

MELSEC A Series

Programmable Logic Controllers

User's Manual

Analog Input/Output Module A1S63ADA



• SAFETY PRECAUTIONS •

(Always read these instructions before using this equipment.)

When using this equipment, thoroughly read this manual and the associated manuals introduced in this manual. Also pay careful attention to safety and handle the equipment properly.

These precautions apply only to this equipment. For the safety precautions of the PLC system, please read the user's manual for the CPU module to use.



These •SAFETY PRECAUTIONS• classify the safety precautions into two categories: "DANGER" and "CAUTION".

 DANGER	Procedures which may lead to a dangerous condition and cause death or serious injury if not carried out properly.
 CAUTION	Procedures which may lead to a dangerous condition and cause superficial to medium injury, or physical damage only, if not carried out properly.

Depending on circumstances, procedures indicated by  CAUTION may also be linked to serious results.

In any case, it is important to follow the directions for usage. Store this manual in a safe place so that you can take it out and read it whenever necessary. Always forward it to the end user.

[DESIGN PRECAUTIONS]

 DANGER
<ul style="list-style-type: none">• Configure a safety circuit on the outside of the PC so that the entire system works to a safe side even when the external power failure occurs or PC main unit fails. An erroneous output or operation may result in an accident.
 CAUTION
<ul style="list-style-type: none">• Use the PC in the environment given in the general specifications section of the applicable CPU module user's manual. Failure to do so may result in electric shock, fire, or erroneous operation or may damage or degrade the equipment.• Do not bundle, or install, the control cables with, or near, the main circuit and power cables. Keep them at least 100 mm (3.9 inch) away from such cables. Noise may cause erroneous operation.

[INSTALLATION PRECAUTIONS]

CAUTION

- Insert the tabs at the bottom of the module into the holes in the base module before installing the module. Be sure to install the module in the base module with screws tightened to the specified torque.
Improper installation may cause erroneous operation, accident, or the module to fall out.
- Do not directly touch the module's conductive parts or electronic components.
Doing so could cause malfunction or trouble in the module.

[WIRING PRECAUTIONS]

CAUTION

- If noise generates frequently, ground the AG and FG terminals using the PC dedicated class-D ground (class-three ground) or higher.
Failure to do so may result in erroneous operation.
- Confirm the rated voltage and terminal arrangement of the module before wiring it to the PC.
If a power supply of different rating is connected or a wiring is performed erroneously, fire or accident may result.
- Tighten the terminal screws to the specified torque.
Loose terminal screws may cause a short circuit or erroneous operation.
If excessively tightened, the terminal screws may be damaged, and cause a short circuit or erroneous operation.
- Be sure that cuttings, wire chips, or other foreign matter do not enter the module.
Foreign matter may start a fire or cause an accident or erroneous operation.

[STARTING AND MAINTENANCE PRECAUTIONS]

CAUTION

- Do not touch live terminals.
It may cause erroneous operation.
- Turn off the power before cleaning the module or retightening the screws.
Doing this work while the power is on may damage the module or cause erroneous operation.
- Do not disassemble or rebuild the module.
It may cause accidents, erroneous operation, injury, or fire.
- Turn off the power before mounting and dismounting the module.
Mounting or dismounting the module while the power is on may damage the module or cause erroneous operation.
- Before handling the module, make sure to touch a grounded metal object to discharge the static electricity from the human body.
Failure to do so may cause a failure or malfunctions of the module.

[OPERATING PRECAUTIONS]

CAUTION

- Do not output (ON) "Use Prohibited" signals from the PC CPU to the special module.
Doing so could erroneously operate the PC system.

[DISPOSAL PRECAUTIONS]

CAUTION

- When disposing of this equipment, handle it as industrial waste.

REVISIONS

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

Print Date	*Manual Number	Revision
Sep., 1993	IB (NA) - 66435-A	First edition
Dec., 1999	IB (NA) - 66435-B	<div>ADDITION</div> <p>Safety Precautions and Guarantee</p> <div>Partial Correction</div> <p>Chapter 2 (1), Chapter 2 Remark, section 3.1, 3.2.3, 4.1.2, 4.2, 4.3.2, 5.1.1, App. 3</p>
Oct., 2002	IB (NA) - 66435-C	<div>Partial Correction</div> <p>Chapter 2 Remark, section 3.1, 3.2.2, 4.3.2</p>
Feb., 2004	IB (NA) - 66435-D	<div>Partial Correction</div> <p>SAFETY PRECAUTIONS, section 3.1, 3.5, 4.3.2</p>

Japanese Manual Version SH-3528-G

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INTRODUCTION

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

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Conformation to the EMC Directive and Low Voltage Instruction

For details on making Mitsubishi PLC conform to the EMC directive and low voltage instruction when installing it in your product, please see Chapter 3, "EMC Directive and Low Voltage Instruction" of the User's Manual (Hardware) of the PLC CPU to use.

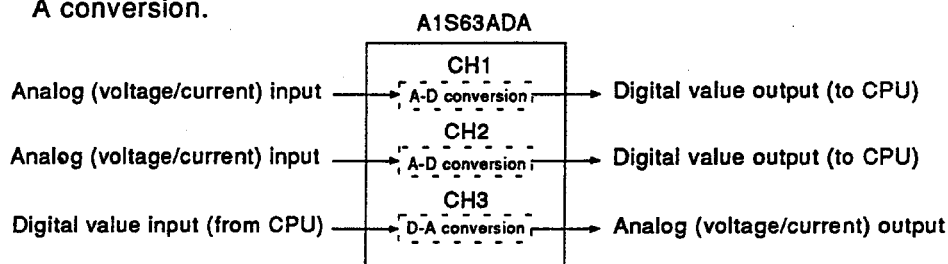
The CE logo is printed on the rating plate on the main body of the PLC that conforms to the EMC directive and low voltage instruction.

By making this product conform to the EMC directive and low voltage instruction, it is not necessary to make those steps individually.

1. GENERAL DESCRIPTION

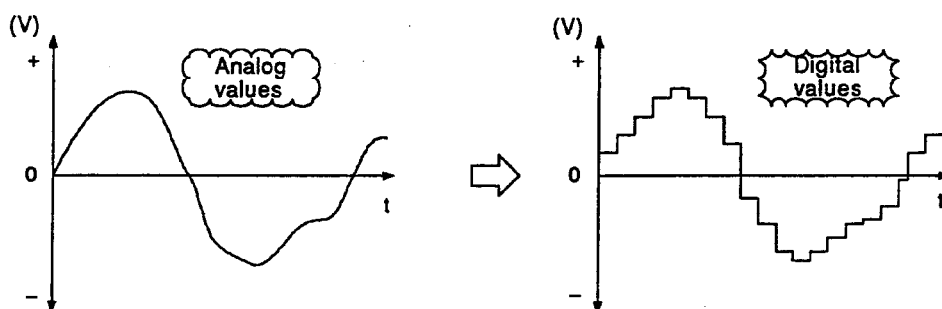
This user's manual explains the specifications, functions, and programming of the A1S63ADA Analog Input/Output Module (hereinafter abbreviated to A1S63ADA).

- (1) The A1S63ADA is a special function module equipped with two analog input channels and one analog output channel. In this manual, analog-to-digital conversion of data is abbreviated to A-D conversion, and digital-to-analog conversion is abbreviated to D-A conversion.



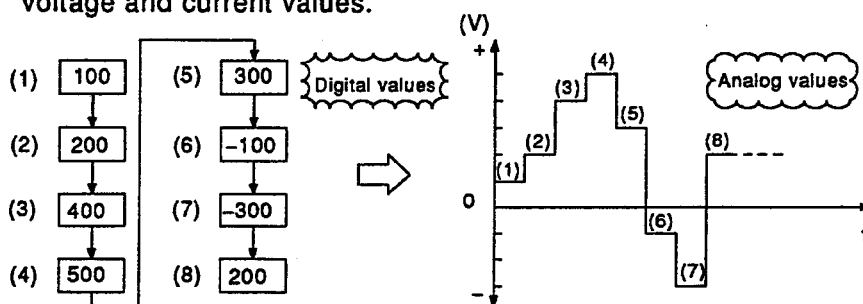
(a) A-D conversion

Analog input values such as voltage and current values are converted to digital output values so that a PC CPU can process the values.



(b) D-A conversion

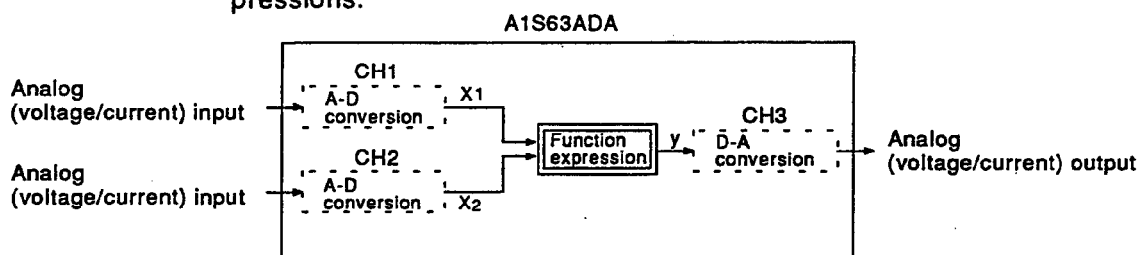
Digital input values are converted to analog output values such as voltage and current values.



The various ranges of input and output (analog and digital) values which the A1S63ADA can handle are as given below.

- Voltage I/O range _____ -10 V to 0 V to 10 V
- Current input range _____ -20 mA to 0 mA to 20 mA
- Current output range _____ 0 mA to 20 mA
- Digital values _____
 - _____ -4000 to 0 to 4000 (Resolution: 1/4000)
 - _____ -8000 to 0 to 8000 (Resolution: 1/8000)
 - _____ -12000 to 0 to 12000 (Resolution: 1/12000)

- (2) Analog input values through CH1 and CH2 are calculated by using preset function expressions and their output is through CH3 as analog values. Simple loop control is possible by using the function expressions.



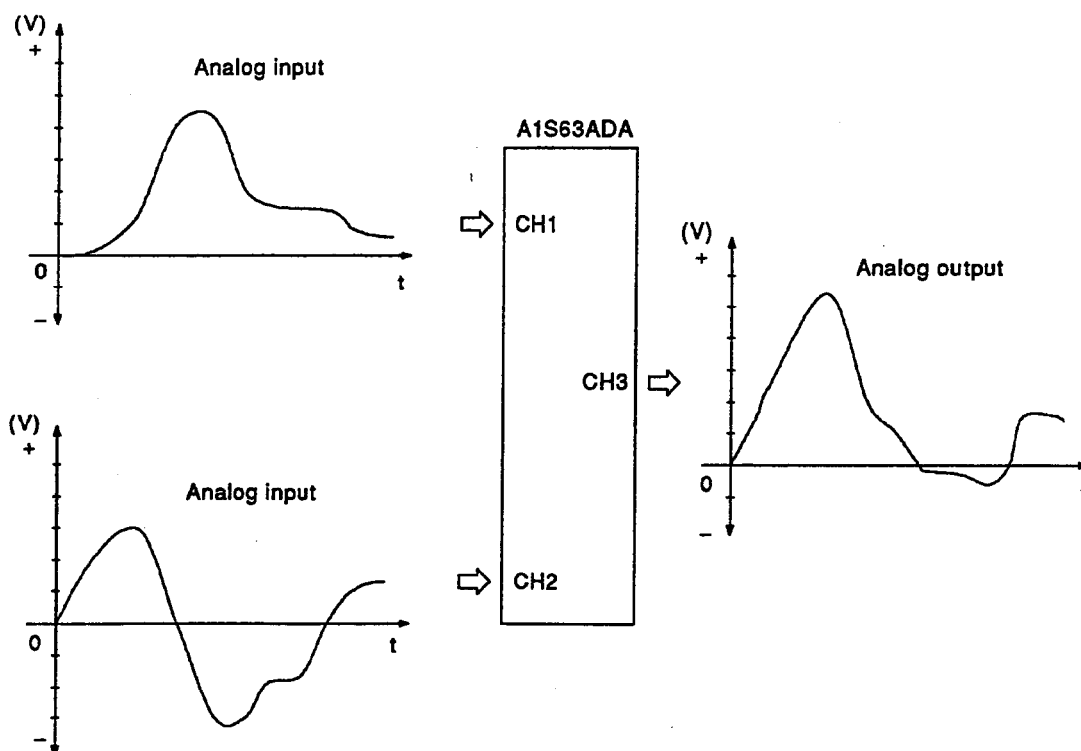
The following three function expressions are used:

Function expression

- (1) $y = AX_1 + BX_2 + C$
- (2) $y = A \frac{X_1}{X_2} + C$
- (3) Coordinate designation:
CH1 analog input/CH3 analog output

A, B, C: Constant
 X_1 : CH1 analog input value
 X_2 : CH2 analog input value
 y : CH3 analog output value

In the example below, the function expression " $y=AX_1+BX_2+C$ " is used with constants A and B as 1 and C as 0 so that the expression used for control is $y=X_1+X_2$ (sum of CH1 and CH2 is output to CH3).



<Application example>

The following operation control is possible by the simple loop control:

Thickness Control

[Description of control]

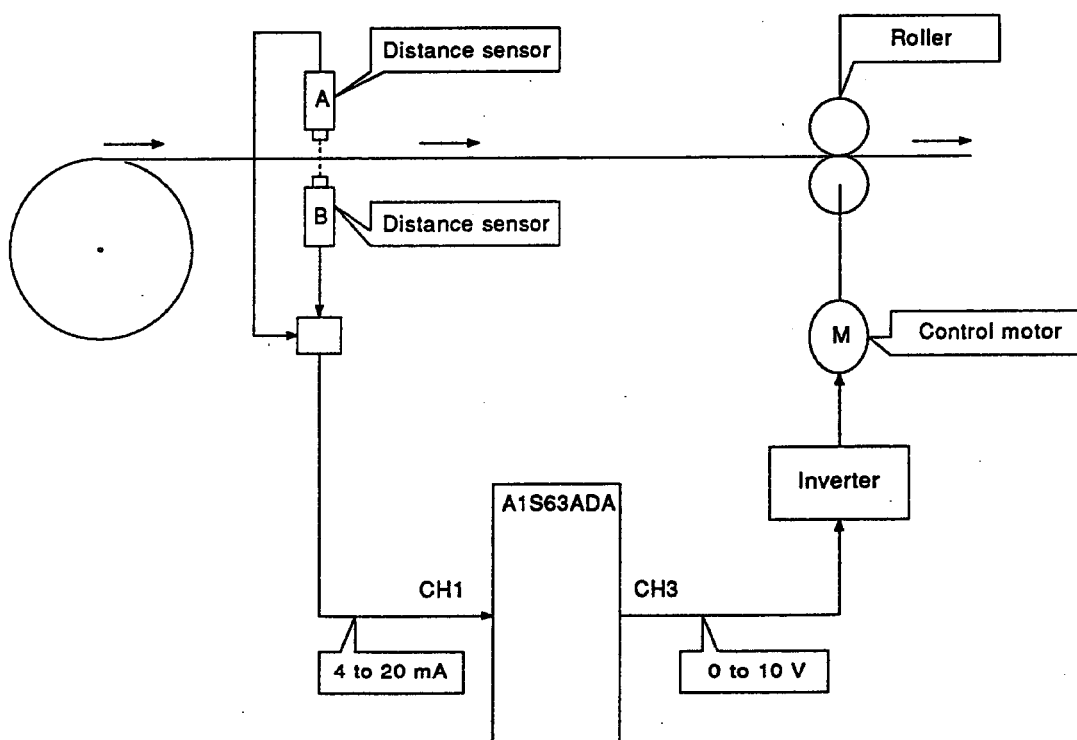
To keep the material thickness at a constant value, sensors are used to measure the thickness, and the A1S63ADA is used to control the roller rotation speed.

[How the system works]

The material thickness measured by a pair of distance sensors is input as an analog value (4 to 20 mA) to CH1.

When the measured value is smaller than the standard value, the analog output value (0 to 10 V) at CH3 is reduced so that the control motor speed is reduced.

When the measured value is larger than the standard value, the analog output value (0 to 10 V) at CH3 is increased so that the control motor speed is increased.



1.1 Features

The A1S63ADA features are listed in each of the following subsections:

1.1.1 A-D and D-A conversions

- (1) High-speed A-D and D-A conversions are possible.

The following high-speed conversions per channel according to resolution setting are possible:

- 1) 1/4000 1 ms/ch (A-D conversion), 1 ms (D-A conversion)
- 2) 1/8000 2 ms/ch (A-D conversion), 2 ms (D-A conversion)
- 3) 1/12000 3 ms/ch (A-D conversion), 3 ms (D-A conversion)

- (2) 1/12000 high resolution is available.

Digital value resolution can be set for 1/4000, 1/8000, or 1/12000. Resolution setting applies equally to all channels.

- (3) A-D conversion at two channels and D-A conversion at one channel are possible.

By using one A1S63ADA module, A-D conversion at two channels and D-A conversion at one channel are possible. Selection of voltage and current can be made for each channel.

- (4) Two processing methods are available with A-D conversion.

- (a) Sampling processing Digital values after A-D conversion are consecutively stored to the buffer memory.
- (b) Average processing Data collected in a preset time or number of times are averaged and stored to the buffer memory.

- (5) A-D or D-A conversion is enabled or disabled.

A-D or D-A conversion is enabled or disabled with each channel. When resolution setting is 1/4000, the sampling time for A-D conversion is 1 msec with one channel enabled, and 2 msec with two channels enabled. For D-A conversion, the sampling time is fixed since only one channel is available.

- (6) Analog output value after D-A conversion is enabled or disabled.

Analog output value after D-A conversion is enabled or disabled. Sequence programs can also be used for enabling or disabling the analog output values after D-A conversion.

- (7) D-A conversion output can be held or cleared when the PC CPU is in the STOP state.

Analog output value after D-A conversion when the PC CPU is in the STOP state can be held or cleared (offset value or 0 V/0 mA) by setting with the HLD/CLR terminal.

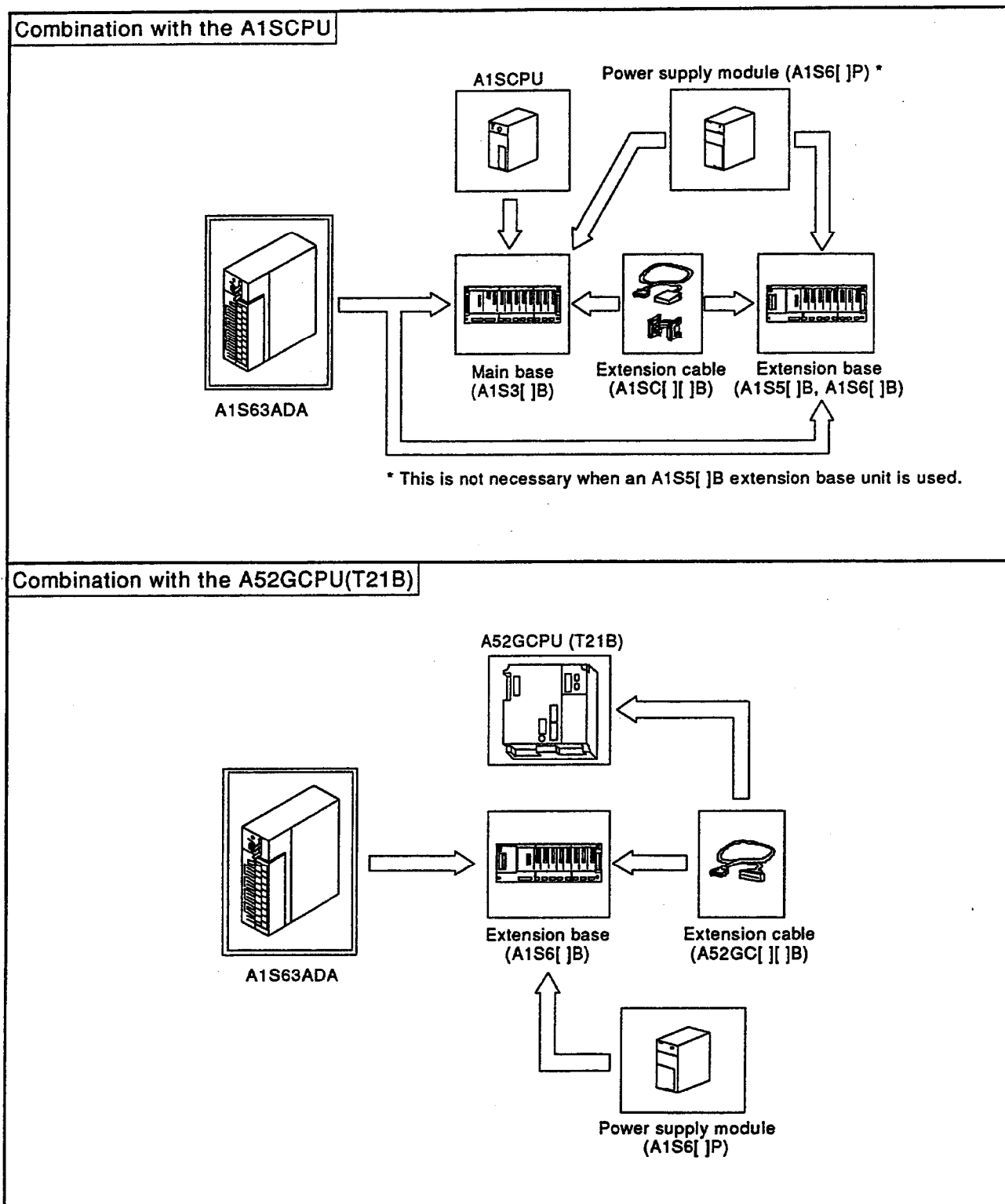
- (8) Analog output value can be limited.

Analog output value at CH3 can be limited by setting the upper/lower limit values.

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2. SYSTEM CONFIGURATION

The following system configurations are possible when using an A1S63ADA.



(1) Applicable CPU types

- A1SJCPU(S3)
- A1SJHCPU(S8)
- A1SCPU(S1)
- A1SCPUC24-R2
- A1SHCPU
- A2SCPU(S1)
- A2SHCPU(S1)
- A2ASCPU(S1/S30)
- A2USHCPU-S1
- Q2ASCPU(S1)
- Q2ASHCPU(S1)
- A52GCPU(T21B)

(2) Number of modules installed

The number of modules to be installed is not limited as long as the number of I/O points is within the I/O point ranges of the applicable CPU.

(3) Installing slots

The A1S63ADA can be installed to any slot in the base unit except the following cases.

When the A1S63ADA is installed to an extension base unit (A1S52B, A1S55B, or A1S58B) which is not equipped with a power supply module, the power supply capacity may sometimes be inadequate.

When installing the A1S63ADA to an extension base unit which is not connected to a power supply module, consider the following items when selecting the appropriate power supply module, main base unit, extension base unit, and extension cable.

- (1) Current capacity of the power supply module on the main base unit
- (2) Voltage drop in the main base unit
- (3) Voltage drop in the extension base unit
- (4) Voltage drop in the extension cable

REMARK

Refer to the following manuals for the I/O point ranges and the calculation procedure for voltage drop

- type A1SJCPU(S3) User's Manual..... IB-66446
- type A1S/A1SC24-R2/A2SCPU(S1) User's Manual IB-66320
- type A2ASCPU(S1) User's Manual IB-66455
- A52GCPU(T21B) User's Manual IB-66419
- A52GCPU(T21B) Reference Manual..... IB-66420
- type A1SJH(S8)/A1SH/A2SHCPU(S1) User's Manual IB-66779
- type A2USHCPU-S1 User's Manual..... IB-66789
- Model Q2AS(H)CPU(S1) User's Manual..... SH-3599

3. SPECIFICATIONS

This section gives the performance specifications, functions, I/O signals, and buffer memory of the A1S63ADA.

Refer to the applicable PC CPU user's manual regarding the general specifications of the A1S63ADA.

3.1 Performance Specifications

Table 3.1 gives the performance specifications of the A1S63ADA.

Table 3.1 Performance Specifications

Item			Specifications							
A-D conversion	Analog input		Voltage: -10 to 0 to 10 V DC (input resistance: 1 MΩ) Current: -20 to 0 to 20 mA DC (input resistance: 250 Ω)							
	Digital output		-4096 to 4095 (at 1/4000 resolution setting) -8192 to 8191 (at 1/8000 resolution setting) -12288 to 12287 (at 1/12000 resolution setting)							
	I/O characteristics *1	Analog input	Digital value output							
			1/4000	1/8000	1/12000					
		10 V 5 V or 20 mA 0 V or 4 mA -5 V or -12 mA -10 V	4000 2000 0 -2000 -4000	8000 4000 0 -4000 -8000	12000 6000 0 -6000 -12000					
		Max. resolution	Voltage Current	2.5 mV 10 μA	1.25 mV 5 μA	0.83 mV 3.33 μA				
		Conversion speed	—	1 ms/ch	2 ms/ch	3 ms/ch				
	Overall accuracy *2	±1%	±40	±80	±120					
	Absolute max. input		Voltage: ±15 V Current: ±30 V							
	Analog input points		2 channels							
D-A conversion	—		Voltage output			Current output				
	Digital input		-4000 to 4000 (at 1/4000 resolution setting) -8000 to 8000 (at 1/8000 resolution setting) -12000 to 12000 (at 1/12000 resolution setting)			0 to 4000 (at 1/4000 resolution setting) 0 to 8000 (at 1/8000 resolution setting) 0 to 12000 (at 1/12000 resolution setting)				
	Analog output		-10 to 0 to 10 V DC (external load resistance: 2 kΩ to 1 MΩ)			0 to 20 mA DC (external load resistance: 0 Ω to 600 Ω)				
	I/O characteristics *3		1/4000	1/8000	1/12000	Analog output value	1/4000	1/8000	1/12000	Analog output value
			4000 2000 0 -2000 -4000	8000 4000 0 -4000 -8000	12000 6000 0 -6000 -12000	10 V 5 V 0 V -5 V -10 V	4000 2000 0 — —	8000 4000 0 — —	12000 6000 0 — —	20 mA 12 mA 4 mA — —
		Max. resolution	1/4000 1/8000 1/12000	2.5 mV 1.25 mV 0.83 mV			5 μA 2.5 μA 1.7 μA			
		Conversion speed *4		1 ms (1/4000) 2 ms (1/8000) 3 ms (1/12000)						
	Overall accuracy *5		±1% (±0.1V)				±1% (±0.2mA)			

*1 ... When offset setting is 0 V/4 mA and gain setting is 5 V/20 mA

*2 ... Accuracy of max. digital output value. Max. digital output value means the maximum value of a selected resolution for both current/voltage input characteristics.

