Chapter 26

OTHERS

Edition 3

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Overview

This chapter describes the OTHERS class of Function Blocks which provides miscellaneous functions including shift registers, rate limiters, a ramp generator for setpoint generation, a general purpose alarm control block and bistable functions.

XRATE_LIMIT FUNCTION BLOCK

(Not for new designs)

From Version 3.00 onwards, this function block has been moved to the Conditions class.

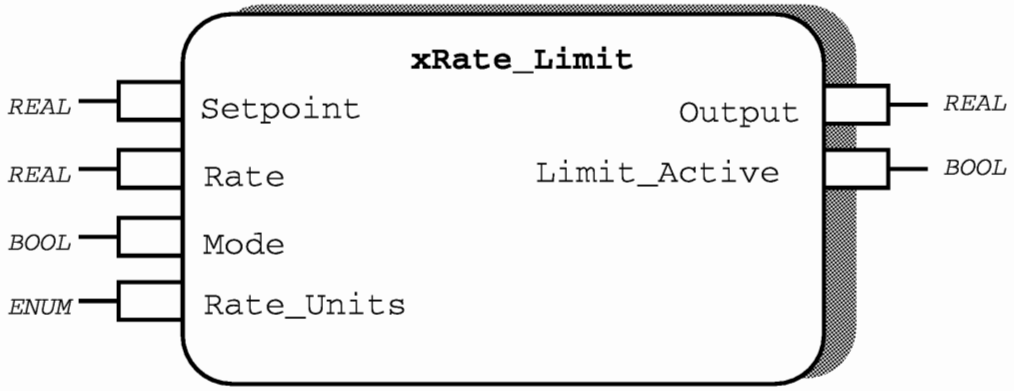

Figure 26-1 xRate_Limit Function Block

Functional Description

The xRate_Limit function block is used to limit the maximum rate of change of a parameter. The parameter to be rate limited is input to the Setpoint and the rate limited value of the parameter is output through Output. The maximum allowed rate of change of Output is defined by Rate, with the units of Rate being defined by the parameter Rate_Units. When rate limiting is occuring, Limit_Active will be set to Limit (1). The function block has two modes of operation, which are defined by the parameter Mode.

Modes of Operation

Track (0): in Track mode, the Output follows the Setpoint without any rate limiting.

Limit (1): in Limit mode, the maximum rate of change of Output is limited to the value set by Rate.

Function Block Attributes

Type:..... F8 20

Class: ..... OTHERS

Default Task: ..... Task_2

Short List: ..... Setpoint, Mode, Output

Memory Requirement:..... 32 Bytes

Execution Time: ..... 298 µ Secs

Parameter Descriptions

Setpoint (SP)

The Setpoint is the input to the function block which is to be rate limited.

Rate (R)

The Rate defines the maximum rate of change to which the Output is to be limited. The units of Rate are defined by Rate_Units.

Mode (M)

The Mode defines the mode of operation of the function block.as described earlier.

Rate_Units (RU)

The Rate_Units defines the units for the Rate parameter. Rate_Units can be set to four possible states:

/Second (0) :	The rate will be per second
/Minute (1):	The rate will be per minute
/Hour (2):	The rate will be per hour
/Day (3):	The rate will be per day

Output (OP)

The Output is the rate limited output of the function block. In Track (0) mode, the Output will follow the Setpoint without rate limiting being implemented. In Limit(1) mode, the Output will track the Setpoint with its maximum rate of change being limited to the value set by Rate.

Limit_Active (LA)

Limit_Output is an indicator to denote that rate limiting is taking place. If the rate limiter is active Output will be different from Setpoint and Limit_Output will be set to Limit (1). If Output is equal to Setpoint, the rate limiter will not be active, so Limit_Output will be set to Track (0).

Parameter Attributes

Name	Type	Cold Start	Read Access	Write Access	Type Specific Information	
Limit_Active	**BOOL**	Track (0)	Oper	Block	Senses	Track (0) Limit (1)
Mode	**BOOL**	Track (0)	Oper	Config	Senses	Track (0) Limit (1)
Output	**REAL**	0.0	Oper	Block	High Limit Low Limit	10,000 -10,000
Rate	**REAL**	0.0	Oper	Oper	High Limit Low Limit	1,000 0
Rate_Units	**ENUM**	/ Second (0)	Oper	Config	Senses	/ Second (0) / Minute (1) / Hour (2) / Day (3)
Setpoint	**REAL**	0.0	Oper	Oper	High Limit Low Limit	10,000 -10,000

