameter PRTYPE for values used in the PIDXE block	ALMSTA.B32–ALMSTA.B28
5 to 7	CRIT_MSK	Criticality; 5 = lowest priority, 1= highest	ALMSTA.B27–ALMSTA.B25
16	LMA	Low Measurement Alarm	ALMSTA.B16
17	HMA	High Absolute Alarm	ALMSTA.B15
18	LOA	Low Output Alarm	ALMSTA.B14
19	HOA	High Output Alarm	ALMSTA.B13
20	LDA	Low Deviation Alarm	ALMSTA.B12
21	HDA	High Deviation Alarm	ALMSTA.B11
22	BAD	BAD output of block	ALMSTA.B10
24	LLA	Low-Low Absolute Alarm	ALMSTA.B8
25	HHA	High-High Absolute Alarm	ALMSTA.B7
29	INH	Alarm inhibit	ALMSTA.B3
30	UNAK	Unacknowledged	ALMSTA.B2

* Bit 0 is the least significant, low order bit.

AMRTIN Alarm Regeneration Timer is a configurable integer that specifies the time interval for an alarm condition to exist continuously, after which a new unacknowledged alarm condition and its associated alarm message is generated.

AUTSW Auto Switch is a boolean input that, when true, overrides the MA and INITMA parameters, and drives the block to the Auto state. If both MANSW and AUTSW are true, MANSW has priority.

BATCHO Batch Control Option is a boolean input that enables the PIDX block to operate as a preloadable controller. You can change BATCHO only by reconfiguring the block. When BATCHO is true, and a limit condition exists, the integral term is set to the value nearer the limit PRLOAD, or the value selected when LIMOPT is 2. In the PIDX block, the only choice is PRLOAD. The PIDA version tends to avoid saw-tooth ratcheting and excessively slow recovery.

BBIAS — Offset for the Bias is a real input used for offsetting the product of the BIAS input with KBIAS.

BCALCI — Back Calculation In is a real input that provides the initial value of the output before the block enters the controlling state, so that the return to controlling is bumpless. It is also the source of the output value when its integration bit, which puts the block into output tracking, is non-zero. The source for this input is the back calculation output (BCALCO) of the downstream block. With V4.2 and later software, BCALCI contains the cascade initialization data bits which were formerly contained in the INITI parameter. Therefore, BCALCI defines the source block and parameter that drives this block into initialization, and INITI and INITO are not required for cascade initialization.

BLKSTA includes bits which can indicate when the downstream output is limited in either direction. BLKSTA.B11 monitors the Limited High condition (BCALCI.LHI) and BLKSTA.B10 monitors the Limited Low condition (BCALCI.LLO).

BCALCO — Back Calculation Output is a real output that is equal to MEAS except in the following situations, where it is equal to SPT:

- The block is transitioning from Local to Remote mode on this cycle.
- MEAS has Bad status.
- MEAS has Out-of-Service status.
- MEAS has Error status.
- MEAS is experiencing source connection problems.

With V4.2 and later software, the status bits of BCALCO contain the cascade initialization requests formerly contained in the INITO parameter. You connect the BCALCO parameter to the BCALCI input of an upstream block so that this upstream block can sense when the PIDX block is open. Therefore with V4.2 and later software INITO is not required for cascade initialization.

BIAS — Bias is a real input added to the controller or algorithm output, to achieve OUT.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the PIDXE block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
FLB	SC	SE	HOL	LOL	MAO	LRO	FS		LLO	LHI	WLCK					ON	UDEF		BAD	MA	LR	STRK		HLD	TRK	ACC	FOL		PTN	STN	MTN

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
0	MTN	Manual Tune Mode	BLKSTA.B32
1	STN	Self-Tune Mode	BLKSTA.B31
2	PTN	Pre-Tune Mode	BLKSTA.B30
4	FOL	Follow	BLKSTA.B28
5	CTL	Controlling	BLKSTA.B27
6	TRK	Tracking	BLKSTA.B26
7	HLD	Holding	BLKSTA.B25
9	STRK	Setpoint Tracking	BLKSTA.B23
10	LR	Local(= false)/Remote(= true)	BLKSTA.B22
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
12	BAD	block in BAD state	BLKSTA.B20
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
20	WLCK	Workstation Lock	BLKSTA.B12
21	LHI	Downstream Limited High	BLKSTA.B11
22	LLO	Downstream Limited Low	BLKSTA.B10
24	FS	Failsafe	BLKSTA.B8
25	LRO	Local/Remote Override	BLKSTA.B7
26	MAO	Manual/Auto Override	BLKSTA.B6
27	LOL	Low Output Limit (Clamped)	BLKSTA.B5
28	HOL	High Output Limit (Clamped)	BLKSTA.B4
29	SE	Supervisory Enabled	BLKSTA.B3
30	SC	Supervisory Control	BLKSTA.B2
31	FLB	FLB Supervisory Control Fallback State	BLKSTA.B1

BMP

Bump is required for pretuning, and can be considered an option only if you do not use the pretune feature. Bump is the amplitude of the doublet pulse imposed at the controller output that causes the measurement to respond. BMP is expressed in percent of the output span and should be large enough to create a change in the measurement, larger than THRESH.

BTRKOP — Bias Track Option, when true, forces the PID algorithm's BIAS input to track the block output (OUT) when the block is in Manual.

CEOPT — Control Error Option is a short integer that specifies how the block responds to the MEAS and BCALCI inputs when either of those inputs is in error. To provide backward compatibility, CEOPT defaults to 1. CEOPT has a range of 0 to 2 where:

- 0 = The block takes no implicit Hold action when it detects a control error.
- 1 = The block goes to the Hold state if, while MBADOP = 0, either MEAS or BCALCI: (a) has its BAD status bit set true; (b) has its Out-of-Service status bit set true; (c) is experiencing peer-to-peer path failure.
- 2 = The block goes to the Hold state if, while MBADOP = 0, either MEAS or BCALCI meets any of the conditions described for CEOPT = 1, or if MEAS has its ERROR status bit set true.

CEOPT is independent of the propagate error option, PROPT, and does not affect the external logical input, HOLD. The HOLD input, when true, still drives the block into the Hold state whenever the block is in Auto (and MBADOP = 0).

CLM — Change Limit clamps the working PBAND and INT values within a range that is expressed as a fraction/multiple of the reference PR and IR values as follows:

PR/CLM < PBAND < PR*CLM

IR/CLM < INT < IR*CLM.

CRIT — Criticality is an integer output that indicates the priority, ranging from 1 to 5, of the block's highest currently active alarm (1 is the highest priority). An output of zero indicates the absence of alarms.

DALOPT — Deviation Alarm Option is a short integer input that enables High and Low deviation alarming, or disables alarming altogether.

0 = No alarming
1 = High and Low deviation alarming
2 = High deviation alarming only
3 = Low deviation alarming only.

You can change DALOPT only by reconfiguring the block.

DEFINE — Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return

DEFINE to a true value, correct all configuration errors and re-install the block.

DELTI1 to DELTI2

Change Delta for Input Range 1 or 2 is a real value that defines the minimum percent of the input range that triggers change driven connections for parameters in the range of RI1 or RI2. The default value is 1.

Entering a 1 causes the Object Manager to recognize and respond to a change of 1 percent of the full error range. If communication is within the same CP that contains the block's compound, change deltas have no effect.

Refer to "Peer-to-Peer Connections of Real-Type Block Inputs" on page 1703 for details on how the I/A Series software affects the change delta percentage during operation.

DELTO1 Change Delta for Output Range 1 is presently unused.

DERIV Derivative Time is a real input that adjusts the derivative time constant in minutes.

NOTE

The working DERIV value is indirectly limited by the DFCT parameter and the working INT value.

DESCRP Description is a user-defined string of up to 32 characters that describe the block's function (for example. "PLT 3 FURNACE 2 HEATER CONTROL").

DEVADB Deviation Alarm Deadband is a real input, in MEAS units, that applies to both High and Low Deviation Limits. You can adjust this parameter at the workstation.

DEVGRP Deviation Group is a short integer input that directs deviation alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.

DEVPRI Deviation Priority is an integer input, from 1 to 5, that sets the priority level of the deviation alarm (1 is the highest priority).

DFCT Derivative Factor is an input that controls the weight of the derivative term; it multiplies the calculated derivative term by the derivative factor. Setting DFCT to 0.0 eliminates the derivative term. Setting DFCT to 1.0 produces optimal controller tunings for a lag-delay process. A factor greater than 1 signals Pretune to override the factor based on its identification of the process delay and of primary and secondary lag times. For processes requiring a large amount of derivative action (for example, a double integral process), DFCT can be as large as 4.0.

DM — Memory Derivative is one of the three parameters that support the PID recall tuning feature, and is used to store a fallback DERIV setting.

DMP — Damping limit is the maximum allowed damping of the closed loop response. In the self-tuning mode, it is used with the OVR limit to set the tuning criteria, to obtain the desired closed loop response. Generally, damping and overshoot cannot be set independently. Best control is usually obtained using the damping limit.

DR — Reference Derivative is a real input that can be entered at configuration, or derived from the Pre-tune operation. Use DR in combination with the change limit (CLM) parameter, to limit the actual working derivative value about the reference value.

EI1 to EI2 — Engineering Units for Input Ranges 1 and 2, as defined by the parameters HSCI1 to HSCI2, LSCI1 to LSCI2, and DELTI1 to DELTI2, provide the engineering units text for the values defined by Input Ranges 1 and 2. "Deg F" or "pH" are typical entries.

EO1 — Engineering Units for Output Range 1, as defined by the parameters HSCO1, LSCO1, and DELTO1, provides the engineering units text for the values defined by Output Range 1. "Deg F" or "pH" are typical entries. Make the units for the Output Range (EO1) consistent with the units of Input Range 1 (EI1) and Input Range 2 (EI2).

ERCODE — Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block's DEFINE parameter to be set false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the PIDXE block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
"W43 – INVALID PERIOD/ PHASE COMBINATION"	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
"W44 – INVALID ENGINEERING RANGE"	High range value is less than or equal to low range value.
"W46 – INVALID INPUT CONNECTION"	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
"W48 – INVALID BLOCK OPTION"	The configured value of a block option is illegal.

Message	Value
“W53 – INVALID PARAMETER VALUE”	A parameter value is not in the acceptable range.
“W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK”	A Database Installer error has occurred.

ERROR Control Error is a real output that equals Setpoint minus Measurement. ERROR can be sourced to other blocks.

FBK Feedback is a real input used to generate integration action. Its function is to prevent integral windup. FBK is normal.

FLBOPT Fallback Option is a short integer input that defines the control action to be taken by the block when a Supervisory fallback occurs:

0 = Take no fallback action (default)
1 = Set MA parameter to Auto
2 = Set MA parameter to Manual
3 = Set LR parameter to Remote
4 = Set LR parameter to Local.

FLBOPT overrides linked MA and LR parameters, but does *not* override the AUTSW, MANSW, REMSW, and LOCSW parameters.

FLBREQ Fallback Request is a short integer output that is an explicit request for the block to go to the Fallback state, with recovery at the block level (when SE is set), and/or at the group level (when the appropriate group enable bit is set in SUPENA).

0 = No fallback requested
1 = Fallback requested; recovery at block or group level
2 = Fallback requested; recovery *only* at block level.

HDAIND High Deviation Alarm Indicator is a boolean output set true when the measurement exceeds the setpoint by more than the deviation limit HDALIM. When the measurement passes back through the DEVADB deadband, the block sets HDAIND to false.

HDALIM High Deviation Alarm Limit is a real input that establishes the amount by which the measurement must exceed the setpoint to initiate a high deviation alarm and set the High Deviation Alarm Indicator, HDAIND, true.

HDATXT High Deviation Alarm Text is a user-configurable text string of up to 32-characters, output with the alarm message to identify the alarm.

HHAGRP High-High Absolute Alarm Group is a short integer input that directs High-High Absolute alarm messages to one of eight groups of alarm devices.

HHAIND High-High Alarm Indicator is a boolean output set true when the block-dependent parameter value (generally the measurement input) exceeds the

	high-high absolute alarm limit (HHALIM). HHAIND is set to false when the value is less than HHALIM. Once the Indicator is set true, it does not return to false until the value falls below the limit less a deadband.
HHALIM	High-High Absolute Alarm Limit is a real input that defines the value of the block-dependent parameter (generally the measurement input) that triggers a High High alarm.
HHAOPT	High-High Alarm Option is a configured short integer input that enables High-High and Low-Low absolute alarming for alarming of a block-dependent value, generally the measurement input, or disables absolute alarming altogether. Each alarm triggers an indicator and text message. 0 = No alarming 1 = High-High and Low-Low alarming 2 = High-High alarming only 3 = Low-Low alarming only.
HHAPRI	High-High Absolute Priority is an integer input, from 1 to 5, that sets the priority level of the high-high absolute alarm (1 is the highest priority).
HHATXT	High-High Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the high-high absolute alarm message to identify it.
HOAIND	High Output Alarm Indicator is a boolean output that is set true whenever the output is greater than HOALIM.
HOALIM	High Output Alarm Limit is a real input, in OUT units, that defines the value of the output that initiates a high output alarm.
HOATXT	High Output Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can change HOATXT only by reconfiguring the block.
HOLD	Hold is a boolean input. When true, HOLD forces the block into the Hold substate of Auto, holding the output at its last computed value.
HOLIM	High Output Limit is a real input that establishes the maximum output value, in OUT units. If the algorithm tries to drive the output to a higher value, the output is clamped at the HOLIM value and the indicator HOLIND is set true.
HOLIND	High Output Limit Indicator is a boolean output that is set true whenever the output is clamped at the high output limit, HOLIM.
HSCI1 to HSCI2	High Scale for Input Ranges 1 and 2 are real values that define the upper limit of the measurement ranges. EI1 to EI2 define the units. Make the range and units consistent with the measurement source. A typical value is 100 (percent).
HSCO1	High Scale for Output Range 1 is a real value that defines the upper limit of the ranges for output 1. A typical value is 100 (percent). EO1 defines

the units. Make the range and units consistent with those of the output destination.

HZONE

High Zone is a real input that defines, in terms of the error, the upper limit of the zone in which the nonlinear gain option is exercised. In the PIDXE block, HZONE is expressed in engineering units.
Also, refer to “HZONE and LZONE (Conversion to PIDA)” on page 1977.

IM

Memory Integral is one of the three parameters that support the PID recall tuning feature and is used to store a fallback INT setting.

INCOPT

Increase/Increase Option is a boolean input. When set true, INCOPT reverses the normal sense of the control action so that the controller output increases with increasing measurement.

INHALM

Inhibit Alarm contains packed boolean values that represent alarm inhibit requests for each alarm type or point configured in the block. For the PIDXE block, only the following bits are used:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16

Bit Number* (0 to 15)	Description When True	Boolean Connection (B16 to B1)
0	Inhibit Low Absolute Alarm	INHALM.B16
1	Inhibit High Absolute Alarm	INHALM.B15
2	Low Output Alarm	INHALM.B14
3	High Output Alarm	INHALM.B13
4	Low Deviation Alarm	INHALM.B12
5	High Deviation Alarm	INHALM.B11
8	Inhibit Low-Low Absolute Alarm	INHALM.B8
9	Inhibit High-High Absolute Alarm	INHALM.B7

* Bit 0 is the least significant, low order bit.

There are no mnemonic names for the individual bits of INHALM.

INHIB

Inhibit is a boolean input. When true, it inhibits all block alarms; the alarm handling and detection functions are determined by the INHOPT setting. Alarms can also be inhibited based on INHALM and the compound parameter CINHIB.

INHOPT

Inhibit Option specifies the following actions applying to all block alarms:

0 = When an alarm is inhibited, disable alarm messages but do not disable alarm detection.

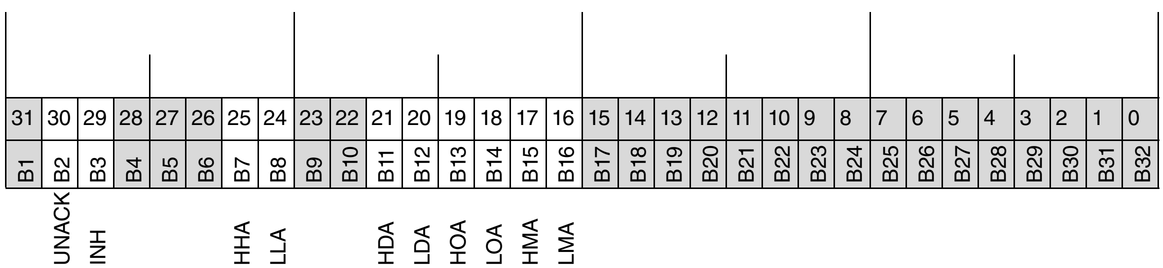
1 = When an alarm is inhibited, disable both alarm messages and alarm detection. If an alarm condition already exists at the time the alarm transitions into the inhibited state, clear the alarm indicator.

2 = Same as 0 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

3 = Same as 1 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

INHSTA

Inhibit Status contains packed long values that represent the actual inhibit status of each alarm type configured in the block. For the PIDXE block, only the following bits are used:



Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
16	LMA	Low Absolute Alarm Inhibited	INHSTA.B16
17	HMA	High Absolute Alarm Inhibited	INHSTA.B15
18	LOA	Low Output Alarm	INHSTA.B14
19	HOA	High Output Alarm	INHSTA.B13
20	LDA	Low Deviation Alarm	INHSTA.B12
21	HDA	High Deviation Alarm	INHSTA.B11
24	LLA	Low-Low Absolute Alarm Inhibited	INHSTA.B8
25	HHA	High-High Absolute Alarm Inhibited	INHSTA.B7
29	INH	Inhibit Alarm	INHSTA.B3
30	UNACK	Unacknowledged	INHSTA.B2

* Bit 0 is the least significant, low order bit.

INITI

Initialization In defines the source block and parameter that drives this block into initialization. The source for this short integer input is the initialization output of a downstream block. With V4.2 or later software, BCALCI contains the cascade initialization request data bit eliminating the need to configure INITI connections in cascades. However, to preserve backward compatibility, the INITI parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITI short value is maintained, but the setting of the handshaking bits, via the INITI to INITO connection, is eliminated.

INITLR

Initialize Local/Remote is an integer input that specifies the desired state of the LR input during initialization, where:

0 = Local
1 = Remote
2 = The LR state as specified in the checkpoint file.

The block asserts this initial LR state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a restart operation.
- The compound in which it resides is turned on.

The Initialize LR state is ignored if the LR input has an established linkage.

INITMA

Initialize Manual/Auto specifies the desired state of the MA input during initialization, where:

0 = Manual
1 = Auto
2 = The MA state as specified in the checkpoint file.

The block asserts this initial M/A state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a reboot operation.
- The compound in which it resides is turned on.
- The INITMA parameter itself is modified via the control configurator. (The block does not assert INITMA on ordinary reconfiguration.)

INITMA is ignored if MA has an established linkage.

INITO

Initialization Output is set true when:

- The block is in Manual or initializing.
- Permanent or temporary loss of FBM communications occurs.
- The ladder logic in the FBM is not running.
- MMAIND (mismatch indicator) is true.

- DISABL is true.
- RSP (the remote setpoint) is not the setpoint source.

The block clears INITO when none of these conditions exist. You connect this parameter to the INITI input of upstream blocks so that these upstream blocks can sense when this block is open loop. This block keeps INITO True, for one cycle (PRIBLK = 0), until the acknowledge is received from upstream (PRIBLK = 1 and PRITIM = 0.0), or for a fixed time delay (PRIBLK = 1 and PRITIM = nonzero).

With V4.2 or later software, BCALCO contains the initialization output eliminating the need to configure INITO connections in cascades. However, to preserve backward compatibility, the INITO parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITO short value has been maintained, but the setting of the handshaking bits, via the INITI to INITO connection, is eliminated.

INITSE

Initial Supervisory Enable (INITSE) specifies the initial state of the SE parameter in a block configured for Supervisory Control (that is: SUPOPT = 1 or 3) when the block initializes due to reboot, installing the block, or turning on the compound.

0 = Disable
1 = Enable
2 = Do not change SE parameter.

INT

Integral Time is a real input that adjusts the integral time constant. As this block only operates in PID mode, balance time will not be utilized and this parameter will not appear as BTIME as it does in the other PID-type blocks.

IR

Reference Integral is a real input that can be entered at configuration or derived from the Pre-tune operation. Use IR in combination with the change limit (CLM) parameter to limit the actual working integral value about the IR value. See CLM.

KBIAS

BIAS scale or gain factor is a real input that multiplies the BIAS input. It is expressed in OUT units divided by BIAS units.

KD

Derivative Filter Gain is a real input that adjusts the derivative filter gain.

KSCALE

KSCALE is a conversion factor used to make the time units of the rate parameters, which are in EI1 units per minute, dimensionally compatible with the time units of the output, as defined by EO1.

KZONE

Zone Gain establishes the gain within the nonlinear zone defined by HZONE and LZONE. KZONE is usually set at less than unity for pH control applications. If KZONE is set to zero, the block behaves as a dead zone controller.

LDAIND	The Low Deviation Alarm Indicator is a boolean output that is set true when the measurement falls below the setpoint by more than the deviation limit, LDALIM. When the measurement passes back through the DEVADB deadband, the block sets LDAIND to false.
LDALIM	Low Deviation Alarm Limit is a real input that defines how far the measurement must fall below the setpoint to initiate a low deviation alarm and set the Low Deviation Alarm Indicator LDAIND true.
LDATXT	Low Deviation Alarm Text is a user-defined text string of up to 32-characters that are output with the alarm message to identify the alarm.
LLAIND	Low-Low Alarm Indicator is a boolean output set true when the block-dependent parameter value (generally the measurement input) falls below the low-low absolute alarm limit (LLALIM). LLAIND is set to false when the value is greater than LLALIM. Once the Indicator is set true, it does not return to false until the value exceeds the limit plus a deadband.
LLALIM	Low-Low Absolute Alarm Limit is a real input that defines the value of the block-dependent parameter (generally the measurement input) that triggers a Low-Low Alarm.
LLATXT	Low-Low Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the low-low absolute alarm message to identify it.
LMT	Output Cycling Limit is a real input that indicates to the self-tuning algorithm that the controller output is changing at a frequency that is too high for the loop response as it is currently tuned. LMT has a range of 2 to 80 percent of output span and defaults to 80 percent. If the average peak-to-peak amplitude exceeds LMT for over three minutes, the controller is detuned by increasing PBAND and reducing DERIV. This feature is useful for processes that have very little dead time and require a higher controller gain.
LOAIND	Low Output Alarm Indicator is a boolean output that is set true whenever the output is less than LOALIM.
LOALIM	Low Output Alarm Limit is a real input, in OUT units, that defines the value of the output that initiates a low output alarm.
LOATXT	Low Output Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can change LOATXT only by reconfiguring the block.
LOCKID	Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.

LOCKRQ	Lock Request is a boolean input which can be set true or false only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.
LOCSP	Local Setpoint Secure is a boolean input. When true, LOCSP provides lockout of user write access to the LR parameter. If LOCSP is configured true, the block secures LR when it initializes and maintains LR in the secured state. The LOCSW and REMSW overrides have higher precedence, but LR remains secured when they are no longer asserted.
LOCSW	Local Switch is a boolean input. When true, LOCSW overrides the LR and INITLR parameters and drives the block to the Local state. If both LOCSW and REMSW are true, LOCSW has priority.
LOLIM	Low Output Limit is a real input that establishes the minimum output value. If the algorithm tries to drive the output to a lower value, the output is clamped at the LOLIM value and the indicator LOLIND is set true.
LOLIND	Low Output Limit Indicator is a boolean output that is set true whenever the output is clamped at the low output limit, LOLIM.
LOOPID	Loop Identifier is a configurable string of up to 32 characters which identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.
LR	Local/Remote is a boolean input that selects the setpoint source (0 = false = Local; 1 = true = Remote). If LR is set to Remote, the source of the setpoint value is the real input parameter RSP. When LR is set to Local, there are two possible sources for the setpoint: (a) MEAS or (b) a user settable input. The choice is based on the conditions of STRKOP and MA, as described under STRKOP.
LSCI1 to LSCI2	Low Scale for Input Ranges 1 and 2 are real values that define the lower limit of the measurement ranges. A typical value is 0 (percent). EI1 to EI2 define the units. Make the range and units consistent with those of the measurement source.
LSCO1	Low Scale for Output Range 1 is a real value that defines the lower limit of the ranges for Output 1. A typical value is 0 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.

LZONE	Low Zone is a real input that defines, in terms of the error, the absolute value of the negative error level that sets the lower limit of the zone in which the nonlinear gain option is exercised. In the PIDXE block, LZONE is expressed in engineering units. Also, refer to "HZONE and LZONE (Conversion to PIDA)" on page 1977.
MA	Manual Auto is a boolean input that controls the Manual/Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. The block automatically limits the output to the output range specified between LSCO1 and HSCO1, for analog blocks. In Manual, the algorithm is not performed, and the output is unsecured. An external program can then set the output to a desired value.
MALOPT	Measurement Alarm Option is a configured short integer input that enables absolute High and Low measurement alarming, or disables absolute alarming altogether. 0 = No alarming 1 = High and Low measurement alarming 2 = High measurement alarming only 3 = Low measurement alarming only. You can change MALOPT only by reconfiguring the block.
MANALM	Manual Alarm Option is a configurable input which enables and disables configured alarm options to function in Manual. Normally alarms are processed only in the Auto mode. 0 = No alarming in Manual 1 = Full alarming in Manual 2 = No Output alarming in Manual 3 = No output alarming in Track 4 = No output alarming in Manual or Track
MANFS	Manual if Failsafe is a boolean input. When configured true, MANFS drives the block to the Manual state if the block detects an incoming failsafe status.
MANSW	Manual Switch is a boolean input. When true, MANSW overrides the MA and INITMA parameters and drives the block to the Manual state. If both MANSW and AUTSW are true, MANSW has priority.
MBADOP	Manual if Bad Option is a manual override feature. When MBADOP is set to 1 or 2, the block sets the unlinked MA input to manual if it detects a BAD status bit in the MEAS, BCALCI or FBK input, and when set to 2, it detects that the Remote Setpoint (RSP) is not healthy (i.e., value status is BAD or has a broken OM connection). This forces the output state to manual as long as the BAD status remains. After the BAD status clears, returning to Auto requires external intervention unless AUTSW is true.

	0 = no option enabled 1 = Switch to Manual when MEAS, BCALCI, or FBK value status is BAD 2 = Same as option 1, plus switch to Manual when RSP is not healthy You can change MBADOP only by reconfiguring the block. MBADOP has the same priority as the MANSW override, and it has precedence over the AUTSW override. MBADOP has no effect when MA is linked. If any of the MBADOP conditions are true, the block will be switched to Manual regardless of the MANSW and AUTSW settings.
MCLOPT	Manual Clamping Option allows you to invoke output clamping while the block is in manual.
MEAS	Measurement is an input identifying the source of the block's input, or the controlled variable.
MEASDB	Measurement Alarm Deadband is a configured input, expressed in MEAS units, that applies to both High and Low Alarm Limits. You can adjust this parameter at the workstation.
MEASGR	Measurement Group is a short integer input that directs measurement alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.
MEASHI	Measurement High Alarm Indicator is a boolean output that is set true when the measurement exceeds the high alarm limit (MEASHL). When the measurement passes back through the deadband, the block sets MEASHI to false.
MEASHL	Measurement High Alarm Limit is a real input that defines the value of the measurement that initiates a high absolute alarm.
MEASHT	Measurement High Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can only change the message text by reconfiguring the block.
MEASLI	Measurement Low Alarm Indicator is a boolean output that is set true when the measurement falls below the low alarm limit (MEASLL). When the measurement passes back through the MEASDB deadband, the block sets MEASLI to false.
MEASLL	Measurement Low Alarm Limit is a real input that defines the value of the measurement that initiates a low absolute alarm.
MEASLT	Measurement Low Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can only change the message text by reconfiguring the block.
MEASNM	Measurement Alarm Name is a user-defined text string of up to 12 characters that identifies the alarm source in the alarm message. It serves as a point descriptor label (for example, Furn 37 Temp).

MEASPR Measurement Priority is an integer input (1 to 5), that sets the priority level of the measurement alarm (1 is the highest priority).

MESSAG Message Indicator is an integer output that represents an encoded status or error message pertaining to the self-tune algorithm. The assigned integers and the message that each represents are:

MI Code	Message
MI_001	Block in Auto
MI_002	Increase Bump
MI_003	Wait Steady State
MI_004	PID Computed
MI_005	Measuring Noise Band
MI_006	PRETUNE Done
MI_007	Bad INC/DEC Action
MI_008	Meas Noise Corrupt
MI_009	Cascade Open Loop
MI_010	Output Limit Exceeded
MI_011	Excessive Output Manually
MI_012	Tune Block Request Error
MI_013	Error on Inputs to PID
MI_015	Linkage on Tuning Constant
MI_101	One Peak Found
MI_102	WMAX1 Small Overdamp
MI_103	Two Peaks Found
MI_105	Three Peaks Found
MI_106	Two Peaks Found
MI_107	Three Peaks Found
MI_109	WMAX2 Small Overdamp
MI_110	Suspicious 1 Shape
MI_111	Suspicious 2 Shape
MI_112	Suspicious 3 Shape
MI_113	WMAX3 Small Overdamp
MI_114	Three Peaks Found
MI_150	Undefined
MI_151	WMAX or Process Fast
MI_153	Excess SP Change
MI_154	Process Out of Control
MI_155	PI Clamped CLM Limit
MI_156	Self-Tune Initialize
MI_157	Linkage on Tuning Constant
MI_160	PID Open Loop

NAME — Name is a user-defined string of up to 12 characters used to access the block and its parameters.

NASOPT — Alarm Suppression Option is a configurable, non-settable short integer that specifies how the nuisance alarm delay is implemented:

- 0 = Suppress nuisance alarms by delaying the Return-to-Normal (default) by the length of time specified in NASTDB
- 1 = Suppress nuisance alarms by delaying alarm detection by the length of time specified in NASTDB
- 2 = Suppress nuisance alarms by delaying both the Alarm Detection and the Return-to-Normal by the length of time specified in NASTDB

NASTDB — Alarm Deadband Timer is a configurable long integer. Depending on the value of NASOPT, it either specifies the deadband time interval that must elapse before an alarm condition is allowed to return to normal, or the length of a delay-on timer which specifies the amount of time between an alarm's detection and the announcement of the alarm. The parameter value ranges from zero (default, no delay) to 2147483647 ms.

NB — Noise Band is a measure of the intrinsic noise content of the measurement signal. Its peak-to-peak magnitude is expressed as a percentage of the measurement span. Self-tuning begins to extract tuning information whenever the error signal exceeds twice the magnitude of NB. It is also used to decide whether an observed peak may be noise. You can enter a value for NB at configuration or derive a value from a pretune operation.

NONLOP — Nonlinear Option is a configured boolean input that allows you to customize the gain in a zone about zero error. The zone is defined by HZONE and LZONE, the gain by KZONE. You can change NONLOP only by reconfiguring the block.

OALOPT — Output Alarm Option is a configured short integer input that enables absolute High and Low alarming of the block output (OUT) or disables output alarming altogether.

0 = No alarming
1 = High and Low output alarming
2 = High output alarming only
3 = Low output alarming only.

You can change OALOPT only by reconfiguring the block.

OSV — Output Span Variance is a real input that defines the amount by which the output clamp limits (HOLIM, LOLIM) can exceed the specified output range, as defined by HSCO1 and LSCO1.

OUT — Output, in Auto mode, is the result of the block algorithm applied to one or more input variables. In Manual, OUT is unsecured, and can be set by you or by an external task.

OUTADB	Output Alarm Deadband is a real input that specifies the size of the deadband for both High and Low Output Alarm Limits. You can adjust this parameter at the workstation.
OUTGRP	Output Group is a short integer input that directs high and low output alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.
OUTNM	The Output Alarm Name is a user-defined string of up to 12 characters that identify the alarm source in the alarm message. It serves as a point descriptor label (for example, F2 Fuel Ctrl).
OUTPRI	Output Priority is an integer input (1 to 5) that sets the priority level of the High and Low Output Alarms (1 is the highest priority).
OVR	Overshoot Limit is the target overshoot of the closed loop response, if the fuzzy interpolation method is used (PR_FL=0), in the self tuning mode. OVR has a range from 0.0 to 0.2 of the magnitude of the first peak.
OWNER	Owner is a string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are successful only if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.
PBAND	Proportional Band is an input expressed in percent. PBAND is the percent of span change in input, that causes a full-span change in output. [100 / PBAND] determines the gain of the controller when MEAS and OUT are converted to percent of span. It is adaptively set by FBTUNE.
PCTMES	Percent of Measurement is a real value representing the percent of measurement span per unit.
PCTOUT	Percent of Output is a real value representing the percent of output span per unit.
PERIOD	Period is a short input that defines the block execution time. Along with the control processor’s Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to “Scan Period” in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PERTIM	Period Time is the period of the block expressed in seconds.

PHASE

Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PIDRCL

PID Recall is a boolean input request that causes the memory tuning values PM, IM, and DM to be copied into the working values PBAND, INT, and DERIV. PIDRCL is honored only in the FB_HOLD mode. This feature provides a convenient means for you to save a fallback set of PID settings, which can be recalled if needed.

PM

Memory PBAND is one of the three parameters that support the PID recall tuning feature and is used to store a fallback PBAND setting.

PR

Reference Pband is a real input that can be entered at configuration or derived from the Pretune operation. Use PR in combination with the change limit (CLM) parameter to limit the actual working proportional band value about the PR value. See CLM.

PRIBLK

Primary Block is a configuration option. When true (=1), PRIBLK enables a block in a cascaded configuration to initialize without bumping the process, either at initial startup or whenever control is transferred up to a primary block. Depending on the value of PRITIM, PRIBLK does this by forcing the PIDXE block to remain in the Hold state until the Acknowledge status bit (Bit 10) of MEAS is detected from the upstream block (PRITIM = 0.0), or until the time defined by PRITIM expires (PRITIM > 0.0). In the latter case, the explicit acknowledge from the upstream block is not needed.

Use PRIBLK in a cascade situation when the source of the block's input connection needs to be initialized.

For correct operation, set EROPT = 1 or 2, and implement the connections between each primary-secondary block combination. These connections include BCALCI/BCALCO and OUT/RSP (or OUT/MEAS).

Except for the most primary controller block, Invensys recommends that PRIBLK be set true for all applicable blocks in a cascaded scheme. When PRIBLK is false (default value), no special handling takes place.

Refer to “PRIBLK and PRITIM Functionality” on page 1977 for more information on this parameter.

PRITIM

Primary Cascade Timer is a configurable parameter used to delay the closing of the cascade to a primary block, when the output is initialized in the PIDXE block. It is used only if the PRIBLK option is set. The cascade is closed automatically when the timer expires without requiring an explicit acknowledge by the upstream block logic.

Refer to “PRIBLK and PRITIM Functionality” on page 1977 for more information on this parameter.

PRLOAD Batch Preload is a real input that is loaded into the controller's integral term whenever the output is being limited at either the LOLIM or HOLIM values. PRLOAD is operational only when the block is in Auto and the Batch Control Option is configured. It provides a normalized output between 0-100%.

PROPT Propagate Error Option is a short integer input. PROPT was changed from a Boolean to a Short Integer in I/A Series software v8.5 for this block. It can be set to 0-2, with the following exception:

NOTE

If PROPT is configured from IACC v2.4 or later, it can only be set to 0 or 1.

- 0 = option is disabled (default)
- 1 = set the ERROR Status bit of the output parameter (OUT) if the input to the MEAS parameter is in error (see below) while the block is in Auto
- 2 = copy (propagate) the BAD, OOS (Out-of-Service), and ERROR status bits from the MEAS parameter to the output parameter (OUT). This value cannot be set from IACC v2.4 or later.

The input to the MEAS parameter is in error when:

- Its BAD status bit is set true
- Its OOS (Out-of-Service) status bit is set true
- Its ERROR status bit is set true
- It is experiencing peer-to-peer path failure.

If a transition to Manual occurs while the ERROR status is true, it remains true until either a set command is written to that output or until the block transfers to Auto with the error condition returned to normal.

PRSCAS Present Cascade State is a data store that indicates the cascade state. It has the following possible values:

Value	State	Description
1	“INIT_U”	Unconditional initialization of the primary cascade is in progress.
2	“PRI_OPN”	The primary cascade is open.
3	“INIT_C”	Conditional initialization of the primary cascade is in progress.
4	“PRI_CLS”	The primary cascade is closed.
5	“SUP_INIT”	The supervisory cascade is initializing.
6	“SUP_OPN”	The supervisory cascade is open.

Value	State	Description
7	“SUP_CLS”	The supervisory cascade is closed.

PRSCON

Present Control state is a short integer data store that contains the sub-states of Auto:

1 = Holding
2 = Tracking
3 = Controlling (not open loop).

PRSTUN

Present tuner operational state:

-1 = Manual Tune
 0 = Pretune
 1 = Selftune.

PRTYPE

Priority Type is an indexed output parameter that indicates the alarm type of the highest priority active alarm. The PRTYPE output of this block includes the following alarm types:

0 = No active alarm

1 = High Absolute

2 = Low Absolute

3 = High High

4 = Low Low

5 = High Deviation

6 = Low Deviation

7 = Rate alarm

8 = BAD Alarm

PTNREQ

Pretune Request is a user-set short integer input that initiates the Pretune function. The controller must be in Manual, and the process should be reasonably stationary before setting PTNREQ to 1. You can abort Pretune by resetting PTNREQ to 0.

QALSTA

Quality Status parameter (QALSTA) is a non-configurable packed long that provides a combination of value record status, block status (BLKSTA), and alarm status (ALMSTA) information in a single connectable output parameter. Available bits for this block are provided below.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1]	Definition	Contents	Boolean Connection (B32 to B1)
30	Alarms Unacknowledged	ALMSTA.UNA	QALSTA.B2
29	Alarms Inhibited	ALMSTA.INH	QALSTA.B3
25	High-High Absolute Alarm	ALMSTA.HHA	QALSTA.B7
24	Low-Low Absolute Alarm	ALMSTA.LLA	QALSTA.B8
21	High Deviation Alarm	ALMSTA.HDA	QALSTA.B11
20	Low Deviation Alarm	ALMSTA.LDA	QALSTA.B12
19	High Output Alarm	ALMSTA.HOA	QALSTA.B13
18	Low Output Alarm	ALMSTA.LOA	QALSTA.B14
17	High Absolute Alarm	ALMSTA.HMA	QALSTA.B15
16	Low Absolute Alarm	ALMSTA.LMA	QALSTA.B16
5	Manual	BLKSTA.MA	QALSTA.B27
4	Low Limited	MEAS.LLO status	QALSTA.B28
3	High Limited	MEAS.LHI status	QALSTA.B29
2	Uncertain	MEAS.ERR status	QALSTA.B30
1	Out-of-Service	MEAS.OOS status	QALSTA.B31
0	Bad	MEAS.BAD status	QALSTA.B32

1. Bit 0 is the least significant, low order bit.

RATD — Ratio Deriv/period of oscillation is a real input.

RATI — Ratio Int/period of oscillation is a real input.

REMSW — Remote Switch is a boolean input. When true, REMSW overrides the unlinked LR and INITLR parameters, and drives the block to the Remote state. If both LOCSW and REMSW are true, LOCSW has priority.

RI1 to RI2 — Range Input is an array of real values that specify the high and low engineering scale and change delta of a particular real input. For a given block, it also forms an association with a group of real input parameters that have the same designated range and change delta.

RO1 — Range Output is an array of real values that specify the high and low engineering scale of a particular real output. For a given block, it also forms an association with a group of real output parameters that have the same designated range.

RSP — Remote Setpoint is the selected setpoint source when LR is set to Remote. RSP is a real input. Typically RSP connects to an upstream block in a cascade scheme. RSP and its source must be expressed in MEAS units.

SE — Supervisory Enable is a boolean input that enables/disables Supervisory Control in a block.

0 = Disable
1 = Enable.

SETTLE
: Settle is an override input that holds the self tuning algorithm in the Settle substate of the self-tune state. An operator or a linked source can use this parameter to inhibit self-tune adaptation during undesirable process conditions. This feature can alleviate the need for the operator to manually return the self-tune algorithm to the STN mode after an abnormal process condition.

SIGN
: Sign is a real value representing the sign of the first error peak.

SPLCOP
: Sample Controller Option enables the PIDXE to operate as a sampling controller with an effective control period much larger than the block's PERIOD parameter. The effective period can be controlled asynchronously by TSAMPL or synchronously by SPLRDY. In the PIDX and PIDXE blocks, SPLCOP invokes a run-hold duty cycle mode of operation. If True, the control algorithm can be executed when triggered by SPLRDY or with the variable update interval TSAMPL. In the PID and PIDX, SPLCOP invokes a run-hold duty cycle.

SPLRDY
: Sample Ready is a boolean pulse input. On a 0-to-1 transition, SPLRDY clocks the block from the Sample and Hold state to the Control state. If used with the TSAMPL timer, SPLRDY synchronizes the timer with an external event.

SPT
: Setpoint always represents the active controller setpoint. Setpoint is the reference variable that is compared with the MEAS input to produce the ERROR signal. SPT is implemented as a configurable output that determines its source from the Local/Remote setpoint selector, LR. When LR is true (Remote), SPT is nonsettable and assumes the Remote Setpoint (RSP) value. When LR is false (Local), SPT is an unsecured, and thus settable, output and the SPT source is the set value. Configure the value you want the SPT to assume when it first goes to Local. As an output, SPT can also source the setpoint value to other blocks.

While settable by default, SPT is nonsettable while setpoint tracking is active. (See STRKOP.)

STNREQ
: Self-Tune Request is a boolean input that drives the self-tuning algorithm into the self-tune operational mode. It can be initiated by either an operator request or by a connection-based signal. If STNREQ is set to 1, self-tuning begins when both PTNREQ and STHREQ are 0. Resetting STNREQ turns self tuning off. The active tuning constants remain active but the adapted stored tuning sets are erased.

STRKOP
: Setpoint Track Option is a short integer input. When active, STRKOP enables the setpoint to track the measurement input under the following conditions.

0 = no option enabled

1 = SPT parameter tracks the measurement input when the block is in Manual, or the cascade is open downstream (Initialization input INITI is true), or Track Enable (TRKENL) is set.

2 = SPT parameter tracks the measurement only when the block is in Manual.

STRKOP is active only when the setpoint source selector LR is in Local.

SPT is nonsettable while setpoint tracking is active. You can change STRKOP only by reconfiguring the block.

SUPBCO

Supervisory Back-Calculated Output (SUPBCO) is a real output that specifies the value to be used by the Supervisory Application to initialize its output to the current setpoint of the block

This parameter also contains the following status bits:

Bit 10: 1= Initialize SUP_IN

Bit 13: 1= SUP_IN is Limited High

Bit 14: 1= SUP_IN is Limited Low

(Both B13 and B14 =1: indicates Supervisory cascade is open).

SUPGRP

Supervisory Group (SUPGRP) specifies the group to which the block is assigned for Supervisory Control. Range: 1 through 8 (default = 1)

SUPOPT

Supervisory Option is a configurable short integer input that specifies whether or not this block is under control of a Supervisory Control application:

0 = No Supervisory control

1 = Set Point Control (SPC) of the block's set point (Supervisory setpoint control (SSC))

2 = Direct Digital Control (DDC) of the block output (Supervisory output control)

NOTE

Setting SUPOPT=2 enables DDC control only, i.e. supervisory control over the output in the PIDXE block. It is not intended to be used with Advanced Process Control (APC), which performs SSC, i.e., supervisory control of the setpoint in the PIDXE. To use APC, configure SUPOPT=1 (or 3 if automatic acknowledgement of a setpoint change is desired).

3 = SPC, with an implicit acknowledge by the CP

4 = DDC, with an implicit acknowledge by the CP

Be aware that options 1 and 2 require an explicit acknowledge by the application software to close the supervisory cascade. This must be done by setting the ACK status bit in the SUP_IN parameter using special OM access functions.

SUP_IN Supervisory Input is a real output that is the parameter set by a Supervisory application when performing supervisory control of this block's set point. SUP_IN also contains a status bit (Bit 10) that must be set by the supervisor to acknowledge a request to initialize (Bit 10 in SUPBCO).

TCTRL Control Time is a real input that specifies the number of minutes the block stays in the Controlling substate when the sample controller option is active. If used with the TSAMPL timer, TCTRL establishes the duty cycle between the Controlling and the Sample and Hold states.

TRACK Track is a real input that provides the input signal block output tracks when the block is in Auto and TRKENL is true.

TRKENL Track Enable is a boolean input that enables the block output to follow the TRACK input.

TSAMPL Sampling Time is a real input parameter that specifies the period, in minutes, of an internal timer that triggers an output update. If external triggering of the control action is desired, set TSAMPL to 0 and use SPLRDY to trigger the output update.

TSTATE Tuner State is an encoded integer output that corresponds to the current substate of the EXACT-tuning algorithm. The assigned integers and the message that each represents are:

SI CODE	Substate Name
SI_-01	MTUNE
SI_000	Quiet
SI_001	Locate First Peak
SI_002	Verify First Peak
SI_003	Locate Second Peak
SI_004	Verify Second Peak
SI_005	Locate Third Peak
SI_006	Verify Third Peak
SI_007	Adjust PID
SI_008	Adapt PID
SI_009	Settle
SI_100	Bump
SI_101	Return Output
SI_102	Wait Steady State
SI_103	Monitor Noise

TYPE When you enter "PIDXE" or select "PIDXE" from the block type list under Show, an identifying integer is created specifying this block type.

UNACK Unacknowledge is a boolean output that the block sets to True when it detects an alarm. It is typically reset by operator action.

WMAX Wait Max is a crude estimate of the time scale of the process and represents the maximum time that the self-tune algorithm waits for the second peak. It should be set larger than half the maximum period of oscillation and smaller than eight times the minimum period of oscillation. You can enter an NB value at configuration or derive a value from a pretune operation.

101.4 Detailed Operation

Each execution cycle, this block provides PID control and then runs its self-tuning algorithm, unless you make the self-tune algorithm inoperable by running the block in the manual-tune mode. Since this algorithm tunes a three-term interactive PID controller, the PIDXE block does not use a MODOPT parameter. The block operates as a PI-only controller, in the self-tune mode if the Derivative Factor (DFCT) is 0.0, or in the manual-tune mode when DERIV equals 0.0.

When in the control portion of the execution cycle, the block generates an output that incorporates the following:

1. A Proportional factor based on a user specified proportional band applied to an error term. The error term equals the setpoint (SPT) minus the derivative factor applied to the measurement (MEAS).
2. An Integral factor derived from a first-order lag of the block's integral feedback (FBK) input.
3. A Derivative factor with a second order Butterworth filter applied to the measurement (MEAS).

The MEAS parameter is an input identifying the source of the signal that is coming to this block as the controlled variable in the control loop.

The SPT parameter is the active controller setpoint. SPT can be set in Local, or is made equal to RSP in Remote, or is made equal to SUP_IN in Supervisory Control. SPT can be used as a source for other blocks.

The setpoint sources are prioritized as follows:

1. Supervisory Control
2. Local (LOCSW) and Remote Switch (REMSW)
3. Local or Remote.

When the Supervisory Option (SUPOPT) is set to 1-4, it specifies that the block can be under control of a Supervisory Application Program. The Supervisory Back Calculated Output (SUPBCO) provides the current setpoint and initialization bits to the Supervisory Application Program. When Supervisory Enable (SE) is set by the application program or operator, the PIDXE block is prepared to do Supervisory Setpoint Control (SSC) functions. When the proper handshaking occurs with the application software, the block accepts sets to the Supervisory Setpoint (SUP_IN). If the block is in Auto, it then uses the supervisory setpoint in the calculation of the block's output.

If SUPOPT is set to 1 or 2, the handshake requires the application software to return an explicit acknowledge to close the supervisory cascade. The software must set the ACK status bit in the SUP_IN parameter using special OM access functions. However, if SUPOPT is set to 3 or 4, this acknowledgement is implicitly provided by the CP and is not required from the user application software. In the latter case, the CP closes the supervisory cascade automatically when the supervisory input (SUP_IN) is written by the application, provided the block is in the Supervisory Initialization (SUP_INIT) state. The control block enters the SUP_INIT state when supervisory control is enabled in the block and the cascade is closed downstream. Upon entering this state, the CP sets the initialize request bit (INITC) in the SUPBCO parameter for the application software. When SUP_IN is then written by the software, the CP access logic sets the ACK status automatically in the SUP_IN parameter. When the block runs, the CP block logic then closes the supervisory cascade automatically.

The setpoint source selector input, LR (Local/Remote), together with the two overrides, LOCSW and REMSW, determines the setpoint source at any time.

When LR is switched to local, the block sets the BCALCO initialization status value to true, and releases the SPT parameter, allowing any user to input the desired controller setpoint value. The setpoint track option, STRKOP, can be used to assure bumpless transfer.

When LR is switched to Remote (true), SPT is no longer settable and takes on the value of the remote setpoint input, RSP. RSP provides a link to the remote setpoint source. If RSP is unlinked when LR is true, the block forces the LR parameter to local and secures it.

The PIDXE block also provides the LOCSW and REMSW parameters to drive the setpoint state to Local or Remote.

LOCSP allows the block to secure the LR parameter when the block initializes and to maintain that secured state except when LOCSW and/or REMSW is asserted.

When the block is in the Remote mode, the status of the local setpoint (SPT) tracks the status of the remote setpoint (RSP).

When the block is switched to Local mode, the setpoint status depends on the setpoint tracking option (STRKOP):

- If STRKOP = 1 or 2, the SPT status is cleared.
- If STRKOP = 0, the SPT status reflects the RSP status at the time the switch to Local occurred. The block maintains this status as long as block is in Local, unless you change the SPT value via data access. At that time the status is cleared.

The local setpoint is clamped each cycle when the setpoint mode is Remote, Local, or Supervisory. The clamp limits used are the measurement scale limits HSCI1 and LSCI1. If the setpoint value before clamping is equal to or less than LCSI1, status bit LLO of SPT is set true. If the value before clamping is equal to or higher than HSCI1, status bit LHI of SPT is true.

The PIDXE block has two output states, Auto and Manual. In Manual, the block releases the output, allowing it to be set by you. In Auto, the block secures the output.

Auto has three substates: Controlling, Tracking, and Holding.

Closed loop automatic PID control is actually performed in the substate of Auto called Controlling. In this state, the block computes the output signal based on the deviation between SPT and MEAS. Proportional control is fixed by the steady state gain term (100/PBAND).

Integral control action is generated by feeding back the external integral feedback signal (FBK) through a first order lag. INT, the integral setting of the controller, fixes the time constant of the lag. Such a scheme avoids the pitfalls of integral windup. See “Normal Configuration” on page 1976 for more details.

Derivative control action consists of a second-order Butterworth filtering of the Measurement signal. Both the time constant and the derivative gain of this filtering action are fixed by the user-specified DERIV parameter.

In Auto, the computed output value undergoes limiting. Limiting clamps the output between the variable output limits, HOLIM and LOLIM. You can place these limits anywhere within the range defined by LSCO1 and HSCO1. Moreover, the output span variance parameter (OSV) enables you to extend this range at both the high and low ends by an equal amount, up to 25 percent. If you set LOLIM higher than HOLIM, then HOLIM is automatically set equal to the higher of the two values, which is LOLIM. The block provides, for control purposes, output limit indicators that are active when the output is clamped at either limit.

In Auto, when you switch the setpoint source selector from Local to Remote, the transfer is made bumpless by removing derivative dynamics (if applicable) and forcing the integral to absorb any proportional action.

Switching from Remote to Local is always bumpless, because SPT retains the last value transferred from the remote setpoint. For cascade purposes, the block sets the BCALCO initialization status value true when the setpoint is under local control, or when the block is open-looped. This tells an upstream block to perform an explicit initialization, so that the return to remote setpoint operation is bumpless.

The block goes to Tracking when the BCALCI initialization status value is set true, as long as the block is not in HOLD, and there is no control error. The block performs explicit initialization in the Tracking substate. When the BCALCI initialization status value returns to false, the block returns to the Controlling substate to resume closed-loop control.

In the Tracking substate, OUT = BCALCI unless BCALCI is out of range, in which case OUT is clamped between the LOLIM and HOLIM values. The block calculates the BCALCO parameter, sets the BCALCO initialization status value to true (requesting upstream blocks to perform their own explicit initialization), and sets bit 6 (TRCK) in the BLKSTA parameter.

When the PIDXE block is the upstream block in a cascade control scheme, output tracking (BTRKOP = true) assures a bumpless transfer for the downstream block.

Output tracking, a feature of the PIDXE block, functions only when the controller is in Auto. While the TRKENL input is true, the output is forced into the Tracking substate of Auto; but the output tracks the Track input instead of the BCALCI input as in the explicit initialization that occurs when the BCALCI initialization status value is true. If both the BCALCI initialization status value and TRKENL are true, BCALCI takes precedence and the output tracks BCALCI. Output clamping is still active. If the block detects control errors, it bypasses output tracking and goes to the Holding substate, which holds the last good output.

During Auto operation, the block checks the critical inputs MEAS, FBK, and BCALCI for data errors (off-scan, or BAD, OOS or ERROR status bits set). If an error is detected, the PID block, depending on the value of the CEOPT parameter (see CEOPT definition), can propagate the error to its outputs by setting the ERROR status bit of the output, OUT.

The block goes to Hold if, while MBADOP = 0 and CEOPT = 1 or 2, either the HOLD parameter goes true, or a condition required by the CEOPT parameter is met.

In the Hold substate, OUT keeps the last good value before the block went into Hold, and the block secures this value against any changes. The block sets the BCALCO status to bad and sets bit 7 (HOLD) in the BLKSTA parameter.

When all error conditions have ceased, the block returns to the Controlling substate and resumes closed loop control.

No implicit Hold action takes place if CEOPT = 0.

A transition to Manual sets all alarm and limit indicators to false.

If MBADOP = 1 or 2 (and the MA parameter is unlinked), the block goes to the Manual state when it detects a control error or when the HOLD input goes true, regardless of the CEOPT value. MBADOP has the same priority as MANSW and has precedence over AUTSW. Therefore, if MBADOP = 1 or 2 and a bad input is detected, the block goes to Manual regardless of the AUTSW setting.

When the block is switched to Manual, the OUT status reflects the MEAS/SPT status at the time the switch occurred. While the block is in Manual, it maintains this status until you change the OUT output via data access. At that time, the block clears the status.

During Manual operation, PID control is not performed. Alarm outputs are settable. The controller output (OUT) is unsecured and can have its value set by an external task or program and, if the manual clamp option (MCLOPT) is configured, these set values undergo output clamping.

The setpoint track option forces the local setpoint (SPT) to track the measurement. While setpoint tracking is active, SPT becomes nonsettable to prevent any user from manipulating the local setpoint value. Setpoint tracking is only performed if the setpoint source selector is switched to Local and the block is either operating in Manual or the BCALCI initialization status value is true. BCALCI status value being true indicates that a block downstream in the cascade is open loop.

The following summarizes the secured/released condition of the SPT parameter:

SPT is secured (non-settable) if any of the following are true:

- The block is in Remote mode, that is, LR is true. In this case, BLKSTA.LR is also true.
- Supervisory control is enabled, that is, SUPOPT is set to 1 or 3 and BLKSTA.SE is true, and SUP_IN is not in error.
- Setpoint tracking is active, that is, BLKSTA.STRK is true. In order for this status bit to be true, all of the following conditions must exist:
  - The STRKOP parameter must be 1 or 2.
  - There must be no control error condition.
  - One of the following conditions must be true:
    - The block is in Manual mode.
    - The cascade is open downstream (either the data value of BCALCI is true, or the LHI and LLO status bits of BCALCI are simultaneously true).
    - A request for conditional initialization has been received from downstream.
    - Parameter TRKENL is true.

Otherwise SPT is released (settable).

When the block restarts, the INITMA configured option specifies the value of the MA parameter, unless MA has an established linkage, or MANSW or AUTSW is set true. Likewise, the INITLR specifies the value of the LR parameter, unless LR is linked, or LOCSW or REMSW is set true.

The PIDXE block offers a Nonlinear Gain Option to specify a gain factor and a zone of error values in which this alternate gain multiplies 100/PBAND. This nonlinear zone is defined by the HZONE and LZONE parameters, and is situated, but not necessarily centered, about zero error.

The PIDXE block offers two other options, the Batch Control option and the Sampling Controller option. Both function only while the block is in the Automatic state.

The Batch Option presets the integral term of the PID to the value of PRLOAD while the controller output is limited, a situation often arising at the start of a batch process.

Operationally, the Batch Option preloads the integral term of the controller to the value of the preload (PRLOAD) input whenever the output is being clamped at either its high or low output limit. The PRLOAD input is usually set according to the anticipated load conditions to prevent overshoot following startup.

The Sampling Controller option operates in two modes, synchronous and asynchronous. Both modes cycle the block between the S/Hold (Sample and Hold) and the Controlling substates of Auto and both use the Control Time parameter (TCTRL) to fix the length of time that the controller stays in the Controlling substate.

The synchronous mode presumes a strobe input from the measurement source that tells the controller that collection of the data from a chromatograph or other slow-sampling measuring instrument is completed. This “Sample Ready” strobe input is connected to the block’s SPLRDY (Sample Ready) parameter.

In operation, the block waits in the S/Hold state taking data until a positive transition of the SPLRDY input drives the block to the Controlling substate. In this substate, the block performs normal closed-loop automatic PID control. After a time period defined by TCTRL (Control Time), the controller is forced back to the S/Hold state to await the next SPLRDY input. Controller tuning must take the duty cycle into account.

The asynchronous mode presumes no timing inputs from the source. In this mode, the block waits in the S/Hold state collecting data until a strobe from an internal Sample Timer drives the block to the Controlling substate. After controlling for a time period defined by TCTRL, the controller is forced back to the S/Hold state to await the next Sample Timer strobe. The Sample Time parameter (TSAMPL) fixes the period of the internal repeating Sample Timer.

In a synchronous operation, you can disable the Sample Timer by setting TSAMPL (Sample Time) to zero. This ensures that the controller initializes to the S/Hold state and produces no control action before a valid measurement is available.

The EXACT-tuning algorithm is separate from the PID algorithm, and operates without affecting the operation of the PID control algorithm except to provide new working values of PBAND, INT, and DERIV following a process upset. The operator can override even this action by placing the self-tune algorithm in either the Manual Tune state, or the Settle substate of the Self-Tune state.

The PIDXE block has three sets of P, I, and D values:

1. The working values – these are the values used by the PID control algorithm; PBAND, INT, and DERIV. Working values are obtained from 1) the real values entered at block configuration, or 2) the self-tune algorithm after a process upset, or 3) the Memory values when copied to the working values by the operator.

   Although the parameters PBAND, INT, and DERIV are listed as connectable, they must not be linked to other blocks if exact self-tuning is desired. Linking these parameters to other blocks secures these working values from other sources such as the Memory values and the self-tune algorithm.

2. The memory values – these are values of P, I, and D that are stored into the PM, IM, and DM parameters by the operator to be recalled later for a special situation or because the loop performed particularly well with these values. The operator-initiated PID Recall function loads these memory values into the PID working value records.

3. The reference values – these parameters, PR, IR, and DR, are used to form a range of values which restrain, and clamp, the working values. Reference values are obtained from the real values entered at block configuration or from a Pretune operation.

The self-tune algorithm has three primary states: Manual-Tune (MTN), Self-Tune (STN), and Pretune (PTN).

When the PIDXE block is initialized, the self-tuning algorithm goes to the MTN state. EXACT-tuning is inoperable in the MTN state. MTN is the only state that responds to the PIDRCL signal that is sent when the operator requests a PID Recall. If any of the working values are linked, PID Recall is ignored.

The algorithm enters the other two states, PTN and STN, only through the MTN state. Furthermore, both these states exit only to the MTN state. This description moves first from the manual-tune state to the Pretune state and then to the self-tune state.

Before the EXACT-tune algorithm can operate, the operator has to provide several tuning range parameters. Pretune can help the operator who is tuning an unfamiliar loop obtain values for some of these parameters. Specifically it does this by running through an open-loop upset and getting some rough estimates for the IR, PR, DR, NB, and WMAX parameters. When more reliable values are not already available, the operator can have these estimates stored into the reference values by requesting pretune from the detail display.

To enter the PTN state, the block must be in Manual and the EXACT-tune algorithm must be in the MTN state when you make a pretune request at the detail display. BMP is the only parameter you must define for a pretune. BMP is the output step change that causes the measurement to undergo the “process reaction curve” (a minimum of 2.5 percent of the measurement span).

The “process reaction curve” identifies the process deadtime and the process sensitivity. The algorithm uses the deadtime to estimate the reference values for the integral time (IR), the derivative time (DR), and the maximum wait time (WMAX). Both the process sensitivity and the deadtime enter into the estimate for the proportional band reference (PR). Pretune produces overly conservative tunings for a dominant deadtime process.

Pretune estimates the noiseband (NB) by determining the amplitude of the measurement component whose frequency is too high for the closed loop to remove. Reduce the Derivative Factor (DFCT) if NB is high, since derivative is ineffective in a high-noise environment.

When the pretune operation is complete, the algorithm sets the pretune request to false, causing an automatic return to the MTN state.

Before entering the STN mode, the operator or the configuration must define the following parameters.

To establish ranges for P, I, and D, the algorithm needs the reference values (PR, IR, and DR), the change limit (CLM) value, and the derivative factor (DFCT).

To accurately detect peaks, and to correct for the oscillating or the overdamped response, the algorithm needs values for the noiseband (NB), the maximum wait time (WMAX), and the output cycling limit (LMT).

To confirm that its computed values provides the desired closed-loop response, the algorithm needs values for the maximum allowed damping (DMP) and the overshoot limit (OVR).

To enter the self-tune state (STN), the block’s working values must be free of linkages, the self-tune algorithm must be in the MTN state, when the self-tune request (STNREQ) is true. STNREQ can, based on its configuration, come from the operator or from another control block.

Once in STN, the EXACT-tuning algorithm remains in this state until STNREQ is set false or, the block is initialized.

In STN, the algorithm looks at the error each block execution cycle, immediately after the PID algorithm is completed. As long as the error magnitude does not exceed twice the NB, the STN mode remains in its quiescent state.

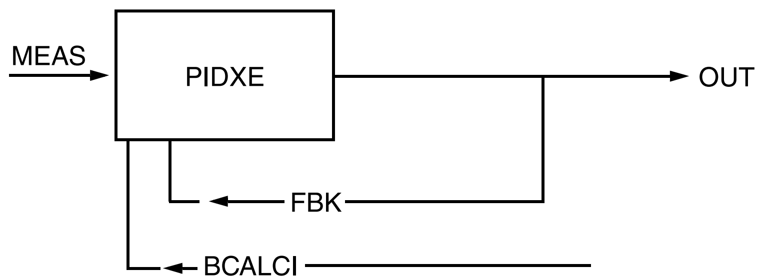
If the error magnitude does exceed twice NB, the algorithm records the next three peaks in the error curve. Based on the magnitude of these three peaks and the period of time between peaks, the algorithm computes new values for P, I, and D, and checks that they are consistent with other user-defined parameters. If they are consistent, the self-tune algorithm copies them into the PID algorithm's working values.

If the computed values violate any of these constraining parameters (for example, Overshoot, or Damping), the algorithm adjusts one or more of the computed values and rechecks for consistency until it meets all constraints.

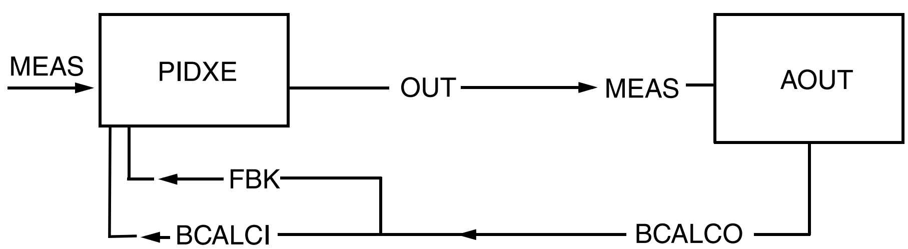
101.4.1 Normal Configuration

Normal configuration of the PIDXE block is as follows:

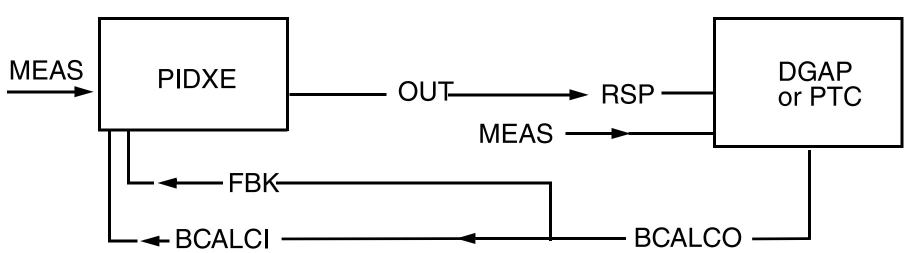
If there are no downstream control blocks, then link the FBK parameter to the OUT parameter.



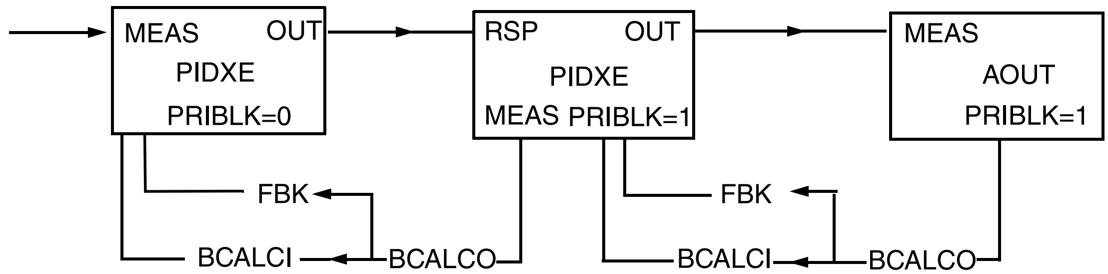
If the downstream block is an AOUT block, link BCALCI and FBK to the downstream block's BCALCO parameter.



If the secondary block is a DGAP or PTC block, link BCALCI and FBK to the secondary block's BCALCO parameter.



In a cascade configuration, link the blocks as shown below.



In a cascade configuration, connect the FBK of the primary to the BCALCO of the secondary controller to prevent windup.

Use the PRIBLK option in all cascade configurations.

101.4.2 PRIBLK and PRITIM Functionality

The Primary Block (PRIBLK) parameter indicates whether the PIDXE block has a connection from an upstream block (PRIBLK=1) or not (PRIBLK=0). Its value, together with that of the Primary Cascade Timer (PRITIM), determines whether the PIDXE block remains in Hold for a fixed time delay (of length defined by PRITIM), or ends the Hold when the Acknowledge status bit (Bit 10) of MEAS is detected from the upstream block (if PRITIM = 0.0). During initialization, the acknowledgement is not required and a Hold of one cycle only occurs.

101.4.3 HZONE and LZONE (Conversion to PIDA)

As mentioned in “PIDA is Recommended Over Other PID Algorithms” on page 1820, you may wish to convert existing PIDXE blocks to PIDA blocks. Before performing this conversion, be aware that in the PIDXE block, the HZONE and LZONE parameters are expressed in engineering units, while in the PIDA block (and other PID-type blocks), these parameters are expressed as a percentage of the measurement span.

You must change HZONE and LZONE accordingly if you wish to retain the same behavior in the PIDA block as was performed in the PIDXE block.

The following formulas are provided for converting HZONE and LZONE values in a PIDXE block to the values needed for a PIDA block.

For HZONE:

[PIDA HZONE] = (([PIDXE HZONE])/([PIDXE HSCI1] - [PIDXE LSCI1])) * 100

For LZONE:

[PIDA LZONE] = (([PIDXE LZONE])/([PIDXE HSCI1] - [PIDXE LSCI1])) * 100

where:

[PIDA HZONE] is the value of HZONE in the PIDA block

[PIDA LZONE] is the value of LZONE in the PIDA block

[PIDXE HZONE] is the value of HZONE in the PIDXE block

[PIDXE LZONE] is the value of LZONE in the PIDXE block

102. PIDE – PID With EXACT Block

This chapter describes the PID with EXACT Block, its features, parameters and detailed operations.

102.1 Overview

The PIDA (with FBTUNE and FFTUNE when necessary) is recommended for use in all PID applications. The PIDA block has all of the functionality of the older PID algorithms plus additional functionality. See “PIDA – Advanced PID Block” on page 1819 for more details.

The PIDE (Proportional-Integral-Derivative with EXACT) block adds a self-tuning function to the traditional functions of a three-term interacting PID controller. The PID portion of this block behaves exactly as the PID block except that the PIDE block does not support the MODOPT parameter.

102.1.1 I/O Diagram

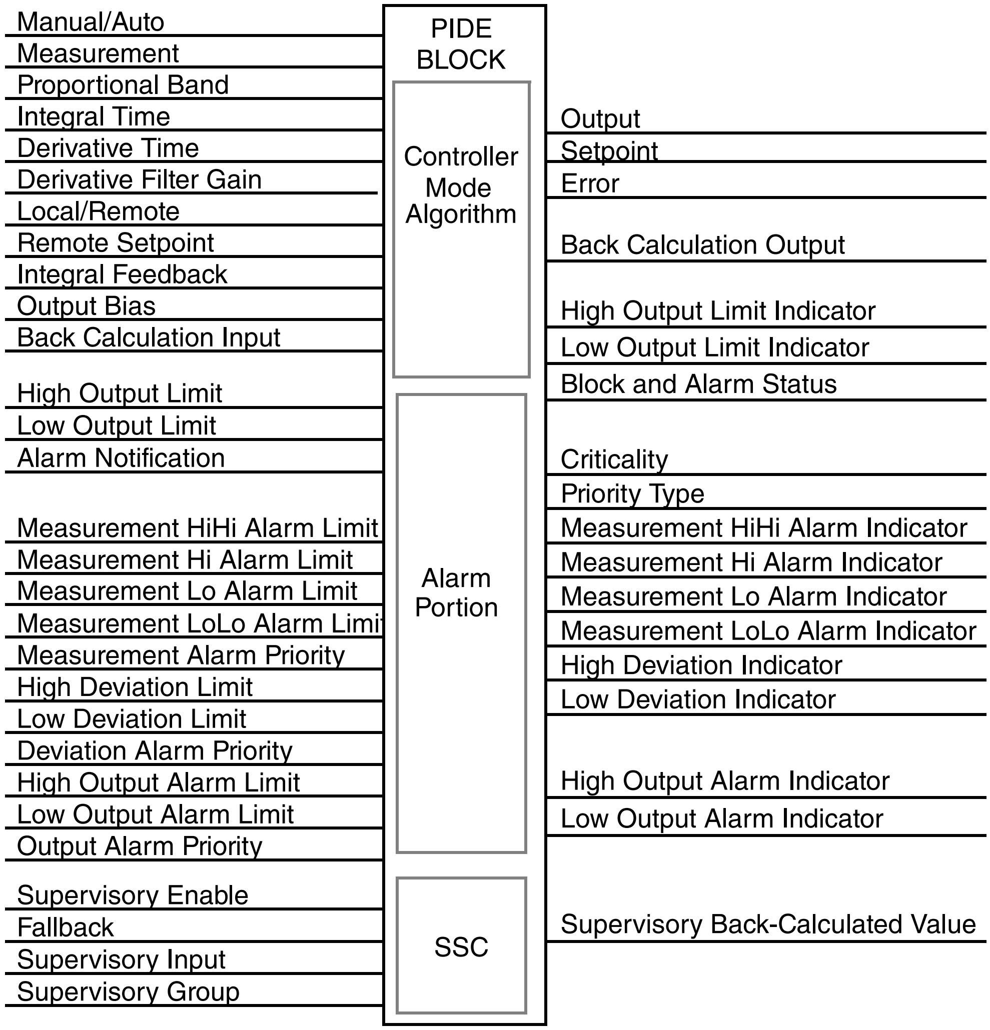


Figure 102-1. PIDE Block I/O Diagram

102.2 Features

The features are:

- Manual/Auto control of the outputs, which can be initiated by a host process or another block
- Auto and Manual latch switch inputs (AUTSW and MANSW) that allow the block to be switched to Auto or Manual
- Local/Remote setpoint source selection
- Local and Remote latch switch inputs (LOCSW and REMSW) that allow the block to be switched to Auto or Manual
- Derivative filtering using a second-order Butterworth filter for high frequency noise rejection
- External integral feedback to prevent windup during closed loop operation

- Separate assignable engineering range and units to the parameters Measurement, Bias, and Input
- Bumpless transfer of the output signal when the block returns to controlling operation in Auto
- Adjustable derivative gain parameter (KD)
- Automatic scaling, based on assigned engineering ranges, so that the controller gain is normalized
- Output biasing with scaling
- Output clamping between variable output limits
- Bad inputs detection and handling
- Automatic cascade handling using an input and output parameter (back-calculated) that includes:
  - Initialization of cascade schemes
  - Back calculation of the setpoint input for the upstream block, to provide bumpless cascade operation when the cascade is open loop
- Supervisory Control (SSC) allows user application software to perform supervisory control over the PIDE block's setpoint.

The options are:

- Setpoint Tracking Option (STRKOP) forces the setpoint to track the Measurement signal. STRKOP takes this action when the LR parameter has transitioned in either direction and 1) either the output is in Manual or a cascade is broken (a downstream block is in open loop - INITI true) or the block is in Manual, or 2) when the block is in Manual only. This feature enables a bumpless return to automatic control when the PIDE or any downstream block returns to closed-loop operation. The block does not perform STRKOP if any critical data errors are detected.
- Manual if Bad Option (MBADOP) is a Manual override feature. When MBADOP = 1 or 2, the block sets an unlinked MA input to Manual when it detects bad status of a control input (MEAS, FBK, and/or INITI) or optionally (when MBADOP = 2), if the Remote Setpoint (RSP) is not healthy (i.e., value status is BAD or has a broken OM connection). This forces the output state to Manual. Returning to Auto requires external intervention, unless AUTSW is true.
- Returning to Auto requires external intervention, unless AUTSW is true.
- Increase/Increase Option (INCOPT) reverses the normal sense of the control action so that the controller output increases with increasing measurement.
- Measurement Alarming Option (MALOPT) provides absolute alarming of the measurement during auto operation. This option also provides standard alarm notification and reporting features.
- Deviation Alarm Option (DALOPT) enables (when true) deviation alarming of the measurement-setpoint error signal.
- High-High Alarm Option (HHAOPT) enables High-High and Low-Low absolute alarming for the measurement input, or disables absolute alarming altogether. Each alarm triggers an indicator (HHAIND or LLAIND) and text message (HHATXT and LLATXT) at a given priority level (HHAPRI) to be sent to the configured alarm

group (HHAGRP). Once an alarm limit (HHALIM or LLALIM) is exceeded, the indicators remain set until the measurement returns within the defined limit plus (or minus) the deadband (MEASDB).

0 = No alarming

1 = High-High and Low-Low alarming

2 = High-High alarming only

3 = Low-Low alarming only.

- Manual Alarming Option (MANALM) allows you to invoke, while the block is in manual, either all configured alarm options or all configured alarm options *except* output alarming. Otherwise, alarming is normally performed only in Auto.
- Manual Clamping Option (MCLOPT) allows you to invoke output clamping while the block is in manual. You can alter this boolean input at the workstation.
- Output Alarm Option (OALOPT) enables (when true) absolute alarming of the block output signal (OUT).
- Unacknowledge (UNACK) is a boolean output parameter which is set true, for notification purposes, whenever the block goes into alarm. It is settable, but sets are only allowed to clear UNACK to false, and never in the opposite direction. The clearing of UNACK is normally via an "acknowledge" pick on a default or user display, or via a user task.
- Bias Track Option (BTRKOP), when true, forces the algorithm's output Bias to track the block output (OUT). BTRKOP is a boolean input that you can change only by reconfiguring the block.
- Control Error Option (CEOPT) allows you to enable, or disable, the block's implicit Hold action when it detects an error in the MEAS, FBK, or BCALCI input.
- Propagate Error Option (PROPT) gives you the option of propagating the ERROR status bit from the MEAS input to the block's OUT parameter.
- Local Setpoint Secure (LOCSP) enables you to secure against any write access to the LR parameter.
- Manual If Failsafe (MANFS) allows you have the block go to the Manual state when the block receives a Failsafe notification.
- Supervisory Option (SUPOPT) specifies whether or not the block is to be under control of a Supervisory Application Program.
- Fallback Option (FLBOPT) specifies the action taken in a block when Supervisory fallback occurs. The fallback options can be: normal fallback, Auto, Manual, Remote, or Local.

102.3 Parameters

Table 102-1. PIDE Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars

Table 102-1. PIDE Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
TYPE	block type	integer	no-con/no-set	122	PIDE
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
MEAS	process input	real	con/set	0.0	RI1
HSCI1 to HSCI2	high scale in 1 to 2	real	no-con/no-set	100.0	specifiable
LSCI1 to LSCI2	low scale in 1 to 2	real	no-con/no-set	0.0	specifiable
DELTI1 to DELTI2	change delta 1 to 2	real	no-con/no-set	1.0	percent
EI1 to EI2	eng units input	string	no-con/no-set	%	specifiable
PROPT	propagate error	boolean	no-con/no-set	0	0 to 1
SPT	setpoint	real	con/set	0.0	RI1
FBK	reset feedback	real	con/set	0.0	RO1
PBAND	proportional band	real	con/set	1000.0	[0.1..]percent
INT	integral time	real	con/set	100.0	[0..]minutes
DERIV	derivative time	real	con/set	0.0	[0..]minutes
KD	derivative gain	real	con/set	10.0	[10.0..50.0]
INCOPT	increase/increase option	boolean	no-con/no-set	0	0 to 1
HSCO1	high scale out 1	real	no-con/no-set	100.0	specifiable
LSCO1	low scale out 1	real	no-con/no-set	0.0	specifiable
DELTO1	change delta 1	real	no-con/no-set	1.0	percent
EO1	eng unit output	string	no-con/no-set	%	specifiable
HOLIM	high output limit	real	con/set	100.0	RO1
LOLIM	low ouput limit	real	con/set	0.0	RO1
OSV	span variance	real	no-con/no-set	2.0	[0..25]percent
BIAS	bias	real	con/set	0.0	RI2
BBIAS	offset for the bias	real	no-con/no-set	0.0	RO1
KBIAS	bias scale or gain factor	real	no-con/no-set	1.0	scalar
BTRKOP	bias track option	boolean	no-con/no-set	0	0 to 1
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	[0|1|2]
MANFS	manual If failsafe	boolean	no-con/no-set	0	0 to 1
MBADOP	manual bad option	short	no-con/no-set	0	[0|1|2]
MANSW	manual switch	boolean	con/set	0	0 to 1
AUTSW	auto switch	boolean	con/set	0	0 to 1
MCLOPT	manual clamp option	boolean	no-con/no-set	0	0 to 1
CEOPT	control error option	short	no-con/no-set	1	0 to 2
HOLD	hold mode	boolean	con/set	0	0 to 1
PRIBLK	primary block cascade option	boolean	no-con/no-set	0	0 to 1
PRITIM	primary cascade timer	real	no-con/no-set	0.0	seconds
INITI	initialize in	short	con/set	0	0 to 1
BCALCI	back calculate in	real	con/set	0.0	RO1
LR	local/remote	boolean	con/set	0	0 to 1
INITLR	initialize LR	short	no-con/no-set	2	[0|1|2]
LOCSP	local setpoint	boolean	no-con/no-set	0	0 to 1
LOCSW	local switch	boolean	con/set	0	0 to 1

Table 102-1. PIDE Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
REMSW	remote switch	boolean	con/set	0	0 to 1
RSP	remote setpoint	real	con/set	0.0	RI1
STRKOP	setpoint track option	short	no-con/no-set	0	[0|1|2]
MANALM	manual alarm option	short	no-con/no-set	1	0 to 4
INHOPT	inhibit option	short	no-con/no-set	0	0 to 3
INHIB	alarm inhibit	boolean	con/set	0	0 to 1
INHALM	inhibit alarm	pack_b	con/set	0	0 to 0xFFFF
MEASNM	meas alarm name	string	no-con/no-set	blank	1 to 12 chars
MALOPT	meas alarm option	short	no-con/no-set	0	0 to 3
MEASHL	meas high alarm limit	real	con/set	100.0	RI1
MEASHT	meas high alarm text	string	no-con/no-set	blank	1 to 32 chars
MEASLL	meas low alarm limit	real	con/set	0.0	RI1
MEASLT	meas low alarm text	string	no-con/no-set	blank	1 to 32 chars
MEASDB	meas alarm deadband	real	no-con/set	0.0	RI1
MEASPR	meas alarm priority	integer	con/set	5	[1..5]
MEASGR	meas alarm group	short	no-con/set	1	[1..8]
DALOPT	deviation alarm option	short	no-con/no-set	0	0 to 3
HDALIM	high deviation limit	real	con/set	100.0	RI1
HDATXT	high deviation alarm text	string	no-con/no-set	blank	1 to 32 chars
LDALIM	low deviation limit	real	con/set	-100.0	RI1
LDATXT	low deviation alarm text	string	no-con/no-set	blank	1 to 32 chars
DEVADB	deviation alarm deadband	real	no-con/set	0.0	RI1
DEVPRI	deviation alarm priority	integer	con/set	5	[1..5]
DEVGRP	deviation alarm group	short	no-con/set	1	[1..8]
HHAOPT	high-high option	short	no-con/no-set	0	0 to 3
HHALIM	high-high limit	real	con/set	100.0	RI1
HHATXT	high-high alarm text	string	no-con/no-set	blank	1 to 32 chars
LLALIM	low-low alarm limit	real	con/set	0.0	RI1
LLATXT	low-low absolute text	string	no-con/no-set	blank	1 to 32 chars
HHAPRI	high-high priority	integer	con/set	5	[1..5]
HHAGRP	high-high group	short	no-con/set	1	[1..8]
OALOPT	output alarm option	short	no-con/no-set	0	0 to 3
OUTNM	output alarm name	string	no-con/no-set	blank	1 to 12 chars
HOALIM	high out alarm limit	real	con/set	100.0	RO1
HOATXT	high out alarm text	string	no-con/no-set	blank	1 to 32 chars
LOALIM	low out alarm limit	real	con/set	0.0	RO1
LOATXT	low out alarm text	string	no-con/no-set	blank	1 to 32 chars
OUTADB	output alarm deadband	real	no-con/set	0.0	RO1
OUTPRI	output alarm priority	integer	con/set	5	[1..5]
OUTGRP	output alarm group	short	no-con/set	1	[1..8]
PR	reference proportional band	real	con/set	1000.0	[0.1..]%
IR	reference integral	real	con/set	100.0	[0..]minutes
DR	reference derivative	real	con/set	0.0	[0..]minutes
NB	noise band	real	con/set	1.0	[1.0..30.0]%
DFCT	derivative factor	real	con/set	1.0	[0.0..4.0]
WMAX	wait maximum time	real	con/set	0.5	[0..]minutes

Table 102-1. PIDE Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
CLM	change limit	real	con/set	4.0	[1.25..16.0]
LMT	output cycle limit	real	con/set	80.0	[2.0..80.0]%
OVR	overshoot	real	con/set	[0.5	[0.0..1.0]
DMP	damping factor	real	con/set	0.3	[0.1..1.0]
BMP	output bump	real	con/set	10.0	[-50.0..50.0]%
SETTLE	selftune override	boolean	con/set	0	0 to 1
STNREQ	request selftune	boolean	con/set	0	0 to 1
PM	memory proportional band	real	no-con/set	1000.0	[0.1..]%
IM	memory integral	real	no-con/set	100.0	[0..]minutes
DM	memory derivative	real	no-con/set	0.0	[0..]minutes
FLBOPT	fallback option	short	no-con/no-set	0	0 to 4
FLBREQ	fallback request	short	no-con/set	0	0 to 2
INITSE	intial SE	short	no-con/no-set	0	0 to 2
SUPGRP	supervisory group	short	no-con/no-set	1	1 to 8
SUPOPT	supervisory option	short	no-con/no-set	0	0 to 4
SE	supervisory enable	boolean	no-con/set	0	0 to 1
SUP_IN	supervisory setpoint	real	con/set	0.0	RI1
BATCHO	batch control option	boolean	no-con/no-set	0	0 to 1
AMRTIN	alarm regeneration timer	integer	no-con/no-set	0	0 to 32767 s
NASTDB	alarm deadband timer	long integer	no-con/no-set	0	0-2147483647 ms
NASOPT	nuisance alarm suppression option	short	no-con/no-set	0	0 to 2
OUTPUTS					
ALMSTA	alarm status	pack_l	con/no-set	0	bit map
BCALCO	back calculate out	real	con/no-set	0.0	RI1
BLKSTA	block status	pack_l	con/no-set	0	bit map
CRIT	criticality	integer	con/no-set	0	[0..5]
ERROR	control error	real	con/no-set	0.0	meas minus setpoint
HDAIND	high deviation indicator	boolean	con/no-set	0	0 to 1
HHAIND	high-high absolute indicator	boolean	con/no-set	0	0 to 1
HOAIND	high out alarm indicator	boolean	con/no-set	0	0 to 1
HOLIND	high out limit indicator	boolean	con/no-set	0	0 to 1
INHSTA	inhibit status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
INITO	initialize out	short	con/no-set	0	0 to 1
LDAIND	low deviation indicator	boolean	con/no-set	0	0 to 1
LLAIND	low-low alarm indicator	boolean	con/no-set	0	0 to 1
LOAIND	low out alarm indicator	boolean	con/no-set	0	0 to 1
LOLIND	low out limit indicator	boolean	con/no-set	0	0 to 1
MEASHI	meas high alarm indicator	boolean	con/no-set	0	0 to 1
MEASLI	meas low alarm indicator	boolean	con/no-set	0	0 to 1
MESSAG	message index	integer	con/set	-100	---
OUT	output	real	con/no-set	0.0	RO1
PRTYPE	priority type	integer	con/no-set	0	[0..10]
QALSTA	quality status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
SUPBCO	back calculated value	real	con/no-set	0	RI1
TSTATE	tuner state	integer	con/set	-1	---

Table 102-1. PIDE Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
UNACK	alarm notification	boolean	con/no-set	0	0 to 1
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
ALMOPT	alarm options	pack_l	no-con/no-set	0	0 to 0xFFFFFFFF
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	config error	string	no-con/no-set	0	1 to 43 chars
KSCALE	gain scaler	real	no-con/no-set	1.0	scalar
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars
PCTMES	percent meas span	real	no-con/no-set	1.0	---
PCTOUT	percent output span	real	no-con/no-set	1.0	---
PERTIM	period time	real	no-con/no-set	0.1	---
PIDRCL	recall memory pid	boolean	no-con/set	0	0 to 1
PRLOAD	batch preload	real	con/set	0.0	RO1
PRSCAS	cascade state	short	no-con/no-set	0	0 to 7
PRSCON	present control	short	no-con/no-set	0	0 to 3
PRSTUN	state of exact	integer	no-con/no-set	-1	-1, 0, or 1
PTNREQ	pretune request	short	con/set	0	0 to 1
RATD	ratio derivative	real	no-con/no-set	0.125	scalar
RATI	ratio integral	real	no-con/no-set	0.5	scalar
RI1 to RI2	eng range input	real[3]	no-con/no-set	100,0,1	specifiable
RO1	eng range output	real[3]	no-con/no-set	100,0,1	specifiable
SIGN	sign of error	real	no-con/no-set	1.0	scalar
SPLRDY	sample ready	boolean	con/set	0	0 to 1
TSAMPL	sampling time	real	con/set	0.0	[0..]minutes

102.3.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

ALMOPT

Alarm Options contains packed long values representing the alarm types that have been configured as options in the block, and the alarm groups that are in use. For the PIDE block, only the following unshaded bits are used

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1] (0 to 31)	Configured Alarm Option When True
0	Alarm Group 8 in Use
1	Alarm Group 7 in Use
7	Alarm Group 1 in Use
16	Low Absolute Alarm Configured
17	High Absolute Alarm Configured
24	Low-Low Absolute Alarm Configured
25	High-High Absolute Alarm Configured

1. Bit 0 is the least significant, low order bit.

ALMSTA

Alarm Status is a 32-bit output, bit-mapped to indicate the block's alarm states. For the PIDE block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
	UNAK	INH	OOR			HHA			BAD	HDA	LDA	HOA	LOA	HMA	LMA										CRIT				PRTYPE		

Bit Number (0 to 31)*	Name	Description When True	Boolean Connection (B32 to B1)
0 to 4	PTYP_MSK	Priority Type: See parameter PRTYPE for values used in the PIDE block	ALMSTA.B32– ALMSTA.B28

Bit Number (0 to 31)*	Name	Description When True	Boolean Connection (B32 to B1)
5 to 7	CRIT_MSK	Criticality; 5 = lowest priority, 1= highest	ALMSTA.B27–ALMSTA.B25
16	LMA	Low Measurement Alarm	ALMSTA.B16
17	HMA	High Absolute Alarm	ALMSTA.B15
18	LOA	Low Output Alarm	ALMSTA.B14
19	HOA	High Output Alarm	ALMSTA.B13
20	LDA	Low Deviation Alarm	ALMSTA.B12
21	HDA	High Deviation Alarm	ALMSTA.B11
22	BAD	BAD output of block	ALMSTA.B10
24	LLA	Low-Low Absolute Alarm	ALMSTA.B8
25	HHA	High-High Absolute Alarm	ALMSTA.B7
28	OOR	Out of Range Alarm	ALMSTA.B4
29	INH	Alarm inhibit	ALMSTA.B3
30	UNAK	Unacknowledged	ALMSTA.B2

* Bit 0 is the least significant, low order bit.

AMRTIN Alarm Regeneration Timer is a configurable integer that specifies the time interval for an alarm condition to exist continuously, after which a new unacknowledged alarm condition and its associated alarm message is generated.

AUTSW Auto Switch is a boolean input that, when true, overrides the MA and INITMA parameters, and drives the block to the Auto state. If both MANSW and AUTSW are true, MANSW has priority.

BATCHO Batch Control Option allows the PID to function as a preloadable controller. It works in conjunction with the integral modes of the controller and the integral preload input PRLOAD. Operationally, the batch option preloads the integral term of the controller to the value of the preload whenever the output is being limited to either its high or low output limits.

BBIAS Offset for the Bias is a real input used for offsetting the product of the BIAS input with KBIAS.

BCALCI Back Calculation In is a real input that provides the initial value of the output before the block enters the controlling state, so that the return to controlling is bumpless. It is also the source of the output value when its integration bit, which puts the block into output tracking, is non-zero. The source for this input is the back calculation output (BCALCO) of the downstream block. With V4.2 and later software, BCALCI contains the cascade initialization data bits which were formerly contained in the

INITI parameter. Therefore, BCALCI defines the source block and parameter that drives this block into initialization, and INITI and INITO are not required for cascade initialization.

BLKSTA includes bits which can indicate when the downstream output is limited in either direction. BLKSTA.B11 monitors the Limited High condition (BCALCI.LHI) and BLKSTA.B10 monitors the Limited Low condition (BCALCI.LLO).

BCALCO

Back Calculation Output is a real output that is equal to MEAS except in the following situations, where it is equal to SPT:

- The block is transitioning from Local to Remote mode on this cycle.
- MEAS has Bad status.
- MEAS has Out-of-Service status.
- MEAS has Error status.
- MEAS is experiencing source connection problems.

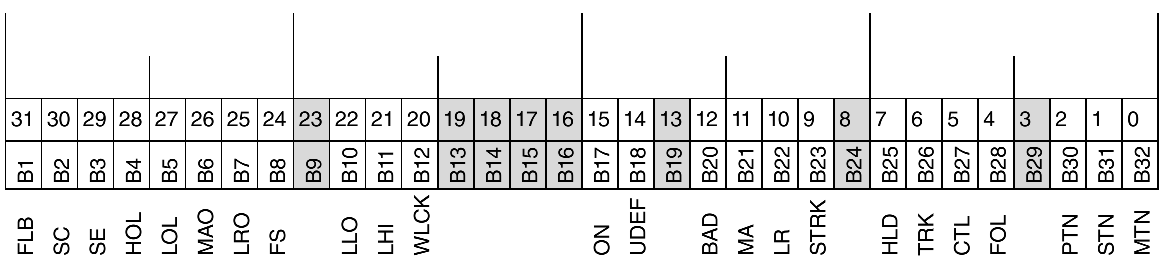
With V4.2 and later software, the status bits of BCALCO contain the cascade initialization requests formerly contained in the INITO parameter. You connect the BCALCO parameter to the BCALCI input of an upstream block so that this upstream block can sense when the PIDE block is open. Therefore with V4.2 and later software INITO is not required for cascade initialization.

BIAS

Bias is a real input added to the controller or algorithm output, to achieve OUT.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the PIDE block, only the following bits are used:



Bit Number[1] (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
0	MTN	Manual Tune Mode	BLKSTA.B32
1	STN	Self-Tune Mode	BLKSTA.B31
2	PTN	Pre-Tune Mode	BLKSTA.B30
4	FOL	Follow	BLKSTA.B28
5	CTL	Controlling	BLKSTA.B27

Bit Number[1] (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
6	TRK	Tracking	BLKSTA.B26
7	HLD	Holding	BLKSTA.B25
9	STRK	Setpoint Tracking	BLKSTA.B23
10	LR	Local(= false)/Remote(= true)	BLKSTA.B22
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
12	BAD	block in BAD state	BLKSTA.B20
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
20	WLCK	Workstation Lock	BLKSTA.B12
21	LHI	Downstream Limited High	BLKSTA.B11
22	LLO	Downstream Limited Low	BLKSTA.B10
24	FS	Failsafe	BLKSTA.B8
25	LRO	Local/Remote Override	BLKSTA.B7
26	MAO	Manual/Auto Override	BLKSTA.B6
27	LOL	Low Output Limit (Clamped)	BLKSTA.B5
28	HOL	High Output Limit (Clamped)	BLKSTA.B4
29	SE	Supervisory Enabled	BLKSTA.B3
30	SC	Supervisory Control	BLKSTA.B2
31	FLB	FLB Supervisory Control Fallback State	BLKSTA.B1

1. Bit 0 is the least significant, low order bit.

BMP

Bump is required for pretuning, and can be considered an option only if you do not use the pretune feature. Bump is the amplitude of the doublet pulse imposed at the controller output that causes the measurement to respond. BMP is expressed in percent of the output span and should be large enough to create a change in the measurement, larger than THRESH.

BTRKOP

Bias Track Option, when true, forces the PID algorithm's BIAS input to track the block output (OUT) when the block is in Manual.

CEOPT

Control Error Option is a short integer that specifies how the block responds to the MEAS and BCALCI inputs when either of those inputs is in error. To provide backward compatibility, CEOPT defaults to 1. CEOPT has a range of 0 to 2 where:

0 = The block takes no implicit Hold action when it detects a control error.

1 = The block goes to the Hold state if, while MBADOP = 0, either MEAS or BCALCI: (a) has its BAD status bit set true; (b) has its Out-of-Service status bit set true; (c) is experiencing peer-to-peer path failure.

2 = The block goes to the Hold state if, while MBADOP = 0, either MEAS or BCALCI meets any of the conditions described for CEOPT = 1, or if MEAS has its ERROR status bit set true.

CEOPT is independent of the propagate error option, PROPT, and does not affect the external logical input, HOLD. The HOLD input, when true, still drives the block into the Hold state whenever the block is in Auto (and MBADOP = 0).

CLM

Change Limit clamps the working PBAND and INT values within a range that is expressed as a fraction/multiple of the reference PR and IR values as follows:

PR/CLM < PBAND < PR*CLM

IR/CLM < INT < IR*CLM

CRIT

Criticality is an integer output that indicates the priority, ranging from 1 to 5, of the block's highest currently active alarm (1 is the highest priority). An output of zero indicates the absence of alarms.

DALOPT

Deviation Alarm Option is a short integer input that enables High and Low deviation alarming, or disables alarming altogether.

0 = No alarming
1 = High and Low deviation alarming
2 = High deviation alarming only
3 = Low deviation alarming only.

You can change DALOPT only by reconfiguring the block.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block.

DELTI1 to DELTI2

Change Delta for Input Range 1 or 2 is a real value that defines the minimum percent of the input range that triggers change driven connections for parameters in the range of RI1 or RI2. The default value is 1.

Entering a 1 causes the Object Manager to recognize and respond to a change of 1 percent of the full error range. If communication is within the same CP that contains the block's compound, change deltas have no effect.

Refer to "Peer-to-Peer Connections of Real-Type Block Inputs" on page 1703 for details on how the I/A Series software affects the change delta percentage during operation.

DELTO1 Change delta for Output Range 1 is a configurable real value that defines the minimum percent of the output range that triggers change-driven connections for parameters in the range RO1. The default value is 1.0 percent. If communication is within the same control station that contains the block's compound, DELTO1 has no effect.

DERIV Derivative Time is a real input that adjusts the derivative time constant in minutes.

NOTE

The working DERIV value is indirectly limited by the DFCT parameter and the working INT value.

DESCRP Description is a user-defined string of up to 32 characters that describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

DEVADB Deviation Alarm Deadband is a real input, in MEAS units, that applies to both High and Low Deviation Limits. You can adjust this parameter at the workstation.

DEVGRP Deviation Group is a short integer input that directs deviation alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.

DEVPRI Deviation Priority is an integer input, from 1 to 5, that sets the priority level of the deviation alarm (1 is the highest priority).

DFCT Derivative Factor is an input that controls the weight of the derivative term; it multiplies the calculated derivative term by the derivative factor. Setting DFCT to 0.0 eliminates the derivative term. Setting DFCT to 1.0 produces optimal controller tunings for a lag-delay process. A factor greater than 1 signals Pretune to override the factor based on its identification of the process delay and of primary and secondary lag times. For processes requiring a large amount of derivative action (for example, a double integral process), DFCT can be as large as 4.0.

DM Memory Derivative is one of the three parameters that support the PID recall tuning feature, and is used to store a fallback DERIV setting.

DMP Damping limit is the maximum allowed damping of the closed loop response. In the self-tuning mode, it is used with the OVR limit to set the tuning criteria, to obtain the desired closed loop response. Generally, damping and overshoot cannot be set independently. Best control is usually obtained using the damping limit.

DR

Reference Derivative is a real input that can be entered at configuration, or derived from the Pre-tune operation. Use DR in combination with the change limit (CLM) parameter, to limit the actual working derivative value about the reference value.

EI1 to EI2

Engineering Units for Input Ranges 1 and 2, as defined by the parameters HSCI1 to HSCI2, LSCI1 to LSCI2, and DELTI1 to DELTI2, provide the engineering units text for the value defined by Input Ranges 1 and 2. “Deg F” or “pH” are typical entries.

EO1

Engineering Units for Output Range 1, as defined by the parameters HSCO1, LSCO1, and DELTO1, provide the engineering units text for the value defined by Output Range 1. “Deg F” or “pH” are typical entries. Make the units for the Output Range (EO1) consistent with the units of Input Range 1 (EI1) and Input Range 2 (EI2).

ERCODE

Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block’s DEFINE parameter to be set false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the PIDE block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
“W43 – INVALID PERIOD/ PHASE COMBINATION”	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
“W44 – INVALID ENGINEERING RANGE”	High range value is less than or equal to low range value.
“W46 – INVALID INPUT CONNECTION”	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
“W48 – INVALID BLOCK OPTION”	The configured value of a block option is illegal.
“W53 – INVALID PARAMETER VALUE”	A parameter value is not in the acceptable range.
“W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK”	A Database Installer error has occurred.

ERROR	Control Error is a real output that equals Setpoint minus Measurement. ERROR can be sourced to other blocks.
FBK	Feedback is a real input used to generate integration action. Its function is to prevent integral windup. FBK is normally connected to BCALCI or BCALCO of downstream blocks.
FLBOPT	Fallback Option is a short integer input that defines the control action to be taken by the block when a Supervisory fallback occurs: 0 = Take no fallback action (default) 1 = Set MA parameter to Auto 2 = Set MA parameter to Manual 3 = Set LR parameter to Remote 4 = Set LR parameter to Local. FLBOPT overrides linked MA and LR parameters, but does *not* override the AUTSW, MANSW, REMSW, and LOCSW parameters.
FLBREQ	Fallback Request is a short integer output that is an explicit request for the block to go to the Fallback state, with recovery at the block level (when SE is set), and/or at the group level (when the appropriate group enable bit is set in SUPENA). 0 = No fallback requested 1 = Fallback requested; recovery at block or group level 2 = Fallback requested; recovery *only* at block level.
HDAIND	High Deviation Alarm Indicator is a boolean output set true when the measurement exceeds the setpoint by more than the deviation limit HDALIM. When the measurement passes back through the DEVADB deadband, the block sets HDAIND to false.
HDALIM	High Deviation Alarm Limit is a real input that establishes the amount by which the measurement must exceed the setpoint to initiate a high deviation alarm and set the High Deviation Alarm Indicator, HDAIND, true.
HDATXT	High Deviation Alarm Text is a user-configurable text string of up to 32-characters, output with the alarm message to identify the alarm.
HHAGRP	High-High Absolute Alarm Group is a short integer input that directs High-High Absolute alarm messages to one of eight groups of alarm devices.
HHAIND	High-High Alarm Indicator is a boolean output set true when the block-dependent parameter value (generally the measurement input) exceeds the high-high absolute alarm limit (HHALIM). HHAIND is set to false when the value is less than HHALIM. Once the Indicator is set true, it does not return to false until the value falls below the limit less a deadband.
HHALIM	High-High Absolute Alarm Limit is a real input that defines the value of the block-dependent parameter (generally the measurement input) that triggers a High High alarm.

HHAOPT	High-High Alarm Option is a configured short integer input that enables High-High and Low-Low absolute alarming for alarming of a block-dependent value, generally the measurement input, or disables absolute alarming altogether. Each alarm triggers an indicator and text message. 0 = No alarming 1 = High-High and Low-Low alarming 2 = High-High alarming only 3 = Low-Low alarming only.
HHAPRI	High-High Absolute Priority is an integer input, from 1 to 5, that sets the priority level of the high-high absolute alarm (1 is the highest priority).
HHATXT	High-High Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the high-high absolute alarm message to identify it.
HOAIND	High Output Alarm Indicator is a boolean output that is set true whenever the output is greater than HOALIM.
HOALIM	High Output Alarm Limit is a real input, int OUT units, that defines the value of the output that initiates a high output alarm.
HOATXT	High Output Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can change HOATXT only by reconfiguring the block.
HOLD	Hold is a boolean input. When true, HOLD forces the block into the Hold substate of Auto, holding the output at its last computed value.
HOLIM	High Output Limit is a real input that establishes the maximum output value, in OUT units. If the algorithm tries to drive the output to a higher value, the output is clamped at the HOLIM value and the indicator HOLIND is set true.
HOLIND	High Output Limit Indicator is a boolean output that is set true whenever the output is clamped at the high output limit, HOLIM.
HSCI1 to HSCI2	High Scale for Input Ranges 1 and 2 are real values that define the upper limit of the measurement ranges. EI1 to EI2 define the units. Make the range and units consistent with the measurement source. A typical value is 100 (percent).
HSCO1	High Scale for Output Range 1 is a real value that defines the upper limit of the ranges for output 1. A typical value is 100 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.
IM	Memory Integral is one of the three parameters that support the PID recall tuning feature and is used to store a fallback INT setting.

INCOPT

Increase/Increase Option is a boolean input. When set true, INCOPT reverses the normal sense of the control action so that the controller output increases with increasing measurement.

INHALM

Inhibit Alarm contains packed boolean values that represent alarm inhibit requests for each alarm type or point configured in the block. For the PIDE block, only the following bits are used:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16

Bit Number* (0 to 15)	Description When True	Boolean Connection (B16 to B1)
0	Inhibit Low Absolute Alarm	INHALM.B16
1	Inhibit High Absolute Alarm	INHALM.B15
2	Low Output Alarm	INHALM.B14
3	High Output Alarm	INHALM.B13
4	Low Deviation Alarm	INHALM.B12
5	High Deviation Alarm	INHALM.B11
8	Inhibit Low-Low Absolute Alarm	INHALM.B8
9	Inhibit High-High Absolute Alarm	INHALM.B7
13	Inhibit Alarm	INHALM.B3
14	Unacknowledged	INHALM.B2

* Bit 0 is the least significant, low order bit.

There are no mnemonic names for the individual bits of INHALM.

INHIB

Inhibit is a boolean input. When true, it inhibits all block alarms; the alarm handling and detection functions are determined by the INHOPT setting. Alarms can also be inhibited based on INHALM and the compound parameter CINHIB.

INHOPT

Inhibit Option specifies the following actions applying to all block alarms:

0 = When an alarm is inhibited, disable alarm messages but do not disable alarm detection.

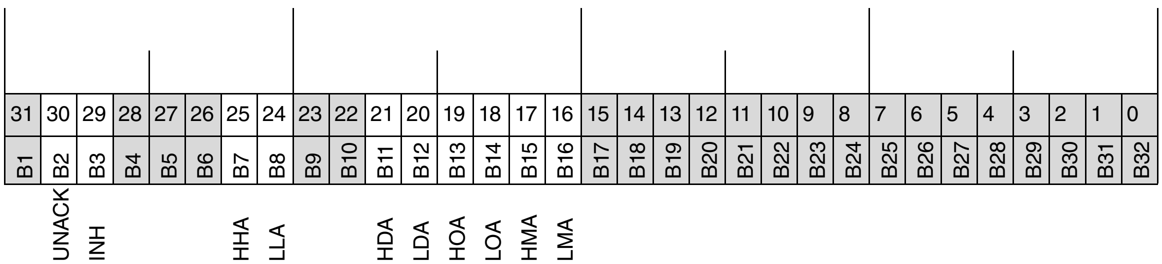
1 = When an alarm is inhibited, disable both alarm messages and alarm detection. If an alarm condition already exists at the time the alarm transitions into the inhibited state, clear the alarm indicator.

2 = Same as 0 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

3 = Same as 1 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

INHSTA

Inhibit Status contains packed long values that represent the actual inhibit status of each alarm type configured in the block. For the PIDE block, only the following bits are used:



Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
16	LMA	Low Absolute Alarm Inhibited	INHSTA.B16
17	HMA	High Absolute Alarm Inhibited	INHSTA.B15
18	LOA	Low Output Alarm	INHSTA.B14
19	HOA	High Output Alarm	INHSTA.B13
20	LDA	Low Deviation Alarm	INHSTA.B12
21	HDA	High Deviation Alarm	INHSTA.B11
24	LLA	Low-Low Absolute Alarm Inhibited	INHSTA.B8
25	HHA	High-High Absolute Alarm Inhibited	INHSTA.B7
29	INH	Inhibit Alarm	INHSTA.B3
30	UNACK	Unacknowledged	INHSTA.B2

* Bit 0 is the least significant, low order bit.

INITI

Initialization In defines the source block and parameter that drives this block into initialization. The source for this short integer input is the initialization output of a downstream block. With V4.2 or later software, BCALCI contains the cascade initialization request data bit eliminating the need to configure INITI connections in cascades. However, to preserve backward compatibility, the INITI parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITI short value is maintained, but the setting of the handshaking bits, via the INITI to INITO connection, is eliminated.

INITLR

Initialize Local/Remote is an integer input that specifies the desired state of the LR input during initialization, where:

0 = Local
1 = Remote
2 = The LR state as specified in the checkpoint file.

The block asserts this initial LR state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a restart operation.
- The compound in which it resides is turned on.

The Initialize LR state is ignored if the LR input has an established linkage.

INITMA

Initialize Manual/Auto specifies the desired state of the MA input during initialization, where:

0 = Manual
1 = Auto
2 = The MA state as specified in the checkpoint file.

The block asserts this initial M/A state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a reboot operation.
- The compound in which it resides is turned on.
- The INITMA parameter itself is modified via the control configurator. (The block does not assert INITMA on ordinary reconfiguration.)

INITMA is ignored if MA has an established linkage.

INITO

Initialization Output is set true when:

- The block is in Manual or initializing.
- Permanent or temporary loss of FBM communications occurs.
- The ladder logic in the FBM is not running.
- MMAIND (mismatch indicator) is true.
- DISABL is true.
- RSP (the remote setpoint) is not the setpoint source.

The block clears INITO when none of these conditions exist. You connect this parameter to the INITI input of upstream blocks so that these upstream blocks can sense when this block is open loop. This block keeps INITO True, for one cycle (PRIBLK = 0), until the acknowledge is received from upstream (PRIBLK = 1 and PRITIM = 0.0), or for a fixed time delay (PRIBLK = 1 and PRITIM = nonzero).

With V4.2 or later software, BCALCO contains the initialization output eliminating the need to configure INITO connections in cascades. However, to preserve backward compatibility, the INITO parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITO short value has been maintained, but the setting of the handshaking bits, via the INITI to INITO connection, is eliminated.

INITSE — Initial Supervisory Enable specifies the initial state of the SE parameter in a block configured for Supervisory Control (SUPOPT = 1 or 3) when the block initializes due to reboot, installing the block, or turning on the compound. Options are:

0 = Disable
1 = Enable
2 = Do not change SE parameter.

INT — Integral Time is a real input that adjusts the integral time constant when the controller operates in the PI, IO, or PID modes. In the PO and PD modes, Integral Time becomes the balance time (the time constant that governs the rate at which the output approaches the proportional signal).

IR — Reference Integral is a real input that can be entered at configuration or derived from the Pre-tune operation. Use IR in combination with the change limit (CLM) parameter to limit the actual working integral value about the IR value. See CLM.

KBIAS — BIAS scale or gain factor is a real input that multiplies the BIAS input. It is expressed in OUT units divided by BIAS units.

KD — Derivative Filter Gain is a real input that adjusts the derivative filter gain.

KSCALE — KSCALE is a conversion factor used to make the time units of the rate parameters, which are in EI1 units per minute, dimensionally compatible with the time units of the output, as defined by EO1.

LDAIND — The Low Deviation Alarm Indicator is a boolean output that is set true when the measurement falls below the setpoint by more than the deviation limit, LDALIM. When the measurement passes back through the DEVADB deadband, the block sets LDAIND to false.

LDALIM — Low Deviation Alarm Limit is a real input that defines how far the measurement must fall below the setpoint to initiate a low deviation alarm and set the Low Deviation Alarm Indicator LDAIND true.

LDATXT — Low Deviation Alarm Text is a user-defined text string of up to 32-character that is output with the alarm message to identify the alarm.

LLAIND	Low-Low Alarm Indicator is a boolean output set true when the block-dependent parameter value (generally the measurement input) falls below the low-low absolute alarm limit (LLALIM). LLAIND is set to false when the value is greater than LLALIM. Once the Indicator is set true, it does not return to false until the value exceeds the limit plus a deadband.
LLALIM	Low-Low Absolute Alarm Limit is a real input that defines the value of the block-dependent parameter (generally the measurement input) that triggers a Low-Low Alarm.
LLATXT	Low-Low Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the low-low absolute alarm message to identify it.
LMT	Output Cycling Limit is a real input that indicates to the self-tuning algorithm that the controller output is changing at a frequency that is too high for the loop response as it is currently tuned. LMT has a range of 2 to 80 percent of output span and defaults to 80 percent. If the average peak-to-peak amplitude exceeds LMT for over three minutes, the controller is detuned by increasing PBAND and reducing DERIV. This feature is useful for processes that have very little dead time and require a higher controller gain.
LOAIND	Low Output Alarm Indicator is a boolean output that is set true whenever the output is less than LOALIM.
LOALIM	Low Output Alarm Limit is a real input, in OUT units, that defines the value of the output that initiates a low output alarm.
LOATXT	Low Output Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can change LOATXT only by reconfiguring the block.
LOCKID	Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.
LOCKRQ	Lock Request is a boolean input which can be set true or false only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ may be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.

LOCSP	Local Setpoint Secure is a boolean input. When true, LOCSP provides lockout of user write access to the LR parameter. If LOCSP is configured true, the block secures LR when it initializes and maintains LR in the secured state. The LOCSW and REMSW overrides have higher precedence, but LR remains secured when they are no longer asserted.
LOCSW	Local Switch is a boolean input. When true, LOCSW overrides the LR and INITLR parameters and drives the block to the Local state. If both LOCSW and REMSW are true, LOCSW has priority.
LOLIM	Low Output Limit is a real input that establishes the minimum output value. If the algorithm tries to drive the output to a lower value, the output is clamped at the LOLIM value and the indicator LOLIND is set true.
LOLIND	Low Output Limit Indicator is a boolean output that is set true whenever the output is clamped at the low output limit, LOLIM.
LOOPID	Loop Identifier is a configurable string of up to 32 characters which identifies the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.
LR	Local/Remote is a boolean input that selects the setpoint source (0 = false = Local; 1 = true = Remote). If LR is set to Remote, the source of the setpoint value is the real input parameter RSP. When LR is set to Local, there are two possible sources for the setpoint: (a) MEAS or (b) a user settable input. The choice is based on the conditions of STRKOP and MA, as described under STRKOP.
LSCI1 to LSCI2	Low Scale for Input Ranges 1 and 2 are real values that define the lower limit of the measurement ranges. A typical value is 0 (percent). EI1 to EI2 define the units. Make the range and units consistent with those of the measurement source.
LSCO1	Low Scale for Output Range 1 is a real value that defines the lower limit of the ranges for Output 1. A typical value is 0 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.
MA	Manual Auto is a boolean input that controls the Manual/Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. The block automatically limits the output to the output range specified between LSCO1 and HSCO1. In Manual, the algorithm is not performed, and the output is unsecured. An external program can then set the output to a desired value.
MALOPT	Measurement Alarm Option is a configured short integer input that enables absolute High and Low measurement alarming, or disables absolute alarming altogether.

0 = No alarming
1 = High and Low measurement alarming
2 = High measurement alarming only
3 = Low measurement alarming only.

You can change MALOPT only by reconfiguring the block.

MANALM

Manual Alarm Option is a configurable input which enables and disables configured alarm options to function in Manual. Normally alarms are processed only in the Auto mode.

0 = No alarming in Manual

1 = Full alarming in Manual

2 = No Output alarming in Manual

3 = No output alarming in Track

4 = No output alarming in Manual or Track

MANFS

Manual if Failsafe is a boolean input. When configured true, MANFS drives the block to the Manual state if the block detects an incoming Failsafe status.

MANSW

Manual Switch is a boolean input. When true, MANSW overrides the MA and INITMA parameters and drives the block to the Manual state. If both MANSW and AUTSW are true, MANSW has priority.

MBADOP

Manual if Bad Option is a manual override feature. When MBADOP is set to 1 or 2, the block sets the unlinked MA input to manual if it detects a BAD status bit in the MEAS, BCALCI or FBK input, and when set to 2, it detects that the Remote Setpoint (RSP) is not healthy (i.e., value status is BAD or has a broken OM connection). This forces the output state to manual as long as the BAD status remains. After the BAD status clears, returning to Auto requires external intervention unless AUTSW is true.

0 = no option enabled

1 = Switch to Manual when MEAS, BCALCI, or FBK value status is BAD

2 = Same as option 1, plus switch to Manual when RSP is not healthy

You can change MBADOP only by reconfiguring the block. MBADOP has the same priority as the MANSW override, and it has precedence over the AUTSW override. MBADOP has no effect when MA is linked. If any of the MBADOP conditions are true, the block will be switched to Manual regardless of the MANSW and AUTSW settings.

MCLOPT

Manual Clamping Option allows you to invoke output clamping while the block is in manual. You can alter this configurable boolean input at the workstation.

MEAS

Measurement is an input identifying the source of the block's input, or the controlled variable.

MEASDB	Measurement Alarm Deadband is a configured input, expressed in MEAS units, that applies to both High and Low Alarm Limits. You can adjust this parameter at the workstation.
MEASGR	Measurement Group is a short integer input that directs measurement alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.
MEASHI	Measurement High Alarm Indicator is a boolean output that is set true when the measurement exceeds the high alarm limit (MEASHL). When the measurement passes back through the deadband, the block sets MEASHI to false.
MEASHL	Measurement High Alarm Limit is a real input that defines the value of the measurement that initiates a high absolute alarm.
MEASHT	Measurement High Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can only change the message text by reconfiguring the block.
MEASLI	Measurement Low Alarm Indicator is a boolean output that is set true when the measurement falls below the low alarm limit (MEASLL). When the measurement passes back through the MEASDB deadband, the block sets MEASLI to false.
MEASLL	Measurement Low Alarm Limit is a real input that defines the value of the measurement that initiates a low absolute alarm.
MEASLT	Measurement Low Alarm Message Text is a user-defined text string of up to 32 characters that is output with the alarm message to identify the alarm. You can only change the message text by reconfiguring the block.
MEASNM	Measurement Alarm Name is a user-defined text string of up to 12 characters that identify the alarm source in the alarm message. It serves as a point descriptor label (for example, Furn 37 Temp).
MEASPR	Measurement Priority is an integer input (1 to 5), that sets the priority level of the measurement alarm (1 is the highest priority).
MESSAG	Message Indicator is an integer output that represents an encoded status or error message pertaining to the self-tune algorithm. The assigned integers and the message that each represents are:

MI Code	Message	MI Code	Message
MI_001	Block in Auto	MI_107	Three Peaks Found
MI_002	Increase Bump	MI_109	WMAX2 Small Overdamp
MI_003	Wait Steady State	MI_110	Suspicious 1 Shape
MI_004	PID Computed	MI_111	Suspicious 2 Shape
MI_005	Measuring Noise Band	MI_112	Suspicious 3 Shape

MI Code	Message	MI Code	Message
MI_006	PRETUNE Done	MI_113	WMAX3 Small Overdamp
MI_007	Bad INC/DEC Action	MI_114	Three Peaks Found
MI_008	Meas Noise Corruption	MI_150	Undefined
MI_009	Cascade Open Loop	MI_151	WMAX or Process Fast
MI_010	Output Limit Exceeded	MI_153	Excess Setpoint Change
MI_011	Excessive Output Manually	MI_154	Process Out of Control
MI_012	Tune Block Request Error	MI_155	PI Clamped CLM Limit
MI_013	Error on Inputs to PID	MI_156	Self-Tune Initialize
MI_015	Linkage on Tuning Constant	MI_157	Linkage on Tuning Constant
MI_101	One Peak Found	MI_160	PID Open Loop
MI_102	WMAX1 Small Overdamp		
MI_103	Two Peaks Found		
MI_105	Three Peaks Found		
MI_106	Two Peaks Found		

NAME

Name is a user-defined string of up to 12 characters used to access the block and its parameters.

NASOPT

Nuisance Alarm Suppression Option is a configurable, non-settable short integer that specifies how the nuisance alarm delay is implemented:

- 0 = Suppress nuisance alarms by delaying the Return-to-Normal (default) by the length of time specified in NASTDB
- 1 = Suppress nuisance alarms by delaying alarm detection by the length of time specified in NASTDB
- 2 = Suppress nuisance alarms by delaying both the Alarm Detection and the Return-to-Normal by the length of time specified in NASTDB

NASTDB

Alarm Deadband Timer is a configurable long integer. Depending on the value of NASOPT, it either specifies the deadband time interval that must elapse before an alarm condition is allowed to return to normal, or the length of a delay-on timer which specifies the amount of time between an alarm's detection and the announcement of the alarm. The parameter value ranges from zero (default, no delay) to 2147483647 ms.

NB

Noise Band is a measure of the intrinsic noise content of the measurement signal. Its peak-to-peak magnitude is expressed as a percentage of the measurement span. Self-tuning begins to extract tuning information whenever the error signal exceeds twice the magnitude of NB. It is also used to decide whether an observed peak may be noise. You can enter a value for NB at configuration or derive a value from a pretune operation.

OALOPT	Output Alarm Option is a configured short integer input that enables absolute High and Low alarming of the block output (OUT) or disables output alarming altogether. 0 = No alarming 1 = High and Low output alarming 2 = High output alarming only 3 = Low output alarming only. You can change OALOPT only by reconfiguring the block.
OSV	Output Span Variance is a real input that defines the amount by which the output clamp limits (HOLIM, LOLIM) can exceed the specified output range, as defined by HSCO1 and LSCO1.
OUT	Output, in Auto mode, is the result of the block algorithm applied to one or more input variables. In Manual, OUT is unsecured, and can be set by you or by an external task.
OUTADB	Output Alarm Deadband is a real input that specifies the size of the deadband for both High and Low Output Alarm Limits. You can adjust this parameter at the workstation.
OUTGRP	Output Group is a short integer input that directs high and low output alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.
OUTNM	The Output Alarm Name is a user-defined string of up to 12 characters that identify the alarm source in the alarm message. It serves as a point descriptor label (for example, F2 Fuel Ctrl).
OUTPRI	Output Priority is an integer input (1 to 5) that sets the priority level of the High and Low Output Alarms (1 is the highest priority).
OVR	Overshoot Limit is the target overshoot of the closed loop response, if the fuzzy interpolation method is used (PR_FL=0), in the self tuning mode. OVR has a range from 0.0 to 0.2 of the magnitude of the first peak.
OWNER	Owner is a string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are successful only if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.
PBAND	Proportional Band is an input expressed in percent. PBAND is the percent of span change in input, that causes a full-span change in output. [100 / PBAND] determines the gain of the controller when MEAS and OUT are converted to percent of span. It is adaptively set by FBTUNE.

PCTMES — Percent of Measurement is a real value representing the percent of measurement span per unit.

PCTOUT — Percent of Output is a real value representing the percent of output span per unit.

PERIOD — Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PERTIM — Period Time is the period of the block expressed in seconds.

PHASE — Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PIDRCL — PID Recall is a boolean input request that causes the memory tuning values PM, IM, and DM to be copied into the working values PBAND, INT, and DERIV. PIDRCL is honored only in the FB_HOLD mode. This feature provides a convenient means for the operator to save a fallback set of PID settings, which can be recalled if needed.

PM — Memory PBAND is one of the three parameters that support the PID recall tuning feature and is used to store a fallback PBAND setting.

PR — Reference Pband is a real input that can be entered at configuration or derived from the Pretune operation. Use PR in combination with the change limit (CLM) parameter to limit the actual working proportional band value about the PR value. See CLM.

PRIBLK — Primary Block is a configuration option. When true (=1), PRIBLK enables a block in a cascaded configuration to initialize without bumping the process, either at initial startup or whenever control is transferred up to a primary block. Depending on the value of PRITIM, PRIBLK does this by forcing the PIDE block to remain in the Hold state until the Acknowledge status bit (Bit 10) of MEAS is detected from the upstream block (PRITIM = 0.0), or until the time defined by PRITIM expires (PRITIM > 0.0). In the latter case, the explicit acknowledge from the upstream block is not needed.

Use PRIBLK in a cascade situation when the source of the block's input connection needs to be initialized.

For correct operation, set EROPT = 1 or 2, and implement the connections between each primary-secondary block combination. These connections include BCALCI/BCALCO and OUT/RSP (or OUT/MEAS).

Except for the most primary controller block, Invensys recommends that PRIBLK be set true for all applicable blocks in a cascaded scheme. When PRIBLK is false (default value), no special handling takes place.

Refer to "PRIBLK and PRITIM Functionality" on page 2019 for more information on this parameter.

PRITIM Primary Cascade Timer is a configurable parameter used to delay the closing of the cascade to a primary block, when the output is initialized in the PIDE block. It is used only if the PRIBLK option is set. The cascade is closed automatically when the timer expires without requiring an explicit acknowledge by the upstream block logic.

Refer to "PRIBLK and PRITIM Functionality" on page 2019 for more information on this parameter.

PRLOAD PreLoad is the value that the integral term is set when the output is being limited at either the LOLIM or HOLIM limit. It is operational only under the batch option (BATCHO) when the PID is in Auto. It preconditions the integral term of the PID while the controller operates in Auto during an open-loop situation, which usually arises during batch applications. The preload is usually set to the specific load conditions that existed during closed-loop operation.

PROPT Propagate Error Option is a short integer input. PROPT was changed from a Boolean to a Short Integer in I/A Series software v8.5 for this block. It can be set to 0-2, with the following exception:

NOTE

If PROPT is configured from IACC v2.4 or later, it can only be set to 0 or 1.

- 0 = option is disabled (default)
- 1 = set the ERROR Status bit of the output parameter (OUT) if the input to the MEAS parameter is in error (see below) while the block is in Auto
- 2 = copy (propagate) the BAD, OOS (Out-of-Service), and ERROR status bits from the MEAS parameter to the output parameter (OUT). This value cannot be set from IACC v2.4 or later.

The input to the MEAS parameter is in error when:

- Its BAD status bit is set true
- Its OOS (Out-of-Service) status bit is set true
- Its ERROR status bit is set true
- It is experiencing peer-to-peer path failure.

If a transition to Manual occurs while the ERROR status is true, it remains true until either a set command is written to that output or until the block transfers to Auto with the error condition returned to normal.

PRSCAS

Present Cascade State is a data store that indicates the cascade state. It has the following possible values:

Value	State	Description
1	"INIT_U"	Unconditional initialization of the primary cascade is in progress.
2	"PRI_OPN"	The primary cascade is open.
3	"INIT_C"	Conditional initialization of the primary cascade is in progress.
4	"PRI_CLS"	The primary cascade is closed.
5	"SUP_INIT"	The supervisory cascade is initializing.
6	"SUP_OPN"	The supervisory cascade is open.
7	"SUP_CLS"	The supervisory cascade is closed.

PRSCON

Present Control state is a short integer data store that contains the sub-states of Auto:

1 = Holding
2 = Tracking
3 = Controlling (not open loop).

PRSTUN

Present tuner operational state:

-1= Manual Tune
 0 = Pretune
 1= Selftune.

PRTYPE

Priority Type is an indexed output parameter that indicates the alarm type of the highest priority active alarm. The PRTYPE output of this block includes the following alarm types:

0 = No active alarm

1 = High Absolute

2 = Low Absolute

3 = High High

4 = Low Low

5 = High Deviation

6 = Low Deviation

7 = Rate alarm

8 = BAD Alarm

PTNREQ

Pretune Request is a user-set short integer input that initiates the Pretune function. The controller must be in Manual, and the process should be reasonably stationary before setting PTNREQ to 1. You can abort Pretune by resetting PTNREQ to 0.