*3 ... When offset setting is 0 V/4 mA and gain setting is 10 V/20 mA

*4 ... Conversion may be delayed by up to one conversion processing time unit due to the timing of digital value writing of the PC CPU. The response time of the amplifier which outputs data after D-A conversion is 1 msec at maximum.

*5 ... Accuracy of max. analog output value.

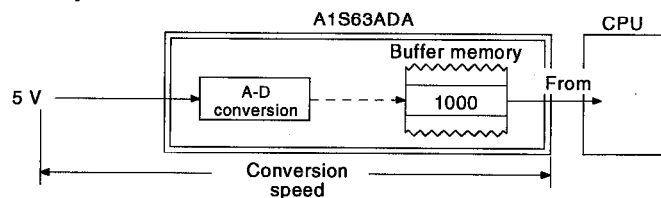
Table 3.1 Performance Specifications (Continued)

Item		Specifications			
D-A conversion	Absolute max. output	Voltage: ± 12 V Current: +28 mA			
	Output shorting protection	Provided			
	Analog output points	1 channel			
Common to A-D and D-A conversions	Isolation specification	Specific isolated area	Isolation method	Dielectric withstand voltage	Insulation resistance
		Between I/O terminal and PLC power supply	Photocoupler isolation	500V AC for 1 minute	5M Ω or more (measured with a 500V DC insulation resistance tester)
		Between channels	Not isolated	-	-
Conversion speed in *6 simple loop control		4 ms (1/4000) 7ms (1/8000) 9 ms (1/12000)			
Number of occupying I/O points		32 points			
Connecting terminal base		20-point terminal base (M3.5 x 7 screws)			
Applicable wire size		0.75 to 1.5 mm ²			
Applicable crimp terminal		1.25-3.5 1.25-YS3A 2-3.5 2-YS3A V1.25-M3 V1.25-YS3A V2-S3 V2-YS3A			
Internal current consumption (5VDC)		0.8 A			
Weight		0.3 kg			

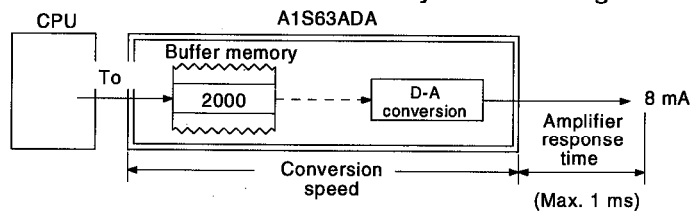
*6 ... The response time of the amplifier which outputs data after D-A conversion is 1 ms.

Maximum conversion speed

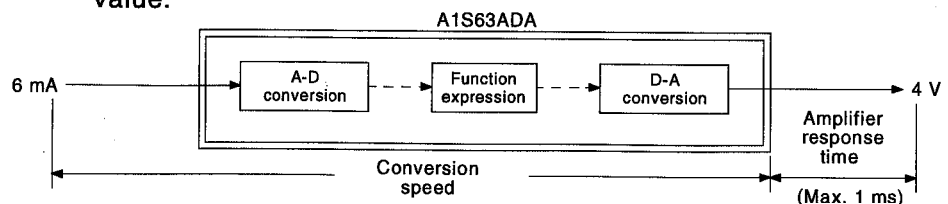
- (1) A-D conversion Conversion speed is defined by the time required for converting the input analog value to the digital value and storing it to the buffer memory.



- (2) D-A conversion Conversion speed is defined by the time required for converting the digital value stored in the buffer memory to the analog value.



- (3) Simple loop control Conversion speed is defined by the time required for converting the input analog value to the digital value and for converting the digital value calculated by function expressions to the analog value.



3.2 A-D Conversion I/O Characteristics

The I/O characteristics of A-D conversion are defined by the inclination of a straight line which passes the offset and gain coordinates when the analog value (voltage or current) input from outside the PC is converted to the digital value.

- (1) An offset value is defined as an analog input value (voltage or current) with which "0" digital output is obtained after A-D conversion.
- (2) A gain value is defined as an analog input value (voltage or current) with which the following digital output values are obtained after A-D conversion:
 - (a) 2000 (at 1/4000 resolution)
 - (b) 4000 (at 1/8000 resolution)
 - (c) 6000 (at 1/12000 resolution)

Fig. 3.1 shows an example of the I/O characteristics of A-D conversion of the A1S63ADA.

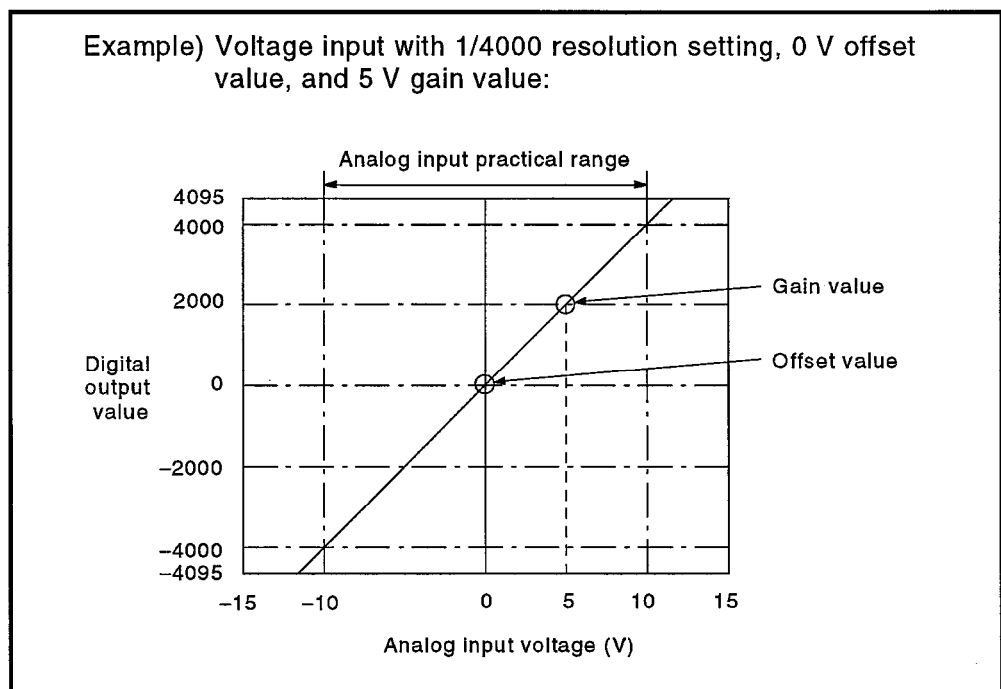


Fig. 3.1 A-D Conversion I/O Characteristics

3. SPECIFICATIONS

MELSEC-A

3.2.1 Voltage input characteristics

Fig. 3.2 shows the voltage input characteristics when offset/gain settings are changed.

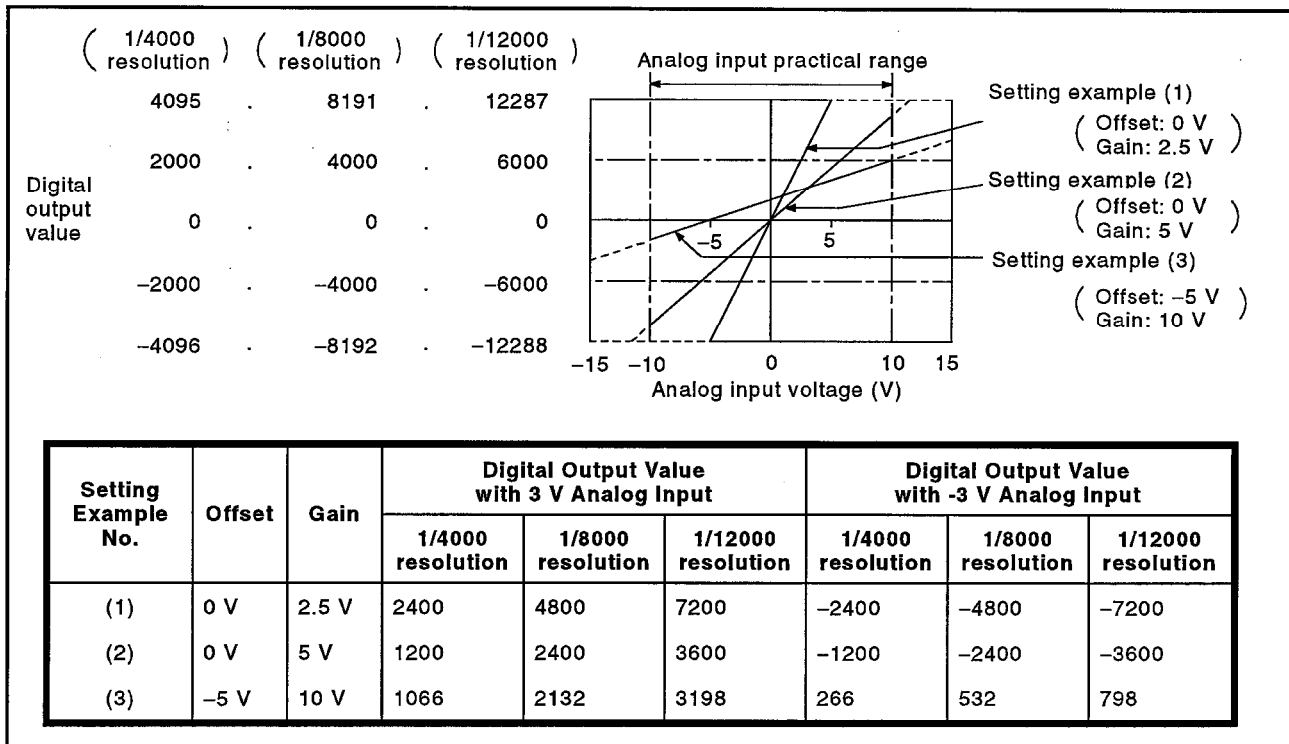


Fig. 3.2 Voltage Input Characteristics

POINTS

- Input voltage must be in -15 to 15 V range.
When a voltage outside the -15 to 15 V range is input, computer chips may sometimes be damaged.
- The maximum resolution and the overall accuracy listed in the performance specifications are obtained when the input voltage is in -10 to 10 V range.
When a voltage outside the -10 to 10 V range is input, the accuracies listed by the performance specifications may not be obtained.
(Do not use the values indicated by dotted lines shown in Fig. 3.2.)
- When an analog input value makes the digital output value exceed the maximum value (4095, 8191, or 12287) or the minimum value (-4096, -8192, or -12288) at set resolution, the digital output value is fixed at the maximum (4095, 8191, or 12287) or the minimum value (-4096, -8192, or -12288) at set resolution.
- Always follow the conditions mentioned below when setting the offset/gain values. When a setting does not conform to the condition, the appropriate voltage input characteristics are not guaranteed.

Resolution	n [V]
1/4000	1.0
1/8000	1.5
1/12000	2.0

$$\{ (\text{Gain value}) - (\text{Offset value}) \} > \pm n$$

3. SPECIFICATIONS

MELSEC-A

3.2.2 Current input characteristics

Fig. 3.3 shows the current input characteristics when offset/gain settings are changed.

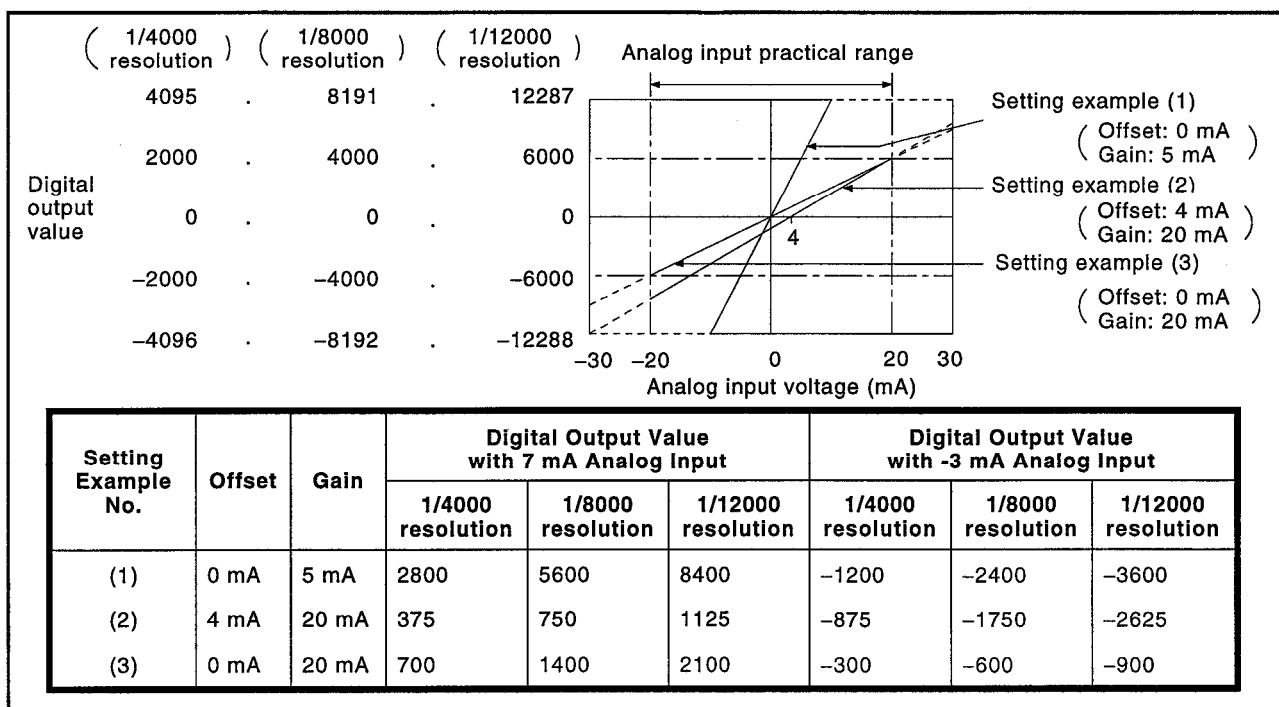


Fig. 3.3 Current Input Characteristics

POINTS

- (1) Input current must be in -30 to 30 mA range.
When a current outside the -30 to 30 mA range is input, heat will build up inside the module and a malfunction may occur.
- (2) The maximum resolution and the overall accuracy listed in the performance specifications are obtained when the input current is in -20 to 20 mA range.
When a current outside the -20 to 20 mA range is input, the accuracies listed in the performance specifications may not be obtained. (Do not use the values indicated by dotted lines shown in Fig. 3.3.)
- (3) When an analog input value makes the digital output value exceed the maximum value (4095, 8191, or 12287) or the minimum value (-4096, -8192, or -12288) at set resolution, the digital output value is fixed at the maximum (4095, 8191, or 12287) or the minimum value (-4096, -8192, or -12288) at set resolution.
- (4) Always follow the conditions mentioned below when setting the offset/gain values. When a setting does not conform to the condition, the appropriate voltage input characteristics are not guaranteed.

Resolution	n [mA]
1/4000	4.0
1/8000	6.0
1/12000	8.0

$$\{ (\text{Gain value}) - (\text{Offset value}) \} > \pm n$$

3.2.3 Relationship between offset/gain settings and digital output value

The relationship between offset/gain settings and digital output value is as explained below.

(1) Resolution

The resolution is obtained by the following formula:

(a) Voltage input

$$\text{Resolution} = \frac{(\text{Gain value}) - (\text{Offset value})}{A} \times 1000 \text{ [mA]}$$

..... Voltage width in which the digital output value increases or decreases by "1".

(b) Current input

$$\text{Resolution} = \frac{(\text{Gain value}) - (\text{Offset value})}{A} \times 1000 \text{ [}\mu\text{A]}$$

..... Current width in which the digital output value increases or decreases by "1".

- The value "A" in the above formula is determined as follows:

Resolution	Value A
1/4000	2000
1/8000	4000
1/12000	6000

(2) Relationship between the maximum resolution and digital output value

When the condition specified by the following formula is not satisfied, the increment (decrement) of digital output value will not be "1".

$$\frac{(\text{Gain value}) - (\text{Offset value})}{A} \times 1000 < \text{Max. resolution}$$

- The value "A" and the maximum resolution in the above formula are provided as follows:

Resolution	Value A	Max. Resolution	
		Voltage [mA]	Current [μA]
1/4000	2000	2.5	10
1/8000	4000	1.25	5
1/12000	6000	0.83	3.33

(3) Overall accuracy

Overall accuracy is when digital output is at the maximum value. The overall accuracy is maintained within the range listed in the performance specifications even when the input characteristics are changed by changing the offset/gain settings. Figs. 3.4 and 3.5 show the overall accuracy of the voltage/current input characteristics.

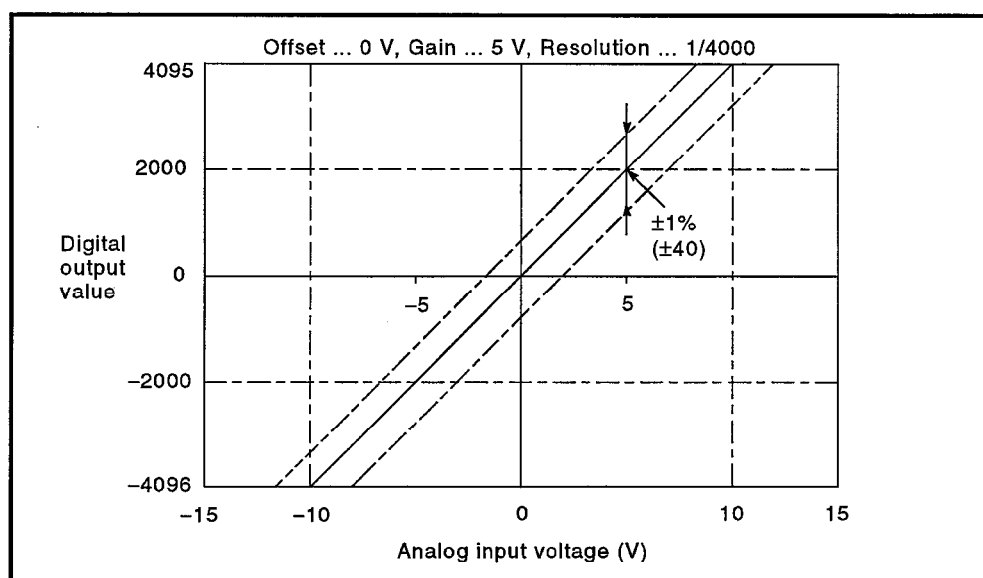


Fig. 3.4 Overall Accuracy of the Voltage Input Characteristics

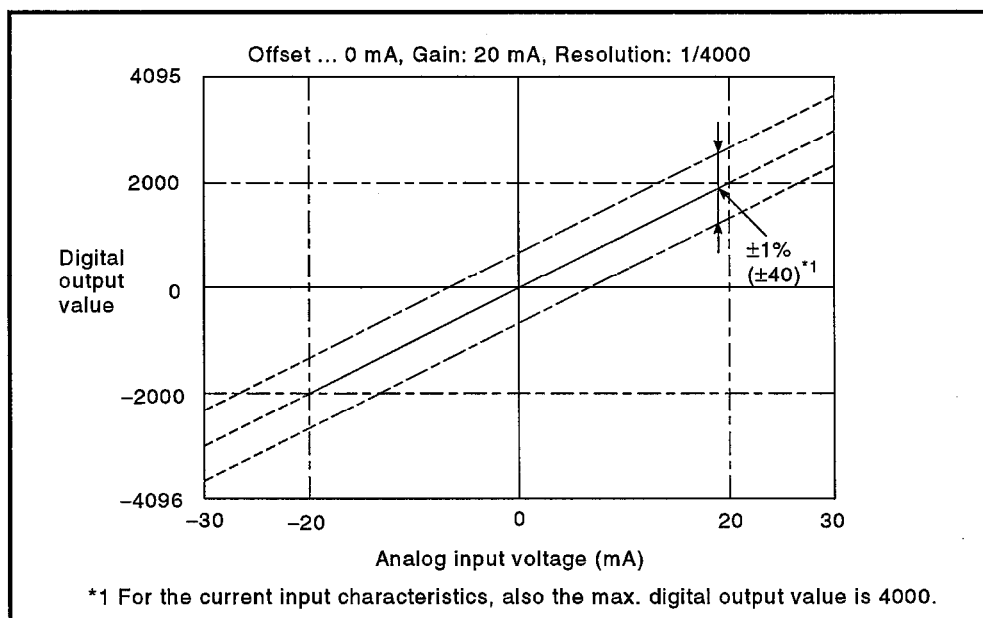


Fig. 3.5 Overall Accuracy of the Current Input Characteristics

3.3 D-A Conversion I/O Characteristics

The I/O characteristics of D-A conversion are defined by the inclination of a straight line which passes the offset and gain coordinates when the digital value set with the PC CPU is converted to the analog value (voltage or current).

- (1) An offset value is defined as an analog value (voltage or current) output from the A1S63ADA when the digital input value is "0".
- (2) A gain value is defined as an analog value (voltage or current) output from the A1S63ADA when the following digital values are input:
 - 1) 4000 (at 1/4000 resolution)
 - 2) 8000 (at 1/8000 resolution)
 - 3) 12000 (at 1/12000 resolution)

Fig. 3.6 shows an example of the I/O characteristics of D-A conversion of the A1S63ADA.

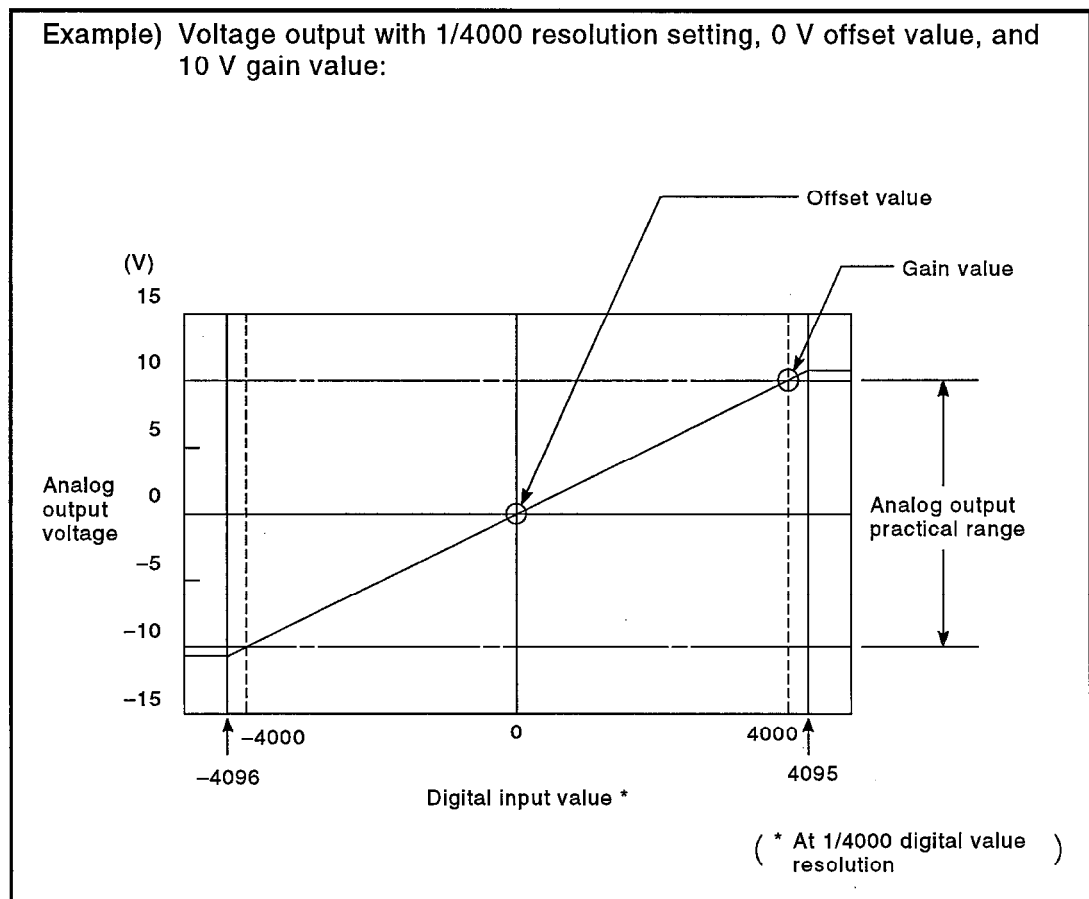


Fig. 3.6 D-A Conversion I/O Characteristics

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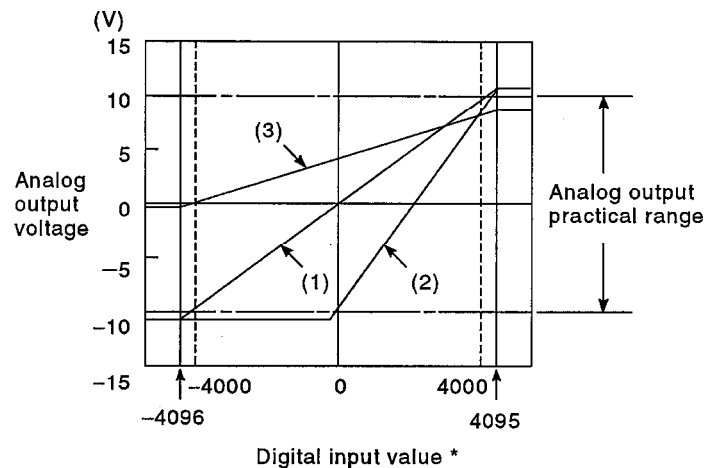
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3.3.1 Voltage output characteristics

Fig. 3.7 shows the voltage output characteristics when offset/gain settings are changed.