Table 26-1 xRate_Limit Parameter Attributes

XRAMP FUNCTION BLOCK

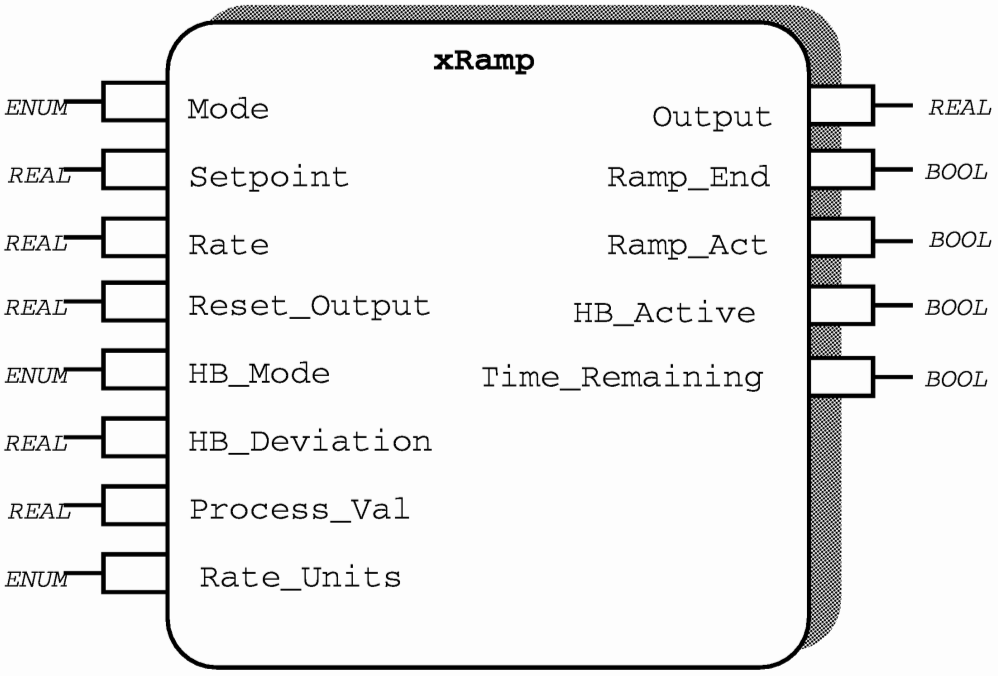

Figure 26-2 xRamp Function Block

Functional Description

The xRamp function block ramps the Output at a constant Rate towards a target Setpoint. The block has three modes of operation, which are defined by the Mode. Holdback functionality can be activated to restrict the Rate in the event of a sluggish Process_Val.

The remaining time to complete the current ramp is given as an output.

Modes of Operation:

Reset (0): in Reset mode the Output will be set to Reset_Output and Ramp_Act will be set to No (0).

Hold (2): in Hold mode the Output will remain constant at the value reached before entering Hold mode

Run (1): in Run mode the Output will ramp towards Setpoint at a rate defined by the Rate parameter and Ramp_Act will be set to Yes(1). When the Output has reached Setpoint, Ramp_End will be set to True (1).

Holdback Operation

Holdback serves to hold the Output at a constant value in the event that the deviation between the Output and the Process_Val exceeds the value defined by HB_Deviation. The Figure below shows holdback acting in response to the Process_Val lagging behind the increasing ramp Output. When the Process_Val input deviates from the ramp Output by more than HB_Deviation, the ramping Output is held at constant value until the deviation decreases below HB_Deviation. In the case shown, this has the effect of limiting the ramp Rate to be equal to the maximum rate of rise of Process_Val.

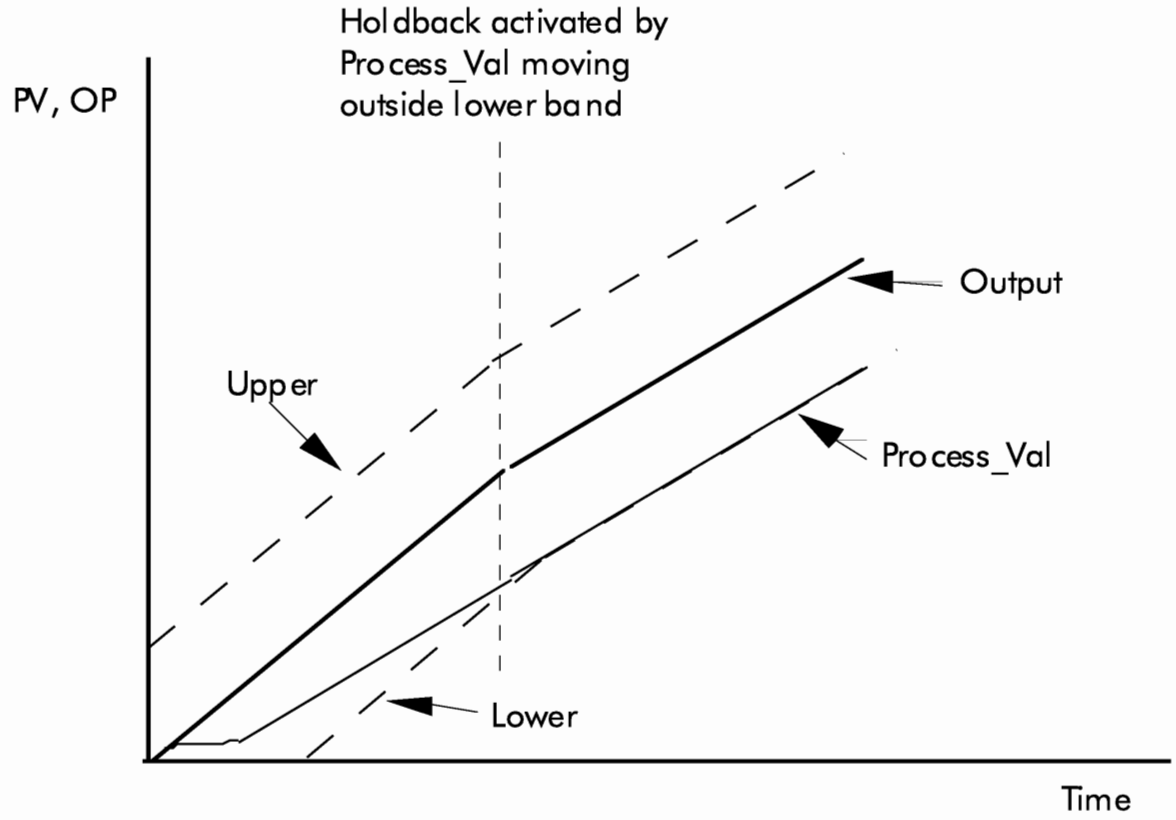

Figure 26-3 Holdback operation with lagging Process_Val.

Modes of Holdback Operation:

OFF(0):	in OFF mode the holdback option is disabled.
LOWER (1):	in LOWER mode the holdback will be enabled when the Output minus Process_Val is greater than HB_Deviation.
UPPER (2):	in UPPER mode the holdback will be enabled when the Process_Val minus Output is greater than the
HB_Deviation.	
BAND (3):	in BAND mode the holdback will be enabled when the absolute value of Output minus Process_Val is greater than the HB_Deviation.