QALSTA Quality Status parameter (QALSTA) is a non-configurable packed long that provides a combination of value record status, block status (BLKSTA), and alarm status (ALMSTA) information in a single connectable output parameter. Available bits for this block are provided below.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1]	Definition	Contents	Boolean Connection (B32 to B1)
30	Alarms Unacknowledged	ALMSTA.UNA	QALSTA.B2
29	Alarms Inhibited	ALMSTA.INH	QALSTA.B3
25	High-High Absolute Alarm	ALMSTA.HHA	QALSTA.B7
24	Low-Low Absolute Alarm	ALMSTA.LLA	QALSTA.B8
21	High Deviation Alarm	ALMSTA.HDA	QALSTA.B11
20	Low Deviation Alarm	ALMSTA.LDA	QALSTA.B12
19	High Output Alarm	ALMSTA.HOA	QALSTA.B13
18	Low Output Alarm	ALMSTA.LOA	QALSTA.B14
17	High Absolute Alarm	ALMSTA.HMA	QALSTA.B15
16	Low Absolute Alarm	ALMSTA.LMA	QALSTA.B16
5	Manual	BLKSTA.MA	QALSTA.B27
4	Low Limited	MEAS.LLO status	QALSTA.B28
3	High Limited	MEAS.LHI status	QALSTA.B29
2	Uncertain	MEAS.ERR status	QALSTA.B30
1	Out-of-Service	MEAS.OOS status	QALSTA.B31
0	Bad	MEAS.BAD status	QALSTA.B32

1. Bit 0 is the least significant, low order bit.

RATD Ratio Deriv/period of oscillation is a real input.

RATI Ratio Int/period of oscillation is a real input.

REMSW Remote Switch is a boolean input. When true, REMSW overrides the unlinked LR and INITLR parameters, and drives the block to the Remote state. If both LOCSW and REMSW are true, LOCSW has priority.

RI1 to RI2	Range Input is an array of real values that specify the high and low engineering scale and change delta of a particular real input. For a given block, it also forms an association with a group of real input parameters that have the same designated range and change delta.
RO1	Range Output is an array of real values that specify the high and low engineering scale of a particular real output. For a given block, it also forms an association with a group of real output parameters that have the same designated range.
RSP	Remote Setpoint is the selected setpoint source when LR is set to Remote. RSP is a real input. Typically RSP connects to an upstream block in a cascade scheme. RSP and its source must be expressed in MEAS units.
SE	Supervisory Enable is a boolean input that enables or disables Supervisory Control in this block: 0 = Disable 1 = Enable.
SETTLE	Settle is an override input that holds the self tuning algorithm in the Settle substate of the self-tune state. An operator or a linked source can use this parameter to inhibit self-tune adaptation during undesirable process conditions. This feature can alleviate the need for you to manually return the self-tune algorithm to the STN mode after an abnormal process condition.
SIGN	Sign is a real value representing the sign of the first error peak.
SPLRDY	Sample Ready is an input that indicates a new measurement MEAS is ready. This signal is usually connected to an external device, such as a chromatograph, to begin a new sample period in which control begins. If used in conjunction with the TSAMPL timer, it restarts the timer to be synchronous with an external event. *
SPT	Setpoint always represents the active controller setpoint. Setpoint is the reference variable that is compared with the MEAS input to produce the ERROR signal. SPT is implemented as a configurable output that determines its source from the Local/Remote setpoint selector, LR. When LR is true (Remote), SPT is nonsettable and assumes the Remote Setpoint (RSP) value. When LR is false (Local), SPT is an unsecured, and thus settable, output and the SPT source is the set value. Configure the value you want the SPT to assume when it first goes to Local. As an output, SPT can also source the setpoint value to other blocks. While settable by default, SPT is nonsettable while setpoint tracking is active. (See STRKOP.)
STNREQ	Self-Tune Request is a boolean input that drives the self-tuning algorithm into the self-tune operational mode. It can be initiated by either your request or by a connection-based signal. If STNREQ is set to 1, self-tuning begins when both PTNREQ and STHREQ are 0. Resetting STN-

REQ turns self tuning off. The active tuning constants remain active but the adapted stored tuning sets are erased.

STRKOP

Setpoint Track Option is a short integer input. When active, STRKOP enables the setpoint to track the measurement input under the following conditions.

0 = no option enabled

1 = SPT parameter tracks the measurement input when the block is in Manual, or the cascade is open downstream (Initialization input INITI is true).

2 = SPT parameter tracks the measurement only when the block is in Manual.

STRKOP is active only when the setpoint source selector LR is in Local.

SPT is nonsettable while setpoint tracking is active. You can change STRKOP only by reconfiguring the block.

SUPBCO

Supervisory Back-Calculated Output is a real output that specifies the value to be used by the Supervisory application to initialize its output to the current setpoint. SUPBCO also contains the following status bits:

Status	Meaning
Bit 10 = 1	Initialize SUP_IN
Bit 13 = 1	SUP_IN is limited high
Bit 14 = 1	SUP_IN is limited low
Bit 13 = 1 and Bit 14 =1	Supervisory cascade is open

SUPGRP

Supervisory Group is a short integer input (1 to 8) that specifies one of eight groups to which this block is assigned for Supervisory Control.

SUPOPT

Supervisory Option is a configurable short integer input that specifies whether or not this block is under control of a Supervisory Control application:

0 = No Supervisory control

1 = Set Point Control (SPC) of the block's set point (Supervisory setpoint control (SSC))

2 = Direct Digital Control (DDC) of the block output (Supervisory output control)

NOTE

Setting SUPOPT=2 enables DDC control only, i.e. supervisory control over the output in the PIDE block. It is not intended to be used with Advanced Process Control (APC), which performs SSC, i.e., supervisory control of the setpoint in the PIDE. To use APC, configure SUPOPT=1 (or 3 if automatic acknowledgement of a setpoint change is desired).

3 = SPC, with an implicit acknowledge by the CP

4 = DDC, with an implicit acknowledge by the CP

Be aware that options 1 and 2 require an explicit acknowledge by the application software to close the supervisory cascade. This must be done by setting the ACK status bit in the SUP_IN parameter using special OM access functions.

SUP_IN — Supervisory Input is a real output that is the parameter set by a Supervisory application when performing supervisory control of this block's set point. SUP_IN also contains a status bit (Bit 10) that must be set by the supervisor to acknowledge a request to initialize (Bit 10 in SUPBCO).

TSAMPL — Sampling Time establishes the time period of an internal repeating timer that cycles the controller updating. This timer can be used to effectively control a dead-time-dominant process. If external triggering of the control action is desired, TSAMPL should be set to 0, which effectively disables the timer. SPLRDY triggers the controlling state from S/HOLD.

TSTATE — Tuner State is an encoded integer output that corresponds to the current substate of the EXACT-tuning algorithm. The assigned integers and the message that each represents are:

SI CODE	Substate Name	SI CODE	Substate Name
SI_-01	MTUNE	SI_007	Adjust PID
SI_000	Quiet	SI_008	Adapt PID
SI_001	Locate First Peak	SI_009	Settle
SI_002	Verify First Peak	SI_100	Bump
SI_003	Locate Second Peak	SI_101	Return Output
SI_004	Verify Second Peak	SI_102	Wait Steady State
SI_005	Locate Third Peak	SI_103	Monitor Noise
SI_006	Verify Third Peak		

TYPE — When you enter “PIDE” or select “PIDE” from the block type list under Show, an identifying integer is created specifying this block type.

UNACK — Unacknowledge is a boolean output that the block sets to True when it detects an alarm. It is typically reset by operator action.

WMAX — Wait Max is a crude estimate of the time scale of the process and represents the maximum time that the self-tune algorithm waits for the second peak. It should be set larger than half the maximum period of oscillation and smaller than eight times the minimum period of oscillation. You can enter an NB value at configuration or derive a value from a pretune operation.

102.4 Detailed Operation

Each execution cycle, this block provides PID control and then runs its self-tuning algorithm, unless you make the self-tune algorithm inoperable by running the block in the manual-tune mode. Since this algorithm tunes a three-term interactive PID controller, the PIDE block does not use a MODOPT parameter. The block operates as a PI-only controller, in the self-tune mode if the Derivative Factor (DFCT) is 0.0, or in the manual-tune mode when DERIV equals 0.0.

When in the control portion of the execution cycle, the block generates an output that incorporates the following:

1. A Proportional factor based on a user-specified proportional band applied to an error term. The error term equals the setpoint (SPT) minus the derivative factor applied to the measurement (MEAS).
2. An Integral factor derived from a first-order lag of the block's integral feedback (FBK) input.
3. A Derivative factor with a second-order Butterworth filter applied to the measurement (MEAS).

The MEAS parameter is an input identifying the source of the signal that is coming to this block as the controlled variable in the control loop.

The SPT parameter is the local setpoint and always represents the active controller setpoint or is made equal to SUP_IN in Supervisory Control. SPT can be used as a source other blocks.

The setpoint sources are prioritized as follows:

1. Supervisory Control
2. Local (LOCSW) nad Remote Switch (REMSW)
3. Local or Remote.

When the Supervisory Option (SUPOPT) is set to 1-4, it specifies that the block can be under control of a Supervisory Application Program. The Supervisory Back Calculated Output (SUPBCO) provides the current setpoint and initialization bits to the Supervisory Application Program. When Supervisory Enable (SE) is set by the application program or operator, the PIDE block is prepared to do Supervisory Setpoint Control (SSC) functions. When the proper handshaking occurs with the application software, the block accepts sets to the Supervisory Setpoint (SUP_IN). If the block is in Auto, it then uses the Supervisory setpoint in the calculation of the block's output.

If SUPOPT is set to 1 or 2, the handshake requires the application software to return an explicit acknowledge to close the supervisory cascade. The software must set the ACK status bit in the SUP_IN parameter using special OM access functions. However, if SUPOPT is set to 3 or 4, this acknowledgement is implicitly provided by the CP and is not required from the user application software. In the latter case, the CP closes the supervisory cascade automatically when the supervisory input (SUP_IN) is written by the application, provided the block is in the Supervisory Initialization (SUP_INIT) state. The control block enters the SUP_INIT state when supervisory control is enabled in the block and the cascade is closed downstream. Upon entering this state, the CP sets the initialize request bit (INITC) in the SUPBCO parameter for the application software. When SUP_IN is then written by the software, the CP access logic sets the ACK status automatically in the SUP_IN parameter. When the block runs, the CP block logic then closes the supervisory cascade automatically.

The setpoint source selector input, LR (Local/Remote), together with the two overrides, LOCSW and REMSW, determines the setpoint source at any time.

When LR is switched to local, the block sets the BCALCO initialization status value to true, and releases the SPT parameter, allowing any user to input the desired controller setpoint value. The setpoint track option, STRKOP, can be used to assure bumpless transfer.

When LR is switched to Remote (true), SPT is no longer settable and takes on the value of the remote setpoint input, RSP. RSP provides a link to the remote setpoint source. If RSP is unlinked when LR is true, the block forces the LR parameter to local and secures it.

The PIDE block also provides the LOCSW and REMSW parameters to drive the setpoint state to Local or Remote.

LOCSP allows the block to secure the LR parameter when the block initializes and to maintain that secured state except when LOCSW and/or REMSW is asserted.

When the block is in the Remote mode, the status of the local setpoint (SPT) tracks the status of the remote setpoint (RSP).

When the block is switched to Local mode, the setpoint status depends on the setpoint tracking option (STRKOP):

- ♦ If STRKOP = 1 or 2, the SPT status is cleared.
- ♦ If STRKOP = 0, the SPT status reflects the RSP status at the time the switch to Local occurred. The block maintains this status as long as block is in Local, unless you change the SPT value via data access. At that time the status is cleared.

The local set point is clamped each cycle when the set point mode is Remote, Local, or Supervisory. The clamp limits used are the measurement scale limits HSCI1 and LSCI1. If the set point value before clamping is equal to or less than LCSI1, status bit LLO of SPT is set true. If the value before clamping is equal to or higher than HSCI1, status bit LHI of SPT is true.

The PIDE block has two output states, Auto and Manual. In Manual, the block releases the output, allowing it to be set by you. In Auto, the block secures the output.

Auto has three substates: Controlling, Tracking, and Holding.

Closed loop automatic PID control is actually performed in the substate of Auto called Controlling. In this state, the block computes the output signal based on the deviation between SPT and MEAS. Proportional control is fixed by the steady state gain term (100/PBAND).

Integral control action is generated by feeding back the external integral feedback signal (FBK) through a first order lag. INT, the integral setting of the controller, fixes the time constant of the lag. Such a scheme avoids the pitfalls of integral windup. See “Normal Configuration” on page 2018 for more details.

Derivative control action consists of a second-order Butterworth filtering of the Measurement signal. Both the time constant and the derivative gain of this filtering action are fixed by the user-specified DERIV parameter.

In Auto, the computed output value undergoes limiting. Limiting clamps the output between the variable output limits, HOLIM and LOLIM. You can place these limits anywhere within the range defined by LSCO1 and HSCO1. Moreover, the output span variance parameter (OSV) enables you to extend this range at both the high and low ends by an equal amount, up to 25 percent. If you set LOLIM higher than HOLIM, then HOLIM is automatically set equal to the higher of the two values, which is LOLIM. The block provides, for control purposes, output limit indicators that are active when the output is clamped at either limit.

In Auto, when you switch the setpoint source selector from Local to Remote, the transfer is made bumpless by removing derivative dynamics (if applicable) and forcing the integral to absorb any proportional action.

Switching from Remote to Local is always bumpless, because SPT retains the last value transferred from the remote setpoint. For cascade purposes, the block sets the BCALCO initialization status value true when the setpoint is under local control, or when the block is open-looped. This tells an upstream block to perform an explicit initialization, so that the return to remote setpoint operation is bumpless.

The block goes to Tracking when the BCALCI initialization status value is set true, as long as the block is not in HOLD, and there is no control error. The block performs explicit initialization in the Tracking substate. When the BCALCI initialization status value returns to false, the block returns to the Controlling substate to resume closed-loop control.

In the Tracking substate, OUT = BCALCI unless BCALCI is out of range, in which case OUT is clamped between the LOLIM and HOLIM values. The block calculates the BCALCO parameter, sets the BCALCI initialization status value to true (requesting upstream blocks to perform their own explicit initialization), and sets bit 6 (TRCK) in the BLKSTA parameter.

During Auto operation, the block checks the critical inputs MEAS, FBK, and BCALCI for data errors (off-scan, or BAD, OOS, or ERROR status bits set). If an error is detected, the PIDE block, depending on the value of the CEOPT parameter (see CEOPT definition), may propagate the error to its outputs by setting the ERROR status bit of the output, OUT.

The block goes to Hold if, while MBADOP = 0 and CEOPT = 1 or 2, either the HOLD parameter goes true, or a condition required by the CEOPT parameter is met.

In the Hold substate, OUT keeps the last good value before the block went into Hold, and the block secures this value against any changes. The block sets the BCALCO status to bad and sets bit 7 (HOLD) in the BLKSTA parameter.

When all error conditions have ceased, the block returns to the Controlling substate and resumes closed loop control.

No implicit Hold action takes place if CEOPT = 0.

A transition to Manual sets all alarm and limit indicators to false.

If MBADOP = 1 or 2 (and the MA parameter is unlinked), the block goes to the Manual state when it detects a control error or when the HOLD input goes true, regardless of the CEOPT value. MBADOP has the same priority as MANSW and has precedence over AUTSW. Therefore, if MBADOP = 1 or 2 and a bad input is detected, the block goes to Manual regardless of the AUTSW setting.

When the block is switched to Manual, the OUT status reflects the MEAS/SPT status at the time the switch occurred. While the block is in Manual, it maintains this status until you changes the OUT output via data access. At that time, the block clears the status.

During Manual operation, PID control is not performed. Alarm outputs are settable. The controller output (OUT) is unsecured and may have its value set by an external task or program and, if the manual clamp option (MCLOPT) is configured, these set values will undergo output clamping.

The setpoint track option forces the local setpoint (SPT) to track the measurement. While setpoint tracking is active, SPT becomes nonsettable to prevent any user from manipulating the local setpoint value. Setpoint tracking is only performed if the setpoint source selector is switched to Local and the block is either operating in Manual or the BCALCI initialization value status is true. BCALCI value status being true indicates that a block downstream in the cascade is open loop.

The following summarizes the secured/released condition of the SPT parameter:

SPT is secured (non-settable) if any of the following are true:

- The block is in Remote mode, that is, LR is true. In this case, BLKSTA.LR is also true
- Supervisory control is enabled, that is, SUPOPT is set to 1 or 3 and BLKSTA.SE is true, and SUP_IN is not in error
- Setpoint tracking is active, that is, BLKSTA.STRK is true. In order for this status bit to be true, all of the following conditions must exist:
  - The STRKOP parameter must be 1 or 2.
  - There must be no control error condition.
  - One of the following conditions must be true:
    - The block is in Manual mode.
    - The cascade is open downstream (either the data value of INITI is true, or the LHI and LLO status bits of BCALCI are simultaneously true).
    - A request for conditional initialization has been received from downstream.

Otherwise SPT is released (settable).

When the block restarts, the INITMA-configured option specifies the value of the MA parameter, unless MA has an established linkage, or MANSW or AUTSW are set true. Likewise, the INITLR specifies the value of the LR parameter, unless LR is linked, or LOCSW or REMSW are set true.

The EXACT-tuning algorithm is separate from the PID algorithm, and operates without affecting the operation of the PID control algorithm except to provide new working values of PBAND, INT, and DERIV following a process upset. The operator can override even this action by placing the self-tune algorithm in either the Manual Tune state, or the Settle substate of the Self-Tune state.

The PIDE block has three sets of P, I, and D values:

1. The working values – these are the values used by the PID control algorithm: PBAND, INT, and DERIV. Working values are obtained from 1) the real values entered at block configuration, or 2) the self-tune algorithm after a process upset occurs, or 3) the Memory values when copied to the working values by the operator. Although the parameters PBAND, INT, and DERIV are listed as connectable, they must not be linked to other blocks if EXACT self-tuning is desired. Linking these parameters to other blocks secures these working values from other sources such as the Memory values and the self-tune algorithm.
2. The memory values – these are values of P, I, and D that are stored into the PM, IM, and DM parameters by the operator to be recalled later for a special situation or because the loop performed particularly well with these values. The operator-initiated PID Recall function loads these memory values into the PID working value records.
3. The reference values – these parameters, PR, IR, and DR, are used to form a range of values which restrain, and clamp, the working values. Reference values are obtained from the real values entered at block configuration or from a Pretune operation.

The self-tune algorithm has three primary states: Manual-Tune (MTN), Self-Tune (STN), and Pretune (PTN).

When the PIDE block is initialized, the self-tuning algorithm goes to the MTN state. EXACT-tuning is inoperable in the MTN state. MTN is the only state that responds to the PIDRCL signal that is sent when the operator requests a PID Recall. If any of the working values are linked, PID Recall is ignored.

The algorithm enters the other two states, PTN and STN, only through the MTN state. Furthermore, both these states exit only to the MTN state. This description moves first from the manual-tune state to the Pretune state and then to the self-tune state.

Before the EXACT-tune algorithm can operate, the operator has to provide several tuning range parameters. Pretune can help the operator who is tuning an unfamiliar loop obtain values for some of these parameters. Specifically, it does this by running through an open-loop upset and getting some rough estimates for the IR, PR, DR, NB, and WMAX parameters. When more reliable values are not already available, the operator can have these estimates stored into the reference values by requesting pretune from the detail display.

To enter the PTN state, the block must be in Manual and the EXACT-tune algorithm must be in the MTN state when the operator makes a pretune request at the detail display. BMP is the only parameter the operator has to define for a pretune. BMP is the output step change that causes the measurement to undergo the “process reaction curve” (a minimum of 2.5 percent of the measurement span).

The “process reaction curve” identifies the process deadtime and the process sensitivity. The algorithm uses the deadtime to estimate the reference values for the integral time (IR), the derivative time (DR), and the maximum wait time (WMAX). Both the process sensitivity and the deadtime enter into the estimate for the proportional band reference (PR). Pretune produces overly conservative tunings for a dominant deadtime process.

Pretune estimates the noiseband (NB) by determining the amplitude of the measurement component whose frequency is too high for the closed loop to remove. Reduce the Derivative Factor (DFCT) if NB is high, since derivative is ineffective in a high-noise environment.

When the pretune operation is complete, the algorithm sets the pretune request to false, causing an automatic return to the MTN state.

Before entering the STN mode, the operator, or the configuration, must define the following parameters.

To establish ranges for P, I, and D, the algorithm needs the reference values (PR, IR, and DR), the change limit (CLM) value, and the derivative factor (DFCT).

To accurately detect peaks, and to correct for the oscillating or the overdamped response, the algorithm needs values for the noiseband (NB), the maximum wait time (WMAX), and the output cycling limit (LMT).

To confirm that its computed values will provide the desired closed-loop response, the algorithm needs values for the maximum allowed damping (DMP) and the overshoot limit (OVR).

To enter the self-tune state (STN), the block’s working values must be free of linkages, the self-tune algorithm must be in the MTN state, when the self-tune request (STNREQ) is true. STNREQ may, based on its configuration, come from the operator or from another control block. Once in STN, the EXACT-tuning algorithm remains in this state until STNREQ is set false or the block is initialized.

In STN, the algorithm looks at the error each block execution cycle, immediately after the PID algorithm is completed. As long as the error magnitude does not exceed twice the NB, the STN mode remains in its quiescent state.

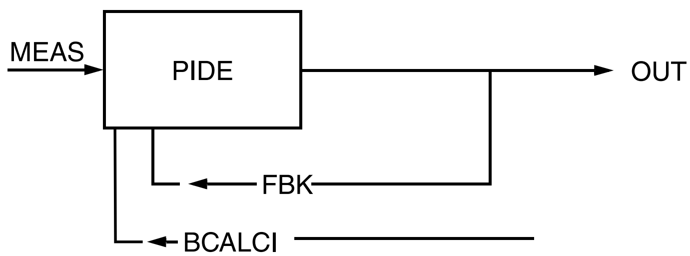
If the error magnitude does exceed twice NB, the algorithm records the next three peaks in the error curve. Based on the magnitude of these three peaks and the period of time between peaks, the algorithm computes new values for P, I, and D, and checks that they are consistent with other user-defined parameters. If they are consistent, the self-tune algorithm copies them into the PID algorithm's working values.

If the computed values violate any of these constraining parameters (for example, Overshoot or Damping), the algorithm adjusts one or more of the computed values and rechecks for consistency until it meets all constraints.

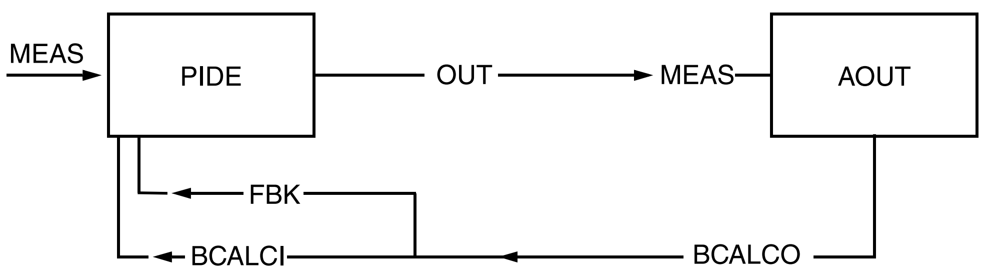
102.4.1 Normal Configuration

Normal configuration of the PIDE block is as follows:

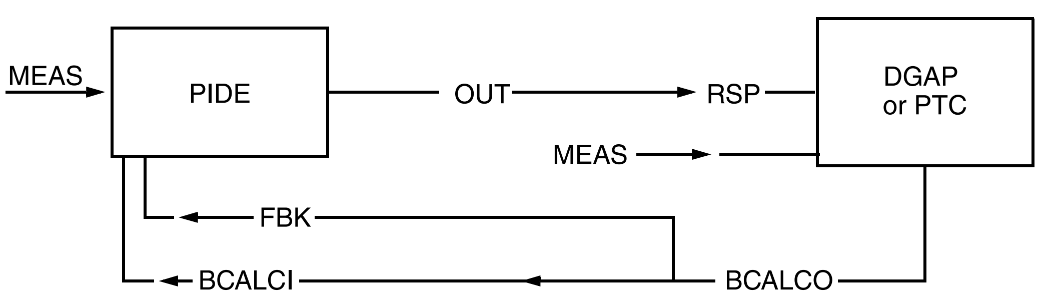
If there are no downstream control blocks, then link the BCALCI and FBK parameters to the OUT parameter.



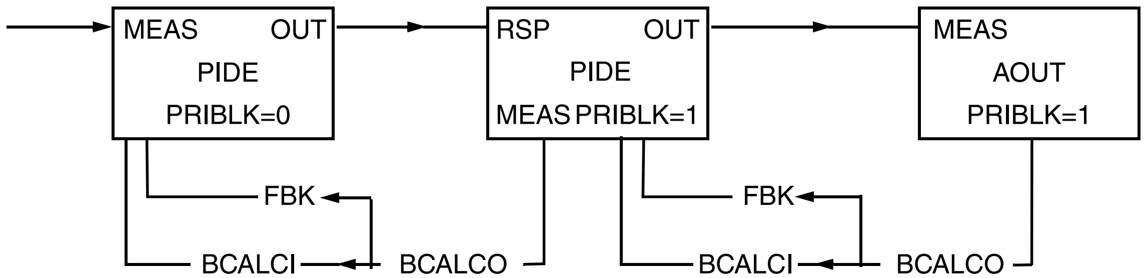
If the downstream block is an AOUT block, link BCALCI and FBK to the downstream block's BCALCO parameter.



If the secondary block is a DGAP or PTC block, link BCALCI and FBK to the secondary block's BCALCO parameter.



In a cascade configuration, link the blocks as shown below.



In a cascade configuration, connect the FBK of the primary to the BCALCO of the secondary controller to prevent windup.

Use the PRIBLK option in all cascade configurations.

102.4.2 PRIBLK and PRITIM Functionality

The Primary Block (PRIBLK) parameter indicates whether the PIDE block has a connection from an upstream block (PRIBLK=1) or not (PRIBLK=0). Its value, together with that of the Primary Cascade Timer (PRITIM), determines whether the PIDE block remains in Hold for a fixed time delay (of length defined by PRITIM), or ends the Hold when the Acknowledge status bit (Bit 10) of MEAS is detected from the upstream block (if PRITIM = 0.0). During initialization, the acknowledgement is not required and a Hold of one cycle only occurs.

103. PLB –Programmable Logic Block

This chapter covers the PLB (Programmable Logic Block), including its features, parameters, detailed operations, and channel designators.

103.1 Overview

The Programmable Logic block (PLB) supports ladder logic executing in a digital Fieldbus Module (FBM). A PLB connects user tasks, other blocks, and other ladder diagrams with a digital FBM's physical inputs and outputs and a ladder diagram's I/O flags.

103.1.1 I/O Diagram

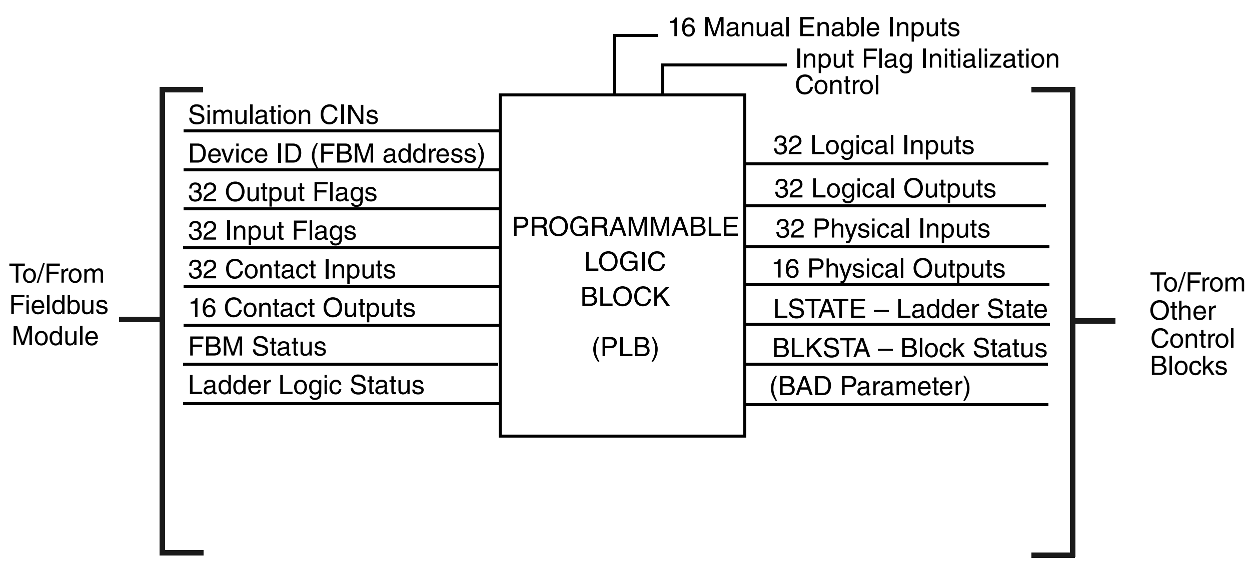


Figure 103-1. PLB Block I/O Diagram

103.2 Features

The features are:

— NOTE —

The actual number of physical I/O channels available depends upon the hardware implemented. The block's 32 input flag and 32 output flag parameters accommodate the maximum number of flag references you can create when constructing a ladder diagram.

- At the configured processing interval, control processor software reads each physical I/O channel and each ladder logic output flag reference from the FBM and updates the appropriate PLB parameter values.
- At the configured processing interval, control processor software writes each input parameter value from the PLB to the appropriate ladder logic input flag reference in the FBM.
- The PLB name identifies the source file for a ladder diagram. Before you build the ladder, you must create the PLB. You can configure the block's parameters before building the ladder or accept the default parameters, build the ladder, and then configure the block parameters.

The options are:

- Input Flag Mask (IFLMSK) specifies which IFLs are initialized when the compound is turned on.
- Input Flag Pattern (IFLPAT) contains packed boolean values representing the initial values of IFLs specified in the IFLMSK parameter.
- Initialize Manual/Auto (INITMA) specifies the desired state of the MA input during initialization.
- Manual Enable 1 through 16 (MAE_1 to MAE_16) determine whether or not the corresponding physical output remains functionally connected to its ladder rung when the PLB goes to Manual.

103.3 Parameters

Table 103-1. PLB Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	181	PLB
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
IOM_ID	FBM reference	string	no-con/no-set	blank	---
IFLMSK	input flag mask	pack_l	no-con/no-set	0	0 to 0xFFFFFFFF
IFLPAT	input flag pattern	pack_l	no-con/no-set	0	0 to 0xFFFFFFFF
IFL_1 to IFL_32	input flag 1 to 32	boolean	con/set	0	0 to 1
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	[0|1|2]
MAE_1 to MAE_16	M/A enable, 1 to 16	boolean	no-con/no-set	0	0 to 1
OUTPUTS					
BAD	bad I/O status	boolean	con/no-set	0	0 to 1
BLKSTA	block status	pack_l	con/no-set	0	bit map
CIN_1 to CIN_32	output point 1 to 32	boolean	con/no-set	0	0 to 1
CO_1 to CO_16	contact output 1 to 16	boolean	con/no-set	0	0 to 1

Table 103-1. PLB Block Parameters (Continued)

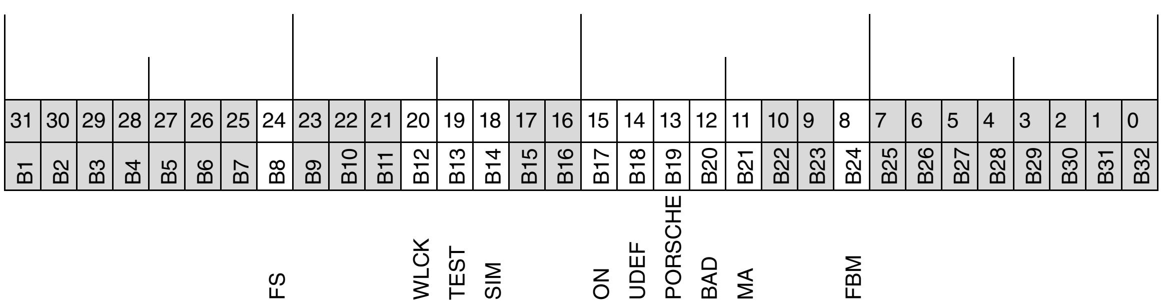
Name	Description	Type	Accessibility	Default	Units/Range
FS	failsafe state	boolean	con/no-set	0	0 to 1
INITMR	initialization timer	real	con/no-set	0	any real
INITO	initialize out	short	con/no-set	0	0 to 1
IOGRPS	input/output groups	short	no-con/no-set	0	bit map
LSTATE	ladder state	integer	con/no-set	0	0 to 4
OFL_1 to OFL_32	output flag 1 to 32	boolean	con/no-set	0	0 to 1
PAKCIN	packed inputs	pack_l	con/no-set	0	0 to 0xFFFFFFFF
PAKCO	packed contact outputs	pack_b	con/no-set	0	0 to 0xFFFFFFFF
PAKIFL	packed input flags	pack_l	con/no-set	0	0 to 0xFFFFFFFF
PAKOFL	packed output flags	pack_l	con/no-set	0	0 to 0xFFFFFFFF
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
DEV_ID	FBM letterbug	char[6]	no-con/no-set	blank	1 to 6 chars
ERCODE	config error	string	no-con/no-set	0	0 to 43 chars
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars

103.3.1 Parameter Definitions

ACHNGE — Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

BAD — Bad is a boolean output parameter which is set true when the input to the block is unacceptable in any way. The BAD bit of BLKSTA (BLKSTA.BAD) is also set true whenever BAD is true.

BLKSTA — Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the PLB block, only the following bits are used:



Bit Number[1] (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
8	FBM	FBM Failure	BLKSTA.B24

Bit Number[1] (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
12	BAD	Bad I/O (I/O Blocks only - block in BAD state)	BLKSTA.B20
13	PORS CHE	Block contains I/A Series v8.5 controller enhancements (parameter INITMR)	BLKSTA.B19
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
18	SIM	Simulation Mode	BLKSTA.B14
19	TEST	Test Mode	BLKSTA.B13
20	WLCK	Workstation Lock	BLKSTA.B12
24	FS	Failsafe	BLKSTA.B8

1. Bit 0 is the least significant, low order bit.

CIN_1 to CIN_32

Contact Inputs 1 through 32 are block output parameters originating as the 32 input values from physical input channels in the FBM. The actual number of channels available depends on the hardware implemented.

CO_1 to CO_16 Contact Outputs 1 through 16 are boolean outputs that report the conditions of the digital output points of the configured FBM. In Manual, the output is unsecured and open to manipulation by Object Manager SET commands.

DEFINE Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block.

DESCRP Description is a user-defined string of up to 32 characters that describe the block’s function (for example, “PLT 3 FURNACE 2 HEATER CONTROL”).

DEV_ID Device Identifier is a character array that specifies the 6-character letterbug identifier of the connected FBM or FBC. DEV_ID differs from IOM_ID in that it is of character array rather than string type, and does not allow the use of the ECB NAME parameter or ECB pathname in specifying the connected FBM or FBC.

ERCODE Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block’s

DEFINE parameter to be set false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the PLB block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
"W43 – INVALID PERIOD/ PHASE COMBINATION"	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
"W46 – INVALID INPUT CONNECTION"	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
"W48 – INVALID BLOCK OPTION"	The configured value of a block option is illegal.
"W51 – INVALID HARDWARE/ SOFTWARE TYPE"	An I/O block is connected to an ECB or the wrong type.
"W52 – INVALID I/O CHANNEL/GROUP NUMBER"	An I/O block is connected to an ECB when the specified point number is invalid or when the specified group or octet number is invalid.
"W53 – INVALID PARAMETER VALUE"	A parameter value is not in the acceptable range.
"W54 – ECB DOES NOT EXIST"	An I/O block has a connection to an ECB that does not exist or has not yet been installed. When the ECB is installed, previously installed I/O blocks waiting for that ECB will initialize automatically.
"W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK"	A Database Installer error has occurred.

Message	Value
“W59 – DUPLICATE OUTPUT CHANNEL”	This block and another output block are connected to the same output point. Since this may be intentional, this message is only a warning. **Conditions under which this warning may be issued:** 1) The PLB block cannot perform duplicate I/O checking of output assignment - that is, multiple PLB blocks have the same output point. Output assignments are configured within the LADDER logic not in a block parameter. This warning is shown to aid a user of a possible duplicate assignment. The warning message does not prevent the control station from accepting this block when the DONE pick is selected. 2) This Warning message is also presented in the configuration where an FBM consists of a main FBM and an extender FBM (FBM41 + FBM42), which requires two PLB blocks, one for each. In this configuration, both blocks refer to the same FBM letterbug. As the interface between the CP and the FBM does not have any secure knowledge of what resources belong to each block (the connections are made at the FBM itself), the warning is issued. However, in this configuration, the warning may be ignored.

FS

Failsafe is a boolean output that is set true when the block detects the FBM going to the Failsafe state. While in this state, the block retains the actual Failsafe value of the output point as it is read back from the FBM. This value, depending on the ECB Failsafe option, is either the fallback or the hold value.

IFLMSK

Input Flag Mask contains packed boolean values that specify which IFLs are initialized from the IFLPAT values when the PLB block is installed, and when the compound is turned on. For each bit in the mask:

0 = use the current value

1 = initialize to the IFLPAT bit

IFLPAT
: Input Flag Pattern contains packed boolean values that represent the initial values of the IFLs specified in the IFLMSK parameter.

IFL_1 to IFL_32
: Input Flags 1 through 32 are the input parameters transferring up to 32 values from other blocks or tasks to the input flag references in the ladder diagram executing in the FBM.

INITMA
: Initialize Manual/Auto specifies the desired state of the MA input during initialization, where:

0 = Manual

1 = Auto

2 = The MA state as specified in the checkpoint file.

The block asserts this initial M/A state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a reboot operation.
- The compound in which it resides is turned on.
- The INITMA parameter itself is modified via the control configurator. (The block does not assert INITMA on ordinary reconfiguration.)

INITMA is ignored if MA has an established linkage.

INITMR
: Initialization Timer is a configurable, non-settable real parameter that is used to specify the time interval (in seconds) during which a PLB block will be in the HOLD state when the block is initializing its outputs. This will occur when the block restarts and when the block is recovering from loss of communications to a ladder-logic FBM.

INITO
: Initialization Output is set true when:

- The block is in Manual or initializing.
- Permanent or temporary loss of FBM communications occurs.
- The ladder logic in the FBM is not running.

The block clears INITO when none of these conditions exist. You connect this parameter to the INITI input of upstream blocks so that these upstream blocks can sense when this block is open loop. With V4.2 or later software, BCALCO contains the initialization output eliminating the need to configure INITO connections in cascades. However, to preserve backward compatibility, the INITO parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITO short value has been maintained, but the setting of the handshaking bits, via the INITI to INITO connection, is eliminated.

IOGRPS
: I/O Groups is used to indicate the type of contact I/O groups in an FBM connected to a PLB block.

Bits 1 to 0 for Points 25 to 32: 0 = none, 1 = DI, 2 = DO.

Bits 3 to 2 for Points 17 to 24: 0 = none, 1 = DI, 2 = DO.

Bits 5 to 4 for Points 9 to 16: 0 = none, 1 = DI, 2 = DO.

Bits 7 to 6 for Points 1 to 8: 0 = none, 1 = DI, 2 = DO

(Bit 7 = MSB, Bit 0 = LSB).

IOM_ID

Fieldbus Module Identifier is a configurable string that specifies the pathname of the FBM or FBC to which the block is connected.

IOM_ID has the form CompoundName:BlockName, where CompoundName is the 1-12 character name of the local compound containing the ECB, and BlockName is the 1-12 character block name of the ECB.

If the compound containing the ECB is the CPletterbug_ECB compound where CPletterbug is the station letterbug of the CP, the CompoundName may be omitted from the IOM_ID configuration. In this case, the 1-12 character ECB block name is sufficient.

LOCKID

Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.

LOCKRQ

Lock Request is a boolean input which can be set true or false only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.

LOOPID

Loop Identifier is a configurable string of up to 32 characters which identifies the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.

LSTATE

Ladder State is an integer output. LSTATE values range from 1 to 4, and indicate the following Ladder Logic operational states:

LSTATE Value	Status	Description
1	Running	The FBM is OK; Ladder Logic is running without logic error.
2	Stopped	The FBM is OK; Ladder Logic is not running. There is no logic error.

LSTATE Value	Status	Description
3	Error	The FBM is OK but the Ladder Logic is experiencing a logic error.
4	Failed	The FBM is not OK.

MA

Manual Auto is a boolean input that controls the Manual/ Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. In Manual, the algorithm is not performed, and the output is unsecured. An external program can then set the output to a desired value.

MAE_1 to MAE_16

Manual Enable 1 through 16 are configuration parameters that determine whether or not the corresponding physical output remains functionally connected to its ladder rung when the PLB goes to Manual. For example, if MAE_1 is set to 1 and the block is in the Manual state, the first physical output in the FBM is driven by whatever connection exists to the block's CO_1 output parameter. Set commands from tasks can also change the state of the physical output. If MAE_1 is set to 0, or if the block is in the Auto state, the ladder logic of the rung ending with coil symbol CO_1 determines the value of the first physical output point. This value is also reflected as a readback to the PLB block and appears as the value of the block's output parameter, CO_1. CO_1 is thus a functional input to the FBM when in Manual (MAE set) and a functional output from the FBM at other times.

NAME

Name is a user-defined string of up to 12 characters used to access the block and its parameters.

OFL_1 to OFL_32

Output Flags 1 through 32 are output parameters providing other blocks or tasks with output values from output flag references in the ladder diagram executing in an FBM. These outputs are accompanied by an OOS status bit that is set when:

- The FBM is failed.
- The Ladder Logic is experiencing a logic error in the FBM.
- The Ladder Logic is not running.

OWNER

Owner is a string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are successful only if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.

PAKCIN	Packed Contact Input is a 32-bit packed boolean where the LSB is the value (1 or 0) of the channel 32 block output, CIN_32, and the MSB is the value of the channel 1 block output, CIN_1. For example a PAKCIN value of decimal 18 means that the physical input values for channels 28 and 31 were 1s, and all other channels had a physical input value of zero.
PAKCO	Packed Contact Output contains boolean values that represent the states of the CO parameters in a PLB block.
PAKIFL	Packed Input Flag contains packed boolean values that represent the input flag states in a PLB block.
PAKOFL	Packed Output Flag contains packed boolean values that represent the output flag states in a PLB block.
PERIOD	Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PHASE	Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
TYPE	When you enter "PLB" or select "PLB" from the block type list under Show, an identifying integer is created specifying this block type.

103.4 Detailed Operation

The PLB and the ladder program execute at independent scan periods. The PLB executes at the period you specify during block configuration, while the ladder program executes as often as the length and complexity of the ladder allows.

Initialization of the IFL parameters is controlled by the IFLMSK packed long parameter, which indicates which IFLs to write to the FBM with predetermined values and which IFLs to read back from the FBM.

At initialization:

- Linked IFL parameters are written to the FBM

- Unlinked parameters specified in IFLMSK by having their bit set are initialized differently depending on the circumstance, as listed in the following table:

When ...	This Happens...
Turning on the compound	The IFL value is initialized to the pattern specified in IFLPAT, and then written to the FBM
Installing the PLB block	
Reconfiguring the PLB block	The IFL value in the block is written to the FBM
Rebooting	The IFL is read back from the FBM

- Unlinked IFL parameters *not* specified in IFLMSK are read back from the FBM.

As part of normal I/O processing, the PLB updates the control strategy with FBM physical I/O contact states, FBM status, ladder logic input/output flag states, ladder logic status on a per-segment basis, the values of the MAE parameters (readback), and the values of the manually forced CO's (readback). When the block is scheduled to run, the PLB output parameters are updated with physical I/O values and ladder logic output flag values.

In addition, each time the PLB is processed, in either Auto or Manual mode, the boolean input/output parameters associated with the IFL, OFL, CIN, and CO parameters are packed and stored into their packed boolean output parameters, as follows:

Parameter	Data Type	Data Format
PAKIFL	Packed Long	Boolean 1 = IFL_1, Boolean 32 = IFL_32
PAKCIN	Packed Long	Boolean 1 = CIN_1, Boolean 32 = CIN_32
PAKOFL	Packed Long	Boolean 1 = OFL_1, Boolean 32 = OFL_32
PAKCO	Packed Boolean	Boolean 1 = CO_1, Boolean 16 = CO_16

The OOS status bits of the individual CO and OFL parameters are continually updated while the block is in Manual.

If the FBM is not operational or the ladder program is off-line, the inputs are not written and the outputs are not updated. The BAD parameter is set true and the Bad status of all output parameters is set to true. The BAD parameter can be used to effect alternate control strategies. The CO and OFL parameters are secured while the FBM is BAD and the block is in Manual. On a bad-to-good transition, CO parameters are read back to determine their actual values in the FBM.

When the CP detects that the connected FBM has entered the Failsafe state, the FS boolean output is set in this and all connected I/O contact output blocks. The block's FS block status boolean is also set. Both FS booleans remain set for a single execution cycle of the block.

To enable the reinitialization of control schemes, the block sets INITO to true when it loses FBM communications, or when the FBM's ladder logic is not running, or when the block is in Manual.

The block supports Manual/Auto mode for manually updating block outputs. Manual does not affect the operation of the input parameters or input flags.

Setting a PLB's MA input false places the block in the Manual mode. Control of each physical output depends upon the state of its MAE parameter. If MAE is set true, the ladder program does not update the output. Workstations, other blocks, displays, and processes (user tasks or programs) can write to the unsecured output parameter, and these values are sent to the FBM's physical output.

When multiple ladder (up to eight) exist in a single FBM, the MAE parameters let each PLB in manual release only the output parameters that it is responsible for.

You can use the MA parameter to control linkage between ladders. By setting the MA parameter input to the other PLBs false, you can isolate ladders when you want each to operate independently.

103.4.1 Block Interface

Each PLB represents an independent ladder program; the name of the ladder is the block name. Multiple PLBs can be connected to a single FBM to support multiple independent ladders. The order of concatenation of multiple ladder segments is the same as the order of listing of the PLBs in the `Ladder Assignment` pick of the **`FBM`** menu in the Integrated Control Configurator.

Ladders in different FBMs can communicate with each other through their PLBs. An output flag from a ladder program in one FBM can be connected to an input flag of a ladder program in another FBM through the flag parameters of the respective PLBs.

Blocks, tasks, or other ladders can read an FBMs physical inputs and outputs by connecting to the corresponding PLB parameters. Alarming can be handled by connecting output flags to a boolean alarm (BLNALM) block.

103.4.2 Display Interface

Various software subsystems access internal information to edit a ladder diagram, display rung power flow, read and write timer/counter values, and control the modes of ladder logic operation.

Displays that you configure can access ladder logic through input flag and output flag parameters in PLBs. Displays can also show the contents of the physical CIN_x and CO_x parameters.

103.4.3 Simulation

An ECB8, the ladder logic Equipment Control Block, provides a special pair of parameters, SIMOPT and SIMCIN, to enable you to simulate contact inputs for an associated PLB block.

SIMOPT is automatically downloaded to the FBM on installation and modification of the ECB from the Integrated Control Configurator. SIMCIN is automatically downloaded to the FBM when the PLB block runs. When communications from the CP to a failed FBM is restored, SIMCIN is unchanged.

When simulation is active, the FBM sets a simulation status bit in all READ command response messages, which in turn is reflected in a block status bit in all PLB blocks connected to the FBM. This simulation status is also displayed in the PLB monitor and the PLB Ladder Logic default displays. Based on the value of the SIMOPT parameter, the FBM logic selects between the simulated CINs downloaded from the CP or the physical CINs.

103.4.4 Input Flag Configuration

When configuring PLBs for different ladder diagrams in a single FBM, avoid assigning an input flag to more than one block. If any IFL is referenced in multiple segments of a composite ladder, the value sent down to the FBM for use in solving the ladder is the value of that IFL parameter in the PLB which is processed last. This depends on the zones, and positions within the zones, of the various PLBs involved, as shown on the Block/ECB Functions screen of the Integrated Control Configurator.

103.4.5 Output Flag Configuration

When entering contact and coil symbols in a ladder, you should note that the ladder elements constitute a fixed pool of resources associated with the FBM. A given element (for example, OFL_1) can be entered in more than one segment of a composite ladder, but doing so does not create additional OFLs. There is only one OFL_1, with a single data value, in the FBM. It can be entered as an output coil in multiple segments of the ladder, in which case the final concatenated ladder has more than one rung ending with symbol OFL_1. When the OFL_1 value is transmitted to the control processor, its value depends on the evaluation of the highest-numbered rung ending in OFL_1, that is, the last calculation of OFL_1 during the ladder scan. All PLBs connected to that FBM receive this value of OFL_1 as an input parameter. This implies that if the usage of technical identifiers is overlapped, a PLB block could receive values of parameters from the FBM different from the ones expected on the basis of their own ladder segments.

The same considerations apply to overlapped usage of COs and TCs.

103.4.6 I/O Configuration Example

The PLB configuration example, in the following five-part diagram, shows part of a control strategy to pump a fluid from either of two tanks. The first shows the process, the next two show the control blocks, the fourth shows the I/O table and flag table connections to the PLBs, and the fifth shows a portion of the ladder diagram.

The example is not a practical application. It is intended only to show concepts associated with segments, while limiting each segment to one rung for simplicity. Arbitrarily, some of the control is implemented through I/O flags and some through physical I/O channels to demonstrate the two methods of communicating with ladder logic.

In the example, an operator presses one of two switches to select a tank to supply fluid. If the tank's low level switch is not closed, the ladder logic output to an On/Off Valve controller (VLV) block opens the tank's drain valve. Ladder logic causes the pump to run if either tank valve is open.

Physical contact inputs are available to the ladder from input channels of the FBM. Contact inputs from the operator panel and from valve limit switches activate one of the module's physical output channels to operate a motor control relay in the process. To demonstrate another input path, one input is routed through a MCIN block to the PLB as an input flag to the ladder. To demonstrate other output paths, the PLBs transfer output flags from the ladder to VLV blocks and a COUT block.

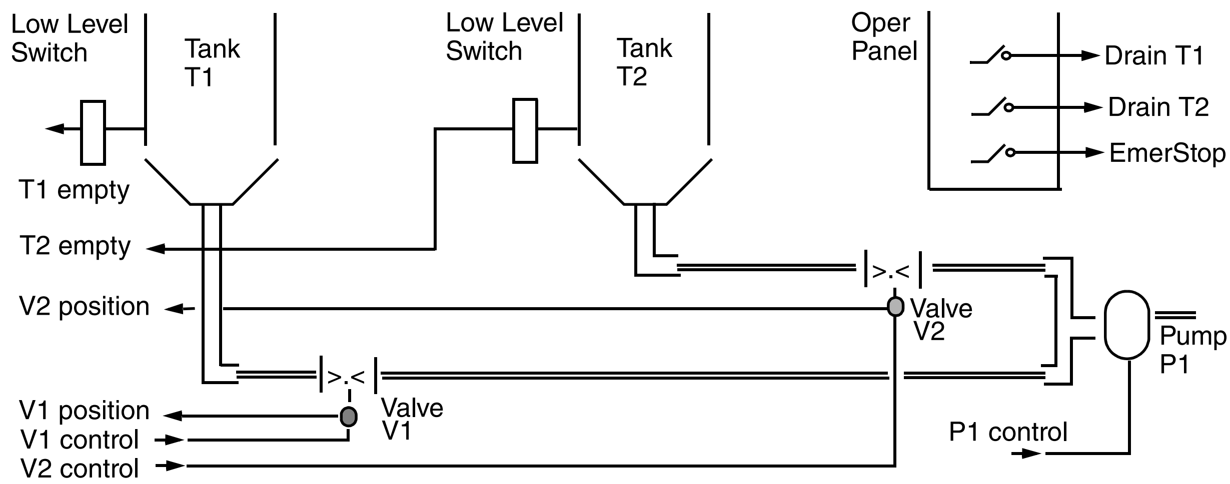


Figure 103-2. PLB Configuration (1 of 5)

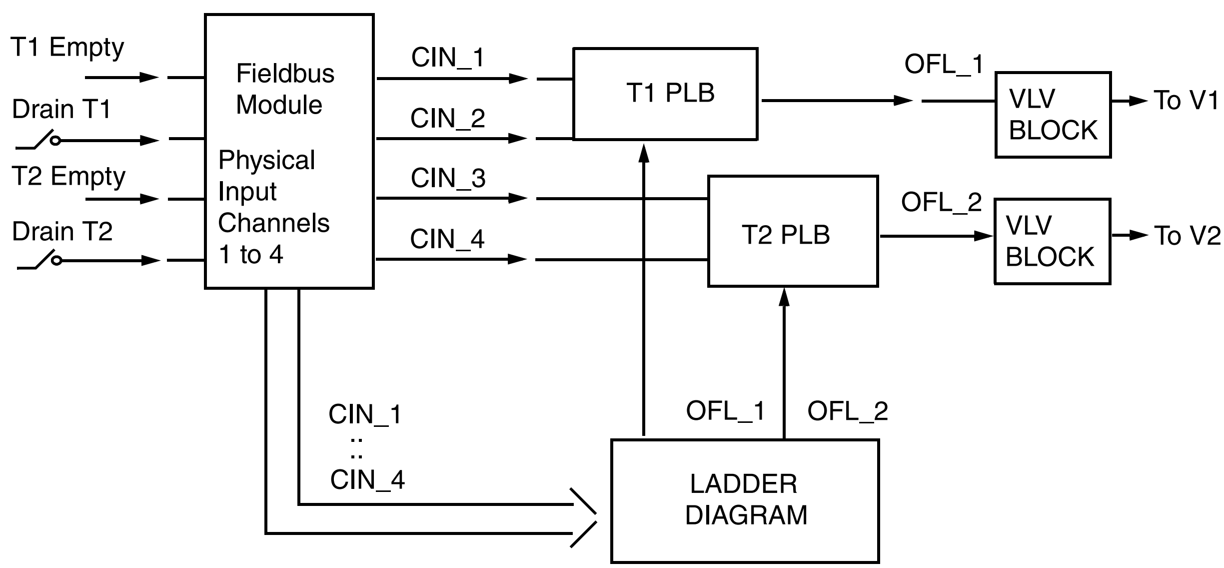


Figure 103-3. PLB Configuration (2 of 5)

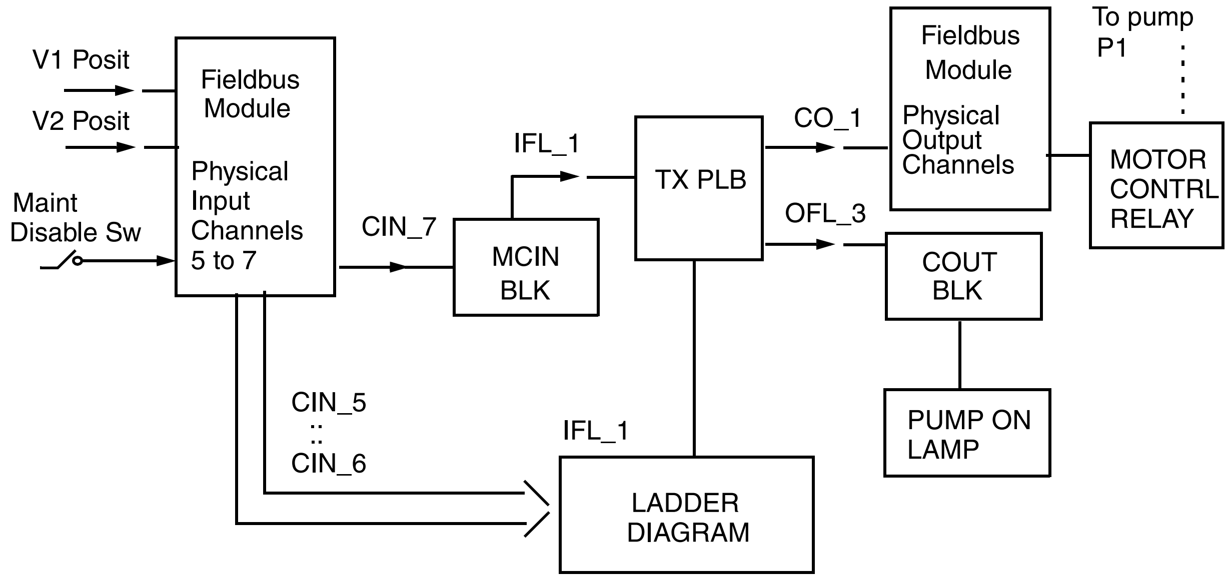


Figure 103-4. PLB Configuration (3 of 5)

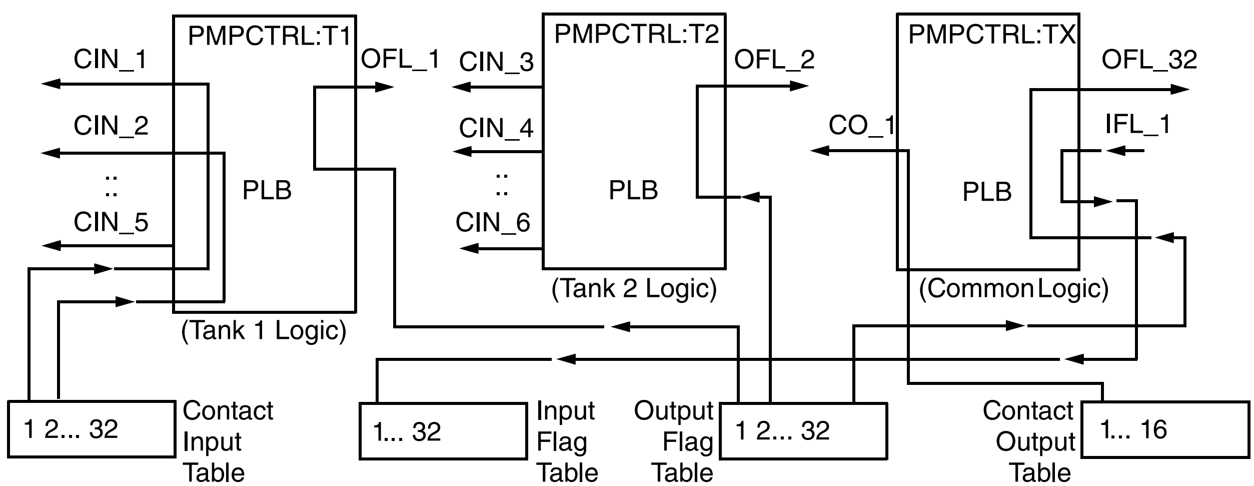


Figure 103-5. PLB Configuration (4 of 5)

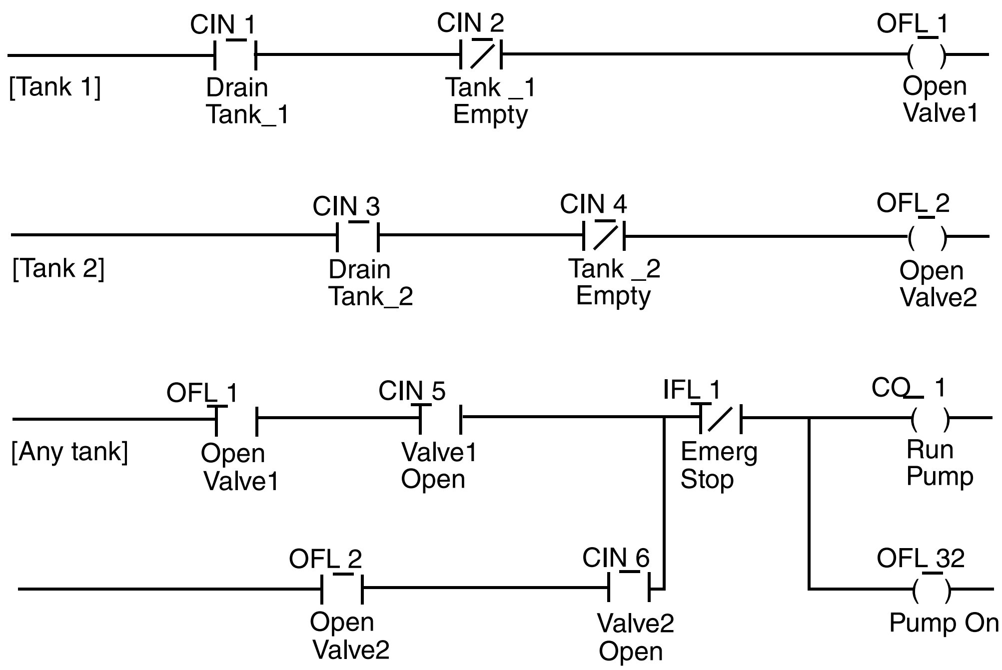


Figure 103-6. PLB Configuration (5 of 5)

103.5 Channel Designators

FBM Type FBM #	DI (7,8,20)	DI (12,13,21)	DI/DO (9,10,11)	DI/DO (14,15,16)
CH 1	cin_1	---	cin_1	---
CH 2	cin_2	---	cin_2	---
CH 3	cin_3	---	cin_3	---
CH 4	cin_4	---	cin_4	---
CH 5	cin_5	---	cin_5	---
CH 6	cin_6	---	cin_6	---
CH 7	cin_7	---	cin_7	---
CH 8	cin_8	---	cin_8	---
CH 9	cin_9	---	co_1	---
CH 10	cin_10	---	co_2	---
CH 11	cin_11	---	co_3	---
CH 12	cin_12	---	co_4	---
CH 13	cin_13	---	co_5	---
CH 14	cin_14	---	co_6	---
CH 15	cin_15	---	co_7	---
CH 16	cin_16	---	co_8	---
CH 17	---	cin_17	---	cin_17

FBM Type FBM #	DI (7,8,20)	DI (12,13,21)	DI/DO (9,10,11)	DI/DO (14,15,16)
CH 18	---	cin_18	---	cin_18
CH 19	---	cin_19	---	cin_19
CH 20	---	cin_20	---	cin_20
CH 21	---	cin_21	---	cin_21
CH 22	---	cin_22	---	cin_22
CH 23	---	cin_23	---	cin_23
CH 24	---	cin_24	---	cin_24
CH 25	---	cin_25	---	co_9
CH 26	---	cin_26	---	co_10
CH 27	---	cin_27	---	co_11
CH 28	---	cin_28	---	co_12
CH 29	---	cin_29	---	co_13
CH 30	---	cin_30	---	co_14
CH 31	---	cin_31	---	co_15
CH 32	---	cin_32	---	co_16

NOTE

The PLB automatically sets the `cin_` and `co_` designations for the block when it detects the FBM type to which it is connected.

104. PLSOUT – Pulse Output Block

This chapter describes the function of the Pulse Output (PLSOUT) block and defines its parameters.

NOTE

This chapter describes the Distributed Control Interface (DCI) PLSOUT block. For a description of how the PLSOUT block is used in PLC applications, refer to *PLC Interface Block Descriptions* (B0193YQ).

104.1 Overview

The Pulse Output (PLSOUT) block is a Distributed Control Interface (DCI) block. (DCI blocks support connectivity of I/A Series control stations to various bus resident devices via a general purpose interface.)

PLSOUT allows the control strategy or operator to output on/off or start/stop type commands through momentary pulsed outputs on two separate lines to addresses in an external device. Typically, these commands are sent to a latching function in a device, with one command used for the set input of the latch and the other used for the reset input.

The first pulsed output is presented at Pulse Output 1 (COUT_1) and is transmitted to address Output 1 Point Number (CO1_PT) associated with the field device. The other is presented at Pulse Output 2 (COUT_2) and transmitted to address Output 2 Point Number (CO2_PT) associated with the field device. Each of these addresses contains either the value transmitted by the PLSOUT block, or a value written locally (such as from a local panel display), depending on which write action is most recent.

When in Auto, in the outbound direction, the block accepts transitions on IN to drive the output pulses. In Manual, the output pulses are driven by operator settings to inputs SET and RESET.

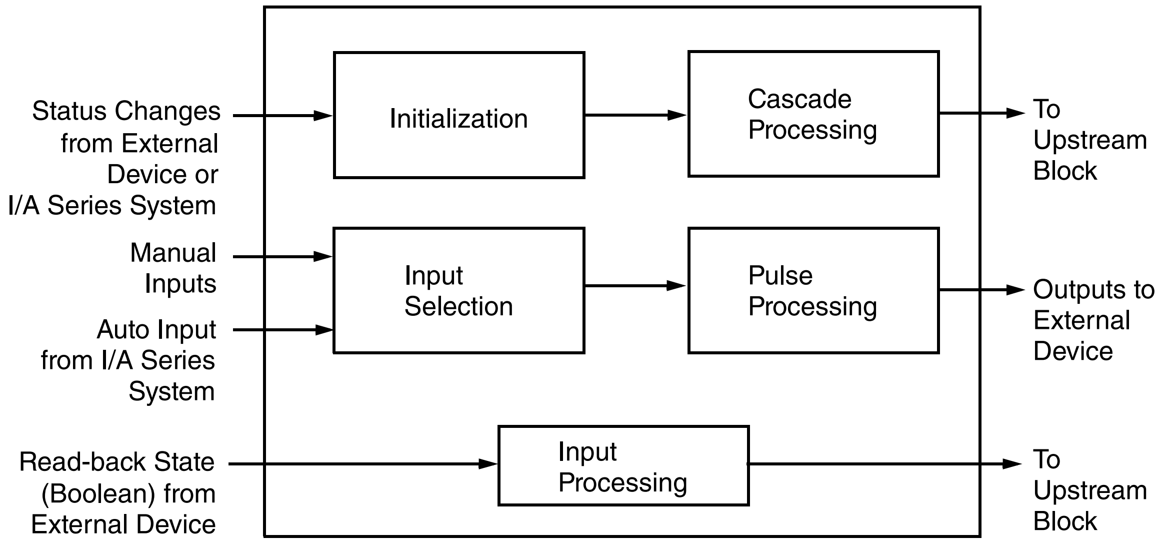


Figure 104-1. PLSOUT Block Diagram

104.2 Basic Operation

When in Auto, the block accepts transitions at parameter Input Request (IN) to drive the output pulses. A transition of IN from 0 to 1 causes a positive-going pulse at COUT_1, and the opposite transition causes a positive-going pulse at COUT_2. In each case the pulse has a duration of Pulse Time (PLSTIM). In Manual, operator sets at parameters Set Request (SET) and Reset Request (RESET) drive the output pulses.

A limit-switch function is provided by parameter Readback State (RBK), made available from the external device. Any reversal of the value of RBK causes immediate termination of an active pulse.

The block provides the parameters Initialize Output (INITCO) and Back-Calculated Output (BKCO) to alert upstream blocks to various abnormal situations and for cascade handling.

To force the I/A Series control station to Track during initialization procedures within the external device, a specific signal is made available to the PLSOUT block at a configured Initialization Point Number (INI_PT) within the external device.

The PLSOUT block does not provide any alarm detection or reporting capabilities.

104.3 Features

The PLSOUT block provides the following features:

- Separate block inputs for use in triggering pulses when in Auto and Manual
- Two pulsed outputs to two configured device addresses may be used to set and reset inputs of a latching function
- Limit switch state made available at specific configured device point
- Specific point reserved for Tracking notification from device.

104.4 Parameters

Table 104-1. PLSOUT Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
Configurable Parameters					
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	PLSOUT_TYPE	144
DESCRP	description	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short integer	no-con/no-set	1	0 to10, and 13 for CPs, 0 to 12 for Gateways
PHASE	block execute phase	integer	no-con/no-set	0	—
LOOPID	loop identifier	string	no-con/set	blank	1 to 32 chars
IOM_ID	ECB identifier	string	no-con/no-set	blank	1 to 12 chars
CO1_PT	output 1 point number	string	no-con/no-set	0	device specific
CO2_PT	output 2 point number	string	no-con/no-set	0	device specific
RBK_PT	read-back address	string	no-con/no-set	0	device specific
INI_PT	initialization point	string	no-con/no-set	0	device specific
EROPT	error option	short integer	no-con/no-set	0	0 to 2
IN	input request	boolean	con/set	0	0 to 1
PLSTIM	pulse time	real	no-con/no-set	0.0	seconds
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short integer	no-con/no-set	1	0 to 2
AUTSW	auto switch	boolean	con/set	0	0 to 1
MANSW	manual switch	boolean	con/set	0	0 to 1
PRIBLK	primary block	short integer	no-con/no-set	0	0 to 1
SIMOPT	simulation option	boolean	no-con/no-set	0	0 to 1
PRITIM	cascade closure delay	real	no-con/no-set	0.0	seconds
Non-Configurable Parameters					
INPUTS					
SET	set request	boolean	no-con/set	0	0 to 1
RESET	reset request	boolean	no-con/set	0	0 to 1
RBK	read-back state	boolean	con/no-set	0	0 to 1
OUTPUTS					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
BLKSTA	block status	packed long	con/no-set	0	bit map
COUT_1	pulse output 1	boolean	con/no-set	0	0 to 1
COUT_2	pulse output 2	boolean	con/no-set	0	0 to 1
INITCO	initialization output	boolean	con/no-set	0	0 to 1
BKCO	back calc. contact out	boolean	con/no-set	0	0 to 1
DATA STORES					
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	configuration error	string	no-con/no-set	blank	1 to 43 chars
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars

Table 104-1. PLSOUT Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars
DEV_ID	device identifier	character	no-con/no-set	blank	6 chars

104.4.1 Parameter Definitions

ACHNGE Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

AUTSW Auto Switch forces the block mode to Auto. It is of higher priority than configured, set, or linked values in MA, or the value of INITMA. It is of lower priority than MANSW, however. If both MANSW and AUTSW are true, the block mode is forced to Manual.

BKCO Back Calculated Contact Out is set equal to the value of RBK while the cascade is initializing. Since its purpose is to provide the upstream block with a back-calculated value, you may connect BKCO to the BCALCI parameter of any upstream block capable of providing that functionality.

BLKSTA Block Status is a 32-bit output, bit-mapped to indicate various block operational states. For the PLSOUT block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
					MAO						WLCK					ON	UDEF			MA			FBM	HLD							

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
7	HLD	Block Output Holding	BLKSTA.B25
8	FBM	Bad Status of ECB	BLKSTA.B24
11	MA	Manual = 0, Auto = 1	BLKSTA.B21
14	UDEF	Block Undefined	BLKSTA.B18
15	ON	Block On	BLKSTA.B17
20	WLCK	Access Locked	BLKSTA.B12
26	MAO	M/A Override Active	BLKSTA.B6

*Bit 0 is the least significant, low order bit.

CO1_PT

For the PROFIBUS interface to the I/A Series system (FBM223) Output 1 Point Number (CO1_PT) must be configured to contain a PROFIBUS data identifier. This information identifies, to the FBM, specific data (in this case the Output 1 Point Number address) associated with the external device in the PROFIBUS data stream. Refer to *PROFIBUS-DP Communication Interface Module (FBM223) User's Guide* (B0400FE) for details.

For the Modbus interface (FBM224), CO1_PT must be configured to contain the address of a coil in a Modbus device. Refer to *Modbus Communication Interface Module (FBM224) User's Guide* for details.

CO2_PT

For the PROFIBUS interface to the I/A Series system (FBM223) Output 2 Point Number (CO2_PT) must be configured to contain a PROFIBUS data identifier. This information identifies, to the FBM, specific data (in this case the Output 2 Point Number address) in the PROFIBUS data stream. Refer to *PROFIBUS-DP Communication Interface Module (FBM223) User's Guide* (B0400FE) for details.

For the Modbus interface (FBM224), CO2_PT must be configured to contain the address of a coil in a Modbus device. Refer to *Modbus Communication Interface Module (FBM224) User's Guide* for details.

COUT_1

Pulse Output 1 is the pulsed block output generated by either a positive-going transition of IN (Auto) or a change of SET from 0 to 1 (Manual). All PLSOUT pulses are positive going.

COUT_2

Pulse Output 2 is the pulsed block output generated by either a negative-going transition of IN (Auto) or a change of RESET from 0 to 1 (Manual). All PLSOUT pulses are positive going.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing (see ERCODE for the list of all possible validation errors in this block). In that case, no further processing of the block occurs, including further validation of remaining parameters. To return DEFINE to a true value, you should correct all configuration errors and re-install the block.

DESCRP

Description is a user-defined string of up to 32 characters that describes the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

DEV_ID

Device Identifier is a character array that specifies the 6-character identifier of the connected device. It is copied from the DEV_ID configured in the ECB specified by the IOM_ID parameter.

ERCODE

Error Code is a character data store which indicates the type of configuration error which caused the block's DEFINE parameter to be set false. Validation of configured parameters does not proceed past the first error encountered by the block logic. Each nonzero value of ERCODE results in an explanatory message at the block's detail display. For the PLSOUT block, the following list shows the possible messages you may see:

ERCODE Message	Meaning
W52 – INVALID I/O CHANNEL/GROUP NUMBER	The first character of CO1_PT or CO2_PT is blank.
W62 – UNRESOLVED CONNECTION	Connection is not yet resolved. (Block remains defined.)
W65 – INVALID POINT ADDRESS	The FBM parsing algorithm found that CO1_PT or CO2_PT is invalid
W66 – DUPLICATE CONNECTION	There is a duplicate connection to a point.
W67 – INSUFFICIENT FBM MEMORY	There is no available memory in the FBM.
W68 – INVALID DEVICE CONNECTION	The device connection is invalid.
W69 – INVALID POINT CONNECTION	The point connection is invalid.

EROPT

Error Option specifies the conditions under which IN is considered to have bad status. It is used in determining whether there has been a bad-to-good transition of IN.

- If EROPT = 1, IN is considered bad if its status word indicates Bad, Out-of-Service, or not On Scan. If it is not On Scan, then the source of the connection has been deleted, it is in a nonexistent compound, or there has been a peer-to-peer failure.
- If EROPT = 2, IN is considered bad in any of the above situations, or, if the Error bit in the status of IN is true.
- If EROPT = 0, IN is never considered bad, and there is never a Bad-to-Good transition.

IN

Input Request is the block input in Auto mode. A transition of the value of IN causes a pulse to be initiated at either COUT_1 or COUT_2.

INITCO

Initialization Output is a cascade initialization signal which is set true by the block logic whenever the cascade is opened. You may connect INITCO to the INITI input of any upstream block providing this functionality. The PLSOUT block keeps INITCO true either for one cycle (PRIBLK = 0), or until the PRITIM delay has expired (PRIBLK = 1).

INI_PT

INI_PT contains a user-configured string which specifies the device address of the initialization input.

For the PROFIBUS interface to the I/A Series system (FBM223), INI_PT must be configured to contain a PROFIBUS data identifier, which contains the device address of the initialization input. Refer to *PROFIBUS-DP Communication Interface Module (FBM223) User's Guide* (B0400FE) for details.

For the Modbus interface (FBM224), INI_PT must be configured to contain the address of a coil in a Modbus device. Refer to *Modbus Communication Interface Module (FBM224) User's Guide* for details.

For the FDSI (FBM230/231/232/233), INI_PT contains a data identifier to identify, to the FBM, specific data in the I/O data stream and to specify the elements of the data. Refer to *Field Device System Integrators (FBM230/231/232/233) User's Guide* (B0700AH) for additional information.

INITMA

Initialize Manual/Auto specifies the desired state of the MA input under certain initialization conditions, namely:

- The block has just been installed into the I/A Series control station database.
- The I/A Series control station is rebooted.
- The compound in which the block resides is turned on.
- The INITMA parameter is modified via the Integrated Control Configurator.

INITMA is ignored if MA has an established linkage.

When INITMA is asserted, the value set into MA is:

- 0 (Manual) if INITMA = 0
- 1 (Auto) if INITMA = 1
- The MA value from the checkpoint file if INITMA = 2.

IOM_ID

ECB Identifier is a configurable string that specifies the pathname of the ECB201 for the device, for the purpose of connecting to (accessing) a field parameter that resides in a field device hosted by a (parent) ECB200/202.

IOM_ID has the form CompoundName:BlockName, where CompoundName is the 1-12 character name of the local compound containing the ECB, and BlockName is the 1-12 character block name of the ECB.

If the compound containing the ECB is the CPletterbug_ECB compound where CPletterbug is the station letterbug of the CP, the CompoundName may be omitted from the IOM_ID configuration. In this case, the 1-12 character ECB block name is sufficient.

LOCKID	Lock Identifier is a string identifying the workstation that has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.
LOCKRQ	Lock Request is a Boolean input, which can be set true or false only by a set command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion, a workstation identifier accompanying the set command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.
LOOPID	Loop Identifier is a configurable string of up to 32 characters used to identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.
MA	Manual/Auto is a Boolean input that controls the block's operating state (0 = false = Manual; 1= true = Auto). When in Auto, the block input is taken from IN, usually from an upstream connection. In Manual, the input is taken from SET and RESET, usually via operator sets.
MANSW	Manual Switch unconditionally forces the block mode to Manual. It is of higher priority than any other method of establishing the value MA, since it overrides configured, set, or linked values. MANSW is also of higher priority than AUTSW or INITMA.
NAME	Name is a user-defined string of up to 12 characters used to access the block and its parameters.
OWNER	Owner is a settable string of up to 32 ASCII characters used to allocate control blocks to applications. Attempts to set OWNER are successful only if the present value of OWNER is the null string, an all-blank string, or identical to the value in the set request. Otherwise, the request is rejected with a LOCKED_ACCESS error. OWNER can be cleared by any application by setting it to the null string. This value is always accepted, regardless of the current value of OWNER. Once set to the null string, the value can then be set as desired. This parameter is set by an Object Manager get/set call. Refer to *Object Manager Calls* (B0193BC) for more information.
PERIOD	Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For

more details, refer to “Scan Period” in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PHASE
: PHASE is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the I/A Series station is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PLSTIM
: Pulse Time specifies the width of all generated pulses, in seconds. If you specify a value less than 1.0, all pulses have a width of 1.0 sec.

PRIBLK
: Primary Block specifies the cascade behavior of the PLSOUT block. When PRIBLK is 1, PLSOUT remains in Holding for PRITIM seconds when the cascade has been opened.

Use PRIBLK in a cascade situation when the source of the block's input connection needs to be initialized.

Be aware that the combination of PRIBLK = 1 and PRITIM = 0.0 is invalid.
When PRIBLK = 0, PLSOUT ends the Hold after one cycle.

Primary Block indicates whether the PLSOUT block has a connection from an upstream block (PRIBLK = 1) or not (PRIBLK = 0). Its value determines whether the PLSOUT block remains in Holding until the PRITIM delay has expired, or ends the Hold after one cycle.

PRITIM
: Primary Cascade Timer is a configurable parameter used to delay the closing of the cascade to a primary block when the output is initialized in PLSOUT block. It is used only if the PRIBLK option is set. If PRITIM = 0 and PRIBLK is used, the cascade remains open indefinitely, or until acknowledged by the primary block.

RBK	Read-back State is a Boolean block input read from point RBK_PT. It is typically used to indicate whether a valve is fully open or closed, or the off/on state of a motor. Thus, it is intended to be used for a limit switch output or other pulse override signal to the I/A Series station.
RBK_PT	Read-back Address is a PROFIBUS data identifier (configurable string) that specifies the point address of an optional read-back Boolean input (RBK) to the PLSOUT block. For information on configuring the PROFIBUS data identifier, refer to *PROFIBUS-DP Communication Interface Module (FBM223) User's Guide* (B0400FE). For the Modbus interface (FBM224), RBK_PT must be configured to contain the address of a coil in a Modbus device. Refer to *Modbus Communication Interface Module (FBM224) User's Guide* for details. For the FDSI (FBM230/231/232/23), RBK_PT contains a data identifier to identify, to the FBM, specific data in the I/O data stream and to specify the elements of the data. Refer to *Field Device System Integrators (FBM230/231/232/233) User's Guide* (B0700AH) for additional information.
RESET	Reset Request is one of the two Manual mode pulse-driving inputs. Any transition of RESET from false to true causes a pulse output at COUT_2.
SET	Set Request is one of the two Manual mode pulse-driving inputs. Any transition of SET from false to true causes a pulse output at COUT_1.
SIMOPT	Simulation Option is a configurable parameter that specifies if the DCI block input/output value is to be simulated. In the PLSOUT block, the block output is stored into its read-back value to simulate confirmation by the field device.
TYPE	When you enter "PLSOUT" or select it from a configurator list, an identifying integer is created specifying this block type. For this ECB, the value of TYPE is 144.

104.5 Functions

104.5.1 Detailed Diagram

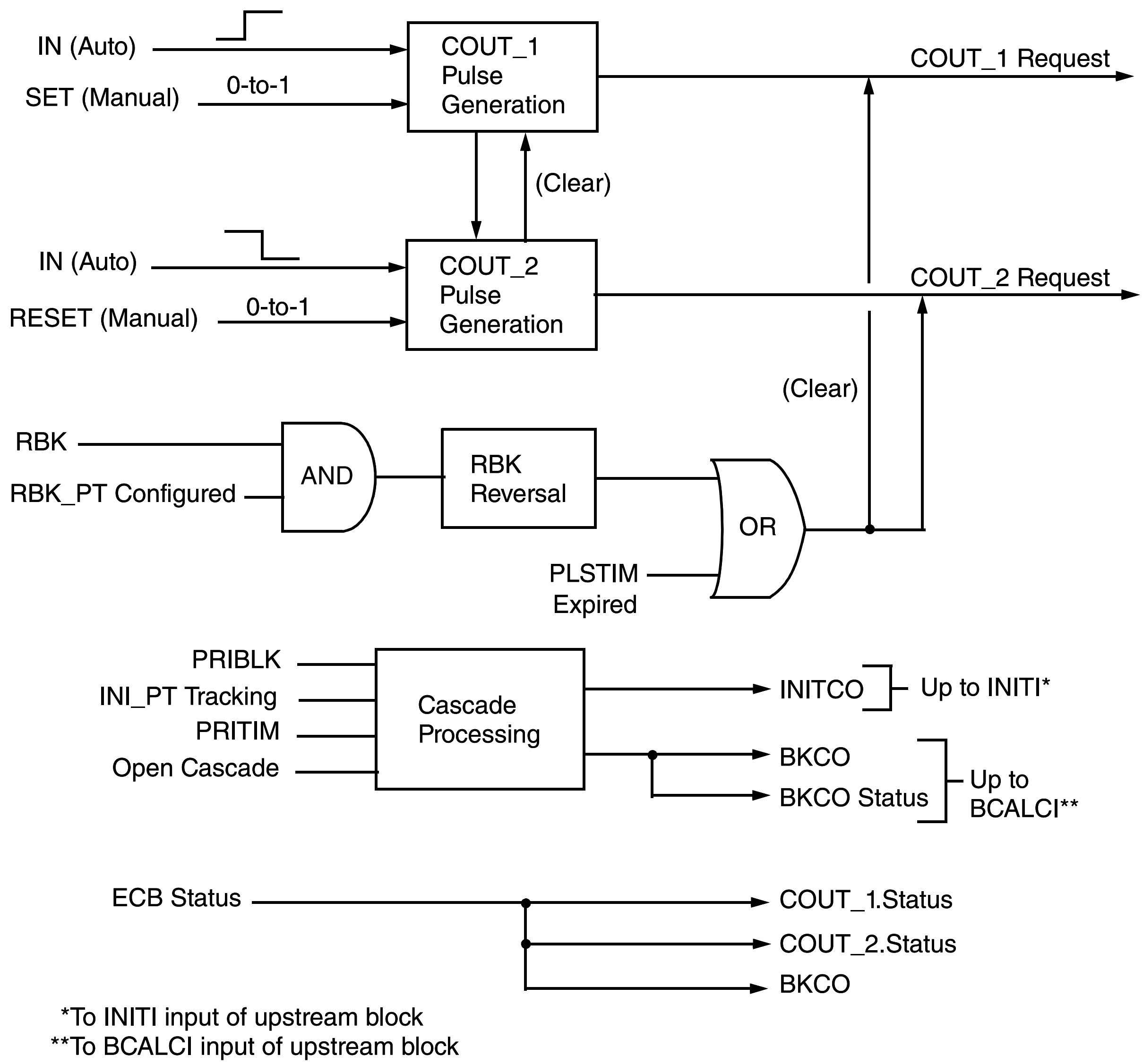


Figure 104-2. PLSOUT Block Operational Diagram

104.5.2 Associated ECBs

The configured parameter IOM_ID of the PLSOUT block specifies an ECB201 (the Device ECB) to connect to field parameters that reside in a field device hosted by an ECB200 (the FBM ECB). The PARENT parameter of the ECB201 specifies the associated ECB200 hosting the field device.

104.5.3 DCI Connections

The PLSOUT block establishes from two to four DCI connections to the specified ECB upon occurrence of any of the following:

- The I/A Series control station in which it resides has just been rebooted.
- The block has just been installed.
- A parameter of the block has been modified by the ICC or FoxCAE configurator.
- A device or parent ECB specified by the PLSOUT block has just been installed.

A DCI connection is added to a linked list of all the DCI connections, of any type, for all blocks specifying the same ECB. This arrangement permits multiple DCI blocks of differing data types to communicate with a single device at input/output scan time. It also allows multiple DCI connections in the same DCI block to be established (for example, connections in redundant type DCI blocks or for INI_PT connections in most output type blocks, such as this one).

The PLSOUT block always establishes DCI connections for parameters CO1_PT and CO2_PT. If parameter INI_PT is configured with a non-null value, an additional DCI connection is established for it. Similarly, if parameter RBK_PT is configured with a non-null value, an additional DCI connection is established for it.

The DCI connections are deleted (that is, the linkages are removed from the linked list for the ECB) when the PLSOUT block is deleted.

104.5.4 Output Points and Optional Input Points

The device addresses of the outputs are configured as strings in CO1_PT and CO2_PT. The device address of the initialization input is configured as a string in INI_PT, and the device address of the RBK (read-back) input is configured as a string in RBK_PT.

Either or both of INI_PT and RBK_PT may be blank if they are not used.

The formats of the CO1_PT, CO2_PT, INI_PT and RBK_PT parameters are bus specific and device specific. When the PIO maintenance task runs after the DCI connections have been made (see "DCI Connections" above), the strings are passed to the FBM for parsing and validation. In DCI blocks, point identification strings are not parsed by the I/A Series control station.

If the first character of either CO1_PT or CO2_PT is blank, the string is not sent to the FBM. The block is set undefined with ERCODE = 52. The detail display shows "W52 – INVALID I/O CHANNEL/GROUP NUMBER".

In each of the following cases, the block is also set undefined:

- If the FBM parsing algorithm finds that CO1_PT or CO2_PT is invalid, the detail display shows "W65 – INVALID POINT ADDRESS" with ERCODE = 65.
- If there is a duplicate connection to any point, the detail display shows "W66- DUPLICATE CONNECTION" with ERCODE = 66.
- If there is no available memory in the FBM, the detail display shows "W67 – INSUFFICIENT FBM MEMORY" with ERCODE = 67.
- If the device connection is invalid, the detail display shows "W68 – INVALID DEVICE CONNECTION" with ERCODE = 68.
- If the point connection is invalid, the detail display shows "W69 – INVALID POINT CONNECTION" with ERCODE = 69.

In the following case, the block remains defined:

- ♦ If the connection is not yet resolved, the detail display shows "W62 – UNRESOLVED CONNECTION" with ERCODE = 62.

If INI_PT is used, the tests described by the six bullets above are repeated, but for INI_PT rather than CO1_PT. The failure of any of these tests also causes the block to be set undefined.

104.5.5 Auto/Manual Arbitration

The auto/manual mode selection arbitrates between inputs by the operator (manual) and inputs from the control strategy (auto). The block, regardless of its auto/manual state, always detects changes in the point values made by the external device while a pulse is active.

Parameters MA, INITMA, AUTSW, and MANSW are used to establish the control mode of the block.

104.5.6 Pulse Initiation in Auto and Manual

When the block is in Auto, any transition in the value of IN initiates a new pulse. A transition of IN from 0 to 1 sets COUT_1 to 1, and this value is written to CO1_PT. At the same time, COUT_2 is set to 0, and this is written to CO2_PT. On a 1-to-0 transition of IN, the opposite values are written to CO1_PT and CO2_PT.

In Manual, the SET and RESET parameters are used to initiate the pulses, on a change-driven basis. If an operator set causes RESET to change from 0 to 1, a pulse is initiated with 0 written to CO1_PT and 1 written to CO2_PT. (The value of SET is cleared to 0 at that time). An operator setting of SET from 0 to 1 causes a pulse to start with opposite values on CO1_PT and CO2_PT. (The value of RESET is cleared to 0 at this time.) If both parameters are changed on the same cycle, RESET takes precedence.

Note that COUT_1 and COUT_2 are never directly settable, whether in Auto or Manual.

104.5.7 Pulse Duration

The configured parameter PLSTIM determines the pulse width. If PLSTIM is set less than 1.0 second, it is changed internally to 1.0 second. However, no pulse can be less than one execution cycle in length, even if PLSTIM is set to 0.0.

If the conditions for a new pulse initiation are fulfilled ("Pulse Initiation in Auto and Manual" following) while a previous pulse is active, a new pulse is begun, and any active pulse on the other output is terminated.

A pulse terminates whenever the PLSTIM value is reached or the value of RBK is reversed (provided a non-null address has been configured for RBK_PT), whichever is first. RBK is reserved for pulse override signals from the external device, and has the functionality of a limit switch.

104.5.8 Status of INI_PT

Transitions in the status of initialization input INI_PT are used in determining whether block initialization is required. This status is considered true if:

- ♦ The device value at INI_PT is true (that is, the external device has requested that the block go into tracking).
- ♦ The DCI connection status information indicates Initialization Request, Local Override, Fail-safe, or Open Cascade.

104.5.9 Initialization

The PLSOUT block initializes whenever the block is restarted, whenever there is a bad-to-good transition of the ECB status, a bad-to-good transition of the field device parameter, or whenever the status of INI_PT transitions from true to false (see "Status of INI_PT" above). If RBK_PT has been configured, the value from the external device at this point is set into IN, and also into parameter RBK. If RBK_PT is unconfigured, the current value of IN is copied into RBK. Any active pulses are terminated at this time by turning off COUT_1 and COUT_2 and resetting the pulse timer.

If there is a bad-to-good transition of IN while in Auto, IN is initialized to the value at RBK_PT.

Whenever RBK is configured, and it changes on any cycle, whether or not that change has caused a premature termination of a pulse, IN is initialized to the value of RBK.

In any initialization, the cascade is opened to force an upstream initialization (See "Cascade Processing" following.)

104.5.10 Cascade Processing

INITCO should be connected to the INITI input of the block immediately upstream from the PLSOUT block, if that block has an INITI parameter. When the cascade is opened, INITCO is turned on. The status of BKCO, which should be connected to the BCALCI input of the block immediately upstream if that block has a BCALCI parameter, and is set to indicate "open cascade". Although there may be no support for actual back-calculated values in BKCO, the current read-back value from the external device is set into the value of BKCO. The block then goes into a Hold, thereby disallowing any change-driven outputs. The upstream block (the block connected to IN) is then commanded to run immediately. This feature causes a Run flag in the header of the upstream block to be set, causing the compound processor to execute this block on the next BPC, without regard to its period and phase.

If there is no support for cascade processing in the upstream block, PRIBLK should be configured as 0. In this case the cascade is held open for one cycle, after which the Hold is released. If a specific time delay for closure of the cascade is desired, the value PRIBLK = 1 should be configured, with PRITIM specifying the (nonzero) delay period. The cascade is closed after the PRITIM delay has expired.

In the PLSOUT block, the ACK option "PRITIM = 0.0" is invalid, and results in a validation error.

104.5.11 Status of the Output Values

The status of COUT_1, together with the status of the ECB, is determined each time the block is executed. The status bits of COUT_1, COUT_2, and BKCO are then set according to the following rules.

The status bits are set to Out-of-Service if any of the following conditions exists:

- The ECB status indicates that the field device is off-line or out-of-service.
- The DCI connection cannot be configured due to lack of configuration information in the FBM database.
- The DCI is not yet connected, that is, the PIO maintenance task has not yet sent the DATA_CONNECT message to the FBM for the linked-list addition described under "DCI Connections" above.

- The DCI connection status information, which specifies the condition of the connected device parameter, indicates out-of-service, meaning (in general) that the parameter value is unavailable, or
- The status information indicates disconnected, meaning (in general) that the parameter is not connected or not defined.
- The connection status information indicates that the connection is not yet resolved. The detail display shows "W62 – UNRESOLVED CONNECTION" with ERCODE = 62.
- An ECB201 is specified and the ECB device status indicates that the DCI connection is unresolved.

The status bits are set to Bad if the ECB status indicates that the field device has failed.

104.5.12 Holding, Tracking, and Securing

The block goes into Holding whenever the ECB is bad or out-of-service, the field device parameter has bad status, IN is "bad", or the block is in Auto with the cascade not closed. The block does not perform any output processing when it is in Hold.

The block goes into Tracking when the status of INI_PT is true (see "Status of INI_PT" above). When in Tracking, the block does not initiate any new pulses, although currently active pulses are allowed to run to completion.

Manual mode inputs SET and RESET are secured whenever the outputs are bad or out-of-service, or the initialization input (at INI_PT) has true status.

104.5.13 Simulation Option

When Simulation Option (SIMOPT) is configured true, there is no connection to the ECB, and no DCI connections are established for the block. The status information and data values of COUT_1, COUT_2 and INI_PT are not recovered from the field, and no writing to the field outputs occurs.

However, the basic actions of Auto and Manual modes are still observed when SIMOPT is true. If the block is in Auto, IN may be used for simulated inputs; if the block is in Manual, SET and RESET may be used. All normal processing of the inputs, including pulse generation and timing, are performed.

105. PTC – Proportional Time Controller Block

This chapter describes the PTC (Proportional Time Controller Block), its features, parameters and detailed operations.

105.1 Overview

The Proportional Time Controller block, PTC, activates one of two pulsed outputs, OUTINC or OUTDEC, for a time duration that varies directly with the deviation between the setpoint and the measurement (see Figure 105-1). The outputs normally control on/off valves or bidirectional type motor driven final operator devices, via COUT, MCOUT, VLV, MOVLV, or MTR Input/Output blocks, or a suitable combination thereof.

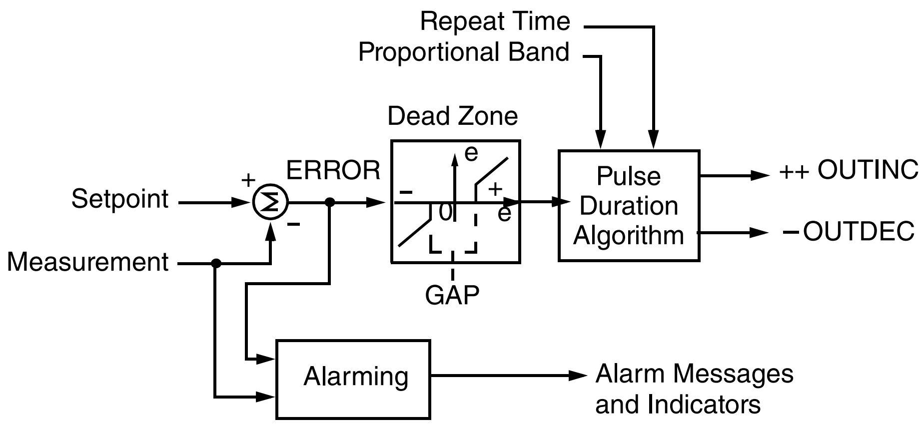


Figure 105-1. PTC Block I/O Diagram

105.2 Features

The features are:

- Manual/Auto control of the outputs, which can be initiated by a host process or another block
- Auto and Manual latch switch inputs (AUTSW and MANSW) that force the block to be switched to Auto or Manual
- Local/Remote setpoint source selection, the ability to lock out setpoint operator changes, and the ability to secure against any write access to the LR parameter.
- Local and Remote latch switch inputs (LOCSW and REMSW) that force the block to be switched to local or remote
- Bad input detection and handling

- Automatic cascade handling that includes:
  - Initialization output connection parameter that provides proper coordination and initialization of cascade schemes
  - Back calculation of the setpoint input for the upstream block, to provide bumpless cascade operation when the cascade is open loop.

The options are:

- STRKOP, Setpoint Tracking Option, forces the setpoint to track the measurement signal. STRKOP takes this action when the LR parameter has transitioned in either direction and 1) either the output is in Manual or a cascade is broken (a downstream block is in open loop - INITI true) or the block is in Manual, or 2) when the block is in Manual only. STRKOP is not performed if any measurement data errors are detected. This feature allows bumpless return to automatic control when the PTC returns to closed-loop operation.
- MBADOP, Manual if Bad Option, is a manual override feature. It sets the unlinked MA input to manual (thereby forcing the output state to manual), if the Measurement or Initialization In (or optionally Remote Setpoint) is disconnected, bad, or off-scan. A return to Auto requires external intervention.
- MALOPT, Measurement Alarming Option, provides absolute alarming of the measurement during auto operation. This option also provides standard alarm notification and reporting features.
- HHAOPT, High-High and Low-Low Absolute Alarming option, provides absolute alarming for target (HHALIM and LLALIM) alarming of the measurement input at a given priority level (HHAPRI), or disables High-High and Low-Low absolute alarming altogether. Each alarm triggers an indicator and text message.
- INHOPT, Inhibit Option, allows you to specify alarm inhibit options.
- DALOPT, Deviation Alarm Option, enables (when true) deviation alarming of the measurement-setpoint (MEAS - SPT) signal.
- MANALM, Manual Alarming Option, allows you to invoke all configured alarm options while the block is in manual. Otherwise, alarming is normally performed only in Auto.
- CEOPT, Control Error Option, allows you to enable, or disable, the block's implicit Hold action when it detects an error (ERR) in the MEAS input.
- PROPT, Propagate Error Option, gives you the option of propagating the error (ERR) status bit from the MEAS input to the block's OUTDEC and OUTINC output parameters.
- LOCSP, Local Setpoint Secure, enables you to secure against any write access to the LR parameter.
- INITLR, Initialize Local/Remote, specifies the desired state of the LR input during initialization.
- INITMA, Initialize Manual/Auto, specifies the desired state of the MA input during initialization.

105.3 Parameters

Table 105-1. PTC Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	12	PTC
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
MEAS	process input	real	con/set	0.0	RI1
HSCI1, HSCI2	high scale in 1 and 2	real	no-con/no-set	100.0	specifiable
LSCI1, LSCI2	low scale in 1 and 2	real	no-con/no-set	0.0	specifiable
DELTI1, DELTI2	change delta 1 and 2	real	no-con/no-set	1.0	percent
EI1 to EI2	eng units input 1 and 2	string	no-con/no-set	%	specifiable
PROPT	propagate error	Boolean	no-con/no-set	0	0 to 1
SPT	setpoint	real	con/set	0.0	RI1
PBAND	proportional band	real	con/set	1000.0	[0.1..]percent
GAP	control dead zone	real	con/set	0.0	[0..]RI2
REPTIM	repeat time	real	con/set	0.0	[0..]minutes
MA	manual/auto	Boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	[0|1|2]
MBADOP	manual bad option	short	no-con/no-set	0	[0|1|2]
MANSW	manual switch	Boolean	con/set	0	0 to 1
AUTSW	auto switch	Boolean	con/set	0	0 to 1
CEOPT	control error option	short	no-con/no-set	1	0 to 2
HOLD	hold mode	Boolean	con/set	0	0 to 1
INITI	initialize in	short	con/set	0	0 to 1
LR	local/remote	Boolean	con/set	0	0 to 1
INITLR	initialize LR	short	no-con/no-set	2	[0|1|2]
LOCSP	local setpoint	Boolean	no-con/no-set	0	0 to 1
LOCSW	local switch	Boolean	con/set	0	0 to 1
REMSW	remote switch	Boolean	con/set	0	0 to 1
RSP	remote setpoint	real	con/set	0.0	RI1
STRKOP	setpoint track option	short	no-con/no-set	0	[0|1|2]
MANALM	manual alarm option	short	no-con/no-set	1	0 to 1
INHOPT	inhibit option	short	no-con/no-set	0	0 to 3
INHIB	alarm inhibit	Boolean	con/set	0	0 to 1
INHALM	inhibit alarm	pack_b	con/set	0	0 to 0xFFFF
MEASNM	meas alarm name	string	no-con/no-set	blank	1 to 12 chars
MALOPT	meas alarm option	short	no-con/no-set	0	0 to 3
MEASHL	meas high alarm limit	real	con/set	100.0	RI1
MEASHT	meas high alarm text	string	no-con/no-set	blank	1 to 32 chars
MEASLL	meas low alarm limit	real	con/set	0.0	RI1
MEASLT	meas low alarm text	string	no-con/no-set	blank	1 to 32 chars

Table 105-1. PTC Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
MEASDB	meas alarm deadband	real	no-con/set	0.0	RI1
MEASPR	meas alarm priority	integer	con/set	5	[1..5]
MEASGR	meas alarm group	short	no-con/set	1	[1..8]
DALOPT	deviation alarm option	short	no-con/no-set	0	0 to 3
HDALIM	high deviation limit	real	con/set	100.0	RI1
HDATXT	high deviation alarm text	string	no-con/no-set	blank	1 to 32 chars
LDALIM	low deviation limit	real	con/set	-100.0	RI1
LDATXT	low deviation alarm text	string	no-con/no-set	blank	1 to 32 chars
DEVADB	deviation alarm dead-band	real	no-con/set	0.0	RI1
DEVPRI	deviation alarm priority	integer	con/set	5	[1..5]
DEVGRP	deviation alarm group	short	no-con/set	1	[1..8]
HHAOPT	high-high option	short	no-con/no-set	0	0 to 3
HHALIM	high-high limit	real	con/set	100.0	RI1
HHATXT	high-high alarm text	string	no-con/no-set	blank	1 to 32 chars
LLALIM	low-low alarm limit	real	con/set	0.0	RI1
LLATXT	low-low absolute text	string	no-con/no-set	blank	1 to 32 chars
HHAPRI	high-high priority	integer	con/set	5	[1..5]
HHAGRP	high-high group	short	no-con/set	1	[1..8]
AMRTIN	alarm regeneration timer	integer	no-con/no-set	0	0 to 32767 s
NASTDB	alarm deadband timer	long integer	no-con/no-set	0	0-2147483647 ms
NASOPT	nuisance alarm suppression option	short	no-con/no-set	0	0 to 2
OUTPUTS					
ALMSTA	alarm status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
BCALCO	back calculated out	real	con/no-set	0.0	RI1
BLKSTA	block status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
CRIT	criticality	integer	con/no-set	0	[0..5]
ERROR	control error	real	con/no-set	0.0	RI1
HDAIND	high deviation indicator	Boolean	con/no-set	0	0 to 1
HHAIND	high-high absolute indicator	Boolean	con/no-set	0	0 to 1
INHSTA	inhibit status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
INITO	initialize out	short	con/no-set	0	0 to 1
LDAIND	low deviation indicator	Boolean	con/no-set	0	0 to 1
LLAIND	low-low alarm indicator	Boolean	con/no-set	0	0 to 1
MEASHI	meas high alarm indicator	Boolean	con/no-set	0	0 to 1
MEASLI	meas low alarm indicator	Boolean	con/no-set	0	0 to 1
OUTDEC	output decrease	Boolean	con/no-set	0	0 to 1
OUTINC	output increase	Boolean	con/no-set	0	0 to 1
PRTYPE	priority type	integer	con/no-set	0	[0 to 8]
QALSTA	quality status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
UNACK	alarm notification	Boolean	con/no-set	0	0 to 1
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767

Table 105-1. PTC Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
ALMOPT	alarm options	pack_l	no-con/no-set	0	0 to 0xFFFFFFFF
DEFINE	no config errors	Boolean	no-con/no-set	1	0 to 1
ERCODE	config error	string	no-con/no-set	0	0 to 43 chars
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	Boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars
PERTIM	period time	real	no-con/no-set	0.1	---
PRSCON	present control	short	no-con/no-set	0	0 to 3
RI1 to RI2	eng range input	real[3]	no-con/no-set	100,0,1	specifiable

105.3.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

ALMOPT

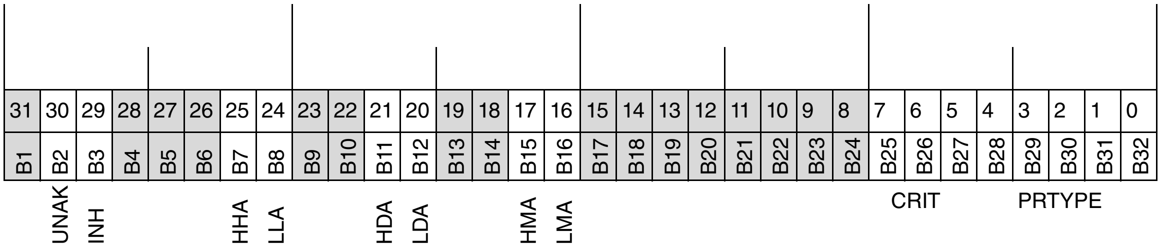
Alarm Options contains packed long values representing the alarm types that have been configured as options in the block, and the alarm groups that are in use. For the PTC block, only the following unshaded bits are used

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1] (0 to 31)	Configured Alarm Option When True
0	Alarm Group 8 in Use
1	Alarm Group 7 in Use
7	Alarm Group 1 in Use
16	Low Absolute Alarm Configured
17	High Absolute Alarm Configured
20	Low Deviation Alarm Configured
21	High Deviation Alarm Configured
24	Low-Low Absolute Alarm Configured
25	High-High Absolute Alarm Configured

1. Bit 0 is the least significant, low order bit.

ALMSTA Alarm Status is a 32-bit output, bit-mapped to indicate the block's alarm states. For the PTC block, only the following bits are used:



Bit Number (0 to 31)*	Name	Description When True	Boolean Connection (B32 to B1)
0 to 4	PTYP_MSK	Priority Type: See parameter PRTYPE for values used in the PTC block	ALMSTA.B32–ALMSTA.B28
5 to 7	CRIT_MSK	Criticality; 5 = lowest priority, 1= highest	ALMSTA.B27–ALMSTA.B25
16	LMA	Low Absolute Alarm	ALMSTA.B16
17	HMA	High Absolute Alarm	ALMSTA.B15
20	LDA	Low Deviation Alarm	ALMSTA.B12
21	HDA	High Deviation Alarm	ALMSTA.B11
24	LLA	Low-Low Absolute Alarm	ALMSTA.B8
25	HHA	High-High Absolute Alarm	ALMSTA.B7
29	INH	Alarm inhibit	ALMSTA.B3
30	UNAK	Unacknowledged	ALMSTA.B2

* Bit 0 is the least significant, low order bit.

AMRTIN Alarm Regeneration Timer is a configurable integer that specifies the time interval for an alarm condition to exist continuously, after which a new unacknowledged alarm condition and its associated alarm message is generated.

AUTSW Auto Switch is a Boolean input that, when true, overrides the MA and INITMA parameters, and drives the block to the Auto state. If both MANSW and AUTSW are true, MANSW has priority.

BCALCO Back Calculation Output is a nonsettable, real output that is equal to MEAS except in the following situations, where it is equal to SPT:

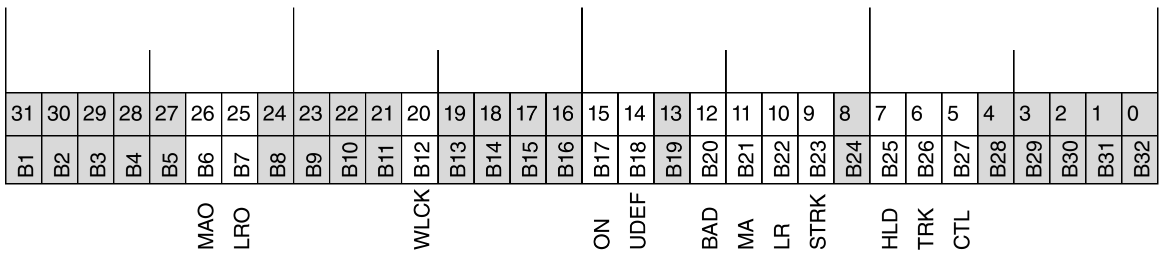
- The block is transitioning from Local to Remote mode on this cycle.
- MEAS has Bad status.
- MEAS has Out-of-Service status.

- MEAS has (ERR) Error status.
- MEAS is experiencing source connection problems.

With V4.2 and later software, the status bits of BCALCO contain the cascade initialization requests formerly contained in the INITO parameter. You connect the BCALCO parameter to the BCALCI input of an upstream block so that this upstream block can sense when the PTC block is open.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the PTC block, only the following bits are used:



Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
5	CTL	Controlling	BLKSTA.B27
6	TRK	Tracking	BLKSTA.B26
7	HLD	Holding	BLKSTA.B25
9	STRK	Setpoint Tracking	BLKSTA.B23
10	LR	Local(= false)/Remote(= true)	BLKSTA.B22
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
12	BAD	block in BAD state	BLKSTA.B20
14	UDEF	Undefined (Inverse of DEFINE)	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
20	WLCK	Workstation Lock	BLKSTA.B12
25	LRO	Local/Remote Override	BLKSTA.B7
26	MAO	Manual/Auto Override	BLKSTA.B6

* Bit 0 is the least significant, low order bit.

CEOPT

Control Error Option is a short integer that specifies how the block responds to the MEAS input when it is in error. To provide backward compatibility, CEOPT defaults to 1. CEOPT has a range of 0 to 2 where:

0 = The block takes no implicit Hold action when it detects a control error.

1 = The block goes to the Hold state if, while MBADOP = 0, MEAS: (a) has its BAD status bit set true; (b) has its Out-of-Service status bit set true; (c) is experiencing peer-to-peer path failure.

2 = The block goes to the Hold state if, while MBADOP = 0, MEAS meets any of the conditions described for CEOPT = 1, or if MEAS has its ERR status bit set true.

CEOPT is independent of the propagate error option, PROPT, and does not affect the external logical input, HOLD. The HOLD input, when true, still drives the block into the Hold state whenever the block is in Auto (and MBADOP = 0).

CRIT

Criticality is an integer output that indicates the priority, ranging from 1 to 5, of the block's highest currently active alarm (1 is the highest priority). A value of zero indicates the absence of alarms.

DALOPT

Deviation Alarm Option is a short integer input that enables High and Low deviation alarming of the deviation signal (MEAS - SPT), or disables alarming altogether.

0 = No alarming

1 = High and Low deviation alarming

2 = High deviation alarming only

3 = Low deviation alarming only.

You can change DALOPT only by reconfiguring the block.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block. DEFINE is the inverse of undefined (UDEF) in the BLKSTA parameter.

DELTI1 to DELTI2

Change Delta for Input Range 1 or 2 is a real value that defines the minimum percent of the input range that triggers change driven connections for parameters in the range of RI1 or RI2. The default value is 1.

Entering a 1 causes the Object Manager to recognize and respond to a change of 1 percent of the full error range. If communication is within the same CP that contains the block's compound, change deltas have no effect.

Refer to "Peer-to-Peer Connections of Real-Type Block Inputs" on page 1703 for details on how the I/A Series software affects the change delta percentage during operation.

DESCRP Description is a user-defined string of up to 32 characters that describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

DEVADB Deviation Alarm Deadband is a real input, in MEAS units, that applies to both High and Low Deviation Limits.

DEVGRP Deviation Group is an integer input that directs deviation alarm messages to one of eight groups of alarm devices.

DEVPRI Deviation Priority is an integer input, from 1 to 5, that sets the priority level of the deviation alarm (1 is the highest priority).

EI1 to EI2 Engineering Units for Input Ranges 1 and 2, as defined by the parameters HSCI1 to HSCI2, LSCI1 to LSCI2, and DELTI1 to DELTI2, provide the engineering units text for the values defined by Input Ranges 1 through 8. "DEG F" or "PH" are typical entries. EI1 is used with MEAS and EI2 is used with the setpoint.

ERCODE Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block's DEFINE parameter to be set false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the PTC block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
"W43 – INVALID PERIOD/PHASE COMBINATION"	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
"W44 – INVALID ENGINEERING RANGE"	High range value is less than or equal to low range value.
"W46 – INVALID INPUT CONNECTION"	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
"W48 – INVALID BLOCK OPTION"	The configured value of a block option is illegal.
"W53 – INVALID PARAMETER VALUE"	A parameter value is not in the acceptable range.

Message	Value
“W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK”	A Database Installer error has occurred.

ERROR
Control Error is a real output that equals the Setpoint minus Measurement (SPT - MEAS). ERROR can be sourced to other blocks.

GAP
Control Dead Zone is a real input defining the size of the region which the measurement (MEAS) may traverse without activating OUTINC or OUTDEC. This parameter sizes a symmetric envelope (around the selected setpoint), that determines the measurement level that activates one of the outputs. GAP has the same relative units as relative MEAS and SPT, but is clamped by RI2.

HDAIND
High Deviation Alarm Indicator is a Boolean output set true when the measurement exceeds the setpoint by more than the deviation limit HDALIM. When the measurement passes back through the DEVADB deadband, the block sets HDAIND to false.

HDALIM
High Deviation Alarm Limit is a real input that establishes the amount by which the measurement must exceed the setpoint to initiate a high deviation alarm and set the High Deviation Alarm Indicator, HDAIND, true.

HDATXT
High Deviation Alarm Text is a user-configured text string of up to 32-characters, output with the alarm message to identify the alarm.

HHAGRP
High-High Absolute Alarm Group is an integer input that directs High-High Absolute alarm messages to one of eight groups of alarm devices.

HHAIND
High-High Alarm Indicator is a Boolean output set true when the measurement input exceeds the high-high absolute alarm limit (HHALIM). Once the Indicator is set true, it does not return to false until the value falls below the limit less a deadband.

HHALIM
High-High Absolute Alarm Limit is a real input that defines the value of the measurement input that triggers a High-High absolute alarm.

HHAOPT
High-High Alarm Option is an integer input that enables High-High and Low-Low absolute alarming for alarming of a block-dependent value, generally the measurement input, or disables High-High and Low-Low absolute alarming altogether. Each alarm triggers an indicator and text message.

0 = No alarming

1 = High-High and Low-Low alarming

2 = High-High alarming only

3 = Low-Low alarming only.

HHAPRI
: High-High Absolute Priority is an integer input, from 1 to 5, that sets the priority level of the high-high absolute alarm (1 is the highest priority)

HHATXT
: High-High Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the high-high absolute alarm message to identify it.

HOLD
: Hold is a Boolean input. When true, HOLD forces the block into the Hold substate of Auto mode, holding the output at its last computed value.

HOLD is not affected by CEOPT.

HSCI1 to HSCI2
: High Scale for Input Ranges 1 and 2 are real values that define the upper limit of the measurement ranges. EI1 and EI2 define the text for the units. Make the range and units consistent with the measurement source. A typical value is 100 (percent).

HSCI1 is used for scaling MEAS and SPT. HSCI2 is used for scaling GAP.

INHALM
: Inhibit Alarm contains packed Boolean values that represent alarm inhibit requests for each alarm type or point configured in the block. For the PTC block, only the following bits are used:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16

Bit Number* (0 to 15)	Description When True	Boolean Connection (B16 to B1)
0	Inhibit Low Absolute Alarm	INHALM.B16
1	Inhibit High Absolute Alarm	INHALM.B15
4	Inhibit Low Deviation Alarm	INHALM.B12
5	Inhibit High Deviation Alarm	INHALM.B11
8	Inhibit Low-Low Absolute Alarm	INHALM.B8
9	Inhibit High-High Absolute Alarm	INHALM.B7

* Bit 0 is the least significant, low order bit.

There are no mnemonic names for the individual bits of INHALM.

INHIB
: Inhibit is a Boolean input. When true, it inhibits all block alarms; the alarm handling and detection functions are determined by the INHOPT setting. Alarms can also be inhibited based on INHALM and the compound parameter CINHIB.

INHOPT Inhibit Option specifies the following actions applying to all block alarms:

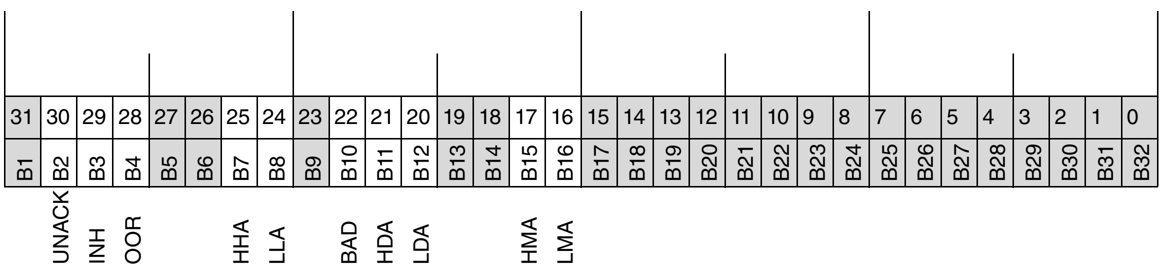
0 = When an alarm is inhibited, disable alarm notification but do not disable alarm detection.

1 = When an alarm is inhibited, disable both alarm notification and alarm detection. If an alarm condition already exists at the time the alarm transitions into the inhibited state, clear the alarm indicator.

2 = Same as 0 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge "return-to-normal" notification. "Into alarm" messages may be acknowledged by explicitly setting UNACK false.

3 = Same as 1 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge "return-to-normal" notification. "Into alarm" messages may be acknowledged by explicitly setting UNACK false.

INHSTA Inhibit Status contains values that represent the actual inhibit status of each alarm type configured in the block. For the PTC block, only the following bits are used:



Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
16	LMA	Low Absolute Alarm Inhibited	INHSTA.B16
17	HMA	High Absolute Alarm Inhibited	INHSTA.B15
20	LDA	Low Deviation Alarm Inhibited	INHSTA.B12
21	HDA	High Deviation Alarm Inhibited	INHSTA.B11
22	BAD	Bad I/O Alarm Inhibited	INHSTA.B10
24	LLA	Low-Low Absolute Alarm Inhibited	INHSTA.B8

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
25	HHA	High-High Absolute Alarm Inhibited	INHSTA.B7
28	OOR	Out-of-Range Alarm Inhibited	INHSTA.B4
29	INH	Inhibit Alarm Inhibited	INHSTA.B3
30	UNACK	Unacknowledged Inhibited	INHSTA.B2

* Bit 0 is the least significant, low order bit.

INITLR

Initialize Local/Remote is an integer input that specifies the desired state of the LR input during initialization, where:

0 = Local

1 = Remote

2 = The LR state as specified in the checkpoint file (reboot only).

The block asserts this initial LR state whenever:

- ♦ It is installed into the Control Processor database.
- ♦ The Control Processor undergoes a restart operation.
- ♦ The compound in which it resides is turned on.

The Initialize LR state is ignored if the LR input has an established linkage.

INITMA

Initialize Manual/Auto specifies the desired state of the MA input during initialization, where:

0 = Manual

1 = Auto

2 = The MA state as specified in the checkpoint file (reboot only).

The block asserts this initial M/A state whenever:

- ♦ It is installed into the Control Processor database.
- ♦ The Control Processor undergoes a reboot operation.
- ♦ The compound in which it resides is turned on.
- ♦ The INITMA parameter itself is modified via the Integrated Control Configurator. (The block does not assert INITMA on ordinary reconfiguration.)

INITMA is ignored if MA has an established linkage, or if MANSW or AUTSW is set true.

INITO

Initialization Output is set true when:

- ♦ The block is in Manual or initializing.
- ♦ Permanent or temporary loss of FBM communications occurs.
- ♦ The ladder logic in the FBM is not running.

- RSP (the remote setpoint) is not the setpoint source.

The block clears INITO when none of these conditions exist. You connect this parameter to the INITI input of upstream blocks so that these upstream blocks can sense when this block is open loop. With V4.2 or later software, BCALCO contains the initialization output eliminating the need to configure INITO connections in cascades. However, to preserve backward compatibility, the INITO parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITO Boolean value has been maintained, but the setting of the handshaking bits, via the INITO connection, is eliminated.

LDAIND	Low Deviation Alarm Indicator is a Boolean output that is set true when the measurement falls below the setpoint by more than the deviation limit, LDALIM. When the measurement passes back through the DEVADB deadband, the block sets LDAIND to false.
LDALIM	Low Deviation Alarm Limit is an input that defines how far the measurement must fall below the setpoint to initiate a low deviation alarm and set the Low Deviation Alarm Indicator LDAIND true.
LDATXT	Low Deviation Alarm Text is a user-defined text string of up to 32-character that is output with the alarm message to identify the alarm.
LLAIND	Low-Low Alarm Indicator is a Boolean output set true when the block-dependent parameter value (generally the measurement input) falls below the low-low absolute alarm limit (LLALIM). Once the Indicator is set true, it does not return to false until the value exceeds the limit plus a deadband.
LLALIM	Low-Low Absolute Alarm Limit is a real input that defines the value of the measurement input that triggers a Low-Low absolute alarm.
LLATXT	Low-Low Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the low-low absolute alarm message to identify it.
LOCKID	Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.
LOCKRQ	Lock Request is a Boolean input which can be set true or false only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a

new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.

LOCSP Local Setpoint Secure is a Boolean input. When true, LOCSP provides lockout of user write access to the LR parameter. If LOCSP is configured true, the block secures LR when it initializes and maintains LR in the secured state. The LOCSW and REMSW overrides have higher precedence, but LR remains secured when they are no longer asserted.

LOCSW Local Switch is a Boolean input. When true, LOCSW overrides the LR and INITLR parameters and drives the block to the Local state. If both LOCSW and REMSW are true, LOCSW has priority.

LOOPID Loop Identifier is a configurable string of up to 32 characters which identifies the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.

LR Local/Remote is a Boolean input that selects the setpoint source (0 = false = Local; 1 = true = Remote). If LR is set to Remote, the source of the setpoint value is the real input parameter RSP. When LR is set to Local, there are two possible sources for the setpoint: (a) MEAS or (b) a user settable input. The choice is based on the conditions of STRKOP and MA, as described under STRKOP.

LSCI1 to LSCI2 Low Scale for Input Ranges 1 and 2 are real values that define the lower limit of the measurement ranges. A typical value is 0 (percent). EI1 and EI2 define the units. Make the range and units consistent with those of the measurement source.

LSCI1 is used for scaling MEAS and SPT. LSCI2 is used for scaling GAP.

MA Manual Auto is a Boolean input that controls the Manual/ Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. In Manual, the algorithm is not performed, and the output is unsecured. An external program can then set the output to a desired value.

MALOPT Measurement Alarm Option is a configured short integer input that enables absolute High and Low measurement alarming, or disables absolute alarming altogether.

0 = No alarming

1 = High and Low measurement alarming

2 = High measurement alarming only

3 = Low measurement alarming only.

You can change MALOPT only by reconfiguring the block.

MANALM	Manual Alarm Option is a configurable input which enables and disables configured alarm options to function in Manual. Normally alarms are processed only in the Auto mode. 0 = No alarming in Manual 1 = Full alarming in Manual. You can change MANALM only by reconfiguring the block.
MANSW	Manual Switch is a Boolean input. When true, MANSW overrides the MA and INITMA parameters and drives the block to the Manual state. If both MANSW and AUTSW are true, MANSW has priority.
MBADOP	Manual if Bad Option is a manual override feature. When MBADOP is set to 1 or 2, the block sets the unlinked MA input to manual if it detects a BAD status bit in the MEAS or INITI input, and when set to 2, it detects that the Remote Setpoint (RSP) is not healthy (i.e., value status is BAD or has a broken OM connection). This forces the output state to manual as long as the BAD status remains. After the BAD status clears, returning to Auto requires external intervention unless AUTSW is true. 0 = no option enabled 1 = Switch to Manual when MEAS or INITI value status is BAD 2 = Same as option 1, plus switch to Manual when RSP is not healthy You can change MBADOP only by reconfiguring the block. MBADOP has the same priority as the MANSW override, and it has precedence over the AUTSW override. MBADOP has no effect when MA is linked. If any of the MBADOP conditions are true, the block will be switched to Manual regardless of the MANSW and AUTSW settings.
MEAS	Measurement is an input identifying the source of the block's input, or the controlled variable.
MEASDB	Measurement Alarm Deadband is a configured, settable input, expressed in MEAS units, that applies to both High, High-High, Low and Low-Low absolute alarm limits.
MEASGR	Measurement Group is a short integer input that directs measurement alarm messages to one of eight groups of alarm devices.
MEASHI	Measurement High Alarm Indicator is a Boolean output that is set true when the measurement exceeds the high alarm limit (MEASHL). When the measurement passes back through the deadband, the block sets MEASHI to false.
MEASHL	Measurement High Alarm Limit is a real input that defines the value of the measurement that initiates a high absolute alarm.
MEASHT	Measurement High Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can only change the message text by reconfiguring the block.

MEASLI	Measurement Low Alarm Indicator is a Boolean output that is set true when the measurement falls below the low alarm limit (MEASLL). When the measurement passes back through the MEASDB deadband, the block sets MEASLI to false.
MEASLL	Measurement Low Alarm Limit is a real input that defines the value of the measurement that initiates a low absolute alarm.
MEASLT	Measurement Low Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can only change the message text by reconfiguring the block.
MEASNM	Measurement Alarm Name is a user-defined text string of up to 12 characters that identify the alarm source in the alarm message. It serves as a point descriptor label (for example, FURN 37 TEMP).
MEASPR	Measurement Priority is an integer input (1 to 5), that sets the priority level of the measurement alarm (1 is the highest priority).
NAME	Name is a user-defined string of up to 12 characters used to access the block and its parameters.
NASOPT	Nuisance Alarm Suppression Option is a configurable, non-settable short integer that specifies how the nuisance alarm delay is implemented: ♦ 0 = Suppress nuisance alarms by delaying the Return-to-Normal (default) by the length of time specified in NASTDB ♦ 1 = Suppress nuisance alarms by delaying alarm detection by the length of time specified in NASTDB ♦ 2 = Suppress nuisance alarms by delaying both the Alarm Detection and the Return-to-Normal by the length of time specified in NASTDB
NASTDB	Alarm Deadband Timer is a configurable long integer. Depending on the value of NASOPT, it either specifies the deadband time interval that must elapse before an alarm condition is allowed to return to normal, or the length of a delay-on timer which specifies the amount of time between an alarm's detection and the announcement of the alarm. The parameter value ranges from zero (default, no delay) to 2147483647 ms.
OUTDEC	Output Decrease is a pulsed output. In the Auto mode, OUTDEC is pulsed when the measurement input goes above the setpoint by more than ½ the GAP. The pulse train continues until the measurement passes back through the gap deadband into the gap dead zone. Moving from Auto to Manual clears the OUTDEC output. In Manual, no proportional time control is performed and the OUTDEC output is settable.
OUTINC	Output Increase is a pulsed output. In the Auto mode, OUTINC is pulsed when the measurement input falls below the setpoint by more than

½ the GAP. The pulse train continues until the measurement passes back through the gap deadband into the gap dead zone.

