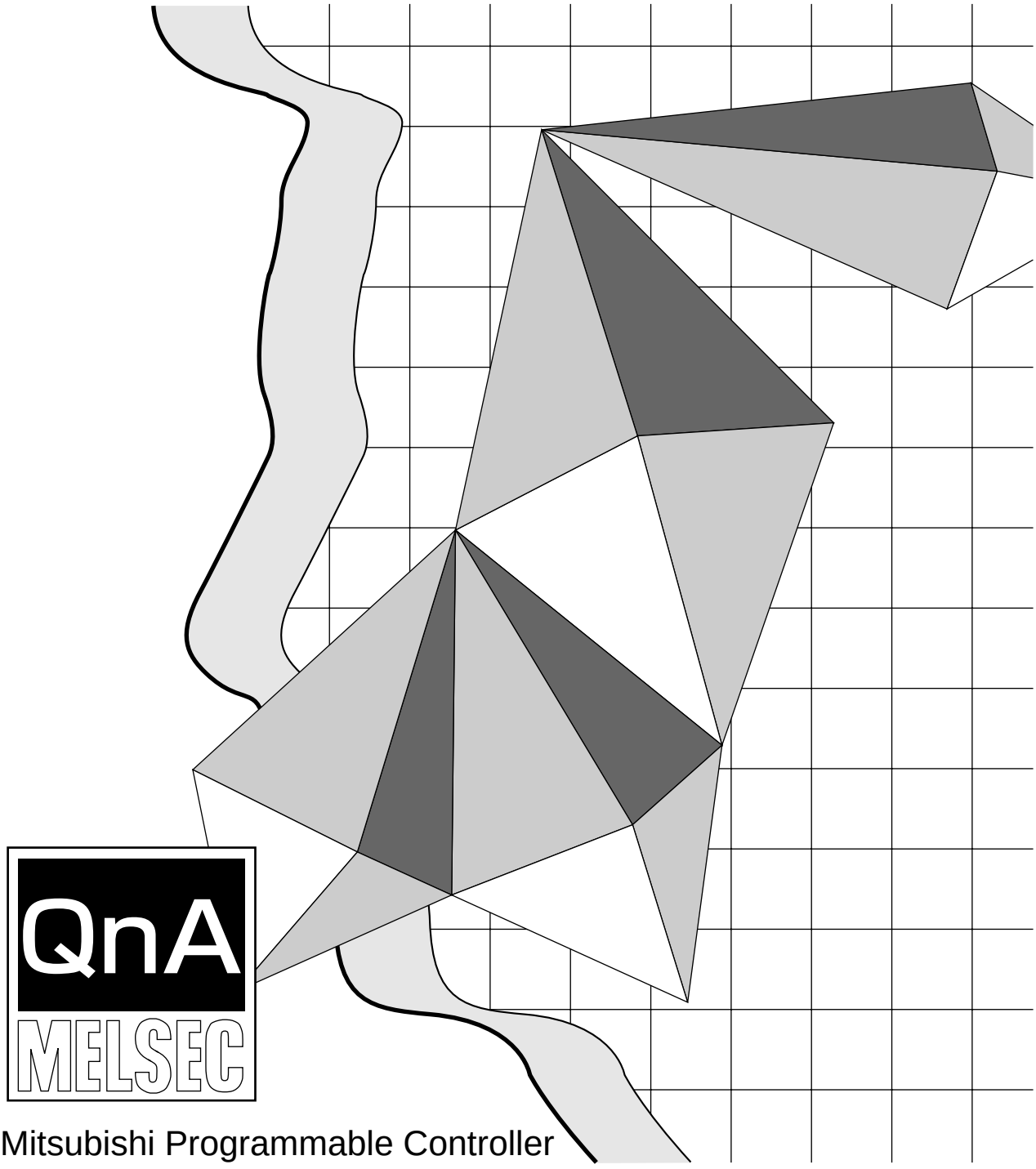
MITSUBISHI

QnA SERIES

Q4ARCPU

Programming Manual (Process Control Instruction Edition)



QnA
MELSEC

Mitsubishi Programmable Controller

Mitsubishi
QnA Series
Advanced Encounter that Creates Technology--SOCIO-TECH
Q4ARCPU Programming Manual (Process Control Instruction Edition)
Mitsubishi General Purpose PC

REVISIONS

* The manual number is given on the bottom left of the back cover.

Print Date	* Manual Number	Revision
Sep. 1996	SH (NA) -66696-A	First edition

Index

About this manual

The manuals relating to this product are given in the table below. When necessary refer to the following table to order the manuals.

Related manuals

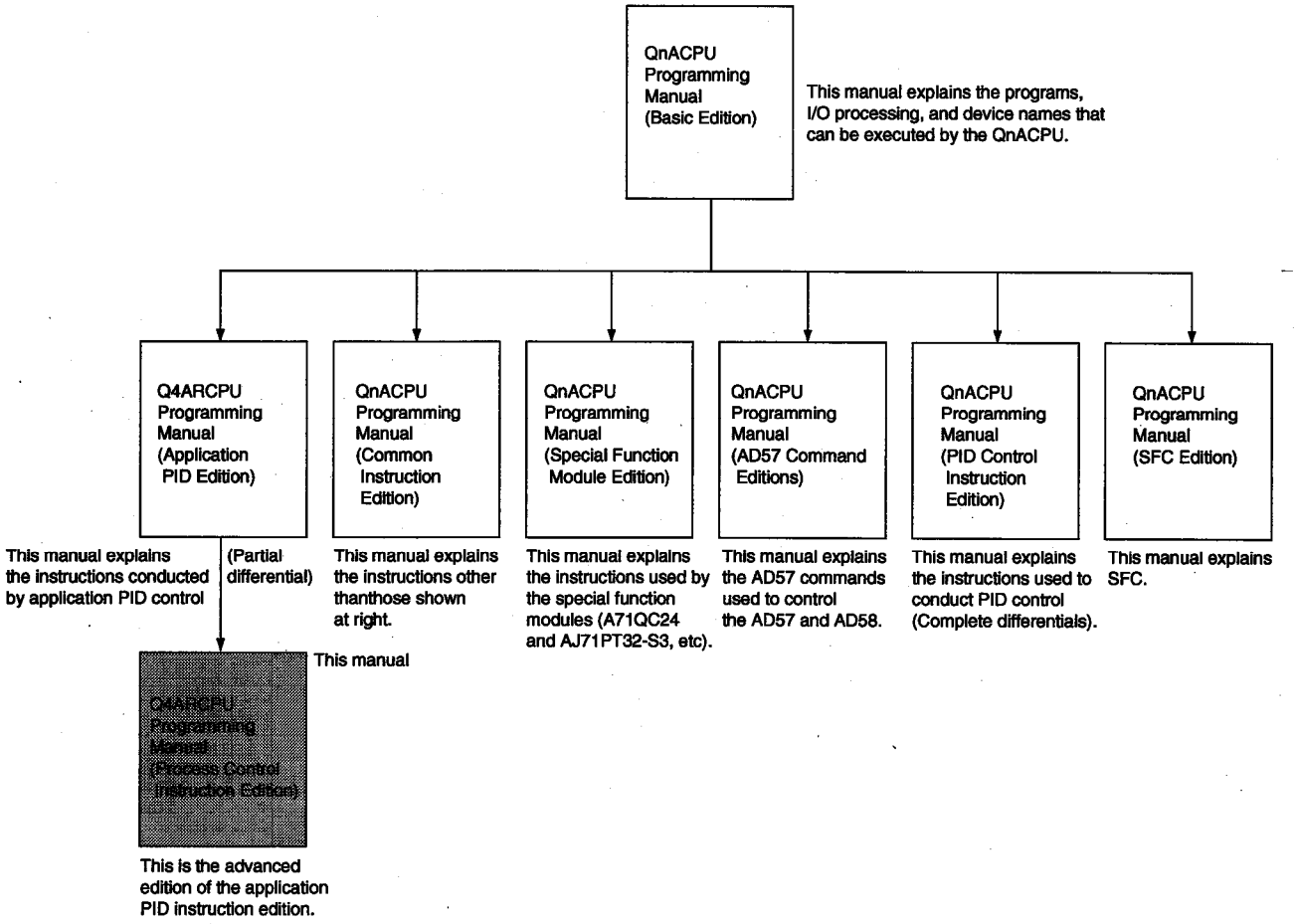
Manual Name	Manual No. (Model Code)
Q4ARCPU Programming Manual (Application PID Edition) This manual explains the programming methods and device names, etc., required to create a program to conduct application PID control using process control instructions. (Sold separately)	IB-66695 (13JF52)
Q4ARCPU User's Manual (Detailed Edition) This manual explains the items relating to the Q4ARCPU performance, functions, and handling and the bus switching module, system control module, power supply module, memory card, and base unit specifications and handling. (Sold separately)	IB-66685 (13J852)
MELSECNET/10 Network System Reference Manual for QnA/Q4AR This manual explains the network overview, specifications, and programming method, etc., that use the QnACPU and the Q4ARCPU. (Sold separately)	IB-66690 (13JF78)
Type SW0IVD-GPPQ GPP Software package OPERATING MANUAL (Offline) This manual explains the offline functions such as the SW0IVD-GPPQ program creation method, print out method, and file maintenance. (Included in packaging)	IB-66623 (13JF12)
Type SW0IVD-GPPQ GPP Software package OPERATING MANUAL (Online) This manual explains the online functions such as SW0IVD-GPPQ monitor method and debugging method. (Included in packaging)	IB-66624 (13JF13)
SW0NX-GPPQ GPP Software package OPERATING MANUAL (SFC) This manual explains the SFC functions such as the SFC program editing methods and monitoring methods. (Included in packaging)	IB-66625 (13JF14)

Related Programming Manuals

In addition to this manual there are related programming manuals that explain all of the Q4ARCPU instructions.

- QnACPU Programming Manual (Basic Edition)
- QnACPU Programming Manual (Common Instruction Edition)
- QnACPU Programming Manual (Special Function Module Edition)
- QnACPU Programming Manual (PID Control Instruction Edition)
- QnACPU Programming Manual (AD75 Command Edition)
- QnACPU Programming Manual (SFC Edition)
- Q4ARCPU Programming Manual (Application PID Instruction Edition)

Before reading this manual please read the QnACPU Programming Manual (Basic Edition) and (Common Instruction Edition) to gain a basic knowledge of this product.



Introduction

Thank you for purchasing the Mitsubishi General Purpose PC MELSEC-QnA series.
Before use read this manual carefully and correctly use the equipment after fully understanding the QnA series sequence functions and performance.
Please put this manual in a location accessible to the end user.

Table of Contents

1 General Description

This manual explains the process control instructions used to conduct application PID control in the Q4ARCPU.
This manual is used as the advanced edition of the Application PID Instruction Edition.

1.1 Features

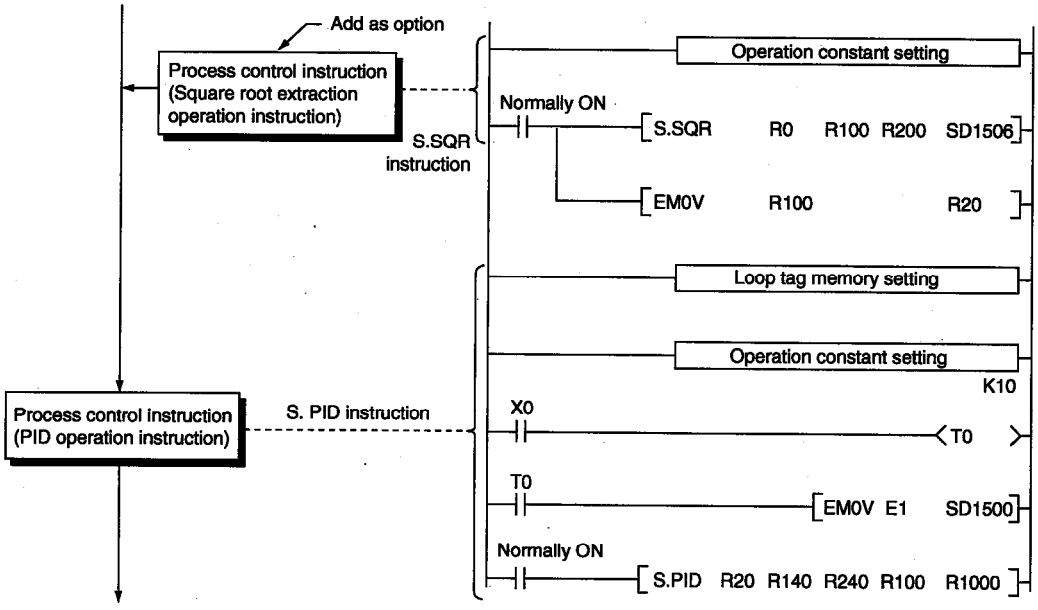
The process control instructions have the features shown below, and make it possible to easily conduct simple control to advanced control.

(1) Because the CPU contains a floating point operation processor, floating point real number operations for PID processing can be processed at high speed.

(2) Because floating point real number data is handled, a wide range of operations can be executed at high accuracy.

(3) All types of control algorithm can be conducted.
PID control PIDP control Sampling PID control I-PD control Other

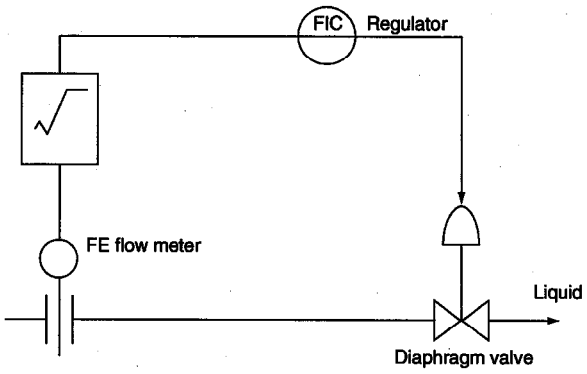
(4) Because the system can be built up by adding options, a wide range of applications are possible. Process control instructions can be freely added as options to the loop tied in to each process control instruction.



Remarks

PID control is recorded in the Application PID Control Edition.

In the above example, the input signal is subjected to a square root extraction operation and an output signal is emitted and is used as a linearalized differential pressure input. In addition, it can also be used as a differential pressure flow meter linearalizer.

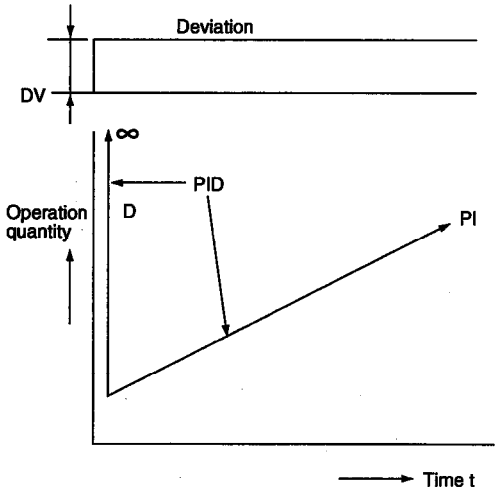


(5) A save system can be developed because various warning information can be automatically detected by the system.

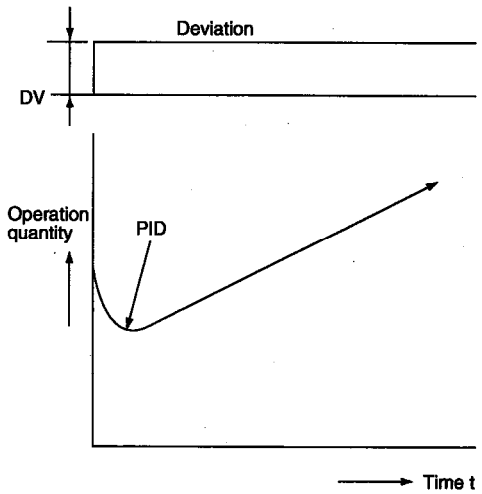
(6) PID algorithm using a velocity type incomplete differential format ..... Partial differential has the following advantages over the complete differential format.

① The differential gain is 1/μ and the limit value can be set.

② The output contains time amplitude, so the system actually responds to the operation edge so the differential operation makes the movement valid.



For complete differential



For incomplete differential

This section explains the loop basic format.

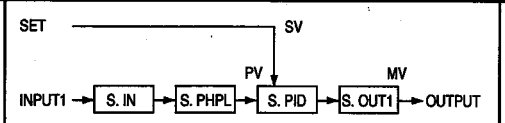
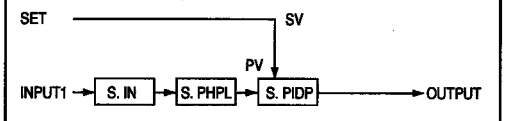
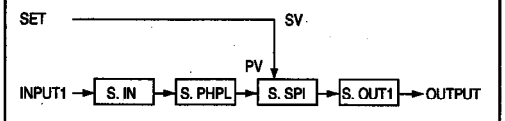
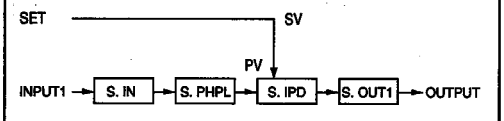
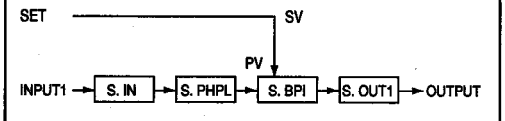
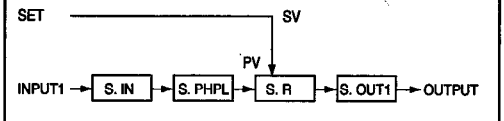
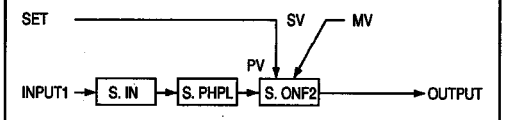
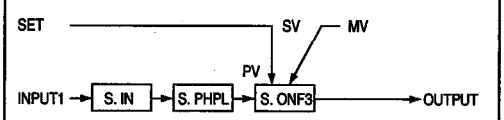
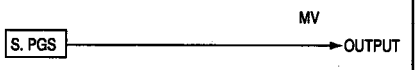
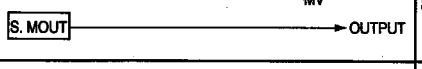
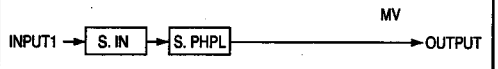
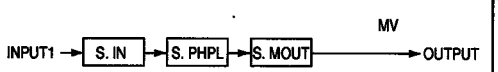
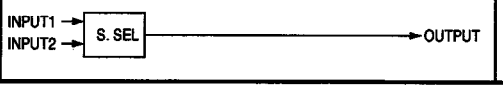
Loop type	Configuration	Application
PID control (SPID)		Used for general PID control. (velocity type) Conducts PID operations for each control time.
PIDP control (SPIDP)		Used for general PID control. (Position type) Conducts PID control for each control time.
Sample PID control (SSPI)		Because the operation output is continually updated without the operation output results being checked when continuous PID control is used for processes with a large dead time, this method conducts PI control for only the control execution time for each control time and after that the output is held constant.
I-PD control (SIPD)		This method is used when you want to solely respond without applying a shock to the operation terminal or process when changing the set value.
Blend PI control (SBPI)		This is used in processes where the control value can be held constant for a long period of time when it is all right if it vibrates for a short period of tie.
Percentage control (SR)		This is used to make it so that a control value is always kept at a constant ratio with another change value and the process whereby a set value is subject to change control to keep it at a constant ration with another change value is called ratio control and this is used to control the air fuel ratio for fuel systems, the mixing of liquids with different densities and compositions to keep the densities and compositions at a specified value.
2 position on/off control (SONF2)		This uses air positive and negative to turn the manipulated value on and off and is the easiest operation to use during control operation. For example, a bimetal thermostat uses on/off operation.
3 position on/off control (SONF3)		Because the 3 position on/off operation can control the process value by outputting 3 range signals, it can suppress rapid manipulated value changes.
Program setter (SPGS)		This is output in accordance with the previously set set value time change.
Manual output (SMOUT)		This manually operates the operation terminal adjustment.
Monitor (SMONI)		This inputs the process value and detects process errors such as upper and lower limit alarms.
Manual output with monitor (SMWM)		This inputs the process value and conducts manual operation while checking that no errors occur.
Selector (SSEL)		This is used to select signals.

Table 1.1 Loop tag list

2 Trucking Function

2.1 Trucking Function Information

(1) Bumpless function and output limiter processing function:
For details, refer to Section 2 of the Application PID Instruction Edition.

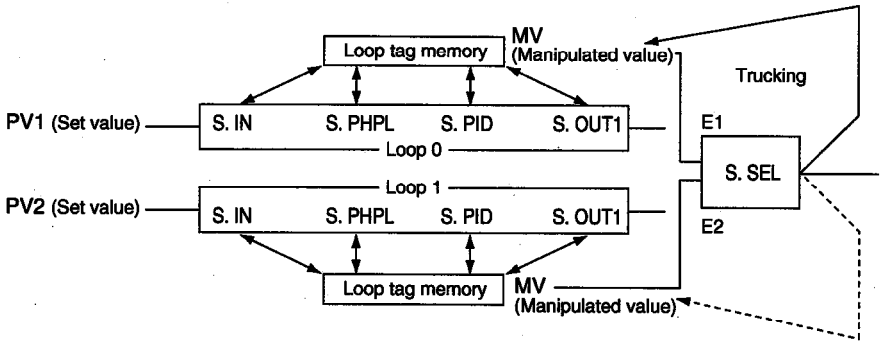
S.OUT1 S.OUT2 S.MOUT

(2) Cascade loop trucking
For details, refer to Section 2 of the Application PID Instruction Edition.

S.R S.PID S.IPD S.BPI S.SPI S.ONF2 S.ONF3 S.PIDP

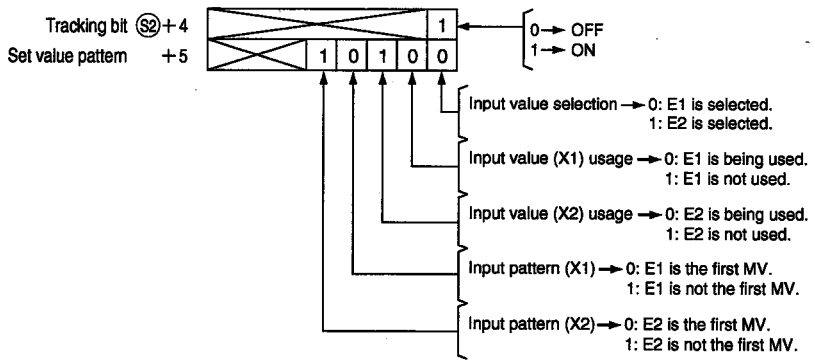
(3) Loop selector trucking function
S. SEL

(a) When the control mode MAN, CMB, CMV, LCM, LCC, or BB = 1, trucking is processed in accordance with the following conditions.



Example:
When the S.SEL instruction uses the input value E1 and E1 uses the first MV, the S.SEL instruction's MV value is trucked to loop 0's MV. The setting that conducts trucking is shown below.

Operation constant



Remarks

The [redacted] are recorded in the Application PID instruction edition.

3 Instruction List

The process control instruction is largely divided into the I/O control instructions, control operation instructions, correction operation instructions, arithmetic operation instructions, and proportional operation instructions.

3.1 How to Read the Instruction List Table

Table 3.1 How to read the instruction list

Classification	Instruction code	Symbol	Function	Basic number of steps	Explanation page
I/O control instruction	S.OUT2	S. OUT2 S1 D1 S2 D2	Output processing 2 with mode switching	8	5-1

① ② ③ ④ ⑤ ⑥

Explanation

① Classifies the instructions by application.
② Shows the instruction signal used by the program.
③ Shows the symbol diagram used in the circuit.

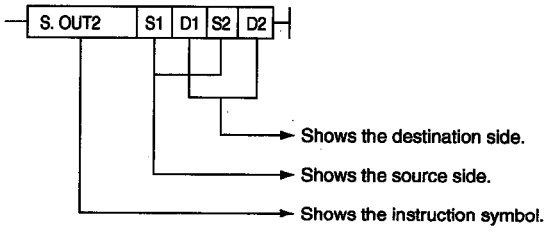


Figure 3.1 Symbols in the circuit

Destination: Shows the destination of the data after operation.
Source: Stores the data before the operation.

④ Shows the processing contents of each instruction.
⑤ Shows the number of steps for each instruction.
⑥ Shows the explanation page for each instruction.

3.2 I/O Control Instructions

Table 3.2 I/O instructions

Classification	Instruction signal	Symbol	Function	Basic number of steps	Explanation page
I/O control instruction	S. OUT2	S. OUT2 S1 D1 S2 D2	Output processing -2 with mode switching	8	5-1
	S. MOUT	S. MOUT S1 D1 S2 D2	Manual output	8	5-5

3.3 Control Operation Instructions

Table 3.3 Control Operation Instructions

Classification	Instruction signal	Symbol	Function	Basic number of steps	Explanation page
Control operation instruction	S. R	S. R S1 D1 S2 D2 S3	Ratio	7	5-8
	S. PIDP	S. PIDP S1 D1 S2 D2 S3	Position type PID	9	5-13
	S. SPI	S. SPI S1 D1 S2 D2 S3	Sample PI control	9	5-20
	S. IPD	S. IPD S1 D1 S2 D2 S3	I-PD control	9	5-26
	S. BPI	S. BPI S1 D1 S2 D2 S3	Blend PI control	9	5-32
	S. HS	S. HS S1 D1 S2 D2	High selector	7	5-38
	S. LS	S. LS S1 D1 S2 D2	Low selector	7	5-40
	S. MID	S. ASW S1 D1 S2 D2	Middle value selection	8	5-42
	S. AVE	S. AVE S1 D1 S2 D2	Average value	8	5-44
	S. LIMT	S. LIMT S1 D1 S2 D2	Upper and lower limit limiter	8	5-46
	S. VLMT1	S. VLMT1 S1 D1 S2 D2	Variation rate limiter 1	9	5-48
	S. VLMT2	S. VLMT2 S1 D1 S2 D2	Variation rate limiter 2	9	5-50
	S. ONF2	S. ONF2 S1 D1 S2 D2 S3	2 position on/off	9	5-52
	S. ONF3	S. ONF3 S1 D1 S2 D2 S3	3 position on/off	8	5-57
	S. DBND	S. DBND S1 D1 S2 D2	Dead Band	8	5-63
	S. PGS	S. PGS S1 D1 S2 D2	Program setter	8	5-65
	S. SEL	S. SEL S1 D1 S2 D2 S3	Loop selector	8	5-69
	S. BUMP	S. BUMP S1 D1 S2 D2	Bumpless transfer	8	5-74
	S. AMR	S. AMR S1 D1 S2 D2	Analog memory	8	5-76

3.4 Correction Operation Instruction

Table 3.4 Correction operation instruction

Classification	Instruction signal	Symbol	Function	Basic number of steps	Explanation page
Correction operation instruction	S. SUM	S. SUM S1 D1 S2 D2	Summation	8	5-78
	S. TPC	S. TPC S1 D1 S2 D2	Temperature pressure correction	8	5-80

3.5 Arithmetic Operation Instruction

Table 3.5 Arithmetic operation instruction

Classification	Instruction signal	Symbol	Function	Basic number of steps	Explanation page
Arithmetic operation instruction	S. ADD	S. ADD S1 D1 S2 D2	Addition	8	5-82
	S. SUB	S. SUB S1 D1 S2 D2	Subtraction	8	5-84
	S. MUL	S. MUL S1 D1 S2 D2	Multiplication	8	5-86
	S. DIV	S. DIV S1 D1 S2 D2	Division	8	5-88
	S. SQR	S. SQR S1 D1 S2 D2	Square root ($\sqrt{\ }$)	8	5-90

3.6 Comparison Operation Instruction

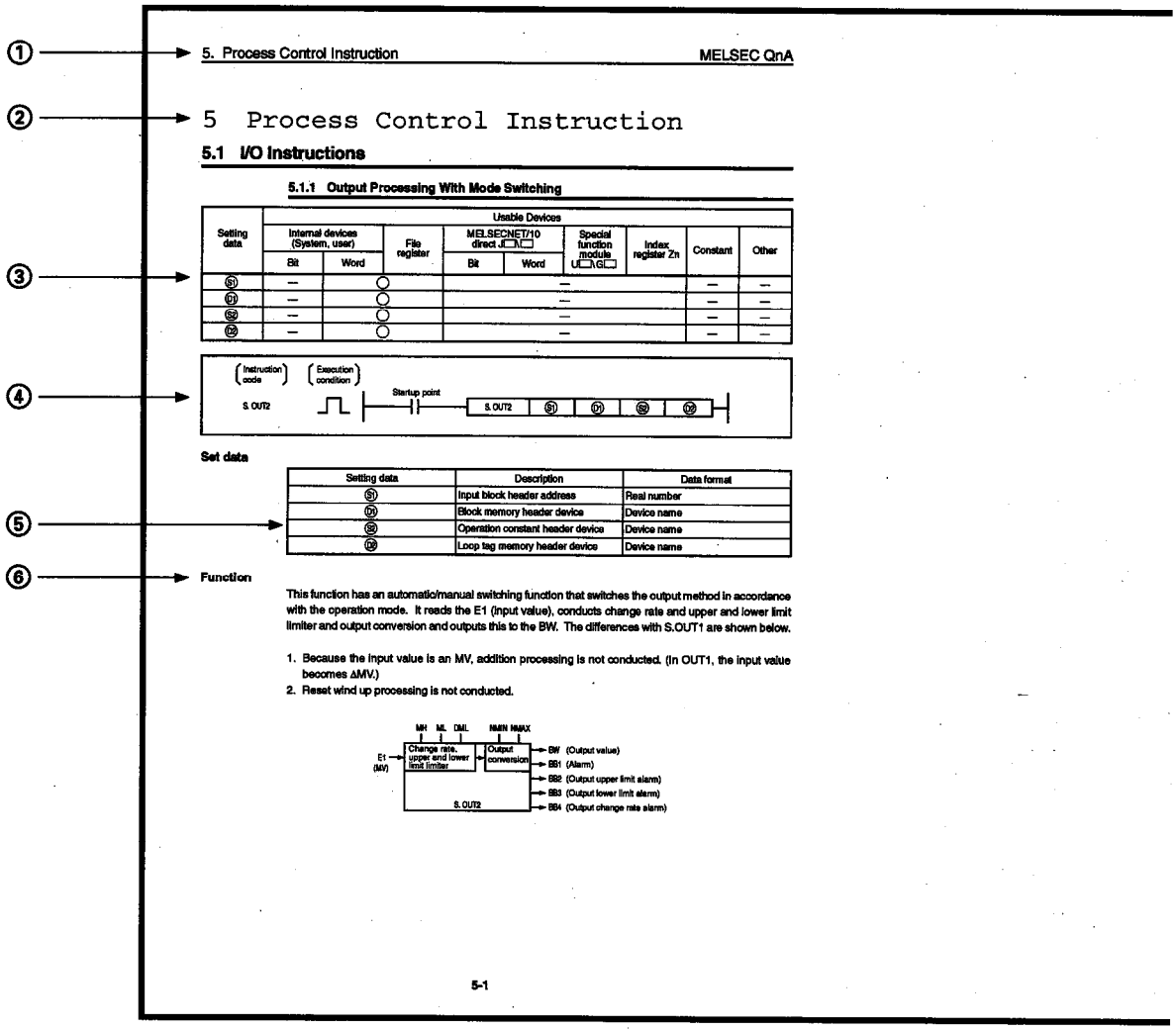
Table 3.6 Comparison operation instruction

Classification	Instruction signal	Symbol	Function	Basic number of steps	Explanation page
Comparison operation instruction	S. >	S. > S1 D1 S2 D2	Compare Greater Than	7	5-92
	S. <	S. < S1 D1 S2 D2	Compare Less Than	7	5-94
	S. =	S. = S1 D1 S2 D2	Compare Equal Than	7	5-96
	S. >=	S. >= S1 D1 S2 D2	Compare Greater Or Equal	7	5-98
	S. <=	S. <= S1 D1 S2 D2	Compare Less Or Equal	7	5-100

MEMO

4 How to Read Instructions

The following format will be used to explain how to read instructions presented hereafter.



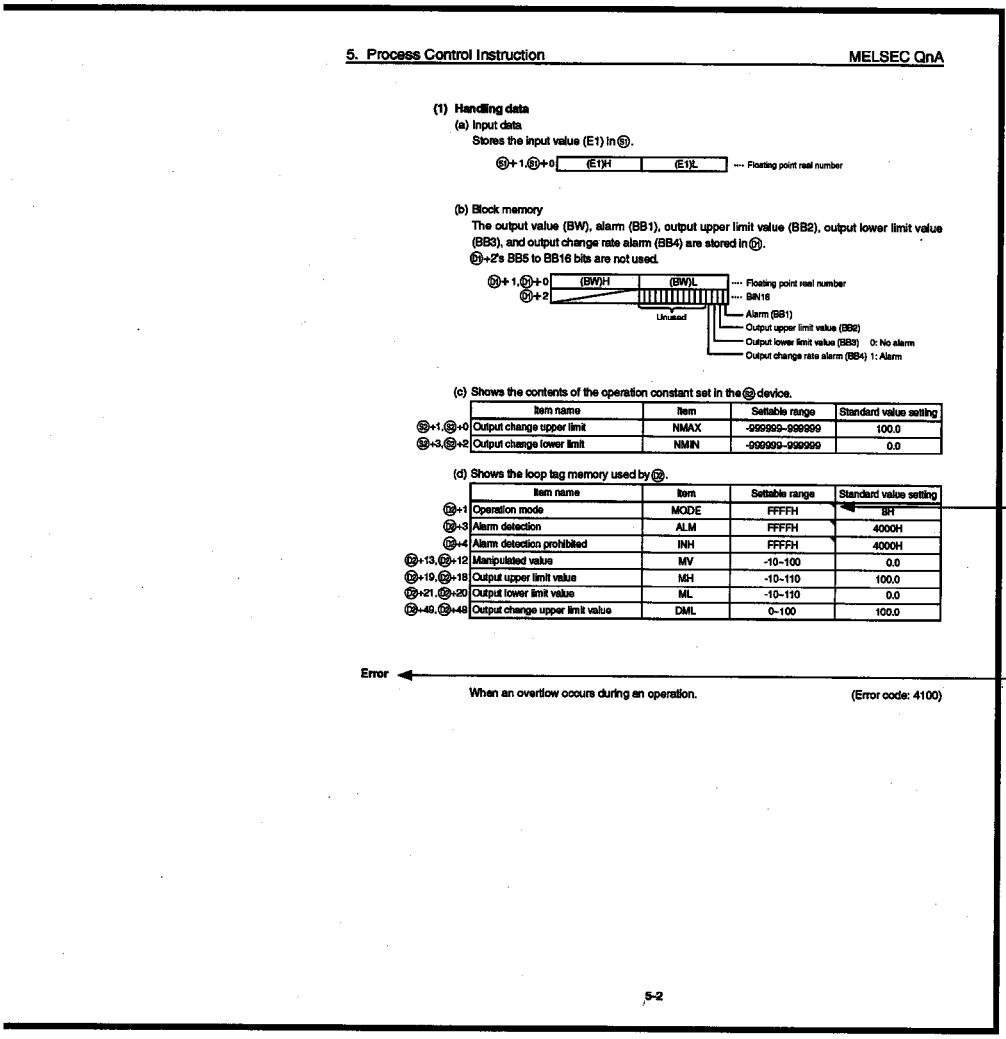
① Shows the instruction symbol.

② Shows the item No. in the instruction summary.

③ ○ is added to devices that can be used by the instruction. The usage classifications for devices that can be used is shown below.

Device classifications	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Z□	Constant	Other
	Bit	Word		Bit	Word				
Usable devices	FX, FY, S, SM, X, Y, M, L, F, B, SB	A, VD, SD T, C, D, W, SW, ST	R, ZR	J□\X J□\Y J□\B J□\SB	J□\W J□\SW	U□\G□	Z	Decimal constant Hexadecimal constant Real number constant Character string constant	P, I, J, U, DX, DY, N, BL, TR, BL\S

An asterisk by a constant or other use shows what device can be used. For constants a decimal constant is shown by K, hexadecimal constant by H, real number constant by E, and a character string constant by $.



5. Process Control Instruction MELSEC QnA

(1) Handling data

(a) Input data

Stores the input value (E1) in ⑤.

⑤+1,⑥+0 | (E1)H | (E1)L | ···· Floating point real number

(b) Block memory

The output value (BW), alarm (BB1), output upper limit value (BB2), output lower limit value (BB3), and output change rate alarm (BB4) are stored in ⑪.

⑪+2's BB5 to BB16 bits are not used.

⑪+1,⑰+0 | (BW)H | (BW)L | ···· Floating point real number

⑪+2 | ···· BIN16

Unused

Alarm (BB1)

Output upper limit value (BB2)

Output lower limit value (BB3) 0: No alarm

Output change rate alarm (BB4) 1: Alarm

(c) Shows the contents of the operation constant set in the ⑱ device.

	Item name	Item	Settable range	Standard value setting
⑱+1,⑱+0	Output change upper limit	NMAX	-999999~999999	100.0
⑱+3,⑱+2	Output change lower limit	NMIN	-999999~999999	0.0

(d) Shows the loop tag memory used by ⑫.