Function Block Attributes

Type: F8 48

Class:.....OTHERS

Default Task: Tsk100ms

Short List: .....Mode, Setpoint, Rate, Output

Memory Requirements: .....80 Bytes

Execution Time: .....282 µ Secs

Parameter Descriptions

Mode (M)

Mode defines the mode of operation of the function block, see earlier description.

Setpoint (SP)

The Setpoint is the target value to which the Output is ramped.

Rate (R)

The Rate parameter determines the rate at which the Output changes. Its units are defined by the parameter Rate_Units.

Reset_Output

The Reset_Output parameter defines the value written to the parameter Output when the Mode is Reset.

HB_Mode

The HB_Mode parameter defines the mode of operation of holdback.

HB_Deviation

The HB_Deviation parameter defines the amount of deviation allowed between Output and Process_Val before holdback is applied.

Process_Val (PV)

The Process_Val parameter operates in conjunction with HB_Deviation to determine whether holdback is active. The parameter is not used if HB_Mode is set to Off (0).

Rate_Units

The Rate_Units parameter is used to define the units in which the rate of change of Output are defined.

Output (OP)

The Output parameter is the Real output of the Ramp function block, which will ramp towards Setpoint when the Mode is set to Run (1) and the function block is not in holdback. The Output will equal Reset_Output when the Mode is set to Reset (0).

Ramp_End (RE)

The Ramp_End parameter defines when the Output has completed its ramping to the Setpoint. When the Mode is equal to Reset (0), Ramp_End will be set to False (0). When the Mode is equal to Run (1), Ramp_End will be set to True (1) only when the Output equals the Setpoint. If the Setpoint is changed after Ramp_End has become True (1) the Ramp_End will then change to False (0) until Output is equal to Setpoint again. When in holdback, the operation of Ramp_End is unchanged, with Ramp_End being set to False (0) unless Output equals Setpoint.

Ramp_Act (RA)

The Ramp_Act defines whether the Output is ramping towards Setpoint. When the Mode is set to Reset (0), Ramp_Act will be set to No (0). When the Mode is set to Run (1) or Hold (2), Ramp_Act will be set to Yes (1) when the Output does not equal Setpoint and will be set to No (0) when the Output equals the Setpoint.

HB_Active

The HB_Active parameter is an indicator to the action of the holdback function. When the Mode parameter is set to Reset (0) or Hold (2), HB_Active will equal No (0). When the Mode parameter is set to Run (1) and HB_Mode is set to Lower (1), Upper (2) or Band (3), HB_Active will be equal Yes (1) if the block is in holdback.

Parameter Attributes

Name	Type	Cold Start	Read Access	Write Access	Type Specific Information	
HB_Active	**BOOL**	No (0)	Oper	Block	Senses	No (0) Yes (1)
HB_Deviation	**REAL**	0.0	Oper	Oper	High Limit Low Limit	999,999 -99,999
HB_Mode	**ENUM**	Off (0)	Oper	Oper	Senses	Off (0) Lower (1) Upper (2) Band (3)
Mode	**ENUM**	Reset (0)	Oper	Oper	Senses	Reset (0) Run (1) Hold (2)
Output	**REAL**	0.0	Oper	Block	High Limit Low Limit	999,999 -99,999
Process_Val	**REAL**	0.0	Oper	Oper	High Limit Low Limit	999,999 -99,999
Ramp_Act	**BOOL**	No (0)	Oper	Block	Senses	No (0) Yes (1)
Ramp_End	**BOOL**	False (0)	Oper	Block	Senses	False (0) True (1)
Rate	**REAL**	0.0	Oper	Oper	High Limit Low Limit	100,000 0
Rate_Units	**ENUM**	/Second (0)	Oper	Oper	Enumerated Values	/Second (0) /Minute (1) /Hour (2) /Day (3)
Reset_Output	**REAL**	0.0	Oper	Oper	High Limit Low Limit	999,999 -99,999
Setpoint	**REAL**	0.0	Oper	Oper	High Limit Low Limit	999,999 -99,999