Moving from Auto to Manual clears the OUTINC output.

In Manual, no proportional time control is performed and the OUTINC output is settable.

OWNER

Owner is a settable string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are successful only if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.

PBAND

Proportional Band is an input that determines, for any given error, the length of the OUTINC or OUTDEC "on" time during each controlling period. PBAND defaults to 1000. A smaller value results in greater sensitivity and a longer "on" time for a given error. A larger PBAND value reduces sensitivity and the "on" time for a given error.

PERIOD

Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PERIOD should be chosen to obtain the minimum pulse width required for the process being controlled.

PERTIM

Period Time is the period of the block expressed in seconds.

PHASE

Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PROPT

Propagate Error Option is a Boolean input. When true, PROPT sets the ERR Status bit of the output parameter if the input to the MEAS parameter is in error while the block is in Auto. The input to the MEAS parameter is in error when:

- Its BAD status bit is set true.
- Its OOS (Out-of-Service) status bit is set true.

- Its ERR status bit is set true.
- It is experiencing peer-to-peer path failure.

If a transition to Manual occurs while the ERR status is true, it remains true until either a set command is written to that output or until the block transfers to Auto with the error condition returned to normal.

PRSCON

Present Control state is a short integer data store that contains the sub-states of Auto:

1 = Holding

3 = Controlling (not open loop).

PRTYPE

Priority Type is an indexed output parameter that indicates the alarm type of the highest priority active alarm. The PRTYPE output of this block includes the following alarm types:

0 = No active alarm

1 = High Absolute

2 = Low Absolute

3 = High-High Absolute

4 = Low-Low Absolute

5 = High Deviation

6 = Low Deviation

8 = BAD Alarm

If there is more than one active alarm with the highest priority, PRTYPE reports the alarm type according to which occurs first as follows: Bad, High-High Absolute, Low-Low Absolute, High Absolute and Low Absolute.

For example: if the Bad and High-High Absolute alarms both have priority 3 and the Low-Low alarm has priority 4, and all three alarms are active, then CRIT = 3 and PRTYPE = 8.

QALSTA

Quality Status parameter (QALSTA) is a non-configurable packed long that provides a combination of value record status, block status (BLKSTA), and alarm status (ALMSTA) information in a single connectable output parameter. Available bits for this block are provided below.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1]	Definition	Contents	Boolean Connection (B32 to B1)
30	Alarms Unacknowledged	ALMSTA.UNA	QALSTA.B2
29	Alarms Inhibited	ALMSTA.INH	QALSTA.B3
25	High-High Absolute Alarm	ALMSTA.HHA	QALSTA.B7
24	Low-Low Absolute Alarm	ALMSTA.LLA	QALSTA.B8
21	High Deviation Alarm	ALMSTA.HDA	QALSTA.B11
20	Low Deviation Alarm	ALMSTA.LDA	QALSTA.B12
17	High Absolute Alarm	ALMSTA.HMA	QALSTA.B15
16	Low Absolute Alarm	ALMSTA.LMA	QALSTA.B16
5	Manual	BLKSTA.MA	QALSTA.B27
2	Uncertain	MEAS.ERR status	QALSTA.B30
1	Out-of-Service	MEAS.OOS status	QALSTA.B31
0	Bad	MEAS.BAD status	QALSTA.B32

1. Bit 0 is the least significant, low order bit.

REMSW — Remote Switch is a Boolean input. When true, REMSW overrides the unlinked LR and INITLR parameters, and drives the block to the Remote state. If both LOCSW and REMSW are true, LOCSW has priority.

REPTIM — Repeat Time is a real input that establishes the periodic time interval in which proportional time control occurs. REPTIM determines the sampling period of the on/off controller and should be much smaller than the dominant time constant of the process while still much greater than the scan interval (PERIOD) of the block. Within each time interval, the percentage of "on" time of the appropriate on/off command signal is directly proportional to the amount of error that exists at the instant the time period begins, and inversely proportional to the PBAND value.

RI1 to RI2 — Range Input is an array of real values that specify the high and low engineering scale (HSCI - LSCI) and change delta (DELTI) of a particular real input. For a given block, it also forms an association with a group of real input parameters that have the same designated range and change delta, as defined by the parameters HSCI1 to HSCI2, LSCI1 to LSCI2, and DELTI1 to DELTI2.

RI1 is used for MEAS and SPT. RI2 is used for GAP.

RSP — Remote Setpoint is the selected setpoint source when LR is set to Remote. RSP is a real input. Typically RSP connects to an upstream block in a cascade scheme. RSP and its source must be expressed in MEAS units.

SPT — Setpoint always represents the active controller setpoint. Setpoint is the reference variable that is compared with the MEAS input to produce the ERROR signal. SPT is implemented as a configurable output that determines its source from the Local/Remote setpoint selector, LR. When LR is true (Remote), SPT is nonsettable and assumes the Remote Setpoint (RSP) value. When LR is false (Local), SPT is an unsecured, and thus settable, output and the SPT source is the set value. Configure the value you want the SPT to assume when it first goes to Local. As an output, SPT can also source the setpoint value to other blocks.

While settable by default, SPT is nonsettable while setpoint tracking is active. (See STRKOP.)

STRKOP — Setpoint Track Option is a short integer input. When active, STRKOP enables the setpoint to track the measurement input under the following conditions.

0 = no option enabled

1 = SPT parameter tracks the measurement input when the block is in Manual, or the cascade is open downstream (Initialization input INITI is true).

2 = SPT parameter tracks the measurement only when the block is in Manual.

STRKOP is active only when the setpoint source selector LR is in Local and Supervisory Enable (SE) is enabled (1).

SPT is nonsettable while setpoint tracking is active. You can change STRKOP only by reconfiguring the block.

TYPE — When you enter “PTC” or select “PTC” from the block type list under Show, an identifying integer is created specifying this block type.

UNACK — Unacknowledge is a Boolean output that the block sets to true when it detects an alarm. It is typically reset by operator action.

105.4 Detailed Operation

The Proportional Time Controller block activates one of two Boolean outputs, OUTINC or OUTDEC, for a time duration that varies directly with the error between the setpoint and the measurement (MEAS - SPT). The outputs normally control on/off valves or bidirectional type motor driven final operator devices, via specialized Input/Output blocks.

The PTC block optionally supports absolute and deviation alarming of the measurement.

105.4.1 Detailed Diagram

Figure 105-2 is a simplified block diagram that depicts the functional signal flow of the PTC block. It shows the forward path of the block as it relates to the various states, logic control signals, and options represented by toggle switches.

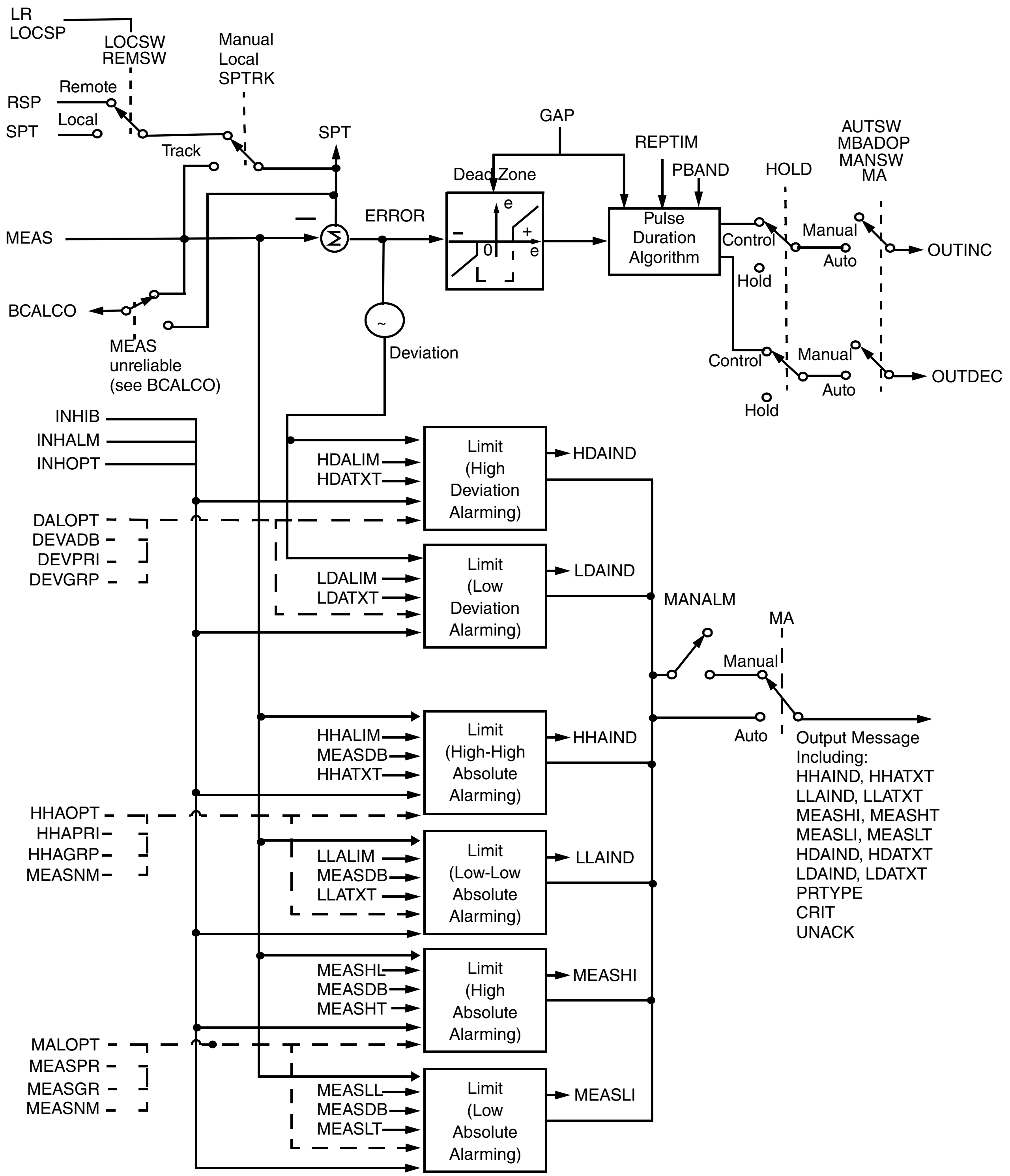


Figure 105-2. PTC, Detailed Block Diagram

105.4.2 Proportional Time Control

Key Parameters: GAP, MEAS, OUTDEC, OUTINC, PBAND, REPTIM, RSP, SPT

The Proportional Time Controller consists of two output signals, OUTDEC and OUTINC, with a fixed control period and the logic to turn either output signal “on” for a portion of that control period. The block controls by varying the percentage of “on” time (or “duty cycle”) within each control period. See Figure 105-3.

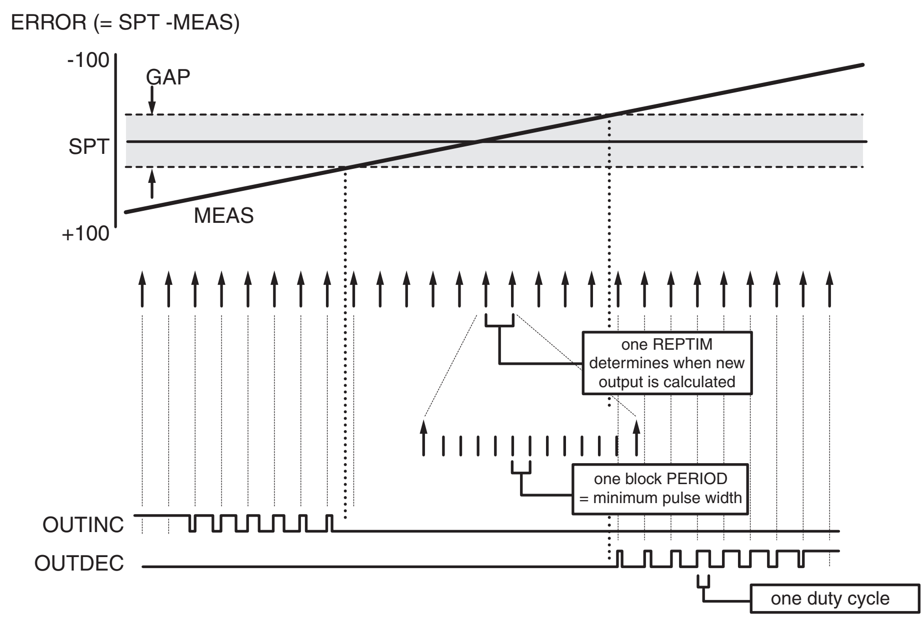


Figure 105-3. Pulse Duration Algorithm Timing Diagram

The entire control period is called the “Repeat Time” and is set by you when you enter the REPTIM. The percentage of “on” time is:

- inversely proportional to the proportional band value (PBAND), and
- directly proportional to the error (MEAS – SPT) existing at the instant the control period begins.

Therefore, the controller operates as a linear proportional-only controller whose gain is adjusted by the PBAND setting.

105.4.2.1 Output Pulse Width

Key Parameters: ERROR, MEAS, PBAND, PERIOD, REPTIM, RI1

The duty cycle is the portion of “ON” time for OUTINC or OUTDEC, depending on the direction of the ERROR (see Figure 105-3), as a fraction of the defined REPTIM for the block. This fraction is related to the sampled error signal by the following equation:

duty_cycle = (100/PB) ERROR / (meas_span)

Where:

ERROR = (SP - MEAS)

meas_span = (RI1.HSCALE - RI1.LSCALE)

RI1 = the MEAS range array

In this expression, dividing by the measurement span normalizes the error in proportion to the repeat time period, so that duty_cycle is a dimensionless variable with the range of 0 - 1.0. Then, actual output pulse width in any repeat time period is:

pulse_width = duty_cycle * REPTIM

The GAP parameter of the block defines a symmetrical region around the SP in which there is no control response (see Figure 105-3); i.e., neither output is ON. Control action begins when ERROR exceeds (0.5*GAP), at the next block execution. However, ERROR is still calculated with respect to the SP value, so that at the edge of the GAP region:

duty_cycle = (100/PB) (0.5*GAP) / (meas_span)

In application, REPTIM should be shorter than the dominant time constraint of the process, but should also be much greater than the PERIOD parameter time. GAP should be set to enclose the noise band of the measurement. The execution period of the block (PER parameter) is also the minimum pulse width. Its size, in ratio to REPTIM, determines the controller's resolution within each REPTIM period.

In short:

PERIOD << REPTIM << dominant time constraint

105.4.2.2 PTC Application

Key Parameters: GAP, MEAS, OUTDEC, OUTINC, PBAND, REPTIM, RSP, SPT

The two Boolean outputs, OUTINC and OUTDEC can be used to control tristate final operator devices such as bi-directional motor-driven actuators and dual-switch contactors.

For on-off control applications that require only one output, you can employ either OUTDEC or OUTINC to control bi-state devices like a solenoid valve or an electrical heater element.

Each output operates independently, as a function of the sense of the error. OUTINC is operational when the error is positive (measurement less than setpoint). OUTDEC is operational if the error is negative (measurement greater than setpoint).

An adjustable GAP band centered about zero deviation creates a dead-zone region (see Figure 105-3). While the deviation is in this region, OUTINC and OUTDEC are inoperative.

The measurement has one source; the upstream block output that is linked to the MEAS parameter at configuration.

For applications requiring combinations of proportional, integral, and derivative control action, a PID block may be used to drive the PTC block in a cascade arrangement with the PTC block configured as either a controller (positioner) or a signal converter.

105.4.3 Setpoint Control Mode

Key Parameters: LOCSP, LOCSW, LR, REMSW, RSP, SPT, STRKOP

The SPT parameter is the local setpoint and always represents the active controller setpoint.

The setpoint source selector input, LR (Local/Remote), together with the two overrides, LOCSW and REMSW, determines the setpoint source at any time.

- When LR is switched to Local (false), the block releases the SPT parameter, allowing you to input the desired controller setpoint value.
- When LR is switched to Remote (true), SPT is nonsettable and takes on the value of the remote setpoint input, RSP. RSP is a establishes a link to a remote setpoint source.

If RSP has no linkage when LR is true, the block uses whatever value is in the unconnected RSP parameter.

The LOCSW and REMSW override parameters can drive the setpoint state to Local or Remote, respectively.

LOCSP allows the block to secure the LR parameter when the block initializes and to maintain that secured state except when LOCSW or REMSW is asserted.

When the block is in the Remote mode, the value of the setpoint (SPT) tracks the value of the remote setpoint (RSP).

When the block is switched to Local mode, the setpoint value depends on the setpoint tracking option (STRKOP):

- ♦ If STRKOP = 1 or 2, the SPT value is cleared.
- ♦ If STRKOP = 0, the SPT value reflects the RSP value at the time the switch to Local occurred. The block maintains this value as long as block is in Local, unless the user changes the SPT value via data access.

105.4.3.1 Setpoint Tracking

Key Parameters: LR, MEAS, SPT, STRKOP

The setpoint track option, STRKOP, forces the PTC setpoint, SPT, to track the measurement input, MEAS.

When the block is switched to Local mode with the block in manual, the setpoint value depends on the setpoint tracking option (STRKOP):

- ♦ If STRKOP = 1 or 2, the SPT value is cleared.
- ♦ If STRKOP = 0, the SPT value reflects the RSP value at the time the switch to Local occurred. The block maintains this value as long as block is in Local, unless the user changes the SPT value via data access.

To prevent external manipulation, the tracked setpoint value, SPT, is nonsettable while setpoint tracking is active.

105.4.4 Block States

The PTC block has three states: Initialization, Manual and Auto.

105.4.4.1 Initialization

Key Parameters: INITMA

At initialization, the block initializes MA. DEFINE is set to 0 if any configured parameters fail validation testing.

When the block restarts, the INITMA configured option specifies the value of the MA parameter, unless MA has an established linkage, or MANSW or AUTSW are set true. Likewise, the INITLR specifies the value of the LR parameter, unless LR is linked, or LOCSW or REMSW are set true.

105.4.4.2 Manual

Key Parameters: MA

In manual, the block releases the outputs, allowing them to be set by the user.

A state change from Auto to Manual forces the block to set OUTINC, OUTDEC, and all alarm indicators false. In the Manual state, PTC does not perform proportional time control and the outputs become settable.

When the block is switched to Manual, the OUTINC or OUTDEC status reflects the MEAS/SPT status at the time the switch occurred. While the block is in Manual, it maintains this status until you change the output via data access. At that time, the block clears the status.

Alarming is only performed in Manual if the MANALM option is configured true.

105.4.4.3 Auto

Key Parameters: MA

In auto mode, the block secures the outputs. Auto has two substates: Controlling and Hold.

Configured alarming is always performed in Auto.

105.4.4.3.1 Controlling

Key Parameters: PROPT, MA, MEAS, OUTDEC, OUTINC, PBAND, REPTIM, SPT

In the Controlling substate, the block performs proportional time control (described above). Control action for the two outputs is derived by a pulse-duration algorithm that is a function of error (MEAS – SPT), the control period (REPTIM), and the proportional band setting (PBAND).

During Auto operation, the block checks the input MEAS for data errors (off-scan, or BAD, OOS, or ERR status bits set). If an error is detected, the PTC block may propagate the error to its outputs by setting the ERR status bit of OUTDEC and OUTINC, depending on the value of the PROPT parameter (see PROPT definition).

105.4.4.3.2 Hold

Key Parameters: CEOPT, HOLD, MA, MBADOP, OUTDEC, OUTINC

In the Hold substate, the block holds the process at the last controlled state by setting OUTINC and OUTDEC to false. The block goes to the Hold substate if, while MBADOP = 0 and CEOPT = 1 or 2, either the HOLD parameter goes true, or a condition required by the CEOPT parameter is met. When all error conditions are removed, the block returns to the Controlling substate to resume on-off control.

105.4.5 Alarming

The PTC block optionally supports absolute, high-high, low-low of the measurement and deviation alarming for (MEAS – SPT). Configured alarming is always performed in Auto. Alarming is only performed in Manual if the MANALM option is configured true. The block logs, and generates, alarm messages if the INHIB input is false.

Unacknowledge (UNACK) is a Boolean output parameter which is set true, for notification purposes, whenever the block goes into alarm. It is settable, but sets are only allowed to clear UNACK to false, and never in the opposite direction. The clearing of UNACK is normally via an operator "acknowledge" pick on a default or user display, or via a user task.

The different types of alarming are discussed below.

105.4.5.1 Inhibit Alarming

Key Parameters: DALOPT, HHAOPT, INHALM, INHIB, INHOPT, MANALM, MALOPT

INHALM is a parameter that is used in conjunction with the CINHIB compound parameter and the INHIB block parameter to determine which alarm types/points are inhibited in the block. See Table 105-1 for its formatting.

The INHOPT parameter specifies the actions taken when alarms are inhibited in the block. See Table 105-1 to determine the possible actions.

HHAOPT enables/disables High-High and/or Low-Low absolute alarming.

MALOPT enables/disables High and/or Low absolute measurement alarming.

DALOPT enables/disables High and/or Low deviation alarming.

Refer to the parameter descriptions for setting HHAOPT, MALOPT, and DALOPT.

105.4.5.2 Absolute Alarming

Absolute alarming checks if MEAS has exceeded a predefined limit. See Figure 105-4.

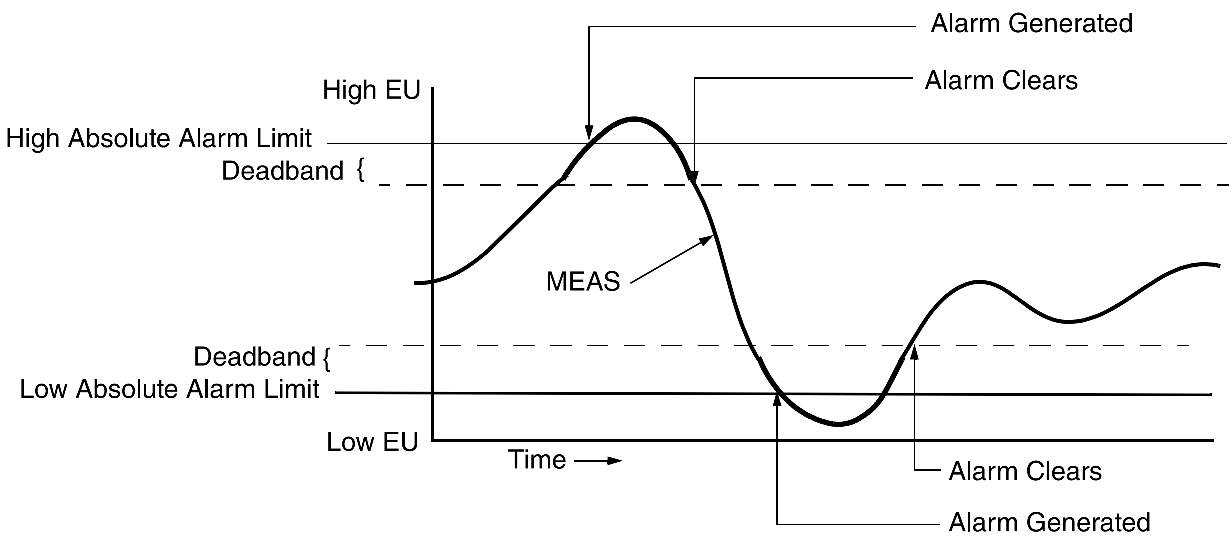


Figure 105-4. Absolute Alarming

Four forms of absolute alarming are available in PTC, as described below.

105.4.5.2.1 High-High Absolute Alarming

Key Parameters: HHAIND, HHALIM, HHATXT, MEAS, MEASDB

In High-High Absolute Alarming, MEAS is compared to the high-high absolute alarm limit (HHALIM). If MEAS is greater than HHALIM, the block sets HHAIND true and outputs an alarm message that includes the user-defined HHATXT. When MEAS falls to, or below, HHALIM minus the deadband (MEASDB), the block sets HHAIND to false and outputs a return-to-normal message.

105.4.5.2.2 Low-Low Absolute Alarming

Key Parameters: LLAIND, LLALIM, LLATXT, MEAS, MEASDB

In Low-Low Absolute Alarming, MEAS is compared to low-low absolute alarm limits (LLALIM). If MEAS is less than LLALIM, the block sets LLAIND to true and outputs an alarm message that includes the user-defined LLATXT. When MEAS rises to, or above, LLALIM plus the deadband (MEASDB), the block sets LLAIND to false and outputs a return-to-normal message.

105.4.5.2.3 High Absolute Alarming

Key Parameters: MEAS, MEASDB, MEASHI, MEASHL, MEASHT

In High Absolute Alarming, MEAS is compared to the high absolute alarm limit (MEASHL). If MEAS is greater than MEASHL, the block sets MEASHI true and outputs an alarm message that includes the user-defined MEASHT. When MEAS falls to, or below, MEASHL minus the deadband (MEASDB), the block sets MEASHI to false and outputs a return-to-normal message.

105.4.5.2.4 Low Absolute Alarming

Key Parameters: MEAS, MEASDB, MEASLI, MEASLL, MEASLT

In Low Absolute Alarming, MEAS is compared to the low absolute alarm limits (MEASLL). If MEAS is less than MEASLL, the block sets MEASLI true and outputs an alarm message that includes the user-defined MEASLT. When MEAS rises to, or above, MEASLL plus the deadband (MEASDB), the block sets MEASLI to false and outputs a return-to-normal message.

105.4.5.3 Deviation Alarming

Deviation alarming checks if the error (MEAS - SPT) has exceeded the predefined deviation limits. See Figure 105-5.

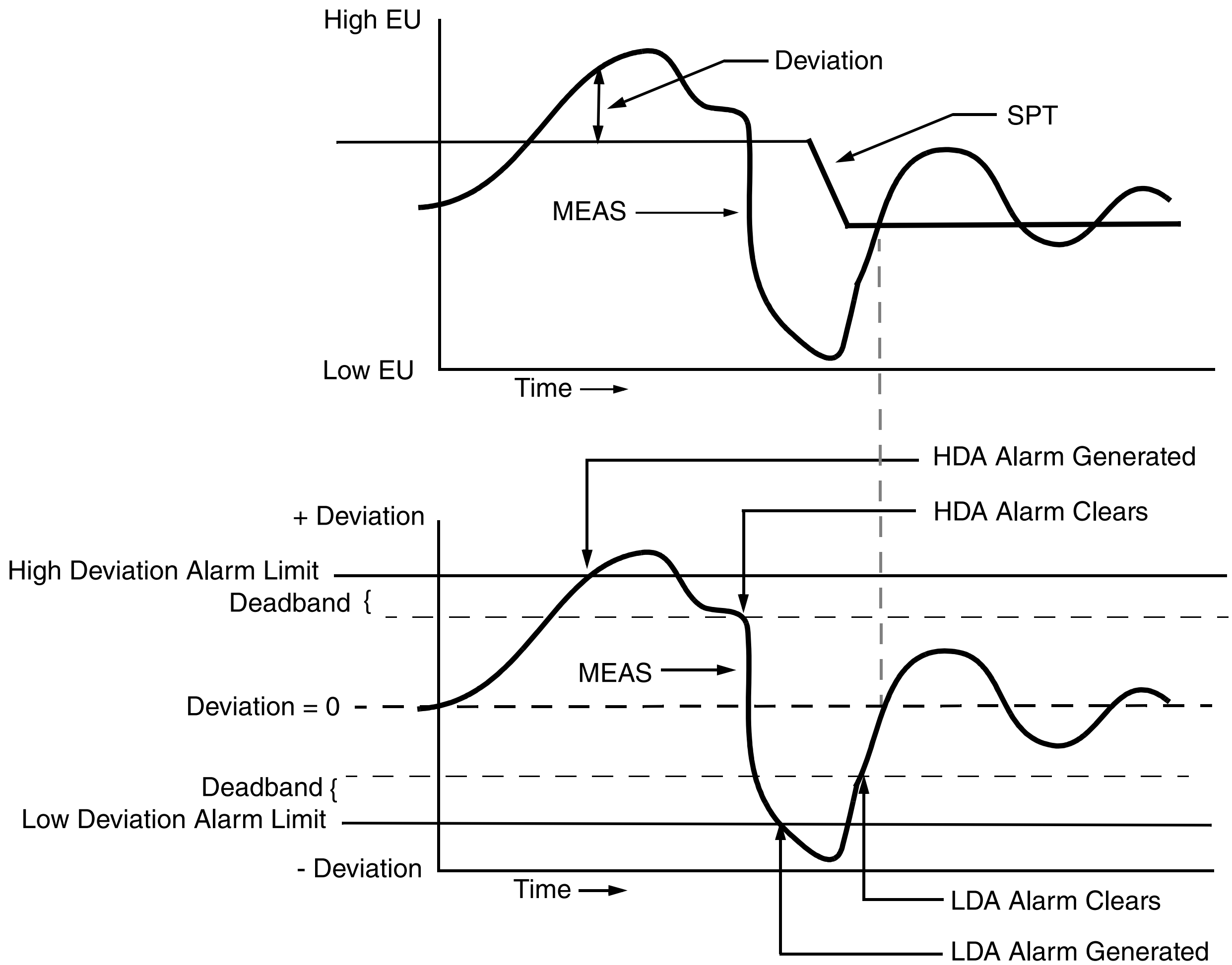


Figure 105-5. Deviation Alarming

Two forms of deviation alarming are available, as described below.

105.4.5.3.1 High Deviation Alarming

Key Parameters: DEVADB, MEAS, HDAIND, HDALIM, HDATXT, SPT

In High Deviation Alarming, the deviation (MEAS – SPT) is compared to the high deviation alarm limit (HDALIM). If the deviation is greater than HDALIM, the block sets HDAIND true and outputs an alarm message that includes the user-defined HDATXT. When the deviation falls to, or below, HDALIM minus the deadband (DEVADB), the block sets HDAIND to false and outputs a return-to-normal message. The alarm limit field of the messages reports the limit in absolute terms, rather than using HDALIM, which is a relative quantity (that is, Alarm Limit Field = Setpoint + HDALIM, rather than Alarm Limit Field = HDALIM).

105.4.5.3.2 Low Deviation Alarming

Key Parameters: DEVADB, LDAIND, LDALIM, LDATXT, MEAS, SPT

In Low Deviation Alarming, the deviation (MEAS – SPT) is compared to the absolute value of the low deviation alarm limit (LDALIM). If the deviation is less than the absolute value of LDALIM, the block sets LDAIND true and outputs an alarm message that includes the user-defined LDATXT. When the deviation rises to, or above, LDALIM plus the deadband

(DEVADB), the block sets LDAIND to false and outputs a return-to-normal message. The alarm limit field of the messages reports the limit in absolute terms, rather than using LDALIM, which is a relative quantity (that is, Alarm Limit Field = Setpoint - LDALIM, rather than Alarm Limit Field = LDALIM).

105.4.6 Cascade Configuration

A typical configuration using the PTC block (as a secondary block) is shown below.

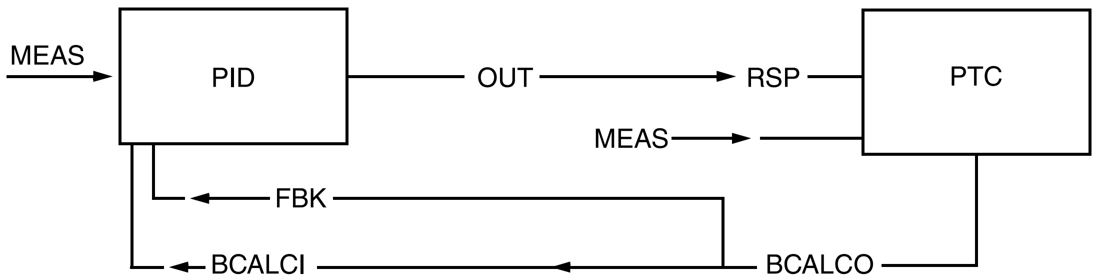


Figure 105-6. PTC Block in Cascade Configuration

To provide bumpless initialization of the upstream block in a cascade:

- Link BCALCI of the primary controller (PID in Figure 105-6) to BCALCO of the PTC block.
- Link FBK (external reset) of the primary controller to BCALCO of the PTC block.

105.4.7 Application

Figure 105-7 shows the PTC block as a valve positioner for a furnace air damper, with feedback from a position sensor, for example, slide wire, in the actuator. This application uses the PTC pulse duration algorithm with the feedback signal connecting to the measurement input. The PID controller sets the demand for valve position via the remote setpoint (RSP) input.

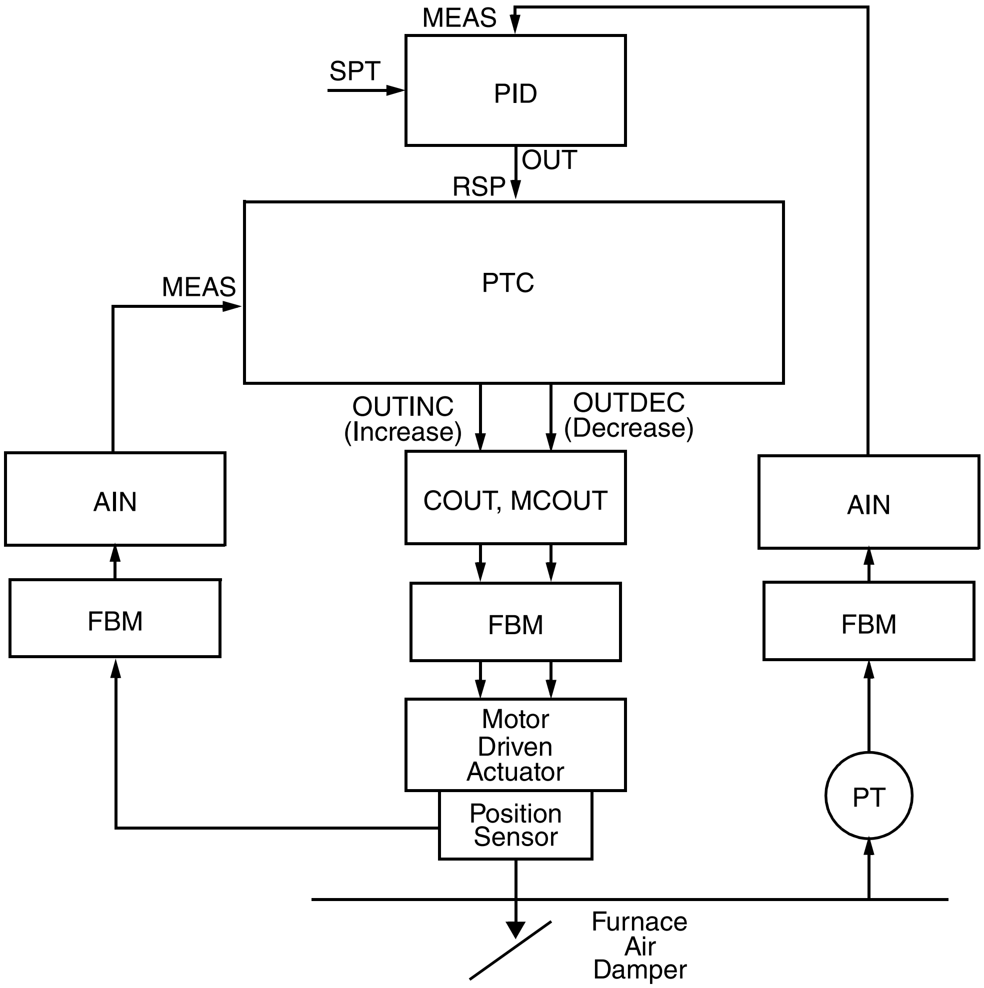


Figure 105-7. PTC with Position Feedback Using Pulse-Duration-Algorithm

106. RAMP – Ramp Block

This chapter describes the RAMP block, its features, parameters and detailed operations.

106.1 Overview

The Ramp function generator, RAMP, ramps the output (OUT) in a velocity mode. The toggle input, UPDOWN, controls the direction of the ramp and two independent ramp rates, DNRATE and UPRATE, determine the speed, or slope, of the ramp. Two variable output limits, HOLIM and LOLIM, constrain the peak-to-peak amplitude of the output ramp waveform. It is also possible to specify the direction of ramping using the RMPUP and RMPDWN parameters. To use these parameters, set the RMPOPT option to true.

106.1.1 I/O Diagram

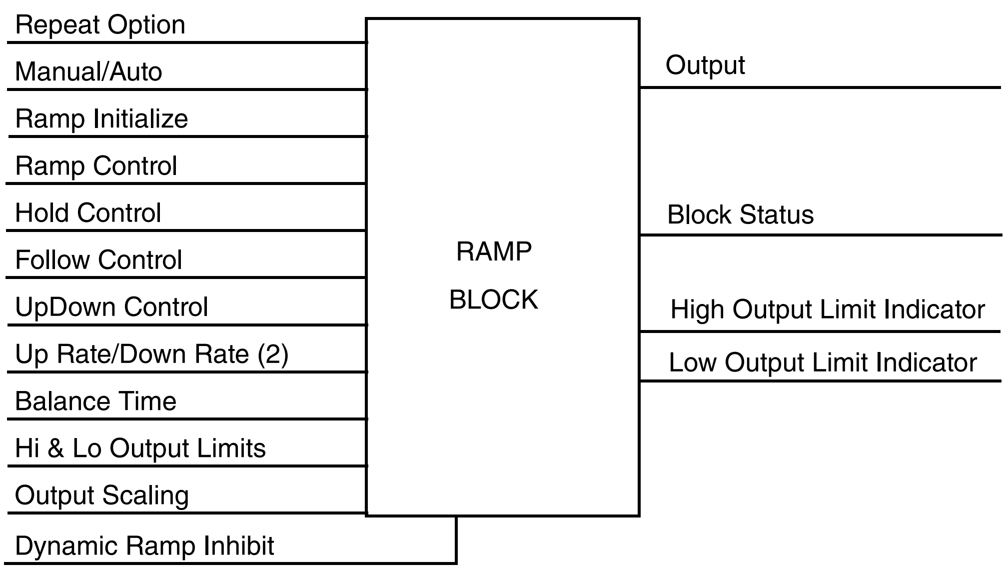


Figure 106-1. RAMP Block I/O Diagram

106.2 Features

The features are:

- Manual/Auto mode for disconnecting control schemes from the process, for simulation and checkout purposes
- Output Limiting – High and Low Absolute.
- Dynamic ramp inhibiting.

The options are:

- Repeat Option (REPTOP) allows the output to continuously ramp up and down between the output limits, as long as the block is in the Ramp substate.
- Manual output clamping (MCLOPT).

- Ramp Option (RMPOPT) allows you to specify RMPDWN and RMPUP parameters. The RAMP block uses these parameters to determine the direction of the ramp. If not set, the UPDOWN parameter is used.
- Initialize Manual/Auto (INITMA) specifies the desired state of the MA input during initialization.

106.3 Parameters

Table 106-1. RAMP Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	15	RAMP
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	1 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
RAMP	ramping mode	boolean	con/set	0	0 to 1
RMPOPT	ramp block option	boolean	no-con/no-set	0	0 to 1
UPDOWN	ramp direction	boolean	con/set	0	0 to 1
RMPDWN	ramp down	boolean	con/set	0	0 to 1
RMPUP	ramp up	boolean	con/set	0	0 to 1
INHDWN	inhibit down ramp	boolean	con/set	0	0 to 1
INHUP	inhibit up ramp	boolean	con/set	0	0 to 1
UPRATE	up ramp rate	real	con/set	0.0	EI1/minute, RI1
DNRATE	down ramp rate	real	con/set	0.0	EI1/minute, RI1
HSCI1	high scale 1	real	no-con/no-set	100.0	specifiable
LSCI1	low scale 1	real	no-con/no-set	0.0	specifiable
DELTI1	change delta 1	real	no-con/no-set	1.0	percent
EI1	eng units input	string	no-con/no-set	%	specifiable
KSCALE	gain scaler	real	no-con/no-set	1.0	scalar
RAMPIN	ramp initialize	real	con/set	0.0	RO1
HSCO1	high scale out 1	real	no-con/no-set	100.0	specifiable
LSCO1	low scale out 1	real	no-con/no-set	0.0	specifiable
DELTO1	change delta 1	real	no-con/no-set	1.0	percent
EO1	eng unit output	string	no-con/no-set	%	specifiable
HOLIM	high output limit	real	con/set	100.0	RO1
LOLIM	low ouput limit	real	con/set	0.0	RO1
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	[0|1|2]
MCLOPT	manual clamp optIon	boolean	no-con/no-set	0	0 to 1
HOLD	hold mode	boolean	con/set	0	0 to 1
FOLLOW	follow mode	boolean	con/set	0	0 to 1
BTIME	balance time	real	con/set	0.0	[0..]minutes
REPTOP	repeat option	boolean	no-con/no-set	0	0 to 1

Table 106-1. RAMP Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
OUTPUTS					
HOLIND	high out limit indicator	boolean	con/no-set	0	0 to 1
LOLIND	low out limit indicator	boolean	con/no-set	0	0 to 1
OUT	output	real	con/no-set	0.0	RO1
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
BLKSTA	block status	pack_l	con/no-set	0	bit map
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	config error	string	no-con/no-set	0	1 to 43 chars
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
NR_INP	number of inputs	short	no-con/no-set	0	0 to 255
NR_OUT	number of outputs	short	no-con/no-set	0	0 to 255
OF_INP	offset of input	integer	no-con/no-set	0	0 to 255
OF_OUT	offset of outputs	integer	no-con/no-set	0	0 to 255
OWNER	owner name	string	no-con/set	blank	1 to 32 chars
PERTIM	period time	real	no-con/no-set	0.1	---
RI1	eng range input	real[3]	no-con/no-set	100,0,1	specifiable
RO1	eng range output	real[3]	no-con/no-set	100,0,1	specifiable

106.3.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the RAMP block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
			HOL	LOL							WLCK			RAMP	REPT	ON	UDEF			MA				HLD		RMP	FOL				

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
4	FOL	Follow	BLKSTA.B28
5	RMP	Ramp	BLKSTA.B27
7	HLD	Holding	BLKSTA.B25

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
16	REPT	Repeat Option	BLKSTA.B16
17	RAMP	Ramp Option	BLKSTA.B15
20	WLCK	Workstation Lock	BLKSTA.B12
27	LOL	Low Output Limit (Clamped)	BLKSTA.B5
28	HOL	High Output Limit (Clamped)	BLKSTA.B4

* Bit 0 is the least significant, low order bit.

BTIME
Balance Time is a real input that specifies the time constant, in minutes, of the rate at which the OUT value returns to the Auto setting, when the block transits from Manual, Tracking, or Holding, to Auto state.

DEFINE
Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block.

DELTI1
Change Delta for Input Range 1 is a real value that defines the minimum percent of the input range that triggers change driven connections for parameters in the range of RI1. The default value is 1.

Entering a 1 causes the Object Manager to recognize and respond to a change of 1 percent of the full error range. If communication is within the same CP that contains the block's compound, change deltas have no effect.

Refer to "Peer-to-Peer Connections of Real-Type Block Inputs" on page 1703 for details on how the I/A Series software affects the change delta percentage during operation.

DELTO1
Change delta for Output Range 1 is a configurable real value that defines the minimum percent of the output range that triggers change-driven connections for parameters in the range RO1. The default value is 1.0 percent. If communication is within the same control station that contains the block's compound, DELTO1 has no effect.

DESCRP
Description is a user-defined string of up to 32 characters that describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

DNRATE Down Rate is a real input whose absolute value determines the output's ramp rate when the block is in the Ramp mode and the UPDOWN input is true, or RMPDWN is true when RMPOPT enters the Follow state. The physical units are defined by EI1. The time units are minutes.

EI1 Engineering Units for Input Range 1, as defined by the parameters HSCI1, LSCI1, and DELTI1, provide the engineering units text for the values defined by Input Range 1. "Deg F" or "pH" are typical entries.

EO1 Engineering Units for Output Range 1, as defined by the parameters HSCO1, LSCO1, and DELTO, provide the engineering units text for the values defined by Output Range 1. "Deg F" or "pH" are typical entries. Make the units for the Output Range (EO1) consistent with the units of Input Range 1 (EI1) and Input Range 2 (EI2).

ERCODE Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block's DEFINE parameter to be set false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the RAMP block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
"W43 – INVALID PERIOD/ PHASE COMBINATION"	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
"W44 – INVALID ENGINEERING RANGE"	High range value is less than or equal to low range value.
"W46 – INVALID INPUT CONNECTION"	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
"W48 – INVALID BLOCK OPTION"	The configured value of a block option is illegal.
"W53 – INVALID PARAMETER VALUE"	A parameter value is not in the acceptable range.
"W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK"	A Database Installer error has occurred.

FOLLOW Follow is a boolean input. When true, FOLLOW forces the block into the Follow substate of Auto. In this substate, the output follows the input RAMPIN.

HOLD	Hold is a boolean input. When true, HOLD forces the block into the Hold substate of Auto, holding the output at its last computed value.
HOLIM	High Output Limit is a real input that establishes the maximum output value, in OUT units. If the algorithm tries to drive the output to a higher value, the output is clamped at the HOLIM value and the indicator HOLIND is set true.
HOLIND	High Output Limit Indicator is a boolean output that is set true whenever the output is clamped at the high output limit, HOLIM.
HSCI1	High Scale for Input Range 1 is a real value that defines the upper limit of the measurement ranges. EI1 defines the units. Make the range and units consistent with the measurement source. A typical value is 100 (percent).
HSCO1	High Scale for Output Range 1 is a real value that define the upper limit of the ranges for output 1. A typical value is 100 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.
INHDWN	Inhibit Down inhibits the ramp down function in a RAMP block.
INHUP	Inhibit Up inhibits the ramp up function in a RAMP block.
INITMA	Initialize Manual/Auto specifies the desired state of the MA input during initialization, where: 0 = Manual 1 = Auto 2 = The MA state as specified in the checkpoint file. The block asserts this initial M/A state whenever: ♦ It is installed into the Control Processor database. ♦ The Control Processor undergoes a reboot operation. ♦ The compound in which it resides is turned on. ♦ The INITMA parameter itself is modified via the control configurator. (The block does not assert INITMA on ordinary reconfiguration.) INITMA is ignored if MA has an established linkage.
KSCALE	KSCALE is a conversion factor used to make the time units of the rate parameters, which are in EI1 units per minute, dimensionally compatible with the time units of the output, as defined by EO1.
LOCKID	Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.

LOCKRQ	Lock Request is a boolean input which can be set true or false only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.
LOLIM	Low Output Limit is a real input that establishes the minimum output value. If the algorithm tries to drive the output to a lower value, the output is clamped at the LOLIM value and the indicator LOLIND is set true.
LOLIND	Low Output Limit Indicator is a boolean output that is set true whenever the output is clamped at the low output limit, LOLIM.
LOOPID	Loop Identifier is a configurable string of up to 32 characters which identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.
LSCI1	Low Scale for Input Range 1 is a real value that defines the lower limit of the measurement ranges. A typical value is 0 (percent). EI1 defines the units. Make the range and units consistent with those of the measurement source.
LSCO1	Low Scale for Output Range 1 is a real value that defines the lower limit of the ranges for Output 1. A typical value is 0 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.
MA	Manual Auto is a boolean input that controls the Manual/ Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. The block automatically limits the output to the output range specified between LSCO1 and HSCO1. In Manual, the algorithm is not performed, and the output is unsecured. An external program can then set the output to a desired value.
MCLOPT	Manual Clamping Option allows you to invoke output clamping while the block is in manual. You can alter this configurable boolean input at the workstation.
NAME	Name is a user-defined string of up to 12 characters used to access the block and its parameters.
NR_INP	Number of Inputs is a short value representing the number of inputs in the block. It is used internally.

NR_OUT	Number of Outputs is a short value representing the number of outputs in the block. It is used internally.
OF_INP	Offset to Inputs is the zero-based offset, in bytes, of the first block input from the head of the block. It is used internally.
OF_OUT	Offset to Outputs is the zero-based offset, in bytes, of the first block output from the head of the block. It is used internally.
OUT	Output, in Auto mode, is the result of the block algorithm applied to one or more input variables. In Manual, OUT is unsecured, and can be set by you or by an external task.
OWNER	Owner is a string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are successful only if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.
PERIOD	Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PERTIM	Period Time is the period of the block expressed in seconds.
PHASE	Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
RAMP	Ramping is an input that forces the block into the RAMP mode, which is a substate of Auto. While in RAMP, the output ramps in a velocity mode in which the direction is selected by the UPDOWN input and the speed is governed by the absolute value of the appropriate UPRATE or DNRATE input. The output continues ramping until it is clamped at either of the output limits, HOLIM or LOLIM. The RAMP input is overridden by either the MA, the HOLD, or the FOLLOW input.

RAMPIN	Ramp Initialize is a real input that determines the initial value of the output at the time the block is switched into the Ramp mode. Also, in the Follow mode, RAMPIN is the output forcing function.
REPTOP	Repeat Option is a boolean input. When REPTOP is set true, the RAMP block output, OUT, continuously ramps up and down between the output limits, as long as the block is in the Ramp substate. In this mode, the UPDOWN or RMPUP/RMPDWN inputs dictate the initial direction of the ramp at the instant the block enters the Ramp substate.
RI1	Range Input is an array of real values that specify the high and low engineering scale and change delta of a particular real input. For a given block, it also forms an association with a group of real input parameters that have the same designated range and change delta.
RMPDWN	Ramp Down requests the output to be ramped in a downward direction in a RAMP block, provided RMPOPT is set true.
RMPOPT	Ramp Option specifies that the RMPDWN and RMPUP parameters be used to determine the direction of the ramp action in a RAMP block. If not set, the UPDOWN parameter is used for this purpose.
RMPUP	Ramp Up requests the output to be ramped in an upward direction in a RAMP block, provided RMPOPT is set true.
RO1	Range Output is an array of real values that specify the high and low engineering scale of a particular real output. For a given block, it also forms an association with a group of real output parameters that have the same designated range.
TYPE	When you enter “RAMP” or select “RAMP” from the block type list under Show, an identifying integer is created specifying this block type.

UPDOWN	Up/Down is a boolean input (0 = false = UP; 1 = true = DOWN) that controls the direction of the ramped output and selects the velocity parameter (UPRATE or DNRATE) when the block is in the Ramp mode, and RMPOPT is set false.
UPRATE	Up Rate is a real input whose absolute value determines the output's ramp rate when the block is in the Ramp mode and the UPDOWN input is false, or RMPUP is true when RMPOPT is true. The physical units are defined by EI1. The time units are minutes.

106.4 Detailed Operation

The MA, HOLD, FOLLOW, and RAMP inputs control the mode of operation. When multiple combinations of these inputs are active simultaneously, the output mode defaults to the following priorities; Manual (highest), Hold, Follow, and Ramp (lowest). Hold, Follow, and Ramp are substates of the Auto mode.

In Manual, the ramp function is not performed, and the output may be set by an external source.

The Manual clamping option (MCLOPT) offers output clamping in Manual mode. If MCLOPT is set:

1. OUT is clamped whenever its value exceeds the clamp limits.
2. HOLIND and LOLIND are secured to prevent them from being changed by you.

If MCLOPT is not set, both HOLIND and LOLIND are released and set to false when the block is switched to Manual mode.

You can use the Manual mode to pre-position the output prior to operating the block in the Ramp mode.

Setting the MA input true switches the block to Auto. If none of the mode control inputs (HOLD, FOLLOW, and RAMP) are true when the block is in Auto, then the output simply rests at the last Manual value.

When the RAMP input goes to true while the other two inputs, HOLD and FOLLOW, remain false, the block enters the Ramp substate of Auto and automatically initializes the ramp output. In the Auto mode, initialization only occurs when the RAMP input makes a zero-to-one transition while the HOLD and FOLLOW inputs remain at logical zero. Initialization causes the output to take on the RAMPIN value, enables output clamping, and starts the ramping procedure.

The method of configuring the RAMPIN input can dictate how the initial ramp value is obtained. If you configure RAMPIN as a constant value, which is always settable, then you can set the initial ramp value indirectly. If you connect RAMPIN to the block output, you can set the initial ramp value when the block is in Manual. If you connect RAMPIN to an external source, the initial ramp value is externally controlled.

As long as the RAMP input is true, and the HOLD and FOLLOW inputs remain false, the block ramps the output. The UPDOWN input (or RMPUP and RMPDWN) fixes the direction of the ramp while the appropriate rate input determines the slope. When the UPDOWN input is false (default state, or RMPUP is true), the block ramps the output upward with a slope equal to the absolute value of the UPRATE parameter. Conversely, when the UPDOWN input is true (or RMPDWN is true) the block ramps the output down with a slope equal to the absolute value of the DNRATE parameter.

If RMPOPT=0, you can toggle the UPDOWN input at any time to change the direction and slope of the ramp.

Ramping continues until the output reaches one of the output limits, setting the appropriate limit indicator (HOLIND or LOLIND) true.

If the Repeat Option, REPTOP, is set false, the output remains clamped at the limit until either the limit is changed in the direction of the ramp, or the ramp direction is reversed.

If REPTOP is set true, the RAMP block output, OUT, continuously ramps up and down between the output limits, as long as the block is in the Ramp substate. In this mode, the UPDOWN input (or RMPUP and RMPDWN) dictates the initial direction of the ramp at the instant the block enters the ramp mode.

Both UPRATE and DNRATE parameters have the physical engineering units of EI1 at a per minute rate unit, fixed by the block. The KSCALE parameter allows you to reconcile the specified rate units to the actual units of the output (EO1).

For example, the default KSCALE value of one implies that the units of the rate parameters (EI1), per minute, are the same as the positional units of the output, EO1. With the chosen time convention of minutes, you need not rescale the ramp rates if the block period is changed.

Ramp rates can have positive, negative, or zero values, but the block actually uses the absolute value of the rate parameter. It is the UPDOWN (or RMPUP and RMPDWN) parameter that determines the direction. This allows you to enter negative DNRATE values for display purposes.

Set the HOLD input true to delay the start of, or suspend the operation of, the ramp waveform. See Figure . In Hold, the output retains its present value until HOLD is set false.

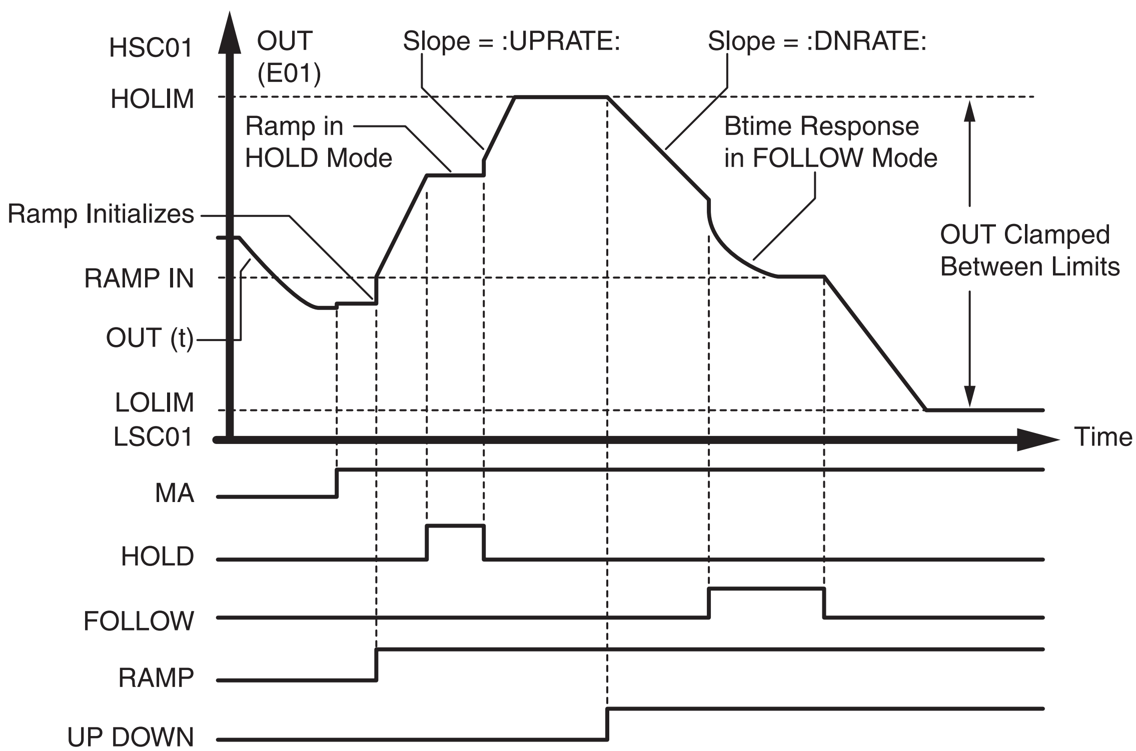


Figure 106-2. Ramp Timing Device

HOLD overrides both RAMP and FOLLOW modes. Output clamping is active in the Hold mode.

Set the FOLLOW input true when you want the output to track some other variable that has been connected to the RAMPIN input. Setting the FOLLOW input true, while the block is in Auto and not in the Hold mode, forces the block to the Follow mode, in which the output, OUT, tracks the RAMPIN input.

Output clamping is active in the Follow mode. If the RAMP input is true when the FOLLOW input is set to false, the output resumes ramping, without a bump.

To avoid bumping the output when the block enters the Follow mode, the block provides a balance time (BTIME) parameter. This parameter is the time constant of the first order lag that smooths the output's transition, from the value it had when the block entered the Follow mode, to the RAMPIN value.

Ramping can be inhibited up or down or both using the RMPOPT option parameter in conjunction with the INHUP and INHDWN parameters.

When RMPOPT = 0 (which is the default), ramping occurs in the direction specified by UPDOWN (false indicating up and true indicating down) providing INHUP or INHDWN is not set for the specified direction.

When RMPOPT = 1, ramping occurs only if either RMPUP or RMPDWN is set. If RMPUP is set, ramping up occurs if INHUP is not set. If RMPDWN is set, ramping down occurs if INHDWN is not set. If RMPOPT is set and both RMPUP and RMPDWN are true, ramping up occurs and RMPDWN is ignored. If RMOPT is set, and neither RMPUP nor RMPDWN is set, no ramping occurs.

107. REAL – Real Variable Block

This chapter describes the REAL (Real Variable Block), its features, parameters and basic operations.

107.1 Overview

The REAL variable block provides data storage for a real value, and its configured high and low scale clamping limits and engineering units (see Figure 107-1). When the real value reaches either the high or low limit, it is clamped at this limit. The real value parameter is typically connected to other blocks for use in a control strategy.

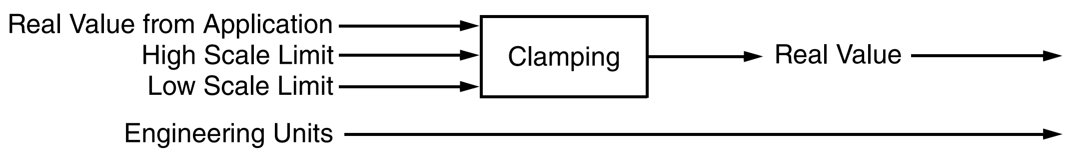


Figure 107-1. REAL Block Functional Diagram

107.2 Features

The REAL variable block provides the following features:

- Real data variable (VALUE) for storing a real value
- Clamping of VALUE between user-defined high (HSCO1) and low (LSCO1) limits
- User-defined engineering units (EO1) for VALUE.

107.3 Parameters

Table 107-1. REAL Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
Configured Parameters					
INPUTS					
NAME	variable name	string	no-con/no-set	2 blanks	1 to 12 chars
TYPE	variable type	integer	no-con/no-set	153	REAL
DESCRP	variable descriptor	string	no-con/no-set	2 blanks	1 to 32 chars
HSCO1	high scale clamp limit	real	no-con/no-set	100.0	any real value
LSCO1	low scale clamp limit	real	no-con/no-set	0.0	any real value
EO1	engineering units	string	no-con/no-set	%	1 to 32 chars
DATA VARIABLE					
VALUE	variable value	real	con/set	0.0	RO1

Table 107-1. REAL Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
Non-Configured Parameters					
DATA STORE					
RO1	engineering range	real[3]	no-con/no-set	100,0,1	specifiable

107.3.1 Parameter Definitions

DESCRP — Descriptor is a user-defined string of up to 32 characters that describe the variable (for example, TEMPERATURE – DEG C).

EO1 — Engineering Units for Output Range 1, a user-defined string of up to 32 characters, provides the engineering units text for the VALUE parameter. The value configured for this text string should be consistent with the values used for HSCO1 and LSCO1.

HSCO1 — High Scale Clamp for Output Range 1 is a real value that defines the upper range value for the VALUE parameter. HSCO1 must be greater than LSCO1.

LSCO1 — Low Scale Clamp for Output Range 1 is a real value that defines the lower range value for the VALUE parameter.

NAME — Name is a user-defined string of up to 12 characters used to access the data variable block and its parameters.

RO1 — Range Output 1 is a real array consisting of the three values, HSCO1, LSCO1, and 1.0 (1.0 is normally the change delta, but it is not used by this block). RO1 and its members can be accessed as an array by user tasks and displays.

TYPE — Type is a system-level mnemonic label indicating the block type. Enter “REAL” or select “REAL” from the block type list under SHOW when configuring the block.

VALUE — Value is a real data variable that can be set by an application to store data for use by other blocks.

107.4 Detailed Operation

The REAL block provides storage, clamping, and engineering units for a value set by an application for use by other blocks.

The REAL block does not contain PERIOD and PHASE parameters because it is not executed by the compound processor. Using the Integrated Control Configurator, any number of REAL blocks can be inserted in the **END DATA** zone of any compound.

107.4.1 Detailed Diagram

Figure 107-2 is a simplified block diagram that depicts the functional signal flow of the REAL block. It shows the forward path of the block as it relates to the various states, logic control signals, and options represented by toggle switches.

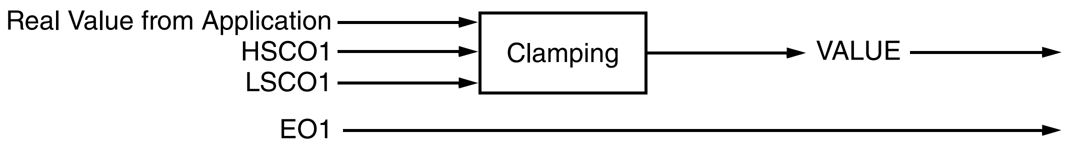


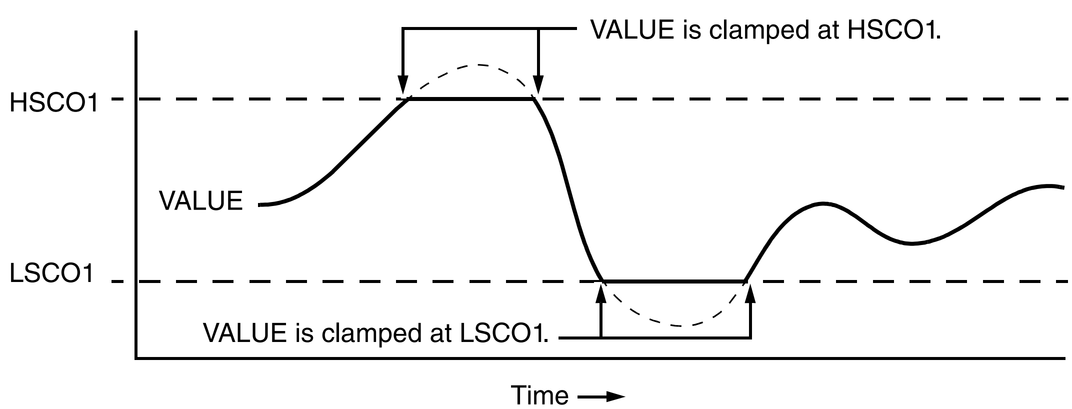
Figure 107-2. REAL, Detailed Block Diagram

107.4.2 Block Clamping

Key Parameters: VALUE, HSCO1, LSCO1, EO1

The REAL block contains a real data variable parameter (VALUE) that can be set by an application to store a value for use by other blocks. You can configure the high scale (HSCO1) and low scale (LSCO1) clamping limits, and engineering units (EO1) for VALUE. The VALUE record contains a status field in which an application can set the Bad and out-of-service (OOS) bits.

When VALUE is changed by an application or block reconfiguration, the set command clamps the output between HSCO1 and LSCO1. See Figure 107-3. If VALUE reaches either limit, it is set to this limit, and the corresponding high limit (LHI) or low limit (LLO) bit in the status field of the VALUE parameter is set.



Note: EO1 provides units for VALUE.

Figure 107-3. VALUE Clamping

107.5 Block Validation

The REAL block is validated whenever:

- It is installed in the Control Processor (CP) database.
- The CP undergoes a reboot operation.
- The compound in which the block resides is turned on.

Block validation does *not* change any parameter values that have *not* been reconfigured, except for a CP reboot, in which case it installs the parameter values in the checkpoint file. If you turn the compound off and then on, the VALUE parameter value is unchanged.

107.6 Block Detail Display

The REAL block has a Detail Display for viewing and setting parameters. REAL and other data variable blocks appear on the `Select` display in the order they are configured, following all other blocks in the compound.

108. RATIO – Ratio Block

This chapter describes the RATIO Block, its features, parameters and detailed operations.

108.1 Overview

The Ratio block, RATIO, performs a scaled multiplication of the measurement input with the ratio setpoint to maintain an output which is scaled to the measurement.

108.1.1 I/O Diagram

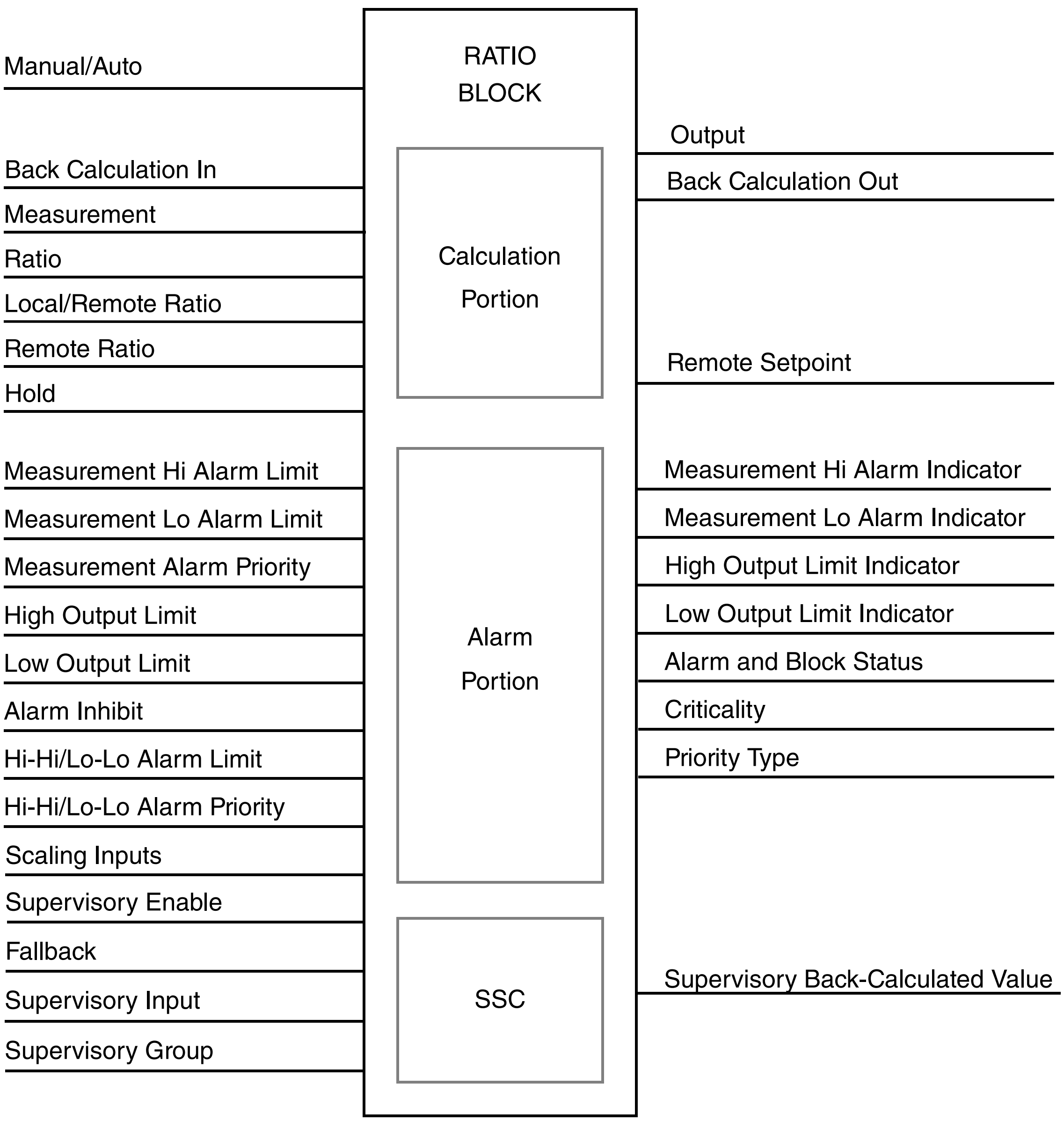


Figure 108-1. RATIO Block I/O Diagram

108.2 Features

The features are:

- Manual/Auto control of the output, which can be initiated by a host process or another block
- Auto and Manual latch switch inputs (AUTSW and MANSW) that force the block to be switched to Auto or Manual
- Local/Remote ratio source selection
- Local and Remote latch switch inputs (LOCSW and REMSW) that force the block to Local or Remote Ratio
- Assignable engineering range and units to the local ratio setpoint, input measurement and the output
- Output clamping between variable output limits
- User configurable scaling of the ratio calculation to make the computed output dimensionally compatible with the specified output units
- Bad inputs detection and handling
- Automatic cascade handling using an input and output parameter (back-calculate) that includes:
  - Initialization of cascade schemes.
  - Back calculation on the ratio setpoint input for the upstream block to provide bumpless cascade operation.
- Supervisory Control (SSC) that allows user application software to perform supervisory control over the RATIO block's ratio input.

The options are:

- Manual if Bad Option (MBADOP) is a manual override feature. When MBADOP = 1 or 2, the block sets the MA input to manual when it detects a control error (CE = true), when the HOLD parameter goes true, or (when MBADOP = 2) when the Remote Ratio input (REMRAT) is not healthy (i.e., value status is BAD or has a broken OM connection). This forces the output state to manual. Returning to Auto requires external intervention, unless AUTSW is true.
- Manual Clamping Option (MCLOPT) allows you to invoke output clamping while the block is in manual.
- Ratio Tracking Option (RTRKOP) forces the local ratio setpoint, RATIO, to track the back-calculated ratio value, BCALCO. RTRKOP takes this action when the LR parameter has transitioned in either direction and 1) either the output is in Manual or a cascade is broken (a downstream block is in open loop - INITI true) or the block is in Manual, or 2) when the block is in Manual only. RTRKOP is not performed if any measurement data errors are detected. This feature allows bumpless return to ratio control when the block returns to auto or the cascade returns to closed-loop operation.
- Measurement Alarming Option (MALOPT) provides absolute alarming of the measurement during auto operation. This option also provides standard alarm notification and reporting features.

- Control Error Option (CEOPT) allows you to enable, or disable, the block's implicit Hold action when it detects an error in the MEAS or BCALCI input.
- Propagate Error Option (PROPT) gives you the option of propagating the ERROR status bit from the MEAS input to the block's OUT parameter.
- Local Setpoint Secure (LOCSP) enables you to secure against any write access to the LR parameter.
- Manual If Failsafe (MANFS) allows you to have the block go to the Manual state when the block receives a Failsafe notification.
- Hi-Hi and Lo-Lo Absolute Alarming option (HHAOPT) provides absolute alarming for target (HHALIM and LLALIM) alarming of the input at a given priority level (HHAPRI), or disables the alarming altogether. Each alarm triggers an indicator (HHAIND and LLAIND) and text message (HHATXT and LLATXT) to be sent to the configured alarm group (HHAGRP). Indicators remain set until the measurement returns within the defined limit plus (or minus) the deadband (MEASDB).

  0 = No alarming

  1 = High-High and Low-Low alarming

  2 = High-High alarming only

  3 = Low-Low alarming only.
- Unacknowledge (UNACK) is a boolean output parameter which is set true, for notification purposes, whenever the block goes into alarm. It is settable, but sets are only allowed to clear UNACK to false, and never in the opposite direction. The clearing of UNACK is normally via an operator “acknowledge” pick on a default or user display, or via a user task.
- Supervisory Option (SUPOPT) specifies whether or not the block is under control of a Supervisory Application Program.
- Fallback Option (FLBOPT) specifies the action taken in a block when Supervisory fallback occurs. The fallback options can be: normal fallback, Auto, Manual, Remote, or Local.

108.3 Parameters

Table 108-1. RATIO Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	21	RATIO
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
MEAS	process input	real	con/set	0.0	RI1
HSCI1 to HSCI2	high scale in 1 to 2	real	no-con/no-set	100.0	specifiable
LSCI1 to LSCI2	low scale in 1 to 2	real	no-con/no-set	0.0	specifiable

Table 108-1. RATIO Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
DELTI1 to DELTI2	change delta 1 to 2	real	no-con/no-set	1.0	percent
EI1 to EI2	eng units input	string	no-con/no-set	%	specifiable
PROPT	propagate error	short	no-con/no-set	0	0 to 2
RATIO	ratio setpoint	real	con/no-set	0.0	RI2
KSCALE	gain scaler	real	con/set	1.0	scalar
BSCALE	bias scale factor	real	con/set	0.0	output units
HSCO1	high scale out 1	real	no-con/no-set	100.0	specifiable
LSCO1	low scale out 1	real	no-con/no-set	0.0	specifiable
DELTO1	change delta 1	real	no-con/no-set	1.0	percent
EO1	eng unit output	string	no-con/no-set	%	specifiable
HOLIM	high output limit	real	con/set	100.0	RO1
LOLIM	low ouput limit	real	con/set	0.0	RO1
OSV	span variance	real	no-con/no-set	2.0	[0..25]percent
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	[0|1|2]
MANFS	manual If failsafe	boolean	no-con/no-set	0	0 to 1
MBADOP	manual bad option	short	no-con/no-set	0	0 to 1
MANSW	manual switch	boolean	con/set	0	0 to 1
AUTSW	auto switch	boolean	con/set	0	0 to 1
MCLOPT	man clamp option	boolean	no-con/no-set	0	0 to 1
CEOPT	control error option	short	no-con/no-set	1	0 to 2
HOLD	hold mode	boolean	con/set	0	0 to 1
PRIBLK	primary block cascade option	boolean	no-con/no-set	0	0 to 1
PRITIM	primary cascade timer	real	no-con/no-set	0.0	seconds
INITI	initialize in	short	con/set	0	0 to 1
BCALCI	back calculate in	real	con/set	0.0	RO1
LR	local/remote	boolean	con/set	0	0 to 1
INITLR	initialize LR	short	no-con/no-set	2	[0|1|2]
LOCSP	local setpoint	boolean	no-con/no-set	0	0 to 1
LOCSW	local switch	boolean	con/set	0	0 to 1
REMSW	remote switch	boolean	con/set	0	0 to 1
REMRAT	remote ratio	real	con/set	0.0	RI2
RTRKOP	ratio track option	short	no-con/no-set	0	[0|1|2]
MANALM	manual alarm option	short	no-con/no-set	1	0 to 4
INHOPT	inhibit option	short	no-con/no-set	0	0 to 3
INHIB	alarm inhibit	boolean	con/set	0	0 to 1
INHALM	inhibit alarm	pack_b	con/set	0	0 to 0xFFFF
MEASNM	meas alarm name	string	no-con/no-set	blank	1 to 12 chars
MALOPT	meas alarm option	short	no-con/no-set	0	0 to 3
MEASHL	meas high alarm limit	real	con/set	100.0	RI1
MEASHT	meas high alarm text	string	no-con/no-set	blank	1 to 32 chars
MEASLL	meas low alarm limit	real	con/set	0.0	RI1
MEASLT	meas low alarm text	string	no-con/no-set	blank	1 to 32 chars
MEASDB	meas alarm deadband	real	no-con/set	0.0	RI1
MEASPR	meas alarm priority	integer	con/set	5	[1..5]
MEASGR	meas alarm group	short	no-con/set	1	[1..8]

Table 108-1. RATIO Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
HHAOPT	high-high option	short	no-con/no-set	0	0 to 3
HHALIM	high-high limit	real	con/set	100.0	RI1
HHATXT	high-high alarm text	string	no-con/no-set	blank	1 to 32 chars
LLALIM	low-low alarm limit	real	con/set	0.0	RI1
LLATXT	low-low absolute text	string	no-con/no-set	blank	1 to 32 chars
HHAPRI	high-high priority	integer	con/set	5	[1..5]
HHAGRP	high-high group	short	no-con/set	1	[1..8]
OUTNM	output alarm name	string	no-con/no-set	blank	1 to 12 chars
BAO	bad alarm option	boolean	no-con/no-set	0	0 to 1
BAT	bad alarm text	string	no-con/no-set	blank	1 to 32 chars
BAP	bad alarm priority	integer	con/set	5	1 to 5
BAG	bad alarm group	short	no-con/set	1	1 to 8
FLBOPT	fallback option	short	no-con/no-set	0	0 to 4
FLBREQ	fallback request	short	con/set	0	0 to 2
INITSE	initial SE	short	no-con/no-set	0	0 to 1
SE	supervisory enable	boolean	no-con/set	0	0 to 1
SUPGRP	supervisory group	short	no-con/no-set	1	1 to 8
SUPOPT	super option	short	no-con/no-set	0	0 to 4
SUP_IN	supervisory ratio input	real	con/no-set	0.0	RI1
AMRTIN	alarm regeneration timer	integer	no-con/no-set	0	0 to 32767 s
NASTDB	alarm deadband timer	long integer	no-con/no-set	0	0-2147483647 ms
NASOPT	nuisance alarm suppression option	short	no-con/no-set	0	0 to 2
OUTPUTS					
ALMSTA	alarm status	pack_l	con/no-set	0	bit map
BCALCO	back calculated out	real	con/no-set	0.0	RI1
BLKSTA	block status	pack_l	con/no-set	0	bit map
CRIT	criticality	integer	con/no-set	0	[0..5]
HHAIND	high-high absolute indicator	boolean	con/no-set	0	0 to 1
HOLIND	high out limit indicator	boolean	con/no-set	0	0 to 1
INHSTA	inhibit status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
INITO	initialize out	short	con/no-set	0	0 to 1
LLAIND	low-low alarm indicator	boolean	con/no-set	0	0 to 1
LOLIND	low out limit indicator	boolean	con/no-set	0	0 to 1
MEASHI	meas high alarm indicator	boolean	con/no-set	0	0 to 1
MEASLI	meas low alarm indicator	boolean	con/no-set	0	0 to 1
OUT	output	real	con/no-set	0.0	RO1
PRTYPE	priority type	integer	con/no-set	0	[0..10]
QALSTA	quality status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
SUPBCO	supervisory back calculated value	real	con/no-set	0	RI1
UNACK	alarm notification	boolean	con/no-set	0	0 to 1
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
ALMOPT	alarm options	pack_l	no-con/no-set	0	0 to 0xFFFFFFFF
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1

Table 108-1. RATIO Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
ERCODE	config error	string	no-con/no-set	0	0 to 43 chars
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars
PERTIM	period time	real	no-con/no-set	0.1	---
PRSCAS	cascade state	short	no-con/no-set	0	0 to 7
PRSCON	present control	short	no-con/no-set	0	0 to 3
RI1 to RI2	eng range input	real[3]	no-con/no-set	100,0,1	specifiable
RO1	eng range output	real[3]	no-con/no-set	100,0,1	specifiable

108.3.1 Parameter Definitions

ACHNGE Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

ALMOPT Alarm Options contains packed long values representing the alarm types that have been configured as options in the block, and the alarm groups that are in use. For the RATIO block, only the following unshaded bits are used

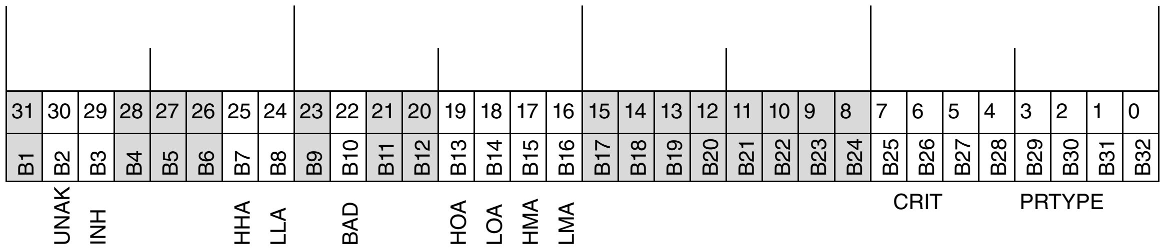
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1] (0 to 31)	Configured Alarm Option When True
0	Alarm Group 8 in Use
1	Alarm Group 7 in Use
7	Alarm Group 1 in Use
16	Low Absolute Alarm Configured
17	High Absolute Alarm Configured
22	Bad I/O Alarm Configured
24	Low-Low Absolute Alarm Configured
25	High-High Absolute Alarm Configured

1. Bit 0 is the least significant, low order bit.

ALMSTA

Alarm Status is a 32-bit output, bit-mapped to indicate the block's alarm states. For the RATIO block, only the following bits are used:



Bit Number (0 to 31)*	Name	Description When True	Boolean Connection (B32 to B1)
0 to 4	PTYP_MSK	Priority Type: See parameter PRTYPE for values used in the RATIO block	ALMSTA.B32–ALMSTA.B28
5 to 7	CRIT_MSK	Criticality; 5 = lowest priority, 1= highest	ALMSTA.B27–ALMSTA.B25
16	LMA	Low Measurement Alarm	ALMSTA.B16
17	HMA	High Absolute Alarm	ALMSTA.B15
18	LOA	Low Output Alarm	ALMSTA.B14
19	HOA	High Output Alarm	ALMSTA.B13
22	BAD	Input/Output Bad (BAD output of block)	ALMSTA.B10
24	LLA	Low-Low Absolute Alarm	ALMSTA.B8
25	HHA	High-High Absolute Alarm	ALMSTA.B7
29	INH	Alarm inhibit	ALMSTA.B3
30	UNAK	Unacknowledged	ALMSTA.B2

* Bit 0 is the least significant, low order bit.

AMRTIN

Alarm Regeneration Timer is a configurable integer that specifies the time interval for an alarm condition to exist continuously, after which a new unacknowledged alarm condition and its associated alarm message is generated.

AUTSW

Auto Switch is a boolean input that, when true, overrides the MA and INITMA parameters, and drives the block to the Auto state. If both MANSW and AUTSW are true, MANSW has priority.

BAG

Bad Alarm Group is a short integer input that directs Bad alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.

BAO
Bad Alarm Option is a configurable option that enables alarm generation for each state change of the BAD parameter. The parameter values are:

0= No generation of Bad alarms.

1= Bad alarm generation if the FBM or FBC has Bad status.

2= Bad alarm generation in the measurement (MEAS or OUTPUT parameter) of a PID block family, RATIO block, or BIAS block when the MEAS or OUT parameter is connected to the RATIO block.

BAP
Bad Alarm Priority is an integer input, ranging from 1 to 5, that sets the priority level of the Bad alarm (1 is the highest priority).

BAT
Bad Alarm Text is a user-configurable text string of up to 32 characters, sent with the bad alarm message to identify it.

BCALCI
Back Calculation In is a real input that provides the initial value of the output before the block enters the controlling state, so that the return to controlling is bumpless. It is also the source of the output value when its integration bit, which puts the block into output tracking, is non-zero. The source for this input is the back calculation output (BCALCO) of the downstream block. With V4.2 and later software, BCALCI contains the cascade initialization data bits which were formerly contained in the INITI parameter. Therefore, BCALCI defines the source block and parameter that drives this block into initialization, and INITI and INITO are not required for cascade initialization.

BLKSTA includes bits which can indicate when the downstream output is limited in either direction. BLKSTA.B11 monitors the Limited High condition (BCALCI.LHI) and BLKSTA.B10 monitors the Limited Low condition (BCALCI.LLO).

BCALCO
Back Calculation Output is a real output that is determined by back calculation of the block algorithm based on the BCALCI input from the downstream block. With V4.2 and later software, the status bits of BCALCO contain the cascade initialization requests formerly contained in the INITO parameter. You connect the BCALCO parameter to the BCALCI input of an upstream block so that this upstream block can sense when the RATIO block is open. Therefore, with V4.2 and later software, INITO is not required for cascade initialization.

BLKSTA Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the RATIO block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
FLB	SC	SE	HOL	LOL	MAO	LRO	FS		LLO	LHI	WLCK					ON	UDEF	PORSCHE	BAD	MA	LR	STRK		HLD	TRK	CTL					

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
5	CTL	Controlling	BLKSTA.B27
6	TRK	Tracking	BLKSTA.B26
7	HLD	Holding	BLKSTA.B25
9	STRK	Setpoint Tracking	BLKSTA.B23
10	LR	Local(= false)/Remote(= true)	BLKSTA.B22
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
12	BAD	Block in BAD state	BLKSTA.B20
13	PORS CHE	Block contains I/A Series v8.5 controller enhancements (parameters BAO, BAG, BAP, BAT and OUTNM)	BLKSTA.B19
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
20	WLCK	Workstation Lock	BLKSTA.B12
21	LHI	Downstream Limited High	BLKSTA.B11
22	LLO	Downstream Limited Low	BLKSTA.B10
24	FS	Failsafe	BLKSTA.B8
25	LRO	Local/Remote Override	BLKSTA.B7
26	MAO	Manual/Auto Override	BLKSTA.B6
27	LOL	Low Output Limit (Clamped)	BLKSTA.B5
28	HOL	High Output Limit (Clamped)	BLKSTA.B4
29	SE	Supervisory Enabled	BLKSTA.B3
30	SC	Supervisory Control	BLKSTA.B2
31	FLB	Supervisory Control Fallback State	BLKSTA.B1

* Bit 0 is the least significant, low order bit.

BSCALE

Bias Scale is an additive term used with thermocouple and RTD SCIs. BSCALE provides positive or negative offset to the span of temperatures that result when KSCALE is multiplied by the span of Celsius temperatures.

You can configure BSCALE as a sink connection or a constant (in which case BSCALE is runtime settable). This allows you to dynamically bias the output with a CALC block or an application program.

CEOPT

Control Error Option is a short integer that specifies how the block responds to the MEAS and BCALCI inputs when either of those inputs is in error. To provide backward compatibility, CEOPT defaults to 1. CEOPT has a range of 0 to 2 where:

0 = The block takes no implicit Hold action when it detects a control error.

1 = The block goes to the Hold state if, while MBADOP = 0, either MEAS or BCALCI: (a) has its BAD status bit set true; (b) has its Out-of-Service status bit set true; (c) is experiencing peer-to-peer path failure.

2 = The block goes to the Hold state if, while MBADOP = 0, either MEAS or BCALCI meets any of the conditions described for CEOPT = 1, or if MEAS has its ERROR status bit set true.

CEOPT is independent of the propagate error option, PROPT, and does not affect the external logical input, HOLD. The HOLD input, when true, still drives the block into the Hold state whenever the block is in Auto (and MBADOP = 0).

CRIT

Criticality is an integer output that indicates the priority, ranging from 1 to 5, of the block’s highest currently active alarm (1 is the highest priority). An output of zero indicates the absence of alarms.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block.

DELTI1 to DELTI2

Change Delta for Input Range 1 or 2 is a real value that defines the minimum percent of the input range that triggers change driven connections for parameters in the range of RI1 or RI2. The default value is 1.

Entering a 1 causes the Object Manager to recognize and respond to a change of 1 percent of the full error range. If communication is within the same CP that contains the block’s compound, change deltas have no effect.

Refer to "Peer-to-Peer Connections of Real-Type Block Inputs" on page 1703 for details on how the I/A Series software affects the change delta percentage during operation.

DELTO1 Change Deltas for Output Range 1 is presently unused.

DESCRP Description is a user-defined string of up to 32 characters that describe the block's function (for example., "PLT 3 FURNACE 2 HEATER CONTROL").

EI1 to EI2 Engineering Units for Input Ranges 1 and 2, as defined by the parameters HSCI1 to HSCI2, LSCI1 to LSCI2, and DELTI1 to DELTI2, provide the engineering units text for the values defined by Input Ranges 1 and 2. "Deg F" or "pH" are typical entries.

EO1 Engineering Units for Output Range 1, as defined by the parameters HSCO1, LSCO1, and DELTO1, provides the engineering units text for the values defined by Output Range 1. "Deg F" or "pH" are typical entries. Make the units for the Output Range (EO1) consistent with the units of Input Range 1 (EI1) and Input Range 2 (EI2).

ERCODE Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block's DEFINE parameter to be set false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the RATIO block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
"W43 – INVALID PERIOD/ PHASE COMBINATION"	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
"W44 – INVALID ENGINEERING RANGE"	High range value is less than or equal to low range value.
"W46 – INVALID INPUT CONNECTION"	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
"W48 – INVALID BLOCK OPTION"	The configured value of a block option is illegal.
"W53 – INVALID PARAMETER VALUE"	A parameter value is not in the acceptable range.

Message	Value
"W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK"	A Database Installer error has occurred.

FLBOPT

Fallback Option is a short integer input that defines the control action taken by the block when a Supervisory Set Point Control fallback occurs:

0 = Take no fallback action (default)
1 = Set MA parameter to Auto
2 = Set MA parameter to Manual
3 = Set LR parameter to Remote
4 = Set LR parameter to Local.

FLBOPT overrides linked MA and LR parameters, but does *not* override the AUTSW, MANSW, REMSW, and LOCSW parameters.

FLBREQ

Fallback Request is a short integer input that is an explicit request for the block to go to the Fallback state, with recovery at the block level (when SE is set), and/or at the group level (when the appropriate group enable bit is set in SUPENA).

0 = No fallback requested
1 = Fallback requested; recovery at block or group level
2 = Fallback requested; recovery *only* at block level.

HHAGRP

High-High Absolute Alarm Group is a short integer input that directs High-High Absolute alarm messages to one of eight groups of alarm devices.

HHAIND

High-High Alarm Indicator is a boolean output set true when the measurement (MEAS) value rises above the high-high absolute alarm limit (HHALIM). Once HHAIND is set true, it does not return to false until MEAS falls below HHALIM less the deadband (MEASDB).

HHALIM

High-High Absolute Alarm Limit is a real input that defines the value of the block-dependent parameter (generally the measurement input) that triggers a High High alarm.

HHAOPT

High-High Alarm Option is a configured short integer input that enables High-High and Low-Low absolute alarming for alarming of a block-dependent value, generally the measurement input, or disables absolute alarming altogether. Each alarm triggers an indicator and text message.

0 = No alarming
1 = High-High and Low-Low alarming
2 = High-High alarming only
3 = Low-Low alarming only.

HHAPRI

High-High Absolute Priority is an integer input, from 1 to 5, that sets the priority level of the high-high absolute alarm (1 is the highest priority)

HHATXT	High-High Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the high-high absolute alarm message to identify it.
HOLD	Hold is a boolean input. When true, HOLD forces the block into the Hold substate of Auto, holding the output at its last computed value.
HOLIM	High Output Limit is a real input that establishes the maximum output value, in OUT units. If the algorithm tries to drive the output to a higher value, the output is clamped at the HOLIM value and the indicator HOLIND is set true.
HOLIND	High Output Limit Indicator is a boolean output that is set true whenever the output is clamped at the high output limit, HOLIM.
HSCI1 to HSCI2	High Scale for Input Ranges 1 and 2 are real values that define the upper limit of the measurement ranges. EI1 to EI2 define the units. Make the range and units consistent with the measurement source. A typical value is 100 (percent).
HSCO1	High Scale for Output Range 1 is a real value that defines the upper limit of the ranges for Output 1. A typical value is 100 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.
INHALM	Inhibit Alarm contains packed boolean values that represent alarm inhibit requests for each alarm type or point configured in the block. For the RATIO block, only the following bits are used:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16

Bit Number* (0 to 15)	Description When True	Boolean Connection (B16 to B1)
0	Inhibit Low Absolute Alarm	INHALM.B16
1	Inhibit High Absolute Alarm	INHALM.B15
8	Inhibit Low-Low Absolute Alarm	INHALM.B8
9	Inhibit High-High Absolute Alarm	INHALM.B7

* Bit 0 is the least significant, low order bit.

INHIB	Inhibit is a boolean input. When true, it inhibits all block alarms; the alarm handling and detection functions are determined by the INHOPT setting. Alarms can also be inhibited based on INHALM and the compound parameter CINHIB.

INHOPT

Inhibit Option specifies the following actions applying to all block alarms:

0 = When an alarm is inhibited, disable alarm messages but do not disable alarm detection.

1 = When an alarm is inhibited, disable both alarm messages and alarm detection. If an alarm condition already exists at the time the alarm transitions into the inhibited state, clear the alarm indicator.

2 = Same as 0 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

3 = Same as 1 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

INHSTA

Inhibit Status contains packed long values that represent the actual inhibit status of each alarm type configured in the block. For the RATIO block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
	UNACK	INH				HHA	LLA		BAD			HOA	LOA	HMA	LMA																

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
16	LMA	Low Absolute Alarm Inhibited	INHSTA.B16
17	HMA	High Absolute Alarm Inhibited	INHSTA.B15
18	LOA	Low Output Alarm	INHSTA.B14
19	HOA	High Output Alarm	INHSTA.B13
22	BAD	Bad I/O Alarm Inhibited	INHSTA.B10
24	LLA	Low-Low Absolute Alarm Inhibited	INHSTA.B8
25	HHA	High-High Absolute Alarm Inhibited	INHSTA.B7
29	INH	Inhibit Alarm	INHSTA.B3
30	UNACK	Unacknowledged	INHSTA.B2

* Bit 0 is the least significant, low order bit.

INITI

Initialization In defines the source block and parameter that drives this block into initialization. The source for this short integer input is the initialization output of a downstream block. With V4.2 or later software, BCALCI contains the cascade initialization request data bit eliminating the need to configure INITI connections in cascades. However, to preserve backward compatibility, the INITI parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITI short value is maintained, but the setting of the handshaking bits, via the INITI to INITO connection, is eliminated.

INITLR

Initialize Local/Remote is an integer input that specifies the desired state of the LR input during initialization, where:

0 = Local
1 = Remote
2 = The LR state as specified in the checkpoint file.

The block asserts this initial LR state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a restart operation.
- The compound in which it resides is turned on.

The Initialize LR state is ignored if the LR input has an established linkage.

INITMA

Initialize Manual/Auto specifies the desired state of the MA input during initialization, where:

0 = Manual
1 = Auto
2 = The MA state as specified in the checkpoint file.

The block asserts this initial M/A state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a reboot operation.
- The compound in which it resides is turned on.
- The INITMA parameter itself is modified via the control configurator. (The block does not assert INITMA on ordinary reconfiguration.)

INITMA is ignored if MA has an established linkage.

INITO

Initialization Output is set true when:

- The block is in Manual or initializing.
- Permanent or temporary loss of FBM communications occurs.
- The ladder logic in the FBM is not running.
- MMAIND (mismatch indicator) is true.
- DISABL is true.
- RSP (the remote setpoint) is not the setpoint source.

	The block clears INITO when none of these conditions exist. You connect this parameter to the INITI input of upstream blocks so that these upstream blocks can sense when this block is open loop. This block keeps INITO True, for one cycle (PRIBLK = 0), until the acknowledge is received from upstream (PRIBLK = 1 and PRITIM = 0.0), or for a fixed time delay (PRIBLK = 1 and PRITIM = nonzero). With V4.2 or later software, BCALCO contains the initialization output eliminating the need to configure INITO connections in cascades. However, to preserve backward compatibility, the INITO parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITO short value has been maintained, but the setting of the handshaking bits, via the INITI to INITO connection, is eliminated.
INITSE	Initial Supervisory Enable (INITSE) specifies the initial state of the SE parameter in a block configured for Supervisory Control (that is: SUPOPT = 1 or 3) when the block initializes due to reboot, installing the block, or turning on the compound. 0 = Disable 1 = Enable 2 = Do not change SE parameter.
KSCALE	KSCALE is a conversion factor used to make the time units of the rate parameters, which are in EI1 units per minute, dimensionally compatible with the time units of the output, as defined by EO1.
LLAIND	Low-Low Alarm Indicator is a boolean output that is set true when the measurement (MEAS) value falls below the low-low absolute alarm limit (LLALIM). Once LLAIND is set true, it does not return to false until MEAS rises above LLALIM plus the deadband (MEASDB).
LLALIM	Low-Low Absolute Alarm Limit is a real input that defines the value of the block-dependent parameter (generally the measurement input) that triggers a Low-Low Alarm.
LLATXT	Low-Low Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the low-low absolute alarm message to identify it.
LOCKID	Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.
LOCKRQ	Lock Request is a boolean input which can be set true or false only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's

	parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.
LOCSP	Local Setpoint Secure is a boolean input. When true, LOCSP provides lockout of user write access to the LR parameter. If LOCSP is configured true, the block secures LR when it initializes and maintains LR in the secured state. The LOCSW and REMSW overrides have higher precedence, but LR remains secured when they are no longer asserted.
LOCSW	Local Switch is a boolean input. When true, LOCSW overrides the LR and INITLR parameters and drives the block to the Local state. If both LOCSW and REMSW are true, LOCSW has priority.
LOLIM	Low Output Limit is a real input that establishes the minimum output value. If the algorithm tries to drive the output to a lower value, the output is clamped at the LOLIM value and the indicator LOLIND is set true.
LOLIND	Low Output Limit Indicator is a boolean output that is set true whenever the output is clamped at the low output limit, LOLIM.
LOOPID	Loop Identifier is a configurable string of up to 32 characters which identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.
LR	Local/Remote is a boolean input that selects the setpoint source (0 = false = Local; 1 = true = Remote). If LR is set to Remote, the source of the setpoint value is the real input parameter RSP. When LR is set to Local, there are two possible sources for the setpoint: (a) MEAS or (b) a user settable input. The choice is based on the conditions of STRKOP and MA, as described under STRKOP.
LSCI1 to LSCI2	Low Scale for Input Range 1 and 2 are real value that define the lower limit of the measurement ranges. A typical value is 0 (percent). EI1 and EI2 define the units. Make the range and units consistent with those of the measurement source.
LSCO1	Low Scale for Output Range 1 is a real value that defines the lower limit of the ranges for Output 1. A typical value is 0 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.
MA	Manual Auto is a boolean input that controls the Manual/Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. The block automatically limits the output to the output range specified between LSCO1 and HSCO1. In Manual, the algorithm

is not performed, and the output is unsecured. An external program can then set the output to a desired value.

MALOPT

Measurement Alarm Option is a configured short integer input that enables absolute High and Low measurement alarming, or disables absolute alarming altogether.

0 = No alarming
1 = High and Low measurement alarming
2 = High measurement alarming only
3 = Low measurement alarming only.

You can change MALOPT only by reconfiguring the block.

MANALM

Manual Alarm Option is a configurable input which enables and disables configured alarm options to function in Manual or Track mode. Normally alarms are processed only in the Auto mode.

0 = No alarming in Manual

1 = Full alarming in Manual

2 = No output alarming in Manual

3 = No output alarming in Track

4 = No output alarming in Manual or Track

MANFS

Manual if Failsafe is a boolean input. When configured true, MANFS drives the block to the Manual state if the block detects an incoming failsafe status.

MANSW

Manual Switch is a boolean input. When true, MANSW overrides the MA and INITMA parameters and drives the block to the Manual state. If both MANSW and AUTSW are true, MANSW has priority.

MBADOP

Manual if Bad Option is a manual override feature. When MBADOP is set to 1 or 2, the block sets the unlinked MA input to manual if it detects a BAD status bit in the MEAS or BCALCI input, and when set to 2, it detects that the Remote Ratio input (REMRAT) is not healthy (i.e., value status is BAD or has a broken OM connection). This forces the output state to manual as long as the BAD status remains. After the BAD status clears, returning to Auto requires external intervention unless AUTSW is true.

0 = no option enabled

1 = Switch to Manual when MEAS or BCALCI value status is BAD

2 = Same as option 1, plus switch to Manual when REMRAT is not healthy

You can change MBADOP only by reconfiguring the block. MBADOP has the same priority as the MANSW override, and it has precedence over the AUTSW override. MBADOP has no effect when MA is linked. If any of the MBADOP conditions are true, the block will be switched to Manual regardless of the MANSW and AUTSW settings.

MCLOPT	Manual Clamping Option allows you to invoke output clamping while the block is in manual. You can alter this configurable boolean input at the workstation.
MEAS	Measurement is an input identifying the source of the block's input, or the controlled variable.
MEASDB	Measurement Alarm Deadband is a configured input, expressed in MEAS units, that is used for the measurement high, high-high, low, and low-low absolute alarming functions. You can adjust this parameter at the workstation.
MEASGR	Measurement Group is a short integer input that directs measurement alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.
MEASHI	Measurement High Alarm Indicator is a boolean output that is set true when the measurement (MEAS) value rises above the high alarm limit (MEASHL). Once MEASHI is set true, it does not return to false until MEAS falls below MEASHI less the deadband (MEASDB).
MEASHL	Measurement High Alarm Limit is a real input that defines the value of the measurement that initiates a high absolute alarm.
MEASHT	Measurement High Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can only change the message text by reconfiguring the block.
MEASLI	Measurement Low Alarm Indicator is a boolean output that is set true when the measurement (MEAS) value falls below the low alarm limit (MEASLL). Once MEASLI is set true, it does not return to false until MEAS rises above MEASLL plus the deadband (MEASDB).
MEASLL	Measurement Low Alarm Limit is a real input that defines the value of the measurement that initiates a low absolute alarm.
MEASLT	Measurement Low Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm. You can only change the message text by reconfiguring the block.
MEASNM	Measurement Alarm Name is a user-defined text string of up to 12 characters that identify the alarm source in the alarm message. It serves as a point descriptor label (for example, Furn 37 Temp).
MEASPR	Measurement Priority is an integer input (1 to 5), that sets the priority level of the measurement alarm (1 is the highest priority).
NAME	Name is a user-defined string of up to 12 characters used to access the block and its parameters.

NASOPT

Nuisance Alarm Suppression Option is a configurable, non-settable short integer that specifies how the nuisance alarm delay is implemented:

- 0 = Suppress nuisance alarms by delaying the Return-to-Normal (default) by the length of time specified in NASTDB
- 1 = Suppress nuisance alarms by delaying alarm detection by the length of time specified in NASTDB
- 2 = Suppress nuisance alarms by delaying both the Alarm Detection and the Return-to-Normal by the length of time specified in NASTDB

NASTDB

Alarm Deadband Timer is a configurable long integer. Depending on the value of NASOPT, it either specifies the deadband time interval that must elapse before an alarm condition is allowed to return to normal, or the length of a delay-on timer which specifies the amount of time between an alarm's detection and the announcement of the alarm. The parameter value ranges from zero (default, no delay) to 2147483647 ms.

OSV

Output Span Variance is a real input that defines the amount by which the output clamp limits (HOLIM, LOLIM) can exceed the specified output range, as defined by HSCO1 and LSCO1.

OUT

Output, in Auto mode, is the result of the block algorithm applied to one or more input variables. In Manual, OUT is unsecured, and can be set by you or by an external task.

OUTNM

The Output Alarm Name is a user-defined string of up to 32 characters that identifies the alarm source in the alarm message. It serves as a point descriptor label (for example, F2 Fuel Ctrl).

OWNER

Owner is a string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are successful only if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.

PERIOD

Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PERTIM

Period Time is the period of the block expressed in seconds.

PHASE

Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PRIBLK

Primary Block is a configuration option. When true (=1), PRIBLK enables a block in a cascaded configuration to initialize without bumping the process, either at initial startup or whenever control is transferred up to a primary block. Depending on the value of PRITIM, PRIBLK does this by forcing the RATIO block to remain in the Hold state until the Acknowledge status bit (Bit 10) of MEAS is detected from the upstream block (PRITIM = 0.0), or until the time defined by PRITIM expires (PRITIM > 0.0). In the latter case, the explicit acknowledge from the upstream block is not needed.

Use PRIBLK in a cascade situation when the source of the block's input connection needs to be initialized.

For correct operation, set EROPT = 1 or 2, and implement the connections between each primary-secondary block combination. These connections include BCALCI/BCALCO, and OUT/RSP (or OUT/MEAS).

Except for the most primary controller block, it is recommended that PRIBLK be set true for all applicable blocks in a cascaded scheme. When PRIBLK is false (default value), no special handling takes place.

Refer to “PRIBLK and PRITIM Functionality” on page 2133 for more information on this parameter.

PRITIM

Primary Cascade Timer is a configurable parameter used to delay the closing of the cascade to a primary block, when the output is initialized in the RATIO block. It is used only if the PRIBLK option is set. The cascade is closed automatically when the timer expires without requiring an explicit acknowledge by the upstream block logic.

Refer to “PRIBLK and PRITIM Functionality” on page 2133 for more information on this parameter.

PROPT

Propagate Error Option is a short integer input. PROPT was changed from a Boolean to a Short Integer in I/A Series software v8.5 for this block. It can be set to 0-2, with the following exception:

NOTE

If PROPT is configured from IACC v2.4 or later, it can only be set to 0 or 1.

- 0 = option is disabled (default)
- 1 = set the ERROR Status bit of the output parameter (OUT) if the input to the MEAS parameter is in error (see below) while the block is in Auto

- 2 = copy (propagate) the BAD, OOS (Out-of-Service), and ERROR status bits from the MEAS parameter to the output parameter (OUT). This value cannot be set from IACC v2.4 or later.

The input to the MEAS parameter is in error when:

- Its BAD status bit is set true
- Its OOS (Out-of-Service) status bit is set true
- Its ERROR status bit is set true
- It is experiencing peer-to-peer path failure.

If a transition to Manual occurs while the ERROR status is true, it remains true until either a set command is written to that output or until the block transfers to Auto with the error condition returned to normal.

PRSCAS

Present Cascade State is a data store that indicates the cascade state. It has the following possible values:

Value	State	Description
1	"INIT_U"	Unconditional initialization of the primary cascade is in progress.
2	"PRI_OPN"	The primary cascade is open.
3	"INIT_C"	Conditional initialization of the primary cascade is in progress.
4	"PRI_CLS"	The primary cascade is closed.
5	"SUP_INIT"	The supervisory cascade is initializing.
6	"SUP_OPN"	The supervisory cascade is open.
7	"SUP_CLS"	The supervisory cascade is closed.

PRSCON

Present Control state is a short integer data store that contains the substates of Auto:

1 = Holding
2 = Tracking
3 = Controlling (not open loop).

PRTYPE

Priority Type is an indexed (0 to 9) output parameter that indicates the alarm type of the highest priority active alarm. The PRTYPE outputs of this block include the following alarm types:

0 = No active alarm
1 = High Absolute
2 = Low Absolute
3 = High High
4 = Low Low
5 = High Deviation
6 = Low Deviation
8 = BAD Alarm

QALSTA

Quality Status parameter (QALSTA) is a non-configurable packed long that provides a combination of value record status, block status (BLKSTA), and alarm status (ALMSTA) information in a single connectable output parameter. Available bits for this block are provided below.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1]	Definition	Contents	Boolean Connection (B32 to B1)
30	Alarms Unacknowledged	ALMSTA.UNA	QALSTA.B2
29	Alarms Inhibited	ALMSTA.INH	QALSTA.B3
25	High-High Absolute Alarm	ALMSTA.HHA	QALSTA.B7
24	Low-Low Absolute Alarm	ALMSTA.LLA	QALSTA.B8
21	High Deviation Alarm	ALMSTA.HDA	QALSTA.B11
20	Low Deviation Alarm	ALMSTA.LDA	QALSTA.B12
17	High Absolute Alarm	ALMSTA.HMA	QALSTA.B15
16	Low Absolute Alarm	ALMSTA.LMA	QALSTA.B16
5	Manual	BLKSTA.MA	QALSTA.B27
4	Low Limited	MEAS.LLO status	QALSTA.B28
3	High Limited	MEAS.LHI status	QALSTA.B29
2	Uncertain	MEAS.ERR status	QALSTA.B30
1	Out-of-Service	MEAS.OOS status	QALSTA.B31
0	Bad	MEAS.BAD status	QALSTA.B32

1. Bit 0 is the least significant, low order bit.

RATIO

RATIO Setpoint is the multiplier that the block applies to the measurement to produce the output. This parameter is implemented as an output whose source is determined by the Local/Remote setpoint selector input, LR. When the block is in Auto and LR is switched to local, RATIO becomes settable allowing you to input the desired ratio setpoint value.

REMRAT

Remote Ratio input is the selected ratio setpoint source when LR is set to Remote. This real value is usually connected to an upstream block in a cascade scheme.

REMSW

Remote Switch is a boolean input. When true, REMSW overrides the unlinked LR and INITLR parameters, and drives the block to the Remote state. If both LOCSW and REMSW are true, LOCSW has priority.

RI1 to RI2	Range Input 1 and 2 are arrays of real values that specify the high and low engineering scale and change delta of a particular real input. For a given block, it also forms an association with a group of real input parameters that have the same designated range and change delta.
RO1	Range Output is an array of real values that specify the high and low engineering scale of a particular real output. For a given block, it also forms an association with a group of real output parameters that have the same designated range.
RTRKOP	Remote Track Option is a short integer input. When active, RTRKOP enables the setpoint to track the back calculation output (BCALCO) under the following conditions. 0 = no option enabled 1 = RATIO setpoint tracks BCALCO when the block is in Manual, or the cascade is open downstream (Initialization input BCALCI is true). 2 = SPT parameter tracks BCALCO only when the block is in Manual. RTRKOP is active only when the setpoint source selector LR is in Local and Supervisory Enable (SE) is enabled (1). The RATIO setpoint is nonsettable while ratio tracking is active. You can change RTRKOP only by reconfiguring the block.
SE	Supervisory Enable (SE) enables/disables Supervisory Control in a block. 0 = Disable 1 = Enable.
SUPBCO	Supervisory Back-Calculated Output (SUPBCO) is the value to be used by the Supervisory Application to initialize its output to the current ratio of the block. This parameter also contains the following status bits: Bit 10: 1 = Initialize SUP_IN Bit 13: 1 = SUP_IN is Limited High Bit 14: 1 = SUP_IN is Limited Low (Both B13 and B14 =1: indicates Supervisory cascade is open).
SUPGRP	Supervisory Group (SUPGRP) specifies the group to which the block is assigned for Supervisory Control. Range: 1 through 8 (default = 1)
SUPOPT	Supervisory Option is a configurable short integer input that specifies whether or not this block is under control of a Supervisory Control application: 0 = No Supervisory control 1 = Set Point Control (SPC) of the block's set point (Supervisory setpoint control (SSC)) 2 = Direct Digital Control (DDC) of the block output (Supervisory output control)

NOTE

Setting SUPOPT=2 enables DDC control only, i.e. supervisory control over the output in the RATIO block. It is not intended to be used with Advanced Process Control (APC), which performs SSC, i.e., supervisory control of the setpoint in the RATIO. To use APC, configure SUPOPT=1 (or 3 if automatic acknowledgement of a setpoint change is desired).

3 = SPC, with an implicit acknowledge by the CP

4 = DDC, with an implicit acknowledge by the CP

Be aware that options 1 and 2 require an explicit acknowledge by the application software to close the supervisory cascade. This must be done by setting the ACK status bit in the SUP_IN parameter using special OM access functions.

SUP_IN	Supervisory Input (SUP_IN) is a real input parameter set by a Supervisory application when performing supervisory control of this block's set point. SUP_IN also contains a status bit (Bit 10) that must be set by the supervisor to acknowledge a request to initialize (Bit 10 in SUPBCO).
TYPE	When you enter "RATIO" or select "RATIO" from the block type list under Show, an identifying integer is created specifying this block type.
UNACK	Unacknowledge is a boolean output that the block sets to True when it detects an alarm. It is typically reset by operator action.

108.4 Detailed Operation

When the block is in Auto, it produces an output that is a scaled multiplication of the measurement input with the local ratio setpoint. The equation for this computation is:

OUT = (MEAS * RATIO * KSCALE) + BSCALE

You calculate the constants BSCALE and KSCALE so as to make the computed result dimensionally compatible with the specified output engineering units. KSCALE and BSCALE are inputs that can be connected to other blocks' outputs.

The MEAS parameter is an input identifying the source of the input that is coming to this block to be multiplied by the ratio setpoint value.

The RATIO parameter always represents the active ratio setpoint. Since RATIO is an output, you can use it as a source for the ratio value to other blocks.

The ratio sources are prioritized as follows:

1. Supervisory Control
2. Local (LOCSW) and Remote Switch (REMSW)
3. Local or Remote.

When the Supervisory Option (SUPOPT) is set to 1-4, it specifies that the block can be under control of a Supervisory Application Program. The Supervisory Back Calculated Output (SUPBCO) provides the current ratio and initialization bits to the Supervisory Application Program. When Supervisory Enable (SE) is set by the application program or operator, the RATIO block is prepared to do Supervisory Setpoint Control (SSC) functions. When the proper handshaking occurs with the application software, the block accepts sets to the Supervisory Ratio (SUP_IN). If the block is in Auto, it then uses the supervisory ratio in the calculation of the block's output.

If SUPOPT is set to 1 or 2, the handshake requires the application software to return an explicit acknowledge to close the supervisory cascade. The software must set the ACK status bit in the SUP_IN parameter using special OM access functions. However, if SUPOPT is set to 3 or 4, this acknowledgement is implicitly provided by the CP and is not required from the user application software. In the latter case, the CP closes the supervisory cascade automatically when the supervisory input (SUP_IN) is written by the application, provided the block is in the Supervisory Initialization (SUP_INIT) state. The control block enters the SUP_INIT state when supervisory control is enabled in the block and the cascade is closed downstream. Upon entering this state, the CP sets the initialize request bit (INITC) in the SUPBCO parameter for the application software. When SUP_IN is then written by the software, the CP access logic sets the ACK status automatically in the SUP_IN parameter. When the block runs, the CP block logic then closes the supervisory cascade automatically.

The ratio source selector input, LR (Local/Remote), together with the two overrides, LOCSW and REMSW, determines the ratio source at any time.

When LR is switched to Local (false), the block releases the RATIO parameter, allowing any user to input the desired controller ratio value.

When LR is switched to Remote, RATIO is no longer settable and takes on the value of the remote ratio input, REMRAT. REMRAT is a parameter that provides a link to the remote ratio source. If REMRAT is unlinked when LR is true, the block forces the LR parameter to Local and secures it.

The RATIO block also provides the LOCSW and REMSW parameters to drive the ratio state to Local or Remote.

LOCSP allows the block to secure the LR parameter when the block initializes and to maintain that secured state except when LOCSW and/or REMSW is asserted.

When the block is in the Remote mode, the status of the local ratio (RATIO) tracks the status of the remote ratio (REMRAT).

When the block is switched to Local mode, the ratio status depends on the ratio tracking option (RTRKOP):

- If RTRKOP = 1 or 2, the RATIO status is cleared.
- If RTRKOP = 0, the RATIO status reflects the REMRAT status at the time the switch to Local occurred. The block maintains this status as long as block is in Local, unless the user changes the RATIO value via data access. At that time the status is cleared.

The local set point is clamped each cycle when the set point mode is Remote, Local, or Supervisory. The clamp limits used are the ratio/bias scale limits HSCI2 and LSCI2. If the set point value before clamping is equal to or less than LCSI2, status bit LLO of SPT is set true. If the value before clamping is equal to or higher than HSCI2, status bit LHI of SPT is true.

The RATIO block has two output states, Auto and Manual. In Manual, the block releases the output, allowing it to be set by you. In Auto, the block secures the output.

Auto has three sub-states: Controlling, Tracking, and Holding.

The block performs the algorithm that automatically generates the output in the Controlling substate of Auto. In this state the block computes the output signal based on the MEAS and RATIO values and the user-supplied values of KSCALE and BSCALE.

In Auto, the block clamps the output between the variable output limits, HOLIM and LOLIM. You can place these limits anywhere within the range defined by LSCO1 and HSCO1, or, using the output span variance parameter (OSV) you can extend this range at both the high and low ends by an equal amount, up to 25 percent. If the algorithm calculates a value less than LOLIM or greater then HOLIM, the block clamps the value at the limit and sets the appropriate indicator, HOLIND or LOLIND, to true. If you set LOLIM higher than HOLIM, then HOLIM is automatically set equal to the higher of the two values, which is LOLIM. Output clamping occurs in the Manual state when MCLOPT is true.

If the BCALCI initialization status value input goes to true while the block is in Auto, the block performs explicit initialization, by entering the Tracking substate of Auto. In this state, the output tracks the value of the BCALCI input. This causes the downstream block's remote setpoint to track its own measurement so that a return to closed loop control is bumpless. The BCALCO initialization status value is also set true in this state to request any upstream block to perform its own explicit initialization. When BCALCI initialization status value sets to false, the block returns to the Controlling substate of Auto to resume closed loop control.

For the BIAS block, BLKSTA includes bits which indicate when the downstream output is limited in either direction by monitoring for the Limited High condition (BCALCI.LHI via BLKSTA.B11) and Limited Low condition (BCALCI.LLO via BLKSTA.B10).

The ratio track option, RTRKOP, forces the RATIO setpoint to track BCALCO. BCALCO is the actual ratio of the dependent controlled variable, BCALCI, to the measurement.

When ratio tracking is active, RATIO becomes nonsettable to prevent any user from manipulating the local ratio value. Ratio tracking is only performed if the ratio source selector is switched to Local and the block is either operating in Manual or the BCALCI Initialization Input status value is true. BCALCI initialization status value being true indicates that a block downstream in the cascade is open loop.

During Auto operation, the block checks the critical inputs MEAS and BCALCI for data errors (off-scan, or BAD, OOS or ERROR status bits set). If an error is detected, the RATIO block, depending on the value of the CEOPT parameter (see CEOPT definition), may propagate the error to its outputs by setting the ERROR status bit of the output, OUT.

The block goes to Hold if, while MBADOP = 0 and CEOPT = 1 or 2, either the HOLD parameter goes true, or a condition required by the CEOPT parameter is met. In the Hold substate the block holds the output at its last value. When all error conditions are removed, the block returns to the Controlling substate and resumes closed loop control.

No implicit Hold action takes place if CEOPT = 0.

If MBADOP = 1 or 2 (and the MA parameter is unlinked), the block goes to the Manual state when it detects a control error, or when the HOLD input goes true, regardless of the CEOPT value. MBADOP has the same priority as MANSW and has precedence over AUTSW. Therefore, if MBADOP is configured true and a bad input is detected, the block goes to Manual regardless of the AUTSW setting.

When the block is switched to Manual, the OUT status reflects the MEAS/RATIO status at the time the switch occurred. While the block is in Manual, it maintains this status until you change the OUT output via data access. At that time the status is cleared.

The block also goes to Manual if, while MANFS is configured true, it detects the Failsafe status bit (BCALCO.FS) at its BCALCI input.

A transition to Manual sets all alarm and limit indicators to false.

In Manual mode, the block does not perform ratio calculation. Alarm outputs are settable. The block output (OUT) is unsecured and may have its value set by an external task or program and if the manual clamp option (MCLOPT) is configured, these set values will undergo output clamping.

When the block restarts, the INITMA configured option specifies the value of the MA parameter, unless MA has an established linkage, or MANSW or AUTSW are set true. Likewise, the INITLR specifies the value of the LR parameter, unless LR is linked, or LOCSW and/or REMSW are set true.

In SCC, when the Fallback Option (FLBOPT) is set, the block falls back to the configured normal, Auto, Manual, Remote, or Local mode of operation.

Figure 108-2 is a simplified block diagram that depicts the functional signal flow of the RATIO block. It shows the forward path of the controller as it relates to the various states, logic control signals, and options represented by toggle switches.

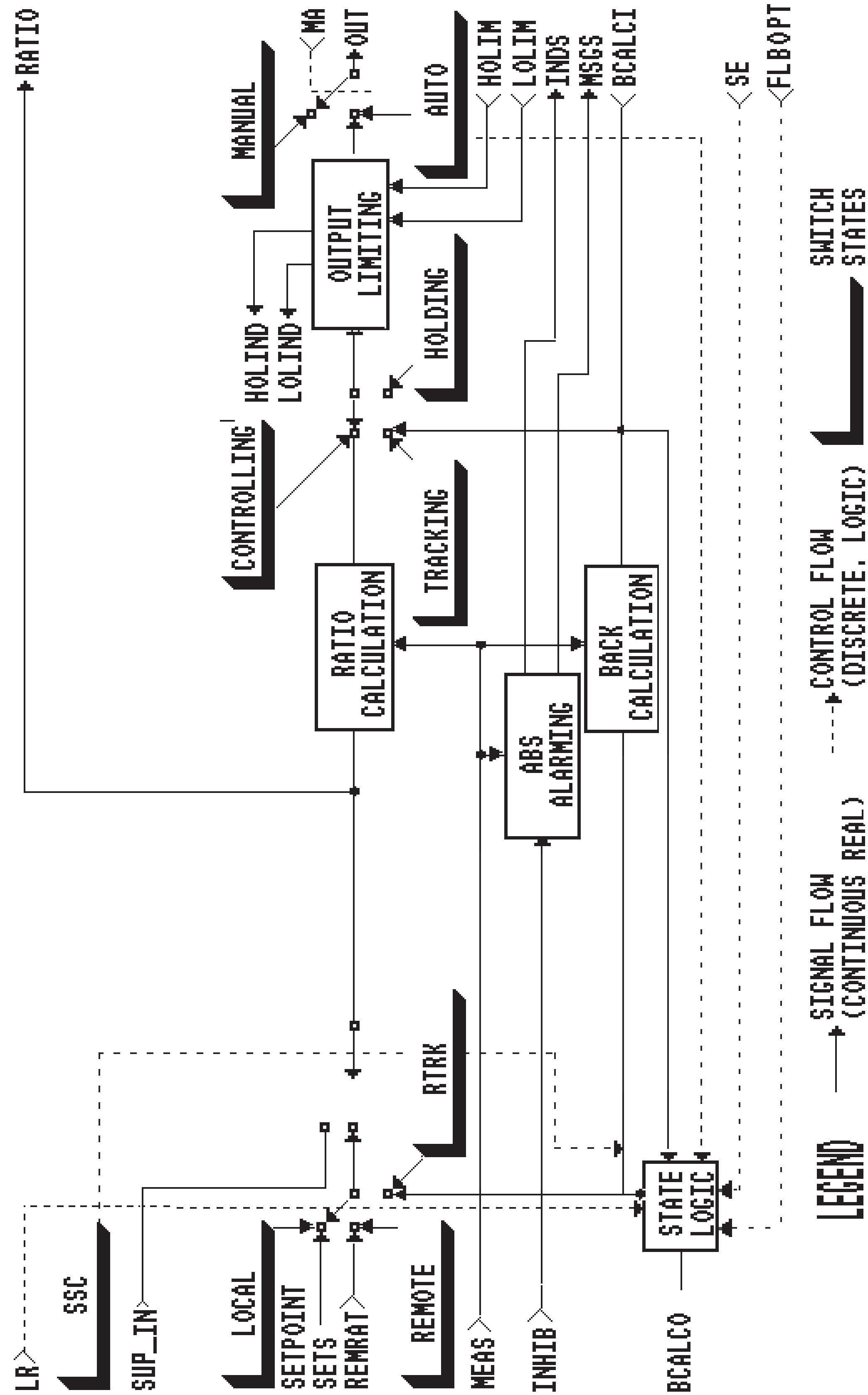


Figure 108-2. Ratio Signal Flow Diagram

108.4.1 Configuration

If the downstream block is an AOUT block (see Figure 108-3), link BCALCI to the downstream block's BCALCO parameter and link the downstream block's MEAS parameter to OUT.

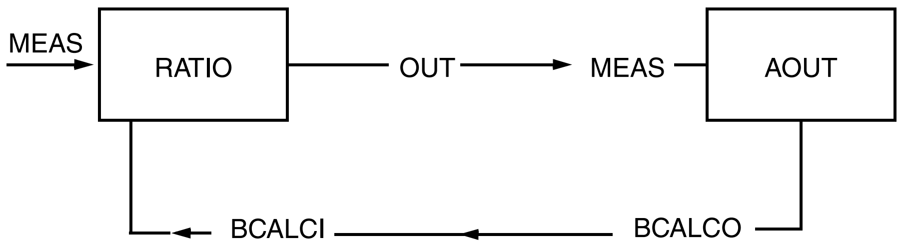


Figure 108-3. Configuration for AOUT Downstream Block

If the secondary block is a DGAP or PTC block (see Figure 108-4), link BCALCI to the secondary block's BCALCO parameter and link OUT to the secondary block's RSP.

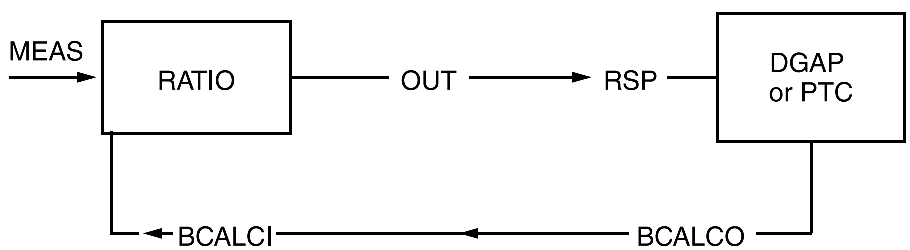


Figure 108-4. Configuration for DGAP or PTC Secondary block

In a cascade configuration, link the blocks as shown in Figure 108-5.