The chart on the right shows the I/O conversion characteristics when offset/gain settings are made as given below.

No.	Offset Value	Gain Value
(1)	0 V	+10 V
(2)	-10 V	+10 V
(3)	+4 V	+8 V



(* At 1/4000 digital value resolution)

Example

The analog output voltage when the digital input value is set at 2000 and 500 with the characteristics chart numbers (1) to (3) above is as follows.

No.	Digital Input Value	Analog Output Value
(1)	2000	5.0 V
	500	1.25 V
(2)	2000	0 V
	500	-0.75 V
(3)	2000	6.0 V
	500	4.5 V

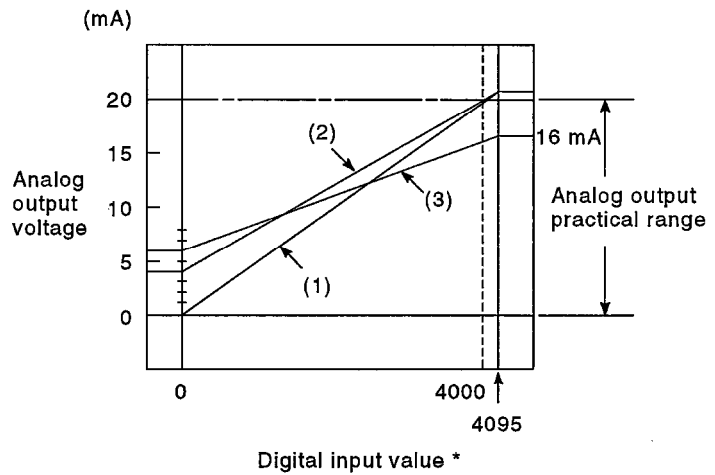
Fig. 3.7 Voltage output characteristics

3.3.2 Current output characteristics

Fig. 3.8 shows the current output characteristics when offset/gain settings are changed.

The chart on the right shows the I/O conversion characteristics when offset/gain settings are made as given below.

No.	Offset Value	Gain Value
(1)	0 mA	20 mA
(2)	4 mA	20 mA
(3)	6 mA	16 mA



(* At 1/4000 digital value resolution)

Example

The analog output voltage when the digital input value is set at 2000 and 1000 with the characteristics chart numbers (1) to (3) above is as follows.

No.	Digital Input Value	Analog Output Value
(1)	2000	10 mA
	1000	5 mA
(2)	2000	12 mA
	1000	8 mA
(3)	2000	11 mA
	1000	8.5 mA

Fig. 3.8 Current output characteristics

3.3.3 Relationship between offset/gain settings and analog output value

The relationship between offset/gain settings and analog output value is as explained below.

(1) Resolution

The resolution is obtained by the following formula:

(a) Voltage input

$$\text{Resolution} = \frac{(\text{Gain value}) - (\text{Offset})}{A^{*1}} \dots\dots \text{Voltage width in which the digital value increases or decreases by "1".}$$

(b) Current input

$$\text{Resolution} = \frac{(\text{Gain value}) - (\text{Offset})}{A^{*1}} \dots\dots \text{Current width in which the digital value increases or decreases by "1".}$$

(2) Analog output

Analog output

$$\begin{aligned} &= \frac{(\text{Gain value}) - (\text{Offset})}{A^{*1}} \times (\text{Digital input value}) + (\text{Offset value}) \\ &= (\text{Resolution}) \times (\text{Digital input value}) + (\text{Offset value}) \end{aligned}$$

*1 The value "A" in the formula in (1) and (2) above is determined as follows:

Resolution	Value A
1/4000	4000
1/8000	8000
1/12000	12000

POINT

The A1S63ADA's maximum resolution of analog values varies according to resolution setting as given in Table 3.2 of performance specifications. Therefore, the analog output variations when the digital value increment (decrement) is "1" may sometimes be different from the result obtained by the formula given above.

(3) Overall accuracy

Overall accuracy is when the analog output is at the maximum value. The overall accuracy is maintained within the range listed in the performance specifications even when the output characteristics are changed by changing the offset/gain settings.

Figs. 3.9 and 3.10 show the overall accuracy of the voltage/current output characteristics.

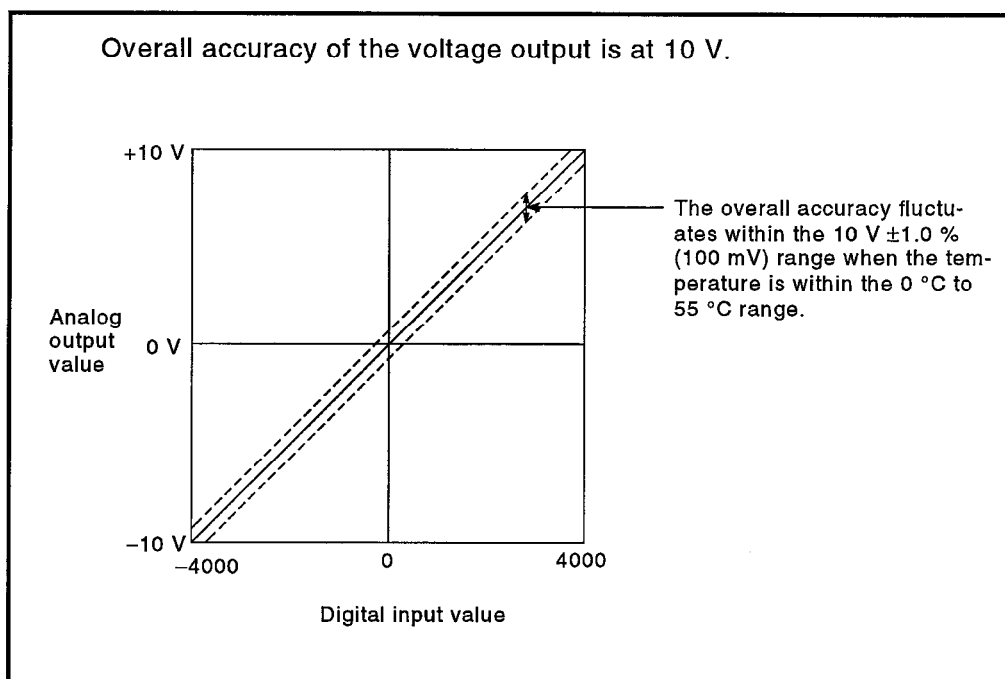


Fig. 3.9 Overall accuracy of the voltage output characteristics

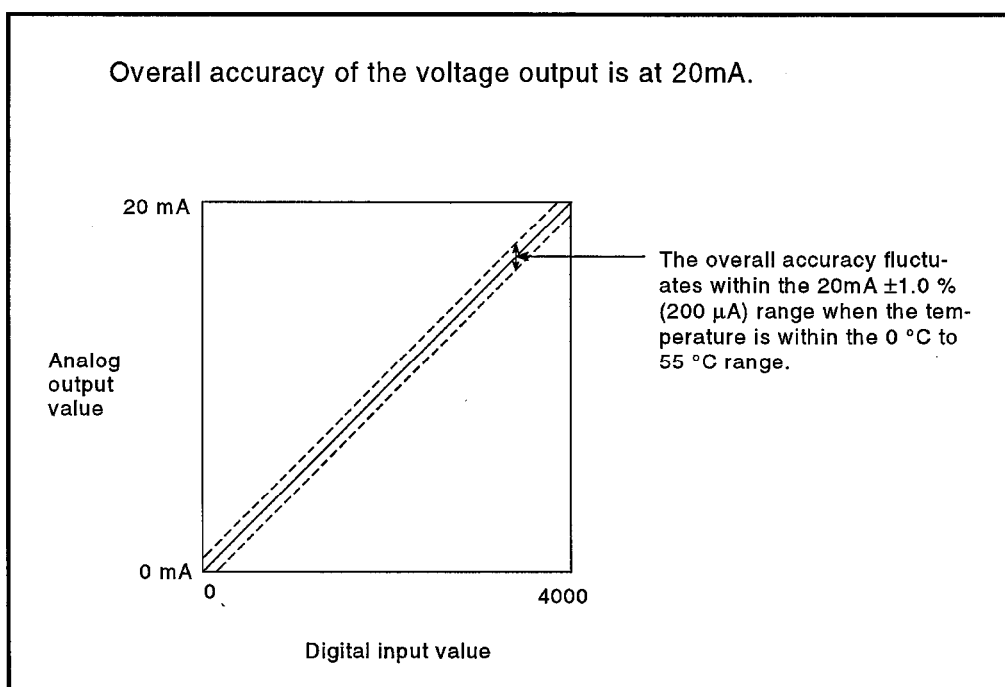


Fig. 3.10 Overall accuracy of the current output characteristics

3.4 Functions

This section gives the functions of the A1S63ADA.

Refer to Sections 3.6 and 3.7 for the I/O signals used for executing functions and the methods of use and setting for the buffer memory.

3.4.1 Enabling/disabling conversion

Each channel can be set for A-D conversion (CH1 and CH2) or D-A conversion (CH3) with the enable/disable options.

Default settings for all channels are "conversion disabled".

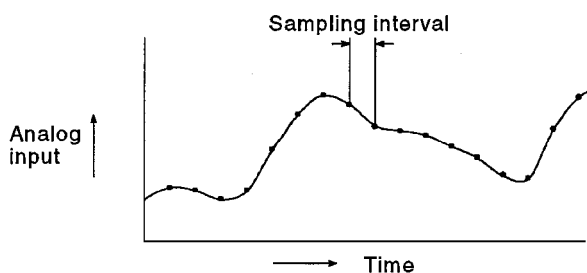
The A-D/D-A conversion enable/disable settings are made with buffer address 0.

The sampling time of the A-D conversion with an enabled channel can be shortened by setting unused channels for "conversion disabled".

3.4.2 Sampling

Digital values after A-D conversion are stored to the buffer memory at pre-set sampling intervals. This setting can be made for each channel.

This setting is made with A-D conversion averaging setting (buffer address 1).



• ... Analog input used for A-D conversion

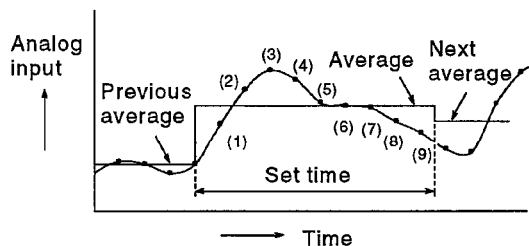
Sampling Interval

Resolution	Number of Channels Set for A-D Conversion	
	1 channel	2 channels
1/4000	1 ms	2 ms
1/8000	2 ms	4 ms
1/12000	3 ms	6 ms

3.4.3 Averaging

Data after A-D conversion is accumulated according to the preset time or number of times of conversion, and then, averaged and stored to the buffer memory. This setting can be made for each channel.

This setting is made with A-D conversion averaging setting (buffer address 1) and averaging time/count setting (addresses 2 and 3).



Values less the largest and smallest values are averaged.

(1) Time averaging

Averaging is done at time intervals which are set with each channel, and averaged digital values are stored to the buffer memory.

(2) Count averaging

Averaging is done at the number of times (count) of conversion set with each channel, and averaged digital values are stored to buffer memory. The processing time of count averaging is "sampling time x set number of times".

3.4.4 Analog output hold/clear when the PC CPU is in the STOP state (D-A conversion)

Analog output value after D-A conversion when the PC CPU is in the STOP state can be held or cleared (offset value or 0 V/0 mA) by setting with the HLD/CLR terminal.

3.4.5 Analog output enable/disable setting (D-A conversion)

Output of the analog values after D-A conversion is enabled or disabled. This setting is made with CH3 D-A conversion output enable (Y10) ON/OFF setting.

3.4.6 Analog output value limit (D-A conversion)

Analog output value at CH3 can be limited by setting the upper/lower limit values (addresses 4 and 5). This limitation can be canceled with CH3 upper/lower limit cancel (Y13) setting.

3.4.7 Simple loop control (Function expressions)

Analog input values through CH1 and CH2 are converted to digital values, calculated by using preset function expressions, and then, output through CH3 as analog values.

The following three function expressions are used:

Function expression	(1) $y = AX_1 + BX_2 + C$	A : Constant
	(2) $y = A \frac{X_1}{X_2} + C$	B : Constant
	(3) Coordinate designation	C : Constant
		X ₁ : CH1 digital value
		X ₂ : CH2 digital value
		y : CH3 digital value

No limitation applies to the calculated value. The digital value range for D-A conversion varies according to resolution setting.

Resolution	Digital Value Range for D-A Conversion
1/4000	-4096 to 4095
1/8000	-8192 to 8191
1/12000	-12288 to 12287

- (1) Select function expression by setting the type of simple loop control (buffer address 6).
- (2) Set the constants A, B, and C for function expressions (1) and (2) (buffer addresses 7, 8, and 9).
- (3) When function expression (3) above is selected, set the coordinate points (buffer address 17) and the CH1/CH3 coordinates for points 0 to 9 (buffer addresses 18 to 37).
- (4) The simple loop control is executed by turning ON the simple loop control execution enable signal (Y11).

- (1) When the function expression is $y = AX_1 + BX_2 + C$

Digital values after A-D conversion in CH1 and CH2 are assigned to the above expression. The resultant digital values are then converted to analog values and output through CH3.

- (a) The calculation result is stored to buffer address 13.
- (b) When the digital value of CH1 or CH2 is not used for calculation, set the constant (A or B) that corresponds to the channel at "0".
- (c) When averaging has been set with A-D conversion, the value after averaging is used for calculation.
- (d) It is possible to change the constant (A, B, and C) during the execution of simple loop control.

- (2) When the function expression is $y = A \frac{X_1}{X_2} + C$

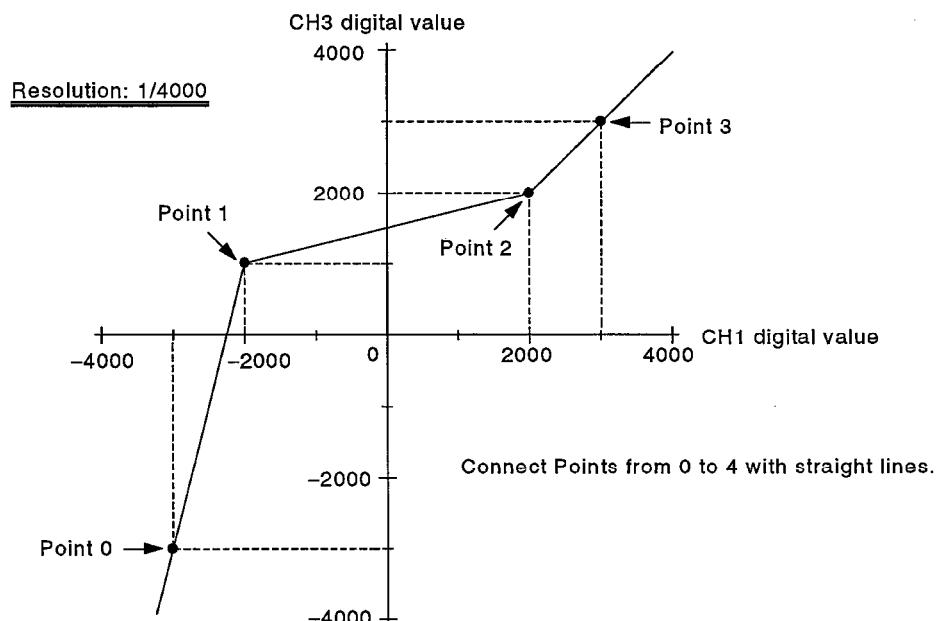
Digital values after A-D conversion in CH1 and CH2 are assigned to the above expression. The resultant digital values are then converted to analog values and output through CH3.

- (a) The calculation result is stored to buffer address 13.
- (b) When the digital value X_2 of CH2 is "0", it is calculated as "1".
- (c) When averaging has been set with A-D conversion, the value after averaging is used for calculation.
- (d) It is possible to change the constant (A and C) during the execution of simple loop control.

- (3) When coordinate designation is used

Digital value of CH3 corresponding to the digital value of CH1 is output according to the digital values of CH1 and CH3 for which points have been set on the two-dimensional coordinates.

- (a) The calculation result is stored to buffer address 13.
- (b) CH2 can be used regardless of simple loop control.
- (c) It is impossible to change the point and coordinate settings during the execution of simple loop control.



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3.4.8 Analog output states and function settings

The analog output state of CH3 varies according to "HLD/CLR terminals", "analog value external output enable/disable", and "D-A conversion enable/disable" settings and the state of PC CPU or A1S63ADA.

Table 3.2 gives the analog output states and function settings.

Table 3.2 Analog output state combinations

Execution State Setting Combination	HLD/CLR Terminals	Open (Clear)				Shorted (Hold)	
	Analog Value External Output Enable/Disable	Enable (Y10: ON)		Disable (Y10: OFF)		_____	
	D-A Conversion Enable/Disable	Enable (1)	Disable (0)	Enable (1)	Disable (0)	Enable (1)	Disable (0)
Analog output state when CPU is in the RUN state		The value after D-A conversion of the value set by the CPU is output.	0 V/0 mA	Offset value is output.	0 V/0 mA	The value after D-A conversion of the value set by the CPU is output.	0 V/0 mA
Analog output state when CPU is in the STOP state		Offset value is output.	0 V/0 mA	Offset value is output.	0 V/0 mA	The analog value before the CPU stops is held.	0 V/0 mA
Analog output state when CPU causes an error		0 V/0 mA	0 V/0 mA	0 V/0 mA	0 V/0 mA	0V/0 mA	0 V/0 mA
Analog output state when ^{*1} A1S63ADA causes an error (error code 107)		The upper or lower limit analog value is output.	0 V/0 mA	Offset value is output.	0 V/0 mA	The upper or lower limit analog value is output.	0 V/0 mA

^{*1} ... Error codes other than 107 have no relation to the CH3 analog output.

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3.5 I/O Signals Used for Communications with a PC CPU


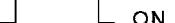
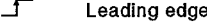



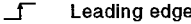

The A1S63ADA uses 32 input points and 32 output points for communications with a PC CPU.

The device numbers and signal names used for the I/O signals are as given in the table below.

The X devices are used for the signals transmitted from the A1S63ADA to a PC CPU, and the Y devices are used for the signals transmitted from a PC CPU to the A1S63ADA.

The following I/O (X/Y) numbers are allocated when the A1S63ADA is installed to "slot 0" of the main base unit.

Table 3.3 List of I/O signals

Signal Direction: A1S63ADA → PC CPU			Signal Direction: PC CPU → A1S63ADA			
Device No.	Signal Name		Device No.	Signal Name	Operation Timing	
X00	WDT error		Y00	Unusable *		
X01	Conversion READY		Y01			
X02	Error detection		Y02			
X03	CH3 output upper limit value hold		Y03			
X04	CH3 output lower limit value hold		Y04			
X05	Simple loop control in execution		Y05			
X06	Unusable		Y06			
X07			Y07			
X08	Resolution	Offset/gain selection	Y08			
X09			Y09			
X0A	CH1 voltage/current		Y0A			
X0B	CH2 voltage/current		Y0B			
X0C	CH3 voltage/current		Y0C			
X0D	Unusable		Y0D			
X0E			Y0E			
X0F			Y0F			
X10			Y10	CH3 D-A conversion value output enable		
X11			Y11	Simple loop control execution enable		
X12			Y12	Error reset		
X13			Y13	CH3 upper/lower limits cancel		
X14			Y14	Unusable *		
X15			Y15			
X16			Y16			
X17			Y17			
X18			Y18	Resolution selection	Offset/gain selection	
X19			Y19			
X1A	Y1A	CH1 voltage/current				
X1B	Y1B	CH2 voltage/current				
X1C	Y1C	CH3 voltage/current				
X1D	Y1D	Offset/gain setting				
X1E	Y1E	Unusable *				
X1F	Y1F					

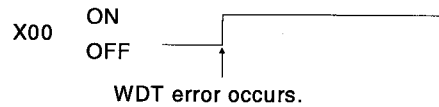
IMPORTANT

*: When device numbers Y00 to 0F, Y14 to 17, and Y1E to Y1F are turned ON/OFF by a sequence program, specified functions of the A1S63ADA are not guaranteed.

(1) X00: WDT error

This device turns ON when a watchdog timer error is generated by the A1S63ADA's self-check function.

When this error occurs, the A-D and D-A conversions are suspended, and the analog output level of A-D conversion becomes 0 V/4 mA.

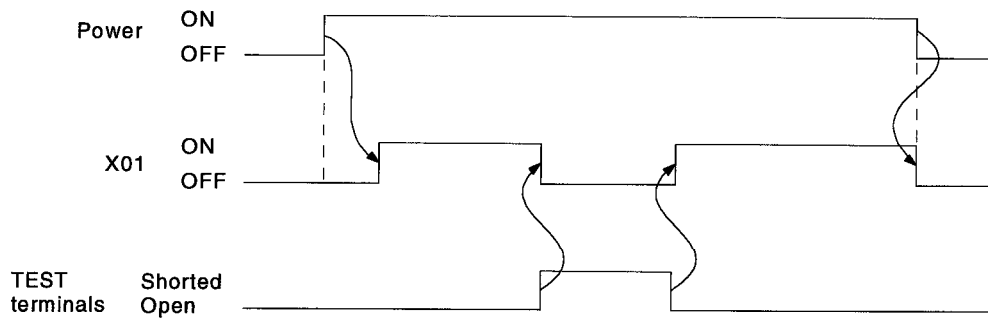


* This device can be used as an interlock for all programs which control the A1S63ADA.

(2) X01: Conversion READY

This device turns ON when the A1S63ADA is ready for A-D and D-A conversions after the PC CPU is powered on or reset.

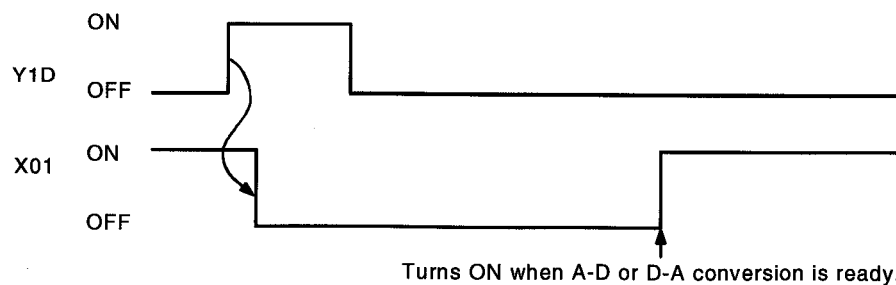
This device turns OFF when the TEST terminals are shorted.



* This device can be used for executing a program for initial setting.

REMARK

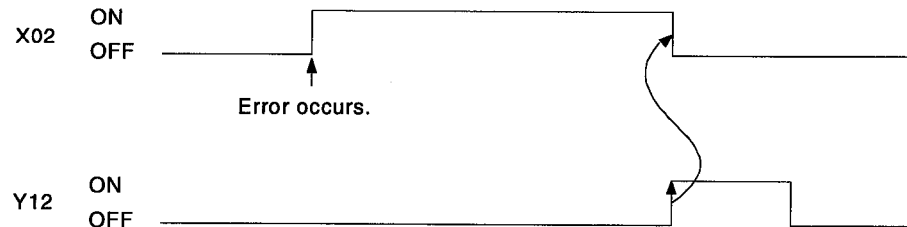
X01 (Conversion READY) turns OFF when Y1D (Offset/gain setting) turns ON (start-up), and turns ON when preparation for A-D or D-A conversion is completed.



Turns ON when A-D or D-A conversion is ready.

(3) X02: Error detection

This device turns ON when an error other than a WDT error (X00) occurs. When this device turns ON, an error code is stored to buffer address 16, and the RUN LED on the front side of the module starts flashing. This device is turned OFF when the error reset (Y12) is turned ON or when "0" is written to buffer address 16. When the error reset (Y12) is turned ON, buffer address 16 turns to "0".