Table 26-2 Ramp Parameter Attributes

SHIFT_REAL FUNCTION BLOCK

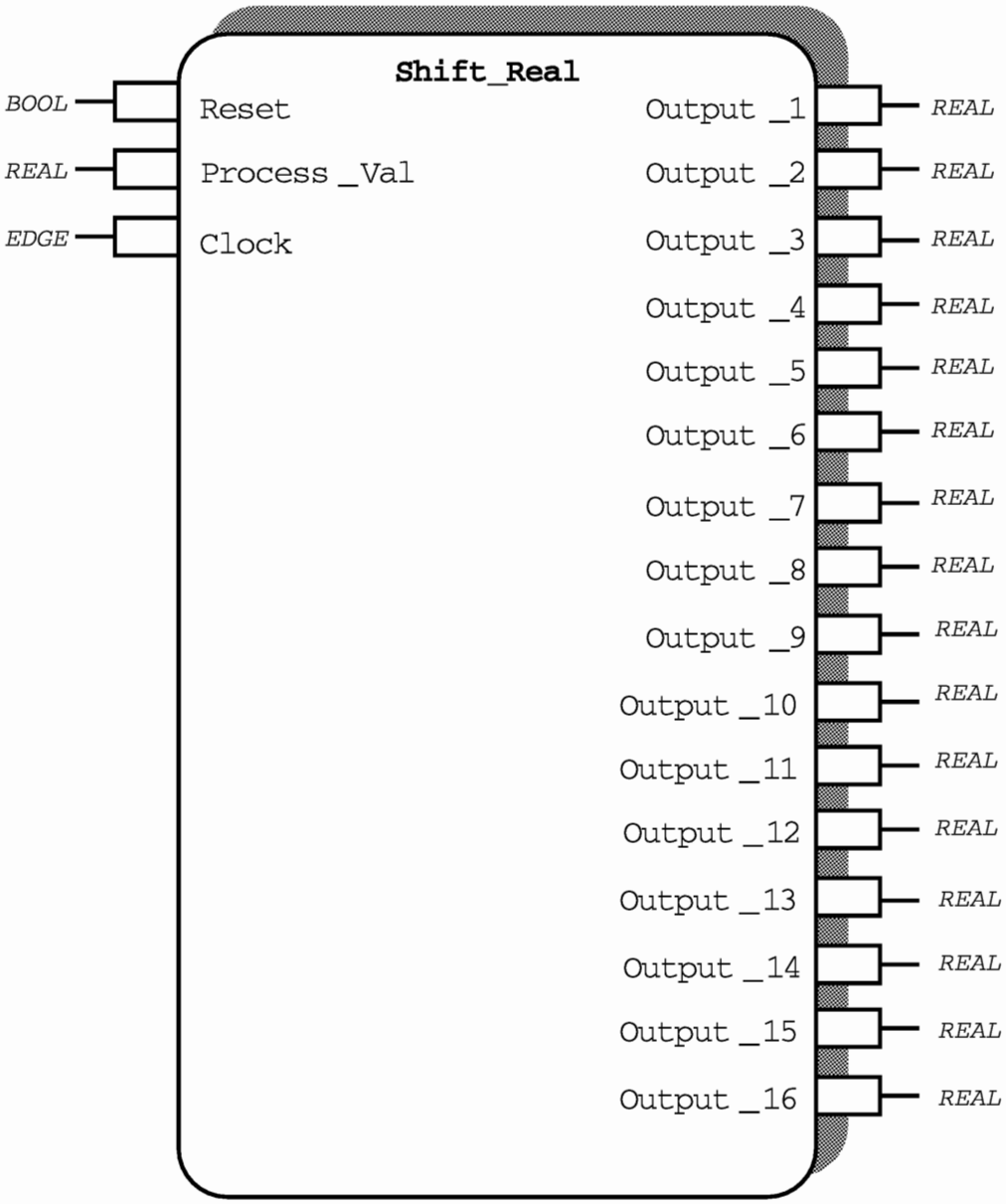

Figure 26-4 Shift_Real Function Block

Functional Description

The Shift_Real function block is a 16 REAL shift register. The function block has 16 real outputs, Output_1 to Output_16, through which values are shifted on receipt of a rising edge input to the parameter Clock.

Modes of Operation

The function block has two modes of operation, which are defined by the parameter Reset:

Run (0): in Run mode the action of the shift register is activated when the value of the input parameter Clock is changed from Tock (0) to Tick (1). On receipt of the Tick (1) input, the function block outputs shift once according to the relationship:

On Clock = Tick (1) AND LAST CLOCK = TOCK(0)

Output_*n* := Output_*n*-1 for *n* = 2 to 16

Output_1 := Process_Val

The outputs then hold their values until the next time that Clock is changed from Tock (0) to Tick (1). It is therefore necessary to reset Clock from Tick (1) to Tock (0) between shifts of the outputs.

Reset (1): in Reset mode all outputs are reset to zero. The outputs are then held at zero until the mode is changed to Run (0).

Function Block Attributes

Type: F8 40

Class:.....OTHERS

Default Task: .....Task_2

Short_List: .....Process_Val, Clock, Reset, Output_1

Memory Requirements; .....74 Bytes

Execution Time: .....22 µ Secs

Parameter Descriptions

Reset (RST)

The parameter Reset defines the Mode of operation of the function block.

Process_Val (PV)

The Process_Val is the input to the function block.

Clock (CLK)

When the function block is operating in run mode, changing the parameter Clock from Tock (0) to Tick (1) causes the outputs to shift once. Note that the rate of change of the input signal must be less than twice the task duration time, because it is necessary to reset Clock from Tick (1) to Tock (0) between shifts.

Output_1 to Output_16 (O1 to O16)

The parameters Output_1 to Output_16 are the outputs whose floating point (REAL) values are incrementally shifted each time the Clock input changes from Tock (0) to Tick (1).

Output_16 may be used as the carry output. Larger shift registers may be formed by soft wiring all clock inputs together and correcting the Output_15 parameter of the first shift register to the Process_Val input of the second. Further shift registers may be similarly connected.

Parameter Attributes

Name	Type	Cold Start	Read Access	Write Access	Type Specific	
Reset	**BOOL**	Run (0)	Oper	Oper	Senses	Run (0) Reset (1)
Process_Val	**REAL**	0.0	Oper	Oper	High Limit Low Limit	999,999 - 999,999
Clock	**BOOL**	Tock (0)	Oper	Oper	Senses	Tock (0) Tick (1)
Output_1 to Output_16	**REAL**	0.0	Oper	Block	High Limit Low Limit	999,999 - 999,999

