User's Manual

LG Programmable Logic Controller

GLOFA

G3F – PIDA
G4F – PIDA

L G Industrial Systems

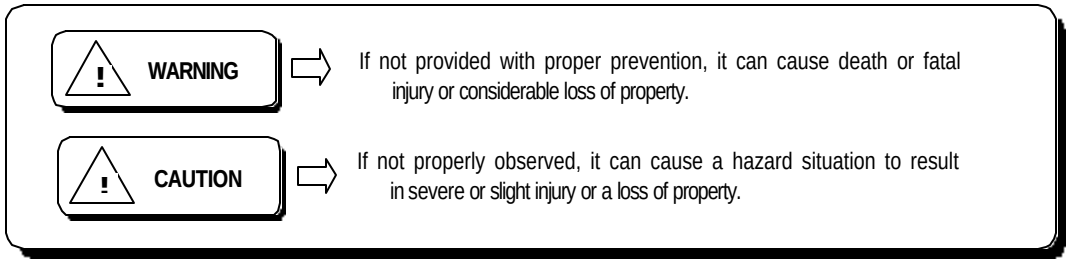
SAFETY PRECAUTIONS

Be sure to read carefully the safety precautions given in data sheet and user's manual before operating the module and follow them.

The precautions explained here only apply to the G3F-PIDA and G4F-PIDA.

For safety precautions on the PLC system, see the GLOFA GM3/4 User's Manuals.

A precaution is given with a hazard alert triangular symbol to call your attention, and precautions are represented as follows according to the degree of hazard.



However, a precaution followed with **CAUTION** can also result in serious conditions.

Both of two symbols indicate that an important content is mentioned, therefore, be sure to observe it.

Keep this manual handy for your quick reference in necessary.

Installation Precautions

CAUTION

- Operate the PLC in the environment conditions given in the general specifications.
- If operated in other environment not specified in the general specifications, it can cause an electric shock, a fire, malfunction or damage or degradation of the module
- Make sure the module fixing projections is inserted into the module fixing hole and fixed.
- Improper installation of the module can cause malfunction, disorder or falling.

Test Run and Maintenance Precautions

CAUTION

- Do not separate the module from the printed circuit board(PCB), or do not remodel the module.
  They can cause disorder, malfunction, damage of the module or a fire.
  When mounting or dismounting the module, perform them after the power has been turned off.
- Do not perform works while the power is applied, which can cause disorder or malfunction.

Waste Disposal Precautions

CAUTION

- When disposing the module, do it as an industrial waste.

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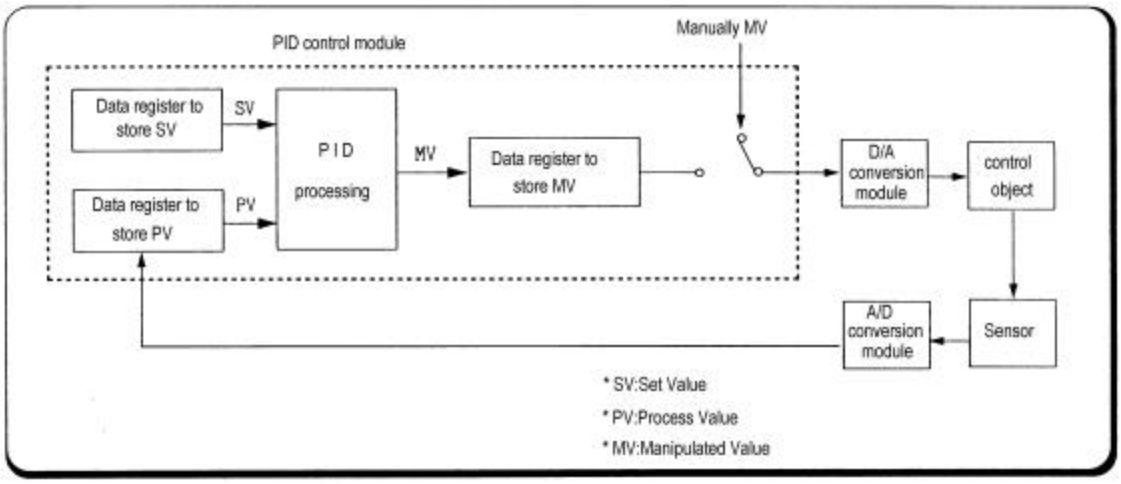
Chapter 1. INTRODUCTION

These two modules are called G3F-PIDA and G4F-PIDA. The G3F-PIDA is used with the CPU of GLOFA PLC GM1.2.3 series and MASTER-K 1000S series , The G4F-PIDA is used with the CPU of GM4 series and MASTER-K 300S series. Hereafter, the two modules will be commonly called the PID control module.

PID control means a control action that in order to keep the object at a value set beforehand (SV), it compares the SV with a sensor-measured value (PV) and when a difference between them is detected the controller makes PV come to be SV by adjusting output to eliminate the difference. The PID control is composed of combinations of Proportional (P), Integral (I) and Derivative (D) actions.

When a difference between SV and PV occurs, proportional, integral, differential quantities are calculated upon that difference and a MV(Manipulated Value) is output.



1.1 Features

The features of the PID control module are as follows.

1) One module can control various processes separately and at the same time.
2) Forward/reverse action selection is available.
3) Manually manipulated out (forced to be output by the user), not operation processing output, is available.
4) The number of modules available on one base unit is unlimited.
5) auto-tuning function finds the value of P,I,D constant automatically

Chapter 2. SPECIFICATIONS

2.1 General Specifications

Table 2.1 shows the general specifications of GLOFA GM series and MASTER-K series.

<table>
<tr><th>No</th><th>Items</th><th>Specifications</th><th>Standard</th></tr>
<tr><td>1</td><td>Operating ambient temperature</td><td>0 ~ 55°C</td><td></td></tr>
<tr><td>2</td><td>Storage ambient temperature</td><td>-25 ~ 75°C</td><td></td></tr>
<tr><td>3</td><td>Operating ambient humidity</td><td>5 ~ 95%RH, non-condensing</td><td></td></tr>
<tr><td>4</td><td>Storage ambient humidity</td><td>5 ~ 95%RH, non-condensing</td><td></td></tr>
<tr><td rowspan="6">5</td><td rowspan="6">Vibration</td><td colspan="4">Occasional vibration</td><td rowspan="6">IEC 61131-2</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Sweep count</td></tr>
<tr><td>10≤f∠57 Hz</td><td>-</td><td>0.075 mm</td><td rowspan="3">10 times in each direction for X, Y, Z</td></tr>
<tr><td>57 ≤f≤150 Hz</td><td>9.8㎨ {1G}</td><td>-</td></tr>
<tr><td colspan="4">Continuous vibration</td></tr>
<tr><td>Frequency
10≤f∠57 Hz
57≤f≤150 Hz</td><td>Acceleration
-
4.9㎨ {0.5G}</td><td>Amplitude
0.035 mm
-</td></tr>
<tr><td>6</td><td>Shocks</td><td colspan="2">*Maximum shock acceleration: 147 ㎨ {15G}
*Duration time :11 ms
*Pulse wave: half sine wave pulse(3 times in each of X, Y and Z directions)</td><td>IEC 61131-2</td></tr>
<tr><td rowspan="4">7</td><td rowspan="4">Noise immunity</td><td>Square wave impulse noise</td><td colspan="3">±1,500 V</td><td>LGIS Standard</td></tr>
<tr><td>Electrostatic discharge</td><td colspan="3">Voltage :4kV(contact discharge)</td><td>IEC 61131-2
IEC1000-4-2</td></tr>
<tr><td>Radiated electromagnetic field</td><td colspan="3">27 ~ 500 MHz, 10 V/m</td><td>IEC 61131-2
IEC 1000-4-3</td></tr>
<tr><td rowspan="2">Fast transient burst noise</td><td>Severity Level</td><td>All power modules</td><td>Digital I/Os (Ue ≥ 24 V)</td><td>Digital I/Os (Ue < 24 V) Analog I/Os communication I/Os</td><td rowspan="2">IEC 61131-2
IEC1000-4-4</td></tr>
<tr><td>Voltage</td><td>2 kV</td><td>1 kV</td><td>0.25 kV</td></tr>
<tr><td>8</td><td>Operating atmosphere</td><td colspan="2">Free from corrosive gases and excessive dust</td><td></td></tr>
<tr><td>9</td><td>Altitude for use</td><td colspan="2">Up to 2,000m</td><td></td></tr>
<tr><td>10</td><td>Pollution degree</td><td colspan="2">2 or lower</td><td></td></tr>
<tr><td>11</td><td>Cooling method</td><td colspan="2">Self-cooling</td><td></td></tr>
</table>

[Table 2.1] General specifications

REMARK

1) IEC(International Electrotechnical Commission)

: The international civilian organization which produces standards for electrical and electronics industry.

2) Pollution degree

: It indicates a standard of operating ambient pollution level.

The pollution degree 2 means the condition in which normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation shall be expected.

2.2 Performance Specifications

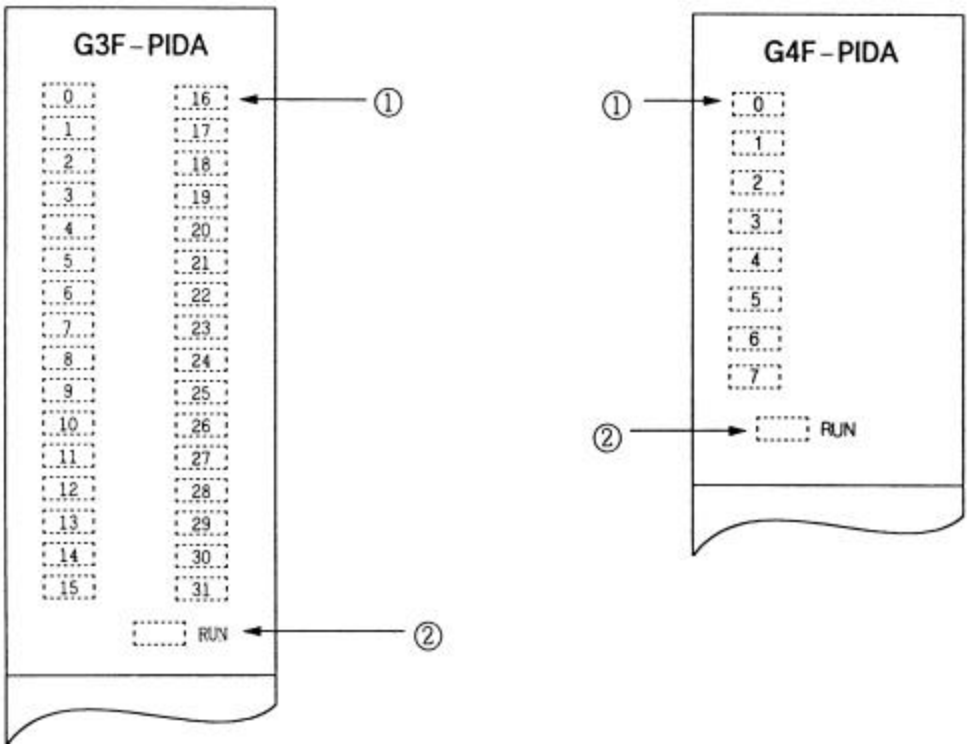
Table. 2.2 shows performance specifications of the PID control module.

Items		Specifications	
		G3F-PIDA	G4F-PIDA
Setting range of PID constants	Proportional constant (P)	0.01 ~ 100.00 (When integral and derivative constants are set to 0.0 sec, proportional action is applied.)	
	Integral constant (I)	0.0 ~ 3000.0 sec (When integral constant is set to 0.0 sec, integral action shall not be applied.)	
	Derivative constant (D)	0.0 ~ 3000.0 sec (When derivative constant is set to 0.0 sec, derivative action shall not be applied.)	
Setting range : SV (Set Value)		0 ~ 16,000	
Input range : PV (Process Value)		0 ~ 16,000	
Output range : MV (Manipulated Value)		0 ~ 16,000	
Setting range : M_MV (Manually Manipulated Value)		0 ~ 16,000	
LED	RUN / STOP	RUN : The run LED of corresponding loops ON STOP : The run LED of corresponding loops OFF	
	NORMAL/ERROR	Normal : RUN LED ON Error : RUN LED flickering	
Number of PID control loops		32 loops	8 loops
Control action		Forward/Reverse action control is available.	
Control cycle		0.1 sec	
Processing type		Measured value derivative type (Pre-derivative type)	
Internal current consumption		0.3 A	0.2 A
Weight		370 g	190 g

[Table. 2.2 Performance Specifications]

2.3 Names of Parts and Functions

The following gives names of parts :



No.	Descriptions
←	Loop Run LED It shows the PID control module run status. ● ON : The corresponding loop is running. ● OFF : The corresponding loop is running. ● Flickering : Error status. Error Value is displayed.
↑	RUN LED It shows the PID module Operating status. ● ON: Normal ● Flickering : Error

2.4 PID Control Action

2.4.1 Processing type

1) Velocity type

Velocity type is a processing that in PID processing, the process Manipulated Value(MV) is obtained by adding the calculated variation of MV (ΔMV) to the previous MV

$$MV_n = MV_{n-1} + \Delta MV_n$$

MV_n : Present Manipulated Value

MV_{n-1} : Previous Manipulated Value

ΔMV_n : Variation of the Previous Manipulated Value

2) Measured Value Derivative Type (Pre-derivative)

Measured value derivative processing, in PID processing, uses the process value(PV) for the derivative term. Generally, PID processing, when a deviation occurs, operates toward the direction in which the deviation will be reduced.
The deviation occurs due to alteration of set value(SV) or outside disturbances. Therefore, if the deviation is used in the derivative processing, the output of the derivative term changes rapidly when the deviation occur due to alteration of set value (SV). So, to prevent raid changes like that, this processing uses the process value(PV) for the derivative term.

$$MV_n = MV_{n-1} + K_p \cdot (E_n - E_{n-1}) + K_p \cdot S/K_I \cdot E_n + K_p \cdot K_d/S \cdot (2PV_n - PV_{n-1} - PV_{n-2})$$

MV_n : Manipulated Value

MV_{n-1} : Previous Manipulated Value

ΔMV_n : Variation of the Previous Manipulated Value

E_n : present Deviation

E_{n-1} : Previous Deviation

K_p : Proportional Constant

K_i : Integral Constant

K_d : Derivative Constant

S : Control Cycle (100ms)

PV_n : present Process Value

PV_{n-1} : One-step previous Process Value

PV_{n-2} : Two-step previous Process Value

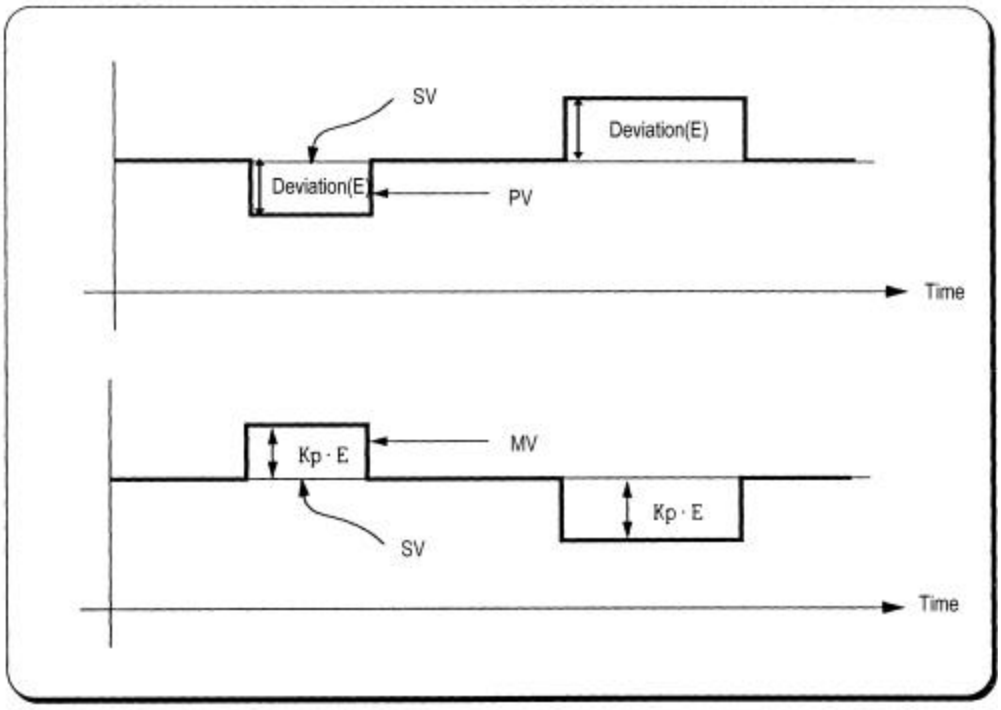
2.4.2 Control Action

1) Proportional Action (P Action)

(1) P action means a control action that obtains a MV which is proportional to the deviation (E: the difference between SV and PV).
(2) The expression which denotes the change relationship of E to MV in P action is shown as follows:

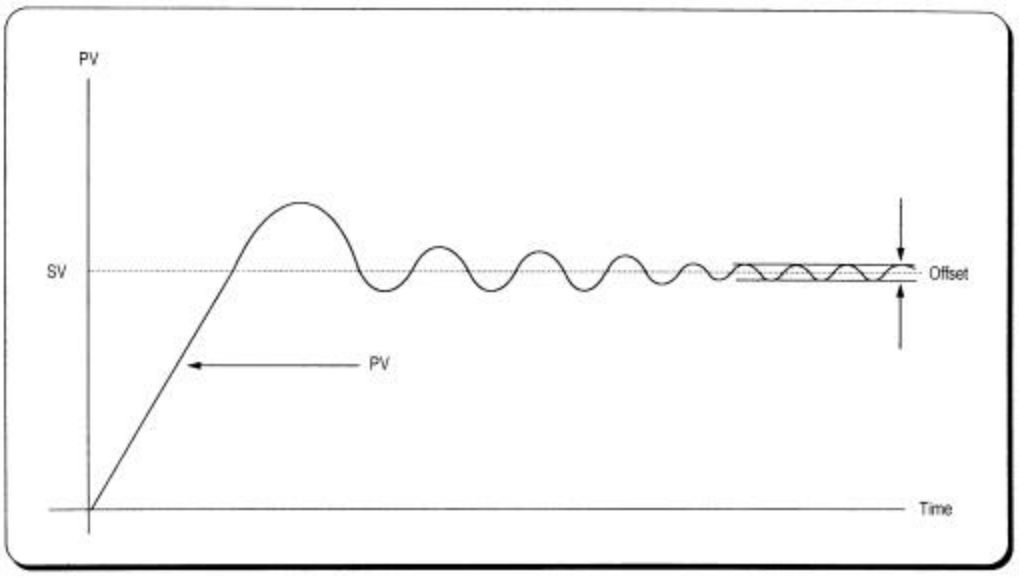
$$MV = Kp \cdot E$$

where Kp is a proportional constant and means gain.
(3) When deviation occurs, the MV by P action is shown in Fig. 2.1.

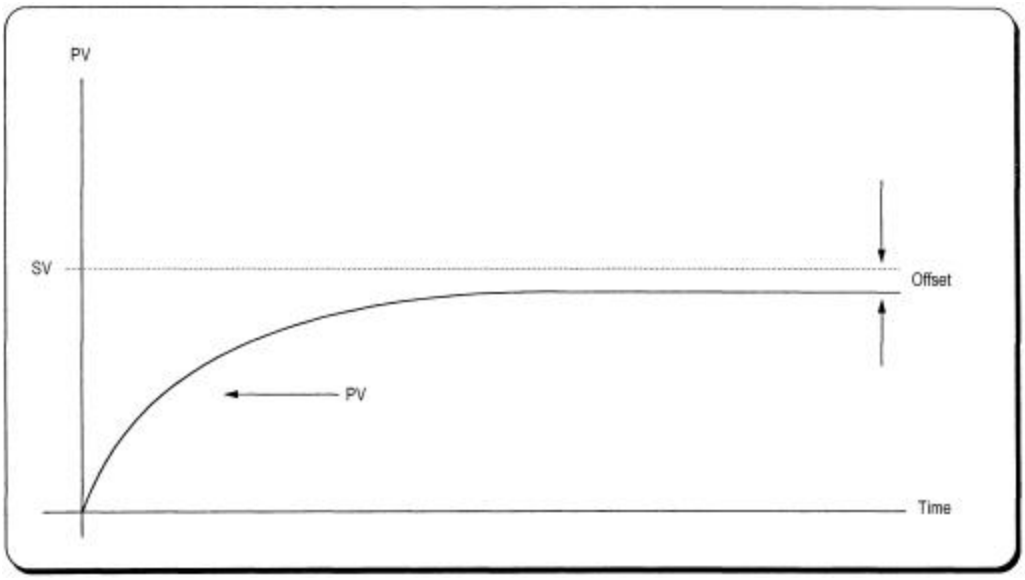


[Fig. 2.1] MV with the proportional action

(4) As shown in Fig. 2.1, the larger the proportional constant Kp the larger the MV, that is, the stronger the P action when the deviation(E) is same . Also, the smaller the Kp the smaller the MV after P action.
(5) If the Kp is too large, PV reaches SV swiftly but can make bad effects like oscillations shown in Fig. 2.2 and cause damage in control stability.
(6) If the Kp is too small, oscillations do not occur but the velocity with which PV reaches SV slows down and offset can happen as shown in Fig. 2.3.
(7) Manipulated Value varies within 0 to 16,000.



[Fig. 2.2] When the proportional constant Kp is large.



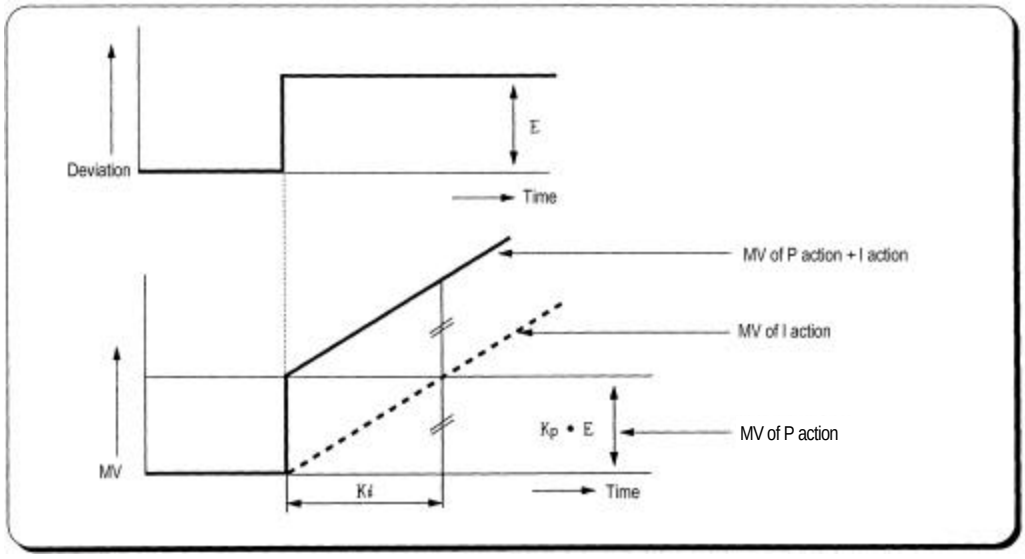
[Fig. 2.3] When the proportional constant Kp is small.

2) Integral Action (I Aaction)

(1) When a deviation(E) occurs between SV and PV, Integral action continuously adds the deviation to or subtracts it from the MV in accordance time in order to eliminate the deviation
When a deviation is small it is not expected that the MV will be changed by P action but I action will eliminate it.
Therefore, the offset which occurs in P action can be eliminated by I action.

(2) The period of the time from when the deviation has occurred in I action to when the MV of I action become that of P action is called Integration time and represented as Ki.

(3) Integral action when a given deviation has occurred is shown as the following Fig. 2.4.



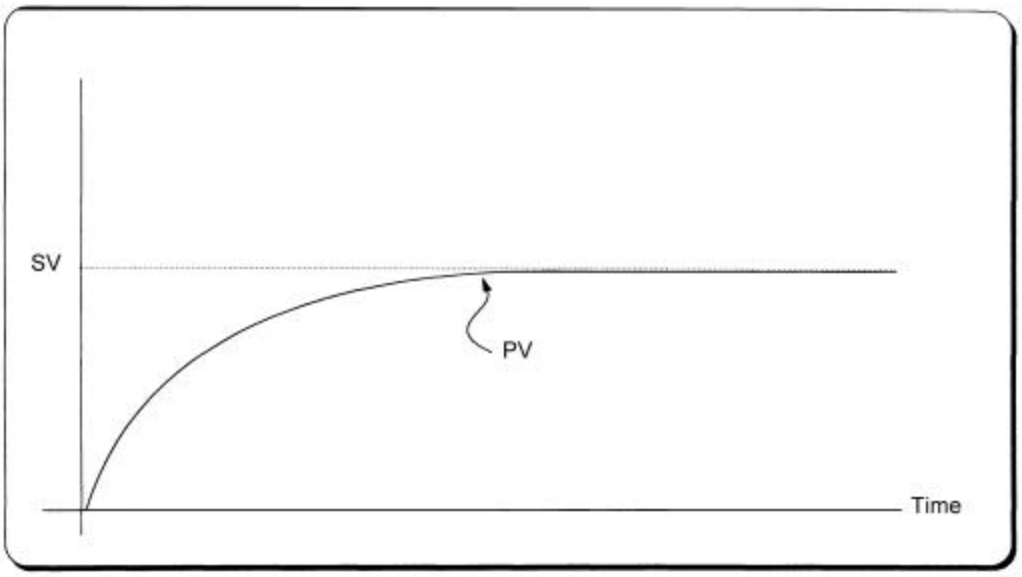
[Fig. 2.4] Integral action at a constant deviation

(4) Expression of Integral Action is as follows:

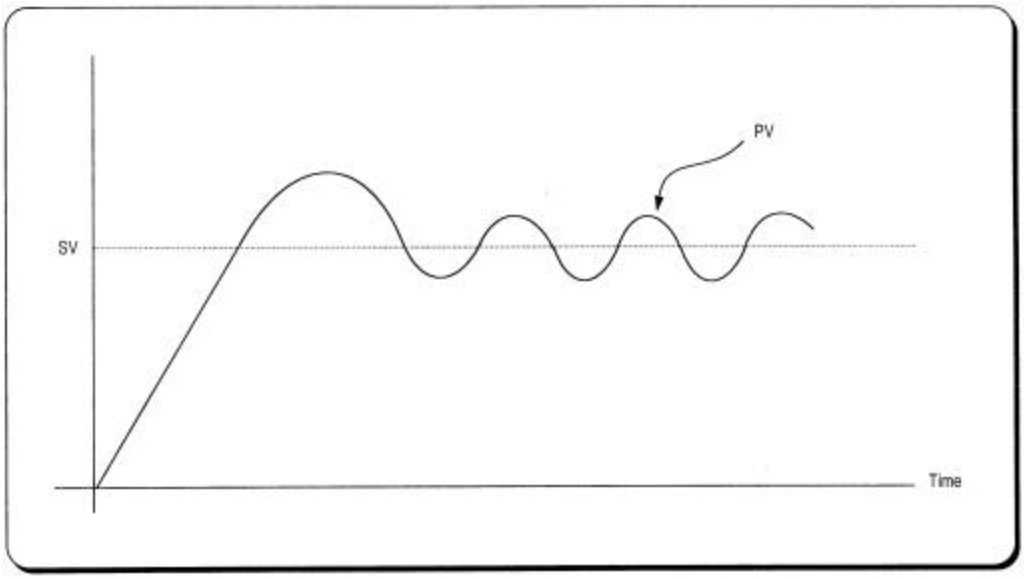
$$MV = P \times E + P \times \frac{1}{K_i} \times \int E dt$$

As shown in the expression, Integral action can be made stronger or weaker by adjusting integration time (K*i*) in I action.
That is, the more the integration time (the longer the integration time) as shown in Fig. 2.5, the lesser the quantity added to or subtracted from the MV and the longer the time needed for the PV to reach the SV.
As shown in Fig. 2.6, when the integration time given is short the PV will approach the SV in short time since the quantity added or subtracted become increased. But, If the integration time is too short then oscillations occurs, therefore, the proper P.I value is requested.

(5) Integral action is used in either PI action in which P action combines with I action or PID action in which P and D actions combine with I action.