	Item name	Item	Settable range	Standard value setting
⑫+1	Operation mode	MODE	FFFFH	8H
⑫+3	Alarm detection	ALM	FFFFH	4000H
⑫+4	Alarm detection prohibited	INH	FFFFH	4000H
⑫+13,⑫+12	Manipulated value	MV	-10~100	0.0
⑫+19,⑫+18	Output upper limit value	MH	-10~110	100.0
⑫+21,⑫+20	Output lower limit value	ML	-10~110	0.0
⑫+49,⑫+48	Output change upper limit value	DML	0~100	100.0

⑦

Error

When an overflow occurs during an operation. (Error code: 4100)

⑧

5-2

④ This shows the expression and instruction execution conditions in the circuit mode.

Execution conditions	Normal execution	Executed during on	Executed once during on	Executed once during off
Displays the No. of the explanation page	Nothing recorded	⎍	Nothing recorded	Nothing recorded

⑤ This shows the instruction setting data explanations and data formats.

Data format	Description
BIN16	Shows how each BIN 16-bit and word device header No. is handled.
Real number	Shows how the floating point data is handled.
Device name	Shows how the device name is handled.
Dummy	Shows how the dummy device is handled.

⑥ This shows the function executing the instruction.

⑦  : This shows word data.
 : This shows the floating point real number data.

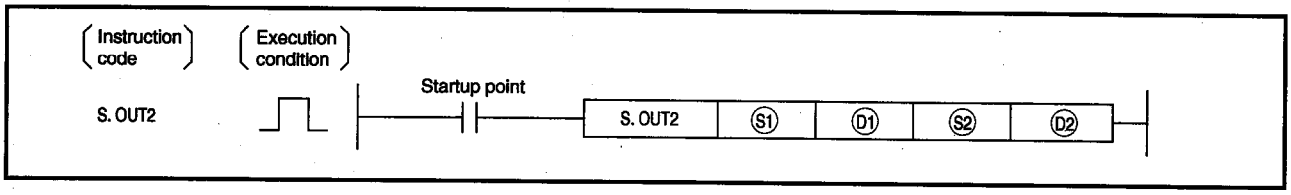
⑧ This shows the conditions and error No. created by an error.

5 Process Control Instruction

5.1 I/O Instructions

5.1.1 Output Processing With Mode Switching

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□ \□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
(S1)	—	○		—				—	—
(D1)	—	○		—				—	—
(S2)	—	○		—				—	—
(D2)	—	○		—				—	—



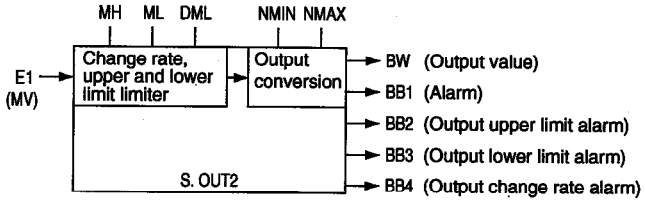
Set data

Setting data	Description	Data format
(S1)	Input block header address	Real number
(D1)	Block memory header device	Device name
(S2)	Operation constant header device	Device name
(D2)	Loop tag memory header device	Device name

Function

This function has an automatic/manual switching function that switches the output method in accordance with the operation mode. It reads the E1 (input value), conducts change rate and upper and lower limit limiter and output conversion and outputs this to the BW. The differences with S.OUT1 are shown below.

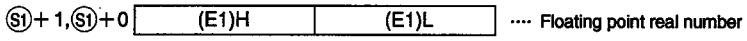
1. Because the input value is an MV, addition processing is not conducted. (In OUT1, the input value becomes ΔMV.)
2. Reset wind up processing is not conducted.



(1) Handling data

(a) Input data

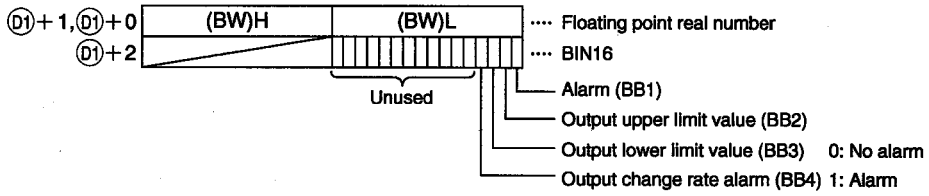
Stores the input value (E1) in (S1).



(b) Block memory

The output value (BW), alarm (BB1), output upper limit value (BB2), output lower limit value (BB3), and output change rate alarm (BB4) are stored in (D1).

(D1)+2's BB5 to BB16 bits are not used.



(c) Shows the contents of the operation constant set in the (S2) device.

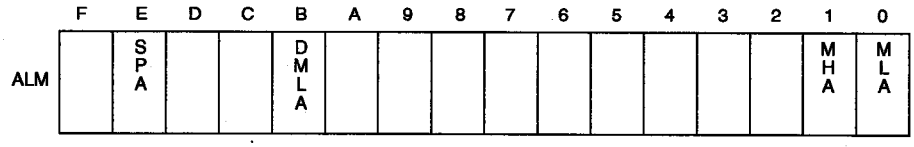
	Item name	Item	Settable range	Standard value setting
(S2)+1, (S2)+0	Output change upper limit	NMAX	-999999 to 999999	100.0
(S2)+3, (S2)+2	Output change lower limit	NMIN	-999999 to 999999	0.0

(d) Shows the loop tag memory used by (D2).

	Item name	Item	Settable range	Standard value setting
(D2)+1	Operation mode	MODE	FFFFH	8H
(D2)+3	Alarm detection	ALM	FFFFH	4000H
(D2)+4	Alarm detection prohibited	INH	FFFFH	4000H
(D2)+13, (D2)+12	Manipulated value	MV	-10 to 100	0.0
(D2)+19, (D2)+18	Output upper limit value	MH	-10 to 110	100.0
(D2)+21, (D2)+20	Output lower limit value	ML	-10 to 110	0.0
(D2)+49, (D2)+48	Output change upper limit value	DML	0 to 100	100.0

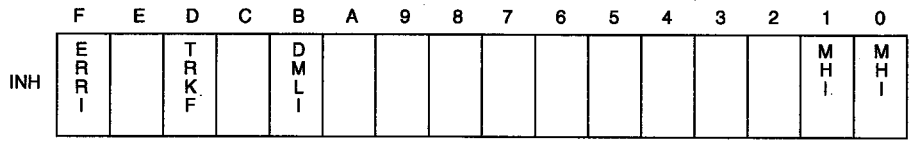
The bit used by the alarm detection (ALM) is shown below.

SPA can be set by the user, and the corresponding bit becomes 1 when DMLA, MHA, MLA outputs an alarm.



The bit used by alarm detection prohibition (INH) is shown below.

ERRI, DMLI, MHI, MLI can be set by the user.



(2) Processing explanation

(a) Loop STOP processing

When the alarm detection (ALM) SPA is 1, the following process is conducted and ended.

① BW holds the previous BW value.

② The operation mode is changed to MAN (MANUAL).

③ BB's BB1 to BB4 is made to 0.

④ Alarm detection (ALM)'s MHA, MLA, DMLA is made to 0.

(b) Mode determination

The following processing is conducted by the operation mode (MODE).

① When the operation mode is MAN, CMB, CMV, or LCM (alarm clear processing)

A The alarm detection (ALM)'s MHA, MLA, and DMLA are made to 0.

B BB's BB1 to BB4 is made to 0.

C Output conversion processing is conducted and ended.

② When the operation mode is AUT, CAB, CAS, CCB, CSV, LCA, or LCC

Processing after (c) input addition is conducted. However, when the alarm detection (ALM)'s SEA is 1 or when there is a hold (SM1501) then BB1 to BB4 is made to 0 and ended.

(c) Lower and upper limit and change rate limiter.

This conducts a check of the change rate and upper and lower limit for the input value (E1) and conducts data and alarm output after limiter processing is finished.

The change rate limiter conducts the following operation and outputs the results to BB4 and DMLA.

Condition	BB4, DMLA	T1	
|T-MV|≤DML	0	T	
T-MV>DML	1	MV+DML	0: No alarm
T-MV<-DML	1	MV-DML	1: Alarm

DML : Output change upper limit value

T : Estimated MV value

MV : Manipulated value

Note 1:

When the alarm detection prohibition (INH)'s DMLI and ERRI are 1, the alarm detection (ALM)'s DMLA and BB4 are made to 0.

The upper and lower limit delimiter conducts the following operations and outputs the results to BB2, BB3, MLA, and MHA.

Condition	BB3, MLA	BB2, MHA	MV	
T1>MH	0	1	MH	
T1<ML	1	0	ML	0: No alarm
ML≤T1≤MH	0	0	T1	1: Alarm

MH : Output upper limit value

T1 : MV value applied to change rate limiter

ML : Output lower limit value

Note 1:

When the alarm detection prohibited (INH)'s MHI and ERRI are 1, the alarm detection (ALM)'s MHA and BB2 are made to be 0.

Note 2:

When the alarm detection prohibited (INH)'s MLI and ERRI are 1, the alarm detection (ALM)'s MLA and BB3 are made to be 0.

(d) Output conversion processing

Output conversion conducts the following processing.

Output conversion processing

$$BW=\frac{NMAX-NMIN}{100}\times MV+NMIN$$

NMAX: Output upper limit NMIN: Output lower limit MV: Manipulated value

(e) Previous value hold processing

This processing specifies whether to hold or to continue processing as is for the output value from the OUT2 instruction when a sensor error occurs (detected by IN instruction) by loop STOP determination processing.

Selection can be made by setting SM1501 to hold or not hold the MV value when a sensor alarm occurs.

SM1501=0: No hold

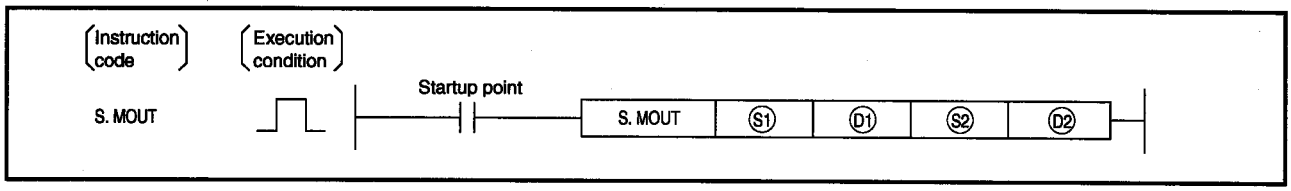
SM1501=1: Hold

Error

- When an overflow occurs during an operation. (Error code: 4100)

5.1.2 Manual Output

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—

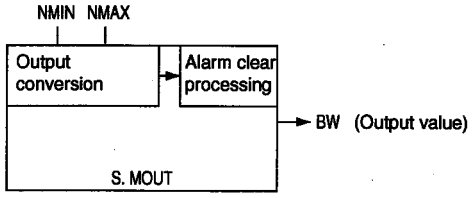


Set data

Setting data	Description	Data format
ⓢ1	Dummy Device	Dummy
ⓓ1	Block memory header device	Device name
ⓢ2	Operation constant header device	Device name
ⓓ2	Loop tag memory header device	Device name

Function

This function reads the loop tag memory's MV, conducts output conversion, conducts alarm clear processing, and outputs results to BW.



(1) Handling data

(a) Input data

Set the (S1) dummy device to the dummy device use device (SD1506).

(b) Block memory

The output value (BW) is stored in (D1).

BB is not used.

(D1)+1,(D1)+0	(BW)H	(BW)L	···· Floating point real number

(c) Shows the contents of the operation constant set in the (S2) device.

	Item name	Item	Settable range	Standard value setting
(S2)+1, (S2)+0	Output change upper limit	NMAX	-999999 to 999999	100.0
(S2)+3, (S2)+2	Output change lower limit	NMIN	-999999 to 999999	0.0

(d) Shows the loop tag memory used by (D2).

	Item name	Item	Settable range	Standard value setting
(D2)+1	Operation mode	MODE	FFFFH	8H
(D2)+3	Alarm detection	ALM	FFFFH	4000H
(D2)+13, (D2)+12	Manipulated value	MV	-10 to 110	0.0

The bit used by the alarm detection (ALM) is shown below.

SPA can be set by the user.

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ALM		SPA														

(2) Processing explanation

(a) Loop STOP processing

When the alarm detection (ALM) SPA is 1, the following process is conducted and ended.

① BW holds the previous BW value.

② The operation mode is changed to MAN (MANUAL).

③ BB's BB1 to BB4 is made to 0.

(b) Mode determination

The following processing is conducted by the operation mode.

① When the operation mode is MAN, CMB, CMV, or LCM

A The MV value becomes the contents for the loop tag memory.

B The following output conversion processing is conducted.

Output conversion processing

$$BW=\frac{NMAX-NMIN}{100}\times MV+NMIN$$

NMIN: Output conversion lower conversion NMAX: Output conversion upper limit

MV: Manipulated value

C Conducts alarm clear processing.

② When the operation mode is AUT, CAB, CAS, CCB, CSV, LCA, or LCC

A The output holds the previous value.

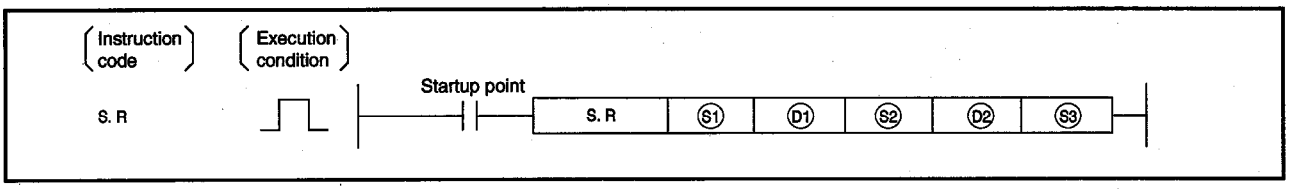
Error

- When an overflow occurs during an operation. (Error code: 4100)

5.2 Control Operation Instruction

5.2.1 Ratio

Setting data	Usable Devices							
	Internal devices (System, user)		File register	MELSECNET/10 direct J□ \□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
(S1)	—	○		—				—	—
(D1)	—	○		—				—	—
(S2)	—	○		—				—	—
(D2)	—	○		—				—	—
(S3)	—	○		—				—	—

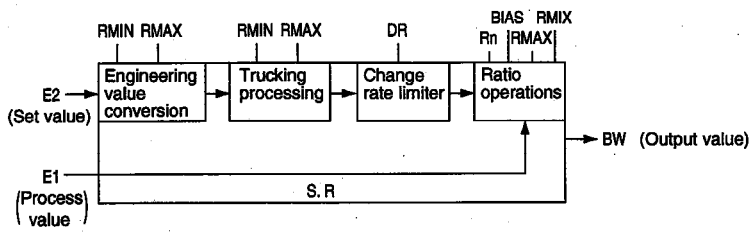


Set data

Setting data	Description	Data format
(S1)	Input block header address	Real number
(D1)	Block memory header device	Real number
(S2)	Operation constant header device	Device name
(D2)	Loop tag memory header device	Device name
(S3)	Input block header address for first MV address (when used)	Real number

Function

This function conducts operation mode (MODE) determination for each control time and conducts engineering value conversion, trucking processing change rate limiter, and ratio operations on the results.



(1) Data handled

(a) Input data

① The process value (E1) is stored in (S1).

② The (S3) set value (E2) can be used when the set value (E2) is set (0 bit=1) by the operation constant set value parameter.
For other cases set the dummy device (SD1506).
In addition, when the set value (E2) is set by the first loop tag memory MV value, set the device (+12: MV value) set by the first loop tag memory MV value.

(S1)+1,(S1)+0	(E1)H	(E1)L	···· Floating point real number
(S3)+1,(S3)+0	(E2)H	(E2)L	···· Floating point real number

(b) Block memory

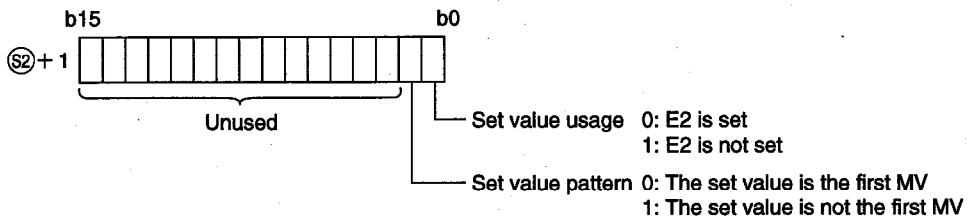
The output value (BW) is stored in (D1).
BB is not used.

(D1)+1,(D1)+0	(BW)H	(BW)L	···· Floating point real number

(c) This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Standard value setting	
(S2)+0	Trucking bit	TRK	0 to 1	0	0: Not trucked 1: Trucked
(S2)+1	Set value pattern	SVPTN	0 to 3	3	

The set value pattern (SVPTN) is a device that sets whether the set value is set by (S3) and whether that set value is set by the first loop device (+12: MV value). The set value pattern (SVPTN) cannot use bits 2 through 15.



(d) Shows the loop tag memory used by (D2).

	Item name	Item	Settable range	Standard value setting
(D2)+1	Operation mode	MODE	FFFFH	4000H
(D2)+3	Alarm detection	ALM	FFFFH	4000H
(D2)+15, (D2)+14	Set value	SPR	-10 to 110	0.0
(D2)+17, (D2)+16	Bias	BIAS	-999999 to 999999	0.0
(D2)+47, (D2)+46	Control time (sec)	CT	0 to 999999	1.0
(D2)+51, (D2)+50	Change rate limit value	DR	0 to 999999	100.0
(D2)+53, (D2)+52	Ratio upper limit value	RMAX	-999999 to 999999	100.0
(D2)+55, (D2)+54	Ratio lower limit value	RMIN	-999999 to 999999	0.0
(D2)+57, (D2)+56	Ratio current value	Rn	-999999 to 999999	0.0

The bit used by the alarm detection (ALM) is shown below.
SPA can be set by the user.

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ALM		SPA														

(e) Loop tag pasted value memory

This shows the contents of the loop tag passed value memory used by the R instruction. The user does not need to set the contents. However, for the initial state it must be cleared by the sequence.

	Description
(D2)+96	Control time counter initial set completed flag
(D2)+97	Control time counter
(D2)+99, (D2)+98	Rn-1

(f) Execution time (ΔT)

Set the execution time in SD1500 and SD1501. (Refer to Q4ARCPU Programming Manual (Application PID Edition) Section 3.)

(2) Processing explanation

(a) Loop STOP processing

① When the alarm detection (ALM) SPA is 1, the following process is conducted and ended.

a BW holds the previous BW value.

b The operation mode is changed to MAN (MANUAL).

When the alarm detection (ALM)'s SPA is 0, processing is conducted from the (b) control time determination.

(b) Control time determination

This determines whether the control time from the control time (CT) has been reached and conducts the following processing.

① If the control time has not been reached

a BW is held, processed, and ended.

② If the control time has been reached

a Processing is continued from the (c) mode determination.

(c) Mode determination

The following processing is conducted by the operation mode (MODE).

① When the operation mode (MODE) is either CAS, CCB, or CSV (when the set value is used as the set value)

a When the set value (E2) is not set, processing is conducted from the (e) change rate limiter.

b When (S3) set value (E2) is set, processing is conducted from the (e) change rate limiter after the following engineering value conversion has been conducted.

Engineering value conversion

$$SPR = \frac{RMAX-RMIN}{100} \times E2 + RMIN$$

RMAX: Ratio upper limit RMIN: Ratio lower limit E2: Set value

② When the operation mode (MODE) is MAN, AUT, CMV, CMB, CAB, LCM, LCA, or LCC

a Processing is conducted from the (d) trucking processing.

(d) Trucking processing

Trucking processing is conducted when the following conditions occur.

① When the operation constant's TRK is 1.

② When the set value (E2) is used.

③ When the mode is not CAS, CCB, or CSV.

Trucking processing

$$E2 = \frac{100}{RMAX-RMIN} \times (SPR - RMIN)$$

RMAX: Ratio upper limit value RMIN: Ratio lower limit value

SPR: Set value subjected to engineering value conversion

When the set value (E2) is the first loop tag memory MVn, the first loop tag memory alarm detection prohibition (INH)'s TRKF is made to be 1.

(e) Change rate limiter

Change rate limiter is conducted using the following processing.

Condition	Output after limiter has passed (Rn)
(SPR-Rn) DR	Rn=Rn-1+DR
(SPR-Rn) -DR	Rn=Rn-1-DR
ISPR-RnI<DR	Rn=SPR

SPR: Set value subjected to engineering value conversion

DR: Change rate limit value Rn: Ratio current value

(f) Ratio operation

The ratio operation is conducted using the following processing.

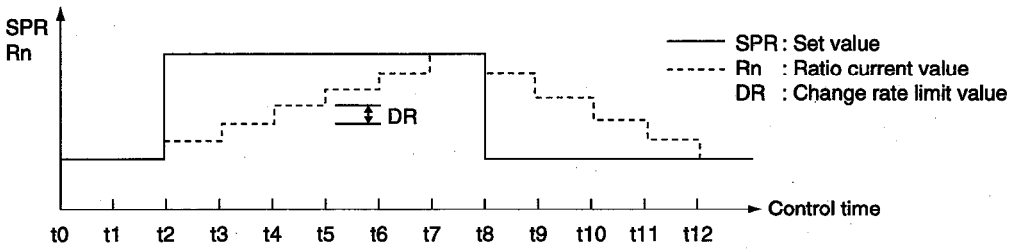
Ratio processing

$$BW = \frac{Rn - RMIN}{RMAX - RMIN} \times E1 + BIAS$$

Rn: Ratio current value RMIN: Ratio lower limit ratio E1: Process value

BIAS: Bias RMAX: Ratio upper limit ratio

R operation

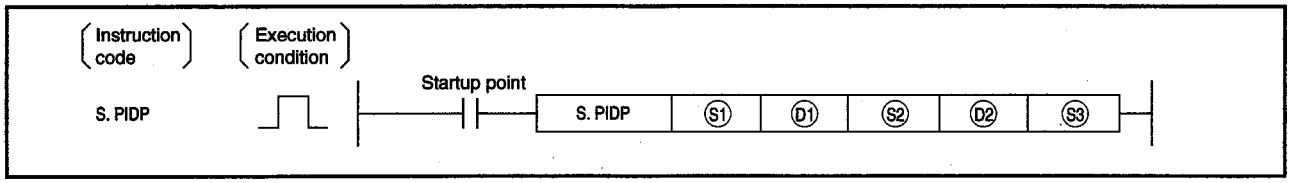


Error

- When an overflow occurs during an operation. (Error code: 4100)

5.2.2 Position type PID

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\N□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
(S1)	—	○		—				—	—
(D1)	—	○		—				—	—
(S2)	—	○		—				—	—
(D2)	—	○		—				—	—
(S3)	—	○		—				—	—

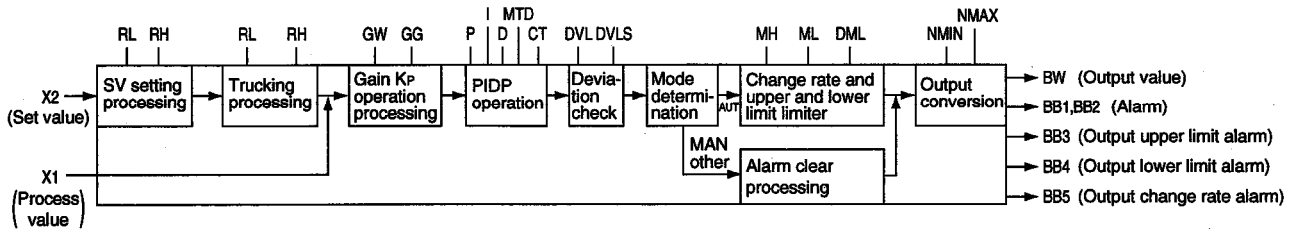


Set data

Setting data	Description	Data format
(S1)	Input block header address	Real number
(D1)	Block memory header device	Device name
(S2)	Operation constant header device	Device name
(D2)	Loop tag memory header device	Device name
(S3)	Input block header address or first MV address (during use)	Real number

Function

PIDP operations are conducted for each control time.
When the control time is reached SV processing, trucking processing, gain KP operation processing, and an deviation check are conducted and then operation mode (MODE) determination is conducted.
These results are used to conduct change rate, upper and lower limit limiter, and output processing or alarm clear processing and output conversion.

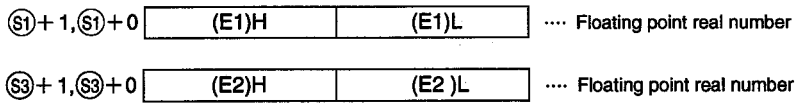


(1) Data handled

(a) Input data

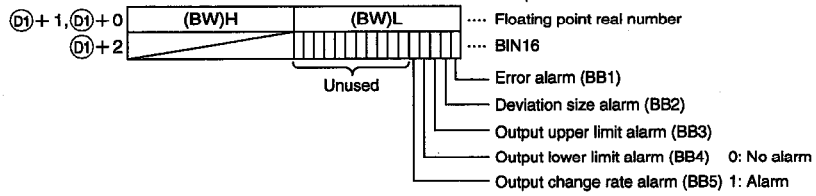
① The input value (E1) is stored in (S1).

② The (S3) set value (E2) can be used when the set value (E2) is set (0 bit=1) by the operation constant set value parameter.
For other cases set the dummy device (SD1506).
In addition, when the set value (E2) is set by the first loop tag memory MV value, set the device (+12: MV value) set by the first loop tag memory MV value.



(b) Block memory

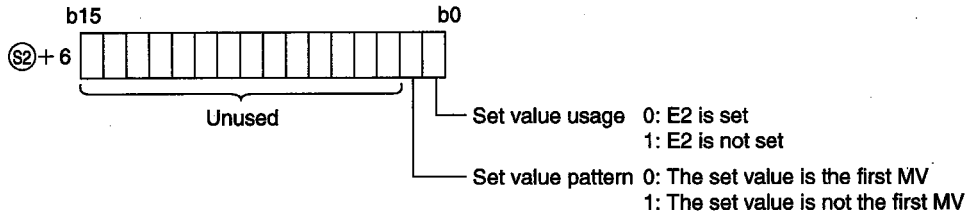
The output value (BW), error alarm (BB1), deviation high alarm (BB2), output upper limit alarm (BB3), output lower limit alarm (BB4), and output change rate alarm (BB5) are stored in (D1).
(D1)+2's BB6 to BB16 are not used.



(c) This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Standard value setting	
(S2)+1, (S2)+0	Deferential gain	MTD	0 to 999999	8.0	
(S2)+3, (S2)+2	Deviation high alarm hysteresis	DVLS	0 to 100	2.0	
(S2)+4	Reverse action, direct action	PN	0 to 1	0	0: Reverse action 1: Direct action
(S2)+5	Trucking bit	TRK	0 to 1	0	0: Not trucked 1: Trucked
(S2)+6	Set value pattern	SVPTN	0 to 3	3	
(S2)+8, (S2)+7	Output conversion upper limit	NMAX	-999999 to 999999	100.0	
(S2)+10, (S2)+9	Output conversion lower limit	NMIN	-999999 to 999999	0.0	

The set value pattern (SVPTN) is a device that sets whether the set value is set by (S3) and whether that set value is set by the first loop device (+12: MV value). The set value pattern (SVPTN) cannot use bits 2 through 15.



(d) Shows the loop tag memory used by ⓓ2.

	Item name	Item	Settable range	Standard value setting
ⓓ2+1	Operation mode	MODE	0 to FFFFH	8H
ⓓ2+3	Alarm detection	ALM	0 to FFFFH	4000H
ⓓ2+4	Alarm detection prohibited	INH	0 to FFFFH	4000H
ⓓ2+13, ⓓ2+12	Manipulated value	MV	-10 to 110	0.0
ⓓ2+15, ⓓ2+14	Set value	SV	RL* (RH*) to RH* (RL*)	0.0
ⓓ2+17, ⓓ2+16	Deviation	DV	-110 to 110	0.0
ⓓ2+19, ⓓ2+18	Output upper limit value	MH	-10 to 110	100.0
ⓓ2+21, ⓓ2+20	Output lower limit value	ML	-10 to 110	0.0
ⓓ2+23, ⓓ2+22	Engineering value upper limit	RH	-999999 to 999999	100.0
ⓓ2+25, ⓓ2+24	Engineering value lower limit	RL	-999999 to 999999	0
ⓓ2+47, ⓓ2+46	Control time (sec)	CT	0 to 999999	1.0
ⓓ2+49, ⓓ2+48	Output change rate limit value	DML	0 to 100	100.0
ⓓ2+51, ⓓ2+50	Change rate limit value	DVL	0 to 100	100.0
ⓓ2+53, ⓓ2+52	Gain	P	0 to 999999	1.0
ⓓ2+55, ⓓ2+54	Integral constant (sec)	I	0 to 999999	10.0
ⓓ2+57, ⓓ2+56	Derivative constant (sec)	D	0 to 999999	0.0
ⓓ2+59, ⓓ2+58	Gap width	GW	0 to 100	0.0
ⓓ2+61, ⓓ2+60	Gap gain	GG	0 to 999999	1.0

The bits used by the PIDP instruction alarm detection are shown below.
SPA can be set by the user, and corresponding bit is 1 when DMLA, DVLA, MHA, MLA outputs an alarm.

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ALM		SPA			DMLA									DVLA	MHA	MLA

The bit used by alarm detection prohibition is shown below.
ERRI, DMLI, DVLI, MHI, MLI can be set by the user.

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
INH	ERRI		TRKF		DMLI									DVLI	MHI	MHI

(e) Loop tag pasted value memory
This shows the contents of the loop tag passed value memory used by the PID instruction. The user does not need to set the contents. However, for the initial state it must be cleared by the sequence.

	Description
ⓓ2+96	Control time counter initial set completed flag
ⓓ2+97	Control time counter
ⓓ2+101, ⓓ2+100	In-1
ⓓ2+103, ⓓ2+102	Bn-1
ⓓ2+105, ⓓ2+104	PV'n
ⓓ2+107, ⓓ2+106	PV'n-1

(f) Execution time (ΔT)
Set the execution time in SD1500 and SD1501. (Refer to Q4ARCPU Programming Manual (Application PID Edition) Section 3.)

(2) Processing explanation

(a) Loop STOP processing

① When the alarm detection (ALM) SPA is 1, the following process is conducted and ended.

a BW holds the previous BW value.

b BB's BB1 to BB5 is made to 0.

c Alarm detection (ALM)'s DVLA, MHA, MLA, DMLA becomes 0.

d The operation mode (MODE) is changed to MAN (MANUAL).

When the alarm detection (ALM)'s SPA is 0, processing is conducted from the (b) control time determination.

(b) Control time determination

This determines whether the control time from the control time (CT) has been reached and conducts the following processing.

① If the control time has not been reached

a The BW value is held, processed, and ended.

② If the control time has been reached

a Processing is continued from the (c) SV setting processing.

(c) SV setting processing

The following processing is conducted by the operation mode (MODE).

① When the operation mode (MODE) is either CAS, CCB, or CSV

a When the set value (E2) is not set, processing is conducted from the (d) trucking processing.

b When ⓢ3 set value (E2) is set, processing is conducted from the (d) trucking processing after the following engineering value conversion has been conducted.

Engineering value conversion

$$SVn = \frac{RH-RL}{100} \times E2 + RL$$

RH: Engineering value upper limit RL: Engineering value lower limit

E2: Set value

② When the operation mode (MODE) is MAN, AUT, CMV, CMB, CAB, LCM, LCA, or LCC

a Processing is conducted from the (d) trucking processing.

(d) Trucking processing

This conducts the engineering value conversion (SVn').

Inverse engineering value conversion

$$SVn' = \frac{100}{RH-RL} \times (SVn - RL)$$

Trucking processing is conducted when the following conditions occur.

① When the operation constant's TRK is 1.

② When the set value (E2) is used.

③ When the mode is not CAS, CCB, or CSV.

Trucking processing stores the set value (E2) after the above engineering value conversion (SVn') is conducted.

E2=SVn'

In addition, when the set value (E2) is the first loop tag memory MVn, the first loop tag memory alarm detection prohibition (INH)'s TRKF is made to be 1.

(e) Gain Kp operation processing

The deviation (DV) is calculated.

Condition	Calculation results (DV)
Direct action (PN=1)	DV=E1–SVn'
Reverse action (PN=0)	DV=SVn'–E1

E1: Process value SVn': Engineering value conversion processing results

Next the PID value final output value's output gain is calculated.

Condition	Formula
When IDVI GW	K=GG
When IDVI > GW	$K=1-\frac{(1-GG)\times GW}{IDVI}$

DV: Deviation GG: Gap gain $K_P=K \times P$ GW: Gap width

(f) PID calculation

Item	For direct action (PN=1)	For reverse action (PN=0)
Bn	$Bn-1+\frac{MD\times TD}{MD\times CT+TD}$ $\{(PVn-PVn-1)-\frac{CT\times Bn-1}{TD}\}$	$Bn-1+\frac{MD\times TD}{MD\times CT+TD}$ $\{-(PVn-PVn-1)-\frac{CT\times Bn-1}{TD}\}$
T	K_P {(DVn+In+Bn}	
In	$In-1+\frac{CT}{TI}$ DVn	

K_P: K x gain (P) MD: Derivative gain (MTD) T: Integral constant (I) CT: Control time

TD: Derivative constant (D) PVn: Process value (E1) PVn-1: Previous process value

However, special processing is done for the following cases so take due precaution.

Condition	Processing
When either 1 or 2 below 1. When TD=0 2. When the operation mode (MODE) is either MAN, LCM, or CMV	Bn=0 (However, passed value set is conducted.)
For either 1, 2, or 3 below 1. When TI=0 2. When an MH error occurs $\frac{CT}{TI}\times DVn>0$ 3. When an ML error occurs $\frac{CT}{TI}\times DVn<0$	$\frac{CT}{TI}\times DVn=0$

When the PIDP operation is ended the PV passed value memory data is overwritten with new data.

PVn-1 PVn PVn E1

(g) Error check

A deviation check is conducted under the following conditions and the results are output to DVLA and BB1.

Condition	Results
DVL<|DVI	DVLA=BB2=1
(DVL-DVLS)<|DVI DVL	DVLA=Previous status hold
|DVI (DVL-DVLS)	DVLA=BB2=0

DV: Deviation DVLS: Deviation high alarm hysteresis

DVL: Change rate limit value DVLA: Deviation high alarm

Note 1:

When the alarm detection prohibition (INH)'s DVLI or ERRI are 1, the DVLA and BB2 become 0.

(h) Mode determination

The following processing is conducted by the operation mode (MODE) determination.

① When the operation mode (MODE) is MAN, CMB, CMV, or LCM (alarm clear processing)

a The alarm detection (ALM)'s MHA, MLA, and DMLA are made to 0.

b BB's BB3 to BB5 is made to 0.

c For BB1, it is made so that BB1=BB2.

d Output conversion processing is conducted and ended.

② When the operation mode (MODE) is AUT, CAB, CAS, CCB, CSV, LCA, or LCC

a Processing is executed from the (i) lower and upper limit and change rate limite.

(i) Lower and upper limit and change rate limiter.

This conducts a check of the change rate and upper and lower limit for the input value (E1) and conducts data and alarm output after limiter processing is finished.

Change rate limiter

Condition	BB4, DMLA	T1	
|T-MV| DML	0	T	
T-MV>DML	1	MV+DML	0: No alarm
T-MV<-DML	1	MV-DML	1: Alarm

MV: Manipulated value T: Estimated MV value

DML: Output change rate limit value

Note 1:

When the alarm detection prohibition (INH)'s DMLI and ERRI are 1, the DMLA and BB4 are made to 0.

Upper and lower limit delimiter

Condition	BB4, MLA	BB3, MHA	MV	
T1>MH	0	1	MH	
T1<ML	1	0	ML	0: No alarm
ML T1 MH	0	0	T1	1: Alarm

MH: Output upper limit value ML: Output lower limit value

T1: Change rate limiter with applied MV value

Note 1:

When the alarm detection prohibited (INH)'s MHI and ERRI are 1, the alarm detection (ALM)'s MHA and BB3 are made to be 0.

Note 2:

When the alarm detection prohibited (INH)'s MLI and ERRI are 1, the alarm detection (ALM)'s MLA and BB4 are made to be 0.

(j) Output conversion processing

Output conversion conducts the following processing.

Output conversion processing

$$BW=\frac{NMAX-NMIN}{100}MV+NMIN$$

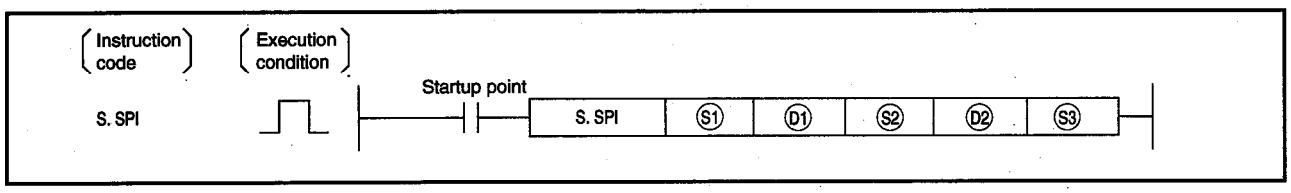
NMAX: Output upper limit NMIN: Output lower limit MV: Manipulated value

Error

- When an overflow occurs during an operation. (Error code: 4100)

5.2.3 Sample PI control

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□ \G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—
ⓢ3	—	○		—				—	—

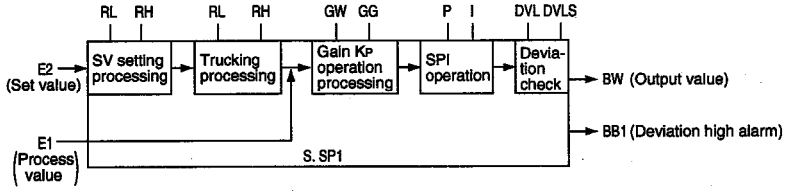


Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Real number
ⓓ1	Block memory header device	Device name
ⓢ2	Operation constant header device	Device name
ⓓ2	Loop tag memory header device	Device name
ⓢ3	Input block header address or first MV address (during use)	Real number

Function

The regular PI operation is conducted during the operation time (ST).
During hold time (HT) output=0, and when combined with the OUT1 instruction it holds the manipulated value MV. When the operation time and hold time are determined by the operation time monitor during operation time, SV setting processing, trucking processing, gain KP operation processing, SPI operation, and deviation check are conducted.