Table 26-3 Shift_Real Parameter Attributes

SHIFT_DINT FUNCTION BLOCK

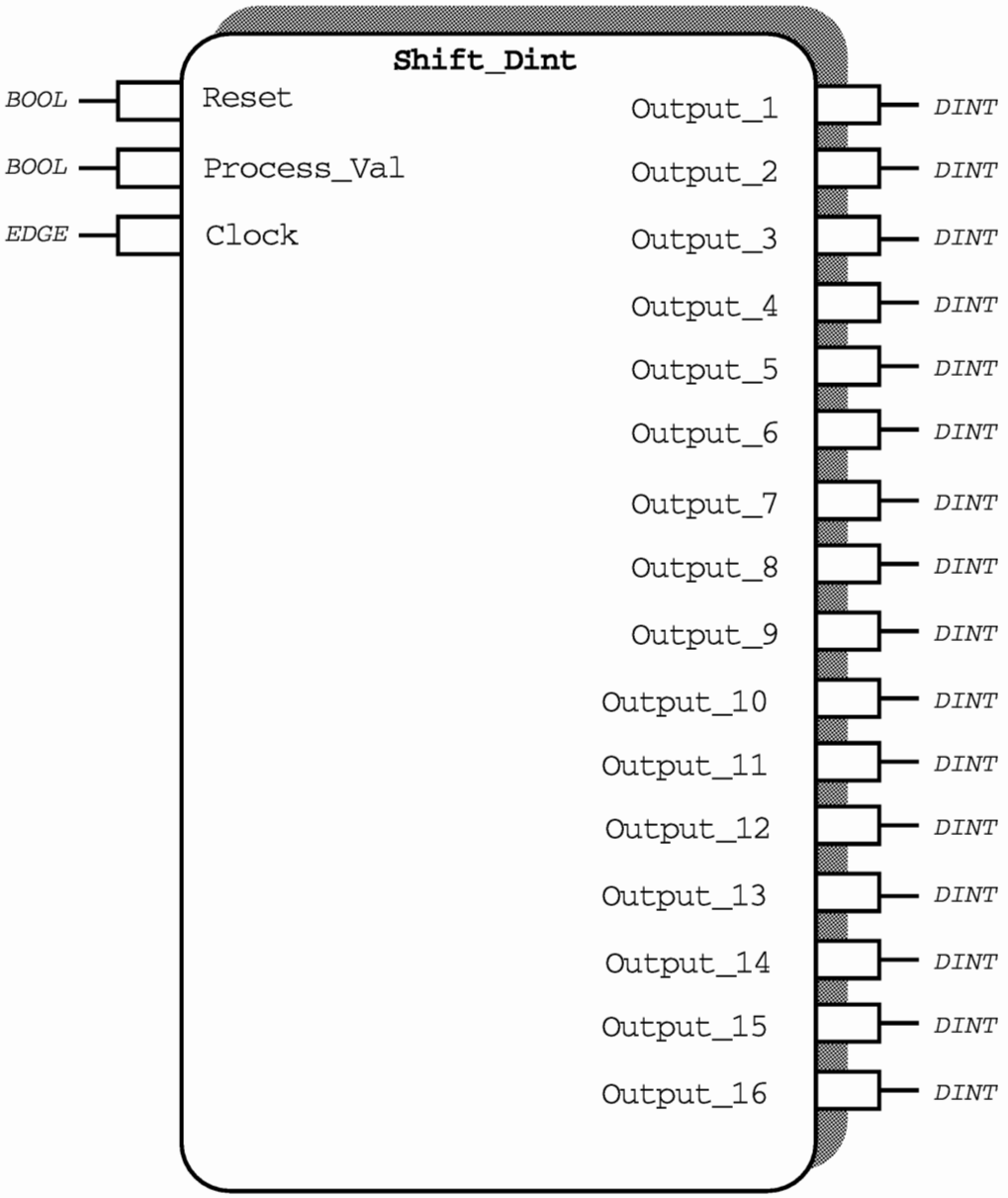

Figure 26-5 Shift_Dint Function Block

Functional Description

The Shift_Dint function block is a 16 integer shift register. The function block has 16 integer (DINT) outputs, Output_1 to Output_16, through which values are shifted on receipt of a rising edge input to the parameter Clock.

Modes of Operation

The function block has two modes of operation, which are defined by the parameter Reset:

Run (0): in Run mode the action of the shift register is activated when the value of the input parameter Clock is changed from Tock (0) to Tick (1). On receipt of the Tick (1) input, the function block outputs shift once according to the relationship:

On Clock = Tick (1) AND LAST CLOCK = TOCK(0)

Output_*n* := Output_*n*-1 for *n* = 2 to 16

Output_1 := Process_Val

The outputs then hold their values until the next time that Clock is changed from Tock (0) to Tick (1). It is therefore necessary to reset Clock from Tick (1) to Tock (0) between shifts of the outputs.

Reset (1): in Reset mode all outputs are reset to zero. The outputs are then held at zero until the mode is changed to Run (0)

Function Block Attributes

Type: F8 45

Class:.....OTHERS

Default Task: .....Task_2

Short_List: .....Process_Val, Clock, Reset, Output_1

Memory Requirements; .....74 Bytes

Execution Time: .....22 µ Secs

Parameter Descriptions

Reset (RST)

The parameter Reset defines the Mode of operation of the function block.

Process_Val (PV)

The Process_Val is the input to the function block.

Clock (CLK)

When the function block is operating in run mode, changing the parameter Clock from Tock (0) to Tick (1) causes the outputs to shift once. Note that the rate of change of the input signal must be less than twice the task duration time, because it is necessary to reset Clock from Tick (1) to Tock (0) between shifts.

Output_1 to Output_16 (O1 to O16)

The parameters Output_1 to Output_16 are the outputs whose integer (DINT) values are incrementally shifted each time the Clock input changes from Tock (0) to Tick (1).

Output_16 may be used as the carry output. Larger shift registers may be formed by soft wiring all clock inputs together and correcting the Output_15 parameter of the first shift register to the Process_Val input of the second. Further shift registers may be similarly connected.

Parameter Attributes

Name	Type	Cold Start	Read Access	Write Access	Type Specific	
Reset	**BOOL**	Run (0)	Oper	Oper	Senses	Run (0) Reset (1)
Process_Val	**DINT**	0	Oper	Oper	High Limit Low Limit	999,999 - 999,999
Clock	**BOOL**	Tock (0)	Oper	Oper	Senses	Tock (0) Tick (1)
Output_1 to Output_16	**DINT**	0	Oper	Block	High Limit Low Limit	999,999 - 999,999

