MITSUBISHI

Analog input/ output module

User's Manual

(Hardware)

A1S63ADA

Thank you for buying the Mitsubishi general-purpose programmable logic controller MELSEC-A Series

Prior to use, please read both this manual and detailed manual thoroughly and familiarize yourself with the product.

A MELSEC

MODEL	A1S63ADA-U-(H/W)
MODEL CODE	13JG43
IB(NA)-68474-H(1112)MEE	

● SAFETY PRECAUTIONS ●
(Read these precautions before using this product.)

Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.
These precautions apply only to this equipment. Refer to the CPU module user's manual for a description of the PC system safety precautions.
In this manual, the safety precautions are classified into two levels:
"⚠WARNING" and "⚠CAUTION".

⚠**WARNING**	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠**CAUTION**	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Under some circumstances, failure to observe the precautions given under "⚠CAUTION" may lead to serious consequences.
Observe the precautions of both levels because they are important for personal and system safety.
Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[DESIGN PRECAUTIONS]

⚠**WARNING**
● 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**
● 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. ● At power ON/OFF, voltage or current may instantaneously be output from the output terminal of this module. In such case, wait until the analog output becomes stable to start controlling the external device.

[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. ● Be sure to shut off all phases of the external power supply used by the system before cleaning or retightening the terminal screws. Not doing so can cause the module to fail or malfunction. ● Do not disassemble or rebuild the module. It may cause accidents, erroneous operation, injury, or fire. ● Be sure to shut off all phases of the external power supply used by the system before mounting or removing the module. Not doing so may cause damage to the module. ● Do not install/remove the terminal block more than 50 times after the first use of the product. (IEC 61131-2 compliant) ● Before handling the module, always touch grounded metal, etc. to discharge static electricity from the human body. Failure to do so may cause the module to fail or malfunction.

[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.

● CONDITIONS OF USE FOR THE PRODUCT ●

(1) Mitsubishi programmable controller ("the PRODUCT") shall be used in conditions;

i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and

ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.

MITSUBISHI SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI'S USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.
("Prohibited Application")

Prohibited Applications include, but not limited to, the use of the PRODUCT in;

- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above, restrictions Mitsubishi may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTs are required. For details, please contact the Mitsubishi representative in your region.

REVISIONS

＊ The manual number is given on the bottom right of the front cover.

Print Date	＊ Manual Number	Revision
Oct.,1994	IB (NA)-68474-A	First edition
Feb.,1999	IB (NA)-68474-B	Addition Safety precautions Partial Correction Section 3.1
Dec.,1999	IB (NA)-68474-C	Partial Correction Chapter 2
Nov.,2001	IB (NA)-68474-D	Partial Correction Contact ad dress (Back cover)
Oct.,2002	IB (NA)-68474-E	Partial Correction Chapter 2, Section 5.2
Sep.,2005	IB (NA)-68474-F	Addition Conformation to the EMC Directive and Low Voltage Instruction Partial Correction SAFETY PRECAUTIONS
Sep.,2006	IB (NA)-68474-G	Partial Correction SAFETY PRECAUTIONS
Dec.,2011	IB (NA)-68474-H	Addition SAFETY PRECAUTIONS (Chinese), CONDITIONS OF USE FOR THE PRODUCT

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■ CONTENTS

About the Manuals

The following manuals are related to this product.
Order them if necessary.

Detailed manuals

Manual Name	Manual No. (Model code)
Analog input/output module type A1S63ADA User's Manual.	IB-66435 (13JE30)

COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

(1) Method of ensuring compliance
To ensure that Mitsubishi programmable controllers maintain EMC and Low Voltage Directives when incorporated into other machinery or equipment, certain measures may be necessary. Please refer to one of the following manuals.
• User's manual for the CPU module used
• User's manual (hardware) for the CPU module or base unit used
The CE mark on the side of the programmable controller indicates compliance with EMC and Low Voltage Directives.

(2) Additional measures
No additional measures are necessary for the compliance of this product with EMC and Low Voltage Directives.

1. OVERVIEW

This manual describes specifications, handling and wiring of an A1S63ADA Analog input/output module (hereinafter referred to as the A1S63ADA).

2 PREFORMANCE SPECIFICATIONS

The performance specifications of the A1S63ADA are shown below.