(1) Data handled

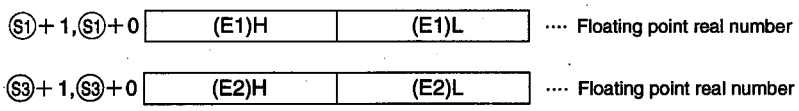
(a) Input data

① The input value (E1) is stored in (S1).

② The (S3) set value (E2) can be used when the set value (E2) is set (0 bit=1) by the operation constant set value parameter.

For other cases set the dummy device (SD1506).

In addition, when the set value (E2) is set by the first loop tag memory MV value, set the device (+12: MV value) set by the first loop tag memory MV value.

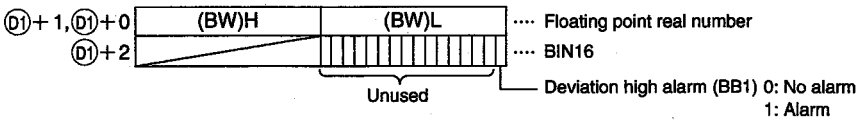


(b) Block memory

The ΔMV output value (BW) and deviation size alarm (BB1) are stored in (D1).

BB2 to BB16 are not used.

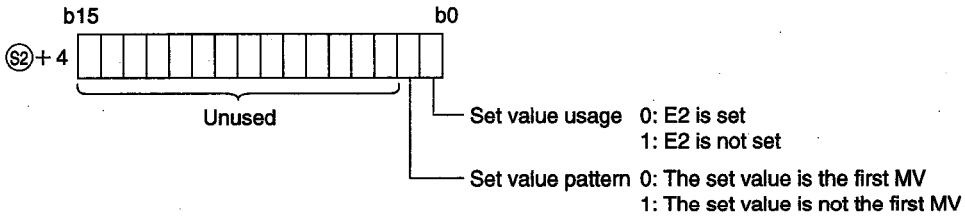
The output value is made to 0 when an error occurs.



(c) This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Standard value setting	
(S2)+1, (S2)+0	Deviation size alarm hysteresis	DVLS	0 to 100	2.0	
(S2)+2	Reverse action, direct action	PN	0 to 1	0	0: Reverse action 1: Direct action
(S2)+3	Trucking bit	TRK	0 to 1	0	0: Not trucked 1: Trucked
(S2)+4	Set value pattern	SVPTN	0 to 3	3	

The set value pattern (SVPTN) is a device that sets whether the set value is set by (S3) and whether that set value is set by the first loop device (+12: MV value). The set value pattern (SVPTN) cannot use bits 2 through 15.



(d) Shows the loop tag memory used by (D2).

	Item name	Item	Settable range	Standard value setting
(D2)+1	Operation mode	MODE	0 to FFFFH	8H
(D2)+3	Alarm detection	ALM	0 to FFFFH	4000H
(D2)+4	Alarm detection prohibited	INH	0 to FFFFH	4000H
(D2)+15, (D2)+14	Set value	SV	RL* (RH*) to RH* (RL*)	0.0
(D2)+17, (D2)+16	Deviation	DV	-110 to 110	0.0
(D2)+47, (D2)+46	Operation time (sec)	ST	0 to 999999	0.0
(D2)+51, (D2)+50	Change rate limit value	DVL	0 to 100	100.0
(D2)+53, (D2)+52	Gain	P	0 to 999999	1.0
(D2)+55, (D2)+54	Integral constant (sec)	I	0 to 999999	10.0
(D2)+57, (D2)+56	Sample time (sec)	STHT	0 to 999999	0.0
(D2)+59, (D2)+58	Gap width	GW	0 to 100	0.0
(D2)+61, (D2)+60	Gap gain	GG	0 to 999999	1.0
(D2)+63, (D2)+62	MV internal operation value	MVP	-999999 to 999999	0.0

The bit used by the alarm detection (ALM) is shown below.
SPA can be set by the user, and corresponding bit is 1 when DVLA, MHA, MLA outputs an alarm.

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ALM		SPA												DVLA	MHA	MLA

The bit used by alarm detection prohibition (INH) is shown below.
ERRI, DVLI, MHI, MLI can be set by the user.

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
INH	ERRI		TRKF											DVLI	MHI	MHI

(e) Loop tag pasted value memory
This shows the contents of the loop tag passed value memory used by the SPI instruction. The user does not need to set the contents. However, for the initial state it must be cleared by the sequence.

	Item name
(D2)+96	Control time counter initial set completed flag
(D2)+97	Sample counter
(D2)+98	Operation counter
(D2)+99	Hold counter
(D2)+101, (D2)+100	DVn-1

(f) Execution time (ΔT)
Set the execution time in SD1500 and SD1501. (Refer to Q4ARCPU Programming Manual (Application PID Edition) Section 3.)

(2) Processing explanation

(a) Loop STOP processing

① When the alarm detection (ALM) SPA is 1, the following process is conducted and ended.

a BW outputs 0.

b Alarm detection (ALM)'s DVLA becomes 0.

c The operation mode (MODE) is changed to MAN (MANUAL).

d BB's BB1 is made to 0.

When the alarm detection (ALM)'s SPA is 0, processing is conducted from the (b) time/hold time check determination.

(b) Operation time/hold time check determination

The operation time (ST) or hold time (HT) is determined using the following processing.

① For operation time (ST)

SV setting processing, trucking processing, gain KP operation processing, PI processing (operation time), and Deviation check operations are conducted.

② For hold time (HT)=(STHT-ST)

Trucking processing, PI operation (hold time), and deviation check processing are conducted. However, under the following conditions the hold time (HT) is 0 and continuous PI control is conducted.

$$\frac{STHT}{\Delta T} \leq \frac{ST}{\Delta T}$$

STHT: Sample time ΔT: Execution time ST: Operation time

In addition, when the STHT/ΔT integer section=0, no processing is conducted. (ΔMV also stays as it is.)

(c) SV setting processing

The following processing is conducted by the operation mode (MODE).

① When the operation mode is either CAS, CCB, or CSV (when the input value is used as the set value)

a When the set value (E2) is not set, processing is conducted from the (d) trucking processing.

b When Ⓢ3 set value (E2) is set, processing is conducted from the (d) trucking processing after the following engineering value conversion has been conducted.

Engineering value conversion

$$SVn = \frac{RH-RL}{100} \times E2 + RL$$

RH: Engineering value upper limit RL: Engineering value lower limit

E2: Set value

② When the operation mode (MODE) is MAN, AUT, CMB, CAB, CMV, LCC, LCA, or LCM

a Processing is conducted from the (d) trucking processing.

(d) Trucking processing

This conducts the engineering value conversion (SVn').

Inverse engineering value conversion

$$SVn' = \frac{100}{RH - RL} \times (SVn - RL)$$

Trucking processing is conducted when the following conditions occur.

① When the operation constant's TRK is 1.

② When the set value (E2) is used.

③ When the mode is not CAS, CCB, or CSV.

Trucking processing stores the set value (E2) after the above engineering value conversion (SVn') is conducted.

E2=SVn'

In addition, when the set value (E2) is the first loop tag memory MVn, the first loop tag memory alarm detection prohibition (INH)'s TRKF is made to be 1.

(e) Gain KP operation processing

The deviation (DV) is calculated using the following conditions.

Condition	Calculation results (DV)
Direct action (PN=1)	DV=E1–SVn'
Reverse action (PN=0)	DV=SVn'–E1

E1: Process value SVn': Engineering value converted set value

Next the SPI value final output value's output gain (K) is calculated using the following conditions.

Condition	Formula
When IDVI GW	K=GG
When IDVI > GW	$K=1-\frac{(1-GG) \times GW}{IDVI}$

KP=K x gain (P) DV: Deviation GW: Gap width

K: Output gain GG: Gap gain

(f) The PID calculation is found using the following formula.

Condition	Formula
During operation time (ST)	$BW = KP \times (DVn - DVn_{-1}) + \frac{BT}{TI} \times DVn$
During hold time (STHT-ST)	BW=0 (Passed value set is not conducted)

KP: K x gain (P) TI: Integral constant (I) BT: Execution time

However, special processing is done for the following cases so take due precaution.

Condition	Processing
For either 1, 2, or 3 below 1. TI=0 2. When MVP > MH when an MH or ML error occurs $\frac{BT}{TI} \times DVn > 0$ 3. When MVP < MH when an MH or ML error occurs $\frac{BT}{TI} \times DVn < 0$	$\frac{BT}{TI} \times DVn = 0$

(g) Deviation check

An deviation check is conducted under the following conditions and the results are output to DVLA and BB1.

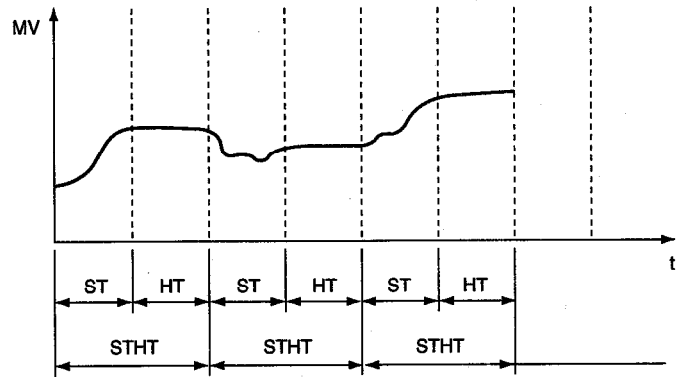
Condition	Results
DVL<|DVI	DVLA=BB1=1
(DVL-DVLS)<|DVI DVL	DVLA=Previous status held
|DVI (DVL-DVLS)	DVLA=BB1=0

DV: Deviation DVL: Change rate limit value DVLS: Deviation size alarm hysteresis

Note 1:

When the alarm detection prohibition (INH)'s DVLI or ERRI are 1, the DVLA and BB1 become 0.

SPI operation

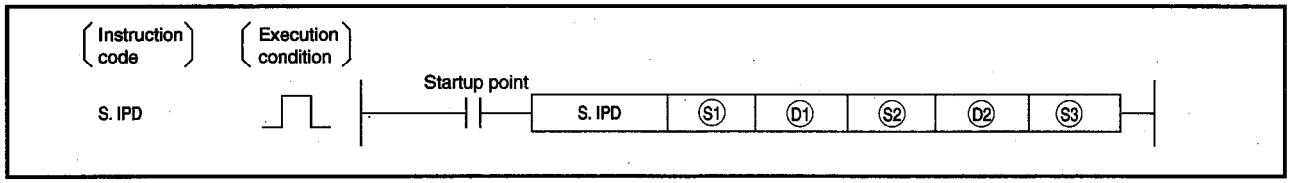


Error

- When an overflow occurs during an operation. (Error code: 4100)

5.2.4 I-PD Control

Setting data	Usable Devices							
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—
ⓢ3	—	○		—				—	—

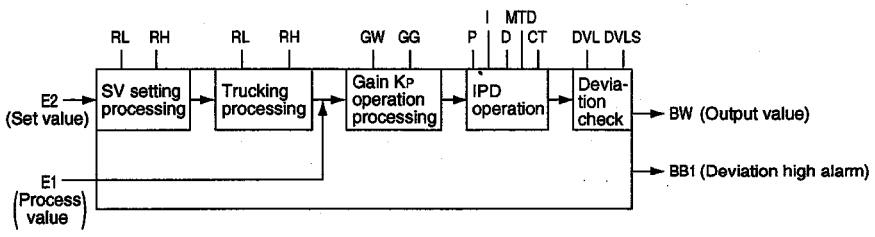


Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Real number
ⓓ1	Block memory header device	Device name
ⓢ2	Operation constant header device	Device name
ⓓ2	Loop tag memory header device	Device name
ⓢ3	Input block header address or first MV address (during use)	Real number

Function

When the control time is reached SV setting processing, trucking processing, gain KP operation processing, IPD operation, and deviation check are conducted.

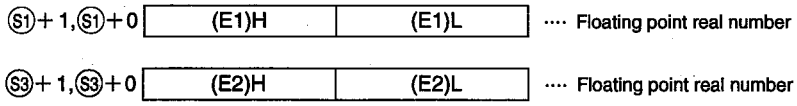


(1) Data handled

(a) Input data

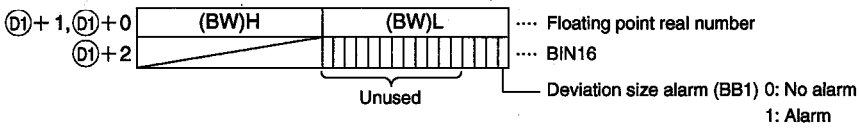
① The input value (E1) is stored in (S1).

② The (S3) set value (E2) can be used when the set value (E2) is set (0 bit=1) by the operation constant set value parameter.
For other cases set the dummy device (SD1506).
In addition, when the set value (E2) is set by the first loop tag memory MV value, set the device (+12: MV value) set by the first loop tag memory MV value.



(b) Block memory

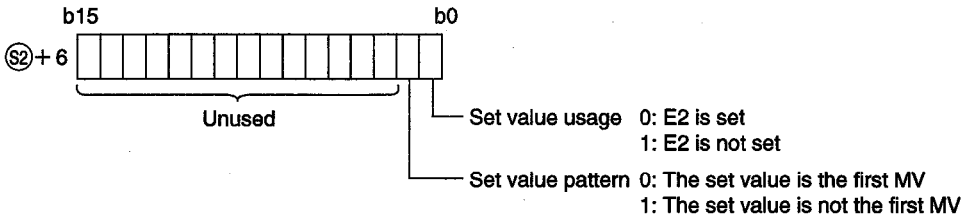
The output value (BW=ΔMV) and deviation size alarm (BB1) are stored in (D1).
The output value is made to 0 when an error occurs.
(D1)+2's BB2 to BB16 are not used.



(c) This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Standard value setting	
(S2)+1, (S2)+0	Deferential gain	MTD	0 to 999999	8.0	
(S2)+3, (S2)+2	Deviation size alarm hysteresis	DVLS	0 to 100	2.0	
(S2)+4	Reverse action, direct action	PN	0 to 1	0	0: Reverse action 1: Direct action
(S2)+5	Trucking bit	TRK	0 to 1	0	0: Not trucked 1: Trucked
(S2)+6	Set value pattern	SVPTN	0 to 3	3	

The set value pattern (SVPTN) is a device that sets whether the set value is set by (S3) and whether that set value is set by the first loop device (+12: MV value). The set value pattern (SVPTN) cannot use bits 2 through 15.



(d) Shows the loop tag memory used by (D2).

	Item name	Item	Settable range	Standard value setting
(D2)+1	Operation mode	MODE	0 to FFFFH	8H
(D2)+3	Alarm detection	ALM	0 to FFFFH	4000H
(D2)+4	Alarm detection prohibited	INH	0 to FFFFH	4000H
(D2)+15, (D2)+14	Set value	SV	RL* (RH*) to RH* (RL*)	0.0
(D2)+17, (D2)+16	Deviation	DV	-110 to 110	0.0
(D2)+47, (D2)+46	Control time (sec)	CT	0 to 999999	1.0
(D2)+51, (D2)+50	Change rate limit value	DVL	0 to 100	100.0
(D2)+53, (D2)+52	Gain	P	0 to 999999	1.0
(D2)+55, (D2)+54	Integral constant (sec)	I	0 to 999999	10.0
(D2)+57, (D2)+56	Derivative constant (sec)	D	0 to 999999	0.0
(D2)+59, (D2)+58	Gap width	GW	0 to 100	0.0
(D2)+61, (D2)+60	Gap gain	GG	0 to 999999	1.0
(D2)+63, (D2)+62	MV internal operation value	MVP	-999999 to 999999	0.0

The bit used by the alarm detection (ALM) is shown below.
SPA can be set by the user, and corresponding bit is 1 when DVLA, MHA, MLA outputs an alarm.

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ALM		SPA												DVLA	MHA	MLA

The bit used by alarm detection prohibition (INH) is shown below.
ERRI, DVLI, MHI, MLI can be set by the user.

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
INH	ERRI		TRKF											DVLI	MHI	MHI

(e) Loop tag pasted value memory

This shows the contents of the loop tag passed value memory used by the IPD instruction. The user does not need to set the contents. However, for the initial state it must be cleared by the sequence.

	Item name
(D2)+96	Control time counter initial set completed flag
(D2)+97	Control time counter
(D2)+103, (D2)+102	Bn-1
(D2)+105, (D2)+104	PV'n
(D2)+107, (D2)+106	PV'n-1
(D2)+109, (D2)+108	PV'n-2

(f) Execution time (ΔT)

Set the execution time in SD1500 and SD1501. (Refer to Q4ARCPU Programming Manual (Application PID Edition) Section 3.)

(2) Processing explanation

(a) Loop STOP processing

① When the alarm detection (ALM) SPA is 1, the following process is conducted and ended.

a BW outputs 0.

b Alarm detection (ALM)'s DVLA becomes 0.

c The operation mode (MODE) is changed to MAN (MANUAL).

d BB's BB1 is made to 0.

When the alarm detection (ALM)'s SPA is 0, processing is conducted from the (b) control time determination.

(b) Control time determination

This determines whether the control time from the control time (CT) has been reached and conducts the following processing.

① If the control time has not been reached

The BW value is made to 0 and processing is ended.

② If the control time has been reached

Processing is continued from the (c) SV setting processing.

(c) SV setting processing

The following processing is conducted by the operation mode (MODE).

① When the operation mode (MODE) is either CAS, CCB, or CSV (when the input value is used as the set value)

a When the set value (E2) is not set, processing is conducted from the (d) trucking processing.

b When ㊸ set value (E2) is set, processing is conducted from the (d) trucking processing after the following engineering value conversion has been conducted.

Engineering value conversion

$$SVn = \frac{RH-RL}{100} \times E2 + RL$$

RH: Engineering value upper limit RL: Engineering value lower limit

E2: Set value

② When the operation mode (MODE) is MAN, AUT, CMB, CAB, CMV, LCC, LCA, or LCM

a Processing is conducted from the (d) trucking processing.

(d) Trucking processing

This conducts the engineering value conversion (SVn').

Inverse engineering value conversion

$$SVn' = \frac{100}{RH - RL} \times (SVn - RL)$$

Trucking processing is conducted when the following conditions occur.

① When the operation constant's TRK is 1.

② When the set value (E2) is used.

③ When the mode is not CAS, CCB, or CSV.

Trucking processing stores the set value (E2) after the above engineering value conversion (SVn') is conducted.

E2=SVn'

In addition, when the set value (E2) is the first loop tag memory MVn, the first loop tag memory alarm detection prohibition (INH)'s TRKF is made to be 1.

(e) Gain KP operation processing

The deviation (DV) is calculated using the following conditions.

Condition	Calculation results (DV)
Direct action (PN=1)	DV=E1–SVn'
Reverse action (PN=0)	DV=SVn'–E1

DV: Deviation SVn': Set value subjected to engineering value conversion

E1: Process value

Next the IPD value final output value's output gain (K) is calculated using the following conditions.

Condition	Formula
When IDVI GW	K=GG
When IDVI>GW	$K=1-\frac{(1-GG) \times GW}{IDVI}$

DV: Deviation K: Output gain GW: Gap width GG: Gap gain

(f) The IPD calculation is found using the following formula.

Item	For forward action (PN=1)	For reverse action (PN=0)
Bn	$Bn_{-1} + \frac{M_D \times T_D}{M_D \times CT + T_D}$ $\{(PVn-2PVn_{-1}+PVn_{-2}) - \frac{CT \times Bn_{-1}}{T_D}\}$	$Bn_{-1} + \frac{M_D \times T_D}{M_D \times CT + T_D}$ $\{-(PVn-2PVn_{-1}+PVn_{-2}) - \frac{CT \times Bn_{-1}}{T_D}\}$
BW (ΔMV)	$K_P \{\frac{CT}{T_I} DVn+(PVn-PVn_{-1})+Bn\}$	$K_P \{\frac{CT}{T_I} DVn-(PVn-PVn_{-1})+Bn\}$

K_P: K x gain (P) M_D: Derivative gain T: Integral constant (I) CT: Control time
T_D: Derivative constant PVn: Process value (E1) PVn_{-1}: Previous process value
PVn_{-2}: Process value before last

However, special processing is done for the following cases so take due precaution.

Condition	Processing
When either 1 or 2 below 1. T_D=0 2. When the operation mode (MODE) is either MAN, LCM, or CMV	Bn=0 (However, passed value set is conducted.)
For either 1, 2, or 3 below 1. T_I=0 2. When MVP > MH when an MH or ML error occurs $\frac{CT}{T_I} \times DVn > 0$ 3. When MVP < ML when an MH or ML error occurs $\frac{CT}{T_I} \times DVn < 0$	$\frac{CT}{T_I} \times DVn = 0$

When the IPD operation is ended the PV passed value memory data is overwritten with new data.
PVn_{-2} PVn_{-1} PVn_{-1} PVn PVn E1

(g) Deviation check
An error check is conducted under the following conditions and the results are output to DVLA and BB1.

Condition	Results
DVL<|DV|	DVLA=BB1=1
(DVL-DVLS)<|DV| DVL	DVLA=Previous status hold
|DV| (DVL-DVLS)	DVLA=BB1=0

DV: Deviation DVL: Change rate limit value DVLS: Deviation size alarm hysteresis

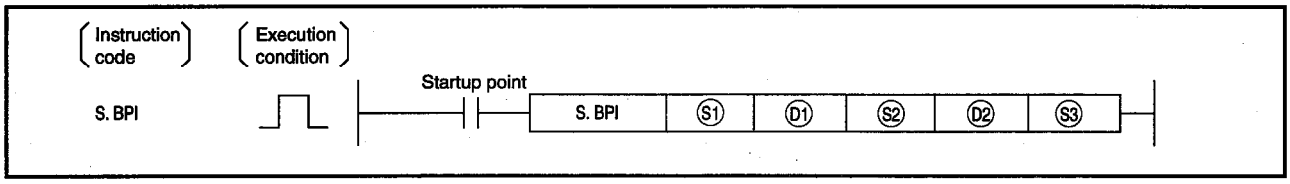
Note 1:
When the alarm detection prohibition (INH)'s DVLI or ERRI are 1, the DVL1 and BB1 become 0.

Error

- When an overflow occurs during an operation. (Error code: 4100)

5.2.5 Blend PI control

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
(S1)	—	○		—				—	—
(D1)	—	○		—				—	—
(S2)	—	○		—				—	—
(D2)	—	○		—				—	—
(S3)	—	○		—				—	—

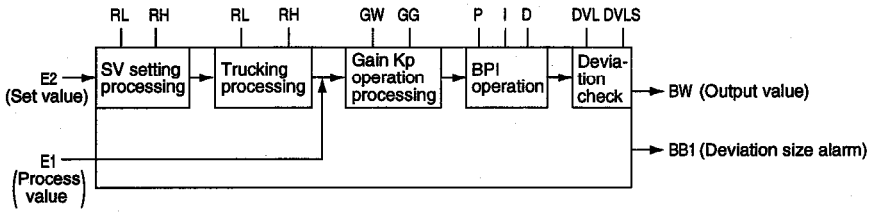


Set data

Setting data	Description	Data format
(S1)	Input block header address	Real number
(D1)	Block memory header device	Device name
(S2)	Operation constant header device	Device name
(D2)	Loop tag memory header device	Device name
(S3)	Input block header address or first MV address (during use)	Real number

Function

When the control time is reached SV setting processing, trucking processing, gain KP operation processing, BPI operation, and deviation check are conducted.

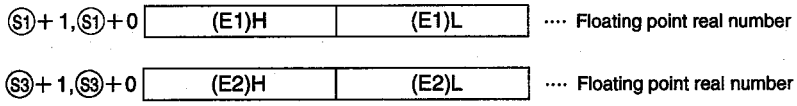


(1) Data handled

(a) Input data

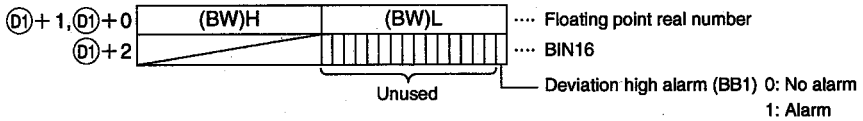
① The input value (E1) is stored in (S1).

② The (S3) Set value (E2) can be used when the set value (E2) is set (0 bit=1) by the operation constant set value parameter.
For other cases set the dummy device (SD1506).
In addition, when the set value (E2) is set by the first loop tag memory MV value, set the device (+12: MV value) set by the first loop tag memory MV value.



(b) Block memory

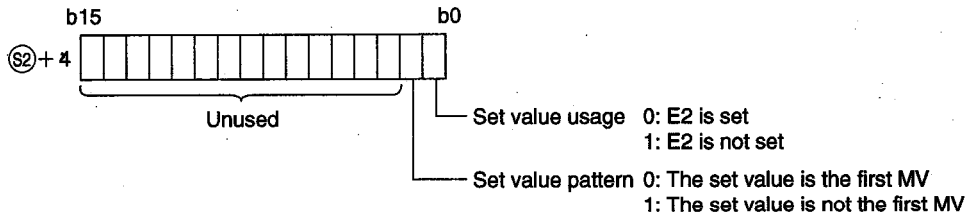
The output value (BW=ΔMV) and deviation high alarm (BB1) are stored in (D1).
(D1)+2's BB2 to BB16 are not used.
The output value is made to 0 when an error occurs.



(c) This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Standard value setting	
(S2)+1, (S2)+0	Deviation size alarm hysteresis	DVLS	0 to 100	2.0	
(S2)+2	Reverse action, forward action	PN	0 to 1	0	0: Reverse action 1: Forward action
(S2)+3	Trucking bit	TRK	0 to 1	0	0: Not trucked 1: Trucked
(S2)+4	Set value pattern	SVPTN	0 to 3	3	

The set value pattern (SVPTN) is a device that sets whether the set value is set by (S3) and whether that set value is set by the first loop device (+12: MV value). The set value pattern (SVPTN) cannot use bits 2 through 15.



(d) Shows the loop tag memory used by (D2).

	Item name	Item	Settable range	Standard value setting
(D2)+1	Operation mode	MODE	0 to FFFFH	8H
(D2)+3	Alarm detection	ALM	0 to FFFFH	4000H
(D2)+4	Alarm detection prohibited	INH	0 to FFFFH	4000H
(D2)+15, (D2)+14	Set value	SV	RL* (RH*) to RH* (RL*)	0.0
(D2)+17, (D2)+16	Deviation	DV	-110 to 110	0.0
(D2)+47, (D2)+46	Control time (sec)	CT	0 to 999999	1.0
(D2)+51, (D2)+50	Change rate limit value	DVL	0 to 100	100.0
(D2)+53, (D2)+52	Gain	P	0 to 999999	1.0
(D2)+55, (D2)+54	Integral constant (sec)	I	0 to 999999	10.0
(D2)+57, (D2)+56	DV total value (ΣDV)	SDV	-999999 to 999999	0.0
(D2)+59, (D2)+58	Gap width	GW	0 to 100	0.0
(D2)+61, (D2)+60	Gap gain	GG	0 to 999999	1.0

The bit used by the alarm detection (ALM) is shown below.
SPA can be set by the user, and corresponding bit is 1 when DVLA, MHA, MLA outputs an alarm.

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ALM		SPA												DVLA	MHA	MLA

The bit used by alarm detection prohibition (INH) is shown below.
ERRI, DVLI, MHI, MLI can be set by the user.

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
INH	ERRI		TRKF											DVLI	MHI	MHI

(e) Loop tag pasted value memory

This shows the contents of the loop tag passed value memory used by the BPI instruction. The user does not need to set the contents. However, for the initial state it must be cleared by the sequence.

	Item name
(D2)+96	Control time counter initial set completed flag
(D2)+97	Control time counter
(D2)+99, (D2)+98	$CT/T_I \oplus DV_I$

(f) Execution time (ΔT)

Set the execution time in SD1500 and SD1501. (Refer to Q4ARCPU Programming Manual (Application PID Edition) Section 3.)

(2) Processing explanation

(a) Loop STOP processing

① When the alarm detection (ALM) SPA is 1, the following process is conducted and ended.

a BW outputs 0.

b Alarm detection (ALM)'s DVLA becomes 0.

c The operation mode (MODE) is changed to MAN (MANUAL).

d BB's BB1 is made to 0.

When the alarm detection (ALM)'s SPA is 0, processing is conducted from the (b) control time determination.

(b) Control time determination

① This determines whether the control time from the control time (CT) has been reached and conducts the following processing.

If the control time has not been reached

The BW value is made to 0 and processing is ended.

② If the control time has been reached

Processing is continued from the (c) SV setting processing.

(c) SV setting processing

The following processing is conducted by the operation mode (MODE).

① When the operation mode (MODE) is either CAS, CCB, or CSV (when the input value is used as the set value)

a When the set value (E2) is not set, processing is conducted from the (d) trucking processing.

b When Ⓢ3 set value (E2) is set, processing is conducted from the (d) trucking processing after the following engineering value conversion has been conducted.

Engineering value conversion

$$SVn = \frac{RH-RL}{100} \times E2 + RL$$

RH: Engineering value upper limit RL: Engineering value lower limit

E2: Set value

② When the operation mode (MODE) is MAN, AUT, CMB, CAB, CMV, LCC, LCA, or LCM

a Processing is conducted from the (d) trucking processing.

(d) Trucking processing

This conducts the engineering value conversion (SVn').

Inverse engineering value conversion

$$SVn' = \frac{100}{RH - RL} \times (SVn - RL)$$

Trucking processing is conducted when the following conditions occur.

① When the operation constant's TRK is 1.

② hen the set value (E2) is used.

③ When the mode is not CAS, CCB, or CSV.

Trucking processing stores the set value (E2) after the above engineering value conversion (SVn') is conducted.

E2=SVn'

In addition, when the set value (E2) is the first loop tag memory MVn, the first loop tag memory alarm detection prohibition (INH)'s TRKF is made to be 1.

(e) Gain KP operation processing

The deviation (DV) is calculated using the following conditions.

Condition	Calculation results (DV)
Direct action (PN=1)	DV=E1–SVn'
Reverse action (PN=0)	DV=SVn'–E1

E1: Process value SVn': Engineering value conversion results

Next the BPI value final output value's output gain (K) is calculated using the following conditions.

Condition	Formula
When IDVI GW	K=GG
When IDVI > GW	$K=1-\frac{(1-GG) \times GW}{IDVI}$

DV: Deviation K: Output gain GW: Gap width GG: Gap gain KP = K x P

(f) The blend PI operation is found using the following formula.

Item	Processing
BW (ΔMV)	$K_P \times BT \times (DVn + \frac{CT}{T_I} \times \Sigma DV_I)$

K_P: K x gain (P) BT: Execution time T_I: Integral constant (I)
CT: Control time ΣDV_I: DVn's total value DVn: Deviation

However, special processing is used in the following case, so take due precautions.

Condition	
For either 1 or 2 below 1. $T_I = 0$ 2. When either MLA or MHA	$\frac{CT}{T_I} \times \Sigma DV_I =$ previous value as is
1. T_I 0	$\frac{CT}{T_I} \times \Sigma DV_I = \frac{CT}{T_I} \times (\Sigma DV_I + DVn)$

(g) Error check
An deviation check is conducted under the following conditions and the results are output to DVLA and BB1.

Condition	Results
DVL<|DV|	DVLA=BB1=1
(DVL-DVLS)<|DV| DVL	DVLA=BB1=Previous status hold
|DV| (DVL-DVLS)	DVLA=BB1=0

DV: Deviation DVL: Change rate limit value DVLS: Deviation high alarm hysteresis

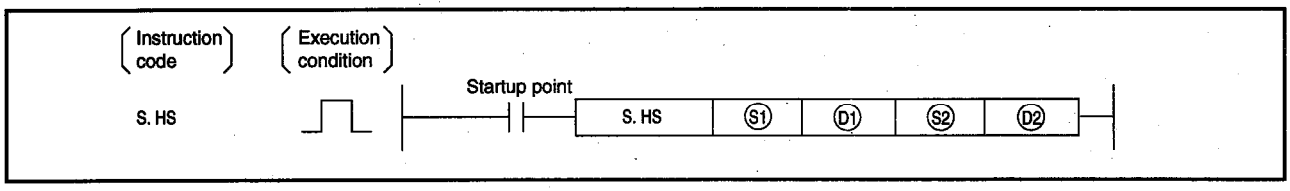
Note 1:
When the alarm detection prohibition (INH)'s DVLI or ERRI are 1, the DVLA and BB1 become 0.

Error

- When an overflow occurs during an operation. (Error code: 4100)

5.2.6 High Selector

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—



Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Device name
ⓢ2	Dummy device	Dummy
ⓓ2	Dummy device	Dummy

Function

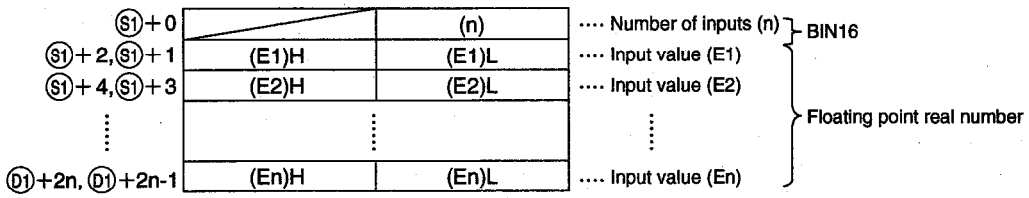
The maximum value of the input values is output.

(1) Data Handling

(a) Input data

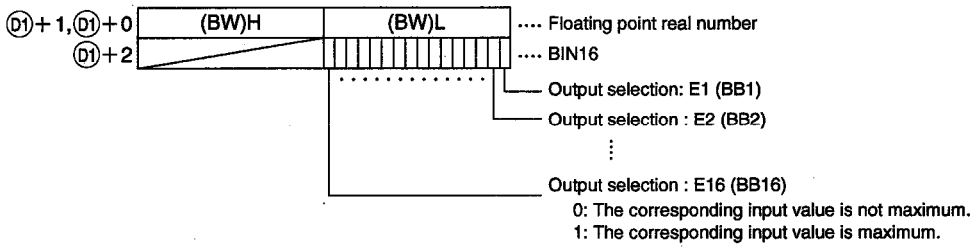
The number of inputs (n) and the input values (E1 to En) are stored in ⓢ1.

Set the number of inputs (n) within the range of 1 to 16.



(b) Block memory

The BW (Output value) and BB1 to BB16 (Output selections) are stored in ⓓ1.



(c) Set ⓢ2as the dummy device (SD1506).

(d) Set ⓓ2 as the dummy device (SD1506).

(2) Processing explanation

The maximum value of the input E1 to E16 is output and at the same time the bit that corresponds to the input value selected as the maximum value from bits BB1 to BB16 corresponding to the input is changed to 1.

Input value	E1	E2	E3	.....	E16
The bit set during the selection.	BB1	BB2	BB3	.....	BB16

(a) When multiple maximum values exist
Sets all bits that correspond to the input to 1.

(b) When there is only one input
① Only uses the input value (E1)
BW is used as E1 and BB1 is changed to 1.
BB2 to BB16 are changed to 0.

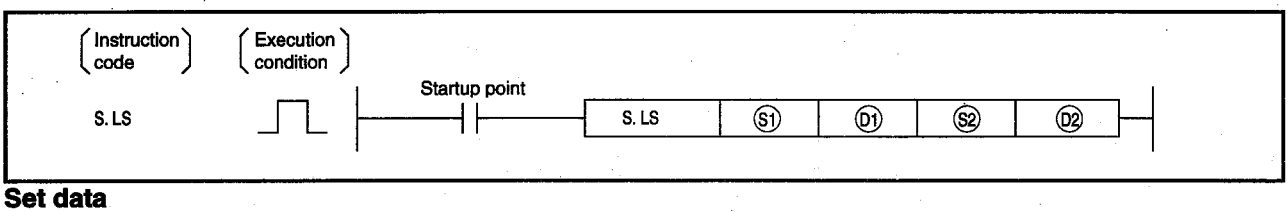
② When only one of E2 to E16 is used
The instruction is executed between the E2 to E16 and the previous block output.
When E1 is not specified as the input then the previous block memory's BW (Output) is automatically used.

Error

- When an overflow occurs during an operation. (Error code: 4100)
- When not 1 number of inputs (n) 16. (Error code: 4100)

5.2.7 Low Selector

Setting data	Usable Devices							
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—



Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Device name
ⓢ2	Dummy device	Dummy
ⓓ2	Dummy device	Dummy

Function

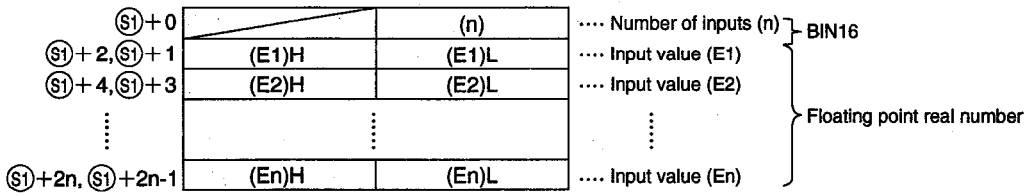
The minimum value of the input values is output.