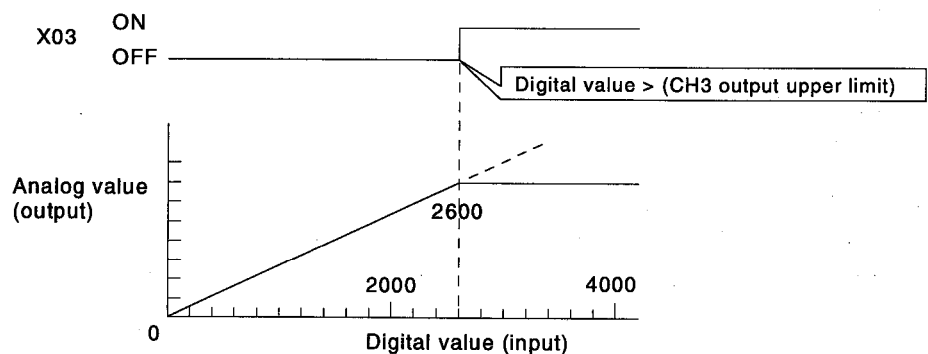
(4) X03: CH3 output upper limit value hold

This device turns ON when the digital value (addresses 10 and 13) for D-A conversion on CH3 exceeds the "CH3 output upper limit value setting" (address 4) and when the output is actually held when Y10 is ON. This device turns OFF when CH3 upper/lower limits cancel (Y13) is ON.

Data to be held varies according to the state of the simple loop control execution enable (Y11).

State of Y11	Digital Value to be Held
ON (simple loop control in execution)	Address 13 (simple loop control output calculation value)
OFF (simple loop control not in execution)	Address 10 (CH3 digital value setting)

Example) When resolution setting is 1/4000 and CH3 output upper limit setting (address 4) is 2600:



(5) X04: CH3 output lower limit value hold

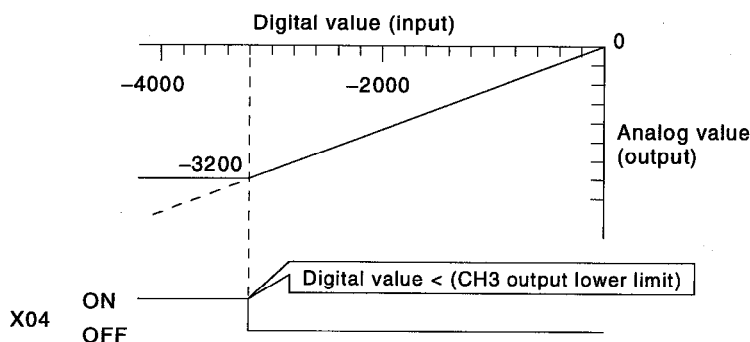
This device turns ON when the digital value (addresses 10 and 13) for D-A conversion on CH3 is less than the "CH3 output lower limit value setting" (address 5) and when the output is actually held when Y10 is ON.

This device turns OFF when CH3 upper/lower limits cancel (Y13) is ON.

Data to be held varies according to the state of the simple loop control execution enable (Y11).

State of Y11	Digital Value to be Held
ON (simple loop control in execution)	Address 13 (simple loop control output calculation value)
OFF (simple loop control not in execution)	Address 10 (CH3 digital value setting)

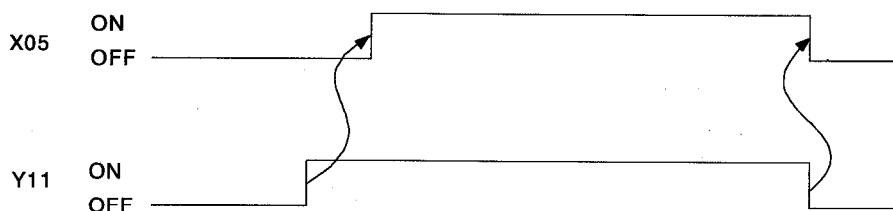
Example) When resolution setting is 1/4000 and CH3 output lower limit setting (address 4) is -3200:



(6) X05: Simple loop control in execution

This device turns ON when simple loop control is in execution after the simple loop control execution enable (Y11) turned ON.

This device turns OFF when the simple loop control execution enable (Y11) turned OFF.



(7) X08 to X0C: Offset/gain selection

Present offset/gain selection are stored in X08 to X0C.
Refer to Section 4.4.1 for the contents pertaining to factory settings.

(a) X08 and X09: Resolution setting state

Device No.	Factory Settings			User Setting
	1/4000	1/8000	1/12000	
X08	ON	OFF	ON	OFF
X09	OFF	ON	ON	OFF

(b) X0A to X0C: Voltage and current settings for each channel

Device No.	Factory Settings		User Setting
	Voltage	Current	
X0A (CH1)	OFF	ON	OFF
X0B (CH2)	OFF	ON	OFF
X0C (CH3)	OFF	ON	OFF

(8) Y10: CH3 D-A conversion output enable

ON: Analog value after D-A conversion is output.

OFF: Offset value is output.

This device is invalid when the HLD/CLR terminal on the front side of the module is set for "hold".

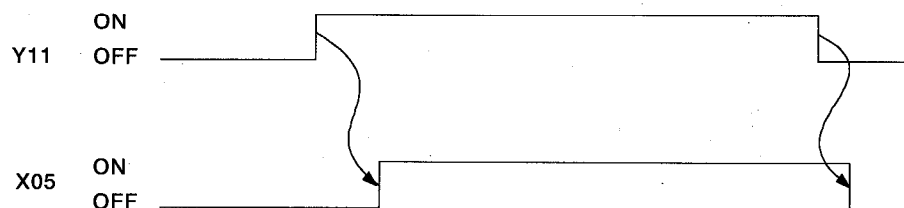
(9) Y11: Simple loop control execution enable

ON: Simple loop control is executed.

Data in buffer addresses 6 to 9 and 17 to 37 are checked.
Data in addresses 17 to 37 are checked according to the number of coordinate points set when address 6 contains 3.
When there is no error, the simple loop control in execution (X05) turns ON, and simple loop control is executed.
When an error occurs, the error detection (X02) turns ON.

OFF: Ordinary D-A and A-D conversions are executed.

The simple loop control in execution (X05) turns OFF.

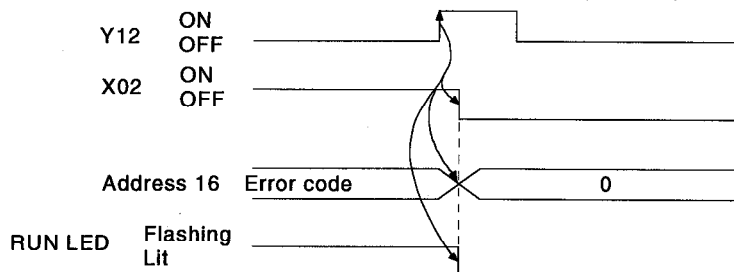


The CH3 analog output value varies according to the state of simple loop control execution enable (Y11).

State of Y11	Data for CH3 Analog Output Value
ON (simple loop control in execution)	Address 13 (simple loop control output calculation value)
OFF (simple loop control not in execution)	Address 10 (CH3 digital value setting)

(10) Y12: Error reset

ON (leading edge): Turns OFF the error detection (X02) which turned ON when an error occurred.
Error code in buffer address 16 is turned to "0".
The RUN LED switches from flashing (error occurrence) to lit (normal operation).



(11) Y13: CH3 upper/lower limits cancel

ON: The analog output limits set with buffer addresses 4 and 5 are canceled.

The CH3 output upper/lower limits hold (X03 and X04) is also turned OFF.

OFF: The analog output is limited according to the setting with buffer addresses 4 and 5.

(12) Y18 to Y1D: Offset/gain setting

These devices are used to select offset/gain values.

Refer to Section 4.4.1 for the contents pertaining to factory settings.

Y18 and Y19: Used to select resolution.

Device No.	Factory Settings			User Setting
	1/4000	1/8000	1/12000	
Y18	ON	OFF	ON	OFF
Y19	OFF	ON	ON	OFF

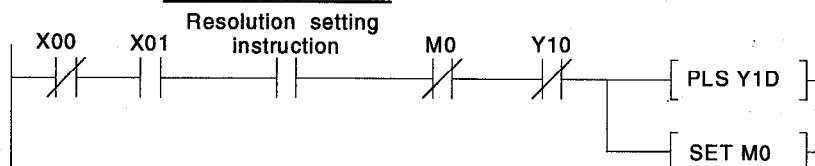
Y1A to Y1C: Used to select voltage or current for each channel.

Device No.	Factory Settings		User Setting
	Voltage	Current	
Y1A (CH1)	OFF	ON	Ignored
Y1B (CH2)	OFF	ON	
Y1C (CH3)	OFF	ON	

Y1D (leading edge): Used to store data of Y18 to Y1C to the A1S63ADA.

The following precautions must be observed:

- 1) Y1D must be used only once between a power on (reset) and a power off (reset).
- 2) CH3 D-A conversion value output enable (Y10) must be turned ON at 100 ms or later after Y1D has turned ON.



- 3) This setting cannot be made during the execution of simple loop control.

3. SPECIFICATIONS

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3.6 Buffer Memory

3.6.1 Buffer memory allocation

The buffer memory allocation of the A1S63ADA is as given in the table below.

Table 3.4 Buffer memory allocation

Address (decimal)	Name		Default (decimal)	Read/Write	Remarks
0	A-D/D-A conversion enable/disable setting		0	Read/write enable	See Section 3.6.2
1	A-D conversion averaging setting		0		See Section 3.6.3
2	CH1 averaging time/count setting		1		See Section 3.6.4
3	CH2 averaging time/count setting		1		
4	CH3 output upper limit value setting		12000		See Section 3.6.5
5	CH3 output lower limit value setting		-12000		See Section 3.6.6
6	Simple loop control type setting		0		
7	Constant A setting		0		See Section 3.6.7
8	Constant B setting		0		
9	Constant C setting		0		
10	CH3 digital value setting		0		See Section 3.6.8
11	CH1 A-D conversion digital value		0	Read only	See Section 3.6.9
12	CH2 A-D conversion digital value		0		
13	Simple loop control output calculation value		0		See Section 3.6.10
14	Resolution setting		1		See Section 3.6.11
15	A-D conversion completion flag		0		See Section 3.6.12
16	Error code		0	Read/write enable	See Section 3.6.13
17	Coordinate points setting		2		See Section 3.6.14
18	Point 0	CH1 coordinates	0		See Section 3.6.15
19		CH3 coordinates	0		
20	Point 1	CH1 coordinates	0		
21		CH3 coordinates	0		
22	Point 2	CH1 coordinates	0		
23		CH3 coordinates	0		
24	Point 3	CH1 coordinates	0		
25		CH3 coordinates	0		
26	Point 4	CH1 coordinates	0		
27		CH3 coordinates	0		
28	Point 5	CH1 coordinates	0		
29		CH3 coordinates	0		
30	Point 6	CH1 coordinates	0		
31		CH3 coordinates	0		
32	Point 7	CH1 coordinates	0		
33		CH3 coordinates	0		
34	Point 8	CH1 coordinates	0		
35		CH3 coordinates	0		
36	Point 9	CH1 coordinates	0		
37		CH3 coordinates	0		

3.6.2 A-D/D-A conversion enable/disable setting: Address 0

Each channel of the A1S63ADA can be set for A-D conversion or D-A conversion with the enable/disable options.
 The default setting is "conversion disabled (0000H)" for all channels.
 The sampling time can be shortened by setting only used channels for "conversion enabled".

- (1) The sampling time varies according to resolution setting and the number of conversion-enabled channels.

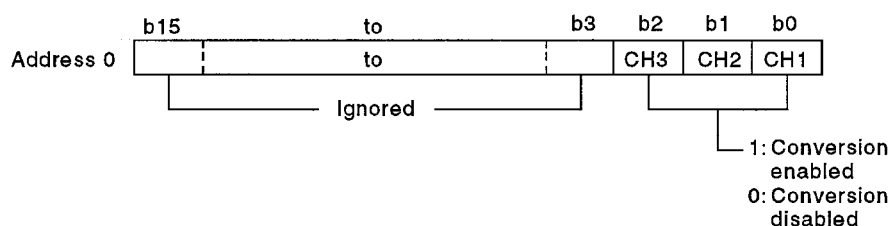
The relationship between resolution setting and the number of conversion-enabled channels is as given in the table below.

Table 3.5 Sampling time

Resolution	Number of Channels Set for A-D Conversion		Number of Channels Set for D-A Conversion
	1 channel	2 channels	1 channel
1/4000	1 ms	2 ms	1 ms
1/8000	2 ms	4 ms	2 ms
1/12000	3 ms	6 ms	3 ms

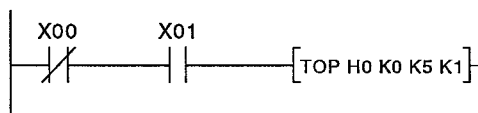
- (2) Method for A-D/D-A conversion enable/disable setting

- (a) Make conversion enable/disable setting with each channel.



- (b) Write the setting to address 0 when the conversion READY (X01) signal is turned ON.

Example) When the A1S63ADA is installed to slot 0 and CH1 and CH3 are set for conversion enabled:



- (3) Processing when A-D/D-A conversion enable/disable setting is made

- (a) Averaging is initialized.

When enable/disable setting is made during averaging, averaging is executed from the beginning.
 The digital value in buffer memory after A-D conversion retains the state immediately before this setting is made.

- (b) The A-D conversion completion flag is reset.

The A-D conversion completion flag for CH1 and CH2 (buffer address 15) is reset.

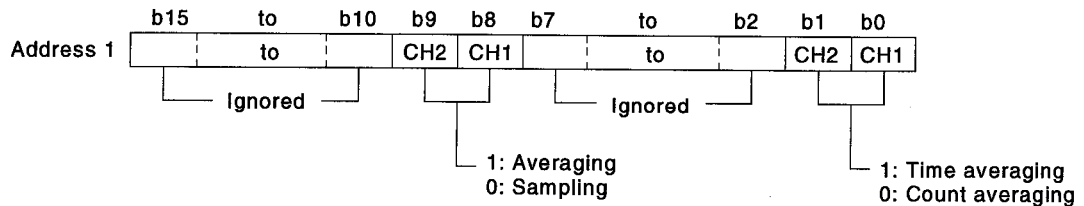
3. SPECIFICATIONS

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3.6.3 A-D conversion averaging setting: Address 1

This is used for setting the A-D conversion method for CH1 and CH2.
The default setting is "sampling (0000H)" for CH1 and CH2.

- (1) When the power is turned ON and the A1S63ADA's conversion READY (X01) is ON, all channels are set for sampling.
- (2) Set averaging/sampling and time averaging/count averaging with each channel.



POINTS

- (1) Before setting averaging, it is necessary to set the time or count for averaging.
- (2) When averaging is not set, sampling is set as the default regardless of the time/count setting.

3.6.4 A-D conversion time/count setting: Addresses 2 and 3

This is used for setting the time or count for the channel which is set for averaging.

The default setting is "1" for CH1 and CH2.

Setting unit of time is 10 ms. Values smaller than 10 ms are rounded down.
For example, when "1234" is set, it is processed as "1230 ms".

The setting ranges are as follows:

Averaging based on time setting: 10 to 10000 ms

Averaging based on count setting: 1 to 500 times (count)

POINT

When values other than those mentioned above are set, buffer memory will be overwritten. However, a setting error occurs, and the A1S63ADA continues A-D conversion based on the time or count setting which is immediately before the setting error occurred.

3. SPECIFICATIONS

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3.6.5 D-A conversion output upper/lower limit value setting: Addresses 4 and 5

This is used for setting the upper limit value (address 4) and the lower limit value (address 5) of the set ranges of digital values (addresses 10 and 13) used for D-A conversion on CH3.

Valid setting ranges vary according to resolution setting as given below.

Resolution	Valid Setting Range	Default	
		Address 4	Address 5
1/4000	-4000 to 4000	12000	-12000
1/8000	-8000 to 8000		
1/12000	-12000 to 12000		

3.6.6 Simple loop control type setting: Address 6

This is used for setting the type of simple loop control.

The following set values are used:

Setting is valid when the simple loop control execution enable (Y11) is ON.

Set Value	Type of Simple Loop Control
0	Ordinary operation (other than simple loop control)
1	$y = AX_1 + BX_2 + C$
2	$y = A \frac{X_1}{X_2} + C$
3	Coordinate designation

A, B, C: Constants

y : CH3 D-A conversion digital value

X₁ : CH1 A-D conversion digital value

X₂ : CH2 A-D conversion digital value

POINT

When values other than those mentioned above are set, buffer memory will be overwritten. However, a setting error will occur, and the A1S63ADA continues control with the data which is immediately before the setting error occurred.

3.6.7 Simple loop control constant setting: Addresses 7, 8 and 9

This is used to set the constants A, B, and C for simple loop control.

Set unused channels with "0" constant.

Settings are as given below.

Address	Constant	Setting Range	Default
7	A	-327.68 to 327.67	0.00
8	B	-327.68 to 327.67	0.00
9	C	-32768 to 32767	0

When writing data of constant A or B to buffer memory, write a value of "setting value x 100".

For example, to set "123.45", write "12345".

REMARK

This setting is valid also when it is changed during the execution of simple loop control.

3.6.8 D-A conversion digital value setting: Address 10

This is used to set the digital values used for D-A conversion on CH3. The setting ranges vary according to resolution setting.

Resolution	Setting Range
1/4000	-4096 to 4095
1/8000	-8192 to 8191
1/12000	-12288 to 12287

POINTS

- (1) Data written during simple loop control will be invalid.
- (2) When values other than the ranges mentioned above are set, buffer memory will be overwritten. However, a setting error will occur, and the A1S63ADA will make output as mentioned in Section 3.5.8.
- (3) Current output of D-A conversion will never become "negative" regardless of set values.

3.6.9 A-D conversion digital value: Addresses 11 and 12

The digital values after A-D conversion on CH1 and CH2 are stored to these addresses.

Address 11: CH1 digital value

Address 12: CH2 digital value

The digital value ranges to be stored vary according to resolution setting.

Resolution	Range of Storage
1/4000	-4096 to 4095
1/8000	-8192 to 8191
1/12000	-12288 to 12287

3.6.10 Simple loop control output calculation value: Address 13

The "CH3 digital value" calculated by simple loop control is stored to this address.

Calculated value is not limited at all. However, in the actual operation, the digital value range used for D-A conversion varies according to resolution setting.

Resolution	Digital Value Range for D-A Conversion
1/4000	-4096 to 4095
1/8000	-8192 to 8191
1/12000	-12288 to 12287

3.6.11 Resolution setting: Address 14

Present resolution setting is stored to this address.

Stored Value	Resolution
1	1/4000
2	1/8000
3	1/12000

3.6.12 A-D conversion completion flag: Address 15

The state of A-D conversion on CH1 and CH2 is stored to this address.

- (1) The A-D conversion completion flag processing is executed only once when a change is made with the A-D conversion enable/disable setting (address 0).

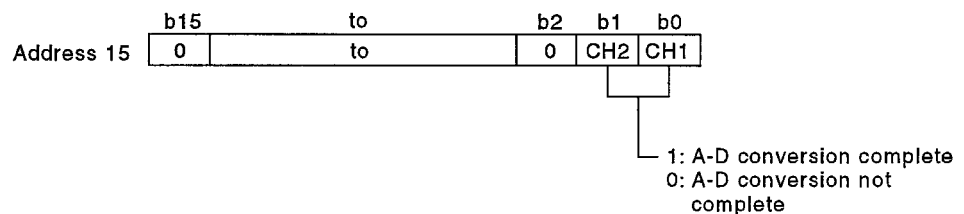
(a) Disable → Enable

When this change is made while averaging is executed, averaging is completed, and the digital value after A-D conversion is stored to buffer memory. Then, setting changes from "0" to "1".

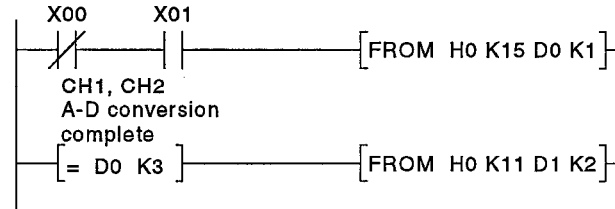
(b) Enable → Disable

Setting for the corresponding channel changes from "1" to "0".

- (2) The A-D conversion completion flag is provided for each channel.



- (3) The A-D conversion completion flag can be used as an interlock for digital value reading.



3.6.13 Error code: Address 16

When wrong data is set in the buffer write area, a setting error will occur and a corresponding error code (cause) will be stored to this address. And, the RUN LED starts flashing and the error detection signal (X02) turns ON.

- (1) When multiple errors occur, the error code for the last-detected error will be stored.
Refer to Section 6.1 for details of error codes.
- (2) To reset an error, eliminate the cause, and "turn ON the error reset (Y12)" or "write 0 to buffer address 16".

3.6.14 Simple loop control coordinate points setting: Address 17

This is used to set the number of coordinate points when "3 (coordinate designation)" has been set with buffer address 6.

The default setting is "2".

The setting range is "2 to 10".

POINT

When values other than those mentioned above are set, buffer memory will be overwritten. However, a setting error will occur, and the A1S63ADA continues control with the data which is immediately before the setting error occurred.

3.6.15 Point coordinates setting: Addresses 18 to 37

This is used for setting coordinates of points 0 to 9 on CH1 and CH3.

(1) CH1 coordinate setting

(a) The setting range varies according to resolution setting.

Resolution	Setting Range
1/4000	-4000 to 4000
1/8000	-8000 to 8000
1/12000	-12000 to 12000

(b) Setting condition is as follows:

(Point n coordinate setting) < (Point n+1 coordinate setting)

(2) CH3 coordinate setting

The setting range varies according to resolution setting.

Resolution	Setting Range
1/4000	-4000 to 4000
1/8000	-8000 to 8000
1/12000	-12000 to 12000

POINT

When values other than those mentioned above are set, buffer memory will be overwritten. However, a setting error will occur, and the A1S63ADA continues control with the data which is immediately before the setting error occurred.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

4. PRE-OPERATION SETTING PROCEDURES

4.1 Precautions for Handling

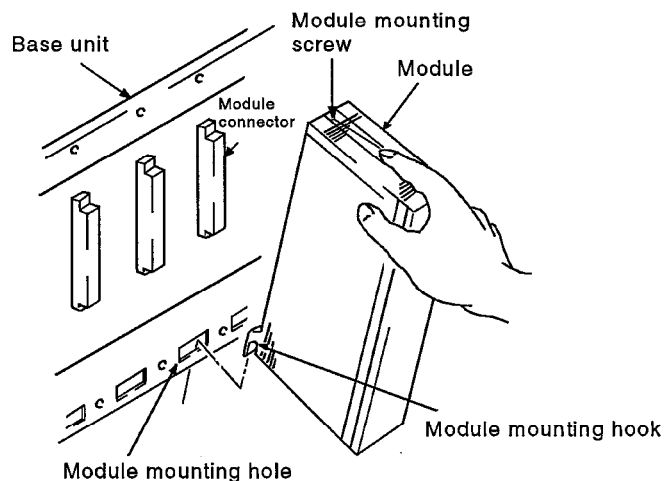
This section gives the precautions for handling the A1S63ADA module.

- (1) Since the case and the terminal block of the module are made of plastic, do not drop the module or subject the module to intensive mechanical shock.
- (2) Do not remove the printed circuit board of any module from its case.
- (3) When wiring, take care to prevent entry of wire offcuts into the module.
- (4) Tighten the module mounting screws and terminal fixing screws as given below.

Location	Tightening Torque
Module mounting screws (M4 screw)	78 to 118 N·cm
Terminal block terminal screws (M3.5 screw)	59 to 88 N·cm
Terminal block fixing screws (M4 screw)	78 to 118 N·cm

- (5) To correctly install the module to the base unit, insert the module mounting hook provided at the bottom of the module in the module mounting hole in the base unit. And then, secure the module by tightening the module mounting screw.

To remove the module, remove the module mounting screw first. And then, pull out the module so that the module mounting hook is removed from the hole in the base unit.