<table>
<tr><td colspan="2">Item</td><td colspan="4">Specifications</td></tr>
<tr><td rowspan="20">A-D conversion</td><td rowspan="2">Analog input</td><td colspan="4">Voltage:-10 to 0 to 10VDC(input resistance: 1MΩ)</td></tr>
<tr><td colspan="4">Current:-20 to 0 to 20mADC(input resistance: 250Ω)</td></tr>
<tr><td rowspan="2">Digital output</td><td colspan="4">-4096 to 4095 (when resolution is set to 1/4000)
-8192 to 8191 (when resolution is set to 1/8000)
-12288 to 12287 (when resolution is set to 1/12000)</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="8">I/O characteristics *1</td><td rowspan="2">Analog input</td><td colspan="3">Digital value output</td></tr>
<tr><td>1/4000</td><td>1/8000</td><td>1/12000</td></tr>
<tr><td>10V</td><td>4000</td><td>8000</td><td>12000</td></tr>
<tr><td>5V or 20mA</td><td>2000</td><td>4000</td><td>6000</td></tr>
<tr><td>0V or 4mA</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>-5V or –20mA</td><td>-2000</td><td>-4000</td><td>-6000</td></tr>
<tr><td>-10V</td><td>-4000</td><td>-8000</td><td>-12000</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Max. resolution</td><td>Voltage</td><td>2.5mV</td><td>1.25mV</td><td>0.83mV</td></tr>
<tr><td>Current</td><td>10µA</td><td>5µA</td><td>3.33µA</td></tr>
<tr><td>Conversion speed</td><td>————</td><td>1ms/ch</td><td>2ms/ch</td><td>3ms/ch</td></tr>
<tr><td>General accuracy*2</td><td>± 1%</td><td>± 40</td><td>± 80</td><td>± 120</td></tr>
<tr><td>Absolute max. input</td><td colspan="4">Voltage: ± 15V　　Current: ± 30mA*3</td></tr>
<tr><td>Analog input points</td><td colspan="4">2 channel</td></tr>
<tr><td rowspan="13">D-A conversion</td><td>————</td><td colspan="2">Voltage output</td><td colspan="2">Current output</td></tr>
<tr><td>Digital input</td><td colspan="2">-4000 to 4000
(when resolution is set to 1/4000)
-8000 to 8000
(when resolution is set to 1/8000)
-12000 to 12000
(when resolution is set to 1/12000)</td><td colspan="2">0 to 4000
(when resolution is set to 1/4000)
0 to 8000
(when resolution is set to 1/8000)
0 to 12000
(when resolution is set to 1/12000)</td></tr>
<tr><td>Analog output</td><td colspan="2">-10 to 0 to 10VDC(external load resistance:2kΩ to 1MΩ)</td><td colspan="2">0 to 20mADC(external load resistance:0Ω to 600Ω)</td></tr>
</table>

<table>
<tr><td rowspan="6">I/O characteristics *4</td><td>1/4000</td><td>1/8000</td><td>1/12000</td><td>Analog output value</td><td>1/4000</td><td>1/8000</td><td>1/12000</td><td>Analog output value</td></tr>
<tr><td>4000</td><td>8000</td><td>12000</td><td>10V</td><td>4000</td><td>8000</td><td>12000</td><td>20mA</td></tr>
<tr><td>2000</td><td>4000</td><td>6000</td><td>5V</td><td>2000</td><td>4000</td><td>6000</td><td>12mA</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0V</td><td>0</td><td>0</td><td>0</td><td>4mA</td></tr>
<tr><td>-2000</td><td>-4000</td><td>-6000</td><td>-5V</td><td>—</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td>-4000</td><td>-8000</td><td>-12000</td><td>-10V</td><td>—</td><td>—</td><td>—</td><td>—</td></tr>
</table>

<table>
<tr><td rowspan="3">Max. resolution</td><td>1/4000</td><td>2.5mV</td><td>5µA</td></tr>
<tr><td>1/8000</td><td>1.25mV</td><td>2.5µA</td></tr>
<tr><td>1/12000</td><td>0.83mV</td><td>1.7µA</td></tr>
</table>

Item			Specifications	
		———	Voltage output	Current output
D-A conversion		Conversion speed*5	1ms(1/4000) 2ms(1/8000) 3ms(1/12000)	
		General accuracy*6	± 1%(± 0.1V)	± 1%(± 0.2mA)
		Solute max. output	Voltage: ± 12V Current: + 28mA	
		Output shorting protection	Provided	
		Analog output points	1channel	

Common to A-D and D-A conversions	Isolation specifications	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	5MΩ or more (measured with a 500V DC insulation resistance tester)
		Between channels	Not isolated	-	-

Conversion speed in simple loop control*7	4ms(1/4000) 7ms(1/8000) 9ms(1/12000)
Number of occupying I/O points	32 points
Connection terminal block	20-point terminal block (M3.5 × 7 screw)
Applicable wire size	0.75 to1.5mm^2
Applicable crimp terminal	1.25-3.5 1.25-YS3A 2-3.5 2-YS3A V1.25-M3 V1.25-YS3A V2-3.5 V2-YS3A
Internal current consumption (5 VDC)	0.8A
Weight	0.3kg

The offset and gain are set as shown below as the default setting.

      CH1 ... Offset: 0V/4mA, Gain: 5V/20mA

      CH2 ... Offset: 0V/4mA, Gain: 5V/20mA

      CH3 ... Offset: 0V/4mA, Gain: 10V/20mA

*1: For offset value: 0V/4mA, gain value: 5V/20mA

*2: This is the accuracy in respect to the maximum digital output value. The maximum digital output value is the maximum value at the selected resolution, and is the same for either a current input or voltage input.

