Engineering Course

CENTUM VP

SEQUENCE CONTROL (LOGIC CHART)

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The following function blocks are catagorized as sequence control blocks:

1. Sequence Table Blocks

2. Logic Chart Block

3. Sequential Function Chart Block

4. Switch Instrument Blocks

5. Sequence Element Blocks

6. Valve Monitoring Block

LOGIC CHART BLOCK

This function blocks performs interlock sequence control programmed in the expression of a logic chart diagram.
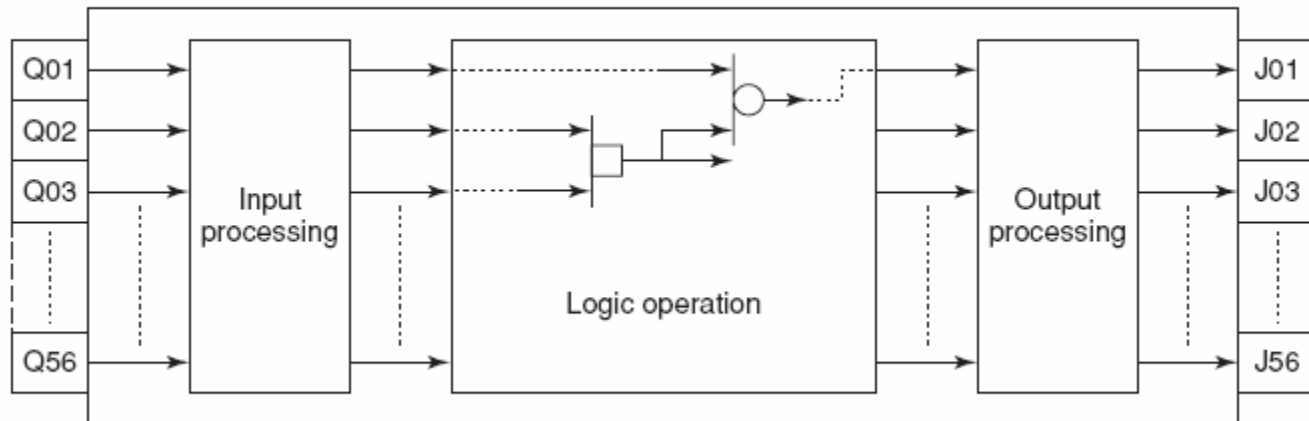
The following is the function block catagorized as logic chart:

• Logic Chart LC64
  Number of input elements: 32
  Number of output elements: 32
  Number of logic elements: 64

In a logic chart block, the conditions and operations are listed and the combination of conditions with the logic operatiors corresponding to the logic requirement may manipulate the operation signals. This block can be used as the description of an interlock sequence control or a logic chart.

Logic Chart Block is the function block that describes the relations of the input signals, the output signals and the logic calculation operators in the interlock diagram form, so that it can perform its main function, the interlock sequence control using the same expressions as those used on the logic chart blue prints.

An architecture of LC64 Logic Chart Block is shown as follows.

Figure   Function Block Diagram of Logic Chart Block (LC64)

| Comment | Condition signal | Logic element | Action signal | Comment |

Stop→Cool | %SW0500.PV.ON
Level 1 | %SW0100.PV.ON
Level 2 | %SW0150.PV.ON
Cool→Stop | %SW0120.PV.ON
Auto | %SW0101.PV.ON

WO
TM100
TM100

%SW0200.PV.L | Mooving into cooling phase
%SW0140.ON | Cooling printout
%SW0160.PV.L | TCV full close command
TV100.CSV.2 | Shutoff valve 1 open output
TV101.CSV.2 | Shutoff valve 2 open output

Open shutoff valve 1 | TV100.PV.2
Open shutoff valve 2 | TV101.PV.2
No.1 temperature <- 70 ℃ | RL001.X01.LT
No.2 temperature <- 70 ℃ | RL002.X02.LT

Open shutoff valve
Comment

%SW0201.PV.L | Cool command
DO0100.PV.L | Cooling and voice message

Comment | Condition signal (Input Signal) | Logic element | Action signal (Output Signal) | Comment
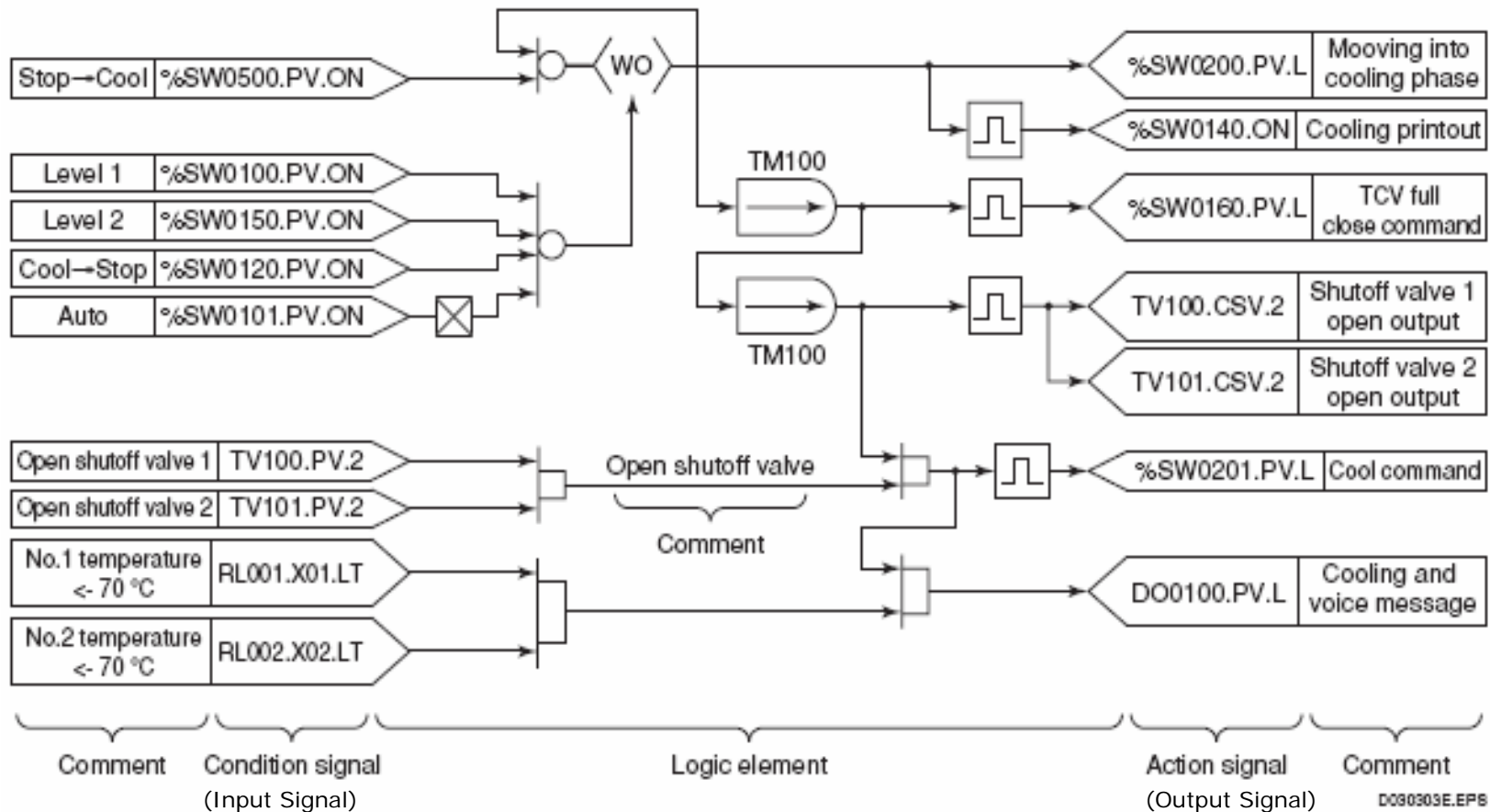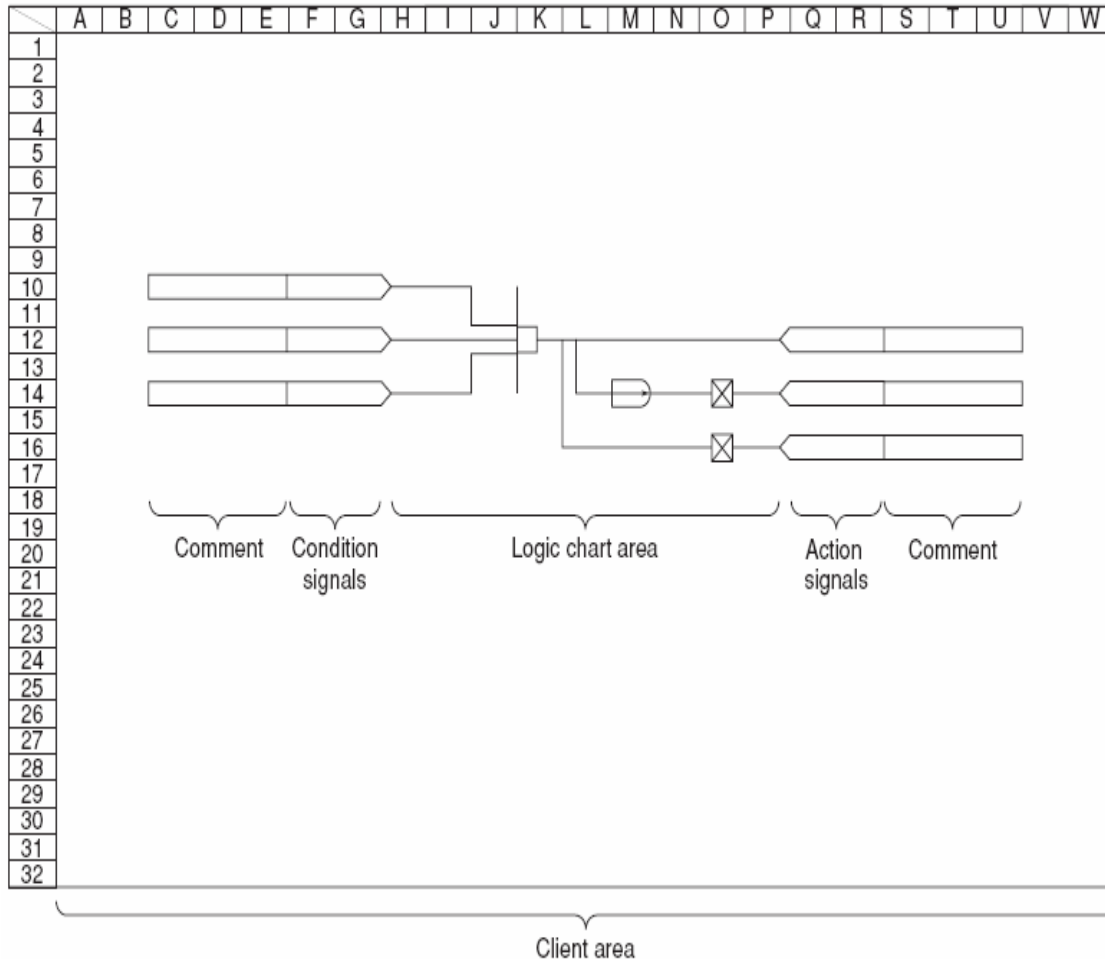
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Figure   Outline of the Logic Chart