4. PRE-OPERATION SETTING PROCEDURES

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4.2 Part Names and Settings



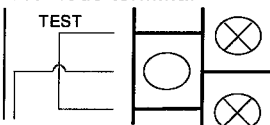

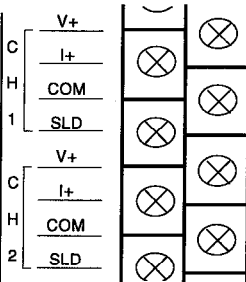
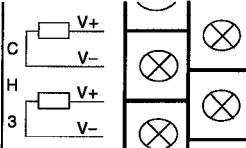
The diagram shows the A1S63A module with the following components labeled:

- (1) RUN LED
- (2) CH (Channel and resolution select switch)
- (3) OFFSET SET GAIN switch
- (4) UP/DOWN switch
- (5) TEST button
- (6) MEDVOLT button
- (7) Channel 1 terminals (V+, COM, SLD)
- (8) Channel 2 terminals (V+, COM, SLD)
- (9) Channel 3 terminals (V+, COM, SLD)
- (10) Input terminals (A/D, I/O, F/G)
- (11) 20-pin connector

No.	Name	Description																								
(1)	RUN LED 	<p>This indicates the state of operation of the A1S63ADA.</p> <ul style="list-style-type: none"> • Normal mode <ul style="list-style-type: none"> Lit: Normal operation Flashing: Data setting error Unlit: 5V power failure or WDT error • Test mode <ul style="list-style-type: none"> Flashing: Flashes at 0.25 sec intervals when the offset/gain select switch is in the OFFSET or GAIN position. Flashes at 0.1 sec intervals when a CH3 setting value exceeds allowable range when the UP/DOWN switch is operated. Unlit: Unlit when the offset/gain select switch is in the "SET" position. 																								
(2)	Channel and resolution select switch 	<p>This is used to select a channel to adjust offset/gain and resolution.</p> <ul style="list-style-type: none"> • Normal mode: Invalid • Test mode: Valid <p style="text-align: right;">(Factory setting: 0)</p> <table border="1"> <thead> <tr> <th>Set value</th> <th>Offset/Gain Adjusting Channel</th> <th>Resolution</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>CH1</td> <td rowspan="3">1/4000</td> </tr> <tr> <td>2</td> <td>CH2</td> </tr> <tr> <td>3</td> <td>CH3</td> </tr> <tr> <td>4</td> <td>CH1</td> <td rowspan="3">1/8000</td> </tr> <tr> <td>5</td> <td>CH2</td> </tr> <tr> <td>6</td> <td>CH3</td> </tr> <tr> <td>7</td> <td>CH1</td> <td rowspan="3">1/12000</td> </tr> <tr> <td>8</td> <td>CH2</td> </tr> <tr> <td>9</td> <td>CH3</td> </tr> </tbody> </table>	Set value	Offset/Gain Adjusting Channel	Resolution	1	CH1	1/4000	2	CH2	3	CH3	4	CH1	1/8000	5	CH2	6	CH3	7	CH1	1/12000	8	CH2	9	CH3
Set value	Offset/Gain Adjusting Channel	Resolution																								
1	CH1	1/4000																								
2	CH2																									
3	CH3																									
4	CH1	1/8000																								
5	CH2																									
6	CH3																									
7	CH1	1/12000																								
8	CH2																									
9	CH3																									

4. PRE-OPERATION SETTING PROCEDURES

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No.	Name	Description						
(3)	Offset/gain select switch 	OFFSET: Offset value can be adjusted. SET: When moved from OFFSET to SET, the offset value is registered. When moved from GAIN to SET, the gain value is registered. GAIN: Gain value can be adjusted.						
(4)	UP/DOWN switch 	This is used to increase and decrease the offset/gain values on CH3. <table border="1"><thead><tr><th>Time Held in the UP/DOWN Position</th><th>Increment/Decrement</th></tr></thead><tbody><tr><td>Less than 1.5 s</td><td>Voltage: Approx. 2.5 mV Current: Approx. 5 μA</td></tr><tr><td>1.5 s or more</td><td>Voltage: Approx. 50 mV Current: Approx. 0.1 mA</td></tr></tbody></table>	Time Held in the UP/DOWN Position	Increment/Decrement	Less than 1.5 s	Voltage: Approx. 2.5 mV Current: Approx. 5 μ A	1.5 s or more	Voltage: Approx. 50 mV Current: Approx. 0.1 mA
Time Held in the UP/DOWN Position	Increment/Decrement							
Less than 1.5 s	Voltage: Approx. 2.5 mV Current: Approx. 5 μ A							
1.5 s or more	Voltage: Approx. 50 mV Current: Approx. 0.1 mA							
(5)	Test mode terminal 	This is used to set the offset/gain values and resolution. <ul style="list-style-type: none">Shorting across terminals 1 and 3: Test modeOpen across terminals 1 and 3: Normal mode						
(6)	Output hold/clear setting terminal 	This is used to set the analog output state on CH3 when the PC CPU is in the STOP state. <ul style="list-style-type: none">Open across terminals 2 and 4: ClearShorting across terminals 2 and 4: Hold <p>* This is not necessary when the output is made by simple loop control.</p>						
(7)	Analog input terminals (CH1, CH2) 	These are used to input analog values (voltage/current) on CH1 and CH2. Refer to Section 4.3 for the connecting procedure.						
(8)	Analog output terminals (CH3) 	These are used to output analog values (voltage/current) on CH3. Refer to Section 4.3 for the connecting procedure.						
(9)	Analog ground terminal	The grounding terminal for analog signals. Refer to Section 4.3 for the connecting procedure.						
(10)	Frame ground terminal	The grounding terminal for the module. Refer to Section 4.3 for the connecting procedure.						

4.3 Connection to External Devices

The precautions and wiring method for making connection to external devices are as given below.

4.3.1 Precautions

To make the best use of the A1S63ADA and to attain high reliability of the system, the wiring connection needs to be arranged so that it is not influenced by noise.

The following precautions must be observed:

- (1) The AC cable must be separate from the analog input cables to the A1S63ADA to avoid the influence by surge and induction of the AC side.
- (2) The I/O cables must be separate from the main circuit cables, high-tension cables, and load-carrying cables connecting from other than a PC so that the I/O cables are not influenced by noise, surge, and induction.
- (3) Shielded wires or the shield of shielded cables must be grounded at one point on the PC side.
However, it is sometimes better to ground the shield on the external device side depending on the conditions of noise transmitted from the external device.

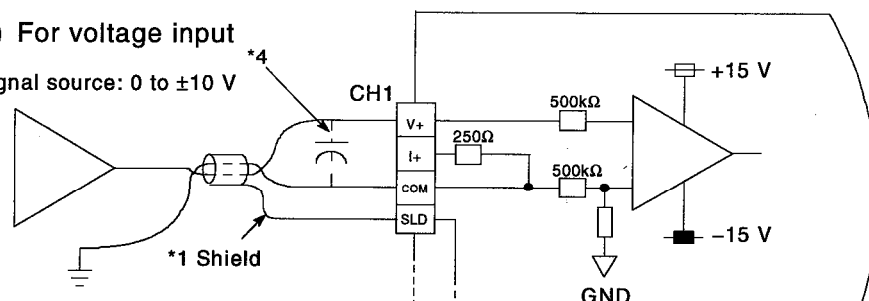
4.3.2 Wiring method

The following gives the wiring method for the A1S63ADA.

(1) CH1 and CH2

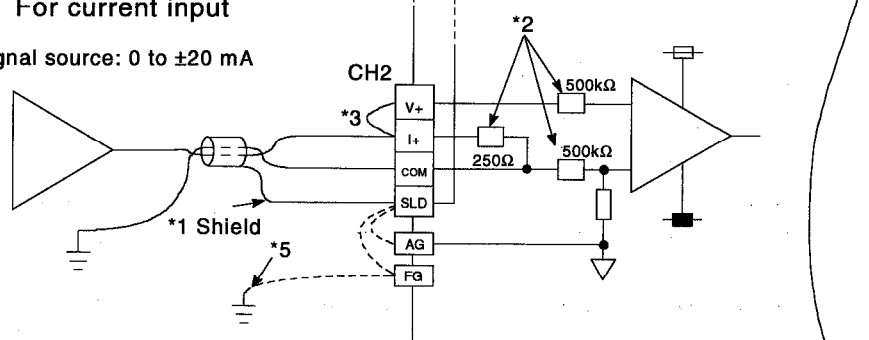
(a) For voltage input

Signal source: 0 to ± 10 V



(b) For current input

Signal source: 0 to ± 20 mA



*1: Use a shielded 2-core twisted cable.

*2: Input resistance of the A1S63ADA

*3: For current input, connect the (V+) and (I+) terminals.

*4: If there is noise or ripples in the external wiring, connect a 0.1 to 0.47 μ F 25V capacitor between V+ terminal and COM.

*5: When noise is produced frequently, make grounding. The FG terminal of the power supply module and/or the A1S63ADA module may also be grounded.

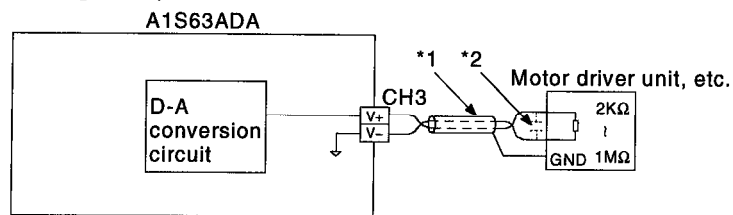
When offset/gain setting has been made and the ground wiring is changed (whether or not grounding is made), offset/gain setting must be done again.

4. PRE-OPERATION SETTING PROCEDURES

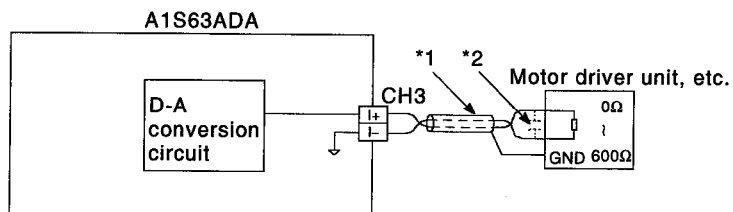
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(2) CH3

(a) For voltage output



(b) For current output



*1: Use a 2-core twisted shield wire for the wire.

*2: If a noise or ripple occurs in the external wiring, connect capacitors of approximate 0.1 to 0.47 μ F, 25V to input terminals of the external device.

IMPORTANT

It is impossible to use a channel for both voltage output and current output at the same time.

If a channel is used accidentally for both outputs, the internal chips will be destroyed. To prevent this accident, leave unused terminals always open.

POINT

For approx. 30 minutes after the power supply has been turned on, the A-D conversion value varies according to the affection by the self-heating.

If this variation causes problems, start controlling it after an approx. 30 min. warm-up operation has been completed.

When adjusting offset/gain values (user setting), also perform it after an approx. 30 min. warm-up operation has been completed.

4. PRE-OPERATION SETTING PROCEDURES

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4.4 Offset/Gain Selection and Adjustment

The following describes the offset/gain selection and adjustment procedures.

- (1) Offset/gain values are used by selecting from "user setting" and "factory setting" by using a sequence program.

- (a) User setting

This setting is made by the user by using the channel and resolution select switch, offset/gain select switch, and UP/DOWN switch provided on the front side of the module.

Set values are held in memory even when the power is turned OFF. Refer to Section 4.4.1, 4.4.2 for the procedures.

- (b) Factory setting

This setting is made at the factory before the A1S63ADA is delivered.

- (2) The user setting and factory setting areas are as shown in the chart below.

Offset/gain value area			
User setting *			
Select value ranges (sequence program)	1/4000	CH1	Offset 0 V, 4 mA
			Gain 5 V, 20 mA
		CH2	Offset 0 V, 4 mA
			Gain 5 V, 20 mA
	1/8000	CH3	Offset 0 V, 4 mA
			Gain 10 V, 20 mA
		CH1	Offset 0 V, 4 mA
			Gain 5 V, 20 mA
	1/12000	CH2	Offset 0 V, 4 mA
			Gain 5 V, 20 mA
		CH3	Offset 0 V, 4 mA
			Gain 10 V, 20 mA

Area for user setting
(with switches on the module)

Factory setting (fixed)

* This area contains the offset/gain value settings with 1/4000 resolution when delivered.

REMARK

The offset/gain values are set with both voltage and current values.

4. PRE-OPERATION SETTING PROCEDURES

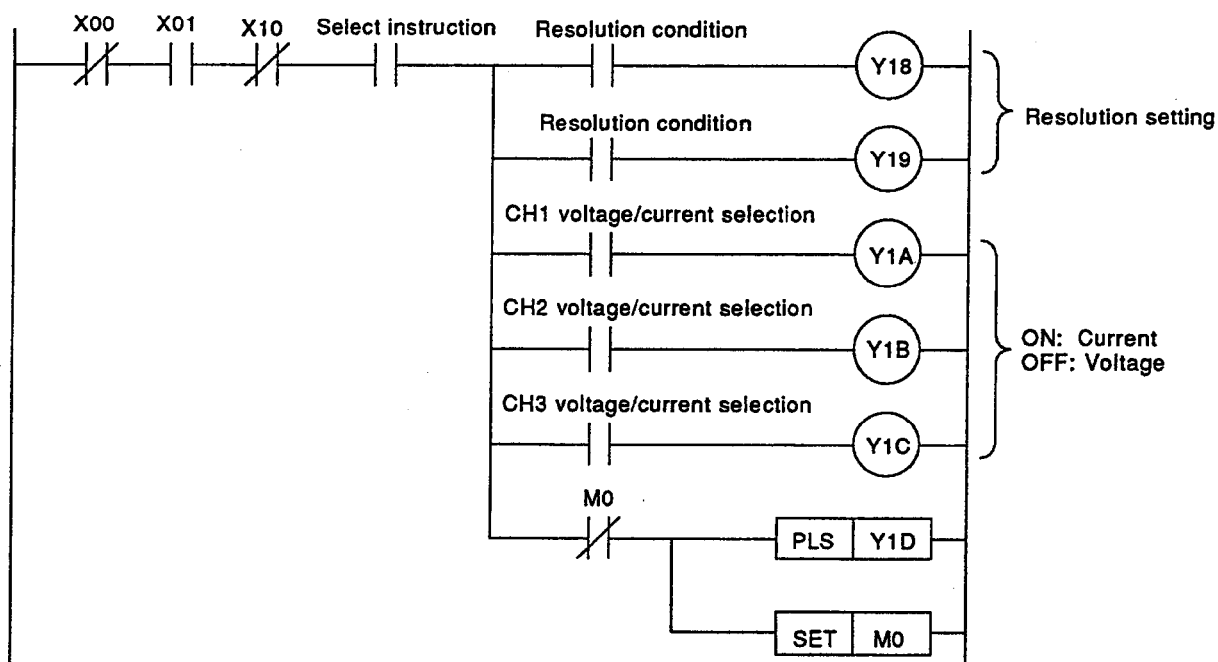
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4.4.1 Offset/gain value selection (sequence program)

The following explains the offset/gain selecting method by using a sequence program.

- (1) Set conditions (Y18 to Y1C), and create a program to turn ON a select command (Y1D).

The program chart shown below is an example assuming that the A1S63ADA is installed to slot 0.



- (2) This setting must be made only once between a power on (reset) and a power off (reset).
- (3) Factory setting is made as given below.

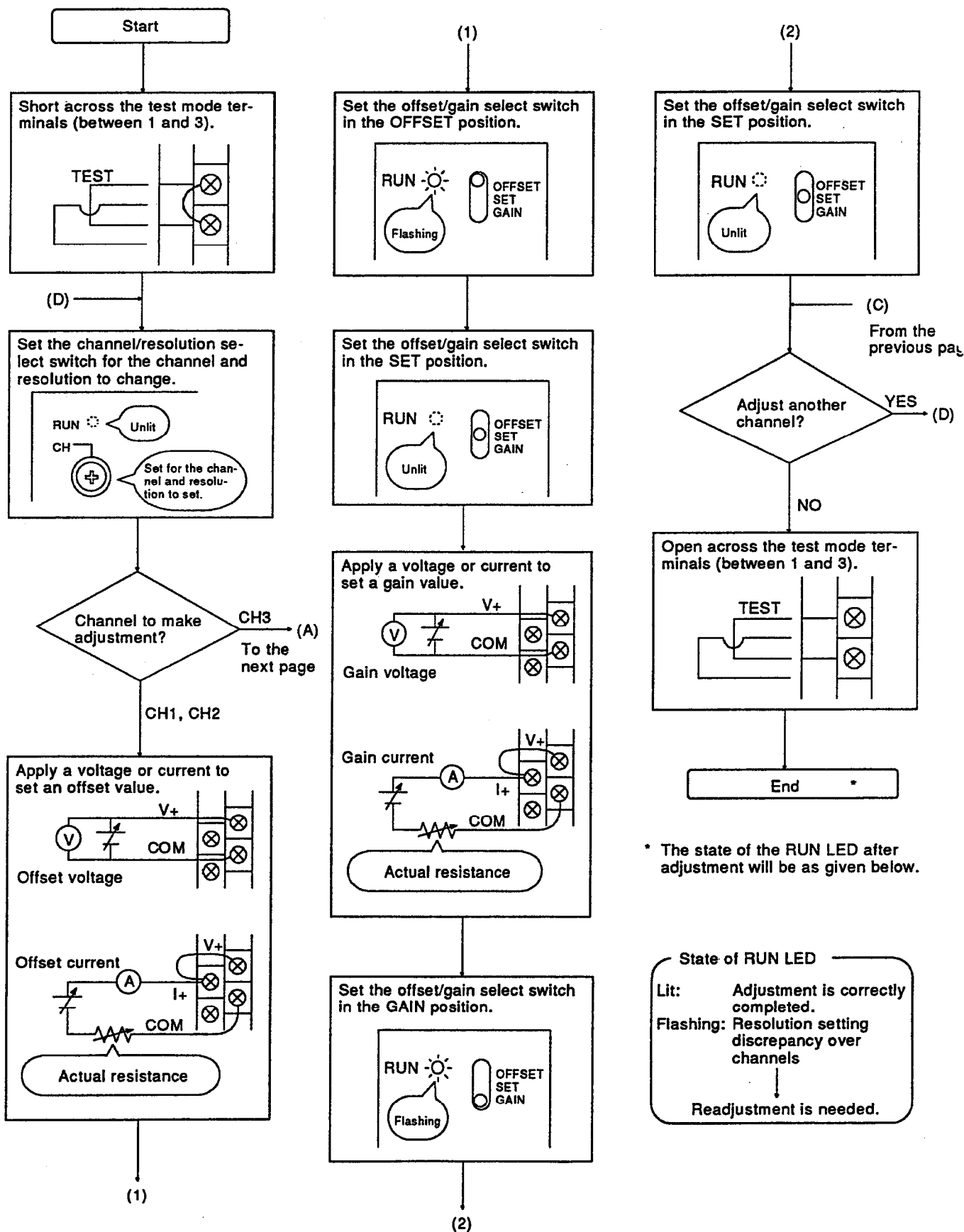
Resolution		CH1		CH2		CH3	
		Voltage	Current	Voltage	Current	Voltage	Current
1/4000	Offset	0 V	4 mA	0 V	4 mA	0 V	4 mA
	Gain	5 V	20 mA	5 V	20 mA	10 V	20 mA
1/8000	Offset	0 V	4 mA	0 V	4 mA	0 V	4 mA
	Gain	5 V	20 mA	5 V	20 mA	10 V	20 mA
1/12000	Offset	0 V	4 mA	0 V	4 mA	0 V	4 mA
	Gain	5 V	20 mA	5 V	20 mA	10 V	20 mA

POINT

When only the user-set offset/gain values are used, it is not necessary to create a sequence program.

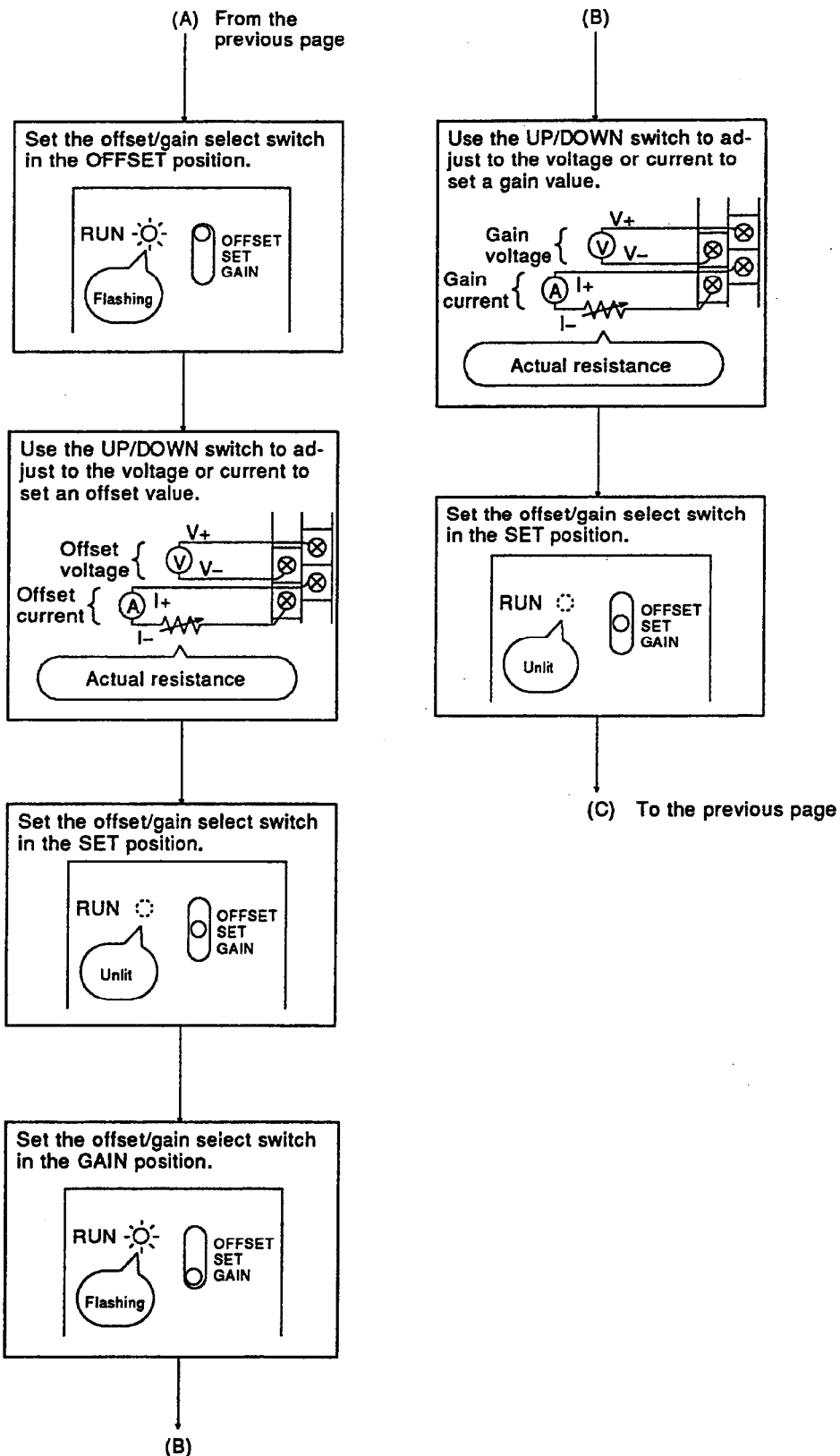
4.4.2 Offset/gain value adjustment procedure (user setting)

The following flow chart gives the offset/gain value adjustment procedure.



4. PRE-OPERATION SETTING PROCEDURES

MELSEC-A



POINT

By making these adjustments in actual operating environment (temperature), accuracy of the conversion can be improved.

[illegible]

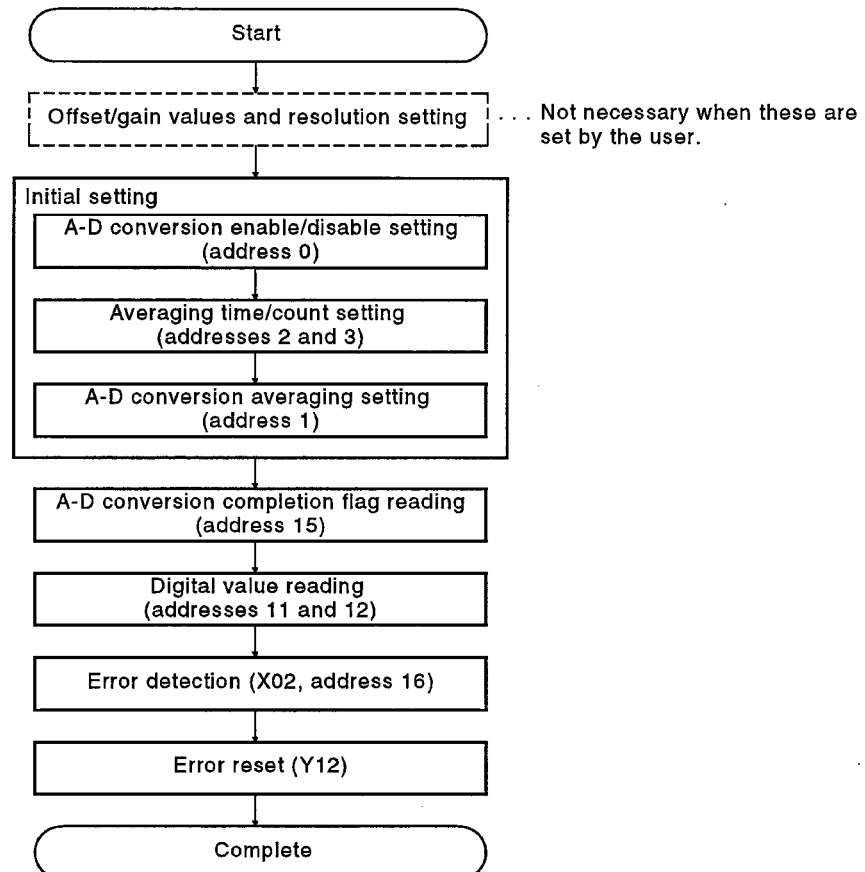
5. PROGRAMMING

5.1 Converting Analog Voltage/Current to Digital Values (A-D Conversion)

This section gives the programming procedures and examples for the conversion of analog input values (voltage/current) on CH1 and CH2 to digital values.