*3: Current value indicates value of instant input current that does not break module inner electrical resistance.

*4: For offset value: 0V/4mA, gain value: 10V/20mA

*5: Depending on the timing of reading the digital value from the PLC CPU, the process may be carried out with a delay of up to one conversion processing time. The response time for the amplifier to output the D/A converted data to an external source is "maximum 1ms".

*6: This is the accuracy in respect to the maximum analog output value.

*7: The response time for the amplifier to output the D/A converted data to an external source is "1ms". For the general specifications, refer to the User's Manual for the PLC CPU in use.
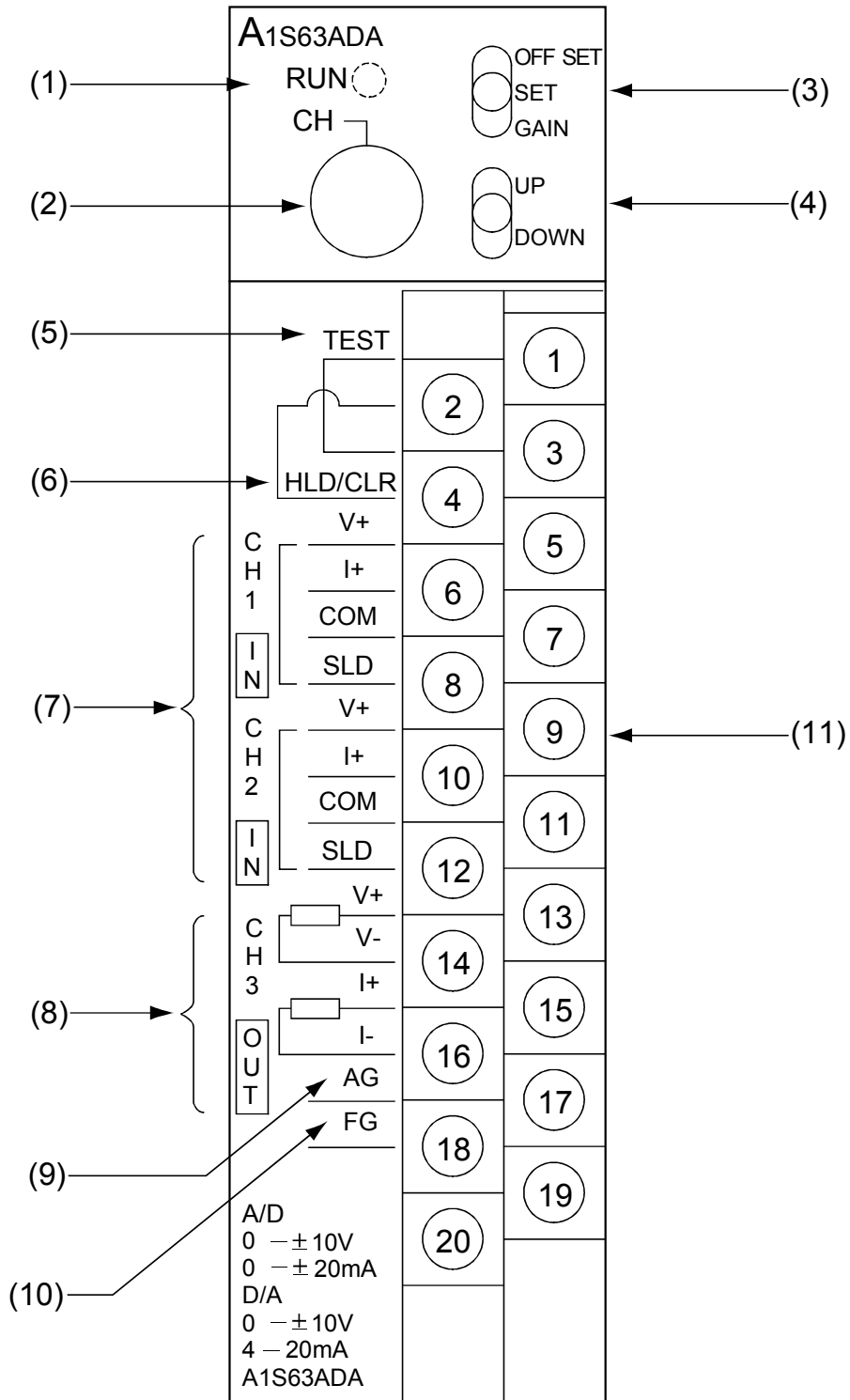
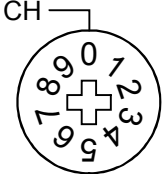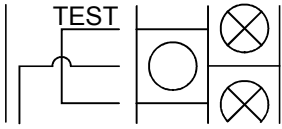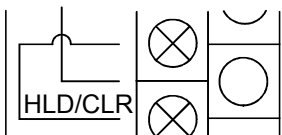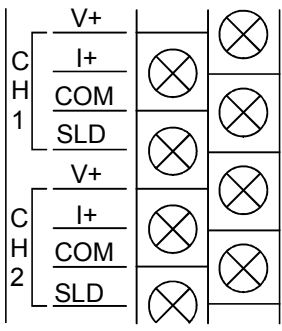| POINT |
| --- |
| For approx. 30 minutes after the power is turned ON, the A/D conversion value will fluctuate due to the effect of the self-generated heat.
If this fluctuation is a problem, start control after warming up for approx. 30 minutes. In the same manner, wait approx. 30 minutes to warm up before adjusting the offset/gain value (user-set). |
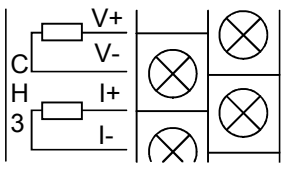
3.1 Names of each part