Logic chart function block can handle up to 32 input elements, 32 output elements and 64 logic elements/operators (however, logic element such as W.O, SR/Flip-Flop, or CMP is counted as 2 logic element operation.

General Outlook Of A Logic Chart

Figure   Configuration of the Entire Logic Chart

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•Processing Timing

There ara two processing timings:

Start/Execution Timing

It refers to the timing at which control algorithms are executed when receiving input signals. Select one of the following type
- *Periodic Execution* (T)
- *One-Shot Processing* (O)
- *Startup at Initial Cold Start/Restart of FCS* (I)
- *Restricted Initial Execution* (B)

Output Timing

It indicates the condition or behaviour of action signals in conjunction with the condition signal status change. For logic chart, the output timing is fixed to
- *Output Each Time Conditions Are Satisfied* (E)

•Scan Period

Sequence table with periodic execution type (T) is activated at defined scan period.
There are three types of scan periods:
- Basic Scan (1 second – fixed)
- Medium Speed Scan (200 & 500 milliseconds) 50, 100, 250 milliseconds are also applicable.
- High Speed Scan (200 & 500 milliseconds) 50, 100, 250 milliseconds are also applicable.

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In the logic chart, the logic calculation is performed based on the result of input processing. Output processing is then performed for the output action to the operation target.
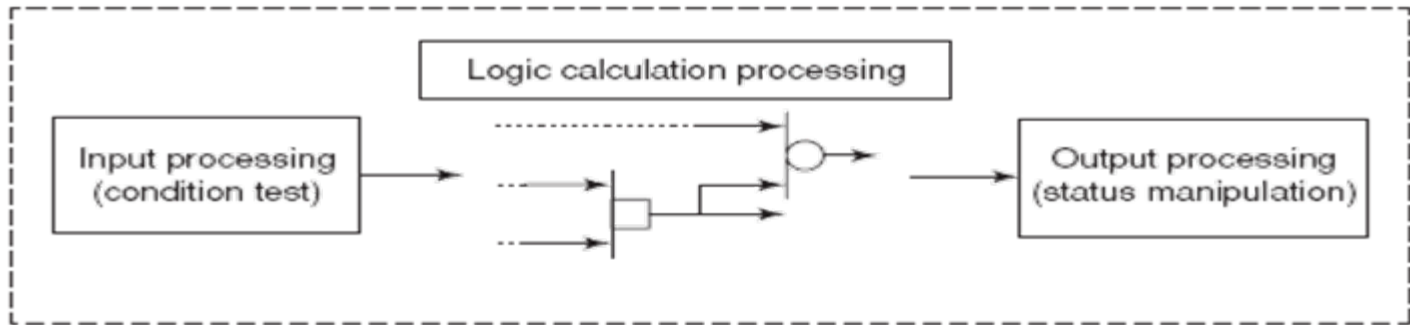

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Figure   Logic Chart Processing Flow

● **Input Processing**

The true or false status of a condition signal is determined by the condition test performed on the input signal.

● **Logic Calculation Processing**

The logic calculation is based on the result of condition test of the input signal (true = 1, false = 0). The logic calculation algorithm is expressed by combinations of logic operators.

● **Output Processing**

Status manipulation output is determined based on the result of logic calculation processing.

The status manipulation will be output as the output signals to the operation target. The status manipulation can send commands such as starting, data setting, and status change to the contact output terminals or to other function blocks.
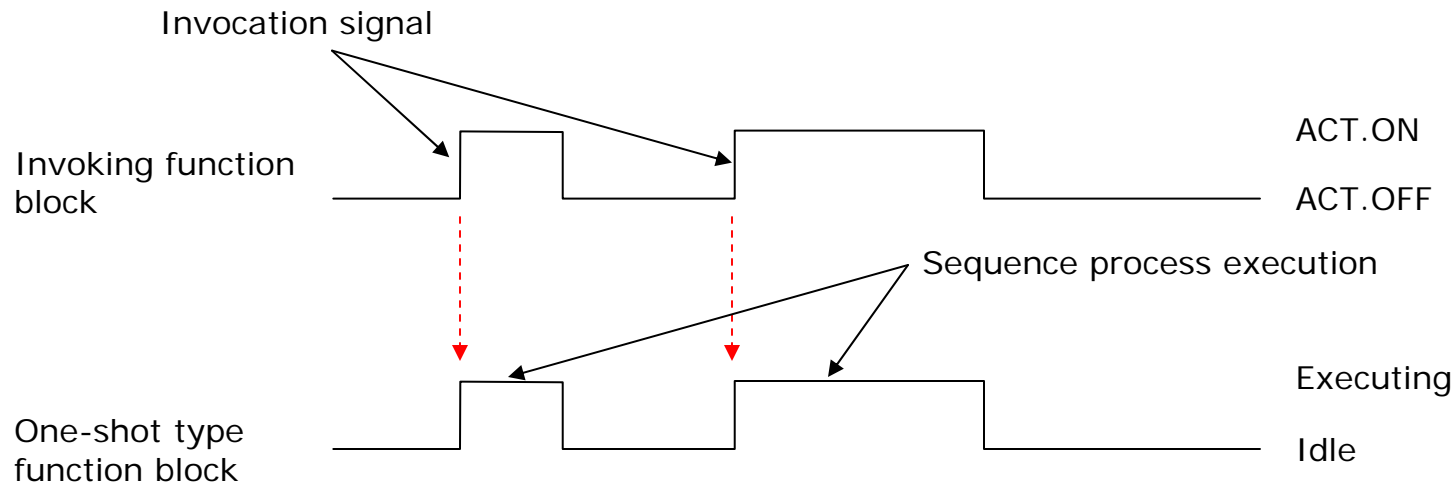
Start / Execution Timing

Periodic Execution (T)

The periodic execution means that the sequence control block is repeatedly executed in a preset cycle.