5.1.1 Programming procedure

The programming procedure is as given below.

**POINT**

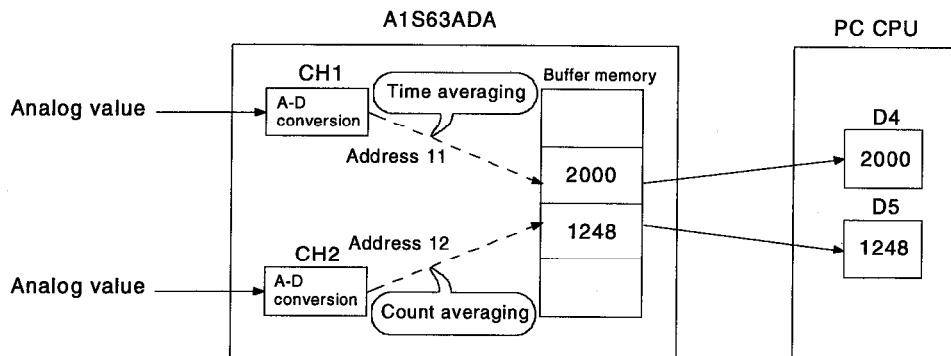
Among various types of processing of the special function modules, an access from the PC CPU takes priority. If an access from the PC CPU to the buffer memory of the special function modules is performed frequently, not only the scanning time of the PC CPU will be extended but also the various types of processings of the special function modules will be delayed. Perform the access from the PC CPU to the buffer memory by FROM/TO instruction only when necessary.

5.1.2 Program examples

The following program examples assume that the A1S63ADA is installed to slot 0.

General description of the program

Analog values are converted to digital values with time averaging (500 ms) on CH1 and count averaging (200 times) on CH2.



<Signals and buffer memory used with the program>

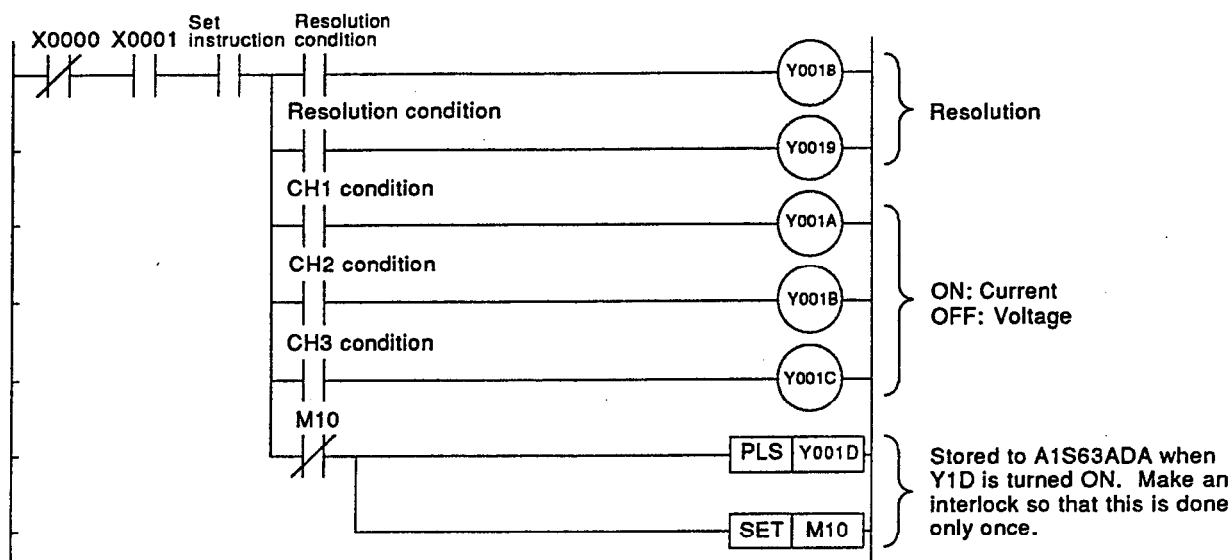
(1) Signals

- X000: Watchdog timer error
- X001: Conversion READY
- X002: Error detection
- Y012: Error reset
- Y018 to 19: Resolution selection
- Y01A: CH1 voltage/current
- Y01B: CH2 voltage/current
- Y01C: CH3 voltage/current
- Y01D: Offset/gain setting

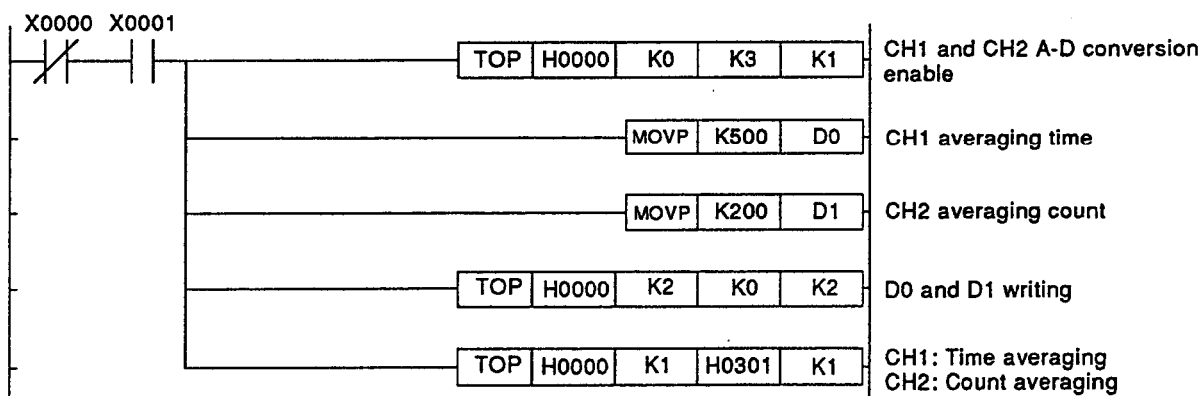
(2) Buffer memory

- Address 0: A-D/D-A conversion enable/disable setting
- Address 1: A-D conversion averaging setting
- Address 2: CH1 averaging time/count
- Address 3: CH2 averaging time/count
- Address 11: CH1 A-D conversion digital value
- Address 12: CH2 A-D conversion digital value
- Address 15: A-D conversion completion flag
- Address 16: Error code

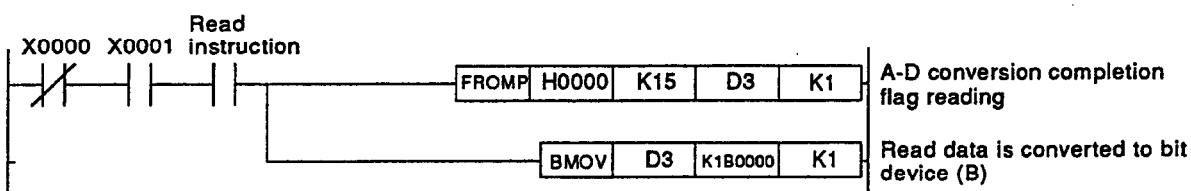
Offset/gain values and resolution setting



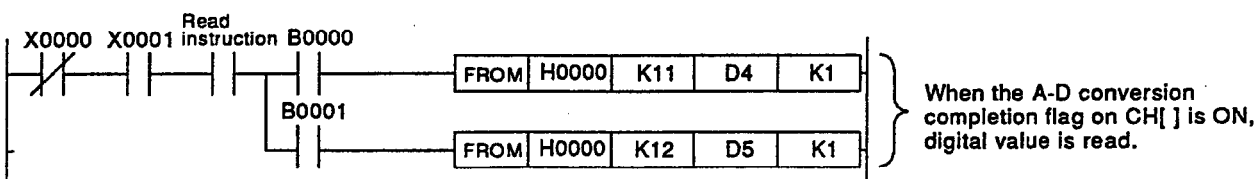
Initial setting



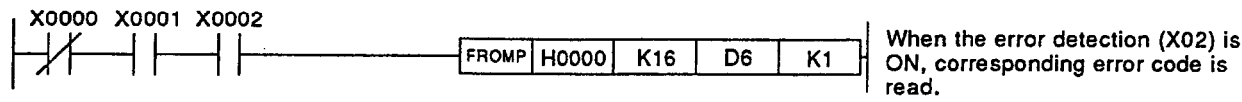
A-D conversion completion flag reading



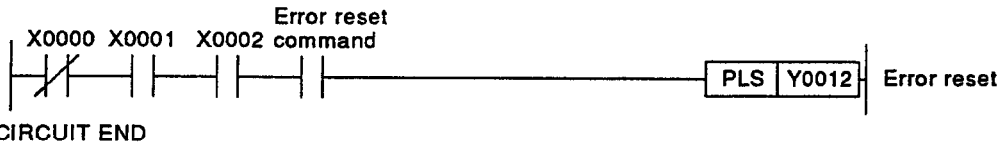
Digital value reading



Error detection



Error reset

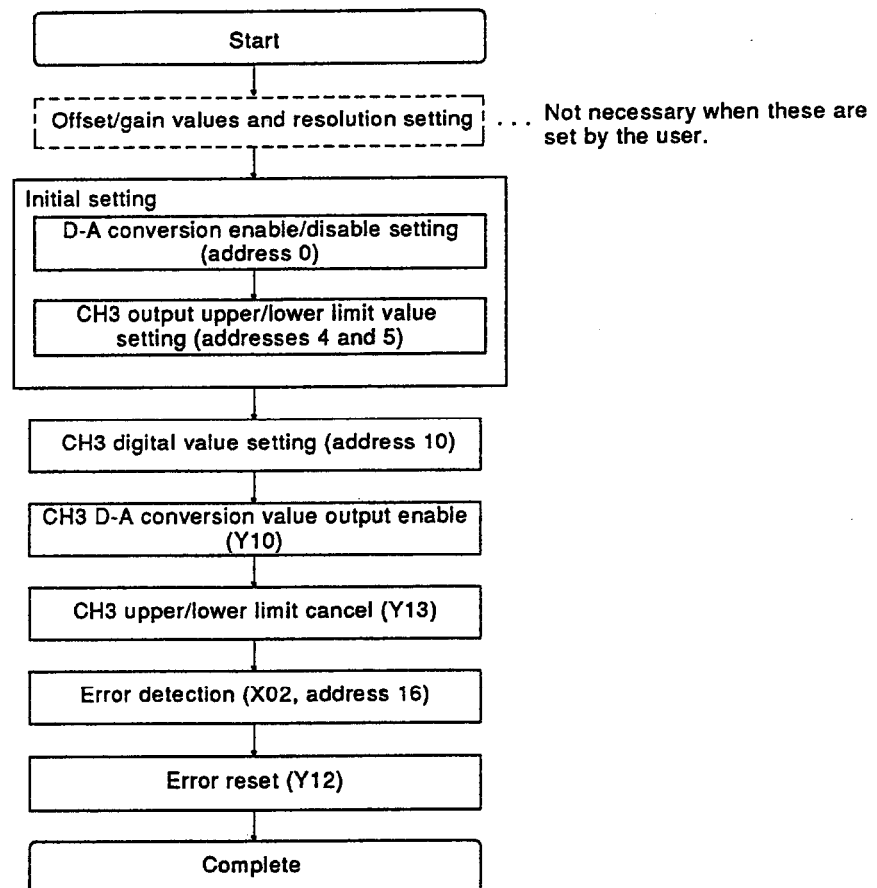


5.2 Converting Digital Values to Analog Voltage/Current (D-A Conversion)

This section gives the programming procedures and examples for the conversion of digital input values on CH3 to analog output values (voltage/current).

5.2.1 Programming procedure

The programming procedure is as given below.

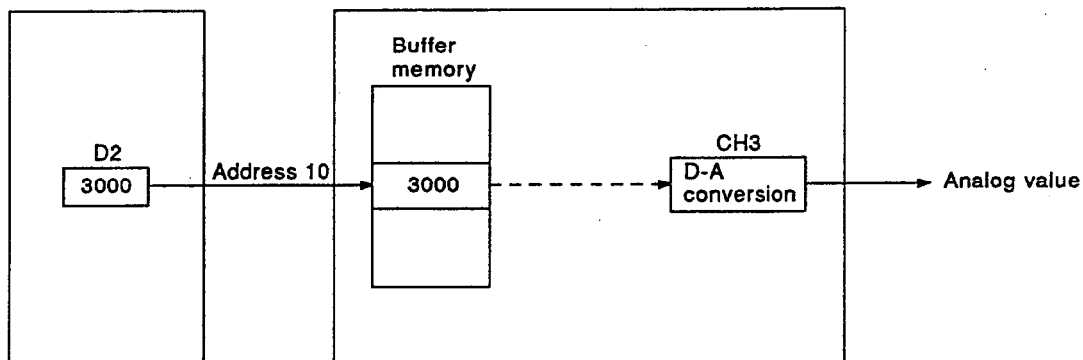


5.2.2 Program examples

The following program examples assume that the A1S63ADA is installed to slot 0.

General discription of the program

Digital values set with the digital switches are converted to analog output values on CH3.



<Signals and buffer memory used with the program>

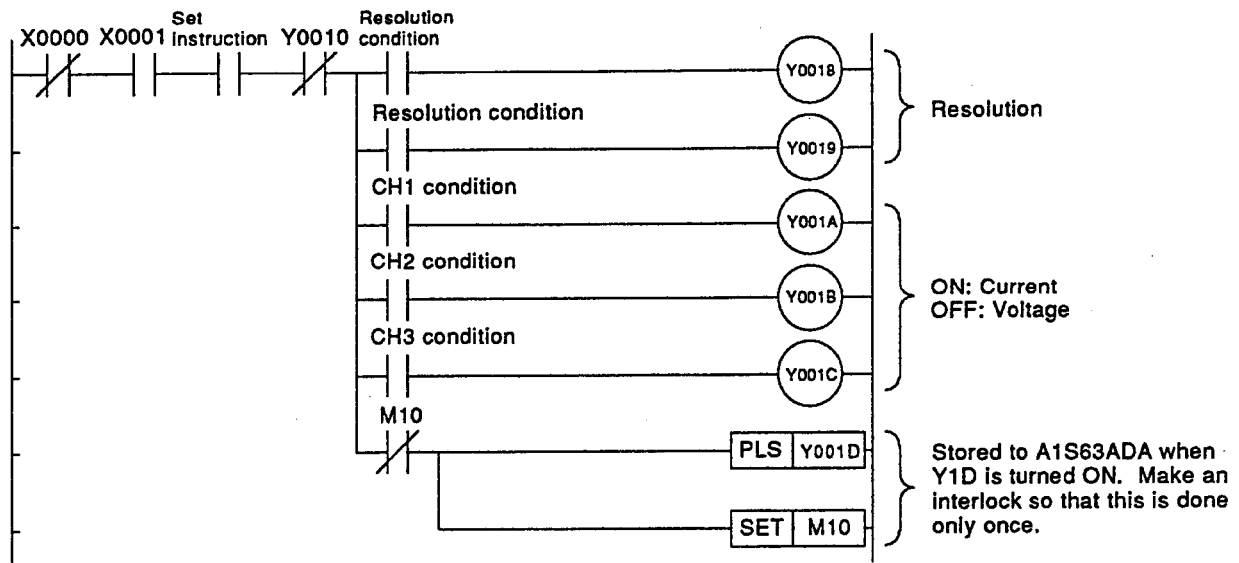
(1) Signals

- | | |
|--|--------------------------------------|
| • X000: Watchdog timer error | • Y013: CH3 upper/lower limit cancel |
| • X001: Conversion READY | • Y018 to 19: Resolution selection |
| • X002: Error detection | • Y01A: CH1 voltage/current |
| • Y010: CH3 D-A conversion value output enable | • Y01B: CH2 voltage/current |
| • Y012: Error reset | • Y01C: CH3 voltage/current |
| | • Y01D: Offset/gain setting |

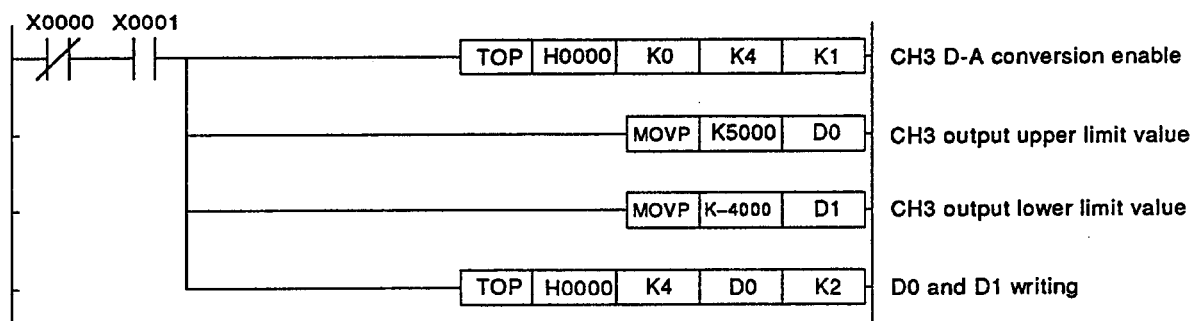
(2) Buffer memory

- Address 0: A-D/D-A conversion enable/disable setting
- Address 4: CH3 output upper limit value setting
- Address 5: CH3 output lower limit value setting
- Address 10: CH3 digital value setting
- Address 16: Error code

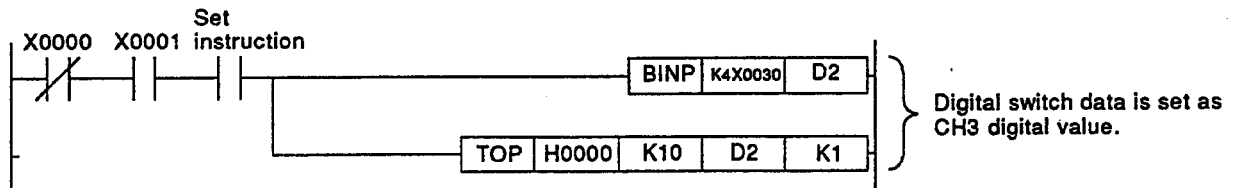
Offset/gain values and resolution setting



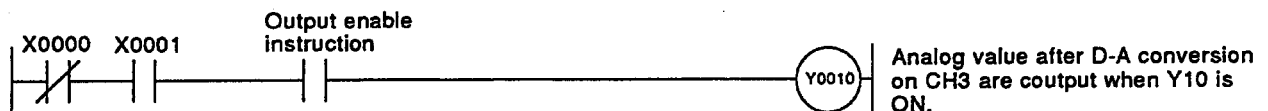
Initial setting



CH3 digital value setting



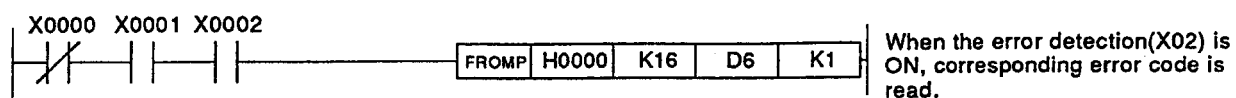
CH3 D-A conversion value output enable



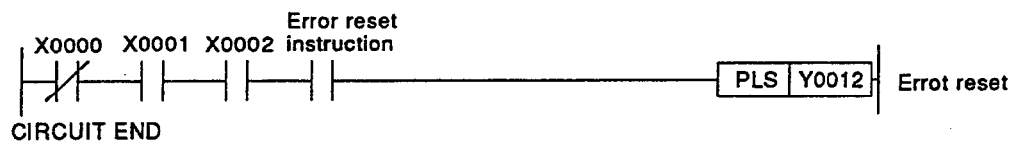
CH3 upper/lower limit cancel



Error detection



Error reset



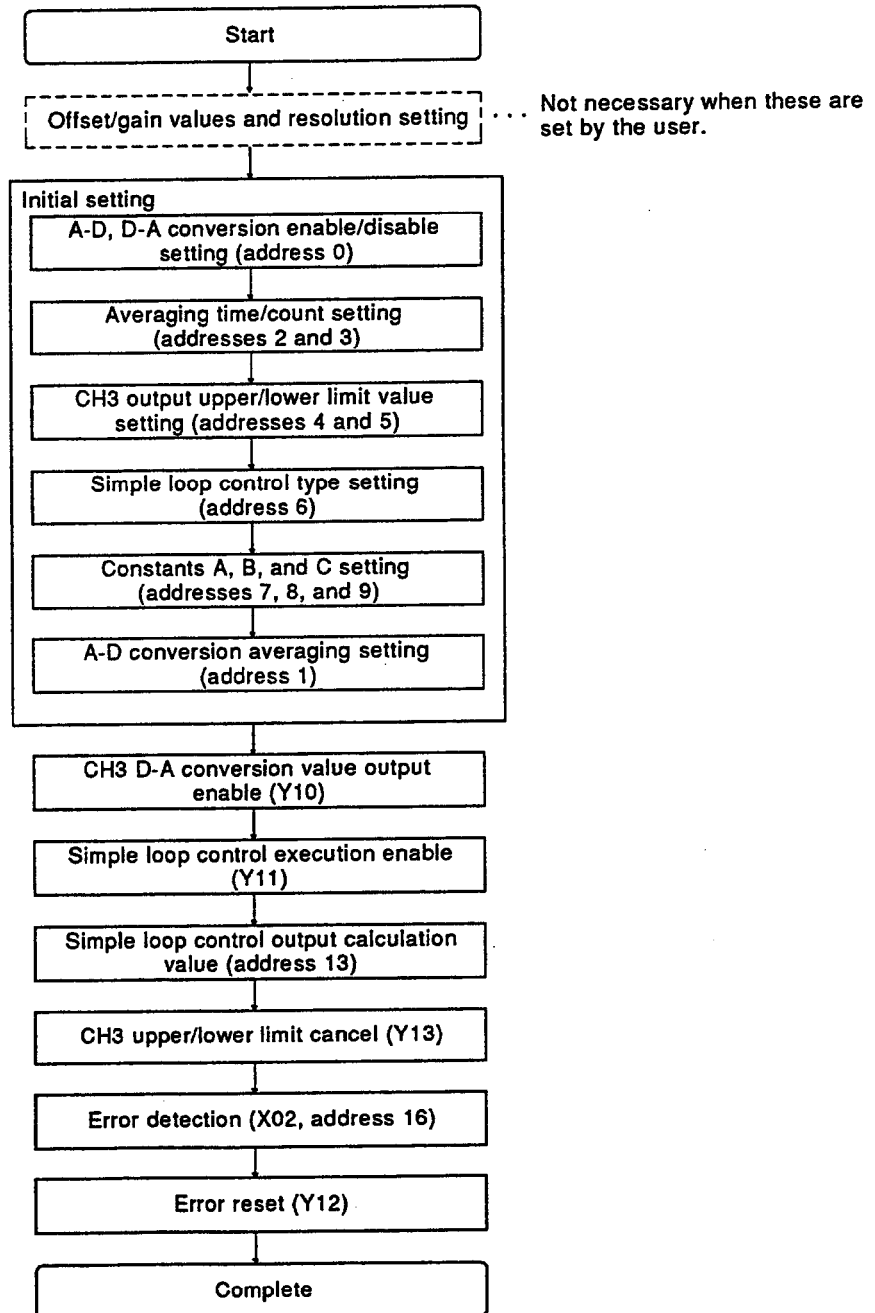
5.3 Executing Simple Loop Control

This section gives the programming procedures and examples for the conversion of analog input values (voltage/current) on CH1 and CH2 to analog output values (voltage/current) on CH3.

5.3.1 Simple loop control by using function expressions

(1) Programming procedure

The programming procedure is as given below.

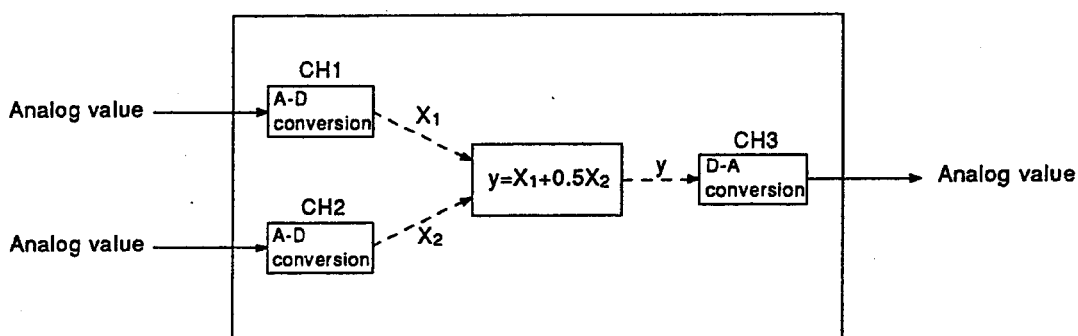


(2) Program examples

The following program examples assume that the A1S63ADA is installed to slot 0.

General description of the program

The sum of the "CH1 digital value" and "half of CH2 digital value" after A-D conversion is processed by D-A conversion on CH3 and output.