The names of each part are explained in this section.
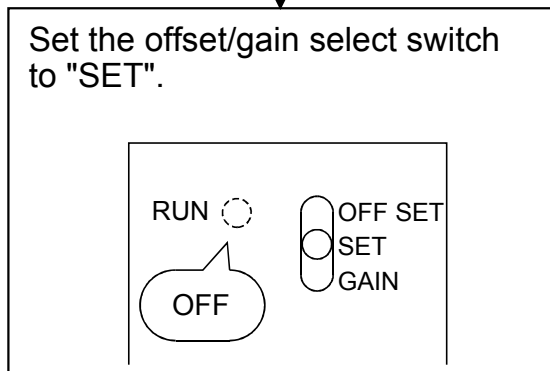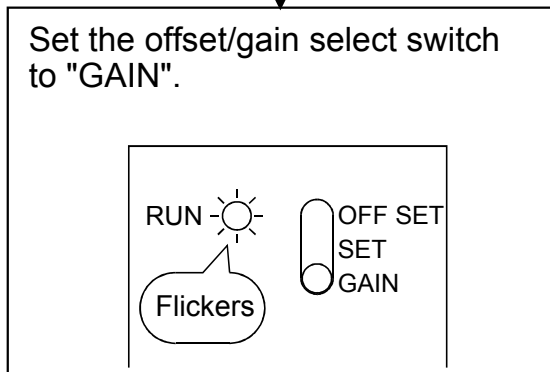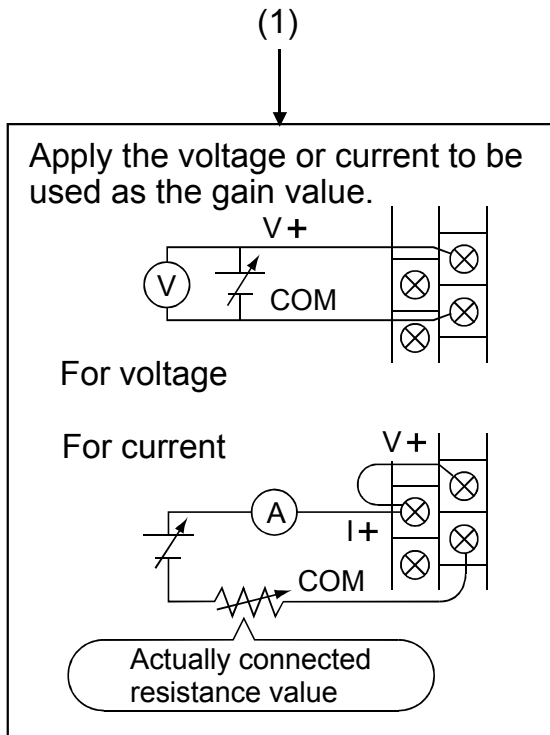
No.	Name	Details
(1)	RUN LED RUN ⬭	This indicates the A1S63ADA operation state. • Normal mode 　LED ON: In normal operation 　Flickering: Setting data error 　LED OFF: 5V power OFF or watch dog timer error • Test mode 　Flickering: The LED flickers at a 0.25 second interval when the offset/gain select switch is set to "OFFSET" or "GAIN". If the CH3 setting value is set above the setting range with the UP/DOWN switch, the LED will flicker at a fast 0.1 second interval. 　LED OFF: The offset/gain select switch is set to "SET".
(2)	Channel, resolution select switch CH ⎯ (dial 0-9)	This sets the channel for adjusting the offset/gain value and the resolution. • Normal mode: Invalid • Test mode　: Valid 　　　　　　　　　　　　　　　(Factly setting: 0) | Setting value	Offset/gain adjustment channel	Resolution
1	CH1	1/14000
2	CH2	
3	CH3	
4	CH4	1/8000
5	CH5	
6	CH6	
7	CH7	1/12000
8	CH8	
9	CH9		
(3)	Offset/gain select switch ◯ OFF SET ◯ SET ◯ GAIN	OFFSET position: The offset value is adjusted. 　SET position　: When moved from OFFSET to SET, the offset value is registered. 　　　　　　　　　When moned from GAIN to SET, the gain value is registered. 　GAIN position : The gain value is adjusted.