One-Shot Execution (O)

When execution timing of a function block is defined as one-shot type, the block is executed only when it is invoked by other function block. A one-shot function block can invoke another one-shot function block. However, such succession is limited to seven blocks. Invocation can only be initiated from the same FCS.

Invocation signal

Invoking function block

ACT.ON

ACT.OFF

Sequence process execution

Executing

Idle

One-shot type function block

One-Shot Processing Conceptual Diagram

Start / Execution Timing

Initial Execution/Restart Execution (I)

In this execution type, the sequence block executes its process when the FCS performs a cold start or a restart.
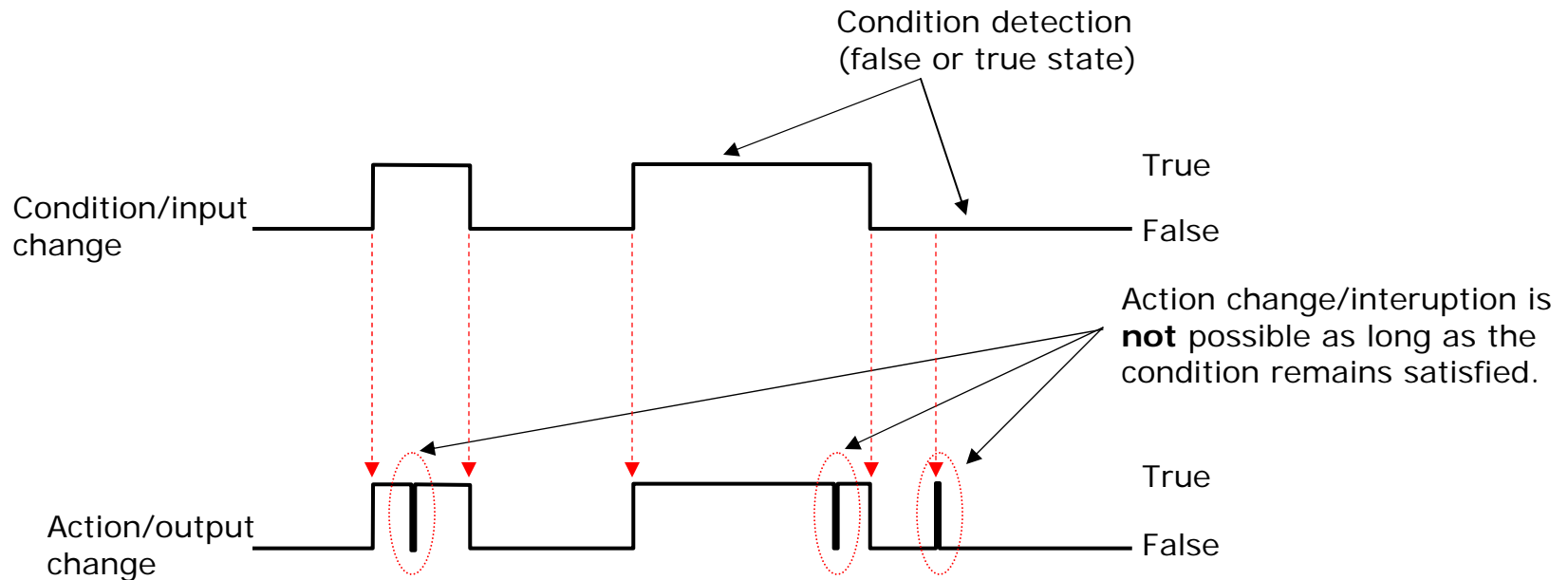
Restricted Initial Execution (B)

In restricted initial execution, the sequence control block executes only when the FCS performs a cold start, not include restart.

Output Timing

Output Each Time Conditions Are Satisfied (E)

The sequence table blocks output its operation/action signal every scan period as long as the judged conditions are satisfied.

Condition detection
(false or true state)

True

Condition/input
change

False

Action change/interuption is **not** possible as long as the condition remains satisfied.

True
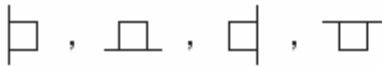
Action/output
change

False

"Output Each Time Conditions Are Satisfied" Conceptual Figure

Logic Elements

● **AND: Logic Product**

It gives one output based on multiple inputs. When all the inputs are True, the output becomes True. The maximum number of inputs is 21.
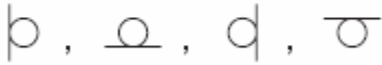
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Figure   AND symbols

● **OR: Logic Sum**

It gives one output based on multiple inputs. When any of inputs is True, the output becomes True. The maximum number of inputs is 21.

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Figure   OR symbols

● **NOT: Negation**

It gives the inverse of the input as an output.

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Figure   NOT symbol

Logic Elements

● **SRS1-R (1 output), SRS2-R (2 outputs): Flip-Flop (Reset-Dominant)**

It gives one output or two outputs shown in the following truth table based on the set and reset input signals.

One flip-flop operation is counted as two logic operation elements.

Without reset output   With reset output

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Figure   SRS1-R and SRS2-R symbols

Table Reset-Dominant Truth Table

Input	S	0	1	0	1
	R	0	0	1	1
Output	OUT1	Latched	1	0	0
	OUT2	Latched	0	1	1

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Latched: The previous state is maintained.

Logic Elements

● **SRS1-S (1 output), SRS2-S (2 outputs): Flip-Flop (Set-Dominant)**

It gives one output or two outputs shown in the following truth table based on the set and reset input signals.

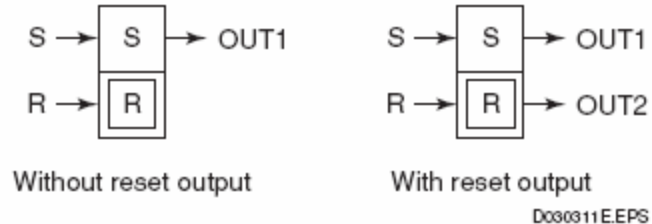One flip-flop operation is counted as two logic operation elements.
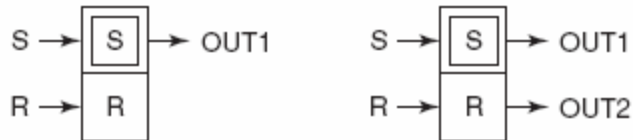
Without reset output   With reset output

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Figure SRS1-S and SRS2-S symbols

Table Set-Dominant Truth Table

Input	S	0	1	0	1
	R	0	0	1	1
Output	OUT1	Latched	1	0	1
	OUT2	Latched	0	1	0

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Latched: The previous state is maintained.

Logic Elements

● OND: On-Delay Timer

When the input status changes from 0 to 1, the internal timer starts. When the set time t elapsed, its output changes from 0 to 1. When the input status changes to 0, the output will be reset to 0 immediately.

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Figure   On-Delay Timer symbol

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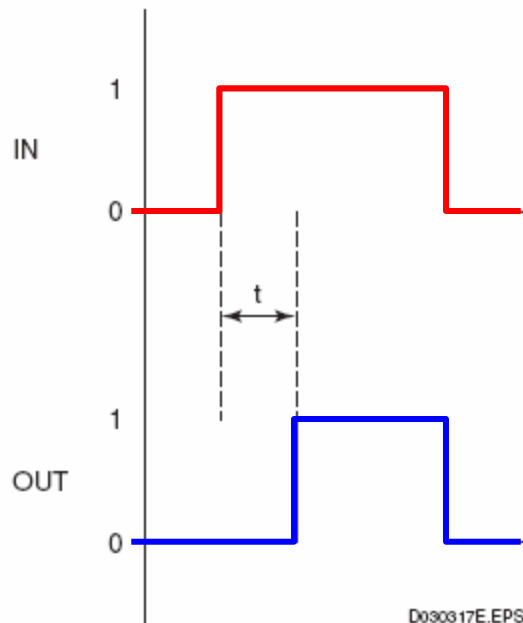
Figure   Behavior of On-Delay Timer

Logic Elements

● OFFD: Off-Delay Timer

When the input status changes from 1 to 0, the internal timer starts. When the set time t elapsed, its output changes from 1 to 0. When the input status changes to 1, the output will be reset to 1 immediately.