(1) Data Handling

(a) Input data

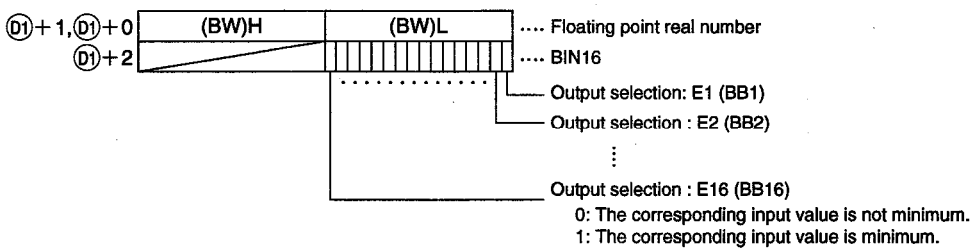
The number of inputs (n) and the input values (E1 to E16) are stored in ⓢ1.

Set the number of inputs (n) within the range of 1 to 16.



(b) Block memory

The BW (Output value) and BB1 to BB16 (Output selections) are stored in ⓓ1.



(2) Processing explanation

The minimum value of the input E1 to E16 is output and at the same time the bit that corresponds to the input value selected as the minimum value from bits BB1 to BB16 corresponding to the input is changed to 1.

Input value	E1	E2	E3	.....	E16
The bit set during the selection.	BB1	BB2	BB3	.....	BB16

(a) When multiple minimum values exist
Sets all bits that correspond to the input to 1.

(b) When there is only one input
① Only uses the input value (E1)
BW is used as E1 and BB1 is changed to 1.
BB2 to BB16 are changed to 0.

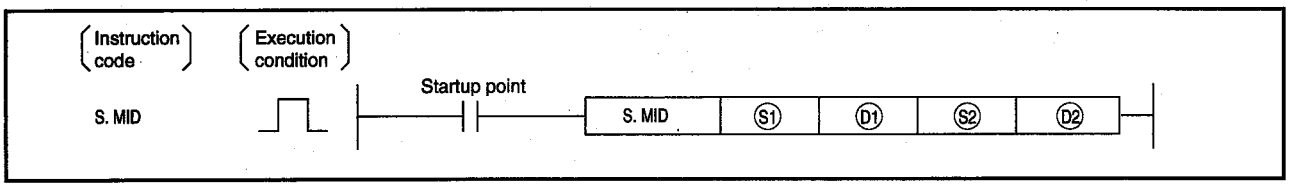
② When only one of E2 to E16 is used
The instruction is executed between the E2 to E16 and the previous block output.
When E1 is not specified as the input then the previous block memory's BW (Output) is automatically used.

Error

- When an overflow occurs during an operation. (Error code: 4100)
- When not 1 number of inputs (n) 16. (Error code: 4100)

5.2.8 Middle Value Selection

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—



Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Device name
ⓢ2	Dummy device	Dummy
ⓓ2	Dummy device	Dummy

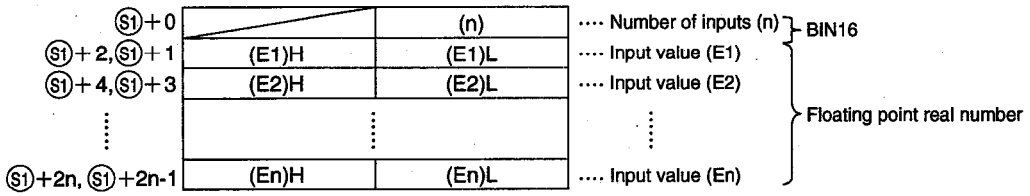
Function

The middle value of the input values between maximum and minimum value is output.

(1) Data Handling

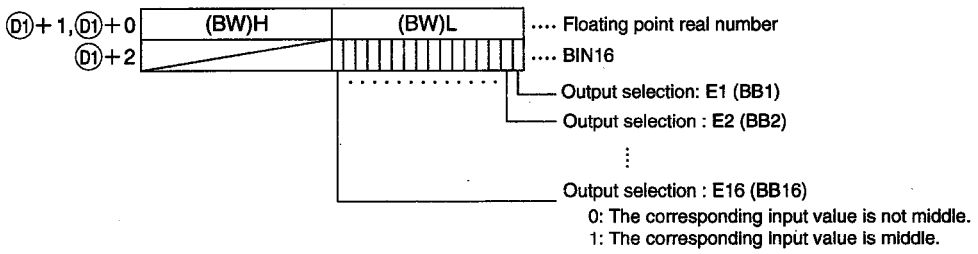
(a) Input data

The number of inputs (n) and the input values (E1 to E16) are stored in ⓢ1.
Set the number of inputs (n) within the range of 1 to 16.



(b) Block memory

The BW (Output value) and BB1 (output selection: E1) to BB16 (Output selection: E16) are stored in ⓓ1.



(2) Processing explanation

The middle values of the input E1 to E16 is output and at the same time the bit that corresponds to the input value selected as the middle values from bits BB1 to BB16 corresponding to the input is changed to 1.

Input value	E1	E2	E3	.....	E16
The bit set during the selection.	BB1	BB2	BB3	.....	BB16

(a) When an even number of inputs exist
The smallest value is output.

(b) When multiple middle values exist
Set all of the bits that correspond to that input to 1.

(3) Middle value selection value

(a) Replace in the order from the smallest value of the input En. (If there are input values that are equal, order from the input with the smallest No.)

(b) Selects the middle value from the ordered values.
Example:

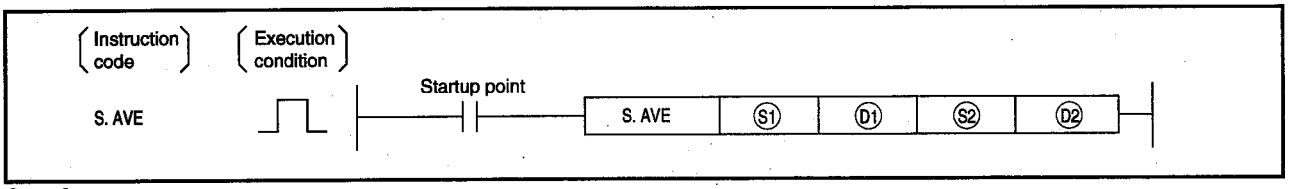
Reordered
2, 5, 1, 4, 3 1, 2, 3, 4, 5
Middle value from this is 3.

Error

- When an overflow occurs during an operation. (Error code: 4100)
- When not 1 number of inputs (n) 16. (Error code: 4100)

5.2.9 Average Value

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—



Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Real number
ⓢ2	Dummy device	Dummy
ⓓ2	Dummy device	Dummy

Function

The maximum value of the input values is output.

(1) Data Handling

(a) Input data

The number of inputs (n) and the input values (E1 to E16) are stored in ⓢ1.

Set the number of inputs (n) within the range of 1 to 16.

ⓢ1+0		(n)	···· Number of inputs (n) — BIN16
ⓢ1+2, ⓢ1+1	(E1)H	(E1)L	···· Input value (E1)
ⓢ1+4, ⓢ1+3	(E2)H	(E2)L	···· Input value (E2) — Floating point real number
⋮	⋮	⋮	⋮
ⓢ1+2n, ⓢ1+2n-1	(En)H	(En)L	···· Input value (En)

(b) Block memory

The BW (Output value) is stored in ⓓ1.

BB is not used.

ⓓ1+1, ⓓ1+0	(BW)H	(BW)L	···· Floating point real number

(2) Processing explanation

The average value of input values E1 to E16 is calculated.
Input value (En) that are not input are calculated as 0. The denominator N is automatically found for the corresponding input En number.

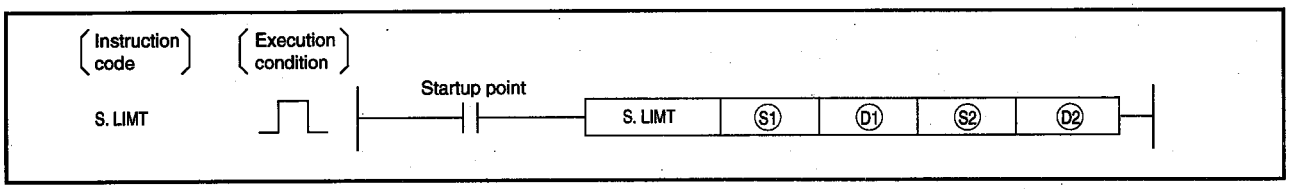
$$BW = \frac{E1+E2+E3+.....+E16}{N}$$

Error

- When an overflow occurs during an operation. (Error code: 4100)
- When not 1 number of inputs (n) 16. (Error code: 4100)

5.2.1 Upper and Lower Limiter

Setting data	Usable Devices							
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—



Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Real number
ⓓ1	Block memory header device	Device name
ⓢ2	Operation constant header device	Device name
ⓓ2	Dummy device	Dummy

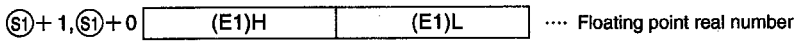
Function

The upper and lower limit limiter is applied to the output value by adding a hysteresis.

(1) Data handling

(a) Input data

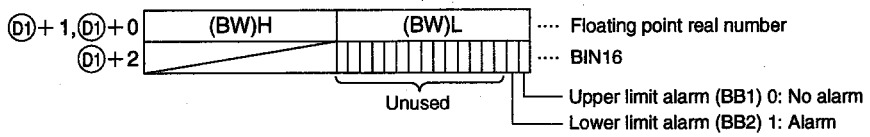
The input value (E1) is stored in ⓢ1.



(b) Block memory

The BW (Output value), BB1 (Upper limit alarm: E1), and BB2 (Lower limit alarm: E2) are stored in ⓓ1.

ⓓ1 + 2's BB3 to BB16 are not used.



(c) This shows the contents of the operation constant set in ⓢ2.

	Item name	Item	Settable range	Initial value setting
ⓢ2+1, ⓢ2+0	Upper limit value	HILMT	-999999 to 999999	100.0
ⓢ2+3, ⓢ2+2	Lower limit value	LOLMT	-999999 to 999999	0.0
ⓢ2+5, ⓢ2+4	Upper limit hysteresis	HS1	0 to 999999	0.0
ⓢ2+7, ⓢ2+6	Lower limit hysteresis	HS2	0 to 999999	0.0

(d) Set ⓓ2 as the dummy device (SD1506).

(2) Processing explanation

The following operations are conducted.

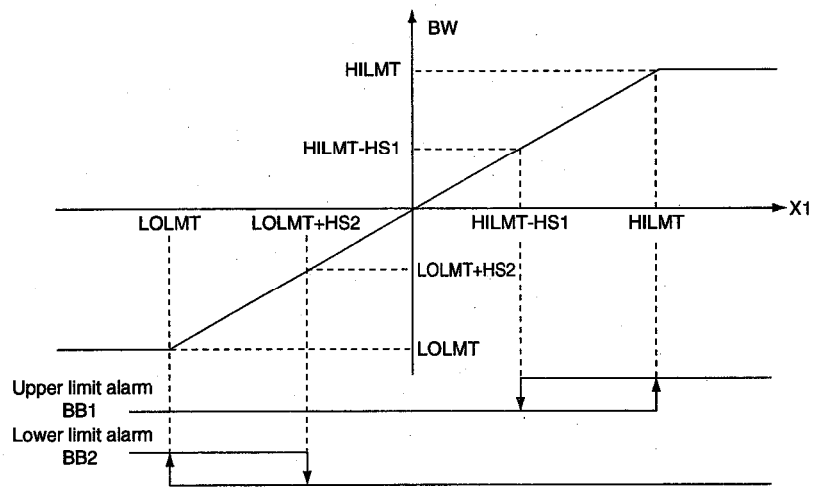
Condition	Output value (BW)	BB1	BB2
E1 HILMT	HILMT	1	0
LOLMT+HS2<E1<HILMT-HS1	E1	0	0
E1 LOLMT	LOLMT	0	1
Other than that above (Hysteresis section)	E1	Previous value	Previous value

Note 1:

The upper limit value is set to HILMT LOLMT.

LOLMT: Lower limit value HILMT: Upper limit value

HS1: Upper limit hysteresis HS2: Lower limit hysteresis

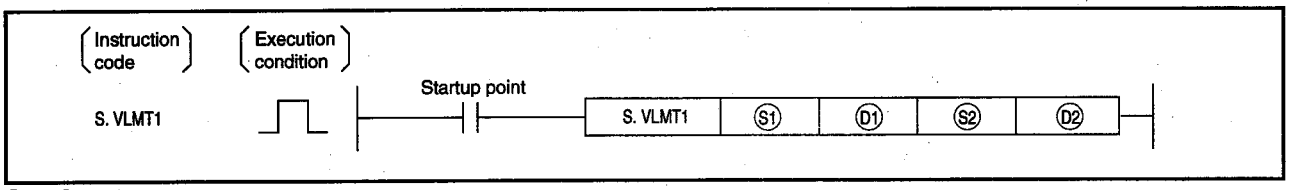


Error

- An overflow occurred during the operation. (Error code: 4100)
- When HS1<0 or HS2<0 (Error code: 4100)

5.2.2 Variation Rate Limiter 1

Setting data	Usable Devices							
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
⑤1	—	○		—				—	—
⑩1	—	○		—				—	—
⑤2	—	○		—				—	—
⑩2	—	○		—				—	—

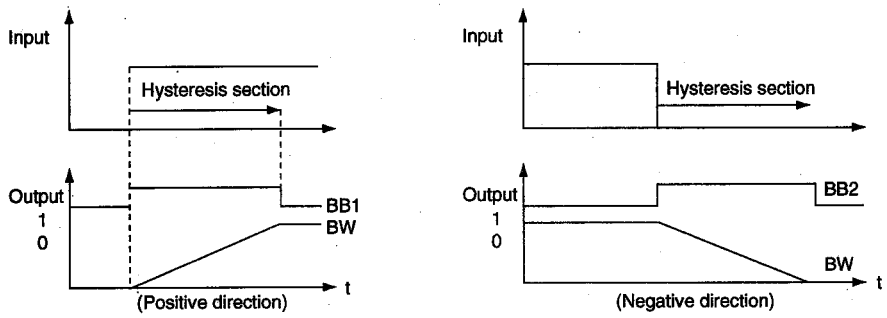


Set data

Setting data	Description	Data format
⑤1	Input block header address	Real number
⑩1	Block memory header device	Device name
⑤2	Operation constant header device	Device name
⑩2	Dummy device	Dummy

Function

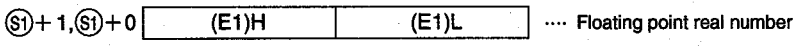
This sets the limit to the output value chain speed.



(1) Data handling

(a) Input data

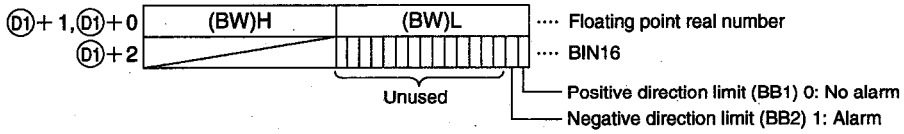
The input value (E1) is stored in (S1).



(b) Block memory

The BW (Output value), BB1 (Upper limit alarm: E1), and BB2 (Lower limit alarm: E2) are stored in (D1).

(D1) + 2's BB3 to BB16 are not used.



(c) This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Initial value setting
(S2)+1, (S2)+0	Positive direction limit value	V1	0 to 999999	100.0
(S2)+3, (S2)+2	Negative direction limit value	V2	0 to 999999	100.0
(S2)+5, (S2)+4	Positive direction hysteresis	HS1	0 to 999999	0.0
(S2)+7, (S2)+6	Negative direction hysteresis	HS2	0 to 999999	0.0

(d) Set (D2) as the dummy device (SD1506).

(e) Execution time (ΔT)

Set the execution time in SD1500 and SD1501. (Refer to Q4ARCPU Programming Manual (Application PID Edition) Section 3.)

(2) Processing explanation

The following operation processing are conducted.

	Input (E1-BW)	Output value (BW)	BB1	BB2
When forward E1 BW	Input value-BW V1 ΔT	BW=BW+V1 ΔT	1	0
	Input value-BW<V1 ΔT-HS1	BW=E1	0	0
	Other	BW=E1	Previous value	Previous value
When reverse E1 < BW	BW-Input value V2 ΔT	BW=BW-V2 ΔT	0	1
	BW-Input value<V2 ΔT-HS2	BW=E1	0	0
	Other	BW=E1	Previous value	Previous value

ΔT: Sampling time BW: Output V1: Positive direction control value

V2: negative direction control value HS1: Positive value direction hysteresis

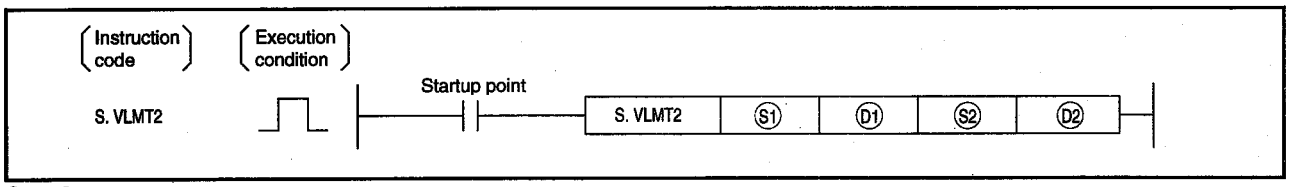
HS2: Negative value direction hysteresis

Error

- An overflow occurred during the operation. (Error code: 4100)
- When HS1< 0 or HS2 < 0 (Error code: 4100)

5.2.3 Variation Rate Limiter 2

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—

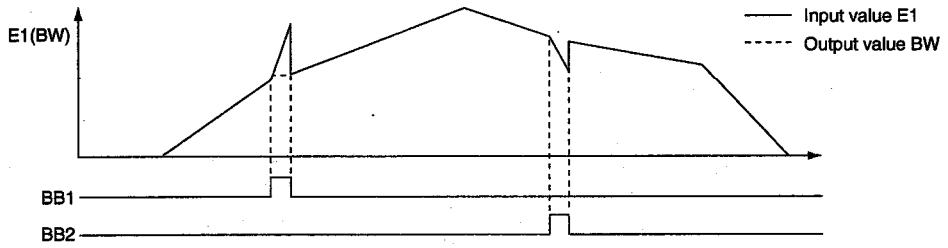


Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Real number
ⓓ1	Block memory header device	Device name
ⓢ2	Operation constant header device	Device name
ⓓ2	Dummy device	Dummy

Function

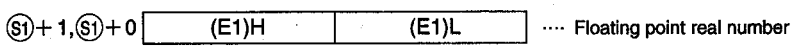
This sets the limit to the output value chain speed.



(1) Data handling

(a) Input data

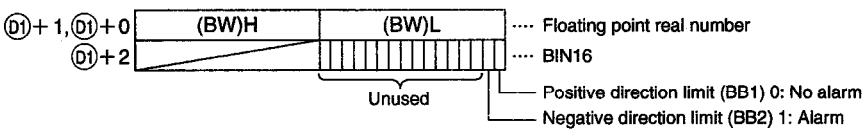
The input value (E1) is stored in ⓢ1.



(b) Block memory

The BW (Output value), BB1 (Upper limit alarm: E1), and BB2 (Lower limit alarm: E2) are stored in ⓓ1.

ⓓ1 + 2's BB3 to BB16 are not used.



(c) This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Initial value setting
(S2)+1, (S2)+0	Positive direction limit value	V1	0 to 999999	100.0
(S2)+3, (S2)+2	Negative direction limit value	V2	0 to 999999	100.0
(S2)+5, (S2)+4	Positive direction hysteresis	HS1	0 to 999999	0.0
(S2)+7, (S2)+6	Negative direction hysteresis	HS2	0 to 999999	0.0

(d) Set (D2) as the dummy device (SD1506).

(e) Execution time (ΔT)
Set the execution time in SD1500 and SD1501. (Refer to Q4ARCPU Programming Manual (Application PID Edition) Section 3.)

(2) Processing explanation

The following operation processing are conducted.

	Input (E1-BW)	Output value (BW)	BB1	BB2
When forward E1 BW	Input value-BW V1 ΔT	BW=BW	1	0
	Input value-BW<V1 ΔT-HS1	BW=E1	0	0
	Other	BW=BW	Previous value	Previous value
When reverse E1 < BW	BW-Input value V2 ΔT	BW=BW	0	1
	BW-Input value<V2 ΔT-HS2	BW=E1	0	0
	Other	BW=BW	Previous value	Previous value

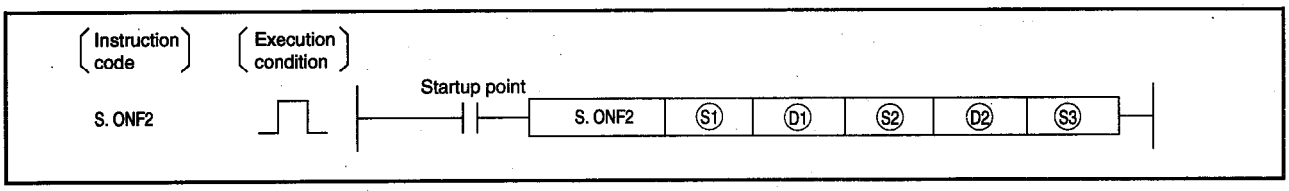
ΔT: Sampling time BW: Output V1: Positive direction control value
V2: negative direction control value HS1: Positive value direction hysteresis
HS2: Negative value direction hysteresis

Error

- An overflow occurred during the operation. (Error code: 4100)
- When HS1< 0 or HS2 < 0 (Error code: 4100)

5.2.4 2 Position On/Off

Setting data	Usable Devices							
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
(S1)	—	○		—				—	—
(D1)	—	○		—				—	—
(S2)	—	○		—				—	—
(D2)	—	○		—				—	—
(S3)	—	○		—				—	—

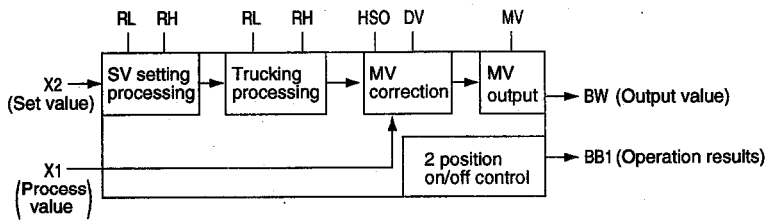


Set data

Setting data	Description	Data format
(S1)	Input block header address	Real number
(D1)	Block memory header device	Device name
(S2)	Operation constant header device	Device name
(D2)	Loop tag memory header device	Device name
(S3)	Input block header address for first MV address (when used)	Real number

Function

This function has an automatic/manual switching function and turns 1 contact on/off in accordance with the mode. It performs SV setting processing, trucking processing, MV correction, MV output processing, and 2 position on/off control for each control time.

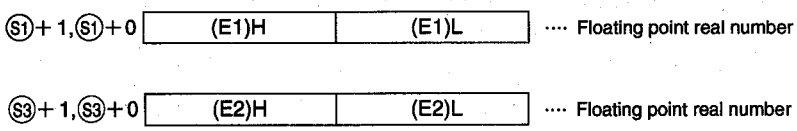


(1) Data handled

(a) Input data

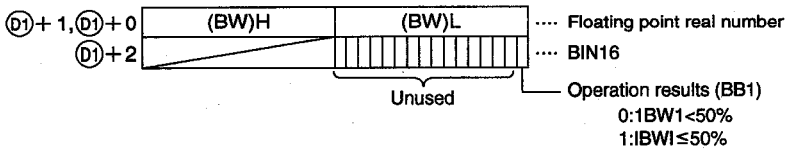
① The process value (E1) is stored in (S1).

② The (S3) set value (E2) can be used when the set value (E2) is set (0 bit=1) by the operation constant set value parameter.
For other cases set the dummy device (SD1506).
In addition, when the set value (E2) is set by the first loop tag memory MV value, set the device (+12: MV value) set by the first loop tag memory MV value.



(b) Block memory

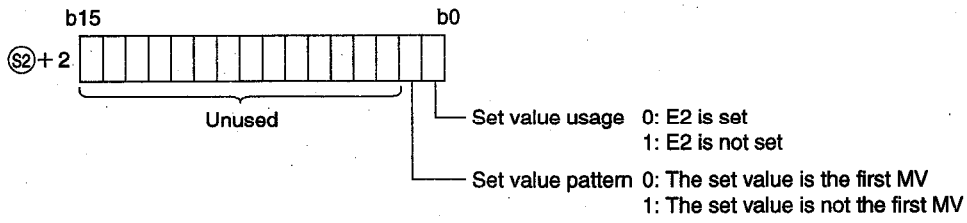
The output value (BW) and operation result (BB1) are stored in (D1).
(D1)+2's BB2 to BB16 are not used.



(c) This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Standard value setting	
(S2)+0	Reverse action, direct action	PN	0 to 1	0	0: Reverse action 1: Direct action
(S2)+1	Trucking bit	TRK	0 to 1	0	0: Not trucked 1: Trucked
(S2)+2	Set value pattern	SVPTN	0 to 3	3	

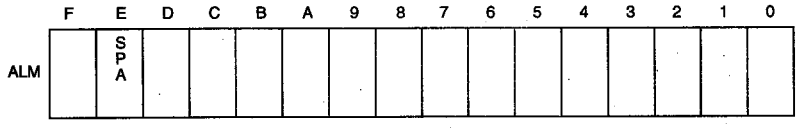
The set value pattern (SVPTN) is a device that sets whether the set value is set by (S3) and whether that set value is set by the first loop device (+12: MV value). The set value pattern (SVPTN) cannot use bits 2 through 15.



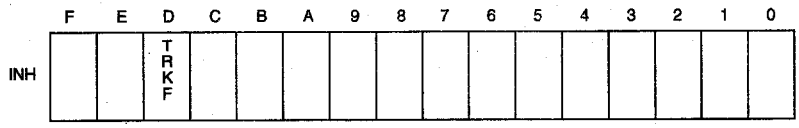
(d) Shows the loop tag memory used by (D2).

	Item name	Item	Settable range	Standard value setting
(D2)+1	Operation mode	MODE	0 to FFFFH	8H
(D2)+3	Alarm detection	ALM	0 to FFFFH	4000H
(D2)+4	Alarm detection prohibited	INH	0 to FFFFH	4000H
(D2)+13, (D2)+12	Process value	MV	-10 to 110	0.0
(D2)+15, (D2)+14	Set value	SV	-999999 to 999999	0.0
(D2)+17, (D2)+16	Deviation	DV	-999999 to 999999	0.0
(D2)+19, (D2)+18	Hysteresis	HS0	0 to 999999	0.0
(D2)+47, (D2)+46	Control time (sec)	CT	0 to 999999	1.0

The bit used by the alarm detection (ALM) is shown below.
SPA can be set by the user.



The bit used by the alarm detection prohibition (INH) is shown below.



(e) Loop tag passed value memory

This shows the contents of the loop tag passed value memory used by the ONF2 instruction. The user does not need to set the contents. However, for the initial setting it must be cleared by the sequence.

	Description
(D2)+96	Control time counter initial set completed flag
(D2)+97	Control time counter

(f) Execution time (ΔT)

Set the execution time in SD1500 and SD1501. (Refer to Q4ARCPU Programming Manual (Application PID Edition) Section 3.)

(2) Processing explanation

(a) Loop STOP processing

① When the alarm detection (ALM) SPA is 1, the following process is conducted and ended.

a BW and BB hold the previous value.

b The operation mode is changed to MAN (MANUAL).

When the alarm detection (ALM)'s SPA is 0, processing is conducted from the (b) control time determination.

(b) Control time determination

This determines whether the control time from the control time (CT) has been reached and conducts the following processing.

① If the control time has not been reached

a When the operation mode (MODE) is other than MAN, CMB, CMV, and LCM then the BW value is held and processed and ended.

b When the operation mode (MODE) is MAN, CMB, CMV, or LCM then BW=MV and is processed 2 position on/off control.

② If the control time has been reached

Processing is continued from the (c) SV setting processing.

(c) SV setting processing

The following processing is conducted by the operation mode (MODE).

① When the operation mode (MODE) is either CAS, CCB, or CSV (when the input value is used as the set value)

a When the set value (E2) is not set, processing is conducted from the (d) trucking processing.

b When (S3) set value (E2) is set, processing is conducted from the (d) trucking processing after the following engineering value conversion has been conducted.

Engineering value conversion

$$SVn = \frac{RH-RL}{100} \times E2 + RL$$

RH: Engineering value upper limit RL: Engineering value lower limit

E2: Set value

② When the operation mode (MODE) is MAN, AUT, CMV, CMB, CAB, LCM, LCA, or LCC

a Processing is conducted from the (d) trucking processing.

(d) Trucking processing

This conducts the engineering value conversion (SVn').

Inverse engineering value conversion

$$SVn' = \frac{100}{RH-RL} \times (SVn - RL)$$

Trucking processing is conducted when the following conditions occur.

① When the operation constant's TRK is 1.

② When the set value (E2) is used.

③ When the mode is not CAS, CCB, or CSV.

Trucking processing stores the set value (E2) after the above engineering value conversion (SVn') is conducted.

E2=SVn'

In addition, when the set value (E2) is the first loop tag memory MVn value, the first loop tag memory alarm detection prohibition (INH)'s TRKF is made to be 1.

(e) MV correction

The deviation (DV) is calculated using the following conditions.

Condition	Calculation results (DV)
When direct action (PN=1)	DV=E1–SVn'
When reverse action (PN=0)	DV=SVn'–E1

E1: Process value SVn': Set value that is trucking processed

Next the MV correction is calculated.

Condition	Formula
DV HS0	MV'=100 (%)
DV -HS0	MV'=0 (%)
-HS0<DV<HS0	MV'=previous value (BW value)

DV: Deviation HS0: Hysteresis

(f) MV output

The MV value (BW) is calculated following the following conditions.

Condition	Calculation results (Bn)
CMV, MAN, CMB, LCM	BW=MVn
CSV, CCB, CAB, CAS, AUT, LCC, LCA	BW=MV' MVn=BW

(g) 2 position on/off control

BB1 is output in accordance with the following conditions.

Condition	Calculation results (BB1)
When IBWI 50 (%)	BB1=1
When IBWI<50 (%)	BB1=0

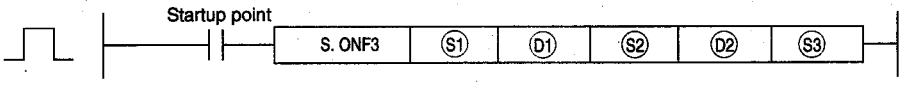
Error

- When an overflow occurs during an operation. (Error code: 4100)

5.2.5 3 Position On/Off

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\N□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—

(Instruction code) S. ONF3 (Execution condition)



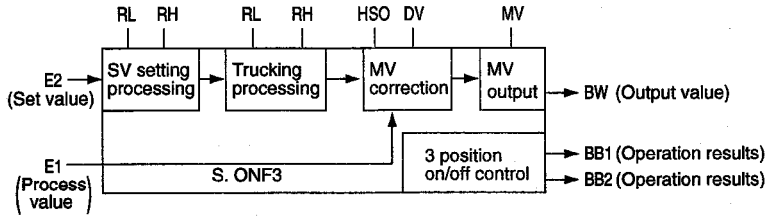
ⓢ3	—	○	—		—	—

Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Real number
ⓓ1	Block memory header device	Device name
ⓢ2	Operation constant header device	Device name
ⓓ2	Loop tag memory header device	Device name
ⓢ3	Input block header address for first MV address (when used)	Real number

Function

This function has an automatic/manual switching function and turns 1 contact on/off in accordance with the mode. It performs SV setting processing, trucking processing, MV correction, MV output processing, and 3 position on/off control for each control time.

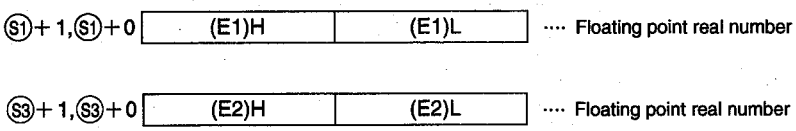


(1) Data handled

(a) Input data

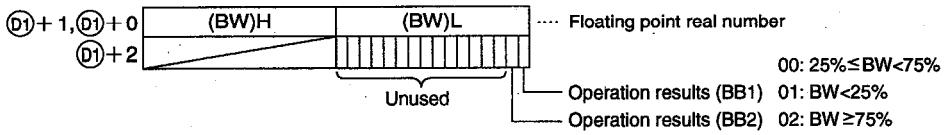
① The process value (E1) is stored in (S1).

② The (S3) set value (E2) can be used when the set value (E2) is set (0 bit=1) by the operation constant set value parameter.
For other cases set the dummy device (SD1506).
In addition, when the set value (E2) is set by the first loop tag memory MV value, set the device (+12: MV value) set by the first loop tag memory MV value.



(b) Block memory

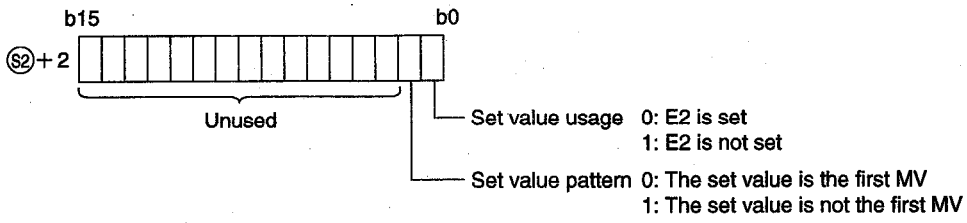
The output value (BW), operation result (BB1), and operation result (BB2) are stored in (D1).
(D1)+2's BB3 to BB16 are not used.



(c) This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Standard value setting	
(S2)+0	Reverse action, direct action	PN	0 to 1	0	0: Reverse action 1: Direct action
(S2)+1	Trucking bit	TRK	0 to 1	0	0: Not trucked 1: Trucked
(S2)+2	Set value pattern	SVPTN	0 to 3	3	

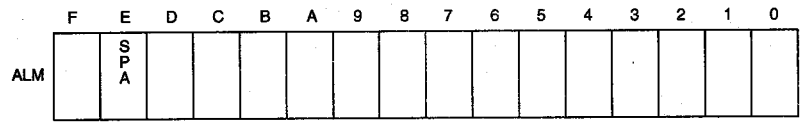
The set value pattern (SVPTN) is a device that sets whether the set value is set by (S3) and whether that set value is set by the first loop device (+12: MV value). The set value pattern (SVPTN) cannot use bits 2 through 15.



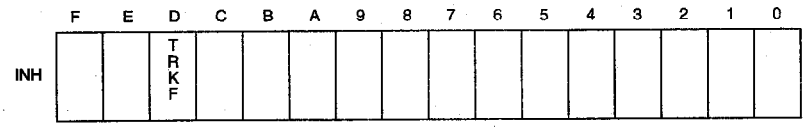
(d) Shows the loop tag memory used by ⓓ2.

	Item name	Item	Settable range	Standard value setting
ⓓ2+1	Operation mode	MODE	0 to FFFFH	8H
ⓓ2+3	Alarm detection	ALM	0 to FFFFH	4000H
ⓓ2+4	Alarm detection prohibited	INH	0 to FFFFH	4000H
ⓓ2+13, ⓓ2+12	Process value	MV	-10 to 110	0.0
ⓓ2+15, ⓓ2+14	Set value	SV	-999999 to 999999	0.0
ⓓ2+17, ⓓ2+16	Deviation	DV	-999999 to 999999	0.0
ⓓ2+19, ⓓ2+18	Hysteresis	HS0	0 to 999999	0.0
ⓓ2+21, ⓓ2+20	Hysteresis	HS1	0 to 999999	0.0
ⓓ2+47, ⓓ2+46	Control time (sec)	CT	0 to 999999	1.0

The bit used by the alarm detection (ALM) is shown below.
SPA can be set by the user.



The bit used by the alarm detection prohibition (INH) is shown below.



(e) Loop tag passed value memory

This shows the contents of the loop tag passed value memory used by the ONF2 instruction. The user does not need to set the contents. However, for the initial setting it must be cleared by the sequence.

	Description
ⓓ2+96	Control time counter initial set completed flag
ⓓ2+97	Control time counter

(f) Execution time (ΔT)

Set the execution time in SD1500 and SD1501. (Refer to Q4ARCPU Programming Manual (Application PID Edition) Section 3.)

(2) Processing explanation

(a) Loop STOP processing

① When the alarm detection (ALM) SPA is 1, the following process is conducted and ended.

a BW, BB1, and BB2 hold the previous value.

b The loop mode is changed to MAN (MANUAL).

When the alarm detection (ALM)'s SPA is 0, processing is conducted from the (b) control time determination.

(b) Control time determination

This determines whether the control time from the control time (CT) has been reached and conducts the following processing.

① If the control time has not been reached

a When the operation mode (MODE) is other than MAN, CMB, CMV, and LCM then the BW value is held and processed and ended.

b When the operation mode (MODE) is MAN, CMB, CMV, or LCM then BW=MV and is processed 3 position on/off control.