5

No.	Name	Details
(4)	UP/DOWN switch UP DOWN	This increments or decrements the CH3 offset value or gain value. <table><tr><th>Time at UP/DOWN position</th><th>Increment/decrement width</th></tr><tr><td>Less than 1.5s</td><td>Voltage: approx. 2.5mV Current: approx. 5μA</td></tr><tr><td>1.5s or more</td><td>Voltage: approx. 50mV Current: approx. 5μA</td></tr></table>
(5)	Test mode terminal TEST	This is used to adjust the offset/gain value and to set the resolution. • Short-circuit across terminals 1 and 3 ... Test mode • Open across terminals 1 and 3 ... Normal mode
(6)	Output hold/clear setting terminal HLD/CLR	This sets the CH3 analog output state when the PLC CPU is stopped. Open across terminals 2 and 4: The offset value is output when the CPU is stopped (clear) Short-circuit across terminals 2 and 4: The analog value is output when the CPU is stopped (hold)
(7)	Analog input terminal(CH1, CH2) CH1 V+ / I+ / COM / SLD CH2 V+ / I+ / COM / SLD	The CH1 and CH2 analog values (voltage/current) are input.
(8)	Analog output terminal(CH3) CH3 V+ / V- / I+ / I-	The CH3 analog values (voltage/current) is output.
(9)	Analog ground terminal	This is the ground terminal for the analog signal.
(10)	Frame ground terminal	This is the module's ground terminal.
(11)	Terminal block	The numbers in the drawing indicate the terminal No.

3.2 Setting the offset and gain

Use the following procedure to change the input/output conversion characteristics.

```
                    ┌──────────────┐
                    │    Start     │
                    └──────┬───────┘
                           │
```

Short-circuit the test mode termi-nals (across 1 and 3).

TEST

(C)

Set the "channel/resolution select switch" to the No. of the channel and resolution to be changed.

RUN ⟨OFF⟩

CH

⊕ Set to the channel and resolution to be set.

What channel is to be adjusted? → CH3 (A)

CH1, CH2

Apply the voltage or current to be used as the offset value.

V+

V / COM

For voltage

For current

V+

A / I+

COM

Actually connected resistance valuel

Set the offset/gain select switch to "OFF SET".

RUN ☀ Flickers

OFF SET
SET
GAIN

Set the offset/gain select switch to "SET".

RUN ⟨OFF⟩

OFF SET
SET
GAIN

(1)

(1)

Apply the voltage or current to be used as the gain value.

V +

(V) COM

For voltage

For current

V +

(A) I +

COM

Actually connected resistance value

Set the offset/gain select switch to "GAIN".

RUN -☀-

OFF SET
SET
GAIN

Flickers

Set the offset/gain select switch to "SET".

RUN ⦂

OFF SET
SET
GAIN

OFF

(B)

Adjust other channels?

YES → (C)

NO

Open the test mode terminals (across 1 and 3).

TEST

End *

* The state of the RUN LED after the adjustment is shown below.
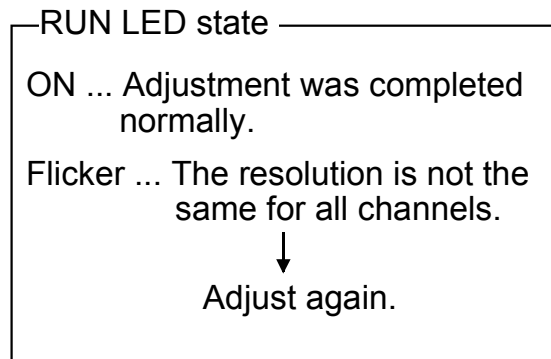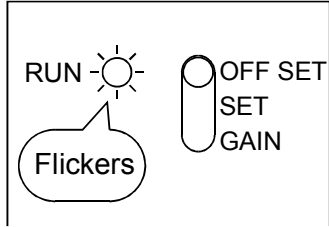
┌─ RUN LED state ─────────┐

ON ... Adjustment was completed normally.

Flicker ... The resolution is not the same for all channels.

↓

Adjust again.

(A)

Set the offset/gain select switch
to "OFF SET".

RUN ☼
Flickers

OFF SET
SET
GAIN

Using the "UP/DOWN switch", set
the voltage or current to be used
as the offset value.

V+
For voltage { (V) V−
For current { (A) I+   COM
I−

Actually connected
resistance value

Set the offset/gain select switch
to "SET".

RUN ○
OFF

OFF SET
SET
GAIN

(2)

(2)

Set the offset/gain select switch
to "GAIN"

RUN ☼
Flickers

OFF SET
SET
GAIN

Using the "UP/DOWN switch", set
the voltage or current to be used
as the gain value.

V+
For voltage { (V) V−
For current { (A) I+   COM
I−

Actually connected
resistance value

Set the offset/gain select switch
to "SET".