Table 26-4 Shift_Dint Parameter Attributes

SHIFT_16 FUNCTION BLOCK

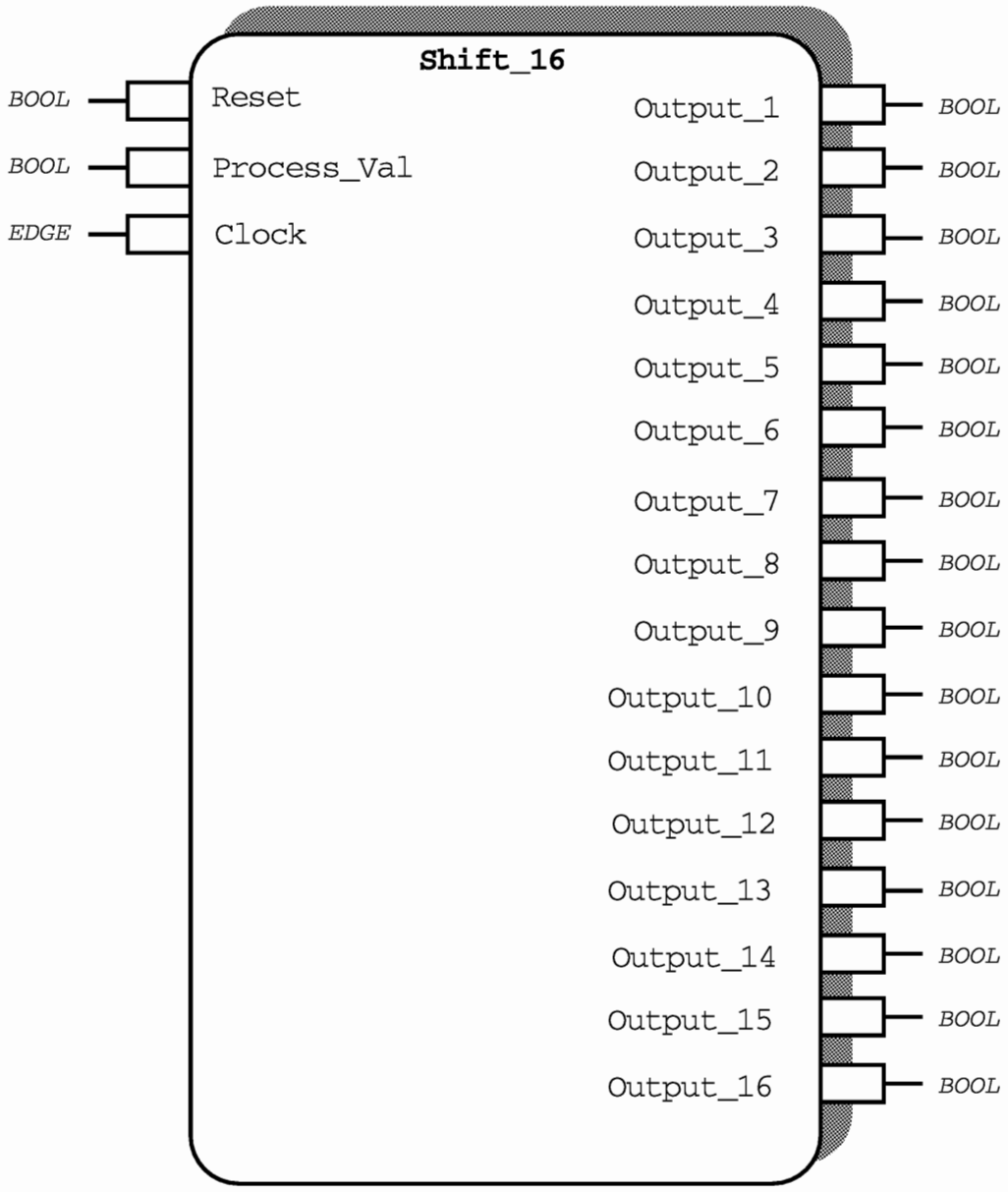

Figure 26-6 Shift_16 Function Block

Functional Description

The Shift_16 function block is a 16 bit shift register. The function block has 16 boolean outputs, Output_1 to Output_16, through which values are incrementaly shifted on receipt of a rising edge input to the parameter Clock.

Modes of Operation

The function block has two modes of operation, which are defined by the parameter Reset:

Run (0): in Run mode the action of the shift register is activated when the value of the input parameter Clock is changed from Tock (0) to Tick (1). On receipt of the Tick (1) input, the function block outputs shift once according to the relationship:

On Clock = Tick (1) AND LAST CLOCK = TOCK(0)

Output_*n* := Output_*n*-1 for *n* = 2 to 16

Output_1 := Process_Val

The outputs then hold their values until the next time that Clock is changed from Tock (0) to Tick (1). It is therefore necessary to reset Clock from Tick (1) to Tock (0) between shifts of the outputs.

Reset (1): in Reset mode all outputs are reset to zero. The outputs are then held at zero until the mode is changed to Run (0).

Function Block Attributes

Type: 248 16

Class:.....OTHERS

Default Task: .....Tsk_10ms

Short_List: .....Process_Val, Clock, Reset, Output_1

Memory Requirements: .....20 Bytes

Parameter Descriptions

Reset (RST)

Reset defines the Mode of operation of the function block.

Process_Val (PV)

The Process_Val is the input to the function block.

Clock (CLK)

When the function block is operating in run mode, changing the parameter Clock from Tock (0) to Tick (1) causes the outputs to shift once. Note that the rate of change of the input signal must be less than twice the task duration time, because it is necessary to reset Clock from Tick (1) to Tock (0) between shifts.

Output_1 to Output_16 (O1 to O16)

Output_1 to Output_16 are the outputs whose values are incrementally shifted each time the Clock input changes from Tock (0) to Tick (1).

Output_16 may be used as the carry output. Larger shift registers may be formed by soft wiring all clock inputs together and correcting the Output_15 parameter of the first shift register to the Process_Val input of the second. Further shift registers may be similarly connected.