② If the control time has been reached

Processing is continued from the (c) SV setting processing.

(c) SV setting processing

The following processing is conducted by the operation mode (MODE).

① When the operation mode (MODE) is either CAS, CCB, or CSV (when the input value is used as the set value)

a When the set value (E2) is not set, processing is conducted from the (d) trucking processing.

b When Ⓢ3 set value (E2) is set, processing is conducted from the (e) MV correction after the following engineering value conversion has been conducted.

Engineering value conversion

$$SVn = \frac{RH-RL}{100} \times E2 + RL$$

RH: Engineering value upper limit RL: Engineering value lower limit

E2: Set value

② When the operation mode (MODE) is MAN, AUT, CMV, CMB, CAB, LCM, LCA, or LCC

a Processing is conducted from the (d) trucking processing.

(d) Trucking processing

This conducts the engineering value conversion (SVn').

Inverse engineering value conversion

$$SVn' = \frac{100}{RH-RL} \times (SVn - RL)$$

Trucking processing is conducted when the following conditions occur.

① When the operation constant's TRK is 1.

② When the set value (E2) is used.

③ When the mode is not CAS, CCB, or CSV.

Trucking processing stores the set value (E2) after the above engineering value conversion (SVn') is conducted.

E2=SVn'

In addition, when the set value (E2) is the first loop tag memory MVn, the first loop tag memory alarm detection prohibition (INH)'s TRKF is made to be 1.

(e) MV correction

The deviation (DV) is calculated using the following conditions.

Condition	Calculation results (DV)
When direct action (PN=1)	DV=E1–SVn'
When reverse action (PN=0)	DV=SVn'–E1

E1: Process value SVn': Set value that is trucking processed

Next the MV correction is calculated.

Condition	Formula
DV HS1+HS0	MV'=100 (%)
DV -(HS1+HS0)	MV'=0 (%)
-HS1+HS0<DV<HS1-HS0	MV'=50 (%)
Other	MV'=previous value (BW value)

DV: Deviation HS1: Hysteresis HS0: Hysteresis

(f) MV output

The MV value (BW) is calculated following the following conditions.

Condition	Calculation results (Bn)
CMV, MAN, CMB, LCM	BW=MVn
CSV, CCB, CAB, CAS, AUT, LCC, LCA	BW=MV' MVn=BW

(g) 3 position on/off control

BB1 is output in accordance with the following conditions.

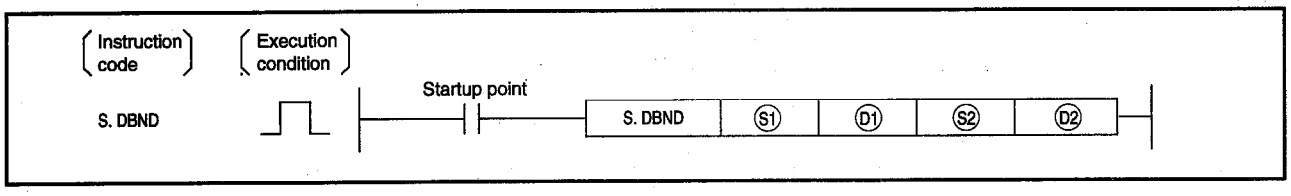
Condition	Calculation results (DV)	
	BB1	BB2
When BW 75 (%)	1	0
When 25 (%) BW<75 (%)	0	0
When BW<25 (%)	0	1

Error

- When an overflow occurs during an operation. (Error code: 4100)

5.2.6 Dead Band

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—

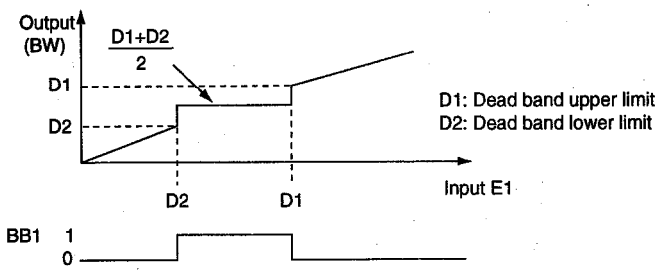


Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Real number
ⓓ1	Block memory header device	Device name
ⓢ2	Operation constant header device	Device name
ⓓ2	Dummy device	Dummy

Function

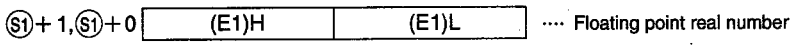
This function adds a dead band and conducts output processing.



(1) Data handling

(a) Input data

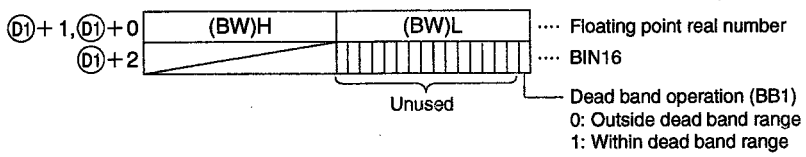
The input value (E1) is stored in ⓢ1.



(b) Block memory

The BW (output value) and BB1 (dead band operation) are stored in ⓓ1.

ⓓ1+2's BB2 to BB16 are not used.



(c) This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Initial value setting
(S2)+1, (S2)+0	Dead band upper limit	D1	-999999 to 999999	100.0
(S2)+3, (S2)+2	Dead band lower limit	D2	-999999 to 999999	0.0

(d) Set (D2) as the dummy device (SD1506).

(2) Processing explanation

The following process is executed.

Input	Output (BW)	Output (BB1)
D2 E1 D1	$\frac{D2 + D1}{2}$	1
E1<D2 OR E1>D1	E1	0

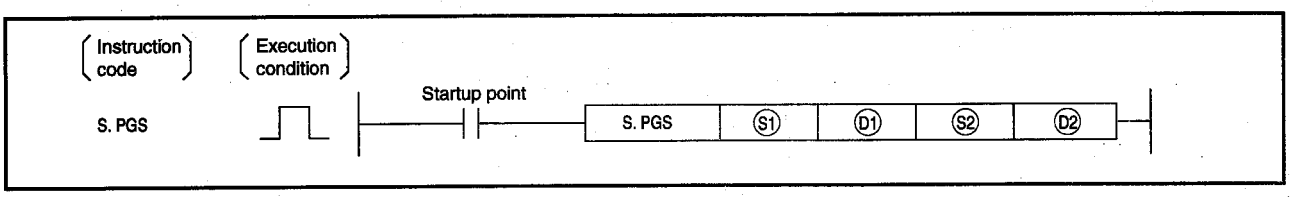
D1: Dead band upper limit D2: Dead band lower limit E1: Input value

Error

- An overflow occurred during an operation. (Error code: 4100)

5.2.7 Program Setter

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—

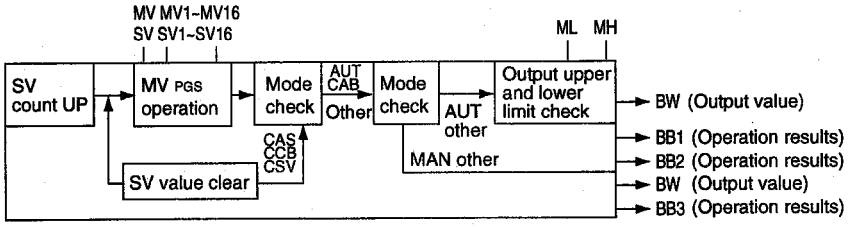


Set data

Setting data	Description	Data format
ⓢ1	Dummy device	Dummy
ⓓ1	Block memory header device	Device name
ⓢ2	Dummy device	Dummy
ⓓ2	Loop tag memory header device	Device name

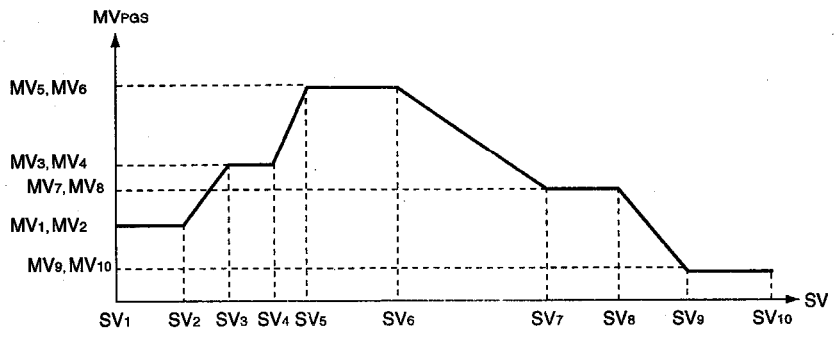
Function

This function has 3 types, the hold type, return type, and cyclic type, and outputs the operation output in accordance with the SV and MV patterns.



Hold type: Outputs the held SV_{10} value as is.
Return type: Makes the SV0 and outputs the MV's previous value.
Cyclic type: Reconducts processing from SV_1 and outputs after processing from SV_1 to SV_{10}.

PGS operation



(1) Handling data

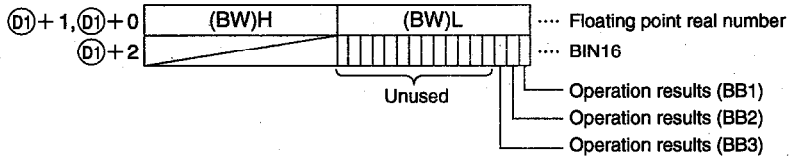
(a) Input data

Set ⓢ1 as the dummy device (SD1506).

(b) Block memory

The output value (BW), operation results (BB1), operation results (BB2), and operation results (BB3) are stored in ⓓ1.

ⓓ1+2's BB4 to BB16 bits are not used.

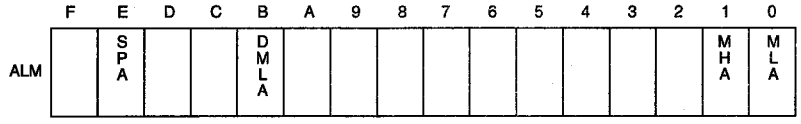


(c) Shows the loop tag memory used by ⓓ2.

	Item name	Item	Settable range	Standard value setting
ⓓ2+1	Operation mode	MODE	0 to FFFFH	8H
ⓓ2+3	Alarm detection	ALM	0 to FFFFH	4000H
ⓓ2+4	Alarm detection prohibited	INH	0 to FFFFH	4000H
ⓓ2+11, ⓓ2+10	Operation constant broken point line	PTNO	0 to 16	0.0
ⓓ2+13, ⓓ2+12	Manipulated value	MV	-10 to 110	0.0
ⓓ2+15, ⓓ2+14	Set value	SV	0 to 999999	0.0
ⓓ2+16	Operation type	TYPE	0 to 1	0
ⓓ2+19, ⓓ2+18	Output upper limit value	MH	0 to 999999	1.0
ⓓ2+21, ⓓ2+20	Output lower limit value	ML	-10 to 110	10.0
ⓓ2+23, ⓓ2+22	Setting time	SV1	0 to 999999	0.0
⋮	⋮	⋮	⋮	⋮
ⓓ2+53, ⓓ2+52	Setting time	SV16	0 to 999999	0.0
ⓓ2+55, ⓓ2+54	Setting output	MV1	-10 to 110	0.0
⋮	⋮	⋮	⋮	⋮
ⓓ2+85, ⓓ2+84	Setting output	MV16	-10 to 110	0.0

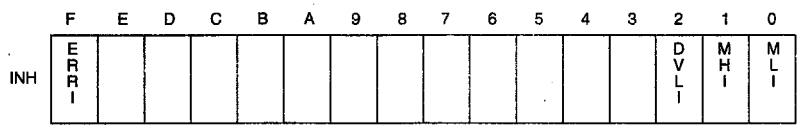
The bit used by the alarm detection (ALM) is shown below.

SPA can be set by the user, and corresponding bit is 1 when MHA, MLA outputs an alarm.



The bit used by alarm detection prohibition (INH) is shown below.

ERRI, MHI, MLI can be set by the user.



(d) Execution time (ΔT)

Set the execution time in SD1500 and SD1501. (Refer to Q4ARCPU Programming Manual (Application PID Edition) Section 3.)

(2) Processing explanation

Mode	TYPE	Type description
MAN, CMB, CMV, LCM, LCA, LCC	—	Operation stopped by current SV, MV
AUT, CAB	0	Hold type operation
	1	Return type operation
CAS, CCB, CSV	—	Cyclic type operation

(a) Loop stop processing

① When the alarm detection (ALM)'s SPA is 1, the following processing is conducted.

a BW outputs the previous BW value.

b BB's BB1 to BB3 are made to 0.

c The alarm detection (ALM)'s MHA and MLA are turned off.

d The operation mode (MODE) is changed to MAN (MANUAL).

Processes from a to d are conducted even when the number of operation constant broken points is 0.

When the alarm detection (ALM)'s SPA is 0, (c) SV count up operation is conducted.

(b) Loop RUN processing

When the loop tag memory alarm detection (ALM)'s SPA is 0 the following processing is conducted.

Type		Hold	Return	Cyclic
Mode		AUT CAB		CAS CCB CSV
MV_{PCS} Calculation	$SV<SV_1$	MV_1		
	$SVn\text{-}1 \le SV < SVn$	$\frac{MVn-MVn-1}{SVn-SVn-1} \times (SV-SVn-1) + MVn-1$		
Processing when SV'>SVn	Mode move	MAN	MAN	Not moved
	SV	Previous value	0	0
	MV	Previous value	Previous value	MV_1
	Restart up	Operation to change MAN to AUT after SV is set	Operation to change MAN to AUT	Automatic restart

(c) SV count processing

SV count up is conducted for each execution time.

$$SV'=SV+\Delta T$$

SV: Set value ΔT: Execution time

(d) Output processing

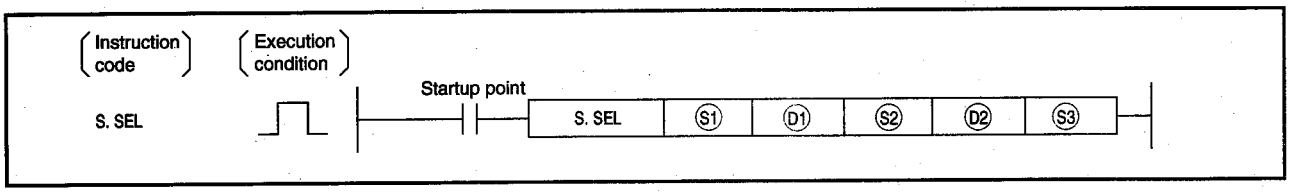
Manual				Automatic
Mode			MAN, CMB, CMV, LCM, LCA, LCC	AUT, CAB, CAS, CCB, CSV
Upper and lower limit check	MV_{PCS}>MH	BW	BW=MVn	BW=MVn=MH
		MHA		1 (BB2)
		MLA		0 (BB3)
	MV_{PCS}<MH	BW		BW=MVn=ML
		MHA		0 (BB2)
		MLA		1 (BB3)
	Other	BW		BW=MVn=MV_{PCS}
		MHA		0 (BB2)
		MLA		0 (BB3)
Alarm output			BB1 to BB3=0 MHA, MLA=0	BB1=BB2 or BB3 MHA=BB2 (However, when the alarm detection prohibition (INH)'s MHI is on, MHA=0) MLA=BB3 (However, when the alarm detection prohibition (INH)'s MLI is on, MLA=0) In addition, when the loop data INH and ERRI are on, MHA=MLA=0

Error

- An overflow occurred during an operation. (Error code: 4100)

5.2.8 Loop Selector

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—
ⓢ3	—	○		—				—	—

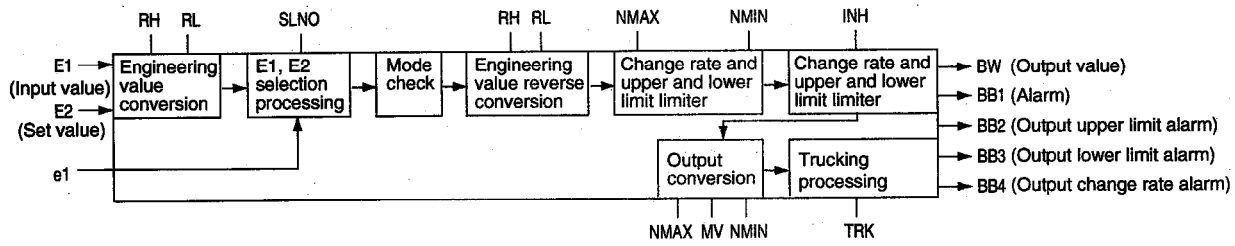


Set data

Setting data	Description	Data format
ⓢ1	Input value (E1)	Real number
ⓓ1	Block memory header device	Device name
ⓢ2	Operation constant header device	Device name
ⓓ2	Loop tag memory header device	Device name
ⓢ3	Input value (E2)	Real number

Function

This function has an automatic/manual switching function and when in automatic mode the selected signal e1 from the input value E1 and E2 is output, and during the manual mode the loop tag data manipulated value MV is output.

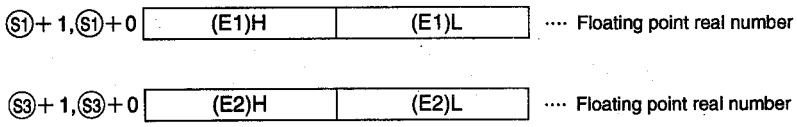


(1) Data handled

(a) Input data

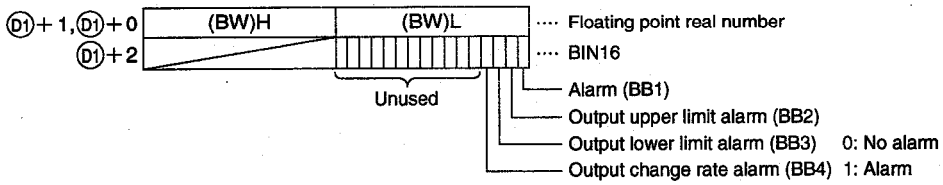
① The process value (E1) is stored in (S1).

② The set value (E2) of (S3) is used when the value is set.
For other cases set the dummy device (SD1506).
In addition, when the set value (E2) is set by the first loop tag memory MV value, set the device (+12: MV value) set by the first loop tag memory MV value.



(b) Block memory

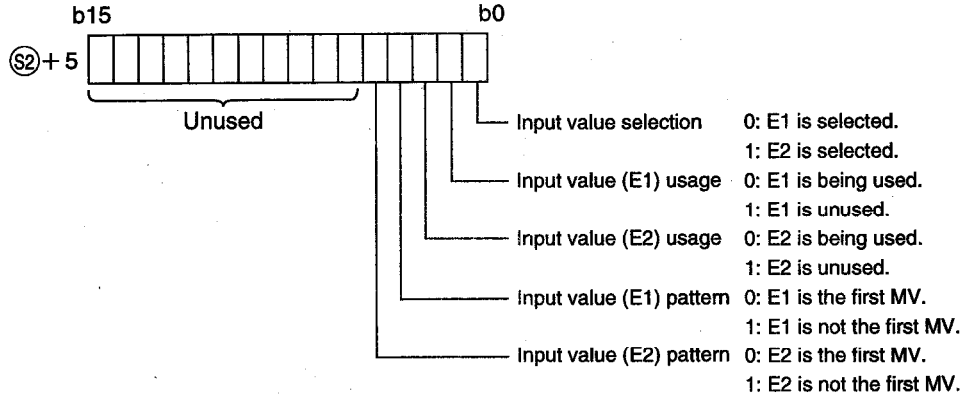
The output value (ΔMV) and BB1 (alarm) are stored in (D1).
(D1)+2's BB5 to BB16 are not used.
The output value becomes 0 when an error occurs.



(c) This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Standard value setting	
(S2)+1, (S2)+0	Output conversion upper limit	NAMAX	-999999 to 999999	100.0	
(S2)+3, (S2)+2	Output conversion lower limit	NMIN	-999999 to 999999	0.0	
(S2)+4	Trucking bit	TRK	0 to 1	0	0: Not trucked 1: Trucked
(S2)+5	Set value pattern	SVPTN	0 to 1F	1E	

The set value pattern (SVPTN) is a device that sets whether the set value is set by (S3) and whether that set value is set by the first loop device (+12: MV value). The set value pattern (SVPTN) cannot use bits 2 through 15.



(d) Shows the loop tag memory contents used by (D2).

	Item name	Item	Settable range	Standard value setting
(D2)+1	Operation mode	MODE	0 to FFFFH	8H
(D2)+3	Alarm detection	ALM	0 to FFFFH	4000H
(D2)+4	Alarm detection prohibited	INH	0 to FFFFH	4000H
(D2)+15, (D2)+14	Selection value	PV	RH* (RK*) to RL* (RH*)	0.0
(D2)+17, (D2)+16	Manipulated value	MV	RH* (RK*) to RL* (RH*)	0.0
(D2)+47, (D2)+46	Set value 1	PV_1	-999999 to 999999	0.0
(D2)+51, (D2)+50	Set value 2	PV_2	-999999 to 999999	0.0
(D2)+53, (D2)+52	Output upper limit value	MH	-999999 to 999999	0.0
(D2)+55, (D2)+54	Output lower limit value	ML	-999999 to 999999	0.0
(D2)+57, (D2)+56	Engineering range upper limit	RH	-999999 to 999999	0.0
(D2)+59, (D2)+58	Engineering range lower limit	RL	-999999 to 999999	0.0
(D2)+61, (D2)+60	No during selection	SLNO	-999999 to 999999	0.0
(D2)+63, (D2)+62	Output change rate limit value	DML	-999999 to 999999	0.0

The bit used by the alarm detection (ALM) is shown below.
The user can set the SPA, but when DVLA, MHA, or MLA outputs an alarm, the corresponding bit becomes 1.

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ALM		SPA			DMLA										MHA	MLA

The bit used by the alarm detection prohibition (INH) is shown below.
ERRI, DVLI, MHI, and MLI can be set by the user.

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
INH	ERRI		TRKF		DMLI										MHI	MLI

(e) Execution time (ΔT)
Set the execution time in SD1500 and SD1501. (Refer to Q4ARCPU Programming Manual (Application PID Edition) Section 3.)

(2) Processing explanation

(a) Loop STOP processing

① When the alarm detection (ALM)'s SPA is 1, the following processing is conducted.

a BW holds the previous BW value.

b The operation mode is set to MAN (MANUAL).

c BB's BB1 to BB4 becomes 0.

d The alarm prohibition (ALM)'s MHA, MLA, and DML become 0.

When the alarm detection (ALM)'s SPA is 0, the processing is conducted from (b) engineering value conversion.

(b) Engineering value conversion

Engineering value conversion

$$PVn = \frac{RH-RL}{100} \times En + RL$$

RH: Engineering value upper limit RL: Engineering value lower limit

En: Input value (E1 or E2)

(c) E1, E2 selection processing

When E1 is 0, PV=PV_1.

When E1 is 1, PV=PV_2.

SLNOn changes the bit selected for PV_1 to PV_2 to 1.

(d) Processing by mode

The following processing is conducted depending on the operation mode (MODE).

① When the operation mode (MODE) is MAN, CMB, CMV, or LCM (alarm clear processing)

a Output conversion processing is conducted.

b The alarm prohibition (ALM)'s MHA, MLA, and DML become 0.

c BB's BB1 to BB4 become 0.

② When the operation (MODE) is AUT, CAB, CAS, CCB, CSV, LCA, or LCC

(c) Processing is conducted from upper and lower limit and change rate limiter.

(e) Upper and lower limit, change rate limiter

This conducts a check of the change rate and upper and lower limit for input values E1 and E2 and outputs an alarm for the data after limiter processing.

Change rate limiter

Condition	T'	BB4
|T-MVn| DML	T'=T	0
T-MVn>DML	T'=MVn+DML	1
T-MVn<-DML	T'=MVn-DML	1

Upper and lower limit limiter

Condition	MV	BB2	BB3
T'>MH	MVn=MH	1	0
T'<ML	MVn=ML	0	1
ML T' MH	MVn=T'	0	0

MH: Output upper limit value T: Estimated MV value

L: Output lower limit value

(f) Output conversion value
The following processing is conducted.

Ratio operation

$$BW=\frac{NMAX-NMIN}{100}MVn+NMIN$$

NMAX: Output conversion upper limit NMIN: Output conversion lower limit
MVn: Manipulated value

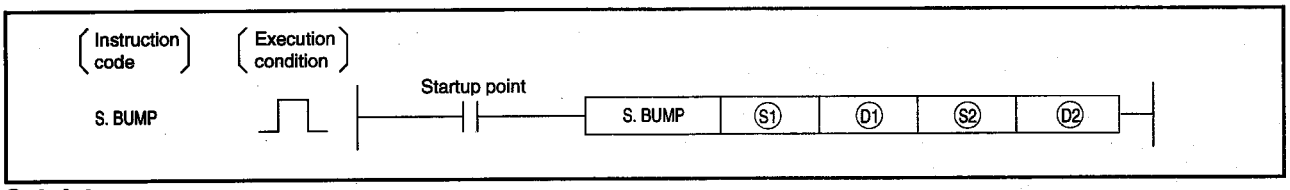
(g) Trucking processing
During the following conditions the MVn values are each output to E1 to E2. (Ei (i=1 to 2))
However, only Ei that is being used is output.
a When the operation constant is 1
b When the operation mode (MODE) is MAN, CMB, CMV, LCA, or LCC
(When the operation mode (MODE) is AUT, CAB, CAS, CCB, or CSV then BB1 is not 1.

Error

- An overflow occurred during operation. (Error code: 4100)

5.2.9 Bumpless Transfer

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—



Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Read number
ⓢ2	Operation constant header device	Device name
ⓓ2	Local work memory header device	Device name

Function

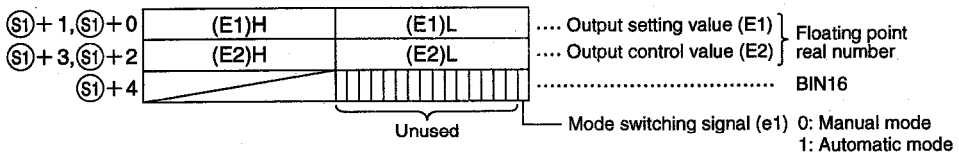
When the mode switching signal is switched from manual to automatic, the output value gradually goes from output control value E2 and approaches output value E1.

(1) Data handling

(a) Input data

Input data (E1) is store in ⓢ1.

ⓢ1+4's 1 to 15 bits are not used.



(b) Block memory

BW (output value) is stored in (D1).

BB is not used.

(D1)+1,(D1)+0	(BW)H	(BW)L	···· Floating point real number

(c) This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Initial value setting
(S2)+1, (S2)+0	Lag time (sec)	T	0 to 999999	1.0
(S2)+3, (S2)+2	Lag zone	a	0 to 999999	1.0

(d) Local work memory

This shows the contents of the local work memory used by the BUMP instruction.

The user does not need to set the contents.

However, the initial state needs to be cleared by the sequence.

(D1)+1, (D1)+0	Initial value deviation value (Xq)
(D1)+3, (D1)+2	Deviation (Xp)

(e) Execution time (ΔT)

Set the execution time in SD1500 and SD1501. (Refer to Q4ARCPU Programming Manual (Application PID Edition) Section 3.)

(2) Processing explanation

The output value approaches the output value (E1) at the constant ratio specified by the minimum LAGTIM (T), but after entering the range specified by LAGBND (a) based on output setting value (E1), it will approach output value (E1) after a temporary lag.

① For manual (e1=0), Xq (initial deviation value) and Xp (deviation) are found using the following formula.

BW=E2

Xq=E2-E1

Xp=E2-E1

② For automatic (e1=1), Xq (initial deviation value) and Xp (deviation) are found using the following conditions.

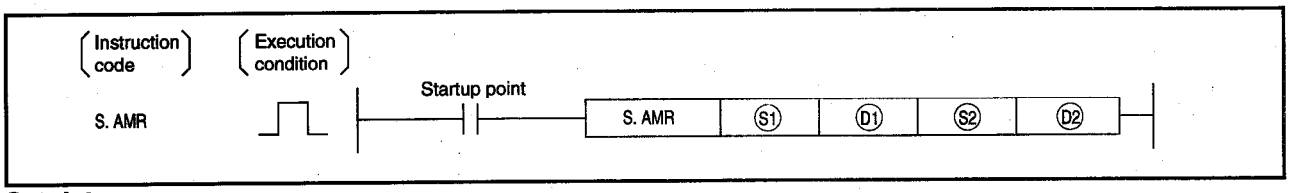
Condition	|Xp|>a	|Xp| a
Xp	$Xp=Xp'-\frac{\Delta T}{T}Xp$	$Xp=\frac{T}{T+\Delta T}Xp'$
BW	BW=E1+Xp However, when the following conditions exist BW=E1, Xp=Xp' $\|Xp\| \frac{\Delta T}{T} \|Xp\|$	BW=E1+Xp However, when the following conditions exist BW=E1, Xp=Xp' $\|Xp\| 10^{-4}$

Error

- When an overflow occurs during operation. (Error code: 4100)

5.2.10 Analog Memory

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—

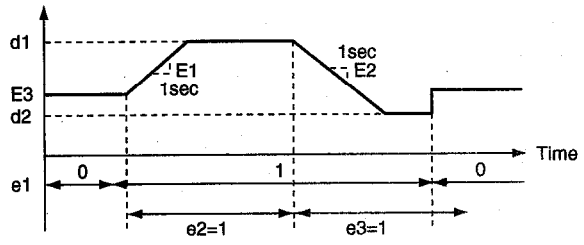


Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Real number
ⓢ2	Operation constant header device	Device name
ⓓ2	Dummy device	Dummy

Function

The input value is added or subtracted using a constant ratio.



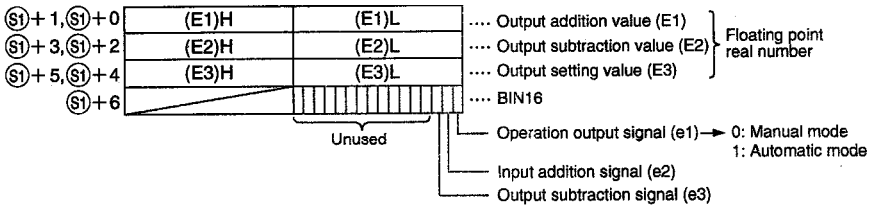
(1) Data handling

(a) Input data

Input value (E1) is stored in ⓢ1.

ⓢ1+6's 3 to 15 bits are not used.

The unused bits are set to 0.



(b) Block memory

BW (output value) is stored in (D1).

BB is not used.

(D1)+1,(D1)+0	(BW)H	(BW)L	···· Floating point real number

(c) Operation constant

This shows the contents of the operation constant set in (S2).

	Input (E1-BW)	Output value (BW)	BB1	BB2
When forward E1 BW	Input value-BW V1 ΔT	BW=BW+V1 ΔT	1	0
	Input value-BW<V1 υππερ λιμιτ ϖαλυε	d1	0 to 999999	1.0
(S2)+3, (S2)+2	Output lower limit value	d2	0 to 999999	1.0

(d) Execution time (ΔT)

Set the execution time in SD1500 and SD1501. (Refer to Q4ARCPU Programming Manual (Application PID Edition) Section 3.)

(2) Processing explanation

The following processing is conducted when the e1 is automatic or manual switching switch (A/M SW), the e2 is the output addition switch (INC SW), and the e3 is the output subtraction switch (DEC SW).

The processing is conducted using the following SW statuses.

① For manual (e1=0), processing is conducted under the following conditions.

BW=E3

② For automatic (e1=1), the following is found.

e2	e3	Calculation results (BW)
1	0	BW=BW+|E1| ΔT However, when the output value is d1 or later: BW=d1
0	1	BW=BW−|E2| ΔT However, when the output value is d2 or later: BW=d2
1	1	BW=BW
0	0	

ΔT: Execution time

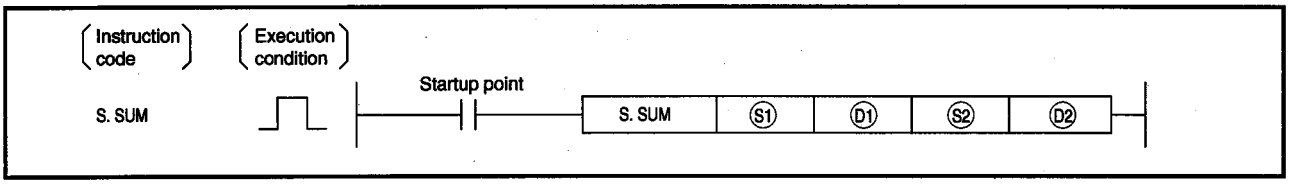
Error

- When an overflow occurs during operation. (Error code: 4100)

5.3 Correction Operation Instruction

5.3.1 Summation

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—



Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Real number
ⓢ2	Operation constant header device	Device name
ⓓ2	Dummy device	Dummy

Function

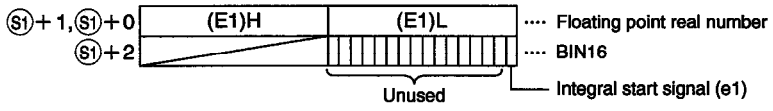
When the summation start signal (e1) changes from 0 to 1, the input (E1) is subject to summation calculation and output.

(1) Data handling

(a) Input data

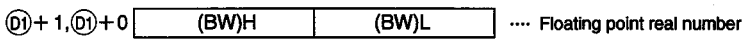
The input value (E1) is stored in ⓢ1.

ⓢ1+2's 1 to 15 bits are not used.



(b) Block memory

BW (output value) is store in ⓓ1.



(c) Operation constant

This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Initial value setting
(S2)+1, (S2)+0	Input locate value	ILC	-999999 to 999999	0.0
(S2)+3, (S2)+2	Initial value	A	-999999 to 999999	0.0
(S2)+4	Input range 1: /sec 2: /min 3: /hour	RANGE	1 to 3	1

(d) Execution time (ΔT)

Set the execution time in SD1500 and SD1501. (Refer to Q4ARCPU Programming Manual (Application PID Edition) Section 3.)

(2) Processing explanation

The following processing is conducted.

e1	E1	BW (output)
0	—	BW=outputs operation constant's initial value A
1	E1≤ILC	BW=previous value stays as is
	E1>ILC	$BW = E1 \times \frac{\Delta T}{T}$ + Previous value

RANGE (input range)=1, T=1

RANGE (input range)=2, T=60

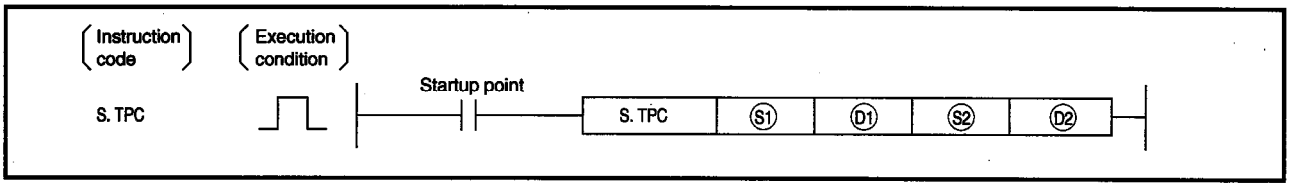
RANGE (input range)=3, T=3600

Error

- When an overflow occurs during operation. (Error code: 4100)
- When the RANGE (input range) is not 1 to 3. (Error code: 4100)

5.3.2 Temperature Pressure Correction

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\N□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—



Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Real number
ⓢ2	Operation constant header device	Device name
ⓓ2	Dummy device	Dummy

Function

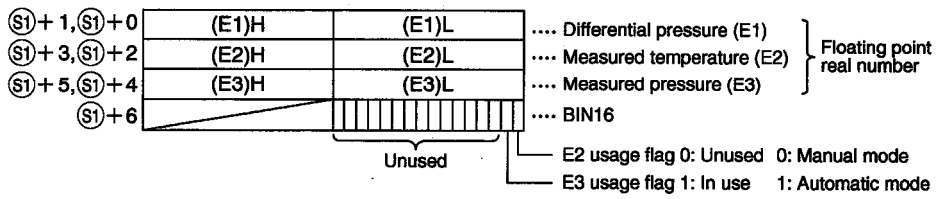
The input value (E1) is subject to temperature pressure correction (temperature or pressure) and output. This is used when you want to find the actual measured pressure difference by using the measured temperature and pressure drop to calculate the flow volume. (Used in combination with the square root extraction operation.)

(1) Data handling

(a) Input data

The input value (E1) is stored in ⓢ1.

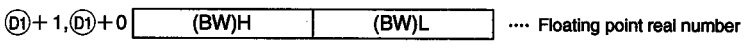
ⓢ1+6's 2 to 15 bits are not used.



(b) Block memory

BW (output value) is stored in ⓓ1.

BB is not used.



(c) Operation constant

This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Initial value setting
(S2)+1, (S2)+0	Designed temperature T' (engineering value)	TEMP	-999999 to 999999	0.0
(S2)+3, (S2)+2	Bias (temperature)	B1	-999999 to 999999	273.15
(S2)+5, (S2)+4	Design pressure P' (engineering value)	PRES	-999999 to 999999	0.0
(S2)+7, (S2)+6	Bias (pressure)	B2	-999999 to 999999	10332.0

(2) Processing explanation

The operation is executed in accordance with the following conditions.

BW=E1 x A1 x A2.

A1 and A2 follow the conditions below.