RUN ○
OFF

OFF SET
SET
GAIN

(B)

9
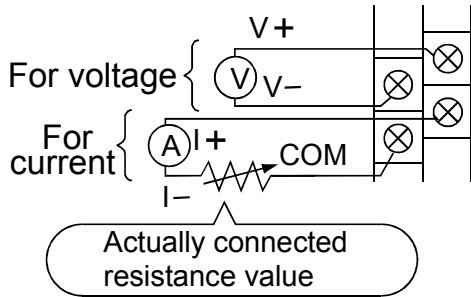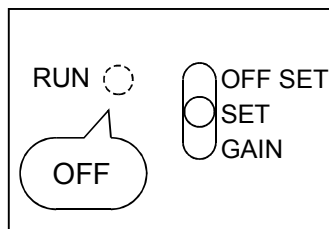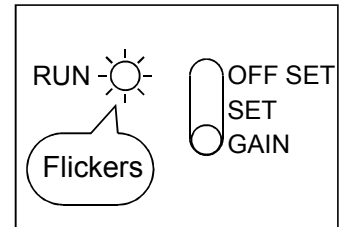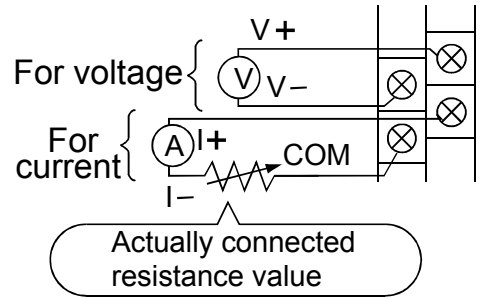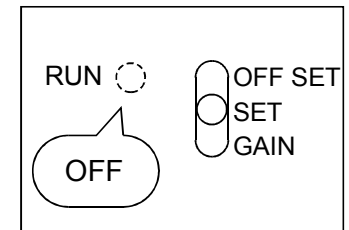
The offset value and gain values are set as follows.

(1) A/D conversion section
   (a) The offset value is the analog input value (voltage or current) at which the digital output value is "0".
   (b) The gain value is the analog input value (voltage or current) at which the digital output value is one of the following.
      1. 2000 (resolution 1/4000)
      2. 4000 (resolution 1/8000)
      3. 6000 (resolution 1/12000)
(2) D/A conversion section
   (a) The offset value is the analog value (voltage or current) output from the A1S63ADA when the digital value is "0".
   (b) The gain value is the analog value (voltage or current) output from the A1S63ADA when the digital value is one of the following.
      1. 4000 (resolution 1/4000)
      2. 8000 (resolution 1/8000)
      3. 12000 (resolution 1/12000)

4. HANDLING

4.1 Precautions for handling

(1) As the body case and terminal block are made of resin, do not drop these or apply strong impacts.
(2) Do not remove the module's PCB from the case. Failure to observe this could lead to faults.
(3) Make sure that foreign matter such as wire scraps do not enter the module from the top while wiring. If any foreign matter enters, remove it.
(4) Tighten the module tightening screws and terminal screws, etc., within the following range.

Screw position	Tightening torque range
Module tightening screw (M4 screw)	78 to 118N • cm
Terminal block terminal screw (M3.5 screw)	59 to 88N • cm
Terminal block installation screw (M4 screw)	78 to 118N • cm

▦ 5. WIRING ▦

The precautions for wiring and examples of connecting the module are given in this section.

5.1 Precautions for wiring

One condition for creating a highly reliable system and using the A1S63ADA functions to the fullest is to carry out wiring that is not easily "affected by noise".

Precautions for wiring are given below.

(1) Use separate cables for the alternating current and A1S63ADA analog input, and make sure that the alternating current side is not affected by surge or induction.
(2) Do not wire near or with the main circuit wires, high-voltage wires or load wire other than from the PLC. If laid close together, the wires will be affected by noise, surge and induction.
(3) Ground the shield wire or the shield of the shield cable at one point on the PLC side.
Note that depending on the state of noise from the external source, these should be grounded on the external side.
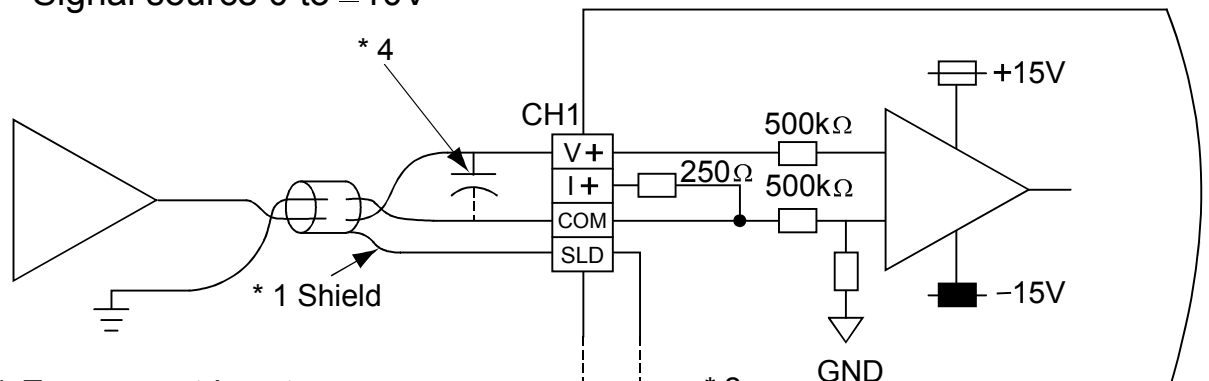
5.2 Example of module connection