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Figure   Off-Delay Timer symbol

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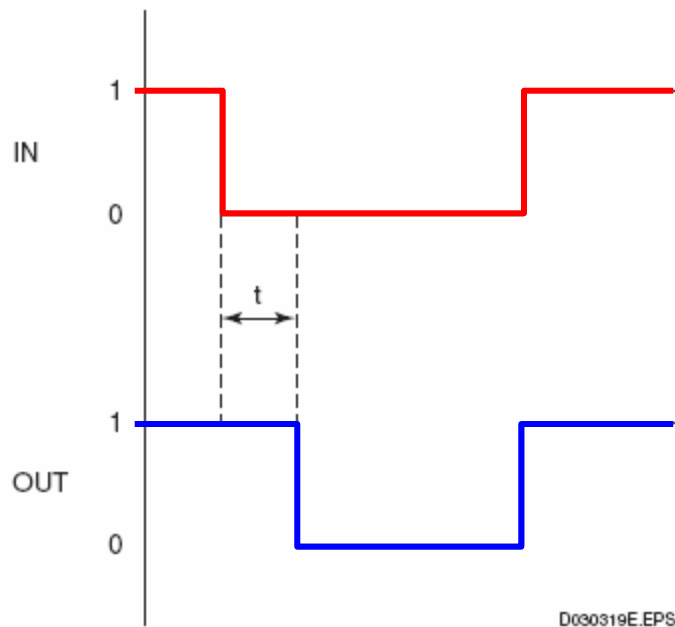
Figure   Behavior of Off-Delay Timer

Logic Elements

● **TON: One-Shot (Rise Trigger)**

When the input status changes from 0 to 1, it gives an output 1 for a one scan cycle. The output is always 0 except for that 1 scan cycle.

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Figure   One-Shot (Rise Trigger) symbol

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Figure   Behavior of One-Shot (Rise Trigger)

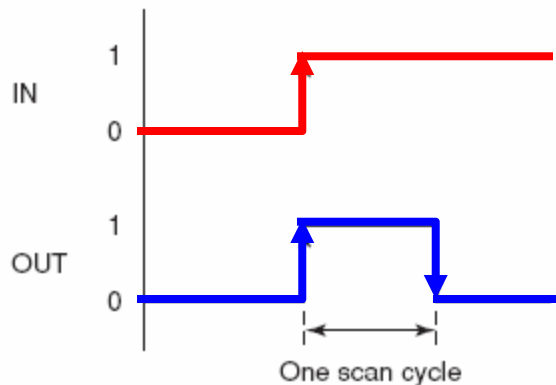## Logic Elements

● **TOFF: One-Shot (Fall Trigger)**

When the input status changes from 1 to 0, it gives an output 1 for a one scan cycle. The output is always 0 except for that 1 scan cycle.

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Figure   One-Shot (Fall Trigger) symbol
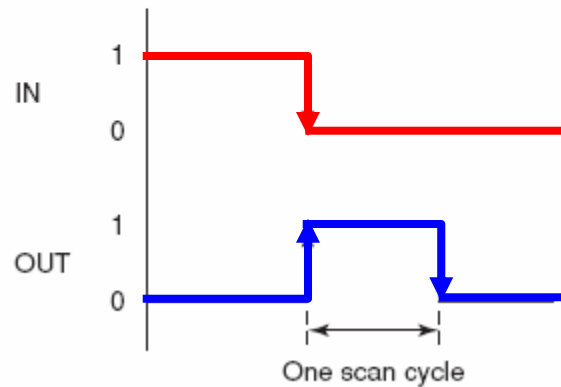
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Figure   Behavior of One-Shot (Fall Trigger)

Logic Elements

● CMP-GE: Comparator

It compares the logic values of input 1 and input 2. It gives an output 1 when input 1 is greater than or equal to input 2, otherwise it gives an output 0.

One Comparator operation is counted as two logic operation elements.

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Figure   CMP-GE symbol

Table   CMP-GE Truth Table

Input	IN1	0	0	1	1
	IN2	0	1	0	1
Output	OUT	1	0	1	1

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● CMP-GT: Comparator

It compares the logic values of input 1 and input 2. It gives an output 1 when input 1 is greater than input 2, otherwise it gives an output 0.

One Comparator operation is counted as two logic operation elements.

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Figure   CMP-GT symbol

Table   CMP-GT Truth Table

Input	IN1	0	0	1	1
	IN2	0	1	0	1
Output	OUT	0	0	1	0

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Logic Elements

● **CMP-EQ: Comparator**

It compares the logic values of input 1 and input 2. It gives an output 1 when input 1 is equal to input 2, otherwise it gives an output 0.

One Comparator operation is counted as two logic operation elements.

=

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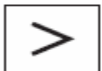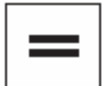**Figure   CMP-GT symbol**

Table   CMP-EQ Truth Table

Input	IN1	0	0	1	1
	IN2	0	1	0	1
Output	OUT	1	0	0	1

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Condition Signal Description (Function Blocks and I/O Data)

Function blocks that can be processed in a sequence table are shown below.

Switch Instrument Block	Valve Monitoring Block (VLVM)
Timer Block (TM)	Regulatory Control Blocks
Software Counter Block (CTS)	Calculation Blocks
Pulse Train Input Counter Block (CTP)	Faceplate Blocks
Code Input Block (CI)	SFC Blocks
Code Output Block (CO)	Unit Instrument Blocks
Relational Expression Block (RL)	Sequence Table Blocks
Resource Scheduler Block (RS)	Logic Chart Block

I/O data that can be processed in a sequence table are shown below.

Processing I/O (Digital Input/Output)
Software I/O (Internal Switch, Annunciator, Global Switch)
Communication I/O

Condition Signal Description (Switch Instrument & Enhanced Switch Instrument Blocks) 1/2

Condition signal description column		True/false	Satisfiable condition
Input signal	Condition specification		
Element symbol.PV.	0, 1, 2	True	Answerback value matches specification
		False	Answerback value does not match specification
Element symbol.PV=	Data status	True	Data status matches specification
		False	Data status does not match specification
Element symbol.MV.	0, 1, 2	True	Output value matches specification
		False	Output value does not match specification
Element symbol.MV=	Data status	True	Data status matches specification
		False	Data status does not match specification
Element symbol.TSW.	0,1	True	Tracking switch in specified state
		False	Tracking switch not in specified state
Element symbol.TSW=	Data status	True	Tracking switch in specified state
		False	Tracking switch not in specified state
Element symbol.BSW.	0, 1	True	Backup switch in specified state
		False	Backup switch not in specified state
Element symbol.MODE.	AUT, MAN, CAS, ROUT, TRK, O/S	True	Block mode matches specification
		False	Block mode does not match specification
Element symbol.XMODE.	BUM	True	Block is in ROUT (MAN) mode
		False	Block is not in ROUT (MAN) mode
	BUA	True	Block is in ROUT (AUT) mode
		False	Block is not in ROUT (AUT) mode
	BUC	True	Block is in ROUT (CAS) mode
		False	Block is not in ROUT (CAS) mode
Element symbol.BSTS.	NR, SIM, ANCK	True	Block status matches specification
		False	Block status does not match specification

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Condition Signal Description (Switch Instrument & Enhanced Switch Instrument Blocks) 2/2

Condition signal description column		True/ false	Satisfiable condition
Input signal	Condition specification		
Element symbol.ALRM.	NR, IOP, OOP, ANS+ ANS-, PERR, CNF	True	Specified alarm occurring
		False	No occurrence of specified alarm
Element symbol.XALRM.	IOP	True	Alarm is in IOP or IOP- status.
		False	Alarm is in neither IOP nor IOP- status.
Element symbol.AFLS.	PERR, AFL (*1), NR, IOP, OOP, ANS+, ANS-, CNF	True	Specified alarm in flashing state
		False	Specified alarm in non-flashing state
Element symbol.AF.	NR, IOP, OOP, ANS+ ANS-, PERR, CNF	True	Canceling the specified alarm detection
		False	Detecting the specified alarm
Element symbol.XAF.	IOP	True	IOP or IOP- detection is disabled
		False	IOP and IOP- detection is enabled
Element symbol.AOFS.	NR, IOP, OOP, ANS+ CNF, ANS-, PERR, AOF (*2)	True	Suppressing the specified alarm
		False	Canceling the specified alarm in suppression
Element symbol.CSV	0, 1, 2	True	Sequence setpoint value matches specification
		False	Sequence setpoint value does not match specification
Element symbol.CSV=	Data status	True	Data status matches specification
		False	Data status does not match specification
Element symbol.RMV	0, 1, 2	True	Remote manipulated output value matches specification
		False	Remote manipulated output value does not match specification
Element symbol.RMV=	Data status	True	Data status matches specification
		False	Data status does not match specification
Element symbol.BPSW.	0, 1	True	Bypass switch in specified state
		False	Bypass switch not in specified state
Element symbol.BPSW=	Data status	True	Data status matches specification
		False	Data status does not match specification

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*1:   The condition specification of the AFL is the reference in all flashing state.
*2:   The condition specification of the AOF is the reference in all suppressing alarm state.