[Fig. 2.5] When a long integration time is given.



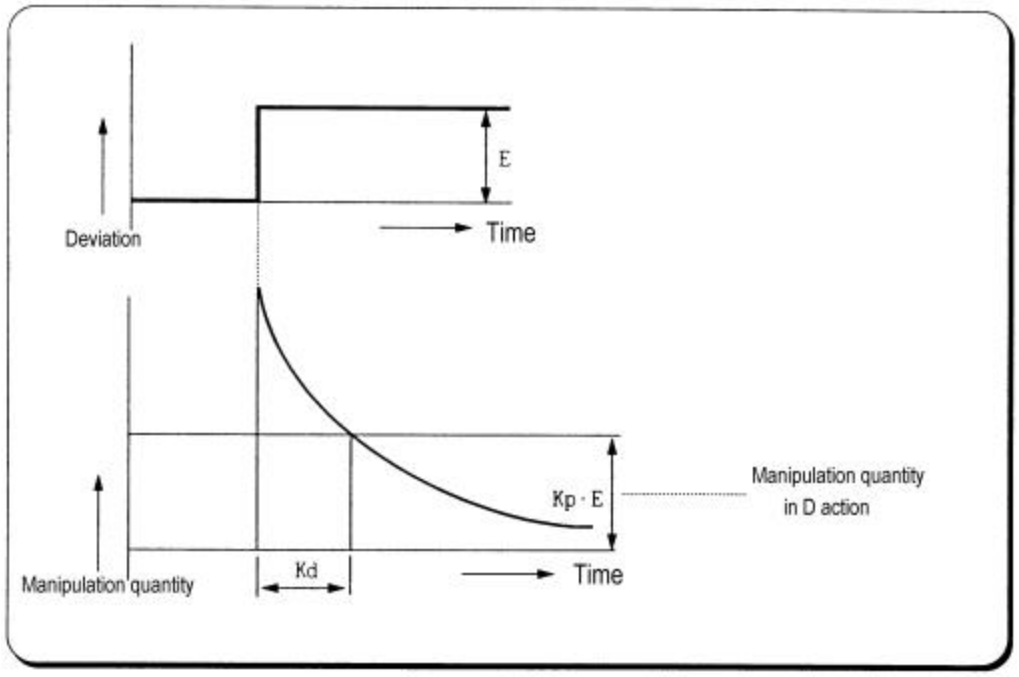
[Fig. 2.5] When a short integration time is given.

3) Derivative Action (D Action)

(1) When a deviation occurs due to alteration of SV or external disturbances, D action restrains the changes of the deviation by producing MV which is proportioned with the change velocity (a velocity whose deviation changes at every constant interval) in order to eliminate the deviation.
- D action gives quick response to control action and has an effect to reduce swiftly the deviation by applying a large control action (in the direction that the deviation will be eliminated) at the earlier time that the deviation occurs.
- D action can prevent the large changes of control object due to external conditions.

(2) The period of time from when the deviation has occurred to when the MV of D action become the MV of P action is called derivative time and represented as Kd.

(3) The D action when a given deviation occurred is shown as Fig. 2.7.



[Fig. 2.7] Derivative action at a constant deviation

(4) The expression of D action is represented as follows:

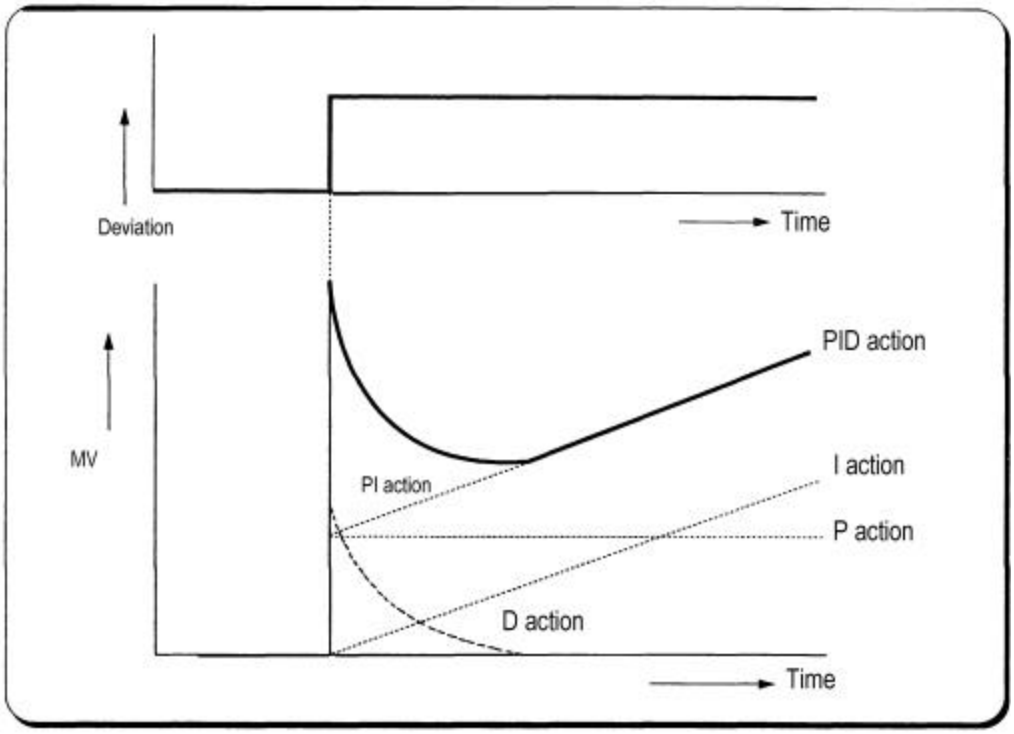
$$MV = K_p \times E + K_p \times \frac{dE}{dt}$$

- In this expression, an output proportional with the variation rate of deviation is added to P action quantity.
- If the derivative time is increased then P action is strengthened.
- D action is applied when a change of deviation occurs and the deviation at normal state become 0. D action, therefore, do not reduce offset.

(5) D action is used in either PD action in which P action combines with D action or PID action in which P and I actions combine with D action.

4) PID Action

(1) PID action controls the control object with the manipulation quantity produced by (P+I+D) action.
(2) PID action when a given deviation has occurred is shown as the following Fig. 2.8.



[Fig. 2.8] PID action at a constant deviation

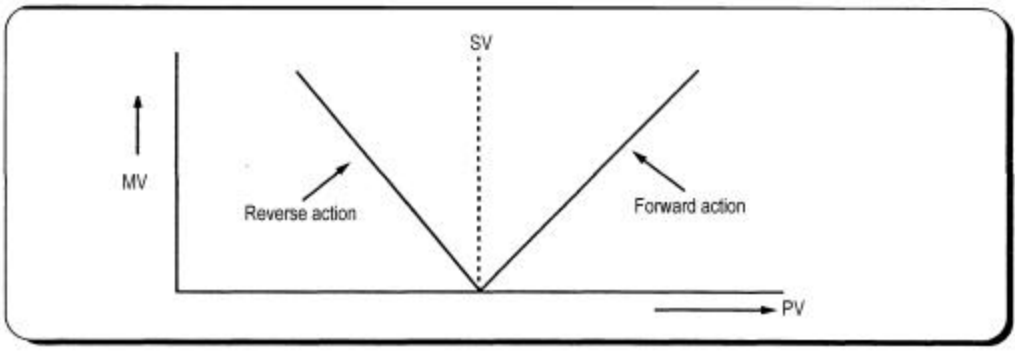
5) PID Processing Expression

PID expressions are of measured value derivative type.

Expressions	Parameters names
$E_n = SV - PV_n$ $MV_n = MV_{n-1} + K_p \{(E_n - E_{n-1}) + K_p \{S/K_I\} E_n + K_p \{K_d/S\} (2PV_n - PV_{n-1} - PV_{n-2})$	**MVn** : Present Manipulated Value **MVn-1** : One-step-previous Manipulated Value **En** : Process deviation **En-1** : Previous deviation **Kp** : Proportional constant **Ki** : Integral constant **Kd** : Derivative constant **S** : Control cycle (100 ms) **PVn** : Process value **PVn-1** : One-step-previous Process Value **PVn-2** : Two-step-previous Process value

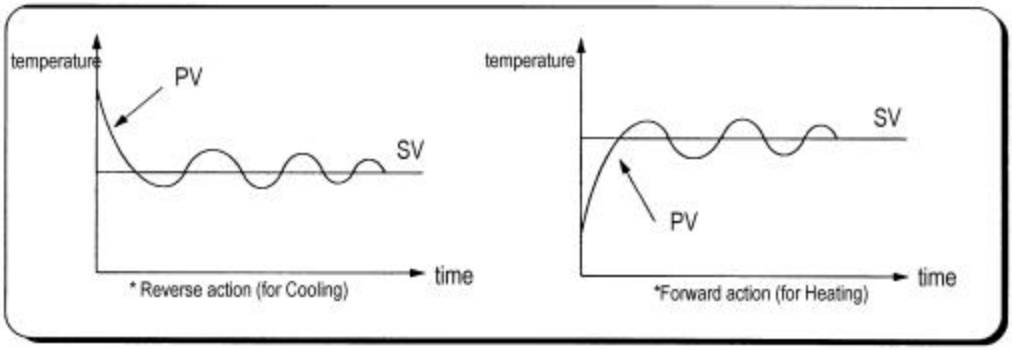
6) Forward/Reverse Actions

(1) PID control has two kinds of action, forward action and reverse action.
a) Forward action makes PV reach SV by outputting MV when PV is less than SV.
b) Reverse action makes PV reach SV by outputting MV when PV is more than SV.
(2) A diagram in which forward and reverse actions are drawn using MV, PV and SV is shown as Fig. 2.9.



[Fig. 2.9] Forward and reverse action with MV, PV and SV

(3) Fig 2.10 shows examples of process control by forward and reverse actions, respectively.



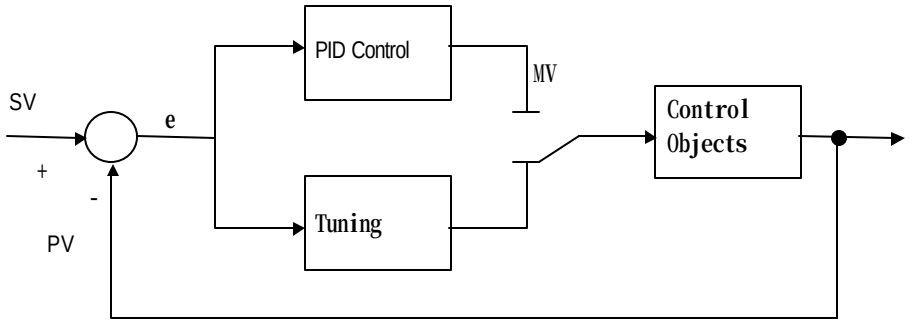
[Fig. 2.10] Examples of process control by forward and reverse actions

2.5 Auto-tuning

2.5.1 Auto-Tuning block Diagram

▶Appropriate P, I, D constant shall be set to perform optimal control when PID control is applied. The function to find these parameters automatically is called Auto-Tuning.

▶If Auto-Tuning command starts, PID control module stops PID calculation and moves to start Auto-Tuning.

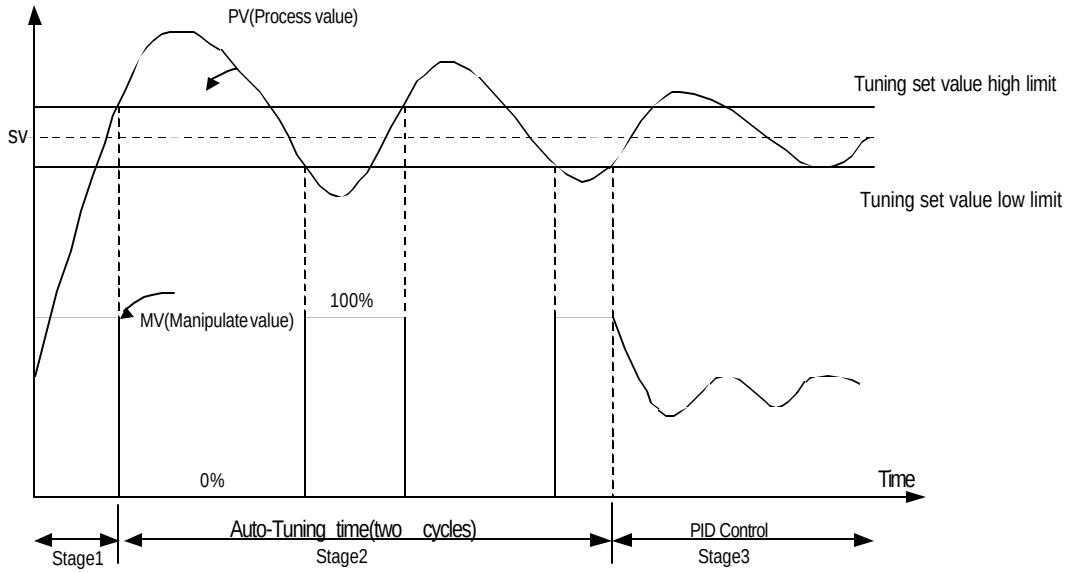


[Fig 2.11] Auto-Tuning block diagram

2.5.2 Sequence of Auto-Tuning

▶Relay control method is applied to Auto-Tuning in PID module, which finds and selects P, I, D constant value of itself while watching the transition of the object to control using relay output.

(1) Forward action (if PV<SV)



[Fig1.11] Auto-Tuning Algorithm

Stage 1) Distinction of forward/reverse

▶ By comparison between Process value(PV) and Tuning setting value(Set value:SV)

Forward : if the process value is lower than the tuning setting value

Reverse : if the process value is higher than the tuning setting value

Stage 2) Auto-tuning operation

Forward : Manipulated value is repeatedly output 2 cycles in order of min.(0% : 0) to max.(100% : 16000).

Reverse : Manipulated value is repeatedly output 2 cycles in order of max.(100% : 16000) to min.(0% : 0).

▶If auto-tuning operation is complete as repeated as above, output variable END of auto-tuning value Read function block(**G3F-PIDA : PID5AATR, G4F-PIDA : PID3AATR**) changes "**0 ⇒ 1**".

Thus, when output variable END of auto-tuning value Read function block changes **"0 ⇒ 1"** in program, P, I, D constant value shall be moved to input variable P, I, D of module initializing function block (**G3F-PIDA : PID5ASET, G4F-PIDA : PID3ASET**).

Stage 3) PID calculation

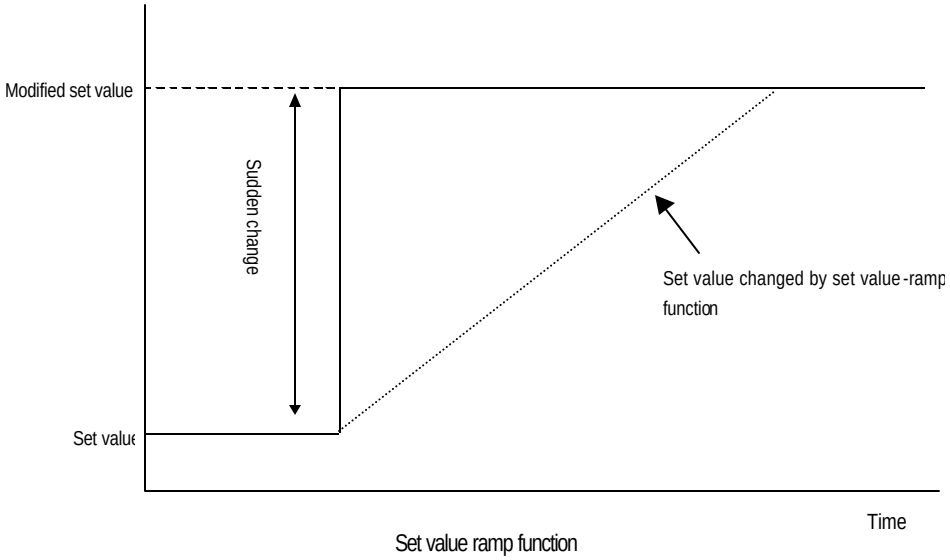
2.6 Set Value(SV) – Ramp function (Set value inclination function)

▶Manipulated value changes by the change of difference the present value to the Manipulated value or by the change of Manipulated value if PID control is used. Thus, sudden change of the set value leads to sudden change of the manipulated value causing damage on the control object.

▶Staged increasing or decreasing function of set value (SV) is the set value-ramp function to prevent set value setting from suddenly changed when modified.

▶Set value-ramp function setting time : 0 65,535(Unit:sec)

▶Related function block: **G3F-PIDA : PID5ASET, G4F-PIDA : PID3ASET**



Set value ramp function

Chapter 3. INSTALLATION

3.1 Installation Ambience

This module has high reliability regardless of its installation ambience. But be sure to check the following for system in higher reliability and stability.

1) Ambience Requirements

Avoid installing this module in locations, which are subjected or exposed to:

- Water leakage and dust a large amount of dust, powder and other conductive power, oil mist, salt, of organic solvent exists.
- Mechanical vibrations of impacts are transmitted directly to the module body.
- Direct sunlight.
- Dew condensation due to sudden temperature change.
- High or low temperatures (outside the range of 0-55℃)

2) Installing and Wiring

- During wiring or other work, do not allow any wire scraps to enter into the PLC
- Install it on locations that are convenient for operation.
- Make sure that it is not located near high voltage equipment on the same panel.
- Make sure that the distance from the walls of duct and external equipment be 50 mm or more.
- Be sure to be grounded to locations that have good noise immunity.

3.2 Handling Precautions

From unpacking to installing the PID control module, be sure to check the following:

1) Do not drop it off, and make sure that strong impacts should not be applied.
2) Do not dismount printed circuit boards from the case. It can cause malfunctions.
3) During wiring, be sure to check any foreign matter like wire scraps should not enter into the upper side of the PLC, and in the event that foreign matter entered into it, always eliminate it.
4) Be sure to disconnect electrical power before mounting or dismounting the module.

Chapter 4. FUNCTION BLOCKS

▶PID control module function blocks used in GMWIN are described below.
▶The type of function block shall be used differently according to the version.
▶Function block list for below V3.0

NO	G3F-PIDA	G4F-PIDA	Function
1	PID5INI	PID3INI	Module initialization
2	PID5ARD	PID3ARD	Reading the Manipulated value (Array type)
3	PID5RD	PID3RDL	Reading the Manipulated value (Single type)

▶ Function block list for V3.0 or later

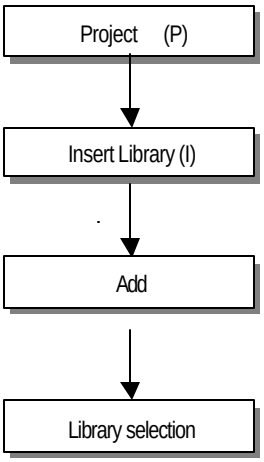
NO	G3F-PIDA	G4F-PIDA	Function
1	PID5AMAN	PID3AMAN	Manual-adjusted value output(plural)
2	PID5MAN	PID3MAN	Manual-adjusted value output(singular)
3	PID5AATI	PID3AATI	Auto-tuning initializing
4	PID5AATR	PID3AATR	Auto-tuning value Read(plural)
5	PID5ATR	PID3ATR	Auto-tuning value Read(singular)
6	PID5ASET	PID3ASET	Setting value input & initializing (plural)
7	PID5ACAL	PID3ACAL	Controlled calculation value Read(plural)
8	PID5CAL	PID3CAL	Controlled calculation value Read(singular)

Remark

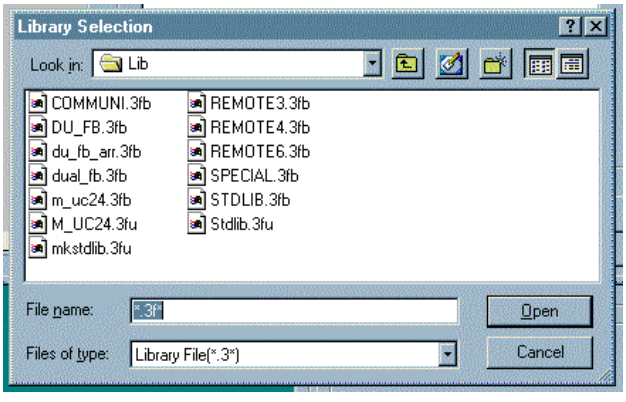
1. If a function block V 3.0 or later is used in below V3.0 and a function block below V3.0 is used in V 3.0 or later, error 5 occurs as displayed on output variable STAT of the function block.
2. Array number of ※1 in 4.2 & 4.3 is 32 (G3F- PIDA) and 8 (G4F-PIDA).

4.1 Insertion of the function blocks for the PID control module on the GMWIN.

Function blocks can be inserted with the following procedures while the GMWIN is running.
Inserting a function block is only possible when a project is open.



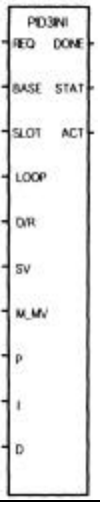
Selection



4.2 Function block used in PID control module below V3.0

4.2.1 Module initialization (G3F-PIDA: PID5INI, G4F-PIDA:PID3INI)

Module initialization function block specifies PID control module base location, slot location, run loop enable/disable and forward/reverse action, and sets MV, M_MV and P.I.D constants for use in program.

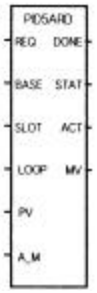
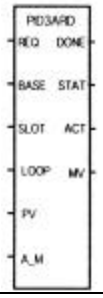
Function Block	I/O	Variable	Data Type	Descriptions
G3F – PIDA 	I	REQ	BOOL	Function block execution request area - Used to request an execution of the initialization function block - If the conditions connected with this area are established while program is running and "0" changes into "1", the initialization function block is executed
		BASE	USINT	Base location No. - Used to write the base No. where the PID control module is mounted. - Setting range: GM1 series(0~31), GM2 series(0~7), GM3/4 series(0-3)
		SLOT	USINT	Slot location No. - Used to write slot No. where the PID control module is mounted. - Setting range: 0~7
		LOOP	BOOL [Array] *Note 1	Run loop enable/disable specification - Used to enable or disable a loop for run. - Specify "1" for enabling, and "0" for disabling
		D/R	BOOL [Array] *Note 1	Forward/Reverse action specification for a run loop. - Specify "0" for forward action and "1" for reverse action.
		SV	BOOL [Array] *Note 1	Setting a SV for a run loop - Setting range: 0~16000
		M_MV	INT [Array] *Note 1	Setting a M_MV for a run loop - Setting range: 0 ~ 16000
		P	UINT [Array] *Note 1	Setting a proportional constant (0.01 ~ 100.00) for a run loop - Setting range: 0~10000 - The initialization function block not executed if the proportional constant is set to "0", whether or not the constant is initialized in the function block.
G4F – PIDA 		I	UINT [Array] *Note 1	Setting an integral constant (0.0 ~3000.0 sec) for arun loop - Setting range: 0~30000 - Integral action not executed if the integral constant is set to '0'.
		D	UINT [Array] *Note 1	Setting a derivative constant (0.0 ~3000.0 sec) for a run loop - Setting range: 0~30000 - Derivative action not executed if the derivative constant is set to '0'.
	O	DONE	BOOL	Function block finished execution status - "1" is output when the initialization function block is finished with no error and "1" remains until next execution. If an error occur, '0' is displayed and the operation enters into the stop state.
		STAT	USINT	Error status indication area - Used to output the number of an error when it occurs during initialization function block execution. - For description of errors, see GM Section 6.3
		ACT	BOOL [Array] *Note1	Run loop status indication area - After the initialization function block is finished with no error, "1" is output if the loop is in normal state. But "0" is output for the disabled loops.

REMARK

* Note 1: The numbers of Array are 32 in G3F-PIDA, 8 in G4F-PIDA.

4.2.2 Manipulated value(MV) reading (array type) : (G3F-PIDA:PID5ARD, G4F-PIDA:PID3ARD)

The Array type MV Reading function block execute all loops of the PID control module in a batch processing and can display the MV for run loops which is output with auto/manual run specification and a PV input.

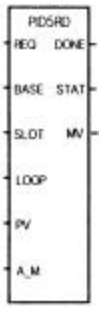
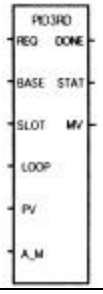
Function block	I/O	Variable	Data Type	Descriptions
G3F－PIDA 	I	REQ	BOOL	Function block execution request area - Used to request an execution of the MV reading function block - Manipulated value reading function block executed if ‘1” with connected condition to this area as composed during program execution.
		BASE	USINT	Base location No. - Used to write the base No. where the PID control module is mounted. - Setting range: GM1 series (0~31), GM2 series(0~7), GM3/4 series(0-3)
		SLOT	USINT	Slot location No. - Used to write slot No. where the PID control module is mounted. - Setting range: 0~7
		LOOP	BOOL [Array] *Note 1	Run loop enable/disable specification - Used to enable or disable a loop for run. - Specify “1” for enabling, and “0” for disabling
		PV	INT [Array] *Note 1	Inputting a PV of the control object for a run loop - Setting range: 0~16000
		A/M	BOOL [Array] *Note 1	MV type specification for a run loop - Specify “0” for auto processing (PID processing) MV - Specify “1” for manual processing (forced processing) MV
G4F－PIDA 	O	DONE	BOOL	Function block finished execution status - “1” is output when the initialization function block is finished with no error and “1” remains until next execution. If an error occur, ‘0’ is displayed and the operation enters into the stop state.
		STAT	USINT	Error status indication area - Used to output the number of an error when it occurs during initialization function block execution. - For description of errors, see GM Section 6.3
		ACT	BOOL [Array] *Note 1	Run loop status indication area - After the initialization function block is finished with no error, “1” is output if the loop is in normal state. But “0” is output for the disabled loops.
		MV	INT [Array] *Note 1	MV data for the enabled run loops - MV output range: 0 ~ 16000

REMARK

*Note 1: The numbers of array are 32 in G3F-PIDA, 8 in G4F-PIDA.

4.2.3 Manipulated value(MV) reading (single type) : (G3F-PIDA:PID5RD, G4F-PIDA:PID3RD)

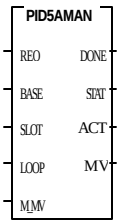
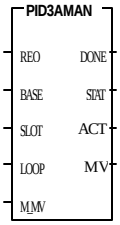
The single type MV Reading function block processes one loop of the PID control module and can display the MV for run loops which is output with auto/manual run specification and a PV input.

Function block	I/O	Variable	Data Type	Description
G3F－PIDA 	I	REQ	BOOL	Function block execution request area - Used to request an execution of the MV reading function block - Manipulated value reading function block executed if '1" with connected condition to this area as composed during program execution.
		BASE	USINT	Base location No. - Used to write the base No. where the PID control module is mounted. - Setting range: GM1 series(0~31), GM2 series(0~7), GM3/4 series(0-3)
		SLOT	USINT	Slot location No. - Used to write the slot No. where the PID control module is mounted. - Setting range: 0~7
		LOOP	USINT	Specifying the loop that will read MV - Setting range : G3F -PIDA: 0 to 31, G4F-PIDA: 0 to 7
		PV	INT	Inputting a PV of the control object for a run loop - Setting range: 0~16000
		A/M	BOOL	MV type specification for a run loop - Specify "0" for auto processing (PID processing) MV - Specify "1" for manual processing (forced processing) MV
G4F－PIDA 	O	DONE	BOOL	Function block finished execution status - "1" is output when the initialization function block is finished with no error and "1" remains until next execution. If an error occur, '0' is displayed and the operation enters into the stop state.
		STAT	USINT	Error status indication area - Used to output the number of an error when it occurs during initialization function block execution. - For description of errors, see GM Section 6.3
		MV	INT	MV data for the enabled run loops - MV output range: 0 ~ 16000

4.3 Function block used in PID control module V3.0 or later

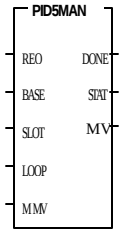
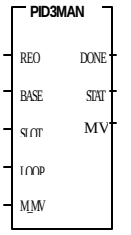
4.3.1 Manual manipulated value output (array type) (G3F-PIDA : PID5AMAN, G4F-PIDA : PID3AMAN)

Manual manipulated value output function block processes whole PID roofs of PID control module totally and the manual manipulated value as set is output as manipulated value.