Input		A1	A2
E2	E3		
Used	Used	$\frac{T' + B1}{E2 + B1}$	$\frac{E3 + B2}{P' + B2}$
Unused	Used	1.0	$\frac{E3 + B2}{P' + B2}$
Used	Unused	$\frac{T' + B1}{E2 + B1}$	1.0

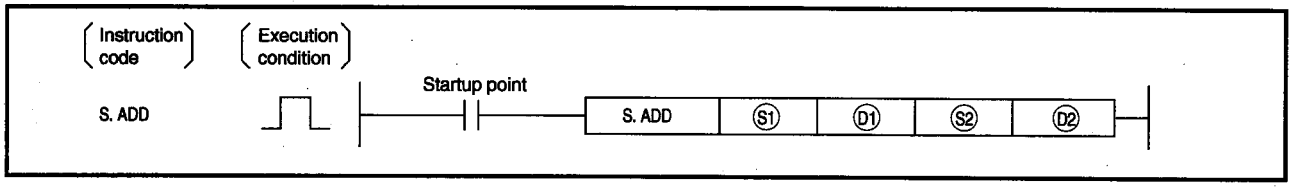
Error

- When overflow occurs during operation. (Error code: 4100)

5.4 Arithmetic Operation Instructions

5.4.1 Addition

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—



Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Real number
ⓢ2	Operation constant header device	Device name
ⓓ2	Dummy device	Dummy

Function

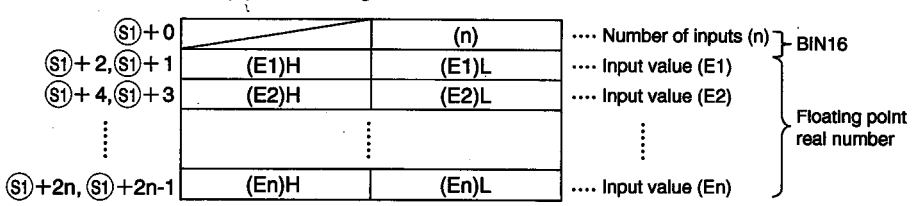
The input value (E1 to En) data is added by attaching a coefficient.

(1) Data handling

(a) Input data

The number of inputs (n) and input values (E1 to E5) are stored in ⓢ1.

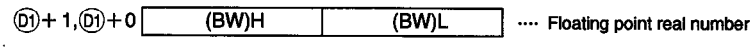
Set the number of inputs (n) in the range 0 to 5.



(b) Block memory

BW (output value) is stored in ⓓ1.

BB is not used.



(c) Operation constant

This shows the contents of the operation constant set in (S2).

Set the coefficient number (n) in the range of 0 to 5.

	Item name	Item	Settable range	Initial value setting
(S2)+0	Coefficient number	n	0 to 5	0
(S2)+2, (S2)+1	Coefficient 1	K1	-999999 to 999999	1.0
(S2)+4, (S2)+3	Coefficient 2	K2	-999999 to 999999	1.0
⋮	⋮	⋮	⋮	⋮
(S2)+2n, (S2)+2n-1	Coefficient n	Kn	-999999 to 999999	1.0
(S2)+2n+2, (S2)+2n+1	Bias	B	-999999 to 999999	0.0

(2) Processing explanation

The following processing is executed.

BW=K1 x E1 + K2 x E2+...+Kn x En + B

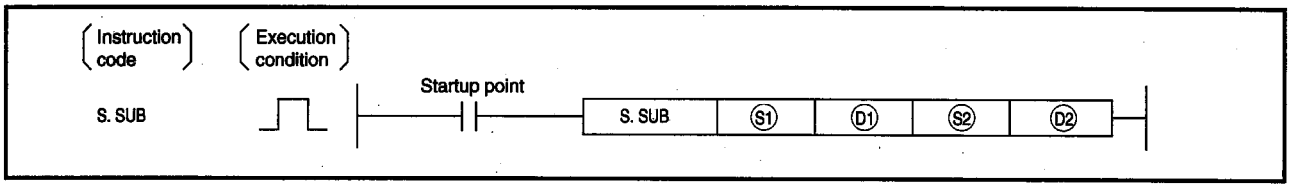
However, when n=0, BW=B.

Error

- When an overflow occurs during operation. (Error code: 4100)
- When not n=0 to 5. (Error code: 4100)

5.4.2 Subtraction

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\N□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—



Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Real number
ⓢ2	Operation constant header device	Device name
ⓓ2	Dummy device	Dummy

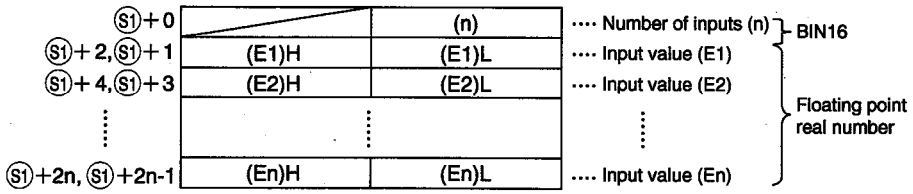
Function

The input value (E1 to En) data is subtracted by attaching a coefficient.

(1) Data handling

(a) Input data

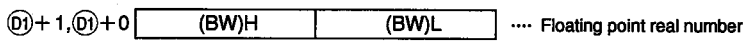
The number of inputs (n) and input values (E1 to E5) are stored in ⓢ1.



(b) Block memory

BW (output value) is stored in ⓓ1.

BB is not used.



(c) Operation constant

This shows the contents of the operation constant set in (S2).

Set the coefficient number (n) in the range of 0 to 5.

	Item name	Item	Settable range	Initial value setting
(S2)+0	Coefficient number	n	0 to 5	0
(S2)+2, (S2)+1	Coefficient 1	K1	-999999 to 999999	1.0
(S2)+4, (S2)+3	Coefficient 2	K2	-999999 to 999999	1.0
⋮	⋮	⋮	⋮	⋮
(S2)+2n, (S2)+2n-1	Coefficient n	Kn	-999999 to 999999	1.0
(S2)+2n+2, (S2)+2n+1	Bias	B	-999999 to 999999	0.0

(2) Processing explanation

The following processing is executed.

BW=K1 x E1 – K2 x E2 – ..... – Kn x En + B

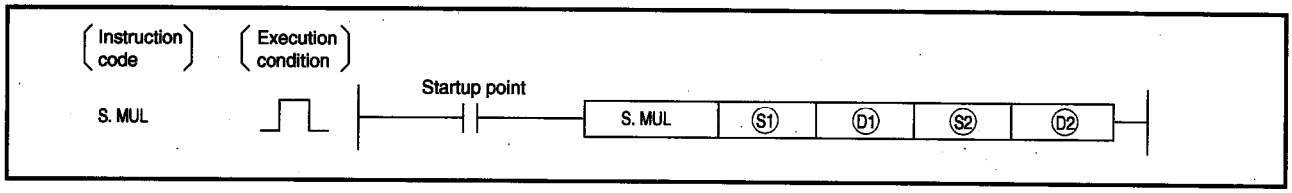
However, when n=0, BW=B.

Error

- When an overflow occurs during operation. (Error code: 4100)
- When not n=0 to 5. (Error code: 4100)

5.4.3 Multiplication

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—



Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Real number
ⓢ2	Operation constant header device	Device name
ⓓ2	Dummy device	Dummy

Function

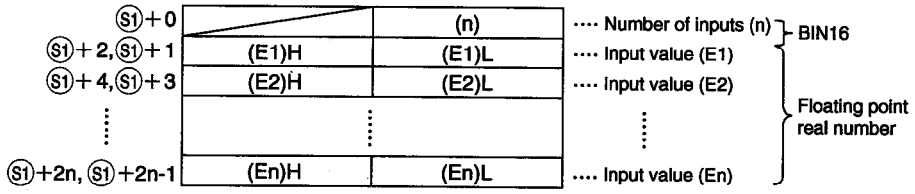
The input value (E1 to En) data is multiplied by attaching a coefficient.

(1) Data handling

(a) Input data

The number of inputs (n) and input values (E1 to E5) are stored in ⓢ1.

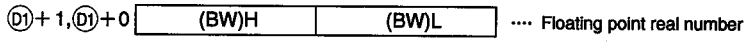
Set the number of inputs (n) in the range 0 to 5.



(b) Block memory

BW (output value) is stored in ⓓ1.

BB is not used.



(c) Operation constant

This shows the contents of the operation constant set in (S2).

Set the coefficient number (n) in the range of 0 to 5.

	Item name	Item	Settable range	Initial value setting
(S2)+0	Coefficient number	n	0 to 5	0
(S2)+2, (S2)+1	Coefficient 1	K1	-999999 to 999999	1.0
(S2)+4, (S2)+3	Coefficient 2	K2	-999999 to 999999	1.0
⋮	⋮	⋮	⋮	⋮
(S2)+2n, (S2)+2n-1	Coefficient n	Kn	-999999 to 999999	1.0
(S2)+2n+2, (S2)+2n+1	Bias	B	-999999 to 999999	0.0

(2) Processing explanation

The following processing is executed.

BW=K1 x E1 x K2 x E2 x ..... x Kn x En + B

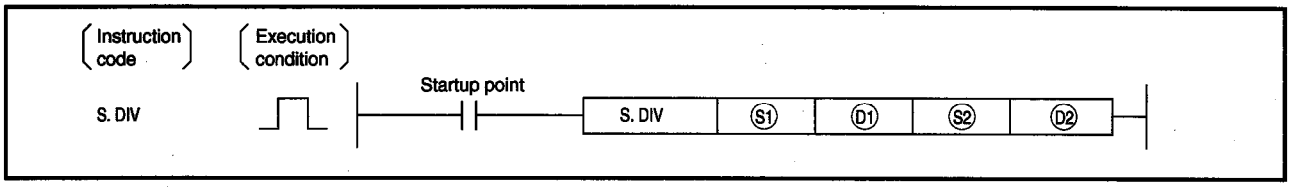
However, when n=0, BW=B.

Error

- When an overflow occurs during operation. (Error code: 4100)
- When not n=0 to 5. (Error code: 4100)

5.4.4 Division

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—



Set data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Real number
ⓢ2	Operation constant header device	Device name
ⓓ2	Dummy device	Dummy

Function

The input value (E1 to E2) data is divided by attaching a coefficient.

(1) Data handling

(a) Input data

The number of inputs (E1) and input values (E2) are stored in ⓢ1.

Set the number of inputs (n) in the range 0 to 5.

ⓢ1+1,ⓢ1+0	(E1)H	(E1)L	···· Numerator (E1) } Floating point real number
ⓢ1+3,ⓢ1+2	(E2)H	(E2)L	···· Denominator (E2) }

(b) Block memory

BW (output value) is stored in ⓓ1.

BB is not used.

ⓓ1+1,ⓓ1+0	(BW)H	(BW)L	···· Floating point real number

(c) Operation constant

This shows the contents of the operation constant set in (S2).

Set the coefficient number (n) in the range of 0 to 5.

	Item name	Item	Settable range	Initial value setting
(S2)+1, (S2)+0	Coefficient 1	A	-999999 to 999999	1.0
(S2)+3, (S2)+2	Coefficient 2	K1	-999999 to 999999	1.0
(S2)+5, (S2)+4	Coefficient n	K2	-999999 to 999999	1.0
(S2)+7, (S2)+6	Bias 1	B1	-999999 to 999999	0.0
(S2)+9, (S2)+8	Bias 2	B2	-999999 to 999999	0.0
(S2)+11, (S2)+10	Bias 3	B3	-999999 to 999999	0.0

(2) Processing explanation

The following processing is executed.

$$BW = A \times \frac{K1 \times E1 + B1}{K2 \times E2 + B2} + B3$$

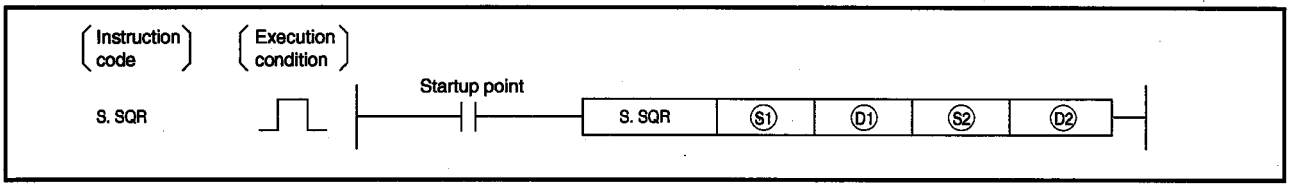
However, when the denominator=0, BW=B3.

Error

- When an overflow occurs during operation. (Error code: 4100)

5.4.5 Square Root

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□N□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—



Setting data

Setting data	Description	Data format
ⓢ1	Input value (E1)	Real number
ⓓ1	Block memory header device	Real number
ⓢ2	Operation constant header device	Device name
ⓓ2	Dummy device	Dummy

Function

The $\sqrt{\ }$ of input value (E1) is output.
When the input value is negative, 0 is output.

(1) Data handling

(a) Input data

The input data (E1) is stored in ⓢ1.

ⓢ1+1,ⓢ1+0	(E1)H	(E1)L	···· Floating point real number

(b) Block memory

BW (output value) is stored in ⓓ1.
BB is not used.

ⓓ1+1,ⓓ1+0	(BW)H	(BW)L	···· Floating point real number

(c) Operation constant

This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Initial value setting
(S2)+1, (S2)+0	Output locate value	OLC	0 to 999999	0.0
(S2)+3, (S2)+2	Coefficient	K	0 to 999999	10.0

(2) Processing explanation

The following processing is executed.

BW=K x $\sqrt{\ }$ (E1)

However, when the K x $\sqrt{\ }$ (E1) ≤ OLC, BW=0.

In addition, when E1<0, BW=0.

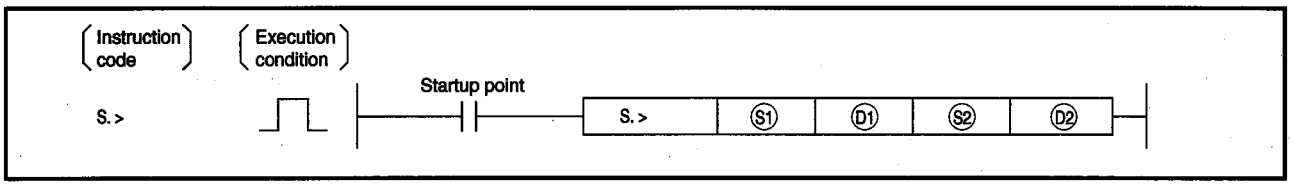
Error

- When an overflow occurs during operation. (Error code: 4100)

5.5 Comparison Operation Instructions

5.5.1 Compare Greater Than

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—



Setting data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Device name
ⓢ2	Operation constant header device	Device name
ⓓ2	Dummy device	Dummy

Function

This function compares the values of input values (E1, E2) and outputs the results.

(1) Data handling

(a) Input data

The input value (E1) and input value (E2) are stored in ⓢ1.

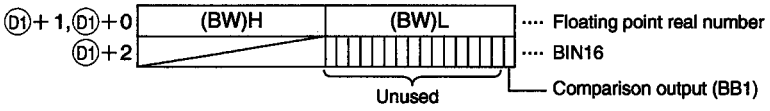
ⓢ1+1,ⓢ1+0	(E1)H	(E1)L	···· Input value (E1) } Floating point real number
ⓢ1+3,ⓢ1+2	(E2)H	(E2)L	.... Input value (E2) }

(b) Block memory

BW (output value) is stored in ⓓ1.

The same values are entered for output value (BW) and input value (E1).

ⓓ1+2's BB2 to BB16 are not used.



(c) Operation constant

This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Initial value setting
(S2)+1, (S2)+0	Set value	K	-999999 to 999999	0.0
(S2)+3, (S2)+2	Hysteresis	HS	0 to 999999	0.0

(2) Processing explanation

The following processing is executed.

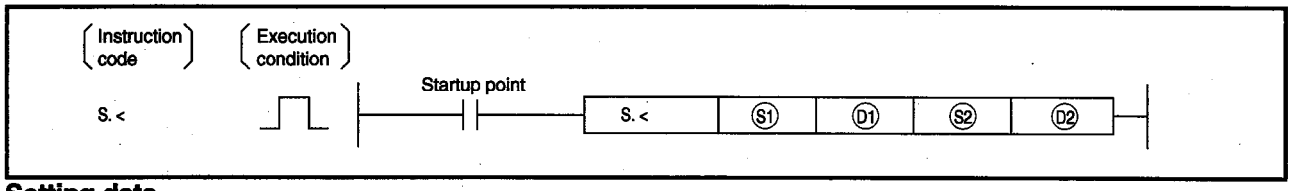
Conditions	BB1
E1>E2+K	1
E1≤E2+K-HS	0
E2+K-HS<E1≤E2+K	Same as previous time

Error

- When the hysteresis value is negative. (Error code: 4100)

5.5.2 Compare Less Than

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	O		—				—	—
ⓓ1	—	O		—				—	—
ⓢ2	—	O		—				—	—
ⓓ2	—	O		—				—	—



Setting data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Device name
ⓢ2	Operation constant header device	Device name
ⓓ2	Dummy device	Dummy

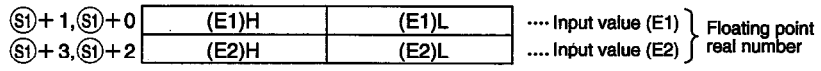
Function

This function compares the values of input values (E1, E2) and outputs the results.

(1) Data handling

(a) Input data

The input value (E1) and input value (E2) are stored in ⓢ1.

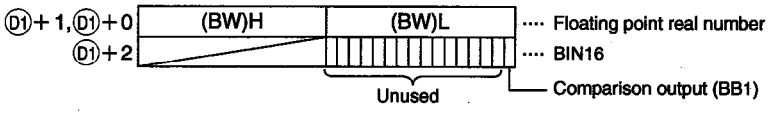


(b) Block memory

BW (output value) is stored in ⓓ1.

The same values are entered for output value (BW) and input value (E1).

ⓓ1+2's BB2 to BB16 are not used.



(c) Operation constant

This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Initial value setting
(S2)+1, (S2)+0	Set value	K	-999999 to 999999	0.0
(S2)+3, (S2)+2	Hysteresis	HS	0 to 999999	0.0

(2) Processing explanation

The following processing is executed.

Conditions	BB1
E1<E2+K	1
E1≥E2+K+HS	0
E2+K≤E1<E2+K+HS	Same as previous time

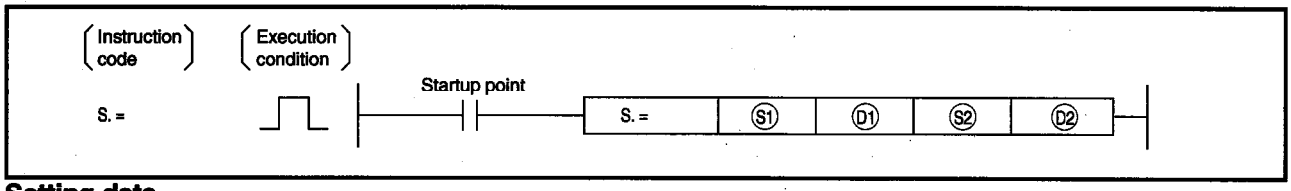
Becomes such that BW=E1. E1's contents are not changed.

Error

- When the hysteresis value is negative. (Error code: 4100)

5.5.3 Compare Equal Than

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	O		—				—	—
ⓓ1	—	O		—				—	—
ⓢ2	—	O		—				—	—
ⓓ2	—	O		—				—	—



Setting data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Device name
ⓢ2	Operation constant header device	Device name
ⓓ2	Dummy device	Dummy

Function

This function compares the values of input values (E1, E2) and outputs the results.

(1) Data handling

(a) Input data

The input value (E1) and input value (E2) are stored in ⓢ1.

ⓢ1+1, ⓢ1+0	(E1)H	(E1)L	···· Input value (E1)
ⓢ1+3, ⓢ1+2	(E2)H	(E2)L	.... Input value (E2)

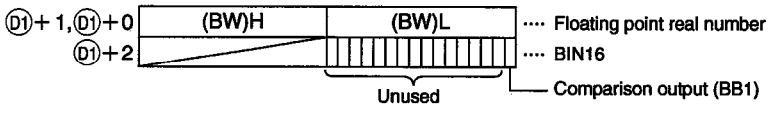
Floating point real number

(b) Block memory

BW (output value) is stored in ⓓ1.

The same values are entered for output value (BW) and input value (E1).

ⓓ1+2's BB2 to BB16 are not used.



(c) Operation constant

This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Initial value setting
(S2)+1, (S2)+0	Set value	K	-999999 to 999999	0.0

(2) Processing explanation

The following processing is executed.

Conditions	BB1
E1=E2+K	1
E1≠E2+K	0

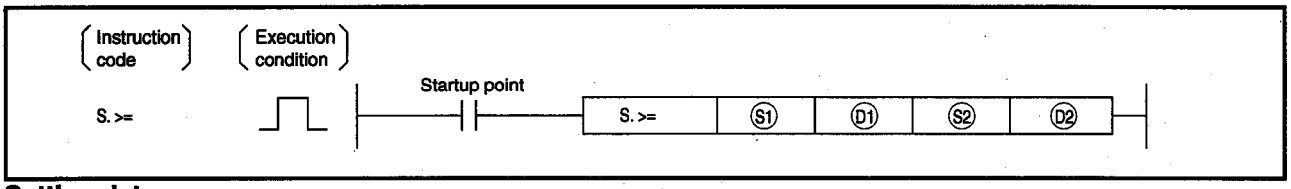
Becomes such that BW=E1. E1's contents are not changed.

Error

- When the hysteresis value is negative. (Error code: 4100)

5.5.4 Compare Greater Or Equal

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\N□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—



Setting data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Device name
ⓢ2	Operation constant header device	Device name
ⓓ2	Dummy device	Dummy

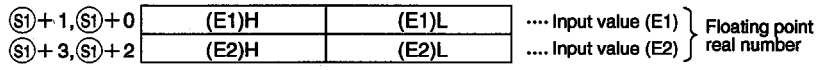
Function

This function compares the values of input values (E1, E2) and outputs the results.

(1) Data handling

(a) Input data

The input value (E1) and input value (E2) are stored in ⓢ1.

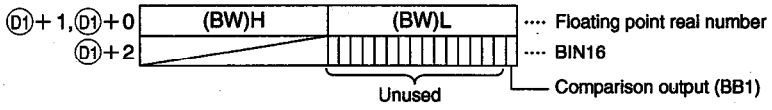


(b) Block memory

BW (output value) is stored in ⓓ1.

The same values are entered for output value (BW) and input value (E1).

ⓓ1+2's BB2 to BB16 are not used.



(c) Operation constant

This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Initial value setting
(S2)+1, (S2)+0	Set value	K	-999999 to 999999	0.0
(S2)+3, (S2)+2	Hysteresis	HS	0 to 999999	0.0

(2) Processing explanation

The following processing is executed.

Conditions	BB1
E1≥E2+K	1
E1<E2+K-HS	0
E2+K-HS≤E1<E2+K	Same as previous time

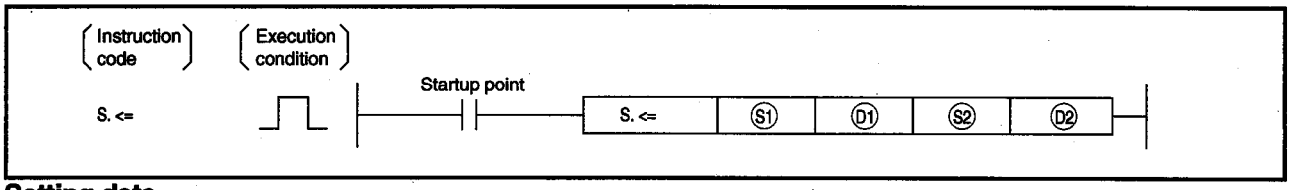
Becomes such that BW=E1. E1's contents are not changed.

Error

- When the hysteresis value is negative. (Error code: 4100)

5.5.5 Compare Less Or Equal

Setting data	Usable Devices								
	Internal devices (System, user)		File register	MELSECNET/10 direct J□\N□		Special function module U□\G□	Index register Zn	Constant	Other
	Bit	Word		Bit	Word				
ⓢ1	—	○		—				—	—
ⓓ1	—	○		—				—	—
ⓢ2	—	○		—				—	—
ⓓ2	—	○		—				—	—



Setting data

Setting data	Description	Data format
ⓢ1	Input block header address	Device name
ⓓ1	Block memory header device	Device name
ⓢ2	Operation constant header device	Device name
ⓓ2	Dummy device	Dummy

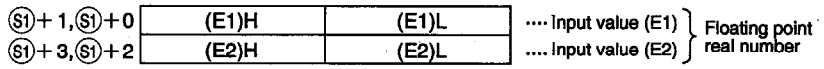
Function

This function compares the values of input values (E1, E2) and outputs the results.

(1) Data handling

(a) Input data

The input value (E1) and input value (E2) are stored in ⓢ1.

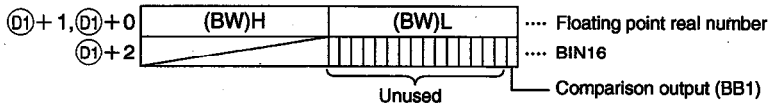


(b) Block memory

BW (output value) is stored in ⓓ1.

The same values are entered for output value (BW) and input value (E1).

ⓓ1+2's BB2 to BB16 are not used.



(b) Operation constant

This shows the contents of the operation constant set in (S2).

	Item name	Item	Settable range	Standard value setting
(S2)+1, (S2)+0	Set value	K	-999999 to 999999	0.0
(S2)+3, (S2)+2	Hysteresis	HS	0 to 999999	0.0

(2) Processing explanation

The following processing is executed.

Conditions	BB1
E1≤E2+K	1
E1>E2+K+HS	0
E2+K<E1≤E2+K+HS	Same as previous time

Becomes such that BW=E1. E1's contents are not changed.

Error

- When the hysteresis value is negative. (Error code: 4100)

6 Error Code

This section explains the contents and countermeasures for errors generated by the Q4ARCPU.

6.1 How to Read Error Codes

When an error occurs, the error code or error message can be read using the GPP function peripheral equipment.
For details regarding the GPP function peripheral equipment operation method, refer to the Peripheral Equipment SW□IVD-GPPQ Operating Manual (Online).

6.2 Error Code List

The process control instruction errors are as follows.

(1) Error occurs during an operation (Error No. : 4100)

(2) CPU internal error (Error No. : 1206)

In addition, when an operation error occurs the detail information is stored in SD1502 to SD1503.
(At times other than when an process control instruction function operation error occurs SD1502 is 0.)

SD1502: This stores the error code that occurs for the process control instruction function. (Refer to Table 1)

SD1503: This stores instruction processing Nos. 1 to 8 for when an error occurred. (Refer to Table 2)

Table 1 Error codes that occur in a process control instruction function

Error code	Error description	Cause
1	There is either a non-numeric or non-correct number.	There is a problem with the set data such as the operation constant, loop tag memory, loop tag past value memory, or execution time. (The set data must be checked.)
2	Symbol error (The number is negative)	
3	Number error (The number is outside the range).	
4	Integer range is exceeded	
5	Tried to divide by 0.	
6	An overflow occurred.	
16	DSP hardware error	CPU internal error
17	Command code error	
18	Data error	
19	Time-out	

Table 2 Instruction processing Nos. for which an error occurred

When the following instruction errors occur the process No. becomes 1.

Process No. / Instruction	1	2	3	4	5	6	7	8S
S. IN	Range check	Input limiter	Engineering value conversion	Digital filter				
S. OUT1	Input addition processing	Change rate upper and lower limit limiter	Reset windup	Output conversion				
S. OUT2		Change rate upper and lower limit limiter		Output conversion				
S. R	Execution time monitoring	Engineering value conversion	Trucking processing	Change rate limiter	Comparison operation			
S. PID	Execution time monitoring	SV setting processing	Trucking processing	Gain KP operation	PID operation	Deviation check		
S. PIDP	Execution time monitoring	SV setting processing	Trucking processing	Gain KP operation	PIDP operation	Deviation check	Conversion rate upper and lower limit limiter	Output conversion
S. SPI	Operation time monitoring	SV setting processing	Trucking processing	Gain KP operation	PI operation	Deviation check		
S. IPD	Execution time monitoring	SV setting processing	Trucking processing	Gain KP operation	IPD operation	Deviation check		
S. BPI	Execution time monitoring	SV setting processing	Trucking processing	Gain KP operation	BPI operation	Deviation check		
S. PHPL	Engineering value reverse conversion	Upper/lower limit value	Change rate check	Engineering value conversion	Loop stop			
S. ONF2	Execution time monitoring	SV setting processing	Trucking processing	MV correction	MV output	2 position on/off control		
S. ONF3	Execution time monitoring	SV setting processing	Trucking processing	MV correction	MV output	3 position on/off control		

Process No. / Instruction	1	2	3	4	5	6	7	8S
PGS	Operation constant check	SV count up	MVPGS operation	Output processing				
SEL	Engineering value conversion	X1, X2 selection	Engineering value reverse conversion	Upper and lower limit and change rate limiter	Output conversion	Trucking processing		

Key Points

When an error other than the application PID instruction has occurred, refer to the QnACPU Programming Manual (Common Instruction Edition).

Appendix

Appendix 1 Program Collection

Combining all previous instruction symbols using programming.

Appendix 1.1 Bit Store (BSTR)

(1) Function

The input signal e1 is output as is to y1 and BB1.

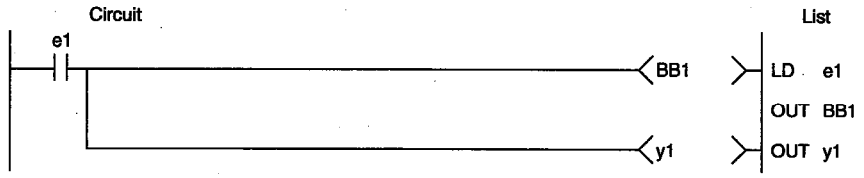
(2) Operation

The operation is output as follows.

e1	Output (y1)	Output (BB1)
0	0	0
1	1	1

(3) Development method

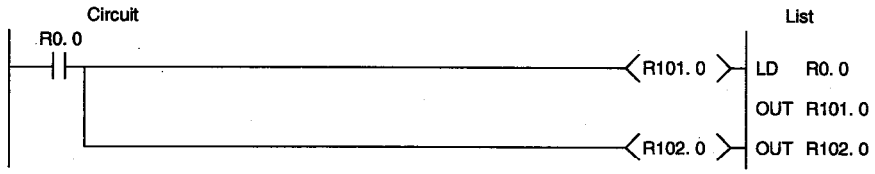
The following system was achieved.



(4) Example

Example program for the following arrangement.

Input bit (e1)	R0.0
Block bit (BB1)	R101.0
Output bit (y1)	R102.0



Appendix 1.2 Word Store (WSTR)

(1) Function

The input E1 information is output as is to Y1 and BW.

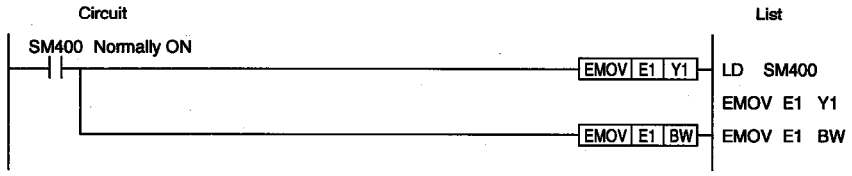
(2) Operation

Output is as follows.

Output (Y1)	Output (BW)
E1	E1

(3) Development method

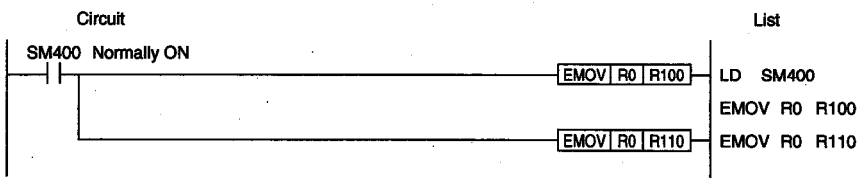
The following sequence was realized.



(4) Example

Example program for the following arrangement.

Input word (E1)	R0, R1
Output word (Y1)	R100, R101
Block memory (BW)	R110, R111



Appendix 1.3 Logical Product (AND)

(1) Function

Input e1 to e5 logical products are output to BB1.

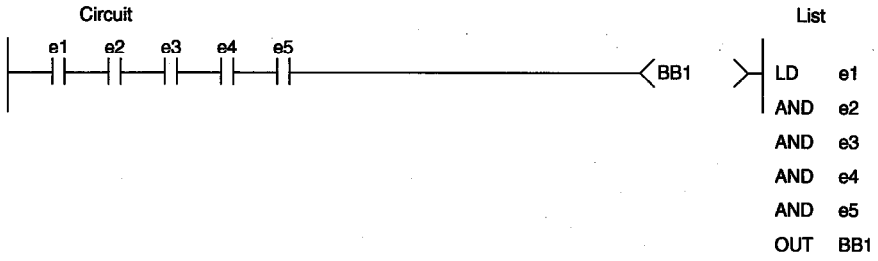
(2) Operation

The output is as follows. (The operation is only valid for the specified en.)

BB1=e1 x e2 x e3 x e4 x e5

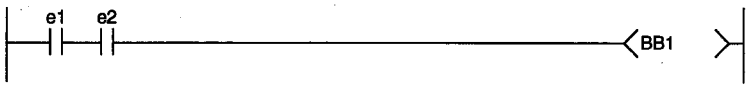
(3) Development method

The following sequence was achieved.



However, the following case is an exception so take due precautions. When only e1 is specified or when all is specified, BB1=e1.

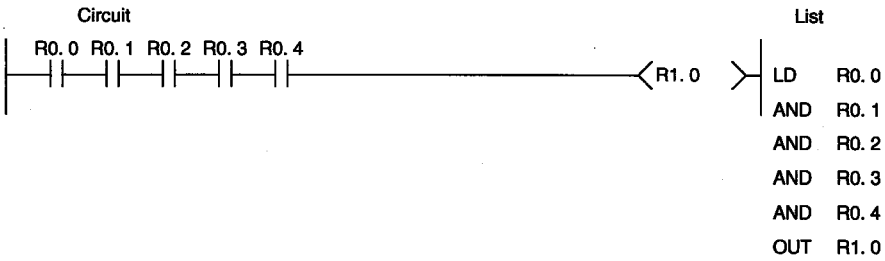
When only one of e2 to e5 is specified, BB1=e1 x en (en shows the specified e).



(4) Example

Example program for the following arrangements.

Output bit (e1, e2, e3, e4, e5)	R0.0, R0.1, R0.2, R0.3, R0.4
Block memory (BW)	R1.0



Appendix 1.4 Logical Sum (OR)

(1) Function

Input e1 to e5 logical sum is output to BB1.

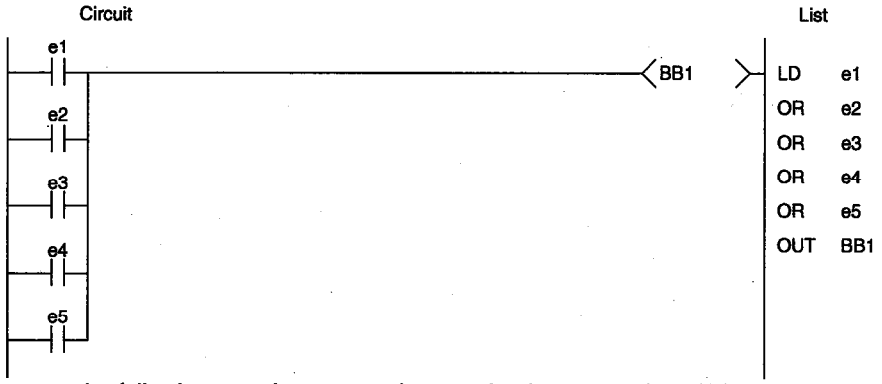
(2) Operation

The output is as follows. (This operation is only valid for the specified en.)

BB1=e1 + e2 + e3 + e4 + e5

(3) Development method

The following sequence was achieved.



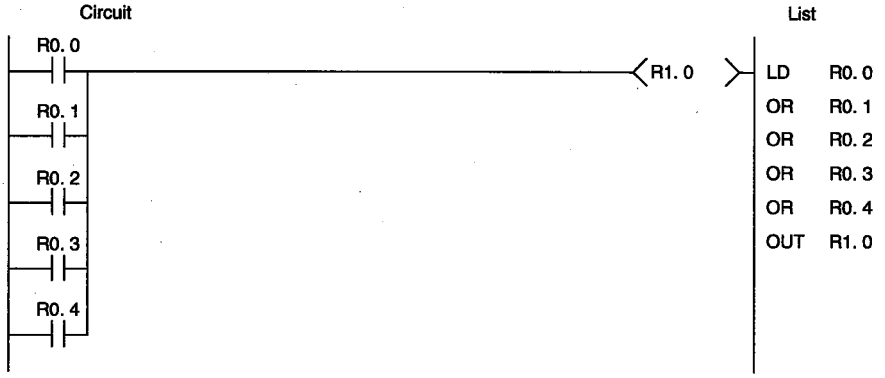
However, the following case is an exception so take due precautions. When only e1 is specified or when all is specified, BB1=e1.

When only one of e2 to e5 is specified, BB1=e1 + en (en shows the specified e).

(4) Example

Example program for the following arrangements.

Output bit (e1, e2, e3, e4, e5)	R0.0, R0.1, R0.2, R0.3, R0.4
Block memory (BW)	R1.0



Appendix 1.5 Not (NOT)

(1) Function

The input e1's not is taken and output to BB1.