Condition Signal Description (Timer Block [TM])

Condition signal description column		True/false	Satisfiable condition
Input signal	Condition specification		
Element symbol.MODE.	AUT, O/S	True	Block mode matches specification
		False	Block mode does not match specification
Element symbol.BSTS.	STOP, RUN, PAUS, NR, PALM, CTUP	True	Block status in specified state
		False	Block status not in specified state
Element symbol.ALRM.	NR	True	Alarm status in specified state
		False	Alarm status not in specified state
Element symbol.AFLS.	AFL (*1), NR	True	Specified alarm in flashing state
		False	Specified alarm in non-flashing state
Element symbol.AF.	NR	True	Canceling the specified alarm detection
		False	Detecting the specified alarm
Element symbol.AOFS.	NR, AOF (*2)	True	Suppressing the specified alarm
		False	Canceling the specified alarm in suppression

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*1:   The condition specification of the AFL is the reference in all flashing state.
*2:   The condition specification of the AOF is the reference in all suppressing alarm state.

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Condition Signal Description (Software Counter Block [CTS])

Condition signal description column		True/false	Satisfiable condition
Input signal	Condition specification		
Element symbol.MODE.	AUT, O/S	True	Block mode matches specification
		False	Block mode does not match specification
Element symbol.BSTS.	STOP, RUN, NR, PALM, CTUP	True	Block status in specified state
		False	Block status not in specified state

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Condition Signal Description (Pulse Train Input [CTP])

Condition signal description column		True/false	Satisfiable condition
Input signal	Condition specification		
Element symbol.MODE.	AUT, O/S	True	Block mode matches specification
		False	Block mode does not match specification
Element symbol.BSTS.	STOP, RUN, PAUS, NR, PALM, CTUP	True	Block status in specified state
		False	Block status not in specified state
Element symbol.ALRM.	CNF, NR, IOP	True	Alarm status in specified state
		False	Alarm status not in specified state
Element symbol.XALRM.	IOP	True	Alarm is in IOP or IOP- status.
		False	Alarm is in neither IOP nor IOP- status.
Element symbol.AFLS.	AFL (*1), CNF, NR, IOP	True	Specified alarm in flashing state
		False	Specified alarm in non-flashing state
Element symbol.AF.	CNF, NR, IOP	True	Canceling the specified alarm detection
		False	Detecting the specified alarm
Element symbol.XAF.	IOP	True	IOP or IOP- detection is disabled.
		False	IOP and IOP- detection is enabled.
Element symbol.AOFS.	CNF, NR, IOP, AOF (*2)	True	Suppressing the specified alarm
		False	Canceling the specified alarm in suppression
Element symbol.PV=	Data status	True	Data status matches specification
		False	Data status does not match specification

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*1: The condition specification of the AFL is the reference in all flashing state.
*2: The condition specification of the AOF is the reference in all suppressing alarm state.

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Condition Signal Description (Code Input Block [CI])

Condition signal description column		True/false	Satisfiable condition
Input signal	Condition specification		
Element symbol.MODE.	AUT, O/S	True	Block mode matches specification
		False	Block mode does not match specification
Element symbol.BSTS.	NR, LO, HI, ERR	True	Block status matches specification
		False	Block status does not match specification
Element symbol.PV=	Data status	True	Data status matches specification
		False	Data status does not match specification

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Condition Signal Description (Code Output Block [CO])

Condition signal description column		True/false	Satisfiable condition
Input signal	Condition specification		
Element symbol.MODE.	AUT, O/S	True	Block mode matches specification
		False	Block mode does not match specification
Element symbol.BSTS.	NR, LO, HL	True	Block status matches specification
		False	Block status does not match specification
Element symbol.PV=	Data status	True	Data status matches specification
		False	Data status does not match specification

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Condition Signal Description (Relational Expression Block [RL])

Condition signal description column		True/false	Satisfiable condition
Input signal	Condition specification		
Element symbol.X01 to 16.	EQ, GT, GE, LT, LE, AND	True	Relationship of two data in specified state
		False	Relationship of two data not in specified state

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Symbol	Name	Meanings
EQ	Equal to	Data 1 = data 2
GT	Greater than	Data 1 > data 2
GE	Great than or equal to	Data 1 ≥ data 2
LT	Less than	Data 1 < data 2
LE	Less than or equal to	Data 1 ≤ data 2
AND	Logical product	The logic product of each pair of bits in data 1 and data 2

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Condition Signal Description (Resource Scheduler Block [RS])

Condition signal description column		True/false	Satisfiable condition
Input signal	Condition specification		
Element symbol.MODE.	AUT, O/S	True	Block mode matches specification
		False	Block mode does not match specification
Element symbol.RQ01 to 32.	0, 1	True	Usage request state matches specification (0: No request 1: Requesting)
		False	Usage state does not match specification
Element symbol.PM01 to 32	0, 1	True	Permission state matches specification (0: No permission 1: Permitted)
		False	Permission state does not match specification
Element symbol.PMH.	0 to 32	True	Maximum allowable number matches specification
		False	Maximum allowable number does not match specification

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Condition Signal Description (Valve Monitoring Block [VLVM])

Condition signal description column		True/false	Satisfiable condition
Input signal	Condition specification		
Element symbol.MODE.	AUT, O/S	True	Block mode matches specification
		False	Block mode does not match specification
Element symbol.ALRM.	NR	True	Specified alarm occurring
		False	No occurrence of specified alarm
Element symbol.AFLS.	NR, AFL (*1)	True	Specified alarm in flashing state
		False	Specified alarm in non-flashing state
Element symbol.AF.	NR	True	Canceling the specified alarm detection
		False	Detecting the specified alarm
Element symbol.AOFS.	NR, AOF (*2)	True	Suppressing the specified alarm
		False	Canceling the specified alarm in suppression
Element symbol.PV01 to 16.	0, 1	True	Valve abnormal matches specification (0: Normal 1: Error)
		False	Valve abnormal does not match specification
Element symbol.PVR.	0, 1	True	Representative valve abnormal matches specification (0: All valves normal 1: At least one error occurred)
		False	Representative valve abnormal does not match specification
Element symbol.MCSW.	0, 1	True	Message suppression matches specification (0: Not suppressed 1: Suppressed)
		False	Message suppression does not match specification

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*1: The condition specification of the AFL is the reference in all flashing state.
*2: The condition specification of the AOF is the reference in all suppressing alarm state.

