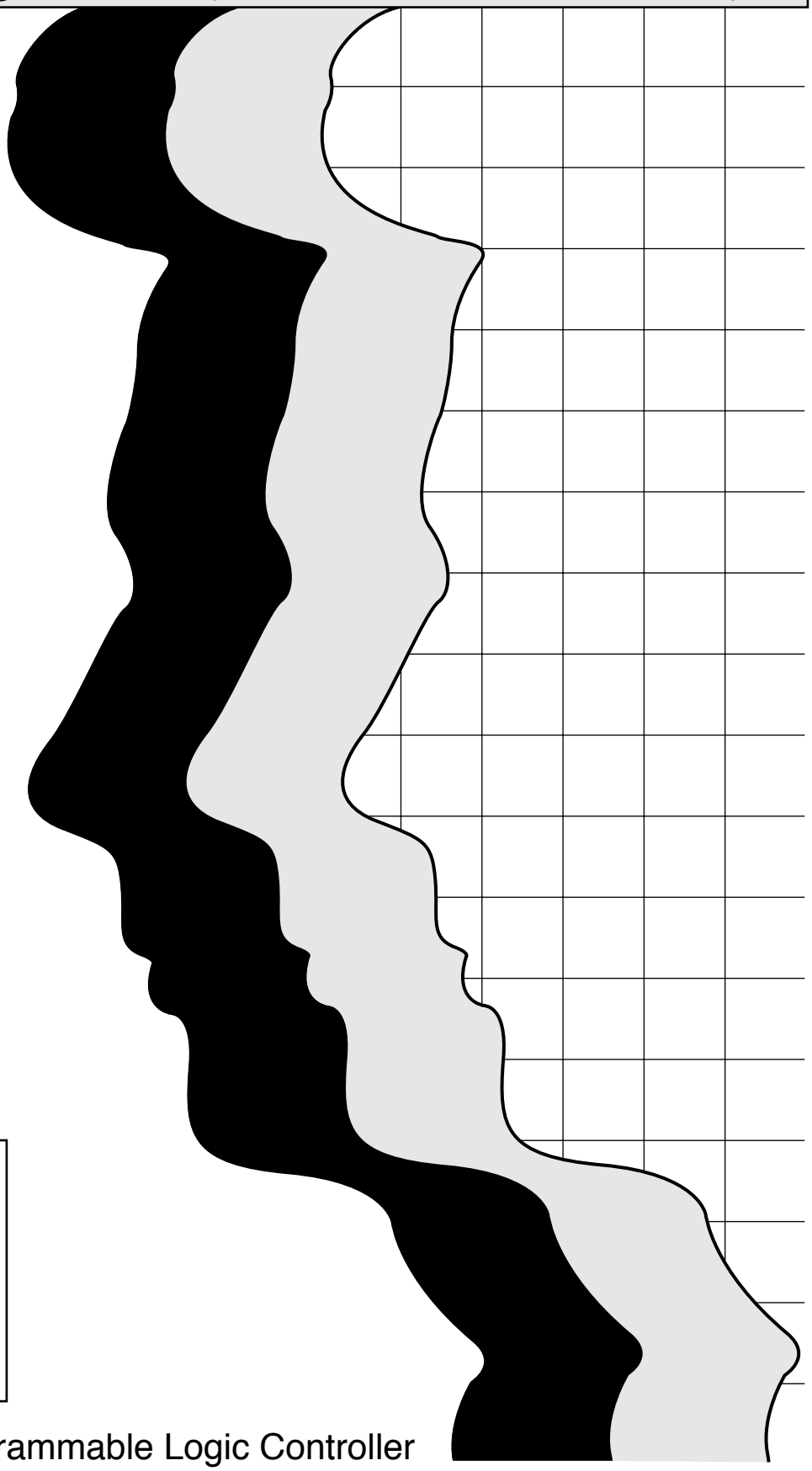
MITSUBISHI

Type AnACPU/AnUCPU/QCPU-A(A mode)

Programming Manual (PID Control Instructions)



A

MELSEC

Mitsubishi Programmable Logic Controller

SAFETY CAUTIONS

(You must read these cautions before using the product)

In connection with the use of this product, in addition to carefully reading both this manual and the related manuals indicated in this manual, it is also essential to pay due attention to safety and handle the product correctly.
The safety cautions given here apply to this product in isolation. For information on the safety of the PC system as a whole, refer to the CPU module User's Manual.
Store this manual carefully in a place where it is accessible for reference whenever necessary, and forward a copy of the manual to the end user.

REVISIONS

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

Print Date	*Manual Number	Revision
Oct., 1990	IB (NA) 66258-A	First edition
Aug., 1993	IB (NA) 66258-B	Changes made to manual by adding supplement: A2U(S1)/A3U/A4UCPU Old manual name: A2A(S1)/A3ACPU (PID control instructions) New manual name: AnACPU/AnUCPU (PID control instructions) Correction CONTENTS, Section 1, 1.1, 2, 4.1, 4.2.1, 4.3, 6.1.2, 6.1.3, 6.3, 6.4, 7.1, 8.2, APP.1 Addition Section 8.3
Dec., 2002	IB (NA) 66258-C	Equivalent to Japanese version E Correction Chapter 5, Section 5.1 Addition SAFETY CAUTIONS
Dec., 2003	IB (NA) 66258-D	The name of the manual is changed to AnACPU/AnUCPU/QCPU-A (A mode) programming manual (PID control instructions). (Old name: AnACPU/AnUCPU/A2US (H) CPU/QnCPU-A programming manual (PID control instructions)) Correction Chapter 1, Section 1.1, 6.1.2, 6.4, 8.4 Addition WARRANTY

INTRODUCTION

Thank you for choosing the Mitsubishi MELSEC-A Series of General Purpose Programmable Controllers. Please read this manual carefully so that the equipment is used to its optimum. A copy of this manual should be forwarded to the end User.

CONTENTS

1. FOREWORD

This manual describes sequence program instructions used to execute PID control with the following CPUs.

- A2ACPU(S1), A3ACPU (hereafter called the AnACPU)
- A2UCPU(S1), A3UCPU, A4UCPU, A2ASCPU(S1), A2USHCPU-S1, (hereafter called the AnUCPU)
- A1SJHCPU, A1SHCPU, A2SHCPU (hereafter called the AnSHCPU)
- Q02CPU-A, Q02HCPU-A, Q06HCPU-A (hereafter called the QCPU-A(A mode))

The AnACPU/AnUCPU / QCPU-A uses instructions that allow PID control to be executed as standard instructions, so PID control can be executed by loading an A/D conversion module and a D/A conversion module.
In addition, PID control status can be monitored with an AD57(S1).

When using an AnACPU/AnUCPU / QCPU-A , refer to the manuals among those listed below that are relevant.

[Reference Manuals]

(a) For details on instructions other than those covered in this manual:
- ACPU Programming Manual (Fundamentals) [IB-66249]
- ACPU, QCPU-A(A mode) Programming Manual (Common instructions) [IB-66250]
- AnSHCPU/AnACPU/AnUCPU /QCPU-A(A mode) Programming Manual (Dedicated instructions) [IB-66251]
- AnACPU/AnUCPU Programming Manual (AD57 control instructions) [IB-66257]

(b) For details on the AnACPU/AnUCPU:
- A2A(S1)/A3ACPU User's Manual [IB-66544]
- A2U(S1)/A3U/A4UCPU User's Manual [IB-66436]
- A2ASCPU(S1) User's Manual [IB-66455]
- A2USHCPU-S1 User's Manual [IB-66789]

(c) For details on the QCPU-A:
- QCPU-A:(A mode) User's Manual [SH-080065]

(d) For details on operating peripheral devices:
1) When using an A6GPP/A6PHP:
- SW5GP-GPPA Operating Manual [IB-66858]

2) When using an IBM PC/AT or 100% compatible PC:
- SW0IX-GPPAE Operating Manual [IB-66314]

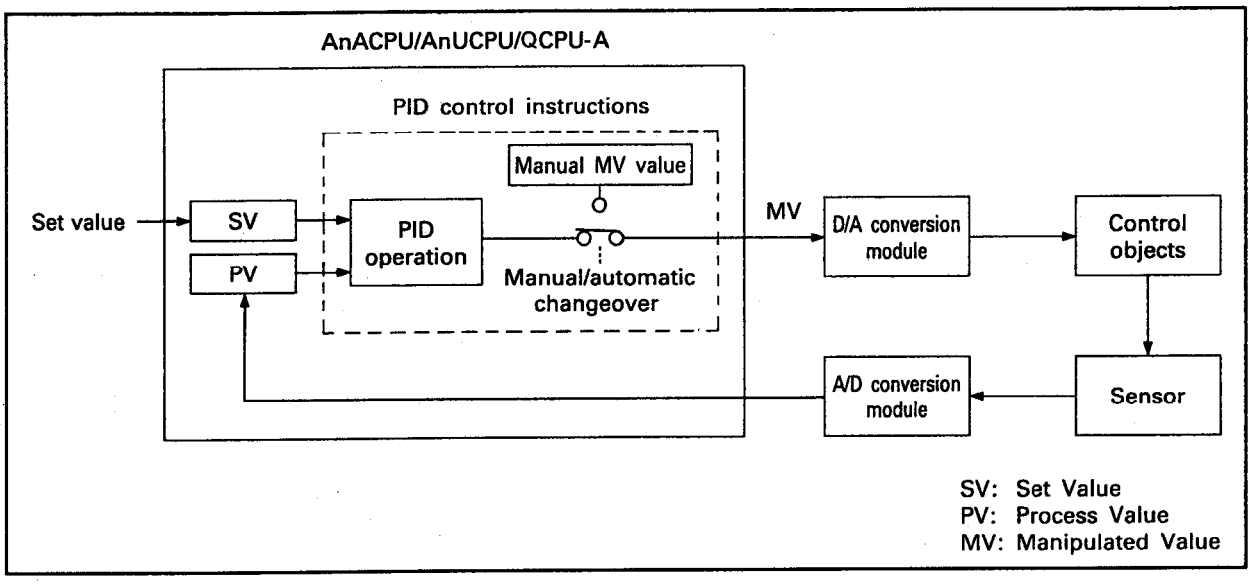
POINTS

(1) The reference range for SV, PV, and MV values used in PID operations is 0 to 2000. If the resolution of the A/D conversion unit or D/A conversion unit used for input/output in PID control is not 0 to 2000, convert the digital values to 0 to 2000.

(2) The equipment in the system configuration will differ according to the CPU module used. Refer to the user's manual for the relevant CPU for guidance on the equipment that can be used.

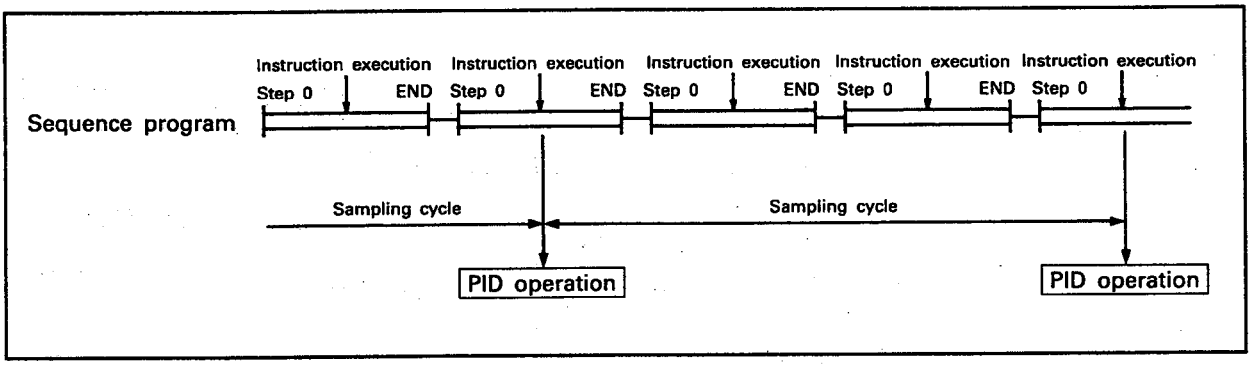
1.1 PID Processing Methods

Execute PID control with a PID control instruction by loading an A/D conversion module and a D/A conversion module.



Using the previously set SV (set value) and the digital PV (process value), which is read from the A/D conversion module with the FROM instruction, PID operation is executed to obtain the MV (manipulated value).
The calculated MV (manipulated value) is output to the D/A conversion module with the TO instruction.

PID operation is executed with a sequence program that contains a PIDCONT instruction as illustrated below.
PID operation with a PIDCONT instruction is executed in preset sampling cycles.



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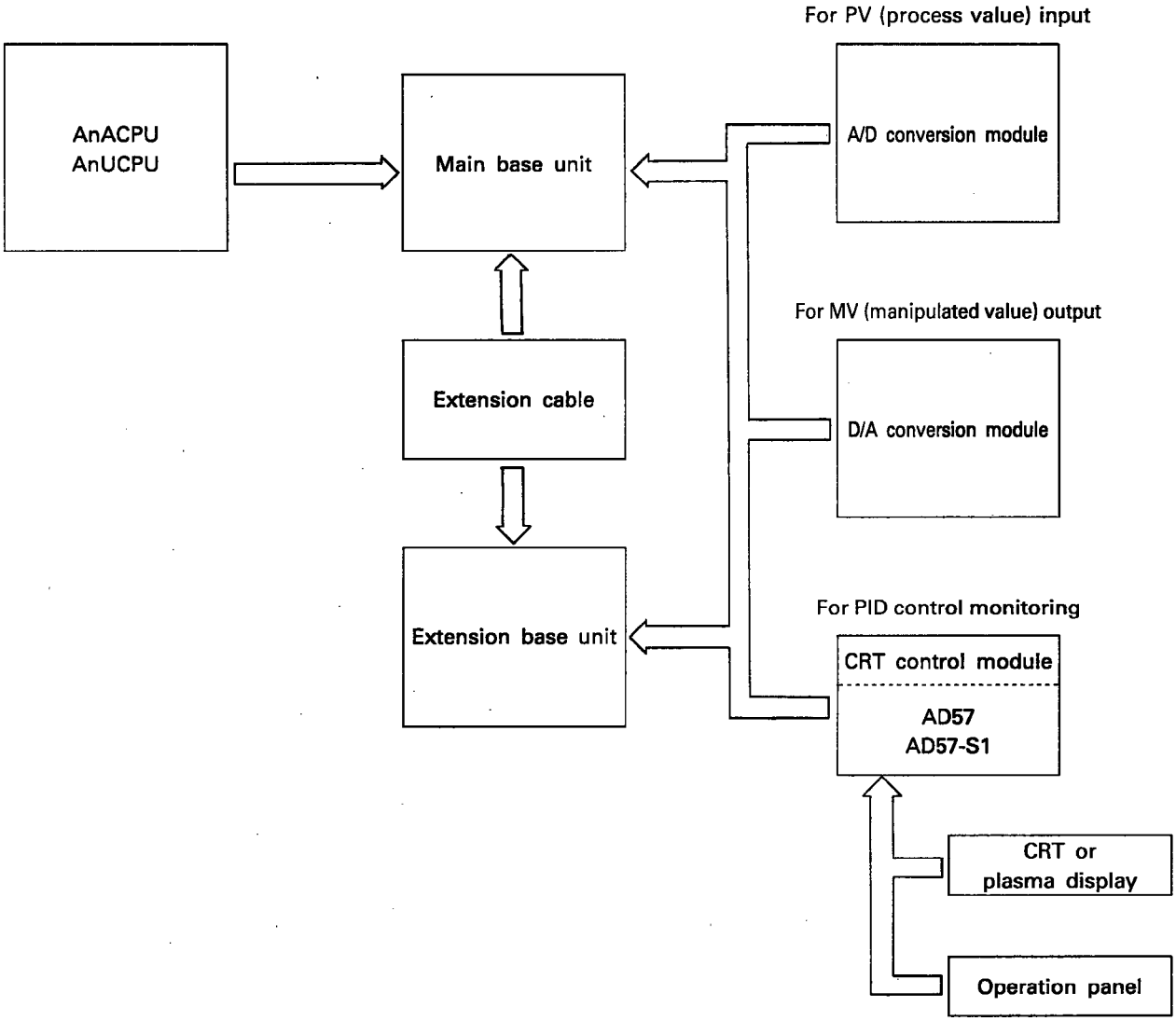
2. SYSTEM CONFIGURATION FOR PID CONTROL



POINTS

(1) The reference range for SV, PV, and MV values used in PID operations is 0 to 2000. If the resolution of the A/D conversion unit or D/A conversion unit used for input/output in PID control is not 0 to 2000, convert the digital values to 0 to 2000.

(2) The equipment in the system configuration will differ according to the CPU module used. Refer to the user's manual for the relevant CPU for guidance on the equipment that can be used.

3. PID CONTROL SPECIFICATIONS

3.1 Performance Specifications

Item			Specification
Number of PID control loops		—	32 loops (maximum)
Sampling cycle		T_S	0.01 to 60.00 sec
PID operation method		—	Process value differentiation (normal operation/reverse operation)
PID constant setting range	Proportion constant	K_P	0.01 to 100.00
	Integration constant	T_I	0.1 to 3000.0 sec
	Differential constant	T_D	0.00 to 300.00 sec
SV (set value) setting range		SV	0 to 2000
PV (process value) setting range		PV	−50 to 2050
MV (manipulated value) output range		MV	

3.2 Operation Expressions

Name		Operation Expressions	Definition of Symbols
Process value differentiation	Normal operation	$EV_n = PV_{nf}^* - SV$ $\triangle MV = K_P\{(EV_n - EV_{n-1}) + \frac{T_S}{T_I}EV_n - \frac{T_D}{T_S}(2PV_{nf-1} - PV_{nf} - PV_{nf-2})\}$ $MV_n = \Sigma\triangle MV$	EV_n : Deviation in the present sampling cycle EV_{n-1} : Deviation in the preceding sampling cycle SV : Set value PV_{nf} : Process value of the present sampling cycle (after filtering) PV_{nf-1} : Process value of the preceding sampling cycle (after filtering) PV_{nf-2} : Process value of the sampling cycle two cycle before (after filtering) $\triangle MV$: Output change amount MV_n : Present manipulation amount K_P : Proportion constant T_S : Sampling cycle T_I : Integration constant T_D : Differential constant
	Reverse operation	$EV_n = SV - PV_{nf}^*$ $\triangle MV = K_P\{(EV_n - EV_{n-1}) + \frac{T_S}{T_I}EV_n - \frac{T_D}{T_S}(2PV_{nf-1} - PV_{nf} - PV_{nf-2})\}$ $MV_n = \Sigma\triangle MV$	

POINT

(1) *: PV_{nf} is calculated using the following expression. Therefore, it is the same as the PV (process value) of the input data as long as the filter coefficient is not set for the input data.

Process Value after Filtering $PV_{nf} = PV_n + \alpha(PV_{nf-1} - PV_n)$

PV_n : Process value of the present sampling
α : Filter coefficient
PV_{nf-1}: Process value of the preceding sampling cycle (after filtering)

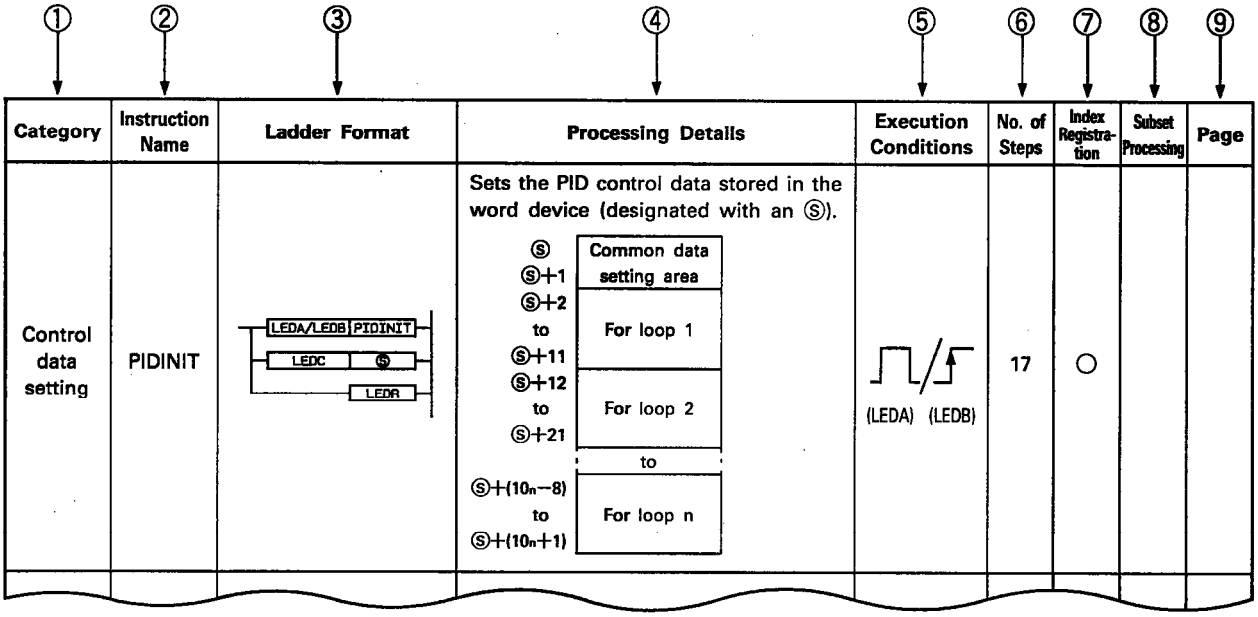
(2) PV_{nf} is stored in the input/output data area of the word devices (T, C, D, W, R).

3.3 PID Control Instruction List

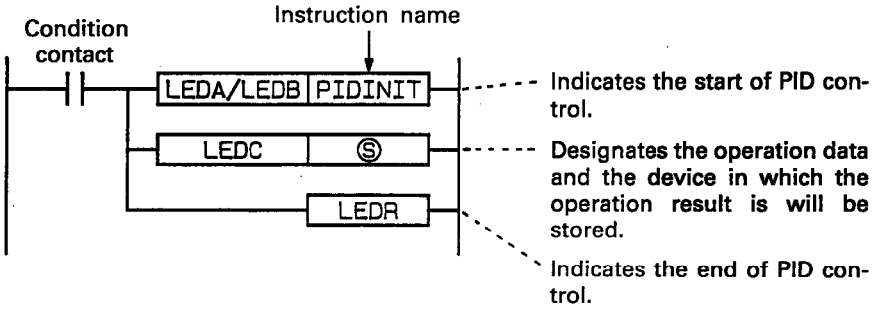
Instruction Name	Processing Details
PIDINIT	Sets the reference data for PID operation.
PIDCONT	Executes PID operation with the SV (set value) and the PV (process value).
PID57	Uses an AD57(S1) to monitor the results of PID operation.