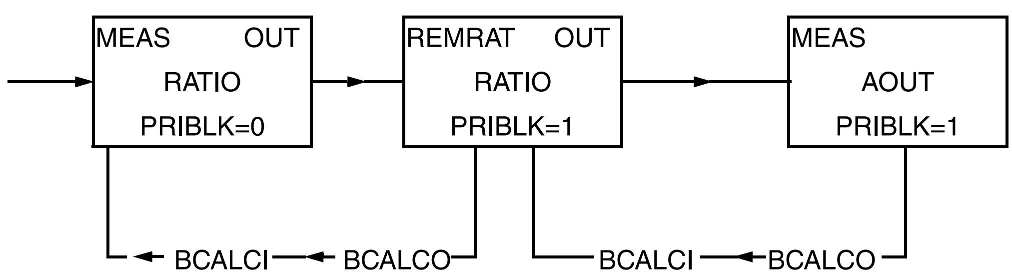


Figure 108-5. Cascade Configuration

Use the PRIBLK option in all cascade configurations.

For more information, refer to the *Supervisory Setpoint Control* (SSC) (B0193RY) document.

108.4.2 PRIBLK and PRITIM Functionality

The Primary Block (PRIBLK) parameter indicates whether the RATIO block has a connection from an upstream block (PRIBLK=1) or not (PRIBLK=0). Its value, together with that of the Primary Cascade Timer (PRITIM), determines whether the RATIO block remains in Hold for a fixed time delay (of length defined by PRITIM), or ends the Hold when the Acknowledge status bit (Bit 10) of MEAS is detected from the upstream block (if PRITIM = 0.0). During initialization, the acknowledgement is not required and a Hold of one cycle only occurs.

109. REALM – Real Alarm Block

This chapter describes the REALM (Real Alarm Block), its features, parameters and detailed operations.

109.1 Overview

The Real Alarm block, REALM, provides any combination of deviation, High/Low and High-High/Low-Low absolutes, and/or rate of change alarming for a single real input. The block also provides boolean indicators for each alarm type, and generates alarm and return-to-normal messages for each alarm event.

109.1.1 I/O Diagram

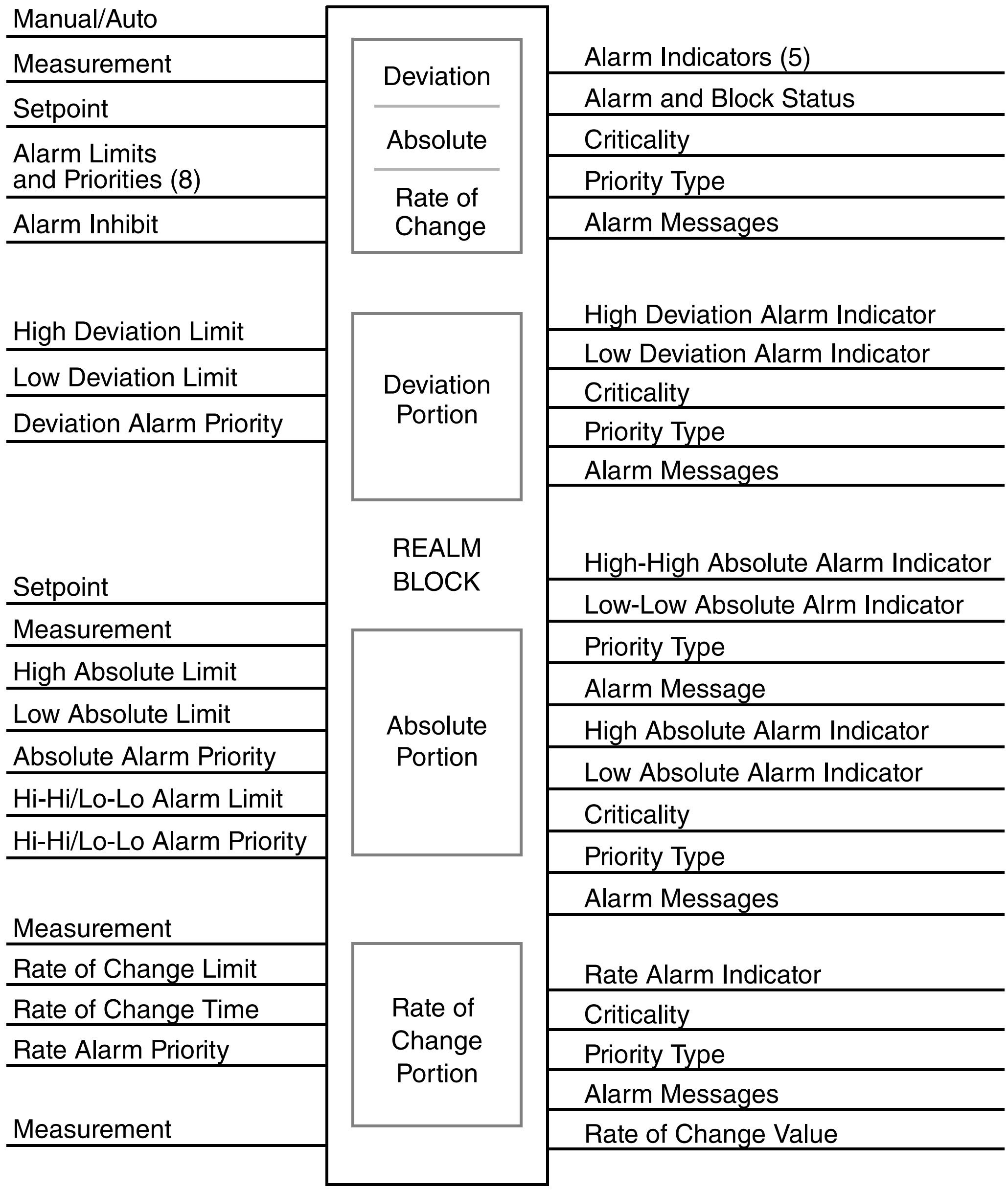


Figure 109-1. REALM Block I/O Diagram

109.2 Features

The features are:

- Manual/Auto mode for disconnecting control schemes from the process, for simulation and checkout purposes
- Alarming: High-High/Low-Low Absolute, High-Low Absolute, Rate-of-Change, and High-Low Deviation
- Alarm messages
- Return to Normal messages.

The options are:

- HHAOPT, High-High Alarm Option, enables High-High and Low-Low absolute alarming for the measurement input, or disables absolute alarming altogether. Each alarm triggers an indicator (HHAIND or LLAIND) and text message (HHATXT and LLATXT) at a given priority level (HHAPRI) to be sent to the configured alarm group (HHAGRP). Once an alarm limit (HHALIM or LLALIM) is exceeded, the indicators remain set until the measurement returns within the defined limit plus (or minus) the deadband (ABSDB).

  0 = No alarming

  1 = High-High and Low-Low alarming

  2 = High-High alarming only

  3 = Low-Low alarming only.
- Absolute Re-alarming (ABSRAL) enables or disables significant re-alarming for the Absolute Alarm.
- Deviation Alarm Option (DALOPT) is a short integer input that enables High and Low deviation alarming, or disables alarming altogether.
- Deviation Re-alarming (DVRAL) enables or disables significant re-alarming for the Deviation Alarm.
- Rate of Change Alarm Option (ROCOPT) enables or disables rate of change alarming.
- Initialize Manual/Auto (INITMA) specifies the desired state of the MA input during initialization.
- Inhibit Option lets you specify alarm inhibit options.
- High/Low Alarm Option (HLAOPT) enables absolute High and Low measurement alarming, or disables absolute alarming altogether.
- Unacknowledge (UNACK) is a boolean output parameter which is set true, for notification purposes, whenever the block goes into alarm. It is settable, but sets are only allowed to clear UNACK to false, and never in the opposite direction. The clearing of UNACK is normally via an operator “acknowledge” pick on a default or user display, or via a user task.

109.3 Parameters

Table 109-1. REALM Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	23	REALM
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars

Table 109-1. REALM Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
MEAS	process input	real	con/set	0.0	RI1
MEASNM	meas alarm name	string	no-con/no-set	blank	1 to 12 chars
HSCI1 to HSCI2	high scale in 1 to 2	real	no-con/no-set	100.0	specifiable
LSCI1 to LSCI2	low scale in 1 to 2	real	no-con/no-set	0.0	specifiable
DELTI1 to DELTI2	change delta 1 to 2	real	no-con/no-set	1.0	percent
EI1 to EI2	eng units input	string	no-con/no-set	%	specifiable
HLAOPT	absolute alarm option	short	no-con/no-set	0	0 to 1
HABLIM	high absolute limit	real	con/set	100.0	RI1
HABTXT	high alarm text	string	no-con/no-set	blank	1 to 32 chars
LABLIM	low absolute limit	real	con/set	0.0	RI1
LABTXT	low alarm text	string	no-con/no-set	blank	1 to 32 chars
ABSDB	absolute alarm deadband	real	no-con/set	0.0	RI1
ABSPRI	absolute alarm priority	integer	con/set	5	[1..5]
ABSGRP	absolute alarm group	short	no-con/set	1	[1..8]
ABSRAL	absolute realarming	boolean	no-con/no-set	0	0 to 1
ABSINC	absolute realarm increment	real	no-con/no-set	5.0	RI1
HHAOPT	high-high option	short	no-con/no-set	0	0 to 3
HHALIM	high-high limit	real	con/set	100.0	RI1
HHATXT	high-high alarm text	string	no-con/no-set	blank	1 to 32 chars
LLALIM	low-low alarm limit	real	con/set	0.0	RI1
LLATXT	low-low absolute text	string	no-con/no-set	blank	1 to 32 chars
HHAPRI	high-high priority	integer	con/set	5	[1..5]
HHAGRP	high-high group	short	no-con/set	1	[1..8]
DALOPT	deviation alarm option	short	no-con/no-set	0	0 to 3
SETPT	setpoint	real	con/set	0.0	RI1
HDALIM	high deviation limit	real	con/set	100.0	RI1
HDATXT	high deviation alarm text	string	no-con/no-set	blank	1 to 32 chars
LDALIM	low deviation limit	real	con/set	-100.0	RI1
LDATXT	low deviation alarm text	string	no-con/no-set	blank	1 to 32 chars
DEVADB	deviation alarm deadband	real	no-con/set	0.0	RI1
DEVPRI	deviation alarm priority	integer	con/set	5	[1..5]
DEVGRP	deviation alarm group	short	no-con/set	1	[1..8]
DEVRAL	deviation realarming	boolean	no-con/no-set	0	0 to 1
DEVINC	deviation realarm increment	real	no-con/no-set	5.0	RI1
ROCOPT	rate alarm option	boolean	no-con/no-set	0	0 to 1
ROCLIM	rate limit	real	con/set	100.0	RI2
KSCALE	gain scaler	real	no-con/no-set	1.0	scalar
ROCTIM	rate interval	real	con/set	0.0	[0..]minutes
ROCTXT	rate alarm text	string	no-con/no-set	blank	1 to 32 chars
ROCPRI	rate alarm priority	integer	con/set	5	[1..5]
ROCGRP	rate alarm group	short	no-con/set	1	[1..8]
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	[0|1|2]
INHOPT	inhibit option	short	no-con/no-set	0	0 to 3
INHIB	alarm inhibit	boolean	con/set	0	0 to 1
INHALM	inhibit alarm	pack_b	con/set	0	0 to 0xFFFF

Table 109-1. REALM Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
AMRTIN	alarm regeneration timer	integer	no-con/no-set	0	0 to 32767 s
NASTDB	alarm deadband timer	long integer	no-con/no-set	0	0-2147483647 ms
NASOPT	nuisance alarm suppression option	short	no-con/no-set	0	0 to 2
OUTPUTS					
ABSLEV	realarm level	integer	con/no-set	0	[0...10]
ALMSTA	alarm status	pack_l	con/no-set	0	bit map
BLKSTA	block status	pack_l	con/no-set	0	bit map
CRIT	criticality	integer	con/no-set	0	[0..5]
DEVLEV	realarm level	integer	con/no-set	0	[0..10]
HAIND	high absolute indicator	boolean	con/no-set	0	0 to 1
HDAIND	high deviation indicator	boolean	con/no-set	0	0 to 1
HHAIND	high-high absolute indicator	boolean	con/no-set	0	0 to 1
INHSTA	inhibit status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
LAIND	low absolute indicator	boolean	con/no-set	0	0 to 1
LDAIND	low deviation indicator	boolean	con/no-set	0	0 to 1
LLAIND	low-low alarm indicator	boolean	con/no-set	0	0 to 1
PRTYPE	priority type	integer	con/no-set	0	[0..10]
QALSTA	quality status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
ROCIND	rate alarm indicator	boolean	con/no-set	0	0 to 1
ROCVAL	rate of change value	real	con/no-set	100.0	RI2
UNACK	alarm notification	boolean	con/no-set	0	0 to 1
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
ALMOPT	alarm options	pack_l	no-con/no-set	0	0 to 0xFFFFFFFF
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	config error	string	no-con/no-set	0	1 to 43 chars
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars
PERTIM	period time	real	no-con/no-set	0.1	---
RI1-RI2	eng range input	real[3]	no-con/no-set	100,0,1	specifiable

109.3.1 Parameter Definitions

ABSDB — Absolute Alarm Deadband is a configured input, expressed in MEAS units, that defines the size of the deadband for the measurement high, high-high, low, and low-low absolute alarming functions. You can adjust this parameter at the workstation.

ABSGRP — Absolute Group is a short integer input that directs absolute alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.

ABSINC

Absolute Increment is a real value that specifies the amount by which the alarmed variable can exceed the alarm limits (or the current re-alarm limits), before incrementing the re-alarm level. Default = 5.0.

ABSLEV

Absolute Level is an integer output that indicates the measurement's current level of re-alarming of the absolute alarm limits. The actual alarm level of re-alarming violation is equal to:

(ABSLEV - 1) * ABSINC ± (high/low deviation limit)

The block clamps the maximum ABSLEV value at 10.

ABSPRI

Absolute Priority is an integer input, from 1 to 5, that sets the priority level of the absolute alarm. 1 is the highest priority.

ABSRAL

Absolute Re-alarming is a boolean parameter that enables (ABSRAL = 1) or disables (ABSRAL = 0) significant re-alarming for the Absolute Alarm. Default = 0.

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

ALMOPT

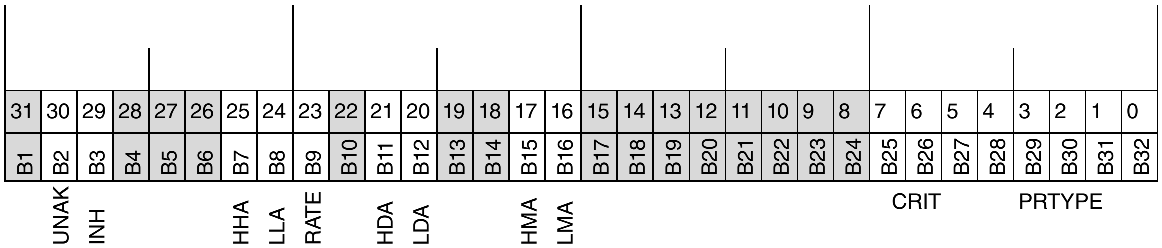
Alarm Options contains packed long values representing the alarm types that have been configured as options in the block, and the alarm groups that are in use. For the REALM block, only the following unshaded bits are used

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1] (0 to 31)	Configured Alarm Option When True
0	Alarm Group 8 in Use
1	Alarm Group 7 in Use
7	Alarm Group 1 in Use
16	Low Absolute Alarm Configured
17	High Absolute Alarm Configured
24	Low-Low Absolute Alarm Configured
25	High-High Absolute Alarm Configured

1. Bit 0 is the least significant, low order bit.

ALMSTA — Alarm Status is a 32-bit output, bit-mapped to indicate the block's alarm states. For the REALM block, only the following bits are used:

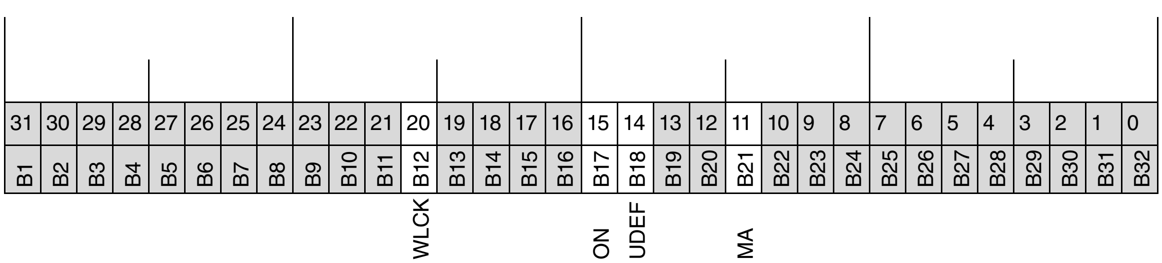


Bit Number (0 to 31)*	Name	Description When True	Boolean Connection (B32 to B1)
0 to 4	PTYP_MSK	Priority Type: See parameter PRTYPE for values used in the REALM block	ALMSTA.B32– ALMSTA.B28
5 to 7	CRIT_MSK	Criticality; 5 = lowest priority, 1= highest	ALMSTA.B27– ALMSTA.B25
16	LMA	Low Measurement Alarm	ALMSTA.B16
17	HMA	High Absolute Alarm	ALMSTA.B15
20	LDA	Low Deviation Alarm	ALMSTA.B12
21	HDA	High Deviation Alarm	ALMSTA.B11
23	RATE	Rate of Change Alarm	ALMSTA.B9
24	LLA	Low-Low Absolute Alarm	ALMSTA.B8
25	HHA	High-High Absolute Alarm	ALMSTA.B7
29	INH	Alarm inhibit	ALMSTA.B3
30	UNAK	Unacknowledged	ALMSTA.B2

* Bit 0 is the least significant, low order bit.

AMRTIN — Alarm Regeneration Timer is a configurable integer that specifies the time interval for an alarm condition to exist continuously, after which a new unacknowledged alarm condition and its associated alarm message is generated.

BLKSTA — Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the REALM block, only the following bits are used:



Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
20	WLCK	Workstation Lock	BLKSTA.B12

* Bit 0 is the least significant, low order bit.

CRIT

Criticality is an integer output that indicates the priority, ranging from 1 to 5, of the block's highest currently active alarm (1 is the highest priority). An output of zero indicates the absence of alarms.

DALOPT

Deviation Alarm Option is a short integer input that enables High and Low deviation alarming, or disables alarming altogether.

0 = No alarming
1 = High and Low deviation alarming
2 = High deviation alarming only
3 = Low deviation alarming only.

You can change DALOPT only by reconfiguring the block.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block.

DELTI1 to DELTI2

Change Delta for Input Range 1 or 2 is a real value that defines the minimum percent of the input range that triggers change driven connections for parameters in the range of RI1 or RI2. The default value is 1.

Entering a 1 causes the Object Manager to recognize and respond to a change of 1 percent of the full error range. If communication is within the same CP that contains the block's compound, change deltas have no effect.

Refer to "Peer-to-Peer Connections of Real-Type Block Inputs" on page 1703 for details on how the I/A Series software affects the change delta percentage during operation.

DESCRP

Description is a user-defined string of up to 32 characters that describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

DEVADB — Deviation Alarm Deadband is a real input, in MEAS units, that defines the size of the deadband that applies to both High and Low Deviation Limits. You can adjust this parameter at the workstation.

DEVGRP — Deviation Group is a short integer input that directs deviation alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.

DEVINC — Deviation Increment is a real value that specifies the amount by which the alarmed variable can exceed the alarm limits (or the current re-alarm limits) before incrementing the re-alarm level. Default = 5.0.

DEVLEV — Deviation Level is an integer output that indicates the measurement's current level of re-alarming of the deviation alarm limits. The actual alarm level of re-alarming violation is equal to:

(DEVLEV - 1) * DEVINC ± (high/low deviation limit)

The block clamps the maximum DEVLEV value at 10.

DEVPRI — Deviation Priority is an integer input, from 1 to 5, that sets the priority level of the deviation alarm (1 is the highest priority).

DEVRAL — Deviation Re-alarming is a boolean parameter that enables (DEVRAL = 1 = true) or disables (DEVRAL = 0 = false) significant re-alarming for the Deviation Alarm. Default = 0.

EI1 to EI2 — Engineering Units for Input Ranges 1 through 8, as defined by the parameters HSCI1 to HSCI2, LSCI1 to LSCI2, and DELTI1 to DELTI2, provide the engineering units text for the values defined by Input Ranges 1 and 2. “Deg F” or “pH” are typical entries.

EI1 is used for scaling MEAS. EI2 is used for scaling KSCALE.

ERCODE — Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block’s DEFINE parameter to be set false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the REALM block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
“W43 – INVALID PERIOD/ PHASE COMBINATION”	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
“W44 – INVALID ENGINEERING RANGE”	High range value is less than or equal to low range value.

Message	Value
"W46 – INVALID INPUT CONNECTION"	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
"W48 – INVALID BLOCK OPTION"	The configured value of a block option is illegal.
"W52 – INVALID I/O CHANNEL/GROUP NUMBER"	An I/O block is connected to an ECB when the specified point number is invalid or when the specified group or octet number is invalid.
"W53 – INVALID PARAMETER VALUE"	A parameter value is not in the acceptable range.
"W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK"	A Database Installer error has occurred.

HABLIM High Absolute Alarm Limit is a real input that defines the value of the measurement that initiates a high absolute alarm.

HABTXT High Absolute Alarm Message Text is a user-defined text string of up to 32 characters, output with the alarm message to identify the alarm.

HAIND High Alarm Indicator is a boolean output that is set true when the measurement (MEAS) rises above the high absolute alarm limit (HABLIM). Once HAIND is set true, it does not return to false until MEAS falls below HABLIM less the deadband (ABSDB).

HDAIND High Deviation Alarm Indicator is a boolean output set true when the measurement exceeds the setpoint by more than the deviation limit HDALIM. When the measurement passes back through the DEVADB deadband, the block sets HDAIND to false.

HDALIM High Deviation Alarm Limit is a real input that establishes the amount by which the measurement must exceed the setpoint to initiate a high deviation alarm and set the High Deviation Alarm Indicator, HDAIND, true.

HDATXT High Deviation Alarm Text is a user-configurable text string of up to 32-characters, output with the alarm message to identify the alarm.

HHAGRP High-High Absolute Alarm Group is a short integer input that directs High-High Absolute alarm messages to one of eight groups of alarm devices.

HHAIND — High-High Alarm Indicator is a boolean output that is set true when the measurement (MEAS) value rises above the high-high absolute alarm limit (HHALIM). Once HHAIND is set true, it does not return to false until MEAS falls below HHALIM less the deadband (ABSDB).

HHALIM — High-High Absolute Alarm Limit is a real input that defines the value of the measurement input (MEAS) that triggers a High High alarm.

HHAOPT — High-High Alarm Option is a configured short integer input that enables High-High and Low-Low absolute alarming for the measurement (MEAS) input, or disables absolute alarming altogether. Each alarm triggers an indicator and text message.

0 = No alarming
1 = High-High and Low-Low alarming
2 = High-High alarming only
3 = Low-Low alarming only.

HHAPRI — High-High Absolute Priority is an integer input, from 1 to 5, that sets the priority level of the high-high absolute alarm (1 is the highest priority).

HHATXT — High-High Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the high-high absolute alarm message to identify it.

HLAOPT — High/Low Alarm Option is a configured short integer input that enables absolute High and Low measurement alarming, or disables absolute alarming altogether.

0 = No alarming
1 = High and Low measurement alarming
2 = High measurement alarming only
3 = Low measurement alarming only.

HSCI1 to HSCI2 — High Scale for Input Ranges 1 and 2 are real values that define the upper limit of the measurement ranges. EI1 to EI2 define the units. Make the range and units consistent with the measurement source. A typical value is 100 (percent).

HSCI1 is used for scaling MEAS. HSCI2 is used for scaling KSCALE.

INHALM — Inhibit Alarm contains packed boolean values that represent alarm inhibit requests for each alarm type or point configured in the block. For the REALM block, only the following bits are used:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16

Bit Number* (0 to 15)	Description When True	Boolean Connection (B16 to B1)
0	Inhibit Low Absolute Alarm	INHALM.B16
1	Inhibit High Absolute Alarm	INHALM.B15
4	Inhibit Low Deviation Alarm	INHALM.B12
5	Inhibit High Deviation Alarm	INHALM.B11
7	Inhibit Rate of Change Alarm	INHALM.B9
8	Inhibit Low-Low Absolute Alarm	INHALM.B8
9	Inhibit High-High Absolute Alarm	INHALM.B7

* Bit 0 is the least significant, low order bit.

There are no mnemonic names for the individual bits of INHALM.

INHIB

Inhibit is a boolean input. When true, it inhibits all block alarms; the alarm handling and detection functions are determined by the INHOPT setting. Alarms can also be inhibited based on INHALM and the compound parameter CINHIB.

INHOPT

Inhibit Option specifies the following actions applying to all block alarms:

0 = When an alarm is inhibited, disable alarm messages but do not disable alarm detection.

1 = When an alarm is inhibited, disable both alarm messages and alarm detection. If an alarm condition already exists at the time the alarm transitions into the inhibited state, clear the alarm indicator.

2 = Same as 0 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

3 = Same as 1 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

INHSTA

Inhibit Status contains packed long values that represent the actual inhibit status of each alarm type configured in the block. For the REALM block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
	UNACK	INH				HHA	LLA	RATE		HDA	LDA			HMA	LMA																

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
16	LMA	Low Absolute Alarm Inhibited	INHSTA.B16
17	HMA	High Absolute Alarm Inhibited	INHSTA.B15
20	LDA	Low Deviation Alarm	INHSTA.B12
21	HDA	High Deviation Alarm	INHSTA.B11
23	RATE	Rate of Change Alarm	INHSTA.B9
24	LLA	Low-Low Absolute Alarm Inhibited	INHSTA.B8
25	HHA	High-High Absolute Alarm Inhibited	INHSTA.B7
29	INH	Inhibit Alarm	INHSTA.B3
30	UNACK	Unacknowledged	INHSTA.B2

* Bit 0 is the least significant, low order bit.

INITMA

Initialize Manual/Auto specifies the desired state of the MA input during initialization, where:

0 = Manual
1 = Auto
2 = The MA state as specified in the checkpoint file.

The block asserts this initial M/A state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a reboot operation.
- The compound in which it resides is turned on.
- The INITMA parameter itself is modified via the control configurator. (The block does not assert INITMA on ordinary reconfiguration.)

INITMA is ignored if MA has an established linkage.

KSCALE	KSCALE is a conversion factor used to make the specified units of ROCLIM dimensionally compatible with the fixed units of the measurement signal in the process of differentiation performed over the time interval of the block PERIOD.
LABLIM	Low Absolute Alarm Limit is a real input that defines the value of the measurement that initiates a low absolute alarm.
LABTXT	Low Absolute Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm.
LAIND	The Low Alarm Indicator is a boolean output that is set true when the measurement (MEAS) value falls below the low absolute alarm limit (LABLIM). Once LAIND is set true, it does not return to false until MEAS rises above LABLIM plus the deadband (ABSDB).
LDAIND	The Low Deviation Alarm Indicator is a boolean output that is set true when the measurement falls below the setpoint by more than the deviation limit, LDALIM. When the measurement passes back through the DEVADB deadband, the block sets LDAIND to false.
LDALIM	Low Deviation Alarm Limit is a real input that defines how far the measurement must fall below the setpoint to initiate a low deviation alarm and set the Low Deviation Alarm Indicator LDAIND true.
LDATXT	Low Deviation Alarm Text is a user-defined text string of up to 32-characters that are output with the alarm message to identify the alarm.
LLAIND	Low-Low Alarm Indicator is a boolean output that is set true when the measurement value falls below the low-low absolute alarm limit (LLALIM). Once LLAIND is set true, it does not return to false until MEAS rises above LLALIM plus the deadband (ABSDB).
LLALIM	Low-Low Absolute Alarm Limit is a real input that defines the value of the measurement (MEAS) input that triggers a Low-Low Alarm.
LLATXT	Low-Low Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the low-low absolute alarm message to identify it.
LOCKID	Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.
LOCKRQ	Lock Request is a boolean input which can be set true or false only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the

workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.

LOOPID — Loop Identifier is a configurable string of up to 32 characters which identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.

LSCI1 to LSCI2 — Low Scale for Input Ranges 1 and 2 are real values that define the lower limit of the measurement ranges. A typical value is 0 (percent). EI1 to EI2 define the units. Make the range and units consistent with those of the measurement source.

LSCI1 is used for scaling MEAS. LSCI2 is used for scaling KSCALE.

MA — Manual Auto is a boolean input that controls the Manual/Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. The block automatically limits the output to the output range specified between LSCO1 and HSCO1, for analog blocks. In Manual, the algorithm is not performed, and the output is unsecured. An external program can then set the output to a desired value.

MEAS — Measurement is an input identifying the source of the block's input, or the controlled variable.

MEASNM — Measurement Alarm Name is a user-defined text string of up to 12 characters that identify the alarm source in the alarm message. It serves as a point descriptor label (for example, Furn 37 Temp).

NAME — Name is a user-defined string of up to 12 characters used to access the block and its parameters.

NASOPT — Alarm Suppression Option is a configurable, non-settable short integer that specifies how the nuisance alarm delay is implemented:

- 0 = Suppress nuisance alarms by delaying the Return-to-Normal (default) by the length of time specified in NASTDB
- 1 = Suppress nuisance alarms by delaying alarm detection by the length of time specified in NASTDB
- 2 = Suppress nuisance alarms by delaying both the Alarm Detection and the Return-to-Normal by the length of time specified in NASTDB

NASTDB — Alarm Deadband Timer is a configurable long integer. Depending on the value of NASOPT, it either specifies the deadband time interval that must elapse before an alarm condition is allowed to return to normal, or the length of a delay-on timer which specifies the amount of time between an alarm's detection and the announcement of the alarm. The parameter value ranges from zero (default, no delay) to 2147483647 ms.

OWNER
: Owner is a string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are successful only if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.

PERIOD
: Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PERTIM
: Period Time is the period of the block expressed in seconds.

PHASE
: Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PRTYPE
: Priority Type is an indexed output parameter that indicates the alarm type of the highest priority active alarm. The PRTYPE output of this block includes the following alarm types:

0 = No active alarm

1 = High Absolute

2 = Low Absolute

3 = High High

4 = Low Low

5 = High Deviation

6 = Low Deviation

7 = Rate alarm

QALSTA
: Quality Status parameter (QALSTA) is a non-configurable packed long that provides a combination of value record status, block status (BLKSTA), and alarm status (ALMSTA) information in a single connectable output parameter. Available bits for this block are provided below.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1]	Definition	Contents	Boolean Connection (B32 to B1)
30	Alarms Unacknowledged	ALMSTA.UNA	QALSTA.B2
29	Alarms Inhibited	ALMSTA.INH	QALSTA.B3
25	High-High Absolute Alarm	ALMSTA.HHA	QALSTA.B7
24	Low-Low Absolute Alarm	ALMSTA.LLA	QALSTA.B8
23	Rate-of-Change Alarm	ALMSTA.RATE	QALSTA.B9
21	High Deviation Alarm	ALMSTA.HDA	QALSTA.B11
20	Low Deviation Alarm	ALMSTA.LDA	QALSTA.B12
17	High Absolute Alarm	ALMSTA.HMA	QALSTA.B15
16	Low Absolute Alarm	ALMSTA.LMA	QALSTA.B16
5	Manual	BLKSTA.MA	QALSTA.B27
4	Low Limited	MEAS.LLO status	QALSTA.B28
3	High Limited	MEAS.LHI status	QALSTA.B29
2	Uncertain	MEAS.ERR status	QALSTA.B30
1	Out-of-Service	MEAS.OOS status	QALSTA.B31
0	Bad	MEAS.BAD status	QALSTA.B32

1. Bit 0 is the least significant, low order bit.

RI1 to RI2 — Range Input 1 and 2 are arrays of real values that specify the high and low engineering scale and change delta of a particular real input. For a given block, it also forms an association with a group of real input parameters that have the same designated range and change delta.

RI1 is used for scaling MEAS. RI2 is used for scaling KSCALE.

ROCGRP — Rate of Change Group is a short integer input that directs Rate of Change alarm messages to one of eight groups of alarm devices. You can change the group number at the workstation.

ROCIND — The Rate of Change Alarm Indicator is a boolean output. It is set true when the measurement experiences a rate of change greater than the rate of change alarm limit (ROCLIM). The block sets ROCIND to false when the rate of change falls below that limit.

ROCLIM	Rate of Change Limit is the absolute value of the allowable change in MEAS, when ROCOPT is true. When ROCLIM is exceeded, it generates a Rate of Change Alarm. You can configure ROCLIM as a constant, or connect it to a block to vary the rate limit. ROCLIM is “per second”, even though ROC detection is changed by KSCALE.
ROCOPT	Rate of Change Alarm Option is a configured input. ROCOPT enables (when true) or disables (when false) rate of change alarming. You can change ROCOPT only by reconfiguring the block.
ROCPRI	Rate of Change Priority is an integer input (1 to 5) that sets the priority level of the rate of change alarm (1 is the highest priority).
ROCTIM	Rate of Change Time is the number of minutes that the measurement's rate of change must remain greater than the rate of change limit, ROCLIM, before the block generates an alarm. It is also the length of time that the rate of change must remain below the limit to come out of alarm.
ROCTXT	The Rate of Change Alarm Message Text is a user-defined text string of up to 32 characters that are output with the alarm message to identify the alarm.
ROCVAL	Rate-of-Change Value is the rate-of-change of the measurement determined by the KSCALE factor and the block period in a REALM block.
SETPT	Setpoint is a real input that identifies the source of the reference input to be used in conjunction with the MEAS parameter to produce a deviation value: (Deviation = Setpoint - Measurement).
TYPE	When you enter “REALM” or select “REALM” from the block type list under Show, an identifying integer is created specifying this block type.
UNACK	Unacknowledge is a boolean output that the block sets to True when it detects an alarm. It is typically reset by operator action.

109.4 Detailed Operation

The Real Alarm block, when in auto, provides the alarm functions described in the following sections for the real value that you connect to the measurement (MEAS) input parameter.

109.4.1 Detailed Diagram

Figure 109-2 is a simplified block diagram that depicts the functional signal flow of the REALM block. It shows the forward path of the block as it relates to the various states, logic control signals, and options represented by toggle switches.

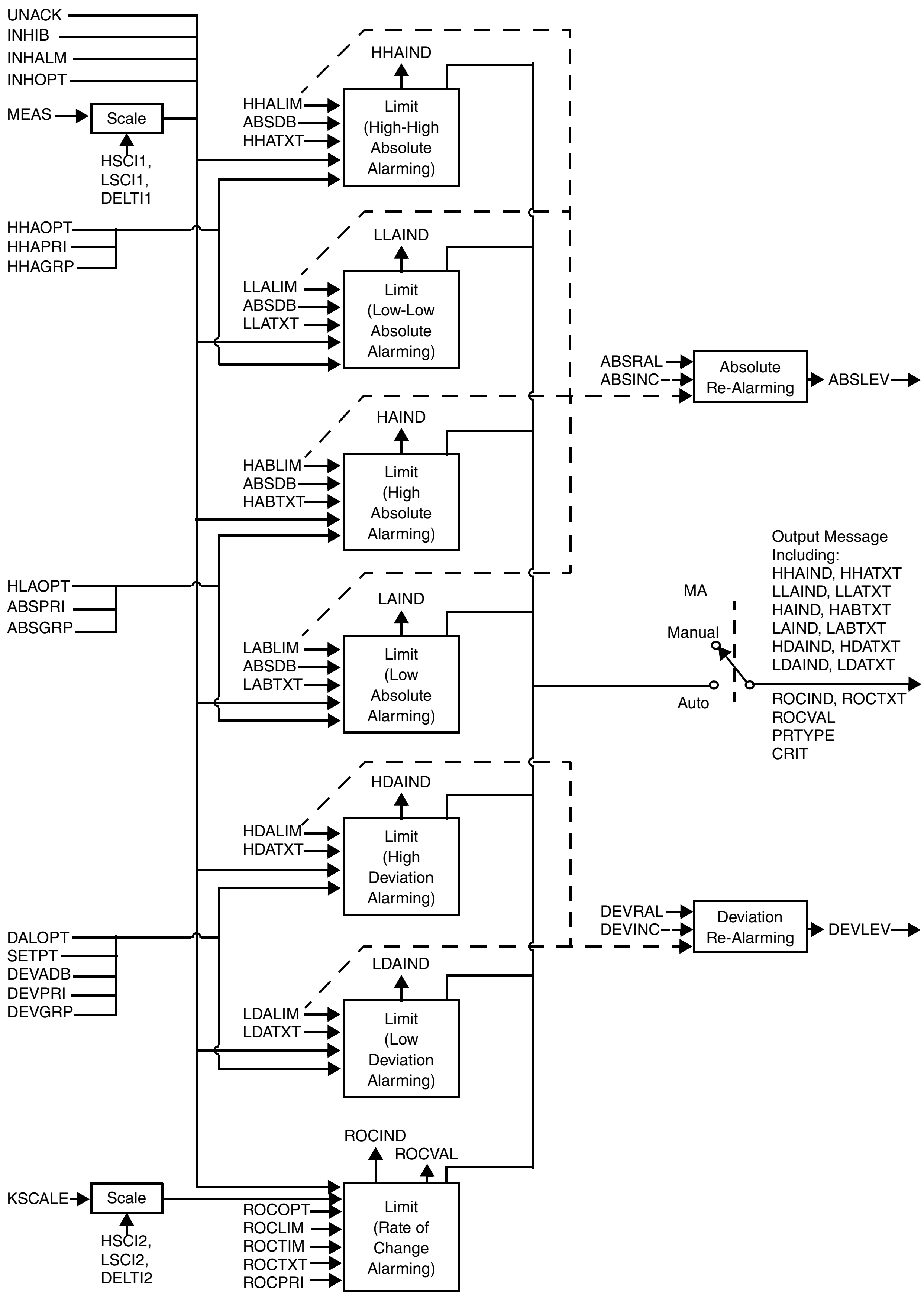


Figure 109-2. REALM, Detailed Block Diagram

109.4.2 Block States

The REALM block has three states: Initialization, Manual and Auto.

109.4.2.1 Initialization

Key Parameters: INITMA

At initialization, the block initializes MA. DEFINE is set to 0 if any configured parameters fail validation testing.

109.4.2.2 Manual

Key Parameters: MA

In manual, the integer outputs CRIT and PRTYPE are reset to zero and all the Boolean indicator outputs are set to false. In manual, the block represses all alarm functions, and all outputs are unsecured and settable.

109.4.2.3 Auto

Key Parameters: MA

In auto mode, the block operates as described below.

109.4.3 Inhibit Alarming

Key Parameters: ABSRAL, DALOPT, DEVRAL, HHAOPT, HLAOPT, INHALM, INHIB, INHOPT, ROCOPT

INHALM is a parameter that is used in conjunction with the CINHIB compound parameter and the INHIB block parameter to determine which alarm types/points are inhibited in the block. See Table 109-1 for its formatting.

The INHOPT parameter specifies the actions taken when alarms are inhibited in the block. See Table 109-1 to determine the possible actions.

Table 109-2 lists the Boolean inhibit option parameters which enable/disable each of the types of alarming supported by REALM.

Table 109-2. REALM Inhibit Alarm Option Booleans

Parameter	Enables/Disables Alarming Type
HHAOPT	High-High/Low-Low Absolute Alarming
HLAOPT	High/Low Absolute Alarming
DALOPT	High/Low Deviation Alarming
ROCOPT	Rate of Change Alarming
ABSRAL	Re-Alarming for the Absolute Alarm
DEVRAL	Re-Alarming for the Deviation Alarm

109.4.4 Absolute Alarming

Absolute alarming checks if MEAS has exceeded a predefined limit. See Figure 109-3.

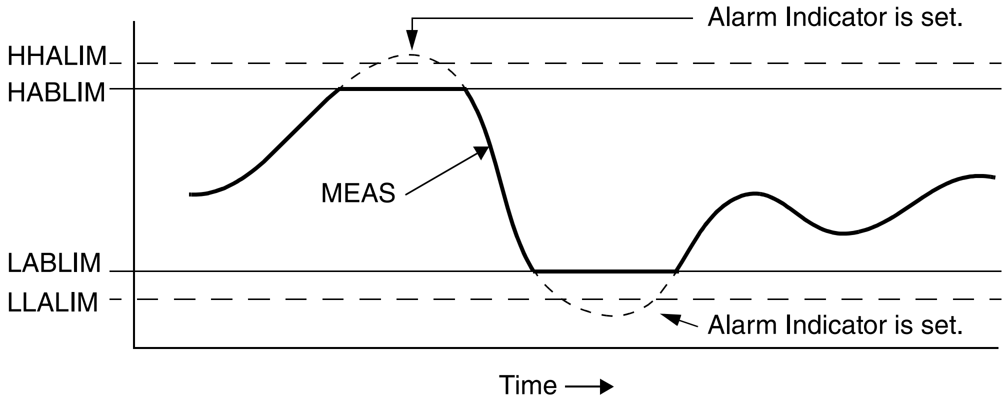


Figure 109-3. Absolute Alarming

Four forms of absolute alarming are available, as described below.

109.4.4.1 High-High Absolute Alarming

Key Parameters: ABSDB, HHAIND, HHALIM, HHATXT, MEAS

In High-High Absolute Alarming, MEAS is compared to the high high absolute alarm limit (HHALIM). If MEAS is greater than HHALIM, the block sets HHAIND true and outputs an alarm message that includes the user-defined HHATXT. When MEAS falls to, or below, HHALIM minus the deadband (ABSDB), the block sets HHAIND to false and outputs a return-to-normal message.

109.4.4.2 Low-Low Absolute Alarming

Key Parameters: ABSDB, LLAIND, LLALIM, LLATXT, MEAS

In Low-Low Absolute Alarming, MEAS is compared to low low absolute alarm limits (LLALIM). If MEAS is less than LLALIM, the block sets LLAIND to true and outputs an alarm message that includes the user-defined LLATXT. When MEAS rises to, or above, LLALIM plus the deadband (ABSDB), the block sets LLAIND to false and outputs a return-to-normal message.

109.4.4.3 High Absolute Alarming

Key Parameters: ABSDB, HABLIM, HABTXT, HAIND, MEAS

In High Absolute Alarming, MEAS is compared to the high absolute alarm limit (HABLIM). If MEAS is greater than HABLIM, the block sets HAIND true and outputs an alarm message that includes the user-defined HABTXT. When MEAS falls to, or below, HABLIM minus the deadband (ABSDB), the block sets HAIND to false and outputs a return-to-normal message.

109.4.4.4 Low Absolute Alarming

Key Parameters: ABSDB, LABLIM, LABTXT, LAIND, MEAS

In Low Absolute Alarming, MEAS is compared to the low absolute alarm limits (LABLIM). If MEAS is less than LABLIM, the block sets LAIND true and outputs an alarm message that includes the user-defined LABTXT. When MEAS rises to, or above, LABLIM plus the deadband (ABSDB), the block sets LAIND to false and outputs a return-to-normal message.

109.4.5 Deviation Alarming

Deviation alarming checks if MEAS has exceeded the predefined deviation limits. See Figure 109-4.

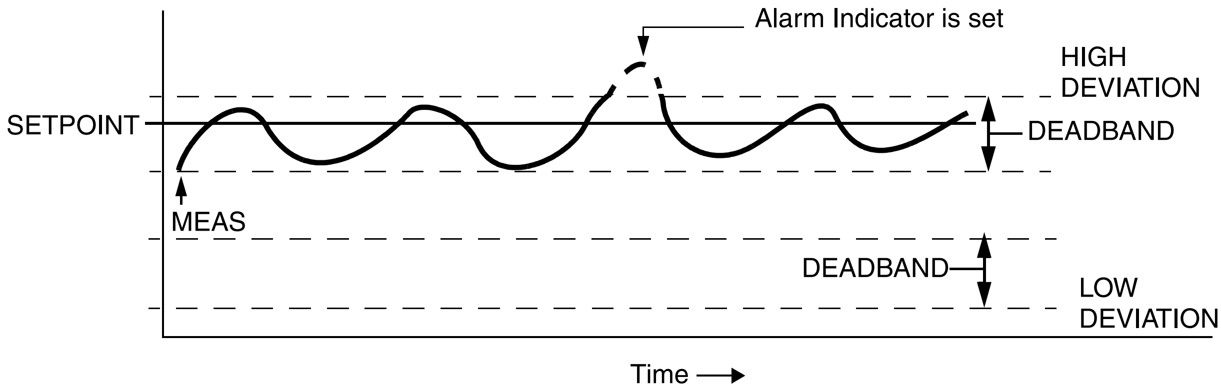


Figure 109-4. Deviation Alarming

Two forms of deviation alarming are available, as described below.

109.4.5.1 High Deviation Alarming

Key Parameters: DEVADB, MEAS, HDAIND, HDALIM, HDATXT, SETPT

In High Deviation Alarming, the deviation (SETPT - MEAS) is compared to the high deviation alarm limit (HDALIM). If the deviation is greater than HDALIM, the block sets HDAIND true and outputs an alarm message that includes the user-defined HDATXT. When the deviation falls to, or below, HDALIM minus the deadband (DEVADB), the block sets HDAIND to false and outputs a return-to-normal message. The alarm limit field of the messages reports the limit in absolute terms, rather than using HDALIM, which is a relative quantity (that is, Alarm Limit Field = Setpoint + HDALIM, rather than Alarm Limit Field = HDALIM).

109.4.5.2 Low Deviation Alarming

Key Parameters: DEVADB, LDAIND, LDALIM, LDATXT, MEAS, SETPT

In Low Deviation Alarming, the deviation (SETPT - MEAS) is compared to the absolute value of the low deviation alarm limit (LDALIM). If the deviation is less than the absolute value of LDALIM, the block sets LDAIND true and outputs an alarm message that includes the user-defined LDATXT. When the deviation rises to, or above, LDALIM plus the deadband (DEVADB), the block sets LDAIND to false and outputs a return-to-normal message. The alarm limit field of the messages reports the limit in absolute terms, rather than using LDALIM, which is a relative quantity (that is, Alarm Limit Field = Setpoint - LDALIM, rather than Alarm Limit Field = LDALIM).

109.4.6 Rate of Change Alarming

Key Parameters: KSCALE, MEAS, ROCIND, ROCLIM, ROCTIM, ROCTXT, ROCVAL

In Rate of Change Alarming, the MEAS rate of change is compared to the rate-of-change limit (ROCLIM) value. The value of ROCLIM is shown in Figure 109-5.

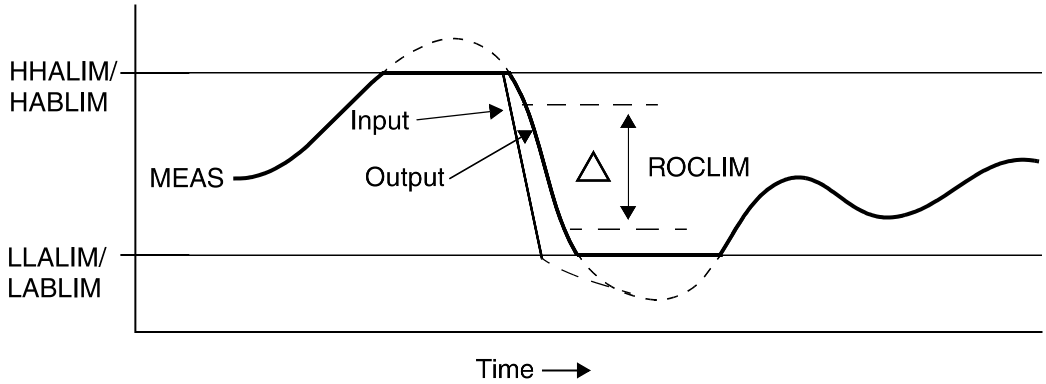


Figure 109-5. Rate of Change Alarming

If the rate of change exceeds ROCLIM over a consecutive time limit greater than the interval time, ROCTIM, the block sets ROCIND true and outputs an alarm message that includes the user-defined ROCTXT. When the rate of change no longer exceeds ROCLIM over a consecutive period greater than ROCTIM, the block resets ROCIND to false and generates a return-to-normal message. ROCLIM and ROCTIM are clamped at a minimum of 0.0 every cycle.

At configuration, define KSCALE so as to make the specified units of ROCLIM dimensionally compatible with the fixed units of the measurement signal in the process of differentiation performed over the time interval of the block PERIOD.

The output ROCVAL contains the rate of change of MEAS at all times. It is computed as follows:

ROCVAL = |MEAS - previous cycle MEAS| / (KSCALE * ROCTIM),

where ROCTIM is the period of the block in seconds.

109.4.7 Re-Alarming

Key Parameters: ABSINC, ABSLEV, ABSRAL, DEVINC, DEVLEV, DEVRAL, MEAS

Re-alarming allows you to check if a MEAS input which has initiated an alarm is extending further beyond the alarm limit, or is returning to a safe level. When re-alarming is enabled, the alarm limit for the initiated alarm is increased/decreased by a specified increment after a MEAS input has triggered the alarm. If the MEAS input goes past the adjusted alarm limit again, the alarm reoccurs, and the alarm limits are increased/decreased again. The alarm limits can be adjusted by re-alarming up to 10 times.

Re-alarming is available for absolute and deviation alarming. The integer outputs ABSLEV and DEVLEV provide the level of re-alarming (0 to 10) of the absolute and deviation alarm limits (that is, the number of times the MEAS input has caused the alarm level to increment). ABSLEV and DEVLEV are reset to zero (0) after the MEAS input has returned to safe levels and the initiated alarm has been turned off.

ABSINC and DEVINC, respectively, provide the specified increments by which the absolute and deviation alarm limits are adjusted each time a new level of re-alarming is established.

Re-alarming for absolute alarms is enabled or disabled via ABSRAL. Re-alarming for deviation alarms is enabled or disabled via DEVRAL.

110. RIN – Real Input Block

This chapter covers the Real Input (RIN) block features, parameters and functions, and application diagrams.

NOTE

This chapter describes the Distributed Control Interface (DCI) RIN block. For a description of how the RIN block is used in PLC applications, refer to *PLC Interface Block Descriptions* (B0193YQ).

NOTE

CP270 and Later Only indicates RIN features supported only on the Field Control Processor 270 (FCP270) and Z-form Control Processor 270 (ZCP270) with I/A Series software v8.4 or later, or on any later control processors such as the Field Control Processor 280 (FCP280) with I/A Series software v9.0 or later.

110.1 Overview

The Real Input (RIN) block is a Distributed Control Interface (DCI) block. (DCI blocks support connectivity of I/A Series control stations to various bus resident devices via a general purpose interface.) RIN receives one analog value from a field device. It presents that value, after input processing, at parameter RINP, whether the block mode is Auto or Manual. An additional parameter, MEAS, is provided for use as the block output to the control strategy. The value of MEAS is the same as that of RINP when the block is in Auto mode. When the block is in Manual mode, MEAS is independent of RINP, and can be used for manual sets.

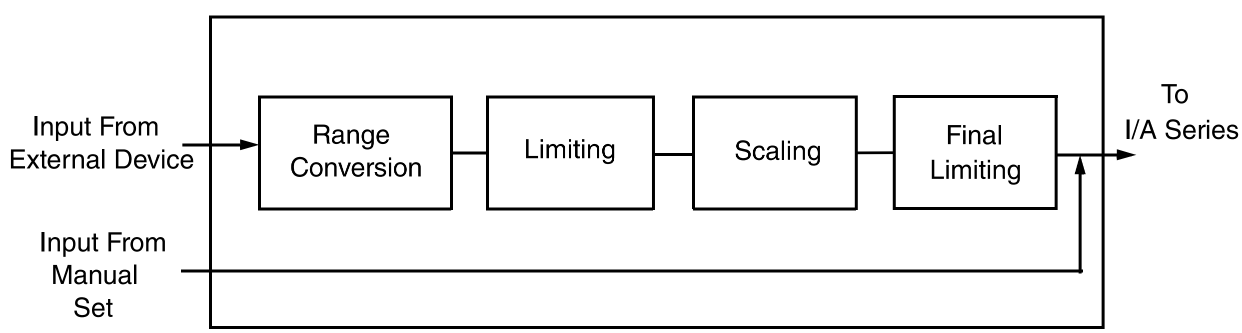


Figure 110-1. RIN Block Diagram

110.2 Basic Operation

The RIN block is used in applications where the field device provides the analog data value to the I/A Series system for use in a Display Manager, FoxView display, or connection to an Invensys control strategy. The raw value from the external device is first scaled into the I/A Series normalized raw count range specified by the configured Signal Conditioning Index (SCI). It is then limited to prevent excursions beyond the upper or lower span limits of that range. The limited I/A Series normalized raw count value is converted into engineering units by a proportionality calculation. After a final limiting calculation, the result, in engineering units, is made available in parameter Real Input (RINP).

RINP contains the value, after input processing, read from the external device address specified by parameter Point Number (PNT_NO) at all times, whether the mode is Auto or Manual. In Auto, this value is copied to parameter Block Output (MEAS). In Manual, it is not copied to MEAS, and the you may set the value of MEAS.

With I/A Series software v8.4 or later, the RIN block operating on the FCP280, FCP270 or ZCP270 provides a variety of alarm detection and reporting features, including alarming for Bad I/O, out-of-range values, and two sets of high and low limits. Alarm options include user control of alarm generation, suppression of nuisance alarms, and optional alarming when the block is in manual mode. Alarming is not supported on other control processors. If alarms are desired, a separate AIN block can be used with a connection to the MEAS parameter of the RIN block.

110.3 Features

The RIN block provides the following features:

- ♦ Support for operator sets in Manual
- ♦ Specification of external device source point as device-specific string
- ♦ Input value scaled into I/A Series normalized raw count range before further processing
- ♦ Input in I/A Series normalized raw count converted to engineering units.

The RIN block supports these additional features on the FCP280, or on the FCP270 and the ZCP270 with I/A Series software v8.4 or later:

- ♦ Alarm detection and reporting for Bad I/O, out-of-range values, high/low absolute limits and high-high/low-low absolute limits, in both Auto and Manual mode
- ♦ Workstation locking
- ♦ User-set output variance limits to control out-of-range alarm generation
- ♦ Configurable signal filtering to smooth output and suppress noise
- ♦ Quality Status (QALSTA) parameter that provides value record status, block status and alarm status in a single connectable output parameter
- ♦ Parameter RAWC provides access to the raw value from the FBM.

110.4 Parameters

Table 110-1. RIN Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
Configurable Parameters					
INPUTS					
NAME	block name	string	no-con/no-set	2 blanks	1 to 12 chars
TYPE	block type	short integer	no-con/no-set	RIN_TYPE	149
DESCRP	block description	string	no-con/no-set	2 blanks	1 to 32 chars
PERIOD	block sample time	short integer	no-con/no-set	1	0 to10, and 13 for CPs, 0 to 12 for Gateways
PHASE	block execution phase	short integer	no-con/no-set	0	---
LOOPID	loop/unit/batch identifier	string	no-con/set	2 blanks	1 to 32 chars
IOM_ID	ECB identifier (pathname)	string	no-con/no-set	2 blanks	1 to 12 chars
PNT_NO	point number	string	no-con/no-set	blanks	1 to 32 chars, or device specific
MA	manual/auto switch	boolean	con/set	0	0 to 1
INITMA	initialize manual/auto	short integer	no-con/no-set	1	0 to 2
EI1	engineering units	string	no-con/no-set	%	1 to 6 chars
HSCI1	high scale input	real	no-con/no-set	100.0	>LSCI1
LSCI1	low scale input	real	no-con/no-set	0.0	<HSCI1
MBIAS	measurement bias	real	no-con/set	0.0	any real
MGAIN	measurement gain	real	no-con/set	1.0	any real
RI1	input range 1	real	no-con/no-set	HSCI1, LSCI1	---
RINP	real input	real	con/set	0.0	LSCI1-HSCI1
ROCV	rate of change limit	real	con/set	0.0	any real
SCI	signal conditioning index	short integer	no-con/no-set	0	0 to 15 and 50 to 59
SIMOPT	simulation option	boolean	no-con/no-set	0	0 = no simulation 1 - simulation
OSV	output span variance	real	no-con/no-set	02.	[0 to 25] percent
BADOPT	BAD/out of range option	short integer	no-con/no-set	0	0 to 3
LASTGV	last good value	boolean	no-con/no-set	0	0 to 1
OOROPT	out of range option	boolean	no-con/no-set	1	0 to 1
INHOPT	inhibit option	short	no-con/no-set	0	0 to 3
INHIB	alarm inhibit	boolean	con/set	0	0 to 1
INHALM	inhibit alarm	packed b	con/set	0	0 to 0xFFFF
MANALM	manual alarm option	short integer	no-con/set	0	0 to 1
FLOP	filter option	short integer	no-con/set	0	0 to 3
FTIM	filter time constant	real	con/set	0.0	minutes
BAO	bad alarm option	boolean	no-con/no-set	0	0 to 1
BAT	bad alarm text	string	no-con/no-set	blank	1 to 32 chars
BAP	bad alarm priority	integer	con/set	5	1 to 5
BAG	bad alarm group	short	no-con/set	1	1 to 8
ORAO	out of range alarm option	boolean	no-con/no-set	0	0 to 1
ORAT	out of range text	string	no-con/no-set	blank	1 to 32 chars
ORAP	out of range priority	integer	con/set	5	1 to 5

Table 110-1. RIN Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
ORAG	out of range group	short	no-con/set	1	1 to 8
HLOP	high/low alarm option	short	no-con/no-set	0	0 to 3
ANM	point alarm name	string	no-con/no-set	blank	0 to 12 chars
HAL	high alarm limit	real	con/set	100.0	RI1
HAT	high alarm text	string	no-con/no-set	blank	0 to 32 chars
LAL	low alarm limit	real	con/set	0.0	RI1
LAT	low alarm text	string	no-con/no-set	blank	0 to 32 chars
HLDB	high alarm deadband	real	no-con/set	0.0	RI1
HLPR	high alarm priority	integer	con/set	5	1 to 5
HLGP	high alarm group	short	no-con/set	1	1 to 8
HHAOPT	high/high alarm option	short	no-con/no-set	0	0 to 3
HHALIM	high/high alarm limit	real	con/set	100.0	RO1
HHATXT	high/high alarm option	short	no-con/no-set	blank	0 to 32 chars
LLALIM	low/low alarm limit	real	con/set	0.0	RO1
LLATXT	low/low alarm option	short	no-con/no-set	blank	0 to 32 chars
HHAPRI	high/high alarm priority	integer	con/set	5	1 to 5
HHAGRP	high/high alarm group	short	no-con/set	1	1 to 8
AMRTIN	alarm regeneration timer	integer	no-con/no-set	0	0 to32767 sec
NASTDB	nuisance alarm suppression deadband	long integer	no-con/set	0	0 to 2147483647 ms
NASOPT	nuisance alarm suppression option	short	no-con/set	0	0 to 2
UPDPER	parm update period	integer	no-con/no-set	10000ms	0 to 2147483647 ms
Non-Configurable Parameters					
OUTPUTS					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
ALMSTA	alarm status	packed long	con/no-set	0	bit map
BLKSTA	block status	packed long	con/no-set	0	0 to 0xFFFFFFFF
CRIT	alarm criticality	integer	con/no-set	0	0 to 5
HOR	high out of range	boolean	con/no-set	0	0 to 1
INHSTA	inhibit status	packed long	con/no-set	0	0 to 0xFFFFFFFF
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
LOR	low out of range	boolean	con/no-set	0	0 to 1
MEAS	real input	real	con/set	0.0	RI1
PRTYPE	priority type	integer	con/no-set	0	0 to 8
QALSTA	quality status	pack_b	con/no-set	0	0 to 0xFFFF
RAWC	raw counts	real	con/no-set	0.0	0 to 65535
SEVSTS*	(reserved)	integer	con/no-set	0	0 to 300
TSTAMP	time stamp	long integer	con/no-set	0	ms after midnight
UNACK	unacknowledged alarm	boolean	con/no-set	0	0 to 1
VALSTS	FF value status	integer	con/no-set	0	0 to 0xFFFF
VUMEAS*	(reserved)	real	con/no-set	0.0	any real>0
DATA STORES					
ALMOPT	alarm options	packed long	no-con/no-set	0	0 to 0xFFFFFFFF

Table 110-1. RIN Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
DEFINE	no config errors	boolean	no-con/no-set	1	---
DEV_ID	device identifier	character	no-con/no-set	---	6-character array
ERCODE	configuration error	string	no-con/no-set	2 blanks	1 to 43 chars
OWNER	owner name	string	no-con/set	2 blanks	1 to 32 chars

* Not currently supported.

110.4.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

ALMOPT
(CP270 and Later Only)

Alarm Options contain packed long values representing the alarm types that have been configured as options in the block, and the alarm groups that are in use. Table 110-2 shows how the parameter is used by the RIN block.

Table 110-2. ALMOPT Parameter Format

Bit Number[1] (0 to 31)	Configured Alarm Option, When True
0 (lsb)	Alarm Group 8 in Use
1	Alarm Group 7 in Use
2	Alarm Group 6 in Use
3	Alarm Group 5 in Use
4	Alarm Group 4 in Use
5	Alarm Group 3 in Use
6	Alarm Group 2 in Use
7	Alarm Group 1 in Use
16	Low Absolute Alarm Configured
17	High Absolute Alarm Configured
22	Bad I/O Alarm Configured
24	Low-Low Absolute Alarm Configured
25	High-High Absolute Alarm Configured
28	Out-of-Range Alarm Configured

1. Bit 0 is the least significant, low order bit.

ALMSTA
(CP270 and Later Only)

Alarm Status is a 32-bit output, bit-mapped to indicate the block's alarm states. Table 110-3 shows the bits used by the RIN block.

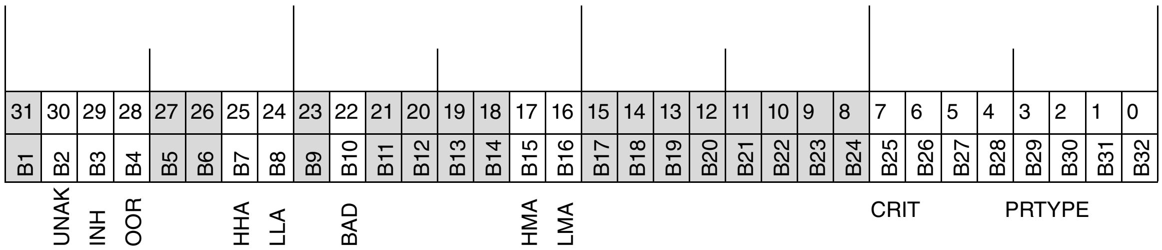


Table 110-3. ALMSTA Parameter Format

Bit Number (0 to 31)*	Name	Description, When True	Boolean Connection (B32 to B1)
0 to 4	PTYP_MSK	Priority Type. See "PRYTPE" page 2174 for values used in the RIN block	---
5 to 7	CRIT_MSK	Criticality: 1 (highest priority) to 5	---
16	LMA	Low Absolute Alarm	ALMSTA.B16
17	HMA	High Absolute Alarm	ALMSTA.B15
22	BAD	Bad I/O Alarm	ALMSTA.B10
24	LLA	Low-Low Absolute Alarm	ALMSTA.B8
25	HHA	High-High Absolute Alarm	ALMSTA.B7
28	OOR	Out-of-Range Alarm	ALMSTA.B4
29	INH	Inhibit Alarm. This bit is set when any of the block's alarms is inhibited	ALMSTA.B3
30	UNAK	Unacknowledged	ALMSTA.B2

*Bit 0 is the least significant, low order bit.

AMRTIN
(CP270 and Later Only)

Alarm Message Regeneration Time Interval specifies the rate at which alarm messages are generated for alarm conditions that have not been cleared. The interval is specified in seconds. The configured interval is rounded up to the closest value that is an even multiple of the station BPC. A value of 0 disables alarm message regeneration.

ANM
(CP270 and Later Only)

Alarm Name is a user-defined string of up to 12 characters which serves as a point descriptor label Bad alarm, state alarm and state change messages (for example, "PLT3 F2 SDR").

BADOPT
(CP270 and Later Only)

Bad and Out-of-Range Option is a short integer option that specifies the conditions that set the BAD output true. Values are:

- 0 = Bad Status (RINP.BAD) only
- 1 = Bad Status (RINP.BAD) or Low Out-of-Range (LOR)
- 2 = Bad Status (RINP.BAD) or High Out-of-Range (HOR)

- 3 = Bad Status (RINP.BAD) or LOR or HOR

The default value is 0. Bad Status is a Logical OR of bad ECB status (that is, the FBM or FBC itself is bad) and bad channel status (that is, the connected point is bad). If there is no FBM or FBC connection, then Bad Status is considered to exist when MEAS is linked and has bad status.

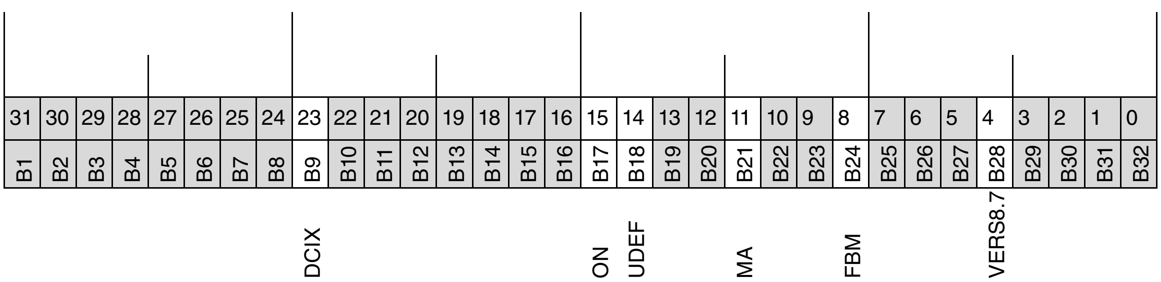
BAG *(CP270 and Later Only)*
: Bad Alarm Group is a short integer input that directs Bad alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.

BAO *(CP270 and Later Only)*
: Bad Alarm Option is a configurable option that enables alarm generation for each state of RINP.BAD.

BAP *(CP270 and Later Only)*
: Bad Alarm Priority is an integer input, ranging from 1 to 5, that sets the priority level of the Bad alarm (1 is the highest priority).

BAT *(CP270 and Later Only)*
: Bad Alarm Text is a user-configurable text string of up to 32 characters, sent with the bad alarm message to identify it.

BLKSTA
: Block Status is a 32-bit output, bit-mapped to indicate various block operational states. For the RIN block, only the following bits are used:



Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
4	VERS8.7	Faceplate visibility bit for LASTGV parameter; enables RIN/RINR displays make the new parameter LASTGV visible on their configuration overlay (*I/A Series v8.7 or later Only*)	BLKSTA.B28
8	FBM	Bad Status of ECB	BLKSTA.B24
11	MA	Manual = 0, Auto = 1	BLKSTA.B21
14	UDEF	Block Undefined	BLKSTA.B18
15	ON	Block ON	BLKSTA.B17
23	DCIX	Enhanced DCI block *(CP270 and Later Only)*	BLKSTA.B9

*Bit 0 is the least significant, low order bit.

CRIT
(CP270 and Later Only)

Criticality is an integer output that indicates the priority of the block's highest currently active alarm. The range is 1 (highest priority) to 5. An output of 0 indicates the absence of alarms.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. (See ERCODE for the list of all possible validation errors in this block.) In that case, no further processing of the block occurs, including further validation of remaining parameters. To return DEFINE to a True value, you should correct all configuration errors and reinstall the block.

DESCRP

Description is a user-defined string of up to 32 characters used to describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

DEV_ID

Device Identifier is a character array that specifies the 6-character identifier of the connected device. It is copied from the DEV_ID configured in the ECB specified by the IOM_ID parameter.

EI1

Engineering Units for Input Range 1 provides the engineering units text for the RINP and MEAS parameters. The value configured for this text string should be consistent with the values used for HSCI1 and LSCI1.

ERCODE

Error Code is a character data store which indicates the type of configuration error which caused the block's DEFINE parameter to be set False, unless indicated otherwise (see meanings below). Validation of configured parameters does not proceed past the first error encountered by the block logic. Each nonzero value of ERCODE results in an explanatory message at the block's detail display. For the RIN block, the following list shows the possible messages you may see:

ERCODE Message	Meaning
W44 – INVALID ENGINEERING RANGE	HSCI1 ≤ LSCI1
W50 – INVALID SIGNAL CONDITIONING INDEX	SCI is out of range for this block.
W52 – INVALID I/O CHANNEL/GROUP NO.	PNT_NO string is blank.
W62 – UNRESOLVED CONNECTION	Connection is not yet resolved. (Block remains defined.)
W65 – INVALID POINT ADDRESS	FBM parsing algorithm finds that a used BIx_PT is invalid.
W66 – DUPLICATE CONNECTION	There is a duplicate connection to a particular point.
W67 – INSUFFICIENT FBM MEMORY/CONNECTIONS	There is no available memory or point connections in the FBM.

ERCODE Message	Meaning
W68 – INVALID DEVICE CONNECTION	The device connection is invalid.
W69 – INVALID POINT CONNECTION	The point connection is invalid.

If a DCI data connection cannot be resolved due to a lack of configuration information, the block is marked DEFINED but the value is marked OOS and one of the following strings is stored in ERCODE to indicate the configuration error:

W77 - FIELDBUS COMMUNICATIONS FAULT (FBM228 only)
W78 - INVALID FUNCTION BLOCK (FBM228 only)
W80 - FIELDBUS DEVICE NOT FOUND (FBM228 only)
W73 - FF FUNCTION BLOCK CONFIGURATION ERROR (FBM228 only).

If a DCI data connection cannot be resolved for any other reason, the block is marked UNDEFINED and one of the following strings is stored in ERCODE to indicate the configuration error:

W74 - FF FUNCTION BLOCK DDITEM MISMATCH (FBM228 only)
W75 - FF FUNCTION BLOCK DDMBR MISMATCH (FBM228 only)
W76 - INVALID FF MODE CONFIGURATION (FBM228 only)
W79 - INVALID PARAMETER INDEX (FBM228 only)
W81 - INVALID PARENT DCI ECB PERIOD/PHASE (FBM228 only).

FLOP
(CP270 and Later Only)

Filter Option is an option parameter that specifies the type of filtering that is applied to the signal before it is set into the RINP output. FLOP has the following values:

- 0 = No Filtering
- 1 = First Order Lag Filtering
- 2 = Butterworth Filtering
- 3 = Two-Sample Average Filtering

CAUTION

Using FLOP without configuring an arbitration limit (ARBLIM) may create a bump in the process.

FTIM
(CP270 and Later Only)

Filter Time is an input that represents the time in minutes for the output value to reach a certain percentage of its ultimate value after a step change to the input. For first-order lag filtering this percentage is approximately 63 percent, and for Butterworth filtering it is approximately 50 percent. FTIM is not applicable to two-sample-average filtering.

HAL
(CP270 and Later Only)
High Absolute Alarm Limit is a real input that defines the value of the RINP output that triggers a High Absolute Alarm.

HAT
(CP270 and Later Only)
High Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the high absolute alarm message to identify it.

HHAGRP
(CP270 and Later Only)
High-High Absolute Alarm Group is a short integer input that directs High-High Absolute alarm messages to one of eight groups of alarm devices.

HHALIM
(CP270 and Later Only)
High-High Absolute Alarm Limit is a real input that defines the value of the RINP output that triggers a High-High Absolute Alarm.

HHAOPT
(CP270 and Later Only)
High-High Absolute Alarm Option is a configured short integer input that enables High-High Absolute and/or Low-Low Absolute alarming of the RINP output, or disables this type of alarming altogether. Values:

- 0 = No Alarming
- 1 = High-High and Low-Low Absolute Alarming
- 2 = High-High Absolute Alarming Only
- 3 = Low-Low Absolute Alarming Only

HHAPRI
(CP270 and Later Only)
High-High Absolute Alarm Priority is an integer input, ranging from1 (highest priority) to 5 (default), that sets the priority level of the high-high alarm.

HHATXT
(CP270 and Later Only)
High-High Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the high-high absolute alarm message to identify it.

HLDB
(CP270 and Later Only)
High/Low Deadband is a real input that defines the size of the deadband that applies to the high, low, high-high, and low-low absolute alarm limits of the RINP output.

HLGP
(CP270 and Later Only)
High/Low Group is a short integer input that directs High/Low Absolute alarm messages to one of eight groups of alarm devices.

HLOP
(CP270 and Later Only)
High/Low Option is a configured short integer input that enables Absolute High and/or Low alarming of the RINP output, or disables absolute alarming altogether. Values:

- 0 = No Alarming
- 1 = High and Low Absolute Alarming
- 2 = High Absolute Alarming Only
- 3 = Low Absolute Alarming Only

HLPR *(CP270 and Later Only)*
High/Low Priority is an integer input, ranging from1 (highest priority) to 5 (default), that sets the priority level of the High/Low Absolute alarm.

HOR *(CP270 and Later Only)*
High Out-of-Range is a boolean output that is set true if the RINP value becomes greater than the limit set by HSCI1 and OSV.

HSCI1
High Scale for Input Range 1 specifies the upper range limit of the block input when converted from limited raw count to engineering units.

INHALM *(CP270 and Later Only)*
Inhibit Alarm contains packed boolean values that represent alarm generation inhibit request for each type of alarm configured in the block. For the RIN block, the following bits are used:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16

Bit Number* (0 to 15)	Description, When True	Boolean Connection (B16 to B1)
0	Inhibit Low Absolute Alarm	INHALM.B16
1	Inhibit High Absolute Alarm	INHALM.B15
6	Inhibit Bad I/O Alarm	INHALM.B10
8	Inhibit Low-Low Absolute Alarm	INHALM.B8
9	Inhibit High-High Absolute Alarm	INHALM.B7
12	Inhibit Out-of-Range Alarm	INHALM.B4

*Bit 0 is the least significant, low order bit.

There are no mnemonic names for the individual bits of INHALM.

INHIB *(CP270 and Later Only)*
Inhibit is a configurable, connectable and settable boolean that, when set, suppresses all alarm message reporting. INHIB affects only alarm message reporting; the alarm handling and detection functions are determined by the INHOPT setting.

INHOPT *(CP270 and Later Only)*
Inhibit Option specifies the following actions applying to all block alarms:

- 0 = When an alarm is inhibited, disables alarm messages but does not disable alarm detection.
- 1 = When an alarm is inhibited, disables both alarm messages and alarm detection. If an alarm condition exists at the time the alarm transitions into the inhibited state, the alarm indicator is cleared.
- 2 = Same as 0 for inhibited alarms. For uninhibited alarms, automatically acknowledges “return-to-normal” messages.

"Into alarm" messages can be acknowledged by explicitly setting UNACK False.

- 3 = Same as 1 for inhibited alarms. For uninhibited alarms, automatically acknowledges "return-to-normal" messages. "Into alarm" messages can be acknowledged by explicitly setting UNACK False.

INHSTA
(CP270 and Later Only)

Inhibit Status contains packed long values that represent the current inhibit status of each alarm type configured in the block. Table 110-4 shows how the parameter is used with the RIN block.

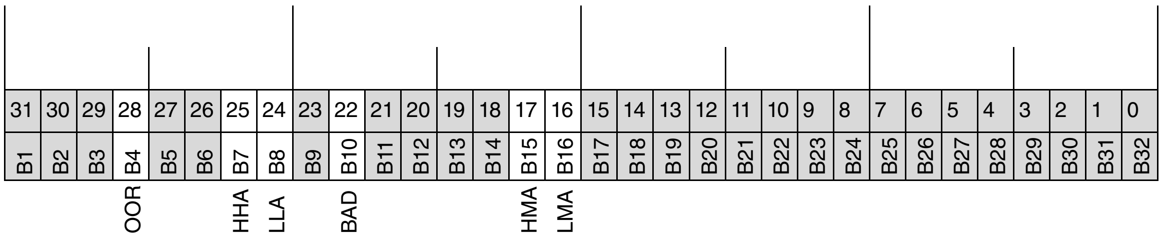


Table 110-4. INHSTA Parameter Format

Bit Number* (0 to 31)	Name	Description, When True	Boolean Connection (B32 to B1)
16	LMA	Low Absolute Alarm Inhibited	INHSTA.B16
17	HMA	High Absolute Alarm Inhibited	INHSTA.B15
22	BAD	Bad I/O Alarm Inhibited	INHSTA.B10
24	LLA	Low-Low Absolute Alarm Inhibited	INHSTA.B8
25	HHA	High-High Absolute Alarm Inhibited	INHSTA.B7
28	OOR	Out-of-Range Alarm Inhibited	INHSTA.B4

*Bit 0 is the least significant, low order bit.

INITMA

Initialize Manual/Auto specifies the desired state of the MA input under certain initialization conditions, namely:

- The block has just been installed into the I/A Series station database.
- The I/A Series station is rebooted.
- The compound in which the block resides is turned on.
- The INITMA parameter is modified via the Integrated Control Configurator.

INITMA is ignored if MA has an established linkage.

When INITMA is asserted, the value set into MA is:

- 0 (Manual) if INITMA = 0
- 1 (Auto) if INITMA = 1
- The MA value from the checkpoint file if INITMA = 2.

IOM_ID	ECB Identifier is a configurable string that specifies the pathname of the ECB201 for the device, for the purpose of connecting to (accessing) a field parameter that resides in a field device hosted by a (parent) ECB200/202. IOM_ID has the form CompoundName:BlockName, where CompoundName is the 1-12 character name of the local compound containing the ECB, and BlockName is the 1-12 character block name of the ECB. If the compound containing the ECB is the CPletterbug_ECB compound where CPletterbug is the station letterbug of the CP, the CompoundName may be omitted from the IOM_ID configuration. In this case, the 1-12 character ECB block name is sufficient.

NOTE

Once configured, IOM_ID may not be modified. A delete/undelete operation will NOT allow IOM_ID to be changed. The block must be deleted and then re-entered into the data base. IOM_ID may then be reconfigured.

LAL *(CP270 and Later Only)*	Low Absolute Alarm Limit is a real input that defines the value of the RINP output that triggers a Low Absolute Alarm.
LASTGV (*I/A Series v8.7 or later Only, CP270 and Later Only*)	Last Good Value is a boolean option. When true in the situations described in Section 110.5.10, LASTGV causes the previous value of MEAS to be retained, and the value obtained this cycle to be ignored. In I/A Series software v8.7-v8.8, the default value is 1. In a post-I/A Series software v8.8 Quick Fix and I/A Series software v9.0 or later, the default is 0.
LAT *(CP270 and Later Only)*	Low Absolute Alarm Text is a user-defined string of up to 32 characters sent with the low absolute alarm message to identify it.
LLALIM *(CP270 and Later Only)*	Low-Low Absolute Alarm Limit is a real input that defines the value of the RINP output that triggers a Low-Low Absolute Alarm.
LLATXT *(CP270 and Later Only)*	Low-Low Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the low-low absolute alarm message to identify it.
LOCKID *(CP270 and Later Only)*	Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.
LOCKRQ *(CP270 and Later Only)*	Lock Request is a Boolean input which can be set True or False only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set True in this fashion, a workstation identifier

accompanying the set command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contests of LOCKID. LOCKRQ can be set False by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.

LOOPID — Loop Identifier is a configurable string of up to 32 characters used to identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.

LOR *(CP270 and Later Only)* — Low Out-of-Range is a boolean output that is set true if the RINP value becomes less than the lower limit set by LSCI1 and OSV.

LSCI1 — Low Scale for Input Range 1 specifies the lower range limit of the block input when converted from limited normalized raw count to engineering units.

MA — Manual/Auto is a Boolean input that controls the block's operating state (0 = False = Manual; 1 = True = Auto). When in Auto mode, the block output is copied from RINP to MEAS. In Manual mode, it is not copied, and MEAS becomes settable.

MANALM *(CP270 and Later Only)* — Manual Alarm Option is a configurable input which enables or disables configured alarm options to function in Manual mode. Normally alarms are processed only in the Auto mode. Values for the RIN block:

- 0 = No alarming in Manual
- 1 = Full alarming in Manual

MBIAS — Measurement Bias is the offset factor applied to the raw count input from the external device when rescaling it into the equivalent I/A Series station normalized raw count.

The scaling is applied before the signal conditioning algorithm specified by SCI is applied.

In the RIN block, the linear scaling is applied before the signal conditioning algorithm is applied. The GAIN and BIAS parameters are used in the linear equation:

x = GAIN (x + BIAS)

MEAS — Block Output contains the same value as RINP when the block mode is Auto. It is independent of RINP in Manual mode (set by operator).

MGAIN — Measurement Gain is the gain factor applied to the raw count input from the external device when rescaling it into the equivalent I/A Series control station normalized raw count.

The scaling is applied before the signal conditioning algorithm specified by SCI is applied.

NAME

Name is a user-defined string of up to 12 characters used to access the block and its parameters.

NASOPT
(CP270 and Later Only)

Nuisance Alarm Suppression Alarm Option is a configurable, settable short integer that specifies how the nuisance alarm delay is implemented:

- 0 = Suppress nuisance alarms by delaying the Return-to-Normal (default) by the length of time specified in NASTDB
- 1 = Suppress nuisance alarms by delaying alarm detection by the length of time specified in NASTDB
- 2 = Suppress nuisance alarms by delaying both the Alarm Detection and the Return-to-Normal by the length of time specified in NASTDB

NASTDB
(CP270 and Later Only)

Nuisance Alarm Suppression Time Deadband is used to reduce the number of alarm messages generated when a block parameter crosses back and forth over an alarm limit. When the parameter is set to zero, an alarm is generated each time the parameter is outside the limit and is cleared each time it crosses back. Thus, a parameter that is fluttering at the alarm limit can result in nuisance alarms. NASTDB specifies, in milliseconds, a time that must lapse before the alarm is cleared and before another alarm message can be generated. The specified value is rounded up to the nearest even multiple of the control station BPC. If the parameter passes from outside one limit to outside the opposite extreme, the deadband is ignored.

OOROPT
(CP270 and Later Only)

Out-Of-Range Option (OOROPT) is a configurable, non-settable boolean option that, if set to 1, causes the ERR status to be set in the MEAS output of this RIN block if the MEAS is Limited High-Out-of-Range (LHI status = 1) or Limited Low Out-of-Range (LLO status = 1).

ORAG
(CP270 and Later Only)

Out-of-Range Alarm Group is a short integer input that directs Out-of-Range alarm messages to one of eight groups of alarm devices.

ORAO
(CP270 and Later Only)

Out-of-Range Alarm Option is a configurable boolean which, when configured true, enables an alarm for each change of the out-of-range status of the block. The block has out-of-range status if either the HOR or the LOR parameter is true.

ORAP
(CP270 and Later Only)

Out-of-Range Alarm Priority is an integer input, ranging from 1 to 5, that sets the priority level of the out-of-range alarm (1 is the highest priority).

ORAT
(CP270 and Later Only)

Out-of-Range Alarm Text is a user-configurable text string of up to 32 characters, sent with the out-of-range alarm message to identify it.

OSV *(CP270 and Later Only)*	Output Span Variance is a configurable real input which defines the percentage by which the output clamp limits exceed the output range defined by HSCI1 and LSCI1.
OWNER	Owner is a string of up to 32 ASCII characters used to allocate control blocks to applications. Attempts to set OWNER are successful only if the present value of OWNER is the null string, an all-blank string, or identical to the value in the set request. Otherwise, the request is rejected with a LOCKED_ACCESS error. OWNER can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of OWNER. Once set to the null string, the value can then be set as desired.
PERIOD	Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PHASE	Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 seconds) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the I/A Series station is 0.5 second. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PRTYPE	The PRTYPE parameter contains the alarm type of the highest active alarm in the block. For the RIN and RINR blocks, the valid possible settings for PRTYPE are as follows: ♦ 0 = No existing alarm ♦ 1 = Hi Absolute Alarm Type ♦ 2 = Lo Absolute Alarm Type ♦ 3 = Hi-Hi Absolute Alarm Type ♦ 4 = Lo-Lo Absolute Alarm Type ♦ 8 = Bad Alarm Type ♦ 25 = Out-of-Range Alarm Type For example, if both a Bad Alarm with a priority of 1 and a High Absolute alarm with a priority of 2 exist, and no other alarm exists, then PRTYPE = 8 (the Bad Alarm type) and CRIT= 1 (the Bad Alarm priority).
PNT_NO	Point Number identifies the source address in the external device memory (or external device data stream) from which the block input is obtained. It

is a string whose syntax depends on the FBM type and fieldbus protocol of the attached device:

- For the FBM223 PROFIBUS interface, PNT_NO must be configured to contain a PROFIBUS data identifier. This information identifies, to the FBM, the address of the input data unit from the device. Refer to *PROFIBUS-DP Communication Interface Module (FBM223) User's Guide* (B0400FE) for further details.
- For the FBM222 Redundant PROFIBUS interface, the PNT_NO configuration string uses the FBM223 syntax with extensions for PROFIBUS-PA status, custom status and other features. Refer to *Implementing PROFIBUS Networks in Foxboro Control Software Applications* (B0750BE) for further details.
- For the HART interface (FBM214/214b/215/216/216b/218/244/245/247), PNT_NO must be configured to contain a point address. This information identifies, to the FBM, specific data in the HART data stream that is to serve as the device data input to this block. Refer to *HART Communication Interface Modules User's Guide* (B0400FF) for details.
- For the Modbus interface (FBM224), PNT_NO must be configured to contain the address of a set of coils in a Modbus device. Refer to *Modbus Communication Interface Module (FBM224) User's Guide* for details.
- For the FDSI (FBM230/231/232/23), PNT_NO contains a data identifier to identify, to the FBM, specific data in the I/O data stream and to specify the elements of the data. Refer to *Field Device System Integrators (FBM230/231/232/233) User's Guide* (B0700AH) for more information.
- For the FBM228 Redundant FOUNDATION fieldbus interface, the point number syntax specifies reads of H1 device function block parameters using a client/server or publisher/subscriber connection, as described in *Implementing FOUNDATION fieldbus on an I/A Series System* (B0700BA), *Implementing FOUNDATION fieldbus* (B0750BC), and *Implementing FOUNDATION fieldbus in Foxboro Control Software Applications* (B0750DA).

QALSTA *(CP270 and Later Only)*

Quality Status parameter (QALSTA) is a non-configurable packed boolean that provides a combination of value record status, block status (BLKSTA), and alarm status (ALMSTA) information in a single connectable output parameter. Available bits for this block are provided below.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1]	Definition	Contents	Boolean Connection (B32 to B1)
30	Alarms Unacknowledged	ALMSTA.UNA	QALSTA.B2
29	Alarms Inhibited	ALMSTA.INH	QALSTA.B3
28	Out-of-Range Alarm	ALMSTA.OOR	QALSTA.B4
25	High-High Absolute Alarm	ALMSTA.HHA	QALSTA.B7
24	Low-Low Absolute Alarm	ALMSTA.LLA	QALSTA.B8
22	Bad Alarm	ALMSTA.IOBD	QALSTA.B10
17	High Absolute Alarm	ALMSTA.HMA	QALSTA.B15
16	Low Absolute Alarm	ALMSTA.LMA	QALSTA.B16
5	Manual[2]	~ BLKSTA.MA	QALSTA.B27
4	Low Limited	MEAS.LLO status	QALSTA.B28
3	High Limited	MEAS.LHI status	QALSTA.B29
2	Uncertain	MEAS.ERR status	QALSTA.B30
1	Out-of-Service	MEAS.OOS status	QALSTA.B31
0	Bad	MEAS.BAD status	QALSTA.B32

1. Bit 0 is the least significant, low order bit.
2. Bit 5 is the inverse of BLKSTA.MA (BLKSTA.B21).

RAWC *(CP270 and Later Only)*
: Raw Count is the value read from the ECB into the block before any form of signal conditioning, characterization, scaling, clamping or filtering is applied. It is of real data type although the ECB value may be integer, or long integer.

RI1
: Range Input is an array of real values that specify the high and low engineering scale and change delta of a particular real input. For a given block, Range Input also forms an association with a group of real input parameters that have the same designated range and change delta.

RINP
: Real Input is an input in the RIN block that can be used when SIMOPT is used to simulate the real input value from the field device. When SIMOPT is not used, RINP contains the selected field device input value.

ROCV
: Rate of Change Limit is a real input that specifies the threshold for Rate of Change violation in engineering units per 100 ms for the analog input when PNT_NO is set to CURRENT in support of FBM214, FBM216,

FBM244 and FBM245. If the normalized A/D channel input experiences a bipolar Rate of Change violation, the channel status is set BAD. The default value of 0.0 disables this feature.

SCI

Signal Conditioning Input is used in converting between normalized raw count and engineering units. See "Signal Conditioning (SCI) Values" on page 2187 for the signal conditioning values.

SEVSTS

This parameter is currently not supported by any FBM or field device.

SIMOPT

Simulation Option is a configurable parameter that specifies whether the DCI block input value is to be simulated. When SIMOPT is configured 1 (True), there is no DCI connection established for the block. The status and data values of RINP are not recovered from the field. RINP, which is normally secured, is released (provided it is unlinked) and becomes available for entry of simulated values.

Such simulated values are limited by HSCI1 and LSCI1. If this limiting action forces a clamping of the entered value, the status of RINP is set to Limited High or Limited Low, as appropriate.

The basic actions of Auto and Manual modes are still observed when SIMOPT is 1 (True). If the block is in Auto mode, the status and value of RINP (including any Limited High or Limited Low bits) is copied to the status and value of MEAS. If in Manual mode, RINP is not copied to MEAS. As noted in Section 110.5.9, manual sets to MEAS are first limited by the range limits of HSCI1 and LSCI1 before being accepted.

TSTAMP

The Time Stamp parameter of the block is updated every time there is a change in the value of MEAS. In Auto mode, this means that the field input value in RINP is changed. In Manual mode, it means that a new manual value is set into MEAS. TSTAMP, which is expressed in units of milliseconds past midnight, is read from the FBM, when it is available there; otherwise, it is computed by the I/A Series control station.

TYPE

When you enter RIN or select it from a configurator list, an identifying integer is created specifying this block type. For this block, the value of TYPE is 149.

UPDPER

Update Period is a configurable non-settable long integer that specifies the update period for certain types of client/server access to FOUNDATION fieldbus H1 devices and PROFIBUS slave devices:

- For the FBM228, the parameter defines the update period for client/server access to device block parameters, as described in *Implementing FOUNDATION fieldbus on an I/A Series System* (B0700BA), *Implementing FOUNDATION fieldbus* (B0750BC) or *Implementing FOUNDATION fieldbus in Foxboro Control Software Applications* (B0750DA). The parameter is not used for publisher/subscriber connections.
- For the FBM222, the parameter defines the update period for acyclic communication between the FBM222 and the

PROFIBUS slave device, as described in *Implementing PROFIBUS Networks in Foxboro Control Software Applications* (B0750BE). The parameter is not used for cyclic communications.

UNACK *CP270 and Later Only*	Unacknowledged is a Boolean output parameter that is set True for notification purposes whenever the block goes into alarm. It is settable, but sets are only allowed to clear UNACK to False, and never in the opposite direction. UNACK is cleared by an operator "acknowledge" pick on a default display, a user display, or the alarms display.
VALSTS	Value Status is an output parameter of any DCI block that contains the value status of a FOUNDATION fieldbus function block parameter value or PROFIBUS-PA parameter provided by a DCI connection to a field device. For other fieldbus types, VALSTS is meaningless. Bits 0-1: Limits: 0 = Not limited 1 = High limited 2 = Low limited 3 = High and Low limited Bits 2-5: Substatus (definition depends on Quality) Bits 6-7: Quality: 0 = Bad 1 = Uncertain 2-3 = Good Note: Bit 0 is the least significant, low order bit. Each time the RIN block is executed, VALSTS reports the status of the FOUNDATION fieldbus or PROFIBUS_PA value from the information in the DCI connection.
VUMEAS	This parameter is currently not supported by any FBM or field device.

110.5 Functions

110.5.1 Detailed Diagram

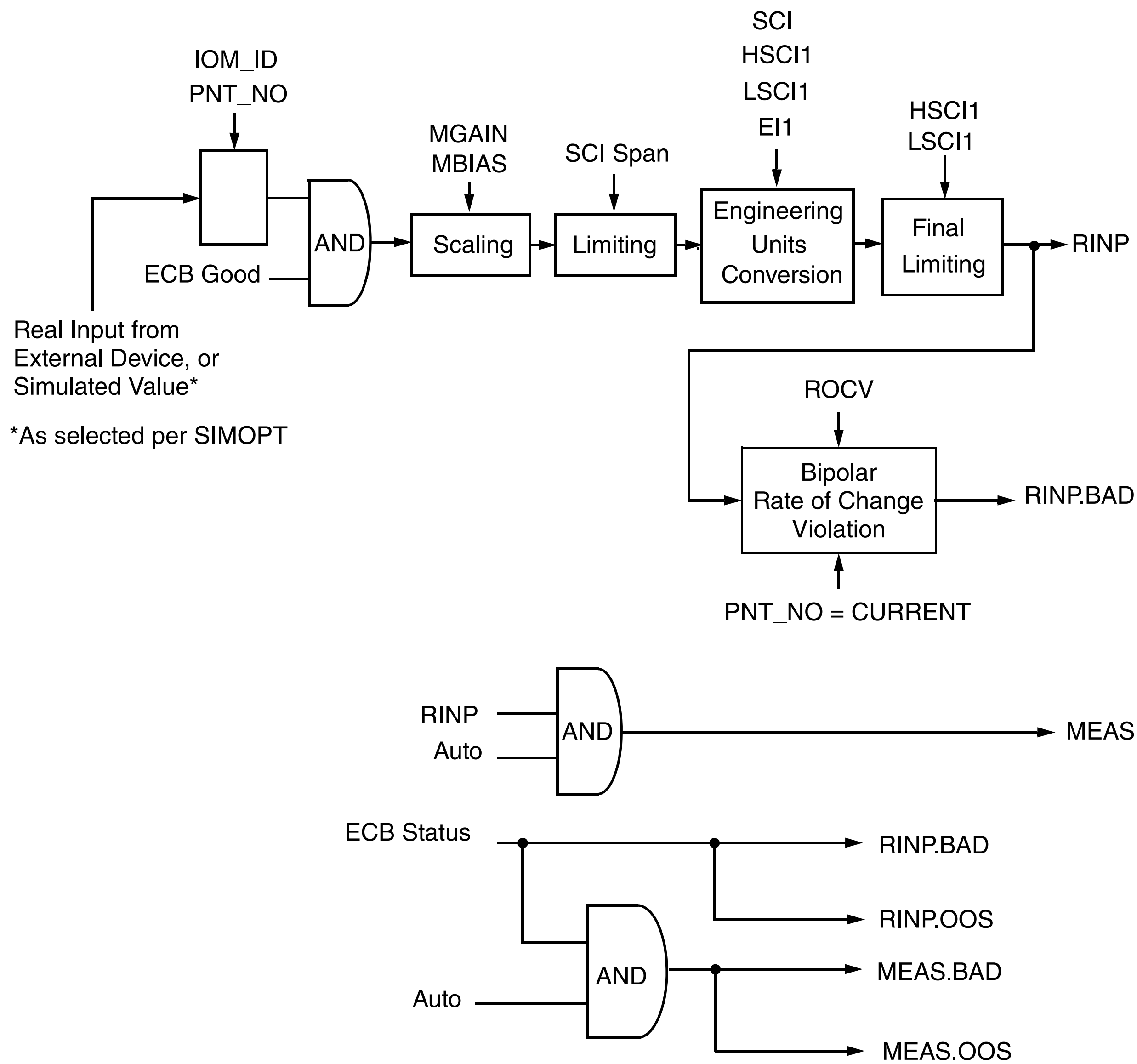


Figure 110-2. RIN Block Operational Diagram

110.5.2 Associated ECBs

The configured parameter IOM_ID in the RIN block specifies an ECB201 (the "Device ECB") to connect to a field parameter that resides in a field device hosted by an ECB200 or ECB202 (the "FBM ECB").

The PARENT parameter of the ECB201 specifies the associated FBM ECB hosting the field device.

IOM_ID may also directly specify the parent FBM ECB to retrieve a parameter resident in the FBM itself.

110.5.3 DCI Connection

The RIN block establishes one DCI connection to the specified ECB at any one of the following times:

- ♦ The block is first installed.
- ♦ The I/A Series station in which it resides has just been rebooted.
- ♦ A parameter of the block has been modified by the ICC or FoxCAE configurator.
- ♦ A device or parent ECB specified by the RIN block has just been installed.

A DCI connection is added to a linked list of all the DCI connections, of any type, for all blocks specifying the same ECB. This arrangement permits multiple DCI blocks, of differing data types, to communicate with a single device at input/output scan time, on a scatter-gather basis. It also allows multiple DCI connections in the same DCI block to be established when required (for example, connections in redundant type DCI blocks such as this one, or for INI_PT connections in output type blocks).

The DCI connection is deleted (that is, the linkage is removed from the linked list for the ECB) when the RIN block is deleted.

110.5.4 Origin of Input Data

The device address supplying the input value is configured as a string in PNT_NO. If PNT_NO is null, the block is set undefined.

The format of PNT_NO is device specific. When the PIO maintenance task runs after the DCI connection has been made (see Section 110.5.3), the PNT_NO string used by the block is passed to the FBM for parsing and validation. (In DCI blocks, point identification strings are not parsed by the I/A Series station.)

If the first character of PNT_NO is blank, the PNT_NO string is not sent to the FBM, and the block is set undefined, with ERCODE = 52. The detail display shows "W52 – INVALID I/O CHANNEL/GROUP NUMBER".

In each of the following cases, the block is also set undefined:

- ♦ If HSCI1 ≤ LSCI1, the detail display shows "W44 – INVALID ENGINEERING RANGE" with ERCODE = 44.
- ♦ If the SCI is out of range for this block, the detail display shows "W50 – INVALID SIGNAL CONDITIONING INDEX" with ERCODE = 50.
- ♦ If the FBM parsing algorithm finds that PNT_NO is invalid, the detail display shows "W65 – INVALID POINT ADDRESS" with ERCODE = 65.

- If there is a duplicate connection to any point, the detail display shows “W66 – DUPLICATE CONNECTION” with ERCODE = 66.
- If there is no available memory in the FBM, or if the maximum number of connections have been allocated in the FBM, the detail display shows “W67 – INSUFFICIENT FBM MEMORY/CONNECTIONS” with ERCODE = 67.
- If the device connection is invalid, the detail display shows “W68 – INVALID DEVICE CONNECTION” with ERCODE = 68.
- If the point connection is invalid, the detail display shows “W69 – INVALID POINT CONNECTION” with ERCODE = 69.

In the following case, the block remains defined:

- If the connection is not yet resolved, the detail display shows “W62 – UNRESOLVED CONNECTION” with ERCODE = 62.

110.5.5 Processing of Input Point Status

The status of PNT_NO input is checked, together with the status of the ECB. Then the status of the RINP parameter is set according to the following rules.

The status of RINP is set to Out-of-Service if one or more of the following conditions exist:

- The device ECB status indicates that the field device is Off-line or Out-of-Service
- The DCI connection cannot be configured due to lack of configuration information in the FBM database.
- The DCI is not yet connected (that is, the PIO maintenance task has not yet sent the DATA_CONNECT message to the FBM for the linked-list addition described in Section 110.5.3).
- The DCI connection status information, which specifies the condition of the accessed device parameter, indicates Out-of-Service, meaning (in general) that the parameter value is unavailable.
- The connection status information indicates Disconnected, meaning (in general) that the parameter is not connected or not defined.
- The connection status information indicates that the connection is not yet resolved. The detail display shows “W62 – UNRESOLVED CONNECTION” with ERCODE = 62.
- An ECB201 is specified, and the ECB device status indicates that the DCI connection is unresolved.

The status of RINP is set to Bad if:

- The device ECB status indicates that the field device has failed, or
- The DCI connection status information indicates a bad value of the field device parameter, or
- The normalized analog channel input experiences a bipolar Rate of Change violation when PNT_NO is set to CURRENT in support of an analog current (mA) input from a HART device via FBM214 or FBM216.

The status of RINP is set to Error if the status information indicates an uncertain or questionable value of the field device parameter.

The status of RINP is set to Limited High or Limited Low (as appropriate) if:

- Either one of the limiting actions (normalized raw count and/or engineering units), described in Section 110.5.6, forces a clamping of the value.
- The DCI connection status information indicates that the field device parameter is limited high or limited low.

110.5.6 Processing of Input Point Data

The raw value from the external device is first scaled into the I/A Series system normalized raw count range by application of MGAIN and MBIAS:

I/A Series System Normalized Raw Count = (Input Raw Value)(MGAIN) + MBIAS

The resulting value is limited to be within the normalized range for the configured value of SCI. (See “Signal Conditioning (SCI) Values” on page 2187 for SCI values.)

This limited I/A Series system normalized raw count value is then converted into engineering units by application of the signal conditioning index SCI and the engineering range limits HSCI1 and LSCI1:

Engineering Units =
((I/A Series Normalized Raw Count - Span Low Limit)(HSCI1 - LSCI1)/span) + LSCI1

For example, if the SCI is linear 1600-64000, the span low limit is 1600, and the span is 64000-1600 or 62400.

The final step in input conditioning consists of limiting the engineering units value to within the engineering range limits, HSCI1 and LSCI1.

110.5.7 Auto/Manual Switching

The Auto/Manual mode selection arbitrates between inputs by the operator (Manual) and inputs from the field (Auto). Parameters MA and INITMA are used to establish the control mode of the RIN block.

110.5.8 Operation in Auto Mode

In Auto mode, MEAS is secured. The Bad, Out-of-Service, Error, Limited High, Limited Low status bits of RINP replace the corresponding status bits of MEAS. If RINP is neither Bad nor Out-of-Service, the value of RINP is copied to the value of MEAS. If RINP is either Bad or Out-of-Service, MEAS remains at its last good value.

110.5.9 Operation in Manual Mode

In Manual mode, neither the status nor the value of RINP is copied to MEAS. MEAS is released and becomes available for manual sets. Such sets are limited to the range limits, HSCI1 and LSCI1 before being accepted.

RINP continues to monitor the value from the field at the specified external device point.

110.5.10 Last Good Value

Key Parameters: LASTGV, MEAS, HSCI1, LSCI1, OSV, SCI, BADOPT

In the following situations, parameter LASTGV only takes effect when BADOPT is configured for LOOR , HOOR, or both.

- In linear/square root signal conditioning, if the raw value is beyond the upper or lower value of the span, as adjusted by OSV, MEAS retains its value from the last cycle.

- When an out-of-range condition occurred due to HSCI1/LSCI1 clamping, MEAS retains its value from the last cycle only if SCI = 0 (no linearization.)

Retention of the MEAS value from the last cycle is independent of BADOPT when MEAS goes out-of-service, regardless of the value of LASTGV.

110.5.11 Filtering (CP270 and Later Only)

With I/A Series software v8.4 or later, the RIN block provides an optional filtering as the final signal processing step on the FCP280, FCP270 and ZCP270. This option is not available on any other control processors.

Key Parameters: FLOP, FTIM

Filtering introduces a lag to changes in the input signal, thus smoothing input changes or suppressing noise. Note that this feature should be used with caution to avoid removing true process information.

Filtering options are applied only when the block is in Auto mode. The options are set in the FLOP parameter as follows:

- FLOP=0, no filtering
- FLOP=1, first-order lag filtering
- FLOP=2, second-order Butterworth filtering
- FLOP=3, two-sample-average filtering.

The lag that first or second-order filtering introduces has time constant Filter Time (FTIM). You can use them to attenuate measurement noise. However, if FTIM is set too low, there is relatively insignificant filtering. If set too high, the lag may be large enough to affect loop accuracy.

In addition to filtering, aliasing is minimized and resolution improved by configuring the RES parameter of the ECB so that the fieldbus integration time is equal to twice the block period. Refer to the section “Fieldbus Integration Time” in the appropriate *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

110.5.11.1 First Order Lag Filtering (FLOP = 1)

The algorithm of this filter is

Filter Output = RINP + (Filter Input - PNT) / (τ+ 1)

where PNT is the present value of the block output, which was actually calculated during the previous block processing cycle. τ represents the number of block processing cycles for the output to reach approximately 63 percent of its ultimate value after a step change to the input; it is computed as follows:

τ = 60 * FTIM / Block Period in Seconds

In Laplace transform notation, the transfer function is $1/(1 + \tau s)$.

Figure 110-3 is a diagram of first-order lag filtering.

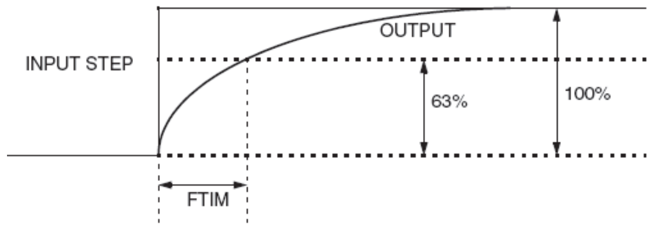


Figure 110-3. First-Order Lag Filtering

110.5.11.2 Butterworth Filtering (FLOP = 2)

The algorithm of this filter is:

New vter = Old vter + (Filter Input - RINP - Old vter) / (τ/2 + 1)

Filter Output = RINP + New vter / (τ + 1)

where τ is computed as in the case of first order lag filtering.

In each block execution cycle, the first step is the computation of New vter, based on the stored value of Old vter from the last cycle (when the filter is initialized the value of Old vter is set to 0.0). As before, RINP is the current value of the block output.

In Laplace transform notation, the transfer function is:

$$\frac{1}{1 + \tau s + (\tau s)^2/2}$$

Figure 110-4 is a diagram of Butterworth filtering.

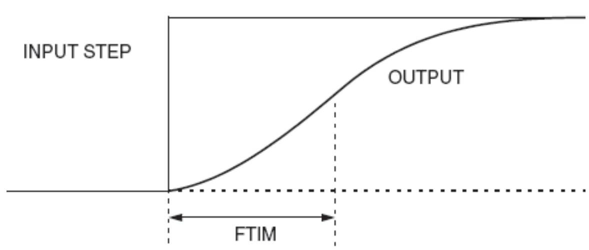


Figure 110-4. Butterworth Filtering

110.5.11.3 Two-Sample-Average Filtering (FLOP = 3)

The algorithm of this filter is:

Filter Output = (Filter Input this cycle + Filter Input previous cycle)/2.

This algorithm eliminates integer multiples of the half-sampling frequency component and attenuates other high frequencies. The filter has a flatter low frequency pass band and sharper cutoff than the other two filters, with the same low-frequency phase shift.

110.5.12 Alarming (CP270 and Later Only)

With I/A Series software v8.4 or later, the RIN block operating on the FCP280, FCP270 or ZCP270 supports the Bad I/O, Out-of-Range, High/Low Absolute, and High-High/Low-Low Absolute alarm types. The functionality of these alarm types is discussed in *Control Processor 270*

(CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts (B0700AG). The nomenclature for identical alarm types varies from block to block for historical reasons involving backward compatibility requirements. Table 110-5 shows the nomenclature for the RIN block.

Table 110-5. RIN Block Alarm Nomenclature

Type	Option	Limit	Priority	Group	Text	Deadband
I/O Bad	BAO=1	--	BAP	BAG	BAT	--
Out-of-Range	ORAO=1	--	ORAP	ORAG	ORAT	OSV
High Absolute	HLOP= 1 or 2	HAL	HLPR	HLGP	HAT	HLDB
Low Absolute	HLOP= 1 or 3	LAL	HLPR	HLGP	LAT	HLDB
High-High Absolute	HHAOPT = 1 or 2	HHALIM	HHAPRI	HHAGRP	HHATXT	HLDB
Low-Low Absolute	HHAOPT = 1 or 3	LLALIM	HHAPRI	HHAGRP	LLAGTXT	HLDB

The column titled “Option” in Table 110-5 specifies the required parameter configuration to enable or disable the actual alarming of any the six alarm types.

110.5.13 Alarm Conditions

Following are the conditions for detection and reporting of each of the six alarm types:

- Bad I/O: The status of RINP or the status of MEAS is set BAD
- Out-of-Range: The value of RINP is greater the limit defined by HSCI1 and OSV (HOR=1) or less than the low limit set by LSCI1 and OSV (LOR=1)
- High Absolute: The value of RINP exceeds the limit set in HAL by the deadband specified in HLDB
- Low Absolute: The value of RINP is less than the lower limit set in LAL by the deadband specified in HLDB
- High-High Absolute: The value of RINP exceeds the limit set in HHALIM by the deadband specified in HLDB
- Low-Low Absolute: The value of RINP is less than the lower limit set in LLALIM by the deadband specified in HLDB

110.5.14 Alarm Processing

When MANALM=0, the block provides alarming in Auto mode only; when MANALM=1, the block performs alarming in both Auto and Manual modes.

An alarm message is generated for the when the specific alarm option is set and the condition is detected. The alarm message is sent to all devices in the alarm group specified by the group parameter (see Table 110-5). This message contains text string identifying the alarm condition, the descriptor in the text parameter (Table 110-5), and the loop identifier in the LOOPID parameter.

When the input value becomes good, a corresponding return-to-normal message is generated and sent to all devices in the bad alarm group.

When the alarm is detected, the following parameters and bits are set:

- The alarm type bit in the alarm status parameter:

  ALMSTA.BAD

  ALMSTA.OOR

  ALMSTA.HMA

  ALMSTA.LMA

  ALMSTA.HHA

  ALMSTA.LLA

- UNACK parameter and the corresponding ALMSTA.UNACK bit
- CRIT parameter and its corresponding ALMSTA.CRIT are according to the priority parameter for the alarm type (Table 110-5)
- PRTYPE parameter and its corresponding ALMSTA.PRTYPE field are set to the alarm type.

When the input value has returned to good status, CRIT, PRTYPE and their corresponding fields in ALMSTA are cleared.

The UNACK parameter and the ALMSTA.UNACK bit are cleared in these cases:

- When the alarm is acknowledged by an OM set operation at either the compound level (by setting the compound UNACK=0) or at the block level (by setting the block UNACK=0).
- When the input value returns to good status and INHOPT is set appropriately.
- When the block is shut down.

When UNACK is cleared, an Alarm Acknowledge message is generated and sent to all devices in the bad alarm group.

Alarm Inhibiting/Disabling are supported using a combination of the compound CINHIB parameter and the INHOPT and INHIB parameters in the RIN block, to allow the bad alarm messages to be inhibited and/or the alarm detection to disabled dynamically.

When the alarms are inhibited or disabled, an appropriate Alarm Disable message is generated and sent to all devices in the respective alarm group. If the Alarm is unacknowledged, an Alarm Acknowledge message is also sent to these devices, and the ALMSTA.INHIB bits are set.

When alarms are uninhibited or enabled, an appropriate Alarm Enable message is generated and sent to all devices in the respective alarm group. If all alarms are uninhibited, the ALMSTA.INHIB bits are cleared.

Parameters NASDB and NASOPT provide control of nuisance alarms by applying a delay (set in NASDB) to return-to-normal condition (NASOPT=0), to alarm detection (NASOPT=1) or to both (NASOPT=2).

The Alarm Message Regeneration Time Interval (AMRTIN) parameter specifies the rate at which alarm messages are generated for alarm conditions that have not been cleared. The interval is specified in seconds. The configured interval is rounded up to the closest value that is an even multiple of the station BPC. A value of 0 disables alarm message regeneration. Refer to *Control Processor*

270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts (B0700AG) on alarm regeneration.

110.6 Signal Conditioning (SCI) Values

NOTE

Valid SCI values for the RIN block are 0-7, 9-15, and 50-59, all inclusive.

SCI = 0: No Linearization
Result is (value)

SCI = 1: Linear (0 to 64000)
Result is (value * span + offset)

SCI = 2: Linear (1600 to 64000)
Result is ((value - 1600.0) * span + offset)

SCI = 3: Linear (12800 to 64000)
Result is ((value - 12800.0) * span + offset)

SCI = 4: Square Root (0 to 64000)
Result is (sqrt (64000.0 * value) * span + offset)

SCI = 5: Square Root (12800 to 64000), Clamped
If (value <= 12800.0) result is (offset)
Otherwise, result is (sqrt (51200.0 * (value - 12800.0)) * span + offset)

SCI = 6: Square Root, Low Cutoff (0 to 64000), Clamped < 3/4%
If (value <= 480.0) result is (offset)
Otherwise, result is (sqrt (64000.0 * value) * span + offset)

SCI = 7: Square Root, Low Cutoff (12800 to 64000), Clamped < 3/4%
If (value <= 13184.0) result is (offset)
Otherwise, result is (sqrt (51200.0 * (value - 12800.0)) * span + offset)

SCI = 9: Linear, Low Cutoff (1600 to 64000)
If (value <= 1600.0) result is (offset)
Otherwise, result is ((value - 1600.0) * span + offset)

SCI = 10: Linear, Low Cutoff (12800 to 64000)
If (value <= 12800.0) result is (offset)
Otherwise, result is ((value - 12800.0) * span + offset)

SCI = 11: Square Root (IT2 signal)
Result is (sqrt (value))

SCI = 12: Linear (2 - 10 V)
Result is ((value - 14080.0) * span + offset)

SCI = 13: Square Root (2 - 10 V), clamped
If (value <= 14080.0) result is (offset)
Otherwise, result is (sqrt (49920.0 * (value - 14080.0)) * span + offset)

SCI = 14: Linear (0 - 16383)
Result is (value * span + offset)

SCI = 15:	Square root (0 - 10 V), clamped Result is (sqrt (62400.0 * (value - 1600.0)) * span + offset);	
SCI = 50:	Linear (0 to 65535)	y = (HSCI1-LSCI1)/65535 * x + LSCI1
SCI = 51:	Linear (-32768 to 32767)	y = (HSCI1-LSCI1)/65535 * (x + 32768) + LSCI1
SCI = 52:	Linear (0 to 32767)	y = (HSCI1-LSCI1)/32767 * x + LSCI1
SCI = 53:	Linear (0 to 1000)	y = (HSCI1-LSCI1)/1000 * x + LSCI1
SCI = 54:	Linear (0 to 999)	y = (HSCI1-LSCI1)/999 * x + LSCI1
SCI = 55:	Linear (0 to 2048)	y = (HSCI1-LSCI1)/2048 * x + LSCI1
SCI = 56:	Linear (409 to 2048)	y = (HSCI1-LSCI1)/1639 * (x – 409) + LSCI1
SCI = 57:	Square Root (0 to 2048)	y = sqrt (2048 * x) * (HSCI1-LSCI1)/2048 + LSCI1
SCI = 58:	Square Root (409 to 2048)	y = sqrt (1639 * (x - 409))* (HSCI1-LSCI1)/1639 + LSCI1
SCI = 59:	Linear (0 to 4095)	y = (HSCI1-LSCI1)/4095 * x + LSCI1

The following notes apply to SCI = 50 through SCI = 59:

- y = engineering units value; x = normalized counts value
- Linear scaling of the analog inputs is also provided.
- In the RIN block, linear scaling is applied before the signal conditioning algorithm is applied. The GAIN and BIAS parameters are used in the linear equation:

  x = GAIN (x + BIAS)

111. RINR – Redundant Real Input Block

This chapter covers the Redundant Real Input (RINR) block features, parameters and functions.

> **NOTE**
> *CP270 and Later Only* indicates RIN features supported only on the Field Control Processor 270 (FCP270) and Z-form Control Processor 270 (ZCP270) with I/A Series software v8.4 or later, or on any later control processors such as the Field Control Processor 280 (FCP280) with I/A Series software v9.0 or later.

111.1 Overview

The Redundant Real Input (RINR) block is a Distributed Control Interface (DCI) block. (DCI blocks support connectivity of I/A Series control stations to various bus resident devices via a general purpose interface.) RINR receives one real value from a field device. The source of the value can be specified as either two or three redundant inputs. The redundant inputs can either be in the same device or in different devices. Each of the redundant inputs is independently scaled, limited, and converted into engineering units before the block's selection algorithm is invoked to determine which of the two or three inputs is set into parameter RINP.

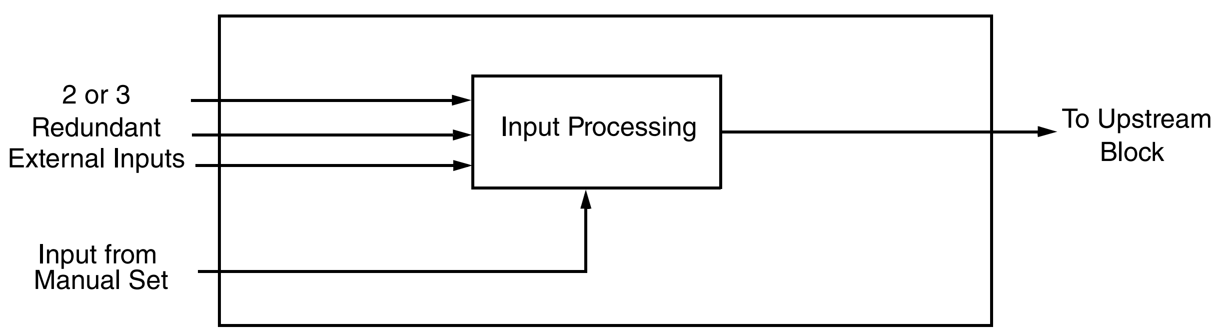


Figure 111-1. RINR Block Diagram

111.2 Basic Operation

The Redundant Real Input (RINR) block receives inputs from 1, 2, or 3 device ECBs. The inputs contain real values read from RI1_PT, RI2_PT, and RI3_PT in the device ECBs specified by IOMID1, IOMID2, and IOMID3 respectively. The ECBOPT parameter determines whether the redundant inputs are from the same device or in different devices. The ARBOPT parameter enables the block to consider either two or three redundant inputs. The block's selection algorithm then determines which of the two or three input values is presented to the control strategy as the block output RINP. In Auto mode, this value is copied to parameter Real Measurement

(MEAS). In Manual mode, it is not copied to MEAS, and you can set the value of MEAS.

With I/A Series software V8.4 or later, the RINR block operating on the FCP280, FCP270 or ZCP270 provides a variety of alarm detection and reporting features, including alarming for Bad I/O, out-of-range values, and two sets of high and low limits. Alarm options include user control of alarm generation, suppression of nuisance alarms, and optional alarming when the block is in manual mode. Alarming is not supported on other control processors. If alarms are desired, a separate AIN block can be used with a connection to the MEAS and RIN_x parameters of the RINR block.

111.3 Features

The RINR block provides the following features:

- Reads one real input value from two or three redundant inputs
- In Auto mode, copies its output to the Real Measurement (MEAS) parameter
- In Manual mode, enables manual setting of the MEAS parameter.

The RINR block supports these additional features on the FCP280, or on the FCP270 and ZCP270 with I/A Series software v8.4 or later:

- Alarm detection and reporting for Bad I/O, out-of-range values, high/low absolute limits and high-high/low-low absolute limits, in both Auto and Manual mode
- Workstation locking
- User-set output variance limits to control out-of-range alarm generation
- Configurable signal filtering to smooth output and suppress noise
- Quality Status (QALSTA) parameter that provides value record status, block status and alarm status in a single connectable output parameter
- Parameters RAW_1, RAW_2, and RAW_3 provide access to the raw values from the FBMs.

111.4 Parameters

Table 111-1. RINR Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
Configurable Parameters					
INPUTS					
NAME	block name	string	no-con/no-set	2 blanks	1 to 12 chars
TYPE	block type	short integer	no-con/no-set	RINR_TYPE	112
DESCRP	block description	string	no-con/no-set	2 blanks	1 to 32 chars
PERIOD	block sample time	short integer	no-con/no-set	1	0 to10, and 13 for CPs, 0 to 12 for Gateways
PHASE	block execution phase	short integer	no-con/no-set	0	period specific
LOOPID	loop/unit/batch identifier	string	no-con/set	2 blanks	1 to 32 chars
IOMID1	primary ECB identifier	string	no-con/no-set	2 blanks	1 to 12 chars
IOMID2	secondary ECB identifier	string	no-con/no-set	2 blanks	1 to 12 chars

Table 111-1. RINR Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
IOMID3	tertiary ECB identifier	string	no-con/no-set	2 blanks	1 to 12 chars
RI1_PT	real input 1 address	string	no-con/no-set	blanks	1 to 32 chars, or device specific
RI2_PT	real input 2 address	string	no-con/no-set	blanks	1 to 32 chars, or device specific
RI3_PT	real input 3 address	string	no-con/no-set	blanks	1 to 32 chars, or device specific
MA	manual/auto switch	boolean	con/set	0	0 to 1
INITMA	initialize manual/auto	short integer	no-con/no-set	1	0 to 2
ARBLIM	arbitration limit	real	no-con/no-set	0.0	any real>=0.0
ARBOPT	arbitration option	boolean	no-con/no-set	0	0 to 1
ECBOPT	redundant ECB optn	boolean	no-con/no-set	0	0 to 1
EI1	engineering units	string	no-con/no-set	%	1 to 6 chars
HSCI1	high scale input	real	no-con/no-set	100.0	>LSCI1
LSCI1	low scale input	real	no-con/no-set	0.0	<HSCI1
MBIAS	measurement bias	real	no-con/set	0.0	any real
MGAIN	measurement gain	real	no-con/set	1.0	any real
RI1	input range 1	real (3)	no-con/no-set	HSCI1, LSCI1	---
RIN_1	primary real input	real	con/no-set	0	RI1
RIN_2	secondary real input	real	con/no-set	0	RI1
RIN_3	tertiary real input	real	con/no-set	0	RI1
RINP	real input	real	con/set	0	RI1
ROCV	rate of change limit	real	con/set	0.0	any real
OSV	output span variance	real	no-con/no-set	02.	[0 to 25] percent
BADOPT	BAD/out of range option	short integer	no-con/no-set	3	0 to 3
LASTGV	last good value	boolean	no-con/no-set	0	0 to 1
OOROPT	out of range option	boolean	no-con/no-set	1	0 to 1
INHOPT	inhibit option	short	no-con/no-set	0	0 to 3
INHIB	alarm inhibit	boolean	con/set	0	0 to 1
INHALM	inhibit alarm	packed b	con/set	0	0 to 0xFFFF
MANALM	manual alarm option	short integer	no-con/set	0	0 to 1
FLOP	filter option	short integer	no-con/set	0	0 to 3
FTIM	filter time constant	real	con/set	0.0	minutes
BAO	bad alarm option	boolean	no-con/no-set	0	0 to 1
BAT	bad alarm text	string	no-con/no-set	blank	1 to 32 chars
BAP	bad alarm priority	integer	con/set	5	1 to 5
BAG	bad alarm group	short	no-con/set	1	1 to 8
ORAO	out of range alarm option	boolean	no-con/no-set	0	0 to 1
ORAT	out of range text	string	no-con/no-set	blank	1 to 32 chars
ORAP	out of range priority	integer	con/set	5	1 to 5
ORAG	out of range group	short	no-con/set	1	1 to 8
HLOP	high/low alarm option	short	no-con/no-set	0	0to 3
ANM	point alarm name	string	no-con/no-set	blank	0 to 12 chars
HAL	high alarm limit	real	con/set	100.0	RO1
HAT	high alarm text	string	no-con/no-set	blank	0 to 32 chars
LAL	low alarm limit	real	con/set	0.0	RO1

Table 111-1. RINR Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
LAT	low alarm text	string	no-con/no-set	blank	0 to 32 chars
HLDB	high alarm deadband	real	no-con/set	0.0	RO1
HLPR	high alarm priority	integer	con/set	5	1 to 5
HLGP	high alarm group	short	no-con/set	1	1 to 8
HHAOPT	high/high alarm option	short	no-con/no-set	0	0 to 3
HHALIM	high/high alarm limit	real	con/set	100.0	RO1
HHATXT	high/high alarm option	short	no-con/no-set	blank	0 to 32 chars
LLALIM	low/low alarm limit	real	con/set	0.0	RO1
LLATXT	low/low alarm option	short	no-con/no-set	blank	0 to 32 chars
HHAPRI	high/high alarm priority	integer	con/set	0.0	---
HHAGRP	high/high alarm group	short	no-con/set	1	1 to 8
AMRTIN	alarm regeneration timer	integer	no-con/no-set	0	0 to32767 sec
NASTDB	nuisance alarm suppression deadband	long integer	no-con/set	0	0 to 2147483647
NASOPT	nuisance alarm suppression option	short	no-con/set	0	0 to 2
SCI	signal conditioning index	short integer	no-con/no-set	0	0 to 15 and 50 to 59
SELOPT	select option	short integer	no-con/no-set	1	0 to 3
SIMOPT	simulation option	boolean	no-con/no-set	0	0 = no simulation 1 = simulation
UPDPER	parm update period	integer	no-con/no-set	10000ms	0 to 2147483647 ms
Non-Configurable Parameters					
OUTPUTS					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
ALMSTA	alarm status	packed long	con/no-set	0	bit map
BLKSTA	block status	packed long	con/no-set	0	0 to 0xFFFFFFFF
CRIT	alarm criticality	integer	con/no-set	0	0 to 5
HOR	high out of range	boolean	con/no-set	0	0 to 1
INHSTA	inhibit status	packed long	con/no-set	0	0 to 0xFFFFFFFF
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
RAW1	raw 1	real	con/no-set	0.0	0 to 65535
RAW2	raw 2	real	con/no-set	0.0	0 to 65535
RAW3	raw 3	real	con/no-set	0.0	0 to 65535
LOR	low out of range	boolean	con/no-set	0	0 to 1
MEAS	real input	real	con/set	0.0	RI1
PRTYPE	priority type	integer	con/no-set	0	0 to 8
QALSTA	quality status	pack_b	con/no-set	0	0 to 0xFFFF
SELECT	selection indicator	short integer	con/no-set	0	0 to 3
SEVSTS*	(reserved)	integer	con/no-set	0	0 to 300
TSTAMP	time stamp	long integer	con/no-set	0	ms after midnight
UNACK	unacknowledged alarm	boolean	con/no-set	0	0 to 1
VALSTS	FF value status	integer	con/no-set	0	0 to 0xFFFF
VUMEAS*	(reserved)	real	con/no-set	0.0	any real>0
DATA STORES					

Table 111-1. RINR Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
ALMOPT	alarm options	packed long	no-con/no-set	0	0 to 0xFFFFFFFF
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
DEVID1	primary device identifier	character	no-con/no-set	2 blanks	1 to 6 characters
DEVID2	secondary device identifier	character	no-con/no-set	2 blanks	1 to 6 characters
DEVID3	tertiary device identifier	character	no-con/no-set	2 blanks	1 to 6 characters
ERCODE	configuration error	string	no-con/no-set	2 blanks	1 to 43 chars
OWNER	owner name	string	no-con/set	2 blanks	1 to 32 chars

* Not currently supported.