Function block	I/O	Varible	Data type	Description
G3F-PIDA  G4F-PIDA  	I	REQ	BOOL	Request area of function block execution -.It is an execution request area of manual manipulated value output function block. - Manual manipulated value output function block executed if ‘1” with connected condition to this area as composed during program execution.
		BASE	USINT	Base location No. - Used to write the base No. where the PID control module is mounted. - Setting range : GM1 series(0 31), GM2 series(0 7), GM3/4 series(0 3)
		SLOT	USINT	Slot loc ation No. - Used to write the slot No. where the PID control module is mounted. - Setting range : 0 7
		LOOP	BOOL [ARRAY]1	Run loop enabled/disabled specification - Setting area of the loop to operate. - Set the loop to operate to “1”, the loop not to operate to “0”.
		M_MV	INT [ARRAY]1	Manual manipulated value for the loop to operate. - Setting range : 0 16000
	O	DONE	BOOL	State displaying area of function block execution complete - If manual manipulated value output function block execution complete without error, “1” is output as kept until the next execution starts. If error occurs, “0” is output.
		STAT	USINT	Error No. displaying area if occurred during manual manipulated value output function block execution - Refer to 4.4 for error description.
		ACT	BOOL [ARRAY]1	Displaying area of loop operation - If the assigned loop normal after manual manipulated value output function block is executed without error, “1”is output. for the loop not set to operate, “0” is output.
		MV	INT [ARRAY]1	Manipulated value data of the loop presently executed - Output range : 0 16000

4.3.2 Manual manipulated value output (single type) (G3F-PIDA : PID5MAN, G4F-PIDA : PID3MAN)

Manual manipulated value output(single type) function block processes one loop of PID control module and the manual manipulated value as set is output.

Function block	I/O	Varible	Data type	Description
G3F-PIDA  G4F-PIDA  	I	REQ	BOOL	Request area of function block execution - It is an execution request area of manual manipulated value output function block. - Manual manipulated ouput function block executed if “1” with connected condition to this area as composed during program execution.
		BASE	USINT	Base location No. - Used to write the base No. where the PID control module is mounted. - Setting range : GM1 series(0 31), GM2 series(0 7), GM3/4 series(0 3)
		SLOT	USINT	Slot location No. - Used to write the slot No. where the PID control module is mounted. - Setting range : 0 7
		LOOP	USINT	Specifying the loop that will read MV - Setting range : G3F-PIDA: 0 to 31, G4F-PIDA: 0 to 7
		M_MV	INT	Manual manipulated value for the loop to operate. - Setting range : 0 16000
	O	DONE	BOOL	State displaying area of function block execution complete - If manual manipulated value output function block execution complete without error, “1” is output as kept if input is “1”. If error occurs, “0” is output.
		STAT	USINT	Error No. displaying area if occurred during manual manipulated value outputfunction block execution - Refer to 4.4 for error description.
		MV	INT	Manipulated value data of the loop presently executed - Output range : 0 16000

4.3.3 Auto tuning initializing (array type) (G3F-PIDA : PID5AATI, G4F-PIDA : PID3AATI)

Auto Tuning initializing (array type) function block sets base location of PID control module, slot location for installation, loop to operate, Auto Tuning start/stop for the loop, forward/reverse operation and other setting values in order to use in the program.

Function block	I/O	Variable	Data type	Description
G3F-PIDA PID5AATI REQ DONE BASE STAT SLOT ACT LOOP AUTO_RS D/R SV **G4F-PIDA** PID3AATI REQ DONE BASE STAT SLOT ACT LOOP AUTO_RS D/R SV	I	REQ	BOOL	Request area of function block execution - It is an execution request area of Auto Tuning initializing function block. - Auto Tuning initializing function block executed if "0→1"(rising edge) with connected condition to this area as composed during program execution
		BASE	USINT	Base location No. - Used to write the base No. where the PID control module is mounted. - Setting range : GM1 series(0 31), GM2 series(0 7), GM3/4 series(0 3)
		SLOT	USINT	Slot location No. - Used to write the slot No. where the PID control module is mounted. - Setting range : 0 7
		LOOP	BOOL [ARRAY][1]	Run loop enabled/disabled specification -Set the loop to operate to "1", the loop not to operate to "0".
		AUTO_RS	BOOL [ARRAY][1]	Auto Tuning start/stop setting for the loop to operate - If "0", set Auto Tuning to stop - If "1", set Auto Tuning to start
		D/R	BOOL [ARRAY][1]	Forward/reverse operation setting for the loop to operate - If "0", forward - If "1", reverse
		SV	INT [ARRAY][1]	Set value input for the loop to operate - Setting value range : 0 ~ 16000
	O	DONE	BOOL	State displaying area of function block execution complete - If Auto Tuning initializing function block execution complete without error, "1" is output as kept until the next execution starts. If error occurs, "0" is output.
		STAT	USINT	Error state displaying area - Error No. displaying area if occurred during Auto Tuning initializing function blockexecution. - Refer to 4.4 for error description.
		ACT	BOOL [ARRAY][1]	Displaying area of the loop to operate - If setting loop is normal after Auto Tuning initializing function block is executed without error, "1" is output. For the roof not set to operate, "0" is output.

REMARK

* Note 1: The numbers of array are 32 in G3F-PIDA, 8 in G4F-PIDA.

4.3.4 Auto tuning read (array type) (G3F-PIDA : PID5AATR, G4F-PIDA : PID3AATR)

Auto tuning read (array type) function block processes whole loops of PID control module totally, inputs present value and outputs manipulated value for auto tuning of PID control module.
If auto tuning is complete, P,I,D constant of the control object is displayed on the output variable.

Function block	I/O	Variable	Data type	Description
G3F-PIDA PID5AATR REQ DONE BASE STAT SLOT ACT LOOP END PV MV P I D	I	REQ	BOOL	Request area of function block execution - It is an execution request area of Auto Tuning read function block. - Auto Tuning read function block executed if "1" with connected condition to this area as composed during program execution
		BASE	USINT	Base location No. - Used to write the base No. where the PID control module is mounted. - Setting range : GM1 series(0 31), GM2 series(0 7), GM3/4 series(0 3)
		SLOT	USINT	Slot location No. - Used to write the slot No. where the PID control module is mounted. - Setting range : 0 7
		LOOP	BOOL [ARRAY][1]	Run loop enabled/disabled specification -Set the loop to operate to "1", the loop not to operate to "0".
		PV	INT [ARRAY][1]	Present value input of control object for the loop to operate - Present value input range : 0 ~ 16000
G4F-PIDA PID3AATR REQ DONE BASE STAT SLOT ACT LOOP END PV MV P I D	O	DONE	BOOL	State displaying area of function block execution complete - If Auto Tuning read function block execution complete without error, "1" is output as kept until the next execution starts. If error occurs, "0" is output.
		STAT	USINT	Error state displaying area - Error No. displaying area if occurred during Auto Tuning read function block execution. - Refer to 4.4 for error description.
		ACT	BOOL [ARRAY][1]	Displaying area of the loop to operate - If setting loop is normal after Auto Tuning read function block is executed without error, "1"is output. For the roof not set to operate,"0" is output.
		END	BOOL [ARRAY][1]	Auto Tuning operation complete state displaying -If "0", Auto Tuning is incomplete -If "1", Auto Tuning is complete
		MV	INT [ARRAY][1]	Manipulated value data where present Auto Tuning is executed. - Output value : 0 or 16000
		P	UINT [ARRAY][1]	Proportional constant of the loop by Auto Tuning -Data range : 1 ~ 10000(proportional constant value : 0.01 ~ 100.00)
		I	UINT [ARRAY][1]	Integral constant of the loop by Auto Tuning -Data range : 0 ~ 30000(integral constant value : 0.0 ~ 3000.0 sec.)
		D	UINT [ARRAY][1]	Differential constant of the roof by Auto Tuning -Data range : 0 ~ 30000(differential constant value : 0.0 ~ 3000.0 sec.)

REMARK
* Note 1: The numbers of array are 32 in G3F-PIDA, 8 in G4F-PIDA.

4.3.5 Auto tuning read (single type)(G3F-PIDA : PID5ATR, G4F-PIDA : PID3ATR)

Auto-tuning read (single type) function block processes one loop of PID control module, inputs present value and outputs manipulated value for auto tuning of PID control module.
If auto tuning is complete, obtained P,I,D constant is output.

Function block	I/O	Variable	Data type	Description
G3F-PIDA PID5ATR REQ DONE BASE STAT SLOT END LOOP MV PV P I D	입력	REQ	BOOL	Request area of function block execution - It is an execution request area of Auto Tuning read function block. - Auto Tuning read function block executed if "1" with connected condition to this area as composed during program execution
		BASE	USINT	Base location No. - Used to write the base No. where the PID control module is mounted. - Setting range : GM1 series(0 31), GM2 series(0 7), GM3/4 series(0 3)
		SLOT	USINT	Slot location No. - Used to write the slot No. where the PID control module is mounted. - Setting range : 0 7
		LOOP	USINT	Specifying the loop that will read MV - Setting range : G3F-PIDA: 0 to 31, G4F-PIDA: 0 to 7
		PV	INT	Present value input of control object for the loop to operate - Present value input range : 0 ~ 16000
G4F-PIDA PID3ATR REQ DONE BASE STAT SLOT END LOOP MV PV P I D	O	DONE	BOOL	State displaying area of function block execution complete - If Auto Tuning read function block execution complete without error, "1" is output as kept until the next execution starts. If error occurs, "0" is output.
		STAT	USINT	Error state displaying area - Error No. displaying area if occurred during Auto Tuning read function block execution. - Refer to 4.4 for error description.
		END	BOOL	Auto Tuning operation complete state displaying - If "0", Auto Tuning is incomplete - If "1", Auto Tuning is complete
		MV	INT	Manipulated value data where present Auto Tuning is executed. - Output value : 0 or 16000
		P	UINT	Proportional constant of the loop by Auto Tuning - Data range : 1 ~ 10000(proportional constant value : 0.01 ~ 100.00)
		I	UINT	Integral constant of the loop by Auto Tuning Data range : 0 ~ 30000(integral constant value : 0.0 ~ 3000.0 sec.)
		D	UINT	Differential constant of the roof by Auto Tuning - Data range : 0 ~ 30000(differential constant value : 0.0 ~ 3000.0 sec.)

4.3.6 Set value input and initializing (array type)(G3F-PIDA : PID5ASET, G4F-PIDA : PID3ASET)

Set value input and initializing(array type) function block sets base location of PID control module, slot location for install ation, loop to operate, forward/reverse for the loop operation, setting value, rising time/falling time and P I D constant to prevent the setting value from changing suddenly in order to use in the program.

Function block	I/O	Variable	Data type	Description
G3F-PIDA PID5ASET REQ DONE BASE STAT SLOT ACT LOOP D/R SV SV_UP SV_DN P I D INIT_PV	I	REQ	BOOL	Request area of function block execution - It is an execution request area of set value and initializing function block. - Set value input and initializing function block executed if "0→1"(rising edge) with connected condition to this area as composed during program execution.
		BASE	USINT	Base location No. - Used to write the base No. where the PID control module is mounted. - Setting range : GM1 series(0 31), GM2 series(0 7), GM3/4 series(0 3)
		SLOT	USINT	Slot location No. - Used to write the slot No. where the PID control module is mounted. - Setting range : 0 7
		LOOP	BOOL [ARRAY][1]	Run loop enabled/disabled specification - Set the loop to operate to "1", the loop not to operate to "0".
		D/R	BOOL [ARRAY][1]	Forward/ reverse operation setting for the loop to operate - If "0", forward - If "1", reverse
		SV	INT [ARRAY][1]	Set value input for the loop to operate - Setting range : 0 ~ 16000
		SV_UP	UINT [ARRAY][1]	Time to reach the set value if the control set value is rising for the operation loop. -. Setting range : 0 65535sec
		SV_DN	UINT [ARRAY][1]	Time to reach the set value if the control set value is falling for the operation loop. - Setting range : 0 65535 sec
		P	UINT [ARRAY][1]	Proportional constant of the roof by Auto Tuning - Data range : 1 ~ 10000(proportional constant value : 0.01 ~ 100.00)
		I	UINT [ARRAY][1]	Integral constant of the roof by Auto Tuning - Data range : 0 ~ 30000(integral constant value : 0.0 ~ 3000.0 sec.)
		D	UINT [ARRAY][1]	Differential constant of the roof by Auto Tuning - Data range : 0 ~ 30000(differential constant value : 0.0 ~ 3000.0 sec.)
		INIT_PV	INT [ARRAY][1]	Present value input during the initial 1 scan for the operation loop - Present value input range : 0 ~ 16000
G4F-PIDA PID3ASET REQ DONE BASE STAT SLOT ACT LOOP D/R SV SV_UP SV_DN P I D INIT_PV	O	DONE	BOOL	State displaying area of function block execution complete - If Auto Tuning initializing function block execution complete without error, "1" is output as kept until the next execution starts. If error occurs, "0" is output.
		STAT	USINT	Error state displaying area - Error No. displaying area if occurred during Auto Tuning initializing function block execution. - Refer to 4.4 for error description.
		ACT	BOOL [ARRAY][1]	Displaying area of the loop to operate -If setting loop is normal after Auto Tuning initializing function block is executed without error, "1"is output. For the roof not set to operate, "0" is output.

REMARK

* Note 1: The numbers of array are 32 in G3F-PIDA, 8 in G4F-PIDA.

4.3.7 Control calculation value read (array type)(G3F-PIDA : PID5ACAL, G4F-PIDA : PID3ACAL)

Control calculation (array type)function block processes whole loops of PID control module totally, inputs present value and outputs its correspondent-manipulated value (PID calculation value) with the set value being changed.

Function block	I/O	Variable	Data type	Description
G3F-PIDA PID5ACAL REQ DONE BASE STAT SLOT ACT LOOP MV PV SV_RAMP	I	REQ	BOOL	Request area of function block execution - It is an execution request area of control calculation function block. - control calculation function block executed if "1" with connected condition to this area as composed during program execution
		BASE	USINT	Base location No. - Used to write the base No. where the PID control module is mounted. - Setting range : GM1 series(0 31), GM2 series(0 7), GM3/4 series(0 3)
		SLOT	USINT	Slot location No. - Used to write the slot No. where the PID control module is mounted. - Setting range : 0 7
		LOOP	BOOL [ARRAY]¹	Run loop enabled/disabled specification - Set the loop to operate to "1", the loop not to operate to "0".
		PV	INT [ARRAY]¹	Present value input of control object for the loop to operate - Present value input range : 0 ~ 16000
G4F-PIDA PID3ACAL REQ DONE BASE STAT SLOT ACT LOOP MV PV SV_RAMP	O	DONE	BOOL	State displaying area of function block execution complete - If Control calculation function block execution complete without error, "1" is output as kept until the next execution starts. If error occurs, "0" is output.
		STAT	USINT	Error state displaying area - Error No. displaying area if occurred during Control calculation function block execution. - Refer to 4.4 for error description.
		ACT	BOOL [ARRAY]¹	Displaying area of the loop to operate -If setting loop is normal after Control calculation function block is executed without error, "1" is output. For the loop not set to operate, "0" is output.
		MV	INT [ARRAY]¹	Manipulated value of the loop set to operate - manipulated value output range : 0 ~ 16000
		SV_RAMP	INT [ARRAY]¹	Value changed when set value is input and RAMP functio n is executed according to input variable SV_UP and SV_DN setting of the initializing (array type) function block - Output range : 0 ~ 16000

4.3.8 Control calculation value read (single type) (G3F-PIDA : PID5CAL, G4F-PIDA : PID3CAL)

Control calculation (single type)function block processes one loop of PID control module , input present value and output its correspondent -manipulated value (PID calculation value) with the set value being changed.

Function block	I/O	Variable	Data type	Description
G3F-PIDA PID5CAL REQ DONE BASE STAT SLOT MV LOOP SV_RAMP PV G4F-PIDA PID3CAL REQ DONE BASE STAT SLOT MV LOOP SV_RAMP PV	I	REQ	BOOL	Request area of function block execution - It is an execution request area of control calculation function block. - control calculation function block executed if "1" with connected condition to this area as composed during program execution
		BASE	USINT	Base location No. - Used to write the base No. where the PID control module is mounted. - Setting range : GM1 series(0 31), GM2 series(0 7), GM3/4 series(0 3)
		SLOT	USINT	Slot location No. - Used to write the slot No. where the PID control module is mounted. - Setting range : 0 7
		LOOP	USINT	Specifying the loop that will read MV - Setting range : G3F-PIDA: 0 to 31, G4F-PIDA: 0 to 7
		PV	INT	Present value input of control object for the loop to operate - Present value input range : 0 ~ 16000
	O	DONE	BOOL	State displaying area of function block execution complete - If Control calculation function block execution complete without error, "1" is output as kept until the next execution starts. If error occurs, "0" is output.
		STAT	USINT	Error state displaying area - Error No. displaying area if occurred during Control calculation function block execution. Refer to 4.4 for error description.
		MV	INT	Manipulated value of the loop set to operate - manipulated value output range : 0 ~ 16000
		SV_RAMP	INT	Value changed when set value is input and RAMP function is executed accord ing to input variable SV_UP and SV_DN setting of the initializing (single type) function block - Output range : 0 ~ 16000

4.4 Errors on function block

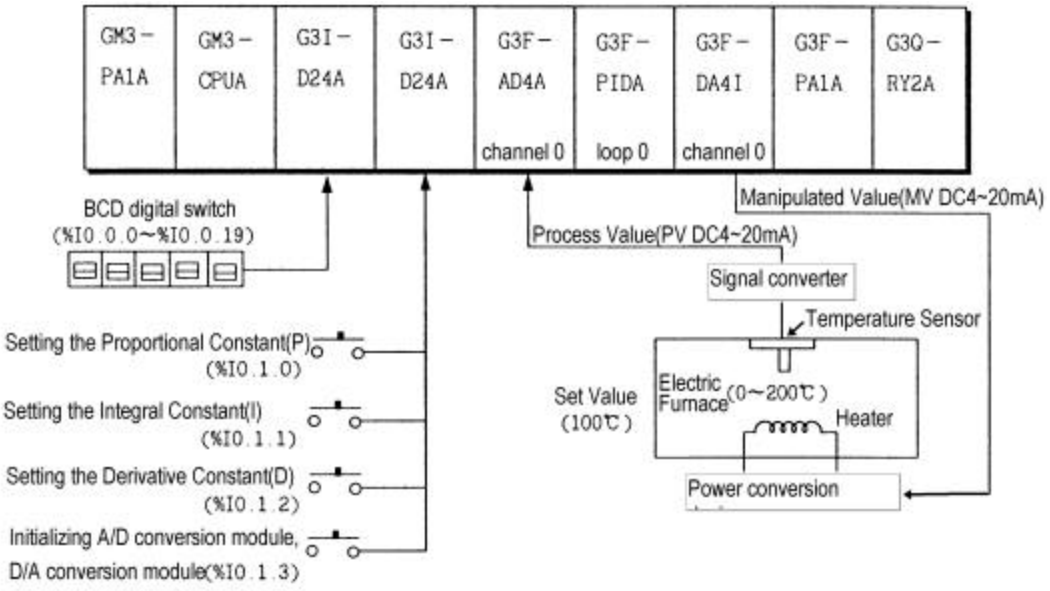
Errors indicated by an output variable STAT and their corrective actions are explained.

STAT No.	Item	Descriptions	Function Block			Corrective Action
			Initilaiza-tion	Reading		
				Array	Single	
0	Local	Normal Run status	O	O	O	—
1		Base location No. outside the setting range	O	O	O	Adjust it within the setting range (See Section 4.2 ,4.3)
2		The corresponding base module hardware defect	O	O	O	Contact a service station
3		Slot location No. outside the setting range	O	O	O	Specify correctly the slot No. where the PID control module is mounted .
4		The specified slot has no PID control module	O	O	O	Mount the PID control module on the specified slot.
5		A module other than the PID control module is loaded on.	O	O	O	Mount the PID control module on the specified slot.
6		Loop No. outside the setting range	—	—	O	Specify correctly the No. of the run loop.
7		PID control Module hardware Defect	O	O	O	Contact a service station.
8		PID control module shared memory defect	O	O	O	Contact a service station.
9		The run loop was not specified in the Initialization function block.	—	O	O	Specify correctly run loops in the initialization function block.
10		Inputs outside the setting range	O	O	O	One or more of SV, M_MV, P, I, D and PV outside the setting range, adjust it/them within its/their setting range.

Chapter 5 Programming

5.1 A program for controlling an electric furnace (PID module for below V3.0)
(with applying the A/D conversion module, PID control module and D/A conversion module)

1) System configuration



2) Initial settings

(1) PID control module
- A) Used loop : loop 0
- B) Specifying forward/reverse action : forward action
- C) Setting SV: 12800
- D) Specifying auto/manual processing : auto processing

(2) A/D conversion module
- A) Used channel: channel 0
- B) Specifying output data type: -192 to 16191
- C) Setting filter constant: 50

(3) D/A conversion module
- A) Used channel: channel 0
- B) Specifying input data type: -192 to 16191
- C) The output when no channel is used or the CPU module is in the stop state : The median value of the output will be output.

3) Descriptions of the program

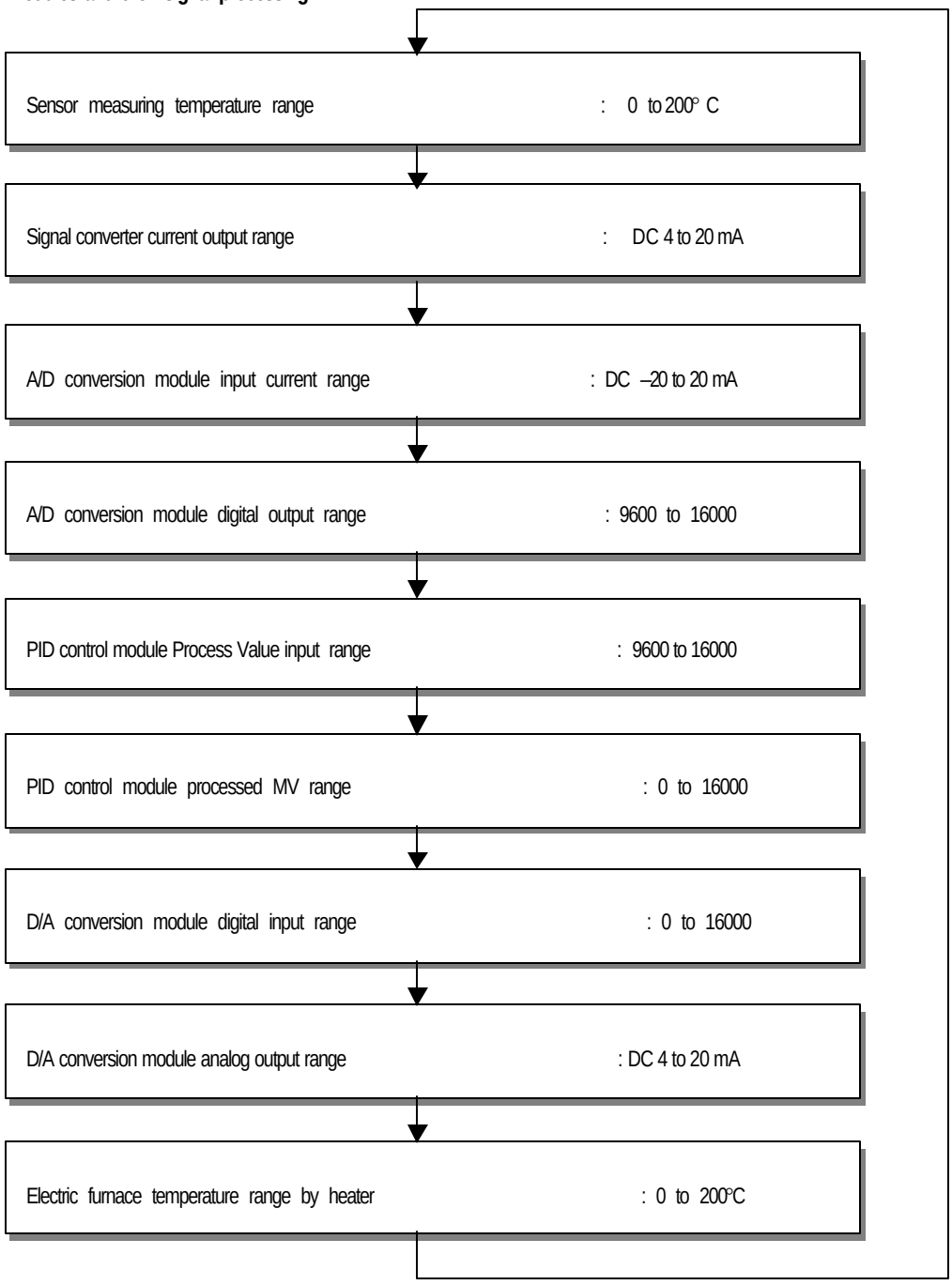
(1) A temperature 0 to 200°C from the temperature sensor is converted into an analog signal 4 to 20 mA and then the signal is input to the channel 0 of the A/D conversion module channel and converted into a digital value 9600 to 16000.

(2) In the PID control module, 100°C (where the signal converter output is 12 mA and 12800 as a digital value.) is set as SV. With regards to P.I.D constants, the manipulated value in the BCD digital switch is set to the proportional constant when %I0.1.0 is on, to the integral constant when %I0.1.1 is on, and to the derivative constant when %I0.1.2 is on.

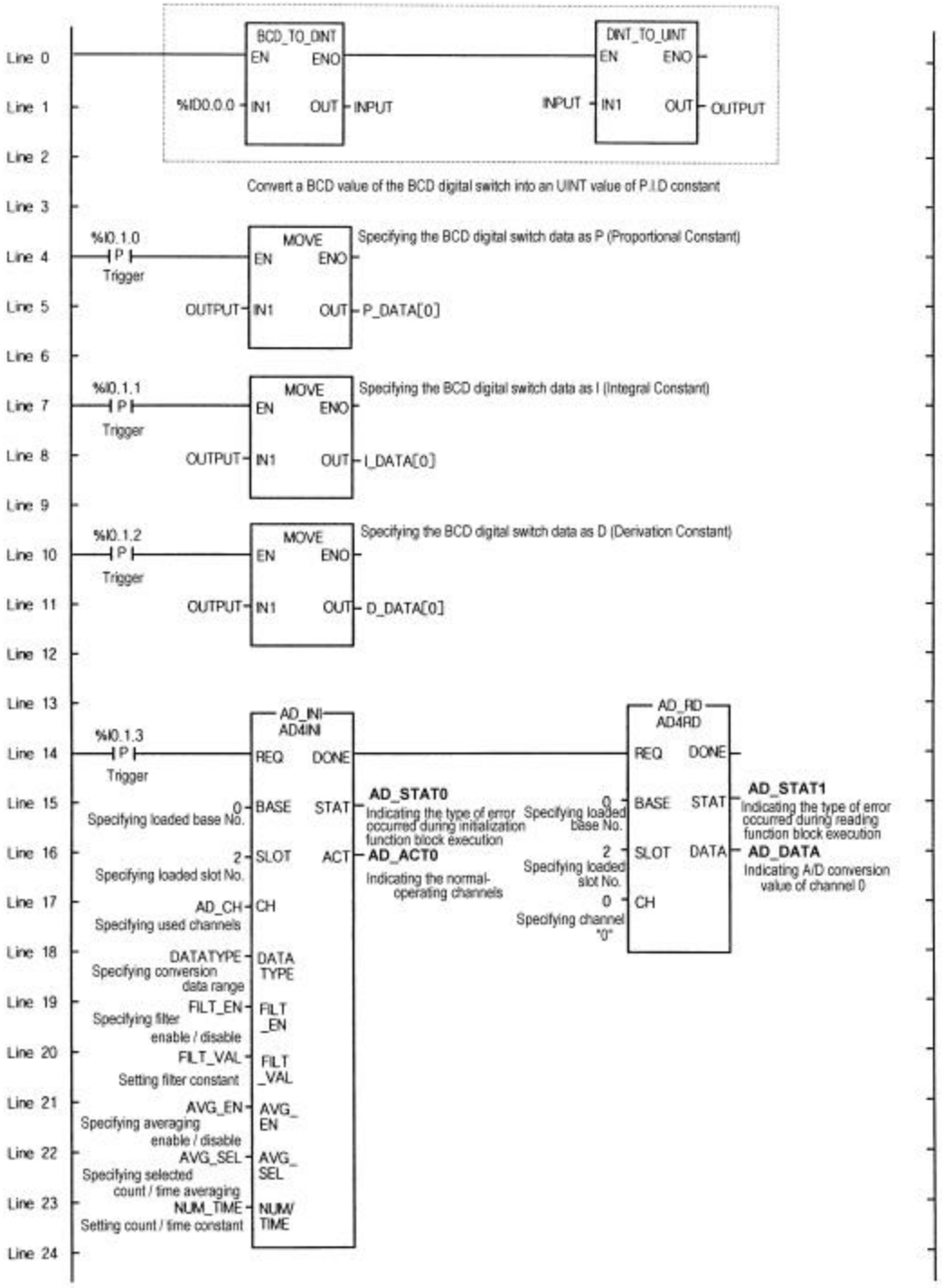
(3) MV, the result from PID processing is output at the channel 0 of the D/A conversion module.