3.3.1 How to read the instruction list

The following information is detailed in the instruction list in Section 3.3.2:

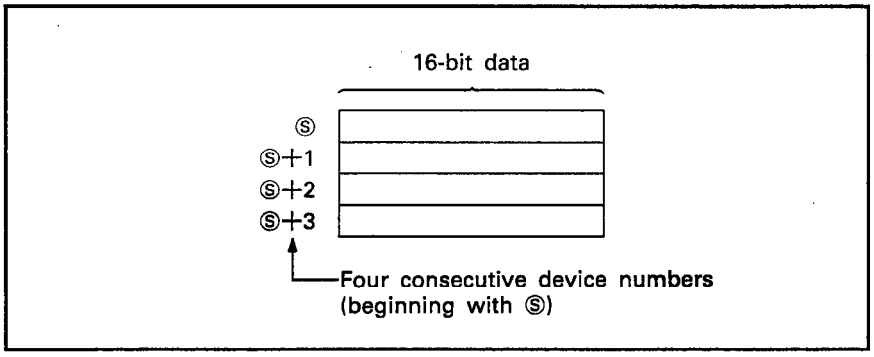


①·····Instructions classified according to the use.
②·····Instruction names written in a sequence program.
③·····Instruction descriptions written in a sequence program ladder chart.



Refer to Chapter 6 for more details.

④·····Details on the processing called by the instruction



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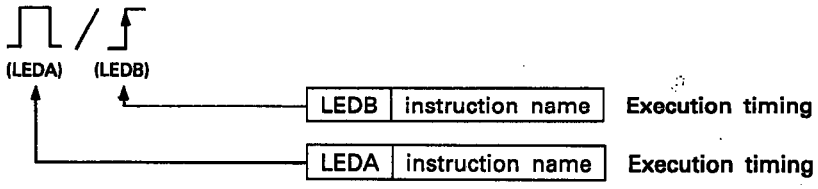
⑤·····Execution timing for the instruction



Symbol	Execution Timing
	The instruction will be executed every scan as long as the conditions for executing that instruction are present.
	The instruction will be executed one time at the leading edge of a conditional signal.

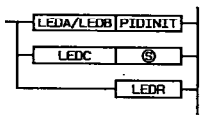
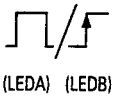
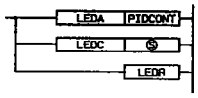
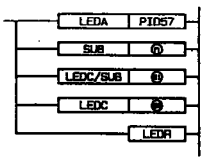
⑥·····Number of instruction steps
Depending on the device to be used, there are cases when the actually required number of steps will be greater than the indicated number of steps.
Refer to Section 6.1.2 for details.

⑦·····A circle indicates that an index register (Z, V) can be used with the devices and constants used for an instruction.

⑧·····A circle indicates that subset processing is possible.

⑨·····Indicates the page number in this manual where a detailed description for the instruction can be found.

3.3.2 PID operation instruction list

Category	Instruction Name	Ladder Format	Processing Details	Execution Conditions	No. of Steps	Index Registration	Subset Processing	Page
Control data setting	PIDINIT		Sets the PID control data stored in the word device (designated with an (S)). (S): Common data setting area (S)+1 to (S)+11: For loop 1 (S)+12 to (S)+21: For loop 2 to (S)+(10n−8) to (S)+(10n+1): For loop n	 (LEDA) (LEDB)	17	○		
PID operation	PIDCONT		Executes PID operation with the SV (set value) and the PV (process value) designated with an (S) and stores the PID operation results to the MV (manipulated value) area of the word device designated with an (S). (S) to (S)+9: Common data setting area (S)+10 to (S)+27: SV setting area, PV setting area, MV setting area — For loop 1 (S)+28 to (S)+45: SV setting area, PV setting area, MV setting area — For loop 2 (S)+(18n−8) to (S)+(18n+9): SV setting area, PV setting area, MV setting area — For loop n		17	○		
Monitoring	PID57		Monitors the PID operation results for the AD57(S1) (designated with an (n)). (n): Head I/O number of the AD57(S1) (S1): Monitor screen number (1: Loop 1 to loop 8 2: Loop 9 to loop 16 3: Loop 17 to loop 24 4: Loop 25 to loop 32) (S2): Monitor screen display request		23	○		

4. PID CONTROL

4.1 Outline of PID Control

PID control is applied to process controls in which the flowrate, velocity, air flow volume, temperature, tension, mixing ratio, etc. must be controlled. The following illustrates the control diagram used for maintaining the control object to the preset value:

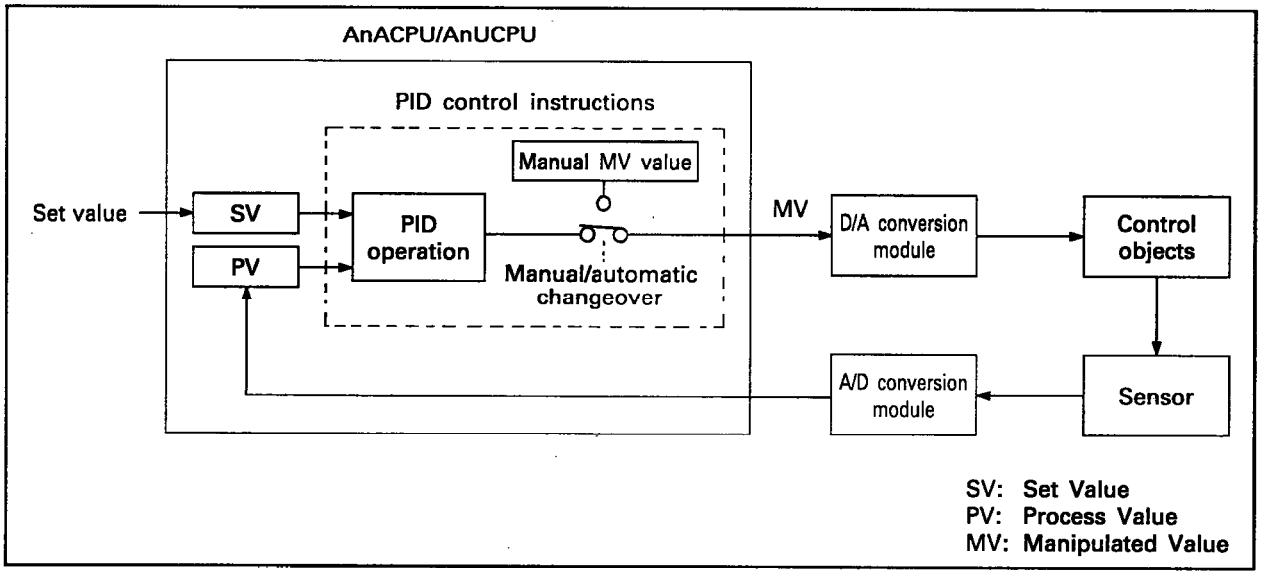


Fig. 4.1 Application of PID Control to Process Control

During PID control, the PV (process value), detected by the detection unit, is compared to the SV (set value). The output data (MV: manipulated value) is adjusted accordingly to zero the difference between the PV and the MV.

The MV (manipulated value) is calculated by combining the proportionate operation (P), the integrating operation (I), and the differentiating operation (D) so that the PV becomes the same as the SV quickly and precisely.
That is, a large MV is taken when the difference between the PV and the SV is large, quickly bringing the PV close to the SV. As the difference between the PV and the SV gets smaller, a smaller MV is taken to again change the PV, precisely bringing it to the SV.

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4.2 PID Control

4.2.1 Operation method

The operation methods for PID control with the PID control instructions are the velocity method and process value differentiation method.
The following describes the control executed for both of these methods:

(1) Velocity method operation
The velocity method operation calculates amounts of changes in the MVs (manipulated values) during PID operation.
The actual MV is the accumulation of change value of the MV calculated for each sampling cycle.

(2) Process value differentiation method operation
The process value differentiation method operation executes PID operations by differentiating the PV (process value).
Because this deviation is not used in differentiating, sudden changes in the output due to the differentiation of the changes in the deviation generated by changing the set value can be reduced.

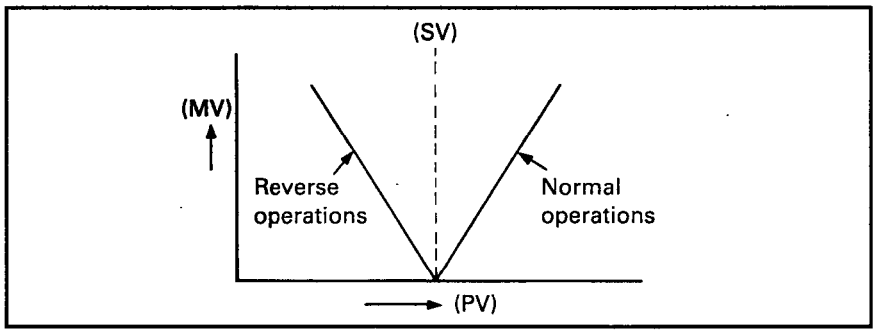
4.2.2 Normal operation and reverse operation

(1) In normal operation, the MV (manipulated value) increases as the PV (process value) increases beyond the SV (set value).

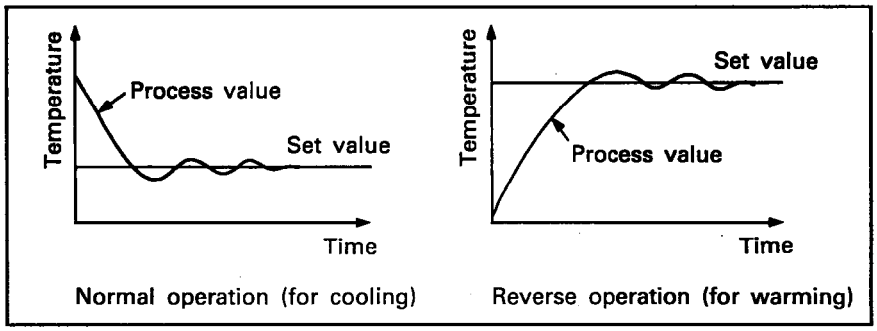
(2) In reverse operation, the MV (manipulated value) decreases as the PV (process value) decreases below the SV (set value).

(3) In normal operation and reverse operation, the MV (manipulated value) becomes larger as the difference between the SV (set value) and the PV (process value) is larger.

(4) The following illustrates normal operation and reverse operation with the MV (manipulated value), the PV (process value), and the SV (set value):



(5) The following illustrates process control examples using normal operation and reverse operation:



4.2.3 Proportionate operation (P operation)

(1) In the proportionate operation, the MV (manipulated value) is obtained in proportion to the error (the difference between the set value and process value).

(2) The relationship between E (error) and the MV (manipulated value) is expressed with the following formula:

$$MV = K_P \cdot E$$

K_P is the proportionate constant called "proportionate gain".

(3) The proportionate operation in step response with a constant E (error) is illustrated in Fig. 4.2.

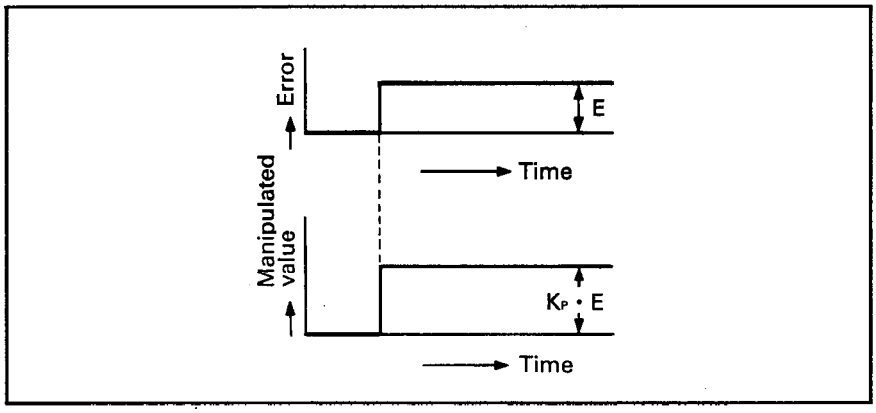


Fig. 4.2 Proportionate Operation with a Constant Error

(4) The MV (manipulated value) changes within the −50 to 2050 range.
The MV (manipulated value) in response to the same error becomes larger as K_P becomes larger, thus the compensating motion is greater.

(5) The proportionate operation is always associated with an offset (remaining error).

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4.2.4 Integrating operation (I operation)

(1) In the integrating operation, the MV (manipulated value) changes continuously to zero an error, if an error exists. This operation can eliminate the offset that is unavoidable in the proportionate operation.

(2) The time required for the MV in the integrating operation to reach the MV for the proportionate operation after the generation of an error is called the integrating time. Integrating time is expressed as T_I.
The smaller the setting for T_I, the greater the integrating operation will become.

(3) The integrating operation in step response with a constant E (error) is illustrated in Fig. 4.3.

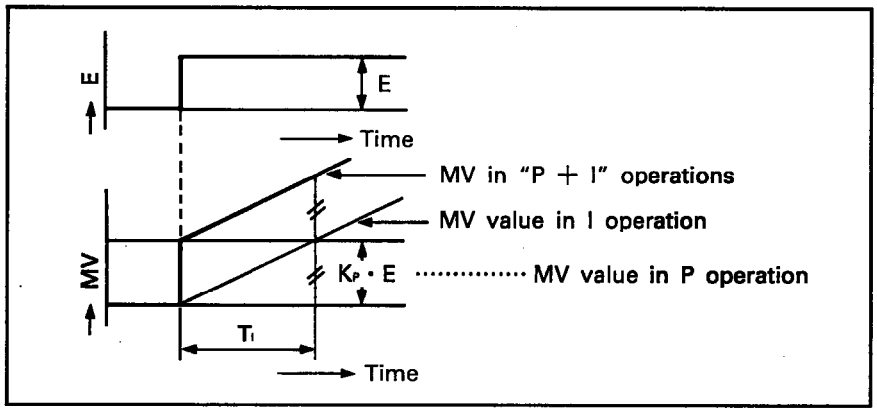

Fig. 4.3 Integrating Operation with a Constant Error

(4) The integrating operation is always used in combination with the proportionate operation (PI operation) or with the proportionate and differentiating operations (PID operation).
The integrating operation cannot be used independently.

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4.2.5 Differentiating operation (D operation)

(1) In the differentiating operation, the MV (manipulated value), in proportion to error variation rate, is added to system value to zero the error, if an error exists.
This operation prevents the control objective from being significantly changed due to external disturbances.

(2) The time required for the MV in the differentiating operation to reach the MV for the proportionate operation after the generation of an error is called the differentiating time. Differentiating time is expressed as T_D.
The smaller the setting for T_D, the greater the differentiating operation will become.

(3) The differentiating operation in step response with a constant E (error) is illustrated in Fig. 4.4.

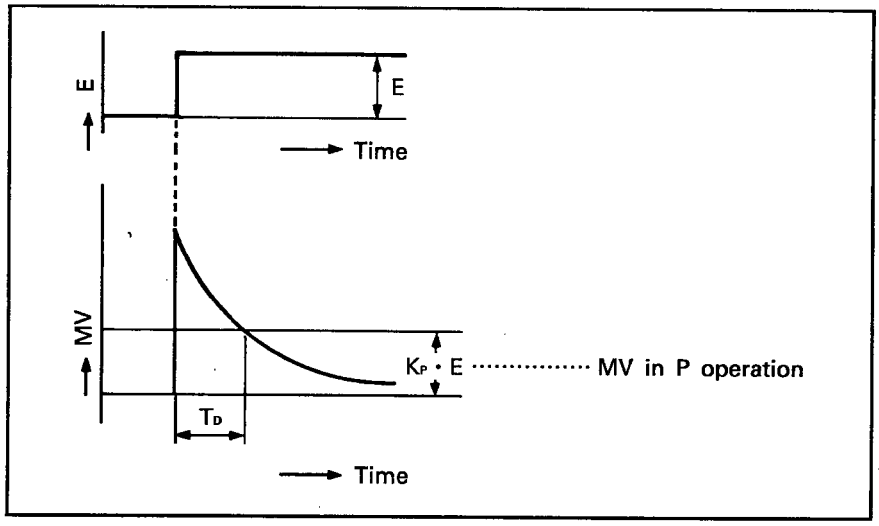

Fig. 4.4 Differentiating Operation with Constant Error

(4) The differentiating operation is always used in combination with the proportionate operation (PD operation) or with the proportionate and integrating operations (PID operation).
The differentiating operation cannot be used independently.

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4.2.6 PID operation

(1) During PID operation, the system is controlled by the MV (manipulated value) calculated in the "P + I + D" operation.

(2) PID operation in step response with a constant E (error) is illustrated in Fig. 4.5.

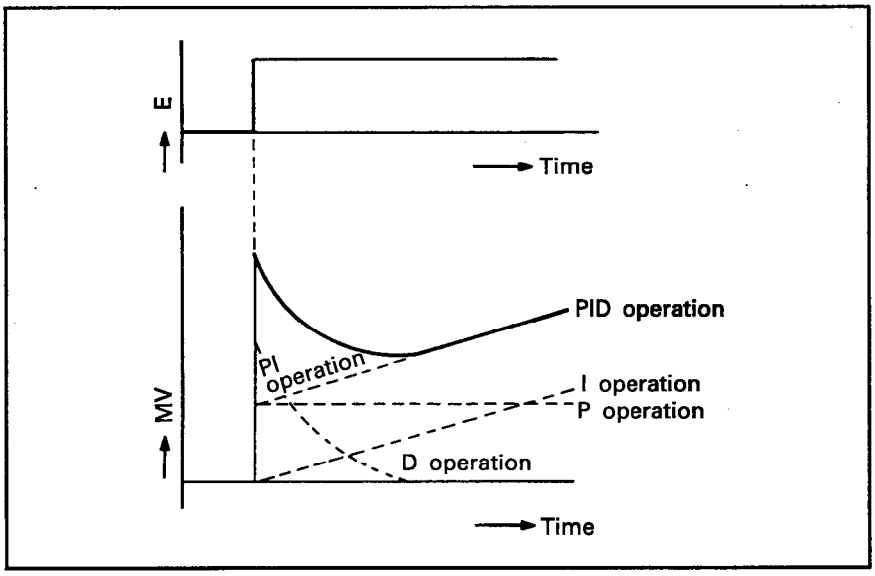


Fig. 4.5 PID Operation with Constant Error

4.3 PID Operation Functions

During PID control with a PID control instruction the MV higher/lower limit control is automatically executed by the changeover function explained below.

4.3.1 Bumpless changeover function

The bumpless function controls the MV (manipulated value) continuously when the control mode is changed between manual and automatic.
When the control mode is changed between manual and automatic, data is transmitted between the MV area for the automatic mode and the MV for manual mode.
The control mode is changed in the input/output data area (refer to Section 5.2).

1) Changing from the manual mode to the automatic mode
   The MV in the manual mode is transmitted to the MV area for the automatic mode.

2) Changing from automatic to manual mode
   The MV in the automatic mode is transmitted to the MV area for the manual mode.

POINT

(1) Manual and automatic modes of PID control:
1) Automatic mode
PID operation is executed with a PID control instruction. The control objective is controlled according to the calculated MV.

2) Manual mode
PID operation is not executed. The MV is calculated by the user and the control objective is controlled according to the user-calculated MV.

(2) The loop set in the manual mode stores the PV (process value) every sampling cycle.

4.3.2 MV higher/lower limit control function

The MV higher/lower limit control function controls the higher or lower limit of the MV calculated in the PID operation. This function is only effective in the automatic mode. It cannot be executed in the manual mode.
By setting the MV higher limit (MVHL) and the MV lower limit (MVLL), the MV calculated in the PID operation can be controlled within the range between the limits.

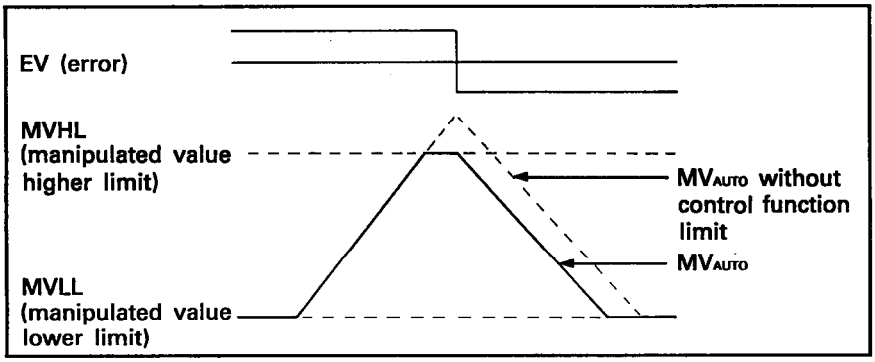


Fig. 4.6 Operations That Use the MV Higher/Lower Limit Control Function

When the MV higher/lower limit control function is used, the MV is controlled as illustrated above.
A value between −50 and 2050 can be set for the higher and lower limits. The following lists the default settings:

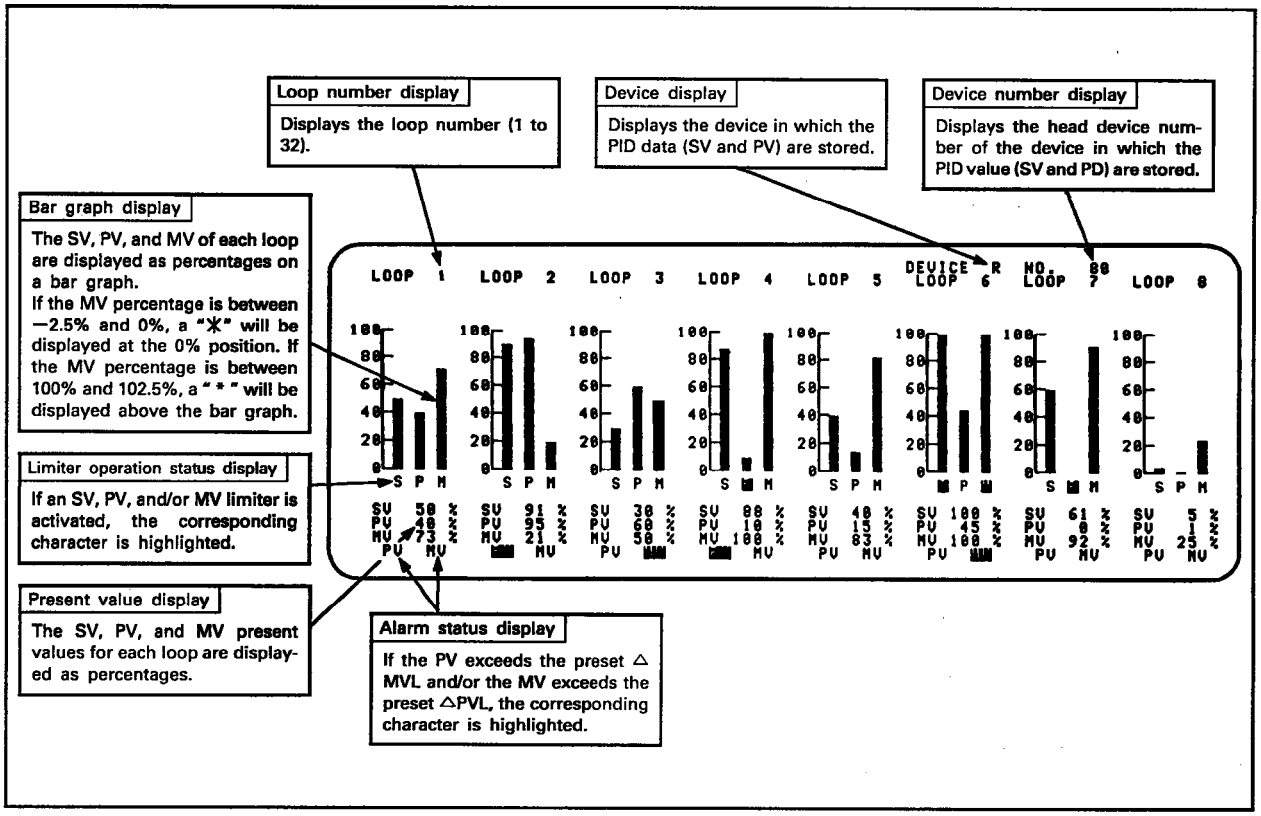
- Higher limit : 2000
- Lower limit : 0

The value set for the higher limit must not be smaller than the value set for the lower limit. An error occurs will occur if this is done.