<Signals and buffer memory used with the program>

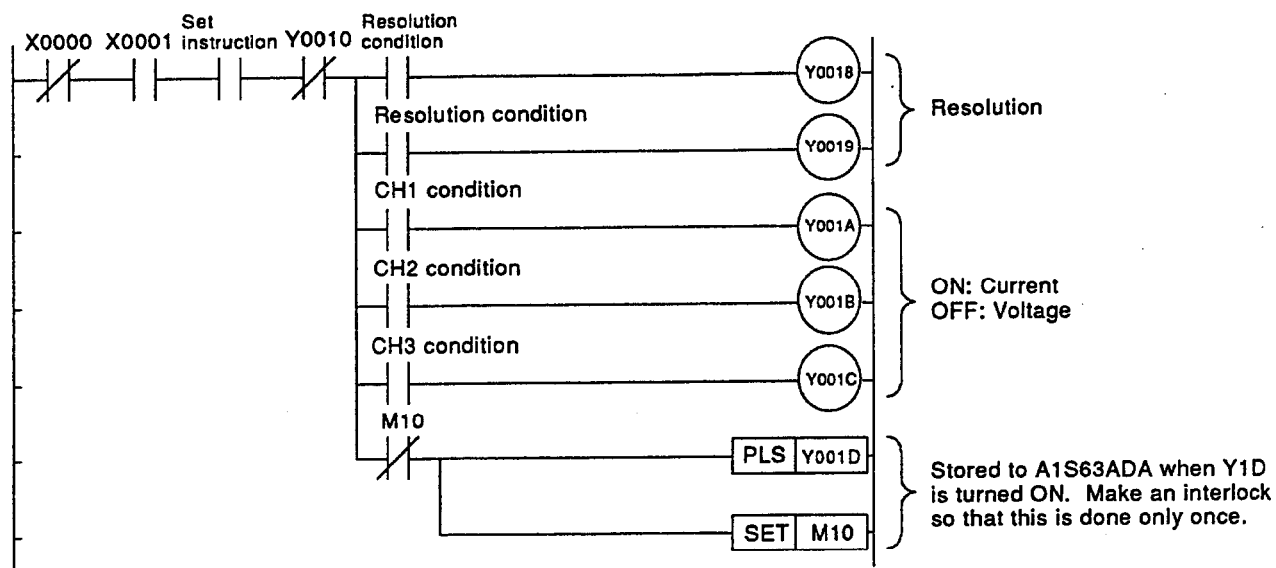
(1) Signals

- X000: Watchdog timer error
- X001: Conversion READY
- X002: Error detection
- X005: Simple loop control in execution
- Y010: CH3 D-A conversion value output enable
- Y011: Simple loop control execution enable
- Y012: Error reset
- Y013: CH3 upper/lower limit cancel
- Y018 to 19: Resolution selection
- Y01A: CH1 voltage/current
- Y01B: CH2 voltage/current
- Y01C: CH3 voltage/current
- Y01D: Offset/gain setting

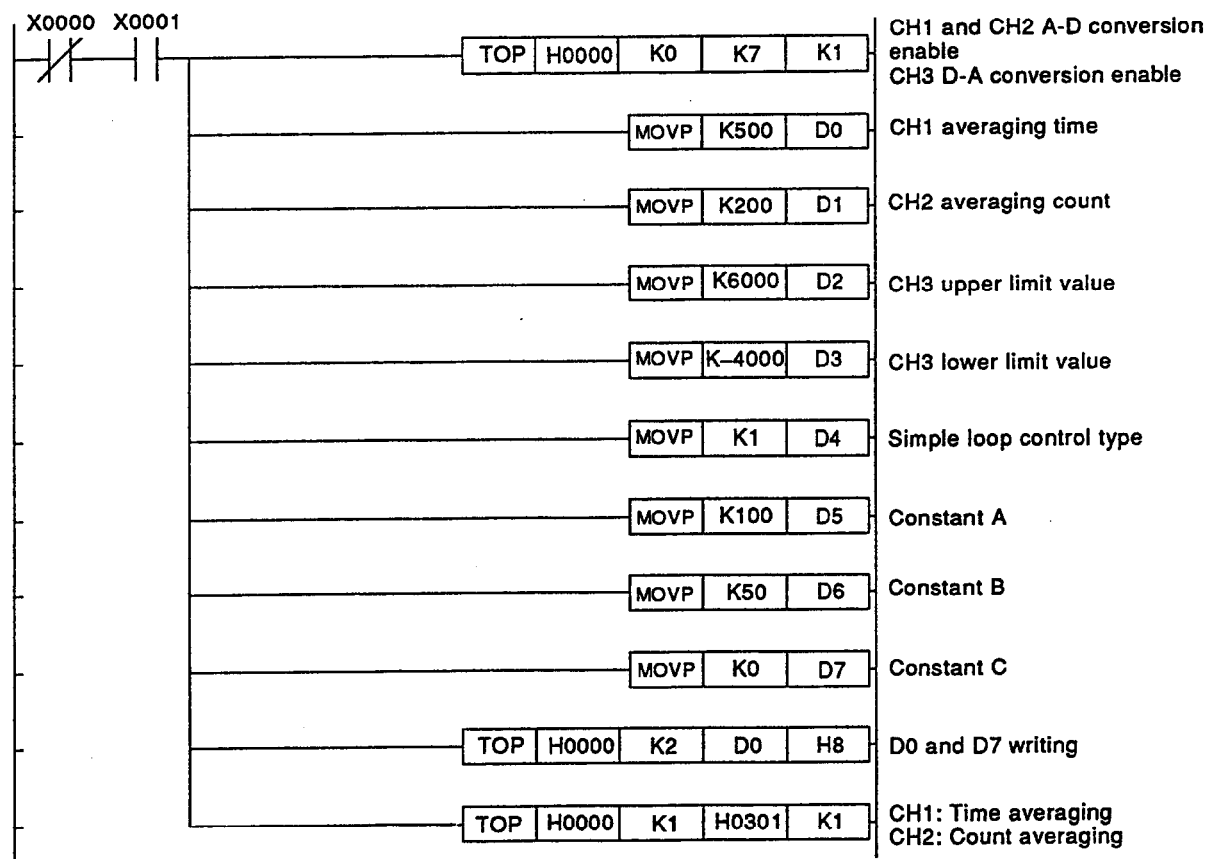
(2) Buffer memory

- Address 0: A-D/D-A conversion enable/disable setting
- Address 1: A-D conversion averaging setting
- Address 2: CH1 averaging time/count
- Address 3: CH2 averaging time/count
- Address 4: CH3 output upper limit value setting
- Address 5: CH3 output lower limit value setting
- Address 6: Simple loop control type setting
- Addresses 7 to 9: Constants A, B, and C setting
- Address 13: Simple loop control output calculation value
- Address 16: Error code

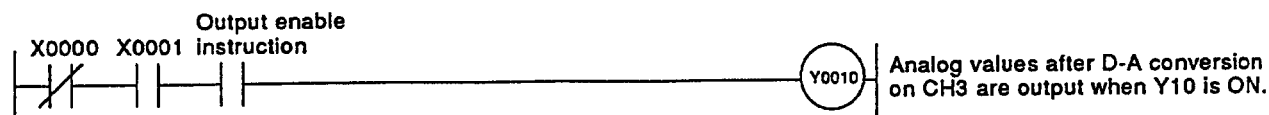
Offset/gain values and resolution setting



Initial setting



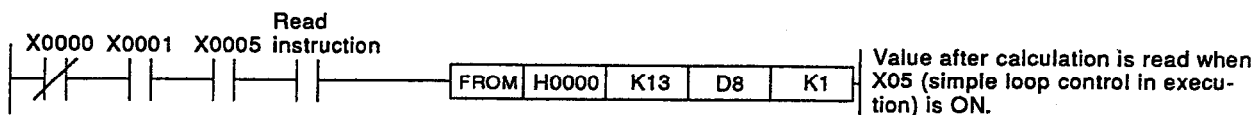
CH3 D-A conversion value output enable



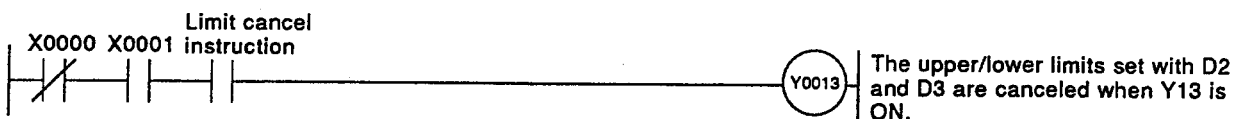
Simple loop control execution enable



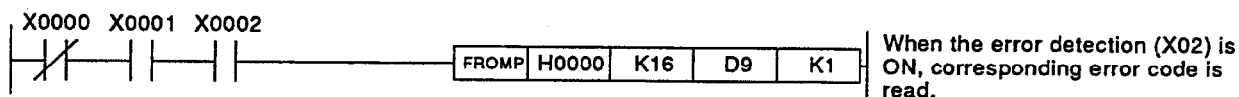
Simple loop control output calculation value



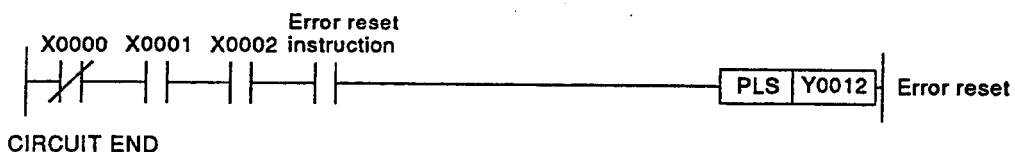
CH3 upper/lower limit cancel



Error detection



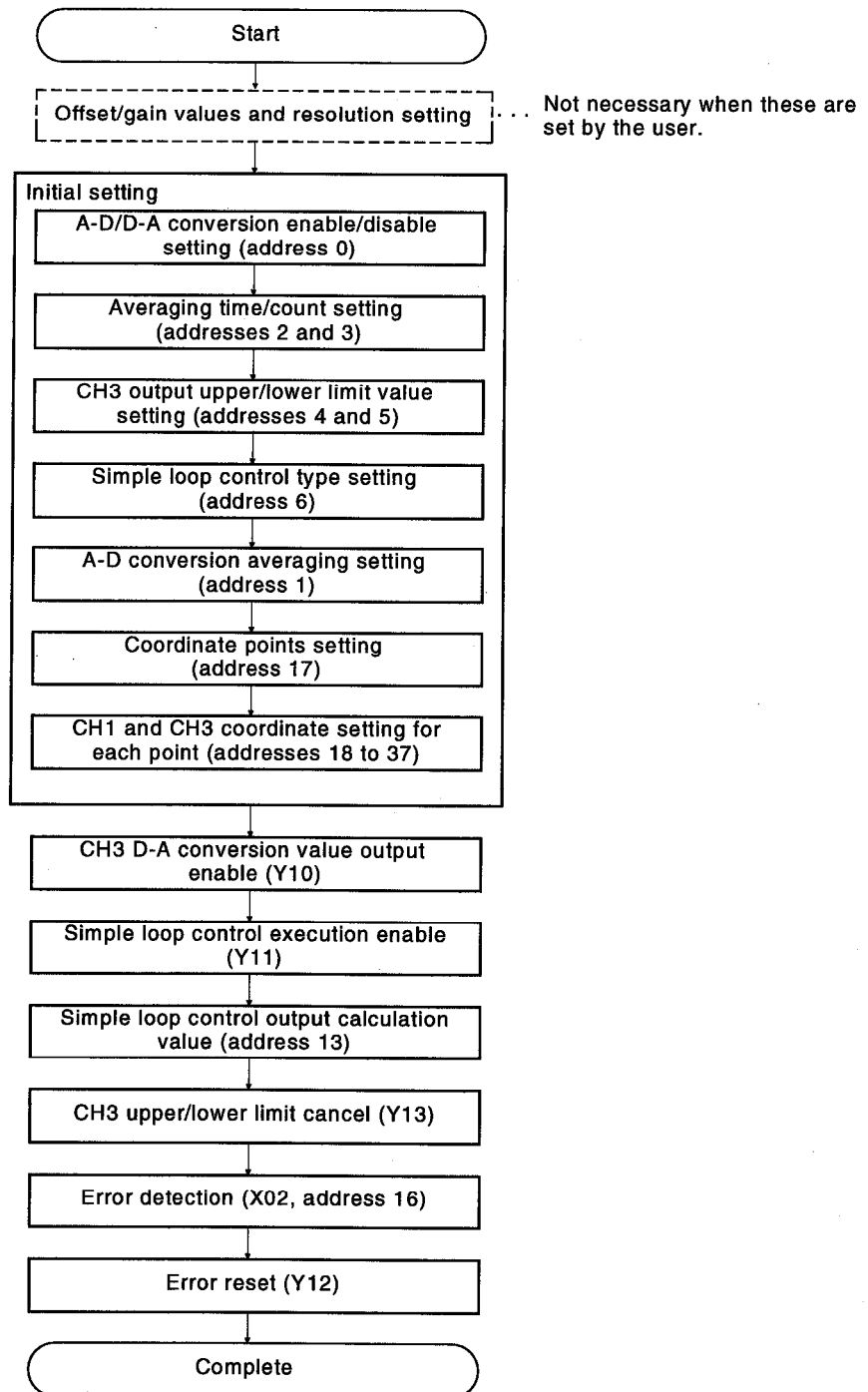
Error reset



5.3.2 Simple loop control by coordinate designation

(1) Programming procedure

The programming procedure is as given below.

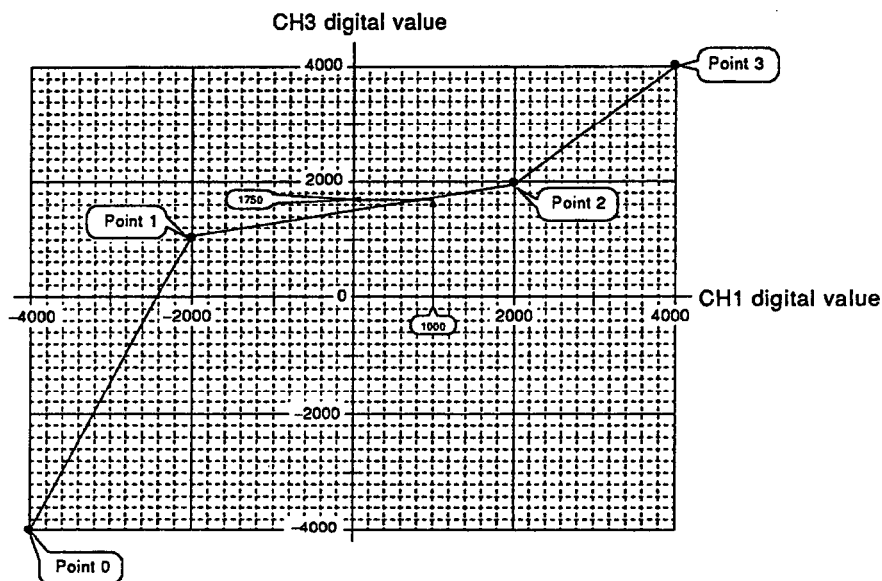


(2) Program examples

The following program examples assume that the A1S63ADA is installed to slot 0.

General description of the program

The CH3 digital value which corresponds to CH1 digital value is processed by D-A conversion and output as an analog value, as shown below. For example, CH1 digital value "1000", corresponding CH3 digital value "1750" is converted and output on CH3 as an analog value.



<Signals and buffer memory used with the program>

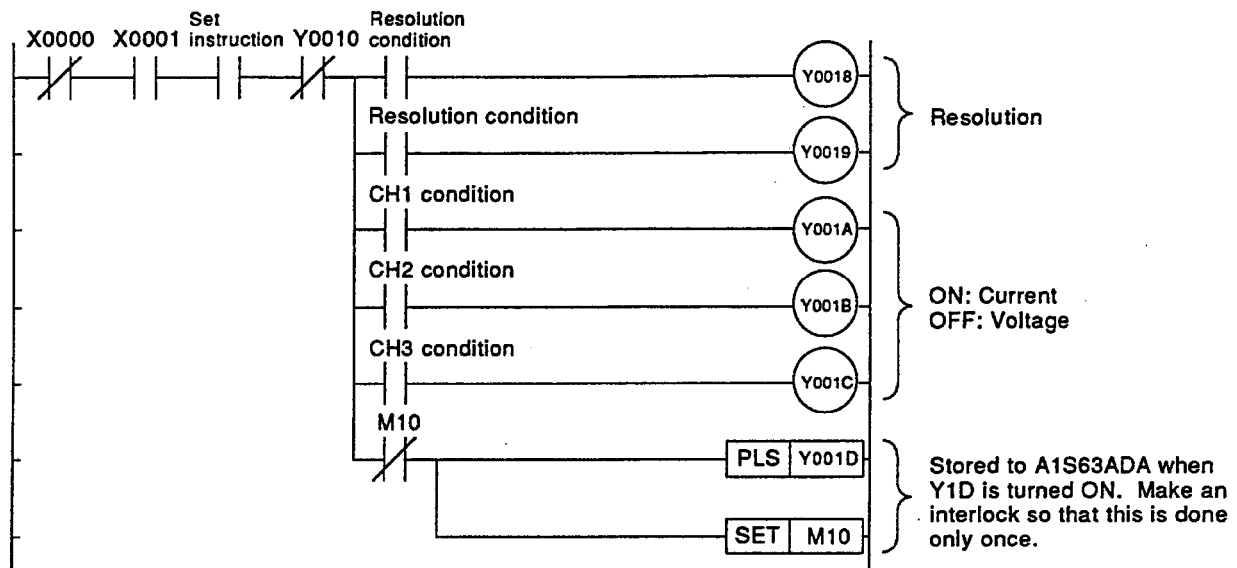
(1) Signals

- X000: Watchdog timer error
- X001: Conversion READY
- X002: Error detection
- X005: Simple loop control in execution
- Y010: CH3 D-A conversion value output enable
- Y011: Simple loop control execution enable
- Y012: Error reset
- Y013: CH3 upper/lower limit cancel
- Y018 to 19: Resolution selection
- Y01A: CH1 voltage/current
- Y01B: CH2 voltage/current
- Y01C: CH3 voltage/current
- Y01D: Offset/gain setting

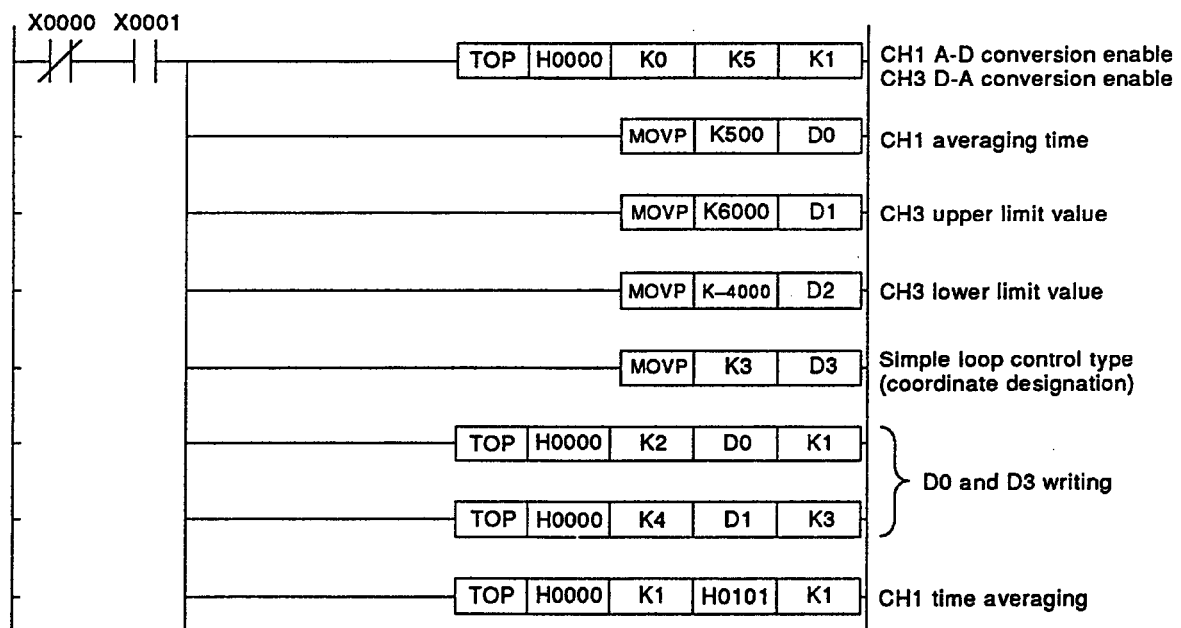
(2) Buffer memory

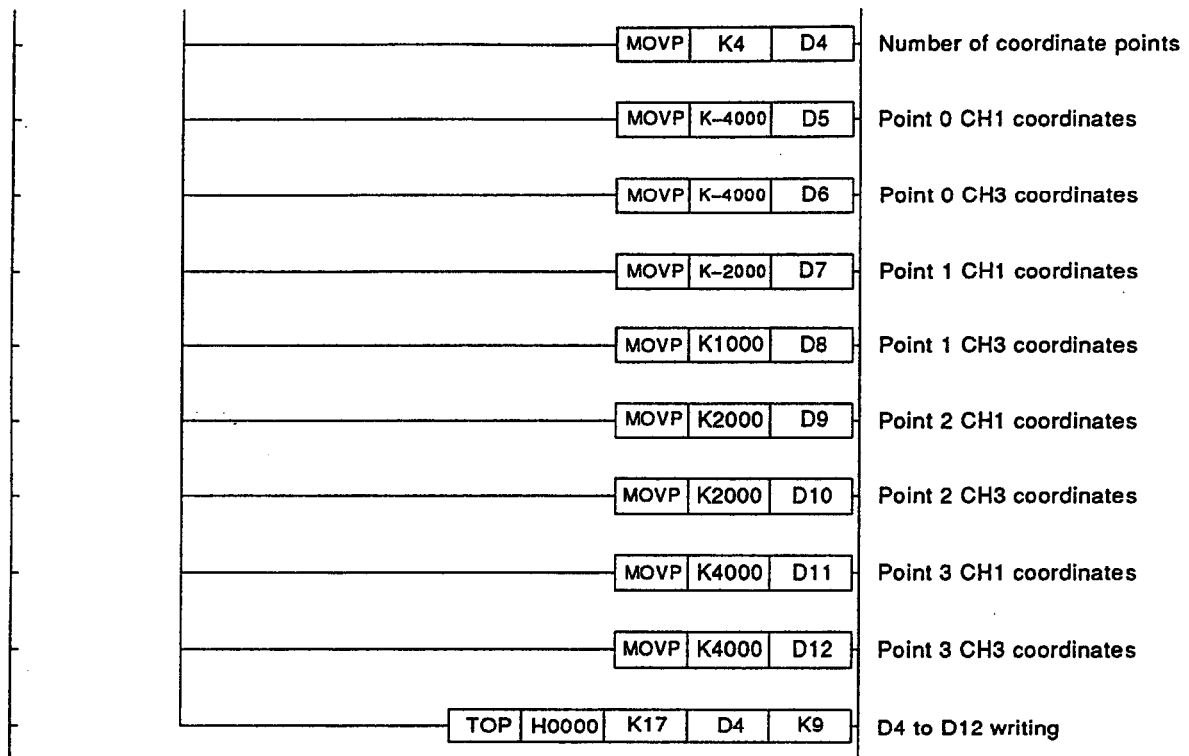
- Address 0: A-D/D-A conversion enable/disable setting
- Address 1: A-D conversion averaging setting
- Address 2: CH1 averaging time/count
- Address 3: CH2 averaging time/count
- Address 4: CH3 output upper limit value setting
- Address 5: CH3 output lower limit value setting
- Address 6: Simple loop control type setting
- Address 13: Simple loop control output calculation value
- Address 16: Error code
- Address 17: Coordinate points setting
- Addresses 18 to 25: CH1/CH3 coordinates for points 0 to 3

Offset/gain values and resolution setting

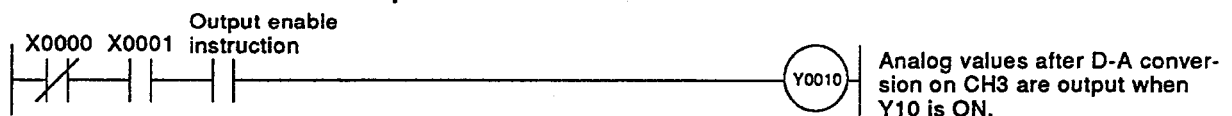


Initial setting

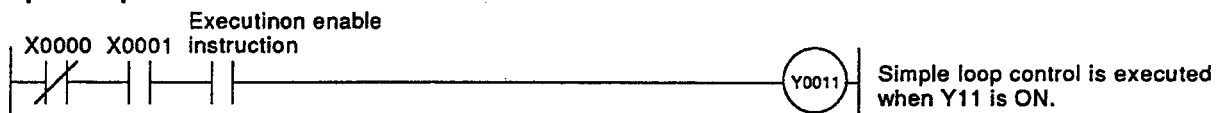




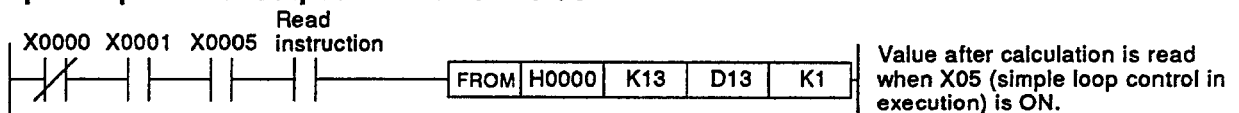
CH3 D-A conversion value output enable



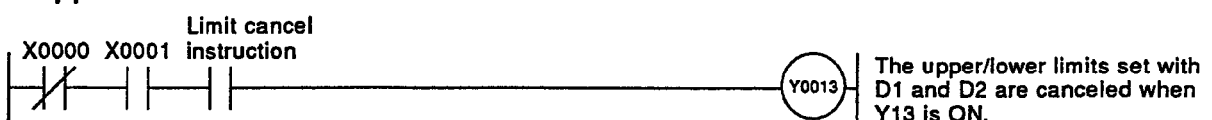
Simple loop control execution enable



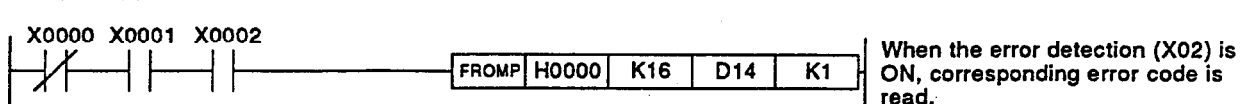
Simple loop control output calculation value



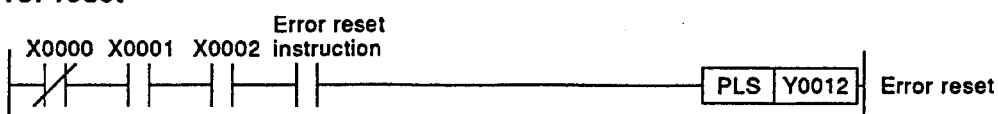
CH3 upper/lower limit cancel



Error detection



Error reset



6. TROUBLESHOOTING

This section gives the description and troubleshooting for the errors that can occur with the A1S63ADA.