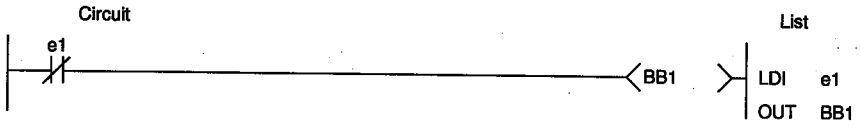
(2) Operation

The following is output.

BB1=NOT(e1)

(3) Development method

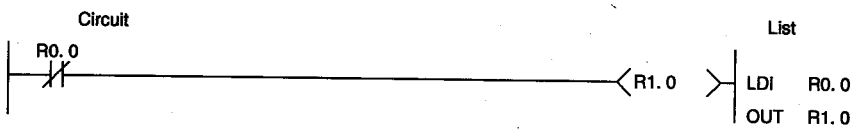
The following sequence was achieved.



(4) Example

The example program for the following arrangement.

Input bit (e1)	R0.0
Block memory (BW)	R1.0



Appendix 1.6 Exclusive Logical Sum (EOR)

(1) Function

Input e1 and e2 exclusive logical sums are output to BB1.

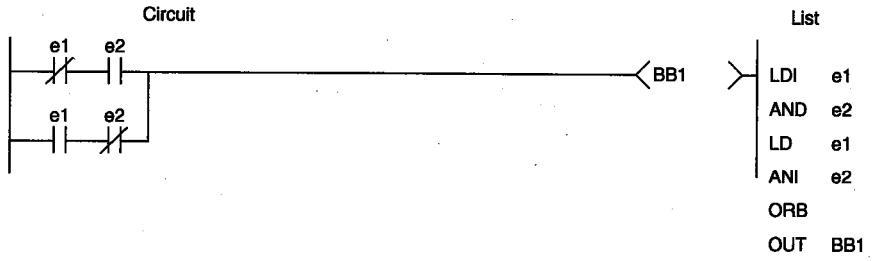
(2) Operation

The output is as follows.

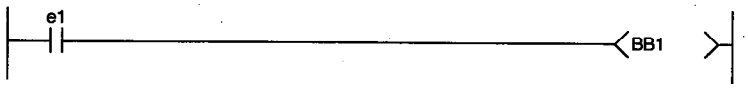
When either e1 or e2 is turned on and the other is off, BB1 is turned on.

(3) Development method

The following sequence was achieved.



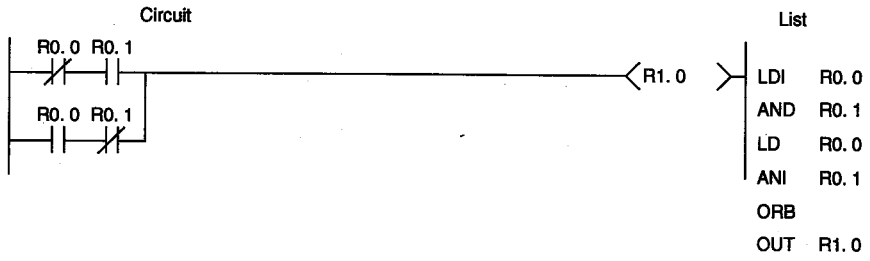
However, the following case is an exception so take due precautions. When only e1 is specified or when all is specified, BB1=e1.



(4) Example

Example program for the following arrangements.

Output bit (e1, e2)	R0.0, R0.1
Block memory (BB1)	R1.0



Appendix 1.7 Word Comparison (WCOMP)

(1) Function

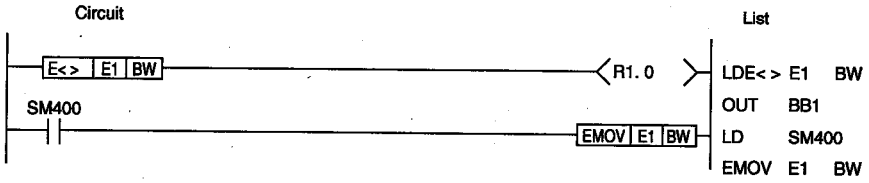
The current input value E1 and the previous value En-1 (data held in BW) are compared and the results are output to BB1.

(2) Operation

When En=En-1, BB1=0 En is output to BW.
When En=En-1, BB1=1.

(3) Development method

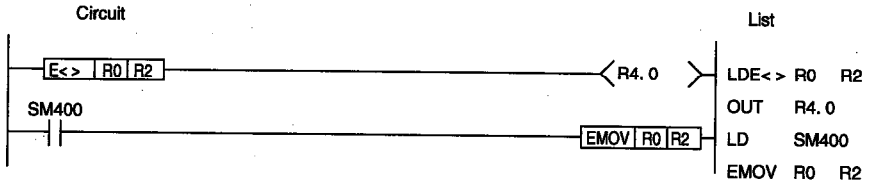
The following sequence was achieved.



(4) Example

The example program for the following arrangement.

Input bit (E1)	R0
Block memory (BW)	R2.0
(BB1)	R4.0



Appendix 1.8 Bit Comparison (BCOMP)

(1) Function

The current input value e1 and the previous value en-1 (data held in BB) are compared and the results are output to BB1.

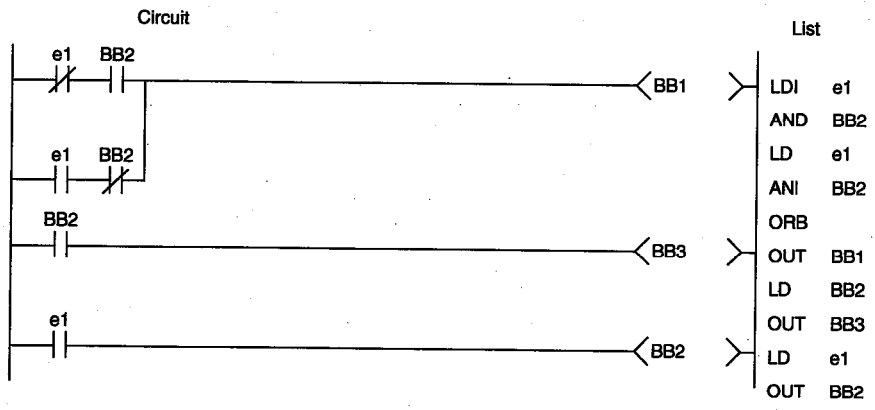
(2) Operation

When en=en-1, BB1=0 en is output to BB2.

When en≠en-1, BB1=1 en-1 is output to BB3.

(3) Development method

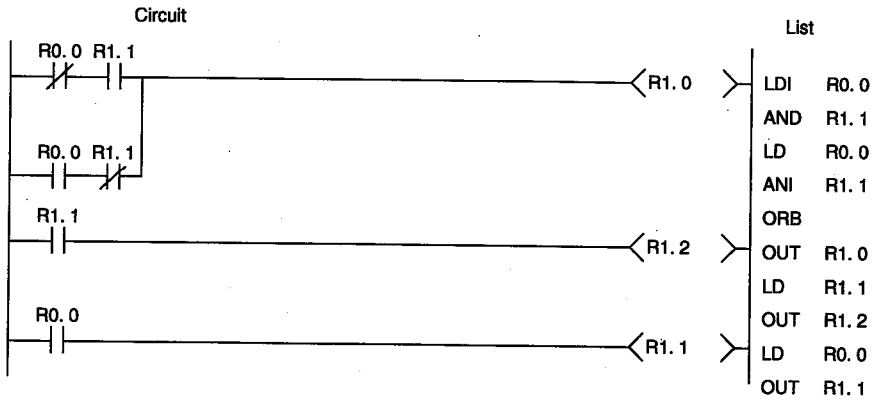
The following sequence was achieved.



(4) Example

Example program for the following arrangement.

Input bit (e1)	R0.0
Block memory (BB)	R1.0 to R1.2

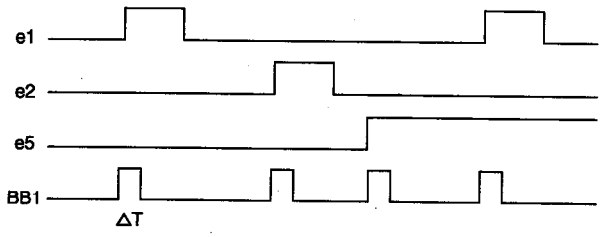


Appendix 1.9 Pulse Cut (PLS)

(1) Function

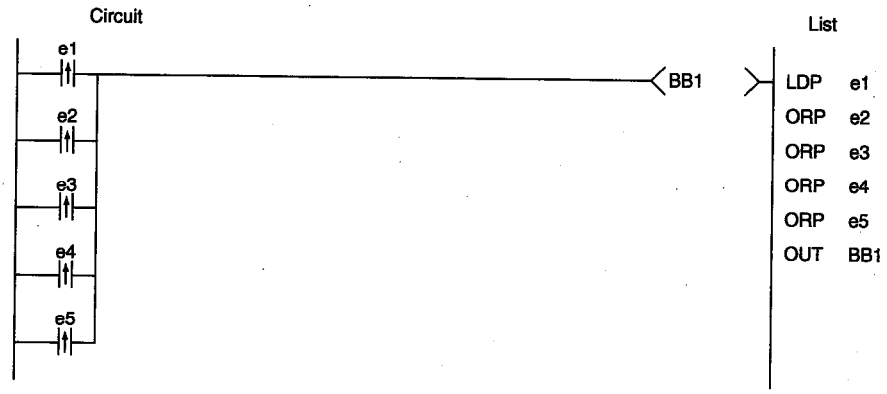
When only one time is captured when the current input value en is started up, then BB1=1 is output.

(2) Operation



(3) Development method

The following sequence was achieved.
(en is stored in the work buffer device.)

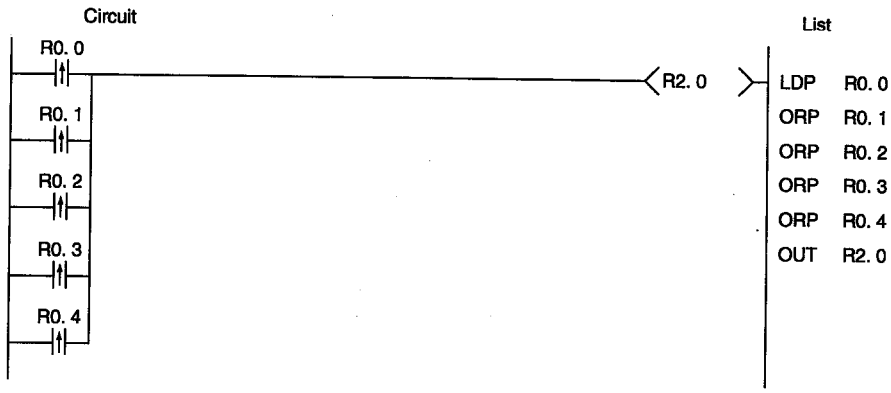


Note: Only the en being used is recorded.

(4) Example

Example program for the following arrangement.

Input (e1)	R0.0 to R0.4
Block memory (BB1)	R2.0



Appendix 1.10 Flip Flop (FF)

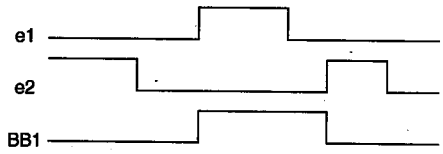
(1) Function

This function conducts the RS flip flop operation.

(2) Operation

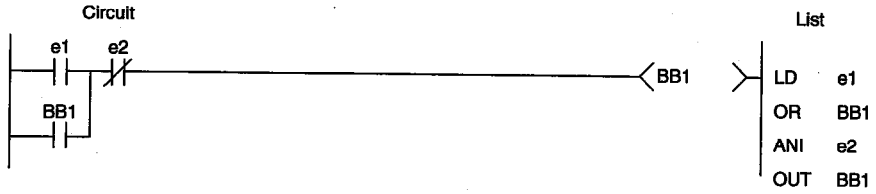
Operate as follows. (The table shows the BB1 value)

e1/e2	0	1
0	Hold	0
1	1	0



(3) Development method

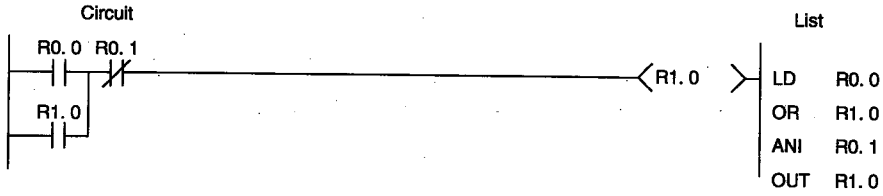
The following sequence was achieved.



(4) Example

Example program for the following arrangement.

Input (e1, e2)	R0.0, R0.1
Block memory (BB)	R1.0



Appendix 1.11 Majority (NM)

(1) Function

The most numerous of input values e1 to e5 is output.

(2) Operation

The input value en (n=1 to 5) status is viewed and if there is the same number then BB1 will be made to equal hold.

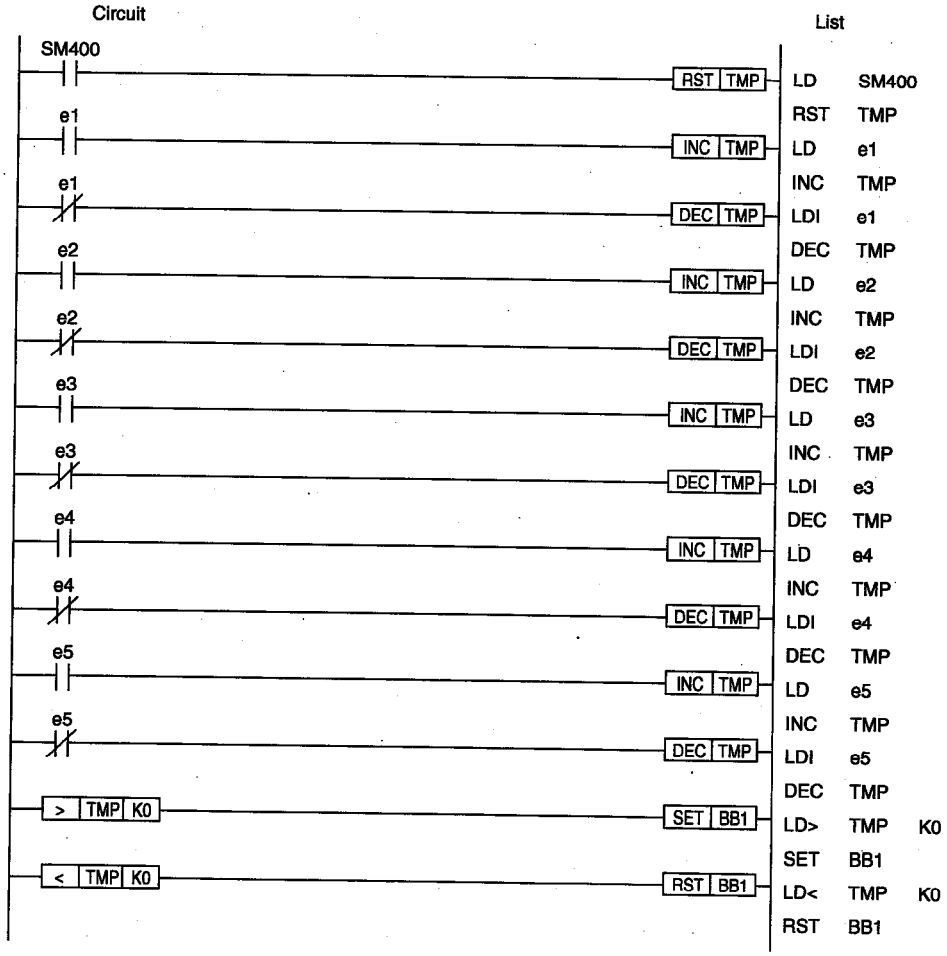
If "1" is the most, BB1=1

If "0" is the most, BB1=0

(3) Development method

The following sequence was achieve.

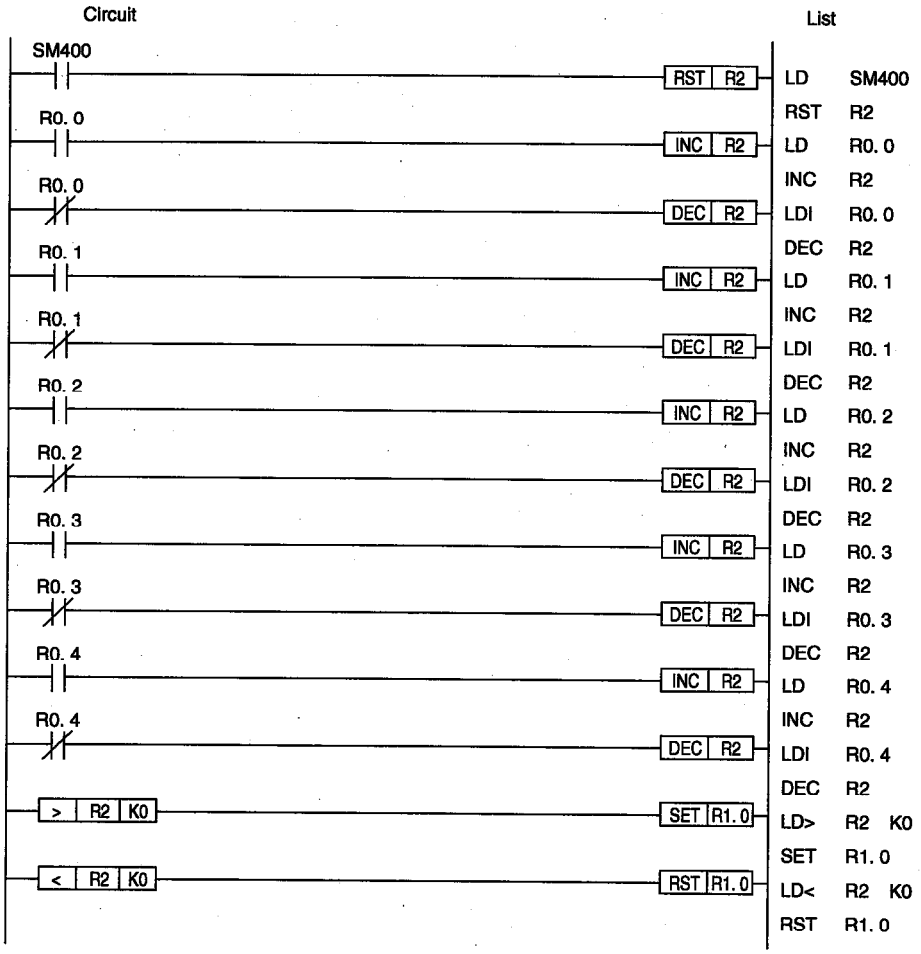
(Temporary work devices (TMP) require 1 word, so take due precautions.)



(4) Example

Example program for the following arrangement.

Input (en)	R0.0 to R0.4
Block memory (BB)	R1.0
Temporary device (TMP)	R2



Appendix 1.12 Mode Switching (MCHG)

(1) Function

This function changes the loop tag memory MODE.
In addition, the input e1 value is output to block memory (BW).

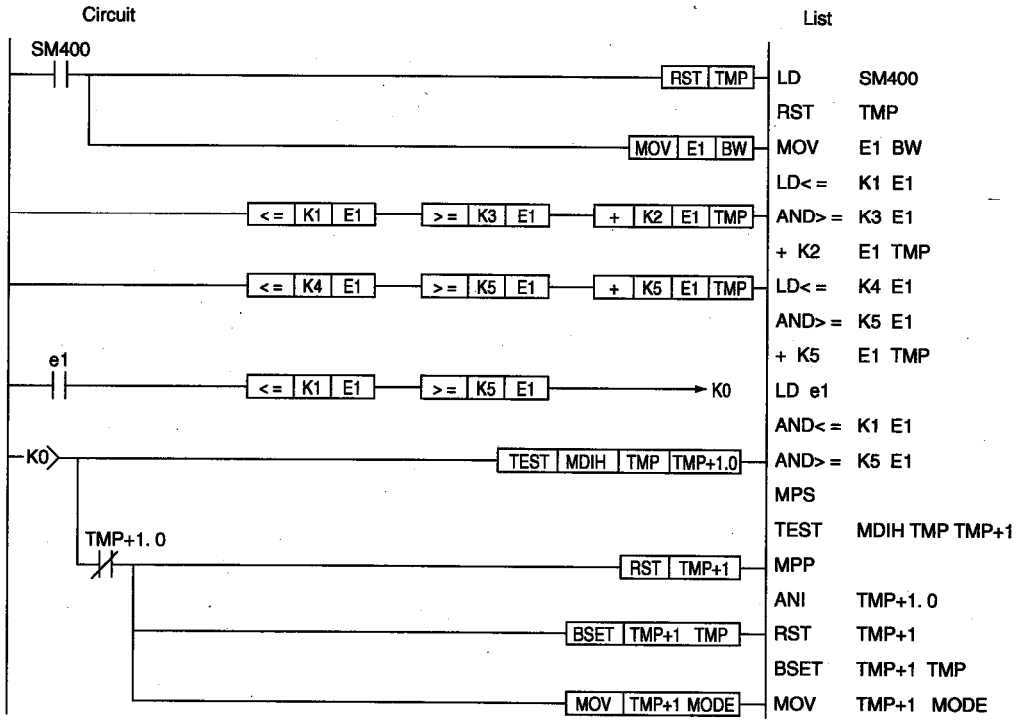
(2) Operation

When e1=1, the mode is changed in accordance with the mode E1 contents.
However, when the bit corresponding to MDIH is on (when mode change is prohibited), no change is conducted.

E1						5	4				3	2	1			
MODE	0	0	0	0	0	CSV	CMV				CAS	AUT	MAN			
MDIH	0	0	0	0	0	CSVI	CMVI				CASI	AUTI	MANI			

(3) Development method

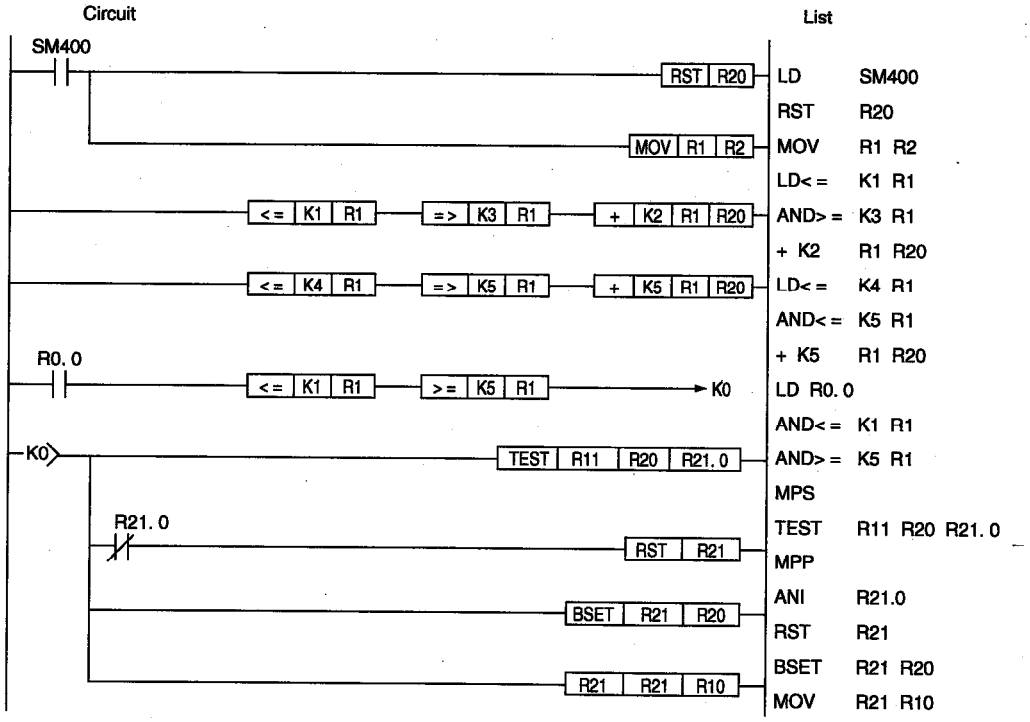
The following sequence was achieved.
Temporary work devices (TMP) require true words, so take appropriate precautions.



(4) Example

Example program for the following arrangement.

Input (e1)	R0.0
(E1)	R1
Block memory (BW)	R2
MODE	R10
MDIH	R11
TMP	R20, R21



Appendix 1.13 Mode Change Prohibition (MINH)

(1) Function

This function sets and resets the MDIH using the e1 value.
In addition the e1 value is output to block memory (BW).

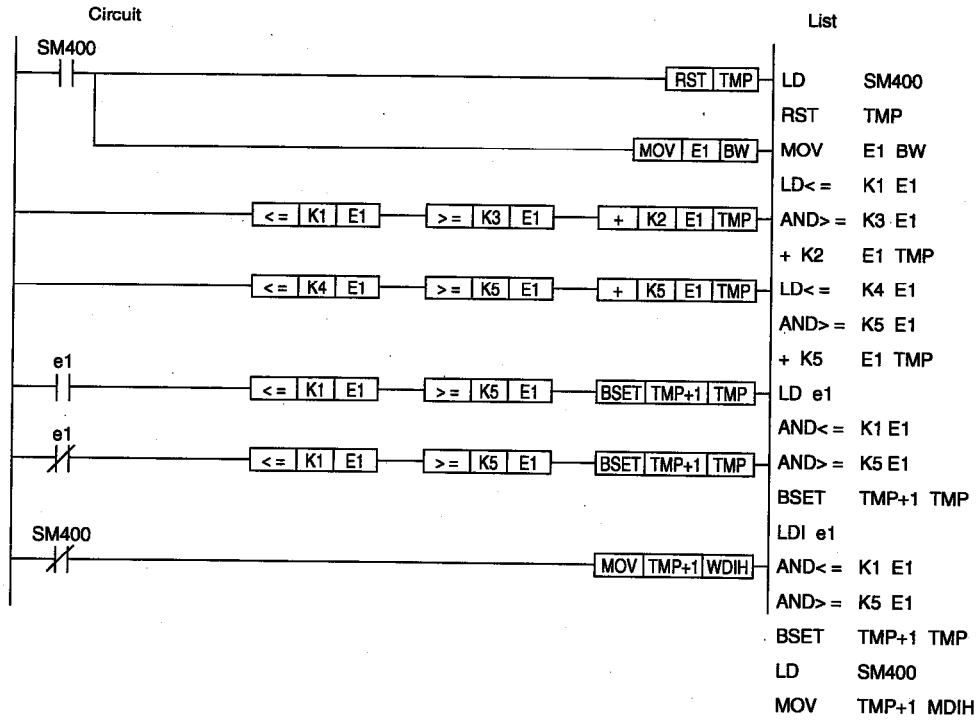
(2) Operation

When e1=1, the MDIH is set in accordance with the mode e1 contents. (mode change prohibited)
When e1=0, the MDIH is reset in accordance with the mode E1 contents. (mode change prohibition cancel)

E1						5	4				3	2	1			
MDIH	0	0	0	0	0	CSVI	CMVI				CASI	AUTI	MANI			

(3) Development method

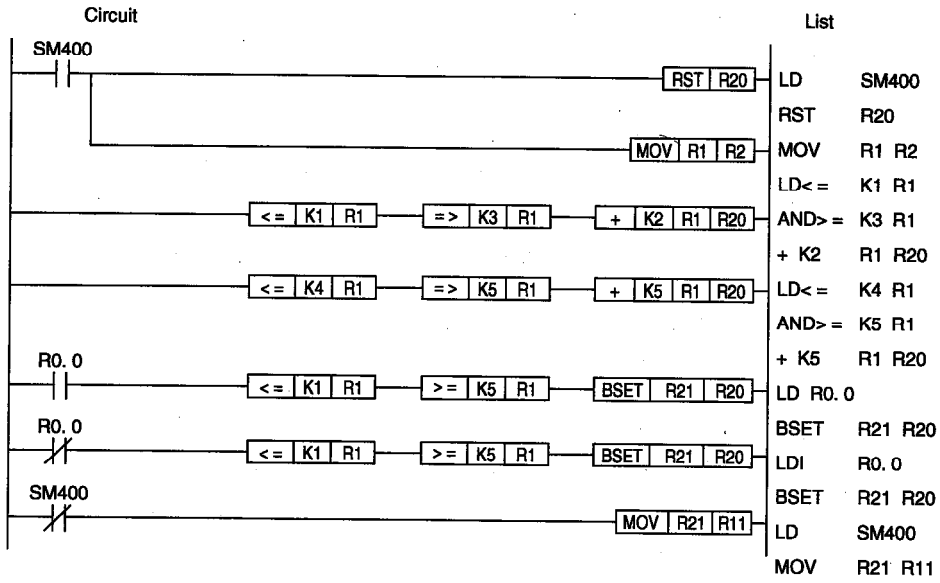
The following sequence was achieved.
Temporary work devices (TMP) require true words, so take appropriate precautions.



(4) Example

Example program for the following arrangement.

Input (e1)	R0.0
(E1)	R1
Block memory (BW)	R2
MODI	R11
TMP	R20, R21



Appendix 1.14 Signal Generator (SET)

(1) Function

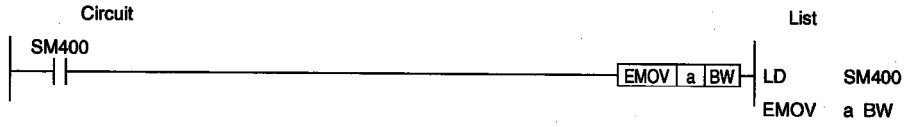
The output setting value a is output as is.

(2) Operation

BW=a

(3) Development method

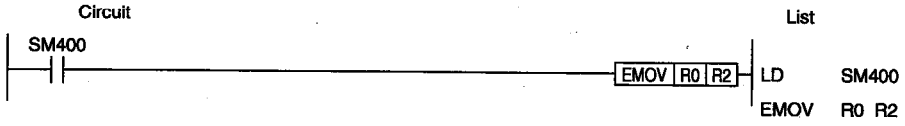
The following sequence was achieved.



(4) Example

Example program for the following arrangement.

Output setting value (a)	R0, R1
Block memory (BW)	R2, R3



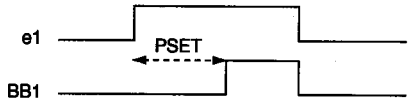
Appendix 1.15 On Delay Timer

(1) unction

From the time that input (e1) changes from 0 to 1 until after the preset time T seconds, the output is changed from 0 to 1.

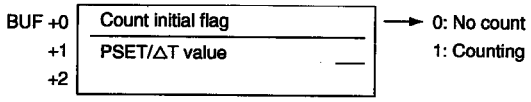
(2) Operation

When e1=0→1, BB1=1 after T seconds.
When e1=0, BB1=0.



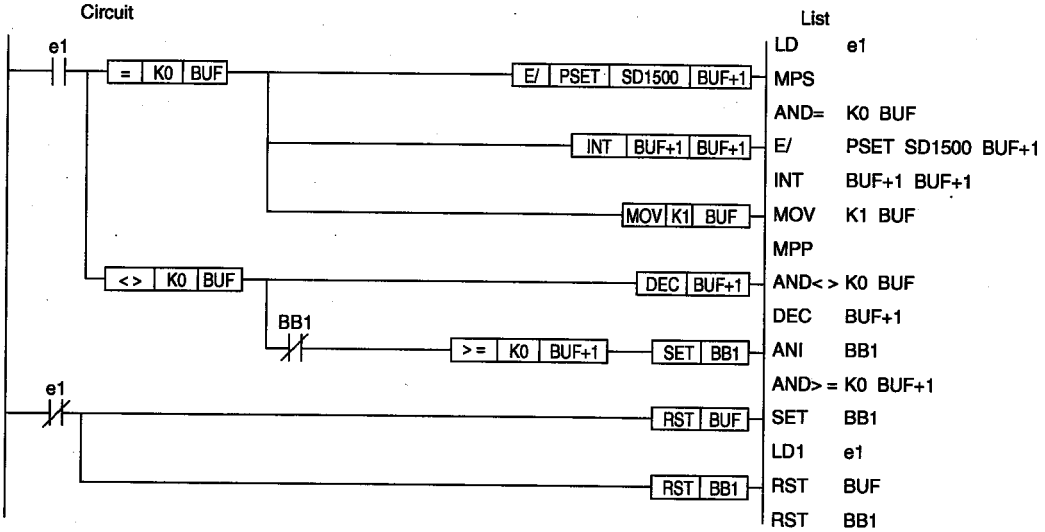
- The preset time is stored beforehand in PSET.
  (Second units, floating)

- The execution time (ΔT) is stored beforehand in SD1500.
  (Second units, floating)
- The following temporary register is used for timer processing.
  (Set the initial value status to 0.)



(3) Development method

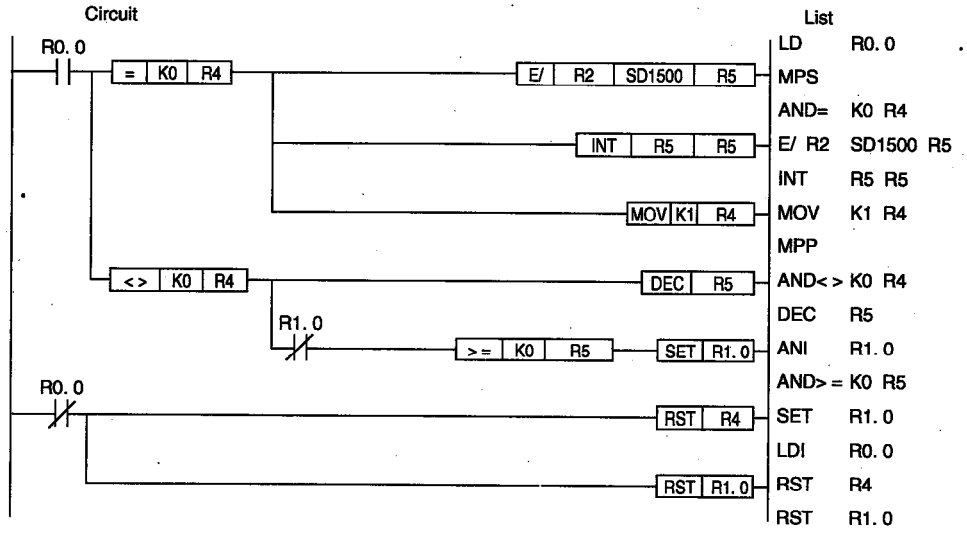
The following sequence was achieved.



(4) Example

Example program for the following arrangement.

Input (e1)	R0.0
Output (BB1)	R1
Preset value (BW)	R2, R3
Buffer (BUF)	R4 to R6



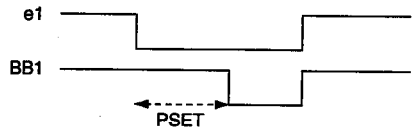
Appendix 1.16 Off Delay Timer (OFTMR)

(1) Function

From the time that input (e1) changes from 1 to 0 until after the preset time T seconds, the output is changed from 1 to 0.

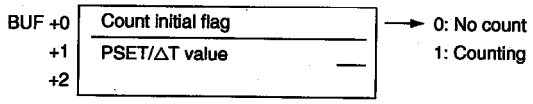
(2) Operation

When e1=1→0, BB1=0 after T seconds.
When e1=0, BB1=1.



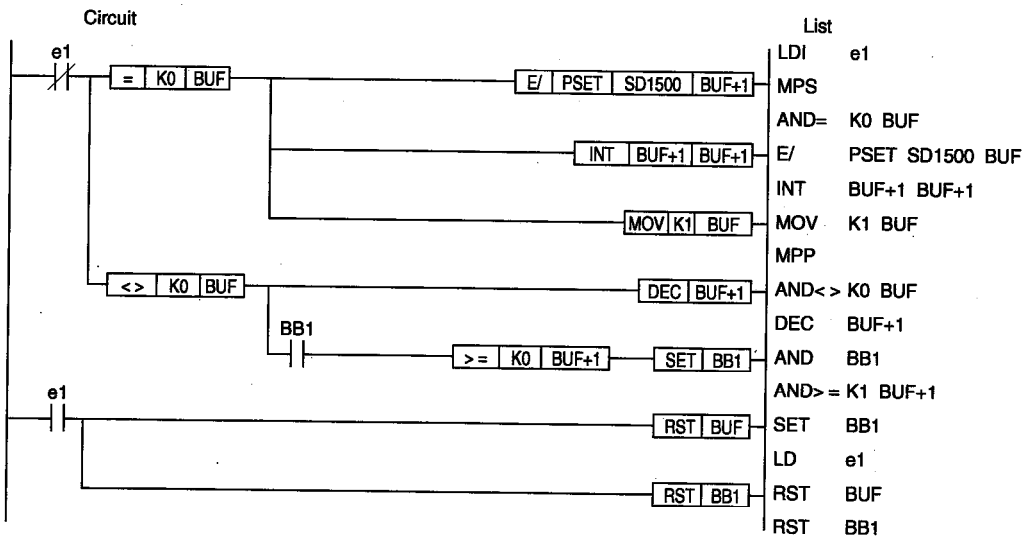
- The preset time is stored beforehand in PSET.
  (Second units, floating)

- The execution time (ΔT) is stored beforehand in SD1500.
  (Second units, floating)
- The following temporary register is used for timer processing.
  (Set the initial value status to 0.)