4.3.3 PID control monitor with the AD57(S1)

The PID control operation results can be monitored on a bar graph with an AD57(S1) CRT controller unit.

(1) The monitor screen displays the monitored information of eight loops beginning with the designated loop number.



POINT

(1) The SV, PV, and MV present value are displayed as percentages of 2000.

1) SV percentage display ..... $\frac{SV}{2000} \times 100$ (%)

2) PV percentage display ..... $\frac{PV}{2000} \times 100$ (%)

3) MV Percentage display ..... $\frac{MV}{2000} \times 100$ (%)

(2) Use the PID57 instruction to execute monitoring with AD57(S1).
Refer to Section 6.4 for on the PID57 instruction.

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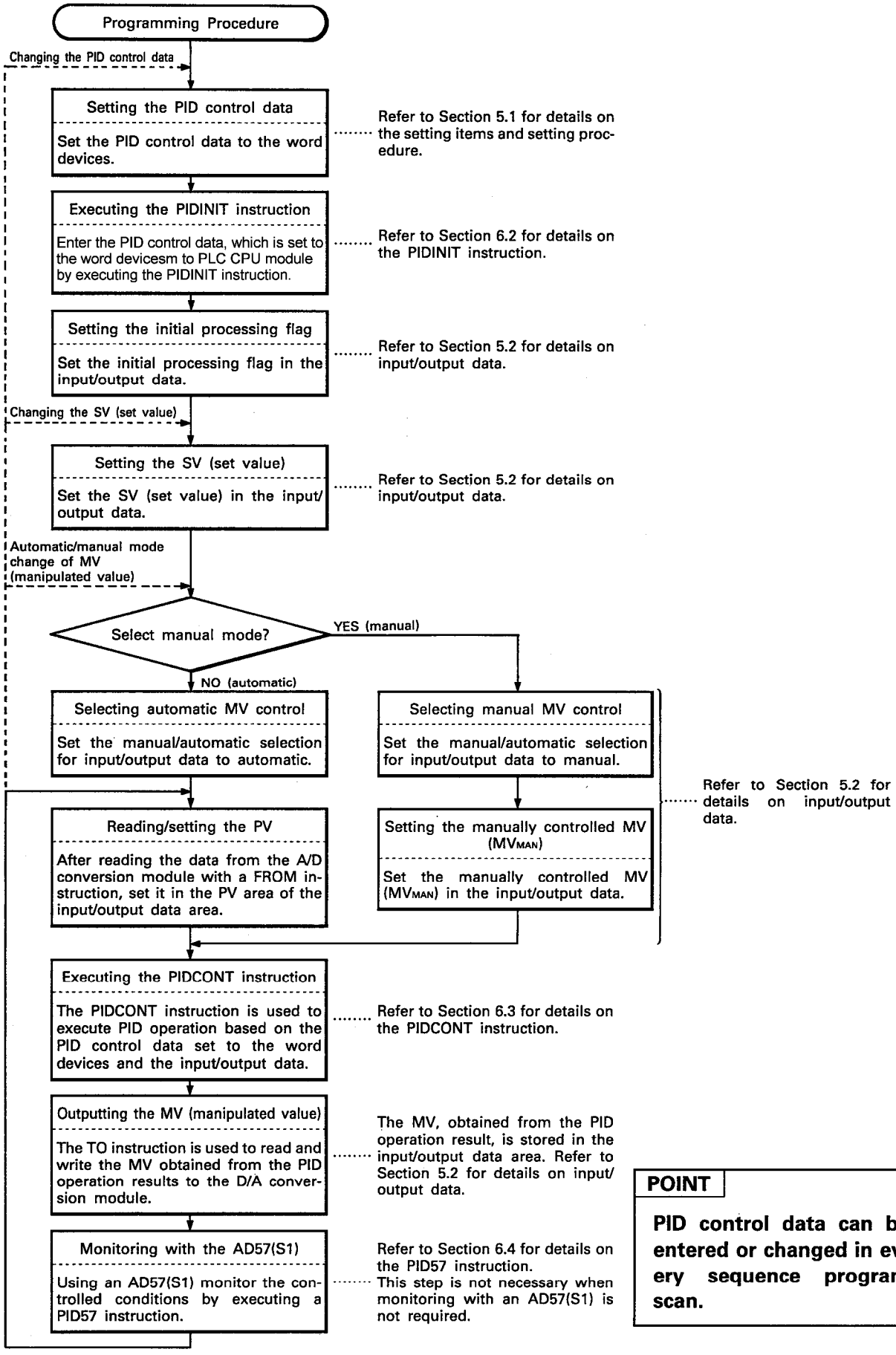
5. PID CONTROL SEQUENCE



POINT

PID control data can be entered or changed in every sequence program scan.

5.1 PID Control Data

PID control data is used for setting the reference value for PID operation and is set before starting PID operation.
PID control data is basically classified into two groups as shown in the table below: data that is common to all loops and data for individual loops. The data for each setting item is set in word devices and is called when the PIDINIT instruction (one of the PID control instructions) is executed.

	Data No.	Data Item	Description	Setting Range	User Designation Range	Processing if Set Data is Outside the Allowable Setting Range
Common setting data	1	Number of loops used	Sets the number of loops for which PID operation is executed.	1 to 32	1 to 32	PID operation is not executed for any of the loops
	2	Number of loops executed in each scan	Sets the number of loops that can be executed in a single PID operation if there is more than one loop for which sampling cycle is reached.			
Data for each loop	1	Selection of operation expression	Selects one of the operation methods described in Section 3.2.	Normal operation .... 0 Reverse operation 1	0 or 1	PID operation for the corresponding loop is not executed.
	2	Sampling cycle (Ts)	Sets the cycle at which an operation is executed.	0.01 to 60.00 s	1 to 6000 (units: 10 ms)	
	3	Proportionate constant (K_P)	PID operation ratio	0.01 to 100.00	1 to 10000 (units: 0.01)	
	4	Integrating constant (T_I)	The constant that expresses the magnitude of the integrating operation (I operation) effect. The MV variation becomes smaller as the integrating constant becomes larger.	0.1 to 3000.0 s Infinite (∞) (If the setting for T_I exceeds 3000.0 s.)	1 to 32767 (units: 100 ms)	PID operation for the corresponding loop is not executed if setting value ≦ 0.
	5	Differentiating constant (T_D)	The constant that expresses the magnitude of the differentiating operation (D operation) effect. The MV variation becomes larger in a small amount of variation of the control objective as the differentiating constant becomes larger.	0.00 to 300.00 s	0 to 30000 (units: 10 ms)	PID operation for the corresponding loop is not executed.
	6	Filter coefficient (α)	Sets degree of filtering applied to the PV (input from an A/D conversion module). The filtering effect becomes less as the value gets closer to "0".	0 to 100%	0 to 100	
	7	MV Lower limit (MVLL)	Sets the lower limit of MV (manipulated value) calculated in PID operation. Effective in the automatic mode. If the calculated MV is smaller than the MV lower limit, the MVLL is the MV.	−50 to 2050	−50 to 2050	If the user-designated MVLL or MVHL is outside the allowable setting range, the value will be changed as described below so that PID operation can be executed: • If the value set for MVLL or MVHL is less than "−50", the value is replaced with "−50". • If the value set for △MVLL or △MVHL is greater than "2050", the value is replaced with "2050".
	8	MV Higher limit (MVHL)	Sets the higher limit of MV (manipulated value) calculated in PID operation. Effective in the automatic mode. If the calculated MV is larger than the MV higher limit, the MVHL is the MV.			

	Data No.	Data Item	Description	Setting Range	User Designation Range	Processing if Set Data is Outside the Allowable Setting Range
Data for each loop	9	MV variation rate limit (△MVL)	Sets the variation limit between the previous and present MV. If MV variation limit exceeds the set limit value, "1" will be set for bit 1 of the device, indicating an alarm. However, MV variation is not limited. (If MV variation exceeds the limit value, it is used intact as MV variation to calculate MV.)	0 to 2000	0 to 2000	If the user-designated △PVL or △MVL is outside the allowable setting range, the value will be replaced as described below so that PID operation can be executed: • If the value set for △PVL or △MVL is less than "0", the value is replaced with "0". • If the value set for △PVL or △MVL is greater than "2000", the value is replaced with "2000".
	10	PV variation rate limit (△PVL)	Sets the variation limit between the previous and present PV. If PV variation value exceeds the set limit value, "1" will be set for bit 0 of the device, indicating and alarm. However, PV variation is not limited. (If PV variation exceeds the limit value, it is used intact as PV variation to perform PID operation.)			

When setting PID control data to word devices, any of the word devices listed below can be used.
All of the data for all of the loops to be used must be set with consecutive device numbers.

Devices that can be used:

Data register (D)..... D0 to D6143
Link register (W)..... W0 to WFFF
File register (R) ..... R0 to R8191
Timer (T)..... T0 to T2047
Counter (C)..... C0 to C1023

Device allocation:

Designated device number			
	+0	Number of loops used	Common to all loops
	+1	Number of loops executed in a single scan	
	+2	Selection of an operation expression	For loop No. 1
	+3	Sampling cycle (Ts)	
	+4	Proportionate constant (KP)	
	+5	Integrating constant (TI)	
	+6	Differentiating constant (TD)	
	+7	Filtering coefficient (α)	
	+8	Manipulated value lower limit (MVLL)	
	+9	Manipulated value higher limit (MVHL)	
	+10	Manipulated value variation rate limit (△MVL)	
	+11	Process value variation rate limit (△PVL)	
	+12	Selection of operation expression	For loop No. 2
	+13	Sampling cycle (Ts)	
	+14	Proportionate constant (KP)	
	+15	Integrating constant (TI)	
	+16	Differentiating constant (TD)	
	+17	Filtering coefficient (α)	
	+18	Manipulated value lower limit (MVLL)	
	+19	Manipulated value higher limit (MVHL)	
	+20	Manipulated value variation rate limit (△MVL)	
	+21	Process value variation rate limit (△PVL)	
	+22	Selection of operation expression	For loop No. 3
	+23	Sampling cycle (Ts)	
	to	to	
	+m	Selection of operation method	For loop No. n
	+(m+1)	Sampling cycle (Ts)	
	+(m+2)	Proportionate constant (KP)	
	+(m+3)	Integrating constant (TI)	
	+(m+4)	Differentiating constant (TD)	
	+(m+5)	Filtering coefficient (α)	
	+(m+6)	Manipulated value lower limit (MVLL)	
	+(m+7)	Manipulated value higher limit (MVHL)	
	+(m+8)	Manipulated value variation rate limit (△MVL)	
	+(m+9)	Process value variation rate limit (△PVL)	

For the total number of loops to be used

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(1) Use the following formula to calculate the number of device points to be used when setting the PID control data:

Number of device points = 2 + 10 × n
(n: Number of loops to be used)

(2) Set the data as a binary number.

(3) An error will occur if the number of device points for the loops to be used exceed the last device number of the designated device. In this case, no processing will occur.

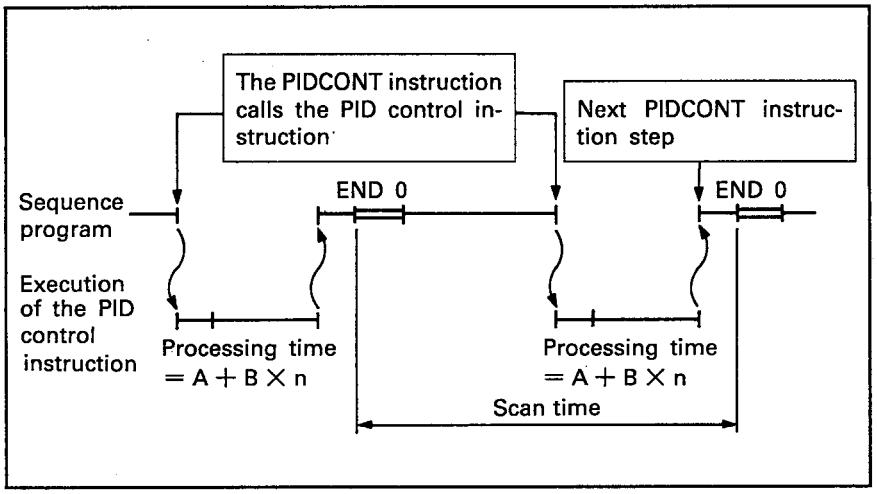
5.1.1 The number of loops to be used and the number of loops to be executed in a single scan

The number of loops to be used means the number of loops for which PID operation is executed. The sampling time is measured for the set number of loops when the PID control instruction (PIDCONT) is executed. PID operation is executed for the loop for which the sampling cycle time reaches or exceeds the set sampling cycle.
The number of loops to be executed in a single scan means the number of loops for which PID operation is executed in one scan when there is more than one loop for which sampling cycle time reaches or exceeds the set sampling cycle when the PID control instruction (PIDCONT) is executed.
Processing time increases in proportion to the number of loops for which PID operation is executed when the PID control instruction (PIDCONT) is executed.

Processing time = A + B × n

A: Fixed time for measuring sampling time
B: Time necessary for execute PID operation for a loop
n = Number of loops

If the number of loops to be executed in a single scan is set, PID operation is only executed for the set number of loops if there are a number of loops for which sampling cycle time reaches or exceeds the set sampling cycle when the PID control instruction is executed. PID operation is executed for the rest of the loops in the next scan.



POINT

If the number of loops for which sampling cycle time reaches or exceeds the set sampling cycle is greater than the number of loops to be executed in a single scan, PID operation execution priority is as follows:

1) The lowest numbered loop is given the highest priority.

2) If there are loops in the preceding scan for which PID operation has not been executed, they are given the highest priority.

5.1.2 Sampling cycle

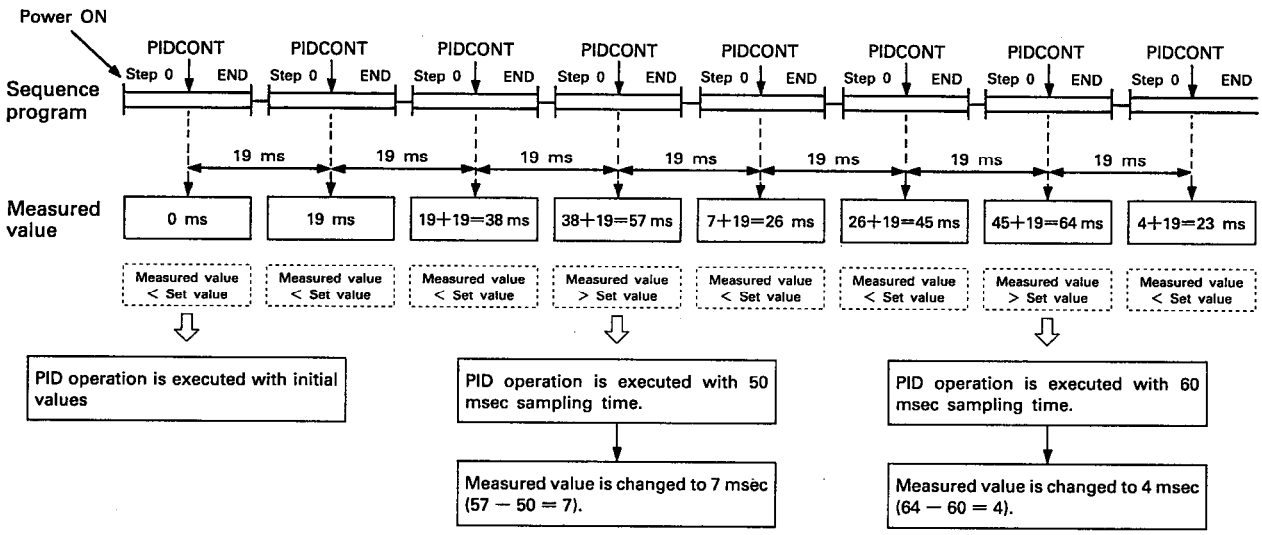
A sampling cycle is the cycle in which PID operation is executed. In sampling time, the measuring time for one scan is added to the sampling time for the preceding scan each time a PID instruction (PIDCONT) is executed. If the accumulated sampling time reaches or exceeds the set sampling cycle, PID operation is executed for the corresponding loop.

The measured value of the sampling time used for PID operation is truncated to the units of 10 msec.

Example: If sampling cycle setting = 50 msec,

- If measured value is 57 msec .... PID operation is executed with 50 msec sampling time.
- If measured value is 64 msec .... PID operation is executed with 60 msec sampling time.

When sampling cycle = 50 msec

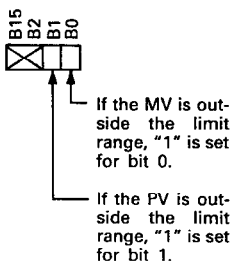


POINT

The sampling cycle is measured when the PIDCONT instruction is executed. Therefore, a value smaller than the sequence program scan time cannot be set for the sampling cycle. If a value smaller than the scan time is set, PID operation will be executed with the scan time.

5.2 Input/Output Data

The input/output data consists of input data, such as SV (set value) and PV (process value), which are set to execute PID operation, and output data, such as operation results.

Data Name		Description	Setting Range	Remark
Set value	SV	PID control target value	0 to 2000	If the SV value is outside the allowable setting range, PID operation is executed after the following processing. • If SV is less than "0", SV is taken as "0". • If SV is greater than "2000", SV is taken as "2000".
Process value	PV	Feedback data from control objective to A/D conversion module	−50 to 2050	If the PV value is outside the allowable setting range, PID operation is executed after the following processing. • If PV is less than "−50", PV is taken as "−50". • If PV is greater than "2050", PV is taken as "2050".
Automatic manipulated value	MV	The manipulated value calculated during PID operation. Output from the D/A conversion module to the control objective.	−50 to 2050	———
Process value after filtering	PV_1	Process value calculated using the operation formula Step 1 of POINT in Section 3.4.		
Manual manipulated value	MV_{MAN}	In the manual control mode, the data output from the D/A conversion module is stored.	−50 to 2050	If the MV_{MAN} value is outside the allowable setting range, PID operation is executed after the following processing. • If MV_{MAN} is less than "−50", PV is taken as "−50". • If MV_{MAN} is greater than "2050", PV is taken as "2050".
Manual/ automatic selection	MAN/ AUTO	Selects whether the output data to the D/A conversion module is a manually manipulated value or an automatically manipulated value. In manual control mode, the automatically manipulated value remains unchanged.	0: Manually manipulated value 1: Automatically manipulated value	An error occurs if the setting is neither 0 nor 1; PID operation of the corresponding loop will not be executed.
Alarm	ALARM	Used to determine if the variation rate of the MV (manipulated value) and the PV (process value) is outside the allowable range. Once set, the alarm data is retained until the user resets it. If the MV is outside the limit range, "1" is set for bit 1. If the PV is outside the limit range, "1" is set for bit 0.		———

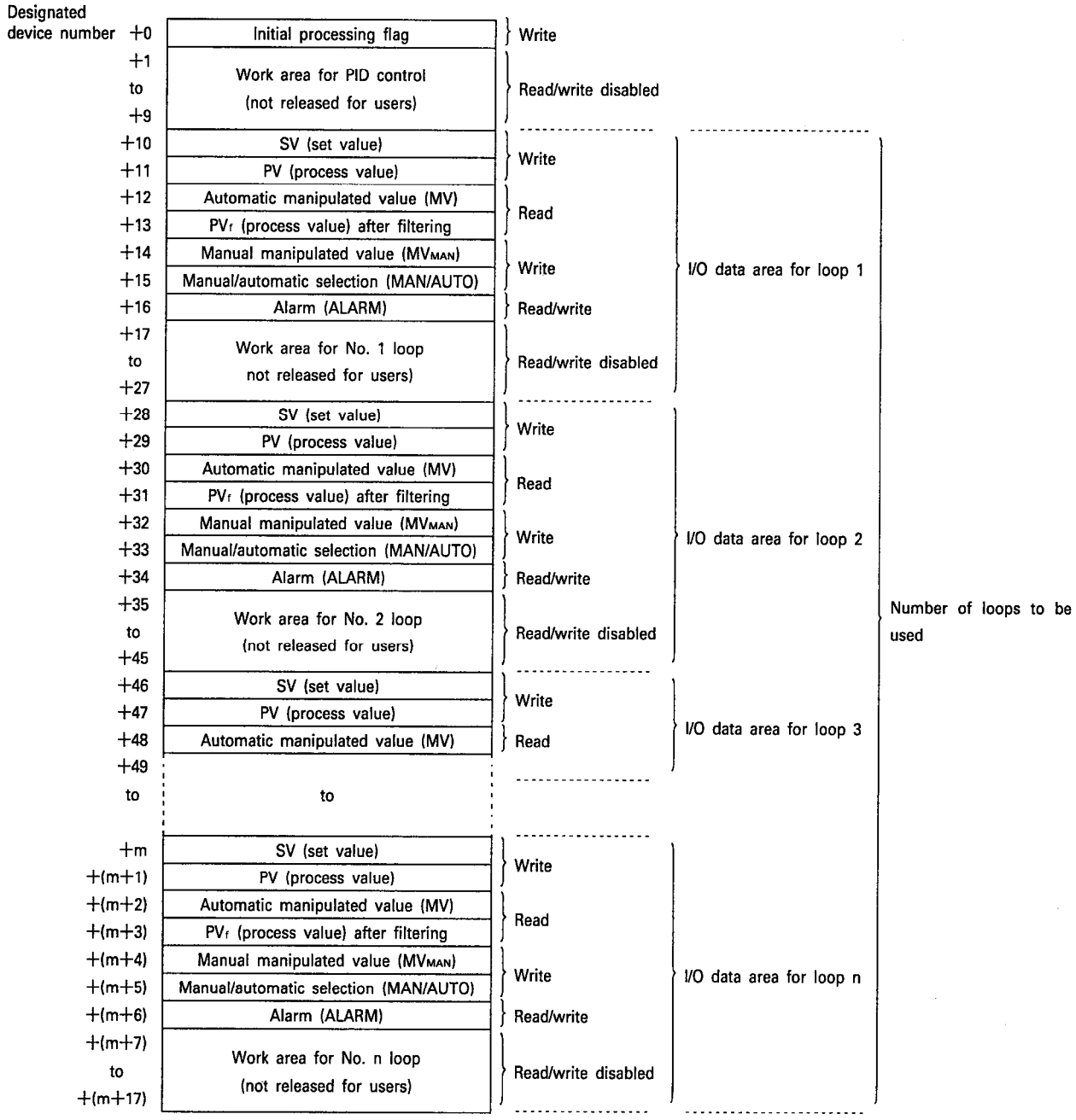
When setting input/output data to word devices, any of the word devices listed below can be used.