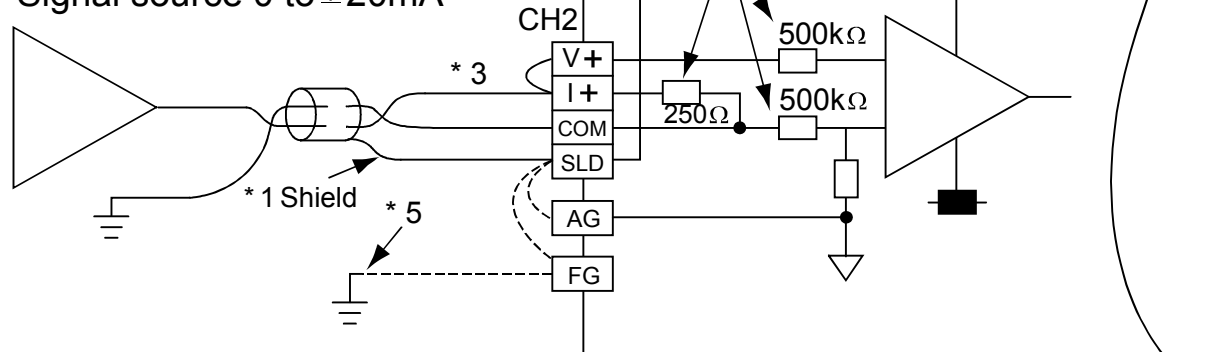The method for wiring the A1S63ADA is shown below.

(1) CH1 and CH2

(a) For voltage input

Signal source 0 to ±10V


(b) For current input

Signal source 0 to ±20mA

11

*1: Use a 2-core twisted shield wire for the wire.
*2: This indicates the A1S63ADA input resistance.
*3: When inputting the current, always connect the (V+) and (I+) terminals.
*4: If noise or ripple is generated in the external wire, connect an approx. 0.1 to 0.47μF25WV capacitor between terminal V and COM.
*5: If there are high levels of noise, always ground. There may be cases where the power supply unit FG or main module FG should also be grounded.
If the grounding wire is changed (connected or disconnected) after setting the offset value and gain value, set the offset value and gain value again.

(2) CH3

(a) For voltage output

A1S63ADA
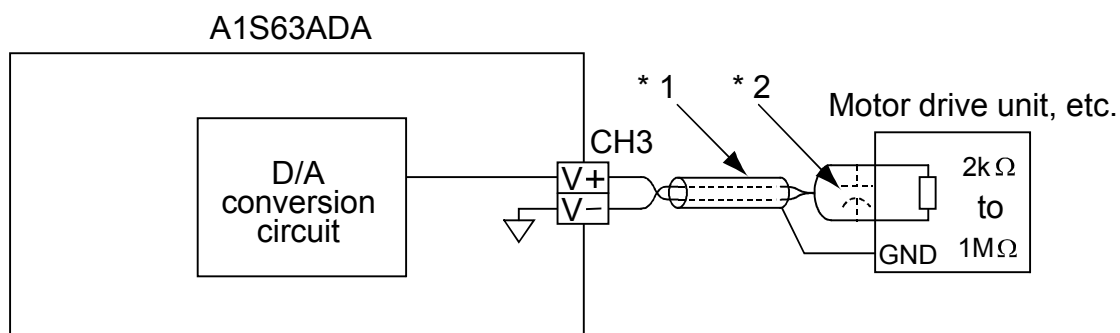
(b) For current output

A1S63ADA
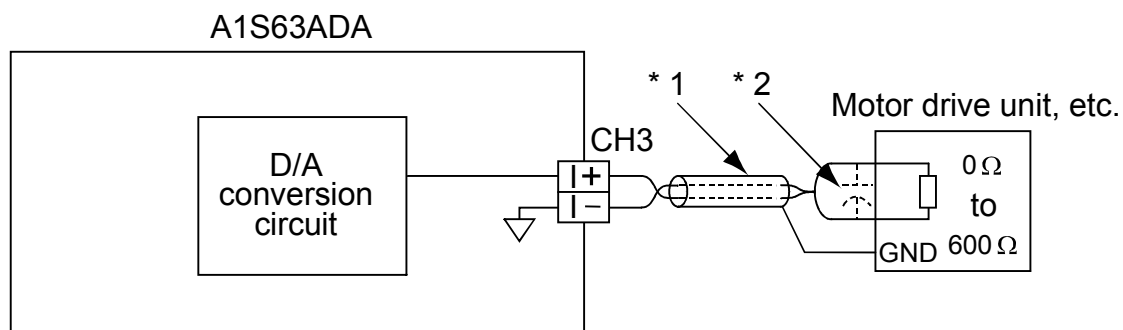
*1: Use a 2-core twisted shield wire for the wire.
*2: If noise or ripple is generated in the external wiring, connect a 0.1 to 0.47μF capacitor (approximate 25V or more withstand voltage) between the terminal V and COM.