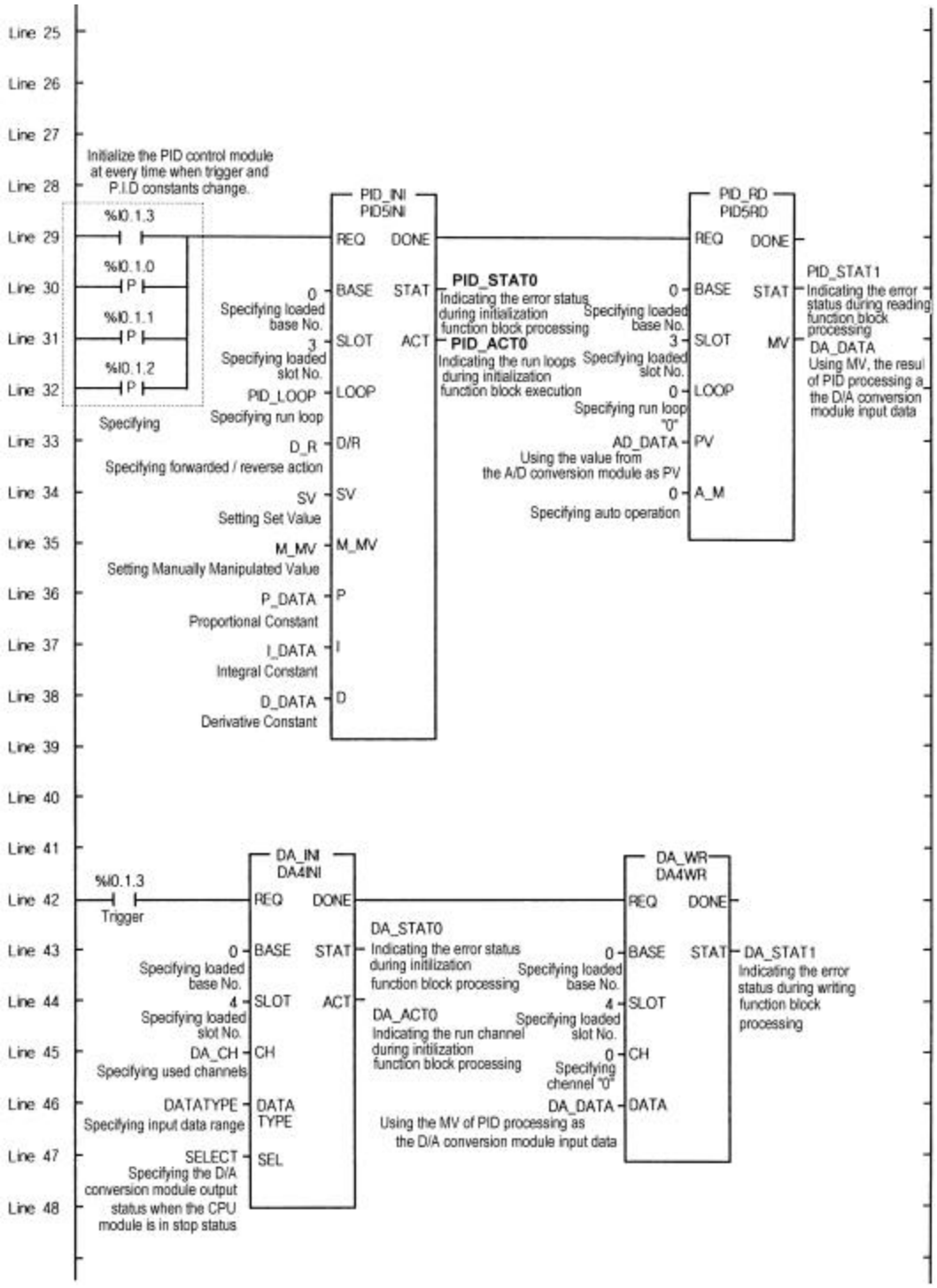
(4) If %I0.1.3 turns on, initial setting of the A/D conversion module, PID control module and D/A conversion module is executed.

1) Modules and their signal processing



5) Program


Line 0
Line 1
Line 2
Line 3
Line 4
Line 5
Line 6
Line 7
Line 8
Line 9
Line 10
Line 11
Line 12
Line 13
Line 14
Line 15
Line 16
Line 17
Line 18
Line 19
Line 20
Line 21
Line 22
Line 23
Line 24
BCD_TO_DINT
EN
ENO
%ID0.0.0
IN1
OUT
INPUT
DINT_TO_UINT
EN
ENO
INPUT
IN1
OUT
OUTPUT
Convert a BCD value of the BCD digital switch into an UINT value of P.I.D constant
%I0.1.0
P
Trigger
MOVE
EN
ENO
OUTPUT
IN1
OUT
P_DATA[0]
Specifying the BCD digital switch data as P (Proportional Constant)
%I0.1.1
P
Trigger
MOVE
EN
ENO
OUTPUT
IN1
OUT
I_DATA[0]
Specifying the BCD digital switch data as I (Integral Constant)
%I0.1.2
P
Trigger
MOVE
EN
ENO
OUTPUT
IN1
OUT
D_DATA[0]
Specifying the BCD digital switch data as D (Derivation Constant)
%I0.1.3
P
Trigger
AD_INI
AD4INI
REQ
DONE
0
Specifying loaded base No.
BASE
STAT
AD_STAT0
Indicating the type of error occurred during initialization function block execution
2
Specifying loaded slot No.
SLOT
ACT
AD_ACT0
Indicating the normal-operating channels
AD_CH
Specifying used channels
CH
DATATYPE
Specifying conversion data range
DATA TYPE
FILT_EN
Specifying filter enable / disable
FILT _EN
FILT_VAL
Setting filter constant
FILT _VAL
AVG_EN
Specifying averaging enable / disable
AVG_ EN
AVG_SEL
Specifying selected count / time averaging
AVG_ SEL
NUM_TIME
Setting count / time constant
NUM TIME
AD_RD
AD4RD
REQ
DONE
0
Specifying loaded base No.
BASE
STAT
AD_STAT1
Indicating the type of error occurred during reading function block execution
2
Specifying loaded slot No.
SLOT
DATA
AD_DATA
Indicating A/D conversion value of channel 0
0
Specifying channel "0"
CH

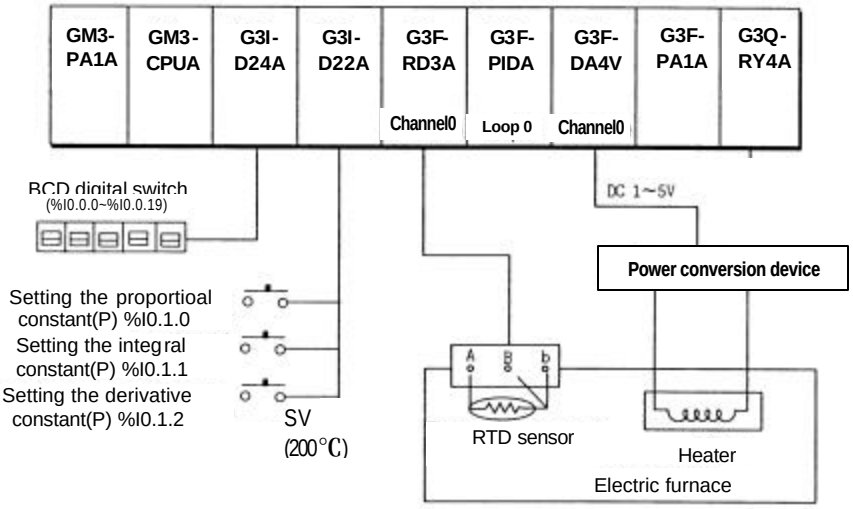

Line 25
Line 26
Line 27
Initialize the PID control module at every time when trigger and P.I.D constants change.
Line 28
%I0.1.3
Line 29
%I0.1.0
Line 30
%I0.1.1
Line 31
%I0.1.2
Line 32
Specifying
Line 33
Line 34
Line 35
Line 36
Line 37
Line 38
Line 39
Line 40
Line 41
%I0.1.3
Line 42
Trigger
Line 43
Line 44
Line 45
Line 46
Line 47
Line 48
PID_INI
PID5INI
REQ
DONE
BASE
STAT
SLOT
ACT
LOOP
D/R
SV
M_MV
P
I
D
0
Specifying loaded base No.
3
Specifying loaded slot No.
PID_LOOP
Specifying run loop
D_R
Specifying forwarded / reverse action
SV
Setting Set Value
M_MV
Setting Manually Manipulated Value
P_DATA
Proportional Constant
I_DATA
Integral Constant
D_DATA
Derivative Constant
PID_STAT0
Indicating the error status during initialization function block processing
PID_ACT0
Indicating the run loops during initialization function block execution
PID_RD
PID5RD
REQ
DONE
BASE
STAT
SLOT
MV
LOOP
PV
A_M
0
Specifying loaded base No.
3
Specifying loaded slot No.
0
Specifying run loop "0"
AD_DATA
Using the value from the A/D conversion module as PV
0
Specifying auto operation
PID_STAT1
Indicating the error status during reading function block processing
DA_DATA
Using MV, the resul of PID processing a the D/A conversion module input data
DA_INI
DA4INI
REQ
DONE
BASE
STAT
SLOT
ACT
CH
DATA TYPE
SEL
0
Specifying loaded base No.
4
Specifying loaded slot No.
DA_CH
Specifying used channels
DATATYPE
Specifying input data range
SELECT
Specifying the D/A conversion module output status when the CPU module is in stop status
DA_STAT0
Indicating the error status during initilization function block processing
DA_ACT0
Indicating the run channel during initilization function block processing
DA_WR
DA4WR
REQ
DONE
BASE
STAT
SLOT
CH
DATA
0
Specifying loaded base No.
4
Specifying loaded slot No.
0
Specifying chennel "0"
DA_DATA
Using the MV of PID processing as the D/A conversion module input data
DA_STAT1
Indicating the error status during writing function block processing

6) I/O variables used in the program

Variable Name	Var_Kind	Data Type	(AT Address) (Initial Value)
AD_ACT0	: VAR	: ARRAY [0..15] OF BOOL	
AD_CH	: VAR	: ARRAY [0..15] OF BOOL	:= (1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0)
AD_DATA	: VAR	: INT	
AD_INI	: VAR	: FB Instance	
AD_RD	: VAR	: FB Instance	
AD_STAT0	: VAR	: USINT	
AD_STAT1	: VAR	: USINT	
AVG_EN	: VAR	: ARRAY [0..3] OF BOOL	:= (0,0,0,0)
AVG_SEL	: VAR	: ARRAY [0..3] OF BOOL	:= (0,0,0,0)
D_DATA	: VAR	: ARRAY [0..31] OF UINT	:= (0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0)
D_R	: VAR	: ARRAY [0..31] OF BOOL	:= (0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0)
DA_ACT0	: VAR	: ARRAY [0..15] OF BOOL	
DA_CH	: VAR	: ARRAY [0..15] OF BOOL	:= (1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0)
DA_DATA	: VAR	: INT	
DA_INI	: VAR	: FB Instance	
DA_STAT0	: VAR	: USINT	
DA_STAT1	: VAR	: USINT	
DA_WR	: VAR	: FB Instance	
DATATYPE	: VAR	: ARRAY [0..15] OF BOOL	:= (0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0)
FILT_EN	: VAR	: ARRAY [0..3] OF BOOL	:= (1,0,0,0)
FILT_VAL	: VAR	: ARRAY [0..3] OF USINT	:= (50,0,0,0)
I_DATA	: VAR	: ARRAY [0..31] OF UINT	:= (0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0)
INPUT	: VAR	: DINT	
M_MV	: VAR	: ARRAY [0..31] OF INT	:= (0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0)
NUM_TIME	: VAR	: ARRAY [0..3] OF UINT	:= (0,0,0,0)
OUTPUT	: VAR	: UINT	
P_DATA	: VAR	: ARRAY [0..31] OF UINT	:= (1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0)
PID_ACT0	: VAR	: ARRAY [0..31] OF BOOL	
PID_INI	: VAR	: FB Instance	
PID_LOOP	: VAR	: ARRAY [0..31] OF BOOL	:= (1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0)
PID_RD	: VAR	: FB Instance	
PID_STAT0	: VAR	: USINT	
PID_STAT1	: VAR	: USINT	
SELECT	: VAR	: ARRAY [0..15] OF USINT	:= (0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0)
SV	: VAR	: ARRAY [0..31] OF INT	:= (12800,0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0,0, 0,0,0)

5.2 A program for control using a RTD(PID module V3.0 or later)

1) System configuration



2) Initial setting

(1) PID control module
- A) Specifying used loop : loop 0
- B) Specifying forward/reverse action : forward action
- C) Specifying set value : 8000
- D) Initial P,I,D constant P=200,I=200,D=519
- E) Specifying auto/manual processing : auto processing — RTD input module is normal operation
  Specifying auto/manual processing : manual processing — RTD input module is abnormal operation

(2) RTD input module
- A) Specifying used channel : channel 0
- B) Specifying RTD sensor type : Pt100
- C) Temperature input range : - 200~600℃ (SCAL:0~16000)

(3) D/A conversion module
- A) Setting the voltage output range –5 to 5VDC (offset : DC 1V, gain : DC 3V)
- B)) Specifying used channel : channel 0
- C) Specifying input data type : -192 ~ 16191
- D) When Errors occur : minimum value output

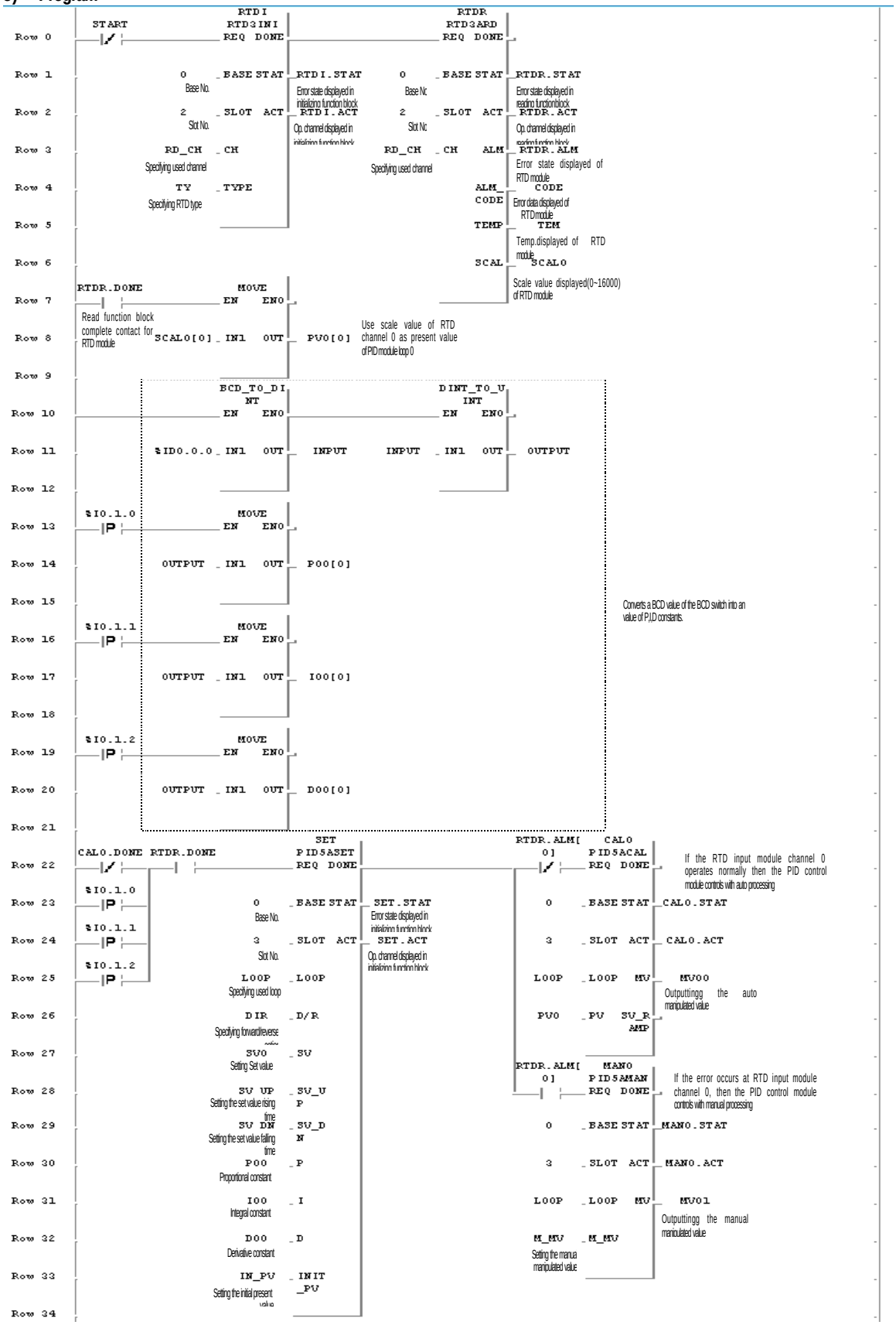
3) Description of the program

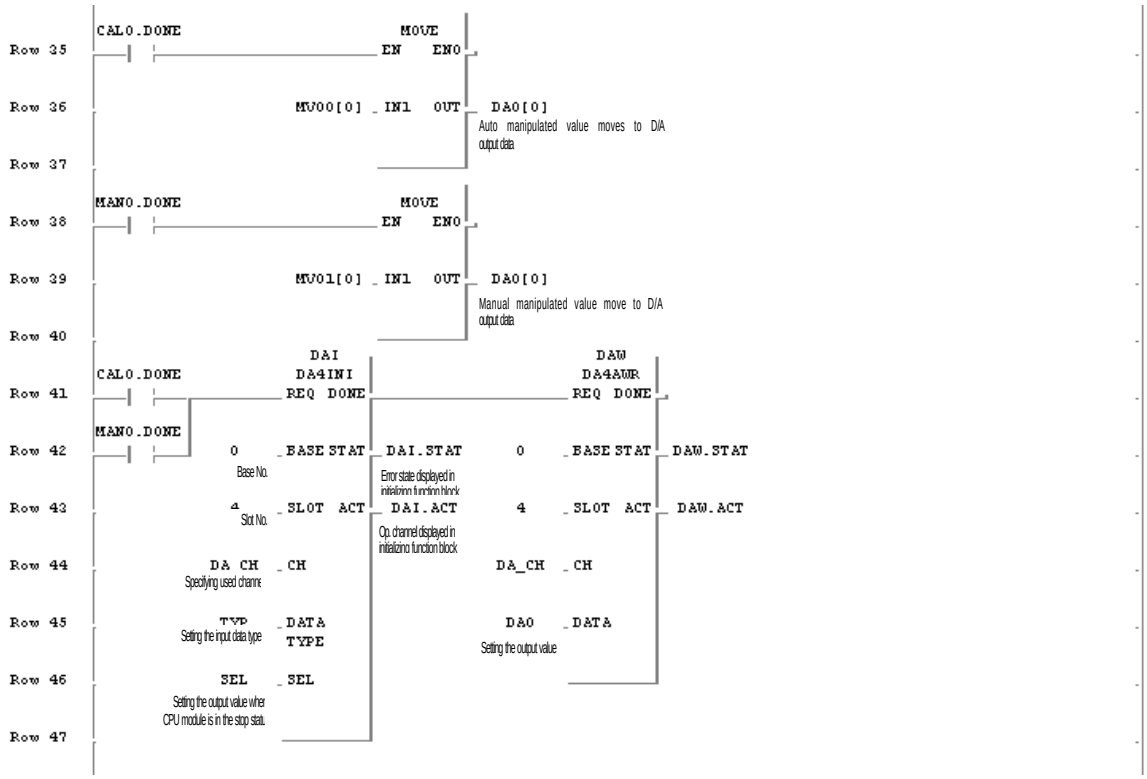
(1) The channel 0 of the RTD input module detects a temperature of the electric furnace through PT100 and receives it as a digital value.

(2) The Set Value of PID control module loop 0 is set to 8000(where the temperature is 200C). With regards to P.I.D constants, the manipulated value in the BCD digital switch is set to the proportional constant when %I0.1.0 is turned on, as the integral constant when %I0.1.1 is turned on, and as the derivative constant when %I0.1.2 is turned on.

(3) MV, the result from PID processing is output at the channel 0 of the D/A conversion module.

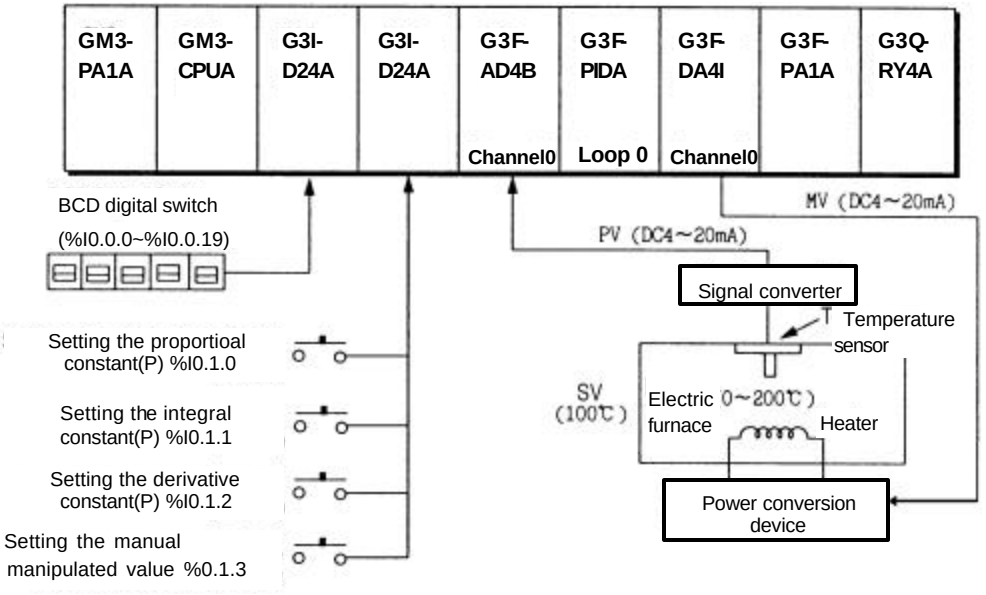
3) Program


START
RTDI
RTD3INI
REQ DONE
RTDR
RTD3ARD
REQ DONE
Row 0
Row 1
Row 2
Row 3
Row 4
Row 5
Row 6
Row 7
Row 8
Row 9
Row 10
Row 11
Row 12
Row 13
Row 14
Row 15
Row 16
Row 17
Row 18
Row 19
Row 20
Row 21
Row 22
Row 23
Row 24
Row 25
Row 26
Row 27
Row 28
Row 29
Row 30
Row 31
Row 32
Row 33
Row 34
0 BASE STAT RTDI.STAT
Base No.
Error state displayed in initializing function block
2 SLOT ACT RTDI.ACT
Slot No.
Op. channel displayed in initializing function block
RD_CH CH
Specifying used channel
TY TYPE
Specifying RTD type
0 BASE STAT RTDR.STAT
Base No.
Error state displayed in reading function block
2 SLOT ACT RTDR.ACT
Slot No.
Op. channel displayed in reading function block
RD_CH CH ALM RTDR.ALM
Specifying used channel
Error state displayed of RTD module
ALM_CODE CODE
Error data displayed of RTD module
TEMP TEM
Temp. displayed of RTD module
SCAL SCAL0
Scale value displayed(0~16000) of RTD module
RTDR.DONE
MOVE
EN ENO
Read function block complete contact for RTD module
SCAL0[0] IN1 OUT PV0[0]
Use scale value of RTD channel 0 as present value of PID module loop 0
BCD_TO_DINT
DINT_TO_UINT
%ID0.0.0 IN1 OUT INPUT
INPUT IN1 OUT OUTPUT
%I0.1.0
OUTPUT IN1 OUT P00[0]
%I0.1.1
OUTPUT IN1 OUT I00[0]
%I0.1.2
OUTPUT IN1 OUT D00[0]
Converts a BCD value of the BCD switch into an value of P,I,D constants.
CAL0.DONE RTDR.DONE
SET
PID5ASET
REQ DONE
%I0.1.0
%I0.1.1
%I0.1.2
0 BASE STAT SET.STAT
Base No.
Error state displayed in initializing function block
3 SLOT ACT SET.ACT
Slot No.
Op. channel displayed in initializing function block
LOOP LOOP
Specifying used loop
DIR D/R
Specifying forward/reverse action
SV0 SV
Setting Set value
SV UP SV_UP
Setting the set value rising time
SV DN SV_DN
Setting the set value falling time
P00 P
Proportional constant
I00 I
Integral constant
D00 D
Derivative constant
IN_PV INIT_PV
Setting the initial present value
RTDR.ALM[0]
CAL0
PID5ACAL
REQ DONE
If the RTD input module channel 0 operates normally then the PID control module controls with auto processing
0 BASE STAT CAL0.STAT
3 SLOT ACT CAL0.ACT
LOOP LOOP MV MV00
Outputtingg the auto manipulated value
PV0 PV SV_RAMP
RTDR.ALM[0]
MAN0
PID5AMAN
REQ DONE
If the error occurs at RTD input module channel 0, then the PID control module controls with manual processing
0 BASE STAT MAN0.STAT
3 SLOT ACT MAN0.ACT
LOOP LOOP MV MV01
Outputtingg the manual manipulated value
M_MV M_MV
Setting the manual manipulated value


CAL0.DONE
MOVE
EN ENO
Row 35
MV00[0] IN1 OUT DA0[0]
Auto manipulated value moves to D/A output data
Row 36
Row 37
MAN0.DONE
MOVE
EN ENO
Row 38
MV01[0] IN1 OUT DA0[0]
Manual manipulated value move to D/A output data
Row 39
Row 40
DAI
DA4INI
REQ DONE
DAW
DA4AWR
REQ DONE
CAL0.DONE
Row 41
MAN0.DONE
Row 42
0 BASE STAT DAI.STAT 0 BASE STAT DAW.STAT
Base No.
Error state displayed in initialization function block
Row 43
4 SLOT ACT DAI.ACT 4 SLOT ACT DAW.ACT
Slot No.
Op. channel displayed in initialization function block
Row 44
DA CH CH DA_CH CH
Specifying used channe
Row 45
TYP DATA TYPE DA0 DATA
Setting the input data type
Setting the output value
Row 46
SEL SEL
Setting the output value when CPU module is in the stop statu
Row 47

5.3 Control program with auto-tuning function(PID module V3.0 or later)

1) System configuration



2) Initial setting details

(1) PID control module
- A) Used loop : loop 0
- B) Operation forward/reverse: Forward
- C) Set value: 8000
- D) Specifying auto/manual processing : auto processing

(2) A/D conversion module
- A) Used channel : Channel 0
- B) Specifying output data type: 0 ~ 16000
- C) Setting Filter constant: 50

(3) D/A conversion module
- A) Used channel: Channel 0
- B) Specifying Input data type: -192 ~ 16191
- C) Output state if a channel is not used or CPU module is at stop state : Intermediate value of the output range is output

2) Initial setting details

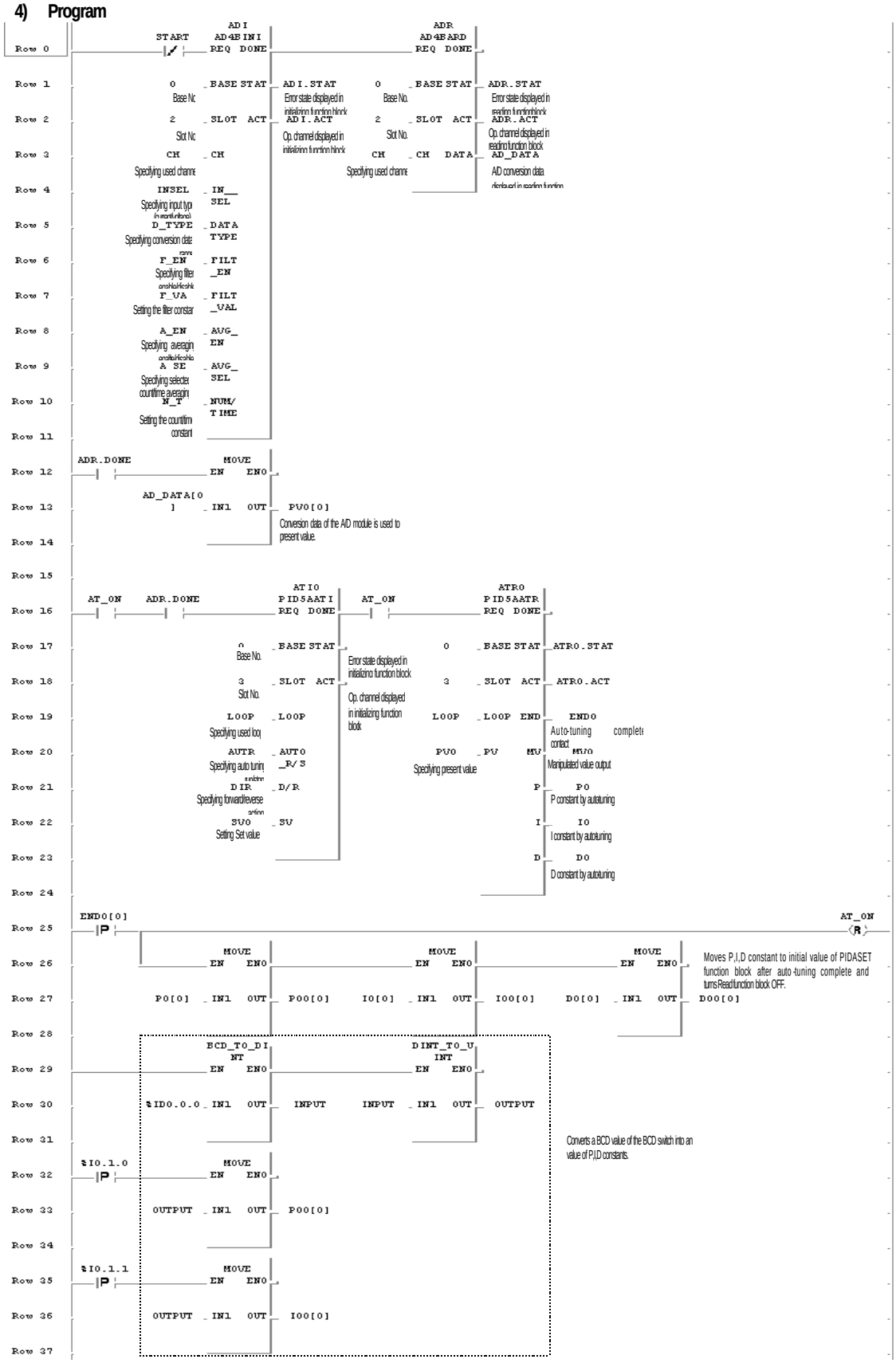
(1) Temperature of 0 ~ 200℃ is converted into digital value of 0 ~ 16000 from the temperature sensor through conversion into analog signal of 4 ~ 20 mA and input to A/D conversion module channel 0.