All of the data for all of the loops to be used must be set with consecutive device numbers.

Devices that can be used:

Data register (D)..... D0 to D6143
Link register (W)..... W0 to WFFF
File register (R) ..... R0 to R8191
Timer (T)..... T0 to T2047
Counter (C)..... C0 to C1023

Allocation to devices:



MEMO

(1) Use the following formula to calculate the number of device points to be used when setting the PID control data.

Number of device points = 10 + 18 × n
(n: Number of loops to be used)

(2) Set the data in binary numbers.

(3) The initial processing flag sets the processing method at the start of PID operation.
In the initial PID operation processing cycle, operation is executed assuming that the set sampling cycle is reached or exceeded.
The initial processing flag is set in the following manner:

0 ..... PID operation is processed in batch in a single scan for the number of loops to be used.

Other than 0 .... PID operation is processed in several scans for number of loops to be used.
Sampling begins sequentially from the loop for which the initial processing has been completed.
The number of processing loops per scan is the number of loops to be executed per scan.

(4) The data area for which "write" is designated indicates the data that should be written with a user sequence program. The data area for which "read" is designated indicates the data that should be read with a user sequence program. Never attempt to write data to a data area designated "read/write disabled" or "read". If this is attempted, correct PID operation will be precluded.

(5) An error will occur if the number of device points for the loops to be used exceeds the last device number of the designated device. If this is done, no processing will occur.

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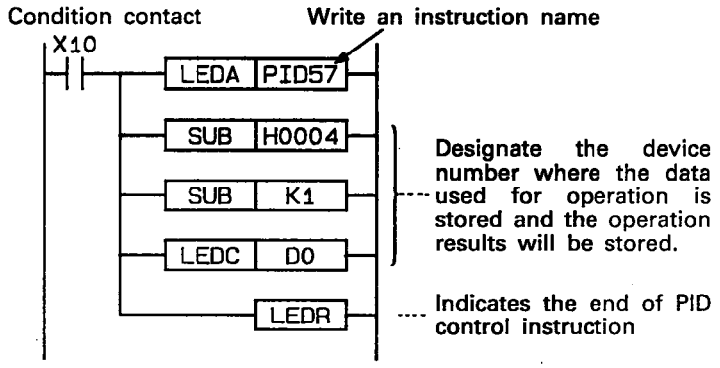
6. PID CONTROL INSTRUCTIONS

6.1 How to Use PID Control Instructions

6.1.1 Writing instructions

PID instructions are used in combination with a LEDA, LEDB, LEDC, LEDR, or SUB instruction.

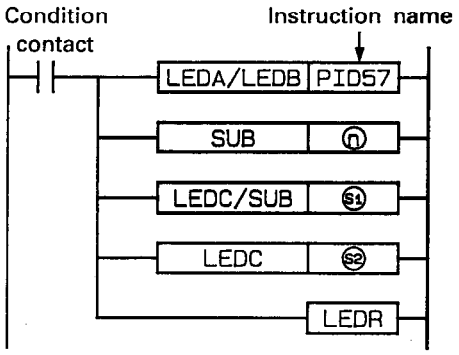
Ladder Circuit Form



Instruction List Form

LD	X10
LEDA	PID57
SUB	H0004
SUB	K1
LEDC	D0
LEDA	

Refer to Section 3.3.2 for an explanation on the form for writing PID instructions. Refer to Sections 6.2, 6.3, and 6.4 for detailed explanations on writing PID instruction.



(1) The LEDA, LEDB, LEDC, LEDR, and SUB instructions are used in the following manner:

| LEDA/LEDB | Instruction name | ····· Indicates the start of a PID control instruction.

| LEDA | Instruction name |

An instruction is executed every scan while the condition contact is ON.

| LEDB | Instruction name |

An instruction is executed only once when the condition contact changes from OFF to ON.

| LEDC/SUB | (S1) | ····· Designates the device where the PID operation data or the PID operation result is stored.

| LEDC | (S) | .....

| SUB | (n) | .....

| LEDC/SUB | (S1) |

Either LEDC or SUB can be designated.

| LEDC | (S) |

Only LEDC can be designated.

| SUB | (n) |

Only SUB can be designated.

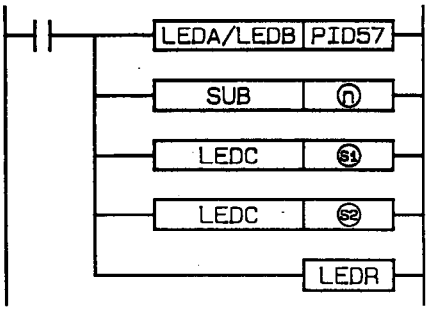
The LEDC instruction is used when setting a device number.

| LEDC | D0 | , | LEDC | W10A |

SUB is used when setting a 16-bit constant.
Setting range is: −32768 to 32767 or 0000_H to $FFFF_H$

| SUB | K32767 | , | SUB | HFFFF |

| LEDR | ····· Indicates the end of the PID control instruction.



(n) ··· Designate the head I/O number of AD57(S1) with the higher 2 digits of the 3-digit expression.

(S) ··· Designate the data to be written, the designation value, or the device number where such are stored.

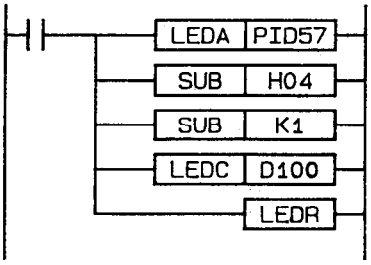
6.1.2 Number of instruction steps

With the following device numbers (devices extended by AnACPU/AnUCPU/QCPU-A), the instruction steps increase by one.

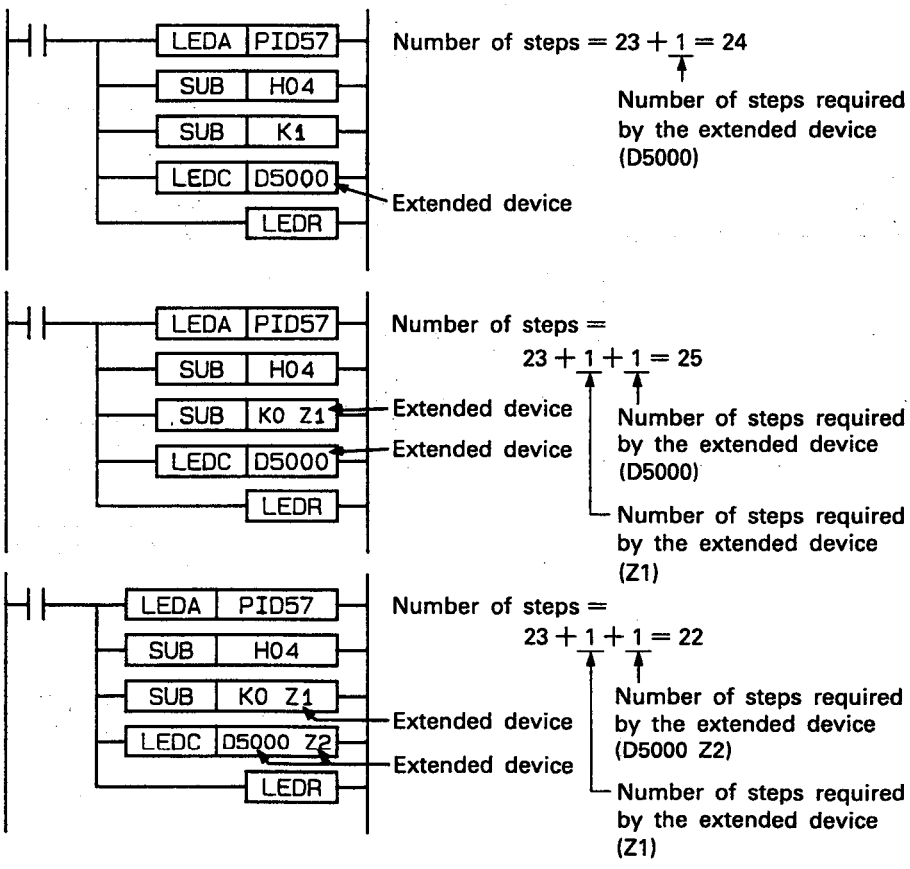
Device Name		Device Number Range
Internal relay (M, L, S)		2048 to 8191
Timer (T)		256 to 2047
Counter (C)		256 to 1023
Data register (D)		1024 to 6143
Link register (W)		400 to FFF
Annunciator (F)		256 to 2047
Index register	(Z)	1 to 6
	(V)	1 to 6

Example

• When the extended device is not used:



• When the extended device is used:



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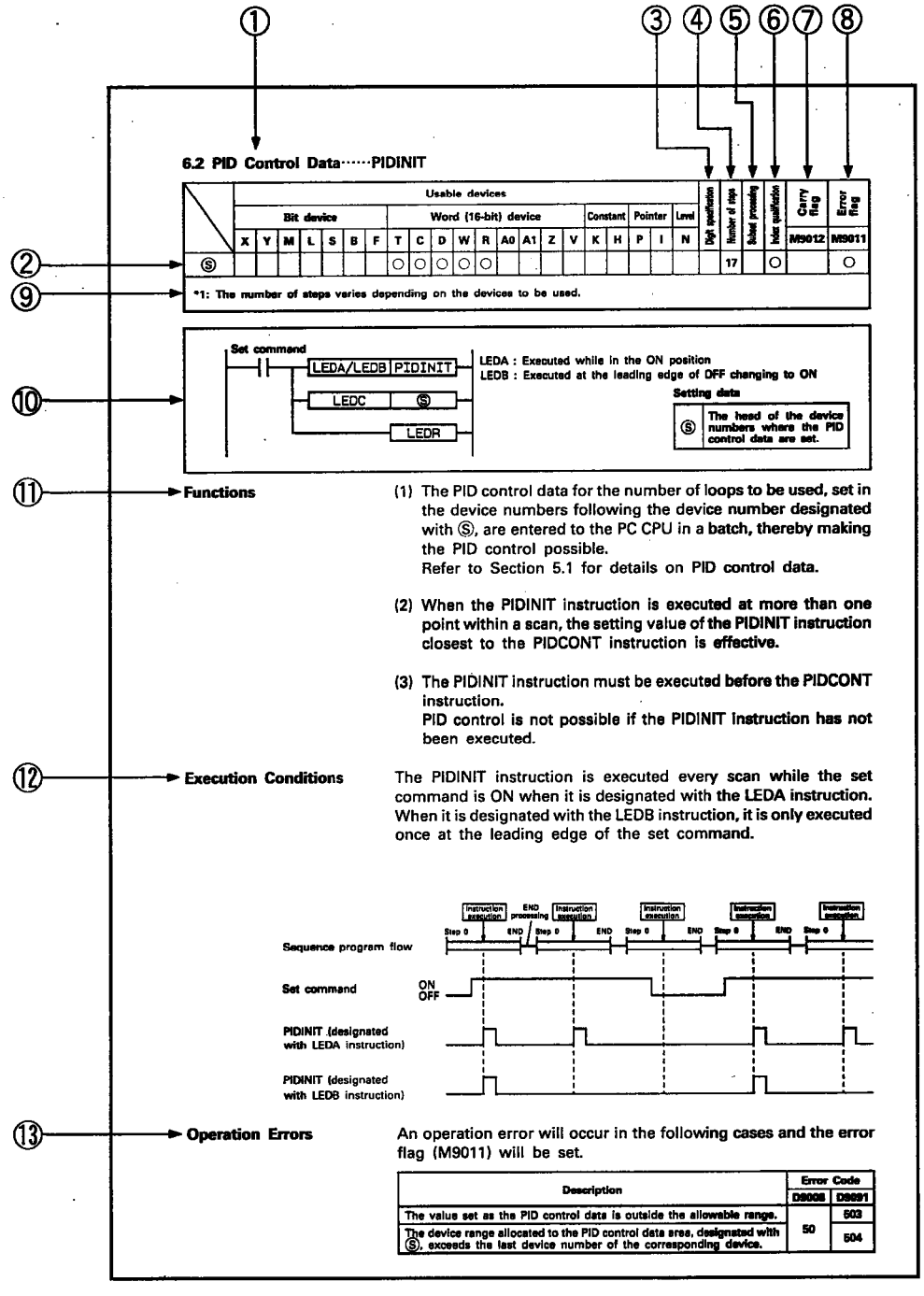
6.1.3 Precautions for dedicated instructions

(1) When a PID instruction is used, a series of instructions beginning with an LEDA/LEDB instruction and ending with an LEDR instruction indicates a single instruction.
Therefore, if an instruction is written in the wrong format in this series of instructions, an error will occur.

(2) The AnACPU/AnUCPU does not check the device number when index qualification is used so that PID operation processing speed will be faster. Note that this check is only made for file registers (R).
Therefore, if the device number exceeds the last device number of the designated device or "0" due to index qualification, processing may occur on the wrong device or the PCCPU might operate erroneously. However, this will not cause an error.

6.1.4 How to read explanations for instructions



① Indicates the function of the instruction and instruction mnemonic.

② Devices that can be used with the instruction are circled.

③ A circle indicates that digits must be designated when a bit device is used.

④ Indicates the number of steps occupied by the instruction. Refer to Section 6.1.2 for details of the number of steps.

⑤ A circle indicates that subset processing is possible.

⑥ A circle indicates that index qualification (Z, V) is possible.

⑦ A circle indicates that the ON/OFF status of the carry flag (M9012) changes according to the instruction execution results.

⑧ A circle indicates that the error flag (M9011) is set when an operation error occurs.

⑨ Describes the precautions for Steps ② to ⑧. The precaution must be read when asterisk is listed.

⑩ Indicates that the format to write an instruction in sequence program ladder circuit form.

⑪ Details the instruction.

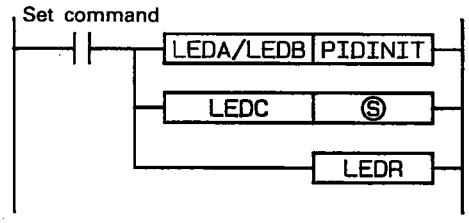
⑫ Indicates when the instruction is executed.

⑬ Indicates the conditions that will cause operation errors and the error codes.

6.2 PID Control Data·····PIDINIT

	Usable devices																			Digit specification	Number of steps	Subset processing	Index qualification	Carry flag	Error flag
	Bit device							Word (16-bit) device								Constant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
Ⓢ								○	○	○	○	○											17		○		○

*1: The number of steps varies depending on the devices to be used.



LEDA : Executed while in the ON position
LEDB : Executed at the leading edge of OFF changing to ON

Setting data

Ⓢ	The head of the device numbers where the PID control data are set.

Functions

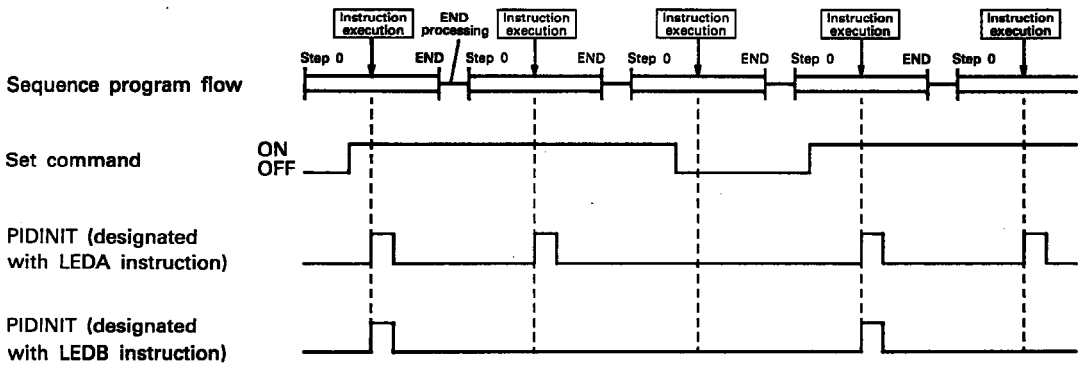
(1) The PID control data for the number of loops to be used, set in the device numbers following the device number designated with Ⓢ, are entered to the PC CPU in a batch, thereby making the PID control possible.
Refer to Section 5.1 for details on PID control data.

(2) When the PIDINIT instruction is executed at more than one point within a scan, the setting value of the PIDINIT instruction closest to the PIDCONT instruction is effective.

(3) The PIDINIT instruction must be executed before the PIDCONT instruction.
PID control is not possible if the PIDINIT instruction has not been executed.

Execution Conditions

The PIDINIT instruction is executed every scan while the set command is ON when it is designated with the LEDA instruction. When it is designated with the LEDB instruction, it is only executed once at the leading edge of the set command.



Operation Errors

An operation error will occur in the following cases and the error flag (M9011) will be set.

Description	Error Code	
	D9008	D9091
The value set as the PID control data is outside the allowable range.	50	503
The device range allocated to the PID control data area, designated with Ⓢ, exceeds the last device number of the corresponding device.		504

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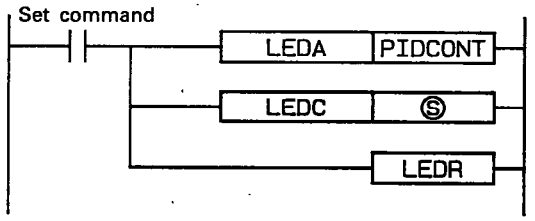
6.3 PID Control·····PIDCONT

	Usable devices																				Digit specification	Number of steps	Subset processing	Index qualification	Carry flag	Error flag
	Bit device							Word (16-bit) device								Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					
																									M9012	M9011
Ⓢ								○	○	○	○	○											17		○		○

*1: The number of steps varies depending on the devices to be used.



Setting data

Ⓢ	The head of the device numbers where the PID control data are set.

Functions

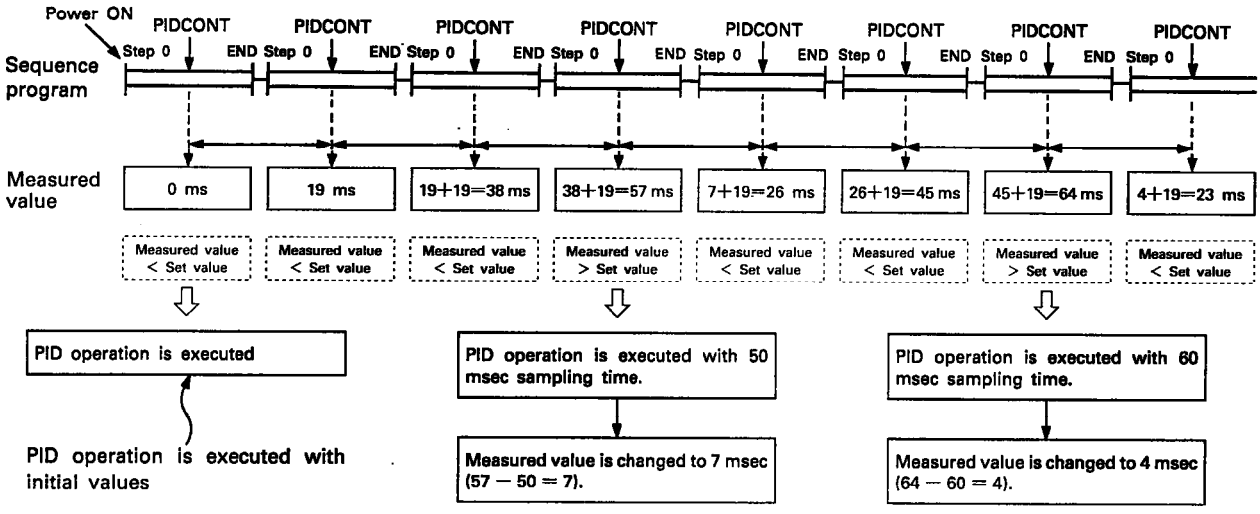
(1) The PIDCONT instruction calls for the sampling time and PID operation to be measured.

(2) PID operation is executed based on the SV (set value) and the PV (process value) in the input/output data area, which is set in device numbers following the device number designated with Ⓢ. The PID operation results are stored in the automatic MV (manipulated value) area in the input/output data area.

(3) PID operation is executed in response to the execution of the PIDCONT instruction appearing first after the set time for sampling cycle has elapsed.
The measured value of the sampling time used for PID operation is truncated to the units of 10 msec.

Example: If sampling cycle setting = 50 msec,
- If measured value is 57 msec:
  PID operation is executed with 50 msec sampling time.
- If measured value is 64 msec:
  PID operation is executed with 60 msec sampling time.

When sampling cycle = 50 msec



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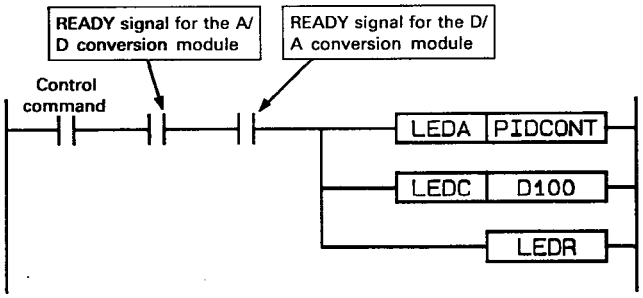
(4) During PID control, turn the control command ON (condition contact preceding the instruction) so that the PIDCONT instruction is executed in every scan.
The sampling time cannot be measured unless the PIDCONT instruction is executed every scan.