IMPORTANT

The voltage and current output of the same channel cannot be used simultaneously.
The internal element will be damaged if used together, so always open the terminals that are not in use.

12

6. EXTERNAL DIMENSIONS DIAGRAM

A1S63ADA

RUN
CH

OFF SET
SET
GAIN

UP
DOWN

130 (5.12)

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

6.5 (0.26)	93.6 (3.69)	7.3 (0.29)	34.5 (1.36)

Unit: mm(inch)

MEMO

14

MEMO

15
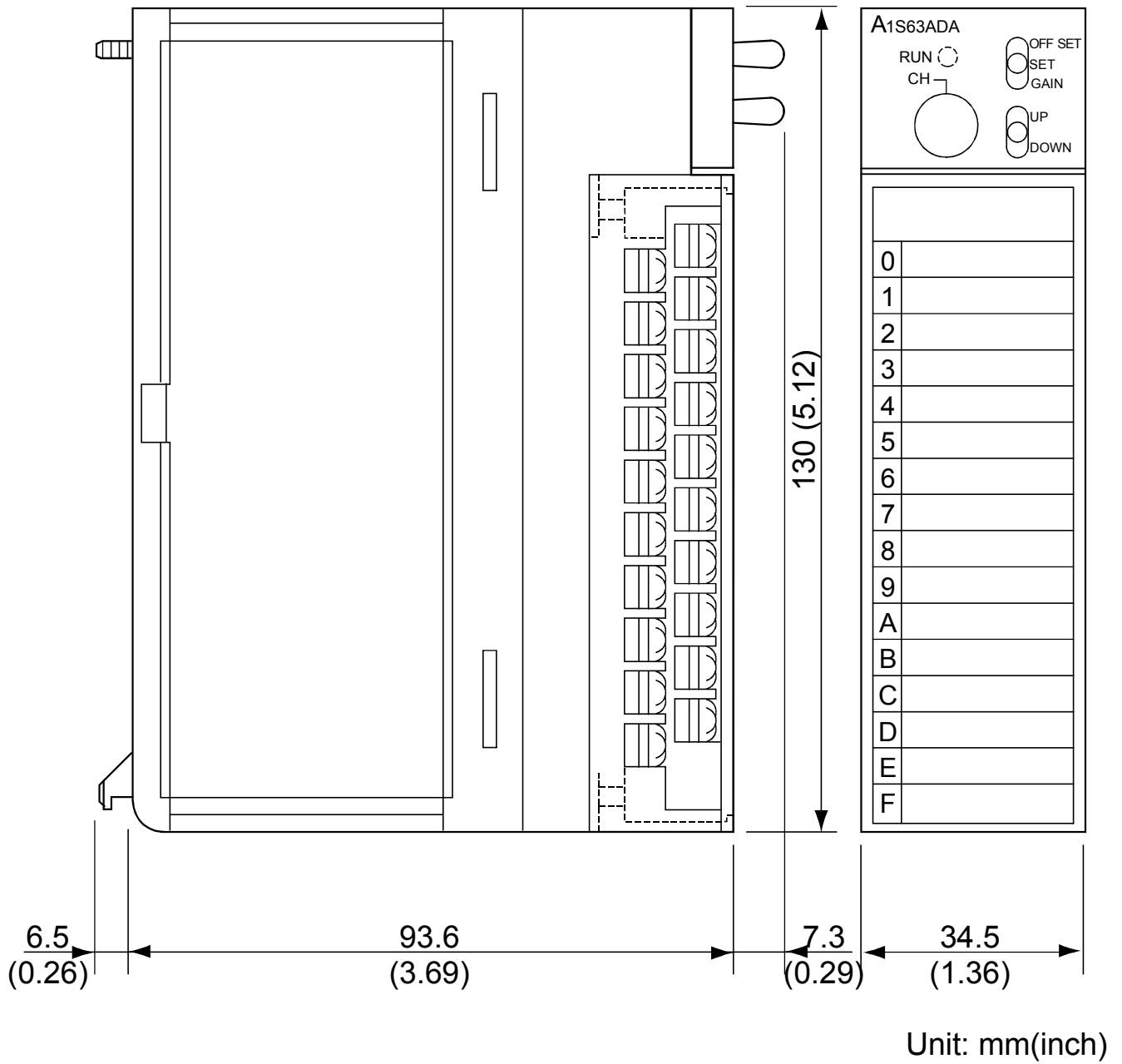
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