Condition Signal Description (Regulatory Control Block) 1/4

Condition signal description column		True/false	Satisfiable condition
Input signal	Condition specification		
Element symbol.MODE.	Block mode	True	Block mode in specified state
		False	Block mode not in specified state
Element symbol.XMODE.	BUM	True	Block is in ROUT (MAN) or RCAS (MAN) mode.
		False	Block is not in ROUT (MAN) or RCAS (MAN) mode.
	BUA	True	Block is in ROUT (AUT) or RCAS (AUT) mode.
		False	Block is not in ROUT (AUT) or RCAS (AUT) mode.
	BUC	True	Block is in ROUT (CAS) or RCAS (CAS) mode.
		False	Block is not in ROUT (CAS) or RCAS (CAS) mode.
Element symbol.BSTS.	Block status	True	Block status in specified state
		False	Block status not in specified state
Element symbol.ALRM.	Alarm status	True	Specified alarm occurring
		False	No occurrence of specified alarm
Element symbol.XALRM.	IOP	True	Alarm is in IOP or IOP- status.
		False	Alarm is in neither IOP nor IOP- status.
	VEL	True	Alarm is in VEL or VEL- status.
		False	Alarm is in neither VEL nor VEL- status.
Element symbol.AFLS.	Alarm status, AFL (*1)	True	Specified alarm in flashing state
		False	Specified alarm in non-flashing state
Element symbol.AF.	Alarm status	True	Canceling the specified alarm detection
		False	Detecting the specified alarm
Element symbol.XAF.	IOP	True	IOP or IOP- detection is disabled.
		False	IOP and IOP- detection is enabled.
Element symbol.AOFS.	Alarm status, AOF (*2)	True	Suppressing the specified alarm
		False	Canceling the specified alarm in suppression
Element symbol, Data item.	Data value	True	Data value matches specification
		False	Data value does not match specification
Element symbol, Data item=	Data status	True	Data status matches specification
		False	Data status does not match specification

Condition Signal Description (Regulatory Control Block) 2/4

Block code	Name	Data Item	Setting range
PID	PID Controller Block	TSW	0, 1
		CSW	0, 1
		PSW	0 to 3
		RSW	0, 1
		BSW	0, 1
PI-HLD	Sampling PI Controller Block	TSW	0, 1
		CSW	0, 1
		PSW	0 to 3
		RSW	0, 1
		BSW	0, 1
PID-BSW	PID Controller Block with Batch Switch	TSW	0, 1
		CSW	0, 1
		PSW	0 to 3
		RSW	0, 1
		BSW	0, 1
PID-TP	Time-Proportioning ON/OFF Controller Block	CSW	0, 1
		PSW	0 to 3
		BSW	0, 1
ONOFF	2-Position ON/OFF Controller Block	PSW	0 to 3
		BSW	0, 1
ONOFF-E	Enhanced 2-Position ON/OFF Controller Block	PSW	0 to 3
		BSW	0, 1
ONOFF-G	3-Position ON/OFF Controller Block	PSW	0 to 3
		BSW	0, 1
ONOFF-GE	Enhanced 3-Position ON/OFF Controller Block	PSW	0 to 3
		BSW	0, 1
PD-MR	PD Controller Block with Manual Reset	TSW	0, 1
		PSW	0 to 3
		RSW	0, 1
		BSW	0, 1
PI-BLEND	Blending PI Controller Block	TSW	0, 1
		PSW	0 to 3
		RSW	0, 1
		BSW	0, 1
		RST	0, 1
Block code	Name	Data Item	Setting range

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Condition Signal Description (Regulatory Control Block) 3/4

Block code	Name	Data Item	Setting range
PID-STC	Self-Tuning PID Controller Block	TSW	0, 1
		CSW	0, 1
		PSW	0 to 3
		RSW	0, 1
		BSW	0, 1
		STC	-1 to 3
MLD	Manual Loader Block	TSW	0, 1
		RSW	0, 1
MLD-PVI	Manual Loader Block with Input Indicator	TSW	0, 1
		RSW	0, 1
MLD-SW	Manual Loader Block with Auto/Man SW	TSW	0, 1
		PSW	0 to 3
		RSW	0, 1
MC-2	2-Position Motor Control Block	TSW	0, 1
		BSW	0, 1
		BPSW	0 to 4
		SIMM	0 to 1
		CSV	0 to 2
		PV	0 to 2
		MV	0 to 2
MC-2E	Enhanced 2-Position Motor Control Block	TSW	0, 1
		BSW	0, 1
		BPSW	0 to 4
		SIMM	0 to 1
		CSV	0 to 2
		PV	0 to 2
		MV	0 to 2
MC-3	3-Position Motor Control Block	TSW	0, 1
		BSW	0, 1
		BPSW	0 to 4
		SIMM	0 to 1
		CSV	0 to 2
		PV	0 to 2
		MV	0 to 2
MC-3E	Enhanced 3-Position Motor Control Block	TSW	0, 1
		BSW	0, 1
		BPSW	0 to 4
		SIMM	0 to 1
		CSV	0 to 2
		PV	0 to 2
		MV	0 to 2
Block code	Name	Data Item	Setting range

Condition Signal Description (Regulatory Control Block) 4/4

Block code	Name	Data Item	Setting range
RATIO	Ratio Set Block	TSW	0, 1
		PSW	0 to 3
		RSW	0, 1
		BSW	0, 1
PG-L13	13-Zone Program Set Block	ZONE	1 to 13
		ZSTR	1 to 13
		ZEND	1 to 13
BSETU-2	Flow-Totalizing Batch Set Block	SW	0 to 4
		EMSW	0, 1
		ZONE	0 to 11
BSETU-3	Weight-Totalizing Batch Set Block	SW	0 to 4
		EMSW	0, 1
		ZONE	0 to 11
VELLIM	Velocity Limiter Block	PSW	0 to 3
		BSW	0, 1
		BPSW	0, 1
SS-H/M/L	Signal Selector Block	SW	0 to 4
		SEL	0 to 3
AS-H/M/L	Autoselector Block	PSW	0 to 3
		SW	0 to 4
		SEL	0 to 3
SS-DUAL	Dual-Redundant Signal Selector Block	SW	1 to 3
		SEL	1 to 2
FFSUM	Feedforward Signal Summing Block	TSW	0, 1
		PSW	0 to 3
		FSW	0, 1
		RSW	0, 1
XCPL	Non-Interference Control Output Block	TSW	0, 1
		PSW	0 to 3
		RSW	0, 1
SPLIT	Control Signal Splitter Block	BSW	0, 1
		SW	0 to 2
ALM-R	Representative Alarm Block	SW	0 to 5
		SV	0 to 15
SBSD	YS Instrument Batch Set Station Block	SV	0 to 8
SLBC	YS Instrument Batch Controller Block	SV	0 to 8
Block code	**Name**	**Data Item**	**Setting range**

Condition Signal Description (Calculation Block) 1/4

Condition signal description column		True/false	Satisfiable condition
Input signal	Condition specification		
Element symbol.MODE.	AUT, O/S	True	Block mode matches specification
		False	Block mode does not match specification
Element symbol.BSTS.	Block status	True	Block status matches specification
		False	Block status does not match specification
Element symbol.ALRM.	CNF, NR	True	Alarm status in specified state
		False	Alarm status not in specified state
Element symbol.XALRM.	IOP	True	Alarm is in IOP or IOP- status.
		False	Alarm is in neither IOP nor IOP- status.
	VEL	True	Alarm is in VEL or VEL- status.
		False	Alarm is in neither VEL nor VEL- status.
Element symbol.AFLS.	Alarm status, AFL (*1)	True	Specified alarm in flashing state
		False	Specified alarm in non-flashing state
Element symbol.AF.	CNF, NR	True	Canceling the specified alarm detection
		False	Detecting the specified alarm
Element symbol.XAF.	IOP	True	IOP or IOP- detection is disabled.
		False	IOP and IOP- detection is enabled.
Element symbol.AOFS.	CNF, NR, AOF (*2)	True	Suppressing the specified alarm
		False	Canceling the specified alarm in suppression
Element symbol.ACT.	ON	True	Calculation execution result is not 0
		False	Calculation execution result is 0
Element symbol.Data item.	Data value (*3)	True	Data value matches specification
		False	Data value does not match specification
Element symbol.Data item=	Data status	True	Data status of specified data matches
		False	Data status of specified data does not match

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*1: The condition specification of the AFL is the reference in all flashing state.
*2: The condition specification of the AOF is the reference in all suppressing alarm state.
*3: Only integers can be handled as data values. When the data type of the data item is a floating-point type, the comparison is made by rounding off the value.