(5) For Ⓢ, designate the head number of the device numbers that are designated as the input/output data area.
If the file registers (R) are designated for the input/output area, do not set the memory protect ON for the file registers (R).
If memory protect is set ON, correct PID operation will be precluded, although an error will not occur.
Refer to Section 5.2 for details on the input/output data area.

(6) The PIDCONT instruction can be executed while the manual manipulated value (MV_{MAN}) is being output in the manual control mode.
The bumpless function cannot be executed if the PIDCONT instruction has not been executed.
Refer to Section 4.3.1 for details on the bumpless function.

(7) Use the READY signal to take interlock for each individual module so that the PIDCONT instruction is executed only when both the A/D conversion module, which reads the PV (process value), and the D/A conversion module, which outputs the MV (manipulated value), are normal.



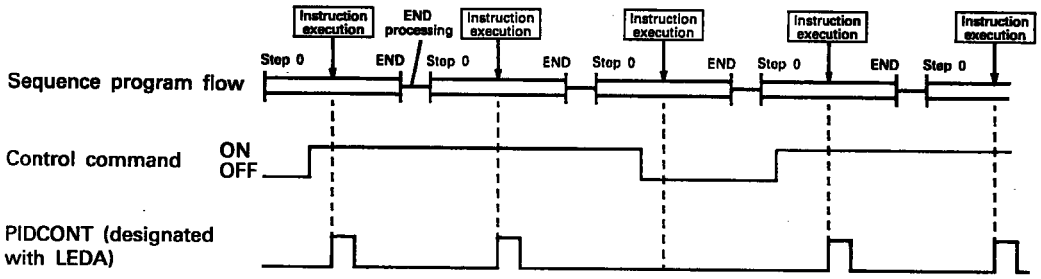
If the PIDCONT instruction is executed while either or both of the modules are faulty, PID operation cannot be executed correctly because the PV (process value) cannot be read correctly and/or the MV (manipulated value) cannot be output correctly.

(8) The PIDCONT instruction cannot be written in an interrupt program.

(9) If both a main program and a sub-program are used with an A3ACPU/A3UCPU/A4UCPU, write the PIDCONT instruction in both of these programs.
If the PIDCONT instruction is not written in both of the main program and the sub-program, the sampling cycle cannot be measured correctly.

Execution Conditions

The PIDCONT instruction is executed every scan while the control command remains ON as illustrated below:



Operation Errors

An operation error will occur in the following cases and the error flag (M9011) will be set.

Description	Error Code	
	D9008	D9091
The PIDINIT instruction was not executed before the PIDCONT instruction was executed.	50	509
The value set in the input/output data area is outside the allowable setting range.		503
The range of the device allocated to the input/output device range, designated with (S), exceeds the last device number of the corresponding devices.		504

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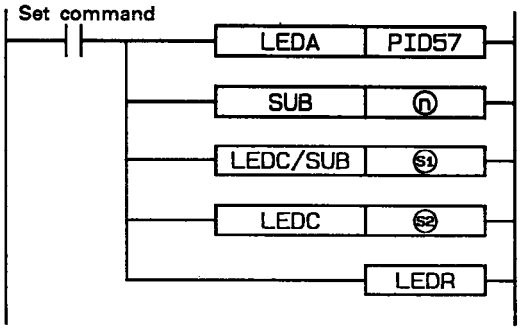
6.4 Monitoring PID Control Status·····PID57

	Usable devices																				Digit specification	Number of steps	Subset processing	Index qualification	Carry flag	Error flag
	Bit device							Word (16-bit) device								Constant		Pointer		Level						
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N					M9012	M9011
ⓝ																	○	○									
(S1)								○	○	○	○	○					○	○					23		○		○
(S2)								○	○	○	○	○															

*1: The number of steps varies depending on the devices to be used.



Setting data

ⓝ	Head I/O number of the AD57(S1), which is used for monitoring the PID control status.
(S1)	The screen number which corresponds to the loop number to be monitored.
(S2)	Initial screen display request

Functions

(1) The display unit of the AD57(S1) designated with ⓝ displays the PID control status of the loop number designated with (S1) on a bar graph.
By executing the initial screen display request, designated with (S2), the characters in the still portion of the monitor screen (with an exception of bar graphs and numerical data) will be displayed in the initial state of the PID control monitor.

(2) Addresses 0 to 1599 in the VRAM area of the AD57(S1) are used for the PID control monitor.
Therefore, if PID control status is monitored, the data stored in these addresses in the VRAM area are lost.

(3) Execute the CMODE instruction to monitor the PID control status before executing the PID57 instruction. The CMODE command is the control command for the AD57(S1)/AD58,
If the CRT standard display mode, set with the CMODE instruction, has not been set for the AD57(S1), the display unit will not be able to display anything.

REMARK

If the module name has been entered with the AnACPU/AnUCPU parameters, the CRT standard mode will be set automatically when the PC CPU operation mode is changed from STOP to RUN,

(4) Execute the PID57 instruction only after the PIDINIT and PIDCONT instructions have been executed.
An error will occur if the PID57 instruction is executed before the PIDINIT and PIDCONT instructions.

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(5) Use ⓝ to designate the head I/O number of the AD57(S1) with the higher 2 digits of the 3-digit hexadecimal.

Example: If AD57 is allocated to X/Y120 to X/Y13F, designate "12_H" for ⓝ.

(6) Designate the loop number with (S1) by displaying the corresponding screen as listed below:

Screen Number	Loop Numbers to Be Monitored
1	Loop 1 to loop 8
2	Loop 9 to loop 16
3	Loop 17 to loop 24
4	Loop 25 to loop 32

(7) The initial screen display request, designated with (S2), displays the characters in the still portion of the monitor screen.
Characters besides the bar graphs and numeric data will be not displayed unless the initial screen display request is executed.

(8) Give the initial screen display request in the following manner:
To make the initial screen display request, set "0".

(9) After the initial screen is displayed, the value designated with (S1) is automatically stored in (S2) and then the PID control monitor function is executed.
If the device, designated with (S2), is a file register (R), do not set the memory protect function for the file register ON. If the memory protect function is ON, the screen cannot display the monitor data correctly.

(10) The initial screen display request should only be executed once with the PID57 instruction, which appears first after the start of PC CPU operation.
If it is executed every scan, the bar graphs and numeric data will not be displayed, although the characters in the still portion are displayed.

(11) To monitor PID control status with the AD57(S1), the character generator ROM and canvas ROM must be created with the SW1GP-AD57P system floppy disk and loaded to the AD57(S1).
Create the Fig. 6.1 characters corresponding to the character codes of 000_H to $00B_H$ in the character generator ROM.
If these characters are not created, bar graphs cannot be displayed.
Refer to the SW1GP-AD57P Operating Manual for details on the procedure for creating the character generator ROM and canvas ROM.

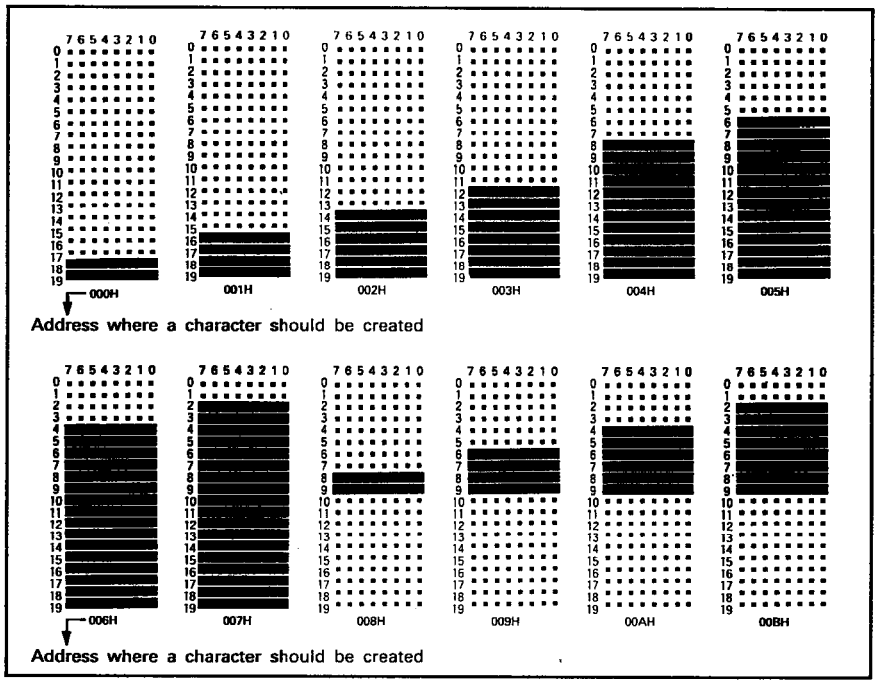
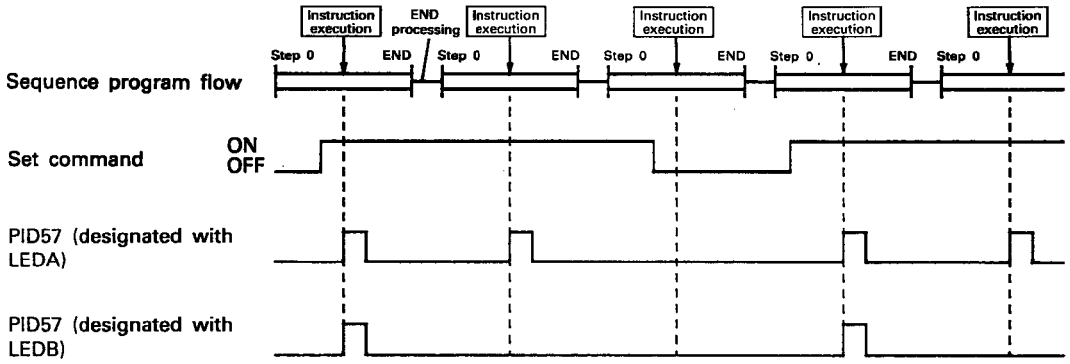


Fig. 6.1 Character for PID Control Status Monitor

Execution Conditions

The PID57 instruction is executed every scan as long as the monitor command is ON and has been designated with the LEDA instruction. When it is designated with the LEDB instruction, it is executed only once at the leading edge of the monitor command.



Operation Errors

An operation error will occur in the following cases and the error flag (M9011) will be set.

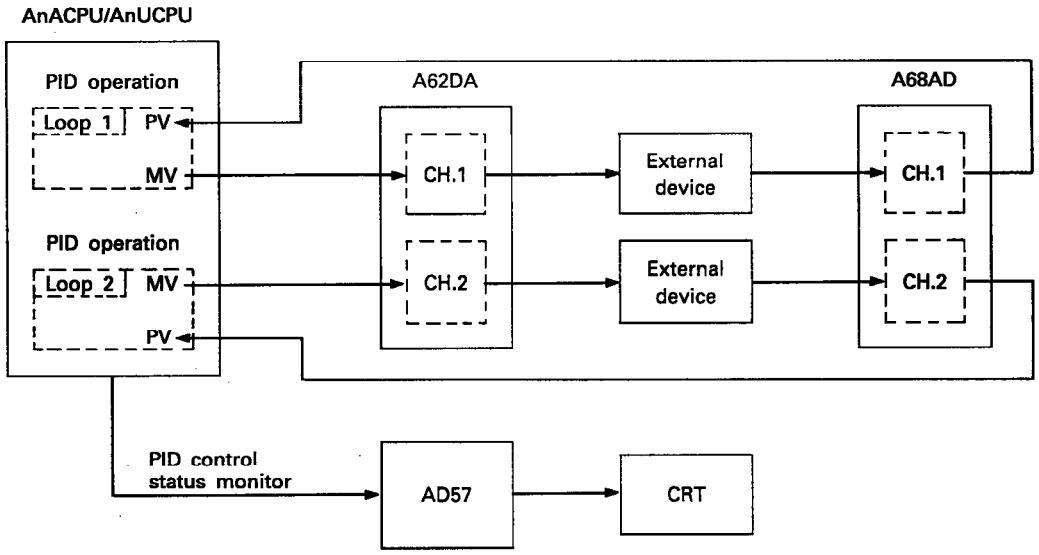
Description	Error Code	
	D9008	D9091
The CMODE instruction has not been executed for AD57(S1).	46	462
The PIDINIT instruction has not been executed before the PID57 instruction.	50	509
The PIDCONT instruction has not been executed before the PID57 instruction.		
The screen number designated with (S1) is outside the range of 1 to 4.		503

MEMO

7. PID CONTROL PROGRAM EXAMPLES

7.1 System Configuration for Program Examples

The following illustrates the system configuration for the program examples in Sections 7.2 and 7.3.



A68AD I/O numbers ····· X/Y80 to X/Y9F
A62DA I/O numbers ····· X/YA0 to X/YBF
AD57 I/O numbers ····· X/YC0 to X/YFF

7.2 Program Example for Automatic Mode PID Control

This section describes a program example for automatic mode PID control in which PID operation is executed with the digital value read from the A68AD as the PV. The MV obtained as the result of PID operation is output from the A62AD to control the external devices.

Programming Conditions

(1) Refer to Section 7.1 for details on the system configuration.

(2) PID operation is executed for two loops.

(3) The sampling cycle is 1 second.

(4) The PID control data is set to the following devices:
- Common data ····· D500 and D501
- Loop 1 data ····· D502 to D511
- Loop 2 data ····· D512 to D521

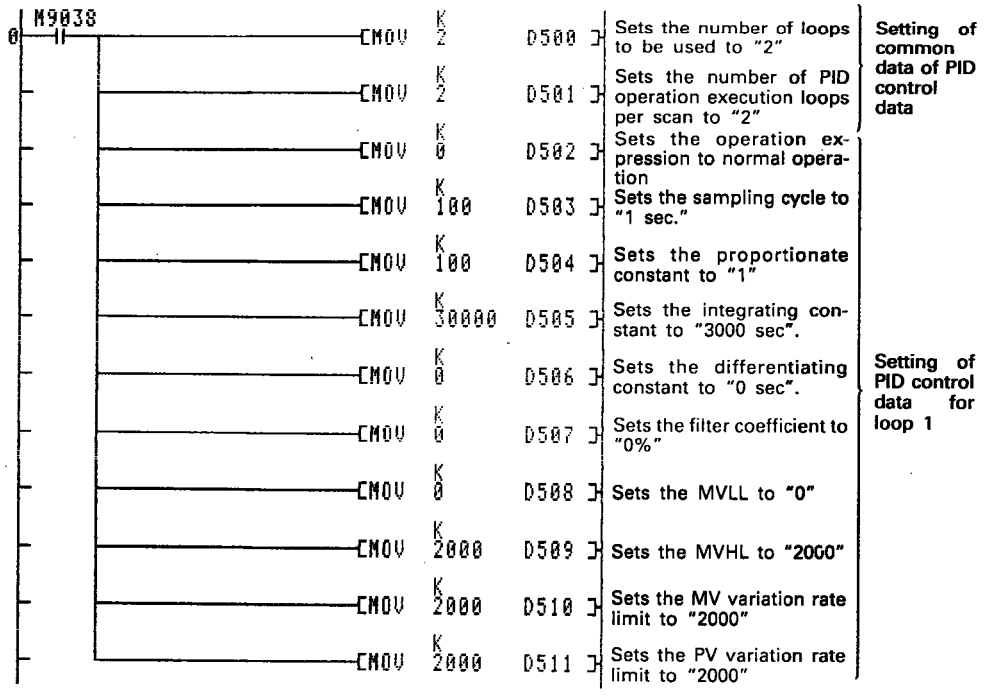
(5) The I/O data is set to the following devices:
- Common data ····· D600 to D609
- Loop 1 data ····· D610 to D627
- Loop 2 data ····· D628 to D645

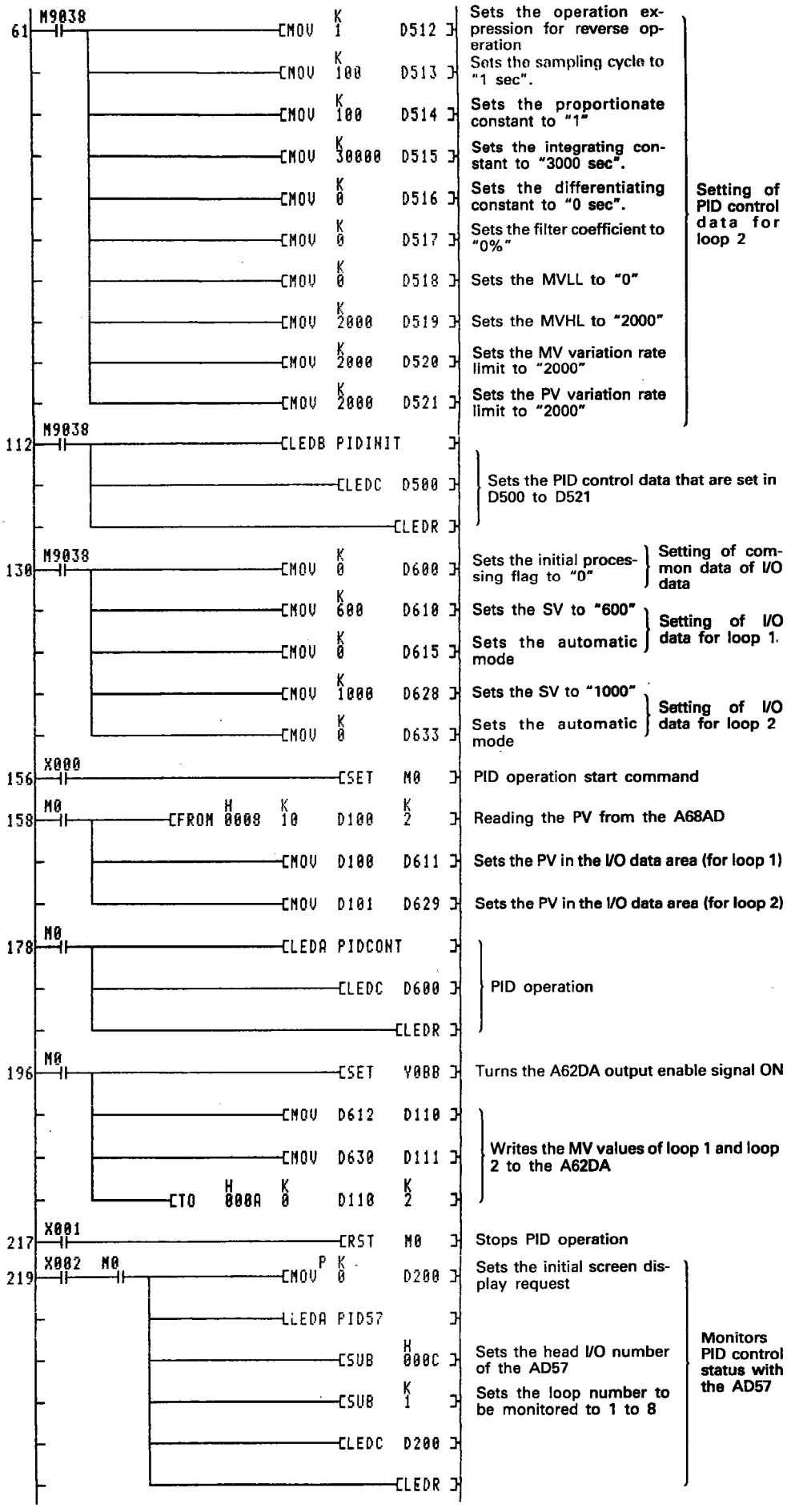
(6) The following SV values are set for loop 1 and loop 2 as indicated below with a sequence program:
- Loop 1 ····· 600
- Loop 2 ····· 1000

(7) The following devices are used to start and stop PID control and the monitor command with the AD57:
- PID control start command ····· X0
- PID control stop command ····· X1
- Monitoring command with AD57 ····· X2

(8) The digital values of the A68AD and A62DA are set within the 0 to 2000 range.

Program Example




61 M9038
CMOV K1 D512
CMOV K100 D513
CMOV K100 D514
CMOV K30000 D515
CMOV K0 D516
CMOV K0 D517
CMOV K0 D518
CMOV K2000 D519
CMOV K2000 D520
CMOV K2000 D521
Sets the operation expression for reverse operation
Sets the sampling cycle to "1 sec".
Sets the proportionate constant to "1"
Sets the integrating constant to "3000 sec".
Sets the differentiating constant to "0 sec".
Sets the filter coefficient to "0%"
Sets the MVLL to "0"
Sets the MVHL to "2000"
Sets the MV variation rate limit to "2000"
Sets the PV variation rate limit to "2000"
Setting of PID control data for loop 2
112 M9038
CLEDB PIDINIT
CLEDC D500
CLEDR
Sets the PID control data that are set in D500 to D521
130 M9038
CMOV K0 D600
CMOV K600 D610
CMOV K0 D615
CMOV K1000 D628
CMOV K0 D633
Sets the initial processing flag to "0"
Sets the SV to "600"
Sets the automatic mode
Sets the SV to "1000"
Sets the automatic mode
Setting of common data of I/O data
Setting of I/O data for loop 1.
Setting of I/O data for loop 2
156 X000
CSET M0
PID operation start command
158 M0
CFROM H0000 K10 D100 K2
CMOV D100 D611
CMOV D101 D629
Reading the PV from the A68AD
Sets the PV in the I/O data area (for loop 1)
Sets the PV in the I/O data area (for loop 2)
178 M0
CLEDA PIDCONT
CLEDC D600
CLEDR
PID operation
196 M0
CSET Y0BB
CMOV D612 D110
CMOV D630 D111
CTO H000A K0 D110 K2
Turns the A62DA output enable signal ON
Writes the MV values of loop 1 and loop 2 to the A62DA
217 X001
CRST M0
Stops PID operation
219 X002 M0
CMOV P K0 D200
CLEDA PID57
CSUB H000C
CSUB K1
CLEDC D200
CLEDR
Sets the initial screen display request
Sets the head I/O number of the AD57
Sets the loop number to be monitored to 1 to 8
Monitors PID control status with the AD57

7.3 Program Example for Changing the PID Control Mode between Automatic and Manual

Programming Conditions

(1) Refer to Section 7.1 for details on the system configuration.

(2) PID operation is executed for one loop.

(3) The sampling cycle is 1 second.