Parameter Attributes

Name	Type	Cold Start	Read Access	Write Access	Type Specific	
Reset	**BOOL**	Run (0)	Oper	Oper	Senses	Run (0) Reset (1)
Process_Val	**BOOL**	Off (0)	Oper	Oper	Senses	Off (0) On (1)
Clock	**BOOL**	Tock (0)	Oper	Oper	Senses	Tock (0) Tick (1)
Output_1 to Output_16	**BOOL**	Off (0)	Oper	Block	Senses	Off (0) On (1)

Table 26-5 Shift_16 Parameter Attributes

ALARM_CNTRL FUNCTION BLOCK

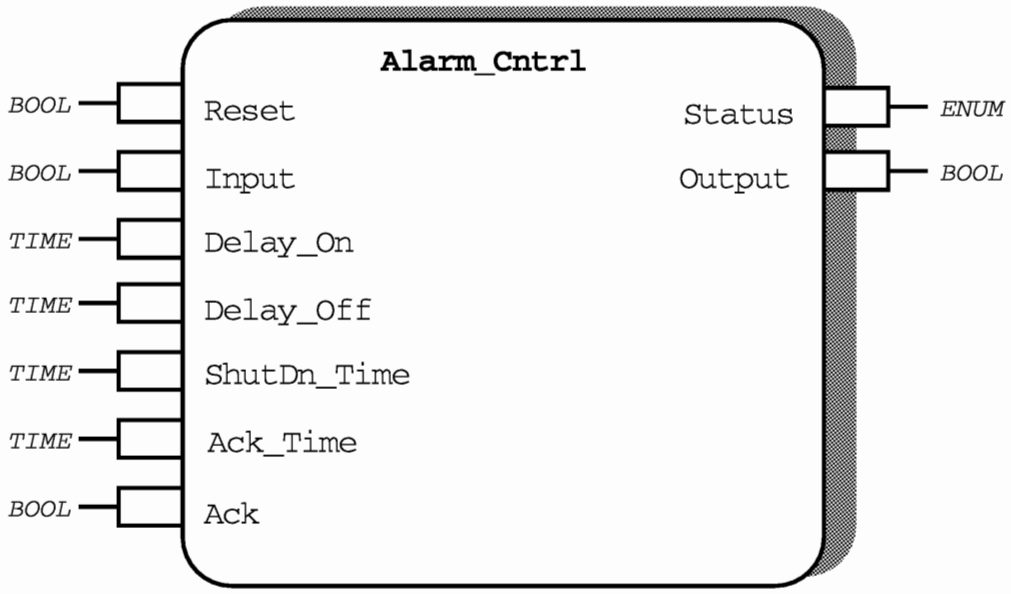

Figure 26-7 Alarm_Cntrl Function Block

Functional Description

The Alarm_Cntrl function block sets the Status output according to the condition of the alarm that is wired to Input. Status can be set to one of four states. These are Clear (0), Alarm (1), Ack (2) and Shut_Dn (3).

From an initial Status of Clear (0), if Input is On (1) for a continuous period greater than Delay_On, Status will change to Alarm (1). If Input then remains On (1) for a further continuous period greater than ShutDn_Time, Status will change to Shut_Dn and Output will be set to On (1). However, if during this second delay period to shut down the alarm is acknowledged by changing Ack from Not_Ack (0) to Ack (1), the shut down timer will be reset to zero and held there for a period equal to Ack_Time, after which the shut down timer will restart. The shut down timer and alarm acknowledge timer can only be reset using Ack by positive transitions from Not_Ack (0) to Ack (1). During the alarm acknowledgement delay Status will be set to Ack (2).

Note:-If Status is set to Alarm (1), Ack (2) or Shut_Dn (3) and Input changes back from On (1) to Off (0), the alarm Status will change back to Clear (0) only after Input has remained Off (0) for a period greater than Delay_Off. A result of this is that if Delay_Off is set greater than ShutDn_Time, resetting Input from On (1) to Off (0) during an alarm state will not prevent shut down because the shut down timer will time out before the reset timer has reached Delay_Off. This situation will be avoided by careful choice of Delay_On, Delay_Off and ShutDn_Time.

Function Block Attributes

Type: .....f 8 50

Class:.....OTHERS

Default Task: .....Task_2

Short List: .....Input, Reset, Status, Output

Memory Requirements: .....82 Bytes

Parameter Descriptions

Reset (RES)

When Reset is set to Run (0) the function block operates normally. Setting Reset to Reset (1) sets all timers to zero, sets Status to Clear (0) and sets Output to Off (0)

Input (IN)

Input is the alarm condition input to the function block.

Delay_On (DON)

Delay_On defines the amount of time for which Input must be On (1) before Status will change from Clear (0) to Alarm (1).

Delay_Off (OFD)

If Input is set to Off (0) for a continuous period greater than or equal to Delay_Off Status will be set to Clear (0), regardless of its previous state.

ShutDn_Time (SDT)

When Status enters the Alarm (1) condition a shut down timer is started. If Status is in the Alarm (1) condition for a continuous period greater than or equal to ShutDn_Time, Status will be set to Shut_Dn (3).

The shut down timer can be reset using Ack, which triggers the acknowledge alarm functionality.

Ack_Time (AT)

When the Status is in alarm, its shut down timer can be reset using Ack. This then changes the Status to Ack(2) and holds it there for a period equal to Ack_Time. On completion of the Ack_Time period, the shut down timer is restarted from zero.

Ack (ACK)

When Status is in the Alarm (1) condition it can be acknowledged by a positive transition of Ack from Not_Ack (0) to Ack (1).

Status (ST)

Status can be set to one of four states:

Clear (0):	The Input has been Off (0) for a period greater than Delay_Off.
Alarm (1):	The Input has been On (1) for a period greater than Delay_On. If not acknowledged before the shut down period has expired, the status will change to Shut_Dn (3).
Ack (2):	The alarm state has been acknowledged. Status will continue in this state until the acknowledgement delay has finished, then it will revert back to Alarm (1).
Shut_Dn (3):	The alarm state has been in Alarm (1) for a period greater than ShutDn_Time without acknowledgement.

Output (OP)

The Output will be set to On (1) when the Status is Shut_Dn (3). For all other states the Output will be set to Off (0).