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Condition Signal Description (Calculation Block) 2/4

Block code	Name	Data item	Setting range
DLAY	Dead-Time Block	RST	0, 1
DLAY-C	Dead-Time Compensation Block		
AVE-M	Moving-Average Block		
INTEG	Integration Block	SW	0, 1, 2
AVE-C	Cumulative-Average Block		
SW-33	Three-Pole Three-Position Selector Switch Block	SW	0 to 3
BDSET-1L	One-Batch Data Set Block	SW	0 to 3
BDSET-1C	One-Batch String Data Set Block		
BDSET-2L	Two-Batch Data Set Block		
BDSET-2C	Two-Batch String Data Set Block		
SW-91	One-Pole Nine-Position Selector Switch Block	SW	0 to 9
DSW-16	Selector Switch Block for 16 Data	SW	0 to 16
DSW-16C	Selector Switch Block for 16 String Data		
BDA-L	Batch Data Acquisition Block	SW	0 to 17
BDA-C	Batch String Data Acquisition Block		

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Condition Signal Description (Calculation Block) 3/4

Block code	Name	Data Item	Setting range
AND	Logical AND Block	RV1	0, 1
		RV2	0, 1
		CPV	0, 1
OR	Logical OR Block	RV1	0, 1
		RV2	0, 1
		CPV	0, 1
NOT	Logical NOT Block	RV	0, 1
		CPV	0, 1
SRS1-S	Set-Dominant Flip-Flop Block with 1 Output	RV1	0, 1
		RV2	0, 1
		CPV	0, 1
SRS1-R	Reset-Dominant Flip-Flop Block with 1 Output	RV1	0, 1
		RV2	0, 1
		CPV	0, 1
SRS2-S	Set-Dominant Flip-Flop Block with 2 Outputs	RV1	0, 1
		RV2	0, 1
		CPV1	0, 1
		CPV2	0, 1
SRS2-R	Reset-Dominant Flip-Flop Block with 2 Outputs	RV1	0, 1
		RV2	0, 1
		CPV1	0, 1
		CPV2	0, 1
WOUT	Wipeout Block	RV1	0, 1
		RV2	0, 1
		CPV	0, 1
OND	ON-Delay Timer Block	RV	0, 1
		CPV	0, 1
OFFD	OFF-Delay Timer Block	RV	0, 1
		CPV	0, 1
TON	One-Shot Block (Rising-Edge Trigger)	RV	0, 1
		CPV	0, 1
TOFF	One-Shot Block (Falling-Edge Trigger)	RV	0, 1
		CPV	0, 1
GT	Comparator Block (Greater Than)	CPV	0, 1
GE	Comparator Block (Greater Than or Equal)	CPV	0, 1
EQ	Equal Operator Block	CPV	0, 1
Block code	Name	Data Item	Setting range

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*1: Logic Operation blocks can be used in FCSs except PFCS.

Condition Signal Description (Calculation Block) 4/4

The table lists the calculation blocks that can be referenced in the condition signal as one-shot operation.

The format is:

TAGNAME.ACT.ON

Block type	Block code	Name
Arithmetic Calculation	ADD	Addition Block
	MUL	Multiplication Block
	DIV	Division Block
	AVE	Averaging Block
Logic Operation Blocks (*1)	AND	Logical AND Block
	OR	Logical OR Block
	NOT	Logical NOT Block
	SRS1-S	Set-Dominant Flip-Flop Block with 1 Output
	SRS1-R	Reset-Dominant Flip-Flop Block with 1 Output
	SRS2-S	Set-Dominant Flip-Flop Block with 2 Outputs
	SRS2-R	Reset-Dominant Flip-Flop Block with 2 Outputs
	WOUT	Wipeout Block
	GT	Comparator Block (Greater Than)
	GE	Comparator Block (Greater Than or Equal)
	EQ	Equal Operator Block
	BAND	Bitwise AND Block
	BOR	Bitwise OR Block
	BNOT	Bitwise NOT Block
General-Purpose Calculation	CALCU	General-Purpose Calculation Block
	CALCU-C	General-Purpose Calculation Block with String I/O

D030348E.EPS

*1: Logic Operation blocks can be used in FCSs except PFCS.

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Condition Signal Description (Faceplate Block) 1/2

| Condition signal description column | | True/ false | Satisfiable condition |
Input signal	Condition specification		
Element symbol.MODE.	Block mode	True	Block mode in specified state
		False	Block mode not in specified state
Element symbol.XMODE.	BUM	True	Block is in ROUT (MAN) or RCAS (MAN) mode.
		False	Block is not in ROUT (MAN) or RCAS (MAN) mode.
	BUA	True	Block is in ROUT (AUT) or RCAS (AUT) mode.
		False	Block is not in ROUT (AUT) or RCAS (AUT) mode.
	BUC	True	Block is in ROUT (CAS) or RCAS (CAS) mode.
		False	Block is not in ROUT (CAS) or RCAS (CAS) mode.
Element symbol.BSTS.	Block status	True	Block status in specified state
		False	Block status not in specified state
Element symbol.ALRM.	Alarm status	True	Specified alarm occurring
		False	No occurrence of specified alarm
Element symbol.XALRM.	IOP	True	Alarm is in IOP or IOP- status.
		False	Alarm is in neither IOP nor IOP- status.
	VEL	True	Alarm is in VEL or VEL- status.
		False	Alarm is in neither VEL nor VEL- status.
Element symbol.AFLS.	Alarm status, AFL (*1)	True	Specified alarm in flashing state
		False	Specified alarm in non-flashing state
Element symbol.AF.	Alarm status	True	Canceling the specified alarm detection
		False	Detecting the specified alarm
Element symbol.XAF.	IOP	True	IOP or IOP- detection is disabled.
		False	IOP and IOP- detection is enabled.
Element symbol.AOFS.	Alarm status, AOF (*2)	True	Suppressing the specified alarm
		False	Canceling the specified alarm in suppression
Element symbol.SV.	1 to 99 (Valid only for BSI blocks)	True	Batch step number matches specification
		False	Batch step number does not match specification
Element symbol.PV01 to 10.	0, 1	True	Operation command matches specification
		False	Operation command does not match specification
Element symbol.Data item=	Data status	True	Data status matches specification
		False	Data status does not match specification

Condition Signal Description (Faceplate Block) 2/2

Condition signal description column		True/false	Satisfiable condition
Input signal (*1)	Condition specification		
Element symbol.SWCR[1 to n].	0 to 15	True	Switch display color matches specification
		False	Switch display color does not match specification
Element symbol.SWST[1 to n].	0, 1	True	Switch flashing status matches specification
		False	Switch flashing status does not match specification
Element symbol.SWOP[1 to n].	-15 to 15	True	Switch operation prohibited status matches specification
		False	Switch operation prohibited status does not match specification

D0303A0E.EPS

*1:   n indicates the number of elements in a one-dimensional array. This is the number of push-button switches in a faceplate block, and varies with the type of each faceplate block.

Condition Signal Description (Sequential Function Chart Block)

Condition signal description column		True/false	Satisfiable condition
Input signal	Condition specification		
Element symbol.MODE.	MAN, SWMI, AUT, O/S	True	Block mode in specified state
		False	Block mode not in specified state
Element symbol.BSTS.	RUN, PAUS, STOP, ABRT	True	Block status in specified state
		False	Block status not in specified state
Element symbol.ALRM.	Alarm status	True	Specified alarm occurring
		False	No occurrence of specified alarm
Element symbol.AFLS.	Alarm status, AFL (*1)	True	Specified alarm in flashing state
		False	Specified alarm in non-flashing state
Element symbol.AF.	Alarm status	True	Canceling the specified alarm detection
		False	Detecting the specified alarm
Element symbol.AOFS.	Alarm status, AOF (*2)	True	Suppressing the specified alarm
		False	Canceling the specified alarm in suppression
Element symbol.Dataitem.	Data value	True	Data value matches specification
		False	Data value does not match specification
Element symbol.Dataitem=	Data status	True	Data status matches specification
		False	Data status does not match specification

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*1: The condition specification of the AFL is the reference in all flashing state.
*2: The condition specification of the AOF is the reference in all suppressing alarm state.

The following lists the data items of SFC block that can describe data values in condition specifications and their setting ranges:

STEPNO: 1 to 99

SWCR[5]: 0 to 15

SWST[5]: 0,1

SWOP[5]: -15 to 15

Condition Signal Description (Unit Supervision Block)

Condition signal description column		True/false	Satisfiable condition
Input signal	Condition specification		
Element symbol.MODE.	MAN,SEMI, AUT,O/S	True	Unit mode in specified state
		False	Unit mode not in specified state
Element symbol.BSTS.	Unit status	True	Unit status in specified state
		False	Unit status not in specified state
Element symbol.ALRM.	Alarm status	True	Specified alarm occurring
		False	No occurrence of specified alarm
Element symbol.AFLS.	Alarm status, AFL (*1)	True	Specified alarm in flashing state
		False	Specified alarm in non-flashing state
Element symbol.AF.	Alarm status	True	Canceling the specified alarm detection
		False	Detecting the specified alarm
Element symbol.AOFS.	Alarm status, AOF (*2)	True	Suppressing the specified alarm
		False	Canceling the specified alarm in suppression
Element symbol.STEPNO.	1 to 99	True	SFC step number matches specification
		False	SFC step number does not match specification

D030351E.EPS

*1: The condition specification of the AFL is the reference in all flashing state.
*2: The condition specification of the AOF is the reference in all suppressing alarm state.