(4) The PID control data is set to the following devices:
Common data ····· D500 and D501
Loop 1 data ····· D502 to D511

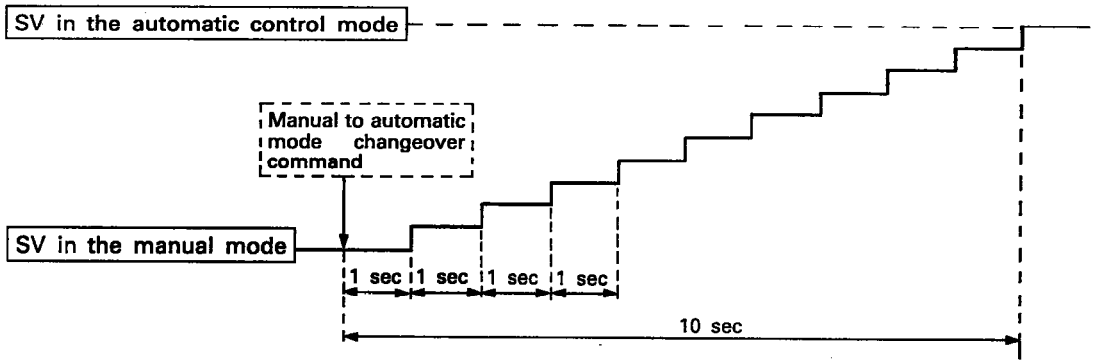
(5) The I/O data is set to the following devices:
Common data ····· D600 to D609
Loop 1 data ····· D610 to D627

(6) The SV and MV in manual mode are set with external digital switches as follows:
SV ····· X30 to X3F
MV (manual control mode) ····· X20 to X2F

(7) The following devices are used to start and stop PID control and the automatic/manual changeover command:
PID control start command ····· X0
PID control stop command ····· X1
Monitoring command with AD57 ····· X2
SV setting command ····· X3
MV setting command in manual mode ····· X4
Automatic/manual mode changeover command ···· X6
(OFF: Automatic mode, ON: Manual mode)

(8) The digital values of the A68AD and A62DA are set within the 0 to 2000 range.

(9) The SV is automatically rewritten to the PV when the control mode is changed from automatic to manual. Therefore, before returning the control mode from manual to automatic, the SV must be rewritten to the one used in the automatic mode. The SV is rewritten step-by-step 10 times as illustrated below:



SV is rewritten with the operation method as illustrated below:

$$\frac{(\text{SV to be used in automatic mode}) - (\text{MV value to be used in manual mode})}{10} = \boxed{\text{Incremental value}} \cdots\cdots \boxed{\text{Remainder}}$$

The incremental value obtained in the formula above is added to SV every second. The remainder is added in the first addition operation.

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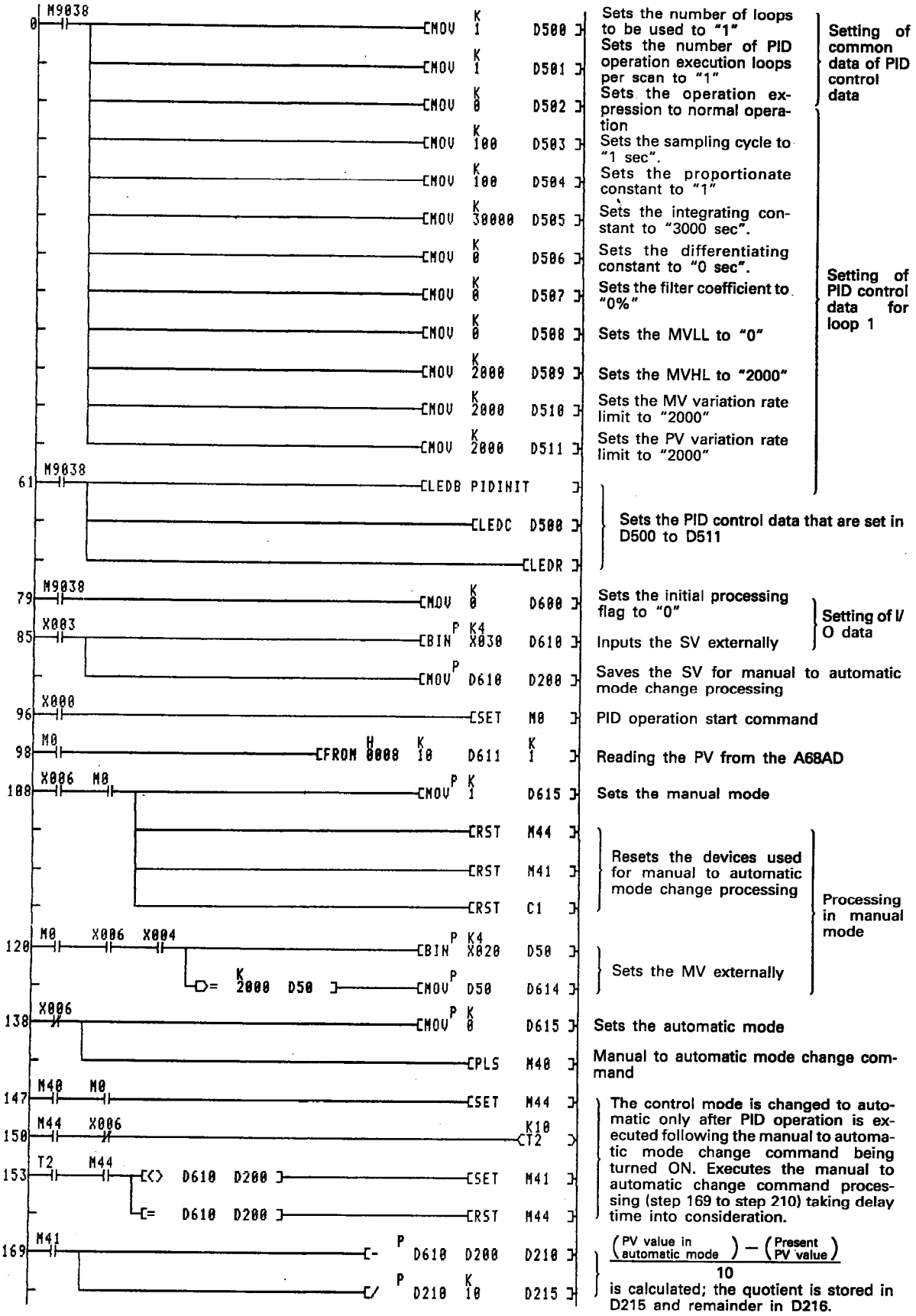
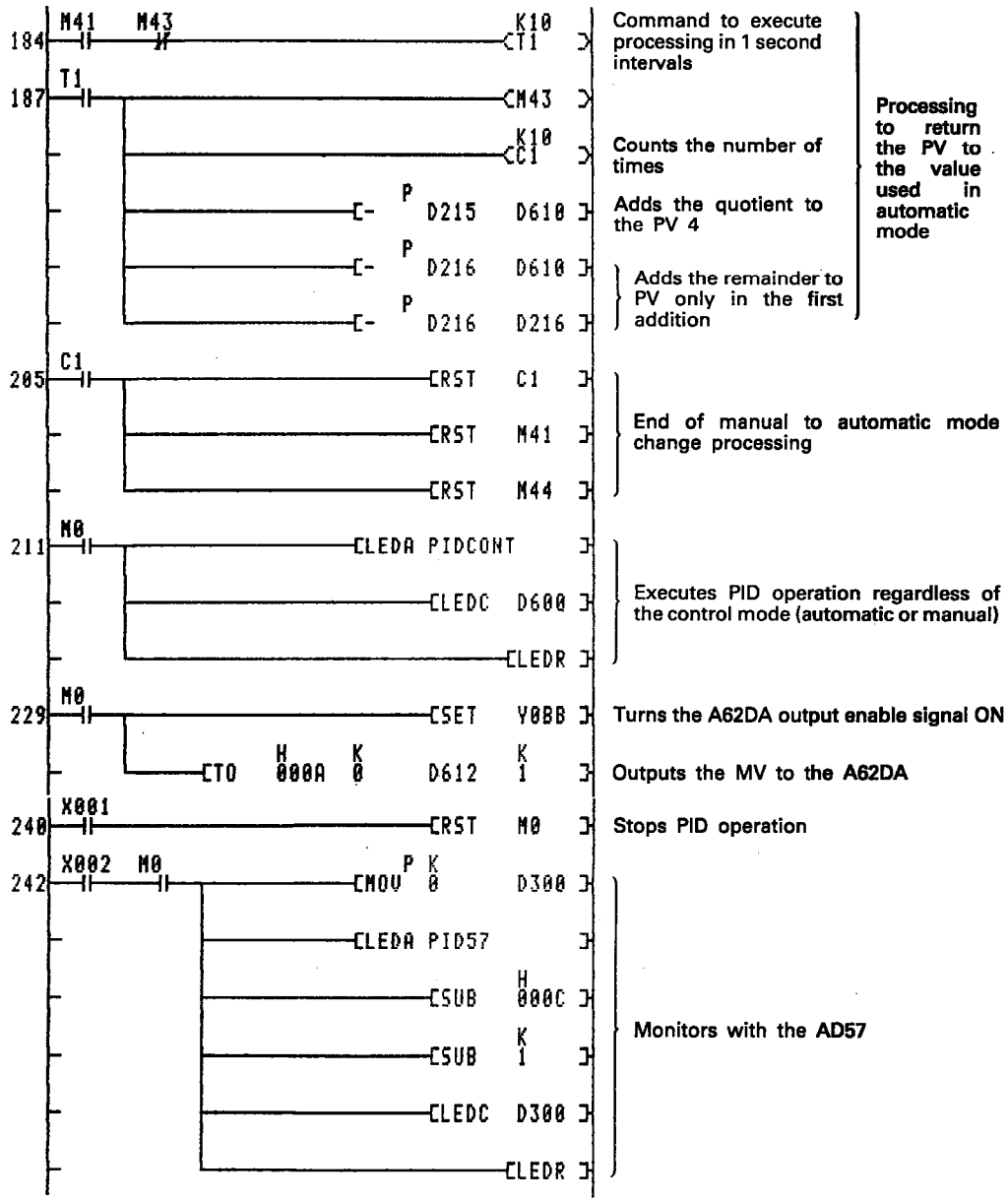
Program Example




184 M41 M43 K10 T1
Command to execute processing in 1 second intervals
187 T1 M43
K10 C1
Counts the number of times
P D215 D610
Adds the quotient to the PV 4
P D216 D610
P D216 D216
Adds the remainder to PV only in the first addition
Processing to return the PV to the value used in automatic mode
205 C1 RST C1 RST M41 RST M44
End of manual to automatic mode change processing
211 M0 CLEDA PIDCONT CLEDC D600 CLEDR
Executes PID operation regardless of the control mode (automatic or manual)
229 M0 SET Y0BB
Turns the A62DA output enable signal ON
TO H 000A K 0 D612 K 1
Outputs the MV to the A62DA
240 X001 RST M0
Stops PID operation
242 X002 M0 P MOV K 0 D300
CLEDA PID57
SUB H 000C
SUB K 1
CLEDC D300
CLEDR
Monitors with the AD57

8 ERROR CODE LIST

When an error occurs at PC RUN or during RUN, the error is displayed or error code is stored in special register D9008, the detailed error code is stored in special register D9091, and the error step is stored in special register D9011 by the self-diagnostic function. The error content and corrective action are shown in Table 8.1 and 8.2.

8.1 Reading of Error Codes

When an error occurs, the error code can be read by peripheral device. Refer to the Peripheral Device Operating Manual for the operation method.

8.2 Error Code List for the AnACPU

Error codes are generated as follows:

Table 8.1 Error Code List for the AnACPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"INSTRCT CODE ERR." (Checked at STOP→RUN or during instruction execution)	10	101	An unrecognized instruction code is being used.	(1) Read the error step by peripheral device and correct the program of that step. (2) Check to see if ROM has an undecodable instruction code and replace with ROM which has the correct content.
		102	Index is qualifying for a 32-bit constant.	Read the error step by peripheral device and correct the program of that step.
		103	The device specified by extension application instruction is incorrect.	
		104	The program structure of the extension application instruction is incorrect.	
		105	The command name of the extension application instruction is incorrect.	
		106	There is a place where index qualifying with Z or V is made in the program in [LEDA/B][IX] to [LEDA/B][IXEND].	
		107	(1) The device number and set value in the OUT instruction of the timer and counter are qualified by an index. (2) The label number of pointer (P) assigned to a destination head of [CJ], [SCJ], [CALL], [CALLP], [JMP], [LEDA/B][FCALL], [LADA/B][BREAK] instructions or the label number of interrupt pointer (I) assigned to an interrupt program head is qualified by an index.	
		108	Error other than 101 to 107 above.	

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Table 8.1 Error Code List for the AnACPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"PARAMETER ERROR" (Checked at power-on, STOP→RUN, and PAUSE→RUN)	11	111	The capacity settings of the main program, subprograms, microcomputer programs, file register comments, status latch, sampling trace or extension file registers are not within the usable CPU range.	Read the parameters in the CPU memory and rewrite to the memory after checking and correcting the content.
		112	The total of the set capacities of the main program, subprograms, file register comments, status latch, sampling trace and extension file registers exceed the memory cassette capacity.	
		113	The latch range in parameters or the M, L, S setting is incorrect.	
		114	Sum check error	
		115	Parameter remote RUN/PAUSE contacts, the run mode at error occurrence, the annunciator display mode or the STOP→RUN display mode settings are incorrect.	
		116	Parameter MELSECNET/MINI-S3 automatic refresh setting is incorrect.	
		117	Parameter timer settings are incorrect.	
		118	Parameter counter settings are incorrect.	
"MISSING END INS." (Checked at STOP→RUN)	12	121	There is no END (FEND) instruction in the main program.	Write END in main program.
		122	Subprogram has been allocated in the parameters and this as no END (FEND) instruction.	Write END in subprogram.
"CAN'T EXECUTE (P)" (Checked at the execution of instruction)	13	131	The device number of pointer (P) or interrupt pointer (I) used as the label added to the destination head is duplicating.	Remove the duplicated number of pointer (P) with the destination head and correct so that the number is not duplicated.
		132	The label of pointer (P) specified by CJ, SCJ, CALL, CALLP, JMP, LEDA/B FCALL, LEDA/B BREAK instructions is not specified prior to the END instruction.	Read the error step by peripheral device, check the content, and insert destination pointer (P).

Table 8.1 Error Code List (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"CHK FORMAT ERR" (Checked at STOP/PAUSE → RUN.)	14	141	STOP	Instructions (including NOP) other than LDX, LDIX, ANDX and ANIX are included in the CHK instruction circuit block.	Check the program of the CHK instruction and correct it referring to contents of detailed error codes.
		142		Multiple CHK instructions are given.	
		143		The number of contact points in the CHK instruction circuit block exceeds 150.	
		144		The LEDA CHK instructions are not paired with the LEDA CHKEND instructions, or 2 or more pairs of them are given.	
		145		Format of the block shown below, which is provided before the CHK instruction circuit block, is not as specified. P254 ⊣⊢ CJ P□	
		146		Device number of D1 in the CHK D1 D2 instruction is different from that of the contact point before the CJ P□ instruction.	
		147		Index qualification is used in the check pattern circuit.	
		148		(1) Multiple check pattern circuits of the LEDA CHK - LEDA CHKEND instructions are given. (2) There are 7 or more check condition circuits in the LEDA CHK - LEDA CHKEND instructions. (3) The check condition circuits in the LEDA CHK - LEDA CHKEND instructions are written without using X and Y contact instructions or compare instructions. (4) The check pattern circuits of the LEDA CHK - LEDA CHKEND instructions are written with 257 or more steps.	

Table 8.1 Error Code List (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"CAN'T EXECUTE (I)" (Checked at occurrence of interrupt.)	15	151	STOP	The IRET instruction was given outside of the interrupt program and was executed.	Read the error step using a peripheral device and delete the IRET instruction.
		152		There is no IRET instruction in the interrupt program.	Check the interrupt program if the IRET instruction is given in it. Write the IRET instruction if it is not given.
		153		Though an interrupt module is used, no interrupt pointer (I) which corresponds to the module is given in the program. Upon occurrence of error, the problem pointer (I) number is stored at D9011.	Monitor special register D9011 using a peripheral device, and check if the interrupt program that corresponds to the stored data is provided or if two or more interrupt pointers (I) of the same number are given. Make necessary corrections.
"CASSETTE ERROR"	16	—	STOP	Memory cassette is not loaded.	Turn off the PC power and load the memory cassette.
"RAM ERROR" (Checked at power on.)	20	201	STOP	The sequence program storage RAM in the CPU module caused an error.	Since this is CPU hardware error, consult Mitsubishi representative.
		202		The work area RAM in the CPU module caused an error.	
		203		The device memory in the CPU module caused an error.	
		204		The address RAM in the CPU module caused an error.	
"OPE CIRCUIT ERROR" (Check during execution of END process)	21	211	STOP	The operation circuit for index qualification in the CPU does not work correctly.	Since this is CPU hardware error, consult Mitsubishi representative.
		212		Hardware (logic) in the CPU does not operate correctly.	
		213		The operation circuit for sequential processing in the CPU does not operate correctly.	
		214		The operation circuit for indexing in the END process check of the CPU does not function correctly.	
		215		Hardware inside the CPU does not function in the END process check of the CPU.	
"WDT ERROR" (Checked at execution of END processing.)	22	—	STOP	Scan time is longer than the WDT time. (1) Scan time of the user's program has been extended due to certain conditions. (2) Scan time has been extended due to momentary power failure occurred during scanning.	(1) Calculate and check the scan time of user program and reduce the scan time using the CJ instruction or the like. (2) Monitor contents of special register D9005 using a peripheral device. If the contents are other than 0, power supply voltage may not be stable. Check power supply and reduce variation in voltage.

Table 8.1 Error Code List (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"END NOT EXECUTE" (Checked at execution of the END instruction.)	24	241	STOP	Whole program of specified program capacity was executed without executing the END instructions. (1) When the END instruction was to be executed, the instruction was read as other instruction code due to noise. (2) The END instruction changed to other instruction code due to unknown cause.	(1) Reset and run the CPU again. If the same error recurs, Since this is CPU hardware error, consult Mitsubishi representative.
"MAIN CPU DOWN"	26	—	STOP	The main CPU is malfunctioning or faulty.	Since this is CPU hardware error, consult Mitsubishi representative
"UNIT VERIFY ERR" (Checked continuously.)	31	—	Stop or Continue (set by para-meter)	Current I/O module information is different from that recognized when the power was turned on. (1) The I/O module (including special function modules) connection became loose or the module was disconnected during operation, or wrong module was connected.	Read detailed error code using a peripheral device and check or replace the module which corresponds to the data (I/O head number). Or, monitor special registers D9116 to D9123 using a peripheral device and check or replace the modules if corresponding data bit is "1".
"FUSE BREAK OFF" (Checked continuously.)	32	—	Stop or Continue (set by para-meter)	There is an output module of which fuse is blown.	(1) Check the FUSE BLOWN indicator LED on the output module and replace the fuse. (2) Read detailed error code using a peripheral device and replace the fuse of the output module which corresponds to the data (I/O head number). Or, monitor special registers D9100 to D9107 using a peripheral device and replace the fuse of the output module of which corresponding data bit is "1".
"CONTROL-BUS ERR"	40	401	STOP	Due to the error of the control bus which connects to special function modules, the FROM/TO instruction cannot be executed.	Since it is a hardware error of special function module, CPU module or base module, replace and check defective module(s). Consult Mitsubishi representative for defective modules.
		402		If parameter I/O assignment is being executed, special function modules are not accessible at initial communication. At error occurrence, the head I/O number (upper 2 digits of 3 digits) of the special function module that caused error is stored at D9011.	

Table 8.1 Error Code List (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"SP.UNIT DOWN"	41	411	STOP	Though an access was made to a special function module at execution of the FROM/TO instruction, no response is received.	Since it is hardware error of the special function module to which an access was made, consult Mitsubishi representative.
		412		If parameter I/O assignment is being executed, no response is received from a special function module at initial communication. At error occurrence, the head I/O number (upper 2 digits of 3 digits) of the special function module that caused error is stored at D9011.	
"LINK UNIT ERROR"	42	—	STOP	(1) Either data link module is loaded to the master station. (2) There are 2 link modules which are set to the master station (station 0).	(1) Remove data link module from the master station. (2) Reduce the number of master stations to 1. Reduce the link modules to 1 when the 3-tier system is not used.
"I/O INT. ERROR"	43	—	STOP	Though the interrupt module is not loaded, an interrupt occurred.	Since it is hardware error of a module, replace and check a defective module. For defective modules, consult Mitsubishi representative.
"SP.UNIT LAY.ERR."	44	441	STOP	A special function module is assigned as an I/O module, or vice versa, in the I/O assignment using parameters from the peripheral device.	Execute I/O assignment again using parameters from the peripheral device according to the loading status of special function modules.
		442		There are 9 or more special function modules (except the interrupt module) which can execute interruption to the CPU module loaded.	Reduce the special function modules (except the interrupt module) which can execute interrupt start to 8 or less.
		443		There are 2 or more data link modules loaded.	Reduce the data link modules to 1 or less.
		444		There are 7 or more modules such as a computer link module loaded to one CPU module.	Reduce the computer link modules to 6 or less.
		445		There are 2 or more interrupt modules loaded.	Reduce the interrupt modules to 1 or less.
		446		Modules assigned by parameters for MNT/MINI automatic refresh from the peripheral device do not conform with the types of station modules actually linked.	Perform again module assignment for MNT/MINI automatic refresh with parameters according to actually linked station modules.
		447		The number of modules of I/O assignment registration (number of loaded modules) per one CPU module for the special function modules which can use dedicated instructions is larger than the specified limit. (Total of the number of computers shown below is larger than 1344.) (AD59 × 5) (AD57(S1)/AD58 × 8) (AJ71C24(S3/S6/S8) × 10) (AJ7IUC24 × 10) (AJ71C21(S1) (S2) × 29) + ((AJ71PT32(S3) in extension mode x 125) Total > 1344	Reduce the number of loaded special function modules.