111.4.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

ALMOPT
(CP270 and Later Only)

Alarm Options contain packed long values representing the alarm types that have been configured as options in the block, and the alarm groups that are in use. Table 111-2 shows how the parameter is used by the RINR block.

Table 111-2. ALMOPT Parameter Format

Bit Number[1] (0 to 31)	Configured Alarm Option, When True
0 (lsb)	Alarm Group 8 in Use
1	Alarm Group 7 in Use
2	Alarm Group 6 in Use
3	Alarm Group 5 in Use
4	Alarm Group 4 in Use
5	Alarm Group 3 in Use
6	Alarm Group 2 in Use
7	Alarm Group 1 in Use
16	Low Absolute Alarm Configured
17	High Absolute Alarm Configured
22	Bad I/O Alarm Configured (set if BAO = 1)
24	Low-Low Absolute Alarm Configured
25	High-High Absolute Alarm Configured
28	Out-of-Range Alarm Configured

1. Bit 0 is the least significant, low order bit.

ALMSTA
(CP270 and Later Only)

Alarm Status is a 32-bit output, bit-mapped to indicate the block's alarm states. Table 111-3 shows the bits used by the RINR block.

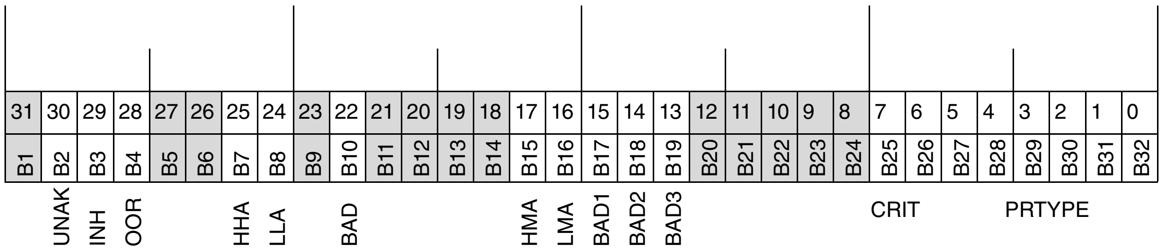


Table 111-3. ALMSTA Parameter Format

Bit Number (0 to 31)*	Name	Description, When True	Boolean Connection (B32 to B1)
0 to 4	PTYP_MSK	Priority Type: See "PRYTPE" on page 2205 for values used in the RINR block	---
5 to 7	CRIT_MSK	Criticality: 1 (highest priority) to 5	---
13	BAD3	Tertiary point is Bad	ALMSTA.B19
14	BAD2	Secondary point is Bad	ALMSTA.B18
15	BAD1	Primary point is Bad	ALMSTA.B17
16	LMA	Low Absolute Alarm	ALMSTA.B16
17	HMA	High Absolute Alarm	ALMSTA.B15
22	BAD	Bad I/O Alarm	ALMSTA.B10
24	LLA	Low-Low Absolute Alarm	ALMSTA.B8
25	HHA	High-High Absolute Alarm	ALMSTA.B7
28	OOR	Out-of-Range Alarm	ALMSTA.B4
29	INH	Inhibit Alarm. This bit is set when any of the block's alarms is inhibited	ALMSTA.B3
30	UNAK	Unacknowledged	ALMSTA.B2

*Bit 0 is the least significant, low order bit.

AMRTIN
(CP270 and Later Only)

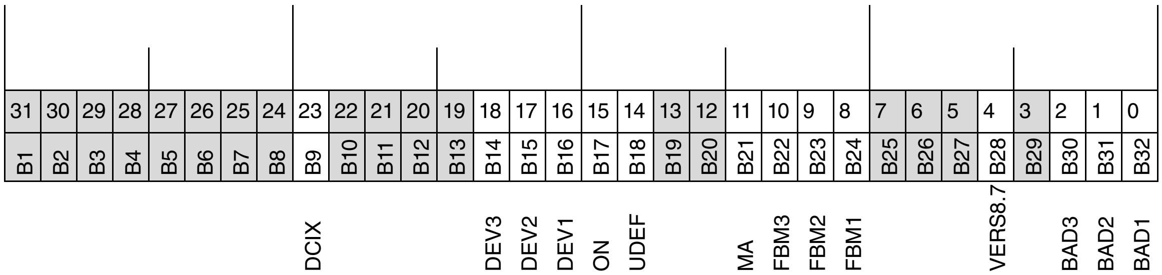
Alarm Message Regeneration Time Interval specifies the rate at which alarm messages are generated for alarm conditions that have not been cleared. The interval is specified in seconds. The configured interval is rounded up to the closest value that is an even multiple of the station BPC. A value of 0 disables alarm message regeneration.

ANM

Alarm Name is a user-defined string of up to 12 characters which serves as a point descriptor label Bad alarm, state alarm and state change messages (for example, "PLT3 F2 SDR").

ARBLIM	Arbitration Limit is a configurable real value that represents the tolerance of the difference between pairs of redundant input values in an RINR block. This value, specified in engineering units, is used to determine whether the redundant input values agree or disagree.
ARBOPT	Arbitration Option is a Boolean input that specifies dual redundancy (DMR) or triple redundancy (TMR); 0 = False = DMR, 1 = True = TMR.
BADOPT *(CP270 and Later Only)*	Bad and Out-of-Range Option is a short integer option that specifies the conditions that set the BAD output true. Values are: ♦ 0 = Bad Status (RINP.BAD) only ♦ 1 = Bad Status (RINP.BAD) or Low Out-of-Range (LOR) ♦ 2 = Bad Status (RINP.BAD) or High Out-of-Range (HOR) ♦ 3 = Bad Status (RINP.BAD) or LOR or HOR. The default value is 3. Bad Status is a Logical OR of bad ECB status (that is, the FBM or FBC itself is bad) and bad channel status (that is, the connected point is bad). If there is no FBM or FBC connection, then Bad Status is considered to exist when MEAS is linked and has bad status.
BAG *(CP270 and Later Only)*	Bad Alarm Group is a short integer input that directs Bad alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.
BAO *(CP270 and Later Only)*	Bad Alarm Option is a configurable option that enables alarm generation for each state of RINP.BAD.
BAP *(CP270 and Later Only)*	Bad Alarm Priority is an integer input, ranging from 1 to 5, that sets the priority level of the Bad alarm (1 is the highest priority).
BAT *(CP270 and Later Only)*	Bad Alarm Text is a user-configurable text string of up to 32 characters, sent with the bad alarm message to identify it.

BLKSTA Block Status is a 32-bit output, bit-mapped to indicate various block operational states. For the RINR block, only the following bits are used:



Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
0	BAD1	Primary point is BAD *(CP270 and Later Only)*	BLKSTA.B32
1	BAD2	Secondary point is BAD *(CP270 and Later Only)*	BLKSTA.B31
2	BAD3	Tertiary point is BAD *(CP270 and Later Only)*	BLKSTA.B30
4	VERS8.7	Faceplate visibility bit for LASTGV parameter; enables RIN/RINR displays make the new parameter LASTGV visible on their configuration overlay (*I/A Series v8.7 or later Only*)	BLKSTA.B28
8	FBM1	Bad Status of primary ECB	BLKSTA.B24
9	FBM2	Bad Status of secondary ECB	BLKSTA.B23
10	FBM3	Bad Status of tertiary ECB	BLKSTA.B22
11	MA	Manual = 0, Auto = 1	BLKSTA.B21
14	UDEF	Block Undefined	BLKSTA.B18
15	ON	Block ON	BLKSTA.B17
16	DEV1	Primary Deviation ([RIN_1-RIN_2] > ARBLIM) *(CP270 and Later Only)*	BLKSTA.B16
17	DEV2	Secondary Deviation ([RIN_1-RIN_3] > ARBLIM) *(CP270 and Later Only)*	BLKSTA.B15
18	DEV3	Tertiary Deviation ([RIN_2-RIN_3] > ARBLIM) *(CP270 and Later Only)*	BLKSTA.B14
23	DCIX	Enhanced DCI block *(CP270 and Later Only)*	BLKSTA.B9

* Bit 0 is the least significant, low order bit.

CRIT *(CP270 and Later Only)* Criticality is an integer output that indicates the priority of the block's highest currently active alarm. The range is 1 (highest priority) to 5. An output of 0 indicates the absence of alarms.

DEFINE Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. (See ERCODE for the list of all possible validation errors in this block.) In that case, no further processing of the block occurs, including further validation of remaining parameters. To return DEFINE to a True value, you should correct all configuration errors and reinstall the block.

DESCRP
: Description is a user-defined string of up to 32 characters used to describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

DEVID1
: Primary Device Identifier is a character array that specifies the 6-character identifier of the first connected device. It is copied from the DEV_ID configured in the ECB specified by IOMID1.

DEVID2
: Secondary Device Identifier is a character array that specifies the 6-character identifier of the second connected device. It is copied from the DEV_ID configured in the ECB specified by IOMID2. If ECBOPT= 0, DEVID2 is ignored.

DEVID3
: Tertiary Device Identifier is a character array that specifies the 6-character identifier of the third connected device. It is copied from the DEV_ID configured in the ECB specified by IOMID3. If ECBOPT= 0, DEVID3 is ignored.

ECBOPT
: Redundant ECB Option specifies whether a single device ECB is to be used for all input points or each input point is to be associated with a separate device ECB. The latter is required if the redundant input points are in different devices. If ECBOPT is 0 (False), only one device ECB is used for all points and is specified by IOMID1 (IOMID2 and IOMID3 are ignored). If ECBOPT is 1 (True), then either two or three separate device ECBs are used depending on whether dual or triple redundancy is specified. This decision is based on the configured parameter ARBOPT.

EI1
: Engineering Units for Input Range 1 provides the engineering units text for the RINP and MEAS parameters. The value configured for this text string should be consistent with the values used for HSCI1 and LSCI1.

ERCODE
: Error Code is a character data store which indicates the type of configuration error which caused the block's DEFINE parameter to be set False, unless indicated otherwise (see meanings below). Validation of configured parameters does not proceed past the first error encountered by the block logic. Each nonzero value of ERCODE results in an explanatory message at the block's detail display. For the RINR block, the following list shows the messages you may see:

ERCODE Message	Meaning
W44 – INVALID ENGINEERING RANGE	HSCI1 ≤ LSCI1
W48 – INVALID BLOCK OPTION	"PRITIM = zero" is not allowed.
W50 – INVALID SIGNAL CONDITIONING INDEX	SCI is out of range for this block.

ERCODE Message	Meaning
W52 – INVALID I/O CHANNEL/GROUP NO.	RI1_PT, RI2_PT, or RI3_PT string is blank.
W62 – UNRESOLVED CONNECTION	Connection is not yet resolved. (Block remains defined.)
W65 – INVALID POINT ADDRESS	FBM parsing algorithm finds that a used BIx_PT is invalid.
W66 – DUPLICATE CONNECTION	There is a duplicate connection to a particular point.
W67 – INSUFFICIENT FBM MEMORY/CONNECTIONS	There is no available memory or point connections in the FBM.
W68 – INVALID DEVICE CONNECTION	The device connection is invalid.
W69 – INVALID POINT CONNECTION	The point connection is invalid.

If a DCI data connection cannot be resolved due to a lack of configuration information, the block is marked DEFINED but the value is marked OOS and one of the following strings is stored in ERCODE to indicate the configuration error:

W77 - FIELDBUS COMMUNICATIONS FAULT (FBM228 only)
W78 - INVALID FUNCTION BLOCK (FBM228 only)
W80 - FIELDBUS DEVICE NOT FOUND (FBM228 only)
W73 - FF FUNCTION BLOCK CONFIGURATION ERROR (FBM228 only).

If a DCI data connection cannot be resolved for any other reason, the block is marked UNDEFINED and one of the following strings is stored in ERCODE to indicate the configuration error:

W74 - FF FUNCTION BLOCK DDITEM MISMATCH (FBM228 only)
W75 - FF FUNCTION BLOCK DDMBR MISMATCH (FBM228 only)
W76 - INVALID FF MODE CONFIGURATION (FBM228 only)
W79 - INVALID PARAMETER INDEX (FBM228 only)
W81 - INVALID PARENT DCI ECB PERIOD/PHASE (FBM228 only).

FLOP
(CP270 and Later Only)

Filter Option is an option parameter that specifies the type of filtering that is applied to the signal before it is set into the RINP output. FLOP has the following values:

- 0 = No Filtering
- 1 = First Order Lag Filtering
- 2 = Butterworth Filtering
- 3 = Two-Sample Average Filtering

CAUTION

Using FLOP without configuring an arbitration limit (ARBLIM) may create a bump in the process.

FTIM *(CP270 and Later Only)*
: Filter Time is an input that represents the time in minutes for the output value to reach a certain percentage of its ultimate value after a step change to the input. For first order lag filtering this percentage is approximately 63 percent, and for Butterworth filtering it is approximately 50 percent. FTIM is not applicable to two-sample-average filtering.

CRIT *(CP270 and Later Only)*
: Criticality is an integer output that indicates the priority of the block's highest currently active alarm. The range is 1 (highest priority) to 5. An output of 0 indicates the absence of alarms.

HSCI1
: High Scale for Input Range 1 specifies the upper range limit of the block input when converted from limited normalized raw count to engineering units.

HOR *(CP270 and Later Only)*
: High Out-of-Range is a boolean output that is set true if the RINP value becomes greater than the limit set by HSCI1 and OSV.

INHALM *(CP270 and Later Only)*
: Inhibit Alarm contains packed boolean values that represent alarm generation inhibit request for each type of alarm configured in the block. For the RINR block, the following bits are used:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16

Bit Number* (0 to 15)	Description, When True	Boolean Connection (B16 to B1)
0	Inhibit Low Absolute Alarm	INHALM.B16
1	Inhibit High Absolute Alarm	INHALM.B15
6	Inhibit Bad I/O Alarm	INHALM.B10
8	Inhibit Low-Low Absolute Alarm	INHALM.B8
9	Inhibit High-High Absolute Alarm	INHALM.B7
12	Inhibit Out-of-Range Alarm	INHALM.B4

*Bit 0 is the least significant, low order bit.

There are no mnemonic names for the individual bits of INHALM.

INHIB
(CP270 and Later Only)

Inhibit is a configurable, connectable and settable boolean that, when set, suppresses all alarm message reporting. INHIB affects only alarm message reporting; the alarm handling and detection functions are determined by the INHOPT setting.

INHOPT
(CP270 and Later Only)

Inhibit Option specifies the following actions applying to all block alarms:

- 0 = When an alarm is inhibited, disables alarm messages but does not disable alarm detection.
- 1 = When an alarm is inhibited, disables both alarm messages and alarm detection. If an alarm condition exists at the time the alarm transitions into the inhibited state, the alarm indicator is cleared.
- 2 = Same as 0 for inhibited alarms. For uninhibited alarms, automatically acknowledges “return-to-normal” messages. “Into alarm” messages can be acknowledged by explicitly setting UNACK False.
- 3 = Same as 1 for inhibited alarms. For uninhibited alarms, automatically acknowledges “return-to-normal” messages. “Into alarm” messages can be acknowledged by explicitly setting UNACK False.

INHSTA
(CP270 and Later Only)

Inhibit Status contains packed long values that represent the current inhibit status of each alarm type configured in the block. Table 111-4 shows how the parameter is used with the RINR block.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
			OOR			HHA	LLA		BAD					HMA	LMA	BAD_1	BAD_2	BAD_3													

Table 111-4. INHSTA Parameter Format

Bit Number* (0 to 31)	Name	Description, When True	Boolean Connection (B32 to B1)
13	BAD_3	Tertiary Point Bad Alarm Inhibited (same as bit 22)	INHSTA.B19
14	BAD_2	Secondary Point Bad Alarm Inhibited (same as bit 22)	INHSTA.B18
15	BAD_1	Primary Point Bad Alarm Inhibited (same as bit 22)	INHSTA.B17
16	LMA	Low Absolute Alarm Inhibited	INHSTA.B16
17	HMA	High Absolute Alarm Inhibited	INHSTA.B15
22	BAD	Bad I/O Alarm Inhibited	INHSTA.B10
24	LLA	Low-Low Absolute Alarm Inhibited	INHSTA.B8
25	HHA	High-High Absolute Alarm Inhibited	INHSTA.B7

Table 111-4. INHSTA Parameter Format

Bit Number* (0 to 31)	Name	Description, When True	Boolean Connection (B32 to B1)
28	OOR	Out-of-Range Alarm Inhibited	INHSTA.B4

*Bit 0 is the least significant, low order bit.

INITMA

Initialize Manual/Auto specifies the desired state of the MA input under certain initialization conditions, namely:

- The block has just been installed into the I/A Series station database.
- The I/A Series station is rebooted.
- The compound in which the block resides is turned on.
- The INITMA parameter is modified via the Integrated Control Configurator.

INITMA is ignored if MA has an established linkage.

When INITMA is asserted, the value set into MA is:

- 0 (Manual) if INITMA = 0
- 1 (Auto) if INITMA = 1
- The MA value from the checkpoint file if INITMA = 2.

IOMID1

Primary ECB Identifier is a configurable string that specifies the path-name of the ECB201 for the primary device, for the purpose of connecting to (accessing) a field parameter that resides in the primary field device hosted by a (parent) ECB200/202.

IOMID1 has the form CompoundName:BlockName, where Compound-Name is the 1-12 character name of the local compound containing the ECB, and BlockName is the 1-12 character block name of the ECB.

If the compound containing the ECB is the CPletterbug_ECB compound where CPletterbug is the station letterbug of the CP, the CompoundName may be omitted from the IOMID1 configuration. In this case, the 1-12 character ECB block name is sufficient.

NOTE

Once configured, IOMID1 may not be modified. A delete/undelete operation will NOT allow IOMID1 to be changed. The block must be deleted and then re-entered into the data base. IOMID1 may then be reconfigured.

IOMID2

Secondary ECB Identifier is a configurable string that specifies the path-name of the ECB201 for the secondary device, for the purpose of connecting to (accessing) a field parameter that resides in the secondary field device hosted by a (parent) ECB200/202.

	IOMID2 must be configured when dual or triple redundancy is specified. For other details, see IOMID1 above.
IOMID3	Tertiary ECB Identifier is a configurable string that specifies the pathname of the ECB201 for the tertiary device, for the purpose of connecting to (accessing) a field parameter that resides in the tertiary field device hosted by a (parent) ECB200/202. IOMID3 must be configured when triple redundancy is specified. For other details, see IOMID1 above.
LAL *(CP270 and Later Only)*	Low Absolute Alarm Limit is a real input that defines the value of the RINP output that triggers a Low Absolute Alarm.
LASTGV (*I/A Series v8.7 or later Only, CP270 and Later Only*)	Last Good Value is a boolean option. When true in the situations described in Section 111.5.11, LASTGV causes the previous value of MEAS to be retained, and the value obtained this cycle to be ignored. In I/A Series software v8.7-v8.8, the default value is 1. In a post-I/A Series software v8.8 Quick Fix and I/A Series software v9.0 or later, the default is 0.
LAT *(CP270 and Later Only)*	Low Absolute Alarm Text is a user-defined string of up to 32 characters sent with the low absolute alarm message to identify it.
LLALIM *(CP270 and Later Only)*	Low-Low Absolute Alarm Limit is a real input that defines the value of the RINP output that triggers a Low-Low Absolute Alarm.
LLATXT *(CP270 and Later Only)*	Low-Low Absolute Alarm Text is a user-defined text string of up to 32 characters, sent with the low-low absolute alarm message to identify it.
LOCKID *(CP270 and Later Only)*	Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.
LOCKRQ *(CP270 and Later Only)*	Lock Request is a Boolean input which can be set True or False only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set True in this fashion, a workstation identifier accompanying the set command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contests of LOCKID. LOCKRQ can be set False by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.

LOOPID	Loop Identifier is a configurable string of up to 32 characters used to identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.
LOR *(CP270 and Later Only)*	Low Out-of-Range is a boolean output that is set true if the RINP value becomes less than the lower limit set by LSCI1 and OSV.
LSCI1	Low Scale for Input Range 1 specifies the lower range limit of the block input when converted from limited normalized raw count to engineering units.
MA	Manual/Auto is a Boolean input that controls the block's operating state (0 = False = Manual; 1 = True = Auto). When in Auto, the block output is copied from RINP to MEAS. In Manual it is not copied, and RINP is settable.
MANALM *(CP270 and Later Only)*	Manual Alarm Option is a configurable input which enables or disables configured alarm options to function in Manual mode. Normally alarms are processed only in the Auto mode. Values for the RINR block: 0 = No alarming in Manual 1 = Full alarming in Manual
MBIAS	Measurement Bias is the offset factor applied to the raw count input from the external device when rescaling it into the equivalent I/A Series station normalized raw count. The scaling is applied before the signal conditioning algorithm specified by SCI is applied. In the RINR block, the linear scaling is applied before the signal conditioning algorithm is applied. The GAIN and BIAS parameters are used in the linear equation: x = GAIN* x + BIAS
MEAS	Block Output contains the same value as RINP when the block mode is Auto. It is independent of RINP in Manual mode (set by operator).
MGAIN	Measurement Gain is the gain factor applied to the raw count input from the external device when rescaling it into the equivalent I/A Series control station normalized raw count. The scaling is applied before the signal conditioning algorithm specified by SCI is applied.
NAME	Name is a user-defined string of up to 12 characters used to access the block and its parameters.
NASOPT	Nuisance Alarm Suppression Alarm Option is a configurable, settable short integer that specifies how the nuisance alarm delay is implemented:

- 0 = Suppress nuisance alarms by delaying the Return-to-Normal (default) by the length of time specified in NASTDB
- 1 = Suppress nuisance alarms by delaying alarm detection by the length of time specified in NASTDB
- 2 = Suppress nuisance alarms by delaying both the Alarm Detection and the Return-to-Normal by the length of time specified in NASTDB

NASTDB

Nuisance Alarm Suppression Time Deadband is used to reduce the number of alarm messages generated when a block parameter crosses back and forth over an alarm limit. When the parameter is set to zero, an alarm is generated each time the parameter is outside the limit and is cleared each time it crosses back. Thus, a parameter that is fluttering at the alarm limit can result in nuisance alarms. NASTDB specifies, in milliseconds, a time that must lapse before the alarm is cleared and before another alarm message can be generated. The specified value is rounded up to the nearest even multiple of the control station BPC. If the parameter passes from outside one limit to outside the opposite extreme, the deadband is ignored.

OOROPT
(CP270 and Later Only)

Out-Of-Range Option (OOROPT) is a configurable, non-settable boolean option that, if set to 1, causes the ERR status to be set in the MEAS output of this RINR block if the MEAS is Limited High-Out-of-Range (LHI status = 1) or Limited Low Out-of-Range (LLO status = 1).

ORAG
(CP270 and Later Only)

Out-of-Range Alarm Group is a short integer input that directs Out-of-Range alarm messages to one of eight groups of alarm devices.

ORAO
(CP270 and Later Only)

Out-of-Range Alarm Option is a configurable boolean which, when configured true, enables an alarm for each change of the out-of-range status of the block. The block has out-of-range status if either the HOR or the LOR parameter is true.

ORAP
(CP270 and Later Only)

Out-of-Range Alarm Priority is an integer input, ranging from 1 (highest priority) to 5 (default), that sets the priority level of the out-of-range alarm.

ORAT
(CP270 and Later Only)

Out-of-Range Alarm Text is a user-configurable text string of up to 32 characters, sent with the out-of-range alarm message to identify it.

OSV
(CP270 and Later Only)

Output Span Variance is a configurable real input which defines the percentage by which the output clamp limits exceed the output range defined by HSCO1 and LSCO1.

OWNER

Owner is a string of up to 32 ASCII characters used to allocate control blocks to applications. Attempts to set OWNER are successful only if the present value of OWNER is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a

LOCKED_ACCESS error. OWNER can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of OWNER. Once set to the null string, the value can then be set as desired.

PERIOD

Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PHASE

Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 seconds) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the I/A Series station is 0.5 second. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PRTYPE

The PRTYPE parameter contains the alarm type of the highest active alarm in the block. For the RIN and RINR blocks, the valid possible settings for PRTYPE are as follows:

- 0 = No existing alarm
- 1 = Hi Absolute Alarm Type
- 2 = Lo Absolute Alarm Type
- 3 = Hi-Hi Absolute Alarm Type
- 4 = Lo-Lo Absolute Alarm Type
- 8 = Bad Alarm Type
- 25 = Out-of-Range Alarm Type

For example, if both a Bad Alarm with a priority of 1 and a High Absolute alarm with a priority of 2 exist, and no other alarm exists, then PRTYPE = 8 (the Bad Alarm type) and CRIT= 1 (the Bad Alarm priority).

QALSTA
(CP270 and Later Only)

Quality Status parameter (QALSTA) is a non-configurable packed boolean that provides a combination of value record status, block status (BLKSTA), and alarm status (ALMSTA) information in a single connectable output parameter. Available bits for this block are provided below.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1]	Definition	Contents	Boolean Connection (B32 to B1)
30	Alarms Unacknowledged	ALMSTA.UNA	QALSTA.B2
29	Alarms Inhibited	ALMSTA.INH	QALSTA.B3
28	Out-of-Range Alarm	ALMSTA.OOR	QALSTA.B4
25	High-High Absolute Alarm	ALMSTA.HHA	QALSTA.B7
24	Low-Low Absolute Alarm	ALMSTA.LLA	QALSTA.B8
22	Bad Alarm	ALMSTA.IOBD	QALSTA.B10
17	High Absolute Alarm	ALMSTA.HMA	QALSTA.B15
16	Low Absolute Alarm	ALMSTA.LMA	QALSTA.B16
15	Bad Tertiary FBM	BLKSTA.FBM3	QALSTA.B17
14	Bad Secondary FBM	BLKSTA.FBM2	QALSTA.B18
13	Bad Primary FBM	BLKSTA.FBM1	QALSTA.B19
12	Bad Tertiary Point	BLKSTA.BAD3	QALSTA.B20
11	Bad Secondary Point	BLKSTA.BAD2	QALSTA.B21
10	Bad Primary Point	BLKSTA.BAD1	QALSTA.B22
9	Tertiary Deviation	BLKSTA.DEV3	QALSTA.B23
8	Secondary Deviation	BLKSTA.DEV2	QALSTA.B24
7	Primary Deviation	BLKSTA.DEV1	QALSTA.B25
5	Manual[2]	~BLKSTA.MA	QALSTA.B27
4	Low Limited	MEAS.LLO status	QALSTA.B28
3	High Limited	MEAS.LHI status	QALSTA.B29
2	Uncertain	MEAS.ERR status	QALSTA.B30
1	Out-of-Service	MEAS.OOS status	QALSTA.B31
0	Bad	MEAS.BAD status	QALSTA.B32

1. Bit 0 is the least significant, low order bit.
2. Bit 5 is the inverse of the BLKSTA.MA bit (BLKSTA.B21).

RAW_1 — Raw 1 is the value read from the ECB specified in RI1_PT before any form of signal conditioning, characterization, scaling, clamping or filtering is applied. It is of the data type Real although the ECB value may be integer, or long integer.

RAW_2
: Raw 2 is the value read from the ECB specified in RI2_PT before any form of signal conditioning, characterization, scaling, clamping or filtering is applied. It is of the data type Real although the ECB value may be integer, or long integer.

RAW_3
: Raw 3 is the value read from the ECB specified in RI3_PT before any form of signal conditioning, characterization, scaling, clamping or filtering is applied. It is of the data type Real although the ECB value may be integer, or long integer.

RI1
: Range Input is an array of real values that specify the high and low engineering scale and change delta of a particular real input. For a given block, this parameter also forms an association with a group of real input parameters that have the same designated range and change delta.

RI1_PT
: Primary Real Input address identifies the source address in the external device memory from which the block input is obtained. It is a string whose syntax depends on the FBM type and fieldbus protocol of the attached device:

- For the FBM223 PROFIBUS interface, PNT_NO must be configured to contain a PROFIBUS data identifier. This information identifies, to the FBM, the address of the input data unit from the device. Refer to *PROFIBUS-DP Communication Interface Module (FBM223) User's Guide* (B0400FE) for further details.
- For the FBM222 Redundant PROFIBUS interface, the PNT_NO configuration string uses the FBM223 syntax with extensions for PROFIBUS-PA status, custom status and other features. Refer to *Implementing PROFIBUS Networks in Foxboro Control Software Applications* (B0750BE) for further details.
- For the HART interface (FBM214/214b/215/216/216b/218/244/245/247), PNT_NO must be configured to contain a point address. This information identifies, to the FBM, specific data in the HART data stream that is to serve as the device data input to this block. Refer to *HART Communication Interface Modules User's Guide* (B0400FF) for details.
- For the Modbus interface (FBM224), PNT_NO must be configured to contain the address of a set of coils in a Modbus device. Refer to *Modbus Communication Interface Module (FBM224) User's Guide* for details.
- For the FDSI (FBM230/231/232/23), PNT_NO contains a data identifier to identify, to the FBM, specific data in the I/O data stream and to specify the elements of the data. Refer to *Field Device System Integrators (FBM230/231/232/233) User's Guide* (B0700AH) for more information.
- For the FBM228 Redundant FOUNDATION fieldbus interface, the point number syntax specifies reads of H1 device function block

parameters using a client/server or publisher/subscriber connection, as described in *Implementing FOUNDATION fieldbus on an I/A Series System* (B0700BA), *Implementing FOUNDATION fieldbus* (B0750BC), and *Implementing FOUNDATION fieldbus in Foxboro Control Software Applications* (B0750DA).

RI2_PT — Secondary Real Input address identifies the source address in the external device memory from which the block input is obtained. RI2_PT is a string whose syntax depends on the FBM type and fieldbus protocol of the attached device, as described for RI1_PT.

RI3_PT — Tertiary Real Input address identifies the source address in the external device memory from which the block input is obtained. RI3_PT is a string whose syntax depends on the FBM type and fieldbus protocol of the attached device, as described for RI1_PT.

RINP — Real Input contains the value selected from RIN_1, RIN_2, and RIN_3 after input processing. RINP displays this value at all times, regardless of the block mode.

RIN_1 — Primary Real Input contains the real value read from BI1_PT, in the ECB specified by IOMID1.

RIN_2 — Secondary Real Input contains the real value read from BI2_PT, in the ECB specified by IOMID2.

RIN_3 — Tertiary Real Input contains the real value read from BI3_PT, in the ECB specified by IOMID3.

ROCV — Rate of Change Limit is a real input that specifies the threshold for Rate of Change violation in engineering units per 100 ms for the analog input when PNT_NO is set to CURRENT in support of FBM214, FBM216, FBM244 and FBM245. This feature is not supported by the FBMs that use the RINR block.

SCI — Signal Conditioning Input is used in converting between normalized raw count and engineering units. Refer to Section 111.6 for the signal conditioning tables.

SELECT — Selection Indicator shows which redundant RIN_x has been chosen by the arbitration algorithm:

- 0 = none of the input values is selected
- 1 = primary input value is selected
- 2 = secondary input value is selected
- 3 = tertiary input value is selected.

SELOPT — Selection Option is a configurable option that specifies the criteria for selecting a redundant input in the RINR block when the arbitration algorithm cannot resolve the choice. For the RINR block:

- 0 = The value of RINP is unchanged
- 1 = Select the lowest of the three inputs
- 2 = Select the highest of the three inputs
- 3 = Use the mean of the three inputs.

SEVSTS This parameter is currently not supported by any FBM or field device.

SIMOPT Simulation Option is a configurable parameter that specifies if the DCI block input/output value is to be simulated. When SIMOPT is configured 1 (True), there are no DCI connections established for the block. The status and data values of RIN_1, RIN_2, and RIN_3 are not recovered from the field. RINP, which is normally secured, is released (provided it is unlinked) and becomes available for entry of simulated values.

Such simulated values are limited by HSCI1 and LSCI1. If this limiting action forces a clamping of the entered value, the status of RINP is set to Limited High or Limited Low, as appropriate.

The basic actions of Auto and Manual modes are still observed when SIMOPT is 1 (True). If the block is in Auto mode, the status and value of RINP (including any Limited High or Limited Low bits) is copied to the status and value of MEAS. If the block is in Manual mode, RINP is not copied to MEAS. As noted in Section 111.5.10, manual sets to MEAS are first limited by the range limits of HSCI1 and LSCI1 before being accepted.

TSTAMP The Time Stamp parameter of the block is updated every time there is a change in value of MEAS. In Auto mode, this means that the arbitrated field input value in RINP has changed. In Manual mode, it means that a new manual value has been set into MEAS. TSTAMP, which is expressed in units of milliseconds past midnight, is read from the FBM, when it is available there, or if not, is computed by the I/A Series control station.

TYPE When you enter RINR or select it from a configurator list, an identifying integer is created specifying this block type. For this block, the value of TYPE is 112.

UNACK
CP270 and Later Only Unacknowledged is a Boolean output parameter that is set True for notification purposes whenever the block goes into alarm. It is settable, but sets are only allowed to clear UNACK to False, and never in the opposite direction. UNACK is cleared by an operator “acknowledge” pick on a default display, a user display, or the alarms display.

UPDPER Update Period is a configurable non-settable long integer that specifies the update period for certain types of client/server access to FOUNDATION fieldbus H1 devices and PROFIBUS slave devices:

- For the FBM228, the parameter defines the update period for client/server access to device block parameters, as described in *Implementing FOUNDATION fieldbus on an I/A Series System* (B0700BA), *Implementing FOUNDATION fieldbus* (B0750BC), or

Implementing FOUNDATION fieldbus in Foxboro Control Software Applications (B0750DA). The parameter is not used for publisher/subscriber connections.

- For the FBM222, the parameter defines the update period for acyclic communication between the FBM222 and the PROFIBUS slave device, as described in *Implementing PROFIBUS-DP Networks* (B0750BE). The parameter is not used for cyclic communications.

VALSTS — Value Status is an output parameter of any DCI block that contains the value status of a FOUNDATION fieldbus function block parameter value or PROFIBUS-PA parameter provided by a DCI connection to a field device. For other fieldbus types, VALSTS is meaningless.

Bits 0-1: Limits:

0 = Not limited
1 = High limited
2 = Low limited
3 = High and Low limited

Bits 2-5: Substatus (definition depends on Quality)

Bits 6-7: Quality:
0 = Bad
1 = Uncertain
2-3 = Good

Note: Bit 0 is the least significant, low order bit.

Each time the RINR block is executed, VALSTS reports the status of the FOUNDATION fieldbus or PROFIBUS_PA value from the information in the DCI connection.

VUMEAS — This parameter is currently not supported by any FBM or field device.

111.5 Functions

111.5.1 Detailed Diagram

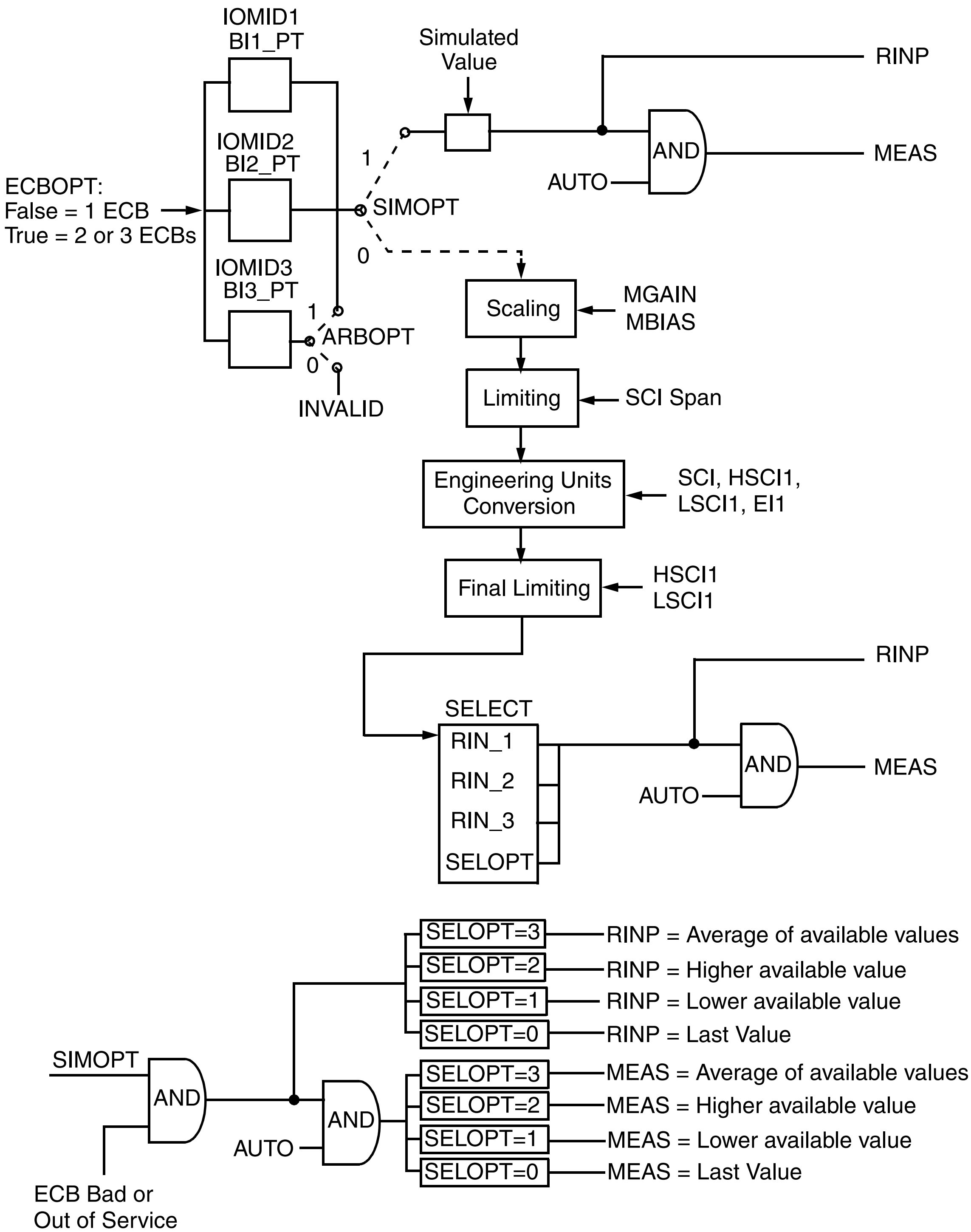


Figure 111-2. RINR Block Operational Diagram

111.5.2 Associated ECBs

The configured parameters IOMID1, IOMID2, and IOMID3 of the RINR block specify one or more ECB201s (the Device ECBs) to connect to field parameters that reside in field devices hosted by one or more ECB200s or ECB202s (the FBM ECBs).

The PARENT parameter of each device ECB specifies the associated FBM ECB hosting the field device.

IOMIDx may also directly specify parent FBM ECB to retrieve parameters resident in the FBMs themselves.

Parameter ECBOPT specifies whether a single ECB is to be used for all input points, or each input point is to be associated with a separate ECB. (The latter is the required choice if the redundant inputs are in different devices or FBMs.) If ECBOPT is false, only one ECB is used for all points, and is specified by IOMID1. (IOMID2 and IOMID3 are ignored.) If ECBOPT is true, then either two or three separate ECBs are used, depending on whether dual or triple redundancy is specified. This decision is based on the configured parameter ARBOPT (see Section 111.5.3). When dual redundancy ("DMR") is specified, IOMID2 must be configured, and IOMID3 is ignored. With triple redundancy ("TMR"), all three IOMIDx values must be configured.

111.5.3 DCI Connections

The RINR block establishes up to three DCI connections to the specified ECBs at any one of the following times:

- The block is first installed (added to your control strategy).
- The I/A Series control station in which it resides has just been rebooted.
- A parameter of the block has been modified by the ICC or FoxCAE configurator.
- A device or parent ECB specified by the RINR block has just been installed.

A DCI connection is added to a linked list of all the DCI connections, of any type, for all blocks specifying the same ECB. This arrangement permits multiple DCI blocks of differing data types to communicate with a single device at input/output scan time on a scatter-gather basis. It also allows multiple DCI connections in the same DCI block to be established (for example, connections in redundant type DCI blocks such as this one or for INI_PT connections in output type blocks).

The following table shows the DCI connections for all combinations of ECBOPT and ARBOPT:

ECBOPT = 0	ARBOPT = 0 (DMR)	2 DCI connections to one ECB
ECBOPT = 0	ARBOPT = 1 (TMR)	3 DCI connections to one ECB
ECBOPT = 1	ARBOPT = 0 (DMR)	2 DCI connections to two ECBs
ECBOPT = 1	ARBOPT = 1 (TMR)	3 DCI connections to three ECBs

The DCI connections are deleted (the linkages are removed from the linked lists for the ECB or ECBs when the RINR block is deleted).

111.5.4 Origins of Input Data

The device addresses supplying the input values are configured in strings in RI1_PT, RI2_PT, and RI3_PT.

When ARBOPT is 0 (DMR), neither RI1_PT nor RI2_PT can be null, and RI3_PT is ignored. When ARBOPT is 1 (TMR), RI1_PT, RI2_PT, and RI3_PT must not be null. These checks are made at block validation time and violations of these rules result in the RINR block being set undefined. Processing does not proceed further.

The format of the RIx_PT parameters is device specific. When the PIO maintenance task runs after the DCI connections have been made, the RIx_PT strings used by the block are passed to the FBM for parsing and validation. In DCI blocks, point identification strings are not parsed by the I/A Series control station.

If the first character of BIx_PT is blank, the BIx_PT string is not sent to the FBM, and the block is set undefined, with ERCODE = 52. The detail display shows "W52 – INVALID I/O CHANNEL/GROUP NUMBER".

In each of the following cases, the block is also set undefined:

- ♦ If PRITIM = 0, the detail display shows "W48 – INVALID BLOCK OPTION" with ERCODE = 48.
- ♦ If the FBM parsing algorithm finds that PNT_NO is invalid, the detail display shows "W65 – INVALID POINT ADDRESS" with ERCODE = 65.
- ♦ If there is a duplicate connection to any point, the detail display shows "W66 – DUPLICATE CONNECTION" with ERCODE = 66.
- ♦ If there is no available memory in the FBM, or if the maximum number of connections have been allocated in the FBM, the detail display shows "W67 – INSUFFICIENT FBM MEMORY/CONNECTIONS" with ERCODE = 67.
- ♦ If the device connection is invalid, the detail display shows "W68 – INVALID DEVICE CONNECTION" with ERCODE = 68.
- ♦ If the point connection is invalid, the detail display shows "W69 – INVALID POINT CONNECTION" with ERCODE = 69.

In the following case, the block remains defined:

- ♦ If the connection is not yet resolved, the detail display shows "W62 – UNRESOLVED CONNECTION" with ERCODE = 62.

111.5.5 Processing the Status of the Input Points

The status of the RI1_PT and RI2_PT inputs are processed together with the status of their ECBs. If ARBOPT specifies TMR, there is a similar processing for the status of the RI3_PT input and its ECB. For each of the two or three inputs, the status of its RIN_x parameter is set according to the following rules:

The status of RIN_x is set to Out-of-Service if:

- ♦ The appropriate device ECB status indicates that the field device is Off-line or Out-of-Service.
- ♦ The DCI connection cannot be configured due to lack of configuration information in the FBM database.

- The DCI is not yet connected (that is, the PIO maintenance task has not yet sent the DATA_CONNECT message to the FBM for the linked-list addition described in Section 111.5.3).
- The DCI connection status information, which specifies the condition of the accessed device parameter, indicates Out-of-Service, meaning (in general) that the parameter value is unavailable.
- The connection status information indicates Disconnected, meaning (in general) that the parameter is not connected or not defined.
- The connection status information indicates that the connection is not yet resolved. The detail display shows "W62 – UNRESOLVED CONNECTION" with ERCODE = 62.
- An ECB201 is specified and the ECB device status indicates that the DCI connection is unresolved.

The status of RIN_x is set to Bad if:

- The device ECB status indicates that the field device has failed
- The DCI connection status information indicates a bad value of the field device parameter.
- The normalized analog channel input experiences a bipolar Rate of Change violation when PNT_NO is set to CURRENT in support of an analog current (mA) input from a HART device via FBM214 or FBM216.

The status of RIN_x is set to Error if the status information indicates an uncertain or questionable value of the field device parameter.

The status of RIN_x is set to Limited High or Limited Low (as appropriate) if:

- Either one of the limiting actions described in Section 111.5.6 (normalized count and/or engineering units) forces a clamping of the value.
- The DCI connection status information indicates that the field device parameter is limited high or limited low.

Finally, if RIN_x is not Out-of-Service, the value of that field input is conditioned as described in Section 111.5.6, and the result is set into the value of RIN_x. Otherwise, the previous value (last good value) of RIN_x is retained.

The statuses and conditioned values of the individual RIN_x are available in the three output parameters, and, in addition, they are used as the inputs to the arbitration algorithm. See Section 111.5.7.

111.5.6 Processing of Input Point Data

The single configured values of SCI, MGAIN, MBIAS, LSCI1, and HSCI1 are used in the conditioning of each of the two or three redundant input points.

For each input point used (see ARBOPT), the raw value from the external device is scaled into the I/A Series system normalized raw count range by application of MGAIN and MBIAS:

I/A Series System Normalized Raw Count = (Input Raw Value)(MGAIN) + MBIAS

The resulting value is limited to be within the normalized range for the configured value of SCI.

This limited I/A Series system normalized raw count value is then converted into engineering units by application of the signal conditioning index SCI and the engineering range limits HSCI1 and LSCI1:

Engineering Units =
(I/A Series Limited Normalized Raw Count - span low limit)(HSCI1 - LSCI1)/span + LSCI1

For example, if the SCI is linear 1600 - 64000, the span low limit is 1600, and the span is 64000 - 1600 or 62400.

The final step in input conditioning consists of limiting the engineering units value to within the engineering range limits, HSCI1 and LSCI1.

111.5.7 Arbitration Algorithm

RIN_1, RIN_2, and RIN_3 each have a value and status, as described in Section 111.5.5 and Section 111.5.6. In the table below, a RIN_x is Valid if its status is neither Bad nor Out-of-Service. Also, if ARBOPT indicates DMR, RIN_3 is never Valid.

The configured real, nonnegative parameter ARBLIM is used to specify how close any two RIN_x values must be to each other, on an absolute basis, to be considered in agreement. Specifically, if (RIN_x - RIN_y) <= ARBLIM, then RIN_x and RIN_y agree. See table below.

RIN_1 Valid	RIN_2 Valid	RIN_3 Valid	Test	Select
Yes	Yes	Yes	RIN_1, RIN_2 agree	RIN_1
Yes	Yes	Yes	RIN_1, RIN_2 disagree and RIN_1, RIN_3 agree	RIN_1
Yes	Yes	Yes	RIN_1, RIN_2 disagree and RIN_1, RIN_3 disagree and RIN_2, RIN_3 agree	RIN_2
Yes	Yes	Yes	RIN_1, RIN_2 disagree and RIN_1, RIN_3 disagree and RIN_2, RIN_3 disagree	See Case 1 below
Yes	Yes	No	RIN_1, RIN_2 agree	RIN_1
Yes	Yes	No	RIN_1, RIN_2 disagree	See Case 2 below
Yes	No	Yes	RIN_1, RIN_3 agree	RIN_1
Yes	No	Yes	RIN_1, RIN_3 disagree	See Case 2 below
No	Yes	Yes	RIN_2, RIN_3 agree	RIN_2
No	Yes	Yes	RIN_2, RIN_3 disagree	See Case 2 below
Yes	No	No	(No Test)	RIN_1
No	Yes	No	(No Test)	RIN_2
No	No	Yes	(No Test)	RIN_3

RIN_1 Valid	RIN_2 Valid	RIN_3 Valid	Test	Select
No	No	No	(No Test)	See Case 3 below

When the Select column (above) reads "See Case x below", the preconfigured parameter SELOPT determines the value of RINP as follows:

Case 1: (all three values are available but all disagree)

- If SELOPT = 0, the value of RINP is unchanged.
- If SELOPT = 1, the algebraically lowest of RIN_1, RIN_2, and RIN_3 is selected.
- If SELOPT = 2, the algebraically highest of RIN_1, RIN_2, and RIN_3 is selected.
- If SELOPT = 3, the algebraic mean of RIN_1, RIN_2, and RIN_3 is used.

Case 2: (two of the three values are available but both disagree)

- If SELOPT = 0, the value of RINP is unchanged (last good value functionality).
- If SELOPT = 1, the algebraically lower of the two valid RIN_x is selected.
- If SELOPT = 2, the algebraically higher of the two valid RIN_x is selected.
- If SELOPT = 3, the algebraic mean of the two valid RIN_x is used.

Case 3: (none of the three values is available)

- The value of RINP is unchanged (last good value functionality).

Output parameter SELECT shows which RIN_x has been selected:

- If RIN_1 is selected, SELECT = 1
- If RIN_2 is selected, SELECT = 2
- If RIN_3 is selected, SELECT = 3
- Otherwise, SELECT = 0.

The status of RINP is set as follows:

- Case 1 or 2: status of RINP is Error if SELOPT = 0 or 3 (the Error status bit is set)
- Case 3: status of RINP is Bad and Out-of-Service (the Bad and Out-of-Service status bits are set).

111.5.8 Auto/Manual Arbitration

The Auto/Manual mode selection arbitrates between inputs by the operator (Manual) and inputs from the field (Auto). Parameters MA and INITMA are used to establish the control mode of the RINR block.

111.5.9 Operation in Auto Mode

In Auto mode, the input data and status from the two or three redundant inputs is processed and arbitrated as described in the previous sections. The result is always set into the status and value of parameter RINP. If neither the Bad nor Out-of-Service bit is set, the value and status of RINP are also copied to the value and status of MEAS. If either of these bits is set, only the status of RINP is copied to the status of MEAS, but MEAS retains its last good value.

111.5.10 Operation in Manual Mode

In Manual mode, the data and status from the two or three redundant inputs is processed and arbitrated as in the case of the Auto mode. Therefore, the value and status of parameter RINP continue to reflect the actual field inputs. However, neither the status nor the value of RINP is copied to MEAS, and MEAS can be used for manual sets. Such sets are subjected to limitation by the range limits HSCI1 and LSCI1 before being accepted.

The output of the RINR block, as normally used by the control strategy, is, therefore, the MEAS parameter, whether the block mode is Auto or Manual.

111.5.11 Last Good Value

Key Parameters: LASTGV, MEAS, HSCI1, LSCI1, OSV, SCI, BADOPT

In the following situations, parameter LASTGV only takes effect when BADOPT is configured for LOOR , HOOR, or both.

- In linear/square root signal conditioning, if the raw value is beyond the upper or lower value of the span, as adjusted by OSV, MEAS retains its value from the last cycle.
- When an out-of-range condition occurred due to HSCI1/LSCI1 clamping, MEAS retains its value from the last cycle only if SCI = 0 (no linearization.)

Retention of the MEAS value from the last cycle is independent of BADOPT when MEAS goes out-of-service, regardless of the value of LASTGV.

111.5.12 Filtering (CP270 and Later Only)

With I/A Series software v8.4 or later, the RINR block provides an optional filtering as the final signal processing step on the FCP280, FCP270 and ZCP270. This option is not available on any other control processors.

Key Parameters: FLOP, FTIM

Filtering introduces a lag to changes in the input signal, thus smoothing input changes or suppressing noise. Note that this feature should be used with caution to avoid removing true process information.

Filtering options are applied only when the block is in Auto mode. The options are set in the FLOP parameter as follows:

- FLOP=0, no filtering
- FLOP=1, first-order lag filtering
- FLOP=2, second-order Butterworth filtering
- FLOP=3, two-sample-average filtering.

The lag that first or second-order filtering introduces has time constant Filter Time (FTIM). You can use them to attenuate measurement noise. However, if FTIM is set too low, there is relatively insignificant filtering. If set too high, the lag may be large enough to affect loop accuracy.

In addition to filtering, aliasing is minimized and resolution improved by configuring the RES parameter of the ECB so that the fieldbus integration time is equal to twice the block period. Refer to the section “Fieldbus Integration Time” in the appropriate *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

111.5.12.1 First Order Lag Filtering (FLOP = 1)

The algorithm of this filter is

Filter Output = RINP + (Filter Input - PNT) / (τ+ 1)

where PNT is the present value of the block output, which was actually calculated during the previous block processing cycle. τ represents the number of block processing cycles for the output to reach approximately 63 percent of its ultimate value after a step change to the input; it is computed as follows:

τ = 60 * FTIM / Block Period in Seconds

In Laplace transform notation, the transfer function is $1/(1 + \tau s)$.

Figure 111-3 is a diagram of first-order lag filtering.

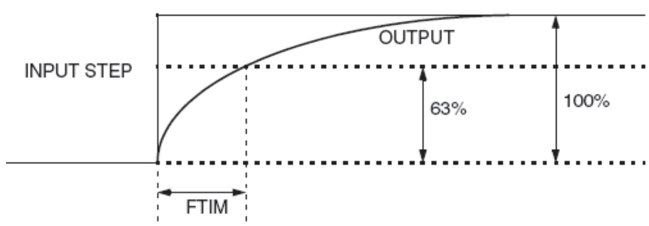


Figure 111-3. First-Order Lag Filtering

111.5.12.2 Butterworth Filtering (FLOP = 2)

The algorithm of this filter is:

New vter = Old vter + (Filter Input - RINP - Old vter) / (τ/2 + 1)

Filter Output = RINP + New vter / (τ + 1)

where τ is computed as in the case of first order lag filtering.

In each block execution cycle, the first step is the computation of New vter, based on the stored value of Old vter from the last cycle (when the filter is initialized the value of Old vter is set to 0.0). As before, RINP is the current value of the block output.

In Laplace transform notation, the transfer function is:

$$\frac{1}{1 + \tau s + (\tau s)^2/2}$$

Figure 111-4 is a diagram of Butterworth filtering.

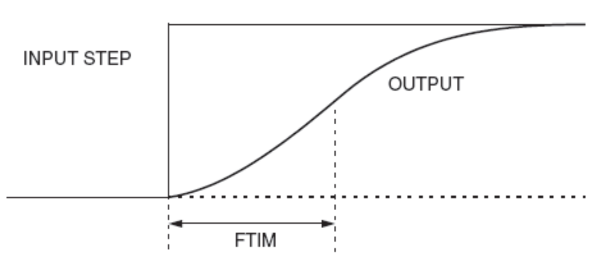


Figure 111-4. Butterworth Filtering

111.5.12.3 Two-Sample-Average Filtering (FLOP = 3)

The algorithm of this filter is:

Filter Output = (Filter Input this cycle + Filter Input previous cycle)/2.

This algorithm eliminates integer multiples of the half-sampling frequency component and attenuates other high frequencies. The filter has a flatter low frequency pass band and sharper cutoff than the other two filters, with the same low-frequency phase shift.

111.5.13 Alarming (CP270 and Later Only)

With I/A Series software v8.4 or later, the RINR block operating on the FCP280, FCP270 or ZCP270 supports the Bad I/O, Out-of-Range, High/Low Absolute, and High-High/Low-Low Absolute alarm types. The functionality of these alarm types is discussed in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG). The nomenclature for identical alarm types varies from block to block for historical reasons involving backward compatibility requirements. Table 111-5 shows the nomenclature for the RINR block.

Table 111-5. RINR Block Alarm Nomenclature

Type	Option	Limit	Priority	Group	Text	Deadband
I/O Bad	BAO=1	--	BAP	BAG	BAT	--
Out-of-Range	ORAO=1	--	ORAP	ORAG	ORAT	OSV
High Absolute	HLOP= 1 or 2	HAL	HLPR	HLGP	HAT	HLDB
Low Absolute	HLOP= 1 or 3	LAL	HLPR	HLGP	LAT	HLDB
High-High Absolute	HHAOPT = 1 or 2	HHALIM	HHAPRI	HHAGRP	HHATXT	HLDB
Low-Low Absolute	HHAOPT = 1 or 3	LLALIM	HHAPRI	HHAGRP	LLAGTXT	HLDB

The column titled “Option” in Table 111-5 specifies the required parameter configuration to enable or disable the actual alarming of any the six alarm types.

When MANALM=0, the block provides alarming in Auto mode only; when MANALM=1, the block performs alarming in both Auto and Manual modes.

111.5.14 BAD I/O Alarms

Bad alarm detection is enabled when the bad alarm option (BAO) is set.

A Bad alarm message is generated for an input value when its status is bad (RIN_1.BAD, RIN_2.BAD, or RIN_3.BAD) independent of the status of the other inputs. The Bad alarm message is sent to all devices in the bad alarm group specified by the BAG parameter. This message contains text string identifying the input value (BAD1, BAD2, or BAD3), the descriptive text in the BAT parameter, and the loop identifier in the LOOPID parameter.

When any input value becomes good, a corresponding return-to-normal message is generated and sent to all devices in the bad alarm group. Bad alarm status information, however, is generated only when all input values are bad.

When all input values are bad, the following parameters and bits are set:

- ♦ BAD bit in the alarm status parameter (ALMSTA.BAD)
- ♦ UNACK parameter and the corresponding ALMSTA.UNACK bit
- ♦ CRIT parameter and its corresponding ALMSTA.CRIT are set to the BAP parameter value
- ♦ PRTYPE parameter and its corresponding ALMSTA.PRTYPE field are set to the Bad alarm type.

When all input values have returned to good status, CRIT, PRTYPE and their corresponding fields in ALMSTA are cleared.

The UNACK parameter and the ALMSTA.UNACK bit are cleared in these cases:

- ♦ When the alarm is acknowledged by an OM set operation at either the compound level (by setting the compound UNACK=0) or at the block level (by setting the block UNACK=0).
- ♦ When all input values return to good status and INHOPT is set appropriately.
- ♦ When the block is shut down.

When UNACK is cleared, an Alarm Acknowledge message is generated and sent to all devices in the bad alarm group.

111.5.15 Other Alarm Types

Following are the conditions for detection and reporting of each of the other five alarm types:

- ♦ Out-of-Range: The value of RINP is greater than the limit defined by HSCI1 and OSV (HOR=1) or is less than the low limit set by LSCI1 and OSV (LOR=1)
- ♦ High Absolute: The value of RINP exceeds the limit set in HAL by the deadband specified in HLDB
- ♦ Low Absolute: The value of RINP is less that the lower limit set in LAL by the deadband specified in HLDB
- ♦ High-High Absolute: The value of RINP exceeds the limit set in HHALIM by the deadband specified in HLDB
- ♦ Low-Low Absolute: The value of RINP is than the lower limit set in LLALIM by the deadband specified in HLDB

An alarm message is generated the when the specific alarm option is set and the condition is detected. The alarm message is sent to all devices in the alarm group specified by the group parameter (see Table 111-5). This message contains text string identifying the alarm condition, the descriptive text in the text parameter (Table 111-5), and the loop identifier in the LOOPID parameter.

When the input value becomes good, a corresponding return-to-normal message is generated and sent to all devices in the bad alarm group.

When the alarm is detected, the following parameters and bits are set:

- ♦ The alarm type bit in the alarm status parameter:

  ALMSTA.OOR

  ALMSTA.HMA

  ALMSTA.LMA

ALMSTA.HHA

ALMSTA.LLA

- UNACK parameter and the corresponding ALMSTA.UNACK bit
- CRIT parameter and its corresponding ALMSTA.CRIT are according to the priority parameter for the alarm type (Table 111-5)
- PRTYPE parameter and its corresponding ALMSTA.PRTYPE field are set to the alarm type.

When the input value has returned to good status, BAD, CRIT, PRTYPE and their corresponding fields in ALMSTA are cleared.

The UNACK parameter and the ALMSTA.UNACK bit are cleared in these cases:

- When the alarm is acknowledged by an OM set operation at either the compound level (by setting the compound UNACK=0) or at the block level (by setting the block UNACK=0).
- When the input value returns to good status and INHOPT is set appropriately.
- When the block is shut down.

When UNACK is cleared, an Alarm Acknowledge message is generated and sent to all devices in the bad alarm group.

111.5.16 Alarm Inhibiting and Control

Alarm Inhibiting/Disabling are supported using a combination of the compound CINHIB parameter and the INHOPT and INHIB parameters in the RINP block, to allow the bad alarm messages to be inhibited and/or the alarm detection to disabled dynamically.

When the alarms are inhibited or disabled, an appropriate Alarm Disable message is generated and sent to all devices in the respective alarm group. If the Alarm is unacknowledged, an Alarm Acknowledge message is also sent to these devices, and the ALMSTA.INHIB bits are set.

When alarms are uninhibited or enabled, an appropriate Alarm Enable message is generated and sent to all devices in the respective alarm group. If all alarms are uninhibited, the ALMSTA.INHIB bits are cleared.

Parameters NASDB and NASOPT provide control of nuisance alarms by applying a delay (set in NASDB) to return-to-normal condition (NASOPT=0), to alarm detection (NASOPT=1) or to both (NASOPT=2).

The Alarm Message Regeneration Time Interval (AMRTIN) parameter specifies the rate at which alarm messages are generated for alarm conditions that have not been cleared. The interval is specified in seconds. The configured interval is rounded up to the closest value that is an even multiple of the station BPC. A value of 0 disables alarm message regeneration. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG) on alarm regeneration.

111.6 Signal Conditioning (SCI Values)

NOTE

Valid SCI values for the RINR block are 0-7, 9-15, and 50-59, inclusive.

SCI = 0:	No Linearization Result is (value)	
SCI = 1:	Linear (0 to 64000) Result is (value * span + offset)	
SCI = 2:	Linear (1600 to 64000) Result is ((value - 1600.0) * span + offset)	
SCI = 3:	Linear (12800 to 64000) Result is ((value - 12800.0) * span + offset)	
SCI = 4:	Square Root (0 to 64000) Result is (sqrt (64000.0 * value) * span + offset)	
SCI = 5:	Square Root (12800 to 64000), Clamped If (value <= 12800.0) result is (offset) Otherwise, result is (sqrt (51200.0 * (value - 12800.0)) * span + offset)	
SCI = 6:	Square Root, Low Cutoff (0 to 64000), Clamped < 3/4% If (value <= 480.0) result is (offset) Otherwise, result is (sqrt (64000.0 * value) * span + offset)	
SCI = 7:	Square Root, Low Cutoff (12800 to 64000), Clamped < 3/4% If (value <= 13184.0) result is (offset) Otherwise, result is (sqrt (51200.0 * (value - 12800.0)) * span + offset)	
SCI = 9:	Linear, Low Cutoff (1600 to 64000) If (value <= 1600.0) result is (offset) Otherwise, result is ((value - 1600.0) * span + offset)	
SCI = 10:	Linear, Low Cutoff (12800 to 64000) If (value <= 12800.0) result is (offset) Otherwise, result is ((value - 12800.0) * span + offset)	
SCI = 11:	Square Root (IT2 signal) Result is (sqrt (value))	
SCI = 12:	Linear (2 - 10 V) Result is ((value - 14080.0) * span + offset)	
SCI = 13:	Square Root (2 - 10 V), clamped If (value <= 14080.0) result is (offset) Otherwise, result is (sqrt (49920.0 * (value - 14080.0)) * span + offset)	
SCI = 14:	Linear (0 - 16383) Result is (value * span + offset)	
SCI = 15:	Square root (0 - 10 V), clamped Result is (sqrt (62400.0 * (value - 1600.0)) * span + offset);	
SCI = 50:	Linear (0 to 65535)	y = (HSCI1-LSCI1)/65535 * x + LSCI1
SCI = 51:	Linear (-32768 to 32767)	y = (HSCI1-LSCI1)/65535 * (x + 32768) + LSCI1
SCI = 52:	Linear (0 to 32767)	y = (HSCI1-LSCI1)/32767 * x + LSCI1
SCI = 53:	Linear (0 to 1000)	y = (HSCI1-LSCI1)/1000 * x + LSCI1
SCI = 54:	Linear (0 to 999)	y = (HSCI1-LSCI1)/999 * x + LSCI1
SCI = 55:	Linear (0 to 2048)	y = (HSCI1-LSCI1)/2048 * x + LSCI1

SCI = 56:	Linear (409 to 2048)	y = (HSCI1-LSCI1)/1639 * (x – 409) + LSCI1
SCI = 57:	Square Root (0 to 2048)	y = sqrt (2048 * x) * (HSCI1-LSCI1)/2048 + LSCI1
SCI = 58:	Square Root (409 to 2048)	y = sqrt (1639 * (x - 409))* (HSCI1-LSCI1)/1639 + LSCI1
SCI = 59:	Linear (0 to 4095)	y = (HSCI1-LSCI1)/4095 * x + LSCI1

The following notes apply to SCI = 50 through SCI = 59:

- y = engineering units value; x = normalized counts value
- Linear scaling of the analog inputs is also provided.
- In the RINR block, linear scaling is applied before the signal conditioning algorithm is applied. The GAIN and BIAS parameters are used in the linear equation:

  x = GAIN (x + BIAS)

112. ROUT – Real Output Block

This chapter covers the Real Output (ROUT) block, its features, parameters and functions, and application diagrams.

NOTE

This chapter describes the Distributed Control Interface (DCI) ROUT block. For a description of how the ROUT block is used in PLC applications, refer to *PLC Interface Block Descriptions* (B0193YQ).

NOTE

CP270 and Later Only indicates ROUT features supported only on the Field Control Processor 270 (FCP270) and Z-form Control Processor 270 (ZCP270) with I/A Series software v8.4 or later, or on any later control processors such as the Field Control Processor 280 (FCP280) with I/A Series software v9.0 or later.

112.1 Overview

The Real Output (ROUT) block is a Distributed Control Interface (DCI) block. (DCI blocks support connectivity of I/A Series control stations to various bus resident devices via a general purpose interface.) ROUT sends one analog value to an address in a field device. In the outbound direction, the block accepts a real value from the control strategy or an operator set and sends it to the addressed point. In the inbound direction, the block's confirmed output structure allows any change made by the FBM to the value in the field device to be read back by the I/A Series block. Therefore, the block logic permits changes to the point value to be made at either end with the two ends remaining in sync at all times.

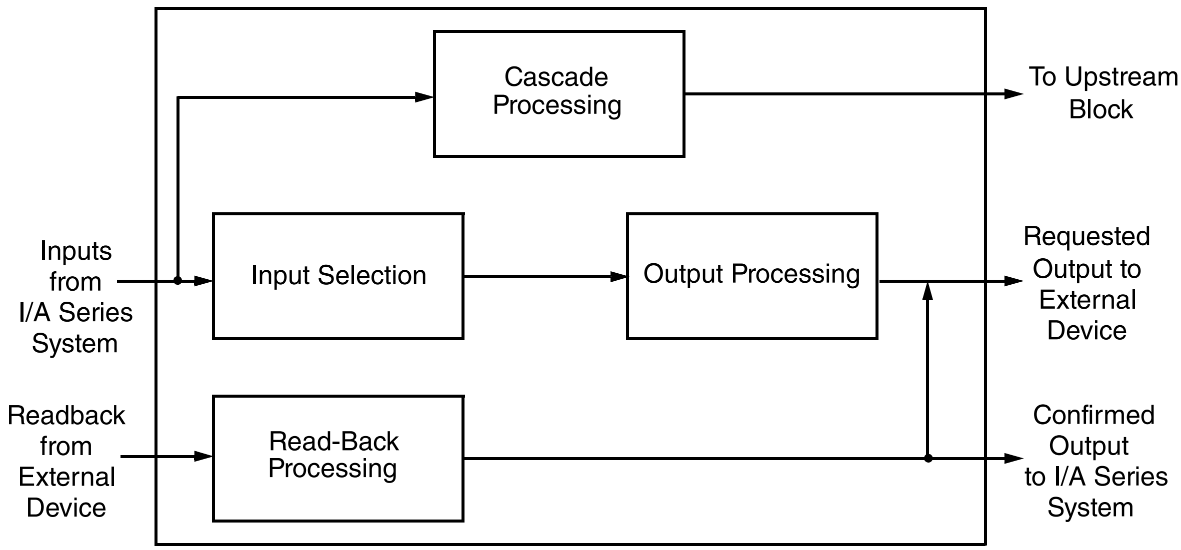


Figure 112-1. ROUT Block Diagram

112.2 Basic Operation

When in Auto, the ROUT block accepts a real input from an upstream control strategy at parameter Measurement (MEAS). In Manual, it accepts a real value from an operator set, generally from an I/A Series Display Manager or FoxView display, at the request component of parameter Output (OUT). It sends this value to the device's address specified at parameter Point Number (PNT_NO). Output from ROUT is change-driven when you configure parameter Secondary Timer (SECTIM) as 0.0. The block only writes to the device when a change occurs in the value of MEAS (Auto) or the request component of OUT (Manual). If SECTIM is nonzero, an output is also forced when no change-driven output has occurred for SECTIM seconds.

The "confirmed" structure of parameter OUT allows the value sent to the field device address to be entered into the "request component", also known as the "shadow component", of OUT and the value read back from the FBM to be reflected in the "confirmed component". The value of OUT shown in displays, or made available for connection to the control strategy, is always the confirmed component. This is the value which has been written successfully to the field device. The value which was sent to the field device as the request component of OUT is displayed at parameter Output Request (OUTQ) to aid in diagnostic testing.

A change timer mechanism is used to keep the I/A Series end synchronized with the device end. If a new I/A Series value is not accepted by the device within a pre-determined time, the I/A Series control station re-initializes its inputs and its output value. The output value is retained for future comparison against read-back values, but is not sent to the field device at this time.

Any new output value is first limited by the configured engineering range limits or clamped by the output limits, and then converted to device raw count by inverse signal conditioning based on the parameter Signal Conditioning Output (SCO), GAIN, and BIAS.

A reverse option (REVOPT) causes the output to reverse its sense. A Fail-Safe Out (FSOUT) is used to specify what value an output type of FBM should go to, if and when the conditions for fail-safe occur.

Read-back values from the external device are first scaled into the I/A Series normalized raw count range. The resulting I/A Series normalized raw count is then converted into engineering units by a proportionality calculation. Finally, it is limited to fall within the range specified by the high and low scale parameters or clamped by the output limits.

The block uses parameters Initialization Output (INITO) and Back-Calculated Output (BCALCO) to alert upstream blocks to various abnormal situations and for cascade handling.

To force the I/A Series station to Track during initialization procedures within the external device, a specific signal for this purpose is made available to the ROUT block at a configured Initialization Point Number (INI_PT) within the external device.

With I/A Series software V8.4 and later, the ROUT block provides Bad I/O alarm detection and reporting on the FCP280, FCP270 and ZCP270. The ROUT block does not provide alarming on other control processors. If alarms are desired, a separate CIN block can be used with a connection to the COUT parameter of the ROUT block.

112.3 Features

The ROUT block provides the following features:

- Separate sources for inputs in Auto and Manual
- Specification of external device destination point as device-specific string
- Output optionally written to device only when output value changes
- Optional periodic outputs added to change-driven outputs
- Displayed output values for both request and read-back values
- Inverse signal conditioning applied to limited or clamped output value
- Read-back values scaled into I/A Series normalized raw count range before further processing
- Change timer that assures closed loop operation in both directions
- Specific point reserved for Tracking notification from the external device
- Open cascade notification to upstream blocks
- Reverse Option (REVOPT) reverses the sense of the output
- Fail-safe Output specifies what value an output type of FBM should go to, if and when the conditions for fail-safe occur.
- Bad I/O alarm detection and reporting (*CP270 and Later Only*)
- Option to have the block switch to manual when input or readback status is Bad (*CP270 and Later Only)*
- Option to have the block switch to manual when fail-safe is asserted (*CP270 and Later Only*).

112.4 Parameters

Table 112-1. ROUT Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
Configurable Parameters					
INPUTS					
NAME	block name	string	no-con/no-set	2 blanks	1 to 12 chars
TYPE	block type	short integer	no-con/no-set	ROUT_TYPE	145
DESCRP	block description	string	no-con/no-set	2 blanks	1 to 32 chars
PERIOD	block sample time	short integer	no-con/no-set	1	0 to10, and 13 for CPs, 0 to 12 for Gateways
PHASE	block execution phase	short integer	no-con/no-set	0	---
LOOPID	loop/unit/batch identifier	string	no-con/set	2 blanks	1 to 32 chars
IOM_ID	ECB identifier	string	no-con/no-set	2 blanks	1 to 12 chars
PNT_NO	point number	string	no-con/no-set	1	1 to 32 chars, or device specific
UPDPER	update period	long	no-con/no-set	10000	0-2147483647
MA	manual/auto switch	boolean	con/set	0	0 to 1
INITMA	initialize manual/auto	short integer	no-con/no-set	1	0 to 2
AUTSW	auto override switch	boolean	con/set	0	0 to 1
BIAS	output bias	real	no-con/set	0.0	---
CLPOPT	clamp option	short integer	no-con/no-set	0	0 to 2
EO1	engineering units	string	no-con/no-set	%	1 to 6 chars
EROPT	error option	short integer	no-con/no-set	0	0 to 2
FSOPTN	fail-safe option	short integer	no-con/no-set	0	bit map
GAIN	output gain	real	no-con/set	1.0	any nonzero real
HOLIM	high output limit	real	con/set	100.0	---
HSCO1	high scale output	real	no-con/no-set	100.0	>LSCO1
INI_PT	initialize point number	string	no-con/no-set	blanks	device specific
LOLIM	low output limit	real	con/set	0.0	<=HLSCO1
LSCO1	low scale output	real	no-con/no-set	0.0	<HSCO1
MANSW	manual override switch	boolean	con/set	0	0 to 1
MEAS	real input	real	con/set	0.0	LSCO1-HSCO1
OUTOPT	output option	boolean	no-con/no-set	0	0 to 1
PRIBLK	primary block opt	short integer	no-con/no-set	0	0 to 1
PRITIM	cascade closure delay	real	no-con/no-set	0.0	seconds
RBKTIM	read-back timer	real	no-con/no-set	5.0	seconds
REVOPT	reverse action opt	boolean	no-con/no-set	0	0 to 1
SUPOPT	supervisory option	short integer	no-con/no-set	0	0, 1, 3
SUPGRP	supervisory group	short integer	no-con/no-set	1	0 to 7
INITSE	initialize SE mode	short integer	no-con/no-set	0	0 to 2
FLBOPT	fallback option	short integer	no-con/no-set	0	0 to 2
FLBREQ	fallback request	short integer	con/set	0	0 to 2
RO1	output range 1	real	no-con/no-set	100.0	0 to 1
SCO	signal conditioning index	short integer	no-con/no-set	0	0-5, 12-15, and 50-59
SECTIM	secondary timer	real	no-con/no-set	0.0	seconds

Table 112-1. ROUT Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
SIMOPT	simulation option	boolean	no-con/no-set	0	0 = no simulation 1 = simulation
OSV	output span variance	real	no-con/no-set	2	[0 to 25] percent
MANFS	manual if fail-safe	boolean	no-con/no-set	0	0 to 1
MBADOP	manual if bad option	boolean	no-con/no-set	0	0 to 1
INHOPT	inhibit option	short	no-con/no-set	0	0 to 3
INHIB	alarm inhibit	boolean	con/set	0	0 to 1
BAO	bad alarm option	boolean	no-con/no-set	0	0 to 1
BAT	bad alarm text	string	no-con/no-set	blank	1 to 32 chars
BAP	bad alarm priority	integer	con/set	5	1 to 5
BAG	bad alarm group	short	no-con/set	1	1 to 8
AMRTIN	alarm regeneration timer	integer	no-con/no-set	0	0 to32767 sec
SETFS	set fail-safe request	boolean	con/set	0	0 to 1
OUTPUTS					
FSOUT	fail-safe real output	real	con/no-set	0.0	---
Non-Configurable Parameters					
OUTPUTS					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
ALMSTA	alarm status	packed long	con/no-set	0	bit map
BCALCO	back-calculated output	real	con/no-set	0.0	---
BLKSTA	block status	packed long	con/no-set	0	0 to 0xFFFFFFFF
CRIT	alarm criticality	integer	con/no-set	0	0 to 5
INHSTA	inhibit status	packed long	con/no-set	0	0 to 0xFFFFFFFF
INITO	initialize output	boolean	con/no-set	0	0 to 1
OUT	real output	real	con/set	0.0	---
OUTFBK	output feedback	real	no-con/no-set	0.0	any real
OUTQ	output request	real	no-con/no-set	(shadow)	any real
PRTYPE	priority type	integer	con/no-set	0	0 to 8
SEVSTS*	(reserved)	integer	con/no-set	0	0 to 300
SUP_IN	supervisory input (*RCAS_IN*)	real	con/set if supervi-sory enabled	0	any real
SUPBCO	supervisory output (*RCAS_OUT*)	real	con/no-set	0.0	any real
TSTAMP	time stamp	long integer	con/no-set	0	ms after midnight
UNACK	unacknowledged alarm	boolean	con/no-set	0	0 to 1
VALSTS	FF value status	integer	con/no-set	0	0 to 0xFFFF
VUMEAS*	(reserved)	real	con/no-set	0.0	any real>0
DATA STORES					
ALMOPT	alarm options	packed long	no-con/no-set	0	0 to 0xFFFFFFFF
DEFINE	no configuration errors	boolean	no-con/no-set	1	---
DEV_ID	device identifier	character	no-con/no-set		6-character array
ERCODE	configuration error	string	no-con/no-set	2 blanks	1 to 43 chars
LOCKID	lock identifier	string	no-con/set	2 blanks	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	2 blanks	1 to 32 chars

Table 112-1. ROUT Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
SE	supervisory enable	boolean	no-con/set	0	0 to 1

*Not currently supported by FBM220/221 or FBM223.

112.4.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

ALMOPT
CP270 and Later Only

Alarm Options contain packed long values representing the alarm types that have been configured as options in the block, and the alarm groups that are in use. Table 112-2 shows how the parameter is used by the ROUT block.

Table 112-2. ALMOPT Parameter Format

Bit Number[1] (0 to 31)	Configured Alarm Option, When True
0 (lsb)	Alarm Group 8 in Use
1	Alarm Group 7 in Use
2	Alarm Group 6 in Use
3	Alarm Group 5 in Use
4	Alarm Group 4 in Use
5	Alarm Group 3 in Use
6	Alarm Group 2 in Use
7	Alarm Group 1 in Use
22	Bad I/O Alarm Configured

1. Bit 0 is the least significant, low order bit.

ALMSTA
CP270 and Later Only

Alarm Status is a 32-bit output, bit-mapped to indicate the block's alarm states. Table 112-3 shows the bits used by the ROUT block.

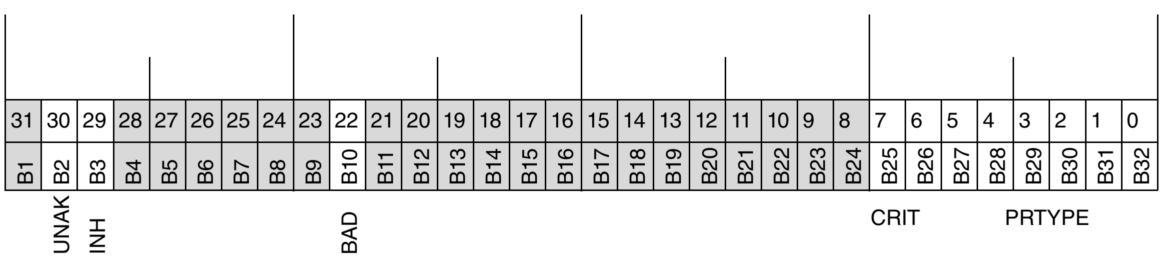


Table 112-3. ALMSTA Parameter Format

Bit Number (0 to 31)*	Name	Description, When True	Boolean Connection (B32 to B1)
0 to 4	PTYP_MSK	Priority Type. See “PRYTPE” on page 2242 for values used in the ROUT block	---
5 to 7	CRIT_MSK	Criticality: 1 (highest priority) to 5	---
22	BAD	Bad I/O Alarm	ALMSTA.B10
29	INH	Inhibit Alarm. This bit is set when any of the block’s alarms is inhibited	ALMSTA.B3
30	UNAK	Unacknowledged	ALMSTA.B2

*Bit 0 is the least significant, low order bit.

AMRTIN *(CP270 and Later Only)*

Alarm Message Regeneration Time Interval specifies the rate at which alarm messages are generated for alarm conditions that have not been cleared. The interval is specified in seconds. The configured interval is rounded up to the closest value that is an even multiple of the station BPC. A value of 0 disables alarm message regeneration.

AUTSW

Auto Switch forces the block mode to Auto. It is of higher priority than configured, set, or linked values in MA, or the value of INITMA. It is of lower priority than MANSW, however. If both MANSW and AUTSW are True, the block mode is forced to Manual.

BAG *(CP270 and Later Only)*

Bad Alarm Group is a configurable, non-settable short integer parameter used to specify the Alarm Group to be used for reporting Bad Alarm messages in the block. The range is 1 (default) to 8.

BAO *(CP270 and Later Only)*

Bad Alarm Option is a configurable, non-settable Boolean parameter used to specify whether or not Bad Alarming is to be performed in the block:

- 0 (default) disables Bad Alarming
- 1 enables Bad Alarming.

BAP *(CP270 and Later Only)*

Bad Alarm Priority is a configurable integer input used to specify the Alarm Priority to be assigned to Bad Alarms in the block. BADPRI is settable if unlinked. The range is 1 (highest) to 5 (default).

BAT *(CP270 and Later Only)*

Bad Alarm Text is a configurable, non-settable ASCII string of up to 32 characters used as descriptive text in Bad Alarm messages in the block.

BCALCO

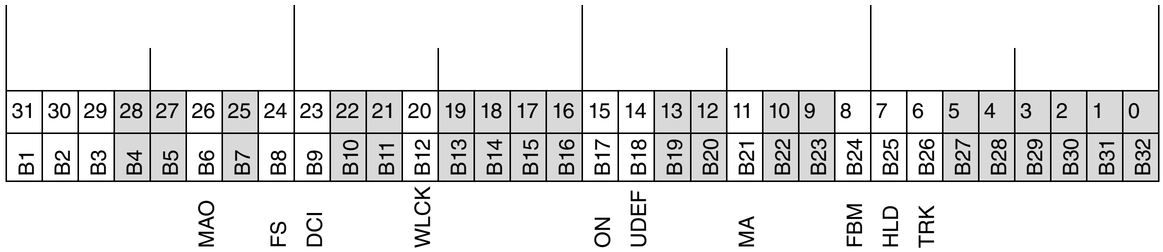
Back Calculated Output is set equal to the confirmed component of OUT while the cascade is initializing. Since its purpose is to provide the upstream block with a back-calculated value, you should connect BCALCO to the BCALCI parameter of that block.

BIAS

Bias is the offset factor used when the read-back value is converted from the device normalized count range into I/A Series system normalized raw count range.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate various block operational states. For the ROUT block, only the following bits are used:



Bit Number[1] (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
6	TRK	Device Initializing	BLKSTA.B26
7	HLD	Block Output Holding	BLKSTA.B25
8	FBM	Bad Status of ECB	BLKSTA.B24
11	MA	Manual = 0, Auto = 1	BLKSTA.B21
14	UDEF	Block Undefined	BLKSTA.B18
15	ON	Block On	BLKSTA.B17
20	WLCK	Access Locked	BLKSTA.B12
23	DCI	Enhance DCI block *(CP270 and Later Only)*	BLKSTA.B9
24	FS	Fail-Safe Active	BLKSTA.B8
26	MAO	M/A Override Active	BLKSTA.B6
29	SE	Supervisory Enabled	BLKSTA.B3
30	SC	Supervisory Control	BLKSTA.B2
31	FLB	Supervisory Control Fallback State	BLKSTA.B1

1. Bit 0 is the least significant, low order bit.

CLPOPT

Clamp Option determines whether the operational limits HOLIM and LOLIM are applied to the engineering units value in the output or read-back direction, instead of the range limits HSCO1 and LSCO1. The values are:

CLPOPT = 0: The values are never clamped.

CLPOPT = 1: The values are clamped only if the block is in Auto.

CLPOPT = 2: The values are clamped in both Auto and Manual.

CRIT *(CP270 and Later Only)*	Criticality is an integer output that indicates the priority of the block's highest currently active alarm. The range is 1 (highest priority) to 5. An output of 0 indicates the absence of alarms.
DEFINE	Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. (See ERCODE for the list of all possible validation errors in this block.) In that case, no further processing of the block occurs, including further validation of remaining parameters. To return DEFINE to a True value, you should correct all configuration errors and reinstall the block.
DESCRP	Description is a user-defined string of up to 32 characters used to describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").
DEV_ID	Device Identifier is a character array that specifies the 6-character identifier of the connected device. It is copied from the DEV_ID configured in the ECB specified by the IOM_ID parameter.
EO1	Engineering Units for Output Range 1 provides the engineering units text for the OUT output. The value configured for this text string should be consistent with the values used for HSCO1 and LSCO1.
ERCODE	Error Code is a character data store which indicates the type of configuration error which caused the block's DEFINE parameter to be set False, unless indicated otherwise (see meanings below). Validation of configured parameters does not proceed past the first error encountered by the block logic. Each nonzero value of ERCODE results in an explanatory message at the block's detail display. For the ROUT block, the following list shows the possible messages you may see:

ERCODE Message	Meaning
W44 – INVALID ENGINEERING RANGE	HSCI1 ≤ LSCI1
W48 – INVALID BLOCK OPTION	CLPOPT > 2
W50 – INVALID SIGNAL CONDITIONING INDEX	SCI is out of range for this block.
W52 – INVALID I/O CHANNEL/GROUP NO.	PNT_NO string is blank.
W62 – UNRESOLVED CONNECTION	Connection is not yet resolved. (Block remains defined.)
W65 – INVALID POINT ADDRESS	FBM parsing algorithm finds that a used BIx_PT is invalid.
W66 – DUPLICATE CONNECTION	There is a duplicate connection to a particular point.
W67 – INSUFFICIENT FBM MEMORY/CONNECTIONS	There is no available memory or point connections in the FBM.

ERCODE Message	Meaning
W68 – INVALID DEVICE CONNECTION	The device connection is invalid.
W69 – INVALID POINT CONNECTION	The point connection is invalid.

If a DCI data connection cannot be resolved due to a lack of configuration information, the block is marked DEFINED but the value is marked OOS and one of the following strings is stored in ERCODE to indicate the configuration error:

W77 - FIELDBUS COMMUNICATIONS FAULT (FBM228 only)
W78 - INVALID FUNCTION BLOCK (FBM228 only)
W80 - FIELDBUS DEVICE NOT FOUND (FBM228 only)
W73 - FF FUNCTION BLOCK CONFIGURATION ERROR (FBM228 only).

If a DCI data connection cannot be resolved for any other reason, the block is marked UNDEFINED and one of the following strings is stored in ERCODE to indicate the configuration error:

W74 - FF FUNCTION BLOCK DDITEM MISMATCH (FBM228 only)
W75 - FF FUNCTION BLOCK DDMBR MISMATCH (FBM228 only)
W76 - INVALID FF MODE CONFIGURATION (FBM228 only)
W79 - INVALID PARAMETER INDEX (FBM228 only)
W81 - INVALID PARENT DCI ECB PERIOD/PHASE (FBM228 only).

EROPT

Error Option specifies the conditions under which MEAS is considered to have bad status. It is used in determining whether there has been a bad-to-good transition of MEAS.

If EROPT = 1, MEAS is considered bad if its status word indicates Bad, Out-of-Service, or Not On Scan. (If it is Not On Scan, then the source of the connection has been deleted or is in a nonexistent compound, or there has been a peer-to-peer failure.)

If EROPT = 2, MEAS is considered Bad in any of the above situations. It is also considered Bad if the Error bit in the status of MEAS is True.

FLBOPT

Fallback Option is a short integer input that defines the control action to be taken by the block when a Supervisory fallback occurs:

- 0 = Take no fallback action (default)
- 1 = Set MA to Auto
- 2 = Set MA to Manual

FLBOPT overrides a linked MA parameter, but does *not* override the AUTSW and MANSW parameters.

FLBREQ

Fallback Request is a short integer output that is an explicit request for the block to go to the Fallback state, with recovery at the block level (when SE is set), and/or at the group level (when the appropriate group enable bit is set in SUPENA).

- 0 = No fallback requested
- 1 = Fallback requested; recovery at block or group level. See the "Supervisory Control" section in the AOUT block chapter.
- 2 = Fallback requested; recovery only at block level. See the "Supervisory Control" section in the AOUT block chapter.

FLBREQ is disabled if MA is driven by a source parameter.

FSOPTN

Fail-Safe Option is a configurable option that specifies the fail-safe conditions and action to be taken by the CP and the FBM for an output point in a ROUT block. Any combination of the following options may be configured:

- Bit 0: 1 = assert fail-safe if input/measurement error (that is, the input/measurement is BAD, OOS, or has a broken connection). Note that EROPT must be configured nonzero for this option to take effect.
- Bit 1: 1 = set/clear fail-safe when SETFS input is set/cleared.
- Bit 2: 1 = assert fail-safe if control station-to-FBM communication is lost (FBM option). This option will be enabled only if fail-safe is enabled at the FBM level via the FSENAB parameter in ECB200 or ECB202.
- Bit 3[1]: 1 = set the output BAD status if input/measurement error (that is, input/measurement is BAD, OOS, or has a broken connection).
- Bit 4[1]: 1 = set/clear the output BAD status when the SETFS input is set/cleared.
- Bit 5[1]: 1 = set the output BAD status if control station-to-FBM communication is lost (FBM option). This option will be enabled only if fail-safe is enabled at the FBM level via the FSENAB parameter in ECB200 or ECB202.

Notes:

- Bit 0 is the least significant, low order bit.
- For FOUNDATION fieldbus equipment, FSOPTN is dependent upon how the fault state parameters are configured in the device with which the ROUT block is being used. The fault state can also be turned off in the device, which would render FSOPTN ineffective.
- For FDSI FBMs, the actual fail-safe actions to be taken for each option are specified in the *Field Device System Integrator (FDSI) User's Guide* (B0700AH).

1. Bits 3, 4 and 5 of FSOPTN only apply to FDSI FBMs. The FDSI FBM uses these options only when interfacing to devices using protocols that support output point status.

- **This parameter (FSOPTN) is currently not supported by Modbus FBM224.**

FSOUT

Fail-Safe Real Output specifies the real fail-safe value that is to be used by the external device when any condition specified in FSOPTN exists. The entered value is limited by HSCO1 and LSCO1 before it is set into parameter FSOUT. If this limiting causes FSOUT to be changed, the status of FSOUT is set to Limited High or Limited Low, as appropriate. FSOUT is first converted to I/A Series system normalized raw count (using reverse action if specified by REVOPT) and then into device raw count (using inverse linear transformation based on GAIN and BIAS) before being sent to the device.

Notes:

- The CP sends the fail-safe value (FSOUT) to the FBM when any of the FSOPTN options are enabled. However, the actions taken by the FBM are unique to the subsystem. Refer to the subsystem user guide for descriptions on how fail-safe functionality is implemented for specific FBM types.
- For FOUNDATION fieldbus equipment, FSOUT's function is dependent upon how the fault state parameters are configured in the device with which the ROUT block is being used. The fault state can also be turned off in the device, which would render FSOUT ineffective.
- **This parameter (FSOUT) is currently not supported by Modbus FBM224.**

GAIN

In the output direction, Gain is used as a scaling factor in converting I/A Series normalized raw count to device raw count. In the input direction (read-back), Gain is used to convert the external device raw count to the I/A Series normalized raw count.

In the ROUT block, the same linear scaling is applied to the read-back value before the signal conditioning is applied, using the GAIN and BIAS parameters. Inverse linear scaling of the output value is applied after the inverse signal conditioning is applied. The following inverse linear equation is used:

$$x = (x - BIAS)/GAIN$$

HOLIM

High Output Limit is the upper operational limit of the engineering units value, optionally applied based on the value you have configured for CLPOPT. HOLIM is forced to be within the HSCO1/LSCO1 range limits, and forced to be greater than or equal to LOLIM.

Configure HOLIM within the output engineering range RO1 defined by parameters HSCO1 and LSCO1. If you change the HSCO1 and LSCO1 values to expand the engineering range, make sure you change the HOLIM value accordingly to prevent output limiting at the old limit. The block does not automatically adjust HOLIM for the expanded range.

HSCO1

High Scale for Output Range 1 specifies the upper range limit of the block input and output when expressed in engineering units.

INHIB
(CP270 and Later Only)

Inhibit is a configurable, connectable and settable boolean that, when set, suppresses all alarm message reporting. INHIB affects only alarm message reporting; the alarm handling and detection functions are determined by the INHOPT setting.

INHOPT
(CP270 and Later Only)

Inhibit Option specifies the following actions applying to all block alarms:

- ♦ 0 = When an alarm is inhibited, disables alarm messages but does not disable alarm detection.
- ♦ 1 = When an alarm is inhibited, disables both alarm messages and alarm detection. If an alarm condition exists at the time the alarm transitions into the inhibited state, the alarm indicator is cleared.
- ♦ 2 = Same as 0 for inhibited alarms. For uninhibited alarms, automatically acknowledges “return-to-normal” messages. “Into alarm” messages can be acknowledged by explicitly setting UNACK False.
- ♦ 3 = Same as 1 for inhibited alarms. For uninhibited alarms, automatically acknowledges “return-to-normal” messages. “Into alarm” messages can be acknowledged by explicitly setting UNACK False.

INHSTA
(CP270 and Later Only)

Inhibit Status contains packed long values that represent the current inhibit status of each alarm type configured in the block. Table 112-4 shows how the parameter is used with the AI block.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
									BAD																						

Table 112-4. INHSTA Parameter Format

Bit Number* (0 to 31)	Name	Description, When True	Boolean Connection (B32 to B1)
22	BAD	Bad I/O Alarm Inhibited	INHSTA.B10

*Bit 0 is the least significant, low order bit.

INITMA

Initialize Manual/Auto specifies the desired state of the MA input under certain initialization conditions, namely:

- ♦ The block has just been installed into the I/A Series station database.
- ♦ The I/A Series station is rebooted.

- The compound in which the block resides is turned on.
- The INITMA parameter is modified via the Integrated Control Configurator.

INITMA is ignored if MA has an established linkage.

When INITMA is asserted, the value set into MA is:

- 0 (Manual) if INITMA = 0
- 1 (Auto) if INITMA = 1
- The MA value from the checkpoint file if INITMA = 2.

INITO

Initialization Output is a cascade initialization signal which is set True by the block logic whenever the cascade is opened. You should connect INITO to the INITI input of the upstream block. The ROUT block keeps INITO True, either for one cycle (PRIBLK = 0) or until the acknowledgement is received from upstream (PRIBLK = 1).

INITSE

Initial Supervisory Enable specifies the initial state of the SE parameter in a block configured for Supervisory Control (SUPOPT = 1 or 3) when the lock initializes due to reboot, installing the block, or turning on the compound. Its options are:

- 0= Disable
- 1= Enable
- 2= Do not change SE parameter.

INI_PT

Initialize Address is a configurable string that specifies the point address of an optional Boolean input connection in the ROUT block. If INI_PT is used, the block output tracks the read-back value when this input Boolean value is set. On a transition of this input value to zero, if PRIBLK is used, the I/A Series cascade is initialized.

The point address syntax depends on the FBM type and the fieldbus protocol of the attached device, as described for "PNT_NO" on page 2241.

IOM_ID

ECB Identifier is a configurable string that specifies the pathname of the ECB201 for the device, for the purpose of connecting to (accessing) a field parameter that resides in a field device hosted by a (parent) ECB200/202.

IOM_ID has the form CompoundName:BlockName, where CompoundName is the 1-12 character name of the local compound containing the ECB, and BlockName is the 1-12 character block name of the ECB.

If the compound containing the ECB is the CPletterbug_ECB compound where CPletterbug is the station letterbug of the CP, the CompoundName may be omitted from the IOM_ID configuration. In this case, the 1-12 character ECB block name is sufficient.

LOCKID

Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-char-

	acter letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.
LOCKRQ	Lock Request is a Boolean input which can be set True or False only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set True in this fashion, a workstation identifier accompanying the set command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set False by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.
LOLIM	Low Output Limit is the lower operational limit of the engineering units value, optionally applied based on the value you have configured for CLPOPT. LOLIM is forced to lie within the HSCO1/LSCO1 range limits, and forced to be less than or equal to HOLIM. Configure LOLIM within the output engineering range RO1 defined by parameters HSCO1 and LSCO1. If you change the HSCO1 and LSCO1 values to expand the engineering range, make sure you change the LOLIM value accordingly to prevent output limiting at the old limit. The block does not automatically adjust LOLIM for the expanded range.
LOOPID	Loop Identifier is a configurable string of up to 32 characters used to identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.
LSCO1	Low Scale for Output Range 1 specifies the lower range limit of the block input and output when expressed in engineering units.
MA	Manual/Auto is a Boolean input that controls the block's operating state (0 = False = Manual; 1 = True = Auto). When in Auto mode, the block input is taken from MEAS, usually from an upstream connection. In Manual mode, the input is taken from the request component of OUT, usually via operator sets.
MANFS *(CP270 and Later Only)*	Manual if Fail-safe allows recovery from FBM fail-safe at the block in which MANFS is set. If MANFS = 1, the output state is forced to manual mode when the block detects the FBM being in fail-safe. The option only takes effect if MA is unlinked. MANFS takes precedence over AUTSW and INITMA. Fail-safe in the block is cleared as soon as the output is changed. For cascade operations, it is recommended that MANFS be enabled in only one block.
MANSW	Manual Switch, when True, forces the block into Manual mode. It is of higher priority than any other method of establishing the value MA, since

	it overrides configured, set, or linked values. MANSW is also of higher priority than AUTSW or INITMA.
MBADOP *(CP270 and Later Only)*	Manual if Bad Option is a manual override feature that, when set TRUE, causes the block to go into Manual mode if the output value status is BAD or MEAS value status is BAD.
MEAS	Measurement is the value used as the input when the block is in Auto mode. After limiting and inverse signal conditioning, this is the value normally set into OUT and sent to the external device.
NAME	Name is a user-defined string of up to 12 characters used to access the block and its parameters.
OSV *(CP270 and Later Only)*	Output Span Variance is a configurable real input which defines the percentage by which the output clamp limits exceed the output range defined by HSCO1 and LSCO1.
OUT	Output is the value sent from the block to the connected external device at point PNT_NO. The displayed value of OUT is always the confirmed component.
OUTFBK	Output Feedback Option is a connectable real output that contains the feedback signal of an analog output devices when the OUTOPT option is used. For FBM220/221, this value is provided by the PV parameter of a FOUNDATION fieldbus AO block in the field device. If OUTOPT is not used, OUTFBK tracks the OUT parameter.
OUTOPT	Output Feedback Option is a configurable boolean that specifies whether a feedback signal of an analog output device exists. If OUTOPT=1, this feedback signal is provided in the OUTFBK parameter.
OUTQ	Output Request displays the value of the request component of the block output for diagnostic purposes. It is not configurable.
OWNER	Owner is a string of up to 32 ASCII characters used to allocate control blocks to applications. Attempts to set OWNER are successful only if the present value of OWNER is the null string, an all-blank string, or identical to the value in the set request. Otherwise, the request is rejected with a LOCKED_ACCESS error. OWNER can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of OWNER. Once set to the null string, the value can then be set as desired.
PERIOD	Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and*

Field Control Processor 280 (CP280) Integrated Control Software Concepts (B0700AG).

PHASE

Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 seconds) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the I/A Series station is 0.5 second. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PNT_NO

Point Number identifies the address in the external device memory (or external device data stream) to which the block output is directed. The address syntax depends on the FBM type and the fieldbus protocol of the attached device:

- For the FBM223 PROFIBUS interface, PNT_NO must be configured to contain a PROFIBUS data identifier. This information identifies, to the FBM, the address of the input data unit from the device. Refer to *PROFIBUS-DP Communication Interface Module (FBM223) User's Guide* (B0400FE) for further details.
- For the FBM222 Redundant PROFIBUS interface, the PNT_NO configuration string uses the FBM223 syntax with extensions for PROFIBUS-PA status, custom status and other features. Refer to *Implementing PROFIBUS Networks in Foxboro Control Software Applications* (B0750BE) for further details.
- For the HART interface (FBM214/214b/215/216/216b/218/244/245/247), PNT_NO must be configured to contain a point address. This information identifies, to the FBM, specific data in the HART data stream that is to serve as the device data input to this block. Refer to *HART Communication Interface Modules User's Guide* (B0400FF) for details.
- For the Modbus interface (FBM224), PNT_NO must be configured to contain the address of a set of coils in a Modbus device. Refer to *Modbus Communication Interface Module (FBM224) User's Guide* for details.
- For the FDSI (FBM230/231/232/23), PNT_NO contains a data identifier to identify, to the FBM, specific data in the I/O data stream and to specify the elements of the data. Refer to *Field Device System Integrators (FBM230/231/232/233) User's Guide* (B0700AH) for more information.
- For the FBM228 Redundant FOUNDATION fieldbus Interface, the point number syntax specifies writes to an H1 device function block parameter using a client/server or publisher/subscriber connection, as described in *Implementing FOUNDATION fieldbus on an I/A Series System* (B0700BA), *Implementing FOUNDATION fieldbus*

(B0750BC), and *Implementing FOUNDATION fieldbus in Foxboro Control Software Applications* (B0750DA).

PRIBLK

Primary Block indicates whether the ROUT block has a connection from an upstream block (PRIBLK = 1) or not (PRIBLK = 0). Its value, together with that of PRITIM, determines whether the ROUT block remains in Hold until the upstream block returns an acknowledgement, remains in Hold for a fixed time delay, or ends the Hold after one cycle.

Use PRIBLK in a cascade situation when the source of the block's input connection needs to be initialized.

PRITIM

Primary Cascade Timer is a configurable parameter used to delay the closing of the cascade to a primary block, when the output is initialized in the ROUT block. It is used only if the PRIBLK option is set. If PRITIM = 0 and PRIBLK is used, the cascade remains open indefinitely until acknowledged by the primary block.

PRTYPE
CP270 and Later Only

Priority Type is an indexed output parameter that indicates the alarm type of the highest priority active alarm. For the ROUT block:

- 0 = No alarm
- 8 = Bad I/O alarm

RBKTIM

Read-Back Timer is a configurable parameter used to time out changes made by the I/A Series system to the output of the ROUT block. If the output change is not confirmed within the allowable timeout, the output is re-initialized to the read-back value. Its default value is 5.0 seconds, but you can configure different values to accommodate different response times from the external device.

REVOPT

Reverse Action Option is a configurable option that specifies whether a real output in a ROUT block is inverted algebraically prior to being sent to the FBM. If reverse action is specified, the read-back value from the FBM also is inverted prior to being stored in the block. The settings are: 0 = normal action, 1= reverse action.

RO1

Range Output is an array of real values that specify the high and low engineering scale of a particular real output. For a given block, it also forms an association with a group of real output parameters that have the same designated range.

SCO

Signal Conditioning Output is used in either direction in converting between device raw count and engineering units. (This is valid for output of data, or input of read-back data.) See Section 112.6 for the signal conditioning tables.

SE

SE Supervisory Enable is a boolean input that enables (SE = 1) or disables (SE = 0) Supervisory Control in this block.

SECTIM

Secondary Timer is a configurable parameter used to force the output of the ROUT block to be written periodically to the FBM, regardless of whether or not the output has changed. It can be used to prevent the FBM from asserting fail-safe action under normal operating conditions.

SETFS Set Fail-Safe Request is a configurable Boolean parameter that requests fail-safe action to be set/reset by the FBM and/or field device for the specific output value of the ROUT block. The settings are:

- 0 = reset fail-safe request
- 1 = set fail-safe request.

SEVSTS **This parameter is currently not supported by any FBM or field device.**

SIMOPT Simulation Option is a configurable parameter that specifies whether the block input/output value is to be simulated. In the ROUT block, the block output is stored into its read-back value to simulate confirmation by the field device.

SUP_IN Supervisory Input is a non-configurable, real parameter that contains the value of the *RCAS_IN* parameter of the associated device function block. The parameter is settable only when the supervisory setpoint control is enabled (SE = 1).

SUPBCO Supervisory Output is a non-configurable, non-settable real output that contains the *RCAS_OUT* parameter of the associated device function block.

SUPGRP Supervisory Group is a short integer input (1 to 8) that specifies one of eight groups to which this block is assigned for Supervisory Control.

SUPOPT Supervisory Option is a configurable short integer input that specifies whether or not this block is under control of a Supervisory Control application:

- 0 = No Supervisory control
- 1 = Set Point Control (SPC) of the block°fs set point (Supervisory setpoint control (SSC))
- 2 = Not supported for the ROUT block
- 3 = SPC, with an implicit acknowledge by the CP
- 4 = Not supported for the ROUT block

Be aware that option 1 requires an explicit acknowledge by the application software to close the supervisory cascade. This must be done by setting the ACK status bit in the SUP_IN parameter using special OM access functions.

TSTAMP The Time Stamp parameter of the block is updated every time there has been a change in the value of the readback from the external device point (that is, the current readback differs from the read-back value obtained in the last execution cycle). TSTAMP, which is expressed in units of milliseconds past midnight, is read from the FBM, when it is available there, or if not, is computed by the control station.

TYPE	When you enter ROUT or select it from a configurator list, an identifying integer is created specifying this block type. For this block, the value of TYPE is 145.
UNACK *CP270 and Later Only*	Unacknowledged is a Boolean output parameter that is set True for notification purposes whenever the block goes into alarm. It is settable, but sets are only allowed to clear UNACK to False, and never in the opposite direction. UNACK is cleared by an operator "acknowledge" pick on a default display, a user display, or the alarms display.
UPDPER	Update Period is a configurable, non-settable long integer that is used to specify the update period for client/server connections scheduled by the FBM228 to read the device function block View 1, View 2 and View 4 parameters. The range is 0 to 2147483647 milliseconds; the default is 10000.
VALSTS	Value Status is an output parameter that contains the value status of a FOUNDATION fieldbus device function block parameter value or PROFIBUS-PA device value provided by a DCI connection to a field device. For fieldbus types other than FOUNDATION fieldbus and PROFIBUS-PA, VALSTS is meaningless. Bits 0-1: Limits: 0 = Not limited 1 = High limited 2 = Low limited 3 = High and Low limited Bits 2-5: Substatus (definition depends on Quality) Bits 6-7: Quality: 0 = Bad 1 = Uncertain 2-3 = Good Note: Bit 0 is the least significant, low order bit. Each time the ROUT block is executed, VALSTS reports the status of the FF value from the information in the DCI connection. This parameter is not supported by PROFIBUS-DP, HART, or FDSI fieldbus devices.
VUMEAS	**This parameter is currently not supported by any FBM or field device.**

112.5 Functions

112.5.1 Detailed Diagram

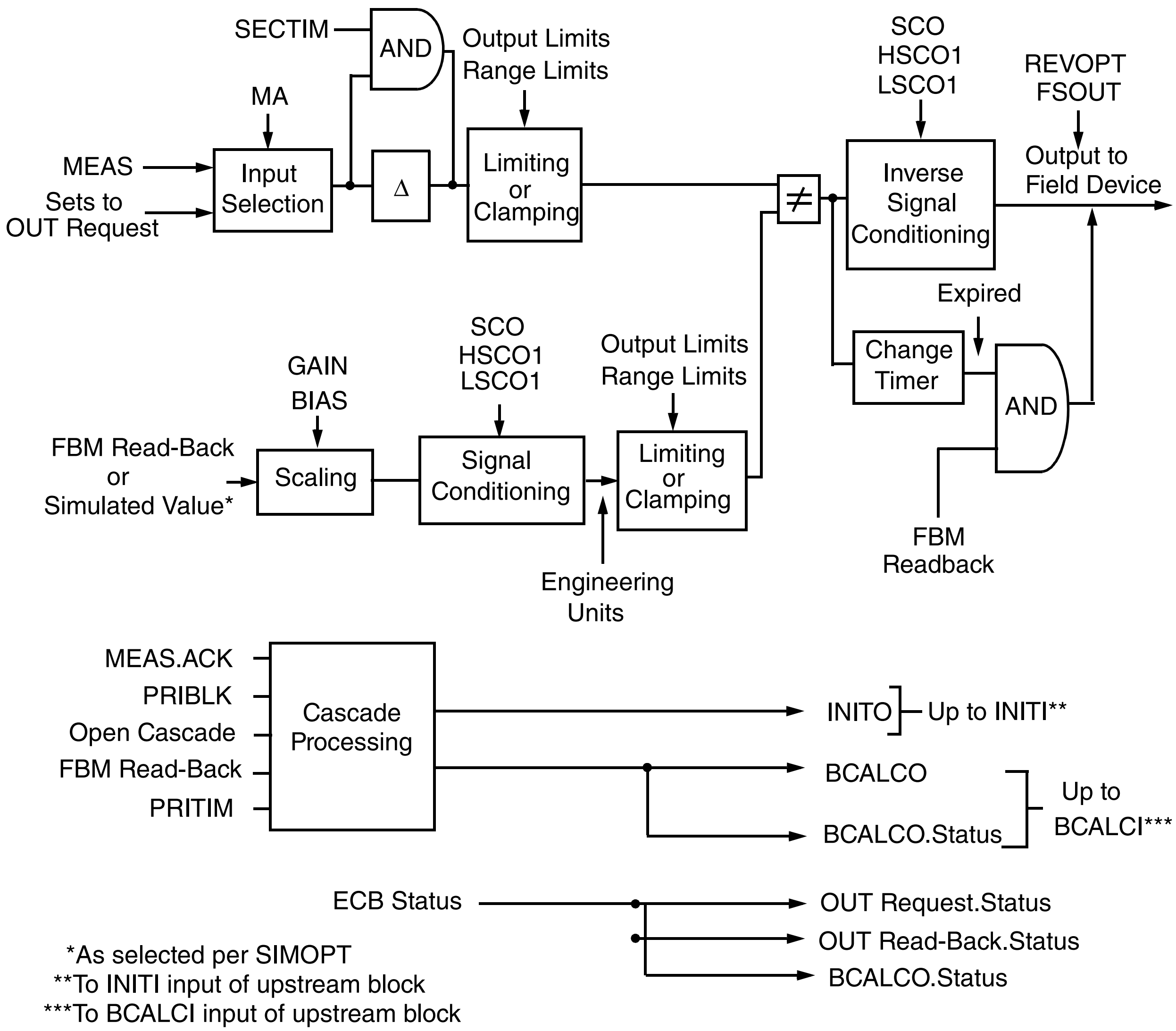


Figure 112-2. ROUT Block Operational Diagram

112.5.2 Associated ECBs

The configured parameter IOM_ID in the ROUT block specifies an ECB201 (Device ECB) to connect to a field parameter that resides in a field device hosted by an ECB200 or ECB202 (FBM ECB).

The PARENT parameter of the ECB201 specifies the associated FBM ECB hosting the field device.

IOM_ID may also directly specify the parent FBM ECB to output to a parameter resident in the FBM itself.

112.5.3 DCI Connections

The ROUT block establishes one or two DCI connections to the specified ECB at any one of the following times:

- The block is first installed.
- The CP station in which it resides has just been rebooted.
- A parameter of the block has been modified by the ICC or FoxCAE configurator.
- A device or parent ECB specified by the ROUT block has just been installed.

A DCI connection is added to a linked list of all the DCI connections, of any type, for all blocks specifying the same ECB. This arrangement permits multiple DCI blocks of differing data types to communicate with a single device at input/output scan time on a scatter-gather basis. It also allows multiple DCI connections in the same DCI block to be established (for example, connections in redundant type DCI blocks and for INI_PT connections in output type blocks, such as this one).

The ROUT block always establishes a DCI connection for parameter PNT_NO. If parameter INI_PT is configured with a non-null value, a second DCI connection is established for it.

These parameter connections are made by the FBM on a client/server basis at the frequency specified in the UPDPER parameter. The parameter can be set from 0 to 2147483647 milliseconds; the default is 10000 (10 seconds). Increasing the frequency of the client/server communication can significantly add to the load on the H1 segment.

The DCI connection is deleted (that is, the linkage is removed from the linked list for the ECB when the ROUT block is deleted).

112.5.4 Output Point and Initialization Input Point

The device address of the output is configured as a string in PNT_NO. The device address of the initialization input is configured as a string in INI_PT.

If PNT_NO is null, the ROUT block is set undefined at validation time, and processing does not proceed further. INI_PT may be null if it is not used.

The formats of the PNT_NO and INI_PT parameters are device specific. When the PIO maintenance task runs after the DCI connections have been made, the PNT_NO (and INI_PT string if used by the block) are passed to the FBM for parsing and validation. In DCI blocks, point identification strings are not parsed by the CP.

If the first character of PNT_NO is blank, the PNT_NO string is not sent to the FBM, and the block is set undefined, with ERCODE = 52. The detail display shows “W52 – INVALID I/O CHANNEL/GROUP NUMBER”.

In each of the following cases, the block is also set undefined:

- If HSCI1 ≤ LSCI1, the detail display shows “W44 – INVALID ENGINEERING RANGE” with ERCODE = 44.
- If CLPOPT > 2, the detail display shows “W48 – INVALID BLOCK OPTION” with ERCODE = 48.
- If the SCI is out of range for this block, the detail display shows “W50 – INVALID SIGNAL CONDITIONING INDEX” with ERCODE = 50.
- If the FBM parsing algorithm finds that PNT_NO is invalid, the detail display shows “W65 – INVALID POINT ADDRESS” with ERCODE = 65.

- If there is a duplicate connection to any point, the detail display shows “W66 – DUPLICATE CONNECTION” with ERCODE = 66.
- If there is no available memory in the FBM, or if the maximum number of connections have been allocated in the FBM, the detail display shows “W67 – INSUFFICIENT FBM MEMORY/CONNECTIONS” with ERCODE = 67.
- If the device connection is invalid, the detail display shows “W68 – INVALID DEVICE CONNECTION” with ERCODE = 68.
- If the point connection is invalid, the detail display shows “W69 – INVALID POINT CONNECTION” with ERCODE = 69.

In the following case, the block remains defined:

- If the connection is not yet resolved, the detail display shows “W62 – UNRESOLVED CONNECTION” with ERCODE = 62.

112.5.5 Confirmed Output Parameters

As with most output parameters in DCI blocks, OUT is a confirmed output. A confirmed output contains two components: a request value and a read-back value. The request value is changed by the I/A Series system end and sent to the field device, and the read-back value is the value read back each cycle from the FBM.

In the ROUT block, the request value is made available for diagnostic purposes as parameter OUTQ (OUTQ is not shown on the detail display). The read-back value is shown as parameter OUT.

112.5.6 Status of the Read-Back Value

The condition of the output readback in OUT, together with the status of the ECB, is determined each time the block is executed. The status bits of the OUT parameter are set according to the following rules.

The status of OUT is set to Out-of-Service if one or more of the following exist:

- The device ECB status indicates that the field device is Off-line or Out-of Service.
- The DCI connection cannot be configured, due to lack of configuration information in the FBM database.
- The DCI is not yet connected (that is, the PIO maintenance task has not yet sent the DATA_CONNECT message to the FBM for the linked-list addition).
- The DCI connection status information, which specifies the condition of the connected device parameter, indicates Out-of-Service. This means (in general) that the parameter value is unavailable.
- The status information indicates Disconnected, meaning (in general) that the parameter is not connected or not defined.
- The connection status information indicates that the connection is not yet resolved. The detail display shows “W62 – UNRESOLVED CONNECTION” with ERCODE = 62.
- An ECB201 is specified and the ECB device status indicates that the DCI connection is unresolved.

The status of OUT is set to Bad if:

- The device ECB status indicates that the field device has failed, or
- The DCI connection status information indicates a bad value regarding the field device parameter.

The status of OUT is set to Error if the status information indicates an uncertain or questionable value of the field device parameter.

The status of OUT is set to Fail-safe if the status information indicates that the addressed device parameter is in fail-safe.

If OUT is not Bad or Out-of Service, the value of the readback becomes the new value of OUT. Otherwise, the previous last good value of OUT is retained.

112.5.7 Processing the Read-Back Value Data

The raw count value from the external device is scaled into the I/A Series system normalized raw count range by application of GAIN and BIAS:

I/A Series System Normalized Raw Count = (Input Raw Value)(GAIN) + BIAS

This I/A Series system normalized raw count value is then converted into engineering units by application of the signal conditioning index (SCO) and the engineering range limits (HSCO1 and LSCO1):

Engineering Units =
((I/A Series System Normalized Raw Count - span low limit)(HSCO1 - LSCO1)/span) + LSCO1

For example, if the SCO is linear 1600-64000, the span low limit is 1600, and the span is 64000-1600 or 62400.

If REVOPT is configured True, this calculation is modified for reverse action.

The final step in read-back conditioning consists of clamping or limiting the engineering units value. Clamping or limiting of the read-back value is carried out optionally, based on the parameter CLPOPT:

If CLPOPT = 1, the value is clamped only if the block is in Auto.

If CLPOPT = 2, the value is clamped in both Auto and Manual.

If CLPOPT = 0, the value is never clamped.

Clamping uses the configured or set LOLIM/HOLIM values, after these have been forced to comply with the range limits and the anticrossover requirement.

With I/A Series software v8.4 and later, ROUT blocks operating on the FCP280, FCP270 and the ZCP270 expand the clamping limits range at each end by the percentage specified in Output Span Variance (OSV) parameter.

When clamping is not applied, the value is simply limited by the range limits LSCO1 and HSCO1.

NOTE

If you change the HSCO1 and LSCO1 values to expand the engineering range, make sure you change the HOLIM and LOLIM values accordingly to prevent output limiting at the old limits. The block does not automatically adjust HOLIM and LOLIM for the expanded range.

112.5.8 Auto/Manual Switching

The Auto/Manual mode selection arbitrates between inputs by the operator (Manual) and inputs from the field (Auto). Parameters MA, INITMA, AUTSW, and MANSW are used to establish the control mode of the ROUT block.

With I/A Series software v8.4 and later, the ROUT block provides two additional controls of the block mode on the FCP280, FCP270 and ZCP270:

- When MANFS=1, the block switches to manual mode when the fail-safe is asserted to allow recovery from FBM fail-safe at the block. The option only takes effect if MA is unlinked. MANFS takes precedence over AUTSW and INITMA. Fail-safe in the block is cleared as soon as the output is changed. For cascade operations, it is recommended that MANFS be enabled in only one block.
- When MBADOP=1, the block switches to manual mode when either the output value status is BAD or MEAS value status is BAD.

These options are not supported on other control processors.

112.5.9 Changing Engineering Range Limits

Changing engineering range limits in the ROUT block may limit output with unexpected results. For example, after changing the engineering units in the ROUT block from 4-20 to 0-100, the block output may still be limited in the 4-20 range.

The absolute engineering range limits of the output in this block is specified by the LSCO1, HSCO1, and OSV parameters. However, this block also contains output limit values (LOLIM and HOLIM), which are normally used to constrain the output to operating limits that are narrower than the engineering range limits.

When this block runs, the LOLIM and HOLIM limit values are not allowed to exceed the engineering range. In the example noted above, the block logic sets LOLIM=4 and HOLIM=20 when the block initializes, since LSCO1=4 and HSCO1=20.

When the block initializes with the modified engineering range (LSCO1=0 and HSCO1=100), the LOLIM, HOLIM values are **not** modified since they are already within the new engineering range. As a result, the output will remain limited between 4-20.

To expand the engineering range, also adjust the LOLIM and HOLIM values accordingly by setting them to their desired values. Once this is done, the new limit values will be used correctly to constrain the output value.

112.5.10 Fail-Safe Functions

Fail-safe support is based on the following parameters:

- FSOPTN – This configured value specifies the condition(s) under which fail-safe is to be asserted.
- FSOUT – This configured value contains, in engineering units, the fail-safe value that is to be used by the FBM when any condition specified in FSOPTN exists. The entered value is limited by HSCO1 and LSCO1 before it is set into parameter FSOUT. If this limiting causes FSOUT to be changed, the status of FSOUT is set to Limited High or Limited Low, as appropriate. FSOUT is first converted to I/A Series normalized raw count (using reverse action if specified by REVOPT) and then into

device raw count (using inverse linear transformation based on GAIN and BIAS) before being sent to the device.

- SETFS – This settable boolean constitutes a command to assert fail-safe. It is only observed when the appropriate FSOPTN so specifies.
- MANFS *(CP270 and Later Only)* – When set to true (MANFS=1), this parameter forces the block to Manual mode when fail-safe is asserted.

The FSOPTN conditions are:

- Assert fail-safe when there is an input error at MEAS, as defined by EROPT (Bit 0).
- Assert fail-safe when the block parameter SETFS has been set true (Bit 1).
- Assert fail-safe value, when communications between the I/A Series control station and the FBM is lost (Bit 2). The block does not perform this option; it is carried out by the FBM software. This option will be enabled only if fail-safe is enabled at the FBM level via the FSENAB parameter in ECB200 or ECB202.
- Set the output BAD status if Input/Measurement Error (Bit 3). The block does not perform this option; it is carried out by the FBM software.
- Set the output BAD status if SETFS is set (Bit 4). The block does not perform this option; it is carried out by the FBM software.
- Set the output BAD status if CP_FBM communications failure (Bit 5). The block does not perform this option; it is carried out by the FBM software. This option will be enabled only if fail-safe is enabled at the FBM level via the FSENAB parameter in ECB200 or ECB202.

FSOPTN is a bit map, allowing combinations of conditions for fail-safe to be specified.

If any of the FSOPTN conditions exists, and OUT is not Bad or Out-of-Service, the fail-safe value is sent to the FBM when the ROUT block is shut down, such as during a delete/undelete operation. This happens when turning off the compound containing the ROUT block and when deleting the ROUT block or the compound containing the ROUT block from the CP database. The actions taken by the FBM (for example, whether or not the FBM sends the fail-safe value to the field device) are unique to the particular FBM subsystem. Refer to the subsystem user guide for descriptions on how fail-safe functionality is implemented for specific FBM types.

In addition, the FSOUT value is sent to the field device via the FBM when the CP is rebooted or the block is restarted. This action is independent of the FSOPTN configuration.

112.5.11 Time Stamp

The time stamp (TSTAMP) parameter of the block is updated every time there is a change in the OUT value. TSTAMP, which is expressed in units of milliseconds past midnight, is read from the FBM when it is available there or, if not, it is computed by the I/A Series control station.

NOTE

For a FOUNDATION fieldbus connection, a 4-byte ms since midnight timestamp is provided by the FOUNDATION fieldbus FBM and stored in the TSTAMP parameter.

112.5.12 Conditions for Sending a Block Output

The following conditions cause a new output from the ROUT block:

- A new value has been set into either or both of the operational limits HOLIM and LOLIM since the last execution cycle, provided the CLPOPT specifies that clamping is in use.
- A periodic output is required. Whenever SECTIM has been configured with a positive value and there has been no output for SECTIM seconds, a block output is forced and the secondary timer is reinitialized.
- The read-back value has actually been changed by application of the clamping or limiting.
- A condition for fail-safe has been met this cycle but was not met the previous cycle (“start of a fail-safe period”).
- A condition for fail-safe was present the previous cycle, but not this cycle (“end of a fail-safe period”).
- The connection status information indicates Initialization Request this cycle, but not on the previous cycle (“start of an IR period”).
- The connection status information indicated Initialization Request last cycle, but not this cycle (“end of an IR period”).
- The block is in Auto and the value of MEAS has changed this cycle.
- The block is in Manual and the value of OUT_request has been changed this cycle.
- This is an initialization cycle, as defined in Section 112.5.18.
- The read-back value has actually been changed by application of the clamping or limiting described in Section 112.5.7.

112.5.13 Processing the Output Data

When any of the conditions for sending a new block output exists, the current value of MEAS [Auto or OUT_request (Manual)] is either clamped or limited before conversion to I/A Series system normalized raw count.

Clamping or limiting of the output value is carried out optionally, based on the parameter CLPOPT.

When clamping is not applied, the value is simple limited by the range limits LSCO1 and HSCO1.

NOTE

If you change the HSCO1 and LSCO1 values to expand the engineering range, make sure you change the HOLIM and LOLIM values accordingly to prevent output limiting at the old limits. The block does not automatically adjust HOLIM and LOLIM for the expanded range.

This clamped or limited value is now compared against the current value of OUT. If they are equal, no new output is sent. (Even if these two values are the same, an output is sent if any of the conditions in the first three bullets of Section 112.5.12 is true.)

Assuming the output is to be sent, conversion to I/A Series system normalized raw count is computed as follows:

Output Raw Count = (New Value - LSCO1)(span)(HSCO1 - LSCO1) + span low limit

If REVOPT is configured True, this calculation is modified for reverse action.

Finally, if conversion from I/A Series system normalized raw count to device normalized count is to be carried out at the I/A Series system end, GAIN and BIAS are carried out by the block as follows:

Device Raw Count = (I/A Series System Normalized Raw Count - BIAS)/GAIN

If conversion to the device normalized count is to be carried out at the device end, GAIN and BIAS should be left at their default values.

112.5.14 Sending the Output

After the output has been processed as described in the previous section, it is sent to the output buffer of the DCI connection for PNT_NO.

The Write Flag is then set in the output buffer. If the connection has an Initialization Request flag set, the Initialization Acknowledge flag is also set in the output buffer. If the output is being sent because of a fail-safe condition, the Fail-safe Request flag is also set in the output buffer.

112.5.15 Status of Other Block Outputs

The Out-of Service, Bad, and Fail-safe status bits of OUT are copied to the status of OUT_request. In addition, the status of OUT_request is set to Limited High or Limited Low (as appropriate) if:

- The clamping or limiting action described in Section 112.5.13 forces a modification of the value
- The DCI connection status information indicates that the field device parameter is limited high or low.

112.5.16 Change Timer

The purpose of the change timer is to facilitate monitoring by the block for an indication that the external device point has received the most recent I/A Series system change. The block expects the device to have received the new value within that time.

The timer is initialized to the configured value of RBKTIM (in seconds) each time a value is sent to the external device. In each cycle thereafter, so long as there is no new output sent, the timer is decremented and tested for expiration.

If the change timer expires, or if there has been a change in the read-back value this cycle, the block inputs are initialized to the value of the current readback. This readback is copied into OUT_request and, if it is unlinked, into MEAS, to establish the new baseline for input change-detection.

112.5.17 Status of INI_PT

Transitions in the status of the initialization input INI_PT are used in determining whether block initialization is required.