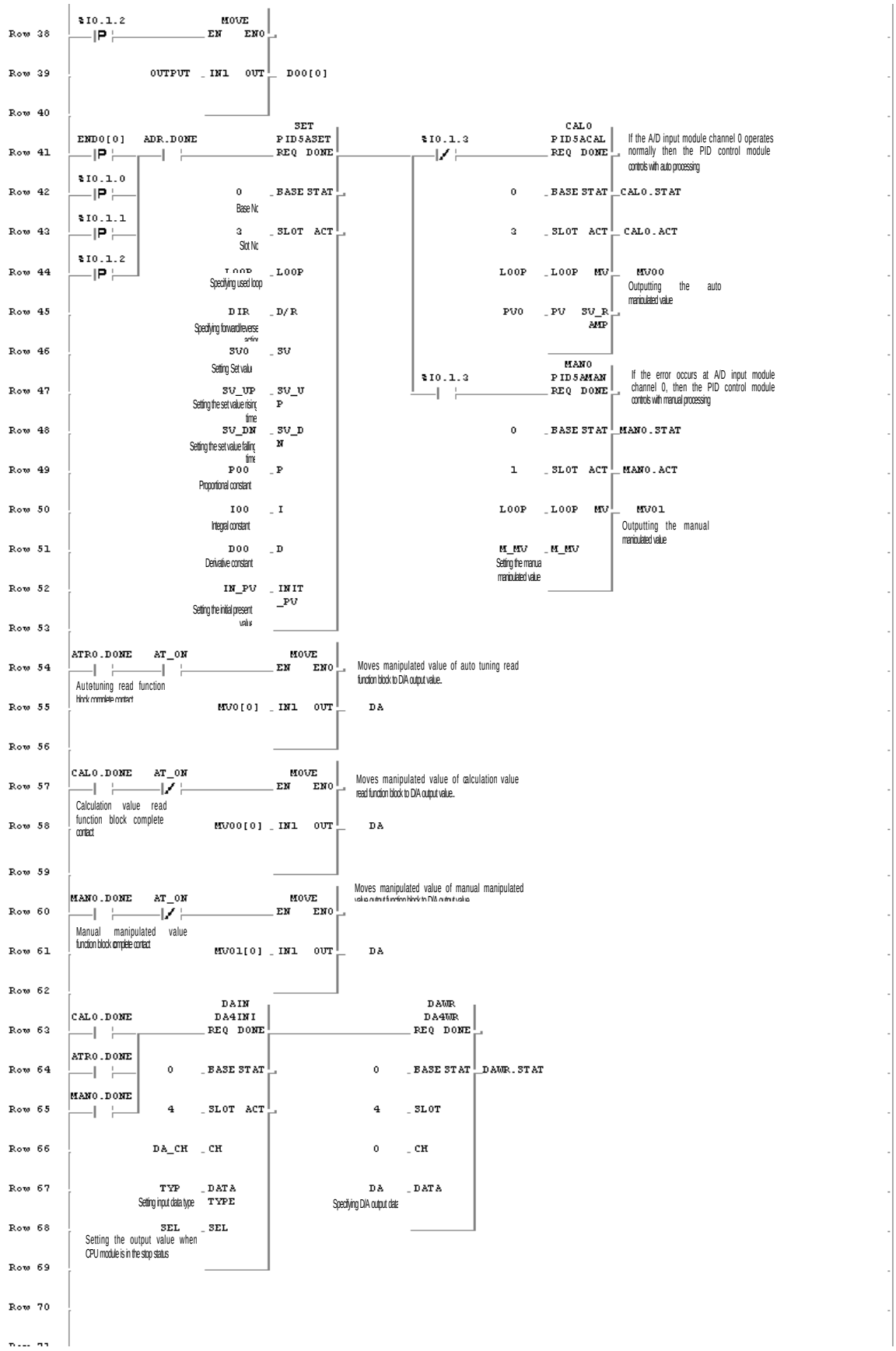
(2) PID control module sets temperature of 100℃ (the signal converter outputs 12 mA this time and the digital value is 8000.) as a target value and calculates P,I,D constant value via the Auto-Tuning control and then perform control with the calculated value. If %I0.1.0 is On, the adjusted value by BCD digital switch is set to proportional constant value for the much appropriate control via the change of P,I,D constant value, if %I0.1.1 is On, the value is set to integral constant value, and if %I0.1.2 is On, the value is set to differential constant value.

(3) Adjusted value resulted from PID calculation is output from the channel 0 of D/A conversion module.

(4) If %I0.1.3 is On, 5000 of manual output value is output.

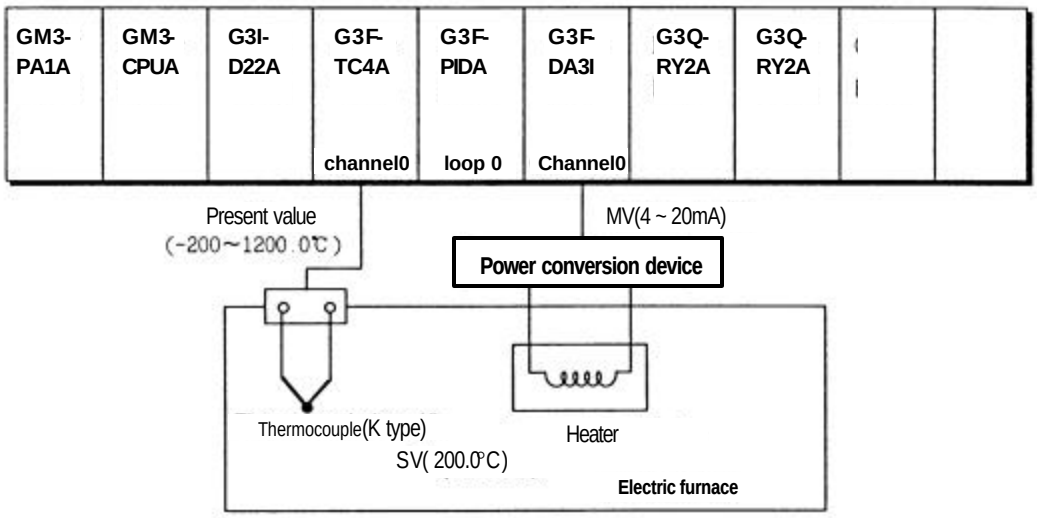
4) Program


ADI
AD4BINI
START
REQ DONE
ADR
AD4BARD
REQ DONE
Row 0
Row 1
Row 2
Row 3
Row 4
Row 5
Row 6
Row 7
Row 8
Row 9
Row 10
Row 11
Row 12
Row 13
Row 14
Row 15
Row 16
Row 17
Row 18
Row 19
Row 20
Row 21
Row 22
Row 23
Row 24
Row 25
Row 26
Row 27
Row 28
Row 29
Row 30
Row 31
Row 32
Row 33
Row 34
Row 35
Row 36
Row 37
0
BASE STAT
Base No.
2
SLOT ACT
Slot No.
CH
CH
Specifying used channe
INSEL
IN__
SEL
Specifying input typ
D_TYPE
DATA
TYPE
Specifying conversion data
F_EN
FILT
_EN
Specifying filter
F_VA
FILT
_VAL
Setting the filter constar
A_EN
AVG_
EN
Specifying averagin
A_SE
AVG_
SEL
Specifying selected
N_T
NUM/
TIME
Setting the countitm
constant
ADI.STAT
Error state displayed in
initializinn funnitnn hlnnk
ADI.ACT
Op. channel displayed in
initializinn funnitnn hlnnk
Base No.
Slot No.
CH
DATA
Specifying used channe
ADR.STAT
Error state displayed in
readinn funnitnn hlnnk
ADR.ACT
Op. channel displayed in
reading function block
AD_DATA
AD conversion data
ADR.DONE
MOVE
EN ENO
AD_DATA[0
]
IN1 OUT
PV0[0]
Conversion data of the AID module is used to
present value.
AT_ON
ADR.DONE
ATIO
PID5AATI
REQ DONE
AT_ON
ATRO
PID5AATR
REQ DONE
Base No.
Slot No.
Error state displayed in
initializinn function block
Op. channel displayed
in initializing function
block
LOOP
Specifying used loo
AUTR
AUTO
Specifying auto tunin
DIR
D/R
Specifying forward/reverse
SV0
SV
Setting Set value
LOOP END
ENDO
Auto-tuning complet
context
PV0
PV
MV
MV0
Specifying present value
Manipulated value output
P
P0
P constant by autotuning
I
I0
I constant by autotuning
D
D0
D constant by autotuning
END0[0]
AT_ON
Moves P,I,D constant to initial value of PIDASET
function block after auto-tuning complete and
turns Readfunction block OFF.
P0[0]
P00[0]
I0[0]
I00[0]
D0[0]
D00[0]
BCD_TO_DI
NT
DINT_TO_U
INT
%ID0.0.0
INPUT
OUTPUT
Converts a BCD value of the BCD switch into an
value of P,I,D constants.
%I0.1.0
%I0.1.1


%I0.1.2
MOVE
EN ENO
OUTPUT IN1 OUT D00[0]
END0[0] ADR.DONE
SET
PID5ASET
REQ DONE
%I0.1.3
CAL0
PID5ACAL
REQ DONE
If the A/D input module channel 0 operates normally then the PID control module controls with auto processing
%I0.1.0
%I0.1.1
%I0.1.2
BASE STAT
SLOT ACT
LOOP
D/R
SV
SV_UP
SV_DN
P
I
D
IN_PV
INIT _PV
0
3
Base No.
Slot No.
Specifying used loop
Specifying forward/reverse action
Setting Set value
Setting the set value rising time
Setting the set value falling time
Proportional constant
Integral constant
Derivative constant
Setting the initial present value
CAL0.STAT
CAL0.ACT
MV
MV00
PV0
PV SV_R AMP
Outputting the auto manipulated value
MAN0
PID5AMAN
MAN0.STAT
MAN0.ACT
MV01
M_MV
1
Outputting the manual manipulated value
Setting the manual manipulated value
If the error occurs at A/D input module channel 0, then the PID control module controls with manual processing
ATR0.DONE AT_ON
Autotuning read function block complete contact
MV0[0]
DA
Moves manipulated value of auto tuning read function block to D/A output value.
CAL0.DONE AT_ON
Calculation value read function block complete contact
MV00[0]
Moves manipulated value of calculation value read function block to D/A output value.
MAN0.DONE AT_ON
Manual manipulated value function block complete contact
MV01[0]
Moves manipulated value of manual manipulated value output function block to D/A output value
DAIN
DA4INI
DAWR
DA4WR
ATR0.DONE
MAN0.DONE
DA_CH
CH
TYP
DATA TYPE
Setting input data type
SEL
Setting the output value when CPU module is in the stop status
DA
Specifying D/A output data
DAWR.STAT

5.4 Control program with thermal conduction module used (PID module V3.0 or later)

1) System configuration



2) Initial setting

(1) Thermocouple input module
A) Used channel : Channel 0
B) Thermocouple type : K type

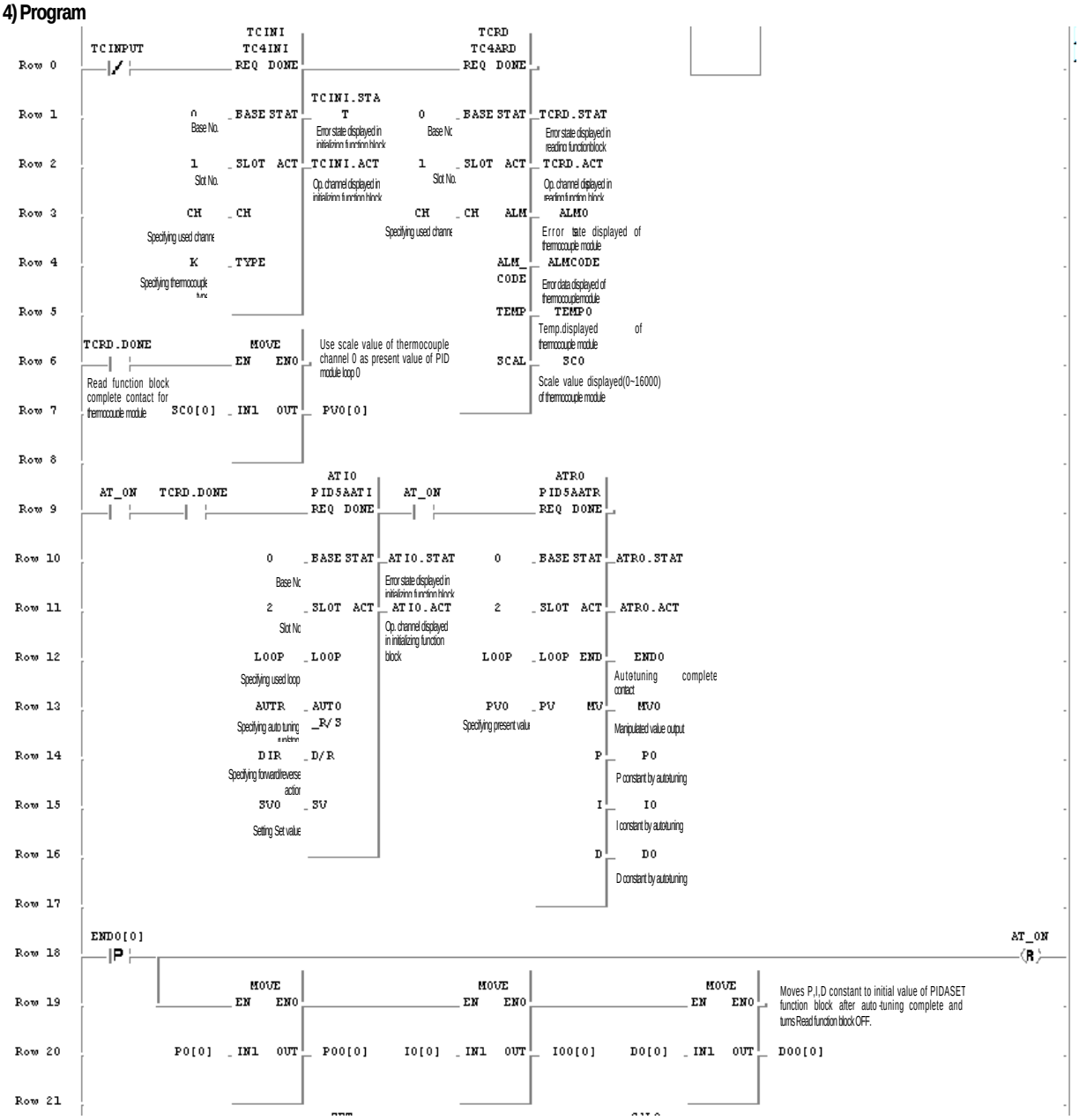
(2) PID control module
A) Used loop : loop 0
B) Specifying Forward/reverse action: forward action
C) Specifying auto/manual processing : auto processing Calculation auto/manual: Auto
D) Set value : 200℃ (digital value of 4571)
E) P,I,D constant value: P=300,I=100,D=100
F) If error in thermocouple module occurs, auto-processing is converted to manual processing (manual-manipulated value:4500)

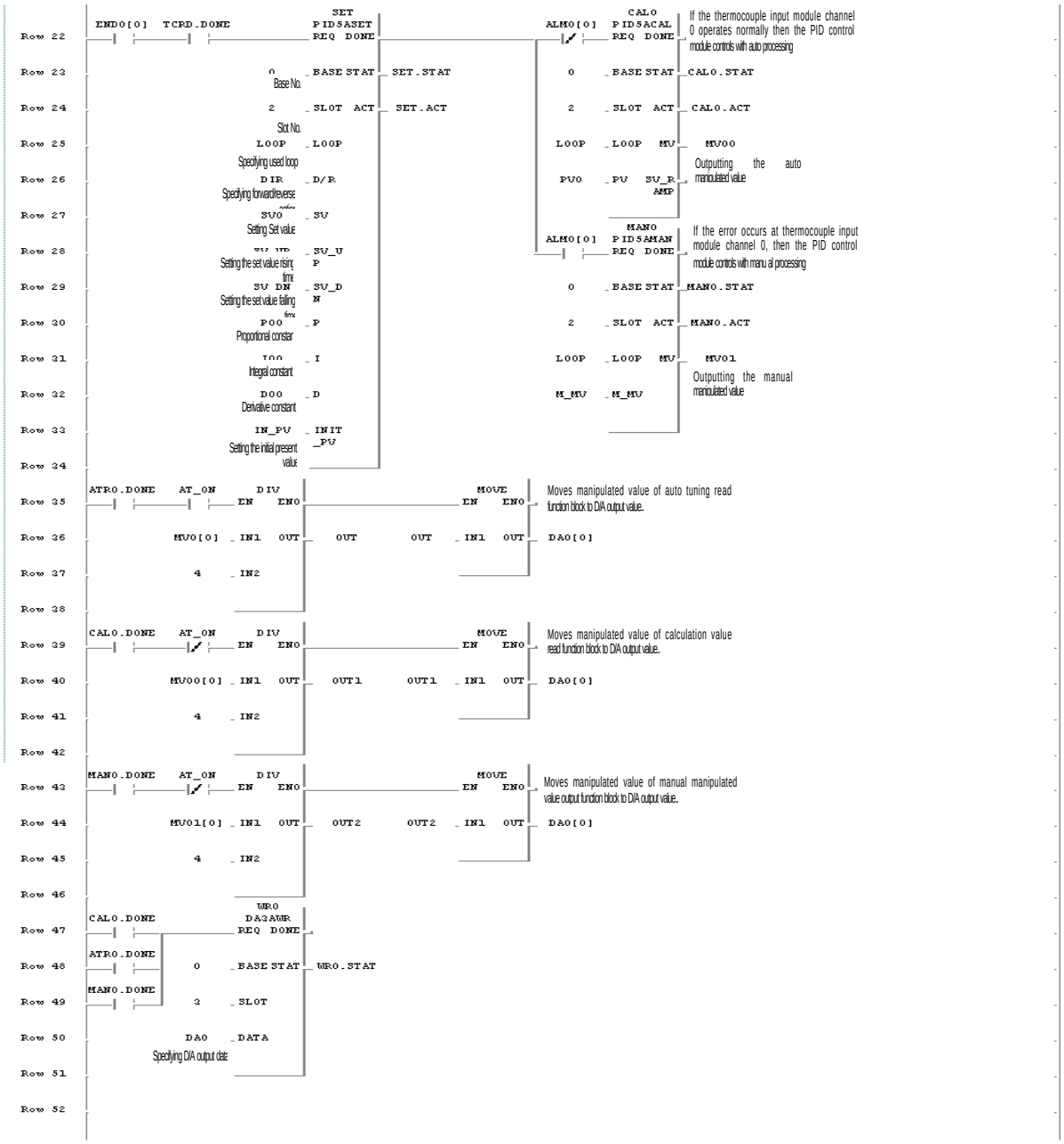
(3) D/A conversion module
A) Used channel: Channel 0
B)) Specifying Input data type : -48 ~ 4047

3) Program description

1) Convert the temperature of electric furnace to digital value via the channel 0 of the thermocouple input module and use the value resulted from converting the temperature value into 0~16000 as present value of PID control module.
2) PID control module sets temperature of 200℃ to set value, calculates P,I,D constant value by auto-tuning control and executes PID control with the calculated value.
3) A manipulated value resulted from PID calculation is output from the channel 0 of the D/A conversion module.
4) If error occurs by K type thermocouple and compensated conducting wire connected with thermocouple input module, PID control module is converted from auto-processing control to manual processing control.

4) Program


TCINPUT
TCINI
TC4INI
REQ DONE
TCRD
TC4ARD
REQ DONE
Row 0
Row 1
Row 2
Row 3
Row 4
Row 5
Row 6
Row 7
Row 8
Row 9
Row 10
Row 11
Row 12
Row 13
Row 14
Row 15
Row 16
Row 17
Row 18
Row 19
Row 20
Row 21
BASE STAT
SLOT ACT
CH
TYPE
TCINI.STAT
TCINI.ACT
TCRD.STAT
TCRD.ACT
ALM
ALMO
ALM_CODE
TEMP
TEMPO
Base No.
Slot No.
Error state displayed in initializing function block
Op. channel displayed in initializing function block
Error state displayed in reading function block
Op. channel displayed in reading function block
Specifying used channel
Specifying thermocouple type
Error state displayed of thermocouple module
Error data displayed of thermocouple module
Temp. displayed of thermocouple module
TCRD.DONE
MOVE
EN ENO
IN1 OUT
SCO[0]
PVO[0]
SCO
SCAL
Use scale value of thermocouple channel 0 as present value of PID module loop 0
Read function block complete contact for thermocouple module
Scale value displayed(0~16000) of thermocouple module
AT_ON
ATIO
PID5AATI
REQ DONE
ATRO
PID5AATR
ATIO.STAT
ATIO.ACT
ATRO.STAT
ATRO.ACT
LOOP
AUTR
DIR
SVO
AUTO
M/S
D/R
SV
Error state displayed in initializing function block
Op. channel displayed in initializing function block
Specifying used loop
Specifying auto tuning
Specifying forward/reverse action
Setting Set value
PVO
PV
MV
MVO
END0
P
PO
I
IO
D
DO
Specifying present value
Autotuning complete contact
Manipulated value output
P constant by autotuning
I constant by autotuning
D constant by autotuning
END0[0]
P
AT_ON
R
P0[0]
P00[0]
I0[0]
I00[0]
D0[0]
D00[0]
Moves P,I,D constant to initial value of PIDASET function block after auto-tuning complete and turns Read function block OFF.


Row 22
END0[0] TCRD.DONE
SET
PID5ASET
REQ DONE
CAL0
ALM0[0] PID5ACAL
REQ DONE
If the thermocouple input module channel 0 operates normally then the PID control module controls with auto processing
Row 23
0 _BASE STAT _SET.STAT
Base No.
0 _BASE STAT _CAL0.STAT
Row 24
2 _SLOT ACT _SET.ACT
Slot No.
2 _SLOT ACT _CAL0.ACT
Row 25
LOOP _LOOP
Specifying used loop
LOOP _LOOP MV _MV00
Outputting the auto manipulated value
Row 26
DIR _D/R
Specifying forward/reverse
PV0 _PV SV_R AMP
Row 27
SV0 _SV
Setting Set value
MAN0
Row 28
ALM0[0] PID5AMAN
REQ DONE
If the error occurs at thermocouple input module channel 0, then the PID control module controls with manual processing
SV UP _SV_U
Setting the set value rising time
P
Row 29
SV DN _SV_D
Setting the set value falling time
N
0 _BASE STAT _MAN0.STAT
Row 30
P00 _P
Proportional constant
2 _SLOT ACT _MAN0.ACT
Row 31
I00 _I
Integral constant
LOOP _LOOP MV _MV01
Outputting the manual manipulated value
Row 32
D00 _D
Derivative constant
M_MV _M_MV
Row 33
IN_PV _INIT_PV
Setting the initial present value
Row 34
Row 35
ATR0.DONE AT_ON DIV EN ENO
MOVE EN ENO
Moves manipulated value of auto tuning read function block to D/A output value.
Row 36
MV0[0] _IN1 OUT _OUT
OUT _IN1 OUT _DA0[0]
Row 37
4 _IN2
Row 38
Row 39
CAL0.DONE AT_ON DIV EN ENO
MOVE EN ENO
Moves manipulated value of calculation value read function block to D/A output value.
Row 40
MV00[0] _IN1 OUT _OUT1
OUT1 _IN1 OUT _DA0[0]
Row 41
4 _IN2
Row 42
Row 43
MAN0.DONE AT_ON DIV EN ENO
MOVE EN ENO
Moves manipulated value of manual manipulated value output function block to D/A output value.
Row 44
MV01[0] _IN1 OUT _OUT2
OUT2 _IN1 OUT _DA0[0]
Row 45
4 _IN2
Row 46
WR0
Row 47
CAL0.DONE
DA3AWR
REQ DONE
Row 48
ATR0.DONE
0 _BASE STAT _WR0.STAT
Row 49
MAN0.DONE
3 _SLOT
Row 50
DA0 _DATA
Specifying D/A output data
Row 51
Row 52

Chapter 6. BUFFER MEMORY CONFIGURATION AND FUNCTIONS

The PID control module has the PLC CPU and the buffer memories for communications.