Table 8.1 Error Code List (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"SP.UNIT ERROR" (Checked at execution of the FROM/TO instruction or the dedicated instructions for special function modules.)	46	461	Stop or Continue (set by para-meter)	Module specified by the FROM / TO instruction is not a special function module.	Read the error step using a peripheral device and check and correct contents of the FROM / TO instruction of the step.
		462		Module specified by the dedicated instruction for special function module is not a special function module or not a corresponding special function module.	Read the error step using a peripheral device and check and correct contents of the dedicated instruction for special function modules of the step.
"LINK PARA. ERROR"	47	—	Continue	(1) Data written to the parameter areas of the link of which range was set by parameters using a peripheral device does not conform with the data of link parameters read by the CPU. Or, link parameters are not written. (2) Total number of local stations is set at 0.	(1) Write in parameters again and check. (2) Check setting of station numbers. (3) If the same error indication is given again, it is hardware failure. Consult Mitsubishi representative.
"OPERATION ERROR" (Checked at execution of instruction.)	50	501	Stop or Continue (set by para-meter)	(1) When file registers (R) are used, operation is executed outside of specified ranges of device numbers and block numbers of file registers (R). (2) File registers are used in the program without setting capacity of file registers.	Read the error step using a peripheral device and check and correct program of the step.
		502		Combination of the devices specified by instruction is incorrect.	
		503		Stored data or constant of specified device is not in the usable range.	
		504		Set number of data to be handled is out of the usable range.	
		505		(1) Station number specified by the LEDA/B LRDP LCDA/B LWTP, LRDP, LWTP instructions is not a local station. (2) Head I/O number specified by the LEDA/B RFRP LEDA/B RTOP, RFRP, RTOP instructions is not of a remote station.	
		506		Head I/O number specified by the LEDA/B RFRP LEDA/B RTOP, RFRP, RTOP instructions is not of a special function module.	
		507		(1) When the AD57(S1) or AD58 was executing instructions in divided processing mode, other instructions were executed to either of them. (2) When an AD57(S1) or AD58 was executing instructions in divided processing mode, other instructions were executed in divided mode to another AD57(S1) or AD58.	Read the error step using a peripheral device and provide interlock with special relay M9066 or modify program structure so that, when the AD57(S1) or AD58 is executing instructions in divided processing mode, other instructions may not be executed to either of them or to another AD57(S1) or AD58 in divided mode.

Table 8.1 Error Code List (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"OPERATION ERROR" (Checked at execution of instruction.)	50	509	STOP	(1) An instruction which cannot be executed by remote terminal modules connected to the MNET/MINI-S3 was executed to the modules. (2) When the PRC instruction was executed to a remote terminal, the communication request registration areas overflowed. (3) The PIDCONT instruction was executed without executing the PIDINIT instruction. The PID57 instruction was executed without executing the PIDINIT or PIDCONT instruction.	(1) Read the error step using a peripheral device and correct the program, meeting loaded conditions of remote terminal modules. (2) Provide interlock using M9081 (communication request registration areas BUSY signal) or D9081 (number of vacant areas in the communication request registration areas) when the PRC instruction is executed to a remote terminal. (3) Execute the PIDCONT instruction after execution of the PIDINIT instruction. Execute the PID57 instruction after execution of the PIDINIT and PIDCONT instructions.
"MAIN CPU DOWN"	60	—	STOP	(1) The CPU malfunctioned due to noise. (2) Hardware failure.	(1) Take proper countermeasures for noise. (2) Hardware failure.
		602		(1) Failure in the power module, CPU module, main base unit or expansion cable is detected.	(1) Replace the power module, CPU module, main base unit or expansion cable.
"BATTERY ERROR" (Checked at power on.)	70	—	Continue	(1) Battery voltage has lowered below specified level. (2) Battery lead connector is not connected.	(1) Replace battery. (2) If a RAM memory or power failure compensation function is used, connect the lead connector.

8.3 Error Code List for the AnUCPU

Error codes are generated as follows:
(*:The dedicated error code newly set for the AnUCPU.)

Table 8.2 Error Code List for the AnUCPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"INSTRCT CODE ERR." (Checked at STOP→RUN or during instruction execution)	10	101	An unrecognized instruction code is being used.	(1) Read the error step by peripheral device and correct the program of that step. (2) Check to see if ROM has an undecodable instruction code and replace with ROM which has the correct content.
		102	Index is qualifying for a 32-bit constant.	Read the error step by peripheral device and correct the program of that step.
		103	The device specified by extension application instruction is incorrect.	
		104	The program structure of the extension application instruction is incorrect.	
		105	The command name of the extension application instruction is incorrect.	
		106	There is a place where index qualifying with Z or V is made in the program in [LEDA/B][IX] to [LEDA/B][IXEND].	
		107	(1) The device number and set value in the OUT instruction of the timer and counter are qualified by an index. (2) The label number of pointer (P) assigned to a destination head of [CJ], [SCJ], [CALL], [CALLP], [JMP], [LEDA/B][FCALL], [LADA/B][BREAK] instructions or the label number of interrupt pointer (I) assigned to an interrupt program head is qualified by an index.	
		108	Error other than 101 to 107 above.	

Table 8.2 Error Code List for the AnUCPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"PARAMETER ERROR" (Checked at power-on, STOP→RUN, and PAUSE→RUN)	11	111	The capacity settings of the main program, subprograms, microcomputer programs, file register comments, status latch, sampling trace or extension file registers are not within the usable CPU range.	Read the parameters in the CPU memory and rewrite to the memory after checking and correcting the content.
		112	The total of the set capacities of the main program, subprograms, file register comments, status latch, sampling trace and extension file registers exceed the memory cassette capacity.	
		113	The latch range in parameters or the M, L, S setting is incorrect.	
		114	Sum check error	
		115	Parameter remote RUN/PAUSE contacts, the run mode at error occurrence, the annunciator display mode or the STOP→RUN display mode settings are incorrect.	
		116	Parameter MELSECNET/MINI-S3 automatic refresh setting is incorrect.	
		117	Parameter timer settings are incorrect.	
		118	Parameter counter settings are incorrect.	
"MISSING END INS." (Checked at STOP→RUN)	12	121	There is no END (FEND) instruction in the main program.	Write END in main program.
		122	Subprogram has been allocated in the parameters and this as no END (FEND) instruction.	Write END in subprogram.
"CAN'T EXECUTE (P)" (Checked at the execution of instruction)	13	131	The device number of pointer (P) or interrupt pointer (I) used as the label added to the destination head is duplicating.	Remove the duplicated number of pointer (P) with the destination head and correct so that the number is not duplicated.
		132	The label of pointer (P) specified by [CJ], [SCJ], [CALL], [CALLP], [JMP], [LEDA/B][FCALL], [LEDA/B][BREAK] instructions is not specified prior to the END instruction.	Read the error step by peripheral device, check the content, and insert destination pointer (P).

Table 8.2 Error Code List for the AnUCPU (Continue)

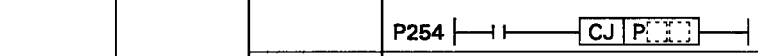
Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"CAN'T EXECUTE (P)" (Checked at the execution of instruction)	13	133	(1) Even though the [CALL] instruction is missing, the [RET] instruction has been executed since it is in the program. (2) Even though the [FOR] instruction is missing, the [NEXT] and [LEDA/B] [BREAK] instructions have been executed since they are in the program. (3) Since the nesting level for the [CALL], [CALLP] or [FOR] instruction is 6 or deeper, the 6th level nest has been executed. (4) The [RET] or [NEXT] instruction is missing at execution of the [CALL] or [FOR] instruction.	(1) Read the error step by peripheral device, check the content, and correct the program at that step. (2) Nesting level for the [CALL], [CALLP], and [FOR] instructions must be 5 or less.
		134	Even though subprogram settings are missing, the [CHG] instruction has been executed since it is in the program.	Read the error step by peripheral device and erase the circuit of that [CHG] instruction.
		135	(1) [LEDA/B] [IX] to [LEDA] [IXEND] instructions are not written as a set. (2) There are more than 32 sets of [LEDA/B] [IX] to [LEDA] [IXEND] instructions.	(1) Read the error step by peripheral device, check the content, and correct the program at that step. (2) [LEDA/B] [IX] to [LEDA] [IXEND] instructions must be less than 33 sets.
"CHK FORMAT ERR." (Checked at STOP/PAUSE →RUN)	14	141	Instructions other than LDX, LDIX, ANDX and ANIX (including NOP) are in the circuit block of the [CHK] instruction.	Refer to the content of the detailed error code, and check and correct programs related to the [CHK] instruction.
		142	There is more than 1 [CHK] instruction.	
		143	The number of contact points in the circuit block of the [CHK] instruction exceeds 150.	
		144	The [LEDA] [CHK] and [LEDA] [CHKEND] instructions are not written as a set, or there are 2 or more sets.	
		145	The format of the block shown below preceding the circuit block of the [CHK] instruction is abnormal. 	
		146	The D1 device number of the [CHK] [D1] [D2] instruction does not match the contact device number preceding the [CJ] instruction.	
		147	There is a place where index qualification is made in the check pattern circuit.	

Table 8.2 Error Code List for the AnUCPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"CHK FORMAT ERR." (Checked at STOP/PAUSE →RUN)	14	148	(1) There is more than 1 check pattern circuit of LEDA CHK to LEDA CHKEND instructions. (2) There are 7 or more check condition circuits in LEDA CHK to LEDA CHKEND instructions. (3) The check condition circuits in LEDA CHK to LEDA CHKEND instructions have been created by instructions other than X and Y contact instructions and comparison instructions. (4) The check pattern circuit of LEDA CHK to LEDA CHKEND instructions has been created by 257 or more steps.	
"CAN'T EXECUTE (1)" (Checked at the occurrence of interruption)	15	151	The IRET instruction exists outside the interrupt program and has been executed.	Read the error step by peripheral device and erase the IRET instruction.
		152	No IRET instruction in the interrupt program.	Check and correct use of IRET instruction inside or outside interrupt program.
		153	An interrupt module is being used though there is no corresponding interrupt pointer (I). At error occurrence, pointer (I) is stored in D9011.	Monitor special register D9011 by peripheral device, check whether or not there is an interrupt program corresponding to the stored numeric values or whether or not the same number exists for the interrupt pointer (I), and correct.
"CASSETTE ERROR"	16	——	The memory cassette is not loaded.	Turn the PC power supply OFF, and load the memory cassette.
"RAM ERROR" (Checked at power-on)	20	201	Error of the CPU sequence program storage RAM.	Possible hardware fault, consult Mitsubishi representative.
		202	Error of the CPU work area RAM.	
		203	CPU device memory error.	
		204	CPU address RAM error.	
"OPE. CIRCUIT ERR." (Checked at power-on)	21	211	The operation circuit executing index qualification in the CPU is not operating normally.	Possible hardware fault, consult Mitsubishi representative.
		212	The CPU hardware (logic) is not operating normally.	
		213	The operation circuit executing PC sequence program in the CPU is not operating normally.	

Table 8.2 Error Code List for the AnUCPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"WDT ERROR" (Checked at the execution of END instruction)	22	—	Scan time exceeds watchdog error monitor time. (1) User program scan time has increased. (2) Momentary power failure during program scan has caused apparent scan time to increase.	(1) Check PC program scan time and reduce using the CJ instruction. (2) Check for momentary power failures by monitoring special register D9005.
"END NOT EXECUTE" (Checked at end of program)	24	241	The entire stored program has been executed without executing the END instruction. (1) The END instruction has been missed (e.g. memory cassette removed during program execution). (2) The END instruction has been corrupted.	(1) Reset CPU. If error persists, possible hard-ware fault, consult Mitsubishi representative.
"PU DOWN"	26	—	The main CPU is malfunctioning or broken.	Possible hardware fault, consult Mitsubishi representative.
"UNIT VERIFY ERR." (Checked continuously)	31	—	Verified data is different from the I/O data at power on. (1) An I/O module (including special function module) has been removed form the base unit while the P.C. power is switched on. Or, wrong module is loaded.	Read the detailed error code by peripheral device, check and replace the module corresponding to that numeric value (I/O head number) or monitor special registers D9116 to D9123 by peripheral device, check and replace the module where that data bit is "1".
"FUSE BREAK OFF" (Checked continuously)	32	—	Output unit fuse blown.	(1) Check the fuse blown LED indicator of the output module and replace the fuse of the lit module. (2) Read the detailed error code by peripheral device and re-place the fuse of the output module corresponding to that numeric value (I/O head number), or monitor special registers D9100 to D9107 by peripheral device and replace the fuse of the output module where that data bit is "1".
"CONTROL-BUS ERR."	40	401	Incorrect FROM/TO instruction execution.	Hardware fault (CPU, special function unit and/or base unit). Consult Mitsubishi representative.
		402	During parameter I/O assignment, special function modules cannot be accessed at initial communication. At error occurrence, the head I/O number (the upper 2 digits of a 3-digit expression) of the special function module causing the error is stored in D9011.	
"SP. UNIT DOWN"	41	411	No response from special function unit after execution of FROM/TO instruction.	Hardware error of the accessed special function module. Consult Mitsubishi representative.

Table 8.2 Error Code List for the AnUCPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"SP. UNIT DOWN"	41	412	During parameter I/O assignment, at initial communication, responses from special function modules have not been returned. At error occurrence, the head I/O number (the upper 2 digits of a 3-digit expression) of the special function module causing the error is stored in D9011.	Hardware error of the accessed special function module. Consult Mitsubishi representative.
"LINK UNIT ERROR"	42	——	AJ71(A)R22 or AJ71(A)P22 located in master station.	Remove AJ71(A)R22 or AJ71(A)P22 from master station.
"I/O INT. ERROR"	43	——	Interrupt signal received with no interrupt module present.	Since a hardware error has occurred in one of the modules, replace the modules one by one to find the faulty module. Consult Mitsubishi representative.
"SP. UNIT LAY. ERR."	44	441	I/O modules allocated in parameter settings by peripheral device have been allocated by special function modules. Or, the opposite settings have been executed.	Reset I/O assignments in parameters by peripheral device according to the loading status of the special function modules.
		442	More than 8 special function modules (except for the AI61 (S1)) which can start interrupts to the CPU have been loaded.	Load less than 9 special function modules (except for the AI61 (S1)) which can start interrupts to the CPU.
		443	More than 3 AJ71AP21s or 3 AJ71AR21s has been loaded.	Load less than 2 AJ71AP21s or 2 AJ71AR21s.
		444	More than 6 computer link modules, etc., have been loaded to 1 CPU module.	Load less than 7 computer link modules.
		445	More than 1 AI61 (S1) has been loaded.	Load only 1 AI61.
		446	The modules of MELSECNET/MINI-S3 automatic refresh allocated in parameter settings by peripheral device and the names of the modules of actually linked station numbers are incorrect.	Reset the module assignments of the MELSECNET/MINI-S3 automatic refresh in parameter settings by peripheral device according to the modules of station numbers actually linked.
		447	The number special function modules which can use dedicated instructions, registered by I.O assignment per one CPU module (number of modules to be loaded) is larger than the specified limit. (The total of computers shown below is 1344 or more.) (AD59 × 5) (AD57(S1)/AD58 × 8) (AJ71C24(S3/S6/S8) × 10) (AJ71UC24 × 10) (AJ71C21(S1) × 29) + (AJ71PT32(S3) × 125) Total > 1344	Decrease the number of loaded special function modules.
		448*	(1) Five or more AJ71LP21, AJ71-BR11s have been installed. (2) A total of five or more of the following have been installed; AJ71AP21/R21, AJ71LP21, AJ71BR21.	(1) Make the total of the installed AJ71AP21/R21, AJ71LP21, AJ71BR21 units four or less.

Table 8.2 Error Code List for the AnUCPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"SP. UNIT ERROR" (Checked when FROM/TO instruction, or special function module dedicated instruction is specified)	46	461	There is no special function module in the area specified by the FROM/TO instruction.	Read the error step by peripheral device, check and correct the content of the FROM/TO instruction of that step.
		462	There is no special function module in the area specified by the FROM/TO instruction or there is no corresponding special function module.	Read the error step by peripheral device, check and correct the content of the special function module dedicated instruction of that step.
"LINK PARA. ERROR"	47	0	[When using MELSECNET/(II)] (1) When the link range at a data link CPU which is also a master station (station number = 00) is set by parameter setting at a peripheral device, for some reason the data written to the link parameter area differs from the link parameter data read by the CPU. Alternatively, no link parameters have been written. (2) The total number of slave stations is set at 0.	(1) Write the parameters again and check. (2) Check the station number settings. (3) Persistent error occurrence may indicate a hardware fault. Consult your nearest Mitsubishi representative, explaining the nature of the problem.
		470*	[When using MELSECNET/10] (1) The contents of the network refresh parameters written from a peripheral device differ from the actual system at the base unit. (2) No network refresh parameters have been written.	Write the network refresh parameters again and check.
		471*	[When using MELSECNET/10] (1) The transfer source device range and transfer destination device range specified for the inter-network transfer parameters are in the same network. (2) The specified range of transfer source devices or transfer destination devices for the inter-network transfer parameters spans two or more networks. (3) The specified range of transfer source devices or transfer destination devices for the inter-network transfer parameters is not used by the network.	Write the network parameters again and check.
		472*	[When using MELSECNET/10] The contents of the routing parameters written from a peripheral device differ from the actual network system.	Write the routing parameters again and check.

Table 8.2 Error Code List for the AnUCPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"LINK PARA. ERROR"	47	473*	[When using MELSECNET/10] (1) The contents of the network parameters for the first link unit, written from a peripheral device, differ from the actual network system. (2) The link parameters for the first link unit have not been written. (3) The setting for the total number of stations is 0.	(1) Write the parameters again and check. (2) Check the station number settings. (3) Persistent error occurrence may indicate a hardware fault. Consult your nearest Mitsubishi representative, explaining the nature of the problem.
		474*	[When using MELSECNET/10] (1) The contents of the network parameters for the second link unit, written from a peripheral device, differ from the actual network system. (2) The link parameters for the second link unit have not been written. (3) The setting for the total number of stations is 0.	
		475*	[When using MELSECNET/10] (1) The contents of the network parameters for the third link unit, written from a peripheral device, differ from the actual network system. (2) The link parameters for the third link unit have not been written. (3) The setting for the total number of stations is 0.	
		476*	[When using MELSECNET/10] (1) The contents of the network parameters for the fourth link unit, written from a peripheral device, differ from the actual network system. (2) The link parameters for the fourth link unit have not been written. (3) The setting for the total number of stations is 0.	
"OPERATION ERROR" (Checked during execution of instruction)	50	501	(1) When using file register (R), operations have been execut-ed exceeding the specified range for the device number and block number of file register (R). (2) The file register is used in the program without executing file register capacity settings.	Read the error step by peripheral device, check and correct the program of that step.
		502	The combination of devices specified by instruction is incorrect.	
		503	The storage data of specified devices or the constants are not within the usable range.	
		504	The quantity of settings used for handled data has exceeded the usable range.	

Table 8.2 Error Code List for the AnUCPU (Continue)

Error Message	Error Code (D9008)	Detailed Error Code (D9091)	Error and Cause	Corrective Action
"OPERATION ERROR" (Checked during execution of instruction)	50	505	(1) The station number specified by instruction LEDA/B LRDP, LCDA/B LWTP, LRDP or LWTP is not a local station. (2) The head I/O number specified by instruction LEDA/B RFRP, LEDA/B RTOP, RFRP or RTOP is not a remote station.	Read the error step by peripheral device, check and correct the program of that step.
		506	The head I/O number specified by instruction LEDA/B RFRP, LEDA/B RTOP, RFRP or RTOP is not a special function module.	
		507	(1) While the AD57 (S1) or the AD58 is executing instructions by partial processing, other instructions have been output to the same module. (2) While the AD57 (S1) or the AD58 is executing instructions by partial processing, instructions have been output to other AD57 (S1) or AD58 by partial processing.	Read the error step by peripheral device and provide interlock by special relay M9066 or change the program structure and correct. This prevents the execution of other instructions to the same module while executing instructions to the AD57 (S1) or AD58 by partial processing and prevents the execution of instructions to other AD57 (S1) or AD58 by partial processing.
		509	(1) An instruction which cannot be executed by remote terminal module connected to the MELSECNET/MINI-S3 was executed to the modules. (2) When the PRC instructionwas executed to a remote terminal, the communicationrequest registration areas overflowed. (3) The PIDCONT instruction was executed without execut-ing the PIDINIT instruction. The PID57 instructon wasexecuted without executing the PIDINIT or PIDCONT instruction.	(1) Read the error step by peripheral device and correct the program, meeting loadedconditions of remote terminal module. (2) Provide interlock using M9081(communication request registration areas BUSY signal)or D9081 (number of vacantareas in the communication request registration areas)when the PRC instruction is executed to a remote terminal. (3) Execute the PIDCONT instruction after execution of the PIDINIT instruction. Execute the PID57 instructionafter execution of the PIDINIT and PIDCONT instructions.
"MAIN CPU DOWN"	60	——	(1) CPU malfunction due to noise. (2) Hardware fault.	(1) Eliminate noise. (2) Hardware fault
"BATTERY ERROR" (Checked at power-on)	70		(1) Battery voltage low. (2) Battery not connected.	(1) Replace the battery. (2) When using RAM memory or the power failure compensation function, load the lead connectors.

Table 8.2 Error Code List for the AnUCPU, A2US(H)CPU (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"OPERATION ERROR" (Checked at execution of instruction.)	50	501	Stop or Continue (set by parameter)	(1) When file registers (R) are used, operation is executed outside of specified ranges of device numbers and block numbers of file registers (R). (2) File registers are used in the program without setting capacity of file registers.	Read the error step using a peripheral device and check and correct program of the step.
		502		Combination of the devices specified by instruction is incorrect.	
		503		Stored data or constant of specified device is not in the usable range.	
		504		Set number of data to be handled is out of the usable range.	
		505		(1) Station number specified by the LEDA/B, LRDP, LCDA/B, LWTP, LRDP, LWTP instructions is not a local station. (2) Head I/O number specified by the LEDA/B, RFRP, LEDA/B, RTOP, RFRP, RTOP instructions is not of a remote station.	
		506		Head I/O number specified by the LEDA/B, RFRP, LEDA/B, RTOP, RFRP, RTOP instructions is not of a special function module.	
		507		(1) When the AD57(S1) or AD58 was executing instructions in divided processing mode, other instructions were executed to either of them. (2) When an AD57(S1) or AD58 was executing instructions in divided processing mode, other instructions were executed in divided mode to another AD57(S1) or AD58.	Read the error step using a peripheral device and provide interlock with special relay M9066 or modify program structure so that, when the AD57(S1) or AD58 is executing instructions in divided processing mode, other instructions may not be executed to either of them or to another AD57(S1) or AD58 in divided mode.
		508		A CC-Link dedicated command was issued to three or more CC-Link modules.	The CC-Link dedicated command can be issued only to two or less CC-Link modules.

Table 8.2 Error Code List for the AnUCPU, A2US(H)CPU (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"OPERATION ERROR" (Checked at execution of instruction.)	50	509	STOP	(1) An instruction which cannot be executed by remote terminal modules connected to the MNET/MINI-S3 was executed to the modules. (2) Though there are 32 entries of FROM or TO instructions registered with a PRC instruction in the mailbox (memory area waiting for execution), another PRC instruction is executed to cause an overflow in the mail box (memory area waiting for execution). (3) The PIDCONT instruction was executed without executing the PIDINIT instruction. The PID57 instruction was executed without executing the PIDINIT or PIDCONT instruction. The program presently executed was specified by the ZCHG instruction. (4) The number of CC-Link dedicated command executed in one scan exceeded 10.	(1) Read the error step using a peripheral device and correct the program, meeting loaded conditions of remote terminal modules. (2) Use special register D9081 (number of empty entries in mailbox) or special relay M9081 (BUSY signal of mail box) to suppress registration or execution of the PRC instruction. (3) Correct the program specified by the ZCHG instruction to other. (4) Set the number of CC-Link dedicated commands executed in one scan to 10 or less.
"MAIN CPU DOWN"	60	—	STOP	(1) The CPU malfunctioned due to noise. (2) Hardware failure.	(1) Take proper countermeasures for noise. (2) Hardware failure.
		602		(1) Failure in the power module, CPU module, main base unit or expansion cable is detected.	(1) Replace the power module, CPU module, main base unit or expansion cable.
"BATTERY ERROR" (Checked at power on.)	70	—	Contin ue	(1) Battery voltage has lowered below specified level. (2) Battery lead connector is not connected.	(1) Replace battery. (2) If a RAM memory or power failure compensation function is used, connect the lead connector.