This status is considered True if:

- ♦ The device value of INI_PT is True (the external device has requested that the block go into Tracking).
- ♦ The ECB status indicates that the field device is Off-line or Out-of Service.
- ♦ The DCI connection for INI_PT cannot be configured, due to lack of configuration information in the FBM database.
- ♦ The DCI for INI_PT is not yet connected (that is, the PIO Maintenance task has not yet sent the DATA_CONNECT message to the FBM for the linked-list addition described in Section 112.5.3).
- ♦ The DCI connection status information for PNT_NO indicates Initialization Request, Local Override, Fail-safe, or Open Cascade.

112.5.18 Initialization

The ROUT block initializes whenever the block is restarted, there is a bad-to-good transition of the status of OUT, or there is a true-to-false transition in the status of INI_PT. See Section 112.5.17.

Initialization action consists of setting the read-back value into MEAS and OUT_request. The cascade is then opened to force an upstream initialization. See Section 112.5.19. The block output is sent to the external device on an initialization cycle.

If the block is in Auto mode, and there has been a bad-to-good transition in the status of MEAS, the same actions are taken, except for the initialization of OUT_request. The definition of Bad for the status of MEAS depends on EROPT.

112.5.19 Cascade Processing

The cascade is opened when the block has initialized for any of the reasons listed in the previous section. When the cascade is opened, INITO, which should be connected to INITI input of the block immediately upstream from the ROUT block (if there is an INITI parameter in that block), is turned on. The status of BCALCO, which should be connected to the BCALCI input of the block immediately upstream, is set to indicate open cascade.

The read-back value is set into the value of BCALCO and the ROUT block then goes into a Hold, thereby disallowing any outputs.

The upstream block (the block connected to MEAS) is then commanded to run immediately. This feature sets a Run flag in the header of the upstream block, causing the compound processor to execute this block on the next BPC without regard to its period and phase.

If there is no support for cascade processing in the upstream block, configure PRIBLK = 0. In this case, the cascade is held open for one cycle, after which the Hold is released. If more specific conditions for closure of the cascade are desired, the value PRIBLK = 1 should be configured as follows:

- ♦ PRIBLK is 1 (True) and PRITIM = 0:
  This is the standard ACK option as used in ordinary control blocks. If there are no cascade levels above the block immediately upstream, this block passes its output to the MEAS of the ROUT block and signals the closure of the cascade by turning on the acknowledge status of MEAS. If there is a cascade level above the one connected to the MEAS of ROUT, the block immediately upstream delays turning on the acknowledge to ROUT until it, in turn, has detected cascade closure above.

- PRIBLK = 1 (True) and PRITIM = positive:
  This is the Tim-out option. The cascade is closed after the time-out constant configured into PRITIM has expired. The acknowledge status of MEAS is ignored.

112.5.20 Holding and Tracking

The block goes into Holding whenever MEAS is Bad, OUT has bad status, or it is in Auto mode with the cascade not closed.

The block goes into Tracking when the status of INI_PT is True and remains that way as long as it stays True.

Ordinarily, no output changes are allowed while the block is in Holding or Tracking. The only exceptions are:

- This is the start or end of either a fail-safe period or an IR period. (See Section 112.5.12.)

This is an initialization cycle, as defined in Section 112.5.18. Exception is when there has been a fail-safe request, as described earlier in Section 112.5.12.

112.6 ROUT Signal Conditioning (SCO) Values

> **NOTE**
> Valid SCO values for the ROUT block are 0-5, 12-15, and 50-59, all inclusive.

SCO = 0: No Conditioning
RAWC = OUT

SCO = 1: Inverse Linear (0 to 64000)
Represents analog output of 0 to 20 mA
RAWC = (OUT - LSCO1) * 64000/(HSCO1 - LSCO1)

SCO = 2: Inverse Linear (1600 to 64000)
Represents analog output of 0 to 10 V dc
RAWC = ((OUT - LSCO1) * 62400/(HSCO1 - LSCO1)) + 1600

SCO = 3: Inverse Linear (12800 to 64000)
Represents analog output of 4 to 20 mA
RAWC = ((OUT - LSCO1) * 51200/(HSCO1 - LSCO1)) + 12800

SCO = 4: Inverse Square Root (0 to 64000)
Represents analog output of 0 to 20 mA
RAWC = $((OUT - LSCO1) * 64000/(HSCO1 - LSCO1))^2 / 64000$

SCO = 5: Inverse Square Root (12800 to 64000)
Represents analog output of 4 to 20 mA
RAWC = $((OUT - LSCO1) * 51200/(HSCO1 - LSCO1))^2 / 51200 + 12800$

SCO = 12: Inverse linear (2 - 10v)
temp_val = (out - offset) / span + 14080.0

SCO = 13:	Inverse square root (2 - 10v) temp_val = (out - offset) /span temp_val = (temp_val * temp_val) / 49920.0 + 14080.0	
SCO = 14:	Inverse linear (0 - 16383) temp_val = (out - offset) /span	
SCO = 15:	Inverse square root (0 - 10v) temp_val = (out - offset) /span temp_val = (temp_val * temp_val) / 62400.0 + 1600.0	
SCO = 50:	Linear (0 to 65535)	x = (y - LSCO1) * 65535/(HSCO1-LSCO1)
SCO = 51:	Linear (-32768 to 32767)	x = (y - LSCO1) * 65535/(HSCO1-LSCO1) - 32768
SCO = 52:	Linear (0 to 32767)	x = (y - LSCO1) * 32767/(HSCO1-LSCO1)
SCO = 53:	Linear (0 to 1000)	x = (y - LSCO1) * 1000/(HSCO1-LSCO1)
SCO = 54:	Linear (0 to 9999)	x = (y - LSCO1) * 999/(HSCO1-LSCO1)
SCO = 55:	Linear (0 to 2048)	x = (y - LSCO1) * 2048/(HSCO1-LSCO1)
SCO = 56:	Linear (409 to 2048)	x = (y - LSCO1) * 1639/(HSCO1-LSCO1) + 409
SCO = 59:	Linear (0 to 4095)	x = (y - LSCO1) * 4095/(HSCO1-LSCO1)

The following notes apply to SCO = 50 through SCO = 59:

- y = engineering units value; x = normalized counts value.
- Linear scaling of the analog outputs is also provided.
- In the ROUT block, the same linear scaling is applied to the read-back value before the signal conditioning is applied, using the GAIN and BIAS parameters. Inverse linear scaling of the output value is applied after the inverse signal conditioning is applied. The following inverse linear equation is used:

  x = (x – BIAS)/GAIN

112.7 Alarming (CP270 and Later Only)

With I/A Series software v8.4 and later, Bad I/O alarm detection and reporting are supported on the FCP280, FCP270 and ZCP270. Alarming is not supported on any other control processors.

Bad alarm detection is enabled when the bad alarm option (BAO) is set.

A Bad alarm message is generated when the status of COUT is set Bad. The Bad alarm message is sent to all devices in the bad alarm group specified by the BAG parameter. This message contains text string identifying the input value (BAD), the descriptive text in the BAT parameter, and the loop identifier in the LOOPID parameter.

When COUT is Bad, the following parameters and bits are set:

- BAD bit in the alarm status parameter (ALMSTA.BAD)
- UNACK parameter and the corresponding ALMSTA.UNACK bit.
- CRIT parameter and its corresponding ALMSTA.CRIT are set to the BAP parameter value
- PRTYPE parameter and its corresponding ALMSTA.PRTYPE field are set to the Bad alarm type.

When COUT becomes Good, a corresponding return-to-normal message is generated and sent to all devices in the bad alarm group, and CRIT, PRTYPE and their corresponding fields in ALMSTA are cleared.

The UNACK parameter and the ALMSTA.UNACK bit are cleared in these cases:

- When the alarm is acknowledged by an OM set operation at either the compound level (by setting the compound UNACK=0) or at the block level (by setting the block UNACK=0).
- When all input values return to good status and INHOPT is set appropriately.
- When the block is shut down.

When UNACK is cleared, an Alarm Acknowledge message is generated and sent to all devices in the bad alarm group.

Alarm Inhibiting/Disabling are supported using a combination of the compound CINHIB parameter and the INHOPT and INHIB parameters in the ROUT block, to allow the bad alarm messages to be inhibited and/or the alarm detection to disabled dynamically.

When the Bad alarm is inhibited or disabled, an appropriate Alarm Disable message is generated and sent to all devices in the respective alarm group. If the Alarm is unacknowledged, an Alarm Acknowledge message is also sent to these devices., and the ALMSTA.INHIB bit is set.

When the Bad alarm is uninhibited or enabled, an appropriate Alarm Enable message is generated and sent to all devices in the respective alarm group. If all alarms are uninhibited, the ALMSTA.INHIB bit also is cleared.

Parameters NASDB and NASOPT provide control of nuisance alarms by applying a delay (set in NASDB) to return-to-normal condition (NASOPT = 0) or to alarm detection (NASOPT=1).

The Alarm Message Regeneration Time Interval (AMRTIN) parameter specifies the rate at which alarm messages are generated for alarm conditions that have not been cleared. The interval is specified in seconds. The configured interval is rounded up to the closest value that is an even multiple of the station BPC. A value of 0 disables alarm message regeneration.

Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG) on alarm regeneration.

113. ROUTR – Redundant Real Output Block

This chapter covers the Redundant Real Output (ROUTR) block: its basic operations, features, parameters, and functions, bad input, out-of-service and error conditions, fail-safe state, manual mode, and alarming.

— NOTE —

The ROUTR block is currently qualified for use only with DCS FBMs for Migration to Moore APACS™+ systems. For more information on these DCS FBMs, refer to the *DCS Fieldbus Modules for Migration of Moore APACS+ Systems User's Guide* (B0700BK).

— NOTE —

CP270 and Later Only indicates ROUTR features supported only on the Field Control Processor 270 (FCP270) and Z-form Control Processor 270 (ZCP270) with I/A Series software v8.4 or later, or on any later control processors such as the Field Control Processor 280 (FCP280) with I/A Series software v9.0 or later.

113.1 Overview

The Redundant Real Output (ROUTR) block is a Distributed Control Interface (DCI) block. DCI blocks support connectivity of I/A Series control stations to various bus resident devices via a general purpose interface.

The ROUTR block (Figure 113-1) can send one real value to either two or three redundant outputs. The outputs may be in the same device or different devices. The output value is clamped or limited, and then converted into raw counts before being sent to the redundant outputs.

ROUTR accepts a real value from the control strategy or an operator set and sends it to the specified point addresses in field devices connected to the FBM. The block also confirms any change made by the FBM to the value in the field device by reading back the value from the FBM and storing it in an output parameter. An arbitration algorithm determines which one of the two or three readback values is to be used. The readback function allows changes to be made to the point value at either end of the block with the two ends remaining in sync at all times.

With I/A Series software v8.4 and later, the ROUTR block provides Bad I/O alarm detection and reporting on the FCP280, FCP270 and ZCP270. The ROUTR block does not provide alarming on other control processors. If alarms are desired, a separate CIN block can be used with a connection to the COUT parameter of the ROUTR block.

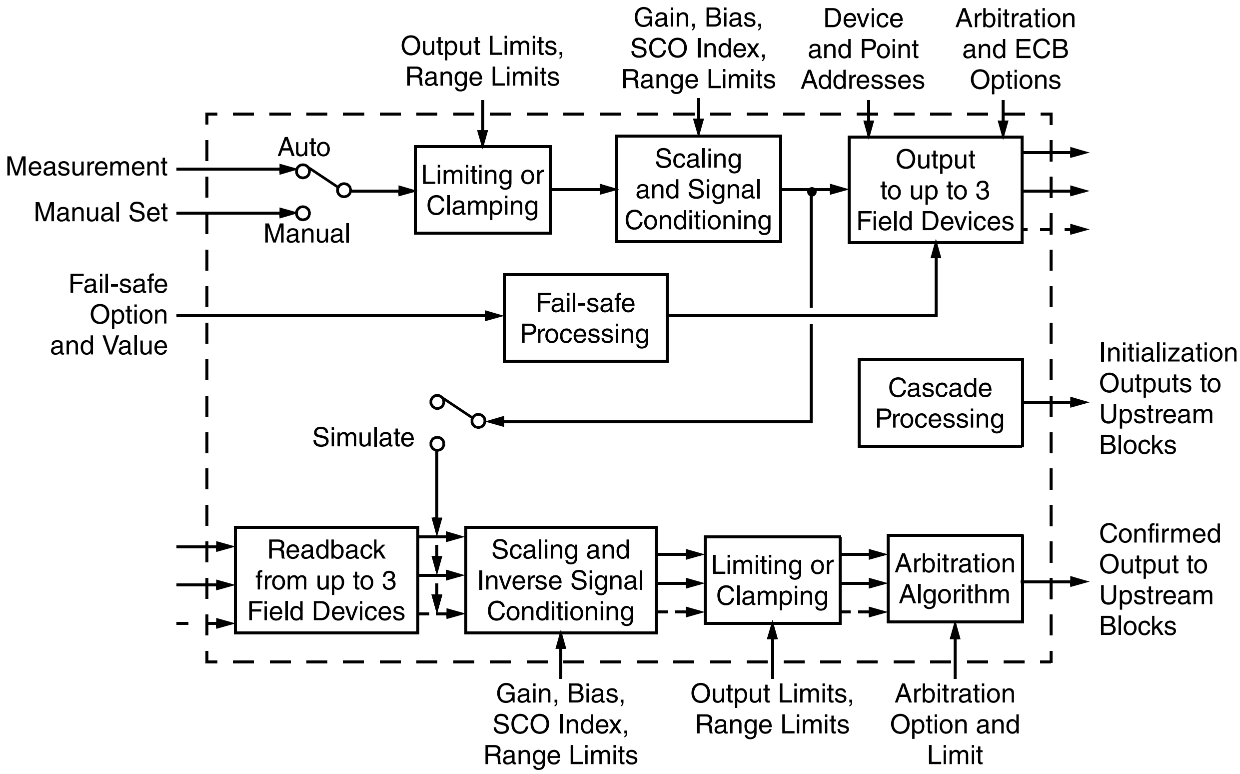


Figure 113-1. ROUTR Block Diagram

113.2 Basic Operation

When in Auto, the ROUTR block accepts a real input from an upstream control strategy at parameter Measurement (MEAS). In Manual, it accepts a real value from an operator set, generally from a FoxView display, at the request component of parameter Output (OUT). It sends this value to up to three field devices specified by ECB identifiers (IOMID1 through IOMID3) at the point addresses specified by the Real Output Point parameters (RO1_PT through RO3_PT). Output from ROUTR is change-driven when you configure parameter Secondary Timer (SECTIM) as 0.0. The block only writes to the devices when a change occurs in the value of MEAS (Auto) or the manual set request to OUT (Manual). If SECTIM is nonzero, an output is also forced when no change-driven output has occurred for SECTIM seconds.

The “confirmed” structure of parameter OUT allows the value sent to the field device addresses to be entered into the “request component” and the arbitrated value read back from the FBM to be reflected in the “confirmed component”. The FBM readback value used for the confirmed output is selected from the redundant readback values The value of OUT shown in displays, or made available for connection to the control strategy, is always the confirmed component. This is the value which has been written successfully to the field device. The value which was sent to the field device as the request component of OUT is displayed at parameter Output Request (OUTQ) to aid in diagnostic testing.

A change timer mechanism is used to keep the I/A Series control strategy synchronized with the device. If a new OUT request value is not accepted by the device within a pre-determined time, the ROUTR block re-initializes its inputs and its output value. The output value is retained for future comparison against readback values, but is not sent to the field device at this time.

Any new output value is first limited by the configured engineering range limits (LSCO1 and HSCO1) or clamped by the output limits (LOLIM and HOLIM), and then converted to device raw count by inverse signal conditioning based on the parameters Signal Conditioning Output (SCO), OGAIN, and OBIAS.

A reverse option (REVOPT) causes the output to reverse its sense. A Fail-Safe Out (FSOUT) parameter is used to specify what value an output type of FBM should go to, if and when the conditions for fail-safe occur.

Readback values from the field devices are first scaled into the I/A Series normalized raw count range. The resulting I/A Series normalized raw count is then converted into engineering units by a proportionality calculation. Finally, it is limited to fall within the range specified by the high and low scale parameters or clamped by the output limits.

The block uses parameters Initialization Output (INITO) and Back-Calculated Output (BCALCO) to alert upstream blocks to various abnormal situations and for cascade handling.

To force the ROUTR block to Track during initialization procedures within the field device, a specific signal for this purpose is made available to the ROUTR block at a configured Initialization Point Number (INI_PT) within the field device.

ROUTR does not provide any alarm detection or reporting capability. If alarms are desired, a separate AIN block can be used with a connection to the OUT parameter of the ROUTR block.

113.3 Features

The ROUTR block provides the following features:

- Arbitration Option (ARBOPT) specifies dual or triple redundancy outputs to the same field device or different devices, as specified by ECB Option (ECBOPT)
- Separate sources for inputs in Auto and Manual
- Specification of field device ECBs and destination points as device-specific strings
- Output optionally written to field device only when output value changes
- Optional periodic outputs added to change-driven outputs
- Displayed output values for both request and readback values
- Signal conditioning applied to limited or clamped output value
- Readback values scaled into I/A Series normalized raw count range before further processing
- Change timer that assures closed loop operation with the field device
- Specific point reserved for Tracking notification from the field device
- Open cascade notification to upstream blocks
- Reverse Option (REVOPT) reverses the sense of the output
- Fail-safe Output specifies what value an output type FBM should go to, if and when the conditions for fail-safe occur.
- Bad I/O alarm detection and reporting (*CP270 and Later Only*)
- Option to have the block switch to manual when input or readback status is Bad (*CP270 and Later Only)*

- ♦ Option to have the block switch to manual when fail-safe is asserted (*CP270 and Later Only*).

113.4 Parameters

Table 113-1. ROUTR Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
Configurable Parameters					
INPUTS					
NAME	block name	string	no-con/no-set	2 blanks	1 to 12 characters
TYPE	block type	short integer	no-con/no-set	ROUTR	145
DESCRP	block description	string	no-con/no-set	2 blanks	1 to 32 characters
PERIOD	block sample time	short integer	no-con/no-set	1	0 to10, and 13 for CPs, 0 to 12 for Gateways
PHASE	block execution phase	short integer	no-con/no-set	0	(period specific)
LOOPID	loop/unit/batch identifier	string	no-con/set	2 blanks	1 to 32 characters
SIMOPT	simulation option	boolean	no-con/no-set	0	0 to 1
ECBOPT	redundant ECB option	boolean	no-con/no-set	0	0 to 1
IOMID1	primary ECB identifier	string	no-con/no-set	2 blanks	6 characters
IOMID2	secondary ECB identifier	string	no-con/no-set	2 blanks	6 characters
IOMID3	tertiary ECB identifier	string	no-con/no-set	2 blanks	6 characters
RO1_PT	real output 1 address	string	no-con/no-set	blanks	device specific
RO2_PT	real output 2 address	string	no-con/no-set	blanks	device specific
RO3_PT	real output 3 address	string	no-con/no-set	blanks	device specific
INI_PT	initialize point number	string	no-con/no-set	2 blanks	device specific
ARBOPT	arbitration option	boolean	no-con/no-set	0	0 to 1
SELOPT	select option	short integer	no-con/no-set	0	0 to 3
MEAS	real input	real	con/set	0.0	RO1
SCO	signal conditioning index	short integer	no-con/no-set	0	0-5, 12-15, and 50-59
OGAIN	output gain	real	no-con/set	1.0	any nonzero real
OBIAS	output bias	real	no-con/set	0.0	RO1 units
HOLIM	high output limit	real	con/set	100.0	RO1
LOLIM	low output limit	real	con/set	0.0	RO1
HSCO1	high scale output	real	no-con/no-set	100.0	>LSCO1
LSCO1	low scale output	real	no-con/no-set	0.0	<HSCO1
EO1	engineering units	string	no-con/no-set	%	1 to 32 characters
EROPT	error option	short integer	no-con/no-set	0	0 to 2
UPDPER	update period	long	no-con/no-set	10000	0-2147483647
MA	manual/auto switch	boolean	con/set	0	0 to 1
INITMA	initialize manual/auto	short integer	no-con/no-set	1	0 to 2
AUTSW	auto override switch	boolean	con/set	0	0 to 1
MANSW	manual override switch	boolean	con/set	0	0 to 1
CLPOPT	clamp option	short integer	no-con/no-set	0	0 to 2
PRIBLK	primary block option	short integer	no-con/no-set	0	0 to 1
PRITIM	cascade closure delay	real	no-con/no-set	0.0	any real >= 0.0
SECTIM	secondary timer	real	no-con/no-set	0.0	any real >= 0.0

Table 113-1. ROUTR Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
RBKTIM	readback timer	real	no-con/no-set	5.0	any real
SUPOPT	supervisory option	short integer	no-con/no-set	0	0, 1, 3
SUPGRP	supervisory group	short integer	no-con/no-set	0	0 to 7
INITSE	initialize SE mode	short integer	no-con/no-set	0	0 to 2
FLBOPT	fallback option	short integer	no-con/no-set	0	0 to 2
FLBREQ	fallback request	short integer	con/set	0	0 to 2
FSOPTN	fail-safe option	short integer	no-con/no-set	0	bit map
FSOUT	fail-safe real output	real	con/no-set	0.0	---
REVOPT	reverse action option	boolean	no-con/no-set	0	0 to 1
ARBLIM	arbitration limit	real	no-con/no-set	0.0	any real >= 0.0
OSV	output span variance	real	no-con/no-set	02.	[0 to 25] percent
MANFS	manual if fail-safe	boolean	no-con/no-set	0	0 to 1
MBADOP	manual if bad option	boolean	no-con/no-set	0	0 to 1
INHOPT	inhibit option	short	no-con/no-set	0	0 to 3
INHIB	alarm inhibit	boolean	con/set	0	0 to 1
BAO	bad alarm option	boolean	no-con/no-set	0	0 to 1
BAT	bad alarm text	string	no-con/no-set	blank	1 to 32 chars
BAP	bad alarm priority	integer	con/set	5	1 to 5
BAG	bad alarm group	short	no-con/set	1	1 to 8
AMRTIN	alarm regeneration timer	integer	no-con/no-set	0	0 to32767 sec
SETFS	set fail-safe request	boolean	con/set	0	0 to 1
Non-Configurable Parameters					
OUTPUTS					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
ALMSTA	alarm status	packed long	con/no-set	0	bit map
BCALCO	back-calculated output	real	con/no-set	0.0	---
BLKSTA	block status	packed long	con/no-set	0	0 to 0xFFFFFFFF
CRIT	alarm criticality	integer	con/no-set	0	0 to 5
INHSTA	inhibit status	packed long	con/no-set	0	0 to 0xFFFFFFFF
INITO	initialize output	boolean	con/no-set	0	0 to 1
OUT	real output	real	con/set	0.0	---
OUTQ	output request	real	con/no-set	0.0	any real
PRTYPE	priority type	integer	con/no-set	0	0 to 8
RRBK_1	primary real readback	real	con/no-set	0.0	any valid real
RRBK_2	secondary real readback	real	con/no-set	0.0	any valid real
RRBK_3	tertiary real readback	real	con/no-set	0.0	any valid real
SELECT	selection indicator	short integer	con/no-set	0	0 to 3
SEVSTS*	(reserved)	integer	con/no-set	0	0 to 300
SUP_IN	supervisory input (*RCAS_IN*)	real	con/set if supervisory enabled	0	any real
SUPBCO	supervisory output (*RCAS_OUT*)	real	con/no-set	0.0	any real
TSTAMP	time stamp	long integer	con/no-set	0	ms after midnight
UNACK	unacknowledged alarm	boolean	con/no-set	0	0 to 1
VALSTS	FF value status	integer	con/no-set	0	0 to 0xFFFF
VUMEAS*	(reserved)	real	con/no-set	0.0	any real>0

Table 113-1. ROUTR Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
DATA STORES					
ALMOPT	alarm options	packed long	no-con/no-set	0	0 to 0xFFFFFFFF
DEFINE	no configuration errors	boolean	no-con/no-set	1	0 to 1
DEVID1	primary device identifier	character	no-con/no-set	2 blanks	6 characters
DEVID2	secondary device identifier	character	no-con/no-set	2 blanks	6 characters
DEVID3	tertiary device identifier	character	no-con/no-set	2 blanks	6 characters
ERCODE	configuration error	string	no-con/no-set	2 blanks	1 to 43 characters
LOCKID	lock identifier	string	no-con/set	2 blanks	8 to 13 characters
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	2 blanks	1 to 32 characters
RO1	output range 1	real[3]	no-con/no-set	100,0,1	specifiable
SE	supervisory enable	boolean	no-con/set	0	0 to 1

*Not currently supported by FBM220/221 or FBM223.

113.4.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

ALMOPT *(CP270 and Later Only)*

Alarm Options contain packed long values representing the alarm types that have been configured as options in the block, and the alarm groups that are in use. Table 113-2 shows how the parameter is used by the ROUTR block.

Table 113-2. ALMOPT Parameter Format

Bit Number[1] (0 to 31)	Configured Alarm Option, When True
0 (lsb)	Alarm Group 8 in Use
1	Alarm Group 7 in Use
2	Alarm Group 6 in Use
3	Alarm Group 5 in Use
4	Alarm Group 4 in Use
5	Alarm Group 3 in Use
6	Alarm Group 2 in Use
7	Alarm Group 1 in Use
22	Bad I/O Alarm Configured

1. Bit 0 is the least significant, low order bit.

ALMSTA *(CP270 and Later Only)*

Alarm Status is a 32-bit output, bit-mapped to indicate the block's alarm states. Table 113-3 shows the bits used by the ROUTR block.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
	UNAK	INH							BAD							BAD1	BAD2	BAD3						CRIT			PRTYPE				

Table 113-3. ALMSTA Parameter Format

Bit Number (0 to 31)*	Name	Description, When True	Boolean Connection (B32 to B1)
0 to 4	PTYP_MSK	Priority Type. See "PRYTYPE" on page 2274 for values used in the ROUTR block	---
5 to 7	CRIT_MSK	Criticality: 1 (highest priority) to 5	---
13	BAD3	Tertiary point is Bad	ALMSTA.B19
14	BAD2	Secondary point is Bad	ALMSTA.B18
15	BAD1	Primary point is Bad	ALMSTA.B17
16	LMA	Low Absolute Alarm	ALMSTA.B16
29	INH	Inhibit Alarm. This bit is set when any of the block's alarms is inhibited	ALMSTA.B3
30	UNAK	Unacknowledged	ALMSTA.B2

*Bit 0 is the least significant, low order bit.

AMRTIN *(CP270 and Later Only)*

Alarm Message Regeneration Time Interval specifies the rate at which alarm messages are generated for alarm conditions that have not been cleared. The interval is specified in seconds. The configured interval is rounded up to the closest value that is an even multiple of the station BPC. A value of 0 disables alarm message regeneration.

ARBLIM

Arbitration Limit is a configurable real value that represents the tolerance of the difference between pairs of redundant output values read back from the devices in a ROUTR block. This value, specified in engineering units, is used to determine whether the redundant output values agree or disagree.

ARBOPT

Arbitration Option is a Boolean input that specifies dual modular redundancy (DMR) or triple modular redundancy (TMR):

- 0 = False = DMR
- 1 = True = TMR.

AUTSW

Auto Switch forces the block mode to Auto. It is of higher priority than configured, set, or linked values in MA, or the value of INITMA. It is of lower priority than MANSW, however. If both MANSW and AUTSW are True, the block mode is forced to Manual.

BAG
(CP270 and Later Only)

Bad Alarm Group is a configurable, non-settable short integer parameter used to specify the Alarm Group to be used for reporting Bad Alarm messages in the block. The range is 1 (default) to 8.

BAO
(CP270 and Later Only)

Bad Alarm Option is a configurable, non-settable Boolean parameter used to specify whether or not Bad Alarming is to be performed in the block:

- 0 (default) disables Bad Alarming
- 1 enables Bad Alarming.

BAP
(CP270 and Later Only)

Bad Alarm Priority is a configurable integer input used to specify the Alarm Priority to be assigned to Bad Alarms in the block. BADPRI is settable if unlinked. The range is 1 (highest) to 5 (default).

BAT
(CP270 and Later Only)

Bad Alarm Text is a configurable, non-settable ASCII string of up to 32 characters used as descriptive text in Bad Alarm messages in the block.

BCALCO

Back Calculated Output is set equal to the confirmed component of OUT while the cascade is initializing. Since its purpose is to provide the upstream block with a back-calculated value, you should connect BCALCO to the BCALCI parameter of that block.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate various block operational states. For the ROUTR block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
					MAO		FS	DCIX			WLCK					ON	UDEF			MA	FBM3	FBM2	FBM1	HLD	TRK				BAD3	BAD2	BAD1

Bit Number[1] (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
0	BAD1	Bad I/O for primary ECB	BLKSTA.B32
1	BAD2	Bad I/O for secondary ECB	BLKSTA.B31
2	BAD3	Bad I/O for tertiary ECB	BLKSTA.B30
6	TRK	ROUTR Tracking	BLKSTA.B26
7	HLD	Block Output Holding	BLKSTA.B25
8	FBM1	Primary FBM failure	BLKSTA.B24
9	FBM2	Secondary FBM failure	BLKSTA.B23

Bit Number[1] (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
10	FBM3	Tertiary FBM failure	BLKSTA.B22
11	MA	Manual = 0, Auto = 1	BLKSTA.B21
14	UDEF	Block Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
20	WLCK	Access Locked	BLKSTA.B12
23	DCIX	Enhanced DCI block *(CP270 and Later Only)*	BLKSTA.B9
24	FS	Fail-Safe Active	BLKSTA.B8
26	MAO	M/A Override Active	BLKSTA.B6
29	SE	Supervisory Enabled	BLKSTA.B3
30	SC	Supervisory Control	BLKSTA.B2
31	FLB	Supervisory Control Fallback State	BLKSTA.B1

1. Bit 0 is the least significant, low order bit.

CLPOPT
Clamp Option determines whether the operational limits HOLIM and LOLIM are applied to the engineering units value in the output or readback direction, instead of the range limits HSCO1 and LSCO1. The values are:

- CLPOPT = 0: The values are never clamped.
- CLPOPT = 1: The values are clamped only if the block is in Auto.
- CLPOPT = 2: The values are clamped in both Auto and Manual.

CRIT
(CP270 and Later Only)
Criticality is an integer output that indicates the priority of the block's highest currently active alarm. The range is 1 (highest priority) to 5. An output of 0 indicates the absence of alarms.

DEFINE
Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. (See ERCODE for the list of all possible validation errors in this block.) In that case, no further processing of the block occurs, including further validation of remaining parameters. To return DEFINE to a True value, you should correct all configuration errors and reinstall the block.

DESCRP
Description is a user-defined string of up to 32 characters used to describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

DEVID1
Primary Device Identifier is a string that specifies the 6-character identifier of the first connected device. It is copied from the DEV_ID configured in the ECB specified by IOMID1.

DEVID2	Secondary Device Identifier is a string that specifies the 6-character identifier of the second connected device. It is copied from the DEV_ID configured in the ECB specified by IOMID2. If ECBOPT= 0, DEVID2 is ignored.
DEVID3	Tertiary Device Identifier is a string that specifies the 6-character identifier of the third connected device. It is copied from the DEV_ID configured in the ECB specified by IOMID3. If ECBOPT= 0, DEVID3 is ignored.
ECBOPT	Redundant ECB Option specifies whether a single device ECB is to be used for all output points or each output point is to be associated with a separate device ECB. The latter is required if the redundant output points are in different devices. If ECBOPT is 0 (False), only one device ECB is used for all points and is specified by IOMID1 (IOMID2 and IOMID3 are ignored). If ECBOPT is 1 (True), then either two or three separate device ECBs are used depending on whether dual or triple redundancy is specified. This decision is based on the configured parameter ARBOPT.
EO1	Engineering Units for Output Range 1 provides the engineering units text for the OUT output. The value configured for this text string should be consistent with the values used for HSCO1 and LSCO1.
ERCODE	Error Code is a string data store which indicates the type of configuration error which caused the block's DEFINE parameter to be set False, unless indicated otherwise (see meanings below). Validation of configured parameters does not proceed past the first error encountered by the block logic. Each nonzero value of ERCODE results in an explanatory message at the block's detail display. For the ROUTR block, the following list shows the possible messages you may see:

ERCODE Message	Meaning
W44 – INVALID ENGINEERING RANGE	HSCO1 ≤ LSCO1
W48 – INVALID BLOCK OPTION	CLPOPT > 2
W50 – INVALID SIGNAL CONDITIONING INDEX	SCO is out of range for this block.
W52 – INVALID I/O CHANNEL/GROUP NO.	RO1_PT, RO2_PT, or RO3_PT string is blank.
W62 – UNRESOLVED CONNECTION	Connection is not yet resolved. (Block remains defined.)
W65 – INVALID POINT ADDRESS	FBM parsing algorithm finds that a used ROx_PT or INI_PT is invalid.
W66 – DUPLICATE CONNECTION	There is a duplicate connection to a particular point.
W67 – INSUFFICIENT FBM MEMORY/CONNECTIONS	There is no available memory or point connections in the FBM.

ERCODE Message	Meaning
W68 – INVALID DEVICE CONNECTION	The device connection is invalid.
W69 – INVALID POINT CONNECTION	The point connection is invalid.

EROPT

Error Option specifies the conditions under which MEAS is considered to have bad status. It is used in determining whether there has been a good-to-bad transition of MEAS.

If EROPT = 1, MEAS is considered bad if its status word indicates Bad, Out-of-Service, or Not On Scan. (If it is Not On Scan, then the source of the connection has been deleted or is in a nonexistent compound, or there has been a peer-to-peer failure.)

If EROPT = 2, MEAS is considered Bad in any of the above situations. It is also considered Bad if the Error bit in the status of MEAS is True.

FLBOPT

Fallback Option is a short integer input that defines the control action to be taken by the block when a Supervisory fallback occurs:

- 0 = Take no fallback action (default)
- 1 = Set MA to Auto
- 2 = Set MA to Manual

FLBOPT overrides a linked MA parameter, but does *not* override the AUTSW and MANSW parameters.

FLBREQ

Fallback Request is a short integer output that is an explicit request for the block to go to the Fallback state, with recovery at the block level (when SE is set), and/or at the group level (when the appropriate group enable bit is set in SUPENA).

- 0 = No fallback requested
- 1 = Fallback requested; recovery at block or group level. See the “Supervisory Control” section in the AOUT block chapter.
- 2 = Fallback requested; recovery only at block level. See the “Supervisory Control” section in the AOUT block chapter.

FLBREQ is disabled if MA is driven by a source parameter.

FSOPTN

Fail-Safe Option is a configurable option that specifies the fail-safe conditions and action to be taken in an FBM for the output points in a ROUTR block:

7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8
					Coms Loss	SETFS	Meas Error

- Bit 0: 1 = assert fail-safe if input/measurement error. Note that EROPT must be configured nonzero for this option to take effect.
- Bit 1: 1 = assert/clear fail-safe when SETFS input is asserted/cleared.
- Bit 2: 1 = assert fail-safe if control station-to-FBM communication is lost (FBM option). This option will be enabled only if fail-safe is enabled at the FBM level via the FSENAB parameter in ECB200 or ECB202.

Notes:

- Bit 0 is the least significant, low order bit.
- For FOUNDATION fieldbus equipment, FSOPTN is dependent upon how the fault state parameters are configured in the device with which the ROUTR block is being used. The fault state can also be turned off in the device, which would render FSOPTN ineffective.
- **This parameter is currently not supported by Modbus FBM224.**

FSOUT

Fail-Safe Real Output specifies the real fail-safe value that is to be used by the field device when any condition specified in FSOPTN exists. The entered value is limited by HSCO1 and LSCO1 before it is set into parameter FSOUT. If this limiting causes FSOUT to be changed, the status of FSOUT is set to Limited High or Limited Low, as appropriate. FSOUT is first converted to I/A Series system normalized raw count (using reverse action if specified by REVOPT) and then into device raw count (using linear transformation based on OGAIN and OBIAS) before being sent to the device.

HOLIM

High Output Limit is the upper operational limit of the engineering units value, optionally applied based on the value you have configured for CLPOPT. HOLIM is forced to be within the HSCO1/LSCO1 range limits, and forced to be greater than or equal to LOLIM.

Configure HOLIM within the output engineering range RO1 defined by parameters HSCO1 and LSCO1. If you change the HSCO1 and LSCO1 values to expand the engineering range, make sure you change the

HOLIM value accordingly to prevent output limiting at the old limit. The block does not automatically adjust HOLIM for the expanded range.

HSCO1

High Scale for Output Range 1 specifies the upper range limit of the block input and output when expressed in engineering units.

INHIB
(CP270 and Later Only)

Inhibit is a configurable, connectable and settable boolean that, when set, suppresses all alarm message reporting. INHIB affects only alarm message reporting; the alarm handling and detection functions are determined by the INHOPT setting.

INHOPT
(CP270 and Later Only)

Inhibit Option specifies the following actions applying to all block alarms:

- 0 = When an alarm is inhibited, disables alarm messages but does not disable alarm detection.
- 1 = When an alarm is inhibited, disables both alarm messages and alarm detection. If an alarm condition exists at the time the alarm transitions into the inhibited state, the alarm indicator is cleared.
- 2 = Same as 0 for inhibited alarms. For uninhibited alarms, automatically acknowledges “return-to-normal” messages. “Into alarm” messages can be acknowledged by explicitly setting UNACK False.
- 3 = Same as 1 for inhibited alarms. For uninhibited alarms, automatically acknowledges “return-to-normal” messages. “Into alarm” messages can be acknowledged by explicitly setting UNACK False.

INHSTA
(CP270 and Later Only)

Inhibit Status contains packed long values that represent the current inhibit status of each alarm type configured in the block. Table 113-4 shows how the parameter is used with the AI block.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
									BAD							BAD1	BAD2	BAD3													

Table 113-4. INHSTA Parameter Forma

Bit Number* (0 to 31)	Name	Description, When True	Boolean Connection (B32 to B1)
13	BAD_3	Tertiary Point Bad Alarm Inhibited (same as Bit 22)	INHSTA.B19
14	BAD_2	Secondary Point Bad Alarm Inhibited (same as Bit 22)	INHSTA.B18
15	BAD_1	Primary Point Bad Alarm Inhibited (same as Bit 22)	INHSTA.B17

Table 113-4. INHSTA Parameter Forma (Continued)

Bit Number* (0 to 31)	Name	Description, When True	Boolean Connection (B32 to B1)
22	BAD	Bad I/O Alarm Inhibited	INHSTA.B10

*Bit 0 is the least significant, low order bit.

INITMA

Initialize Manual/Auto specifies the desired state of the MA input under certain initialization conditions, namely:

- The block has just been installed into the I/A Series station database.
- The I/A Series station is rebooted.
- The compound in which the block resides is turned on.
- The INITMA parameter is modified via the Integrated Control Configurator.

INITMA is ignored if MA has an established linkage.

When INITMA is asserted, the value set into MA is:

- INITMA = 0 = Manual
- INITMA = 1 = Auto
- INITMA = 2 = MA value from the checkpoint file.

INITO

Initialize Output is a cascade initialization signal which is set True by the block logic whenever the cascade is opened. When the conditions that cause the cascade to be opened no longer exist, the block keeps INITO set for one additional cycle if PRIBLK=0, or if PRIBLK=1, until either the acknowledgement is received from the upstream logic or the primary Timer (PRITIM), if used, expires.

INITSE

Initial Supervisory Enable specifies the initial state of the SE parameter in a block configured for Supervisory Control (SUPOPT = 1 or 3) when the lock initializes due to reboot, installing the block, or turning on the compound. Its options are:

- 0= Disable
- 1= Enable
- 2= Do not change SE parameter.

INI_PT

Initialize Address is a configurable string that specifies the point address of an optional Boolean input connection in the ROUTR block. If INI_PT is used, the block output tracks the readback value when this input Boolean value is set. On a transition of this input value to zero, if PRIBLK is used, the I/A Series cascade is initialized.

For FOUNDATION fieldbus, INI_PT is configured with a device specific address. For PROFIBUS, INI_PT is configured to contain a PROFIBUS data identifier string which identifies, to the FBM, the address of an optional Boolean input.

IOMID1 Primary ECB Identifier is a configurable string that specifies the pathname of the ECB201 for the primary device, for the purpose of connecting to (accessing) a field parameter that resides in the primary field device hosted by a (parent) ECB200.

IOMID1 has the form CompoundName:BlockName, where CompoundName is the 1-12 character name of the local compound containing the ECB, and BlockName is the 1-12 character block name of the ECB.

If the compound containing the ECB is the CPletterbug_ECB compound where CPletterbug is the station letterbug of the CP, the CompoundName may be omitted from the IOMID1 configuration. In this case, the 1-12 character ECB block name is sufficient.

IOMID2 Secondary ECB Identifier is a configurable string that specifies the pathname of the ECB201 for the secondary device, for the purpose of connecting to (accessing) a field parameter that resides in the secondary field device hosted by a (parent) ECB200.

IOMID2 must be configured when dual or triple redundancy is specified. For formatting details, see IOMID1 above.

IOMID3 Tertiary ECB Identifier is a configurable string that specifies the pathname of the ECB201 for the tertiary device, for the purpose of connecting to (accessing) a field parameter that resides in the tertiary field device hosted by a (parent) ECB200.

IOMID3 must be configured when triple redundancy is specified. For formatting details, see IOMID1 above.

LOCKID Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format Letterbug:DeviceName, where Letterbug is the 6-character letterbug of the workstation and DeviceName is the 1 to 6 character logical device name of the Display Manager task.

LOCKRQ Lock Request is a Boolean input which can be set True or False only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set True in this fashion, a workstation identifier accompanying the set command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set False by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.

LOLIM Low Output Limit is the lower operational limit of the engineering units value, optionally applied based on the value you have configured for

	CLPOPT. LOLIM is forced to lie within the HSCO1/LSCO1 range limits, and forced to be less than or equal to HOLIM. Configure LOLIM within the output engineering range RO1 defined by parameters HSCO1 and LSCO1. If you change the HSCO1 and LSCO1 values to expand the engineering range, make sure you change the LOLIM value accordingly to prevent output limiting at the old limit. The block does not automatically adjust LOLIM for the expanded range.
LOOPID	Loop Identifier is a configurable string of up to 32 characters used to identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.
LSCO1	Low Scale for Output Range 1 specifies the lower range limit of the block input and output when expressed in engineering units.
MA	Manual/Auto is a Boolean input that controls the block's operating state: ♦ 0 = False = Manual ♦ 1 = True = Auto When in Auto mode, the block input is taken from MEAS, usually from an upstream connection. In Manual mode, the input is taken from the request component of OUT, usually via operator sets.
MANFS *(CP270 and Later Only)*	Manual if Fail-safe allows recovery from FBM fail-safe at the block in which MANFS is set. If MANFS = 1, the output state is forced to manual mode when the block detects the FBM being in fail-safe. The option only takes effect if MA is unlinked. MANFS takes precedence over AUTSW and INITMA. Fail-safe in the block is cleared as soon as the output is changed. For cascade operations, it is recommended that MANFS be enabled in only one block.
MANSW	Manual Switch, when True, forces the block into Manual mode. It is of higher priority than any other method of establishing the value MA, since it overrides configured, set, or linked values. MANSW is also of higher priority than AUTSW or INITMA.
MBADOP *(CP270 and Later Only)*	Manual if Bad Option is a manual override feature that, when set TRUE, causes the block to go into Manual mode if the output value status is BAD or MEAS value status is BAD.
MEAS	Measurement is the value used as the input when the block is in Auto mode. After limiting and inverse signal conditioning, this is the value normally set into OUT and sent to the field devices at points RO1_PT, RO2_PT and RO3_PT, as specified by ARBOPT.
NAME	Name is a user-defined string of up to 12 characters used to access the block and its parameters.

OBIAS	Output Bias is the offset factor used when converting between raw counts in the device and signal-conditioned normalized counts in the block.
OGAIN	Output Gain is used as a scaling factor when converting between raw counts in the device and signal-conditioned normalized counts in the block.
OSV *(CP270 and Later Only)*	Output Span Variance is a configurable real input which defines the percentage by which the output clamp limits exceed the output range defined by HSCO1 and LSCO1.
OUT	Output is the confirmed (readback) value for the output value sent from the block to the connected field devices at point RO1_PT, RO2_PT and RO3_PT. The displayed value of OUT is always the confirmed output.
OUTQ	Output Request displays the value of the request component of the block output for diagnostic purposes.
OWNER	Owner is a string of up to 32 ASCII characters used to allocate control blocks to applications. Attempts to set OWNER are successful only if the present value of OWNER is the null string, an all-blank string, or identical to the value in the set request. Otherwise, the request is rejected with a LOCKED_ACCESS error. OWNER can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of OWNER. Once set to the null string, the value can then be set as desired.
PERIOD	Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PHASE	Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 seconds) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the I/A Series station is 0.5 second. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PRIBLK	Primary Block indicates whether the ROUTR block has a connection from an upstream block (PRIBLK = 1) and whether you want to wait for the ACK from upstream or not (PRIBLK = 0). Its value, together with that of PRITIM, determines whether the ROUTR block remains in Hold until the upstream block returns an acknowledgement, remains in Hold for a fixed time delay, or ends the Hold after one cycle.

Use PRIBLK in a cascade situation when the source of the block's input connection needs to be initialized.

PRITIM

Primary Cascade Timer is a configurable parameter used to delay the closing of the cascade to a primary block, when the output is initialized in the ROUTR block. It is used only if the PRIBLK option is set.
If PRITIM = 0 and PRIBLK is True, the cascade remains open indefinitely until acknowledged by the primary block.

PRTYPE
(CP270 and Later Only)

Priority Type is an indexed output parameter that indicates the alarm type of the highest priority active alarm. For the ROUTR block:

- 0 = No alarm
- 8 = Bad I/O alarm

RBKTIM

Readback Timer is a configurable parameter used to time out changes made by the I/A Series system to the output of the ROUTR block. If the output change is not confirmed within the allowable timeout, the output request value is re-initialized to the readback value. Its default value is 5.0 seconds, but you can configure different values to accommodate different response times from the field device.

REVOPT

Reverse Action Option is a configurable option that specifies whether a real output in a ROUTR block is inverted algebraically prior to being sent to the FBM. If reverse action is specified, the readback value from the FBM also is inverted prior to being stored in the block. The settings are:

- 0 = normal action
- 1= reverse action.

RO1

Range Output is an array of real values that specify the high and low engineering scale of a particular real output. For a given block, it also forms an association with a group of real output parameters that have the same designated range. Since there is no DELTO1 parameter, a delta value of 0.0 is assumed.

RO1_PT

Primary Real Output Point identifies the address in the primary field device memory (or field device data stream) to which the block output is directed.

The ROx_PT string syntax depends on the FBM type and the fieldbus protocol of the attached device:

- For the FDSI (FBM230/231/232/23), ROx_PT contains a data identifier to identify, to the FBM, specific data in the I/O data stream and to specify the elements of the data. Refer to *Field Device System Integrators (FBM230/231/232/233) User's Guide* (B0700AH) for more information.
- For the FBM223 PROFIBUS interface, ROx_PT must be configured to contain a PROFIBUS data identifier. This information identifies, to the FBM, the address of the input data unit from the

device. Refer to *PROFIBUS-DP Communication Interface Module (FBM223) User's Guide* (B0400FE) for further details.

- For the FBM222 Redundant PROFIBUS interface, the ROx_PT configuration string uses the FBM223 syntax with extensions for PROFIBUS-PA status, custom status and other features. Refer to *Implementing PROFIBUS Networks in Foxboro Control Software Applications* (B0750BE) for further details.
- For the HART interface (FBM214/214b/215/216/216b/218/244/245/247), ROx_PT must be configured to contain a point address. This information identifies, to the FBM, specific data in the HART data stream that is to serve as the device data input to this block. Refer to *HART Communication Interface Modules User's Guide* (B0400FF) for details.
- For the Modbus interface (FBM224), ROx_PT must be configured to contain the address of a set of coils in a Modbus device. Refer to *Modbus Communication Interface Module (FBM224) User's Guide* for details.
- For the FBM228, the point number syntax specifies reads of H1 device function block parameters using a client/server or publisher/subscriber connection, as described in *Implementing FOUNDATION fieldbus on an I/A Series System* (B0700BA), *Implementing FOUNDATION fieldbus* (B0750BC), and *Implementing FOUNDATION fieldbus in Foxboro Control Software Applications* (B0750DA).

RO2_PT — Secondary Real Output Point identifies the address in the secondary field device memory (or field device data stream) to which the block output is directed. The RO2_PT string syntax depends on the FBM type and the fieldbus protocol of the attached device, as described for RO1_PT above.

RO3_PT — Tertiary Real Output Point identifies the address in the tertiary field device memory (or field device data stream) to which the block output is directed. The RO3_PT string syntax depends on the FBM type and the fieldbus protocol of the attached device, as described for RO1_PT above.

RRBK_1 — The primary real readback value is the confirmed value that has been written successfully to the primary field device at address RO1_PT.

RRBK_2 — The secondary real readback value is the confirmed value that has been written successfully to the secondary field device at address RO2_PT.

RRBK_3 — The tertiary real readback value is the confirmed value that has been written successfully to the tertiary field device at address RO3_PT.

SCO — Signal Conditioning Output is used in either direction in converting between device raw count and engineering units. (This is valid for output of data, or input of readback data.) See Section 113.6 for the signal conditioning tables.

SE — SE Supervisory Enable is a boolean input that enables (SE = 1) or disables (SE = 0) Supervisory Control in this block.

SECTIM — Secondary Timer is a configurable parameter used to force the output of the ROUTR block to be written periodically to the FBM, regardless of whether or not the output has changed. Since an FBM can be configured to go to Fail-safe if no writes to it occur within a period of time, SECTIM can be used to prevent the FBM from asserting fail-safe action under normal operating conditions.

SELECT — Selection Indicator shows which redundant readback value has been chosen by the arbitration algorithm:

- 0 = none of the input values is selected, SELOPT is used.
- 1 = primary readback value RRBK_1 is selected
- 2 = secondary readback value RRBK_2 is selected
- 3 = tertiary readback value RRBK_3 is selected.

SELOPT — Selection Option is a configurable option that specifies the criteria for selecting a readback value in the ROUTR block when the arbitration algorithm cannot resolve the choice. SELOPT selects the arbitrated readback value as indicated by the following cases:

Case 1 (all three readback values are available but disagree):

- If SELOPT = 0, the readback value of OUT is unchanged (last good value function)
- If SELOPT = 1, the algebraically lowest of RRBK_1, RRBK_2, and RRBK_3 is selected
- If SELOPT = 2, the algebraically highest of RRBK_1, RRBK_2, and RRBK_3 is selected
- If SELOPT = 3, the algebraic mean of RRBK_1, RRBK_2, and RRBK_3 is used.

Case 2 (two of the three readback values are available but disagree):

- If SELOPT = 0, the readback value of OUT is unchanged (last good value function)
- If SELOPT = 1, the algebraically lower of the two valid RRBK_x is selected
- If SELOPT = 2, the algebraically higher of the two valid RRBK_x is selected
- If SELOPT = 3, the algebraic mean of the two valid RRBK_x is used.

Case 3 (none of the three readback values is available):

- The readback value of OUT is unchanged (last good value function).
- The status of the readback value of OUT is set Bad and Out-of-Service.

SETFS

Set Fail-Safe Request is a configurable Boolean parameter that requests fail-safe action to be asserted/reset by the FBM and/or field device for the specific output value of the ROUTR block. The settings are:

- 0 = reset fail-safe request
- 1 = set fail-safe request.

SEVSTS

This parameter is currently not supported by any FBM or field device.

SIMOPT

Simulation Option is a configurable parameter that specifies whether the block input/output value is to be simulated. In the ROUTR block, the block output value is stored into its readback values to simulate confirmation by the FBM.

SUP_IN

Supervisory Input is a non-configurable, real parameter that contains the value of the *RCAS_IN* parameter of the associated device function block. The parameter is settable only when the supervisory setpoint control is enabled (SE = 1).

SUPBCO

Supervisory Output is a non-configurable, non-settable real output that contains the *RCAS_OUT* parameter of the associated device function block.

SUPGRP

Supervisory Group is a short integer input (1 to 8) that specifies one of eight groups to which this block is assigned for Supervisory Control.

SUPOPT

Supervisory Option is a configurable short integer input that specifies whether or not this block is under control of a Supervisory Control application:

- 0 = No Supervisory control
- 1 = Set Point Control (SPC) of the block°fs set point (Supervisory setpoint control (SSC))
- 2 = Not supported for the ROUTR block
- 3 = SPC, with an implicit acknowledge by the CP
- 4 = Not supported for the ROUTR block

Be aware that option 1 requires an explicit acknowledge by the application software to close the supervisory cascade. This must be done by setting the ACK status bit in the SUP_IN parameter using special OM access functions.

TSTAMP

The Time Stamp parameter of the block is updated every time there is a change in the OUT value (that is, when OUT differs from the current readback value). TSTAMP, which is expressed in units of milliseconds past midnight, is read from the FBM, when it is available there; otherwise, it is computed by the control station. TSTAMP is not updated when SELECT= 0; it is left at its last good value.

TYPE	When you enter ROUTR or select it from a configurator list, an identifying integer is entered specifying this block type. For a ROUTR block, the value of TYPE is 145.
UNACK *(CP270 and Later Only)*	Unacknowledged is a Boolean output parameter that is set True for notification purposes whenever the block goes into alarm. It is settable, but sets are only allowed to clear UNACK to False, and never in the opposite direction. UNACK is cleared by an operator "acknowledge" pick on a default display, a user display, or the alarms display.
UPDPER	Update Period is a configurable, non-settable long integer that is used to specify the update period for client/server connections scheduled by the FBM228 to read the device function block View 1, View 2 and View 4 parameters. The range is 0 to 2147483647 milliseconds; the default is 10000.
VALSTS	Value Status is an output parameter of any DCI block that contains the value status of a FOUNDATION fieldbus function block parameter value or PROFIBUS-PA parameter provided by a DCI connection to a field device. For other fieldbus types, VALSTS is meaningless. Bits 0-1: Limits: 0 = Not limited 1 = High limited 2 = Low limited 3 = High and Low limited Bits 2-5: Substatus (definition depends on Quality) Bits 6-7: Quality: 0 = Bad 1 = Uncertain 2-3 = Good Note: Bit 0 is the least significant, low order bit. Each time the ROUTR block is executed, VALSTS reports the status of the FOUNDATION fieldbus or PROFIBUS-PA value from the information in the DCI connection.
VUMEAS	**This parameter is currently not supported by any FBM or field device.**

113.5 Functions

113.5.1 Detailed Diagram

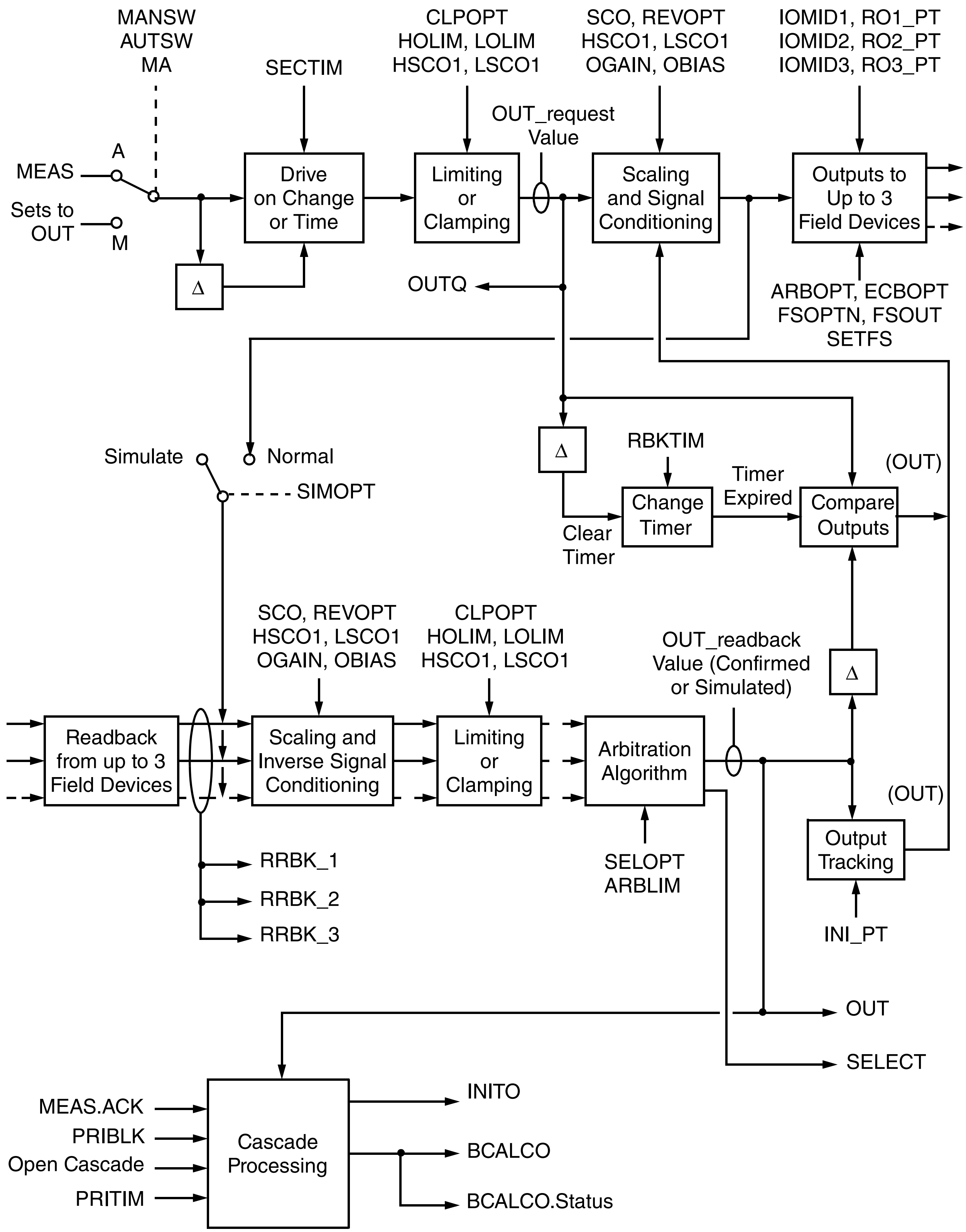


Figure 113-2. ROUTR Block Operational Diagram

113.5.2 Associated ECBs

The configured parameters IOMID1, IOMID2, and IOMID3 of the ROUTR block specify one or more ECB201s (device ECBs) that connect to field parameters residing in field devices hosted by one or more ECB200s or ECB202s (FBM ECBs).

The PARENT parameter of each ECB201 specifies the associated FBM ECB hosting the field device.

The IOMIDx can also directly specify parent ECB200s to output to parameters resident in the FBMs themselves.

113.5.3 DCI Connections

The ROUTR block establishes up to four DCI Connections to the specified ECBs at any one of the following times:

- ♦ When the block has just been installed
- ♦ When the I/A Series control station in which it resides is rebooted
- ♦ When a parameter of the block has been modified by the ICC or FoxCAE configurator
- ♦ When a device or parent ECB specified by the ROUTR block is installed.

A DCI connection is added to a linked list of all the DCI connections, of any type, for all blocks specifying the same ECB. This arrangement permits multiple DCI blocks, of differing data types, to communicate with a single device at input/output scan time, on a scatter-gather basis. It also allows multiple DCI connections in the same DCI block to be established (for example, connections in redundant type DCI blocks such as this one, or for INI_PT connections in most output type blocks such as this one).

The following table shows the DCI connections (for the output points) for all combinations of ECBOPT and ARBOPT:

ECBOPT = 0	ARBOPT = 0 (DMR)	2 DCI connections to one ECB
ECBOPT = 0	ARBOPT = 1 (TMR)	3 DCI connections to one ECB
ECBOPT = 1	ARBOPT = 0 (DMR)	2 DCI connections to two ECBs
ECBOPT = 1	ARBOPT = 1 (TMR)	3 DCI connections to three ECBs

In addition to the output point DCI connections, one additional DCI connection is established whenever the initialization input point INI_PT has been configured with a non-null value. This connection is always to the ECB used by the first of the output points (RO1_PT).

These parameter connections are made by the FBM on a client/server basis at the frequency specified in the UPDPER parameter. The parameter can be set from 0 to 2147483647 milliseconds; the default is 10000 (10 seconds). Increasing the frequency of the client/server communication can significantly add to the load on the H1 segment.

The DCI connections are deleted (that is, the linkages are removed from the linked lists for the ECB) when the ROUTR block is deleted.

113.5.4 Block Validation

The device addresses of the outputs are configured as strings in RO1_PT, RO2_PT, and RO3_PT. The device address of the initialization input is configured as a string in INI_PT.

When ARBOPT is 0 (DMR) neither RO1_PT nor RO2_PT may be null, and RO3_PT is ignored. When ARBOPT is 1 (TMR) RO1_PT, RO2_PT, and RO3_PT must all be non-null. These checks are made at block validation time, and violations of these rules cause the ROUTR block to be set undefined and processing does not proceed further. INI_PT may be null if it is not used.

The formats of the ROx_PT and INI_PT parameters are device-specific. When the PIO Maintenance task runs after the DCI connections have been made (see Section 113.5.3), the ROx_PT and INI_PT strings used by the block are passed to the FBM for parsing and validation. (In DCI blocks, point identification strings are not parsed by the I/A Series control station.)

If the first character of either RO1_PT, RO2_PT, or RO3_PT is blank, the ROx_PT string is not sent to the FBM, and the block is set undefined with ERCODE = 52. The detail display shows "W52 – INVALID I/O CHANNEL/GROUP NUMBER".

In each of the following cases, the block is also set undefined:

- If HSCI1 ≤ LSCI1, the detail display shows "W44 – INVALID ENGINEERING RANGE" with ERCODE = 44.
- If CLPOPT > 2, the detail display shows "W48 – INVALID BLOCK OPTION" with ERCODE = 48.
- If the SCO is out of range for this block, the detail display shows "W50 – INVALID SIGNAL CONDITIONING INDEX" with ERCODE = 50.
- If the FBM parsing algorithm finds that ROx_PT or INI_PT is invalid, the detail display shows "W65 – INVALID POINT ADDRESS" with ERCODE = 65.
- If there is a duplicate connection to any point, the detail display shows "W66 – DUPLICATE CONNECTION" with ERCODE = 66.
- If there is no available memory in the FBM, or if the maximum number of connections have been allocated in the FBM, the detail display shows "W67 – INSUFFICIENT FBM MEMORY/CONNECTIONS" with ERCODE = 67.
- If the device connection is invalid, the detail display shows "W68 – INVALID DEVICE CONNECTION" with ERCODE = 68.
- If the point connection is invalid, the detail display shows "W69 – INVALID POINT CONNECTION" with ERCODE = 69.

In the following case, the block remains defined:

- If the connection is not yet resolved, the detail display shows "W62 – UNRESOLVED CONNECTION" with ERCODE = 62.

113.5.5 Confirmed Output Parameters

As with most output parameters in DCI blocks, OUT is a confirmed output. A confirmed output contains two components; a request value and a readback value. The request value is changed by the I/A Series system and sent to the field device, and the readback value is the value read back each cycle from the FBM.

In the ROUTR block, the request value is made available for diagnostic purposes as parameter OUTQ. (OUTQ is not shown on the detail display). Also, in the ROUTR block, the readback value is first arbitrated from the readback values received from the redundant output points, and then shown as parameter OUT.

The following documentation convention is used: if the name of a confirmed parameter is, for example, PARM, then its request value is referred to as PARM_request and its readback value is referred to as PARM_readback.

113.5.6 Status of the Readback Value

The statuses of the redundant output readbacks RRBK_1 and RRBK_2, together with the statuses of their ECB(s), are determined each time the block is executed. If ARBOPT specifies TMR, there is a similar determination for the statuses of the RRBK_3 readback and its ECB. For each of the two or three readbacks, the status of its RRBK_x parameter is set according to the following rules.

The status of RRBK_x is set to Out-of-Service if one or more of the following exist:

- The device ECB status indicates that the field device is Off-line or Out-of Service.
- The DCI connection cannot be configured, due to lack of configuration information in the FBM database.
- The DCI is not yet connected (that is, the PIO maintenance task has not yet sent the DATA_CONNECT message to the FBM for the linked-list addition, as described in Section 113.5.3).
- The DCI connection status information, which specifies the condition of the connected device parameter, indicates Out-of-Service. This means (in general) that the parameter value is unavailable.
- The status information indicates Disconnected, meaning (in general) that the parameter is not connected or not defined.

The status of RRBK_x is set to Bad if:

- The device ECB status indicates that the field device has failed, or
- The DCI connection status information indicates a bad value regarding the field device parameter.

The status of RRBK_x is set to Error if:

- The status information indicates an uncertain or questionable value of the field device parameter.

The status of RRBK_x is set to Fail-safe if:

- The status information indicates that the addressed device parameter is in fail-safe.

If RRBK_x is not Bad or Out-of Service, the arbitrated readback value becomes the new value of OUT. Otherwise, the previous last good value of RRBK_x is retained.

The values and statuses of the individual RRBK_x parameters are available in the three output parameters, and, in addition, they are used as the inputs in the arbitration algorithm (see below).

113.5.7 Processing the Readback Value Data

For each readback value, the raw count value from the field device is scaled into the I/A Series system normalized raw count range by application of OGAIN and OBIAS:

I/A Series System Normalized Raw Count = (Input Raw Value) (OGAIN) + OBIAS

This I/A Series system normalized raw count value is then converted into engineering units by application of the signal conditioning index (SCO) and the engineering range limits (HSCO1 and LSCO1):

Engineering Units =
((I/A Series System Normalized Raw Count - span low limit) (HSCO1 - LSCO1) / span)
+ LSCO1

For example, if the SCO is linear 1600 - 64000, the span low limit is 1600, and the span is 64000 - 1600 or 62400.

If REVOPT is configured True, this calculation is modified for reverse action.

The final step in readback conditioning consists of clamping or limiting the engineering units value. Clamping or limiting of the readback value is carried out optionally, based on the parameter CLPOPT:

If CLPOPT = 1, the value is clamped only if the block is in Auto.

If CLPOPT = 2, the value is clamped in both Auto and Manual.

If CLPOPT = 0, the value is never clamped.

Clamping uses the configured or set LOLIM and HOLIM values, after these have been forced to comply with the range limits and the anticrossover requirement.

With I/A Series software v8.4 and later, ROUTR blocks operating on the FCP280, FCP270 and the ZCP270 expand the clamping limits range at each end by the percentage specified in Output Span Variance (OSV) parameter.

When clamping is not applied, the value is limited by the range limits LSCO1 and HSCO1.

NOTE

If you change the HSCO1 and LSCO1 values to expand the engineering range, make sure you change the HOLIM and LOLIM values accordingly to prevent output limiting at the old limits. The block does not automatically adjust HOLIM and LOLIM for the expanded range.

113.5.8 Arbitration Algorithm

RRBK_1, RRBK_2, and RRBK_3 each has a value and a status. In the following table, an RRBK_x is valid if its status is neither Bad nor Out-of-Service. Also, if ARBOPT indicates DMR, RRBK_3 is never valid.

The configured real, non-negative parameter ARBLIM is used to specify how close any two RRBK_x values must be to each other, on an absolute value basis, to be considered in agreement. Specifically, if |RRBK_x - RRBK_y| ≤ ARBLIM, then RRBK_x and RRBK_y agree.

RRBK_1 Valid	RRBK_2 Valid	RRBK_3 Valid	Test	Select
Yes	Yes	Yes	RRBK_1 and RRBK_2 agree	RRBK_1
Yes	Yes	Yes	RRBK_1 and RRBK_2 disagree, and RRBK_1 and RRBK_3 agree	RRBK_1
Yes	Yes	Yes	RRBK_1 and RRBK_2 disagree, and RRBK_1 and RRBK_3 disagree, and RRBK_2 and RRBK_3 agree	RRBK_2

RRBK_1 Valid	RRBK_2 Valid	RRBK_3 Valid	Test	Select
Yes	Yes	Yes	RRBK_1 and RRBK_2 disagree, and RRBK_1 and RRBK_3 disagree, and RRBK_2 and RRBK_3 disagree	See Case 1 below
Yes	Yes	No	RRBK_1 and RRBK_2 agree	RRBK_1
Yes	Yes	No	RRBK_1 and RRBK_2 disagree	See Case 2 below
Yes	No	Yes	RRBK_1 and RRBK_3 agree	RRBK_1
Yes	No	Yes	RRBK_1 and RRBK_3 disagree	See Case 2 below
No	Yes	Yes	RRBK_2 and RRBK_3 agree	RRBK_2
No	Yes	Yes	RRBK_2 and RRBK_3 disagree	See Case 2 below
Yes	No	No	(No Test)	RRBK_1
No	Yes	No	(No Test)	RRBK_2
No	No	Yes	(No Test)	RRBK_3
No	No	No	(No Test)	See Case 3 below

When the Select column reads "See Case x below" the pre-configured parameter SELOPT determines the value of OUT_readback as follows:

Case 1 (all three values are available but disagree):

- If SELOPT = 0, the value of OUT_readback is unchanged (last good value function)
- If SELOPT = 1, the algebraically lowest of RRBK_1, RRBK_2, and RRBK_3 is selected
- If SELOPT = 2, the algebraically highest of RRBK_1, RRBK_2, and RRBK_3 is selected
- If SELOPT = 3, the algebraic mean of RRBK_1, RRBK_2, and RRBK_3 is used.

Case 2 (two of the three values are available but disagree):

- If SELOPT = 0, the value of OUT_readback is unchanged (last good value function)
- If SELOPT = 1, the algebraically lower of the two valid RRBK_x is selected.
- If SELOPT = 2, the algebraically higher of the two valid RRBK_x is selected.
- If SELOPT = 3, the algebraic mean of the two valid RRBK_x is used.

Case 3 (none of the three values is available):

- The value of OUT_readback is unchanged (last good value function)
- The status of OUT_readback is set Bad and Out-of-Service

Output parameter SELECT shows which RRBK_x readback has been selected as indicated in the following table:

Selection	SELECT	OUT_readback Status
RRBK_1 selected	1	----
RRBK_2 selected	2	----
RRBK_3 selected	3	----

Selection	SELECT	OUT_readback Status
Case 1 or Case 2, SELOPT = 3	0	Error
Case 1 or Case 2, SELOPT = 0	0	Bad and Out-of-Service
Case 3	0	Bad and Out-of-Service

113.5.9 Auto/Manual Switching

The Auto/Manual mode selection arbitrates between inputs by the operator (Manual) and inputs from the field (Auto). Parameters MA, INITMA, AUTSW, and MANSW are used to establish the control mode of the ROUTR block.

With I/A Series software v8.4 and later, the ROUTR block provides two additional controls of the block mode on the FCP280, FCP270 and ZCP270:

- ♦ When MANFS=1, the block switches to manual mode when the fail-safe is asserted to allow recovery from FBM fail-safe at the block. The option only takes effect if MA is unlinked. MANFS takes precedence over AUTSW and INITMA. Fail-safe in the block is cleared as soon as the output is changed. For cascade operations, it is recommended that MANFS be enabled in only one block.
- ♦ When MBADOP=1, the block switches to manual mode when either the output value status is BAD or MEAS value status is BAD.

These options are not supported on other control processors.

113.5.10 Changing Engineering Range Limits

Changing engineering range limits in the ROUTR block may limit output with unexpected results. For example, after changing the engineering units in the ROUTR block from 4-20 to 0-100, the block output may still be limited in the 4-20 range.

The absolute engineering range limits of the output in this block is specified by the LSCO1, HSCO1, and OSV *(CP270 and Later Only)* parameters. However, this block also contains output limit values (LOLIM and HOLIM), which are normally used to constrain the output to operating limits that are narrower than the engineering range limits.

When this block runs, the LOLIM and HOLIM limit values are not allowed to exceed the engineering range. In the example noted above, the block logic sets LOLIM=4 and HOLIM=20 when the block initializes, since LSCO1=4 and HSCO1=20.

When the block initializes with the modified engineering range (LSCO1=0 and HSCO1=100), the LOLIM, HOLIM values are **not** modified since they are already within the new engineering range. As a result, the output will remain limited between 4-20.

To expand the engineering range, also adjust the LOLIM and HOLIM values accordingly by setting them to their desired values. Once this is done, the new limit values will be used correctly to constrain the output value.

113.5.11 Fail-Safe Functions

Fail-safe support is based on the following parameters:

- ♦ FSOPTN – This configured value specifies the conditions under which the field device will receive a fail-safe value from the I/A Series system.

- FSOUT – This configured value specifies, in engineering units, the fail-safe value that is to be sent to the field device when any condition specified in FSOPTN exists. The entered value is limited by HSCO1 and LSCO1 before it is set into parameter FSOUT. If this limiting causes FSOUT to be changed, the status of FSOUT is set to Limited High or Limited Low, as appropriate. FSOUT is first converted to I/A Series normalized raw count (using reverse action if specified by REVOPT) and then into device raw count (using linear transformation based on OGAIN and OBIAS) before being sent to the device.
- SETFS – This settable boolean parameter constitutes a command to send the configured FSOUT value to the field device. It is only observed when the appropriate FSOPTN so specifies.
- MANFS *(CP270 and Later Only)* – When set to true (MANFS=1), this parameter forces the block to Manual mode when fail-safe is asserted.

The FSOPTN conditions are:

- Send the fail-safe value FSOUT when there is an input error at MEAS, as defined by EROPT (Bit 0).
- Send the fail-safe value FSOUT when the block parameter SETFS has been set true (Bit 1).
- Assert fail-safe, using the FSOUT value, when communications between the I/A Series control station and the FBM is lost (Bit 2). The block does not perform this option; it is carried out by the FBM software. This option will be enabled only if fail-safe is enabled at the FBM level via the FSENAB parameter in ECB200 or ECB202.

FSOPTN is a bit map, allowing combinations of conditions for fail-safe to be specified.

113.5.12 Time Stamp

The time stamp (TSTAMP) parameter of the block is updated every time there is a change in the OUT value (OUT differs from the current readback value). TSTAMP, which is expressed in units of milliseconds past midnight, is read from the FBM when it is available there; otherwise, it is computed by the I/A Series control station. TSTAMP is not updated when SELECT = 0; it is left at its last good value. Refer to Section 113.5.8.

NOTE

For a FOUNDATION fieldbus connection, a 4-byte ms since midnight timestamp is provided by the FOUNDATION fieldbus FBM and stored in the TSTAMP parameter.

113.5.13 Conditions for Sending a Block Output

The following conditions cause a new output from the ROUTR block:

- A new value has been set into either or both of the operational limits HOLIM and LOLIM since the last execution cycle, provided CLPOPT specifies that clamping is in use.
- A periodic output is required. Whenever SECTIM has been configured with a positive value and there has been no output for SECTIM seconds, a block output is forced and the secondary timer is reinitialized.

- A condition for fail-safe has been met this cycle but was not met the previous cycle (“start of a fail-safe period”).
- A condition for fail-safe was present the previous cycle, but not this cycle (“end of a fail-safe period”).
- A condition for fail-safe presently exists, but the DCI connection status information indicates that the device parameter is not now in fail-safe (“unaccepted or delayed response to fail-safe command”).
- The block is in Auto and the value of MEAS has changed this cycle.
- The block is in Manual and the value of OUT-request has been changed this cycle.
- The change timer has expired
- The input Boolean value for INI_PT is set true.

113.5.14 Processing the Output Data

When any of the conditions for sending a new block output exists, the current value of MEAS (Auto) or OUT_request (Manual) is either clamped or limited before conversion to I/A Series system normalized raw count.

Clamping or limiting of the output value is carried out optionally, based on the parameter CLPOPT.

If CLPOPT = 1, the value is clamped only if the block is in Auto.

If CLPOPT = 2, the value is clamped in both Auto and Manual.

If CLPOPT = 0, the value is never clamped.

Clamping uses the configured or set LOLIM and HOLIM values, after these have been forced to comply with the range limits and the anticrossover requirement.

With I/A Series software v8.4 and later, ROUTR blocks operating on the FCP280, FCP270 and ZCP270 expand the clamping limits range at each end by the percentage specified in Output Span Variance (OSV) parameter.

When clamping is not applied, the value is simple limited by the range limits LSCO1 and HSCO1.

NOTE

If you change the HSCO1 and LSCO1 values to expand the engineering range, make sure you change the HOLIM and LOLIM values accordingly to prevent output limiting at the old limits. The block does not automatically adjust HOLIM and LOLIM for the expanded range.

This clamped or limited value is now compared against the current value of OUT. If they are equal, no new output is sent. (Even if these two values are the same, an output is sent if any of the conditions in the first three bullets of Section 113.5.13 is true.)

Assuming the output is to be sent, conversion to I/A Series system normalized raw count is computed as follows:

Normalized Raw Count =
((New Value - LSCO1) (span) / (HSCO1 - LSCO1)) + span low limit

For example, if the SCO is linear 1600 - 64000, the span low limit is 1600, and the span is 64000 - 1600 or 62400.

If REVOPT is configured True, this calculation is modified for reverse action.

Finally, if conversion from I/A Series system normalized raw count to device normalized count is to be carried out at the I/A Series system end, signal conditioning using OGAIN and OBIAS are carried out by the block as follows:

Device Raw Count = (I/A Series System Normalized Raw Count - OBIAS) / OGAIN

If conversion to the device normalized count is to be carried out at the device end, OGAIN and OBIAS should be left at their default values.

113.5.15 Sending the Output

After the output has been processed as described in the previous section, it is sent to the output buffers of the two or three DCI connections for the ROx_PTs used by the block.

The Write Flag is then set in each output buffer receiving the new output. If any of the connections has an Initialization Request flag set, the Initialization Acknowledge flag is also set in that output buffer. If the outputs are being sent because of a fail-safe condition, the Fail-safe Request flag is also set in each output buffer.

113.5.16 Status of Other Block Outputs

The Out-of Service and Bad status bits of OUT, OUT_request, and BCALCO are copied from the corresponding statuses of the selected readback RRBK_x (see Section 113.5.6 and Section 113.5.8). In addition, the Error and Fail-safe status bits of OUT and OUT_request are copied from the corresponding statuses of the selected readback RRBK_x.

The status of OUT_request is also set to Limited High or Limited Low (as appropriate) if:

- The clamping or limiting action described in Section 113.5.14 forces a modification of the value.
- The DCI connection status information indicates that the field device parameter is limited high or low.

113.5.17 Change Timer

The purpose of the change timer is to facilitate monitoring by the block for an indication that the field device point has received the most recent I/A Series system change. The block expects the device to have received the new value within that time.

The timer is initialized to the configured value of RBKTIM (in seconds) each time a value is sent to the field device. In each cycle thereafter, so long as there is no new output sent, the timer is decremented and tested for expiration.

If the change timer expires, the current readback value is compared against the value of OUT_request. If they differ by more than 0.05 percent of the RO1 range, it is assumed that the device value did not change as a result of the I/A Series system change (that is, the most recent I/A Series system value sent to the device has been rejected). After the raw count conversions described in Section 113.5.14, this readback value is copied to OUT_request.

If the change timer has not expired, the readback value is compared against its previous value on any cycle in which there is no new output. If they differ, and the current readback value differs from OUT_request by more than 0.05 percent of the RO1 range, then this readback value is copied to OUT_request, after the raw count conversions described in Section 113.5.14.

113.5.18 Status of INI_PT

Transitions in the status of the initialization input INI_PT are used in determining whether block initialization is required.

This status is considered True if:

- The device value of INI_PT is True (the field device has requested that the block go into Tracking).
- The ECB status indicates that the field device is Off-line or Out-of Service.
- The DCI connection for INI_PT cannot be configured, due to lack of configuration information in the FBM database.
- The DCI for INI_PT is not yet connected (that is, the PIO Maintenance task has not yet sent the DATA_CONNECT message to the FBM for the linked-list addition described in Section 113.5.3).
- The DCI connection status information for the selected ROx_PT, as determined by the arbitration algorithm, indicates Initialization Request, Local Override, Fail-safe, or Open Cascade.

113.5.19 Initialization

The ROUTR block initializes whenever the block is restarted, there is a bad-to-good transition of the status of OUT, or there is a true-to-false transition in the status of INI_PT. See Section 113.5.18.

Initialization action consists of setting the readback value from the selected redundant output point into an unconnected MEAS and OUT_request. The cascade is then opened to force an upstream initialization (see Section 113.5.20). A timeout of the change timer is forced on this cycle, and the OUT_readback value is sent to the field device.

If the block is in Auto mode, and there has been a bad-to-good transition in the status of MEAS, the same actions are taken, except for the initialization of OUT_request. The definition of Bad for the status of MEAS depends on EROPT.

113.5.20 Cascade Processing

The cascade is opened when the block has initialized for any of the reasons listed in the previous section. When the cascade is opened, INITO, which can be connected to the INITI input of the block immediately upstream from the ROUTR block (if there is an INITI parameter in that block), is turned on. The status of BCALCO, which should be connected to the BCALCI input of the block immediately upstream, is set to indicate open cascade. The current readback value is set into the value of BCALCO and the ROUTR block then goes into a Hold, thereby disallowing any outputs.

The upstream block (the block connected to MEAS) is then commanded to run immediately. This feature sets a Run flag in the header of the upstream block, causing the compound processor to execute this block on the next BPC without regard to its period and phase.

If there is no support for cascade processing in the upstream block, configure PRIBLK = 0. In this case, the cascade is held open for one cycle, after which the Hold is released.

When PRIBLK=1, the BCALCI-BCALCO connection must be used. When the cascade conditions no longer exist, the ROUTR block sets either the INITU or INITC status in BCALCO. When the upstream block sees the INITU/INITC, it initializes its output to the BCALCI value and set the ACK status bit in its OUT parameter. When the ROUTR block sees the ACK bit set, it drops the INITU/INITC status bit and the INITO output and closes the cascade.

If closure of the cascade is to occur after a specific timeout, configure PRIBLK = 1. In this case, PRITIM must be configured with a nonzero value. The cascade is closed again after the PRITIM delay has expired.

113.5.21 Holding and Tracking

The block goes into Holding whenever MEAS is Bad, OUT has bad status, or it is in Auto mode with the cascade not closed.

The block goes into Tracking when the status of INI_PT is True and remains that way as long as it stays True.

Ordinarily, no output changes are allowed while the block is in Holding or Tracking. The only exception is when there has been a fail-safe request, as described in the third, fourth, and fifth bullets in Section 113.5.13.

113.5.22 Simulation Option

When Simulation Option (SIMOPT) is configured true, there are no ECBs or DCI connections established for the block. The statuses and data values of RRBK_1, RRBK_2, and RRBK_3 are not recovered from the field device, and no outputs to the field device occur.

However, the basic actions of Auto and Manual modes are still observed when SIMOPT is true. If the block is in Auto, MEAS can be used for simulated inputs, and if in Manual, OUT_request may be set with simulated values. All normal processing of inputs, such as clamping, limiting, change monitoring, and processing of status values of parameters is performed normally. The change timer continues to operate.

113.5.23 Alarming *(CP270 and Later Only)*

With I/A Series software v8.4 and later, the ROUTR blocks provides alarm detection and reporting for Bad I/O on the FCP280, FCP270 and the ZCP270.

Key Parameters: BAO, BAP, BAG, BAT, BAD, AMRTIN

113.5.23.1 Bad Alarming

Bad alarming occurs when the Bad Alarm Option (BAO) is set and one of the connected readback values is bad. A bad alarm messages is generated for each readback value independently when its status is bad (RRBK_x.BAD).

When one readback value becomes bad, the ROUTR block creates a bad alarm message and sends it to all devices specified in the bad alarm group (BAG) parameter. The bad alarm message contains the descriptive text specified in the Bad Alarm Text parameter (BAT) and the loop identifier (LOOPID). To identify which of the readback values are bad, the message also contains a “BAD1”, “BAD2” or “BAD3” text string, depending on which readback value is bad.

When the readback value becomes good, a corresponding return-to-normal message is generated and sent to all devices in the bad alarm group.

Bad alarm status information, however, is generated only when all readback values are bad, at which point, the ROUTR block takes the following actions:

- Sets the bad parameter (BAD) and the corresponding BAD bit of the Alarm Status parameter (ALMSTA.BAD) true
- Sets the UNACK parameter and the corresponding ALMSTA.UNACK bit true
- Sets the criticality (CRIT) parameter and its corresponding ALMSTA.CRIT field to the BAP (Bad Alarm Priority) value.
- Sets the Priority Type (PRTYPE) parameter and its corresponding ALMSTA.PRTYPE bit to the Bad alarm type.

When all readback values return to good status, CRIT, PRTYPE and their corresponding fields in ALMSTA are cleared. The UNACK parameter and the ALMSTA.UNACK bit are cleared if one of the following is true:

- The alarm is acknowledged by an OM set operation at either the compound or block level by setting the compound or block parameter UNACK to 0.
- Both readback values return to a good status and the Inhibit Option (INHOPT) is set appropriately.
- The block is shut down.

When UNACK is cleared, an Alarm Acknowledge message is generated and sent to all devices in the bad alarm group.

113.5.23.2 Inhibiting and Disabling Alarms

Using a combination of the ROUTR block parameters INHOPT and INHIB, and the compound parameter CINHIB, you can inhibit bad alarm messages and/or disable bad alarm detection.

When the Bad alarm is inhibited or disabled, an Alarm Disable message is sent to all devices in the bad alarm group. If the Bad alarm is unacknowledged, an Alarm Acknowledge message is also sent to the devices. In addition, the ALMSTA.INHIB, INHSTA.BAD, and INHSTA.BADx bits are set.

When the Bad alarm is uninhibited or enabled, a corresponding Alarm Enable message is generated and sent to the devices belonging to the bad alarm group, the ALMSTA.INHIB bit is cleared, and the INHSTA parameter is cleared.

Parameters NASDB and NASOPT provide control of nuisance alarms by applying a delay (set in NASDB) to return-to-normal condition (NASOPT = 0) or to alarm detection (NASOPT=1). The ROUTR block also supports alarm reprioritization and regeneration.

Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG) on for further information about alarm generation and management.

113.6 ROUTR Signal Conditioning (SCO) Values

NOTE

Valid SCO values for the ROUTR block are 0-5, 12-15, and 50-59, all inclusive.

SCO = 0:	No Conditioning RAWC = OUT	
SCO = 1:	Inverse Linear (0 to 64000) Represents analog output of 0 to 20 mA RAWC = (OUT - LSCO1) * 64000/(HSCO1 - LSCO1)	
SCO = 2:	Inverse Linear (1600 to 64000) Represents analog output of 0 to 10 V dc RAWC = ((OUT - LSCO1) * 62400/(HSCO1 - LSCO1)) + 1600	
SCO = 3:	Inverse Linear (12800 to 64000) Represents analog output of 4 to 20 mA RAWC = ((OUT - LSCO1) * 51200/(HSCO1 - LSCO1)) + 12800	
SCO = 4:	Inverse Square Root (0 to 64000) Represents analog output of 0 to 20 mA RAWC = $((OUT - LSCO1) * 64000/(HSCO1 - LSCO1))^2$ / 64000	
SCO = 5:	Inverse Square Root (12800 to 64000) Represents analog output of 4 to 20 mA RAWC = $((OUT - LSCO1) * 51200/(HSCO1 - LSCO1))^2$ / 51200 + 12800	
SCO = 12:	Inverse Linear (14080 to 64000) Analog Output 2 to 10 V dc RAWC = ((OUT - LSCO1) * 49920/ (HSCO1 - LSCO1)) + 14080	
SCO = 13:	Inverse Square Root (14080 to 64000) Analog Output 2 to 10 V dc RAWC = $((OUT - LSCO1) * 49920/ (HSCO1 - LSCO1))^2$ / 49920 + 14080	
SCO = 14:	Inverse linear (0 - 16383) RAWC = ((OUT - LSCO1) * 16383/ (HSCO1 - LSCO1))	
SCO = 15:	Inverse Square Root (0 to 64000) Analog Output 0 to 10 V dc RAWC = $((OUT - LSCO1) * 64000/ (HSCO1 - LSCO1))^2$ / 64000	
SCO = 50:	Linear (0 to 65535)	x = (y - LSCO1) * 65535/(HSCO1-LSCO1)
SCO = 51:	Linear (-32768 to 32767)	x = (y - LSCO1) * 65535/(HSCO1-LSCO1) - 32768
SCO = 52:	Linear (0 to 32767)	x = (y - LSCO1) * 32767/(HSCO1-LSCO1)
SCO = 53:	Linear (0 to 1000)	x = (y - LSCO1) * 1000/(HSCO1-LSCO1)
SCO = 54:	Linear (0 to 9999)	x = (y - LSCO1) * 999/(HSCO1-LSCO1)
SCO = 55:	Linear (0 to 2048)	x = (y - LSCO1) * 2048/(HSCO1-LSCO1)
SCO = 56:	Linear (409 to 2048)	x = (y - LSCO1) * 1639/(HSCO1-LSCO1) + 409
SCO = 59:	Linear (0 to 4095)	x = (y - LSCO1) * 4095/(HSCO1-LSCO1)

The following notes apply to SCO = 50 through SCO = 59:

- y = engineering units value; x = normalized counts value.
- Linear scaling of the analog outputs is also provided.

114. SIGSEL – Signal Selector Block

This chapter describes the SIGSEL (Signal Selector Block), its features, parameters and detailed operations.

114.1 Overview

The Signal Selector block (SIGSEL) examines up to eight inputs and, based on your option, generates an output that is either: 1) the highest signal; 2) the lowest signal; 3) the average value of all the configured inputs; 4) the low-median signal; or 5) the high-median signal.

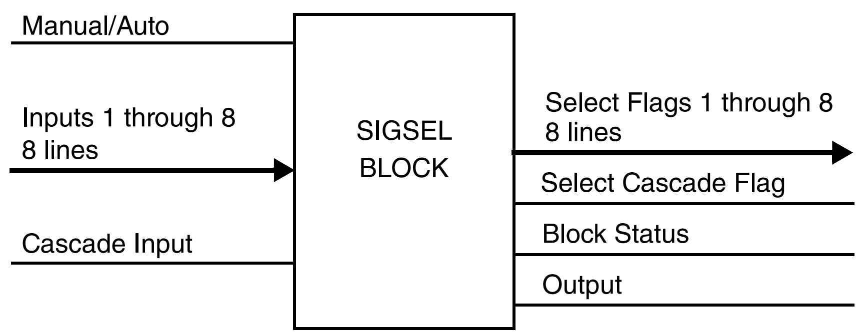


Figure 114-1. SIGSEL Block I/O Diagram

114.2 Features

The features are:

- Manual/Auto control of the outputs, which can be initiated by a host process or another block
- Indication of the selected input (Select Flag) when selecting the high, low, low-median or high-median value.

The options are:

- Select Option (SELOPT) establishes whether the block is selecting the high, the low, the low median, the high median, or the average value of all the active inputs.
- Number of Inputs (NUMINP) allows you to fix the number of active inputs to be included in the selection process.
- Error and error propagation (EROPT and PROPT).
- Bypass options for each INP_n input.

114.3 Parameters

Table 114-1. SIGSEL Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	13	SIGSEL
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
NUMINP	number of inputs	integer	no-con/no-set	8	[2..8]
BNDX	biased index	integer	no-con/no-set	0	
PROPT	propagate error	boolean	no-con/no-set	0	0 to 1
EROPT	error option	short	no-con/no-set	0	[0|1|2]
INP1 to INP8	input 1 to 8	real	con/set	0.0	RI1/RI8
HSCI1 to HSCI8	high scale in 1 to 8	real	no-con/no-set	100.0	specifiable
LSCI1 to LSCI8	low scale in 1 to 8	real	no-con/no-set	0.0	specifiable
DELTI1 to DELTI8	change delta 1 to 8	real	no-con/no-set	1.0	percent
EI1 to EI8	eng units input	string	no-con/no-set	%	specifiable
BYPAS1 to BYPAS8	bypass INP1 to INP8	boolean	con/set	0	0 to 1
CASNDX	cascade index	integer	con/set	0	---
CASINP	cascade input	real	con/set	0.0	RIC
HSCIC	high scale input cascade	real	no-con/no-set	100.0	specifiable
LSCIC	low scale input cascade	real	no-con/no-set	0.0	specifiable
DELTIC	change delta cascade	real	no-con/no-set	1.0	percent
EIC	eng units input cascade	string	no-con/no-set	%	specifiable
HSCO1	high scale out 1	real	no-con/no-set	100.0	specifiable
LSCO1	low scale out 1	real	no-con/no-set	0.0	specifiable
DELTO1	change delta 1	real	no-con/no-set	1.0	percent
EO1	eng unit output	string	no-con/no-set	%	specifiable
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	[0|1|2]
SELOPT	block options	integer	no-con/no-set	1	[1..5]
OUTPUTS					
BLKSTA	block status	pack_l	con/no-set	0	bit map
OUT	output	real	con/no-set	0.0	RO1
SEL1 to SEL8	input 1 to 8 select flag	boolean	con/no-set	0	0 to 1
SELC	cascade select flag	boolean	con/no-set	0	0 to 1
SELNDX	select index	integer	con/no-set	0	---
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
ERCODE	config error	string	no-con/no-set	0	1 to 43 chars
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars

Table 114-1. SIGSEL Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
RI1 to RI8	eng range input 1 to 8	real[3]	no-con/no-set	100,0,1	specifiable
RIC	eng range cascade	real[3]	no-con/no-set	100,0,1	specifiable
RO1	eng range output 1	real[3]	no-con/no-set	100,0,1	specifiable

114.3.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the SIGSEL block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
											WLCK					ON	UDEF			MA											

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
20	WLCK	Workstation Lock	BLKSTA.B12

* Bit 0 is the least significant, low order bit.

BNDX

Biased Index is an integer input that provides a bias to the indexing of the eight standard inputs. It allows the block to be cascaded for HIGH and LOW selection of more than eight inputs. If BNDX = 0, the block ignores the cascade selected input (CASINP), and considers only the eight standard inputs. If BNDX has a nonzero value, and any of the eight inputs are selected, the SELNDX output is set to the index of the selected input plus the bias value of BNDX.

BYPAS1 to BYPAS8

Bypass Inputs 1 through 8 are boolean inputs, which when set true exclude INP1 to INP8 from the selection process.

CASINP — Cascade Input is a real input used in a cascaded SIGSEL configuration. Of all the inputs in the cascaded stages prior to this block, it indicates the value of the selected input in the test for the HIGH (or LOW) value. While PROPT is configured true, the block bypasses the CASINP input if CASINP or CASNDX are in error. Typically, CASINP is linked to the OUT output of the previous stage.

CASNDX — Cascade Index is an integer input used in a cascaded SIGSEL configuration. It indicates which, of all the inputs in the cascaded stages prior to this block, is the selected input in the test for the HIGH (or LOW) value. Typically, CASNDX is linked to the SELNDX output of the previous stage.

DEFINE — Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block.

DELTI1 to DELTI8

Change Delta for Input Ranges 1 through 8 are a real values that define the minimum percent of the input range that triggers change driven connections for parameters in the range of RI1 through RI8. The default value is 1.

Entering a 1 causes the Object Manager to recognize and respond to a change of 1 percent of the full error range. If communication is within the same CP that contains the block's compound, change deltas have no effect.

Refer to "Peer-to-Peer Connections of Real-Type Block Inputs" on page 1703 for details on how the I/A Series software affects the change delta percentage during operation.

DELTIC — Change Delta for Input Cascade is a real value that defines the resolution as a percent of the range for the cascade input CASINP.

DELTO1 — Change Delta for Output Range 1 is presently unused.

DESCRP — Description is a user-defined string of up to 32 characters that describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

EI1-EI8 — Engineering Units for Input Ranges 1 through 8, as defined by the parameters HSCI1 to HSCI8, LSCI1 to LSCI8, and DELTI1 to DELTI8, provide the engineering units text for the values defined by Input Ranges 1 through 8. "Deg F" or "pH" are typical entries.

EIC — Engineering Units for Input Cascade, defined by the parameters HSCIC, LSCIC, and DELTIC, provide the engineering units text for the values defined by Input Range 1. “Deg F”, “PSI”, and “GPM” are typical entries.

EO1 — Engineering Units for Output Range 1, defined by the parameters HSCO1, LSCO1, and DELTO1, provide the engineering units text for the values defined by Output Range 1. “Deg F” or “pH” are typical entries. Make the units for the Output Range (EO1) consistent with the units of Input Range 1 (EI1) and Input Range 2 (EI2).

ERCODE — Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations sets the block’s DEFINE parameter to false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the SIGSEL block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
“W43 – INVALID PERIOD/ PHASE COMBINATION”	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
“W44 – INVALID ENGINEERING RANGE”	High range value is less than or equal to low range value.
“W46 – INVALID INPUT CONNECTION”	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
“W48 – INVALID BLOCK OPTION”	The configured value of a block option is illegal.
“W53 – INVALID PARAMETER VALUE”	A parameter value is not in the accept-able range.
“W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK”	A Database Installer error has occurred.

EROPT — Error Option is a short integer. If PROPT is true, EROPT specifies how the block responds to INP when the INP parameter is in error. EROPT has a range of 0 to 2, where:

0 = The block ignores the errors.

1 = The block sets the ERROR bit in OUT if the INP parameter:
(a) has its BAD status bit set true;
(b) has its OOS status bit set true;
(c) is experiencing peer-to-peer path failure.

2 = The block sets the ERROR bit in OUT if the INP parameter:
(a) has its BAD status bit set true;
(b) has its OOS status bit set true;
(c) has its ERROR status bit set true;
(d) is experiencing peer-to-peer path failure.

The block disregards EROPT if PROPT is configured false. If EROPT = 0, a block in a cascaded scheme does not open the cascade in response to an error of its input signal, even if PRIBLK is configured true.

HSCI1 to HSCI8 — High Scale for Input Ranges 1 through 8 are real values that define the upper limit of the measurement ranges. EI1 to EI8 define the units. Make the range and units consistent with the INP source. A typical value is 100 (percent).

HSCIC — High Scale for Input Cascade is a real value that defines the upper limit of the range for the cascade input, CASINP. EIC defines the units. Make the range and units consistent with those of the input source.

HSCO1 — High Scale for Output Range 1 is a real value that defines the upper limit of the ranges for Output 1. A typical value is 100 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.

INITMA — Initialize Manual/Auto specifies the desired state of the MA input during initialization, where:

0 = Manual
1 = Auto
2 = The MA state as specified in the checkpoint file.

The block asserts this initial M/A state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a reboot operation.
- The compound in which it resides is turned on.
- The INITMA parameter itself is modified via the control configurator. (The block does not assert INITMA on ordinary reconfiguration.)

INITMA is ignored if MA has an established linkage.

INP1 to INP8	Inputs 1 through 8 are inputs that are selected to monitor the output when the TOGGLE input is false.
LOCKID	Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.
LOCKRQ	Lock Request is a boolean input which can be set true or false only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.
LOOPID	Loop Identifier is a configurable string of up to 32 characters which identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.
LSCI1 to LSCI8	Low Scale for Input Ranges 1 through 8 are real values that define the lower limit of the measurement ranges. A typical value is 0 (percent). EI1 to EI8 define the units. Make the range and units consistent with those of the INP source.
LSCIC	Low Scale for Input Cascade is a real value that defines the lower limit of the range for the cascade input, CASINP. A typical value is 0 (percent). Make the range consistent with that of the input source.
LSCO1	Low Scale for Output Range 1 is a real value that defines the lower limit of the ranges for Output 1. A typical value is 0 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.
MA	Manual Auto is a boolean input that controls the Manual/Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. The block automatically limits the output to the output range specified between LSCO1 and HSCO1. In Manual, the algorithm is not performed, and the output is unsecured. An external program can then set the output to a desired value.
NAME	Name is a user-defined string of up to 12 characters used to access the block and its parameters.

NUMINP	Number of Inputs specifies the number of active inputs (2 to 8) available for selection, starting with INP1. You can change NUMINP only by reconfiguring the block.
OUT	Output, in Auto mode, is the result of the block algorithm applied to one or more input variables. In Manual, OUT is unsecured, and can be set by you or by an external task.
OWNER	Owner is a string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are successful only if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.
PERIOD	Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PHASE	Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PROPT	Propagate Error Option is a boolean input. When true, PROPT sets the ERROR Status bit of the output parameter if the input to the INP parameter is in error while the block is in Auto. The input to the INP parameter is in error when: ♦ Its BAD status bit is set true. ♦ Its OOS (Out-of-Service) status bit is set true. ♦ Its ERROR status bit is set true. ♦ It is experiencing peer-to-peer path failure. If a transition to Manual occurs while the ERROR status is true, it remains true until either a set command is written to that output or until the block transfers to Auto with the error condition returned to normal.

— NOTE —

All users of the SIGNEL block - please read the following user note:
Use caution when upgrading from versions of I/A Series software previous to 8.7 with the SIGSEL block. This upgrade changes the functionality of the SIGSEL block to ignore the state of PROPT for bypass switches (BYPAS1 - BYPAS8). This means that if a SIGSEL block was previously configured with PROPT = FALSE, all of the unsecured BYPAS*n* switches are enabled after this upgrade. Therefore, if any of the BYPAS*n* switches are set to TRUE before upgrading, the block's output may not be the same as it was before the upgrade.
In addition, if the intent was to prevent an operator from using the bypass switches by setting PROPT = FALSE, upgrading requires a new configuration, in order to secure all of the BYPAS*n* inputs which an operator should not be allowed to change.
An example: There are two ways to change the configuration after an upgrade to get the same functionality you had before. Both methods require you to secure his input.
1) Connect each BYPAS*n* input to an upstream block.
2) Set the BYPAS*n* inputs to themselves (e.g., BYPAS*n* = COMPOUND:BLOCK.BYPAS*n*.0 to disable and secure the bypass input or BYPAS*n* = COMPOUND:BLOCK.BYPAS*n*.1 to enable and secure the bypass input.). By using either of these methods, you can secure access by the operator to the bypass inputs and still have PROPT = FALSE if that was the operator's intent.

RI1 to RI8 — Range Input is an array of real values that specify the high and low engineering scale and change delta of a particular real input. For a given block, it also forms an association with a group of real input parameters that have the same designated range and change delta.

RIC — Range Array for Input Cascade is a real value that defines the range of the cascade input, CASINP.

RO1 — Range Output is an array of real values that specify the high and low engineering scale of a particular real output. For a given block, it also forms an association with a group of real output parameters that have the same designated range.

SEL1 to SEL8 — Select Flags 1 through 8 are boolean outputs that are set when INP1 through INP8 are the inputs whose values are selected.

SELC — Select Cascade is a boolean output that is set true while the cascade input CASINP is the selected output value.

SELNDX — Select Index is an integer output that indicates the absolute index of the selected input when the SIGSEL block is selecting the HIGH or LOW value, particularly in a cascaded configuration testing more than eight inputs. If any of the standard eight inputs is selected, SELNDX is set to the index of the selected input plus the bias value of BNDX. If the cascade select input CASINP is selected, SELNDX = CASNDX. This allows indication of an absolute index for the selected input when more than eight inputs are selected by cascaded SIGSEL blocks. SELNDX has meaning when you specify High Select (SELOPT = 1), Low Select (SELOPT = 2), Low Median (SELOPT = 4) or High Median (SELOPT = 5).

SELOPT — Select Option is an indexed, integer input parameter that dictates the block's selection criteria when the block is in the Auto mode. The five SELOPT choices are:

- 1 = Select the input with the highest value.
- 2 = Select the input with the lowest value.
- 3 = Compute the average of all active inputs. No specific input is selected. All Select Flags are set to false.
- 4 = Select the input with the low-median value. In operation, the inputs are logically rearranged in ascending order. If the number of inputs is odd, the input in the middle position is selected. If the number of inputs is even, the input having the lesser value of the two middle inputs is selected.
- 5 = Select the input with the high-median value. In operation, the inputs are logically arranged in ascending order. If the number of inputs is odd, the input in the middle position is selected. If the number of inputs is even, the input with the higher value of the two middle inputs is selected.

You can change SELOPT only by reconfiguring the block.

TYPE — When you enter "SIGSEL" or select "SIGSEL" from the block type list under Show, an identifying integer is created specifying this block type.

114.4 Detailed Operation

The Signal Selector block examines up to eight inputs and produces an output that is dependent upon the number of inputs configured and the specific select option. You can exclude any of the inputs from the selection process by setting its BYPASn parameter true.

In Auto the SELOPT input dictates which attribute of the active inputs (high, low, average, low median, or high median value) is directed to the output. In the cases of high, low, and either median value selection, the block also raises the Select Flag (SELn) of the selected input. When computing the average value, the block sets all Select Flags to false.

SELOPT choices range from 1 to 5 and map to the following modes of selection:

1. Select the input with the highest value.
2. Select the input with the lowest value.
3. Compute the average of all active inputs. No individual input is selected and all Select Flags are set to false.
4. Select the input having the median value. In operation, the inputs are rearranged in ascending order. If the number of inputs is odd, the input in the middle position is selected. If the number of inputs is even, the input having the lesser value of the two middle inputs is selected. If there are only two inputs, the median option always selects the input having the lower value.

5. The same as 4, except that, if the number of inputs is even, the input having the greater value of the two middle inputs is selected. If there are only two inputs, the median option always selects the input having the greater value.

In addition, the SELNDX output is updated with the selected signal index, when either the median high or median low option is configured.

Upon transfer to Manual, all Select Flags are set to false.

In Manual, the output is not updated by the block. An external program can then set the output to a desired value.

Upon transfer to Auto, the block instantaneously drives the output to the value dictated by SELOPT.

114.4.1 Cascade Operation

You can cascade two or more SIGSEL blocks in order to select either a HIGH (SELOPT = 1) or LOW (SELOPT = 2) value from more than eight inputs. Select options 3 (average value), 4 (low-median value), and 5 (high-median value) are not supported in a cascade configuration.

114.4.2 Bypass Option

The bypass option parameters BYPAS1 to BYPAS8, in conjunction with parameter EROPT, are used to determine whether any input is bypassed. A bypassed input is not considered in calculating the block's output OUT. The following combinations determine bypassing:

- EROPT = 0: The input is bypassed if and only if BYPASn is true. The status of INP_n is ignored in determining bypassing.
- EROPT = 1: The input is bypassed if:
  - BYPASn is true, or
  - INP_n has BAD status, or
  - INP_n has OOS status, or
  - There is any value in the OM field of INP_n status except 1 (ON_SCAN).
- EROPT = 2: The input is bypassed if any of the four preceding conditions are true, or:
  - INP_n has ERROR status.

114.4.3 Error Propagation

When PROPT is true and the SIGSEL block is in Auto:

- If SELOPT is not 3 (Average), the BAD and OOS status bits of the selected INP_n input are copied to the corresponding bits of OUT.
- If SELOPT = 1 (High) or SELOPT = 2 (Low), the ERROR status bit of OUT is set true when the selected input has any of the following:
  - A BAD status bit
  - An OOS status bit
  - An Error status bit
  - Any value in the om field of its status except ON_SCAN.

- If SELOPT = 3 (Average), SELOPT = 4 (Low Median), or SELOPT = 5 (High Median) the ERROR status bit of OUT is set true when any non-bypassed input has one of the above conditions.
- For any value of SELOPT, the ERROR status bit of OUT is set true if all configured inputs are bypassed.

114.4.4 Cascading the SIGSEL Block

You can cascade Signal Select blocks for the purpose of selecting the High or the Low value of more than eight inputs.

Example:

Use three cascaded Signal Select blocks to find the highest value of 22 inputs. Input 13 has the highest value of the 22 inputs (98.5). Input 3 has the highest value among the first 8 inputs (97.3).

CONFIGURATION – See diagram on next page.

Build SSCAS1 (the first block in the cascade) first. Build SSCAS2 next and finally SSCAS3 to ensure that the Compound Processor processes the cascaded blocks in the correct order.

Inputs – INP1 through INP8

Link inputs 1 through 8 to block SSCAS1, INP1 to INP8.

Link inputs 9 through 16 to block SSCAS2, INP1 to INP8.

Link inputs 17 through 22 to block SSCAS3, INP1 to INP6.

BNDX

Biased Index is an integer input which you can alter only by reconfiguring the block. In effect, it tells the block in a cascaded scheme how many inputs the cascade has tested before it reached this block. Therefore:

configure SSCAS1.BNDX = 0;

configure SSCAS2.BNDX = 8;

configure SSCAS3.BNDX = 16.

CASNDX

Cascade Index is a connectable input that tells which input in the cascade, prior to this block, has the highest value. The previous block, in the cascade, indicates this with its SELNDX output. Therefore:

configure SSCAS1.CASNDX = 0 (default value);

configure SSCAS1.SELNDX to SSCAS2.CASNDX;

configure SSCAS2.SELNDX to SSCAS3.CASNDX.

CASINP

Cascade Input is a connectable input that tells the block the highest value in the cascade, prior to this block. OUT output of the previous block in the cascade provides this value. Therefore:

configure SSCAS1.CASINP = 0.0 (default value);

configure SSCAS1.OUT to SSCAS2.CASINP;

configure SSCAS2.OUT to SSCAS3.CASINP.

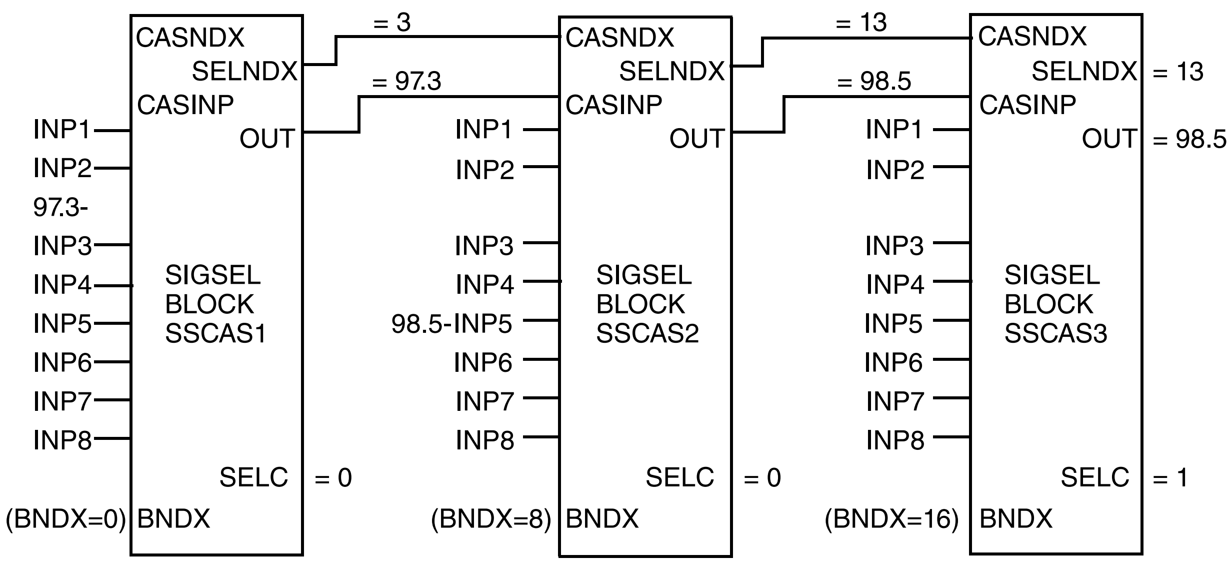
SELOPT

In each of the blocks in the cascade, configure the Select Option to select the high value (SELOPT = 1).

OPERATION

First, SSCAS1 tests inputs 1 through 8 for the highest value among the first eight inputs. The definition of the example established that this is input 3 with a value of 97.3.

SSCAS1.OUT takes the value, 97.3. Since one of the standard eight inputs (INP3) was selected SSCAS1.SELNDX equals BNDX + the index of the selected input, which is 0 + 3, or 3.



Next, SSCAS2 tests inputs 9 through 16 against the cascaded input at CASINP. According to the example definition, Input 13 (connected to SSCAS2.INP5) had the highest value, 98.5, of the 22 inputs. SSCAS2.OUT takes on the value, 98.5. Since one of the standard eight inputs (INP5) was selected SSCAS2.SELNDX equals BNDX + the index of the selected input, which is 8 + 5, or 13.

Finally, SSCAS3 tests inputs 17 through 22 against the cascaded input at CASINP (98.5). According to the example definition, the input at CASINP is higher than the value at any of the six connected standard inputs. SSCAS3.OUT takes the value, 98.5. Since the Cascade Select Input, CASINP, was selected, SELNDX equals CASNDX, which equals 13. The SELC flag is set true.

115. STALM – State Alarm Block

This chapter gives a general overview of STALM (State Alarm Block), its features, parameters and detailed operations.

115.1 Overview

The State Alarm block (STALM) serves as alarm annunciator to activate the I/A Series alarm mechanism upon alarm conditions detected by an external source such as HTG. It supports Window-style ECBs. Other blocks that do not have alarm generation functions (for example, Sequence Control type blocks) can also use the STALM block for alarming.

The State Alarm block (Figure 115-1) uses boolean input parameters as alarm indicators to trigger the alarm. The block detects state changes for absolute, deviation, rate, bad, out-of range, and state alarms (defined by PRTYPE). The corresponding bit of ALMSTA is set if the block detects the alarm condition of a particular type.

The block has a BAD I/O alarm option to generate the alarm if the primary input to the block (IN) has the BAD status bit set. The block sets the BAD I/O indicator in ALMSTA and the BAD boolean output indicator.

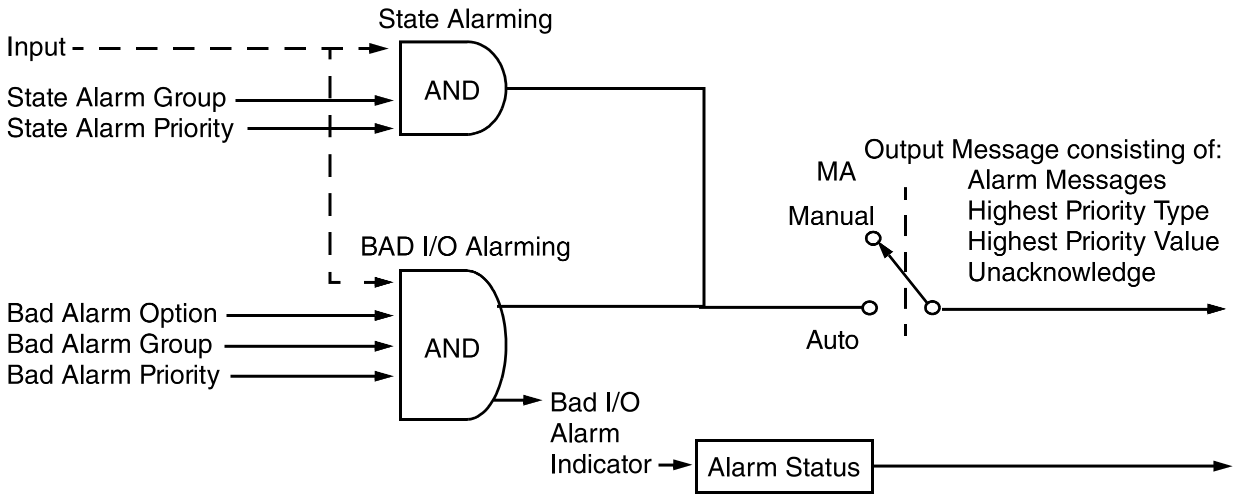


Figure 115-1. STALM Block I/O Diagram

115.2 Features

The features are:

- Alarm message generation
- Alarm acknowledge support
- Bad input status detection and handling
- Alarm detection and/or alarm message inhibit (for all alarm types or individually)
- AUTO/MANUAL block operations.

The options are:

- ♦ The BAD alarm option (BAO) generates a BAD alarm when a primary input status shows “BAD I\O”.
- ♦ The inhibit option (INHOPT) specifies actions to be taken when alarms are inhibited in the block. With this parameter, alarm messages and alarm detection can be individually disabled for inhibited alarms, and “return-to-normal” messages can be automatically acknowledged, as desired.

115.3 Parameters

Table 115-1. STALM Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	93	STALM
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
IN	generic input	boolean	con/set	0	0 to 1
SAP	state alarm priority	integer	con/set	5	[1..5]
SAG	state alarm group	short	no-con/set	1	[1..8]
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	[0|1|2]
INHOPT	inhibit option	short	no-con/no-set	0	0 to 3
INHIB	alarm inhibit	boolean	con/set	0	0 to 1
INHALM	inhibit alarm	pack_b	con/set	0	0 to 0xFFFF
BAO	bad alarm option	boolean	no-con/no-set	0	0 to 1
BAT	bad alarm text	string	no-con/no-set	blank	1 to 32 chars
BAP	bad alarm priority	integer	con/set	5	[1..5]
BAG	bad alarm group	short	no-con/set	1	[1..8]
PNM	point name	string	no-con/no-set	blank	1 to 32 chars
SATXT	alarm text	string	no-con/no-set	blank	1 to 32 chars
RTNTXT	return to normal text	string	no-con/no-set	blank	1 to 32 chars
AMRTIN	alarm regeneration timer	integer	no-con/no-set	0	0 to 32767 s
OUTPUTS					
ALMSTA	alarm status	pack_l	con/no-set	0	bit map
BAD	bad I/O status	boolean	con/no-set	0	0 to 1
BLKSTA	block status	pack_l	con/no-set	0	bit map
CRIT	criticality	integer	con/no-set	0	[0..5]
INHSTA	inhibit status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
PRTYPE	priority type	integer	con/no-set	0	[0..10]
UNACK	alarm notification	boolean	con/no-set	0	0 to 1

Table 115-1. STALM Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
ALMOPT	alarm options	pack_l	no-con/no-set	0	0 to 0xFFFFFFFF
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	config error	string	no-con/no-set	0	1 to 43 chars
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars

115.3.1 Parameter Definitions

ACHNGE Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

ALMOPT Alarm Options contains packed long values representing the alarm types that have been configured as options in the block, and the alarm groups that are in use. For the STALM block, only the following unshaded bits are used

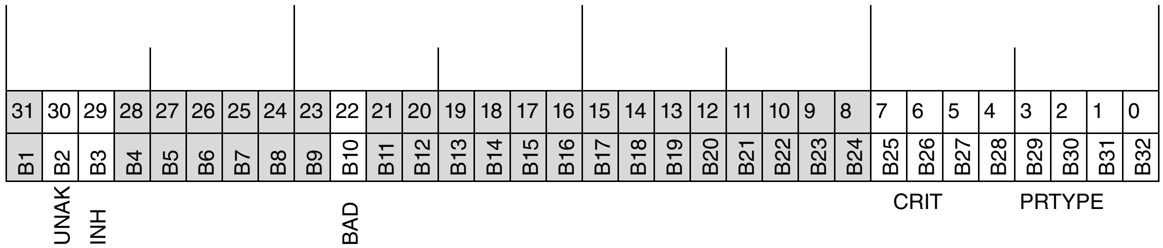
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1] (0 to 31)	Configured Alarm Option When True
0	Alarm Group 8 in Use
1	Alarm Group 7 in Use
7	Alarm Group 1 in Use
22	Bad I/O Alarm Configured

1. Bit 0 is the least significant, low order bit.

ALMSTA

Alarm Status is a 32-bit output, bit-mapped to indicate the block's alarm states. For the STALM block, only the following bits are used:



Bit Number (0 to 31)*	Name	Description When True	Boolean Connection (B32 to B1)
0 to 4	PTYP_MSK	Priority Type: See parameter PRTYPE for values used in the STALM block	ALMSTA.B32–ALMSTA.B28
5 to 7	CRIT_MSK	Criticality; 5 = lowest priority, 1= highest	ALMSTA.B27–ALMSTA.B25
22	BAD	Input/Output Bad (BAD output of block)	ALMSTA.B10
29	INH	Alarm inhibit	ALMSTA.B3
30	UNAK	Unacknowledged	ALMSTA.B2

* Bit 0 is the least significant, low order bit.

AMRTIN

Alarm Regeneration Timer is a configurable integer that specifies the time interval for an alarm condition to exist continuously, after which a new unacknowledged alarm condition and its associated alarm message is generated.

BAD

Bad I/O Indicator is a boolean output parameter which is set true when the input to the block is unacceptable in any way. The BAD bit of BLKSTA (BLKSTA.BAD) is also set true whenever BAD is true.

BAG

Bad Alarm Group is a short integer input that directs Bad alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.

BAO

Bad Alarm Option is a configurable boolean which, when configured true, enables BAD I/O alarm generation for each state change of the BAD parameter.

BAP

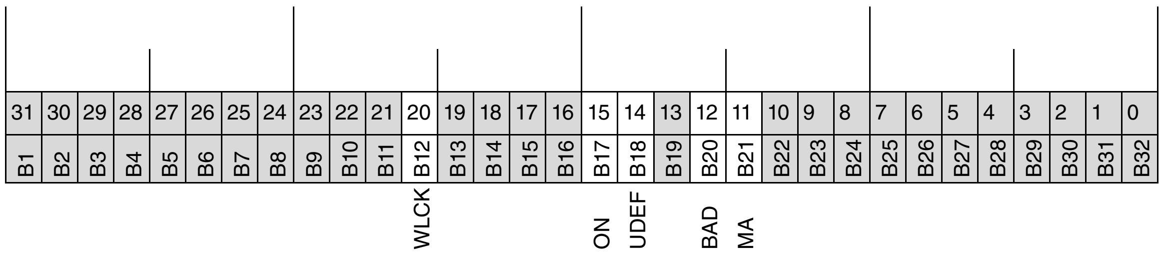
Bad Alarm Priority is an integer input, ranging from 1 to 5, that sets the priority level of the Bad alarm (1 is the highest priority).

BAT

Bad Alarm Text is a user-configurable text string of up to 32 characters, sent with the bad alarm message to identify it.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the STALM block, only the following bits are used:



Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
12	BAD	Bad I/O	BLKSTA.B20
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
20	WLCK	Workstation Lock	BLKSTA.B12

* Bit 0 is the least significant, low order bit.

CRIT

Criticality is an integer output that indicates the priority, ranging from 1 to 5, of the block's highest currently active alarm (1 is the highest priority). An output of zero indicates the absence of alarms.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block.

DESCRP

Description is a user-defined string of up to 32 characters that describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

ERCODE

Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block's DEFINE parameter to be set false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the STALM block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
"W43 – INVALID PERIOD/ PHASE COMBINATION"	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
"W46 – INVALID INPUT CONNECTION"	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
"W48 – INVALID BLOCK OPTION"	The configured value of a block option is illegal.
"W53 – INVALID PARAMETER VALUE"	A parameter value is not in the acceptable range.
"W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK"	A Database Installer error has occurred.

IN Input is a boolean input.

INHALM Inhibit Alarm contains packed boolean values that represent alarm inhibit requests for each alarm type or point configured in the block. For the STALM block, only the following bits are used:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16

Bit Number* (0 to 15)	Description When True	Boolean Connection (B16 to B1)
6	Inhibit Bad I/O Alarm	INHALM.B10
10	Inhibit State Alarm	INHALM.B6

* Bit 0 is the least significant, low order bit.

There are no mnemonic names for the individual bits of INHALM.

INHIB Inhibit is a boolean input. When true, it inhibits all block alarms; the alarm handling and detection functions are determined by the INHOPT setting. Alarms can also be inhibited based on INHALM and the compound parameter CINHIB.

INHOPT — Inhibit Option specifies the following actions applying to all block alarms:

0 = When an alarm is inhibited, disable alarm messages but do not disable alarm detection.

1 = When an alarm is inhibited, disable both alarm messages and alarm detection. If an alarm condition already exists at the time the alarm transitions into the inhibited state, clear the alarm indicator.

2 = Same as 0 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge "return-to-normal" messages. "Into alarm" messages may be acknowledged by explicitly setting UNACK false.

3 = Same as 1 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge "return-to-normal" messages. "Into alarm" messages may be acknowledged by explicitly setting UNACK false.

INHSTA — Inhibit Status contains packed long values that represent the actual inhibit status of each alarm type configured in the block. For the STALM block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
	INH	UNACK							BAD																						

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
22	BAD	Bad I/O Alarm Inhibited	INHSTA.B10
29	INH	Inhibit Alarm	INHSTA.B3
30	UNACK	Unacknowledged	INHSTA.B2

* Bit 0 is the least significant, low order bit.

INITMA — Initialize Manual/Auto specifies the desired state of the MA input during initialization, where:

0 = Manual
1 = Auto
2 = The MA state as specified in the checkpoint file.

The block asserts this initial M/A state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a reboot operation.

- The compound in which it resides is turned on.
- The INITMA parameter itself is modified via the Integrated Control Configurator. (The block does not assert INITMA on ordinary reconfiguration.)

INITMA is ignored if MA has an established linkage.

LOCKID	Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.
LOCKRQ	Lock Request is a boolean input which can be set true or false only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.
LOOPID	Loop Identifier is a configurable string of up to 32 characters which identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.
MA	Manual Auto is a boolean input that controls the Manual/Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. In Manual, the algorithm is not performed, and the output is unsecured. An external program can then set the output to a desired value.
NAME	Name is a user-defined string of up to 12 characters used to access the block and its parameters.
OWNER	Owner is a user-defined string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are successful only if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.

PERIOD	Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PHASE	Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PNM	Point Name is a user-defined, string input acting as a point descriptor label for the BAD I/O and State alarms.
PRTYPE	Priority Type is an indexed output parameter that indicates the alarm type of the highest priority active alarm. The PRTYPE output of this block includes the following alarm types: 0 = No active alarm 1 = High Absolute 2 = Low Absolute 3 = High High 4 = Low Low 5 = High Deviation 6 = Low Deviation 7 = Rate alarm 8 = BAD Alarm 9 = State Alarm. 25 = Out-of-Range If there is more than one active alarm with highest priority, PRTYPE reports the alarm type according to which occurs first as follows: Out-of-Range, High-High Absolute, Low-Low Absolute, High Absolute and Low Absolute. For example: if the Bad and High-High Absolute alarms both have priority 3 and the Out-of-Range alarm has priority 4, and all three alarms are active, then CRIT = 3 and PRTYPE = 8.
RTNTXT	If the block detects a transition out of alarm, a "return-to-normal" message is sent subject to all alarm inhibit rules listed in "Alarm Response and Return to Normal Transition" on page 2318. Return-To-Normal Text is the text used by the STALM block to build this message.