6.1 Buffer memory configuration

The followings describe buffer memory configuration.(PID control module V3.0 or later)

6.1.1 G3F-PIDA buffer memory(Address 8,9 are unused region)

Address (Decimal)	Function	Descriptions	Default Setting	Read / Write
0	Loop enable/disable Specification area (loop 0 to 15)	Bit On(1): Enabled Bit Off(0): Disabled	Disabled	R/W
1	Loop enable/disable Specification area (loop 16 to 31)			
2	Auto/Manual operation Specification area (loop 0 to 15)	Bit On(1): Auto Bit Off(0): Manual	Auto	R/W
3	Auto/Manual operation Specification area (loop 16 to 31))			
4	Forward/Reverse action Specifcation area (loop 0 to 15)	Bit On(1): Reverse Bit Off(0): Forward	Forward	R/W
5	Forward/Reverse action Specification area (loop 16 to 31)			
6	Auto tuning enable/disable Specification area (loop (0 to 15)	Bit On(1): Auto tuning start Bit Off(0): Auto tuning stop	Stop	R/W
7	Auto tuning enable/disable Specification area (loop 16 to 31)			
10	Set data enable/disable Specification area (loop 0 to 15)	Bit On(1) : Set each content of address 0, 1, 4, 5,6,7,16 to110, and 143 to 270 to a new setting. Bit Off(0) : The previous values of 0, 1, 4, 5,6,7,16 to110, and 143 to 270 to remains without change.	No Setting Values	R/W
11	Set data enable/disable Specification area (loop 16 to 31)			
12	Loop run information (loop 0 to 15)	Bit On(1) : Run Bit Off(0) : Stop	—	Read Only
13	Loop run information (loop 16 to 31)			
14	Auto tuning end flag (loop 0 to 15)	Bit On(1) : Auto tuning end Bit Off(0) : Auto tuning processing	—	"
15	Auto tuning end flag (loop 16 to 31)			
16 to 47	SV of each loop	Setting range : 0 to 16000	"0"	R/W
48 to 79	SV-ramp of each loop(rising)*1	Setting range :0 to 65535 sec	0	"
80 to 111	SV-ramp of each loop(falling)*2			
112 to 143	PV of each loop	Input range : 0 to 16000	"0"	R/W
144 to 175	M-MV of each loop	Setting range : 0 to 16000	"0"	R/W
176 to 207	P of each loop	Setting range : 0 to 10000	"500"	R/W
208 to 239	I of each loop	Setting range : 0 to 30000	"1000"	R/W
240 to 271	D of each loop	Setting range : 0 to 30000	"0"	R/W
272 to 303	MV of each loop	Output range : 0 to 16000	—	Read

304~335	SV-ramp of each loop*3	Output range:0~16000	—	Read Only
336 to 367	Error information of each loop	Bit 0 On(1) : out-of-range SV Bit 1 On(1) : out-of-range PV Bit 2 On(1) : out-of-range M_MV Bit 3 On(1) : out-of-range P Bit 4 On(1) : out-of-range I Bit 5 On(1) : out-of-range D	—	Read Only

6.1.2 G4F-PIDA buffer memory(Address 4 is unused region)

Address (Decimal)	Function	Descriptions	Default Setting	Read / Write
0	Loop enable/disable Specification area	Bit On(1): Enabled Bit Off(0): Disabled	Disabled	R/W
1	Auto/Manual operation Specification area	Bit On(1): Auto Bit Off(0): Manual	Auto	R/W
2	Forward/Reverse action Specification area	Bit On(1): Reverse Bit Off(0): Forward	Forward	R/W
3	Auto tuning enable/disable Specification area	Bit On(1): Auto tuning start Bit Off(0): Auto tuning stop	Stop	R/W
5	Set data enable/disable Specification area	Bit On(1) : Set each content of address 0 to 3,8 to 31 and 40 to 71 to a new setting. Bit Off(0) : The previous values of 0 to 3,8 to 31 and 40 to 71 to remains without change.	No Setting Values	R/W
6	Loop run information (loop 0 to 7)	Bit On(1) : Run Bit Off(0) : Stop	—	Read Only
7	Auto tuning end flag (loop 0 to 15)	Bit On(1) : Auto tuning end Bit Off(0) : Auto tuning processing	—	"
8 to15	SV of each loop	Setting range : 0 to 16000	"0"	R/W
16 to 23	SV-ramp of each loop(rising)*1	Setting range :0 to 65535 sec	0	"
24 to 31	SV-ramp of each loop(falling)*2			
32 to 39	PV of each loop	Input range : 0 to 16000	"0"	R/W
40 to 47	M-MV of each loop	Setting range : 0 to 16000	"0"	R/W
48 to 55	P of each loop	Setting range : 0 to 10000	"500"	R/W
56 to 63	I of each loop	Setting range : 0 to 30000	"1000"	R/W
64 to 71	D of each loop	Setting range : 0 to 30000	"0"	R/W
72 to 79	MV of each loop	Output range : 0 to 16000	—	Read
80~87	SV-ramp of each loop*3	Output range:0~16000	—	Read Only
88 to 95	Error information of each loop	Bit 0 On(1) : out-of-range SV Bit 1 On(1) : out-of-range PV Bit 2 On(1) : out-of-range M_MV Bit 3 On(1) : out-of-range P Bit 4 On(1) : out-of-range I Bit 5 On(1) : out-of-range D	—	Read Only

*1:Set rising inclination time so to control the system stably if SV value is to be higher than present SV during PID control

*2:Set falling inclination time so to control the system stably if SV value is to be lower than present SV during PID control

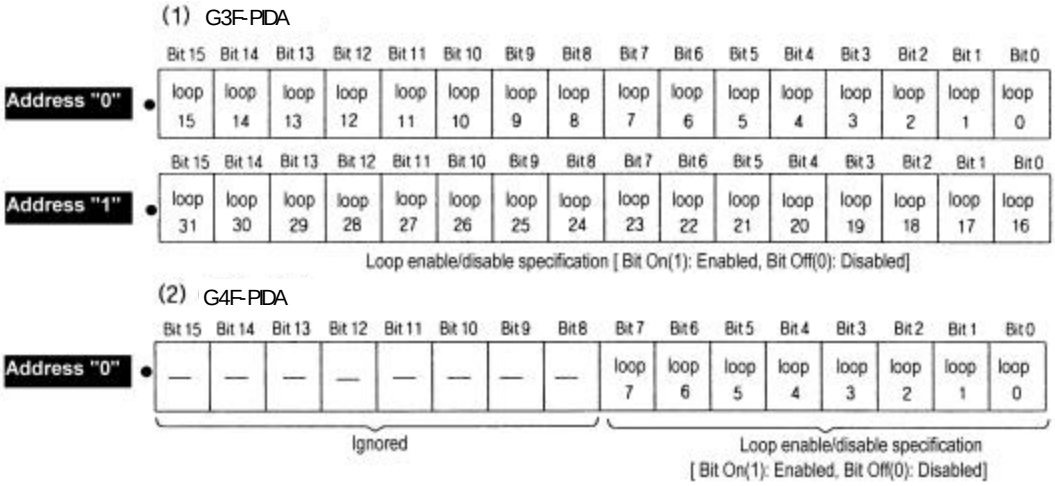
*3:The value with SV being changed appears in proportion to rising or falling inclination time

6.2 Functions of buffer memory

Each address in the buffer memory occupies one word and it is represented with 16 bits.
In the 16 bits which compose an address, every bit can be set to either "1" when it should be turned On or "0" when Off in order to implement the function of each bit.

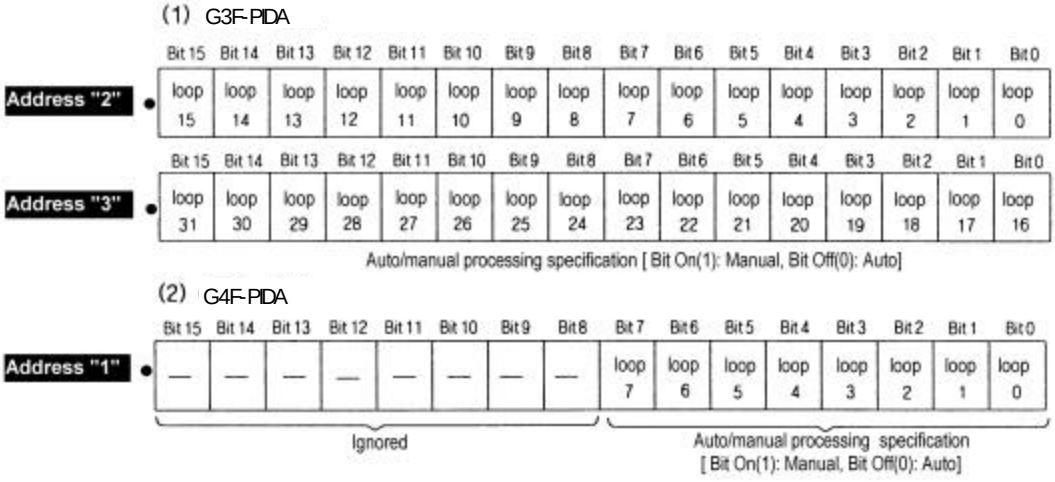
6.2.1 Specifying loop enable/disable (G3F-PIDA : Addresses 0, 1 G4F-PIDA : Address 0)

1) Loop enable/disable specification is possible on every channel.
2) Disabled loops will not be used in processing.
3) The followings show the bit corresponding to each loop.



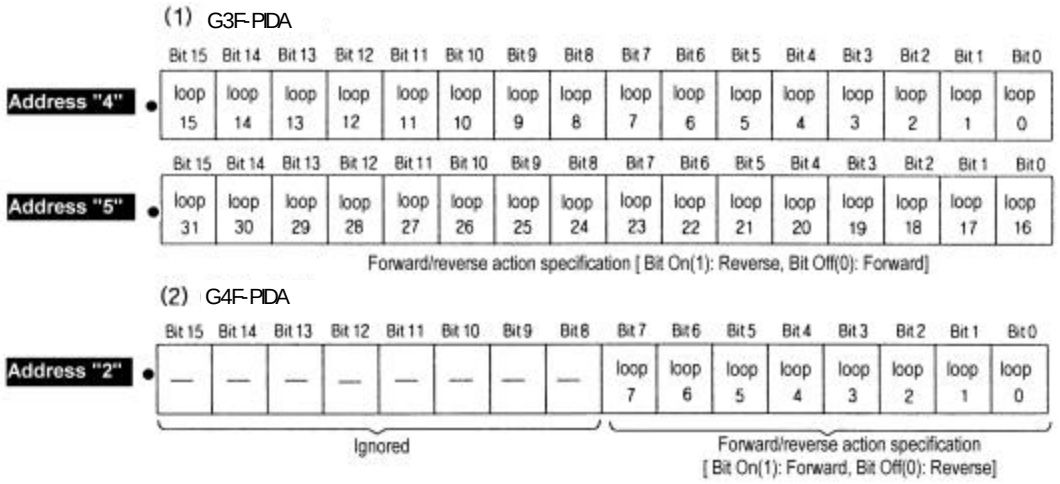
6.2.2 Specifying auto/manual processing (G3F-PIDA : Addresses 2, 3, G4F-PIDA : Address 1)

1) Turn the corresponding bit Off(0) if a loop runs with auto processing. Turn the corresponding bit On if a loop runs with M_MV set before by the user.
2) Default is auto processing.
3) The followings show the bit corresponding to each loop.



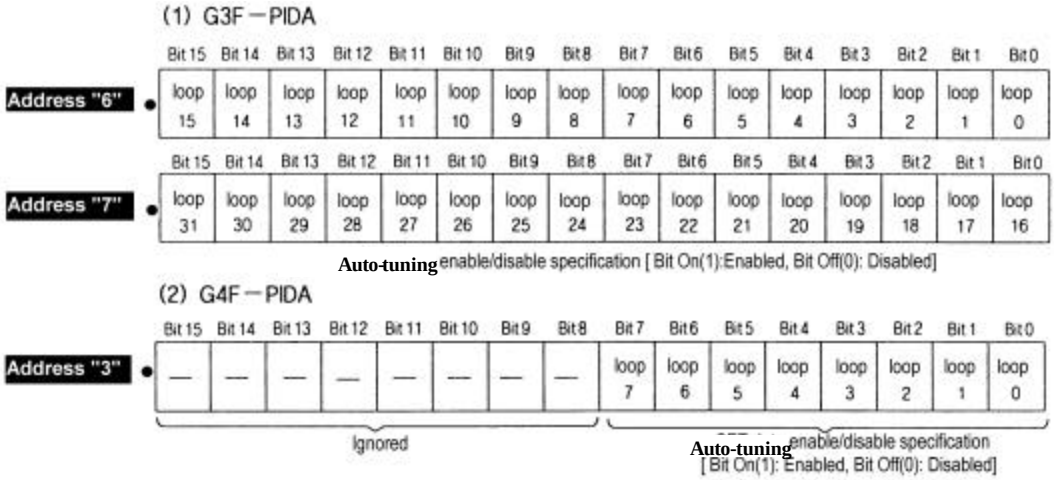
6.2.3 Specifying Forward/Reverse action(G3F-PIDA : Addresses 4, 5, G4F-PIDA : Address 2)

1) Turns the corresponding bit Off(0) for forward action processing and On (1) for reverse action processing.
2) Default is forward action.
3) The following show the bit corresponding to each loop.



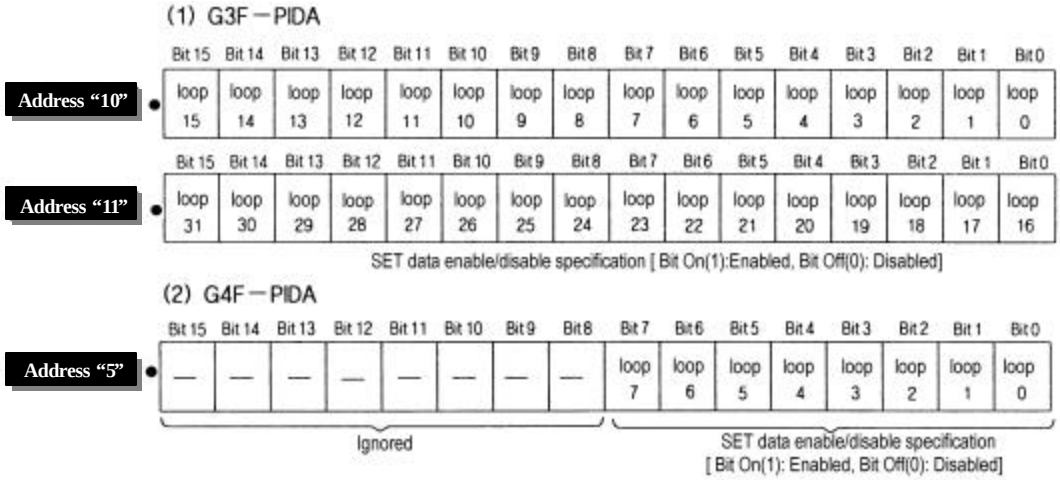
6.2.4 Auto –tuning setting (G3F-PIDA : Addresses 6, 7, G4F-PIDA : Address 3)

1) Proportional constant(P) ,integral constant(I) ,derivative constant(D) of the system to control can be automatically set.
2) Since P,I,D constant decided by auto tuning not to be optimal for the system to control ,the P,I,D constant needs adjustment a little
3) Loop setting is as specified below.



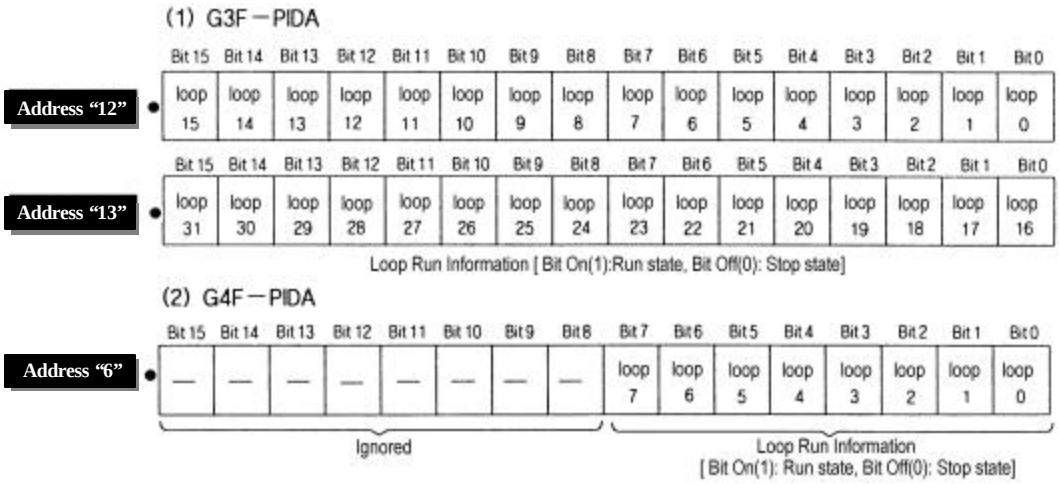
6.2.5 Specifying SET data enable/disable (G3F-PIDA : Addresses 10, 11, G4F-PIDA : Address 5)

1) If a bit, corresponding to each loop, in Set Data specification area is turned On(1), then the PID processing is executed with new user-defined data due to loop enable/disable specification, forward/reverse action specification, setting SV, setting M_MV, and change of P.I.D constants.
2) If the bit corresponding to each loop is not turned On(1), then the PID processing is executed not with the new user-defined data but with the previous Setting range.
3) The followings show the bit corresponding to each loop.



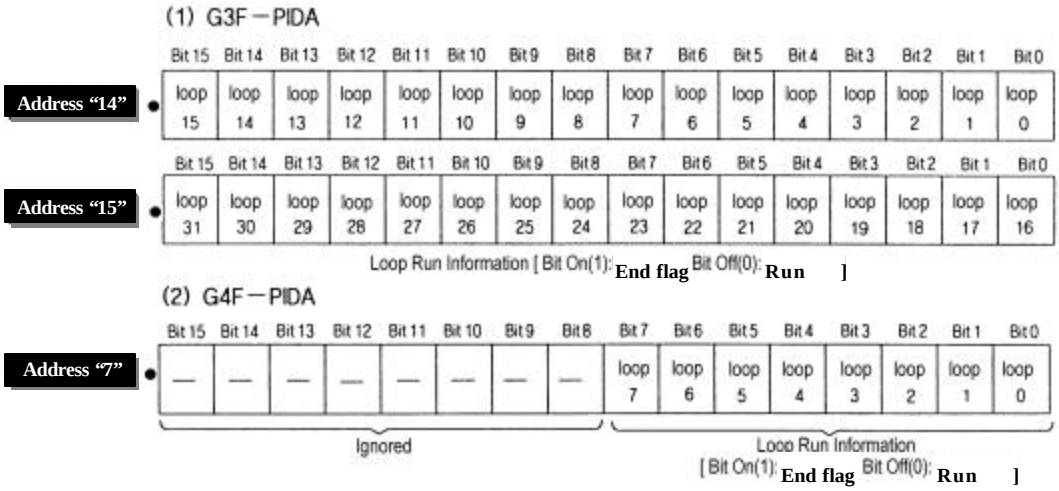
6.2.6 Loop run information (G3F-PIDA : Addresses 12,13, G4F-PIDA : Address 6)

1) This area stores information on run status of each loop.



6.2.7 Auto tuning complete (G3F-PIDA : Addresses 14,15, G4F-PIDA : Address 7)

1) If auto tuning is complete ,each of loop bit is turned on(1).



6.2.8 Setting PID control data

1) The addresses for PID control data and their setting range are given as follows.

Address (10 decimal)		Item	Setting range	Default
G3F-PIDA	G4F-PIDA			
16~47	8~15	SV	0 ~ 16000	"0"
48~79	16~23	SV_UP	0 ~ 65535	
80~111	24~31	SV_DN		
112~143	32~39	PV	0 ~ 16000	
144~175	40~47	M_MV		
176~207	48~55	P constant	1 ~ 10000	"500"
208~239	56~63	I constant	0 ~ 30000	"1000"
240~271	64~71	D constant	0 ~ 30000	"0"
272~303	72~79	MV	0 ~ 1600	
304~335	80~87	RAMP_SV		

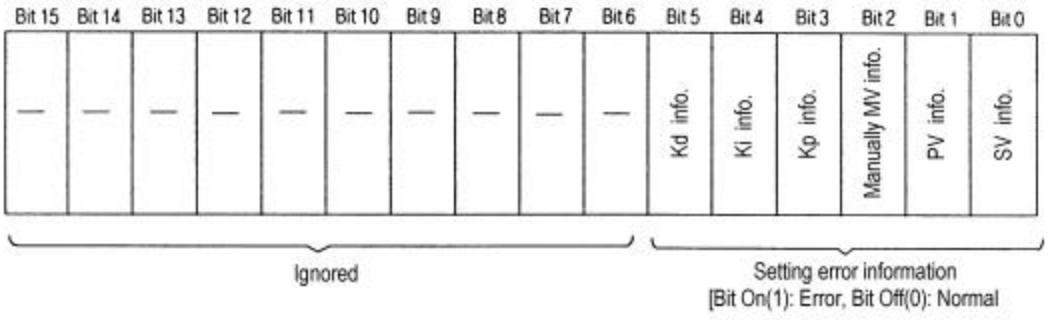
2) If PID control data is outside the range, the execution continues with the setting range of the previous processing.

3) If PID control data is outside its setting range, error information appear on the setting error information area.

6.2.9 Setting error information (G3F-PIDA : Addresses 336 to 367, G4F-PIDA : Addresses 88 to 95)

1) When setting the control data for each loop, if any setting exceeds its range the error information is indicated on this area.

2) Bit 0 to 5 are used to indicate error information for each loop. The following shows the error information indicated by each bit when it turns On(1).

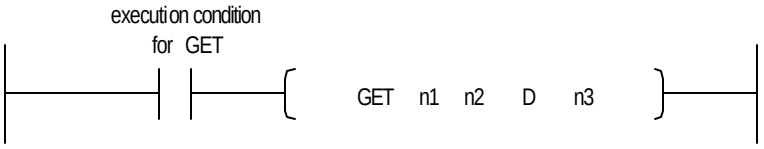


Chapter 7. DEDICATED INSTRUCTIONS FOR SPECIAL MODULES (Read from /Write to buffer memory)

The PID module is available only for local and occupies 16 I/O points.

7.1 Read from buffer memory ㅧㅧㅧ GET, GETP

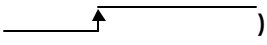
<Format>



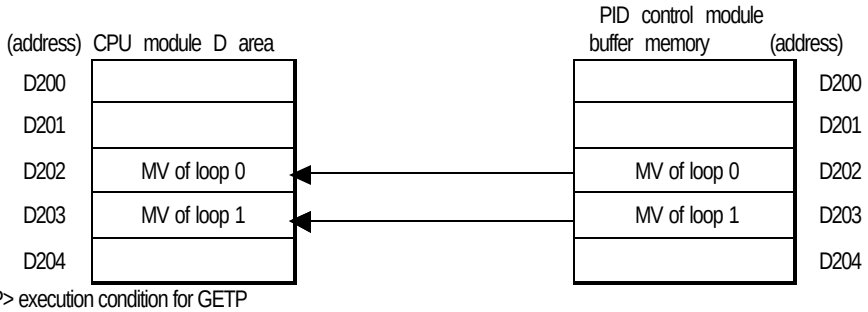
Format	Descriptions	Available Data Type
n1	The slot No. where a special module is mounted	Integer
n2	Head address of the special module buffer memories from which the data will be read.	Integer
D	Head address of the device to store the data read.	M,P,K,J,T,C,D,#D
n3	Number of data to be read .	Integer

<The difference between GET and GETP>

GET: Always executed if the execution condition turns on. ()

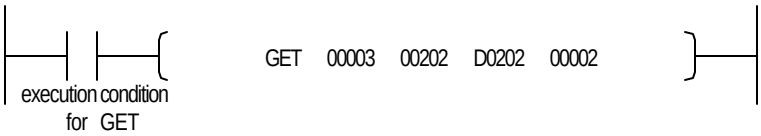
GETP : Executed if the execution condition is triggered. ()

Example 1) In this example, the PID control module is mounted on the slot 3 in the base unit and the data of buffer memory addresses 202 and 203 will be read to the CPU module addresses D202 and D203.

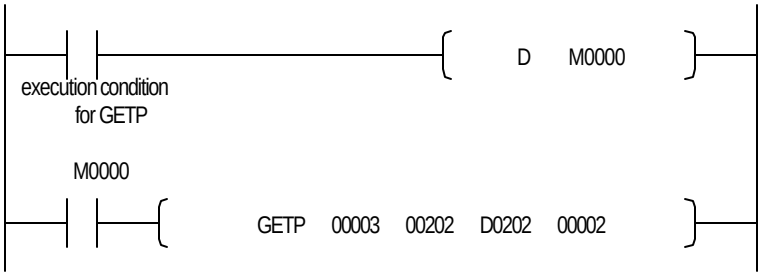


<GETP> execution condition for GETP

<GET>

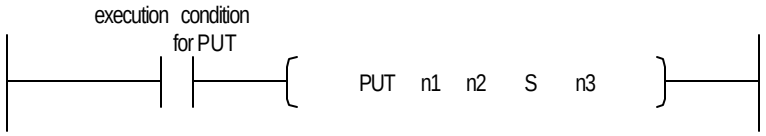


<GETP>



7.2 Write to buffer memory ㅧㅧㅧ PUT, PUTP

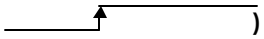
<Format>



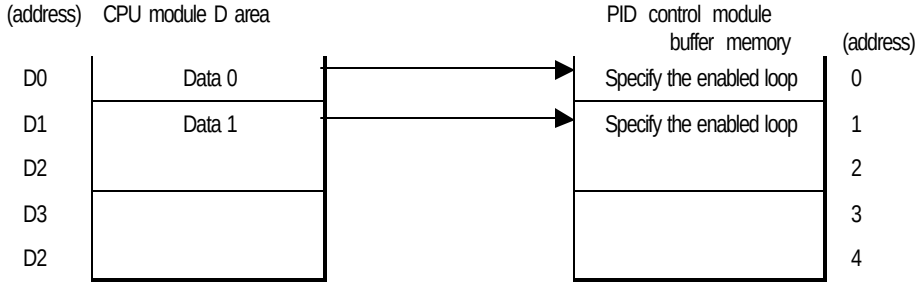
Format	Descriptions	Available Dat a Type
n1	The slot No. where a special module is mounted.	Integer
n2	Head address of the special module buffer memories to which the data will be written..	Integer
D	Head address of the device where the data to be written has been stored, or an integer	M,P,K,L,T,C,D,#D
n3	Number of data to be written.	Integer

<The difference between PUT and PUTP>

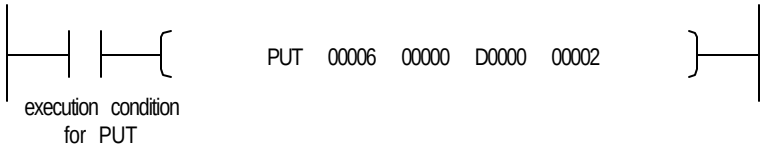
PUT: always executed if the execution condition turns on. **(**  **)**

PUTP : executed if the execution condition is triggered. **(**  **)**

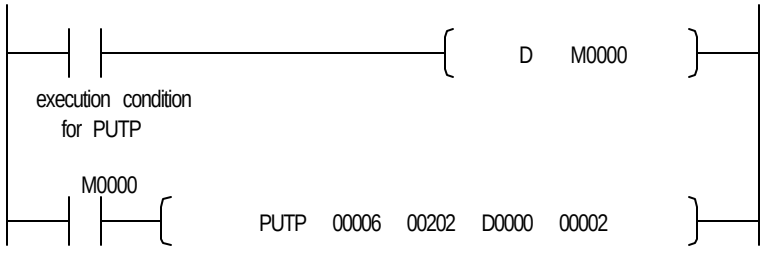
Example 1) In this example, the PID control module is mounted on the slot 6 in the base unit and the data of CPU module addresses D0 and D1 will be written to the buffer memory addresses D202 and D203.