Parameter Attributes

Name	Type	Cold Start	Read Access	Write Access	Type Specific Information	
Reset	**BOOL**	Run (0)	Oper	Oper	Senses	Run (0) Reset (1)
Input	**BOOL**	Off (0)	Oper	Oper	Senses	Off (0) On (1)
Delay_On	**TIME**	0 ms	Oper	Oper	High Limit Low Limit	23d_23h_59m 0
Delay_Off	**TIME**	0 ms	Oper	Oper	High Limit Low Limit	23d_23h_59m 0
ShutDn_Time	**TIME**	0 ms	Oper	Oper	High Limit Low Limit	23d_23h_59m 0
Ack_Time	**TIME**	0 ms	Oper	Oper	High Limit Low Limit	23d_23h_59m 0
Status	**ENUM**	Clear (0)	Oper	Block	Senses	Clear (0) Alarm (1) Ack (2) Shut_Dn (3)
Output	**BOOL**	Off (0)	Oper	Block	Senses	Off (0) On (1)

Table 26-6 Alarm_Cntrl Parameter Attributes

BISTABLE_SD FUNCTION BLOCK

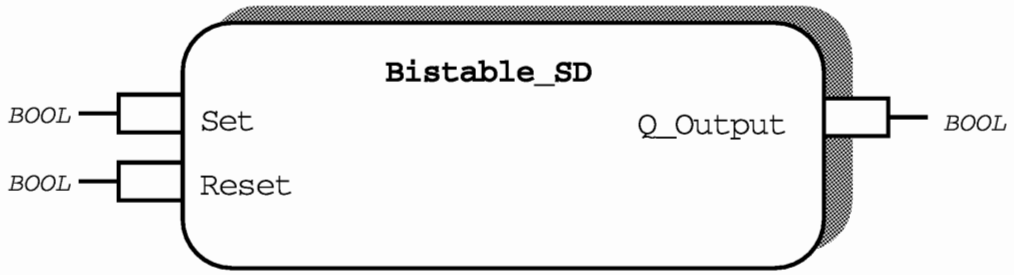

Figure 26-8 Bistable_SD Function Block

Functional Description

The Bistable_SD function block performs the function of a digital set-dominant bistable. The function block has two boolean inputs (Set and Reset) and one boolean output (Q_Output). The state of Q_Output is determined according to the states of Set and Reset. If Set is True (1), then Q_Output is True (1) regardless of the state of Reset. If Set is False (0) and Reset is True (1), then Q_Output will be False (0). If both Set and Reset are False (0), then the state of Q_Output will not change from the value it held prior to Set and Reset becoming False (0).

The relative states of Set, Reset and Q_Output are summarised in the Table below.

Set	Reset	Q_Output
0	0	No Change
1	0	1
1	1	1
0	1	0

Table 26-7 Set Dominant Bistable States

Function Block Attributes

Type:..... f 8 60

Class: ..... OTHERS

Default Task: ..... Task_1

Short List: ..... Set, Reset, Q_Output

Memory Requirements: ..... 4 Bytes

Execution Time: ..... 10.6 µ Secs

Parameter Attributes

Name	Type	Cold Start	Read Access	Write Access	Type Specific Information	
Q_Output	**BOOL**	False (0)	Oper	Oper	Senses	False (0) True (1)
Reset	**BOOL**	False (0)	Oper	Oper	Senses	False (0) True (1)
Set	**BOOL**	False (0)	Oper	Oper	Senses	False (0) True (1)

Table 20-8 Bistable_SD Parameter Attributes

BISTABLE_RD FUNCTION BLOCK

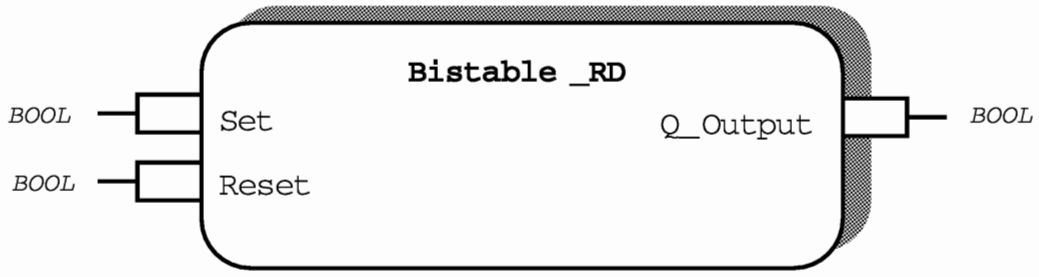

Figure 26-9 Bistable_RD Function Block

Functional Description

The Bistable_RD function block performs the function of a digital reset-dominant bistable. The function block has two boolean inputs (Set and Reset) and one boolean output (Q_Output). The state of Q_Output is determined according to the states of Set and Reset. If Reset is True (1), then Q_Output is False (0) regardless of the state of Set. If Reset is False (0) and Set is True (1), then Q_Output will be True (1). If both Set and Reset are False (0), then the state of Q_Output will not change from the value it held prior to Set and Reset becoming False (0).

The relative states of Set, Reset and Q_Output are summarised in the table below.

Set	Reset	Q_Output
0	0	No Change
1	0	1
1	1	0
0	1	0

Table 26-9 Set Dominant Bistable States

Function Block Attributes

Type:..... f 8 70

Class: ..... OTHERS

Default Task: ..... Task_1

Short List: ..... Set, Reset, Q_Output

Memory Requirements: ..... 4 Bytes

Execution Time: ..... 10.6 µ Secs

Parameter Attributes

Name	Type	Cold Start	Read Access	Write Access	Type Specific Information	
Q_Output	**BOOL**	False (0)	Oper	Oper	Senses	False (0) True (1)
Reset	**BOOL**	False (0)	Oper	Oper	Senses	False (0) True (1)
Set	**BOOL**	False (0)	Oper	Oper	Senses	False (0) True (1)

Table 26-10 Bistable_RD Parameter Attributes