SAG State Alarm Group is a short integer input that directs State alarm messages to one of eight groups of alarm devices.

SAP State Alarm Priority is an integer input, ranging from 1 to 5, that sets the priority level of the State alarm (1 is the highest priority).

SATXT State Alarm Text is the text sent to the alarm device when the alarm is detected.

TYPE When you enter “STALM” or select “STALM” from the block type list under Show, an identifying integer is created specifying this block type.

UNACK Unacknowledge is a boolean output that the block sets to True when it detects an alarm. It is typically reset by operator action.

115.4 Detailed Operation

After initialization and subsequent block scan periods, the STALM block reads the alarm indicator input parameters and the status of the parameters, and performs state alarming and “BAD I/O” alarming, depending on INHALM, INHIB, INHOPT and BAO. PRTYPE and CRIT reflect the type and priority of the highest priority active alarm in the block.

To detect input transitions, the block uses the internal alarm history for comparison. Initially, those values are set to the “no alarm” state (zero (0) value).

115.4.1 Detailed Diagram

Figure 115-2 is a simplified block diagram that depicts the functional signal flow of the STALM block. It shows the forward path of the block as it relates to the various states, logic control signals, and options represented by toggle switches.

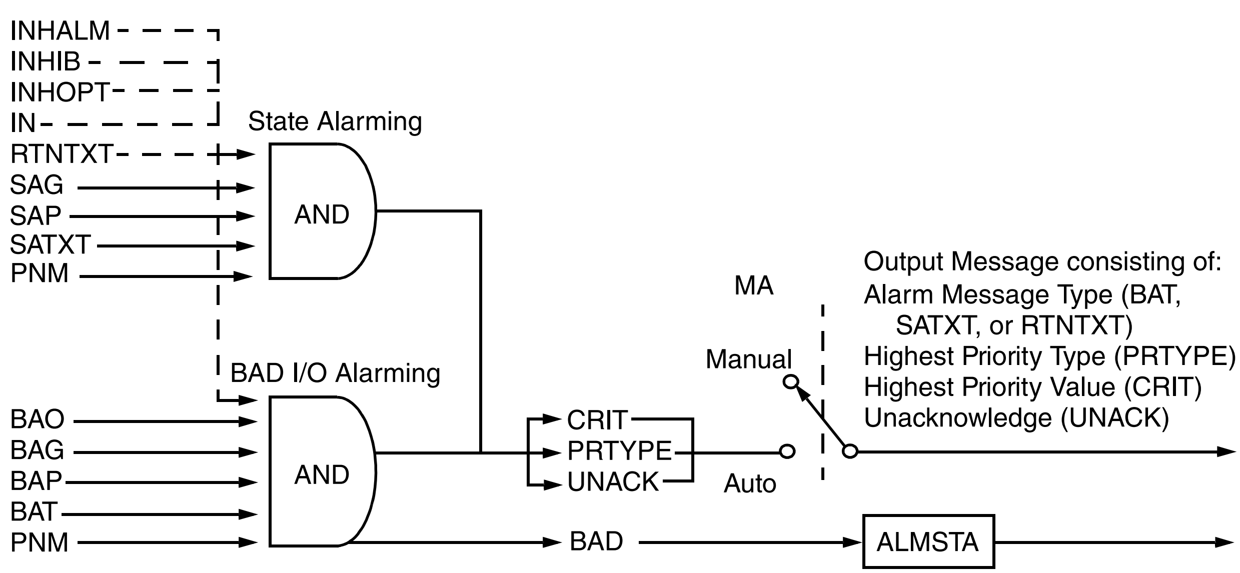


Figure 115-2. STALM, Detailed Block Diagram

115.4.2 Block Initialization

The block executes a restart logic when the surrounding compound is switched from OFF to ON or when the block is installed or modified within a compound that is already ON. The block clears its alarm information. UNACK is reset by the high level logic (Compound Processor).

The station reboot operation forces initialization logic to run. All inputs not connected are reset. Initialization logic places the STALM block in one of three states: Initialization, Manual and Auto.

115.4.2.1 Initialization

Key Parameters: INITMA

At initialization, the block initializes MA. DEFINE is set to 0 if any configured parameters fail validation testing.

115.4.2.2 Manual

Key Parameters: MA

When the block is switched to manual, no alarm detection logic is processed and the BAD alarm indicator output is released. While the block is in manual, you can change the indicator.

115.4.2.3 Auto

Key Parameters: MA

In auto mode, the block operates as described below. On transition from manual to auto, the block resets the indicator and relevant ALMSTA bits to zero and resumes its regular operation with the outputs secured.

115.4.3 State Alarm Generation

Key Parameters: ALMSTA, CINHIB, IN, INHALM, INHIB, INHOPT, SAG, SAP

If a state alarm is not inhibited and if an input parameter that presents an alarm indicator has made a transition from 0 to 1, the block detects an alarm condition and generates a state alarm.

Depending on INHIB, CINHIB, INHALM, and INHOPT, state alarm detection and message generation can be inhibited for:

- All types of alarms
- Alarms with a priority not higher than CINHIB
- Alarm types specified in INHALM (see below).

SAP sets the priority of the alarm. SAG directs the alarm to the appropriate group of alarm devices.

115.4.3.1 Alarm Inhibit

Key Parameters: CINHIB, INHALM, INHIB

INHALM is a parameter that is used in conjunction with the CINHIB compound parameter and the INHIB block parameter to determine if alarm points are inhibited in the block. Points are inhibited if the value of INHALM bit is set to 0x0200.

115.4.4 Bad I/O Alarm Generation

Key Parameters: ALMSTA, BAD, BAO, IN

If BAO (bad alarm option) is configured to 1 and if the status of the primary inputs (IN) has the BAD bit set, the block generates a “BAD I/O” alarm. The block sets the BAD output parameter and the BAD I/O alarm bit in the ALMSTA parameter to signal the BAD I/O alarm condition.

115.4.5 Alarm Response and Return to Normal Transition

Key Parameters: ALMSTA, CRIT, PRTYPE, RTNTXT, UNACK

When alarm conditions are detected, PRTYPE and CRIT are set to the highest priority alarm in the block; PRTYPE reflects the alarm type of the highest priority active alarm, and CRIT is set to this alarm’s priority level. The corresponding bits in ALMSTA are set to 1. The UNACK parameter is set to 1.

The UNACK parameter is protected by higher level logic being set to 1 from outside the block.

If the block detects a transition out of alarm, a “return-to-normal” message is sent subject to all alarm inhibit rules described above. STALM uses RTNTXT to build the message. PRTYPE, CRIT, and the appropriate ALMSTA bits are reset.

UNACK remains unchanged until the acknowledge, after which it reverts to 0.

115.4.6 Block Shutdown

When the compound is turned off, the block clears its alarm information.

115.4.7 Example

Refer to the MEALM block description for an application example involving the use of the MEALM, STALM, and MSG blocks.

116. STATE – State Block

This chapter gives a general of the STATE, or State Block, its basic operations, features, parameters, and functions and provides an application example.

116.1 Overview

The STATE block is configured with up to 16 standard State patterns, a Hold pattern, and an Initialize pattern; each pattern contains up to 16 boolean values (see Figure 116-1). In the State mode, the block outputs the pattern requested by the desired drive input. In the Step mode, the block outputs each standard pattern in sequence as its drive input goes true.

In the Step or State mode, step transition can be inhibited by a mask, maximum step, or pattern match feedback input. Time-out logic indicates when a step exceeds its configured time-out period. Bad input detection inhibits step or mode transition and indicates bad status if one of the related inputs is bad.

The STATE block can use the PATT block to confirm a pattern match before each step transition. If the process requires more than 16 patterns, the STATE block can be cascaded.

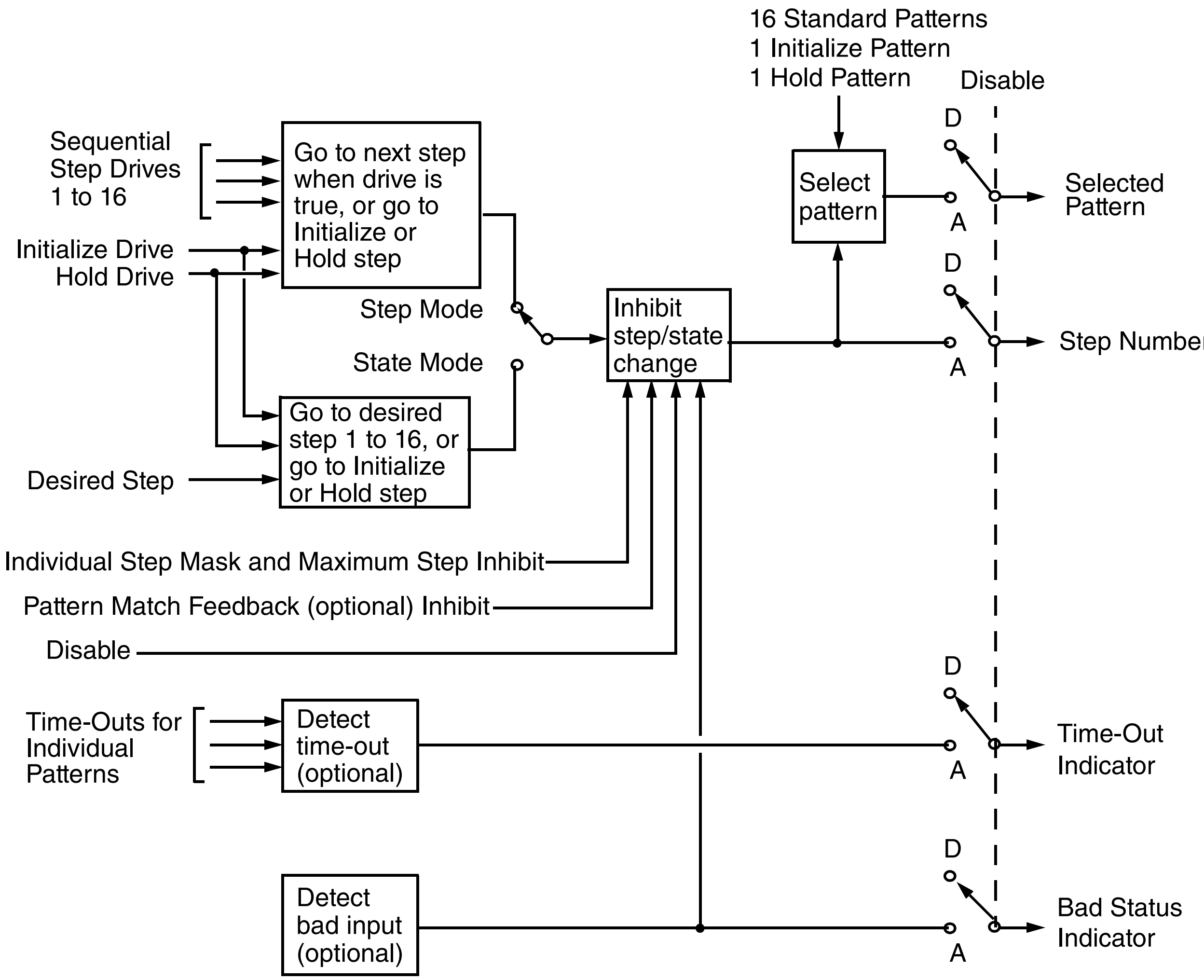


Figure 116-1. STATE Block Functional Diagram

116.2 Basic Operation

In the Step mode the STATE block writes up to 16 preconfigured state patterns (STAT01 to STAT16) into its packed boolean output (PAKOUT) parameter in sequence, as each step drive (1 to 16) is set true. If the Initialize mode drive is set true, the block writes the Initialize pattern (STAT_I) into PAKOUT. If the Hold mode drive is set true, the block writes the Hold pattern (STAT_H) into PAKOUT.

In the State mode the block writes the state pattern (STAT01 to STAT16) requested by the desired step input into PAKOUT; the steps can be requested in any order. If the Initialize mode drive is set true, the block writes STAT_I into PAKOUT. If the Hold mode drive is set true, the block writes STAT_H into PAKOUT.

The maximum step (MAXSTP) parameter and bypass control mask (CHOICE) determine the actual number of output state patterns, not including STAT_I and STAT_H. If the requested step is greater than MAXSTP or bypassed by CHOICE, the block ignores the request.

In Auto, the block operates in either the State or Step mode, as specified by the state mode (STMODE) parameter. These modes can be overridden by the Initialize, Hold, or Manual mode.

In Manual, no step transition is processed. You can change settable outputs such as PAKOUT.

The feedback option (FBKOPT) parameter specifies if the block is to check the match feedback (MATCHF) parameter to confirm process status before each step transition for STAT01 to STAT16. The PATT block can compare process status to one of several preconfigured patterns, as selected by the STATE block current step (ATSTEP) parameter, and then feed back the pattern match status to the STATE block via MATCHF.

The time-out option (TIMOPT) parameter specifies if the block is to count down time and set the time-out (TIMOUT) parameter. When TIMOPT is true, the block times each state pattern and sets TIMOUT whenever the process does not reach the desired state within the time-out period.

The bad lock (BADLCK) option parameter specifies if the block is to allow a step or mode transition only when all related connectable inputs are in good health, that is, not bad (BAD), out-of-service (OOS), or off-scan (OFF). If a requested step or mode transition cannot be made because of an unhealthy input, the bad health indicator (BADIND) parameter is set true.

116.3 Features

The STATE block provides the following features:

- Supports up to 18 user-defined state patterns (steps) for process control, including the Initialize and Hold patterns
- Supports the following block operating modes according to a defined priority: Disable, Manual, Auto, Hold, Initialize, State, and Step
- Provides the option to select the desired state pattern in any order or to step through the state patterns one at a time, when in the Auto mode
- Initializes the output pattern to a user-defined input step number
- Provides maximum step number checking to skip out-of-range steps in the State or Step mode
- Provides state (step) bypassing via a user-specified mask
- Provides an option to check process status feedback from another block, before enabling step transition during run-time
- Interfaces with the PATT block which feeds back pattern match indication of process status to the STATE block
- Provides time-out indication for each state (step) that the block supports, based on user-defined time periods
- Provides an option to prevent step or mode transitions if the driving input or higher priority mode inputs are Bad (BAD), out-of-service (OOS), or off-scan (OFF)
- Can be cascaded in conjunction with a Sequence Control block to provide state outputs to control more than 16 process devices.

116.4 Parameters

Table 116-1. STATE Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
Configured Parameters					
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	79	STATE
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	see Param Def
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	0 to 2
DISABL	disable input	boolean	con/set	0	0 to 1
STMODE	step/state mode	boolean	con/set	0	0 to 1
DRVDSR	desired state drive	integer	con/set	0	1 to 16
I_STEP	initialize step	short	no-con/no-set	0	0 to 17
MAXSTP	maximum step	short	no-con/no-set	16	0 to 16
FBKOPT	feedback option	short	no-con/no-set	0	0 to 2
TIMOPT	time-out option	boolean	no-con/no-set	0	0 to 1
BADLCK	lock on bad	boolean	no-con/no-set	0	0 to 1
MNOBMP	no bump in manual	boolean	no-con/no-set	0	0 to 1
HNOBMP	no bump in hold	boolean	no-con/no-set	0	0 to 1
CHOICE	state bypass mask	pack_b	con/set	0x0000	0x0000 to 0xFFFF
MATCHF	match feedback	boolean	con/set	0	0 to 1
DRVINI	drive to initialize	boolean	con/set	0	0 to 1
STAT_I	initialize state	pack_b	no-con/set	0x0000	0x0000-0xFFFF
TIME_I	initialize time-out	real	no-con/set	0.0	pos value in min
STXT_I	initialize state text	string	no-con/no-set	blank	1 to 32 chars
DRVHLD	drive to hold	boolean	con/set	0	0 to 1
STAT_H	hold state	pack_b	no-con/set	0x0000	0x0000 to 0xFFFF
TIME_H	hold time-out	real	no-con/set	0.0	pos value in min
STXT_H	hold state text	string	no-con/no-set	blank	1 to 32 chars.
DRIV01 to DRIV16	states 1 to 16 drives	boolean	con/set	0	0 to 1
STAT01 to STAT16	states 1 to 16 patts	pack_b	no-con/set	0x0000	0x0000 to 0xFFFF
TIME01 to TIME16	states 1 to 16 time-outs	real	no-con/set	0.0	pos value in min
STXT01 to STXT16	states 1 to 16 text	string	no-con/no-set	blank	1 to 32 chars
DTXT01 to DTXT16	bits 1 to 16 text	string	no-con/no-set	blank	1 to 32 chars
Non-Configured Parameters					
OUTPUTS					
ATSTEP	current step	integer	con/no-set	0	0 to 17
BADIND	bad health indicator	boolean	con/no-set	0	0 to 1
BLKSTA	block status	pack_l	con/no-set	0x00...0	0 to 0xFFFFFFFF
BMODE	block mode	integer	con/no-set	0	0 to 5

Table 116-1. STATE Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
CNTDWN	count down time	real	con/no-set	0.0	pos value in min
CNTUP	elapsed time	real	con/no-set	0.0	pos value in min
PAKOUT	packed outputs	pack_b	con/no-set	0x0000	0x0000 to 0xFFFF
SAVSTP	saved step	integer	con/no-set	0	0 to 17
TIMOUT	time-out indicator	boolean	con/no-set	0	0 to 1
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	configuration error	string	no-con/no-set	2 blanks	20 to 43 chars
LOCKID	lock identification	string	no-con/no-set	2 blanks	1 to 32 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	0 to 32 chars

116.4.1 Parameter Definitions

ACHNGE

Alternate Change is a integer output that is incremented each time a settable parameter is changed externally. It wraps around from 32767 to -32768.

ATSTEP

At Step is an integer output that contains the step number for the state pattern currently in PAKOUT in the Step, State, Initialize, or Hold mode.

Step Number	State Pattern	Step Number	State Pattern
0	STAT_I	9	STAT09
1	STAT01	10	STAT10
2	STAT02	11	STAT11
3	STAT03	12	STAT12
4	STAT04	13	STAT13
5	STAT05	14	STAT14
6	STAT06	15	STAT15
7	STAT07	16	STAT16
8	STAT08	17	STAT_H

BADIND

Bad Indicator is a boolean output that is set true when BADLCK is true and a step or mode transition cannot be made because the status of one of the related inputs is bad (BAD), out-of-service (OOS), or off-scan (OFF). Related inputs are the step drive or any mode drives. For the mode drives, related inputs are all higher priority mode drives.

BADLCK

Bad Lock Option is a configurable boolean input that specifies if the block is to allow a step or mode transition only when all related connectable inputs are in good health, that is, not bad (BAD), out-of-service (OOS), or off-scan (OFF):

0 = no lock
1 = lock.

If BADLCK = 1, transition into another step while the block is in the Step or State mode is allowed only if the step, Disable, Manual/Auto, Hold, and Initialize drive inputs are healthy. Transition between the State and Step modes is allowed only if the STMODE is healthy.

If BADLCK = 1, transition into a higher priority mode is allowed only if the mode drive input is healthy. Transition out of Disable, Manual, Hold, or Initialize into a lower priority mode is allowed only when the drive inputs for all higher priority modes are healthy.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate various block operational states. For the STATE block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
								DSBL			WLCK					ON	UDEF			MA				HOLD							

Bit Number (0 to 31)*	Name	Description	Boolean Connection (B32 to B1)**
7	HOLD	1 = Holding	BLKSTA.B25
11	MA	0 = Manual, 1 = Auto	BLKSTA.B21
14	UDEF	1 = Block Undefined	BLKSTA.B18
15	ON	1 = Compound ON	BLKSTA.B17
20	WLCK	1 = Workstation Lock	BLKSTA.B12
23	DSBL	1 = Disabled	BLKSTA.B9

* Bit 0 is the least significant, low order bit.

** BLKSTA.B1 refers to the most significant bit, and BLKSTA.B32 refers to the least significant bit.

BMODE

Block Mode is an integer output that indicates the block operating mode:

0 = State
1 = Step
2 = Initialize
3 = Hold

4 = Manual
5 = Disable.

CHOICE

Choice is a packed boolean input mask that specifies which step numbers (1 to 16) to bypass in the State or Step mode. When the mask bit is set to 1 for a specific step, that step number is bypassed and the block proceeds to the next step.

Bit Number (15 to 0)[1]	Step Number	Boolean Connection (B1 to B16)[2]
15	1	CHOICE.B1
14	2	CHOICE.B2
13	3	CHOICE.B3
12	4	CHOICE.B4
11	5	CHOICE.B5
10	6	CHOICE.B6
9	7	CHOICE.B7
8	8	CHOICE.B8
7	9	CHOICE.B9
6	10	CHOICE.B10
5	11	CHOICE.B11
4	12	CHOICE.B12
3	13	CHOICE.B13
2	14	CHOICE.B14
1	15	CHOICE.B15
0	16	CHOICE.B16

1. Bit 0 is the least significant, low order bit.
2. CHOICE.B1 refers to the most significant bit, and CHOICE.B16 refers to the least significant bit.

CNTDWN

Count Down is a real output that tracks the countdown timer, which starts when a step change occurs. The countdown timer continues to count in the negative direction to indicate the period for which TIMOUT = 1.

CNTUP

Count Up is a real output that tracks the elapsed time counter, which provides the total time that the block has been in a specific state.

DEFINE

Define is a boolean data store which when true indicates that the block has no configuration errors. It is the inverse of UDEF in parameter BLKSTA. When the block initializes, DEFINE is set to 0 (undefined) if the block detects a parameter configuration error. To return DEFINE to a true state, correct all configuration errors and re-install the block.

DESCRP Descriptor is a user-defined string of up to 32 characters that describe the block's function (for example, PLT 3 FURNACE 2 HEATER CONTROL).

DISABL Disable is a boolean input that when true secures the all outputs and inhibits normal block operation in the either Auto or Manual mode. DISABL is independent of MA, and has a higher priority.

DRIV01-DRIV16 Drives for States 1 to 16 are boolean inputs that when true select STAT01 to STAT16 patterns for output to PAKOUT when the block is in the Step mode.

DRVHLD Drive for Hold is a boolean input that when true selects the STAT_H pattern for output to PAKOUT when the block is in the Step mode.

DRVINI Drive for Initialize is a boolean input that when true selects the STAT_I pattern for output to PAKOUT when the block is in the Step mode.

DRVDSR Drive for Desired State Request is an integer input that specifies the Step number for the State pattern to be written to the PAKOUT parameter, when the block is in the State mode.

Step Number	State Pattern	Step Number	State Pattern
1	STAT01	9	STAT09
2	STAT02	10	STAT10
3	STAT03	11	STAT11
4	STAT04	12	STAT12
5	STAT05	13	STAT13
6	STAT06	14	STAT14
7	STAT07	15	STAT15
8	STAT08	16	STAT16

DTXT01 to DTXT16

Descriptive Text 1 to 16 are user-defined strings of up to 32 characters that describe the state bits in PAKOUT.

ERCODE Error Code is a string data store which indicates the type of configuration error that first caused the block to set the DEFINE parameter to false. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block uses only the following error strings:

W46 - INVALID INPUT CONNECTION

W58 - INSTALL ERROR; DELETE/UNDELETE BLOCK

W53 - INVALID PARAMETER VALUE

FBKOPT

Feedback Option is a configurable short integer input that specifies the following block operation:

0 = No check on MATCHF

1 = Go into the requested step (1 to 16) only if MATCHF = 1

2 = Set TIMOUT true if TIMOPT = 1 and MATCHF does not become true within the configured time-out period. This option simply indicates a process time-out; it does not prevent a step transition.

HNOBMP

Hold No Bump is a configurable boolean input that specifies the PAKOUT output on a transfer from Hold to the Step or State mode.

0 = Restore PAKOUT according to ATSTEP on transfer

1 = Retain STAT_H in PAKOUT on transfer

INITMA

Initialize Manual/Auto specifies the desired state of the MA input during initialization, where:

0 = Manual
1 = Auto
2 = The MA state as specified in the checkpoint file.

The block asserts this initial M/A state whenever:

- ♦ It is installed into the Control Processor database.
- ♦ The Control Processor undergoes a reboot operation.
- ♦ The compound in which it resides is turned on.
- ♦ The INITMA parameter itself is modified via the Integrated Control Configurator. (The block does not assert INITMA on ordinary reconfiguration.)

INITMA is ignored if MA has an established linkage.

I_STEP

Initial Step is a configured short integer input that specifies the Step number of the State pattern to be written to PAKOUT when the block is transferred from the Step or State mode to the Initialize mode.

LOCKID

Lock Identifier is a string data store that identifies the workstation that has exclusive write access to the block. LOCKID arbitrates write access to the control block parameters by operator workstations on the network. It is set when LOCKRQ is set true, and nulled when LOCKRQ is cleared.

LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.

LOCKRQ

Lock Request is a boolean data store. When set true, it locks workstation write access to the block and sets LOCKID to the identifier of the requesting workstation. When LOCKRQ is reset to false, it unlocks write access to the block and nulls LOCKID. An operator at any other workstation can lock and unlock the block by toggling the LOCK U/L key on the Block Detail Display.

LOOPID

Loop Identifier is a user-defined string of up to 32 characters that identify the loop or process associated with the block. It is displayed on the detail display of the block, immediately below the faceplate.

MA

Manual /Auto is a boolean input that controls the block's operating state:

0 = Manual
1 = Auto

In Manual, each STATE block output is unsecured, which makes it settable by an external process (program or display). In Auto, the block secures each output so that it cannot be set externally.

MATCHF

Match Feedback is a boolean input that when true enables a step transition for STAT01 to STAT16 when FBKOPT = 1 in the Step or State mode. MATCHF is typically connected to the MATCHB output of a PATT block to provide confirmation of a pattern match status to the STATE block.

MAXSTP

Maximum Step is a configured short integer input that specifies the maximum step number to which the block can be driven in the State or Step mode while the block is in Auto.

MNOBMP

Manual No Bump is a configurable boolean input that specifies the PAKOUT output on a transfer from Manual to Auto:

0 = Restore PAKOUT according to ATSTEP on transfer.

1 = Retain the manual setting on a transfer.

NAME

Name is a user-defined string of up to 12 characters used to access the block and its parameters.

OWNER

Owner is a user-defined string of up to 32 characters that contain the name of the application program that owns the device associated with this block. OWNER is used to synchronize the use of shared devices. OWNER is settable only if it is currently null, blanks, or the same as the new value; otherwise, write requests to it are rejected with a LOCKED_ACCESS error. OWNER is cleared by setting it to a null string. It does not inhibit write access to other settable parameters in the block.

PAKOUT

Pack Boolean Output contains the currently selected state pattern (16 bits) for controlling the contact output states:

State Pattern Bit Number (15 to 0)*	PAKOUT Bit Number (15 to 0)*	Boolean Connection (B1 to B16)**
15	15	PAKOUT.B1
14	14	PAKOUT.B2
13	13	PAKOUT.B3
12	12	PAKOUT.B4

State Pattern Bit Number (15 to 0)*	PAKOUT Bit Number (15 to 0)*	Boolean Connection (B1 to B16)**
11	11	PAKOUT.B5
10	10	PAKOUT.B6
9	9	PAKOUT.B7
8	8	PAKOUT.B8
7	7	PAKOUT.B9
6	6	PAKOUT.B10
5	5	PAKOUT.B11
4	4	PAKOUT.B12
3	3	PAKOUT.B13
2	2	PAKOUT.B14
1	1	PAKOUT.B15
0	0	PAKOUT.B16

* Bit 0 is the least significant, low order bit.

** PAKOUT.B1 refers to the most significant bit, and PAKOUT.B16 refers to the least significant bit.

PERIOD

Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PHASE

Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For a CP with a BPC of 0.5 sec and a PERIOD of 2.0 sec, the legal phase periods are 0, 1, 2, and 3. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

SAVSTP

Saved Step is an integer output that tracks the current step number (ATSTEP) in the Step or State mode. When in Manual, you can change SAVSTP to go to that step on a transfer to Auto. If SAVSTP has been changed prior to the transfer to Auto, the block copies SAVSTP to ATSTEP, resets the timers, and re-establishes the outputs according to ATSTEP. SAVSTP does not change when the block is driven into the Disable or Hold mode.

STAT01 to STAT16

States 1 to 16 are packed boolean input state patterns that specify the states for output to PAKOUT in the Step or State mode. See the PAKOUT parameter definition for the bit format.

STAT_H

State for Hold is a packed boolean input state pattern that specifies the Hold state pattern for output to PAKOUT. See the PAKOUT parameter definition for the bit format.

STAT_I

State for Initialize is a packed boolean input state pattern that specifies the initial state pattern for output to PAKOUT. See the PAKOUT parameter definition for the bit format.

STMODE

Step Mode is a boolean input that controls the block's operating mode in the Auto state:

0 = State
1 = Step

In the State mode, the block writes the state pattern (STAT01 to STAT16) requested by DRVDSR into PAKOUT one step at a time, except for the steps excluded by the CHOICE bypass mask and MAXSTP.

In the Step mode, the block writes each state pattern (STAT01 to STAT16) into PAKOUT sequentially, except for the steps excluded by the CHOICE bypass mask and MAXSTP. Step transition occurs only if the input drive (DRIV01 to DRIV16) for the next step is true.

Once a step transition has occurred, its drive input can be cleared without affecting block operation.

STXT01 to STXT16

State Text 1 to 16 are a user-defined strings of up to 32 characters that describe the STAT01 to STAT16 state patterns.

STXT_H

State Text for Hold is a user-defined string of up to 32 characters that describe the STAT_H state pattern.

STXT_I

State Text for Initialize is a user-defined string of up to 32 characters that describe the STAT_I state pattern.

TIME01 to TIME16

Time 1 to Time 16 are configurable real inputs that specify the time-out period for the STAT01 to STAT16 states in the Step or State mode when TIMOPT = 1. If the time-out period is 0, the block does not apply the time-out logic to that state.

TIME_H

Time for Hold is a configurable real input that specifies the time-out period for the STAT_H state in the Step or State mode when TIMOPT = 1. If the time-out period is 0, the block does not apply the time-out logic to STAT_H. TIME_H is used only when FBKOPT = 2.

TIME_I	Time for Initialize is a configurable real input that specifies the time-out period for the STAT_I state in the Step or State mode when TIMOPT = 1. If the time-out period is 0, the block does not apply the time-out logic to STAT_I. TIME_I is used only when FBKOPT = 2.
TIMOPT	Time-out option is a configurable boolean input that when true enables the block to detect when it remains at a particular step for a period that exceeds the configured time for that step.
TIMOUT	Time-out is a boolean output that is set true when TIMOPT = 1 and the block remains at a particular step for a period that exceeds the configured time for that step.
TYPE	Type is a system-level mnemonic label indicating the block type. Enter "STATE" or select "STATE" from the block type list under Show when configuring the block.

116.5 Functions

116.5.1 Detailed Functional Diagram

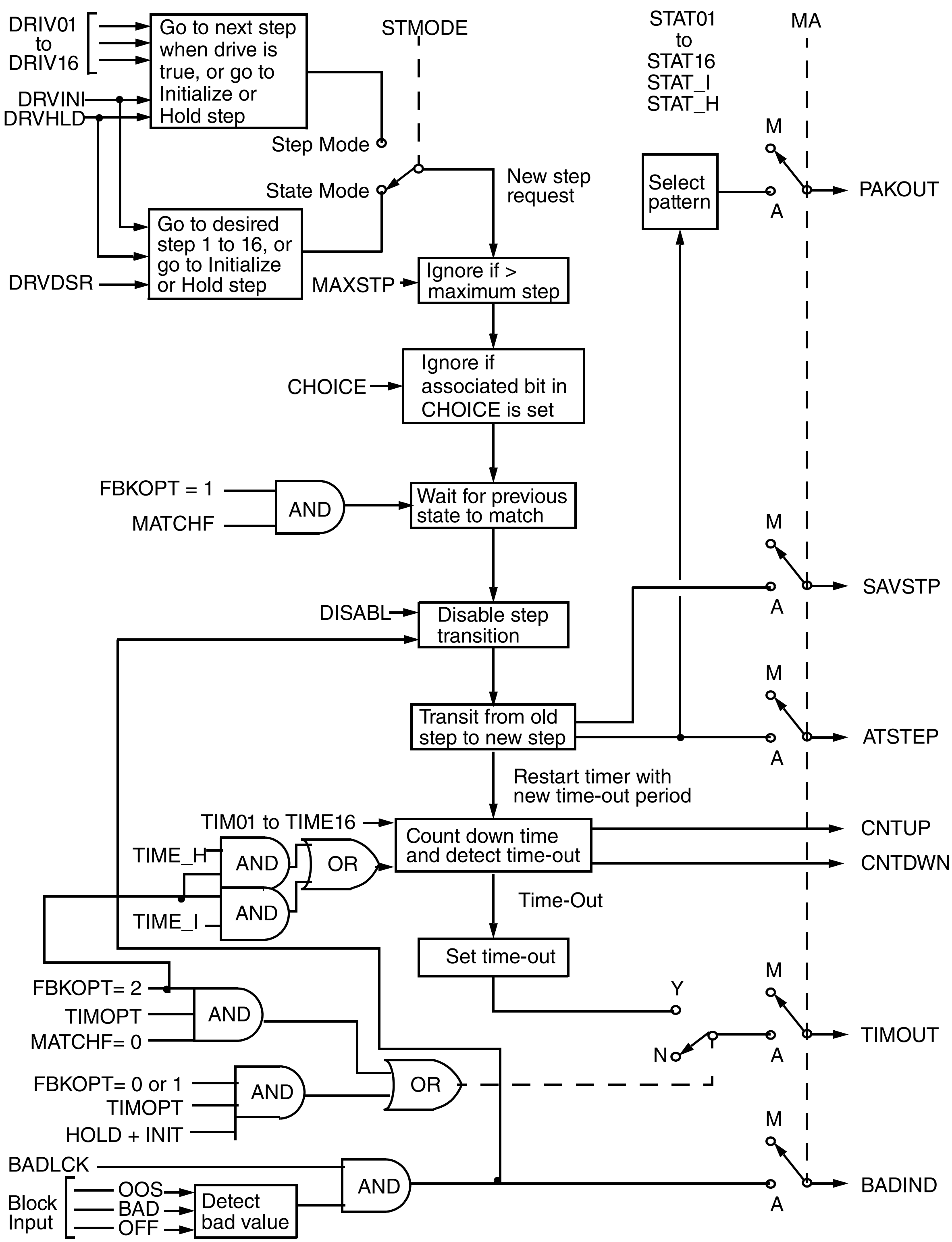


Figure 116-2. STATE Block Detailed Functional Diagram

116.5.2 Detailed Operation

In Auto, the block operates either in the State mode (STMODE = 0) or Step mode (STMODE = 1) to control the process. The Initialization, Hold, or Manual modes can override the State or Step mode. In Manual, no step transition is processed. You can change settable outputs such as PAKOUT.

In the Step mode the STATE block writes up to 16 preconfigured state patterns (STAT01 to STAT16) into its packed boolean output (PAKOUT) parameter in sequence, as each step drive (1 to 16) is set true (see Figure 116-2). If the Initialize mode drive is set true, the block writes the Initialize pattern (STAT_I) into PAKOUT. If the Hold mode drive is set true, the block writes the Hold pattern (STAT_H) into PAKOUT.

In the State mode the block writes the state pattern (STAT01 to STAT16) requested by the desired step input into PAKOUT; the steps can be requested in any order. If the Initialize mode drive is set true, the block writes STAT_I into PAKOUT. If the Hold mode drive is set true, the block writes STAT_H into PAKOUT.

MAXSTP and the CHOICE mask determine the actual number of output state patterns, not including STAT_H and STAT_I. If the requested step (DRVDSR) or the next step in the sequence is greater than MAXSTP or is bypassed by CHOICE, the block ignores the step, except:

- During initialization, the block goes into the step specified by the Initial Step (I_STEP) parameter, if it is configured.
- During a transfer from Manual to the Auto/Step or Auto/State mode, the block goes into the step specified by the saved step (SAVSTP) parameter, if it was changed while in Manual. In Manual you can change SAVSTP to go to that step on a transfer to Auto. In Auto, SAVSTP stores the most recent step number.

The FBKOPT = 1 option allows the block to confirm that the process is at the desired status before making a step transition. If FBKOPT = 1 and the block is in the Step or State mode, the block checks that MATCHF is true before going to the next step, that is, Steps 1 to 16. You can use the PATT block to compare process status to one of several preconfigured patterns, as selected by ATSTEP, and then feed back the pattern match status to MATCHF.

FBKOPT = 2 provides an option to simply detect a process time-out condition and indicate this to another block. If FBKOPT = 2, TIMOPT = 1, and MATCHF = 0, the block sets the TIMOUT output to true when the specified time for the step has expired. This indicates that the process has not reached the desired state within the specified time (TIME01 to TIME16, TIME_I, or TIME_H). It does not prevent a step transition.

When the Disable, Hold, Initialize, or Manual mode is requested, the block does not check MATCHF. A transition from Hold to the Step or State mode requires that MATCHF be true, except for:

- Transition to I_STEP during block initialization
- Transition from Manual to Step mode if you have changed a return step number (refer to SAVSTP) while in Manual.

The countup timer is always enabled. The countdown timer and time-out logic are enabled only if TIMOPT = 1. The elapsed time counter counts up until the first ATSTEP change, at which time it is reset, except for a transition to Hold. The block provides the elapsed time (CNTUP) and count down time (CNTDWN) parameters as outputs.

ATSTEP changes during:

- Transition into any step in State or Step mode.

- Transition into the Initialize or Hold mode.
- Transition into the State or Step mode, if SAVSTP has been changed while the block was in Manual.

When BADLCK = 1, the block allows a step or mode transition only when all related inputs are in good health, that is, not bad (BAD), out-of-service (OOS), or off-scan (OFF). If a requested step or mode transition cannot be made because of an unhealthy input, BADIND is set true. The block checks the health of all related inputs each time it process a step or mode transition request. If one of the related inputs is not healthy and BADLCK = 0, the transition is allowed.

116.5.2.1 Block Initialization

Key parameters: I_STEP, INITMA, PAKOUT

The block initializes when:

- The compound containing the block is turned on.
- The CP containing the block is rebooted.
- The block is installed or modified and the compound containing the block is on.

When the block initializes, it sets:

- PAKOUT to the pattern specified by I_STEP
- ATSTEP and SAVSTP to the step number specified by I_STEP
- MA is set according to the INITMA value.

After a CP reboot, all non-connected inputs are reset.

116.5.2.2 Disable Mode

Key Parameters: DISABL, PAKOUT, SAVSTP

In the Disable mode (DISABL = 1), the block disables step transition and secures all the output parameters from change, even if the Manual mode is requested; it does not reset the timers. Upon exiting Disable, the block assumes the previous state and resumes normal operations. Disable is the highest priority mode. Table 116-2 lists the operating mode priorities.

Table 116-2. Operating Mode Priority

Mode	Priority*
Disable	1
Manual	2
Hold	3
Initialize	4
Auto/State	5
Auto/Step	6

* Highest priority is 1.

Before a transition to Disable, you should place the process in the desired state. When DISABL is set to 1, the block locks the values in PAKOUT, ATSTEP, and SAVSTP until DISABL is reset to 0. The block stores data for the operating mode prior to entering Disable.

When exiting Disable, the block goes to the requested operating mode. If the requested mode is different than the operating mode prior to entering Disable, the block executes transition logic from the prior mode to the requested one.

116.5.2.3 Manual Mode

Key Parameters: MA, PAKOUT, SAVSTP

On a transition from Auto to Manual (MA = 0), PAKOUT does not change, and the time-out counters continue to count (see Figure 116-3).

In Manual no state transition is processed. You can change settable outputs (for example, PAKOUT and SAVSTP) via the Block Detail display or Object Manager `set_val` call. The countup (CNTUP) and countdown (CNTDWN) timers continue. If you change SAVSTP, the block resets the timers upon transition back to the Step or State mode.

116.5.2.4 Auto Mode

Key Parameters: MA, MNOBMP, PAKOUT, SAVSTP

On a transition from Manual to Auto (MA = 1), the block checks if you have requested a new step by changing SAVSTP while in Manual (see Figure 116-3). If SAVSTP has been changed, the block copies SAVSTP into ATSTEP and resets the timers.

If MNOBMP = 0, the block resets PAKOUT to the value defined by ATSTEP.

If MNOBMP = 1 and you have changed PAKOUT while in Manual, PAKOUT retains the manual setting on a transfer from Manual to Auto.

In Auto the block has four modes of operation:

- ♦ Hold
- ♦ Initialize
- ♦ State
- ♦ Step

If you have changed SAVSTP to 0 or 17 while in Manual, the block goes to the specified step (0 or 17) on a transfer to Auto, but it goes to the mode (State or Step) it was in prior to the transfer to Manual. The block does not formally go into the Initialize (step 0) or Hold (step 17) mode, that is:

- ♦ BMODE output parameter indicates State or Step mode, not Initialize or Hold
- ♦ If TIMOPT = 1, the block resets all timers and TIMOUT

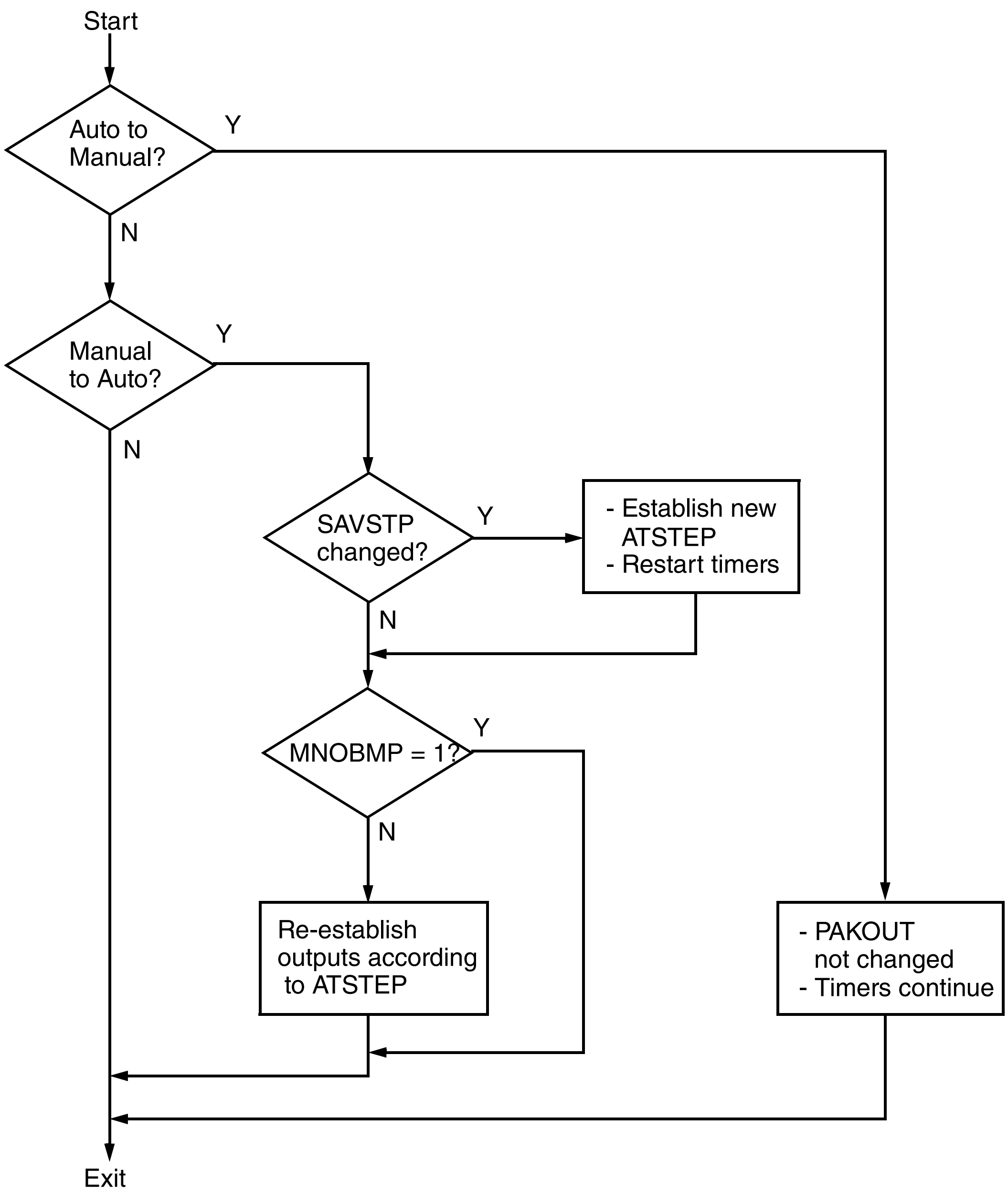


Figure 116-3. Auto/Manual Transition Diagram

116.5.2.5 Hold Mode

Key Parameters: DRVHLD, FBKOPT, HNOBMP, PAKOUT, STAT_H, TIMOPT

On a transition into Hold (DRVHLD = 1), the block sets PAKOUT to the STAT_H pattern and ATSTEP to 17; SAVSTP is unchanged (see Figure 116-4). Feedback matching (FBKOPT = 1) does not delay the transition until MATCHF = 1.

When TIMOPT = 1, FBKOPT determines block operation in Hold as follows:

- If FBKOPT = 0, the block does not reset the timers, and does not check MATCHF.
- If FBKOPT = 1, the block does not reset the timers. To exit Hold, and go to the State or Step mode, MATCHF must be set to 1.
- If FBKOPT = 2, the block resets the countdown timer (CNTDWN).

On exiting Hold, the block restores ATSTEP. If HNOBMP = 0, the block writes into PAKOUT the pattern specified by the step number saved in SAVSTP. If HNOBMP = 1, PAKOUT does not change. If FBKOPT = 2, the block resets the countdown timer (CNTDWN) after transition from Hold to the State or Step mode.

Hold overrides all other modes in Auto, but it can be overridden by Disable or Manual.

116.5.2.6 Initialize Mode

Key Parameters: DRVINI, FBKOPT, I_STEP, MATCHF, PAKOUT, STAT_I

On a transition into Initialize (DRVINI = 1), the block sets PAKOUT to the STAT_I pattern and ATSTEP and SAVSTP to 0. Feedback matching (FBKOPT = 1) does not delay the transition until MATCHF = 1. Transition into Initialize always resets all timers including the countup and countdown timers.

On a transfer from Initialize (DRVINI = 0) to the State or Step mode when FBKOPT = 1, the block checks for MATCHF = 1, which indicates that all devices are in their initialize states. It then performs normal State or Step mode operation.

If FBKOPT = 2, the block resets the countdown timer (CNTDWN) after transition from Initialize to the State or Step mode.

Disable, Manual, or Hold can override the Initialize mode.

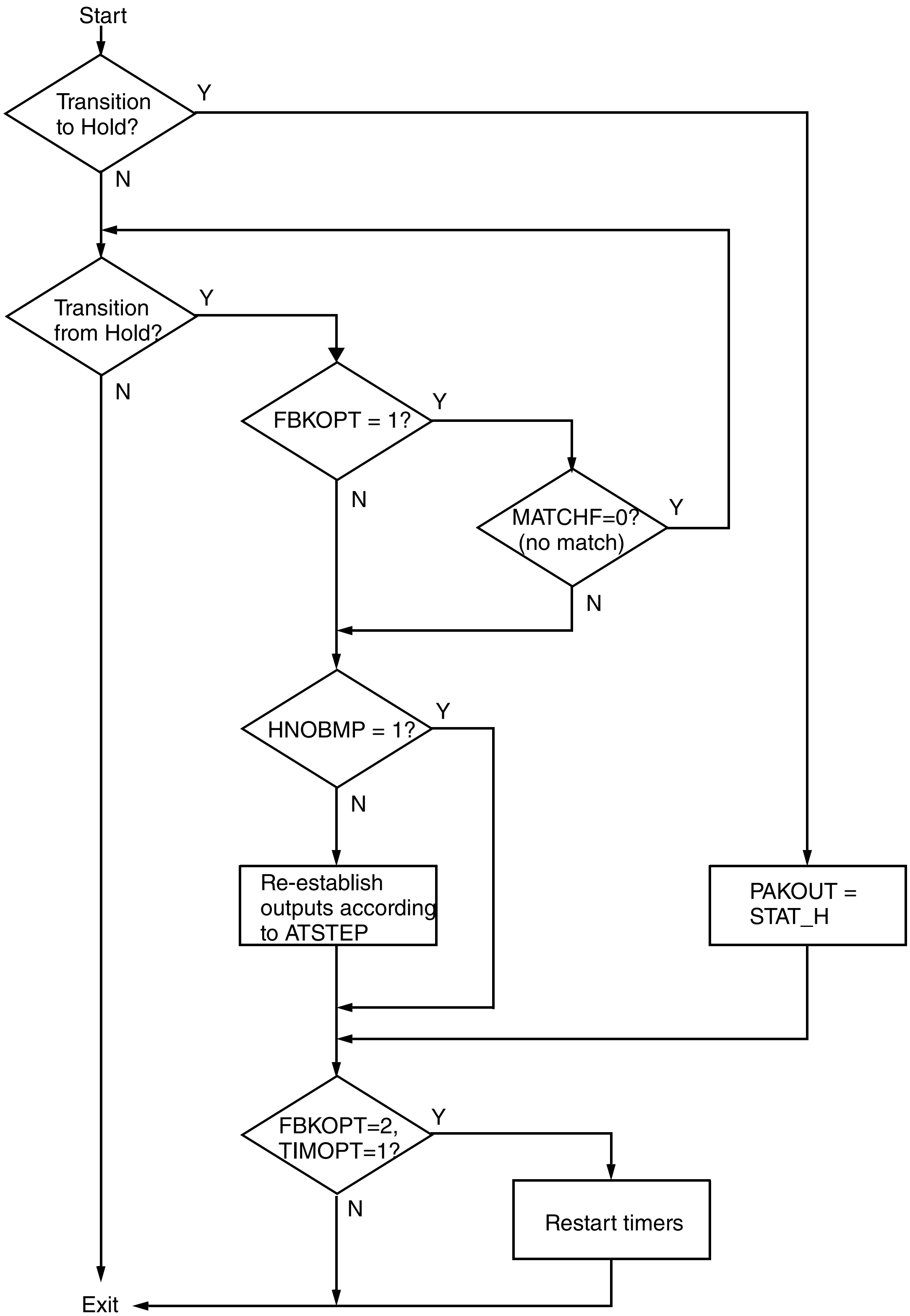


Figure 116-4. Hold Transition Diagram

116.5.2.7 Step Mode

Key Parameters: CHOICE, DRIV01 to DRIV16, FBKOPT, MATCHF, MAXSTP, PAKOUT, STAT01 to STAT16, STMODE

In the Step mode (STMODE = 1), the block writes each state pattern (STAT01 to STAT16) into PAKOUT sequentially, except for the steps excluded by the CHOICE bypass mask and MAXSTP.

If FBKOPT = 1, the block performs a step transition whenever MATCHF = 1 and the next drive input (DRIV01 to DRIV16) allowed by CHOICE goes true. For example, the block goes from Step 1 to Step 2 by writing STAT02 into PAKOUT if:

- Step 2 CHOICE bit = 0
- MAXSTP ≥ 2
- MATCHF = 1
- DRIV02 = 1

If FBKOPT = 0 or 2, the block goes from Step 1 to Step 2 as above except that there is no MATCHF checking.

The block sets ATSTEP to the current step number, and performs timing according to the TIMOPT and FBKOPT settings. Each time the block changes the step, all timers are reset.

On a transition from State to Step mode, PAKOUT maintains its previous state pattern and the block begins step transition from the step number for that pattern.

Disable, Manual, Hold, Initialize, or State can override the Step mode.

NOTE

If a drive input (DRIV01 to DRIV16) or MATCHF is not connected, it is reset when it is used to make a step transition. MATCHF is used when FBKOPT = 1 or 2).

116.5.2.8 State Mode

Key Parameters: CHOICE, DRVDSR, FBKOPT, MATCHF, MAXSTP, PAKOUT, STAT01 to STAT16, STMODE

In the State mode (STMODE = 0), the desired state request drive (DRVDSR) selects the step number (1 to 16). The block writes the selected state pattern into PAKOUT, except for the steps excluded by the CHOICE bypass mask and MAXSTP.

If FBKOPT = 1, the block performs a step transition whenever MATCHF = 1 and DRVDSR changes to another step allowed by CHOICE. For example, the block goes from Step 3 to Step 7 by writing STAT07 into PAKOUT if:

- Step 7 CHOICE bit = 0
- MAXSTP ≥ 7
- MATCHF = 1
- DRVDSR = 7

If FBKOPT = 0 or 2, the block goes from Step 3 to Step 7 as above except that there is no MATCHF checking.

The block sets ATSTEP to the current step number, and performs timing according to the TIMOPT and FBKOPT settings. Each time the block changes the step, all timers are reset.

Disable, Manual, Hold, Initialize, or Step can override the State mode.

On a transition from Step to State mode, PAKOUT is set to the state requested by DRVDSR. If DRVDSR is zero, greater than MAXSTP, or bypassed by CHOICE, PAKOUT maintains its previous state pattern and ATSTEP is unchanged.

NOTE

If MATCHF is not connected, it is reset when it is used to make a step transition, that is, when FBKOPT = 1 or 2.

116.5.2.9 Timing Logic

Key Parameters: CNTDWN, CNTUP, FBKOPT, MATCHF, TIME01 to TIME16, TIME_H, TIME_I, TIMOPT, TIMOUT

In the Step or State mode, the block performs timing according to the TIMOPT and FBKOPT settings. Each time the block changes the step, it resets all the timers.

If TIMOPT = 1 and the block remains at a particular step for a period that exceeds the configured time (TIME01 to TIME16, TIME_I, TIME_H) for that step, the timing logic detects the time-out. The countdown timer, which is tracked by CNTDWN, starts when a step change occurs.

When the configured time is reached or exceeded, the block sets TIMOUT to 1 if:

- FBKOPT = 0 or 1
- FBKOPT = 2 and MATCHF = 0.

If FBKOPT = 2, a time-out indicates that the process has not reached the desired state (that is, MATCHF is not true) within the configured time.

The countdown timer continues to count in the negative direction to indicate the period for which TIMOUT = 1.

If a configured time-out period is 0 or negative, the block does not apply the time-out logic to that state.

The block uses the TIME_I and TIME_H parameters only when FBKOPT = 2.

CNTDWN is reset to 0 during:

- Each step transition in the State or Step mode
- Transition into or out of the Initialize mode when FBKOPT = 0 or 1
- Transition into the Hold mode, when FBKOPT = 2 and TIMOPT = 1
- Transition from Hold to State or Step mode, if FBKOPT = 2 and TIMOPT = 1
- Transition to the State or Step mode, if the user has changed SAVSTP while the block was in Manual.

TIMOUT is reset to 0 when:

- There is a step transition while the block is in the STEP or STATE mode
- There is a transition into or out of the Initialize mode when FBKOPT = 0 or 1
- There is transition into the Hold mode and FBKOPT = 2 and TIMOPT = 1
- FBKOPT = 2, TIMOPT = 1, and MATCHF = 1

- TIMOPT is set to 0 on the block restart, after a compound off-to-on transition, reboot, or install operation.

The elapsed time counter, which is tracked by CNTUP, provides the total time that the block has been in a specific state. The block initializes CNTUP to 0 during:

- Every step transition in the Step or State mode
- Transition into or out of the Initialize mode when FBKOPT = 0 or 1
- Transition from Manual to State or Step mode, if you have changed SAVSTP while in Manual.

116.5.2.10 Bad Lock Option

When BADLCK = 1, the block allows a step or mode transition only when all related inputs are in good health, that is, not bad (BAD), out-of-service (OOS), or off-scan (OFF). If a requested step or mode transition cannot be made because of an unhealthy input, BADIND is set true.

If BADLCK = 1, transition into another step while the block is in the Step or State mode is allowed only when the step, Disable, Manual/Auto, Hold, and Initialize drive inputs are healthy. Transition between the State and Step modes is allowed only if the STMODE is healthy.

If BADLCK = 1, transition into a higher priority mode is allowed only when the mode drive input is healthy. Transition out of Disable, Manual, Hold, or Initialize into a lower priority mode is allowed only when the drive inputs for all higher priority modes are healthy.

116.5.2.11 Cascading STATE Blocks

If the process requires more than 16 states (steps), you can configure two STATE blocks in conjunction with an IND that selects either integer input II0001 or II0002, depending on the step number (see Figure 116-5).

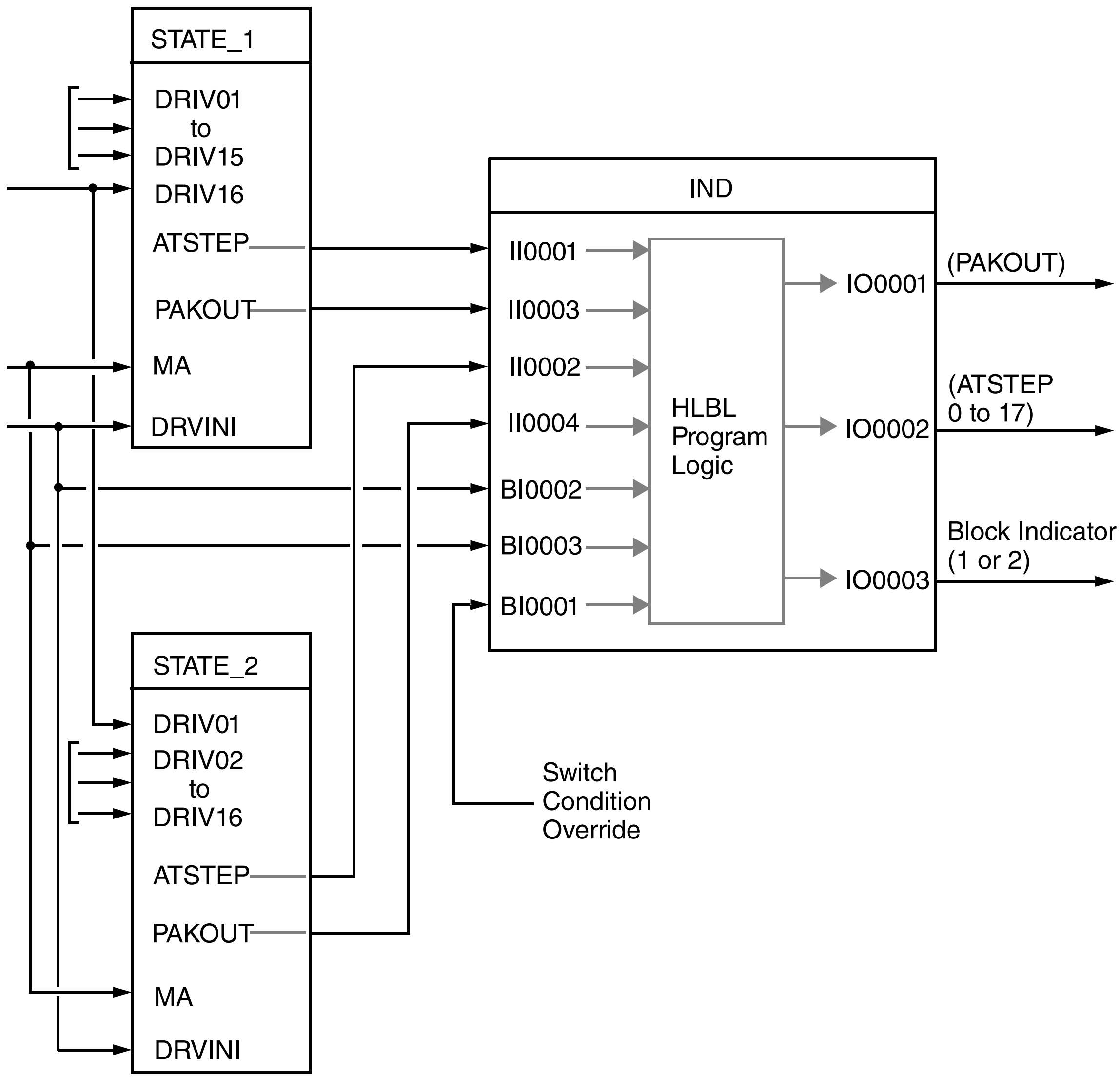


Figure 116-5. Cascade Configuration for STATE Block

116.6 Application Example

Figure 116-6 shows an example of a STATE block used in conjunction with a PATT block to control a simple process with sequence logic. An MCOUT block in conjunction with CIN blocks provides contact status inputs to the STATE and PATT blocks. The state patterns in the STATE block in conjunction with COUT blocks drive the output contacts for controlling the process on/off devices, that is, inlet valve, drain valve, and heater.

In this example, the STATE block drives one of nine preconfigured state patterns (STAT01 to STAT09) into its packed boolean output (PAKOUT) parameter one step at a time (STMODE = 1). The PATT block receives a 16-bit packed boolean input (PAKCRB) from the MCOUT block and compares this input to one of several preconfigured patterns, as selected by the STATE block. The PATT block then feeds back a pattern match status to the STATE block for the purpose of stepping through the STATE block steps. The PATT block thus confirms the desired process status before the STATE block proceeds to the next step.

There are many configurations for using a STATE block to control a process. Instead of using COUT blocks for the output contacts, you can use a MCOUT block. Instead of using CIN blocks and a MCOUT block to input process status, you can use a MCIN block whose PAKCIN parameter connects to the STATE and PATT blocks.

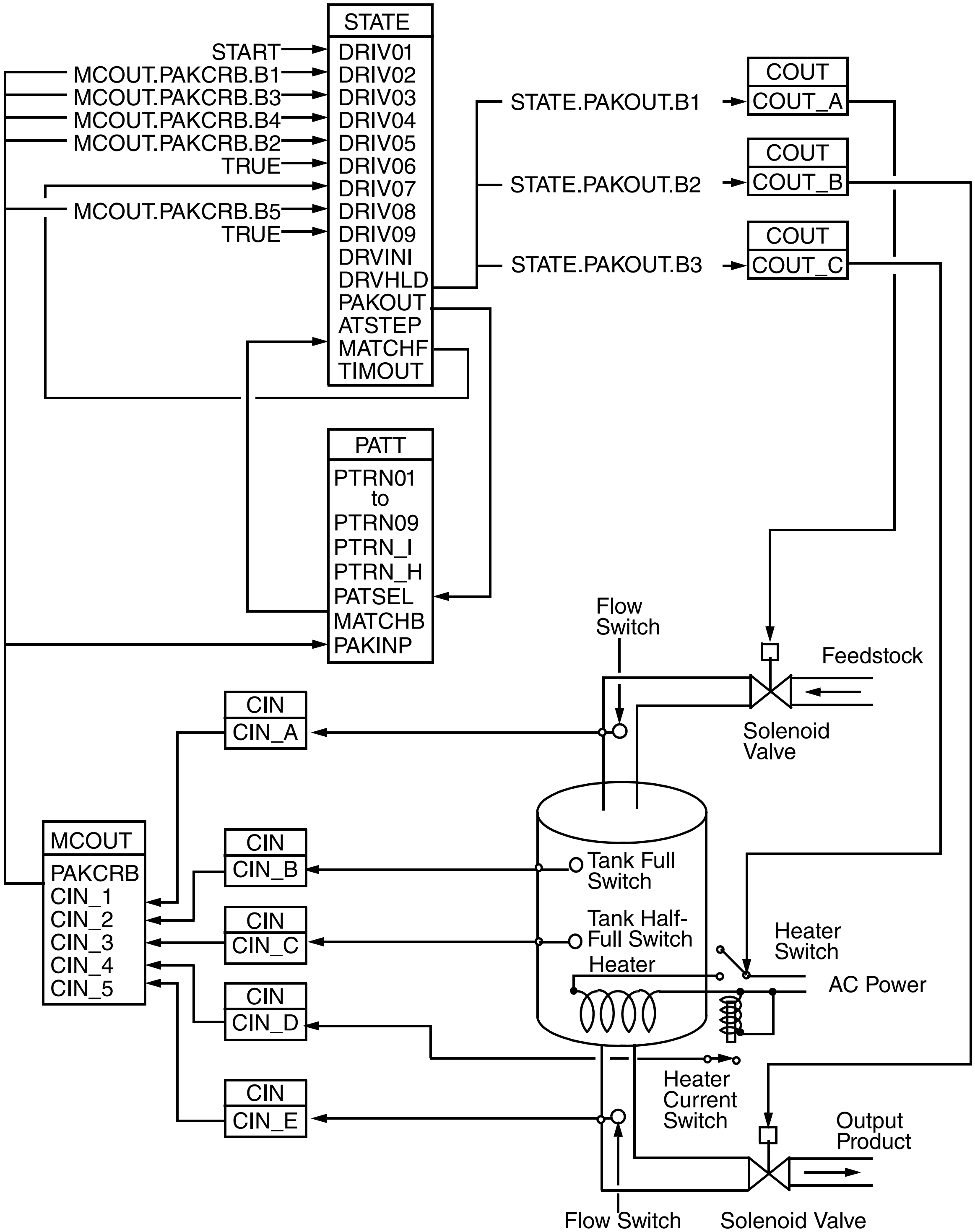


Figure 116-6. Application Diagram

116.6.1 Parameter Configuration

For the example in Figure 116-6, you configure the following STATE block as shown below:

STMODE = 1 (Step mode)

MAXSTP = 9

FBKOPT = 1

TIMOPT = 1

Table 116-3 shows only the first three bits of the state patterns because there are only three devices to be driven. Table 116-4 shows only the first five bits of the feedback pattern (FP) because there are five feedback switches to be monitored. FPxx in Table 116-4 are not actual PATT block parameters, but they represent the result of applying the MASKxx to PTRNxx thus producing the true (1), false (0), and do not care (shaded X) for the feedback. Table 116-5 shows the pattern and mask for each feedback pattern.

Table 116-3. STATE Block Parameter Configuration

	DTXT01	— —	— —	— —	— —	Fill valve
	|	DTXT02	— —	— —	— —	Drain valve
	|	|	DTXT03	— —	— —	Heater
	|	|	|			
PAKOUT	B1	B2	B3	Hex*		
STAT_I	0	0	0	0x0000	STXT_I	Start
STAT01	1	0	0	0x8000	STXT01	Open inlet valve
STAT02	1	0	0	0x8000	STXT02	Wait for half full
STAT03	1	0	1	0xA000	STXT03	Turn heater on
STAT04	1	0	1	0xA000	STXT04	Wait for tank full
STAT05	0	0	1	0x2000	STXT05	Close inlet valve
STAT06	0	0	1	0x2000	STXT06	Time heat
STAT07	0	1	0	0x4000	STST07	Heater off, drain on
STAT08	0	1	0	0x4000	STXT08	Drain
STAT09	0	0	0	0x0000	STXT09	End
STAT_H	0	0	0	0x0000	STXT_H	Hold

* Hexadecimal value that you enter for STATxx.

Table 116-4. PATT Block Feedback Patterns

	CIN_1	— —	— —	— —	— —	— Inlet flow
	|	CIN_2	— —	— —	— —	— Tank full
	|	|	CIN_3	— —	— —	— Tank half full
	|	|	|	CIN_4	— —	— Heater on/off
	|	|	|	|	CIN_5	— Outlet flow
	|	|	|	|	|	
PAKCRB*	B1	B2	B3	B4	B5	
FP_I	0	0	0	0	0	
FP01	1	0	0	0	0	
FP02	1	0	1	0	0	
FP03	1	0	1	1	0	
FP04	X	1	X	X	X	
FP05	0	1	X	1	X	
FP06	X	X	X	X	X	
FP07	0	X	X	0	1	
FP08	0	0	0	0	0	
FP09	0	0	0	0	0	
FP_H	0	X	X	0	0	

* B1 to B5 are boolean connection bits.
** Shaded areas are *do not care* bits.

Table 116-5. PATT Block Pattern and Mask Configuration

PAKCRB*	B1	B2	B3	B4	B5	Hexadecimal
PTRN_I	0	0	0	0	0	0x0000
MASK_I	1	1	1	1	1	0xF800
FP_I	0	0	0	0	0	
PTRN01	1	0	0	0	0	0x8000
MASK01	1	1	1	1	1	0xF800
FP01	1	0	0	0	0	
PTRN02	1	0	1	0	0	0xA000
MASK02	1	1	1	1	1	0xF800
FP02	1	0	1	0	0	
PTRN03	1	0	1	1	0	0xB000
MASK03	1	1	1	1	1	0xF800
FP03	1	0	1	1	0	
PTRN04	1	1	1	1	1	0xF800
MASK04	0	1	0	0	0	0x4000
FP04	X	1	X	X	X	
PTRN05	0	1	1	1	1	0x7800
MASK05	1	1	0	1	0	0xD000
FP05	0	1	X	1	X	
PTRN06	0	1	1	1	1	0x7800
MASK06	0	0	0	0	0	0x0000
FP06	0	1	X	1	X	
PTRN07	0	1	1	0	1	0x6800
MASK07	1	0	0	1	1	0x9800
FP07	0	X	X	0	1	
PTRN08	0	0	0	0	0	0x0000
MASK08	1	1	1	1	1	0xF800
FP08	0	0	0	0	0	
PTRN09	0	0	0	0	0	0x0000
MASK09	1	1	1	1	1	0xF800
FP09	0	0	0	0	0	
PTRN_H	0	0	0	0	0	0x0000
MASK_H	1	0	0	1	1	0x9800
FP_H	0	X	X	0	0	

* B1 to B5 are boolean connection bits.

** Shaded areas are *do not care* bits.

116.6.2 Operation

116.6.2.1 Step 0 – Initialize

In this example the block is assumed to be on and in Auto. You initialize the block to the Initial step, either by turning the compound on or by toggling DRVINI to true and then false. The block then sets ATSTEP to 0 and PAKOUT to STAT_I; MATCHB sets MATCHF to 0. This closes the inlet and outlet valves and turns the heater off.

The PATT block checks for the inlet flow, outlet flow, heater current, tank half full and tank full switches to be all false, at which time MATCHB sets MATCHF true. The STATE block then checks for DRIV01 to go true.

116.6.2.2 Step 1 – Start Fill

When the operator sets START true, DRIV01 goes true. The block then sets ATSTEP to 1, starts the CNTUP timer, starts the CNTDWN timer from TIME01, and sets PAKOUT to STAT01; MATCHB sets MATCHF to 0. This opens the inlet valve and starts filling the tank with liquid feedstock.

The PATT block then checks for the inlet flow switch (B1) to go true, at which time MATCHB sets MATCHF true. The STATE block then checks for DRIV02 to go true.

116.6.2.3 Step 2 – Wait for Half Full

When the inlet flow switch (B1) goes true, DRIV02 goes true. The block then sets ATSTEP to 2, starts the CNTUP timer, starts the CNTDWN timer from TIME02, and sets PAKOUT to STAT02; MATCHB sets MATCHF to 0. This continues to fill the tank.

The PATT block then checks for the half full switch (B3) to go true, at which time MATCHB sets MATCHF true. The STATE block then checks for DRIV03 to go true.

116.6.2.4 Step 3 – Turn Heater On

When the half full switch (B3) goes true, DRIV03 goes true. The block then sets ATSTEP to 3, starts the CNTUP timer, starts the CNTDWN timer from TIME03, and sets PAKOUT to STAT03; MATCHB sets MATCHF to 0. This continues to fill the tank and starts the heater.

The PATT block then checks for the heater current switch (B4) to go true, at which time MATCHB sets MATCHF true. The STATE block then checks for DRIV04 to go true.

116.6.2.5 Step 4 – Wait for Full

When the heater current switch (B4) goes true, DRIV04 goes true. The block the sets ATSTEP to 4, starts the CNTUP timer, starts the CNTDWN timer from TIME04, and sets PAKOUT to STAT04; MATCHB sets MATCHF to 0. This continues to fill the tank and heat the liquid.

The PATT block then checks for the tank full switch (B2) to go true, at which time MATCHB sets MATCHF true. The block then checks for DRIV05 to go true.

116.6.2.6 Step 5 – Tank Is Full

When the tank full switch (B2) goes true, DRIV05 goes true. The block then sets ATSTEP to 5, starts the CNTUP timer, starts the CNTDWN timer from TIME05, and sets PAKOUT to STAT05; MATCHB sets MATCHF to 0. This closes the inlet valve and continues heating the liquid. The PATT block then checks for the inlet flow switch (B1) to go false, at which time MATCHB sets MATCHF true. The block then checks for DRIV06 to go true.

If the inlet valve is locked open, there will be no confirmation of inlet flow stopping, and the block times out in TIME05 minutes. When the CNTDWN timer reaches TIME05, the block sets TIMOUT true. If TIME05 is properly set, the operator can detect this failure and dispatch someone to manually close the valve before the tank overflows.

A sequence block can be used to detect the time-out (TIMOUT = 1) when the step is in stop fill (ATSTEP = 5) and activate an over fill alarm.

At this time, the operator can place the block in the Hold, Manual, or State mode. If the operator places the block in Hold by setting DRVHLD true, then the block sets SAVSTP to ATSTEP, ATSTEP to 17, and PAKOUT to STAT_H; MATCHB sets MATCHF to 0.

This turns the heater off and closes both valves. The PATT block then checks that the heater current (B4), inlet flow (B1), and drain flow (B5) switches are false. The tank level switches (B1 and B3) are *don't cares*. When this state is attained, MATCHB sets MATCHF true, but the block does not attempt to change states until DRVHLD is cleared.

When DRVHLD is reset to 0, the block returns to STAT05 because SAVSTP is 5. The block then does all the steps described in the first part of this section.

116.6.2.7 Step 6 – Time Heat

Because DRIV06 is always true, the block sets ATSTEP to 6, starts the CNTUP timer, starts the CNTDWN timer from TIME06, and sets PAKOUT to STAT06; MATCHB sets MATCHF to 0. This continues to heat the liquid.

Because PTRN06 is all *don't cares*, the PATT block instantaneously confirms a pattern match. The STATE block now checks for DRIV07 to go true.

When TIMOUT goes true, DRIV07 goes true. TIMOUT goes true when the time-out period for Step 6 expires. If TIME06 is set to 60 minutes, then the block advances to Step 7 after 1 hour, thereby heating the liquid for 1 hour.

116.6.2.8 Interrupt Heat Time

After a half hour in Step 6, the operator may decide to move the process ahead. This can be done by setting STMODE to 0 (State mode), and then, setting DRVDSR to 7, at which time the block sets PAKOUT to STAT07. If STMODE is now set to 1, the block continues the stepping process at Step 7.

116.6.2.9 Step 7 – Turn Heat Off and Drain Tank

When TIMOUT goes true, DRIV07 goes true. The block sets ATSTEP to 7, starts the CNTUP timer, starts the CNTDWN timer from TIME07, and sets PAKOUT to STAT07; MATCHB sets MATCHF to 0. This turns the heater off and opens the drain valve.

The PATT block then checks for the outlet flow switch (B5) to go true and the heater current switch (B4) to go false, at which time MATCHB sets MATCHF true. The block then checks for DRIV08 to go true.

116.6.2.10 Step 8 – Drain Tank

When the outlet flow (B5) goes true, DRIV08 goes true. The block sets ATSTEP to 8, starts the CNTUP timer, starts the CNTDWN timer from TIME08, and sets PAKOUT to STAT08; MATCHB sets MATCHF to 0. This continues draining the tank.

The PATT block then checks for the outlet flow switch (B5) to go false, at which time MATCHB sets MATCHF true. The block then checks for DRIV09 to go true.

116.6.2.11 Step 9 – End

Because it is connected to a true state, DRIV09 goes true immediately. The block then sets ATSTEP to 9, starts the CNTUP timer, starts the CNTDWN timer from TIME09, and sets PAKOUT to STAT09; MATCHB sets MATCHF to 0. This closes the inlet and drain valves, and turns the heater off.

116.6.2.12 Restart or Manual Override

To restart the process, re-initialize the block by toggling DRVINI to true, and then, toggling it to false.

If the block is *not* in Disable, you can switch the block from Auto to Manual. While in manual, you can control the process by directly setting PAKOUT. You can open and close the inlet and drain valves, and turn the heater on and off.

117. Station Block

This chapter describes the Station Block, provides an I/O diagram and describes block features, rules and functions.

117.1 Overview

A Station Block provides information about the station's resources. The station block is identical for all stations. A station block is used for each of the following types of stations:

- Control Processors (CPs)
- Integrators and Gateways
- Control Stations.

You can use the Station Block Detail Display to determine:

- Percent (%) of the station's processor time being used to process:
  - All blocks.
  - Continuous blocks.
  - Input/Output (I/O), which includes the time spent waiting for response from Fieldbus modules (FBMs) or devices connected to the station.
- Loading summary (% of BPC).
- Free memory available in the station.
- Cumulative block processor overruns.
- Peer-to-peer point connection status.
- Object Manager (OM) scanner data, including overruns and total inter-station Inter-Process Communications (IPC) connections.
- Supervisory Groups enable/disable and other Supervisory Setpoint Control (SSC) data.
- Station's hosting mode - self hosting vs. non-self-hosting

Figure 117-1 shows an I/O diagram for the Station block.

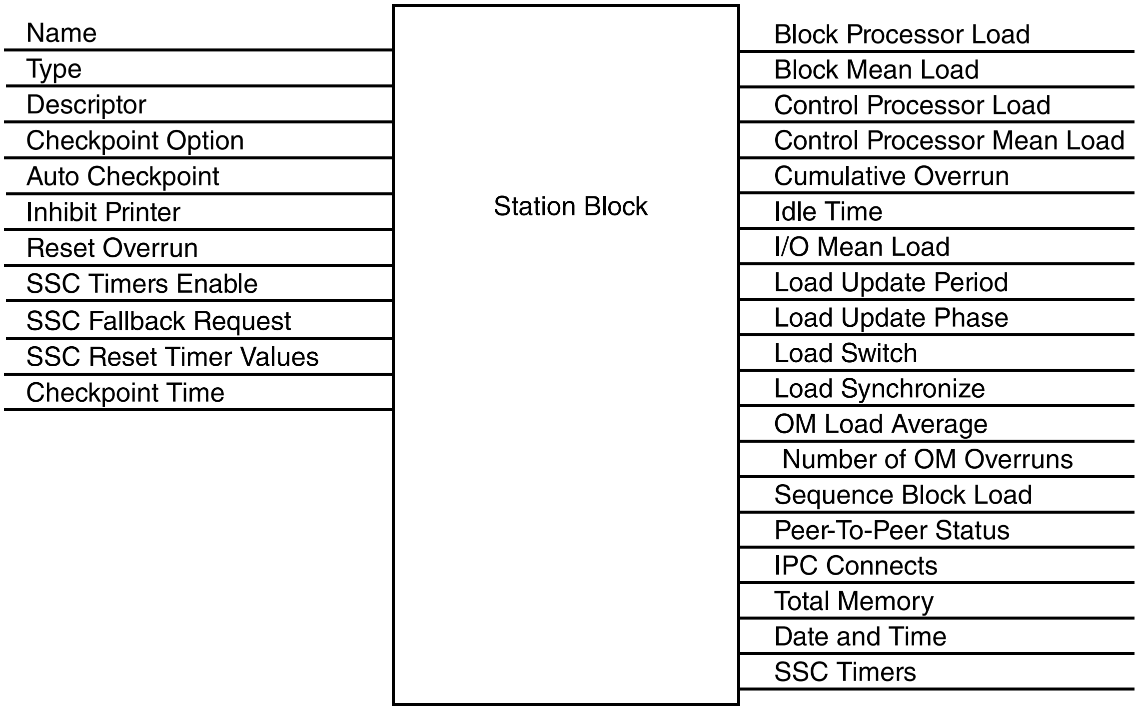


Figure 117-1. Station Block Inputs/Outputs

117.2 Features

The standard features are:

- Percent (%) of the station's processor time being used to process:
  - All blocks.
  - Continuous blocks.
  - Input/Output (I/O) which includes the time spent waiting for response from Fieldbus modules (FBMs) or devices connected to the station.
- Station loading summary (% of BPC).
- Free memory available in the station.
- Cumulative block processor overruns.
- Peer-to-peer point connection status.
- Object Manager (OM) scanner data, including overruns and total inter-station Inter-Process Communications (IPC) connections.
- Supervisory Groups enable/disable and other Supervisory Setpoint Control (SSC) data.

The options are:

- Checkpoint option (CKPOPT) enables/disables automatic checkpoint.
- Configuration option (CFGOPT) enables/disables changes to the station's database and enables/disables self-hosting for the FCP280, or FCP270/ZCP270. Self-hosting mode allows the CP to start up and run, executing its configured control scheme

using the checkpoint file stored in its flash memory. This allows the CP to boot itself with a valid control database even if its host workstation is not present.

- Inhibit printer option (INHPRT) inhibits printing of station's system messages.
- Alarm device group name option.
- Enable/Disable of data collection for the station block.

117.3 Parameters

Table 117-1 lists the compound parameters followed by a description of each parameter.

Table 117-1. Station Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	blank	STA
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
CKPOPT	checkpoint option	short	no-con/no-set	0	0 to 2
AUTCKP	auto checkpoint	short	con/set	0	0 to 127
CFGOPT	configuration option	pack_b	no-con/no-set	0	0 to 32767
INHPRT	inhibit printer	boolean	no-con/no-set	0	0 to 1
INITTE	initial timer enable	pack_b	no-con/no-set	21845	0 to 32767
RESOVR	reset overrun	boolean	no-con/set	0	0 to 1
FLBRQ1 to FLBRQ8	fallback request 1 to 8	boolean	con/set	0	0 to 1
RESVL1 to RESVL8	reset value 1 to 8	integer	no-con/no-set	8	8 to 32767 sec
CKPTIM	checkpoint time	string	no-con/no-set	blank	9999-12-31;23:59
OUTPUTS					
STATYP	station type	short	no-con/no-set	0	0 to 12 chars
VERSNO	version number	string	no-con/no-set	blank	0 to 12 chars
BPLD01 to BPLD10	block processor load 01 to 10	real	con/no-set	0.0	%
BPLOAD	block mean load	real	con/no-set	0.0	%
CPLD01 to CPLD10	compound processor load 01 to 10	real	con/no-set	0.0	%
CPLOAD	control processor mean load	real	con/no-set	0.0	%
CUMOVR	cumulative overrun	long	con/no-set	0	0 to 2147483647
DAY	day of month	integer	con/no-set	0	00 to 31
FLBSTA	fallback status	pack_b	con/no-set	0x00	0x00 to 0xff
HOUR	hour of day	integer	con/no-set	00	00 to 23
IDLETM	idle time	real	con/no-set	0	%
IOLOAD	Input/output mean load	real	con/no-set	0.0	%
LODPER	load update period	integer	con/set	5	seconds
LODPHS	load update phase	integer	con/set	0	---
LODSW	load switch	boolean	con/set	0	0 to 1
LODSYN	load synchronize	boolean	con/set	0	0 to 1
MAXMEM	bytes available	long	con/no-set	0	0 to 2147483647

Table 117-1. Station Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
MINUTE	minutes of the hour	integer	con/no-set	00	00 to 59
MONTH	month of year	integer	con/no-set	01	01 to 012
OMLD01 to OMLD12	percent of Object Manager time 1 to 12	real	con/no-set	0	%
OMLDAV	OM load average	real	con/no-set	0	%
OMOVRN	number of OM overruns	long	con/no-set	0	0 to 2147483647
OVRRUN	over run indicator	boolean	con/no-set	0	0 to 1
PIOE1R	number of transmission retries	long	con/no-set	0	0 to 2147483647
PIOEFT	number of fault tolerant errors	long	con/no-set	0	0 to 2147483647
PIOEGB	number of good - bad	long	con/no-set	0	0 to 2147483647
PP_DEL	peer-to-peer deleted	integer	con/no-set	0	0 to 99999999
PP_DSC	peer-to-peer disconnected	integer	con/no-set	0	0 to 99999999
PP_NFD	peer-to-peer not found	integer	con/no-set	0	0 to 99999999
PP_TOT	peer-to-peer total	integer	con/no-set	0	0 to 99999999
SECOND	seconds	integer	no-con/no-set	0	0-59
SQLOAD	percent of sequence block load	real	con/no-set	0	%
STABPC	basic processing cycle (BPC) in seconds	real	con/no-set	0	seconds
TIMSTA	timer status	pack_b	con/no-set	0	0x00 to 0xff
TIMVL1 to TIMVL8	timer value 1 to 8	integer	con/no-set	0	0 to 32767 sec
TLCONS	number of IPC connects	integer	con/no-set	0	0 to 99999999
TOTMEM	total memory	long	con/no-set	0	0 to 2147483647
YEAR	year	integer	con/no-set	0000	0000 to 9999
OPTIONS					
DV1 to DV16	alarm device group 1 to 16 name	string	no-con/no-set	blank	1 to 32 chars
DATA STORES					
ERCODE	config error	string	no-con/no-set	0	1 to 43 chars

117.3.1 Parameter Definitions

AUTCKP Automatic Checkpoint specifies the period of automatic checkpoints in increments of 30 minutes. Zero equals no periodic checkpoint, 0-127 represents up to 63.5 hours (127 x 30 minutes) between checkpoints. The checkpoint option (CKPOPT) parameter must be true to enable automatic checkpoint. It is shown on the Base Display as AUTO CHECKPOINT and is displayed in hours.

The following list of Control Processors, Stations, and Gateways have the periodic checkpoint feature built into them. All other Control Processors, Stations and Gateways ignore the AUTCKP parameter.

OS1C30	Control Processor 30
OS1C30B	Control Processor 30, Style B
OS1C40	Control Processor 40
OS1C40B	Control Processor 40, Style B
OS1C60	Control Processor 60
OS1C80	Control Processor 280 (FCP280)
OS1C70 or OS1FCP	Control Processor 270 (FCP270)
OS1Z70 or OS1ZCP	Z-Module Control Processor270 (ZCP270)
OS1MC1	Micro-I/A Station
OS1AB3	Allen Bradley Integrator 30
OS1AB3B	Allen Bradley Integrator 30, Style B
OS11S3	Interspec Integrator 30
OS11S3B	Interspec Integrator 30, Style B
OS1MG3	Modicon Integrator 30
OS1MG3B	Modicon Integrator 30, Style B
OS1MG4	Mod Bus Plus
OS1MG5	Mod Bus Plus Redundant
OS1FD3	Foreign Device Gateway 30
OS1ACM	FoxGuard Manager

Before the control software initiates a checkpoint operation, it checks to make sure there is no Integrated Control Configurator or ICCAPI driver session active for that station. The periodic checkpoint is performed with the following conditions:

- When not performing any operation in ICC/ICCAPI such as ADD, DELETE or any changes to the database of that station, the checkpoint occurs every specified period of the auto checkpoint option (AUTCKP).
- When performing operations such as ADD, DELETE, or any changes to the database of that station, the Auto Checkpoint option skips or does not perform its function for just that specified period or the auto checkpoint option and the Auto Checkpoint function occurs for the next period from the time of the last performed operation to the database.

If an attempt is made to open a session via Integrated Control Configurator or ICCAPI driver while a periodic checkpoint operation is being performed, the control software returns the following message:

```
E33 - DATABASE OPERATION IN PROGRESS
```

BPLD01-10 Block Processing Load 1 to 10 are real values that represent 10 consecutive phase executions of the Compound Processor (BPLD01 is the oldest value). They are shown on the Control Loading Overlay as 10 bars/values in the TOTAL CONTROL CYCLE (% Of BPC) box. The values are elapsed time for the total control cycle expressed as a percentage of the station BPC. This includes Fieldbus or I/O scanning, Continuous block execution, and Sequence block execution. When LODSYN is INACTIVE, the 10 values then represent the last 10 Compound Processor cycles.

BPLOAD Block Processing Load is a real value that represents the percent of BPC time used for executing all continuous blocks. It is shown on the Base Display LOADING SUMMARY (% OF BPC) as CONT BLKS.

CFGOPT Configuration Option is a packed boolean with the following options:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1]	Definition	Boolean Connection (B32 to B1)
12	Sets a CP270 to update its Object Manager (OM) change-driven list every 200 milliseconds (msec). In order for an OM list to be scanned every 200 msec, the following conditions must be met: 1. OM Scanner must be running at 100 msec cycle. 2. The list's SET_FAST_SCAN bit must be set to “1” (refer to *Object Manager Calls* (B0193BC, Rev. M or later)). 3. CFGOPT.B20 (bit 12) of the STATION block must be set to 1. This does not apply to the FCP280, or CP60 or earlier CPs.	CFGOPT.B20

Bit Number[1]	Definition	Boolean Connection (B32 to B1)
11	Abort Alarm Group 0 messages: 0 = Off (do not let alarms be aborted) 1 = On (enable alarms to be aborted) This bit allows you to specify specific alarms to be detected without creating alarm messages by setting the relevant alarm group parameter to 0. For example, if BAG= 0 and BAO=1 in an AIN block, Bad Alarm detection will be performed but the Bad Alarm message will be aborted.	CFGOPT.B21
10	Prevents database install operations from using the last 400K of memory. NOTE: This bit is **not** used for the FCP280. The functionality is always enabled on the FCP280 processor. Detail displays for a FCP280 station block will always show the text “MEMORY SELF PRESERVATION DISABLE”, even though the functionality is enabled. It is safe to ignore any messages about memory self-preservation for the FCP280.	CFGOPT.B22
9	Enhanced math checking 0 = Disabled 1 = Enabled This bit enables Sequence block code to halt sequence execution with mathematical “operator exception” on divide by zero and “MOD” by zero operations. With this bit set to zero (disabled), the default behavior is to continue with a forced zero value when dividing or MODing by zero.	CFGOPT.B23

Bit Number[1]	Definition	Boolean Connection (B32 to B1)
8	For CPs which support self-hosting, such as the FCP280, FCP270 and ZCP270: 0 (CFGOPT=0x00XX) = Disable Self-hosting (default) 1 (CFGOPT=0x01XX) = Enable Self-hosting	CFGOPT.B24
6	Re-alarm message with original timestamp option. 0 = Use new timestamp in re-alarm messages (default) 1= Use original timestamp in re-alarm messages in the following cases: ♦ When an alarm priority is changed, but only if CFGOPT bit 3 is also set. ♦ When the re-alarm timer (AMRTIN) expires.	CFGOPT.B26
5	Message Management option. 0 = Send messages and alarms directly from the control station to the workstation's Alarm Management subsystem (default). 1 = Send messages and alarms through the Message Management subsystem	CFGOPT.B27
4	FOUNDATION fieldbus block option. If set to 1, FOUNDATION fieldbus blocks are set to OOS when the compound is turned off.	CFGOPT.B28
3	Alarm Regeneration option. 0 = No action 1 = A new unacknowledged alarm condition is generated with an associated alarm message whenever an alarm's priority (PRTYPE) changes to a higher priority. The block does not realarm if the priority is set to a lower priority.	CFGOPT.B29

Bit Number[1]	Definition	Boolean Connection (B32 to B1)
2	Alarm Criticality Unacknowledged option. 0 = CRIT/PRTYP indicates the highest priority alarm (normal default logic). 1 = CRIT/PRTYP indicates the highest priority Unacknowledged alarm (that is, unacknowledged alarms are higher than CRIT)	CFGOPT.B30
1	Sequence Batch message option. 0 = No action 1 = A return-to-normal message will be generated when the sequence logic unsuspends from a SEND_CONFIRM message.	CFGOPT.B31
0	On-Line Configuration option. 0 = No action 1 = A compound must be turned off to allow any block in that compound to be re-configured.	CFGOPT.B32

1. Bit 0 is the least significant, low order bit.

CKPOPT

Checkpoint Option is a string input that specifies:

0 = Disable periodic checkpoint (default)

1 = Enable periodic checkpoint, disable modification of checkpoint frequency from station block display.

2 = Enable periodic checkpoint, and allow modification of the checkpoint frequency from the station block display.

CKPTIM	Checkpoint Time represents the time and date, in the format: year-month-day;hours:minutes:seconds, that the last checkpoint was initiated. CKPTIM is updated in the station block during a checkpoint operation immediately prior to uploading the snapshot of the STATION block into the checkpoint file. CKPTIM: YYYY-MM-DD hh:mm:ss (19 characters) Where: YYYY = 4-digit year (1998 to YYYY) MM = 2-digit month of year (01 to 012) DD = 2-digit day of month (01 to 031) hh = 2-digit hour of day (00 to 23) mm= 2-digit minute of hour (00 to 59) ss = 2-digit second of minute (00 to 59)
CPLD01-10	Control Processor Load 1-10 are real values that represent 10 consecutive phase executions of the Compound Processor (CPLD01 is the oldest value). They are shown on the Control Loading Overlay as 10 bars/values in the CONTINUOUS BLOCK LOAD (% Of BPC) box. The values are elapsed time for just the Continuous block execution expressed as a percentage of the station BPC. When LODSYN is INACTIVE, the 10 bars then represent the last 10 Compound Processor cycles.
CPLOAD	Control Processor Load is a real value that represents the percent of BPC time used for collecting data from FBMs or I/O load and executing Continuous and Sequence blocks, that is: IOLOAD + BPLOAD + SQLOAD = CPLOAD It is shown on the Base Display LOADING SUMMARY (% of BPC) box as the TOTAL CONTROL CYCLE
CUMOVR	Cumulative Over Run is a long value represents the value of the overrun counter which is incremented when an overrun cycle is detected. CUMOVR is available as an output of the Station block. You reset the CUMOVR counter by setting the block’s momentary input parameter, RESOVR, to true. The overrun counter is shown on the Control Loading Overlay in the OVERRUNS box.
DAY	Day is an integer in the range 01-031 (example: the 12th day of the month is integer value 12). DAY is updated by the station block software every 30 seconds.
DESCRP	Descriptor is a user-defined string of up to 32-character that describe the block's function (for example, “STATION HEATER CONTROL”).
DV1-16	Device 1-16 are 32 character strings of user defined alarm device names for station alarm groups.

ERCODE

For the Station block, ERCODE provides no validation messages and returns only zero (0).

There are only two conditions for which checks for incorrect usage of Station blocks are performed.

- if a request is made to delete a Station block. Station blocks cannot be deleted.
- if a request is made to add the Station block to a user-created compound. Station blocks cannot be added to these compounds.

The CP performs both checks. If either operation is requested, the CP returns (ERCODE 5). Typically, this is not shown in the developer's configurator (ICC, IACC, ICCAPI or IEE). Either the configurator will perform an internal check and reject the operation through a pop-up warning, or the CP itself will deny the operation when directly requested and the configurator will inform the user of this.

For example, in IEE, the Station compound, Station block, ECB compound and Primary ECB cannot be undeployed, or changed to another compound. A developer must undeploy the CP first, which undeploys these blocks and compounds.

FLBRQ1-8

Fallback Request 1-8 (FLBRQ1-8) is an explicit request for an SSC Group n to go to the Fallback state. Fallback Request is shown on the Supervisory Group Display as FALLBACK REQUEST 1-8.

FLBSTA

Fallback Status contains the Fallback status of each of the supervisory groups.

Bits 1-8: Fallback States for groups 1-8

(1= Fallback, 0= not Fallback)

Fallback Status is shown on the Supervisory Group Display as FALLBACK STATUS 1-8.

HOUR

Hour of the Day is an integer in the range 00-23 (example: Midnight is integer value 00, 1:00 AM is integer value 01, 11:00 PM is integer value 23). HOUR is updated by the station block software every 30 seconds.

IDLETM

Idle Time is a real value that represents the percent of BPC time that the station is executing an idle loop. It is shown on the Base Display LOADING SUMMARY (% of BPC) box as the STATION IDLE TIME.

INHPRT

Inhibit print is a boolean input which when true inhibits the printing of system messages from the station.

INITTE

Initial Timer Enable specifies the initial states of Supervisory Control group timers when the CP is rebooted.

Bits 1-2:	Timer #1 Enable/Disable (0 = Disable, 1 = Enable, 2 = leave alone)

Bits 3-4:	Timer #2 Enable/Disable
:	:
Bits 15-16:	Timer #8 Enable/Disable

INITTE is shown on the Supervisory Group Display as TIMERS ENABLE DISABLE.

IOLOAD

Input/Output Load is a real value that represents the percent of BPC time used for collecting data from Fieldbus Modules (FBMs), Fieldbus Processors (FBPs), Fieldbus interface units for intelligent field devices, Integrators, or Gateway device interface units. This is mostly time spent by the coprocessor communicating with FBMs or the device. It is shown on the Base Display LOADING SUMMARY (% of BPC) box as the FIELDBUS SCAN or I/O LOAD.

LODSYN

Load Synchronization is a boolean output that represents the state of data collection as follows:

- When LODSYN is true and DATA COLLECTION is ACTIVE, data collection is done on a scheduled basis in accordance with the specified LODPER, starting at the phase number specified in LODPHS. When LODSYN is true, the value in both the BPLD01 and CPLD01 is the load from the phase defined by the LODPHS number.
- When LODSYN is false, data collection is done on a continuous basis in accordance with the default LODPER, starting at the current execution phase.

LDSYN is shown on the Control Loading Overlay in the PHASE SYNC CNTRL box and can be toggled between the ACTIVE and INACTIVE states.

LODPER

Load Period is an integer that represents the frequency at which the Station block collects loading data for ten consecutive BPC frames. The default value is 10*BPC. The valid range of LODPER is 5 seconds to 1 hour.

LODPER represents the period of data collection for the BPLD01-10 and the CPLD01-10 parameters. If the station BPC is 0.5 seconds and the LODPER is 5.0 seconds, then BPLD01-10 and CPLD01-10 parameters will represent all scans of the Compound Processor. If the LODPER is 10.0 seconds, then BPLD01-10 and the CPLD01-10 represent 10 of the 20 phases beginning with the phase defined in LODPHS. LDPER is shown on the Control Loading Overlay in the PHASE SYNC CNTRL box as a value ranging between 5 seconds to 1 hour.

LODPHS

Load Phase is an integer that represents the phase of the BPLD01-10 and the CPLD01-10 parameters. LODPHS is shown on the Control Loading Overlay in the PHASE SYNC CNTRL box as an integer value.

LOADSW	Load Switch is a boolean output that when true indicates the station performance data collection and station loading updates are being collected and displayed. LOADSW is shown on the Base Display as DATA COLLECTION ACTIVE or INACTIVE.
MAXMEM	In the FCP280, FCP270, or ZCP270 with images from I/A Series software v8.4.3 or later, Maximum Memory (MAXMEM) is a long output that provides an indication of memory fragmentation in the CP and shows the largest continuous area of memory available to applications. It shows (in most cases) 64000 which is larger than any block requirement. As a FCP280, FCP270, or ZCP270 becomes fragmented this number may start to decrement in 1K intervals showing that the memory has no larger spaces available. As it becomes lower, large memory requirements (such as sequence blocks which can require over 32K) may start to not function properly (i.e. an installation may fail). If the fragmentation cause is removed, the number may increase back to the 64000 maximum. For more information on memory preservation in these CPs, refer to “Memory Preservation Bit Configuration” in *Foxboro Control Software Control Database Deployment User's Guide* (B0750AJ). In legacy control processors (CP30, CP40a, CP40b, and CP60), MAXMEM represents the sum of all free-memory segments of user memory in the control processor. It represents the largest contiguous segment of memory within the user free pool. MAXMEM is shown on the Control Loading overlay in the STATION FREE MEMORY box as LARGEST SEG in bytes.
MINUTE	Minute of the Hour is an integer in the range 00-59 (example: 12 minutes past the hour is integer value 12).
MONTH	Month is an integer in the range 01-012 (example: February is integer value 02). MONTH is updated by the station block software every 30 seconds.
NAME	Name is a user-defined string of up to 12 characters used to access the station block and its parameters.
OMLD01 - 12	Object Manager Load 1 -12 are 12 real values that represent the last 12 scans of the Object Manager Scanner (OMLD01 is the oldest value). The values are elapsed time for OM scanning as a percentage of the station BPC. The values can change significantly between scans if Compound Processor scans interrupt the Object Manager scans on some cycles but not other cycles. They are shown on the OM Scanner Loading Overlay as 12 bars/values in the OBJECT MANAGER SCANNER DATA (% Of BPC) box.
OMLDAV	Object Manager Load Average is a real value that represents the percent of BPC time used for scanning Object Manager data. This value is the average load of the past 12 OM Scanner scans. The value is shown on the Base Display LOADING SUMMARY (% of BPC) box as the OM SCAN.

OMOVRN

Object Manager Over Run is a long that represents the number of times the OM Scanner task has overrun since the station was rebooted or the counter was reset. OM Scanner overruns can occur in the following cases:

- ♦ Communications to a station are disconnected. This typically manifests itself by OM Scanner overruns occurring at one minute intervals.
- ♦ A large number of simultaneous display requests from multiple WPs.
- ♦ Simple overload of the OM Scanner task by attempting to connect to many other stations at the current station BPC. This can be corrected by reducing the number of stations receiving data from this CP or by reducing the number of concurrent applications.
- ♦ Block processing overload does not leave enough time for the OM Scanner to complete processing.
- ♦ Overload of the OM Scanner by Sequence Logic that contains too many full pathname references.

OMOVRN is shown on the OM Scanner Loading Overlay in the OM SCANNER OVERRUNS.

OVRRUN

OVRRUN is an output parameter that is set to true (or false) each cycle to indicate when the control processor task does (or does not) overrun.

PIOE1R

Process I/O Errors Retry is the total number of retries that have occurred when transmitting messages over the Fieldbus.

PIOEFT

Process I/O Fault-Tolerant Errors is the total number of errors for a fault-tolerant station that have occurred when transmitting messages over the Fieldbus.

PIOEGB

Process I/O Good-Bad Errors is the number of total number of good - bad station block errors that have occurred during the transmission of messages over the Fieldbus.

PP_DEL

Peer-to-Peer Deleted is an integer that represents the current number of peer-to-peer connections whose source blocks or compounds have been deleted via the Integrated Control Configurator. This is normally a transient state that lasts between the time that the remote block was deleted and the “checkpoint” completing on that remote CP station. PP_DEL is shown on the Control Loading overlay in the SINK PEER TO PEER STATUS box as POINTS DELETED.

Deleted connection errors (PP-DEL) are temporary. When a station is checkpointed following the deletion of any of its control blocks, the status of any peer-to-peer sink connections to these blocks in other stations are changed from Deleted to Not_Found, and the station updates the PP_NFD and PP_DEL error counters accordingly. The station software updates PP_NFD, PP_DEL, and PP_DSC every two minutes.

PP_DSC	Peer-to-Peer Disconnected is an integer that represents the current number of peer-to-peer connections that have been disconnected due to a loss of peer-to-peer communications with the source station. These errors can occur temporarily when a station is rebooted until its connections are made with the source stations. Permanent errors of this type occur when a source station fails. These errors clear automatically when peer-to-peer communications are reestablished with the source station. PP_DSC is shown on the Control Loading overlay in the SINK PEER TO PEER STATUS box as POINTS DISCONNECTED. The station software updates PP_NFD, PP_DEL, and PP_DSC every two minutes.
PP_NFD	Peer-to-Peer Not Found is an integer that represents the current number of peer-to-peer connections that have never been located on the system. These errors can occur temporarily when a station is rebooted until its connections are made with the source stations. Permanent errors of this type indicate the inability to locate the source parameter in any station in the network. These errors occur if the source station is not running, or if the source parameter does not exist. PP_NFD is shown on the Control Loading overlay in the SINK PEER STATUS box as POINTS NOT FOUND. The station software updates PP_NFD, PP_DEL, and PP_DSC every two minutes.
PP_TOT	Peer-to-Peer Total points represents the current number of peer-to-peer control block input connections configured in the control data base. If 20 blocks each have a remote reference to REM_COMPOUND:PID.OUT, there is only 1 remote inter-block linkage that is counted in the PP_TOT parameter. PP_TOT is shown on the Control Loading overlay in the SINK PEER STATUS box as TOTAL POINTS.
RESOVR	Reset Over Run (RESOVR) resets the Cumulative Over Run (CUMOVR) counter when set to true (1).
RESVL1-8	Reset value n (RESVL1-8) is the value used to reset the timer that detects the failure of SSC over blocks assigned to group n. Reset value is shown on the Supervisory Group Display as RESET VALUE 1-8.
SECOND	Second is a non-configurable, non-settable integer that contains the number of seconds in the Time-of-Day in an FCP280, FCP270, or ZCP270. It is part of a family of parameters (YEAR, MONTH, DAY, HOUR, MINUTE, and SECOND) updated once/second, or at the BPC if the BPC > 1 second, from the station clock maintained in an FCP280, FCP270, or ZCP270. Its range is 0-59.
STABPC	Station Basic Processing Cycle is a real value that represents the station's BPC in seconds. The value is shown on the Base Display as the STATION BPC.
STATYP	Station type is a short data type which identifies the station type.

SQLOAD	Sequence Load is a real value that represents the percent of BPC time used for executing all Sequence blocks. The value is shown on the Base Display LOADING SUMMARY (% of BPC) box as SEQ BLKS.
TIMSTA	Timer Status (TIMSTA) contains the timers associated with each of the supervisory groups. Bits 0-7: Expired States for Timers 1-8 (1= Expired, 0= Not Expired) Bits 8-15: Active States for Timers 1-8 (1= Active, 0= Inactive) Fallback Status is shown on the Supervisory Group Display as FALLBACK STATUS 1-8.
TIMVL1-8	Timer 1-8 (TIMVL1-8) is the current running value of the timer used to detect the failure of SSC over blocks assigned to supervisory group 1-8. Fallback Status is shown on the Supervisory Group Display as FALLBACK STATUS 1-8.
TLCONS	Total Connections is an integer that represents the total Inter-Process Communications (IPC) connections among applications running in the workstation. TLCONS is shown on the OM Scanner Loading Overlay as TOTAL INTER-STATION IPC CONNECTIONS.
TOTMEM	Total Memory is a long output parameter, that indicates the number of bytes of dynamic free memory available for the control database. The station updates this value a minimum of every thirty seconds. The value is shown on the Base Display in the STATION FREE MEMORY as TOTAL FREE in bytes.
TYPE	When you enter “STA” or select “STA” from the block type list under Show, an identifying integer is created specifying this block type.
VERSNO	Software Version Number is the number of the installed I/A Series software. It is shown on the Base Display as SOFT VERS.
YEAR	Year is an integer in the range 0000-9999 (example: 1998 is integer value 1998). YEAR is updated by the station block software every 30 seconds.

117.4 Station Block Rules

A Station compound containing one Station block is installed in a station automatically when a station’s database is downloaded, even in an “empty” database. This block provides global data storage for station system functions.

Each Station compound and block has a unique name in any I/A Series network, determined by embedding the station letterbug in the compound name as follows:

- Compound name is: letterbug_STA
- Block name is: STATION

- Full pathname is: letterbug_STA:STATION.

The Station compound and block have the following restrictions:

- The compound cannot be deleted or turned off.
- The block cannot be deleted.
- User-created blocks cannot be added to the compound.
- The compound is not run periodically by the Control Processor Task (CPT).

117.5 Station Block Functions

Station block detail displays consist of a basic Station Load Overview display and selectable overlays. The Station block detail displays for a station consist of a:

- Station Load Overview.
- Station Load Overview with Control Loading Overlay.
- Station Load Overview with Object Manager (OM) Scanner Loading Overlay.
- Station Load Overview with Group Assignments Overlay.
- Station Load Overview with Supervisory Groups Overlay (for Supervisory Setpoint Control)

117.5.1 Station Load Overview

The Station block, when enabled by you, performs several dynamic processor loading calculations. The first is the I/O scan load. The second calculation is for the loading for continuous block processing. The third calculation is for sequence processing. Processor load is the total control block load, that is, the load value for continuous blocks, sequence blocks, and I/O. When the station initializes, the load calculation switch is automatically set to false and remains in that state under normal operation. You enable (or disable) the loading calculations at the Station block display by toggling the ACTIVE pick.

You may synchronize the calculations to start at a specified phase number, LODPHS, or to start at the current phase. You request synchronization, at the block display, by setting the LODSYN input to true.

The Station Load Overview display (see Figure 117-2) includes these parts:

- Title box
- Loading box
- Sink peer to peer status box
- Station free memory box
- Checkpoint fields
- Options
- Soft keys (at bottom of display).

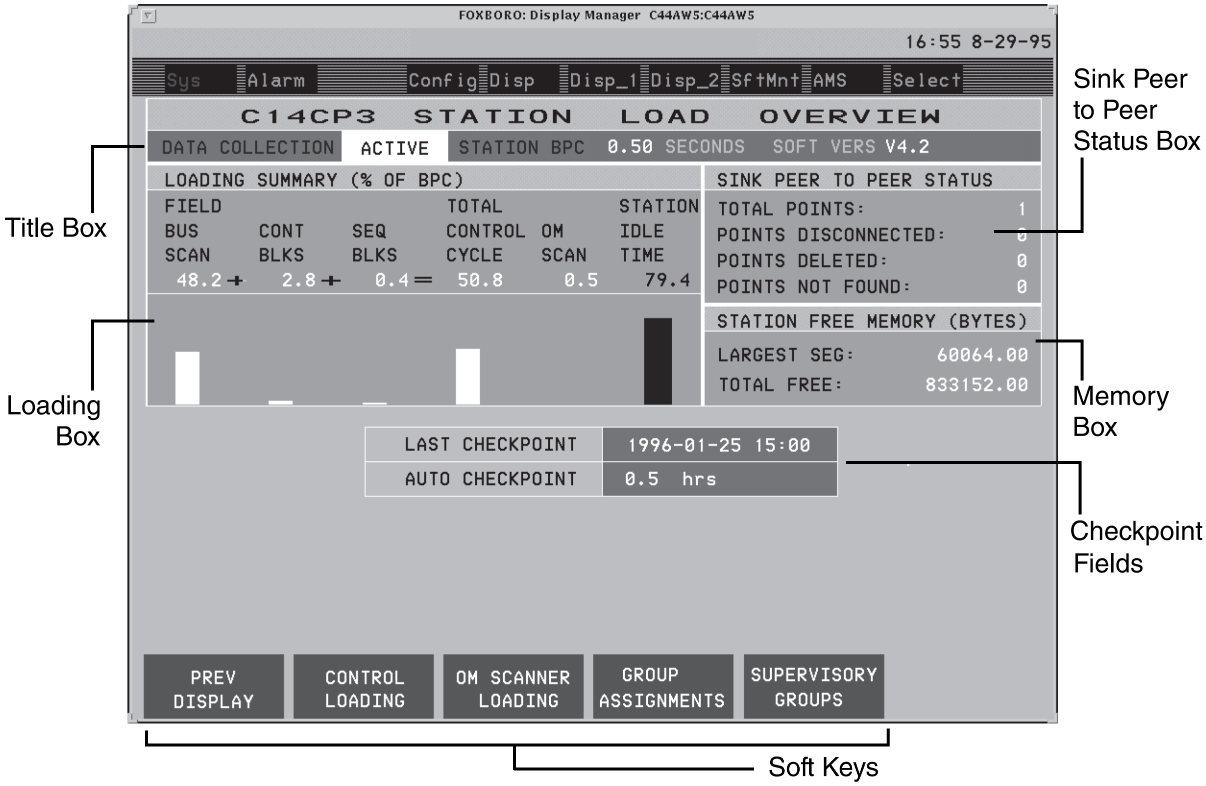


Figure 117-2. Station Load Overview for Station Block Detail Display

117.5.1.1 Title Box

The Station Load Overview title box contains these items:

DATA COLLECTION status box	Toggles the status between **ACTIVE** and **INACTIVE**. Selecting the box enables or disables station performance data collection and station loading updates.
STATION BPC	Displays the Configured Basic Processing Cycle (BPC) for the station, that is, the period for which the Compound Processor executes blocks. The BPC is set during system configuration.
SOFT VERS	Displays the software version number for the I/A Series software.

117.5.1.2 Loading Summary (% Of BPC) Box

The Station Load Overview Loading Summary box contains these fields:

FIELD BUS SCAN or I/O LOAD	Percent (%) of BPC time used for collecting data from Fieldbus modules (FBMs), Fieldbus Processors (FBPs), Fieldbus interface units for intelligent field devices, Integrators, Gateways, Control stations, and device interface units. This is mostly time spent by the Fieldbus coprocessor communicating with FBMs or devices. For Gateways, Integrators and Control Stations the field is labeled I/O LOAD.
CONT BLKS	Percent (%) of BPC time used for executing all Continuous blocks.
SEQ BLKS	Percent (%) of BPC time used for executing all Sequence blocks.
TOTAL CONTROL CYCLE	Percent (%) of BPC time used for collecting data from FBMs or devices and executing Continuous and Sequence blocks, that is: FIELD BUS SCAN + CONT BLKS + SEQ BLKS = TOTAL CONTROL CYCLE
OM SCAN	Percent (%) of BPC time used for scanning Object Manager data. This value is the average load of the past 12 OM Scanner scans.
STATION IDLE TIME	Percent (%) of BPC time that the station is executing an idle loop.

NOTE

(**For Solaris**):
1. The OM SCAN and STATION IDLE TIME fields are not displayed for the CP10 and Gateways because of memory constraints.
2. The loading summary values may not be exact because the algorithms use averaging methods.

117.5.1.3 Sink Peer To Peer Status Box

NOTE

(**Windows NT**): This selection does not apply to stand-alone stations but is presented here because some systems show this data as a result of Interprocess Communications.

The Station Load Overview Sink Peer to Peer Status box presents data about points being collected into this station by the Object Manager to satisfy the station database's remote inter-block linkages. This box does not supply any data about peer-to-peer data that this station is sending to other stations. This box contains the following fields:

TOTAL POINTS	The total number of unique remote inter-block linkages that exist within this station's database. If 20 blocks each have a remote reference to REM_COMPOUND:PID.OUT, there is only 1 remote inter-block linkage that is counted in the TOTAL POINTS field.

POINTS DISCONNECTED	Represents the number of points that were connected at one time, but are currently disconnected. It may indicate failure or reboot of the source station or failure of an intermediate LAN Interface.
POINTS DELETED	Represents the number of points that were connected, but have had the remote source of data deleted from the remote station. This is normally a transient state that lasts between the time that the remote block was deleted and the "checkpoint" completing on that remote station.
POINTS NOT FOUND	Represents the number of points that have never been located on the system. This occurs while multiple stations are being loaded via the "LOADALL" process. Another common cause for this counter being greater than 0 is a typographical error in the Compound:Block.Parameter name or source block not yet built.

117.5.1.4 Free Memory (Bytes) Box

The Station Load Overview Free Memory box contains these fields:

LARGEST SEG	Represents the largest contiguous segment of memory within the user free pool. This value is available on all control processors except the CP10's and gateways. The largest objects that ever exist within the user memory are 32 767 bytes (Sequence blocks). The largest OM lists are approximately 16 000 bytes. **`LARGEST SEG` must be greater than the object you are trying to create.** If `LARGEST SEG` does not show enough space, reduce the memory usage. Sequence blocks with large arrays or much code can be a problem. You can also improve usage by moving control blocks to a different station, making more but smaller OM lists, closing user graphics, or shutting down applications (for example, the Historian)
TOTAL FREE	Represents the sum of all free-memory segments of user memory. Reduce memory usage if this value is less than: ♦ 30 000 for a CP10 or gateway ♦ 250 000 for a CP30 or integrator ♦ 300 000 for a CP40 ♦ 600 000 for a CP60 or later control processor.

— NOTE

(**For Solaris**): The LARGEST SEG field is not displayed for the CP10 and Gateways because of memory constraints.

117.5.1.5 Checkpoint Fields

The Station Load Overview include these checkpoint fields:

LAST CHECKPOINT	Represents the time and date, in the format: year-month-day;hours:minutes, that the last checkpoint was initiated.

AUTO CHECKPOINT	Specifies the period of automatic checkpoints in increments of 30 minutes. Zero equals no periodic checkpoint, 1-127 represents up to 63.5 hours (127 x 30 minutes) between checkpoints. The increment of time is specified by the AUTCKP parameter in the station block via ICC. The checkpoint option (CKPOPT) parameter must be true to enable automatic checkpoint.

The following list of Control Stations and Gateways have the periodic checkpoint feature built into them. All other Control Stations and Gateways ignore the AUTCKP parameter.

OMC	Open Module Control; Micro I/A Control Station.
OS1C30	Control Processor 30
OS1C3B	Control Processor 30, Style B
OS1C40	Control Processor 40
OS1C4B	Control Processor 40, Style B
OS1C60	Control Processor 60
OS1AB3	Allen Bradley Integrator 30
OS1AB3**B**	Allen Bradley Integrator 30, Style B
OS1IS3	Interspec Integrator 30
OS1IS3**B**	Interspec Integrator 30, Style B
OS1MG3	Modicon Integrator 30
OS1MG3B	Modicon Integrator 30, Style B
OS1MG4	Mod Bus Plus
OS1MG5	Mod Bus Plus Redundant
OS1FD3	Foreign Device Gateway 30
OS1ACM	FoxGuard Manager

Before the control software initiates a checkpoint operation, it checks to make sure there is no Integrated Control Configurator or ICCAPI driver session active for that station. if one is, the periodic checkpoint is skipped until the next scheduled time.

If an attempt is made to open a session via Integrated Control Configurator or ICCAPI driver while a periodic checkpoint operation is being performed, the control software will return the following message:

```
E33 - DATABASE OPERATION IN PROGRESS
```

117.5.1.6 Options Box

The Station Load Options box lists the CFGOPT options enabled for the control processor, such as self-hosting, as well as other status messages. Non-enabled messages are grayed out. Messages vary depending on the type of control processor and software revision.

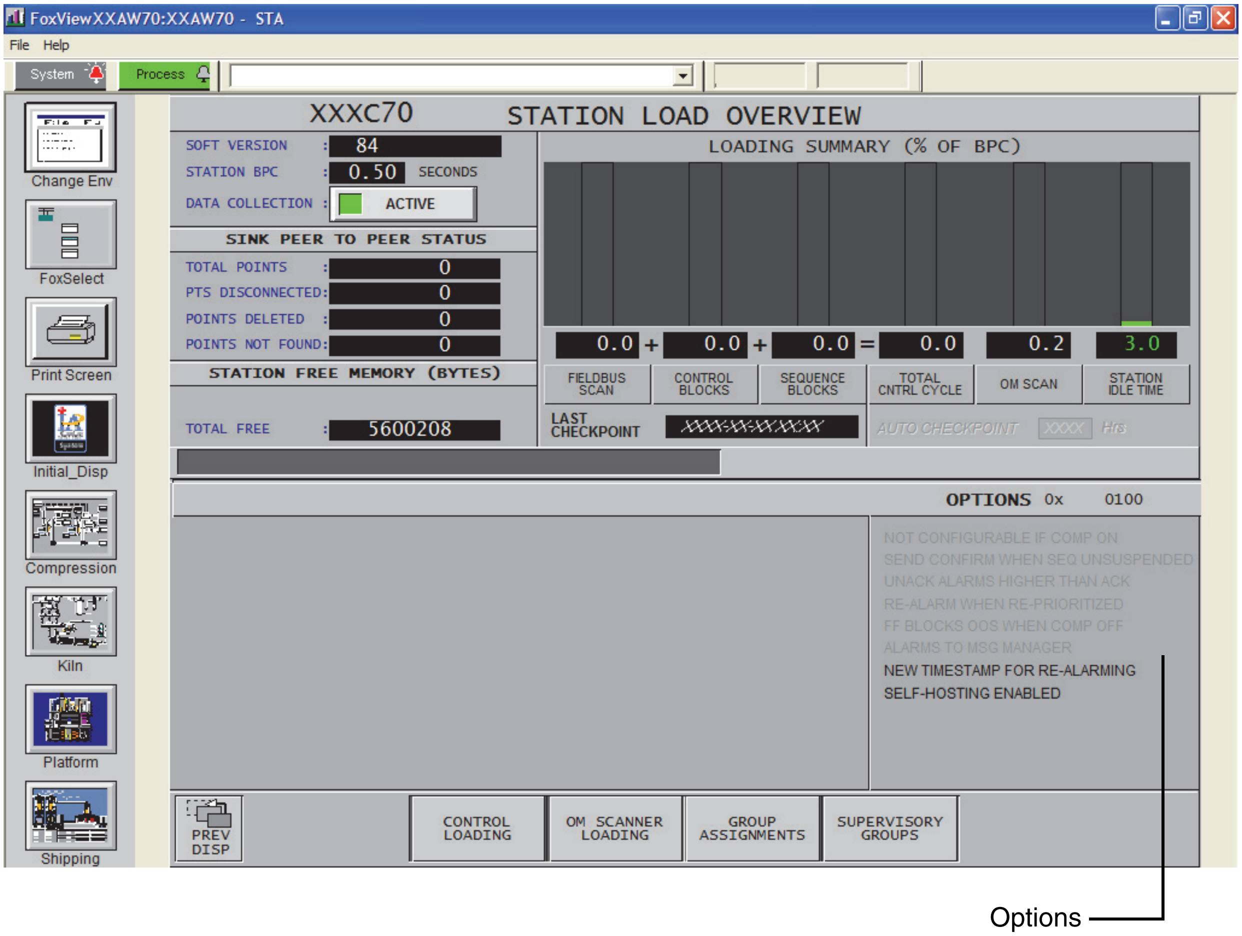


Figure 117-3. Station Load Options (Display from FoxView Application Shown)

117.5.1.7 Soft Keys

The Station Load Overview and overlays include these soft keys at the bottom of the display:

CONTROL LOADING	Displays the Control Loading overlay on the lower half of the screen.
OM SCANNER LOADING	Displays the OM Scanner overlay on the lower half of the screen.
GROUP ASSIGNMENTS	Displays the Group Device Assignments overlay on the lower half of the screen.
SUPERVISORY GROUPS (Solaris)	Displays the Supervisory Setpoint Control (SSC) overlay on the lower half of the screen.
PREV DISPLAY	Previous Display returns you to the previously displayed screen.

NOTE

(**For Solaris**): The OM SCANNER LOADING key does not display on base displays for CP10s or Gateways.

117.5.2 Control Loading Overlay

The Control Loading overlay (see Figure 117-4) includes the following parts:

- Overruns box
- Phase Sync Control box
- Total Control Cycle (% of BPC) box
- Continuous Block Load (% of BPC) box

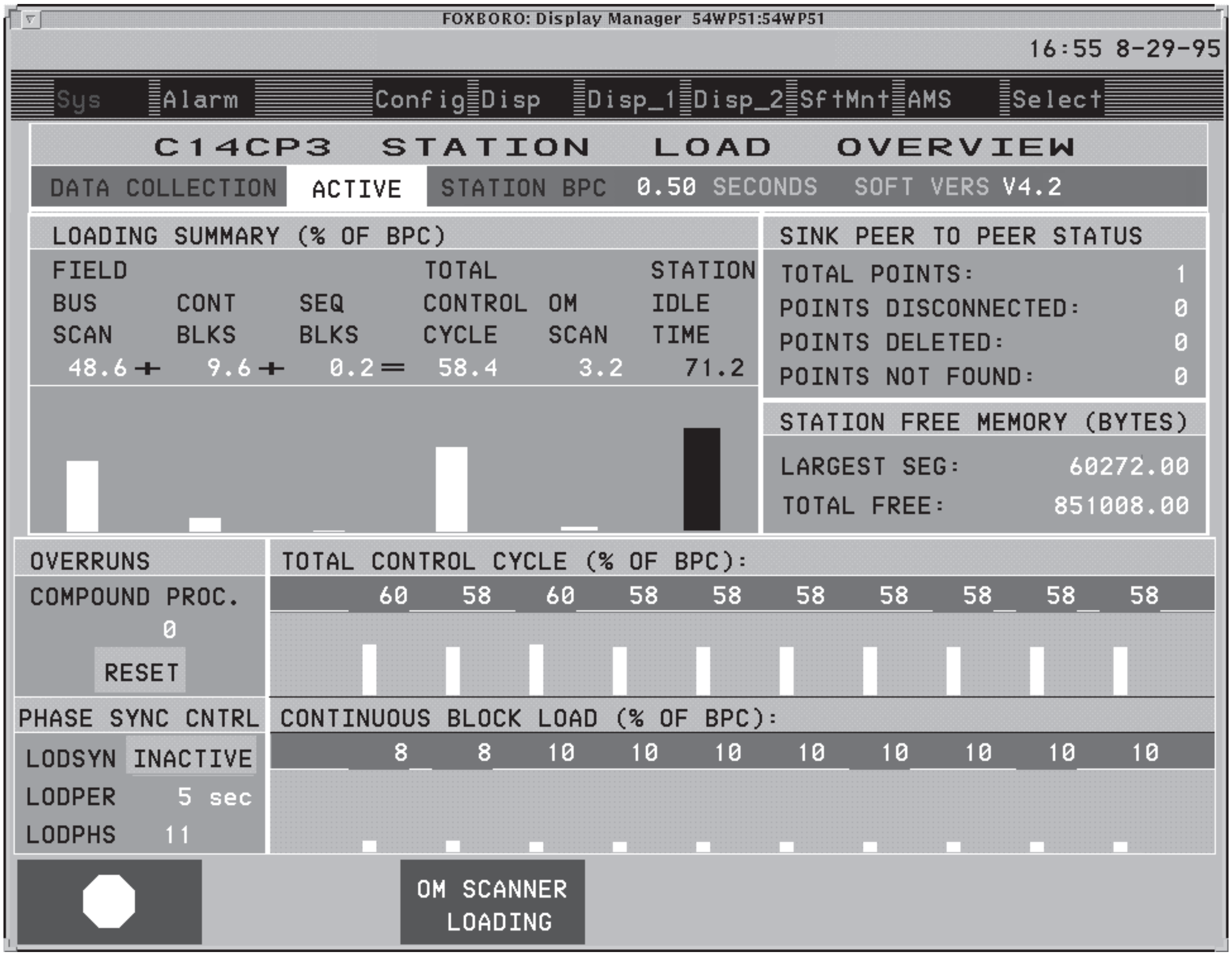


Figure 117-4. Station Load Overview with Control Loading Overlay

117.5.2.1 Overruns Box

The OVERRUNS box contains these items:

RESET	This soft key sets the overruns counter to 0
COMPOUND PROC	Represents the number of times the Compound Processor task has overrun since the station was rebooted or the counter was reset. *Windows NT*—refer to sizing guidelines for details.

117.5.2.2 Phase Sync Control Box

Normally, the TOTAL CONTROL CYCLE and CONTINUOUS BLOCK LOAD boxes represent data collected over the past 10 Compound Processor scans. The PHASE SYNC CNTRL box allows you to lock the data collection onto a fixed set of phases.