<PUT>



<PUTP>

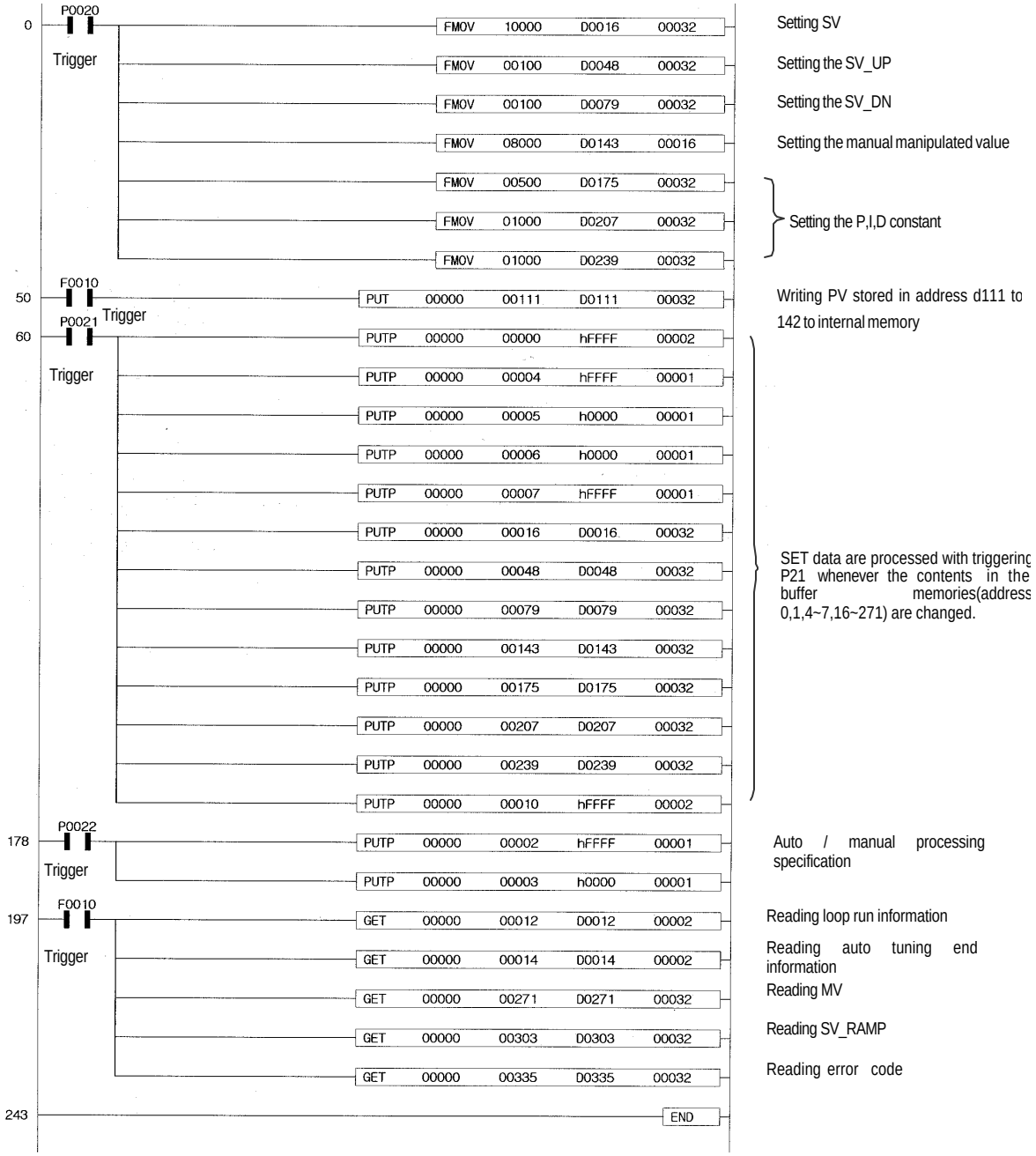


Chapter 8. PROGRAMMING

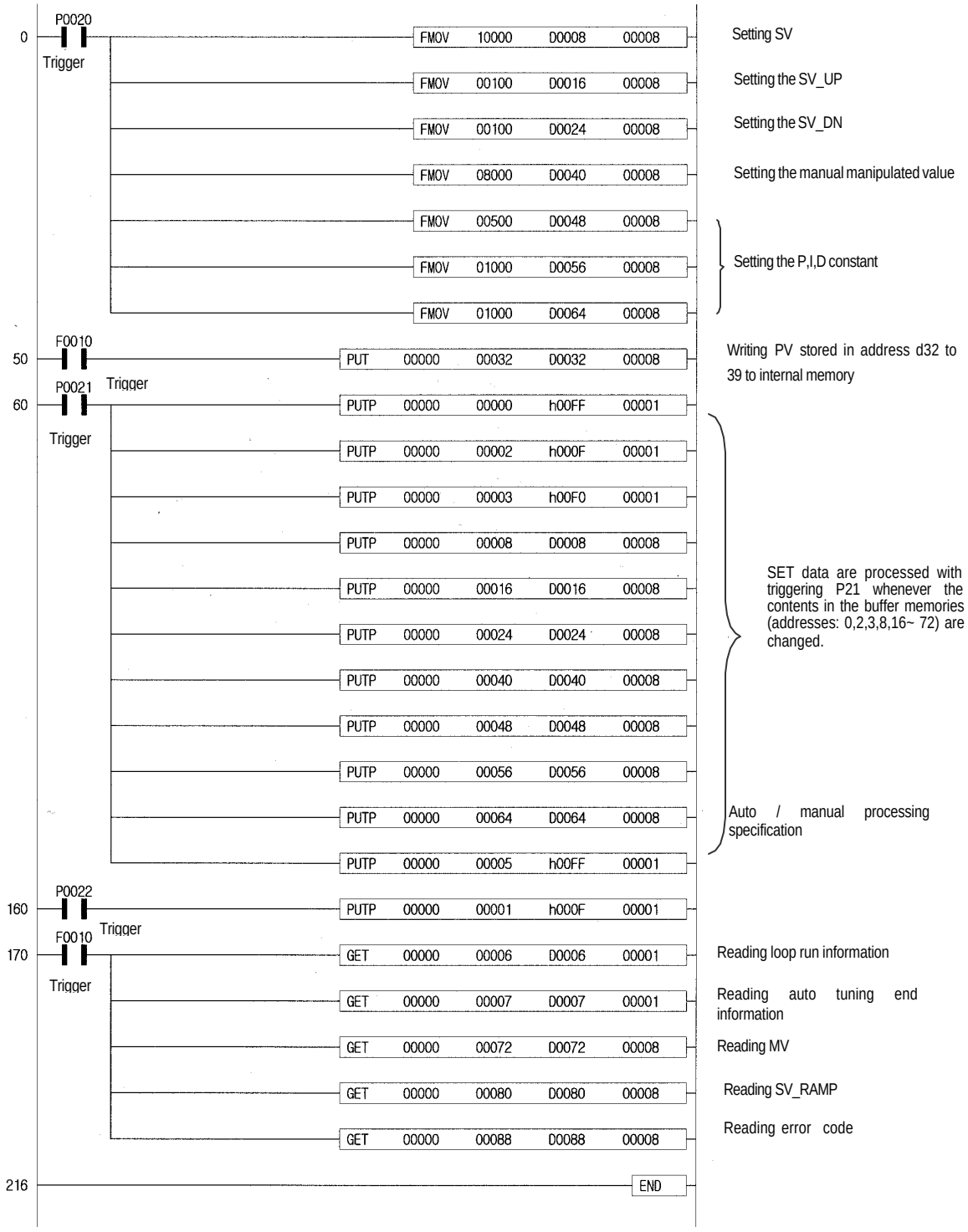
8.1 Basic programming

σ The following describes the method to set the running conditions in the buffer memories of the PID control module.
σ The PID control module is already mounted on the slot 0.
σ The PID control module occupies 16 I/O points.

8.1.1 G3F-PIDA



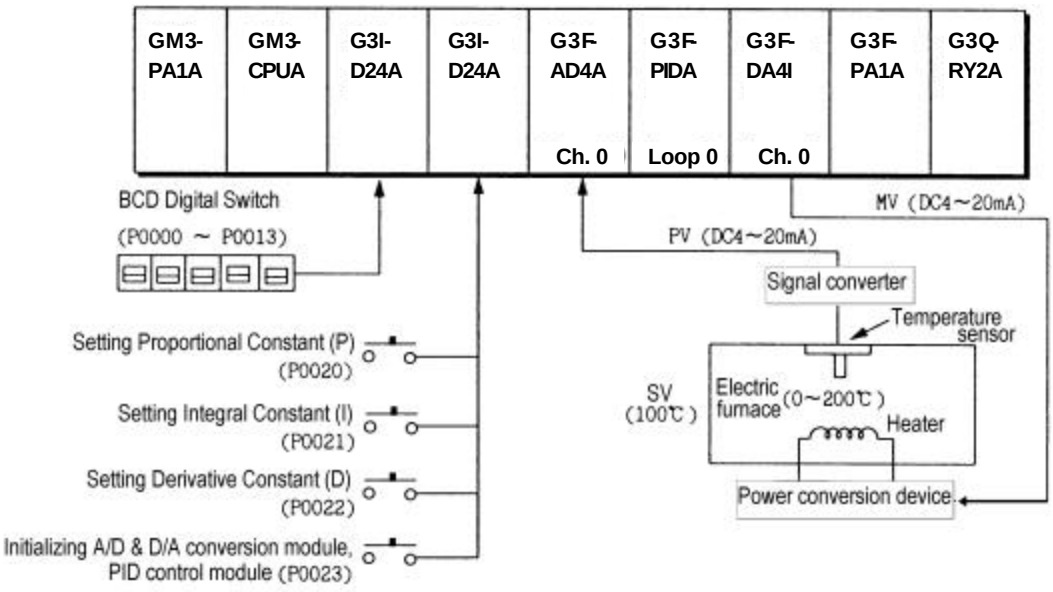
8.1.2 G4F-PIDA


0
P0020
Trigger
FMOV 10000 D0008 00008
Setting SV
FMOV 00100 D0016 00008
Setting the SV_UP
FMOV 00100 D0024 00008
Setting the SV_DN
FMOV 08000 D0040 00008
Setting the manual manipulated value
FMOV 00500 D0048 00008
FMOV 01000 D0056 00008
FMOV 01000 D0064 00008
Setting the P,I,D constant
50
F0010
PUT 00000 00032 D0032 00008
Writing PV stored in address d32 to 39 to internal memory
60
P0021
Trigger
PUTP 00000 00000 h00FF 00001
PUTP 00000 00002 h000F 00001
PUTP 00000 00003 h00F0 00001
PUTP 00000 00008 D0008 00008
PUTP 00000 00016 D0016 00008
PUTP 00000 00024 D0024 00008
PUTP 00000 00040 D0040 00008
PUTP 00000 00048 D0048 00008
PUTP 00000 00056 D0056 00008
PUTP 00000 00064 D0064 00008
PUTP 00000 00005 h00FF 00001
SET data are processed with triggering P21 whenever the contents in the buffer memories (addresses: 0,2,3,8,16~ 72) are changed.
Auto / manual processing specification
160
P0022
Trigger
PUTP 00000 00001 h000F 00001
170
F0010
Trigger
GET 00000 00006 D0006 00001
Reading loop run information
GET 00000 00007 D0007 00001
Reading auto tuning end information
GET 00000 00072 D0072 00008
Reading MV
GET 00000 00080 D0080 00008
Reading SV_RAMP
GET 00000 00088 D0088 00008
Reading error code
216
END

8.2 Application programming

8.2.1 A program for controlling an electric furnace (with applying the A/D conversion module, PID control module and D/A conversion module)

1) System configuration



1) Initial settings

(1) PID control module
- A) Specifying used loop : loop 0
- B) Specifying forward/reverse action : forward action
- C) Setting SV: 12800
- D) Specifying auto/manual processing : auto processing

(2) A/D conversion module
- A) Specifying used channel: channel 0
- B) Specifying output data type: -192 to 16191
- C) Setting filter constant: 50

(3) D/A conversion module
- A) Specifying used channel: channel 0
- B) Specifying input data type: -192 to 16191
- C) Output when no channel is used or the CPU module is in the stop state : The median value of the output range is output.

2) Descriptions of the program

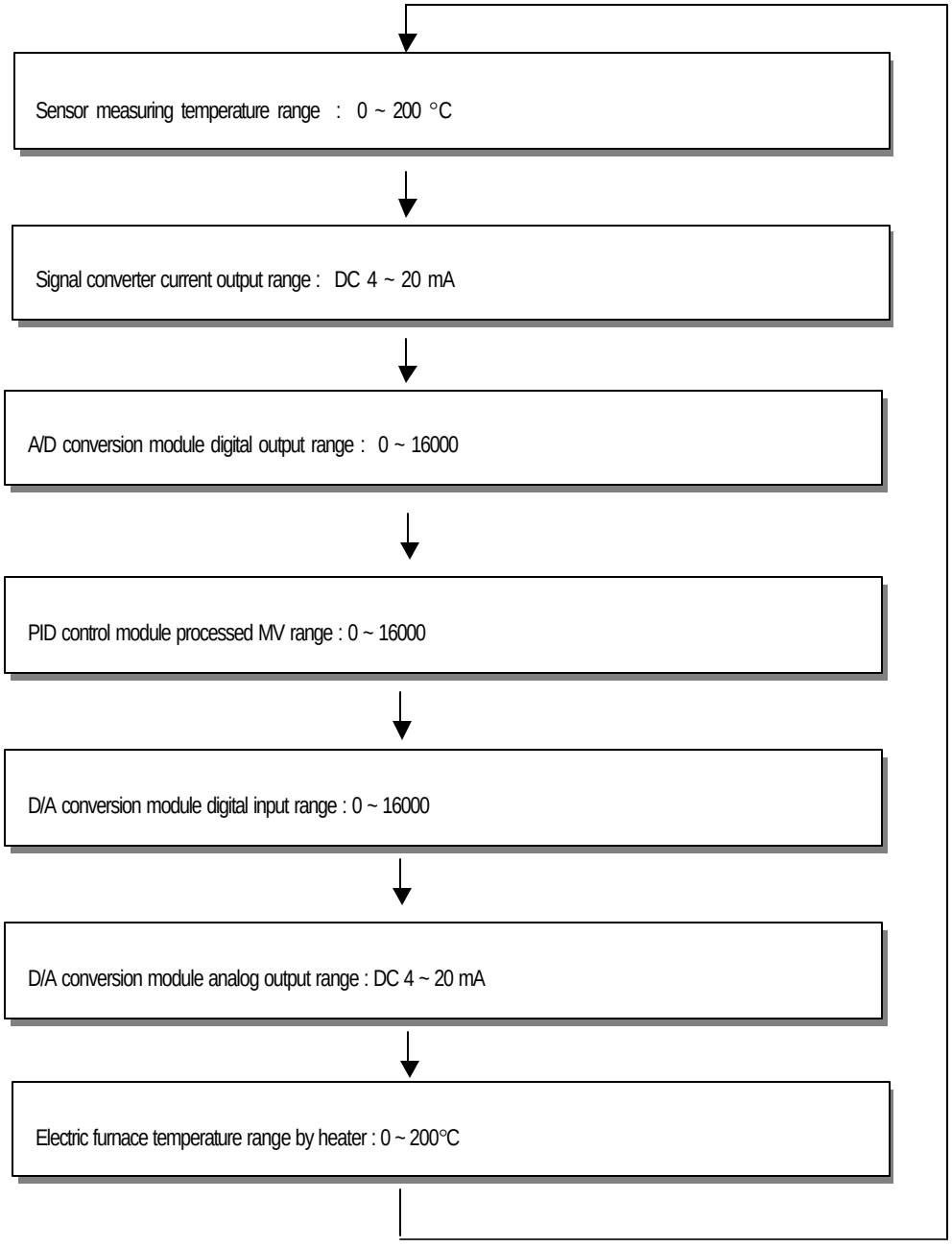
(1) A temperature 0 to 200℃ from the temperature sensor is converted into an analog signal 4 to 20 mA and then the signal is input to the channel 0 of the A/D conversion module channel and converted into a digital value 9600 to 16000.

(1) PID control module sets temperature of 100℃ (the signal converter outputs 12 mA this time and the digital value is 8000.) as a set value and calculates P,I,D constant value via the Auto-Tuning control and then perform control with the calculated value. If P20 is On, the manipulated value by BCD digital switch is set to proportional constant value for the much appropriate control via the change of P,I,D constant value, if P21 is On, the value is set to integral constant value, and if P22 is On, the value is set to differential constant value.

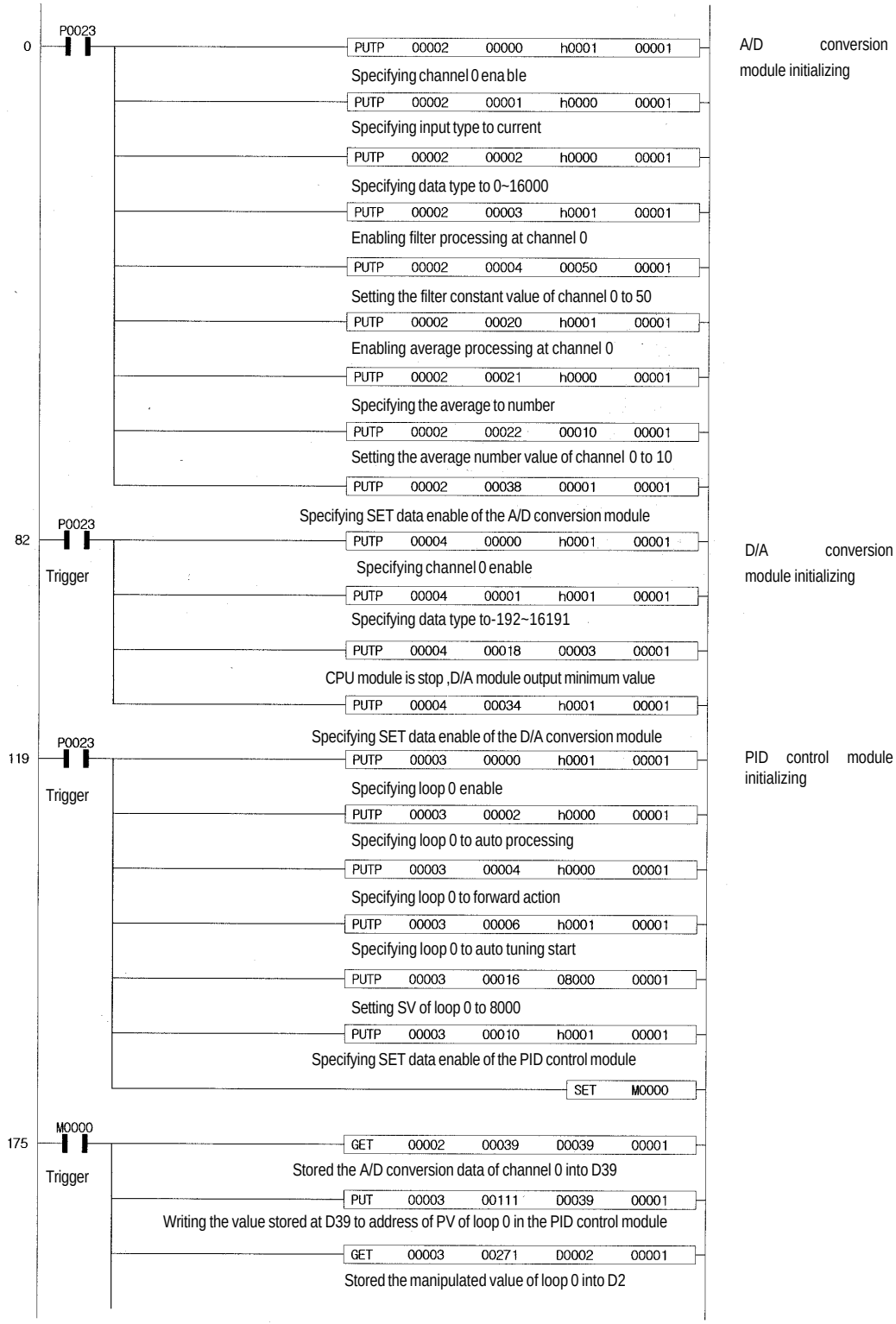
(2) MV, the result from PID processing is output at the channel 0 of the D/A conversion module.

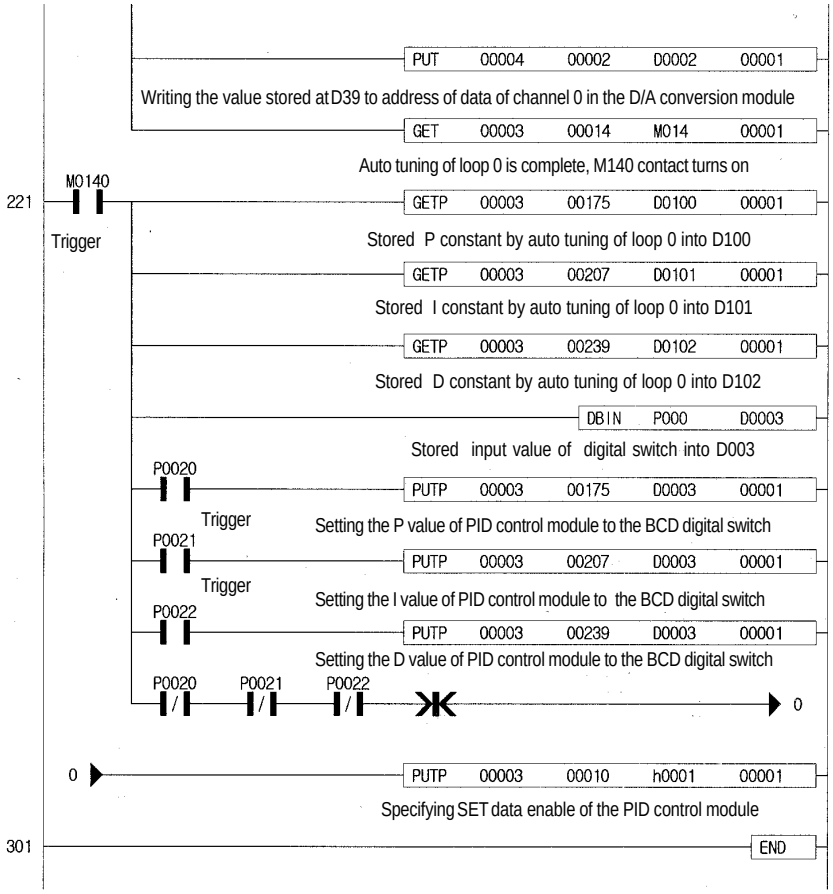
(3) If P0023 turns on, initial setting of the A/D conversion module, PID control module and D/A conversion module is executed.

3) Modules and their signal processing



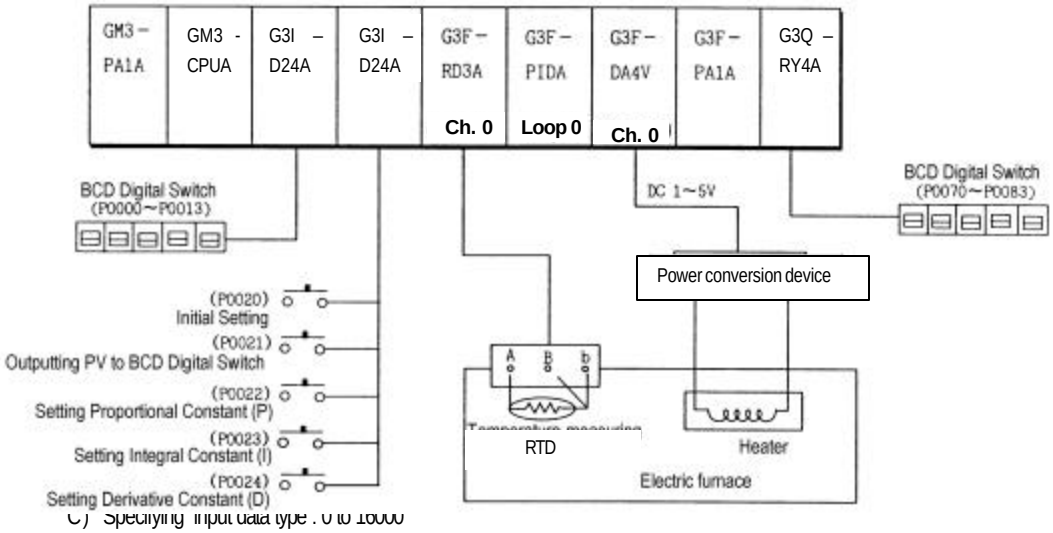
4) Program


0
P0023
PUTP 00002 00000 h0001 00001
Specifying channel 0 enable
PUTP 00002 00001 h0000 00001
Specifying input type to current
PUTP 00002 00002 h0000 00001
Specifying data type to 0~16000
PUTP 00002 00003 h0001 00001
Enabling filter processing at channel 0
PUTP 00002 00004 00050 00001
Setting the filter constant value of channel 0 to 50
PUTP 00002 00020 h0001 00001
Enabling average processing at channel 0
PUTP 00002 00021 h0000 00001
Specifying the average to number
PUTP 00002 00022 00010 00001
Setting the average number value of channel 0 to 10
PUTP 00002 00038 00001 00001
Specifying SET data enable of the A/D conversion module
A/D conversion module initializing
82
P0023
Trigger
PUTP 00004 00000 h0001 00001
Specifying channel 0 enable
PUTP 00004 00001 h0001 00001
Specifying data type to-192~16191
PUTP 00004 00018 00003 00001
CPU module is stop ,D/A module output minimum value
PUTP 00004 00034 h0001 00001
Specifying SET data enable of the D/A conversion module
D/A conversion module initializing
119
P0023
Trigger
PUTP 00003 00000 h0001 00001
Specifying loop 0 enable
PUTP 00003 00002 h0000 00001
Specifying loop 0 to auto processing
PUTP 00003 00004 h0000 00001
Specifying loop 0 to forward action
PUTP 00003 00006 h0001 00001
Specifying loop 0 to auto tuning start
PUTP 00003 00016 08000 00001
Setting SV of loop 0 to 8000
PUTP 00003 00010 h0001 00001
Specifying SET data enable of the PID control module
SET M0000
PID control module initializing
175
M0000
Trigger
GET 00002 00039 D0039 00001
Stored the A/D conversion data of channel 0 into D39
PUT 00003 00111 D0039 00001
Writing the value stored at D39 to address of PV of loop 0 in the PID control module
GET 00003 00271 D0002 00001
Stored the manipulated value of loop 0 into D2


PUT 00004 00002 D0002 00001
Writing the value stored at D39 to address of data of channel 0 in the D/A conversion module
GET 00003 00014 M014 00001
Auto tuning of loop 0 is complete, M140 contact turns on
M0140
221
GETP 00003 00175 D0100 00001
Trigger
Stored P constant by auto tuning of loop 0 into D100
GETP 00003 00207 D0101 00001
Stored I constant by auto tuning of loop 0 into D101
GETP 00003 00239 D0102 00001
Stored D constant by auto tuning of loop 0 into D102
DBIN P000 D0003
Stored input value of digital switch into D003
P0020
PUTP 00003 00175 D0003 00001
Trigger
Setting the P value of PID control module to the BCD digital switch
P0021
PUTP 00003 00207 D0003 00001
Trigger
Setting the I value of PID control module to the BCD digital switch
P0022
PUTP 00003 00239 D0003 00001
Setting the D value of PID control module to the BCD digital switch
P0020 P0021 P0022
0
0
PUTP 00003 00010 h0001 00001
Specifying SET data enable of the PID control module
301
END

8.2.2 A program for control using a RTD (with applying the RTD input module, PID Control module and D/A conversion module)

1) System configuration



C) Specifying input data type : 0 to 10000

3) Descriptions of the program

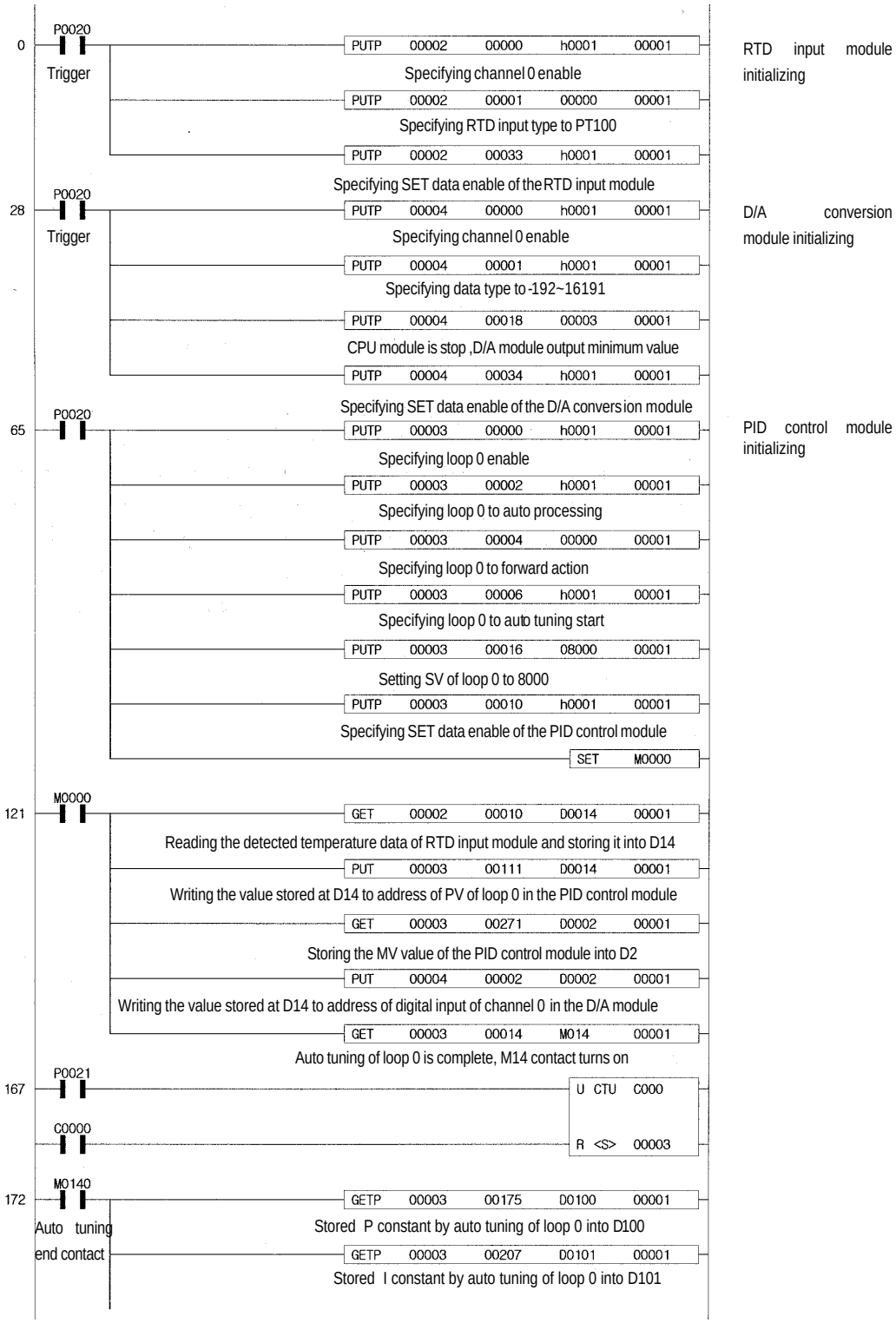
(1) The channel 0 of the RTD input module detects a temperature of the electric furnace through Pt100 and receives it as a digital value.