8.4 Error Code List for the QCPU-A (A Mode)

Meanings and causes of error message, error codes, detailed error codes and corrective actions are described.

Table 8.3 Error Code List for the QCPU-A (A mode)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"INSTRCT CODE ERR" (Checked when STOP → RUN or at execution of instruction.)	10	101	STOP	Instruction codes which the CPU cannot decode are included in the program.	(1) Read the error step using a peripheral device and correct the program of the step. (2) Check the ROM if it contains instruction codes which cannot be decoded. If it does, replace it with a correct ROM.
		102		Index qualification is specified for a 32-bit constant.	Read the error step using a peripheral device and correct the program of the step.
		103		Device specified by a dedicated instruction is not correct.	
		104		An dedicated instruction has incorrect program structure.	
		105		An dedicated instruction has incorrect command name.	
		106		Index qualification using Z or V is included in the program between [LEDA/B IX] and [LEDA/B IXEND].	
		107		(1) Index qualification is specified for the device numbers and set values in the [OUT] instruction of timers and counters. (2) Index qualification is specified at the label number of the pointer (P) provided to the head of destination of the [CJ], [SCJ], [CALL], [CALLP], [JMP], [LEDA/B], [FCALL] and [LEDA/B], [BREAK] instructions or at the label number of the interrupt pointer (I) provided to the head of an interrupt program.	
		108		Errors other than 101 to 107 mentioned above.	

Table 8.3 Error Code List for the QCPU-A (A mode) (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"PARAMETER ERROR" (Checked at power on and at STOP/PAUSE → RUN.)	11	111	STOP	Capacity settings of the main and sub programs, microcomputer program, file register comments, status latch, sampl-ing trace and extension file registers are not within the usable range of the CPU.	Read parameters in the CPU memory, check the contents, make necessary corrections and write them again to the memory.
		112		Total of the set capacity of the main and sub programs, file register comments, status latch, sampling trace and extension file registers exceeds capacity of the memory cassette.	
		113		Latch range set by parameters or setting of M, L or S is incorrect.	Read parameters in the CPU memory, check the contents, make necessary corrections and write them again to the memory
		114		Sum check error	
		115		Either of settings of the remote RUN/ PAUSE contact point by parameters, operation mode at occurrence of error, annunciator indication mode, or STOP → RUN indication mode is incorrect.	
		116		The MNET-MINI automatic refresh setting by parameters is incorrect.	
		117		Timer setting by parameters is incorrect.	
		118		Counter setting by parameters is incorrect.	
"MISSING END INS" (Checked at STOP → RUN.)	12	121	STOP	The END (FEND) instruction is not given in the main program.	Write the END instruction at the end of the main program.
		122		The END (FEND) instruction is not given in the sub program if the sub program is set by parameters.	Write the END instruction at the end of the sub program.
		123		(1) When subprogram 2 is set by a parameter, there is no END (FEND) instruction in subprogram 2. (2) When subprogram 2 is set by a parameter, subprogram 2 has not been written from a peripheral device.	
		124		(1) When subprogram 3 is set by a parameter, there is no END (FEND) instruction in subprogram 3. (2) When subprogram 3 is set by a parameter, subprogram 2 has not been written from a peripheral device.	

Table 8.3 Error Code List for the QCPU-A (A mode) (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"CAN'T EXECUTE (P)" (Checked at execution of instruction.)	13	131	STOP	The same device number is used at two or more steps for the pointers (P) and interrupt pointers (I) used as labels to be specified at the head of jump destination.	Eliminate the same pointer numbers provided at the head of jump destination.
		132		Label of the pointer (P) specified in the [CJ], [SCJ], [CALL], [CALLP], [JMP], [LEDA/B] [FCALL] or [LEDA/B] [BREAK] instruction is not provided before the [END] instruction.	Read the error step using a peripheral device, check contents and insert a jump destination pointer (P).
		133		(1) The [RET] instruction was included in the program and executed though the [CALL] instruction was not given. (2) The [NEXT] [LEDA/B] [BREAK] instructions were included in the program and executed though the [FOR] instruction was not given. (3) Nesting level of the [CALL], [CALLP] and [FOR] instructions is 6 levels or deeper, and the 6th level was executed. (4) There is no [RET] or [NEXT] instruction at execution of the [CALL] or [FOR] instruction.	(1) Read the error step using a peripheral device, check contents and correct program of the step. (2) Reduce the number of nesting levels of the [CALL], [CALLP] and [FOR] instructions to 5 or less.
		134		The [CHG] Instruction was included in the program and executed though no sub program was provided.	Read the error step using a peripheral device and delete the [CHG] instruction circuit block.
		135		(1) [LEDA/B] [IX] and [LEDA/B] [IXEND] instructions are not paired. (2) There are 33 or more sets of [LEDA/B] [IX] and [LEDA/B] [IXEND] instructions.	(1) Read the error step using a peripheral device, check contents and correct program of the step. (2) Reduce the number of sets of [LEDA/B] [IX] and [LEDA/B] [IXEND] instructions to 32 or less.

Table 8.3 Error Code List for the QCPU-A (A mode) (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"CHK FORMAT ERR" (Checked at STOP/PAUSE → RUN.)	14	141	STOP	Instructions (including NOP) other than LDX, LDIX, ANDX and ANIX are included in the CHK instruction circuit block.	Check the program of the CHK instruction and correct it referring to contents of detailed error codes.
		142		Multiple CHK instructions are given.	
		143		The number of contact points in the CHK instruction circuit block exceeds 150.	
		144		The LEDA CHK instructions are not paired with the LEDA CHKEND instructions, or 2 or more pairs of them are given.	
		145		Format of the block shown below, which is provided before the CHK instruction circuit block, is not as specified. P254 — CJ P□□	
		146		Device number of D1 in the CHK D1 D2 instruction is different from that of the contact point before the CJ P□ instruction.	
		147		Index qualification is used in the check pattern circuit.	
		148		(1) Multiple check pattern circuits of the LEDA CHK - LEDA CHKEND instructions are given. (2) There are 7 or more check condition circuits in the LEDA CHK - LEDA CHKEND instructions. (3) The check condition circuits in the LEDA CHK - LEDA CHKEND instructions are written without using X and Y contact instructions or compare instructions. (4) The check pattern circuits of the LEDA CHK - LEDA CHKEND instructions are written with 257 or more steps.	
"CAN'T EXECUTE (I)" (Checked at occurrence of interrupt.)	15	151	STOP	The IRET instruction was given outside of the interrupt program and was executed.	Read the error step using a peripheral device and delete the IRET instruction.
		152		There is no IRET instruction in the interrupt program.	Check the interrupt program if the IRET instruction is given in it. Write the IRET instruction if it is not given.
		153		Though an interrupt module is used, no interrupt pointer (I) which corresponds to the module is given in the program. Upon occurrence of error, the problem pointer (I) number is stored at D9011.	Monitor special register D9011 using a peripheral device, and check if the interrupt program that corresponds to the stored data is provided or if two or more interrupt pointers (I) of the same number are given. Make necessary corrections.

Table 8.3 Error Code List for the QCPU-A (A mode) (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"CASSETTE ERROR"	16	—	STOP	Memory cassette is not loaded.	Turn off the PC power and load the memory cassette.
"RAM ERROR" (Checked at power on.)	20	201	STOP	The sequence program storage RAM in the CPU module caused an error.	Since this is CPU hardware error, consult Mitsubishi representative.
		202		The work area RAM in the CPU module caused an error.	
		203		The device memory in the CPU module caused an error.	
		204		The address RAM in the CPU module caused an error.	
"OPE CIRCUIT ERROR" (Checked at power on.)	21	211	STOP	The operation circuit for index qualification in the CPU does not work correctly.	Since this is CPU hardware error, consult Mitsubishi representative.
		212		Hardware (logic) in the CPU does not operate correctly.	
		213		The operation circuit for sequential processing in the CPU does not operate correctly.	
"OPE. CIRCUIT ERR." (Checked at execution of the END instruction)		214		In the END processing check, the operation circuit for index qualification in the CPU does not work correctly.	
		215		In the END processing check, the hardware in the CPU does not operate correctly.	
"WDT ERROR" (Checked at execution of END processing.)	22	—	STOP	Scan time is longer than the WDT time. (1) Scan time of the user's program has been extended due to certain conditions. (2) Scan time has been extended due to momentary power failure occurred during scanning.	(1) Calculate and check the scan time of user program and reduce the scan time using the CJ instruction or the like. (2) Monitor contents of special register D9005 using a peripheral device. If the contents are other than 0, power supply voltage may not be stable. Check power supply and reduce variation in voltage.
"END NOT EXECUTE" (Checked at execution of the END instruction.)	24	241	STOP	Whole program of specified program capacity was executed without executing the END instructions. (1) When the END instruction was to be executed, the instruction was read as other instruction code due to noise. (2) The END instruction changed to other instruction code due to unknown cause.	(1) Reset and run the CPU again. If the same error recurs, Since this is CPU hardware error, consult Mitsubishi representative.
"MAIN CPU DOWN"	26	—	STOP	The main CPU is malfunctioning or faulty.	Since this is CPU hardware error, consult Mitsubishi representative
"UNIT VERIFY ERR" (Checked continuously.)	31	—	Stop or Continue (set by para-meter)	Current I/O module information is different from that recognized when the power was turned on. (1) The I/O module (including special function modules) connection became loose or the module was disconnected during operation, or wrong module was connected.	Read detailed error code using a peripheral device and check or replace the module which corresponds to the data (I/O head number). Or, monitor special registers D9116 to D9123 using a peripheral device and check or replace the modules if corresponding data bit is "1".

Table 8.3 Error Code List for the QCPU-A (A mode) (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"FUSE BREAK OFF" (Checked continuously.)	32	—	Stop or Continue (set by para-meter)	(1) There is an output module of which fuse is blown. (2) The external power supply for output load is turned OFF or is not connected.	(1) Check the FUSE BLOWN indicator LED on the output module and replace the fuse. (2) Read detailed error code using a peripheral device and replace the fuse of the output module which corresponds to the data (I/O head number). Or, monitor special registers D9100 to D9107 using a peripheral device and replace the fuse of the output module of which corresponding data bit is "1". (3) Check the ON/OFF status of the external power supply for output load.
"CONTROL-BUS ERR"	40	401	STOP	Due to the error of the control bus which connects to special function modules, the FROM/TO instruction cannot be executed.	Since it is a hardware error of special function module, CPU module or base module, replace and check defective module(s). Consult Mitsubishi representative for defective modules.
		402		If parameter I/O assignment is being executed, special function modules are not accessible at initial communication. At error occurrence, the head I/O number (upper 2 digits of 3 digits) of the special function module that caused error is stored at D9011.	
"SP.UNIT DOWN"	41	411	STOP	Though an access was made to a special function module at execution of the FROM/TO instruction no response is received.	Since it is hardware error of the special function module to which an access was made, consult Mitsubishi representative.
		412		If parameter I/O assignment is being executed, no response is received from a special function module at initial communication. At error occurrence, the head I/O number (upper 2 digits of 3 digits) of the special function module that caused error is stored at D9011.	
"LINK UNIT ERROR"	42	—	STOP	(1) Either data link module is loaded to the master station. (2) There are 2 link modules which are set to the master station (station 0).	(1) Remove data link module from the master station. (2) Reduce the number of master stations to 1. Reduce the link modules to 1 when the 3-tier system is not used.
"I/O INT. ERROR"	43	—	STOP	Though the interrupt module is not loaded, an interrupt occurred.	Since it is hardware error of a module, replace and check a defective module. For defective modules, consult Mitsubishi representative.

Table 8.3 Error Code List for the QCPU-A (A mode) (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"SP.UNIT LAY.ERR."	44	441	STOP	A special function module is assigned as an I/O module, or vice versa, in the I/O assignment using parameters from the peripheral device.	Execute I/O assignment again using parameters from the peripheral device according to the loading status of special function modules.
		442		There are 9 or more special function modules (except the interrupt module) which can execute interruption to the CPU module loaded.	Reduce the special function modules (except the interrupt module) which can execute interrupt start to 8 or less.
		443		There are 2 or more data link modules loaded.	Reduce the data link modules to 1 or less.
		444		There are 7 or more modules such as a computer link module loaded to one CPU module.	Reduce the computer link modules to 6 or less.
		445		There are 2 or more interrupt modules loaded.	Reduce the interrupt modules to 1 or less.
		446		Modules assigned by parameters for MNT/MINI automatic refresh from the peripheral device do not conform with the types of station modules actually linked.	Perform again module assignment for MNT/MINI automatic refresh with parameters according to actually linked station modules.
		447		The number of modules of I/O assignment registration (number of loaded modules) per one CPU module for the special function modules which can use dedicated instructions is larger than the specified limit. (Total of the number of computers shown below is larger than 1344.) (AD59 × 5) (AD57(S1)/AD58 × 8) (AJ71C24(S3/S6/S8) × 10) (AJ7IUC24 × 10) (AJ71C21(S1) (S2) × 29) + ((AJ71PT32(S3) in extension mode x 125) Total > 1344	Reduce the number of loaded special function modules.
		448*		(1) Five or more network modules have been installed. (2) A total of five or more of network modules and data link modules have been installed.	Make the total of the installed network modules and data link modules four or less.

Table 8.3 Error Code List for the QCPU-A (A mode) (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"SP.UNIT ERROR" (Checked at execution of the FROM/TO instruction or the dedicated instructions for special function modules.)	46	461	Stop or Continue (set by para-meter)	Module specified by the FROM / TO instruction is not a special function module.	Read the error step using a peripheral device and check and correct contents of the FROM / TO instruction of the step.
		462		(1) Module specified by the dedicated instruction for special function module is not a special function module or not a corresponding special function module. (2) A command was issued to a CC-Link module with function version under B. (3) A CC-Link dedicated command was issued to a CC-Link module for which the network parameters have not been set.	(1) Read the error step using a peripheral device and check and correct contents of the dedicated instruction for special function modules of the step. (2) Replace with a CC-Link module having function version B and above. (3) Set the parameters.
"LINK PARA. ERROR"	47	0	Continue	[When using MELSECNET/(II)] (1) When the link range at a data link CPU which is also a master station (station number = 00) is set by parameter setting at a peripheral device, for some reason the data written to the link parameter area differs from the link parameter data read by the CPU. Alternatively, no link parameters have been written. (2) The total number of slave stations is set at 0.	(1) Write the parameters again and check. (2) Check the station number settings. (3) Persistent error occurrence may indicate a hardware fault. Consult your nearest Mitsubishi representative, explaining the nature of the problem.
		470*		[When using MELSECNET/10] (1) The contents of the network refresh parameters written from a peripheral device differ from the actual system at the base unit. (2) The network refresh parameters have not been written.	Write the network refresh parameters again and check.
		471*		[When using MELSECNET/10] (1) The transfer source device range and transfer destination device range specified for the inter-network transfer parameters are in the same network. (2) The specified range of transfer source devices or transfer destination devices for the inter-network transfer parameters spans two or more networks. (3) The specified range of transfer source devices or transfer destination devices for the inter-network transfer parameters is not used by the network.	Write the network parameters again and check.
		472*		[When using MELSECNET/10] The contents of the routing parameters written from a peripheral device differ from the actual network system.	Write the routing parameters again and check.

Table 8.3 Error Code List for the QCPU-A (A mode) (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"LINK PARA. ERROR"	47	473*	Continue	[When using MELSECNET/10] (1) The contents of the network parameters for the first link unit, written from a peripheral device, differ from the actual network system. (2) The link parameters for the first link unit have not been written. (3) The setting for the total number of stations is 0.	(1) Write the parameters again and check. (2) Check the station number settings. (3) Persistent error occurrence may indicate a hardware fault. Consult your nearest Mitsubishi representative, explaining the nature of the problem.
		474*		[When using MELSECNET/10] (1) The contents of the network parameters for the second link unit, written from a peripheral device, differ from the actual network system. (2) The link parameters for the second link unit have not been written. (3) The setting for the total number of stations is 0.	
		475*		[When using MELSECNET/10] (1) The contents of the network parameters for the third link unit, written from a peripheral device, differ from the actual network system. (2) The link parameters for the third link unit have not been written. (3) The setting for the total number of stations is 0.	
		476*		[When using MELSECNET/10] (1) The contents of the network parameters for the fourth link unit, written from a peripheral device, differ from the actual network system. (2) The link parameters for the fourth link unit have not been written. (3) The setting for the total number of stations is 0.	
		477		A ink parameter error was detected by the CC-Link module.	(1) Write the parameters in again and check. (2) If the error appears again, there is a problem with the hardware. Consult your nearest System Service, sales office or branch office.

Table 8.3 Error Code List for the QCPU-A (A mode) (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"OPERATION ERROR" (Checked at execution of instruction.)	50	501	Stop or Continue (set by para-meter)	(1) When file registers (R) are used, operation is executed outside of specified ranges of device numbers and block numbers of file registers (R). (2) File registers are used in the program without setting capacity of file registers.	Read the error step using a peripheral device and check and correct program of the step.
		502		Combination of the devices specified by instruction is incorrect.	
		503		Stored data or constant of specified device is not in the usable range.	
		504		Set number of data to be handled is out of the usable range.	
		505		(1) Station number specified by the LEDA/B LRDP LCDA/B LWTP, LRDP, LWTP instructions is not a local station. (2) Head I/O number specified by the LEDA/B RFRP LEDA/B RTOP, RFRP, RTOP instructions is not of a remote station.	
		506		Head I/O number specified by the LEDA/B RFRP LEDA/B RTOP, RFRP, RTOP instructions is not of a special function module.	
		507		(1) When the AD57(S1) or AD58 was executing instructions in divided processing mode, other instructions were executed to either of them. (2) When an AD57(S1) or AD58 was executing instructions in divided processing mode, other instructions were executed in divided mode to another AD57(S1) or AD58.	Read the error step using a peripheral device and provide interlock with special relay M9066 or modify program structure so that, when the AD57(S1) or AD58 is executing instructions in divided processing mode, other instructions may not be executed to either of them or to another AD57(S1) or AD58 in divided mode.
		508		A CC-Link dedicated command was issued to three or more CC-Link modules.	The CC-Link dedicated command can be issued only to two or less CC-Link modules.

Table 8.3 Error Code List for the QCPU-A (A mode) (Continue)

Error Massage	Error Code (D9008)	Detailed Error Code (D9091)	CPU States	Error and Cause	Corrective Action
"OPERATION ERROR" (Checked at execution of instruction.)	50	509	STOP	(1) An instruction which cannot be executed by remote terminal modules connected to the MNET/MINI-S3 was executed to the modules. (2) Though there are 32 entries of FROM or TO instructions registered with a PRC instruction in the mailbox (memory area waiting for execution), another PRC instruction is executed to cause an overflow in the mail box (memory area waiting for execution). (3) The PIDCONT instruction was executed without executing the PIDINIT instruction. The PID57 instruction was executed without executing the PIDINIT or PIDCONT instruction. The program presently executed was specified by the ZCHG instruction. (4) The number of CC-Link dedicated command executed in one scan exceeded 10.	(1) Read the error step using a peripheral device and correct the program, meeting loaded conditions of remote terminal modules. (2) Use special register D9081 (number of empty entries in mailbox) or special relay M9081 (BUSY signal of mail box) to suppress registration or execution of the PRC instruction. (3) Correct the program specified by the ZCHG instruction to other. (4) Set the number of CC-Link dedicated commands executed in one scan to 10 or less.
"MAIN CPU DOWN"	60	—	STOP	(1) The CPU malfunctioned due to noise. (2) Hardware failure.	(1) Take proper countermeasures for noise. (2) Hardware failure.
		602		(1) Failure in the power module, CPU module, main base unit or expansion cable is detected.	(1) Replace the power module, CPU module, main base unit or expansion cable.
"BATTERY ERROR" (Checked at power on.)	70	—	Continue	(1) Battery voltage has lowered below specified level. (2) Battery lead connector is not connected.	(1) Replace battery. (2) If a RAM memory or power failure compensation function is used, connect the lead connector.

APPENDIX

APPENDIX 1 PROCESSING TIME LIST

Instruction Name	Conditions		Processing Time (μsec)	
			A3ACPU A3UCPU A4UCPU	A2ACPU(S1) A2UCPU(S1)
PID INT	1 loop		54	72
	32 loops		514	685
PID CONT	1 loop	First	163	217
		Others	155	206
	32 loops	First	3710	4935
		Others	3480	4639
PID 57	1 loop	First	7230	9634
		Others	447	595
	8 loops	First	7230	9634
		Others	2760	3679

APP

WARRANTY

Please confirm the following product warranty details before starting use.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the dealer or Mitsubishi Service Company. Note that if repairs are required at a site overseas, on a detached island or remote place, expenses to dispatch an engineer shall be charged for.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place.

Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.

1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found not to be the responsibility of Mitsubishi or the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not possible after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of chance loss and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to damages caused by any cause found not to be the responsibility of Mitsubishi, chance losses, lost profits incurred to the user by Failures of Mitsubishi products, damages and secondary damages caused from special reasons regardless of Mitsubishi's expectations, compensation for accidents, and compensation for damages to products other than Mitsubishi products and other duties.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

6. Product application

(1) In using the Mitsubishi MELSEC programmable logic controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable logic controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.

(2) The Mitsubishi general-purpose programmable logic controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for Railway companies or National Defense purposes shall be excluded from the programmable logic controller applications.

Note that even with these applications, if the user approves that the application is to be limited and a special quality is not required, application shall be possible.

When considering use in aircraft, medical applications, railways, incineration and fuel devices, manned transport devices, equipment for recreation and amusement, and safety devices, in which human life or assets could be greatly affected and for which a particularly high reliability is required in terms of safety and control system, please consult with Mitsubishi and discuss the required specifications.

Type AnACPU/AnUCPU/QCPU-A(A mode)

Programming Manual (PID Control Instructions)

MODEL	A2A/A3A-PID-P-E
MODEL CODE	13J744
IB(NA)-66258-D(0312)MEE	

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