6.1 Error Codes List

When an error occurs with data set with the A1S63ADA, the corresponding error code is stored to buffer address 16 as given in Table 6.1 below.

Table 6.1 Error Codes List

Error code (decimal)	Cause								
[]0 *	A value other than 10 to 10000 is set with averaging time setting (address 2 or 3).								
[]5 *	A value other than 1 to 500 is set with averaging count setting (address 2 or 3).								
102	Write is attempted to a read-only area (addresses 11 to 15).								
103	A value other than 0 to 3 is set with simple loop control type setting (address 6).								
105	A value other than 2 to 10 is set with number of coordinate points setting (address 17).								
106	CH1 coordinate settings (addresses 18, 20, 22, 24, 26, 28, 30, 32, 34 and 36) include setting as point n coordinates \geq point n + 1 coordinates.								
107	<p>A value other than those mentioned below is set with digital value setting (address 10).</p> <table border="1"> <thead> <tr> <th>Resolution</th><th>Setting Range</th></tr> </thead> <tbody> <tr> <td>1/4000</td><td>-4096 to 4095</td></tr> <tr> <td>1/8000</td><td>-8192 to 8191</td></tr> <tr> <td>1/12000</td><td>-12288 to 12287</td></tr> </tbody> </table>	Resolution	Setting Range	1/4000	-4096 to 4095	1/8000	-8192 to 8191	1/12000	-12288 to 12287
Resolution	Setting Range								
1/4000	-4096 to 4095								
1/8000	-8192 to 8191								
1/12000	-12288 to 12287								
108	There is a discrepancy in resolution setting among CH1, CH2, and CH3.								

* [] indicates the channel where the error occurs.

- (1) When multiple errors occur, the error code for the first-detected error will be stored. Subsequent error codes will not be stored.
- (2) To reset an error, either turn ON the error reset (Y12) signal or write 0 to buffer address 16.
- (3) Before resetting an error, eliminate the cause of error.

6.2 Troubleshooting

The following gives the probable causes and corrective actions to be taken when trouble occurs.

A1S63ADA's RUN LED is flashing

Cause	Corrective action
(1) Data is written to a read-only area (buffer address 11 to 15). Incorrect data setting. (Data outside a specified range is set.)	(1) Check the error code at buffer address 16 with the "Error Codes List" in Section 6.1 and correct the sequence program.
(2) The TEST terminals (1 and 3) are shorted, and the OFFSET/GAIN select switch is set in the "OFFSET" or "GAIN" position.	(2) After making offset/gain setting, open the TEST terminals (between 1 and 3).

A1S63ADA's RUN LED is not lit

Cause	Corrective action
(1) The TEST terminals (between 1 and 3) are shorted.	(1) Open the TEST terminals (between 1 and 3).
(2) A watchdog timer error (X00 is ON) occurs.	(2) Reset the PC CPU. When the LED state does not change to the "lit" state, hardware may be faulty. Consult your nearest Mitsubishi representative.
(3) Power supply capacity supplied to the A1S63ADA is insufficient.	(3) Calculate the current consumption at units and modules other than the A1S63ADA, and select a power supply module which has enough capacity to operate the A1S63ADA.
(4) The PC CPU causes an error.	(4) Check the error by referring to the PC CPU's User's Manual.

Unable to read digital output values

Cause	Corrective action
(1) Voltage or current is not correctly supplied.	(1) Measure the voltage and/or current by using a circuit tester.
(2) Wires are disconnected or broken.	(2) Check visually the wiring and conductivity, and correct abnormal points.
(3) Some of the FROM instruction execution conditions are not "ON".	(3) Check the ON/OFF states by monitoring with a peripheral device.
(4) Buffer addresses designated with a FROM instruction are not correct.	(4) Check the sequence program.
(5) The channel designated with a FROM instruction is not set for "A-D conversion enabled".	(5) Check the content at buffer address 0.
(6) The channel designated with a FROM instruction is not in the "A-D conversion completed" state.	(6) Check the content at buffer address 15.
(7) The PC CPU's RUN LED is "flashing" or "not lit".	(7) Check the CPU by referring to the PC CPU's User's Manual.

Analog values are not output

Cause	Corrective action
(1) CH3 D-A conversion value output enable (Y10) signal is not "ON".	(1) Check the conditions for "ON" by monitoring with a peripheral device.
(2) CH3 is not set for "D-A conversion enabled".	(2) Check the content at buffer address 0.
(3) The PC CPU is not in the "RUN" state.	(3) Set the PC CPU's key switch in the "RUN" position.
(4) The PC CPU's RUN LED is "flashing" or "not lit".	(4) Check the CPU by referring to the PC CPU's User's Manual.
(5) Buffer addresses designated with a TO instruction are not correct.	(5) Check the sequence program.

Analog value is output regardless of the ON/OFF state of CH3 D-A conversion value output enable (Y10) signal

Cause	Corrective action
(1) The HLD/CLR terminals (between 2 and 4) are shorted.	(1) Open the HLD/CLR terminals (between 2 and 4).

Simple loop control is not executed

Cause	Corrective action
(1) The simple loop control execution enable (Y11) signal is not "ON".	(1) Check the conditions for "ON" by monitoring with a peripheral device.
(2) The simple loop control in execution (X05) signal is not "ON".	(2) Incorrect data setting. Check the error code at buffer address 16 with the "Error Codes List" in Section 6.1 and correct the sequence program.

Analog value is held when it becomes larger (smaller) than a certain value

Cause	Corrective action
(1) CH3 output upper/lower limits (addresses 4 and 5) are set as valid values.	(1) The valid range of a set value varies according to resolution setting. Therefore, set a value to make the set value invalid. Turn ON the CH3 upper/lower limit cancel (Y13) signal.

Unable to change resolution and offset/gain values

Cause	Corrective action
(1) Y1D is not turned "ON (leading edge)" after resolution condition setting.	(1) Turn "ON (leading edge)" Y1D after resolution condition setting.

APPENDICES

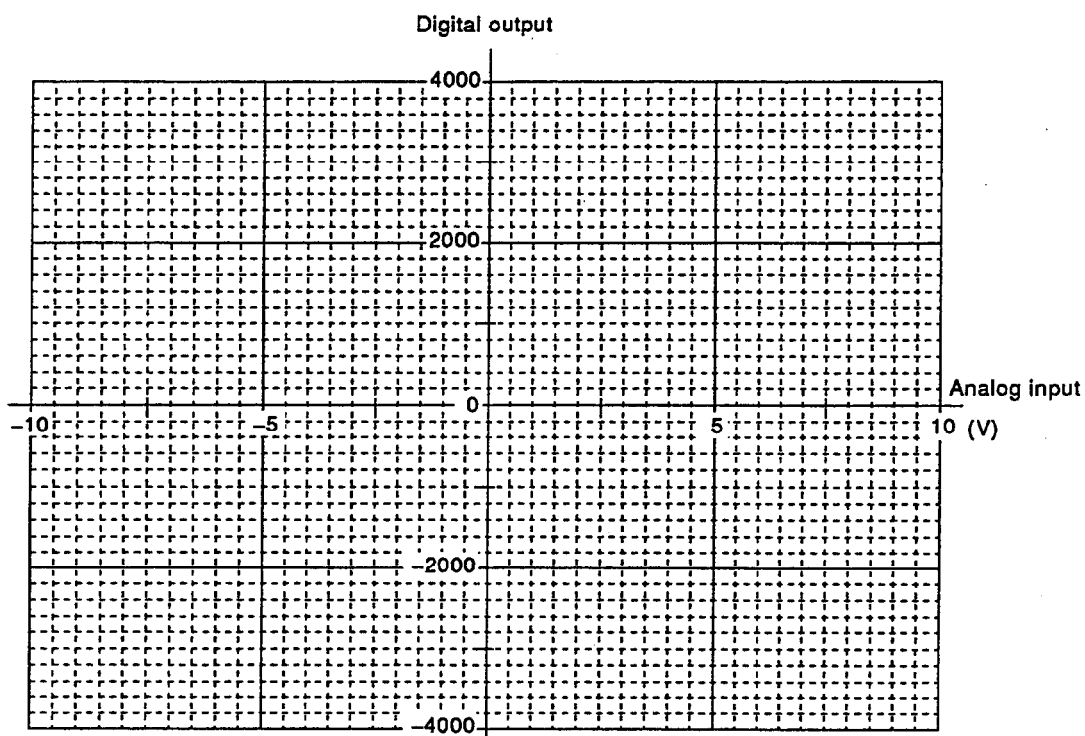
APPENDIX 1 SETTING SHEET

1.1 Buffer Memory Allocation

Address (decimal)	Name		Set Value	Setting Range			Default Value (decimal)
				1/4000	1/8000	1/12000	
0	A-D/D-A conversion enable/disable setting			See Section 3.6.2			0
1	A-D conversion averaging setting			See Section 3.6.3			0
2	CH1 averaging time/count setting			Time: 10 to 10000 Count: 1 to 500			1
3	CH2 averaging time/count setting						1
4	CH3 output upper limit value setting						12000
5	CH3 output lower limit value setting			-4000 to 4000	-8000 to 8000	-12000 to 12000	-12000
6	Simple loop control type setting			1 to 3			0
7	Constant A setting			-32768 to 32767			0
8	Constant B setting						0
9	Constant C setting						0
10	CH3 digital value setting			-4096 to 4095	-8192 to 8191	-12288 to 12287	0
11	CH1 A-D conversion digital value		Setting impossible				0
12	CH2 A-D conversion digital value						0
13	Simple loop control output calculation value						0
14	Resolution setting						1
15	A-D conversion completion flag						0
16	Error code			0			0
17	Coordinate points setting			2 to 10			2
18	Point 0	CH1 coordinates		-4000 to 4000	-8000 to 8000	-12000 to 12000	0
19		CH3 coordinates					0
20	Point 1	CH1 coordinates					0
21		CH3 coordinates					0
22	Point 2	CH1 coordinates					0
23		CH3 coordinates					0
24	Point 3	CH1 coordinates					0
25		CH3 coordinates					0
26	Point 4	CH1 coordinates					0
27		CH3 coordinates					0
28	Point 5	CH1 coordinates					0
29		CH3 coordinates					0
30	Point 6	CH1 coordinates					0
31		CH3 coordinates					0
32	Point 7	CH1 coordinates					0
33		CH3 coordinates					0
34	Point 8	CH1 coordinates					0
35		CH3 coordinates					0
36	Point 9	CH1 coordinates					0
37		CH3 coordinates					0

1.2 Offset/Gain Setting

(1) CH1 and CH2 settings



The above chart shows a case when resolution setting is 1/4000 and the voltage is input.

For resolution settings 1/8000 and 1/12000 and the current input, refer to the following values.

<Digital output>

1/4000	1/8000	1/12000
4000	8000	12000
2000	4000	6000
-2000	-4000	-6000
-4000	-8000	-12000

<Analog input>

Voltage (V)	Current (mA)
10	20
5	10
-5	-10
-10	-20

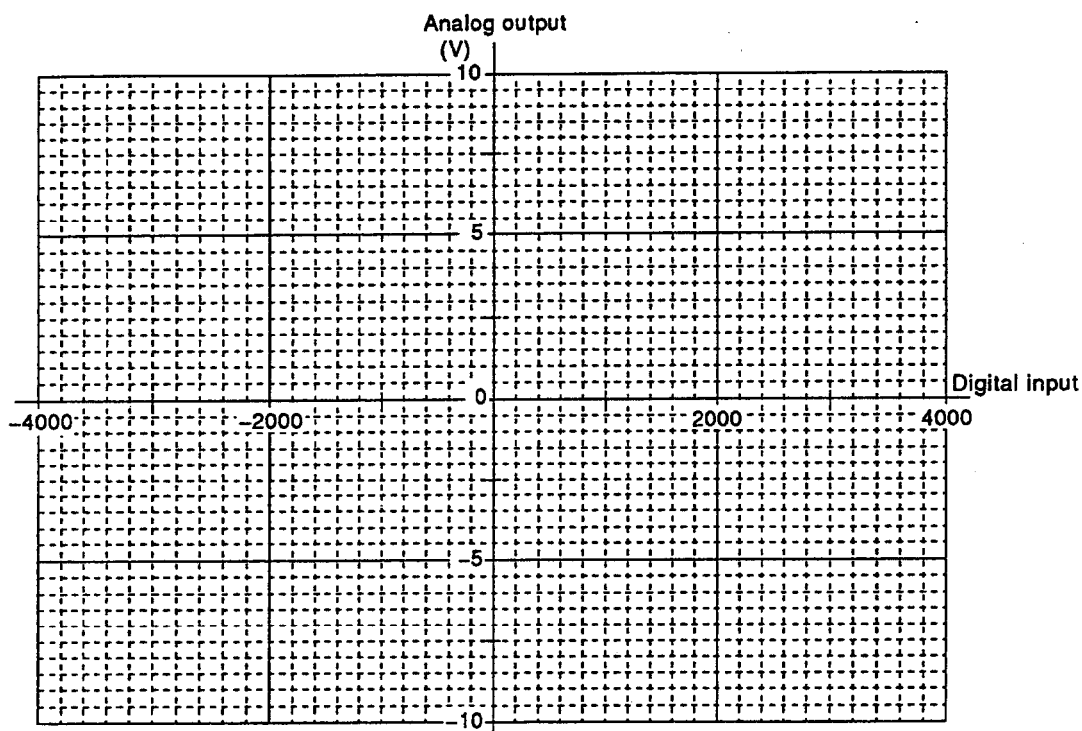
<Offset/gain value setting>

Channel	Offset Value	Gain Value	Resolution
CH1			
CH2			

Offset value: Analog input value which makes the digital output value become "0".

Gain value: Analog input value which makes the digital output value become "2000 (at 1/4000 resolution)", "4000 (at 1/8000 resolution)" or "6000 (at 1/12000 resolution)".

(2) CH3 setting



The above chart shows a case when resolution setting is 1/4000 and the voltage is input.

For resolution settings 1/8000 and 1/12000 and the current input, refer to the following values.

<Digital input>

1/4000	1/8000	1/12000
4000	8000	12000
2000	4000	6000
-2000	-4000	-6000
-4000	-8000	-12000

Impossible to be used with current output.

<Analog output>

Voltage (V)	Current (mA)
10	20
5	10
-5	—
-10	—

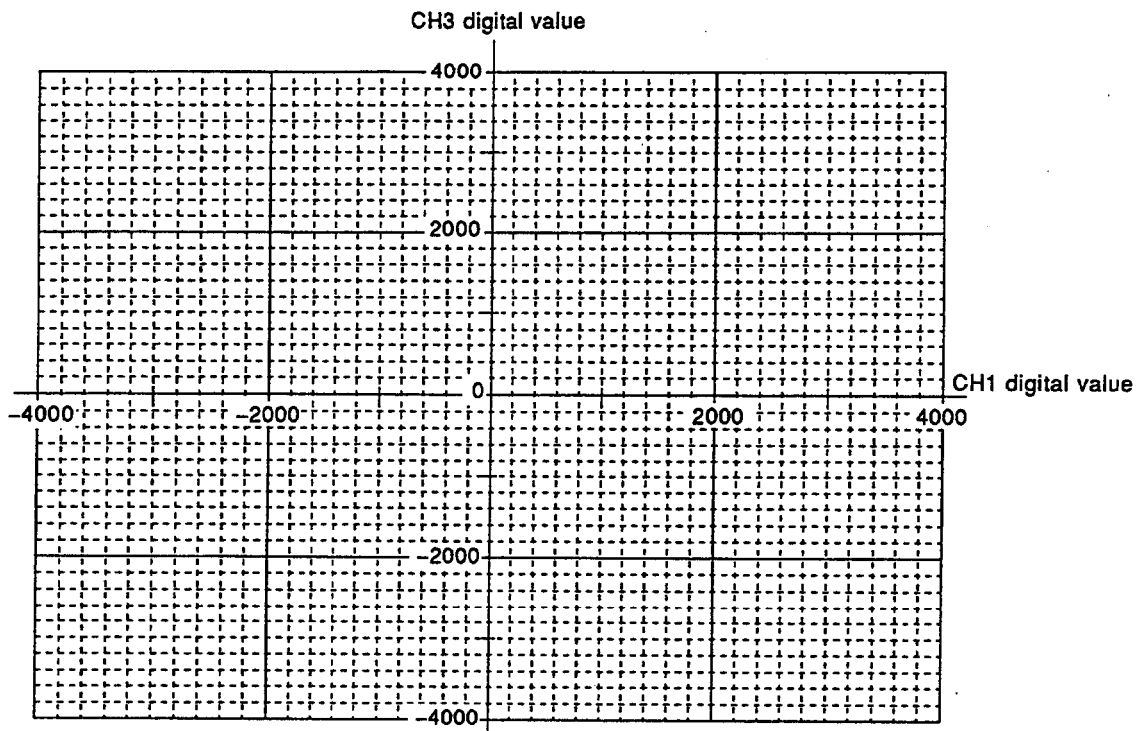
<Offset/gain value setting>

Channel	Offset Value	Gain Value	Resolution
CH3			

Offset value: Analog output value when the digital input value is "0".

Gain value: Analog output value when the digital input value is "4000 (at 1/4000 resolution)", "8000 (at 1/8000 resolution)" or "12000 (at 1/12000 resolution)".

1.3 Point Coordinate Setting (Simple Loop Control)



The above chart shows a case when resolution setting is 1/4000.
For resolution settings 1/8000 and 1/12000, refer to the following values.

1/4000	1/8000	1/12000
4000	8000	12000
2000	4000	6000
-2000	-4000	-6000
-4000	-8000	-12000

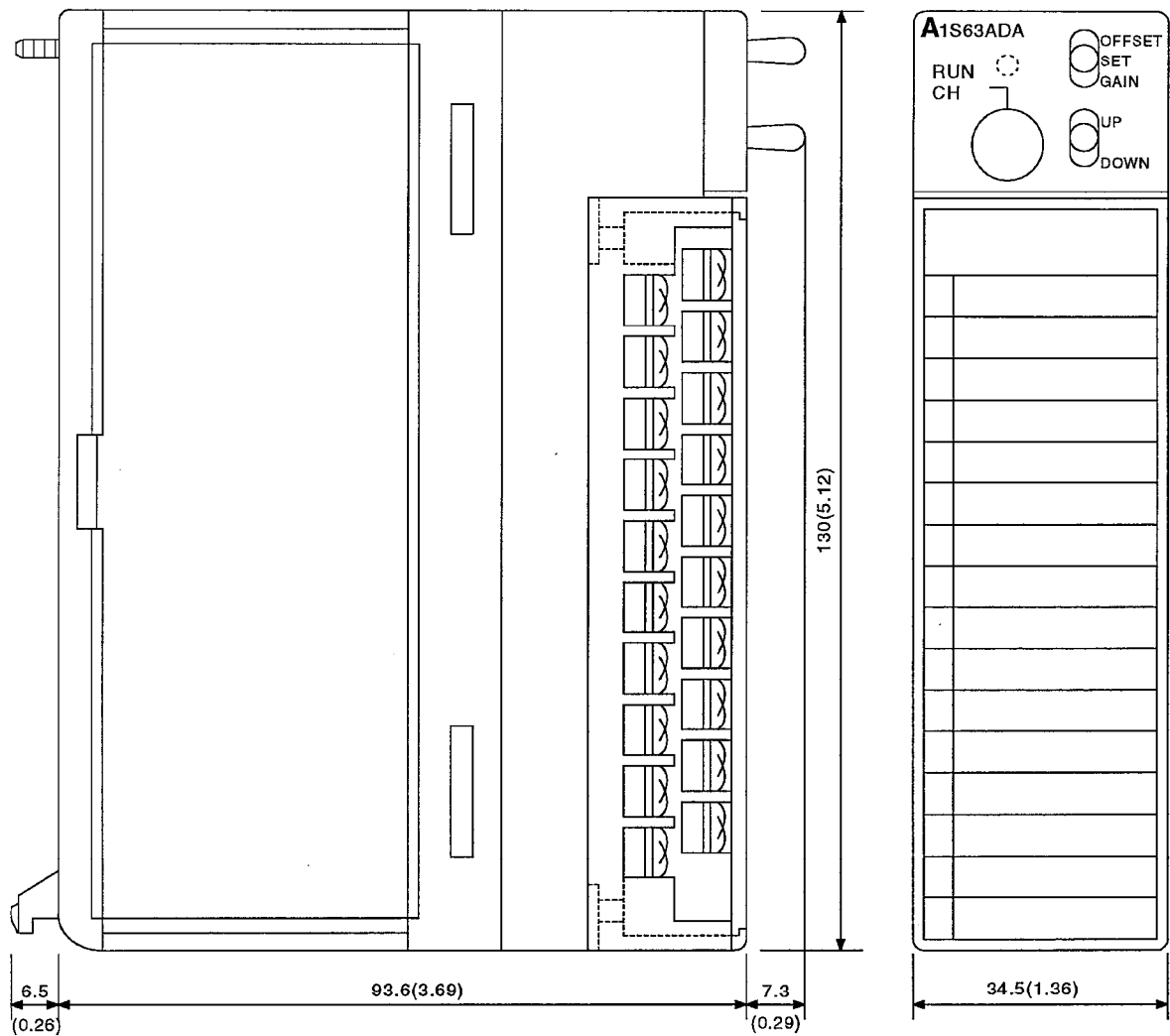
Resolution:

Point	Setting Coordinates		Point	Setting Coordinates	
	CH1	CH3		CH1	CH3
0			5		
1			6		
2			7		
3			8		
4			9		

APPENDIX 2 COMPARISON BETWEEN A1S63ADA AND A1S64AD/A1S62DA

Item	A1S63ADA	A1S64AD	A1S62DA
Number of channels	Input: 2 channels Output: 1 channel	Input: 4 channels	Output: 2 channels
Resolution	1/4000 1/8000 1/12000		
Analog input	DC -10 to 10 V DC -20 to 20 mA	—	—
Analog output	DC -10 to 10 V DC 0 to 20 mA	—	DC -10 to 10 V DC 0 to 20 mA
Digital input	-4000 to 4000 -8000 to 8000 -12000 to 12000	—	-4000 to 4000 -8000 to 8000 -12000 to 12000
Digital output	-4096 to 4095 -8192 to 8191 -12288 to 12287	—	—
Max. conversion speed	1 ms/ch (1/ 4000 resolution) 2 ms/ch (1/ 8000 resolution) 3 ms/ch (1/12000 resolution)	20 ms/ch	25 ms fixed
Sampling	O	O	—
Averaging	O	O	—
Conversion enable/disable	O	O	O
Analog output enable/disable	O	—	O
Analog output hold/clear when PC CPU is in STOP state	O	—	O
Analog output value limit	O	—	X
Simple loop control	O	X	X

APPENDIX 3 OUTSIDE DIMENSIONS



Unit : mm(inch)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

WARRANTY

Please confirm the following product warranty details before starting use.

1. Gratis Warranty Term and Gratis Warranty Range

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

[Gratis Warranty Term]

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

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

[Gratis Warranty Range]

- (1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.
- (2) Even within the gratis warranty term, repairs shall be charged for in the following cases.
 1. failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
 2. Failure caused by unapproved modifications, etc., to the product by the user.
 3. When the Mitsubishi product is assembled into a user's device, failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
 4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
 5. Failure caused by external irresistible forces such as fires or abnormal voltages, and failure caused by force majeure such as earthquakes, lightning, wind and water damage.
 6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
 7. Any other failure found to not be the responsibility of Mitsubishi or the user.

2. Onerous repair term after discontinuation of production

- (1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.
- (2) Product supply (including repair parts) is not possible after production is discontinued.

3. Overseas service

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

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

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

5. Changes in product specifications

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

6. Product application

- (1) In using the Mitsubishi MELSEC programmable logic controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable logic controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.
- (2) The Mitsubishi general-purpose programmable logic controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for each Japan Railways company or the Department of Defense shall be excluded from the programmable logic controller applications.

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

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

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