The PHASE SYNC CNTRL box contains these *selectable* fields:

LODSYN	A status box that can be toggled to `ACTIVE` to lock data collection onto the Phase defined by the `LODPHS` entry. To toggle the box, select it.
LODPER	Field that specifies the frequency at which the Station block collects loading data for ten consecutive BPC frames. The default value is 10*BPC. The valid range of `LODPER` is 5 seconds to 1 hour.
LODPHS	Updating field that defines the Phase that is shown in the first (left-most) bars of the `TOTAL CONTROL CYCLE` box and `CONTINUOUS BLOCK LOAD` box.

When `LODSYN` is toggled to `ACTIVE` while data collection is active, data collection is performed on a scheduled basis in accordance with the specified `LODPER`, starting at the phase number specified in `LODPHS` (see Figure 117-5).

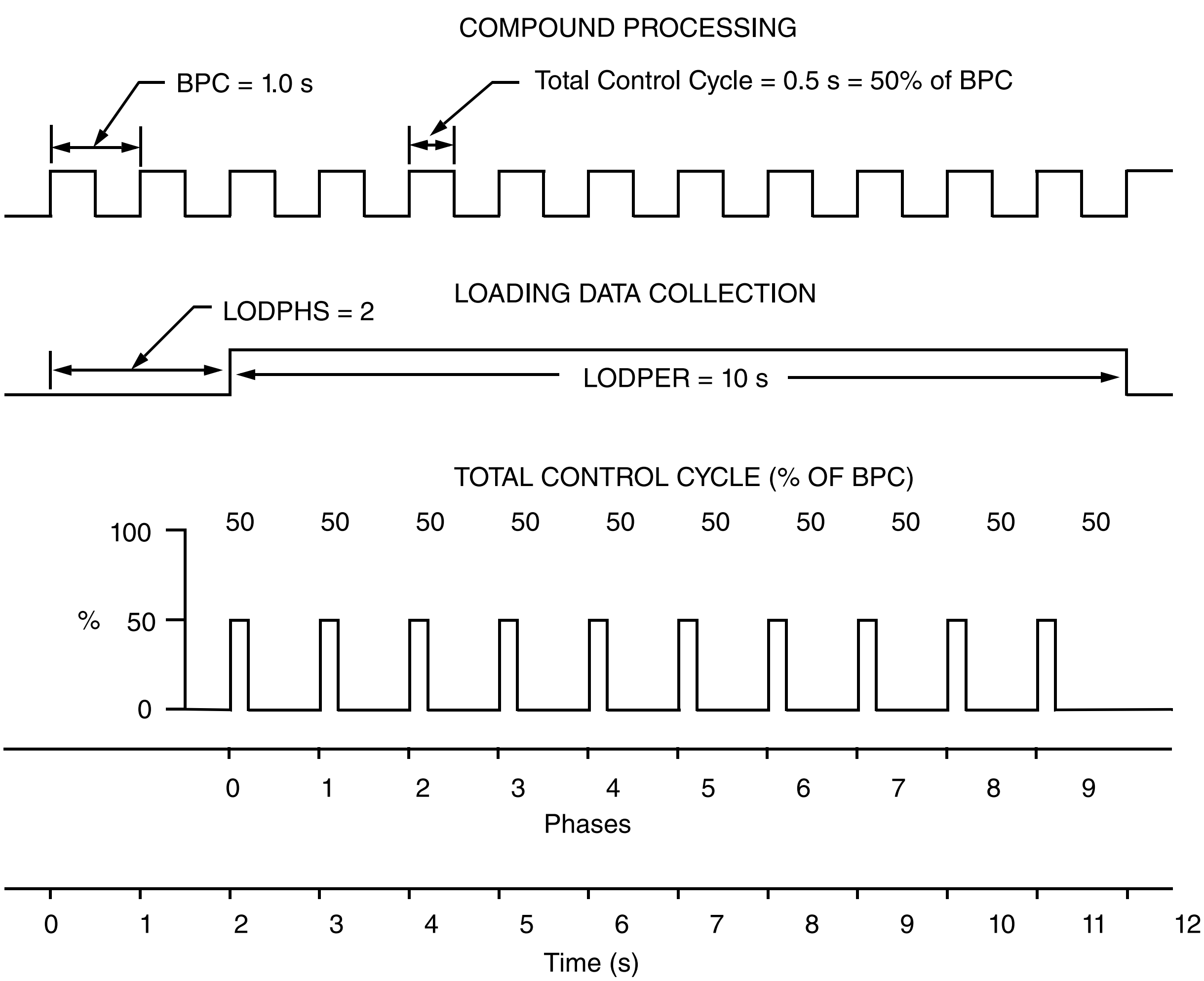


Figure 117-5. Control Loading Data Collection Phasing

LODSYN defines whether data collection is synchronized onto a particular Phase. Toggling LODSYN to ACTIVE while DATA COLLECTION is ACTIVE locks data collection onto the Phase defined by the LODPHS entry. When LODSYN is ACTIVE, the first column in both the TOTAL CONTROL CYCLE box and the CONTINUOUS BLOCK LOAD box is the load from the Phase defined by the LODPHS number.

When LODSYN is toggled to INACTIVE, data collection is performed on a continuous basis in accordance with the default LODPER, starting at the current execution phase.

LODPER represents the period of data collection for the TOTAL CONTROL CYCLE and CONTINUOUS BLOCK LOAD boxes. If the station BPC is 0.5 seconds and the LODPER is 5.0 seconds, the 10 bars in the loading boxes represent all scans of the Compound Processor. If the LODPER is 10.0 seconds, the 10 bars in the loading boxes represent 10 of the 20 phases beginning with the Phase defined in LODPHS.

LODPHS defines the Phase that is shown in the first (left-most) bars of the TOTAL CONTROL CYCLE and CONTINUOUS BLOCK LOAD boxes.

The resolution for loading calculations is as follows:

Resolution = 10 / BPC

where: BPC is in milliseconds.

For example, if BPC = 0.5 s or 500 ms, then:

Resolution = 10 / 500 = 0.02 = 2%

To assert a specific Phase in these boxes

1. Enter a desired LODPER.
2. Enter a desired Phase into LODPHS field.
3. Toggle LODSYN to ACTIVE state.
4. Toggle LOADING DATA COLLECTION to INACTIVE and then to ACTIVE.

   This locks the data collection onto the desired Phase. Example values for load sync fields are listed in the following table.

Table 117-2. Load Sync Fields/ Loading Periods and Valid Phases

Loading Periods (LODPER)	Valid Phases (LODPHS)
5.0	0 - 9
10.0	0 - 19
60.0	0 - 119

117.5.2.3 Total Control Cycle (% Of BPC) Box

The Total Control Cycle (% Of BPC) box shows 10 bars/values that represent 10 consecutive phase executions of the Compound Processor (left bar is the oldest one). The values are elapsed time for the total control cycle expressed as a percentage of the station BPC. This includes Fieldbus scanning, Continuous block execution, and Sequence block execution. When LODSYN is INACTIVE, the 10 bars represent the last 10 Compound Processor cycles.

117.5.2.4 Continuous Block Load (% Of BPC) Box

The `Continuous Block Load (% Of BPC)` box shows 10 bars/values that represent 10 consecutive phase executions of the Compound Processor (left bar is the oldest one). The values are elapsed time for just the Continuous block execution expressed as a percentage of the station BPC. When `LODSYN` is `INACTIVE`, the 10 bars represent the last 10 Compound Processor cycles.

117.5.3 OM Scanner Loading Overlay

The OM SCANNER LOADING overlay (see Figure 117-6) includes these items:

- Total Inter-Station IPC Connections box
- Overruns box
- Object Manager Scanner Data (% Of BPC) Last 12 Scans box.

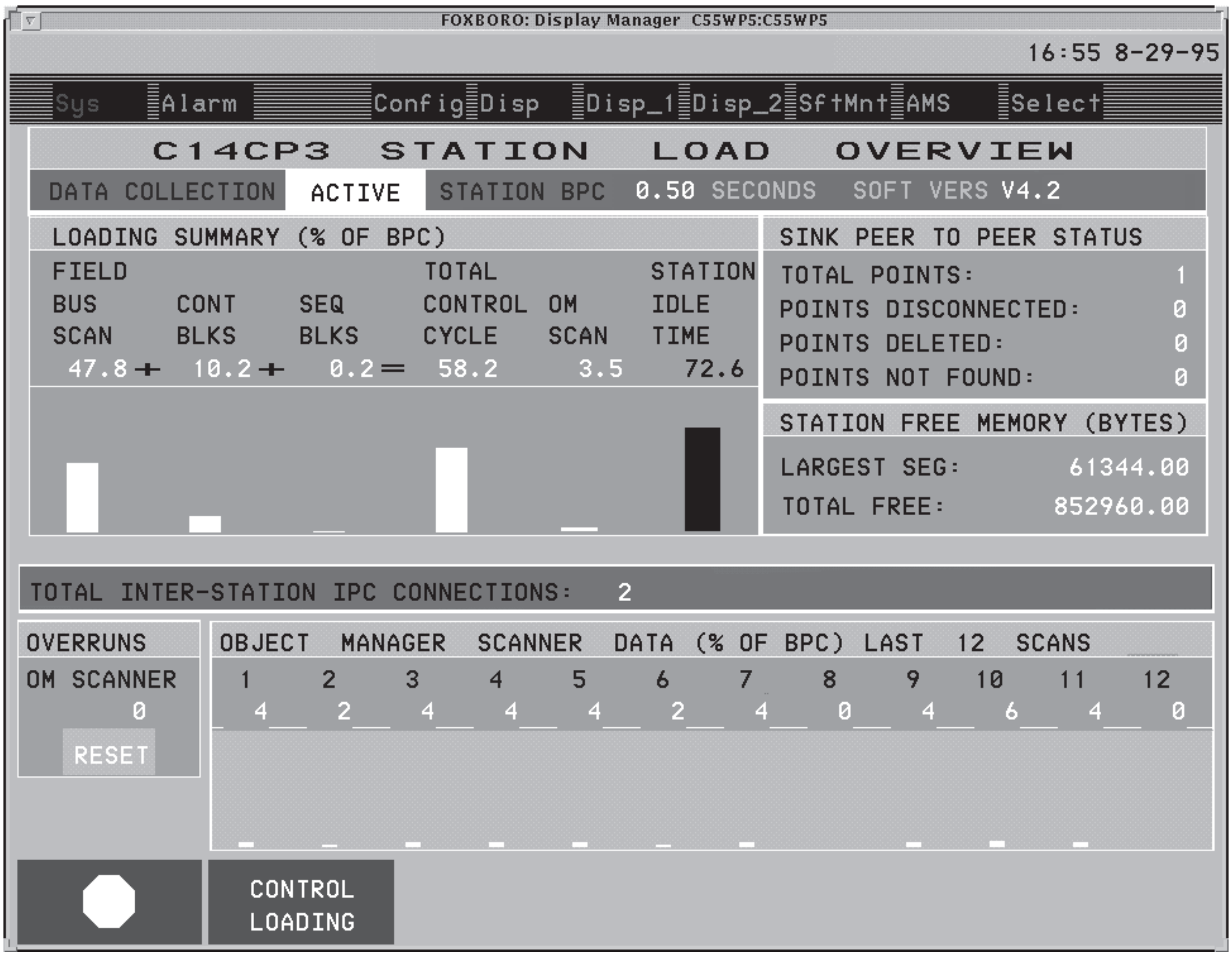


Figure 117-6. Station Load Overview with OM Scanner Loading Overlay

> **NOTE**
>
> The OM Scanner Loading Overlay is available for the CP30, CP40, CP40B, CP60 and later control processors, and Integrators. Differences between the CP30/CP40/CP40B/CP60 Station Block Detail Display and those for the CP10, Integrators, and above listed Gateways are noted in the following sections.

117.5.3.1 Total Inter-Station IPC Connections Box

The Total Inter-Station IPC Connections box defines the total Inter-Process Communications (IPC) connections among applications running in the workstation.

The OM Server receives peer-to-peer data. The OM Scanner transmits data to other stations, AWs, WPs, and APs or other applications.

The Database Installer interfaces to the Integrated Control Configurator.

117.5.3.2 Overruns Box

The `RESET` soft key sets the overruns counter to 0.

The `OM SCANNER` field represents the number of times the OM Scanner task has overrun since the station was rebooted or the counter was reset. OM Scanner overruns can occur when:

- Communications to a station are disconnected. This typically manifests itself by OM Scanner overruns occurring at one minute intervals.
- A large number of simultaneous display requests from multiple WPs.
- Overload of the OM Scanner task by attempting to connect to many other stations at the current station BPC. This can be corrected by reducing the number of stations receiving data from this station or by reducing the number of concurrent applications.
- Block processing overload does not leave enough time for the OM Scanner to complete processing.
- Overload of the OM Scanner by Sequence Logic that contains too many full pathname references.

117.5.3.3 Object Manager Scanner Data (% Of BPC) Last 12 Scans Box

The Object Manager Scanner Data (% Of BPC) Last 12 Scans box shows 12 bars/values that represent the last 12 scans of the Object Manager Scanner (the left bar is the oldest one). The values are elapsed time for OM scanning as a percentage of the station BPC. The values can change significantly between scans if Compound Processor scans interrupt the Object Manager scans on some cycles but not other cycles.

117.5.4 Group Assignments Overlay

The Group Assignments overlay (see Figure 117-7) shows the system output devices (for example, printers) assigned to alarm message groups via the Integrated Control Configurator.

You specify the device names and a hexadecimal value that assigns the devices to the group by editing the STATION block in the letterbug_STA compound via the Control Configurator. This overlay shows generic device names, DEV 1 to DEV 16 (LP001 is typical for a printer), and the group hexadecimal value. You can assign up to 16 devices to up to five groups (GR4 to GR8). Messages assigned to a specific group are sent to all the devices whose bit is set true (1) for that group.

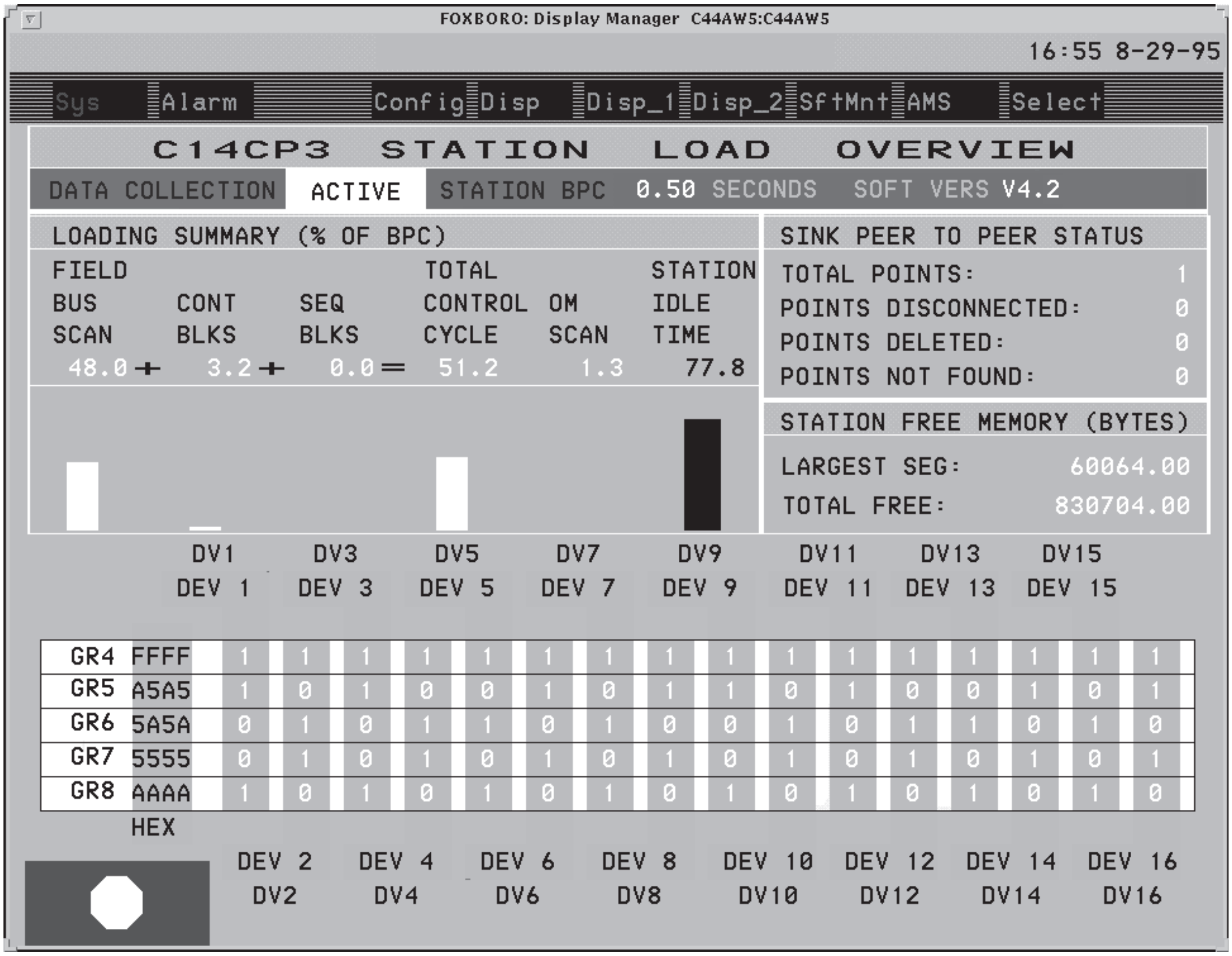


Figure 117-7. Station Load Overview with Group Device Assignments Overlay

117.5.5 Supervisory Groups Overlay

The Supervisory Groups overlay shows whether Supervisory Setpoint Control (SSC) is enabled or disabled for each of eight supervisory groups. In addition, this overlay shows fallback status and fallback request status for each group, and the (enabled/disabled) running time and setpoint for each fallback timer.

You can from the Supervisory Groups Overlay:

- enable or disable SSC for any group.
- request fallback status for a group.
- enable or disable a fallback timer.

SSC is supported in all I/A Series Control processors (CPs) and in most Application Processors (AP), Workstation Processors (WP) and Application Workstations (AW). The AP10 does not support SSC, and the WP20 supports all features except the timer enable/disable actions and the supervisory control enable/disable actions at the group level.

The Station Load Overview Supervisory Groups overlay is shown in Figure 117-8.

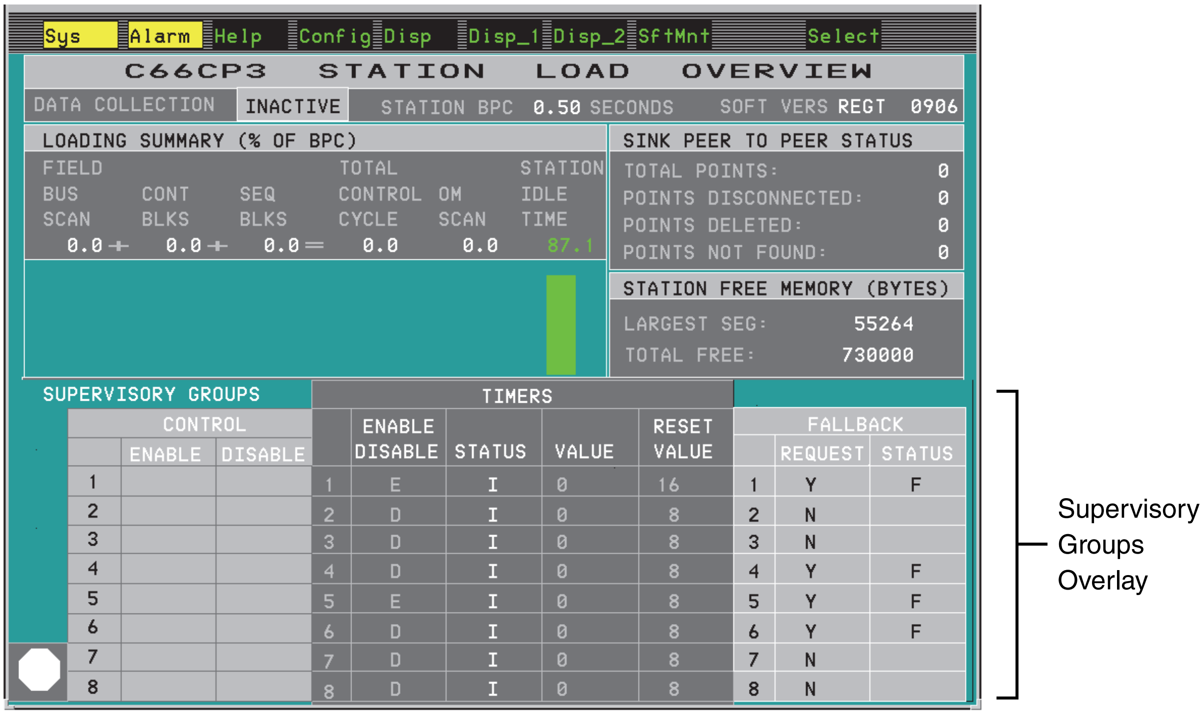


Figure 117-8. Station Load Overview Supervisory Groups Overlay

Groups 1-8 are arranged from top to bottom on the overlay. Table 117-3 defines the contents of the overlay.

SUPERVISORY GROUPS			TIMERS							
CONTROL								FALLBACK		
	Enable	Disable		Enable Disable	Status	Value	Reset Value		Request	Status
1	E/blank	D/blank	1	E/D	X/blank	xxxxx	yyyyy	1	Y/N	F/blank
2	E/blank	D/blank	2	E/D	X/blank	xxxxx	yyyyy	2	Y/N	F/blank
3	E/blank	D/blank	3	E/D	X/blank	xxxxx	yyyyy	3	Y/N	F/blank
4	E/blank	D/blank	4	E/D	X/blank	xxxxx	yyyyy	4	Y/N	F/blank
5	E/blank	D/blank	5	E/D	X/blank	xxxxx	yyyyy	5	Y/N	F/blank
6	E/blank	D/blank	6	E/D	X/blank	xxxxx	yyyyy	6	Y/N	F/blank
7	E/blank	D/blank	7	E/D	X/blank	xxxxx	yyyyy	7	Y/N	F/blank
8	E/blank	D/blank	8	E/D	X/blank	xxxxx	yyyyy	8	Y/N	F/blank

Figure 117-9. Station Load Overview Supervisory Groups Overlay

Table 117-3. Station Load Overview Supervisory Groups Overlay Definitions

Control	Function
CONTROL	
ENABLE 1-8	Enables SSC for selected supervisory group (1-8). E = Enabled, (blank) = not enabled. Momentarily highlighted when selected.
DISABLE 1-8	Disables SSC for selected supervisory group (1-8). D = Disabled, (blank) = not disabled. Disable overrides Enable if both are requested. Momentarily highlighted when selected.
TIMERS	
ENABLE DISABLE	Enables or Disables the selected supervisory group (1-8) timer. E = the timer is Enabled, D = the timer is Disabled.
STATUS	Indicates the status of the timer. x = the timer has expired, blank indicates the timer is running.
VALUE	Indicates the current running value (0-32767 seconds, 0 to 9.1 hours) of the timer.
RESET VALUE	Indicates the selected value (0-32767 seconds, 0 to 9.1 hours) to which the timer is reset when the application issues a setpoint to a block in its assigned supervisory group.
FALLBACK	
REQUEST	Requests that the selected supervisory group (1-8) go the fallback state. Y = fallback is requested, N = fallback is not requested.
STATUS	Indicates the status of the fallback group. F = fallback, (blank) = no fallback.

117.5.5.1 Station Block Operating Information and Procedures

For operating information and procedures, refer to the *Process Operations and Displays* (B0193MM) document.

118. STRIN – String Input Block

This chapter covers the String Input (STRIN) block, its features, parameters and functions, and application diagrams.

118.1 Overview

The String Input (STRIN) block is a Distributed Control Interface (DCI) block. (DCI blocks support connectivity of I/A Series control stations to various bus resident devices via a general purpose interface.) STRIN receives one string value from an external device.

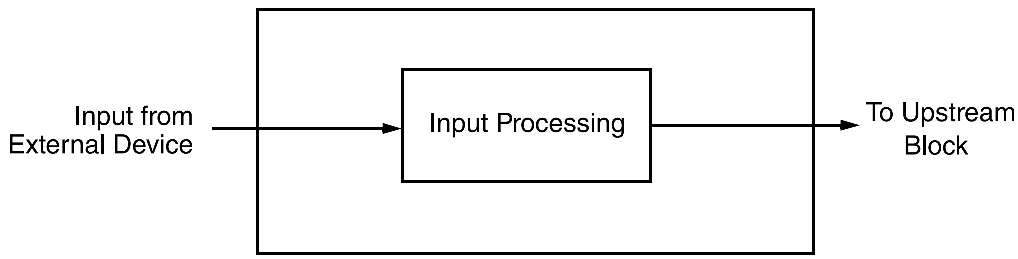


Figure 118-1. STRIN Block Diagram

118.2 Basic Operation

Upon execution, the STRIN block truncates the input from the external device (to 80 characters) and null-terminates it. The resultant value is presented as block output STRING. Auto/manual switching is not supported in this block. When Message Option (MSGOPT) is configured true, the receipt of any new value of STRING causes a message to be sent to the logical devices in the group specified by MSGGRP.

118.3 Features

The STRIN block provides the following features:

- Specification of external device source point as device-specific string
- Block functionality corresponds to the Auto mode at all times.

118.4 Parameters

Table 118-1. STRIN Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
Configurable Parameters					
INPUTS					
NAME	block name	string	no-con/no-set	2 blanks	1 to 12 chars
TYPE	block type	short integer	no-con/no-set	STRIN_TYPE	114
DESCRP	block description	string	no-con/no-set	2 blanks	1 to 32 chars
PERIOD	block sample time	short integer	no-con/no-set	1	0 to10, and 13 for CPs, 0 to 12 for Gateways
PHASE	block execution phase	short integer	no-con/no-set	0	period specific
LOOPID	loop/unit/batch identifier	string	no-con/set	2 blanks	1 to 32 chars
IOM_ID	ECB identifier	string	no-con/no-set	2 blanks	1 to 12 chars
MSGGRP	message group	integer	no-con/set	1	1 to 8
MSGOPT	message option	boolean	no-con/no-set	0	0 to 1
PNT_NO	point number	string	no-con/no-set	blanks	1 to 32 chars, or device specific
SIMOPT	simulation option	boolean	no-con/no-set	0	0 = no simulation 1 = simulation
UPDPER	parm update period	integer	no-con/no-set	10000ms	0 to 2147483647 ms
Non-Configurable Parameters					
OUTPUTS					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
BLKSTA	block status	packed long	con/no-set	0	0-0xFFFFFFFF
STRING	string output	string	con/no-set	2 spaces	up to 80 chars
TSTAMP	time stamp	long integer	con/no-set	0	ms after midnight
UNACK	unacknowledged alarm	boolean	con/no-set	0	0 to 1
DATA STORES					
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
DEV_ID	I/O letterbug	character	no-con/no-set	---	6-character array
ERCODE	configuration error	string	no-con/no-set	2 blanks	1 to 43 chars

118.4.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate various block operational states. For the STRIN block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
																ON	UDEF						FBM								

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
8	FBM	FBM failure	BLKSTA.B24
14	UDEF	Block Undefined	BLKSTA.B18
15	ON	Block On	BLKSTA.B17

*Bit 0 is the least significant, low order bit.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. (See ERCODE for the list of all possible validation errors in this block.) In that case, no further processing of the block occurs, including further validation of remaining parameters. To return DEFINE to a True value, you should correct all configuration errors and reinstall the block.

DESCRP

Description is a user-defined string of up to 32 characters used to describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

DEV_ID

Device Identifier is a character array that specifies the 6-character identifier of the connected device. It is copied from the DEV_ID configured in the ECB specified by the IOM_ID parameter.

ERCODE

Error Code is a character data store which indicates the type of configuration error which caused the block's DEFINE parameter to be set False, unless indicated otherwise (see meanings below). Validation of configured parameters does not proceed past the first error encountered by the block logic. Each nonzero value of ERCODE results in an explanatory message at the block's detail display. For the STRIN block, the following list shows the messages you may see:

ERCODE Message	Meaning
W52 – INVALID I/O CHANNEL/ GROUP NO.	PNT_NO string is blank.
W62 – UNRESOLVED CONNECTION	Connection is not yet resolved. (Block remains defined.)
W65 – INVALID POINT ADDRESS	FBM parsing algorithm finds that a used BIx_PT is invalid.
W66 – DUPLICATE CONNECTION	There is a duplicate connection to a particular point.
W67 – INSUFFICIENT FBM MEMORY/CONNECTIONS	There is no available memory or point connections in the FBM.
W68 – INVALID DEVICE CONNECTION	The device connection is invalid.
W69 – INVALID POINT CONNECTION	The point connection is invalid.

If a DCI data connection cannot be resolved due to a lack of configuration information, the block is marked DEFINED but the value is marked OOS and one of the following strings is stored in ERCODE to indicate the configuration error:

W77 - FIELDBUS COMMUNICATIONS FAULT (FBM228 only)
W78 - INVALID FUNCTION BLOCK (FBM228 only)
W80 - FIELDBUS DEVICE NOT FOUND (FBM228 only)
W73 - FF FUNCTION BLOCK CONFIGURATION ERROR (FBM228 only).

If a DCI data connection cannot be resolved for any other reason, the block is marked UNDEFINED and one of the following strings is stored in ERCODE to indicate the configuration error:

W74 - FF FUNCTION BLOCK DDITEM MISMATCH (FBM228 only)
W75 - FF FUNCTION BLOCK DDMBR MISMATCH (FBM228 only)
W76 - INVALID FF MODE CONFIGURATION (FBM228 only)
W79 - INVALID PARAMETER INDEX (FBM228 only)
W81 - INVALID PARENT DCI ECB PERIOD/PHASE (FBM228 only).

IOM_ID

ECB Identifier is a configurable string that specifies the pathname of the ECB201 for the device, for the purpose of connecting to (accessing) a field parameter that resides in a field device hosted by a (parent) ECB200/202.

IOM_ID has the form CompoundName:BlockName, where CompoundName is the 1-12 character name of the local compound containing the ECB, and BlockName is the 1-12 character block name of the ECB.

If the compound containing the ECB is the CPletterbug_ECB compound where CPletterbug is the station letterbug of the CP, the CompoundName may be omitted from the IOM_ID configuration. In this case, the 1-12 character ECB block name is sufficient.

LOOPID
: Loop Identifier is a configurable string of up to 32 characters used to identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.

MSGGRP
: Message Group is the message device group number.

MSGOPT
: When Message Option is configured True, the receipt of any new value of STRING causes a message to be sent to the logical devices in the group specified by MSGGRP. This message is the INFO (that is, the SEQ_1_MESSAGE) format. UNACK is set True when the message has been sent.

NAME
: Name is a user-defined string of up to 12 characters used to access the block and its parameters.

PERIOD
: Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PHASE
: Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 seconds) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the I/A Series station is 0.5 second. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PNT_NO
: Point Number identifies the source address in the external device memory (or external device data stream) from which the block input is obtained. It is a string whose syntax depends on the make and model of the external device.

For the PROFIBUS interface (FBM223), PNT_NO must be configured to contain a PROFIBUS data identifier string. This information identifies, to the FBM, specific data in the PROFIBUS data stream that is to serve as the device data input to this block. Refer to *PROFIBUS-DP Communication Interface Module (FBM223) User's Guide* (B0400FE) for details.

For the HART interface (FBM214/214b/215/216/216b/218/244/245/247), PNT_NO must be configured to contain a HART point address string. This information identifies, to the FBM, a specific value in the HART device that is to serve as the input to this block. Refer to *HART Communication Interface Modules User's Guide* (B0400FF) for details.

For the FDSI (FBM230/231/232/23), PNT_NO contains a data identifier to identify, to the FBM, specific data in the I/O data stream and to specify the elements of the data. Refer to *Field Device System Integrators (FBM230/231/232/233) User's Guide* (B0700AH) for additional information.

SIMOPT — Simulation Option is a configurable parameter that specifies whether the DCI block input/output value is to be simulated. When SIMOPT is configured 1 (True), there is no DCI connection established for the block and no data from the external device is set into STRING. The STRING itself can be changed by an application program using standard API/OM set access commands or by an operator via key actions available at the detailed display. When the string is changed, a new message is generated if MSGOPT is True.

STRING — String output of the STRIN block. STRING contains the value received from the external device, truncated to 80 actual characters, and null-terminated.

TSTAMP — The Time Stamp parameter of the block is updated every time there is a change in value of STRING. TSTAMP, which is expressed in units of milliseconds past midnight, is read from the FBM, when it is available there; otherwise, it is computed by the I/A Series control station.

TYPE — When you enter STRIN or select it from a configurator list, an identifying integer is created specifying this block type. For this block, the value of TYPE is 114.

UNACK — Unacknowledge is a Boolean output that the block sets to true when it detects an alarm. It is typically reset by operator action.

UPDPER — Update Period is a configurable non-settable long integer that specifies the update period used by an FBM228 when the DCI block has a client/server connection to a specific device parameter. This parameter is not used when the DCI block has a publisher/subscriber connection to a device function block.

118.5 Functions

118.5.1 Detailed Diagram

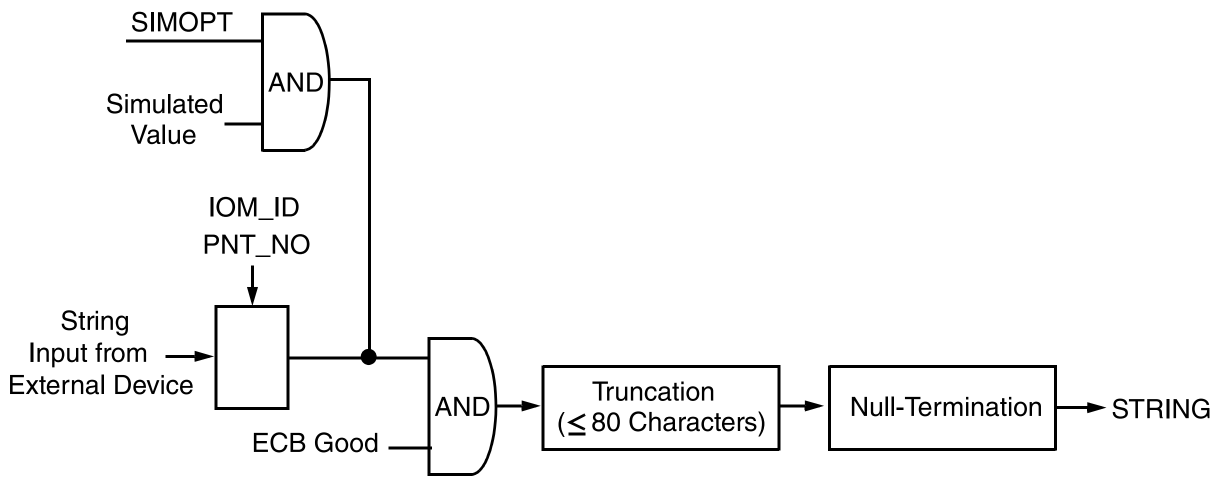


Figure 118-2. STRIN Block Operational Diagram

118.5.2 Associated ECBs

The configured IOM_ID parameter of the STRIN block specifies an ECB201 (the "Device ECB") to connect to a field parameter that resides in a field device hosted by an ECB200 (the "FBM ECB"). The PARENT parameter of this ECB201 specifies the ECB200. The STRIN block also can be connected directly to the parent ECB200 to retrieve a parameter resident in the FBM itself.

118.5.3 DCI Connection

The STRIN block establishes a DCI connection to the specified ECBs at any one of the following times:

- The block is first installed (added to your control strategy)
- The I/A Series control station in which it resides has just been rebooted
- A parameter of the block has been modified by the ICC or FoxCAE configurator
- A device or parent ECB specified by the STRIN block has just been installed.

A DCI connection is added to a linked list of all the DCI connections, of any type, for all blocks specifying the same ECB. This arrangement permits multiple DCI blocks, of differing data types, to communicate with a single device at input/output scan time, on a scatter-gather basis. It also allows multiple DCI connections in the same DCI block to be established (for example, connections in redundant type DCI blocks such as this one or for INI_PT connections in output type blocks).

The DCI connection is deleted (the block is removed from the linked list for the ECB) when the STRIN block is deleted.

118.5.4 Origin of Input Data

The device address supplying the input value is configured as a string in PNT_NO. The format of PNT_NO is device specific.

When the PIO maintenance task runs after the DCI connection has been made, the PNT_NO string is passed to the FBM for parsing and validation. (In DCI blocks, PNT_NO is not parsed by the I/A Series control station.)

If the first character of PNT_NO is blank, the PNT_NO string is not sent to the FBM, and the block is set undefined with ERCODE = 52. The detail display shows “W52 – INVALID I/O CHANNEL/GROUP NUMBER”.

In each of the following cases, the block is also set undefined:

- If the FBM parsing algorithm finds that PNT_NO is invalid, the detail display shows “W65 – INVALID POINT ADDRESS” with ERCODE = 65.
- If there is a duplicate connection to any point, the detail display shows “W66 – DUPLICATE CONNECTION” with ERCODE = 66.
- If there is no available memory in the FBM, or if the maximum number of connections have been allocated in the FBM, the detail display shows “W67 – INSUFFICIENT FBM MEMORY/CONNECTIONS” with ERCODE = 67.
- If the device connection is invalid, the detail display shows “W68 – INVALID DEVICE CONNECTION” with ERCODE = 68.
- If the point connection is invalid, the detail display shows “W69 – INVALID POINT CONNECTION” with ERCODE = 69.

In the following case, the block remains defined:

- If the connection is not yet resolved, the detail display shows “W62 – UNRESOLVED CONNECTION” with ERCODE = 62.

118.5.5 Input Point Data and Status Processing

Each time the STRIN block is executed, the value received from the external device is truncated to 80 actual characters, null-terminated, and set into the STRING parameter of the block.

Updating of the STRING parameter is change driven: STRING is changed on an execution cycle only if a new value has been received from the external device via the DCI connection.

STRING may originate as any text string parameterized in the field device.

The status of STRING is set to Out-of-Service if one or more of the following exists:

- The appropriate ECB status indicates that the field device is Off-line or Out-of-Service.
- The DCI connection cannot be configured due to lack of configuration information in the FBM database.
- The DCI is not yet connected, that is, the PIO maintenance task has not yet sent the DATA_CONNECT message to the FBM for the linked-list addition described in Section 118.5.3.
- The DCI connection status information, which specifies the condition of the accessed device parameter, indicates Out-of-Service, meaning (in general) that the parameter value is unavailable.

- The connection status information indicates Disconnected, meaning (in general) that the parameter is not connected or not defined.
- The connection status information indicates that the connection is not yet resolved. The detail display shows "W62 – UNRESOLVED CONNECTION" with ERCODE = 62.
- An ECB201 is specified, and the ECB device status indicates that the DCI connection is unresolved.

The status of STRING is set to Bad if ECB status indicates that the field device has failed.

118.5.6 Auto/Manual Switching

Auto/Manual switching is not supported in the STRIN block. The block functionally corresponds to the Auto mode at all times.

118.5.7 Time Stamp

The time stamp (TSTAMP) parameter of the block is updated every time there is a change in the value of STRING. TSTAMP, which is expressed in units of milliseconds past midnight, is read from the FBM when it is available there; otherwise, it is computed by the I/A Series control station.

118.5.8 Identification and Access Control

The LOOPID, OWNER, and ACHNGE parameters are used in the standard way in the STRIN block.

119. STRING – String Variable Block

This chapter describes the STRING (String Variable Block), its basic operations, features and parameters.

119.1 Overview

The STRING variable block provides data storage for a string data value (see Figure 119-1). It also provides an output change counter that is incremented each time the string value is changed. The string value parameter is available for display by user graphics.

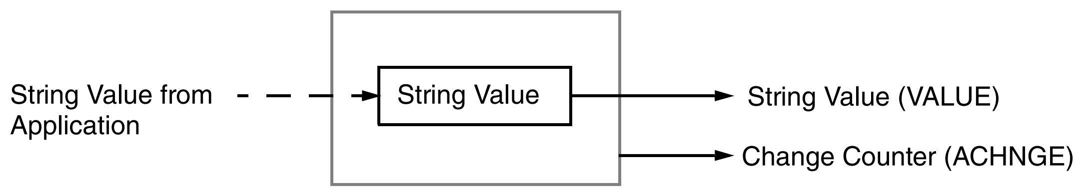


Figure 119-1. STRING Block Functional Diagram

119.2 Basic Operation

The STRING block contains a string data variable parameter (VALUE) that can be set by an application to store a string value for use by other blocks. The VALUE record contains a status field in which an application can set the Bad and out-of-service (OOS) bits.

The STRING also contains an integer output parameter (ACHNGE) that is incremented when VALUE is changed by an application or block reconfiguration. This feature allows you to update the string value on a user's display when ACHNGE changes value.

The STRING block has a Detail Display for viewing and setting parameters. STRING and other data variable blocks appear on the `Select` display in the order they are configured, following all other blocks in the compound.

The STRING block does not contain PERIOD and PHASE parameters because it is not executed by the compound processor. Using the Integrated Control Configurator, any number of STRING blocks can be inserted in the **END DATA** zone of any compound.

The STRING block is validated whenever:

- ♦ It is installed in the Control Processor (CP) database.
- ♦ The CP undergoes a reboot operation.
- ♦ The compound in which the block resides is turned on.

Block validation does *not* change any parameter values that have *not* been reconfigured, except for a CP reboot, in which case it installs the parameter values in the checkpoint file. If you turn the compound off and then on, the VALUE parameter value is unchanged.

119.3 Features

The STRING block provides the following features:

- ♦ STRING data variable (VALUE) for storing a string data value.
- ♦ Output change counter (ACHANGE) for detecting a change in VALUE.

119.4 Parameters

Table 119-1. STRING Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
Configured Parameters					
INPUTS					
NAME	variable name	string	no-con/no-set	2 blanks	1 to 12 chars
TYPE	variable type	integer	no-con/no-set	153	STRING
DESCRP	variable descriptor	string	no-con/no-set	2 blanks	1 to 32 chars
DATA VARIABLE					
VALUE	variable value	string	no-con/set	2 blanks	1 to 32 chars
Non-Configured Parameters					
OUTPUTS					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767

119.4.1 Parameter Definitions

ACHNGE — A Change is a integer output that is incremented each time the VALUE parameter is changed externally.

DESCRP — Descriptor is a user-defined string of up to 32 characters that describe the variable (for example, TEMPERATURE HIGH).

NAME — Name is a user-defined string of up to 12 characters used to access the data variable block and its parameters.

TYPE — Type is a system-level mnemonic label indicating the block type. Enter “STRING” or select “STRING” from the block type list under SHOW when configuring the block.

VALUE — Value is a string data variable that can be set by an application to store data for use by other blocks.

120. STROUT – String Output Block

This chapter describes the function of the String Output (STROUT) block and defines its parameters.

120.1 Overview

The String Output (STROUT) block is a Distributed Control Interface (DCI) block. (DCI blocks support connectivity of I/A Series control stations to various bus resident devices via a general purpose interface.) STROUT can send one string value to an external device.

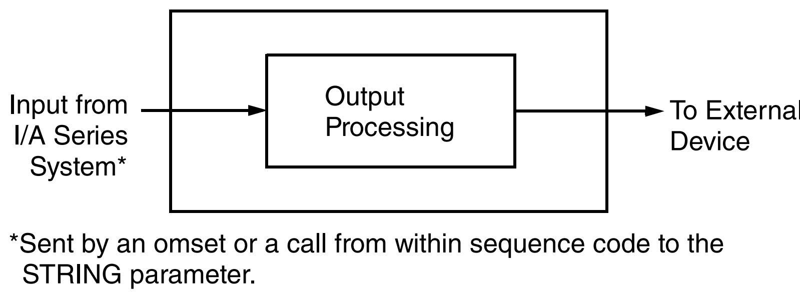


Figure 120-1. STROUT Block Diagram

120.2 Basic Operation

The STROUT block accepts a string value from the control strategy, and sends it to the addressed point. The block output (STRING parameter) is change driven; STRING is sent to the external device only when it is different from the value previously sent. The device address receiving the output value is configured as a string in PNT_NO[1].

STROUT does not support auto/manual switching, nor does it have any alarm detection or reporting capability.

[1] PNT_NO contains a user-configured data identifier string, which identifies, to the FBM, specific data to be sent to the external device. Refer to *PROFIBUS-DP Communication Interface Module (FBM223) User's Guide* (B0400FE) for details.

120.3 Parameters

Table 120-1. STROUT Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
Configurable Parameters					
INPUTS					
NAME	block name	string	no-con/no-set	2 blanks	1 to 12 chars
TYPE	block type	integer	no-con/no-set	STROUT_TYPE	115
DESCRP	description	string	no-con/no-set	2 blanks	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to10, and 13 for CPs, 0 to 12 for Gateways
PHASE	block execute phase	integer	no-con/no-set	0	—
LOOPID	loop identifier	string	no-con/set	2 blanks	1 to 32 chars
IOM_ID	ECB identifier	string	no-con/no-set	2 blanks	1 to 12 chars
PNT_NO	point number	string	no-con/no-set	—	device specific
UPDPER	update period	long	no-con/no-set	10000	0-2147483647
Non-Configurable Parameters					
OUTPUTS					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
BLKSTA	block status	pack_l	con/no-set	0	0 to 0xFFFFFFFF
STRING	string output	string	con/set	2 spaces	up to 80 chars
TSTAMP	time stamp	long integer	con/no-set	0	ms after midnight
DATA STORES					
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	configuration error	string	no-con/no-set	2 blanks	1 to 32 chars
DEV_ID	device identifier	char[6]	no-con/no-set	blank	6 chars

120.3.1 Parameter Definitions

ACHNGE Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

BLKSTA Block Status is a 32-bit output, bit-mapped to indicate various block operational states. For the STROUT block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
																ON	UDEF						FBM								

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
8	FBM	Bad Status of ECB	BLKSTA.B24
14	UDEF	Block Undefined	BLKSTA.B18
15	ON	Block ON	BLKSTA.B17

*Bit 0 is the least significant, low order bit.

DEFINE Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing (see ERCODE for the list of all possible validation errors in this block). In that case, no further processing of the block occurs, including further validation of remaining parameters. To return DEFINE to a true value, you should correct all configuration errors and re-install the block.

DESCRP Description is a user-defined string of up to 32 characters that describes the block’s function (for example, “PLT 3 FURNACE 2 HEATER CONTROL”).

DEV_ID Device Identifier is a character array that specifies the 6-character identifier of the connected device. It is copied from the DEV_ID configured in the ECB specified by the IOM_ID parameter.

ERCODE Error Code is a character data store which indicates the type of configuration error which caused the block’s DEFINE parameter to be set false. Validation of configured parameters does not proceed past the first error encountered by the block logic. Each nonzero value of ERCODE results in an explanatory message at the block’s detail display. For the STROUT block, the following list shows the possible messages you may see:

ERCODE Message	Meaning
W52 – INVALID I/O CHANNEL/GROUP NUMBER	The first character of PNT_NO is blank.
W62 – UNRESOLVED CONNECTION	Connection is not yet resolved. (Block remains defined.)
W65 – INVALID POINT ADDRESS	FBM parsing algorithm found that PNT_NO is invalid.
W66 – DUPLICATE CONNECTION	There is a duplicate connection to a point.
W67 – INSUFFICIENT FBM MEMORY/CONNECTIONS	There is no available memory or point connections in the FBM.

ERCODE Message	Meaning
W68 – INVALID DEVICE CONNECTION	The device connection is invalid.
W69 – INVALID POINT CONNECTION	The point connection is invalid.

IOM_ID

ECB Identifier is a configurable string that specifies the pathname of the ECB201 for the device, for the purpose of connecting to (accessing) a field parameter that resides in a field device hosted by a (parent) ECB200/202.

IOM_ID has the form CompoundName:BlockName, where CompoundName is the 1-12 character name of the local compound containing the ECB, and BlockName is the 1-12 character block name of the ECB.

If the compound containing the ECB is the CPletterbug_ECB compound where CPletterbug is the station letterbug of the CP, the CompoundName may be omitted from the IOM_ID configuration. In this case, the 1-12 character ECB block name is sufficient.

LOOPID

Loop Identifier is a configurable string of up to 32 characters used to identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.

NAME

Name is a user-defined string of up to 12 characters used to access the block and its parameters.

PERIOD

Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PHASE

Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the I/A Series station is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PNT_NO

Point Number identifies the source address in the external device memory (or external device data stream) from which the block input is obtained. It is a string whose syntax depends on the make and model of the external device.

For the PROFIBUS interface (FBM223), PNT_NO must be configured to contain a PROFIBUS data identifier. This information identifies, to the FBM, specific data in the PROFIBUS data stream to be sent to the external device. Refer to *PROFIBUS-DP Communication Interface Module (FBM223) User's Guide* (B0400FE) for details.

For the FDSI (FBM230/231/232/23), PKINGP contains a data identifier to identify, to the FBM, specific data in the I/O data stream and to specify the elements of the data. Refer to *Field Device System Integrators (FBM230/231/232/233) User's Guide* (B0700AH) for additional information.

STRING — String output of the STROUT block. STRING contains the value to be sent to the external device.

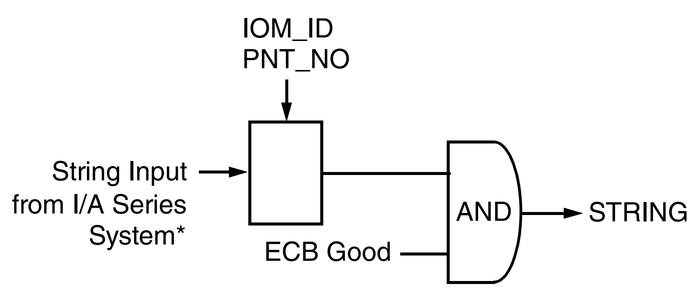
TSTAMP — Time Stamp is a long integer output that represents the time, in milliseconds since midnight, of the most recent updated STRING output. This time stamp is supplied either by the FBM or by the I/A Series control station, depending on the type of FBM. If supplied by the FBM, TSTAMP indicates the time of the latest updated value in the FBM. If supplied by the I/A Series control station, TSTAMP indicates the time of the latest updated value in the I/A Series control station.

TYPE — When you enter "STROUT" or select it from a configurator list, an identifying integer is created specifying this block type. For this block, the value of TYPE is 115.

UPDPER — Update Period is a configurable, non-settable long integer that is used to specify the update period for client/server connections scheduled by the FBM228 to read the device function block View 1, View 2 and View 4 parameters. The range is 0 to 2147483647 milliseconds; the default is 10000.

120.4 Functions

120.4.1 Detailed Diagram



*Sent by an omset or a call from within sequence code to the STRING parameter.

Figure 120-2. STROUT Block Operational Diagram

120.4.2 Associated ECBs

The configured IOM_ID parameter of the STROUT block specifies an ECB201, (the Device ECB) to connect to a field parameter that resides in a field device hosted by an ECB200 (the FBM ECB). The PARENT parameter of this ECB201 specifies the ECB200. In the case of PROFIBUS connections, this block always connects directly to the ECB200, to output a string parameter resident in the FBM223.

120.4.3 DCI Connections

The STROUT block establishes a DCI connection to its specified ECB in any one of the following instances:

- The I/A Series control station in which it resides has just been rebooted.
- The block has just been installed.
- A parameter of the block has been modified by the ICC or FoxCAE configurator.
- The device or parent ECB specified by the STROUT block has just been installed.

The DCI connection is added to a linked list of all the DCI connections, of any type, for all blocks specifying the same ECB. This arrangement permits multiple DCI blocks, of differing data types, to communicate with a single device at input/output scan time. It also allows multiple DCI connections in the same DCI block to be established (for example, connections in redundant type DCI blocks or for INI_PT connections in certain output type blocks).

These parameter connections are made by the FBM on a client/server basis at the frequency specified in the UPDPER parameter. The parameter can be set from 0 to 2147483647 milliseconds; the default is 10000 (10 seconds). Increasing the frequency of the client/server communication can significantly add to the load on the H1 segment.

The DCI connection is deleted (that is, the block is removed from the linked list for the ECB) when the STROUT block is deleted.

120.4.4 Destination of Output Data

The device address receiving the output value is configured as a string in PNT_NO. The format of PNT_NO is bus specific and device specific.

When the PIO maintenance task runs after the DCI connection has been made (see Section 120.4.3), the PNT_NO string is passed to the FBM for parsing and validation. In DCI blocks, PNT_NO is not parsed by the CP

If the first character of PNT_NO is blank, the PNT_NO string is not sent to the FBM, and the block is set undefined with ERCODE = 52. The detail display shows “W52 – INVALID I/O CHANNEL/GROUP NUMBER”.

In all of the following cases, the block is also set undefined:

- If the FBM parsing algorithm finds that PNT_NO is invalid, the detail display shows “W65 – INVALID POINT ADDRESS” with ERCODE = 65.
- If there is a duplicate connection to any point, the detail display shows “W66- DUPLICATE CONNECTION” with ERCODE = 66.
- If there is no available memory in the FBM, or if the maximum number of connections have been allocated in the FBM, the detail display shows “W67 – INSUFFICIENT FBM MEMORY/CONNECTIONS” with ERCODE = 67.

- If the device connection is invalid, the detail display shows “W68 – INVALID DEVICE CONNECTION” with ERCODE = 68.
- If the point connection is invalid, the detail display shows “W69 – INVALID POINT CONNECTION” with ERCODE = 69.

In the following case, the block remains defined:

- If the connection is not yet resolved, the detail display shows “W62 – UNRESOLVED CONNECTION” with ERCODE = 62.

120.4.5 Block Output (STRING)

Output of the STRING parameter is change driven; STRING is only sent to the external device when it is different from the value previously sent.

Each time the STROUT block is executed (and there has been a change in STRING), the actual string is recovered from the string pool based on the index value stored as the block parameter, and copied to the output buffer of the block for transmission. The Write Request flag in the buffer is set at this time.

120.4.6 Time Stamp

The time stamp (TSTAMP) parameter of the block is updated every time there has been a change in the value of STRING. TSTAMP, which is expressed in units of milliseconds past midnight, is computed by the I/A Series control station.

120.4.7 Auto/Manual Switching

Auto/manual switching is not supported in the STROUT block. The block functionality corresponds to the Auto mode at all times.

120.4.8 Bad (BAD) and Out-of-Service (OOS) Status

The STROUT block is Out-of-Service, that is, the status of the STRING parameter is set Out-of-Service, if:

- The ECB status indicates that the field device is off-line or out-of-service.
- The DCI connection cannot be configured, due to lack of configuration information in the FBM database.
- The DCI is not yet connected, that is, the PIO maintenance task has not yet sent the DATA_CONNECT message to the FBM for the linked-list addition described “DCI Connections” on page 2398.
- The DCI connection status information, which specifies the condition of the connected device parameter, indicates out-of-service, meaning (in general) that the parameter value is unavailable, or
- The status information indicates disconnected, meaning (in general) that the parameter is not connected or not defined.
- The connection status information indicates that the connection is not yet resolved. The detail display shows “W62 – UNRESOLVED CONNECTION” with ERCODE = 62.
- An ECB201 is specified and the ECB device status indicates that the DCI connection is unresolved

The STROUT block is Bad (that is, the status of the STRING parameter is set Bad) if the ECB status indicates that the field device has failed.

120.4.9 Loop Identification (LOOPID)

LOOPID is a configurable string which identifies the loop or process with which the block is associated. It is displayed on the detail display, just below the faceplate.

121. SWCH – Switch Block

This chapter describes the SWCH (Switch Block), its features, parameters and detailed operations.

121.1 Overview

The Switch (SWCH) block supports a single-pole, double-throw switch element that selects one of two real inputs. A balance feature provides switching between inputs for bumpless transfers. Auto/Manual control of the output is also provided.

121.1.1 I/O Diagram

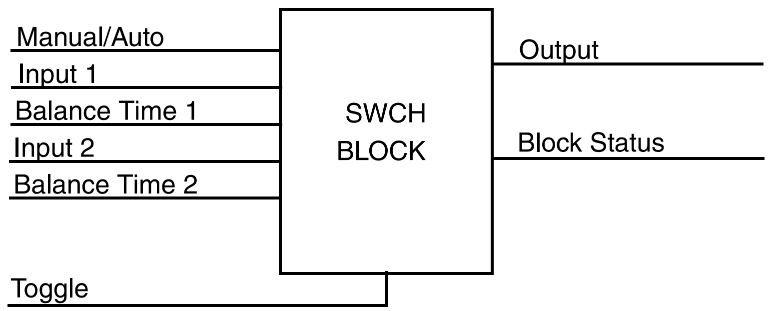


Figure 121-1. SWCH Block I/O Diagram

121.2 Features

The features are:

- Manual/Auto control of the outputs, which can be initiated by a host process or another block
- User specifiable balance times in toggling from input to input to provide bumpless switching
- Automatic cascade handling using an input and output parameter (back-calculate) that includes:
  - Initialization of cascade schemes
  - Back calculation input/output chain from the downstream block to the upstream block, to provide bumpless cascade operation when the cascade is open loop.

The options are:

- Propagate Error Option (PROPT) gives you the option of propagating the Bad, Out-of-Service, and Error status bits from the selected input to the block's OUT parameter.
- Error Option (EROPT) determines how the block responds to an error in its INP and BCALCI inputs.

- Initialize Manual/Auto (INITMA) specifies the desired state of MA input during initialization.
- Primary Block configuration option (PRIBLK) enables a block in a cascaded configuration to initialize without bumping the process.

121.3 Parameters

Table 121-1. SWCH Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	14	SWCH
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
PROPT	propagate error	boolean	no-con/no-set	0	0 to 1
EROPT	error option	short	no-con/no-set	1	[0|1|2]
INP1 to INP2	input 1 to 2	real	con/set	0.0	RI1/RI2
HSCI1 to HSCI2	high scale in 1 to 2	real	no-con/no-set	100.0	specifiable
LSCI1 to LSCI2	low scale in 1 to 2	real	no-con/no-set	0.0	specifiable
DELTI1 to DELTI2	change delta 1 to 2	real	no-con/no-set	1.0	percent
EI1 to EI2	eng units input	string	no-con/no-set	%	specifiable
TOGGLE	switch toggle	boolean	con/set	0	0 to 1
HSCO1	high scale out 1	real	no-con/no-set	100.0	specifiable
LSCO1	low scale out 1	real	no-con/no-set	0.0	specifiable
DELTO1	change delta 1	real	no-con/no-set	1.0	percent
EO1	eng unit output	string	no-con/no-set	%	specifiable
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	[0|1|2]
BTIME1	balance time input 1	real	con/set	0.0	[0..]minutes
BTIME2	balance time input 2	real	con/set	0.0	[0..]minutes
PRIBLK	primary block cascade operation	boolean	no-con/no-set	0	0 to 1
PRITIM	primary cascade timer	real	no-con/no-set	0.0	seconds
INITI	initialize in	short	con/set	0	0 to 1
BCALCI	back calculate in	real	con/set	0.0	RO1
OUTPUTS					
BCALC1 to BCALC2	back calculate value 1 to 2	real	con/no-set	0	RI1
BLKSTA	block status	pack_l	con/no-set	0	bit map
INITO1	initialize out 1	short	con/no-set	0	0 to 1
INITO2	initialize out 2	short	con/no-set	0	0 to 1
OUT	output	real	con/no-set	0.0	RO1
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767

Table 121-1. SWCH Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	config error	string	no-con/no-set	blank	1 to 43 chars
LOCKID	lock id	string	no-con/no-set	blank	1 to 32 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars
PERTIM	period time	real	no-con/no-set	0.1	---
PRSCAS	cascade state	short	no-con/no-set	0	0 to 4
RI1 to RI2	eng range input	real[3]	no-con/no-set	100,0,1	specifiable
RO1	eng range output	real[3]	no-con/no-set	100,0,1	specifiable

121.3.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

BCALC1 to BCALC2

Back-Calculated Output 1 or 2 (BCALC1 or BCALC2) is the value from a SWCH block that is used by a primary block (via its BCALCI connection) to initialize its output to the current INPn input to the SWCH block.

BCALCI

Back Calculation In is a real input that provides the initial value of the output before the block enters the controlling state, so that the return to controlling is bumpless. It is also the source of the output value when its integration bit, which puts the block into output tracking, is non-zero. The source for this input is the back calculation output (BCALCO) of the downstream block. With V4.2 and later software, BCALCI contains the cascade initialization data bits which were formerly contained in the INITI parameter. Therefore, BCALCI defines the source block and parameter that drives this block into initialization, and INITI and INITO are not required for cascade initialization.

BLKSTA

Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the SWCH block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
																ON	UDEF		BAD	MA				HLD							

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
7	HLD	Block is in the Hold state	BLKSTA.B25
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
12	BAD	Bad I/O	BLKSTA.B20
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17

* Bit 0 is the least significant, low order bit.

BTIME1

Balance Time to Input 1 is a real input that specifies the balancing time for toggling from Input 2 to Input 1. The output approaches the Input 1 value with a response characteristic of a first order lag having a time constant of BTIME1, in minutes. The value actually input to this parameter represents nearly one-fifth of the time that it takes the output to transfer from the Input 2 value to the Input 1 value.

BTIME2

Balance Time to Input 2 is a real input that specifies the balancing time for toggling from Input 1 to Input 2. The output approaches the Input 2 value with a response characteristic of a first order lag having a time constant of BTIME2, in minutes. The value actually input to this parameter represents nearly one-fifth of the time that it takes the output to transfer from the Input 1 value to the Input 2 value.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block.

DELTI1 to DELTI2

Change Delta for Input Range 1 or 2 is a real value that defines the minimum percent of the input range that triggers change driven connections for parameters in the range of RI1 or RI2. The default value is 1.

Entering a 1 causes the Object Manager to recognize and respond to a change of 1 percent of the full error range. If communication is within the same CP that contains the block's compound, change deltas have no effect.

Refer to "Peer-to-Peer Connections of Real-Type Block Inputs" on page 1703 for details on how the I/A Series software affects the change delta percentage during operation.

DELTO1

Change delta for Output Range 1 is a configurable real value that defines the minimum percent of the output range that triggers change-driven connections for parameters in the range RO1. The default value is 1.0 percent. If communication is within the same control station that contains the block's compound, DELTO1 has no effect.

DESCRP — Description is a user-defined string of up to 32 character that describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

EI1 to EI2 — Engineering Units for Input Ranges 1 and 2, defined by the parameters HSCI1 to HSCI2, LSCI1 to LSCI2, and DELTI1 to DELTI2, provide the engineering units text for the values defined by Input Ranges 1 and 2. "Deg F" or "pH" are typical entries.

EO1 — Engineering Units for Output Range 1, defined by the parameters HSCO1, LSCO1, and DELTO1, provides the engineering units text for the values defined by Output Range 1. "Deg F" or "pH" are typical entries. Make the units for the Output Range (EO1) consistent with the units of Input Range 1 (EI1) and Input Range 2 (EI2).

ERCODE — Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block's DEFINE parameter to be set false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the SWCH block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
"W43 – INVALID PERIOD/ PHASE COMBINATION"	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
"W44 – INVALID ENGINEERING RANGE"	High range value is less than or equal to low range value.
"W46 – INVALID INPUT CONNECTION"	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
"W48 – INVALID BLOCK OPTION"	The configured value of a block option is illegal.
"W53 – INVALID PARAMETER VALUE"	A parameter value is not in the acceptable range.
"W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK"	A Database Installer error has occurred.

EROPT — Error Option is a short integer. If PROPT is true, EROPT specifies how the block responds to INP when the INP parameter is in error. EROPT has a range of 0 to 2, where:

0 =	The block ignores the errors.
1 =	The block sets the ERROR bit in OUT if the INP parameter: (a) has its BAD status bit set true; (b) has its OOS status bit set true; (c) is experiencing peer-to-peer path failure.
2 =	The block sets the ERROR bit in OUT if the INP parameter: (a) has its BAD status bit set true; (b) has its OOS status bit set true; (c) has its ERROR status bit set true (d) is experiencing peer-to-peer path failure.

The block disregards EROPT if PROPT is configured false. If EROPT = 0, a block in a cascaded scheme does not open the cascade in response to an error of its input signal, even if PRIBLK is configured true.

HSCI1 to HSCI2 — High Scale for Input Ranges 1 and 2 are real values that define the upper limit of the measurement ranges. EI1 to EI2 define the units. Make the range and units consistent with the measurement source. A typical value is 100 (percent).

HSCO1 — High Scale for Output Range 1 is a real value that defines the upper limit of the ranges for Output 1. A typical value is 100 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.

INITI — Initialization In defines the source block and parameter that drives this block into initialization. The source for this short integer input is the initialization output of a downstream block. With V4.2 or later software, BCALCI contains the cascade initialization request data bit eliminating the need to configure INITI connections in cascades. However, to preserve backward compatibility, the INITI parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITI short value is maintained, but the setting of the handshaking bits, via the INITI-INITO connection, is eliminated.

INITMA — Initialize Manual/Auto specifies the desired state of the MA input during initialization, where:

0 = Manual
1 = Auto
2 = The MA state as specified in the checkpoint file.

The block asserts this initial M/A state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a reboot operation.
- The compound in which it resides is turned on.
- The INITMA parameter itself is modified via the Integrated Control Configurator. (The block does not assert INITMA on ordinary reconfiguration.)

INITMA is ignored if MA has an established linkage.

INITO1
: Initialization Output 1 is set true when the block is not in Auto, or not toggled to input INP1. While the block is in Auto, INITO1 is reset to false when the SWCH block selects INP1. In a cascade configuration, you link this parameter to the INITI input of the upstream block that is linked to INP1. This enables that upstream block to sense when it is open loop. This block keeps INITO True, for one cycle (PRIBLK = 0), until the acknowledge is received from upstream (PRIBLK = 1 and PRITIM = 0.0), or for a fixed time delay (PRIBLK = 1 and PRITIM = nonzero).

With V4.2 or later software, BCALCI contains the initialization request data bit eliminating the need to configure INITO1 connections. However, to preserve backward compatibility, the INITO1 parameter has been maintained for use in existing configurations.

INITO2
: Initialization Output 2 is set true when the block is not in Auto, or not toggled to input INP2. While the block is in Auto, INITO2 is reset to false when the SWCH block selects INP2. In a cascade configuration, you link this parameter to the INITI input of the upstream block that is linked to INP2. This enables that upstream block to sense when it is open loop. This block keeps INITO True, for one cycle (PRIBLK = 0), until the acknowledge is received from upstream (PRIBLK = 1 and PRITIM = 0.0), or for a fixed time delay (PRIBLK = 1 and PRITIM = nonzero).

With V4.2 or later software, BCALCO contains the functions of the INITO2 parameter eliminating the need to configure INITO2 connections. However, to preserve backward compatibility, the INITO2 parameter has been maintained in existing configurations.

INP1 to INP2
: Inputs 1 and 2 are real inputs, one of which is selected to send to the output depending on the value of TOGGLE.

LOCKID
: Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.

LOCKRQ
: Lock Request is a boolean input which can be set true or false only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's

parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.

LOOPID — Loop Identifier is a configurable string of up to 32 character which identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.

LSCI1 to LSCI2 — Low Scale for Input Ranges 1 and 2 are real values that define the lower limit of the measurement ranges. A typical value is 0 (percent). EI1 to EI2 define the units. Make the range and units consistent with those of the INP source.

LSCO1 — Low Scale for Output Range 1 is a real value that defines the lower limit of the ranges for Output 1. A typical value is 0 (percent). EO1 defines the units. Make the range and units consistent with those of the output destination.

MA — Manual Auto is a boolean input that controls the Manual/ Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. In Manual, the algorithm is not performed, and the output is unsecured. An external program can then set the output to a desired value.

NAME — Name is a user-defined string of up to 12 character used to access the block and its parameters.

OUT — Output, in Auto mode, is the result of the block algorithm applied to one or more input variables. In Manual, OUT is unsecured, and can be set by you or by an external task.

OWNER — Owner is a user-defined string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are successful only if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.

PERIOD — Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and*

Field Control Processor 280 (CP280) Integrated Control Software Concepts (B0700AG).

PERTIM	Period Time is the period of the block expressed in seconds.
PHASE	Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).
PRIBLK	Primary Block is a configuration option. When true (=1), PRIBLK enables a block in a cascaded configuration to initialize without bumping the process, either at initial startup or whenever control is transferred up to a primary block. Depending on the value of PRITIM, PRIBLK does this by forcing the SWCH block to remain in the Hold state until the Acknowledge status bit (Bit 10) of MEAS is detected from the upstream block (PRITIM = 0.0), or until the time defined by PRITIM expires (PRITIM > 0.0). In the latter case, the explicit acknowledge from the upstream block is not needed. Use PRIBLK in a cascade situation when the source of the block's input connection needs to be initialized. For correct operation, set EROPT = 1 or 2, and implement the connections between each primary-secondary block combination. These connections include BCALCI/BCALCO, and OUT/RSP (or OUT/MEAS). Except for the most primary controller block, Invensys recommends that PRIBLK be set true for all applicable blocks in a cascaded scheme. When PRIBLK is false (default value), no special handling takes place. Refer to “PRIBLK and PRITIM Functionality” on page 2411 for more information on this parameter.
PRITIM	Primary Cascade Timer is a configurable parameter used to delay the closing of the cascade to a primary block, when the output is initialized in the SWCH block. It is used only if the PRIBLK option is set. The cascade is closed automatically when the timer expires without requiring an explicit acknowledge by the upstream block logic. Refer to “PRIBLK and PRITIM Functionality” on page 2411 for more information on this parameter.
PROPT	Propagate Error Option is a boolean input. When true, PROPT sets the ERROR Status bit of the output parameter if the input to the INP parameter is in error while the block is in Auto. The input to the INP parameter is in error when: ♦ Its BAD status bit is set true. ♦ Its OOS (Out-of-Service) status bit is set true.

- Its ERROR status bit is set true.
- It is experiencing peer-to-peer path failure.

If a transition to Manual occurs while the ERROR status is true, it remains true until either a set command is written to that output or until the block transfers to Auto with the error condition returned to normal.

PRSCAS

Present Cascade State is a data store that indicates the cascade state. It has the following possible values:

Value	State	Description
1	"INIT_U"	Unconditional initialization of the primary cascade is in progress.
2	"PRI_OPN"	The primary cascade is open.
3	"INIT_C"	Conditional initialization of the primary cascade is in progress.
4	"PRI_CLS"	The primary cascade is closed.

RI1 to RI2

Range Input is an array of real values that specify the high and low engineering scale and change delta of a particular real input. For a given block, it also forms an association with a group of real input parameters that have the same designated range and change delta.

RO1

Range Output is an array of real values that specify the high and low engineering scale of a particular real output. For a given block, it also forms an association with a group of real output parameters that have the same designated range.

TOGGLE

Toggle is a boolean input that performs the input selection. Input 1 is selected when Toggle = 0 (false). Input 2 is selected when Toggle = 1.

TYPE

When you enter "SWCH" or select "SWCH" from the block type list under Show, an identifying integer is created specifying this block type.

121.4 Detailed Operation

The Switch block supports a single-pole, double-throw switch element. Switching time between inputs is provided by independent user-specified balance times. Auto/Manual control of the output is also provided.

In Auto, the Toggle input controls which input is selected at the output. If the Toggle input is false, input 1 is selected. Upon transition of the Toggle input to true, the output drives to input 2 at a rate set by BTIME2. Upon transition of the Toggle input to false, the output drives to input 1 at a rate set by BTIME1. For the default case of BTIME1 = BTIME2 = 0, switching between inputs is instantaneous.

When PROPT is true and the block is in Auto, the BAD, OOS, and ERROR status bits of the selected input are copied to the output OUT.

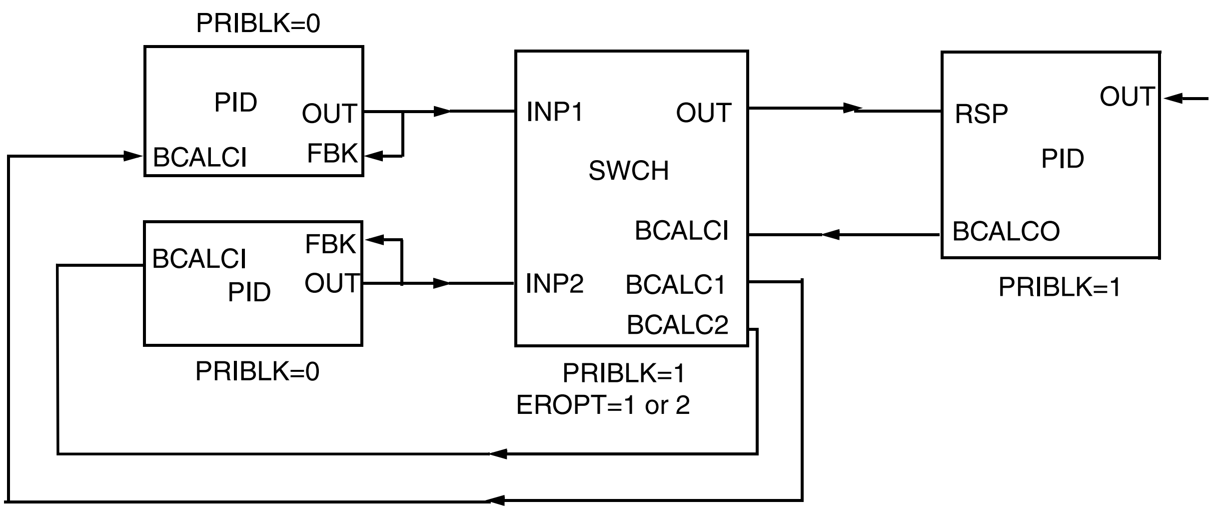
In Manual, the output is not updated by the block. An external program can then set the output to a desired value. Upon transfer to Auto, the block instantaneously drives the output to the input value selected by the Toggle input.

The SWCH block has the capability of being included in a cascaded control scheme. When you include a SWCH block in a cascade loop, configure the PRIBLK option true, implement the two connections between each primary/secondary block combination for correct operation, and configure the EROPT option to 1 or 2. These connections include BCALCI/BCALC1/BCALC2 and OUT/RSP (or OUT/MEAS).

If EROPT = 0, the block does not open the cascade in response to an error of its input signals.

121.4.1 Cascade Configuration

Configuration for the SWCH block when it is used in a cascade to select which of two primary controllers is to drive the secondary controller is shown below.



121.4.2 PRIBLK and PRITIM Functionality

The Primary Block (PRIBLK) parameter indicates whether the SWCH block has a connection from an upstream block (PRIBLK=1) or not (PRIBLK=0). Its value, together with that of the Primary Cascade Timer (PRITIM), determines whether the SWCH block remains in Hold for a fixed time delay (of length defined by PRITIM), or ends the Hold when the Acknowledge status bit (Bit 10) of MEAS is detected from the upstream block (if PRITIM = 0.0). During initialization, the acknowledgement is not required and a Hold of one cycle only occurs.

122. TIM – Timer Block

This chapter describes the TIM (Timer Block), its features, parameters and detailed operations.

122.1 Overview

A Timer (TIM) block contains four individual timers that can be run by a Sequence block (IND, DEP, or EXC) to time sequence activities. A TIM block does not contain any Sequence language statements, only standard parameters.

122.1.1 I/O Diagram

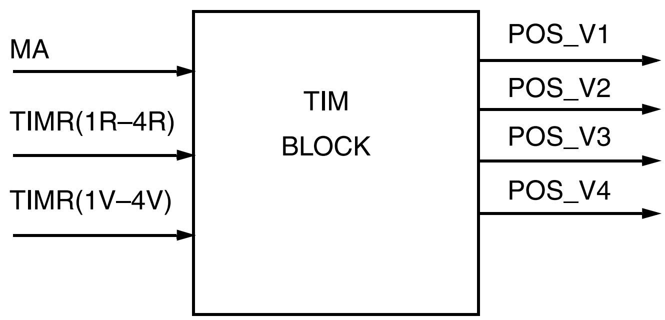


Figure 122-1. TIM Block I/O Diagram

122.2 Features

The features are:

- 4 independent timers per block
- Indicators that switch from 0 to 1 when a timer value changes from negative to positive.

The option is:

- RSTMA, Restart Manual Auto, specifies the desired value of the MA parameter at block initialization.

122.3 Parameters

Table 122-1. TIM Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	167	TIM
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
MA	manual/auto	boolean	con/set	0	0 to 1
RSTMA	restart MA	short	no-con/set	1	[0|1|2]
HSCI1	high scale in 1	real	no-con/no-set	100.0	specifiable
LSCI1	low scale in 1	real	no-con/no-set	0.0	specifiable
DELTI1	change delta 1	real	no-con/no-set	1.0	percent
EI1	eng units input	string	no-con/no-set	%	specifiable
TIMR1R to TIMR4R	timer1 to timer4 running	boolean	con/set	0	0 to 1
TIMR1V to TIMR4V	timer1 to timer4 value	real	con/set	0.0	---
OUTPUTS					
BLKSTA	block status	pack_l	con/no-set	0	bit map
POS_V1 to POS_V4	timer1 to timer4 positve	boolean	con/no-set	0	0 to 1
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
ERCODE	config error	string	no-con/no-set	0	1 to 43 chars
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars
RI1	eng range input	real[3]	no-con/no-set	100,0,1	specifiable

122.3.1 Parameter Definitions

ACHNGE — Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

BLKSTA — Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the TIM block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
											WLCK					ON	UDEF			MA											

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
20	WLCK	Workstation Lock	BLKSTA.B12

* Bit 0 is the least significant, low order bit.

DEFINE

Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block.

DELTI1

Change Delta for Input Range 1 is a real value that defines the minimum percent of the input range that triggers change driven connections for parameters in the range of RI1. The default value is 1.

Entering a 1 causes the Object Manager to recognize and respond to a change of 1 percent of the full error range. If communication is within the same CP that contains the block's compound, change deltas have no effect.

Refer to "Peer-to-Peer Connections of Real-Type Block Inputs" on page 1703 for details on how the I/A Series software affects the change delta percentage during operation.

DESCRP

Description is a user-defined string of up to 32 characters that describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

EI1

Engineering Units for Input Range 1, as defined by the parameters HSCI1, LSCI1, and DELTI1, provides the engineering units text for the values defined by TIMR1V to TIMR4V. "Deg F" or "pH" are typical entries.

ERCODE

Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations set the block's DEFINE parameter to false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the TIM block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
"W43 – INVALID PERIOD/ PHASE COMBINATION"	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
"W44 – INVALID ENGINEERING RANGE"	High range value is less than or equal to low range value.
"W46 – INVALID INPUT CONNECTION"	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
"W48 – INVALID BLOCK OPTION"	The configured value of a block option is illegal.
"W53 – INVALID PARAMETER VALUE"	A parameter value is not in the acceptable range.
"W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK"	A Database Installer error has occurred.

HSCI1

High Scale for Input Range 1 is a real value that defines the upper limit of the TIMR1V to TIMR4V ranges. EI1 defines the units. Make the range and units consistent with the timer source.

LOCKID

Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.

LOCKRQ

Lock Request is a boolean input which can be set true or false only by a SETVAL command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID parameter of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.

LOOPID

Loop Identifier is a configurable string of up to 32 characters which identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.

LSCI1
: Low Scale for Input Range 1 is a real value that defines the lower limit of the TIMR1V to TIMR4V ranges. EI1 defines the units. Make the range and units consistent with those of the timer source.

MA
: Manual Auto is a boolean input that controls the Manual/Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. In Manual, the algorithm is not performed, and the output is unsecured. An external program can then set the output to a desired value.

NAME
: Name is a user-defined string of up to 12 characters used to access the block and its parameters.

OWNER
: Owner is a user-defined string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are successful only if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.

PERIOD
: Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PHASE
: Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

POS_V1 to POS_V4
: Positive Value Timers 1 through 4 are boolean outputs that indicate whether the Timer 1 through 4 values are positive or zero (true = 1) or negative (false = 0). POS_V1 to POS_V4 are useful in a timeout applications. For example, enter the timeout value (in seconds) into Timer 1 as a negative value and monitor this parameter. POS_V1 switches from negative to positive as Timer 1 value increments from a negative value to a zero (or positive) value, thereby indicating that the timeout period has expired.

RI1

Range Input is an array of real values that specify the high and low engineering scale and change delta of a particular real input (TIMR1V to TIMR4V). For a given block, it also forms an association with a group of real input parameters that have the same designated range and change delta.

RSTMA

Restart Manual Auto specifies the desired value of the MA parameter at block initialization. It can have one of three values:

0 = RSTMA sets MA to 0 (Manual)

1 = RSTMA sets MA to 1 (Auto)

2 = RSTMA leaves MA unchanged.

The block asserts this initial M/A state whenever:

- ♦ The compound in which it resides is turned on.
- ♦ The Control Processor undergoes a restart operation.

The state of this parameter is ignored when the Control Processor restarts because of an On-Line Upgrade (OLUG).

TIMR1R to TIMR4R

Timers 1 through 4 Running are boolean inputs which enable/disable the four timers in TIM. For example, when true, TIMR1R enables Timer 1. When TIMR1R is false, Timer 1 is stopped. When the sequence logic from a DEP, IND, or EXC block executes a START_TIMER (sets TIMR1R true) or STOP_TIMER (sets TIMR1R false) sequence language statement, it overwrites the configured TIMR1R value.

TIMR1V to TIMR4V

Timers 1 through 4 Value are real inputs that presets the time value, in seconds. For timeout schemes, as an example, you can enter a negative value (and monitor POS_V1). The START_TIMER sequence language statement can overwrite this configured value. While TIMR1R is true, TIMR1V is updated every scheduled Basic Processing Cycle (BPC).

TYPE

When you enter “TIM” or select “TIM” from a configurator list, it creates an identifying integer specifying this block type.

122.4 Detailed Operation

The TIM block is processed when:

- ♦ The compound is on.
- ♦ The TIM block is in automatic mode.

When a TIM block is processed, any of its timers that have been started by an Independent (IND), Dependent (DEP), or Exception (EXC) Sequence block are updated every scheduled Basic Processing Cycle (BPC).

Each timer is composed of a real and a boolean parameter. The timers are:

Timer	Boolean Parameter	Real Parameter
Timer 1	TIMR1R	TIM1V
Timer 2	TIMR2R	TIM2V
Timer 3	TIMR3R	TIM3V
Timer 4	TIMR4R	TIM4V

A Sequence (IND, DEP, or EXC) block starts a timer with a START_TIMER statement. This sends the value true to the timer's boolean parameter and initializes the timer value. When true, the timer's real parameter is updated each scheduled BPC.

A Sequence block stops a timer with a STOP_TIMER statement. The STOP_TIMER statement sends the value false to the timer's boolean parameter and the timer value initializes. The timer's real parameter is no longer updated.

In manual mode, the TIM block is not processed.

Within a BPC, the block processing order is as follows:

- ♦ Continuous
- ♦ Monitor and Timer
- ♦ Exception
- ♦ Independent and Dependent
- ♦ Extension of Continuous Blocks.

If the block processor cannot process all blocks in a scheduled BPC, there is a Basic Processing Cycle (BPC) overrun. The system produces an error message to indicate when an overrun occurs.

NOTE

In a serious system overload, TIM blocks are always processed, even if it delays the next BPC.

123. VLV – Valve Block

This chapter describes the VLV (Valve Block), its features, parameters and detailed operations.

123.1 Overview

The On/Off Valve block (VLV, Figure 123-1) provides open/close control of a motor or air operated valve and interfaces to a discrete type FBM (Fieldbus Module). The block supports a 2-wire configuration using a single sustained output. VLV supports both Manual and Auto operational modes. The VLV block also provides mismatch timeout alarming of the valve's sensed limit positions.

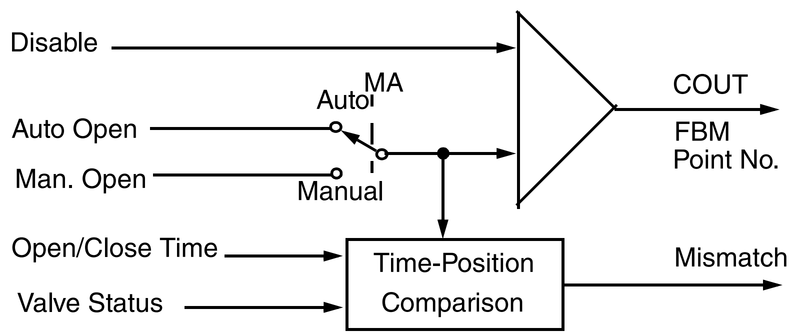


Figure 123-1. VLV Block Diagram

123.2 Features

The features are:

- ♦ Manual/Auto mode for "remote" control of valve
- ♦ Auto and Manual latch switch inputs (AUTSW and MANSW) that allow the block to be switched to Auto or Manual
- ♦ Open loop indication to upstream blocks
- ♦ Timed indication of a mismatch between the desired state and the actual state of the valve
- ♦ State mismatch alarming
- ♦ Bad FBM alarming
- ♦ Alarm message Inhibit
- ♦ Disable input for "local" control of final operator device
- ♦ Failsafe support.

The options are:

- ♦ Fieldbus Module Option (IOMOPT) specifies whether an FBM connection to the block exists.

- Initialize Manual/Auto (INITMA) specifies the desired state of the MA input during initialization.
- Manual If Failsafe (MANFS) when configured true, drives the block to the Manual state if the block detects an incoming failsafe status.
- Inhibit Option (INHOPT) allows you to specify alarm inhibit options.
- Desired State Request Track (DSRTRK) option when set true, forces Manual/Auto DSR parameters to track each other and prevents these parameters from being set while the block is not in the parameter's designated state.

123.3 Parameters

Table 123-1. VLV Block Parameters

Name	Description	Type	Accessibility	Default	Units/Range
INPUTS					
NAME	block name	string	no-con/no-set	blank	1 to 12 chars
TYPE	block type	integer	no-con/no-set	27	VLV
DESCRP	descriptor	string	no-con/no-set	blank	1 to 32 chars
PERIOD	block sample time	short	no-con/no-set	1	0 to 13
PHASE	block phase number	integer	no-con/no-set	0	---
LOOPID	loopid	string	no-con/set	blank	1 to 32 chars
IOMOPT	FBM output option	short	no-con/no-set	0	0 to 1
IOM_ID	FBM reference	string	no-con/no-set	blank	---
PNT_NO	FBM point number	string	no-con/no-set	1	[1..32]
AUTOPN	auto open request	boolean	con/set	0	0 to 1
MANOPN	manual open request	boolean	con/set	0	0 to 1
DISABL	disable input	boolean	con/set	0	0 to 1
CLSLIM	valve close limit	boolean	con/set	0	0 to 1
OPNLIM	valve open limit switch	boolean	con/set	0	0 to 1
TOC	open/close time	real	no-con/no-set	0.0	[0..]minutes
ANM	alarm name point 1	string	no-con/no-set	blank	1 to 12 chars
NM0 to NM1	alarm state name	string	no-con/no-set	blank	1 to 12 chars
INITI	initialize in	short	con/set	0	0 to 1
INITOP	initialization option	short	con/non-set	0	0 to 2
MA	manual/auto	boolean	con/set	0	0 to 1
INITMA	initialize MA	short	no-con/no-set	1	[0|1|2]
MANSW	manual switch	boolean	con/set	0	0 to 1
AUTSW	auto switch	boolean	con/set	0	0 to 1
MANFS	manual If failsafe	boolean	no-con/no-set	0	0 to 1
INHOPT	inhibit option	short	no-con/no-set	0	0 to 3
INHIB	alarm inhibit	boolean	con/set	0	0 to 1
INHALM	inhibit alarm	pack_b	con/set	0	0 to 0xFFFF
SAP	state alarm priority	integer	con/set	5	[1 to 5]
SAG	state alarm group	short	no-con/set	1	[1 to 8]
BAP	bad alarm priory	integer	con/set	5	[1 to 5]
BAG	bad alarm group	short	no-con/set	1	[1 to 8]

Table 123-1. VLV Block Parameters (Continued)

Name	Description	Type	Accessibility	Default	Units/Range
BAT	bad alarm text	string	no-con/no-set	blank	1 to 32 chars
RSMMOP	reset mismatch option	short	no-con/no-set	0	0 to 3
DSRTRK	DSR tracking	boolean	no-con/set	0	0 to 1
AMRTIN	alarm regeneration timer	integer	no-con/no-set	0	0 to 32767 s
OUTPUTS					
ALMSTA	alarm status	pack_l	con/no-set	0	bit map
BAD	bad I/O status	boolean	con/no-set	0	0 to 1
BLKSTA	block status	pack_l	con/no-set	0	bit map
COUT	contact output	boolean	con/no-set	0	0 to 1
CRIT	criticality	integer	con/no-set	0	[0..5]
FS	failsafe state	boolean	con/no-set	0	0 to 1
INHSTA	inhibit status	pack_l	con/no-set	0	0 to 0xFFFF
INITO	initialize out	short	con/no-set	0	0 to 1
MMAIND	mismtch alarm indicator	boolean	con/no-set	0	0 to 1
PRTYPE	priority type	integer	con/no-set	0	[0..10]
UNACK	alarm notification	boolean	con/no-set	0	0 to 1
DATA STORES					
ACHNGE	alternate change	integer	con/no-set	0	-32768 to 32767
ALMOPT	alarm options	pack_l	no-con/no-set	0	0 to 0xFFFFFFFF
DEFINE	no config errors	boolean	no-con/no-set	1	0 to 1
DEV_ID	FBM letterbug	char[6]	no-con/no-set	blank	1 to 6 chars
ERCODE	config error	string	no-con/no-set	0	1 to 43 chars
LOCKID	lock identifier	string	no-con/no-set	blank	8 to 13 chars
LOCKRQ	lock request	boolean	no-con/set	0	0 to 1
OWNER	owner name	string	no-con/set	blank	1 to 32 chars
PERTIM	period time	real	no-con/no-set	0.1	---
TCOUNT	timeout count	integer	no-con/no-set	-2	block executions
TTOTAL	timeout length	integer	no-con/no-set	1	block executions

123.3.1 Parameter Definitions

ACHNGE

Alternate Change is an integer output which is incremented each time a block parameter is changed via a Set command.

ALMOPT

Alarm Options contains packed long values representing the alarm types that have been configured as options in the block, and the alarm groups that are in use. For the VLV block, only the following unshaded bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32

Bit Number[1] (0 to 31)	Configured Alarm Option When True
0	Alarm Group 8 in Use
1	Alarm Group 7 in Use
7	Alarm Group 1 in Use
22[2]	Bad I/O Alarm Configured

1. Bit 0 is the least significant, low order bit.
2. Be aware that for this block, this bit defaults to 1 and cannot be cleared. If you do not want a Bad I/O alarm, you must inhibit Bad I/O alarms for this block.

ALMSTA Alarm Status is a 32-bit output, bit-mapped to indicate the block's alarm states. For the VLV block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
	UNAK	INH							BAD																CRIT				PRTYPE		

Bit Number (0 to 31)[1]	Name	Description When True	Boolean Connection (B32 to B1)
0 to 4	PTYP_MSK	Priority Type: See parameter PRTYPE for values used in the VLV block	ALMSTA.B32–ALMSTA.B28
5 to 7	CRIT_MSK	Criticality; 5 = lowest priority, 1= highest	ALMSTA.B27–ALMSTA.B25
22	BAD	Input/Output Bad (BAD output of block)	ALMSTA.B10
29	INH	Alarm inhibit	ALMSTA.B3
30	UNAK	Unacknowledged	ALMSTA.B2

1. Bit 0 is the least significant, low order bit

AMRTIN Alarm Regeneration Timer is a configurable integer that specifies the time interval for an alarm condition to exist continuously, after which a new unacknowledged alarm condition and its associated alarm message is generated.

ANM Alarm Name is a user-specified character string in which the user can use to identify the source of any alarm message associated with the respective block. It serves as a point descriptor label.

AUTOPN Auto Open is a boolean input. While the block is in Auto, a positive transition at AUTOPN sets COUT true. While the block is in Auto, a negative transition at AUTOPN resets COUT to false. If DSRTRK is set true, an unlinked AUTOPN input tracks the MANOPN input when the block is in Manual.

AUTSW Auto Switch is a boolean input that, when true, overrides the MA and INITMA parameters, and drives the block to the Auto state. If both MANSW and AUTSW are true, MANSW has priority.

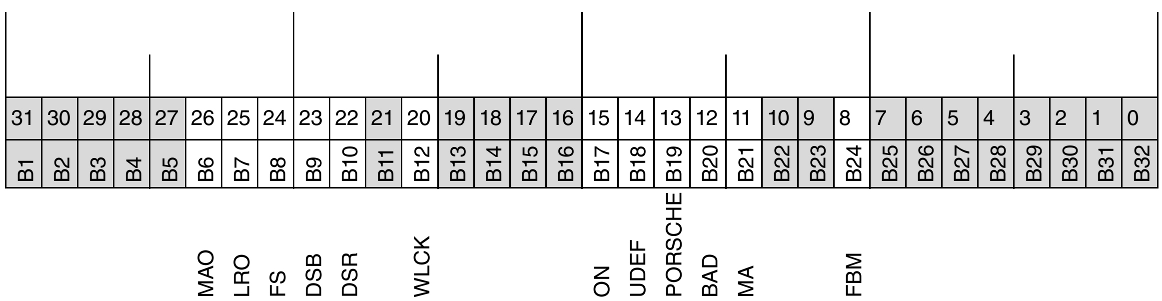
BAD Bad is a boolean output parameter which is set true when the input to the block is unacceptable in any way. The BAD bit of BLKSTA (BLKSTA.BAD) is also set true whenever BAD is true.

BAG Bad Alarm Group is a short integer input that directs Bad alarm messages to one of eight groups of alarm devices. You can change the group number through the workstation.

BAP Bad Alarm Priority is an integer input, ranging from 1 to 5, that sets the priority level of the Bad alarm (1 is the highest priority).

BAT Bad Alarm Text is a user-configurable text string of up to 32 characters, sent with the bad alarm message to identify it.

BLKSTA Block Status is a 32-bit output, bit-mapped to indicate the block's operational states. For the VLV block, only the following bits are used:



Bit Number[1] (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
8	FBM	FBM Failure	BLKSTA.B24
11	MA	Manual(= false)/Auto(= true)	BLKSTA.B21
12	BAD	Bad I/O	BLKSTA.B20

Bit Number[1] (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
13	PORSCHE	Block contains I/A Series v8.5 controller enhancements (parameters INITI and INITOP)	BLKSTA.B19
14	UDEF	Undefined	BLKSTA.B18
15	ON	Compound On	BLKSTA.B17
20	WLCK	Workstation Lock	BLKSTA.B12
22	DSR	DSR Mismatch	BLKSTA.B10
23	DSB	Disabled	BLKSTA.B9
24	FS	Failsafe	BLKSTA.B8
26	MAO	Manual/Auto Override	BLKSTA.B6

1. Bit 0 is the least significant, low order bit.

CLSLIM Close Limit is an input pointing to the program or block that monitors the state of the Valve-Closed Limit Switch.

COUT Contact Out is the block's boolean output (1 = Open; 0 = Close). During normal operation (when DISABL is false), the selected input is written to COUT. COUT is written to the addressed channel of the FBM when IOMOPT is true.The VLV block always secures this output. Refer to the MA and DISABL definitions for details on how they affect block operation.

CRIT Criticality is an integer output that indicates the priority, ranging from 1 to 5, of the block's highest currently active alarm (1 is the highest priority). An output of zero indicates the absence of alarms.

DEFINE Define is a data store which indicates the presence or absence of configuration errors. The default is 1 (no configuration errors). When the block initializes, DEFINE is set to 0 if any configured parameters fail validation testing. In that case, no further processing of the block occurs. To return DEFINE to a true value, correct all configuration errors and re-install the block.

DESCRP Description is a user-defined string of up to 32 characters that describe the block's function (for example, "PLT 3 FURNACE 2 HEATER CONTROL").

DEV_ID Device Identifier is a character array that specifies the 6-character letterbug identifier of the connected FBM or FBC. DEV_ID differs from IOM_ID in that it is a character array rather than a string type, and does not allow the use of the ECB NAME parameter or ECB pathname in specifying the connected FBM or FBC.

DISABL

Disable is a boolean input. When true, DISABL sets the output COUT to false, and inhibits normal block operation in either Auto or Manual mode. While DISABL is false (block enabled), the block accepts requests from either the AUTOPN or MANOPN inputs. DISABL is independent of MA, and has a higher priority.

DSRTRK

Desired State Request Track option, when set true, forces unlinked Manual/Auto DSR parameters to track each other. DSRTRK also prevents the setting of these parameters while the block is not in the parameter's designated state. (For example, in the VLV block, AUTOPN cannot be set in the Manual state, and MANOPN cannot be set in the Auto state.) DSRTRK is a configurable boolean option that can be set at any time, regardless of the compound or block state. However, once DSRTRK is enabled, it can be disabled only by performing a delete/undelete of the block.

ERCODE

Error Code is a string data store which indicates the type of configuration error or warning encountered. The error situations cause the block's DEFINE parameter to be set false, but not the warning situations. Validation of configuration errors does not proceed past the first error encountered by the block logic. The block detailed display shows the ERCODE on the primary page, if it is not null. For the VLV block, the following list specifies the possible values of ERCODE, and the significance of each value in this block:

Message	Value
"W43 – INVALID PERIOD/ PHASE COMBINATION"	PHASE does not exist for given block PERIOD, or block PERIOD not compatible with compound PERIOD.
"W46 – INVALID INPUT CONNECTION"	The source parameter specified in the input connection cannot be found in the source block, or the source parameter is not connectable, or an invalid boolean extension connection has been configured.
"W48 – INVALID BLOCK OPTION"	The configured value of a block option is illegal.
"W51 – INVALID HARDWARE/SOFTWARE TYPE"	An I/O block is connected to an ECB or the wrong type.
"W52 – INVALID I/O CHANNEL/GROUP NUMBER"	An I/O block is connected to an ECB when the specified point number is invalid or when the specified group or octet number is invalid.
"W53 – INVALID PARAMETER VALUE"	A parameter value is not in the acceptable range.

Message	Value
"W54 – ECB DOES NOT EXIST"	An I/O block has a connection to an ECB that does not exist or has not yet been installed. When the ECB is installed, previously installed I/O blocks waiting for that ECB will initialize automatically.
"W58 – INSTALL ERROR; DELETE/UNDELETE BLOCK"	A Database Installer error has occurred.
"W59 – DUPLICATE OUTPUT CHANNEL"	This block and another output block are connected to the same output point. Since this may be intentional, this message is only a warning.

FS

Failsafe is a boolean output that is set true when the block detects the FBM going to the Failsafe state. While in this state, the block retains the actual Failsafe value of the output point as it is read back from the FBM. This value, depending on the ECB Failsafe option, is either the fallback or the hold value.

INHALM

Inhibit Alarm contains packed boolean values that represent alarm inhibit requests for each alarm type or point configured in the block. For the VLV block, only the following bits are used:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16

Bit Number* (0 to 15)	Description When True	Boolean Connection (B16 to B1)
6	Inhibit State Alarm	INHALM.B10
10	Inhibit Bad I/O Alarm	INHALM.B6

* Bit 0 is the least significant, low order bit.

There are no mnemonic names for the individual bits of INHALM.

INHIB

Inhibit is a boolean input. When true, it inhibits all block alarms; the alarm handling and detection functions are determined by the INHOPT setting. Alarms may also be inhibited based on INHALM and the compound parameter CINHIB.

INHOPT

Inhibit Option specifies the following actions applying to all block alarms:

0 = When an alarm is inhibited, disable alarm messages but do not disable alarm detection.

1 = When an alarm is inhibited, disable both alarm messages and alarm detection. If an alarm condition already exists at the time the alarm transitions into the inhibited state, clear the alarm indicator.

2 = Same as 0 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

3 = Same as 1 for all inhibited alarms. For all uninhibited alarms, automatically acknowledge “return-to-normal” messages. “Into alarm” messages may be acknowledged by explicitly setting UNACK false.

INHSTA

Inhibit Status contains packed long values that represent the actual inhibit status of each alarm type configured in the block. For the VLV block, only the following bits are used:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29	B30	B31	B32
	UNACK	INH																													

Bit Number* (0 to 31)	Name	Description When True	Boolean Connection (B32 to B1)
29	INH	Inhibit Alarm	INHSTA.B3
30	UNACK	Unacknowledged	INHSTA.B2

* Bit 0 is the least significant, low order bit

INITI

Initialization In defines the source block and parameter that drives this block into initialization. The source for this short integer input is the initialization output of a downstream block. With V4.2 or later software, BCALCI contains the cascade initialization request data bit eliminating the need to configure INITI connections in cascades. However, to preserve backward compatibility, the INITI parameter has been maintained for use in existing configurations. Existing configurations do not need to reconfigure their cascades. The logic to set or reset the INITI short value is maintained, but the setting of the handshaking bits, via the INITI to INITO connection, is eliminated.

INITMA

Initialize Manual/Auto specifies the desired state of the MA input during initialization, where:

- 0 = Manual
- 1 = Auto
- 2 = The MA state as specified in the checkpoint file.

The block asserts this initial M/A state whenever:

- It is installed into the Control Processor database.
- The Control Processor undergoes a reboot operation.
- The compound in which it resides is turned on.
- The INITMA parameter itself is modified via the Integrated Control Configurator. (The block does not assert INITMA on ordinary reconfiguration.)

INITMA is ignored if MA has an established linkage.

INITO

Initialization Output is set true when:

- The block is in Manual or initializing.
- Permanent or temporary loss of FBM communications occurs.
- The ladder logic in the FBM is not running.
- MMAIND (mismatch indicator) is true.
- DISABL is true.

The block clears INITO when none of these conditions exist. You connect this parameter to the INITI input of upstream blocks so that these upstream blocks can sense when this block is open loop.

INITOP

Initialization Option is a configurable, non-settable short integer that is used to specify how to initialize the block's output when not directly connected to an I/O device (IOMOPT=0) and the block is installed, the compound containing the block is turned on, or the CP is rebooted. INITOP can have the following values (0 is default):

- 0 = use OPNLIM (in Auto, set AUTOPN=OPNLIM; in Manual, set MANOPN=OPNLIM)
- 1 = open the valve (in Auto, set AUTOPN=1; in Manual, set MANOPN=1)
- 2 = close the valve (in Auto, set AUTOPN=0; in Manual, set MANOPN=0)

IOMOPT

Fieldbus Module Option is a short integer that specifies whether an FBM connection to the block exists. IOMOPT for the VLV block has a range of 0 to 1, where:

0 = The block outputs are not connected to an FBM. This option may be used for simulation, or for connecting COUT as an input to other blocks.

1 = The block outputs are connected to a discrete-type FBM specified by the IOM_ID and COUT.

IOM_ID

Fieldbus Module Identifier is a configurable string that specifies the pathname of the ECB for the FBM or FBC to which the block is connected.

IOM_ID has the form CompoundName:BlockName, where CompoundName is the 1-12 character name of the local compound containing the ECB, and BlockName is the 1-12 character block name of the ECB.

If the compound containing the ECB is the CPletterbug_ECB compound where CPletterbug is the station letterbug of the CP, the CompoundName may be omitted from the IOM_ID configuration. In this case, the 1-12 character ECB block name is sufficient.

LOCKID

Lock Identifier is a string identifying the workstation which has locked access to the block via a successful setting of LOCKRQ. LOCKID has the format LETTERBUG:DEVNAME, where LETTERBUG is the 6-character letterbug of the workstation and DEVNAME is the 1 to 6 character logical device name of the Display Manager task.

LOCKRQ

Lock Request is a boolean input which can be set true or false only by a set command from the LOCK U/L toggle key on workstation displays. When LOCKRQ is set true in this fashion a workstation identifier accompanying the SETVAL command is entered into the LOCKID of the block. Thereafter, set requests to any of the block's parameters are honored (subject to the usual access rules) only from the workstation whose identifier matches the contents of LOCKID. LOCKRQ can be set false by any workstation at any time, whereupon a new LOCKRQ is accepted, and a new ownership workstation identifier written to LOCKID.

LOOPID

Loop Identifier is a configurable string of up to 32 characters which identify the loop or process with which the block is associated. It is displayed on the detail display of the block, immediately below the faceplate.

MA

Manual Auto is a boolean input that controls the Manual/Automatic operating state (0 = false = Manual; 1 = true = Auto). In Auto, given the measurement value, the block computes the output according to its specific algorithm. In Manual, the algorithm is not performed, and the output is unsecured. An external program can then set the output to a desired value.

MANFS	Manual If Failsafe is a boolean input. When configured true, MANFS drives the block to the Manual state if the block detects an incoming fail-safe status. MANFS has no effect when MA is linked.
MANOPN	Manual Open is a boolean input that begins with an operator request through the HI interface. A positive transition at MANOPN, while the block is in Manual, set COUT to true. If DSRTRK is true, an unlinked MANOPN input is secured and it tracks the AUTOPN input when the block is in Auto.
MANSW	Manual Switch is a boolean input. When true, MANSW overrides the MA and INITMA parameters and drives the block to the Manual state. If both MANSW and AUTSW are true, MANSW has priority.
MMAIND	Mismatch Indicator is a boolean output that is set true whenever the sensed state of the valve (determined by OPLIM and CLSLIM) does not match the requested state within the timer interval, TOC. The block generates an alarm when it sets MMAIND true, if the INHIB input is false.
NAME	Name is a user-defined string of up to 12 characters used to access the block and its parameters.
NM0	Name 0 is a user-defined string of up to 12 characters. NM0 describes in alarm reports the action generated by the mismatch indicator MMAIND returning from alarm.
NM1	Name 1 is a user-defined string of up to 12 characters. NM1 describes, in alarm reports, the action generated by the mismatch indicator MMAIND going into alarm.
OPNLIM	Open Limit is an input pointing to the program or block that monitors the state of the Valve-Open Limit Switch.
OWNER	Owner is a string of up to 32 ASCII characters which are used to allocate control blocks to applications. Attempts to set Owner are successful only if the present value of Owner is the null string, an all-blank string, or identical to the value in the set request. Otherwise the request is rejected with a LOCKED_ACCESS error. Owner can be cleared by any application by setting it to the null string; this value is always accepted, regardless of the current value of Owner. Once set to the null string, the value can then be set as desired.
PERIOD	Period is a short input that defines the block execution time. Along with the control processor's Block Processing Cycle (BPC), it defines the execution period for this block. For CP40 and later CP stations, PERIOD values range from 0 to 13. For earlier CP stations, Integrators, and Gateways, the PERIOD range is 0 to 12. Its default value is 1. For more details, refer to "Scan Period" in *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PERTIM Period Time is the period of the block expressed in seconds.

PHASE Phase is an integer input that causes the block to execute at a specific BPC within the time determined by the PERIOD. For instance, a block with PERIOD of 3 (2.0 sec) can execute within the first, second, third, or fourth BPC of the 2-second time period, assuming the BPC of the Control Processor is 0.5 sec. Refer to *Control Processor 270 (CP270) and Field Control Processor 280 (CP280) Integrated Control Software Concepts* (B0700AG).

PNT_NO Point Number specifies the point number on the FBM terminal board that connects to a field device.

PRTYPE Priority Type is an indexed (0 to 9) output parameter that indicates the alarm type of the highest priority active alarm. The PRTYPE outputs of this block include the following alarm types:

0 = No active alarm

8 = BAD Alarm

9 = State Alarm.

RSMMOP Reset Mismatch Option is used to specify that the DSR input be reset when a mismatch alarm occurs in a VLV block.

- 0 = option is disabled (default)
- 1 = set AUTOPN, MANOPN and output of VLV block equal to OPNLIM when a mismatch alarm occurs
- 2 = set AUTOPN, MANOPN and output of VLV block equal to 0 when a mismatch alarm occurs
- 3 = set AUTOPN, MANOPN and output of VLV block equal to 1 when a mismatch alarm occurs

SAG State Alarm Group is a short integer input that directs mismatch alarm messages to the corresponding group of alarm devices. You can change the group number through the workstation.

SAP State Alarm Priority is an integer input that sets the alarm priority for the mismatch alarm reporting (1 is the highest priority).

TCOUNT Timeout Count is an integer used by the VLV block as a temporary value in counting the alarm timeout.

TOC Time to Open or Close is the delay, in minutes, before the comparison for mismatch is made. Configure a delay at least as great as the maximum time required for the valve to go from one state to the other. To avoid truncation, set TOC equal to an integral multiple of the PERIOD.

TTOTAL Timeout Length is an integer used by the VLV block as a local value containing the total number of block executions in the alarm timeout for output mismatch.

TYPE	When you enter “VLV”, or select “VLV” from a configurator list, it creates an identifying integer specifying this block type.
UNACK	Unacknowledge is a boolean output that the block sets to True when it detects an alarm. It is typically reset by operator action.

123.4 Functions

123.4.1 Detailed Diagram

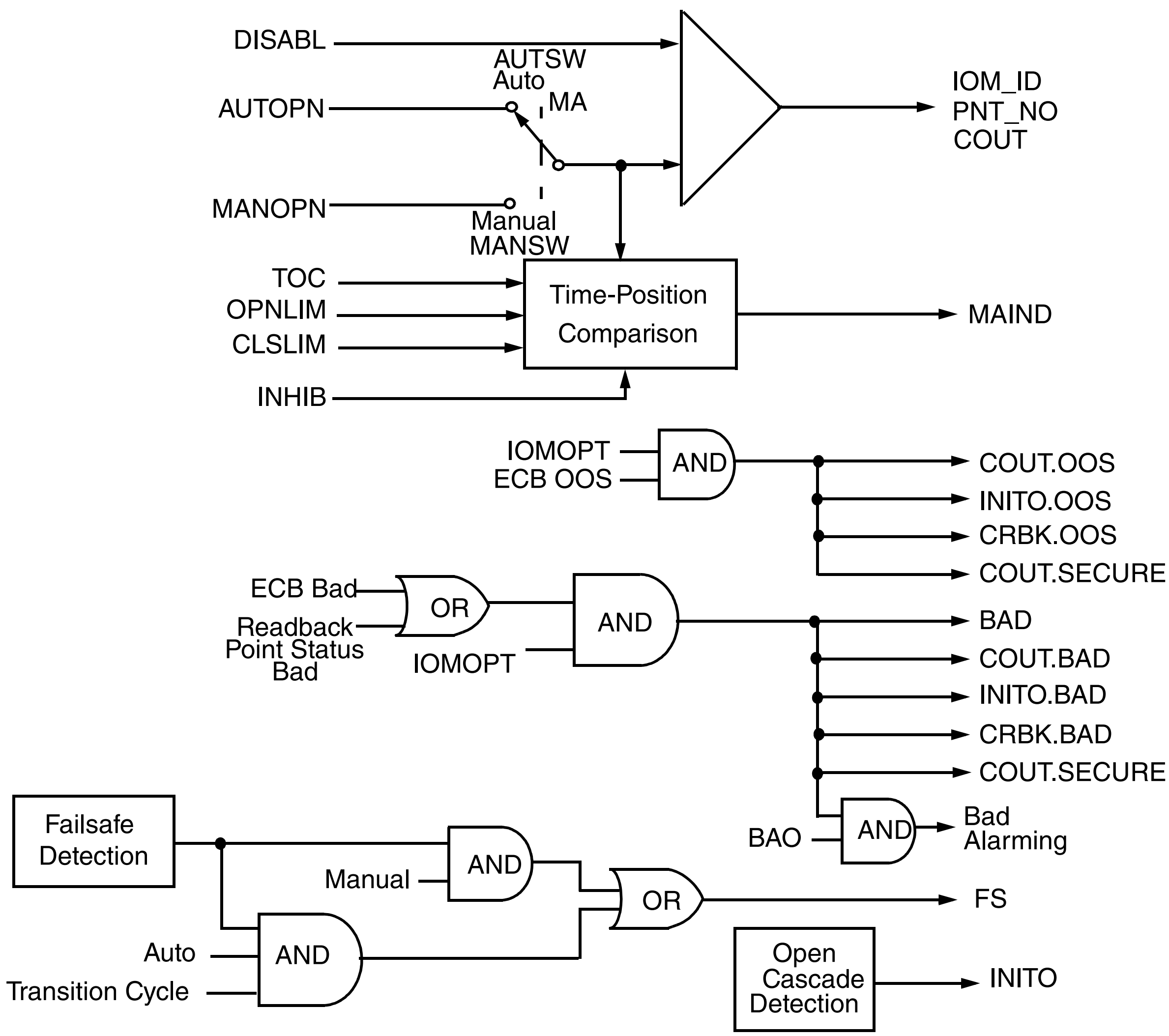


Figure 123-2. VLV Detailed Diagram

123.4.2 Detailed Operation

The VLV block provides open/close control of motor or air operated valves. The block supports the 2-wire configuration using a single sustained output and interfaces with discrete-type FBMs with Sustained or Momentary configurations.

The VLV block has an operator (Manual) mode and an external (Auto) mode. In Manual, the block accepts operator-set Open/Close action to the MANOPN input. In Auto any block, task, or application program can initiate the Open/Close action to the AUTOPN input.

The VLV block drives the I/O directly to either the fully open (COUT = 1) or the fully closed (COUT = 0) position. Local circuitry normally disables valve drive when the valve reaches either extreme.

Unlinked desired state request (DSR) parameters can be changed as follows:

- MANOPN can be changed when the block is in Manual, or while the block is in Auto, provided DSRTRK is true.
- AUTOPN can be changed while the block is in Auto. AUTOPN can also be changed while the block is in Manual, if DSRTRK is set true.

123.4.3 2-Wire Configuration Using Sustained Output

Key Parameters: COUT, AUTOPN, MANOPN, IOM_ID, IOMOPT, PNT_NO, OPLIM

In a 2-wire configuration, COUT is the sustained Open/Close or drive contact:

COUT = 1 = Open

COUT = 0 = Close

During normal 2-wire operation (DISABL = false), the selected input (AUTOPN or MANOPN) is written to COUT. The block drives COUT directly to either the Open or the Close position (Figure 123-3). When an FBM is connected for outputs (that is, IOMOPT = 1), the value of COUT is copied to the output point specified by IOM_ID and PNT_NO.

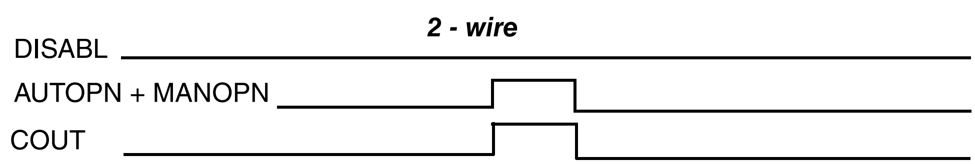


Figure 123-3. 2-wire Typical Timing Diagram

If the block is in I/O simulation mode (IOMOPT = 0), MANOPN, AUTOPN, and COUT initialize to the current setting of the OPNLIM switch. If the block is in I/O mode (IOMOPT = 1), they are initialized to the current contact output value read back from the device. This ensures that the valve state remains unchanged across reinitializations.

123.4.4 Output Processing

Key Parameters: IOM_ID, PNT_NO, COUT

The block output COUT is mapped to physical I/O point by specifying the Letterbug ID of the discrete-type FBM and the output point number. You specify the destination FBM in the Fieldbus Module Identifier (IOM_ID) parameter, and the point within the FBM by the Point Number (PNT_NO) parameter.

At the beginning of an I/O read cycle, the addressed FBM output channel is read and the value is stored in the ECB for that FBM. When the block initializes, this value is used to update the input parameter, assuming this parameter has no connection from other blocks.

The VLV block drives the I/O directly to either the fully open (COUT = 1) or the fully closed (COUT = 0) position. Local circuitry normally disables valve drive when the valve reaches either extreme.

The MTR block interfaces with discrete-type FBMs that have either sustained or momentary configurations.

The following are the FBMs and point numbers providing valid output destinations for the MTR block:

FBM	Electrical Type	Valid Output Points
FBM219	Contact or dc In; Output Switch with Internal or External Source	Points 25 to 32
FBM241	Contact or dc In; Output Switch with Internal or External Source	Points 9 to 16
FBM242	Contact Output; Output Switch with External Source	Points 1 to 16
FBM09	Contact or dc In; Output Switch with Internal or External Source	Points 9 to 16
FBM10	120 V ac In; 120 V ac Output Switch	Points 9 to 16
FBM11	240 V ac In; 240 V ac Output Switch	Points 9 to 16
FBM14	Contact or dc In; Output Switch with Internal or External Source Expansion	Points 25 to 32
FBM15	120 V ac In; 120 V ac Output Switch Expansion	Points 25 to 32
FBM16	240 V ac In; 240 V ac Output Switch Expansion	Points 25 to 32
FBM17	Contact or dc In; Output Switch with Internal or External Source (Plus Analog I/O)	Points 11 to 14
FBM26	Contact or 125 V dc or Contact Externally Powered In; Externally Powered Output Switch	Points 9 to 16
FBM27	Contact or 125 V dc or Contact Externally Powered In; Externally Powered Output Switch Expansion	Points 25 to 32

123.4.5 Auto/Manual State Tracking

Key Parameters: DSRTRK, MANOPN, AUTOPN

The block sets all unlinked DSR parameters (MANOPN and AUTOPN) to the actual output state, on any block Manual-Hold-Auto transition except for the Hold-to-Auto transition.

If DSRTRK is set true, the block, while in Auto, secures the unlinked MANOPN parameter and has it track AUTOPN. In Manual, with DSRTRK set true, the unlinked AUTOPN parameter is secured and tracks MANOPN.

123.4.6 Disable Mode

Key Parameters: DISABL, COUT

The DISABL input, when true, inhibits normal block operation in either Auto or Manual modes and the block outputs are set to the STOP states. In addition, the block output COUT is set to false. Mismatch alarming is not inhibited.

You can drive DISABL with a local field contact and use it as a permissive input for maintenance or local control. If DISABL is true, the block:

- Continues to perform alarm detection, alarm message acknowledgment, and limit switch updating
- Indicates the actual position of the upstream device

- Inhibits operation in the Auto or Manual mode
- Sets COUT to false

When DISABL is false (block enabled), the block operates according to the MA status. In all modes of operation, the block always secures the COUT output.

For bumpless transitions out of DISABL mode, the block initializes the MANOPN/AUTOPN parameters to the state of the block's boolean outputs.

123.4.7 Alarming

123.4.7.1 Mismatch

Key Parameters: OPNLIM, CLSLIM, RSMMOP, AUTOPN, MANOPN, COUT

A mismatch indicator is set true, and a mismatch alarm is generated, if the actual state of the valve does not match the requested state within the user-specified Time to Open or Close (TOC). The open state is determined by the open limit switch (OPNLIM) feedback input and the closed state by the close limit switch (CLSLIM) feedback input. A mismatch alarm also occurs if both limit switches are true at the same time (invalid state).

Mismatch alarming is not inhibited when the DISABL input is true.

The option parameter RSMMOP (Reset Mismatch Alarm Option), when true, causes the AUTOPN or MANOPN parameter to be reset to its original state when a mismatch alarm occurs. This allows you to retry the original request action, without having to toggle the request parameter in the wrong direction, by creating a leading edge for the timeout to begin again.

Mismatch alarms are cleared, and return-to-normal messages are generated, when the alarm is acknowledged by the operator, or the OPNLIM or CLSLIM input indicates that the field device has changed state as requested.

If COUT changes state (from OPEN to CLOSE, or CLOSE to OPEN) before the valve reaches the first state, and before a mismatch timeout could occur, a new time count is begun.

The open limit (OPNLIM) and the close limit switch (CLSLIM) feedback inputs are normally connected from a CIN block. It either input goes bad, the block can be placed in Manual to disable the block. In addition, alarm inhibit (INHIB) can be set true to inhibit erroneous alarms until the bad OPNLIM or CLSLIM input is repaired.

123.4.7.2 Bad FBM

Key Parameters: AUTO, MANUAL, DISABL, COUT

If the FBM becomes non-operational (BAD), the block enters the BAD state and the output (COUT) remains at the last known driven state of the FBM contact. BAD is a higher priority state than the AUTO, MANUAL and DISABLE states. No requests of the AUTOPN and MANOPN inputs are processed, and the DISABL input is not honored; that is, setting the DISABL input true while the block state is BAD does not set COUT to false. On a transfer from BAD to normal, the ECB is read and this value is stored in the controlling input parameter, assuming there is no connection to this parameter from other blocks.

123.4.7.3 Alarm Acknowledge

Key Parameter: UNACK

Unacknowledge (UNACK) is a boolean output parameter which is set true, for notification purposes, whenever the block goes into alarm. It is settable, but sets are only allowed to clear UNACK to false, and never in the opposite direction. The clearing of UNACK is normally via an operator "acknowledge" pick on a default or user display, or via a user task.

123.4.8 Block Initialization

Key Parameter: INITO, MANOPN, AUTOPN, COUT

An Initialization Out parameter, INITO, provides a mechanism for indicating an open-loop condition in the VLV block. The VLV block is open looped if; it is initializing, or the FBM is bad, or the block is in Manual, or the mismatch alarm indicator is true, or the DISABL input is true. Programs and upstream blocks can use INITO to sense when this block is open loop.

If the block is in I/O mode (IOMOPT = 1), COUT is initialized to the current contact output value read back from the device. This ensures that the valve state remains unchanged across reinitializations.

123.4.9 Failsafe Action

Key Parameter: MANFS, FS

When the block detects that it is recovering from an FBM failure, it checks the appropriate channel bits in the FSAFE parameter in the ECB to determine if the failure was a Communications Failure. If the associated channel bits are true in FSAFE, the block parameter FS is set true. If the block is Auto and MANFS is false, FS is cleared in one block cycle. If MANFS is true, the block is switched from Auto to Manual. If the block was either already in Manual or if it switches to Manual, FS remains set true until the block switches to Auto or until the output parameter is written to by the user.

On the cycle that the block recovers from a failure or initializes, the block reads back the output value from the FBM. This value is either the FBM Hold value or the Fallback value dependent upon the configuration of the FBM failsafe mask and failsafe data.

123.4.10 Validation Checks

Duplicate output channel detection alerts you to the fact that this block and another block capable of digital outputs are connected to the same output point. This does not necessarily constitute a conflict, since the other block can be in a compound which is not scheduled to run at the same time as the compound containing this VLV block, or the duplicate connection can be used as part of an elaborate control scheme.

When the VLV block undergoes one of the following actions, the entire data base is checked for duplicate output channels:

- The block is installed.
- The IOMOPT parameter is modified.
- The IOM_ID parameter is modified.
- A variable output point number (PNT_NO) is modified

The duplicate output channel check is also performed when the Control Processor is rebooted. It is not performed when a compound is switched On or Off.

All blocks connected to the same output point receive the DUPLICATE OUTPUT CHANNEL warning message, but are not set Undefined.

123.4.11 Block Mode Control

Key Parameters: DISABL, MA

The operating mode control parameters are DISABL and MA with DISABL having the highest priority. The status of these parameters determines the block operating mode as shown in Table 123-2.

Table 123-2. VLV Block Mode Control

DISABL	MA	Resulting Mode
True	*	Disable
False	False	Manual
False	True	Auto
*Don't care		

123.5 Application Example

A typical application example for the VLV block is shown in Figure 123-4. Connecting the output to the FBM is optional. If you connect the output to an FBM, the output is sent to the FBM (IOM_ID) and point number (PNT_NO) as specified.

The block operation can be disabled without turning off the compound. If the block DISABL is TRUE, then block operation is suspended. Since DISABL is a connectable parameter, a field switch can disable the block preventing inadvertent device operation while maintenance is being performed.

In this application, the valve opens when a low measurement alarm occurs in a PIDA block. The AUTOPN input comes from a task (process display, another block, etc.) external to the block, and is repeated at the output (COUT) when the block is in automatic. In Figure 123-4 the AUTOPN input comes from the :PIDA.MEASL1. The true AUTOPN parameter corresponds to an open request. The MANOPN input is used when the block is in manual; manipulated by the faceplate.

A mismatch alarm provides notification that the output has not produced the desired result. In this example, limit switches, mounted on the valve, indicate a fully open or fully closed position. The limit switches are connected through an MCIN block to the VLV block's CLSLIM and OPNLIM parameters. Assume full traverse from closed to open normally takes 15 seconds. If a traverse from closed to open takes longer than the time allotted by the TOC parameter, a mismatch alarm is generated. Notification is in the form of messages sent to a printer, boolean output MMAIND becomes TRUE, and a STATE alarm is indicated in the block's faceplate.

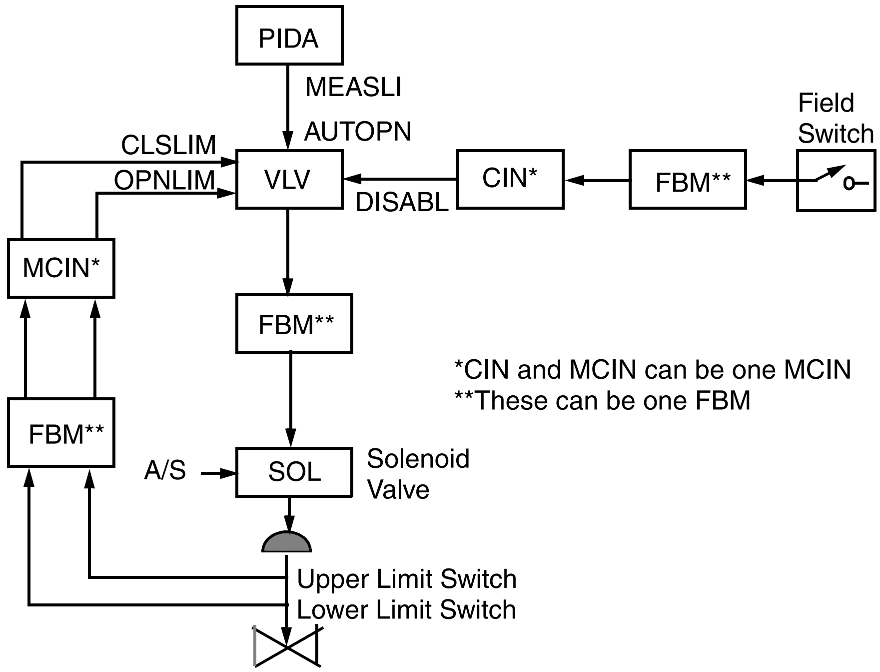


Figure 123-4. VLV Block Application

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