Condition Signal Description (Processing I/O Block)

Condition signal description column		True/false	Satisfiable condition
Input signal	Condition specification		
Element symbol.PV.	ON, OFF	True	Contact I/O ON/OFF state matches specification
		False	Contact I/O ON/OFF state does not match specification
Element symbol.PV=	Data status	True	Contact I/O data status matches specification
		False	Contact I/O data status does not match specification

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Condition Signal Description (Global Switch)

Condition signal description column		True/false	Satisfiable condition
Input signal	Condition specification		
Element symbol.PV.	ON, OFF	True	Specified global switch status is True.
		False	Specified global switch status is False.
Element symbol.PV=	BAD	True	Data status of global switch is BAD.
		False	Data status of global switch is not BAD.

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Condition Signal Description (Annunciator Message)

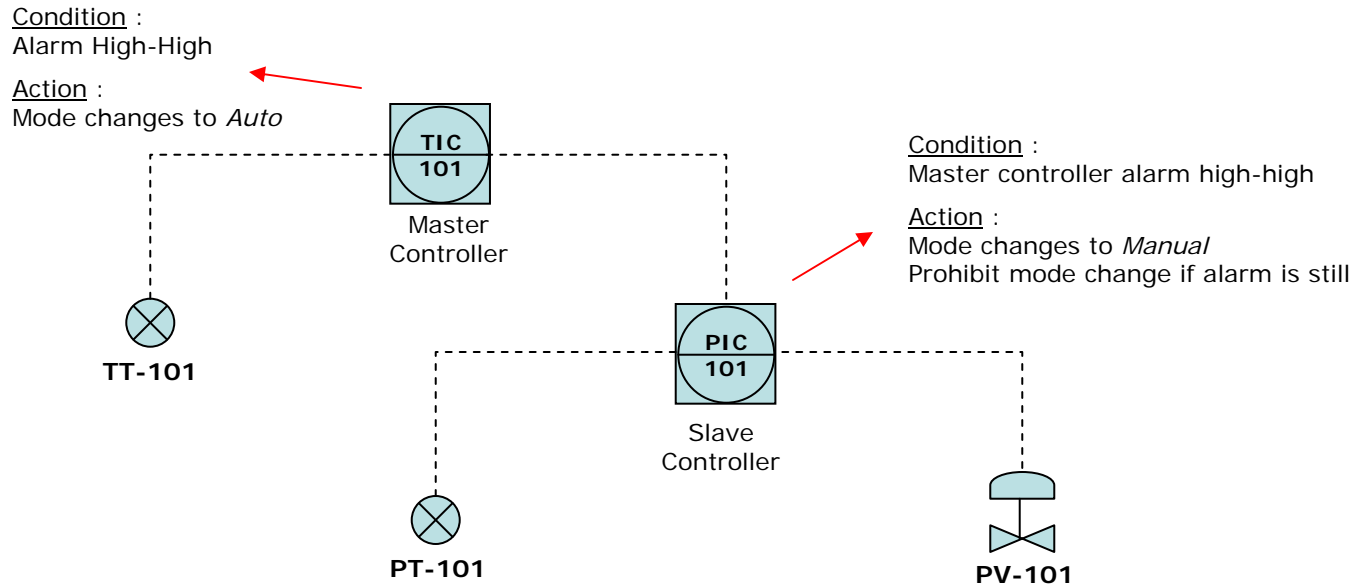| Condition signal description column		True/false	Satisfiable condition
Input signal	Condition specification		
Element symbol.PV.	ON, OFF	True	Annunciator occurrence state matches specification (On: Occurred OFF: No occurrence)
		False	Annunciator occurrence state does not match specification
Element symbol.AFLS.	AFL	True	Flashing state
		False	Steady state (non-flashing state)
Element symbol.AOFS.	AOF	True	Alarm suppressing state
		False	Steady state (non-alarm suppressing state)
Element symbol.RP	ON, OFF	True	Repeated warning status is consistent with specification (ON: Wait for repeated warning OFF: NR)
		False	Repeated warning state is not consistent with specification

D030355E.EPS

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Create a logic sequence from this control narrative:

Case 1

In a cascade loop, if the process variable of the master controller is *High-High* alarm then the slave controller mode will have to switch to *MANUAL* mode and the master controller mode will have to switch to *AUTO* mode.

The control mode of the slave controller cannot be changed until the alarm vanishes (process variable is in normal state).

Condition :
Alarm High-High

Action :
Mode changes to *Auto*

Master Controller

TIC 101

TT-101

Condition :
Master controller alarm high-high

Action :
Mode changes to *Manual*
Prohibit mode change if alarm is still

PIC 101
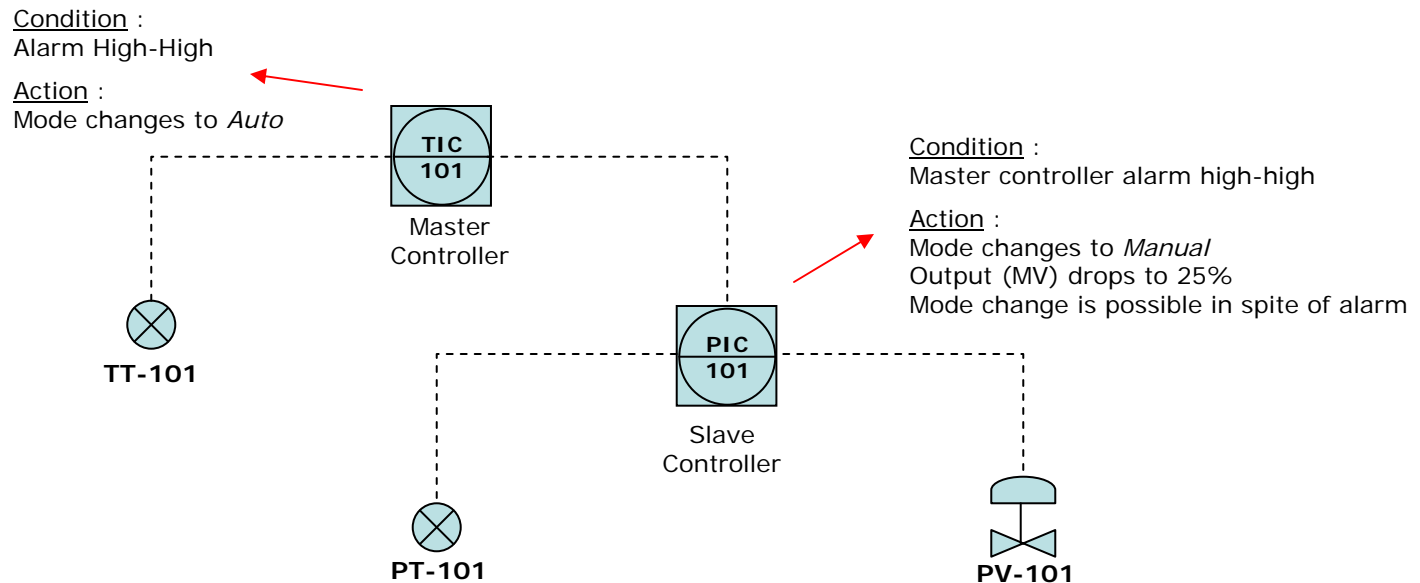
Slave Controller

PT-101

PV-101

Create a logic sequence from this control narrative:

Case 2

In a cascade loop, if the process variable of the master controller is *High-High* alarm then the slave controller mode will have to switch to *MANUAL* mode with its output drops to MV 25% and the master controller mode will have to switch to *AUTO* mode.

However, the operator is allowed to change the mode of slave controller to *CASCADE* or *AUTO* mode even though the process variable is still in *High-High* alarm state.

Condition :
Alarm High-High

Action :
Mode changes to *Auto*

TIC 101

Master Controller

Condition :
Master controller alarm high-high

Action :
Mode changes to *Manual*
Output (MV) drops to 25%
Mode change is possible in spite of alarm

TT-101

PIC 101

Slave Controller

PT-101

PV-101

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If PSW = 0, MV is normal
If PSW = 1, MV = 0% or = MSL
If PSW = 2, MV = 100% or = MSH
If PSW = 3, MV = PMV

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Thanks!