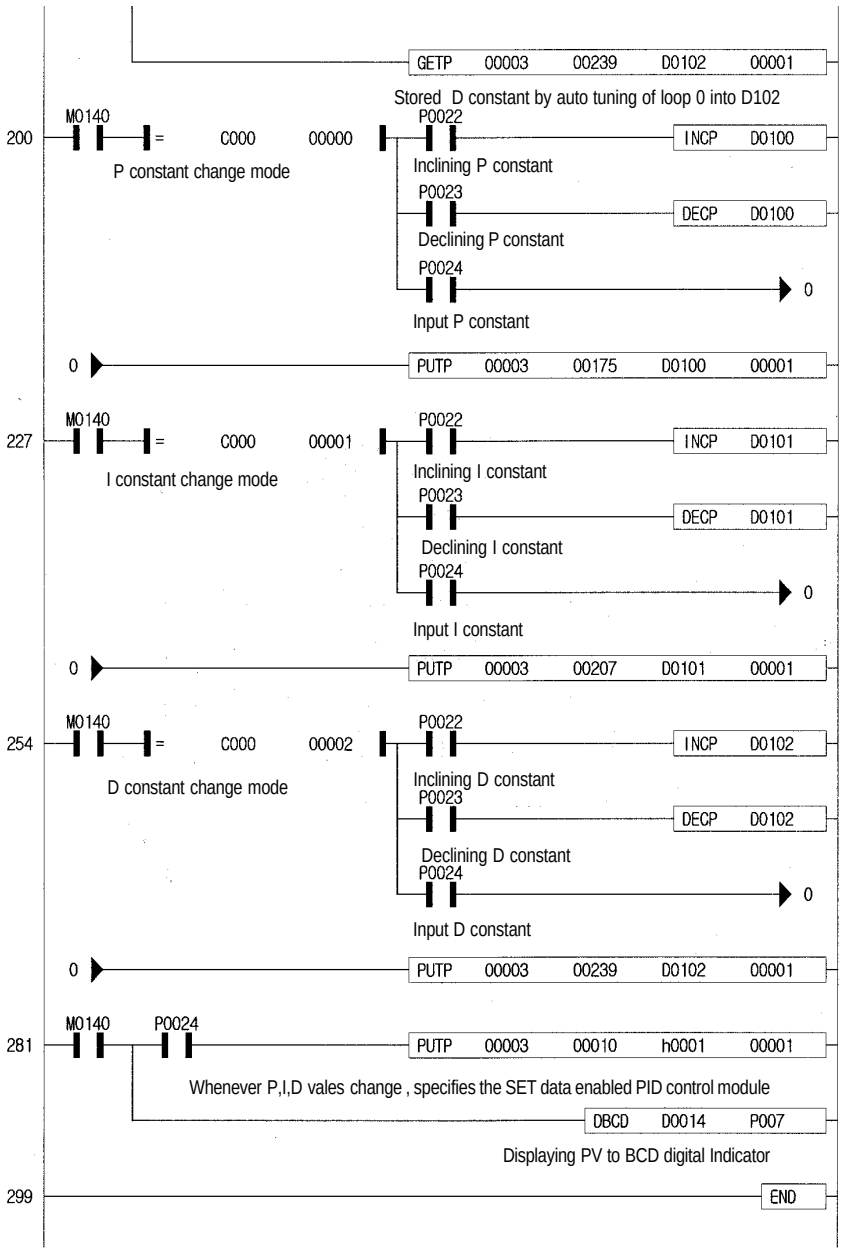
(2) PID control module sets temperature of 100℃ (the signal converter outputs 12 mA this time and the digital value is 8000) as a set value and calculates P,I,D constant value via the Auto-Tuning control and then perform control with the calculated value. With regards to P.I.D constants, the manipulated value in the BCD digital switch is set to the P,I,D constants

(2) MV, the result from PID processing is output at the channel 0 of the D/A conversion module.

(3) Auto tuning is completed, PV is displayed on the BCD digital LED.

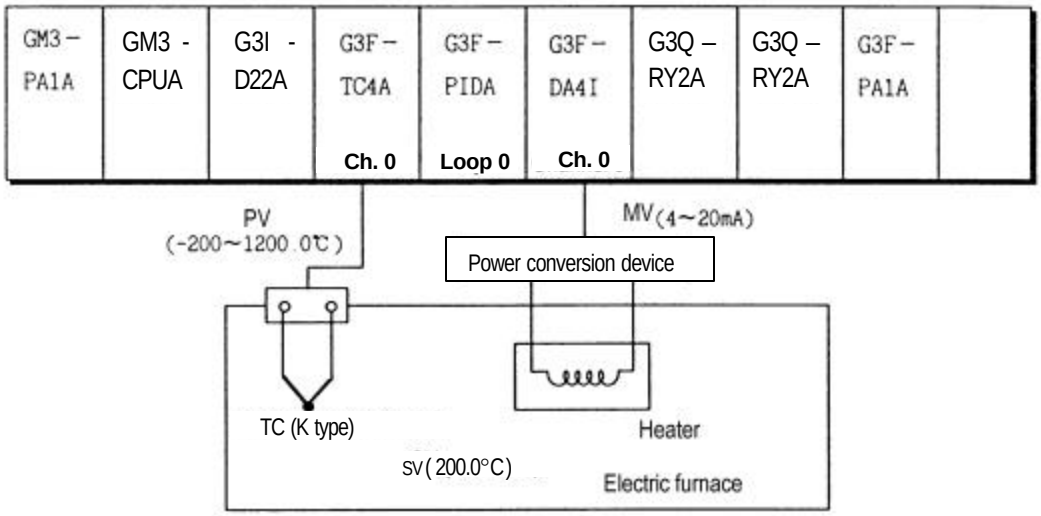
4) Program


0
P0020
Trigger
PUTP 00002 00000 h0001 00001
Specifying channel 0 enable
PUTP 00002 00001 00000 00001
Specifying RTD input type to PT100
PUTP 00002 00033 h0001 00001
Specifying SET data enable of the RTD input module
RTD input module initializing
28
P0020
Trigger
PUTP 00004 00000 h0001 00001
Specifying channel 0 enable
PUTP 00004 00001 h0001 00001
Specifying data type to -192~16191
PUTP 00004 00018 00003 00001
CPU module is stop ,D/A module output minimum value
PUTP 00004 00034 h0001 00001
Specifying SET data enable of the D/A conversion module
D/A conversion module initializing
65
P0020
PUTP 00003 00000 h0001 00001
Specifying loop 0 enable
PUTP 00003 00002 h0001 00001
Specifying loop 0 to auto processing
PUTP 00003 00004 00000 00001
Specifying loop 0 to forward action
PUTP 00003 00006 h0001 00001
Specifying loop 0 to auto tuning start
PUTP 00003 00016 08000 00001
Setting SV of loop 0 to 8000
PUTP 00003 00010 h0001 00001
Specifying SET data enable of the PID control module
SET M0000
PID control module initializing
121
M0000
GET 00002 00010 D0014 00001
Reading the detected temperature data of RTD input module and storing it into D14
PUT 00003 00111 D0014 00001
Writing the value stored at D14 to address of PV of loop 0 in the PID control module
GET 00003 00271 D0002 00001
Storing the MV value of the PID control module into D2
PUT 00004 00002 D0002 00001
Writing the value stored at D14 to address of digital input of channel 0 in the D/A module
GET 00003 00014 M014 00001
Auto tuning of loop 0 is complete, M14 contact turns on
167
P0021
U CTU C000
C0000
R <S> 00003
172
M0140
Auto tuning end contact
GETP 00003 00175 D0100 00001
Stored P constant by auto tuning of loop 0 into D100
GETP 00003 00207 D0101 00001
Stored I constant by auto tuning of loop 0 into D101


GETP 00003 00239 D0102 00001
Stored D constant by auto tuning of loop 0 into D102
200
M0140
= C000 00000
P0022
INCP D0100
P constant change mode
Inclining P constant
P0023
DECP D0100
Declining P constant
P0024
0
Input P constant
0
PUTP 00003 00175 D0100 00001
227
M0140
= C000 00001
P0022
INCP D0101
I constant change mode
Inclining I constant
P0023
DECP D0101
Declining I constant
P0024
0
Input I constant
0
PUTP 00003 00207 D0101 00001
254
M0140
= C000 00002
P0022
INCP D0102
D constant change mode
Inclining D constant
P0023
DECP D0102
Declining D constant
P0024
0
Input D constant
0
PUTP 00003 00239 D0102 00001
281
M0140
P0024
PUTP 00003 00010 h0001 00001
Whenever P,I,D vales change , specifies the SET data enabled PID control module
DBCD D0014 P007
Displaying PV to BCD digital Indicator
299
END

8.2.3 A program for control using a thermocouple (with applying the TC input module, PID control module and D/A conversion module)

1) System configuration

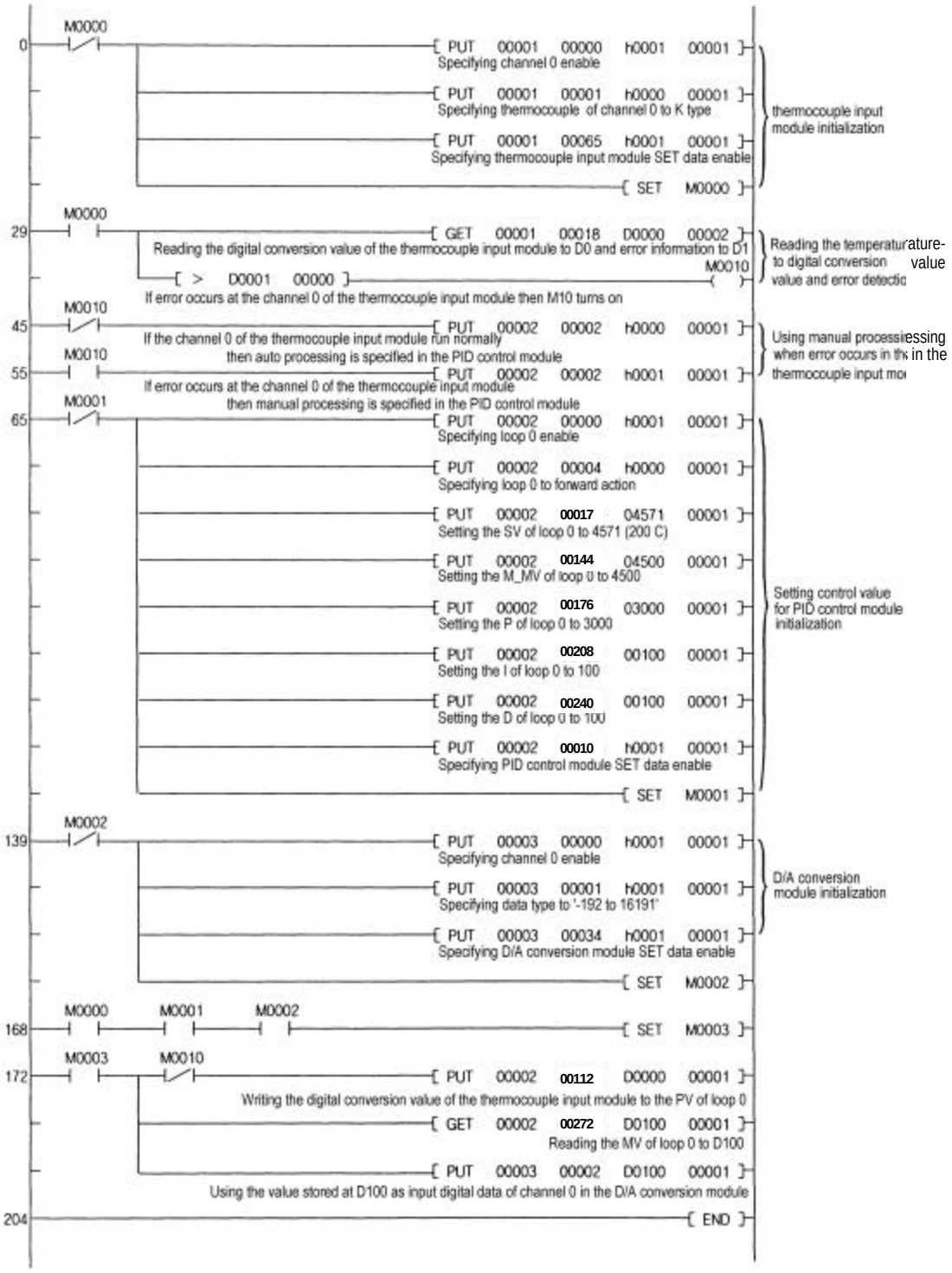


A) Specifying used channel: channel 0
B) Specifying input data type: -192 ~ 16191
C) The output when no channel is used or the CPU module is in the stop state : The median value of the output range.

3) Descriptions of the program

1) The temperature of the electric furnace is converted into a digital value through the channel 0 of the TC input module, and the digital value stored at address 18 is used as PV of the PID control module.
2) The MV of the PID control module is used as input digital data of the channel 0 of the D/A conversion module.
3) If an error occurs by the K type TC or the compensation wire which are connected to the TC input module (In the channel 0, it is indicated at address 19.), then the PID control module changes auto processing into manual processing.

4) Program


M0000
0
[PUT 00001 00000 h0001 00001]
Specifying channel 0 enable
[PUT 00001 00001 h0000 00001]
Specifying thermocouple of channel 0 to K type
[PUT 00001 00065 h0001 00001]
Specifying thermocouple input module SET data enable
[SET M0000]
thermocouple input module initialization
M0000
29
[GET 00001 00018 D0000 00002]
Reading the digital conversion value of the thermocouple input module to D0 and error information to D1
[> D0001 00000]
M0010
If error occurs at the channel 0 of the thermocouple input module then M10 turns on
Reading the temperature-to digital conversion value and error detectio
M0010
45
[PUT 00002 00002 h0000 00001]
If the channel 0 of the thermocouple input module run normally
then auto processing is specified in the PID control module
M0010
55
[PUT 00002 00002 h0001 00001]
If error occurs at the channel 0 of the thermocouple input module
then manual processing is specified in the PID control module
Using manual processessing when error occurs in the in the thermocouple input mo
M0001
65
[PUT 00002 00000 h0001 00001]
Specifying loop 0 enable
[PUT 00002 00004 h0000 00001]
Specifying loop 0 to forward action
[PUT 00002 00017 04571 00001]
Setting the SV of loop 0 to 4571 (200 C)
[PUT 00002 00144 04500 00001]
Setting the M_MV of loop 0 to 4500
[PUT 00002 00176 03000 00001]
Setting the P of loop 0 to 3000
[PUT 00002 00208 00100 00001]
Setting the I of loop 0 to 100
[PUT 00002 00240 00100 00001]
Setting the D of loop 0 to 100
[PUT 00002 00010 h0001 00001]
Specifying PID control module SET data enable
[SET M0001]
Setting control value for PID control module initialization
M0002
139
[PUT 00003 00000 h0001 00001]
Specifying channel 0 enable
[PUT 00003 00001 h0001 00001]
Specifying data type to '-192 to 16191'
[PUT 00003 00034 h0001 00001]
Specifying D/A conversion module SET data enable
[SET M0002]
D/A conversion module initialization
M0000 M0001 M0002
168
[SET M0003]
M0003 M0010
172
[PUT 00002 00112 D0000 00001]
Writing the digital conversion value of the thermocouple input module to the PV of loop 0
[GET 00002 00272 D0100 00001]
Reading the MV of loop 0 to D100
[PUT 00003 00002 D0100 00001]
Using the value stored at D100 as input digital data of channel 0 in the D/A conversion module
204
[END]

Chapter 9. TROUBLESHOOTING

The followings explain errors that could occur during operating the PID control module and their troubleshooting.

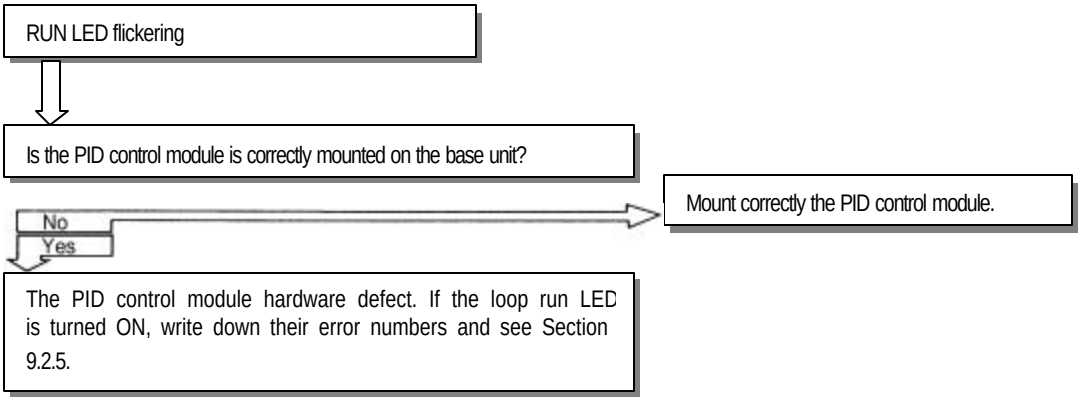
9.1 Errors indicated by RUN LED flickering

Errors indicated by PID control module RUN LED flickering are given below.

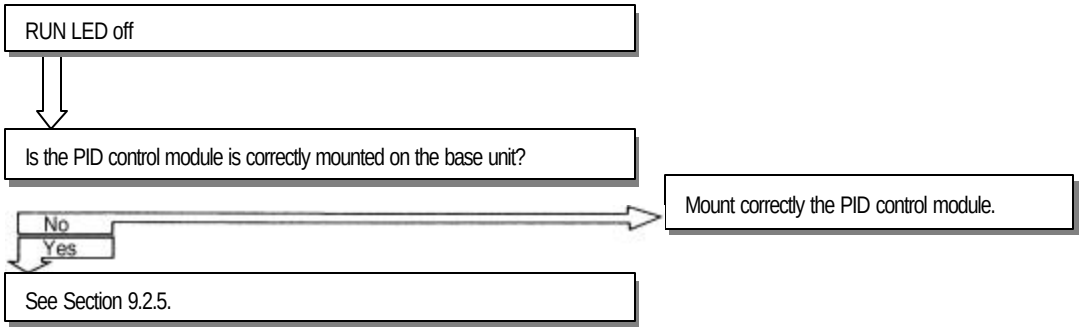
RUN LED Status	Error Type	Loop RUN LED status
Flickering (cycle: 0.1 sec)	WDT Error	Loop "0" RUN LED ON
Flickering (cycle: 0.2 sec)	System Error Buffer Memory Error	All Loops RUN LED OFF Loop "1" RUN LED ON

9.2 Troubleshooting procedure

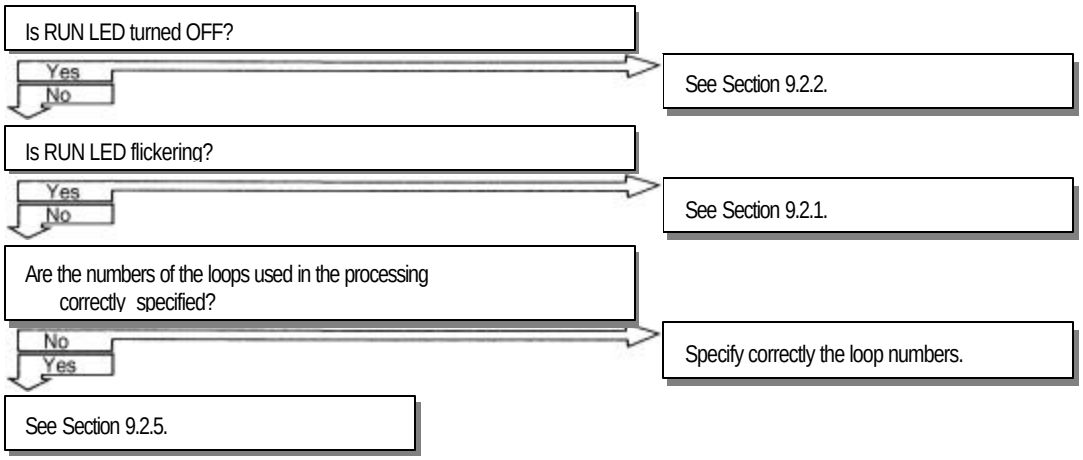
9.2.1 RUN LED flickering



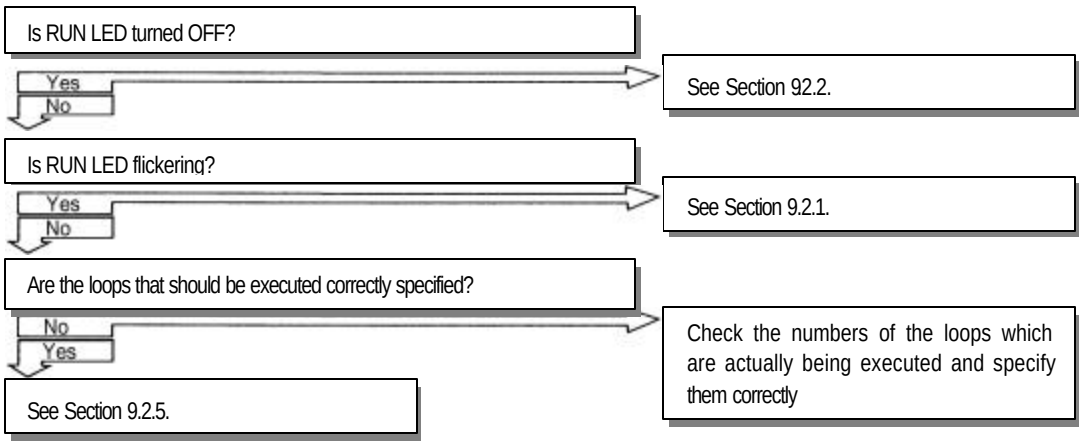
9.2.2 RUN LED off



9.2.3 Unreadable processing result of PID control module



9.2.4 Run LED of enabled loops off



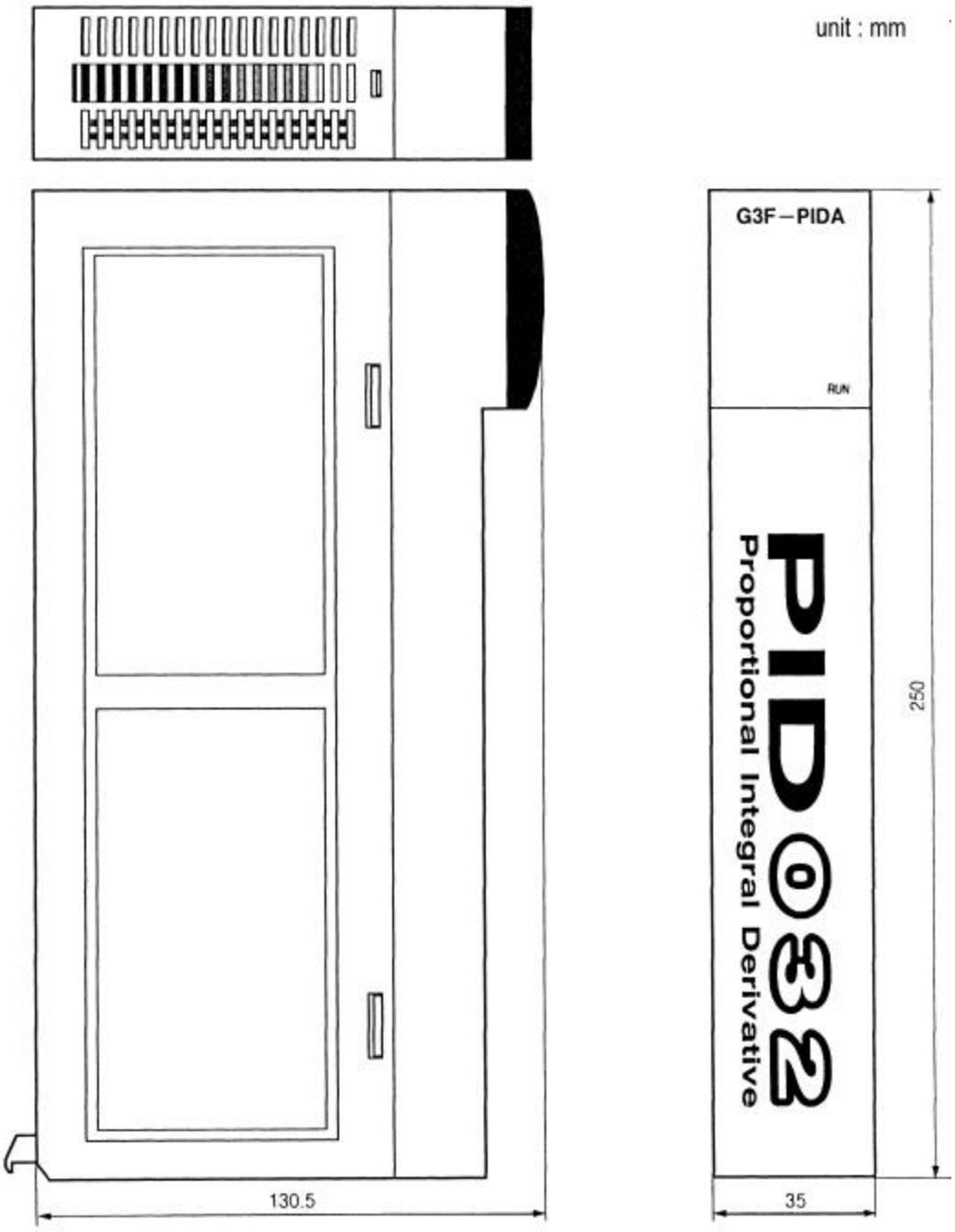
9.2.5 PID control module hardware defect

PID control module hardware defect. Contact the nearest agency or service station.

Chapter 10. dIMENSIONS

10.1 G3F-PIDA Dimensions.

unit : mm



10.2 G4F-PIDA dimensions