(3) Development method

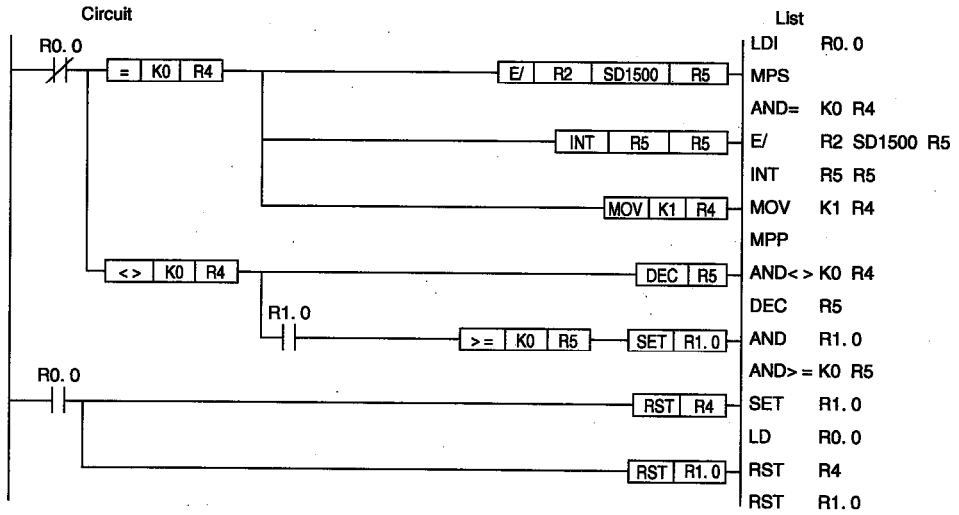
The following sequence was achieved. <D>



(4) Example

Example program for the following arrangement.

Input (e1)	R0.0
Output (BB1)	R1.0
Preset value (BW)	R2, R3
Buffer (BUF)	R4 to R6



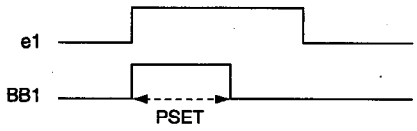
Appendix 1.17 One Shot Timer (STTMR)

(1) Function

From the time that input (e1) changes from 0 to 1 until after the preset time T seconds, the output becomes 1.

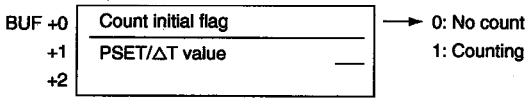
(2) Operation

When e1=0→1, BB1=1 after T seconds.
When e1=0, BB1=0.



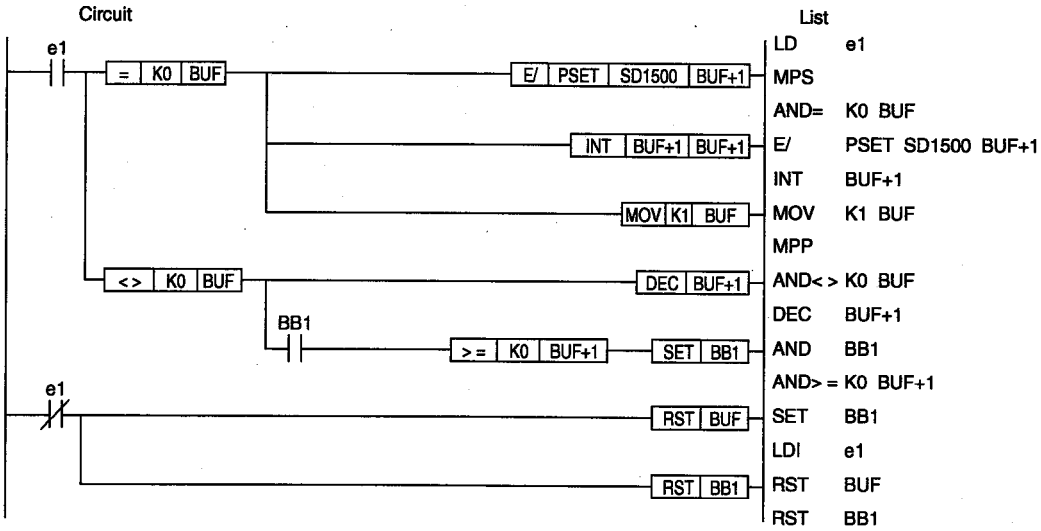
- The preset time is stored beforehand in PSET.
  (Second units, floating)

- The execution time (ΔT) is stored beforehand in SD1500.
  (Second units, floating)
- The following temporary register is used for timer processing.
  (Set the initial value status to 0.)



(3) Development method

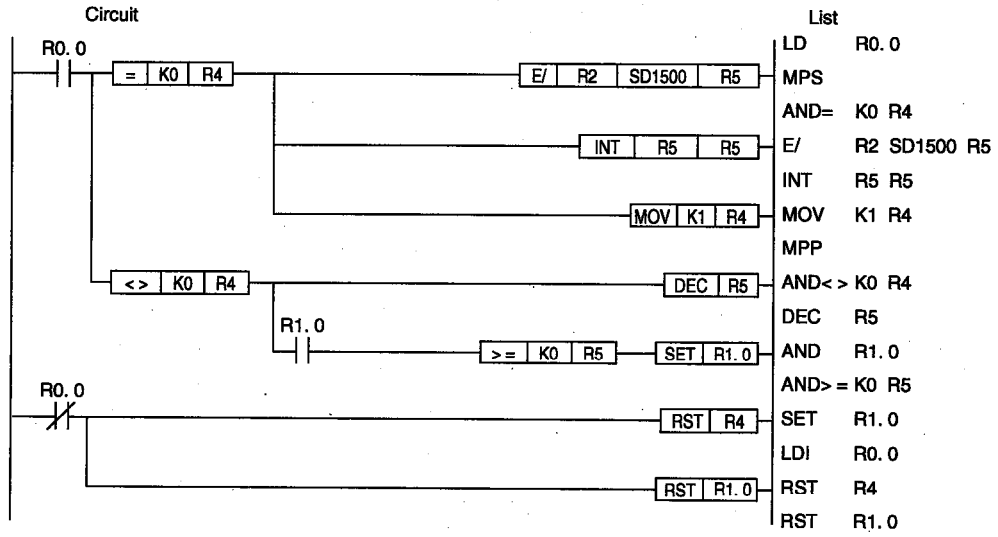
The following sequence was achieved. <D>



(4) Example

Example program for the following arrangement.

Input (e1)	R0.0
Output (BB1)	R1.0
Preset value (BW)	R2, R3
Buffer (BUF)	R4 to R6



Appendix 1.18 Analog Switch (ASW)

(1) Function

The input value E1 and E2 are selected using the switching signal e1 status and then output.

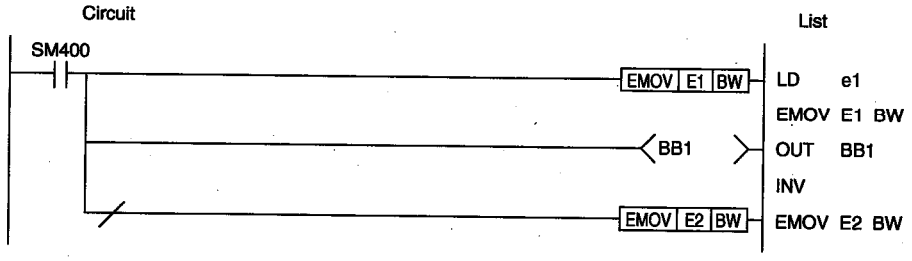
(2) Operation

The following is output.

e1	Output (BW)	Output (BB)
0	E1	0
1	E2	1

(3) Development method

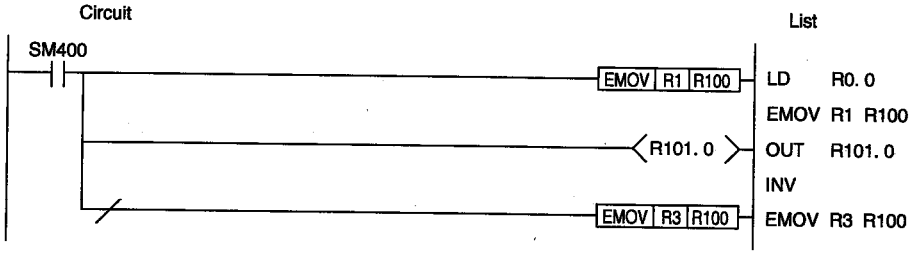
The following sequence was achieved.



(4) Example

Example program for the following arrangement.

Input bit (e1)	R0.0
Input word (E1)	R1, R2
Input word (E1)	R3, R4
Block memory (BW)	R100, R101
Block bit (BB1)	R101.0



Appendix 2 Loop Tag Memory List

The highlighted areas are recorded in the Application PID Instruction Edition.

Loop Tag Memory List

Instruction used	Offset	Item	Name	Setting/storage range	Unit	Data storage	
						SPID	SSPI
	+0	—	—	—	—	—	—
	1	MODE*1	Operation mode	0 to FFFF$_H$	—	U	U
	2	—	—	—	—	—	—
	3	ALM*1	Alarm	0 to FFFF$_H$	—	O/U	O/U
	4	INH*1	Alarm detection prohibition	0 to FFFF$_H$	—	U	U
	5	—	—	—	—	—	—
	6	—	—	—	—	—	—
	7	—	—	—	—	—	—
	8	—	—	—	—	—	—
	9	—	—	—	—	—	—
S. PHPL	10	PV	Process value	-5 to 105	%	O	O
	11						
S. OUT1	12	MV	Manipulated value	-10 to 110	%	O	O
	13						
S.PID/S. SPI	14	SV	Set value	(RL) to (RH)	—	O	O
	15			-5 to 105	%	U	U
S.PID/S. SPI	16	DV	Deviation	-110 to 110	%	O	O
	17						
S. OUT1	18	MH	MV upper limit value	-10 to 110	%	U	U
	19						
S. OUT1	20	ML	MV lower limit value	-10 to 110	%	U	U
	21						
S. PHPL	22	RH	Engineering value upper limit	-999999 to 999999	—	U	U
	23						
S. PHPL	24	RL	Engineering value lower limit	-999999 to 999999	—	U	U
	25						
S. PHPL	26	PH	Upper limit alarm value	(RL) to (RH) (PL)<(PH)	—	U	U
	27						
S. PHPL	28	PL	Lower limit alarm value	(RL) to (RH) (PL)<(PH)	—	U	U
	29						
S. PHPL	30	HH	Upper upper limit alarm value	(RL) to (RH) (PH)≤(HH)	—	U	U
	31						
S. PHPL	32	LL	Lower lower limit alarm value	(RL) to (RH) (LL)≤(PL)	—	U	U
	33						
	34	—	—	—	—	—	—
	35						
	36	—	—	—	—	—	—
	37						
S. IN	38	α	Filter coefficient	0 to 1	—	U	U
	39						
S. PHPL	40	HS	Upper lower limit alarm hysteresis	0 to 999999	—	U	U
	41						
S. PHPL	42	CTIM	Change rate alarm check time	0 to 999999	sec	U	U
	43						

Instruction used	Offset	Item	Name	Setting/storage range	Unit	Data storage	
						SPID	SSPI
S. PHPL	44 45	DPL	Change rate alarm value	0 to 100	—	U	U
S. PID/S. SPI	46 47	CT/ST	Control time/operation time	0 to 999999	sec	U Set CT	U Set CT
S. OUT1	48 49	DML	MV change rate	0 to 100	%	U	U
S. PID/S. SPI	50 51	DVL	Change rate control value	0 to 100	%	U	U
S. PID/S. SPI	52 53	P	Gain	0 to 999999		U	U
S. PID/S. SPI S. OUT1/S. OUT1	54 55	I*2	Integral time	0 to 999999	sec	U	U
S. PID/S. SPI	56 57	D/STHT	Derivative time, sample time	0 to 999999	sec	U (Set D)	U (Set STHT)
S. PID/S. SPI	58 59	GW	Gap width	0 to 100	%	U	U
S. PID/S. SPI	60 61	GG	Gap gain	0 to 999999	—	U	U

Key Points

- The *1MODE, ALM, and INH are used in common for all instruction.
- The *2's 1 uses the same value for the S.PID instruction and S.OUT instruction and for the S.SPI instruction and S.OUT1 instruction.

Loop Tag Memory List

Instruction used	Offset	Item	Name	Setting/storage range	Unit	Data storage	
						SIPD	SBPI
	+0	—	—	—	—	—	—
	1	MODE*1	Operation mode	0 to FFFF$_H$	—	U	U
	2	—	—	—	—	—	—
	3	ALM*1	Alarm	0 to FFFF$_H$	—	O/U	O/U
	4	INH*1	Alarm detection prohibition	0 to FFFF$_H$	—	U	U
	5	—	—	—	—	—	—
	6	—	—	—	—	—	—
	7	—	—	—	—	—	—
	8	—	—	—	—	—	—
	9	—	—	—	—	—	—
S. PHPL	10	PV	Process value	-5 to 105	%	O	O
	11						
S. OUT1	12	MV	Manipulated value	-10 to 110	%	O	O
	13						
S.IPD/S. BPI	14	SV	Set value	(RL) to (RH)	—	O	O
	15			-5 to 105	%	U	U
S.IPD/S. BPI	16	DV	Deviation	-110 to 110	%	O	O
	17						
S. OUT1	18	MH	MV upper limit value	-10 to 110	%	U	U
	19						
S. OUT1	20	ML	MV lower limit value	-10 to 110	%	U	U
	21						
S. PHPL	22	RH	Engineering value upper limit	-999999 to 999999	—	U	U
	23						
S. PHPL	24	RL	Engineering value lower limit	-999999 to 999999	—	U	U
	25						
S. PHPL	26	PH	Upper limit alarm value	(RL) to (RH) (PL)<(PH)	—	U	U
	27						
S. PHPL	28	PL	Lower limit alarm value	(RL) to (RH) (PL)<(PH)	—	U	U
	29						
S. PHPL	30	HH	Upper upper limit alarm value	(RL) to (RH) (PH)≤(HH)	—	U	U
	31						
S. PHPL	32	LL	Lower lower limit alarm value	(RL) to (RH) (LL)≤(PL)	—	U	U
	33						
	34	—	—	—	—	—	—
	35						
	36	—	—	—	—	—	—
	37						
S. IN	38	α	Filter coefficient	0 to 1	—	U	U
	39						
S. PHPL	40	HS	Upper lower limit alarm hysteresis	0 to 999999	—	U	U
	41						
S. PHPL	42	CTIM	Change rate alarm check time	0 to 999999	sec	U	U
	43						
S. PHPL	44	DPL	Change rate alarm value	0 to 100	—	U	U
	45						
S. IPD/S. BPI	46	CT/ST	Control time/operation time	0 to 999999	sec	U (Set CT)	U (Set CT)
	47						

Instruction used	Offset	Item	Name	Setting/storage range	Unit	Data storage	
						SIPD	SBPI
S. OUT1	48 49	DML	MV change rate	0 to 100	%	U	U
S.IPD/S. BPI	50 51	DVL	Change rate control value	0 to 100	%	U	U
S.IPD/S. BPI	52 53	P	Gain	0 to 999999		U	U
S.IPD/S. BPI S. OUT1/S. OUT1	54 55	I*2	Integral time	0 to 999999	sec	U	U
S.IPD/S. BPI	56 57	D/SDV	Derivative time, DV total value	0 to 999999	sec	U (Set D)	U (Set SDV)
S.IPD/S. BPI	58 59	GW	Gap width	0 to 100	%	U	U
S.IPD/S. BPI	60 61	GG	Gap gain	0 to 999999	—	U	U

Key Points

- The *1MODE, ALM, and INH are used in common for all instruction.
- The *2's 1 uses the same value for the S.IPD instruction and S.OUT instruction and for the S.BPI instruction and S.OUT1 instruction.

Loop Tag Memory List

Instruction used	Offset	Item	Name	Setting/storage range	Unit	Data storage	
						SMOUT	SMONI
	+0	—	—	—	—	—	—
	1	MODE*1	Operation mode	0 to $FFFF_H$	—	U	U
	2	—	—	—	—	—	—
	3	ALM*1	Alarm	0 to $FFFF_H$	—	O/U	O/U
	4	INH*1	Alarm detection prohibition	0 to $FFFF_H$	—	U	U
	5	—	—	—	—	—	—
	6	—	—	—	—	—	—
	7	—	—	—	—	—	—
	8	—	—	—	—	—	—
	9	—	—	—	—	—	—
S. PHPL	10	PV	Process value	-5 to 105	%	—	O
	11						
S. MOUT	12	MV	Manipulated value	-10 to 110	%	O	—
	13						
	14						
	15						
	16					—	—
	17						
	18						—
	19						
	20						—
	21						
S. PHPL	22	RH	Engineering value upper limit	-999999 to 999999	—	—	U
	23						
S. PHPL	24	RL	Engineering value lower limit	-999999 to 999999	—	—	U
	25						
S. PHPL	26	PH	Upper limit alarm value	(RL) to (RH) (PL)<(PH)	—	—	U
	27						
S. PHPL	28	PL	Lower limit alarm value	(RL) to (RH) (PL)<(PH)	—	—	U
	29						
S. PHPL	30	HH	Upper upper limit alarm value	(RL) to (RH) (PH)≤(HH)	—	—	U
	31						
S. PHPL	32	LL	Lower lower limit alarm value	(RL) to (RH) (LL)≤(PL)	—	—	U
	33						
	34	—	—	—	—	—	—
	35						
	36	—	—	—	—	—	—
	37						
S. IN	38	α	Filter coefficient	0 to 1	—	—	U
	39						
S. PHPL	40	HS	Upper lower limit alarm hysteresis	0 to 999999	—	—	U
	41						
S. PHPL	42	CTIM	Change rate alarm check time	0 to 999999	sec	—	U
	43						
S. PHPL	44	DPL	Change rate alarm value	0 to 100	—	—	U
	45						
	46					—	—
	47						

Instruction used	Offset	Item	Name	Setting/storage range	Unit	Data storage	
						SMOUT	SMONI
	48 49					—	—
	50 51					—	—
	52 53					—	—
	54 55					—	—
	56 57					—	—
	58 59					—	—
	60 61					—	—

Key Points

- The *1MODE, ALM, and INH are used in common for all instruction.

Loop Tag Memory List

Instruction used	Offset	Item	Name	Setting/storage range	Unit	Data storage	
						SMVM	SPIDP
	+0	—	—	—	—	—	—
	1	MODE*1	Operation mode	0 to FFFF$_H$	—	U	U
	2	—	—	—	—	—	—
	3	ALM*1	Alarm	0 to FFFF$_H$	—	O/U	O/U
	4	INH*1	Alarm detection prohibition	0 to FFFF$_H$	—	U	U
	5	—	—	—	—	—	—
	6	—	—	—	—	—	—
	7	—	—	—	—	—	—
	8	—	—	—	—	—	—
	9	—	—	—	—	—	—
S. PHPL	10	PV	Process value	-5 to 105	%	O	O
	11						
S. MOUT/S. PIDP	12	MV	Manipulated value	-10 to 110	%	O	O
	13						
S. PIDP	14	SV	Set value	(RL) to (RH)	—	—	O
	15			-5 to 105	%	—	U
S. PIDP	16	DV	Deviation	-110 to 110	%	—	O
	17						
S. PIDP	18	MH	MV upper limit value	-10 to 110	%	U	U
	19						
S. PIDP	20	ML	MV lower limit value	-10 to 110	%	U	U
	21						
S. PHPL	22	RH	Engineering value upper limit	-999999 to 999999	—	U	U
	23						
S. PHPL	24	RL	Engineering value lower limit	-999999 to 999999	—	U	U
	25						
S. PHPL	26	PH	Upper limit alarm value	(RL) to (RH) (PL)<(PH)	—	U	U
	27						
S. PHPL	28	PL	Lower limit alarm value	(RL) to (RH) (PL)<(PH)	—	U	U
	29						
S. PHPL	30	HH	Upper upper limit alarm value	(RL) to (RH) (PH)≤(HH)	—	U	U
	31						
S. PHPL	32	LL	Lower lower limit alarm value	(RL) to (RH) (LL)≤(PL)	—	U	U
	33						
	34	—	—	—	—	—	—
	35						
	36	—	—	—	—	—	—
	37						
S. IN	38	α	Filter coefficient	0 to 1	—	U	U
	39						
S. PHPL	40	HS	Upper lower limit alarm hysteresis	0 to 999999	—	U	U
	41						
S. PHPL	42	CTIM	Change rate alarm check time	0 to 999999	sec	U	U
	43						
S. PHPL	44	DPL	Change rate alarm value	0 to 100	—	U	U
	45						
S. PIDP	46	CT	Control time	0 to 999999	sec	—	U
	47						

Instruction used	Offset	Item	Name	Setting/storage range	Unit	Data storage	
						SMVM	SPIDP
S. PIDP	48 49	DML	MV change rate	0 to 100	%	—	U
S. PIDP	50 51	DVL	Change rate control value	0 to 100	%	—	U
S. PIDP	52 53	P	Gain	0 to 999999		—	U
S. PIDP	54 55	I	Integral time	0 to 999999	sec	—	U
S. PIDP	56 57	D	Derivative time	0 to 999999	sec	—	U
S. PIDP	58 59	GW	Gap width	0 to 100	%	—	U
S. PIDP	60 61	GG	Gap gain	0 to 999999	—	—	U

Key Points

- The *1MODE, ALM, and INH are used in common for all instruction.

Loop Tag Memory List

Instruction used	Offset	Item	Name	Setting/storage range	Unit	Data storage	
						SONF2	SONF3
	+0	—	—	—	—	—	—
	1	MODE*1	Operation mode	0 to $FFFF_H$	—	U	U
	2	—	—	—	—	—	—
	3	ALM*1	Alarm	0 to $FFFF_H$	—	O/U	O/U
	4	INH*1	Alarm detection prohibition	0 to $FFFF_H$	—	U	U
	5	—	—	—	—	—	—
	6	—	—	—	—	—	—
	7	—	—	—	—	—	—
	8	—	—	—	—	—	—
	9	—	—	—	—	—	—
S. PHPL	10	PV	Process value	-5 to 105	%	O	O
	11						
S. ONF2/S. ONF3	12	MV	Manipulated value	-10 to 110	%	O	O
	13						
S. ONF2/S. ONF3	14	SV	Set value	(RL) to (RH)	—	U	U
	15			-5 to 105	%	O	O
S. ONF2/S. ONF3	16	DV	Deviation	-110 to 110	%	U	U
	17						
S. ONF2/S. ONF3	18	HS0	Hysteresis 0	0 to 999999	—	U	U
	19						
S. ONF3	20	HS1	Hysteresis 2	0 to 999999	—	—	U
	21						
S. PHPL	22	RH	Engineering value upper limit	-999999 to 999999	—	U	U
	23						
S. PHPL	24	RL	Engineering value lower limit	-999999 to 999999	—	U	U
	25						
S. PHPL	26	PH	Upper limit alarm value	(RL) to (RH) (PL)<(PH)	—	U	U
	27						
S. PHPL	28	PL	Lower limit alarm value	(RL) to (RH) (PL)<(PH)	—	U	U
	29						
S. PHPL	30	HH	Upper upper limit alarm value	(RL) to (RH) (PH)≤(HH)	—	U	U
	31						
S. PHPL	32	LL	Lower lower limit alarm value	(RL) to (RH) (LL)≤(PL)	—	U	U
	33						
	34	—	—	—	—	—	—
	35						
	36	—	—	—	—	—	—
	37						
S. IN	38	α	Filter coefficient	0 to 1	—	U	U
	39						
S. PHPL	40	HS	Upper lower limit alarm hysteresis	0 to 999999	—	U	U
	41						
S. PHPL	42	CTIM	Change rate alarm check time	0 to 999999	sec	U	U
	43						
S. PHPL	44	DPL	Change rate alarm value	0 to 100	—	U	U
	45						
S. ONF2/S. ONF3	46	CT	Control time	0 to 999999	sec	U	U
	47						

Key Points

- The *1MODE, ALM, and INH are used in common for all instruction.

Loop Tag Memory List

Instruction used	Offset	Item	Name	Setting/storage range	Unit	Data storage
						SPGS
	+0	—	—	—	—	—
	1	MODE*1	Operation mode	0 to FFFF$_H$	—	U
	2	—	—	—	—	—
	3	ALM*1	Alarm	0 to FFFF$_H$	—	O/U
	4	INH*1	Alarm detection prohibition	0 to FFFF$_H$	—	U
	5	—	—	—	—	—
	6	—	—	—	—	—
	7	—	—	—	—	—
	8	—	—	—	—	—
	9	—	—	—	—	—
S. PGS	10	PTNO	Operation constant number of breakpoints	0 to 65635	—	U
	11	—	—	—	—	U
S. PGS	12	MV	Manipulated value	-10 to 110	%	0
	13					
S. PGS	14	SV	Set value	0 to 999999	—	U
	15					
S. PGS	16	TYPE	Operation type	0 to 65635	—	U
	17	—	—	—	—	—
S. PGS	18	MH	MV upper limit value	-10 to 110	%	U
	19					
S. PGS	20	ML	MV lower limit value	-10 to 110	%	U
	21					
S. PGS	22	SV1	SV sampling value 1	0 to 999999	—	U
	23					
S. PGS	24	SV2	SV sampling value 2	0 to 999999	—	U
	25					
S. PGS	26	SV3	SV sampling value 3	0 to 999999	—	U
	27					
S. PGS	28	SV4	SV sampling value 4	0 to 999999	—	U
	29					
S. PGS	30	SV5	SV sampling value 5	0 to 999999	—	U
	31					
S. PGS	32	SV6	SV sampling value 6	0 to 999999	—	U
	33					
S. PGS	34	SV7	SV sampling value 7	0 to 999999	—	U
	35					
S. PGS	36	SV8	SV sampling value 8	0 to 999999	—	U
	37					
S. PGS	38	SV9	SV sampling value 9	0 to 999999	—	U
	39					
S. PGS	40	SV10	SV sampling value 10	0 to 999999	—	U
	41					
S. PGS	42	SV11	SV sampling value 11	0 to 999999	—	U
	43					
S. PGS	44	SV12	SV sampling value 12	0 to 999999	—	U
	45					
S. PGS	46	SV13	SV sampling value 13	0 to 999999	—	U
	47					

Instruction used	Offset	Item	Name	Setting/storage range	Unit	Data storage
						SPGS
S. PGS	48 49	SV14	SV sampling value 14	0 to 999999	—	U
S. PGS	50 51	SV15	SV sampling value 15	0 to 999999	—	U
S. PGS	52 53	SV16	SV sampling value 16	0 to 999999	—	U
S. PGS	54 55	MV1	MV sampling value 1	-10 to 110	%	O
S. PGS	56 57	MV2	MV sampling value 2	-10 to 110	%	O
to	to	to	to	to	to	to
S. PGS	82 83	MV15	MV sampling value 15	-10 to 110	%	O
S. PGS	84 85	MV16	MV sampling value 16	-10 to 110	%	O

Key Points

- The *1MODE, ALM, and INH are used in common for all instruction.

Loop Tag Memory List

Instruction used	Offset	Item	Name	Setting/storage range	Unit	Data storage
						SSR
	+0	—	—	—	—	—
	1	MODE*1	Operation mode	0 to FFFF$_H$	—	U
	2	—	—	—	—	—
	3	ALM*1	Alarm	0 to FFFF$_H$	—	O/U
	4	INH*1	Alarm detection prohibition	0 to FFFF$_H$	—	U
	5	—	—	—	—	—
	6	—	—	—	—	—
	7	—	—	—	—	—
	8	—	—	—	—	—
	9	—	—	—	—	—
S. PHPL	10	PV	Process value	-5 to 105	%	O
	11					
S. OUT2	12	MV	Manipulated value	-10 to 110	%	O
	13					
S. R	14	SPR	Set value	-999999 to 999999	—	U
	15					
S. R	16	BIAS	Bias	-999999 to 999999	—	U
	17					
S. OUT2	18	MH	MV upper limit value	-10 to 110	%	U
	19					
S. OUT2	20	ML	MV lower limit value	-10 to 110	%	U
	21					
S. PHPL	22	RH	Engineering value upper limit	-999999 to 999999	—	U
	23					
S. PHPL	24	RL	Engineering value lower limit	-999999 to 999999	—	U
	25					
S. PHPL	26	PH	Upper limit alarm value	(RL) to (RH) (PL)<(PH)	—	U
	27					
S. PHPL	28	PL	Lower limit alarm value	(RL) to (RH) (PL)<(PH)	—	U
	29					
S. PHPL	30	HH	Upper upper limit alarm value	(RL) to (RH) (PH)≤(HH)	—	U
	31					
S. PHPL	32	LL	Lower lower limit alarm value	(RL) to (RH) (LL)≤(PL)	—	U
	33					
	34	—	—	—	—	—
	35					
	36	—	—	—	—	—
	37					
S. IN	38	α	Filter coefficient	0 to 1	—	U
	39					
S. PHPL	40	HS	Upper lower limit alarm hysteresis	0 to 999999	—	U
	41					
S. PHPL	42	CTIM	Change rate alarm check time	0 to 999999	sec	U
	43					
S. PHPL	44	DPL	Change rate alarm value	0 to 100	—	U
	45					
S. R	46	CT	Control time	0 to 999999	sec	U
	47					

Instruction used	Offset	Item	Name	Setting/storage range	Unit	Data storage
						SSR
S. OUT2	48 49	DML	MV change rate	0 to 100	%	U
S. R	50 51	DR	Change rate upper limit	0 to 999999	—	U
S. R	52 53	RMAX	Ratio upper limit	-999999 to 999999	—	U
S. R	54 55	RMIN	Ratio lower limit	-999999 to 999999	—	U
S. R	56 57	Rn	Ratio current value	-999999 to 999999	—	O

Key Points

- The *1MODE, ALM, and INH are used in common for all instruction.

Appendix 3 Operation Processing Time

Following is an example processing time when the actual numeric values are entered into the instruction operation constants in loop tag memories.

Loop type: SSPI

Instruction used:S. IN, S. PHPL, S. SPI, S. OUT1

S.IN instruction operation constant

Item name	Item	Number
Engineering value conversion upper limit	EMAX	E100
Engineering value conversion lower limit	EMIN	E0
Input upper limit	NMAX	E100
Input lower limit	NMIN	E0
Upper limit side range error occurrence	HH	E95
Upper limit side range error return	H	E80
Lower limit side range error return	L	E20
Lower limit side range error occurrence	LL	E5

There is no operation constant for S.PHPL

S.SPI instruction operation constant

Item name	Item	Number
Deviation size alarm hysteresis	DVLS	E4
Reverse action, forward action	PN	K0
Trucking bit	TRK	K0
Set value pattern	SVPTN	K3

S.OUT1 instruction operation constant

Item name	Item	Number
Input upper limit	NMAX	E100
Input lower limit	NMIN	E0

Loop Tag Memory

Offset	Item	Lower limit	Upper limit	Number
+0	FUNC	0	15	
+1	MODE	0	HFFFF	H10
+2	MDIH	0	HFFFF	
+3	ALM	0	HFFFF	H0
+4	INH	0	HFFFF	H0
+5	ALML	0	HFFFF	
+6	CTNO	0	32	
+7	CTFN	0	HFFFF	
+8	UNIT	0	127	
+9	N	0	4	
+10	PV	RL* (RH*)	RL* (RH*)	E0
+12	MV	-10	110	E0
+14	SV	RL* (RH*)	RH* (RL*)	E55
+16	DV	-110	110	E7
+18	MH	-10	110	E100
+20	ML	-10	110	E0
+22	RH	-999999	999999	E100
+24	RL	-999999	999999	E0
+26	PH	RL* (RH*)	RH* (RL*)	E80
+28	PL	RL* (RH*)	RH* (RL*)	E20
+30	HH	RL* (RH*)	RL* (RH*)	E90
+32	LL	RL* (RH*)	RL* (RH*)	E10
+34	SH	RL* (RH*)	RL* (RH*)	
+36	SL	RL* (RH*)	RL* (RH*)	
+38	α	0	1	E0
+40	HS	0	999999	E3
+42	CTIM	0	999999	E8
+44	DPL	0	100	E30
+46	ST	0	999999	E1
+48	DML	0	100	E100
+50	DVL	0	100	E25
+52	P	0	999999	E3
+54	I	0	999999	E8
+56	STHT	0	999999	E5
+58	GW	0	100	E15
+60	GG	0	999999	E2
+62	MVP	FMIN	FMAX	E0.25

Instruction processing times

S. IN 204.38μs

S. PHPL 437.79μs

S. SPI 92.54μs

S. OUT1 227.94μs

The SSPI loop type processing time is 962.65 microseconds.

Loop type: SR
Instruction used:S. IN, S. PHPL, S. R, S. OUT2

S.IN instruction operation constant

Item name	Item	Number
Engineering value conversion upper limit	EMAX	E100
Engineering value conversion lower limit	EMIN	E0
Input upper limit	NMAX	E100
Input lower limit	NMIN	E0
Upper limit side range error occurrence	HH	E95
Upper limit side range error return	H	E80
Lower limit side range error return	L	E20
Lower limit side range error occurrence	LL	E5

There is no operation constant for S.PHPL

S.R instruction operation constant

Item name	Item	Number
Trucking bit	TRK	H0
Set value pattern	SVPTN	H2

S.OUT1 instruction operation constant

Item name	Item	Number
Input upper limit	NMAX	E100
Input lower limit	NMIN	E0

Loop Tag Memory

Offset	Item	Lower limit	Upper limit	Number
+0	FUNC	0	15	
+1	MODE	0	HFFFF	H20
+2	MDIH	0	HFFFF	
+3	ALM	0	HFFFF	H0
+4	INH	0	HFFFF	H0
+5	ALML	0	HFFFF	
+6	CTNO	0	32	
+7	CTFN	0	HFFFF	
+8	UNIT	0	127	
+9	N	0	4	
+10	PV	RL* (RH*)	RH* (RL*)	E0
+12	MV	-10	110	E34
+14	SPR	FMIN	FMAX	E0
+16	BIAS	-999999	999999	E28.75
+18	MH	-10	110	E31
+20	ML	-10	110	E29
+22	RH	-999999	999999	E100
+24	RL	-999999	999999	E0
+26	PH	RL* (RH*)	RH* (RL*)	E80
+28	PL	RL* (RH*)	RH* (RL*)	E20
+30	HH	RL* (RH*)	RL* (RH*)	E90
+32	LL	RL* (RH*)	RL* (RH*)	E10
+34	SH	FMIN	FMAX	
+36	SL	FMIN	FMAX	
+38	α	0	1	E0
+40	HS	0	999999	E3
+42	CTIM	0	999999	E8
+44	DPL	0	100	E30
+46	CT	0	999999	E1
+48	DML	0	100	E4
+50	DR	0	999999	E5
+52	RMAX	-999999	999999	E120
+54	RMIN	-999999	999999	E20
+56	(Rn)	FMIN	FMAX	E20

Instruction processing times

S. IN 204.38μs

S. PHPL 437.79μs

S. R 208.29μs

S. OUT2 144.80μs

The SR loop type processing time is 995.26 microseconds.

Loop type: SONF3
Instruction used:S. IN, S. PHPL, S. ONF3

S.IN instruction operation constant

Item name	Item	Number
Engineering value conversion upper limit	EMAX	E100
Engineering value conversion lower limit	EMIN	E0
Input upper limit	NMAX	E100
Input lower limit	NMIN	E0
Upper limit side range error occurrence	HH	E95
Upper limit side range error return	H	E80
Lower limit side range error return	L	E20
Lower limit side range error occurrence	LL	E5

There is no operation constant for S.PHPL

S.ONF3 instruction operation constant

Item name	Item	Number
Reverse action, forward action	PN	H0
Trucking bit	TRK	H1
Set value pattern	SVPTN	H2

Loop Tag Memory

Offset	Item	Lower limit	Upper limit	Number
+0	FUNC	0	15	
+1	MODE	0	HFFFF	H10
+2	MDIH	0	HFFFF	
+3	ALM	0	HFFFF	H0
+4	INH	0	HFFFF	H0
+5	ALML	0	HFFFF	
+6	CTNO	0	32	
+7	CTFN	0	HFFFF	
+8	UNIT	0	127	
+9	N	0	4	
+10	PV	RL* (RH*)	RH* (RL*)	E0
+12	MV	-10	110	E0
+14	SV	FMIN	FMAX	E-60
+16	DV	FMIN	FMAX	E0
+18	HS0	0	999999	E4
+20	HS1	0	999999	E10
+22	RH	-999999	999999	E100
+24	RL	-999999	999999	E0
+26	PH	RL* (RH*)	RH* (RL*)	E80
+28	PL	RL* (RH*)	RH* (RL*)	E20
+30	HH	RL* (RH*)	RL* (RH*)	E90
+32	LL	RL* (RH*)	RL* (RH*)	E10
+34	SH	RL* (RH*)	RH* (RL*)	
+36	SL	RL* (RH*)	RH* (RL*)	
+38	α	0	1	E0
+40	HS	0	999999	E3
+42	CTIM	0	999999	E8
+44	DPL	0	100	E30
+46	CT	0	999999	E1

Instruction processing times

S. IN 204.38μs

S. PHPL 437.79μs

S. ONF3 231.99μs

The SR loop type processing time is 874.16 microseconds.

Q4ARCPU
Programming Manual (Process Control Instruction Edition)

MODEL	Q4ARCPU-P-PRO-E
MODEL CODE	13JF53
IB(NA)66696-A(9609)MEE	

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : MITSUBISHI DENKI BLDG MARUNOUCHI TOKYO 100-0005 TELEX : J24532 CABLE MELCO TOKYO
NAGOYA WORKS : 1-14 , YADA-MINAMI 5 , HIGASHI-KU, NAGOYA , JAPAN